Grain Transportation and Handling in Western Canada

Technical Report

Appendices

July 1979

Report for
The Grains Group
Department of Industry,
Trade and Commerce

GRAIN TRANSPORTATION AND HANDLING

IN

WESTERN CANADA

TECHNICAL REPORT

CORRIGENDA

Exhibit VI - 10	Keriobert should read Kerrobert
Exhibit VI - 11	Delete reference to CN Lewvan and CP Carman Subdivisions
Page VIII - 6	Reference to Exhibit VII-2 should be Exhibit VIII-2

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Mr. A.W. Burges
Director General, Transportation
Grains Group
Department of Industry, Trade and Commerce
Ottawa, Ontario
KlA

Subject: Grain Transportation and Handling in Western Canada

Dear Mr. Burges:

With this letter is transmitted our Report presenting the results of an Operations Analysis of Grain Transportation and Handling in Western Canada. The work was carried out by Booz, Allen & Hamilton Inc., in association with IBI Group, during the period August 1978 through June 1979.

SCOPE

In accordance with the terms of reference, existing and future operations of the grain transportation and handling system were analyzed extensively under a number of alternative assumptions regarding future grain export demand through the 1985/86 crop year. Operational and institutional changes, and investments in new facilities and equipment, such as West Coast terminal expansion, rail cars and locomotives were examined. The distribution system was simulated under alternative conditions with a computer model, developed for this project to study the impact of various mixes of operating and capital improvements. Relevant operations of the Canadian Wheat Board (CWB), the Railways and the major grain elevator companies were analyzed, as directed by the terms of reference.

EXCLUSIONS

Specifically excluded from the terms of reference were two important factors:

- Possible changes to the statutory rates ("Crow Rates") for grain; and
- Grain marketing, sales contracts and marine shipping arrangements by the Canadian Wheat Board (CWB) and the grain companies.

Where relevant, implications of both of the above factors regarding more efficient use of the grain distribution system are pointed out in this report. The terms of reference also excluded grain movements east of Thunder Bay and Armstrong.

MAJOR RECOMMENDATIONS

Many recommendations are presented in the report. The most significant of these are summarized as follows:

Information, Planning and Control Systems

Improved information, planning and control systems are required to direct the right grain to the right terminal at the right time to meet vessel loading demands.

Other Operational and Institutional Improvements

A lengthy agenda of other operational and institutional improvements should also be implemented to improve the level of cooperation and the incentives for each participant to contribute to efficient operations of the grain distribution system. A target of 15 percent improvement in car fleet utilization, or more if possible, should be sought. All participants, not just the railways, have a major role to play in improving car utilization.

Capital Investments

Even with the operating and institutional improvements recommended, major capital expenditures will be required to meet delivery requirements for grain movements through 1985/86. It is recommended that:

- In addition to the 2,000 covered hopper cars now on order by the CWB, 1,900 hopper cars be ordered for delivery in each of the 1980/81, 1981/82, 1982/83 and 1983/84 crop years with a further 1,700 cars for delivery in 1984/85. A total of 9,300 cars over the six year period will be needed requiring an investment of about $400 million 1979 dollars. The actual number of cars purchased in years after 1980 can be adjusted up or down in light of the effectiveness of operational improvements and actual demand volumes. It is estimated that up to an additional 4,000 cars costing about $173 million may be necessary if the operating improvements recommended are not achieved but the traffic is available. It is suggested that the 9,300 cars be considered a minimum for planning purposes.

- Since acquisition of the new hopper cars outlined above, coupled with targeted operational improvements, are not likely to provide sufficient capacity to preclude lost sales in years of high demand, additional terminal capacity should be constructed on the West Coast. Anticipated rail capacity limitations to Vancouver are such that Prince Rupert is the preferred site. The 10 million bushel storage capacity terminal proposed for Prince Rupert would meet this requirement, and current negotiations to this end should be brought to the action stage as quickly as possible.

It is recognized that there will probably be years between now and 1985/86 in which world grain demand and/or Canadian production will be such that some of the new plant may not be fully utilized. The investment is justified, however, by the fact that substantial sales would be lost in years of top demand if the facilities were not acquired, and the additional income generated in Canada by three such years of top sales would more than return the total cost of the new facilities.

<u>Grain Transportation Improvement Task Force</u>

To expedite implementation of the recommended improvements, a Grain Transportation Improvement Task Force should be set up, headed by a Managing Director with stature in the grain industry, and reporting to an Executive Committee chaired by the Minister responsible for the Wheat Board and comprising the Chief Commissioners of the CWB and Canadian Grain Commission (CGC), the Chief Executive Officers of CN and CP and two of the Presidents of the six major grain companies. The Task Force would have an action-oriented mandate to propose, oversee and monitor the implementation process during its limited lifetime of up to four years, and would make recommendations regarding a body to continue the improvement and monitoring process, subsequently, if appropriate. The Task Force would be made up of about ten experienced persons, hired on a full-time basis and drawn largely from the grain industry and the railways, plus a small support staff.

<u>CWB Transportation Staff</u>

The staff responsible for administering the Block Shipping System, which now reports to the CWB, plays a central role in planning and controlling the grain delivery activities of the grain companies and railways. There are problems in the level of coordination and cooperation now achieved under this arrangement, some of which are due to a perceived potential conflict of interest by the CWB which has a direct interest in marketing Board grain yet whose staff control rail car allocations for both Board and Non-Board grains. These problems are aggravated by the perception of at least some of the grain companies that the CWB staff have from time to time been arbitrary and unnecessarily secretive in the process of allocating rail cars to the companies and assessing penalties against the companies for shipping infractions.

There are a number of important factors to be assessed in considering whether it would be better for the Block Shipping Staff to report to another body such as the CGC or the Task Force. On balance, from the viewpoint of operational efficiency, the consultant team favors relocation of the Block Shipping Staff to report to the Managing Director of the Task Force. This would provide a neutral "home" for this important function and would enhance the Managing Director's ability to achieve implementation of the necessary improvements.

An early decision on this matter is desirable, preferably by the Minister responsible for the Wheat Board (or, subsequently, by the Task Force).

COMPENSATORY RAIL RATES FOR GRAIN

There is a substantial body of opinion among major participants in the production, handling and transportation of grain in Canada, that some way must be found soon to provide a compensatory return to the railways for moving grain. Failing this, the lack of capital renewal of relevant rail facilities will become critical, vitally affecting the grain industry, the railways and other important industries.

While this issue was excluded from the Operations Analysis, it has been noted throughout the analysis and this Report that the introduction of compensatory rates is desirable, not only to achieve the required cash flow for locomotives and for expanded main line capacity but also to enhance the likelihood of achieving many of the identified operating improvements through the incentives provided by a flexible rate structure which would reward efficient use of rail services for grain transport.

It is, therefore, most important that the implementation of the operational improvements recommended in this Report not be seen as a reason to delay resolution of the Crow Rate issue, but that the introduction of compensatory grain rates be pursued in parallel with the operational improvements and be treated as of equally high priority.

OPERATIONS ANALYSIS REPORT

This report is presented in three volumes:

- Volume 1: Executive Summary
- Volume 2: Technical Report
- Volume 3: Appendices

Volume 1 is a digest of the more detailed Technical Report, with an essentially parallel chapter structure to facilitate cross references. Readers of Volume 1 will receive a summary of the most important analyses, findings and recommendations, while those requiring a more detailed account should refer to Volume 2. Volume 3 presents the Appendices for the Report.

ACKNOWLEDGEMENTS

The consultant team wishes to acknowledge with thanks the cooperation and advice of you and your staff, the grain companies, railways, Canadian Wheat Board, Canadian Grain Commission and others. Particular thanks is due to the Industry Liaison Committee, comprising representatives of the grain companies, producers and organized labor, with which the team met regularly during the project. The findings and views expressed in this Report are, however, those of the consultant team which accepts full responsibility for them.

We trust that this Report will contribute to the further growth and prosperity of one of Canada's most economic sectors and one which is based on renewable resources - the grain industry and related agricultural, handling, transportation and processing industries.

Very truly yours,

BOOZ ALLEN & HAMILTON Inc.

Charles W. Hoppe
Vice President

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Managing Director

GRAIN TRANSPORTATION
AND
HANDLING IN WESTERN CANADA

TECHNICAL REPORT

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I. INTRODUCTION

The transporting and handling of grain is vitally important to the Canadian economy and, as such, has been the subject of numerous studies. The overall approach of this operations analysis focuses on practical solutions to the logistics problems encountered in moving the grain from farm to vessel. The primary objective is to develop recommendations to improve throughput of export grain so that the potential for increased grain sales can be optimized.

This analysis was carried out by Booz, Allen & Hamilton Inc. and IBI Group, assisted by T.K. Dyer, Inc. under the direction of the Grains Group at the Department of Industry, Trade and Commerce, Ottawa. The project was also assisted by an Industry Liaison Committee which was comprised of representatives from the major grain companies, the producers and labor. This committee provided review, comment and assistance for carrying out the analyses presented in this report. In addition, this project benefited from the complete cooperation of the railways, the Canadian Wheat Board, and the Canadian Grain Commission.

For the purpose of this analysis, the grain transportation system is defined as the interrelated process in which grain is called from on-farm storage, collected by means of quotas imposed by the Canadian Wheat Board, and forwarded via the grain block system and regional rail network to export terminals. Once the grain arrives at the terminals, it is cleaned and then loaded onto vessels. The focus of this study is restricted to movements within Western Canada, that area bounded by the ports of Vancouver, Prince Rupert, Thunder Bay and Churchill.

1. THE SCOPE OF THIS ANALYSIS WAS GUIDED BY THE TERMS OF REFERENCE

There has been a growing concern regarding the ability of the grain transportation system to handle increasing volumes, particularly in terms of the supply of railway cars required to carry anticipated export increases of more than 50 percent by the mid-1980's. Related requirements for locomotives, rail facilities and western terminal elevators are also significant matters. This operations analysis was prompted largely by these concerns and the anticipated impacts in terms of losses in export sales, producer income, and foreign exchange. In recognition of these concerns, the Grains Group requested proposals to carry out an analysis of the grain transport and handling system.

The objectives of the proposed analysis are outlined below:

- To make an assessment of the operational efficiency of specified components of the contemporary grain transportation system in Western Canada

- To define key institutional, operational and capacity constraints in the present system and prescribe cost minimizing remedies in accord with a range of alternative export volume and system configuration scenarios

- To identify probable operating and capital equipment needs for the movement of grain over the next several years under these scenarios

- To establish an improvement plan which would minimize institutional and operational constraints utilizing specific techniques

- To establish the appropriate implementation mechanism, i.e., the role of key personnel, the required level of expertise and training, and the reporting relationships most appropriate for the overall function.

The scope of work contained in the request for proposals defined by the Grains Group included an evaluation of the following aspects with respect to the effectiveness and efficiency of the whole system:

- <u>Canadian Wheat Board (CWB)</u>

  - Export and domestic grain/oilseed traffic projections

    - volume
    - directional flow
    - seasonal variation

.. origins and destinations by type of grain

.. range of optimistic, median and pessimistic volume assumptions

- Quota system

.. inventory control
.. producer responsiveness
.. grading system

- Block shipping system

.. car allocation formulae

.. definition of blocks and possible rationalization

.. producer cars

.. efficiency (matching terminal requirements with country originations by grade and type of grain)

.. efficiency (railway operations)

- Movement of Non-Board grains

.. CWB control of Non-Board grains
.. car allocation
.. switching of Board and Non-Board grains

- Liaison

.. Canadian Wheat Board and the railways
.. grain companies and the Wheat Board
.. grain companies and the railways.

All of the above were to be reviewed in relation to selected demand scenarios.

• <u>Railway System</u>

- Collection network (overview)

.. ultimate configuration (basic network)

.. present employment capacity

.. rehabilitation

.. car cycles

.. relationship of grain to other bulk traffic

- Branchline network

  .. operating practices and constraints
  .. seasonal restrictions
  .. car spotting and waiting time
  .. demurrage

- Line haul

  .. capacity restraints
  .. interlining/reciprocal agreements
  .. joint track usage
  .. routing practices

- Terminal operations

  .. constraints
  .. assessment of ongoing studies
  .. demurrage

- Motive power and equipment

  .. reduction in box car fleet
  .. efficiency of utilization
  .. future hopper car requirements
  .. motive power

• <u>Grain Trade</u>

- Primary elevator system

  .. evolution and rationalization

  .. storage function versus throughput

  .. allocation of cars within blocks

  .. Non-Board grains and oilseeds

  .. impact of competition: primary and terminal elevators

  .. operating problems

- Terminal elevator system (ports)
  - .. car coordination
  - .. pooling
  - .. Non-Board grains.

Additionally, the terms of reference required a final system evaluation report, together with all relevant appendices, upon completion of the study.

2. THIS ANALYSIS DID NOT COVER THE "CROW'S NEST PASS RATE" OR THE GRAIN MARKETING ISSUE

A major determinant of any system's operating efficiency and capital investment is the pricing structure for the goods and services provided. While the pricing structures for railway grain rates and grain sales are not included in the terms of reference, they both impact the grain transport and handling system.

(1) The Statutory Grain Rates Confer a Perceived Financial Benefit on Producers and a Disincentive to the Railways

It is widely recognized that the lack of normal cash flow to the railways, resulting from statutory grain rates, has discouraged railway investments in grain cars, locomotives, and branchline maintenance. One result has been the failure of the railways to replace overage box cars dedicated to grain with the result that the railway-owned fleet has declined from approximately 26,000 in 1972 to approximately 13,000 in 1978. A number of government actions have been taken to counter railway disinvestment:

- Purchase of 8,000 hopper cars
- Funding of a box car rehabilitation program on a 50-50 basis
- Subsidies to railways for branchline operations
- Funding for branchline rehabilitation
- Tax incentives for railway infrastructure investments.

These measures have been essential for the continued operation of the system at reasonable capacity levels within the context of continuing statutory rates. However, the concern persists that effective system capacity is static or declining in the face of a growing world market for Canadian export grain and oilseeds.

Since the study of statutory rates and possible alternative rail rate structures is specifically excluded from the terms of reference, this analysis is directed at the fundamental challenge of improving the capacity and throughput of the system in a manner which would be compatible with either continuance of statutory grain rates or a change to compensatory rates.

(2) <u>An Analysis of Grain Marketing Issues Was Not Included in the Study</u>

Grain marketing studies including pricing, contracts, and vessel demurrage are also excluded from this analysis. This exclusion leaves several questions unanswered:

- The possibility of reducing the peaks of grain sales over parts of the year
- The impacts of demurrage on specific types of sales or contracts
- The costs of, and opportunities for, substituting one type of grain for another.

The impacts of the marketing and statutory rate issues, while not specifically analyzed, are referred to as appropriate throughout this report.

3. THIS REPORT PRESENTS ALL RELEVANT ANALYSES AND RECOMMENDATIONS DEVELOPED DURING THIS PROJECT

The analyses, findings and recommendations developed during the period from September 1978 through June 1979 are presented in this report as follows:

- <u>Executive Summary</u>, under separate cover, is an abbreviated version of this report focusing on the conclusions and recommendations of this analysis.

- Chapter I - Introduction, (this chapter) provides background and scope of the project.

- Chapter II - System Overview, provides a description of the participants and a general background of how the system operates.

- Chapter III - Forecasts of Future Grain Movements, presents grain volume forecasts to 1985/86 crop year.

- Chapter IV - System Dynamics, focuses on interrelationships among vessel arrivals, grain stocks, and the orders for grain from the primary elevators.

- Chapter V - Grain Car Cycles, presents the findings from the analysis of the Canadian National (CN) and Canadian Pacific (CP) grain car cycles and identifies opportunities for improvement.

- Chapter VI - Prairie Operations, covers primary elevator and railway operations in the country focusing on present practices, future trends and requirements, and improvement opportunities.

- Chapter VII - Port Operations, presents the operations and constraints today and the requirements for the future in the port area.

- Chapter VIII - Rail Operations, includes the findings and recommendations covering rail cars, locomotives, and main line capacity through 1985.

- Chapter IX - Information and Inventory Management Systems, presents a description of the current management process with recommendations for improvement.

- Chapter X - Institutional Relationships and Incentives, presents alternative approaches to the organization and management of the grain transport system.

- Chapter XI - Implementation of Recommendations, presents recommendations on an implementation approach and includes a summary of the recommendations developed in Chapters V through X.

- Appendices, under separate cover, provide further details and information to support the analysis presented in the final report.

*   *   *   *   *

The results presented in this report are the independent judgment of the consultant team. However, most of the findings, conclusions and recommendations have been discussed and reviewed with the following:

- The Grains Group
- Railways
- Canadian Wheat Board
- Canadian Grain Commission
- Industry Liaison Committee.

The consultant team assumes the full responsibility for the findings and recommendations presented herein.

II. SYSTEM OVERVIEW

The recommendations developed in this report can only be understood in the context of the interrelationships between the various parties involved in the Canadian grain logistics system. While key elements of the system are described in some detail in subsequent chapters of this report, a general overview of the roles played by each participant and their interrelationships is presented here as background.

1. NORMAL COMMERCIAL INCENTIVES HAVE BEEN REPLACED BY A COMPLEX STRUCTURE OF RELATIONSHIPS

Unlike most other transportation and handling systems in North America the relationship between the various participants in the grain system is not based solely on commercial principles. In a commercial arrangement, the normal incentive for various parties to perform their function is to earn a profit. In the grain handling and transportation system, the profit incentive is not always present. Various participants perform their functions for a variety of motives, such as:

- The Canadian Wheat Board (a Federal Government organization) owns and markets about 80 percent of the grain and attempts to balance maximizing sales and providing equity to producers.
- The producer-owned cooperatives and private companies handle grains on behalf of the CWB. They market and handle Non-Board grains for their own account.
- The railways provide service under statutory rail rates which covered less than 30 percent of their total costs in 1977.* The railways strive to minimize losses while meeting their obligation to move grain.

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* 1977 Costs and Revenues Incurred by the Railways in the Transportation of Grain Under the Statutory Rates, Snavely, King and Associates, September 1978 .

- The Federal Government, attempting to keep the system viable, has provided:
  - 8,000 covered hopper cars
  - Funds for box car rehabilitation
  - Subsidies for branchline operations
  - Funds for branchline rehabilitation.

For the above reasons, the relationships between the various parties are not based upon normal commercial principles. Instead, a complicated set of interrelationships based on negotiation and consultation has been substituted for the usual market incentives and disincentives based primarily on price and service levels.

This is not to say that such a system does not or cannot operate effectively and efficiently; but that, once commercial disciplines are removed, coordination and control mechanisms must be substituted and constantly reviewed to avoid obsolescence.

In some instances, these mechanisms may not prompt individuals or agencies to operate for the overall benefit of the entire system. Such incentives can encourage "game playing," "blame fixing," and "sub-optimization." Of course, this problem can also exist in a purely commercial system, but it tends to be more constrained by the commercial disciplines of supply, demand and price.

2. THE ROLES OF THE MANY PARTICIPANTS SOMETIMES DIFFER FROM NORMAL COMMERCIAL PRACTICES

The primary participants in the process of handling and transporting grain include:

- Canadian Wheat Board
- Producers
- Grain Companies
- Railways
- Canadian Grain Commission
- Canadian Transport Commission
- Government of Canada.

In addition to these, there are several agencies and organizations which have either an interest or a function in the grain handling system. These include labor unions, associations of shippers, and other industrial and transportation groups. Exhibit II-1 provides a summary of the major participants and their roles.

The functions of the major participants in the system operations are summarized below.

(1) The Canadian Wheat Board (CWB)

The Canadian Wheat Board has the following responsibilities:

- Purchases Board grains (wheat, barley and oats) and markets them throughout the world
- Acts as a profit pool (for Board grains) for the various producers
- Regulates the entry of all grain into the handling system through the setting of quotas
- Coordinates and allocates transportation resources between Board grains, Non-Board grains, and Off-Board grains
  - Board grains include wheat, barley and oats which are purchased and marketed in accordance with the provisions of the Canadian Wheat Board Act
  - Non-Board grains include rye, flax and rapeseed. These grains may be sold on the private market, although the CWB allocates transportation capacity and quotas to the farmers for delivery to the primary elevator systems
  - Off-Board grains are the same species as Board grains, but are used for domestic feed. The domestic feed market is operated privately, although the CWB has responsibility for allocating transportation capacity. The CWB also restricts the amounts of grain held in the elevator system through regulations

EXHIBIT II-1
Major Participants and Their Roles

ROLES \ PARTICIPANTS	CDN. WHEAT BOARD	PRODUCERS	GRAIN COMPANIES	RAILWAYS	CANADIAN GRAIN COMMISSION	CDN. TRANS. COMMISSION/ CAR COORDINATOR	GOV'T OF CANADA
PLANTING, HARVESTING, ON-FARM STORAGE		●					
SETTING AND ADMINISTERING QUOTA SYSTEM	●						
DELIVERY TO COUNTRY ELEVATORS		●					
MARKETING OF BOARD GRAIN	●		○				
MARKETING OF NON-BOARD GRAIN			●				
MARKETING OF NON-BOARD FEED GRAIN			●				
STORAGE/HANDLING IN COUNTRY ELEVATORS			●		○		
SPACE/ALLOCATION AMONG GRAINS			●		●		
CAR ALLOCATION AND CAR ORDERS	●		●	●			
PRICING FOR HANDLING/ STORAGE			○		●		
LICENSING, SETTING OF STANDARDS/GRADES					●		
SCHEDULING OF COUNTRY CAR SPOTTING PICKUPS			○	●			
GRAIN MOVEMENTS TO TERMINAL ELEVATORS				●			
CAR ALLOCATIONS TO TERMINAL ELEVATORS			●	○		○	
STORAGE/HANDLING IN TERMINAL ELEVATORS			●		●		
PRICING FOR RAIL TRANSPORTATION				○			●
PROVISION OF GRAIN CARS	●			●			●
INSPECTION OF PRODUCT IN TERMINALS					●		
PROVISION OF SYSTEM INFORMATION	●	○	●	●	●	○	
INVENTORY MANAGEMENT DECISIONS	●	○	●				
NEGOTIATION OF EXPORT CONTRACTS	●		●				
PROVISION OF MARINE TRANSPORTATION	○		○				

LEGEND
● = MAJOR ROLE
○ = SUPPORTING ROLE

- Supervises the movements of grain from the primary elevator system to the terminals in response to sales commitments.

The CWB has a dominant role in that it markets Board grain for exports and for domestic consumption when traded interprovincially. Such Board grains account for approximately 80 percent of the Canadian grain production.

The CWB also administers the quota delivery system for calling forward deliveries from farms to country elevators, and coordinates and administers the block shipping system which results in a weekly allocation of rail cars by type of grain to blocks and companies for shipment to specified ports. In addition, the CWB applies penalties by withholding rail cars from individual grain companies for various errors, such as misshipments, misallocation of elevator space to Non-Board grain, and improper representation of Non-Board grain sales for which vessels have not been nominated.

The CWB's physical resources are primarily non-plant. These resources include the staff, sales network, information handling system, and legislative authority. The recent decision to purchase 2,000 hopper cars, however, will make the CWB a significant owner of transportation equipment.

(2) The Producers

There are approximately 160,000 farms producing grain in Western Canada. The producers are key decisionmakers in the grain handling system. Their individual and collective decisions each year lead to the formation of a pool from which sales of the various grains can be made. Some of the key producer decisions include:

- How much and what type of grain to plant
- When to market the grain produced
- When to deliver grain to the primary elevator system

- Which primary elevator to use
- Whether to market grains through the CWB or on the domestic feed markets (for Board grains).

In general, the producer has to have on-farm storage for at least one year's crop. This is required since there is normally little time available to haul the crop to the grain elevators during the harvest, even if the quota were available. That part of the crop which is not marketed in one crop year is carried over to the next. This situation may result from either lack of a market or from producers waiting for better prices in the next crop year. These carry-overs account for 20 to 80 percent of the annual production, depending upon world market conditions.

The substantial carry-overs of farm-stored grain have probably affected the producers' decisions on planting. On the other hand, many producers see the need for continuing expansion of production levels in order to remain economically viable in the face of sustained inflationary trends. Production trends have moved steadily upward. Agricultural experts generally agree that significant increases are still possible, at least to the point of allowing a 50 percent increase in exports over the next seven to ten years.

(3) The Grain Companies

The grain trade is comprised of a number of companies which own and operate primary and terminal elevator systems, and also market grains. There are currently more than 30 companies active, although the following companies are dominant:

- Manitoba Wheat Pool (MWP)
- Saskatchewan Wheat Pool (SWP)
- Alberta Wheat Pool (AWP)
- United Grain Growers (UGG)
- Pioneer
- Cargill.

The first three companies are producer-owned cooperatives, while UGG is a limited company controlled by producers. Pioneer and Cargill are the two largest privately owned companies.

The main functions of the grain companies are as follows:

- Purchase of grains at primary elevators, either on behalf of the Wheat Board for Board grains, or on their own account for Non-Board and Off-Board grains

- Handling of grain in both the primary and terminal elevators. This involves receiving, weighing, and grading of grains at primary elevators; and cleaning, drying, and off-loading of grains at terminal elevators

- Marketing of Non-Board, Off-Board, and at times, Board grains.

The primary resources of the grain companies are the elevators, the requisite sales networks, the staffs, and the information handling capability. The companies also provide related farm supplies and services (i.e., fertilizer, grain products) at a number of country locations.

(4) The Railways

The railways provide rail transportation of grain from country elevators to terminal and transfer elevators. In some cases, transportation is provided directly to the domestic customers. The major railways involved with grain, shown with the approximate percentage of grain handled, include:

- Canadian National (CN) - 42%
- Canadian Pacific (CP) - 52%
- Northern Alberta Railway (NAR) - 5%
- British Columbia Railway (BCR) - 1%.

The CN and CP railways have a combined box car fleet of approximately 13,000 cars in grain service, divided approximately equally between the two railways. An additional 8,000 hopper cars owned by the Government of Canada have been assigned to the CN and CP. The hopper cars are operated and maintained by the railways for exclusive use in grain transportation, subject to the provisions of operating and alternate use agreements negotiated with the Canadian Wheat Board and the Federal Government.

The other major assets and resources of the railways relevant to grain transportation are the network of branch lines and main lines, the classification and terminal yards used for grain transportation, plus a substantial fleet of locomotives used for this purpose, and associated operating staff and data networks.

(5) <u>The Canadian Grain Commission (CGC)</u>

The Canadian Grain Commission is responsible for:

- Establishing standards (grades) for grain
- Carrying out grading and inspection
- Licensing and examining all types of elevators
- Authorizing mixing or blending of grades of grain
- Authorizing the movement of producer-loaded cars
- Managing five inland terminals in the Prairies, and one port terminal at Prince Rupert. (The Government is, however, currently in the process of selling these terminals.)

(6) <u>The Canadian Transport Commission (CTC)</u>

Beyond its normal responsibilities for regulatory control and supervising rail safety, the

Canadian Transport Commission is also responsible for:

- Approving railway line abandonments (usually after public hearings)
- Regulating the Government's branchline subsidy program
- Operating the Grain Coordinator's offices in Thunder Bay and Vancouver.

Under the branchline subsidy program, the Government pays the deficits incurred in the operation of uneconomic branchlines which the railways have been forbidden, or have not yet been authorized, to abandon.

The Grain Coordinators in Thunder Bay and Vancouver act as clearinghouses for information in the port areas. They also assist in the distribution of rail cars to the various terminal elevators.

The Canadian Transport Commission also has responsibility for the branchline subsidy program and broad powers concerning the service levels provided by the railways. It investigates complaints received about the level of service and its engineering inspectorate verifies that branchline rehabilitation conforms to program specification.

(7) <u>The Government of Canada</u>

The Federal Government is also intimately involved in the handling of grain. Each year the Federal Government establishes the initial payment for Board grains which effectively acts as a minimum price for the producers. The Government also provides hopper cars and support for various box car rehabilitation programs, pays the actual amounts due under the branchline subsidies, and has recently undertaken the Prairie rail branchline rehabilitation program which is expected to involve some $700 million worth of expenditures over the next several years.

3. THE BLOCK SHIPPING SYSTEM IS THE PRIMARY MECHANISM FOR CAR ALLOCATIONS

The flow of grain from producers to primary elevators is initiated and controlled by the CWB through the use of the quota system. The objectives of the quota system are to:

- Provide orderly flow of the grades and types of grain required to meet sales commitments
- Provide equity of delivery opportunity to all producers.

The Wheat Board places quotas on grain by type and grade in each shipping block according to the perceived availability of the grain and grade on farms in the block. Efforts are also made to minimize the distances from the farm to the port. The block shipping system provides the mechanism to implement the process of moving grain from primary elevators to port.

The block shipping system, introduced in 1969/70, provides a means of allocating rail cars geographically, among types of grain and among companies whereby train runs in the country can be efficiently scheduled and various delivery requirements met. The grain producing areas of the Prairies are divided into 48 blocks, each of which serves about 400 miles of track of one railway, 40 shipping stations, and 125 elevators. Each block is based on railway train runs by subdivisions whereby the railway can provide flexible train service each week to the various branchlines in a block.

The rail car availability is negotiated by the CWB and railways. The CWB allocates available empty rail cars each week to each block; and the grain companies assist by providing information on their car requirements for Board and Non-Board grains and by making the final allocation of cars to elevators and shipping points within a given block. The railways then work with the grain companies and the CWB on the weekly detailed assignment of rail cars and train runs.

In recent years, there has been a tendency for fewer cars to be available each week than are requested by the CWB. The resulting car shortfall allows both the railways and the country elevator agents a certain amount of discretion regarding which car orders they will fill. This discretionary execution of the plan is compounded by the fact that the CWB does not have specific information from the country elevators on which orders were actually filled until approximately one week after the event. This information is relayed via a mail link through the company head offices. This means that in a typical week up to one-third of the cars loaded are "discretionary," or beyond the control of the Wheat Board.

The car allocation process takes place over a six-week cycle, updated and implemented each week as follows:

- Week 1: An initial determination is made of grain requirements for Week 6 at Canadian processing plants and export ports by type and grade.
- Week 2: Stock reporting instructions by block/type/grade of grains required for shipment during week 5 for delivery in week 6 are prepared for distribution for the information of railways, elevator companies, and country agents. A preliminary estimate is made for the number of cars required in week 5. The country elevator reports detailing country stock information are prepared and transmitted to the grain companies.
- Week 3: The companies negotiate with the CWB for Non-Board grain allotments. The CWB prepares a final position statement on required cars at each destination in week 6 by type/grade of grain and meets with the railways to negotiate car supply. Elevator managers report shippable stocks by type and grade of grain at each elevator to the company head offices, through to the CWB transportation department. Bulk allocation to blocks is made.
- Week 4: The CWB prepares a tentative shipping plan giving the number of cars to be allocated to each elevator company in each block,* bearing in mind the final position statement and necessary steps to alleviate elevator space congestion and even out delivery opportunities. The grain companies specify which elevators are to load

* Actually transmitted over the weekend between weeks 3 and 4.

grain in each shipping block for the following week. The railways and the grain companies phone elevator managers with their loading instructions for the next week (railways are now phasing out this function), including the number of cars to be spotted, the types and grades to be loaded, and the destinations.

- Week 5: Railways spot cars at primary elevators; elevator managers load rail cars at elevators.

- Week 6: Shipment to port terminal is completed; cars are unloaded; and processing of grain at the terminals begins.

The block shipping system provides a framework for identifying the major opportunities for improvement in the information systems procedures and data flows. As will be discussed later in this report, the car allocation process as described above works less than half the time, when measured in terms of unloads by week 6. This problem is a major focus of the operations analyses described in this report.

4. ACCEPTABLE SOLUTIONS MUST SATISFY POTENTIAL CONFLICTING GOALS AND CRITERIA

The complexities of the Canadian grain handling and logistics system, as well as the varied and often contradictory goals of the many participants, frustrate simple solutions. Solution paths that might aid in one aspect of the problem may have partially offsetting effects on other aspects of the problem. For example, increasing the number of cars may lead to yard congestion. The effects of such changes may also impose penalties on some parties, while others benefit. Proposed changes must be practical with a high expectation of success in relation to the risks of failure or the risks of inaction.

During this project it became evident that the acceptable, proposed "improvements" would satisfy several criteria. Specifically, they must:

- Provide capacity to move forecasted growth in grain shipments to export position on a timely and economic basis

- Result in a sufficiently robust system to handle the many perturbations which are inherent in the grain market
  - Reasonable "shock loads" should be satisfied
  - Trade-offs in standby capacity investments and costs must be considered
- Provide adequate flexibility so that relatively minor setbacks in one sector do not have disastrous effects on another sector
  - Efforts to integrate process steps must not introduce excessive rigidity
  - Surge capabilities must provide buffering between functions
- Be implementable with minimum disruption to present operations
- Provide perceptions of benefits in excess of risks for each participant whose cooperation is required
  - Present system has evolved to a balance which until recently provided each participant with acceptable risks and benefits
  - Short-term imbalances of risk may be acceptable if individual's perceptions of long-run benefits are adequate
- Provide adequate incentives to be workable
  - Where normal market incentives are absent, alternative motivations must be provided
  - Conversely, if incentives required to make the system work cannot be provided, the system is unacceptable.

The goal of this project has been to recommend system improvements which are substantially better in net terms than the existing system. Furthermore, the recommended improvements must be perceived to be better overall and involve at least acceptable risks to each of the key participants.

* * * * *

Numerous "issues" were examined during this project. Those issues which were judged crucial to the goals of the analysis are covered in the following chapters. The Industry Liaison Committee was asked at an early meeting to evaluate and rank grain handling and transportation issues. Appendix A contains a summary of the Committee's responses at that time.

III. FORECASTS OF FUTURE GRAIN MOVEMENTS

Canada's production of grain has been steadily increasing. Export sales of grain have also grown considerably. This growth is expected to continue as is the entire world grain trade. Several agencies have made forecasts of future production and demands for grain. This chapter reviews the various forecasts and presents recommendations as to which forecast to base analysis of future transportation and handling requirements.

1. FORECASTS PREPARED BY FIVE GROUPS WERE EVALUATED

The forecasts reviewed can be classified according to the methods employed. Trend projections of domestic production and consumption (with the remainder presumably exported) were prepared by the Canada Grains Council, Cargill Grain, and the Saskatchewan Wheat Pool. The Canadian Wheat Board (CWB) used top down forecasts of export demand based on the expected growth in international grain trade. Westburn Development Consultants prepared forecasts for the Grains Group and the Dominion Marine Association. They developed trend projections of domestic production and consumption and of exports.

A summary of these forecasts for 1985 is given in Exhibit III-1. This table presents the forecasts in terms of the total number of actual bushels. The original Canada Grains Council forecast was based on certain assumptions about animal feed practices. The Canada Grains Council forecasts were adjusted by Westburn Development Consultants to reflect more conventional opinions about these practices. These adjusted forecasts are shown on a separate line. Subsequently, the Canada Grains Council (March 1979) revised their forecasts and brought them more into line with the other forecasts. It can be seen from Exhibit III-1 that, after this adjustment was made, the forecasts for export ranged between 850 and 900 million bushels, with the major exception of the Canadian Wheat Board forecast for 1,040 million bushels of exports.

EXHIBIT III-1
Forecasts of Total Production of Principal Grains in 1985

	FORECASTS (Millions of Bushels)		
	DOMESTIC	EXPORT	TOTAL
Canadian Wheat Board	860 1/	1,040 2/	1,900
Canada Grains Council	1,170	480 3/	1,650
Canada Grains Council 4/	905	900	1,805
Canada Grains Council 5/ (Revised March 1979)	925	870	1,795
Cargill Grain	905	850	1,800
Westburn Development 6/7/ Consultants	800	850	1,650
Saskatchewan Wheat Pool 7/8/	1,080	825	1,905

Notes:

1/ Not estimated by CWB. This rough estimate comes from the Grain Commission.

2/ As converted from tonnes by the Grain Commission and Westburn.

3/ As converted from barley equivalent bushels by Westburn using October 1977 forecasts.

4/ As adjusted by Westburn; not official Council forecast.

5/ Converted from tonnes by study team.

6/ Demand projections; total supply estimated at 1,540 (but higher in earlier years).

7/ Western Canadian grains only.

8/ For 2000, not 1985.

Exhibit III-2 shows the distribution of these forecasts by destination. Only a small portion of domestic consumption passes through the ports, the rest being consumed in or near the producing areas. The proportion of export movements through the West Coast has been increasing substantially in recent years due to the relatively high growth rates of Pacific markets. There seems to be a consensus that the West Coast ports will probably handle 50 to 55 percent of export grain by 1985.

2. A RECOMMENDED BASIS FOR PLANNING WAS ADOPTED

The various forecasts were converted to tonnes and analyzed by grain type. A high and a low set of forecasted grain movements were then developed for the 1985/86 crop year. These forecasts are shown in Exhibits III-3 and III-4. The high forecasts generally correspond to the expectations of the Wheat Board and the most recent Canada Grains Council work; the low correspond to the other forecasts available. For comparison purposes the actual movements in 1977/78 are given in Exhibit III-5.

It can be seen from this comparison that the range of generally accepted forecasts for 1985 is as follows:

- Eastward movements are expected to increase between 1 and 18 percent

- West Coast movements are expected to increase between 28 to 57 percent.

In general, there is agreement that the Canadian Wheat Board export projections are plausible in the sense that Canada can produce and sell the required amount of grain. However, many believe that there are real institutional and transportation constraints which must be overcome in order to reach the forecasted levels. The lower forecasts could become self-fulfilling if lower expectations resulted in insufficient capacity. Therefore, the higher volume projections have been used for capacity planning purposes.

Accordingly, we have used the high forecast as the basis for this operations analysis, using a range (of "bottom", "mean" and "top" values) within the high forecast, as discussed in the next section.

EXHIBIT III-2
Forecasts of Movement of Principal Grains Through Ports in 1985

	PRINCIPAL GRAIN FORECASTS (millions of bushels)			
	CANADIAN WHEAT BOARD 1/	CANADA GRAINS COUNCIL 3/	CARGILL GRAIN	SASKATCHEWAN WHEAT POOL 4/
WEST COAST				
Vancouver	-	-	375(39%)	-
Prince Rupert	-	-	65(7%)	-
Total	520(50%)	205(43%)	440	412(41%)
CHURCHILL	-	25(5%)	30(3%)	33(3%)
THUNDER BAY				
Export	520 2/ (50%)	250(52%)	380(40%)	380(47%)
Domestic	-	-	107(11%)	192(19%)
Total	-	-	487	572
TOTALS				
Export	1,040(100%)	480(100%)	850	825 5/
Domestic	-	-	107	195
Grand Total	-	-	957(100%)	1,020(100%)

Notes:

1/ Westburn forecasts export split of 38% West Coast, 41% Atlantic, and 21% in either direction.

2/ Including Churchill.

3/ The Council has another scenario with 55% of exports via the West Coast.

4/ For 2000, not 1985.

5/ Includes 3 million bushels via West Coast.

EXHIBIT III-3
Key Movements of Principal
Western Canadian Grains 1985/86
Low Forecasts

	1985/86 LOW FORECASTS (MEAN VALUES) - THOUSANDS OF METRIC TONNES						
	WHEAT	OATS	BARLEY	RYE	FLAXSEED	RAPESEED	TOTAL
EXPORTS							
Churchill	480	-	160	-	-	-	640
Thunder Bay*	7,040	140	2,260	70	370	270	10,150
Prince Rupert, Vancouver	7,560	-	2,000	130	120	1,030	10,840
Total Exports	15,080	140	4,420	200	490	1,300	21,630
DOMESTIC							
Thunder Bay*	1,940	420	780	50	70	10	3,270
TOTALS							
East Ports	9,460	560	3,200	120	440	280	14,060
West Ports	7,560	-	2,000	130	120	1,030	10,840
Grand Total	17,020	560	5,200	250	560	1,310	24,900

* Thunder Bay							
By Vessel	8,800	360	2,810	120	440	280	12,810
By Rail	180	200	230	-	-	-	610

EXHIBIT III-4
Key Movements of Principal
Western Canadian Grains 1985/86
High Forecasts

	1985/86 HIGH FORECASTS (MEAN VALUES) - THOUSANDS OF METRIC TONNES						
	WHEAT	OATS	BARLEY	RYE	FLAXSEED	RAPESEED	TOTAL
EXPORTS							
Churchill	570	-	200	-	-	-	770
Thunder Bay*	8,630	170	2,760	90	450	330	12,430
Prince Rupert, Vancouver	9,250	-	2,440	160	150	1,250	13,250
Total Exports	18,450	170	5,400	250	600	1,580	26,450
DOMESTIC							
Thunder Bay*	1,940	420	780	50	70	10	3,270
TOTALS							
East Ports	11,140	590	3,740	140	520	340	16,470
West Ports	9,250	-	2,440	160	150	1,250	13,250
Grand Total	20,390	590	6,180	300	670	1,590	29,720

* Thunder Bay							
By Vessel	10,390	390	3,310	140	520	340	15,090
By Rail	180	200	230	-	-	-	610

EXHIBIT III-5
Key Movements of Principal
Western Canadian Grains 1977/78
Actuals (Preliminary)

	THOUSANDS OF METRIC TONNES - ACTUALS						
	WHEAT	OATS	BARLEY	RYE	FLAXSEED	RAPESEED	TOTAL
EXPORTS							
Churchill	666	-	26	-	-	-	692
Thunder Bay*	8,512	73	2,019	132	153	81	10,970
Prince Rupert, Vancouver	6,061	5	1,205	138	98	931	8,438
Total Exports	15,239	78	3,250	270	251	1,012	20,101
DOMESTIC							
Thunder Bay*	937	361	908	11	32	-	2,249
TOTALS							
East Ports	10,115	434	2,953	143	185	81	13,911
West Ports	6,061	5	1,205	138	98	932	8,439
Grand Total	16,176	439	4,158	281	283	1,013	22,350

* Thunder Bay							
By Vessel	9,037	353	2,715	142	185	79	12,511
By Rail	412	81	212	1	-	2	708

3. GRAIN VOLUMES FLUCTUATE FROM YEAR-TO-YEAR

The projections described above are forecasts of conditions in average years. Actual volumes moved fluctuate from year-to-year because of changes in harvest yields and world market conditions. A representation of the type of analysis that is required to account for these fluctuations is included in the Westburn reports. Their method was adopted and their probability distributions were applied to the low and high forecasts to gain an appreciation of the extent of these fluctuations. The results of the application of these probability distributions are shown in Exhibit III-6. For each of the high and low forecasts, three numbers are shown: a "bottom" value (with an 80 percent probability of being exceeded), the mean forecast, and the "top" value (with a 20 percent probability of being exceeded).

For the high forecast, which has been adopted as a basis for planning, the range is as follows:

HIGH FORECASTS FOR 1985/86 CROP YEAR
(Millions Of Tonnes)

	WEST COAST EXPORTS	EASTWARD EXPORTS	TOTAL EXPORTS	TOTAL MAJOR MOVEMENT* (INCLUDING EASTWARD DOMESTIC MOVEMENT)
Bottom	10.7	8.2	21.9	25.2
Mean	13.3	13.2	26.5	29.7
Top	15.8	17.2	31.2	34.5

It should be noted that the total exports shown are higher than the sum of east plus west ports for the bottom forecast, equal to their sum for the mean forecast, and less than their sum for the top forecast. This is because the bottom and top forecasts represent the likely range of fluctuations around the mean for a "bad" and a "good" year, respectively. A very low year for West Coast exports is likely to be partly offset by somewhat higher exports in the other direction. The numbers shown above are based on an analysis of past fluctuations.

System capacity requirements for the 1985/86 crop year, as assessed in this report, are based on the total major

* Excludes Prairie processing.

EXHIBIT III-6
Summary of Grain Forecasts

	WEST COAST EXPORTS		EASTWARD EXPORTS		TOTAL EXPORTS		TOTAL MAJOR MOVEMENTS*	
	Tonnes (000)	Change From 1977/78 Actual (%)	Tonnes (000)	Change From 1977/78 Actual (%)	Tonnes (000)	Change From 1977/78 Actual (%)	Tonnes (000)	Change From 1977/78 Actual (%)
1977/78 ACTUAL	8,439	--	11,662	--	20,101	--	22,350	--
1977/78 TREND LINE								
. Linear	7,854	- 7	11,860	2	19,722	- 2	22,628	1
. Exponential	7,886	- 7	12,706	9	20,430	+ 2	23,236	4
1985/86 PREDICTED								
Trend Line								
. Linear	9,817	16	16,762	44	26,594	32	29,023	30
. Exponential	10,776	28	25,148	116	33,976	69	34,361	54
Low Forecasts								
. Bottom**	8,680	3	6,440	-45	17,090	-15	20,360	- 9
. Mean	10,840	28	10,790	- 7	21,630	8	24,900	11
. Top**	13,010	54	14,390	23	26,150	30	29,420	32
High Forecasts								
. Bottom	10,700	28	8,210	-30	21,930	9	25,200	13
. Mean	13,250	57	13,200	13	26,450	32	29,270	33
. Top	15,830	88	17,180	47	31,230	55	34,500	54

Notes

* Includes domestic shipments through Thunder Bay and Armstrong
** Bottom and top values within each forecast are not additive across as they represent extremes.

movement mean forecasts (29.7 million tonnes), as well as the bottom and top forecasts (25.2 and 34.5 million tonnes, respectively). The top of the range is important because it provides a measure of the level of additional investment (e.g. more rail cars) which may be justified in order not to have to forego sales in good years; the bottom is important because it shows the "downside risk" in making investments which may not be utilized to the planned level as early as anticipated.

4. WESTWARD MOVEMENT WILL INCREASE MORE RAPIDLY THAN EASTWARD SHIPMENTS

The West Coast share of the export volume is expected to increase considerably more than for other ports. The splits previously developed for both the "low" and "high" forecasts assume a greater concentration on movement through West Coast ports in line with the faster growing markets in the Pacific area. The Canada Grains Council's split between eastward and westward movements was based on the average split in years 1973 to 1977, and did not take into account any shift in market patterns. The maximum West Coast volume to plan for in 1985 would seem to be about 16 million tonnes, representing an increase of 78 percent to 90 percent over the actual 1977/78 volume. For this analysis, 15.8 million tonnes is used for West Coast exports in analyzing port and railway line capacity at the top of the forecast range.

Eastward exports at the top range are about 17 million tonnes. The top planning figure for this analysis is 17.2 million tonnes for eastward exports plus 3.3 million tonnes for eastward domestic grain. This totals 20.5 million tonnes eastward through Thunder Bay and Churchill.

The estimates of 15.8 million tonnes westward and 20.5 million tonnes eastward represent the maximum projected volumes which would be carried by 1985. However, maximum total volumes are estimated to be 34.5 million tonnes. This estimate is somewhat lower than the sum of the eastward and westward estimates, 36.3 million tonnes, because of offsetting variations as described above. Therefore, in estimating system requirements such as overall car supply, as opposed to individual port or line requirements, the top, mean and bottom values have been normalized to the appropriate export totals, as shown in the following table:

1985/86 VOLUMES USED AS A BASIS
FOR CAR SUPPLY ESTIMATES
(Millions of Tonnes)

	WESTWARD	EASTWARD	TOTAL
Bottom	13.0	12.2	25.2
Mean	13.2	16.5	29.7
Top	15.0	19.5	34.5

The range defined by the bottom, mean and top estimates for the high forecasts, (as shown in tabular form in Exhibit III-6) is depicted graphically in Exhibit III-7.

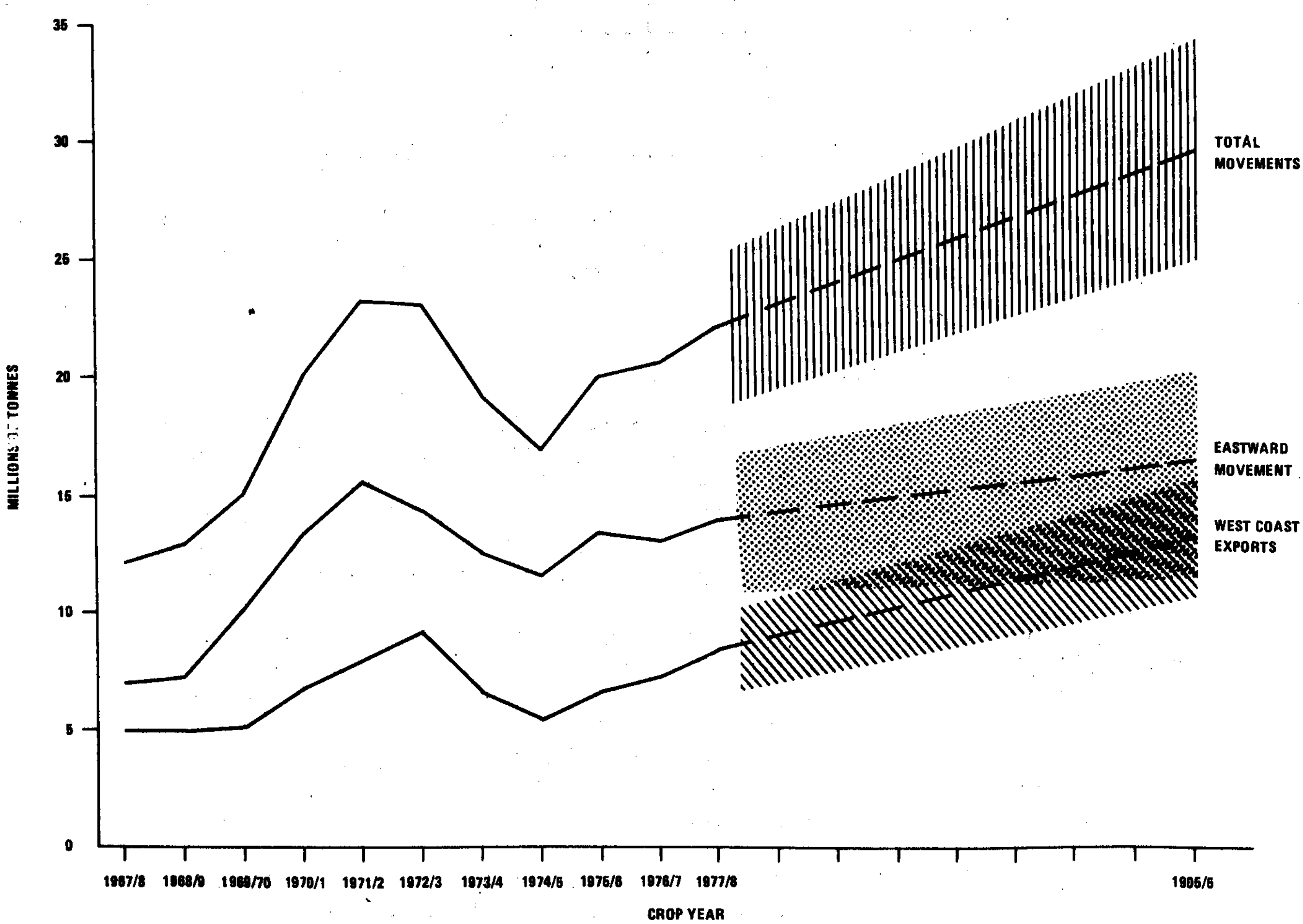
5. THERE ARE EMERGING PROBLEMS

As can be seen from Exhibit III-7, it is probable that the volume for eastward moving grain will be of the same magnitude as in the peak years of 1971/72. Few problems might be anticipated if capacity and operational efficiency in the terminals and local rail facilities in Thunder Bay, and on the rail lines to and from Thunder Bay, are maintained.

On the other hand, the volumes projected for West Coast movements are expected to be considerably higher than in either 1977/78 or the peak year of 1972/73. Given the congestion problem currently being experienced in Vancouver (ship demurrage charges of $18.4 million in 1977/78) and the limited capacity of the railways to and from the West Coast, increasing westward movements may create severe problems.

Given the expected increases in the total movement of grain, shortages of railway rolling stock and locomotives which are apparent today deserve a considerable amount of attention. The impact of branchline abandonments on capacity and on the operational efficiency of the entire system also needs to be considered. These areas are discussed in Chapters V through VIII.

EXHIBIT III-7
Expected Growth in Movement of
Principal Western Canadian Grains



IV. SYSTEM DYNAMICS

As outlined in Chapter II, the transportation of grain from the Prairies to the ports involves the interaction of several participants. To the extent the participants do not coordinate their activities, actions may become unsynchronized and cause a strain on system capacity.

An elaborate organization and decision-making framework has been established for the transportation of grain in Canada, since normal commercial incentives do not operate freely. This framework further complicates an already complex process and introduces additional opportunities for lack of coordination.

Buffers for those periods when there is lack of synchronization are: additional capacity in the port elevators, additional transportation capacity in terms of cars and other requirements to handle peaks, or a queuing of ships at the port. Each of these options is costly. Adequate buffer capacity in one port may require major investments in terminal elevator capacity. The provision of excess capacity in the form of freight cars is expensive not only in terms of car investments, but also in terms of yard and locomotive facilities. The queuing of ships results not only in the payment of ship demurrage,* but may also lead to lost sales if the situation is chronic. It is the queuing of ships which focuses the public's attention on grain problems. Queuing has been especially acute in Vancouver during this current crop year when the situation reached a crisis.

Since the queuing of ships at Vancouver is perhaps the most visible sign that the logistics system is not meshing well, a case study was made of the situation in Vancouver

* There is of course no demurrage on grain cars which accounts in part for their attractiveness as "rolling storage".

during the first twenty weeks of the 1978/79 crop year. In addition, a detailed computer simulation model was developed which allowed further analysis of the system and tested the impact of proposed or expected changes to the system.

1. QUEUING OF SHIPS IS SYMPTOMATIC OF PROBLEMS IN THE SYSTEM

The queuing of ships in port may indicate a number of problems. The terminal elevators generally blame the railways for not bringing enough cars to the port, and the railways blame the elevators for not unloading cars fast enough or on a seven-day schedule. Both blame the CWB for ordering the wrong grains in the first place, and the CWB blames all the players including the shipping lines for bunching their arrivals. Often all are right. The principal causes of ship queues can be summarized as follows:

- There is bunching of ship arrivals.
- The grain in the terminal elevator bins is not the grain required for the ships in queues. (Ownership problems for Non-Board grains may be involved.)
- Railcar unloading capacity or rate of unloads is inadequate. (There may be insufficient hours of operation.)
- The cars available for unloading in the port may be the wrong cars or there may be an insufficient number of cars. (This may reflect rail line capacity limitation, or locomotive or car shortages in the country.)
- The wrong grain may have been ordered in the country for the arriving ships. (This may occur because the lead time for delivery in the country is longer than the lead time available for accurate ETA's on incoming ships.)
- The right grain may have been ordered, but the wrong grain was delivered in the time frame for loading ships without paying demurrage. (This may be caused by loose planning and control processes, by shipments of the wrong grain, by rail ways moving grains on a LIFO basis, or by a

difference between the grading of grains by the Grain Commission inspectors and the primary elevator staff.)

- There is insufficient storage capacity to handle assortment of grades and peak demands.

These issues were examined in the case study covering Vancouver for the first 20 weeks of this crop year. The Vancouver case study is discussed in detail in Appendix B. A summary of the case study is presented below.

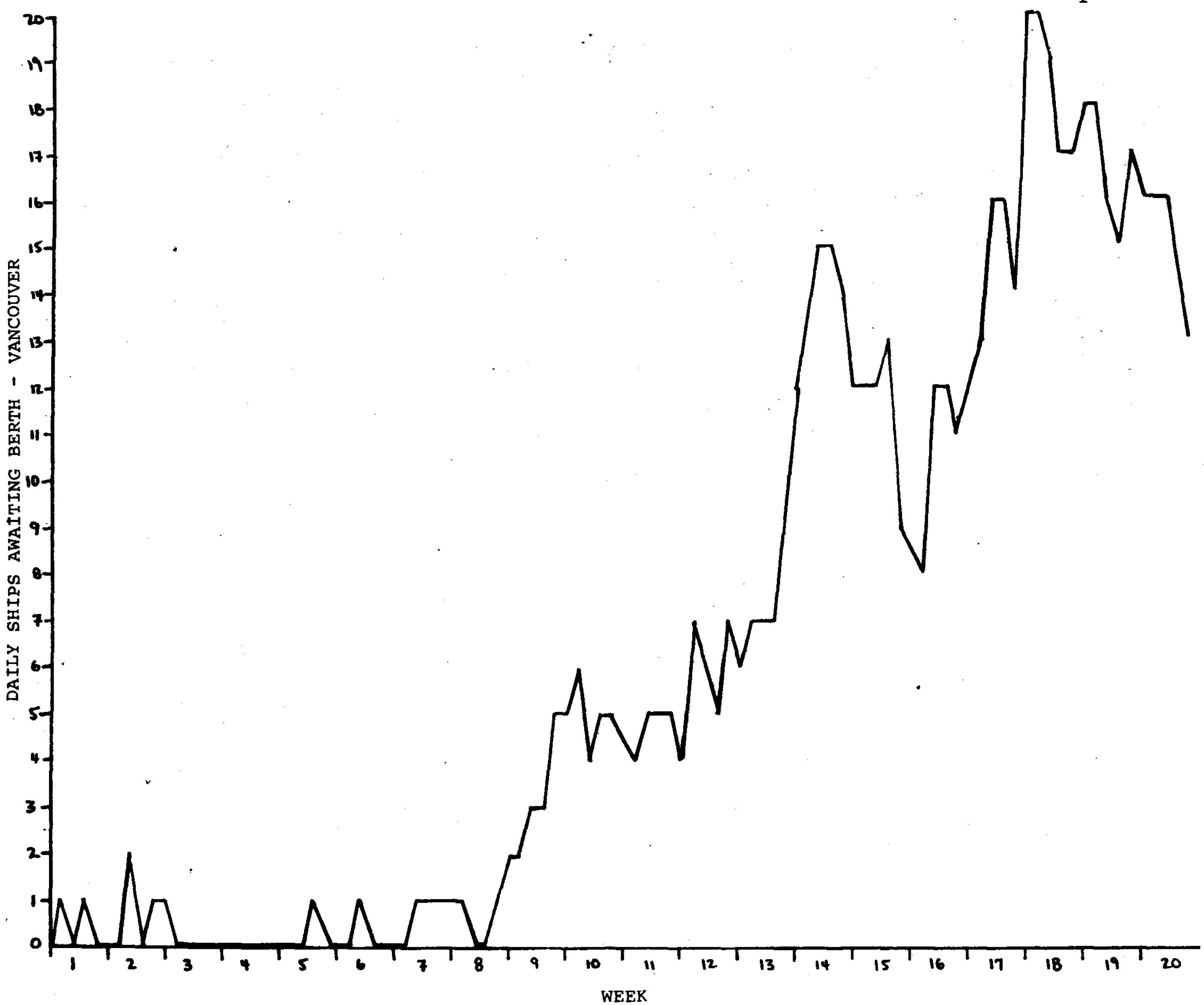
2. VANCOUVER CASE STUDY REFLECTS DYNAMICS OF LOGISTIC SYSTEM

During the course of the 1978/79 crop year, severe vessel delays occurred in Vancouver. Rather than risk Canada's reputation by not meeting grain export contract commitments, the CWB chose not to bid on some Japanese contracts. In the prior crop year the Wheat Board claimed it had foregone about one-half billion dollars in export sales due to the uncertainty of satisfying export delivery commitments at the ports. Additionally, in the 1977/78 pool accounts, the Wheat Board incurred $18.4 million in vessel demurrage on the West Coast. This expense reduced the ultimate payments to producers for the year. The lost sales and demurrage payments are of great concern to the producers, as well as to the grain trade and to the general economy of Canada.

In early December 1978, the number of vessels waiting in Vancouver (Exhibit IV-1) rose to twenty and, reflecting their concern, the Wheat Board called a widely publicized special meeting of the key participants in Vancouver in an effort to effect an immediate improvement as well as to consider longer range solutions to the problems of meeting vessel commitments on the West Coast.

This case study sheds light on the specific factors contributing to Vancouver's problems during the first 20 weeks of the crop year and provides insight into the dynamics of the interrelationships among key elements of the grain movement process from the country loading program through to the loading of vessels.

EXHIBIT IV-1
Vessels Waiting
Vancouver
Crop Year 1978/79



(1) <u>Grain Vessels Waiting for Berths Reflect Complex and Interrelated Problems</u>

As is shown in Exhibit IV-1, the number of grain vessels waiting for a berth was relatively insignificant in this current crop year until week 9. The queue grew until the beginning of week 18 when there were 20 grain vessels waiting for berths in Vancouver.

It was in week 19 that the Wheat Board called the special meeting to discuss the situation in Vancouver. The most immediate problem at that time appeared to be a reduction in the unloading of cars at the terminal elevators as a result of labor problems in the port.

At that meeting it was also noted that for August and September 1978, there had been few delays to vessels. It appeared that the buildup of vessels starting in the ninth week and continuing to week 18 was the combined result of:

- Bunching of vessels in that week
- Arrivals of vessels for grains other than what was in the majority of bins in the terminal elevators
- Drop off in unloads at the elevators immediately preceding week 19.

In the past, queues of vessels were alleged to have built up as a result of railway problems; however, this crisis was acknowledged to result from other than railway problems. Concern was expressed that the situation might soon get worse with the onset of winter and resulting difficulties railways experience with extreme cold and snow in the Prairies and through the mountains.

Steps were taken in that meeting to temporarily combine some of the protein grades to improve the throughput of the elevators so that the grain types in the elevators could be loaded on vessels and terminal stocks of wheat could be refilled for the vessels waiting for high protein.

(2) Grains Sought by the Ships in Queue Vary Through The Period

The chart shown in Exhibit IV-2 illustrates that grain requirements for the waiting vessels varied through the period. The minor delays in the first eight weeks were primarily for high protein wheat destined for Japan. Vessels waiting for low protein wheat for delivery to China experienced brief delays in weeks 1 through 3. The buildup in weeks 9 through 11 consisted almost exclusively of vessels waiting for low protein wheat.

From week 12 on there were vessels waiting for high protein, low protein, and other grains (barley, rapeseed, etc.). Starting in the 12th week, there was a gradual buildup of vessels for high protein wheat to meet Japanese contracts, with fluctuations until week 20 when it reached ten vessels.

There are two reasons grain vessels may be delayed:

- Vessel arrivals exceed berth capacity.
- Inadequate supply of desired grains in elevators at available berths.

1. Vessel Arrival Patterns Affect the Buildup Of Queues

If vessel arrivals are bunched, delays may be expected. Exhibit IV-3 shows daily grain vessel arrivals with the number of vessels in queue each day. From this chart, it appears that in general up to three vessel arrivals per day can be handled without significant delay when the port is fluid as it was in the first eight weeks. Analysis of daily changes in the queue and vessel arrivals indicate that, overall, the bunching of vessel arrivals may be a problem if four or more vessels arrive on any one day. Except in these extreme cases, representing only seven percent of the days in the period, the fluctuations in the number of vessels awaiting a berth appear to be a function of factors other than arrivals.

EXHIBIT IV-2
Vessels Waiting By Grain Types
Vancouver Crop Year 1978/79

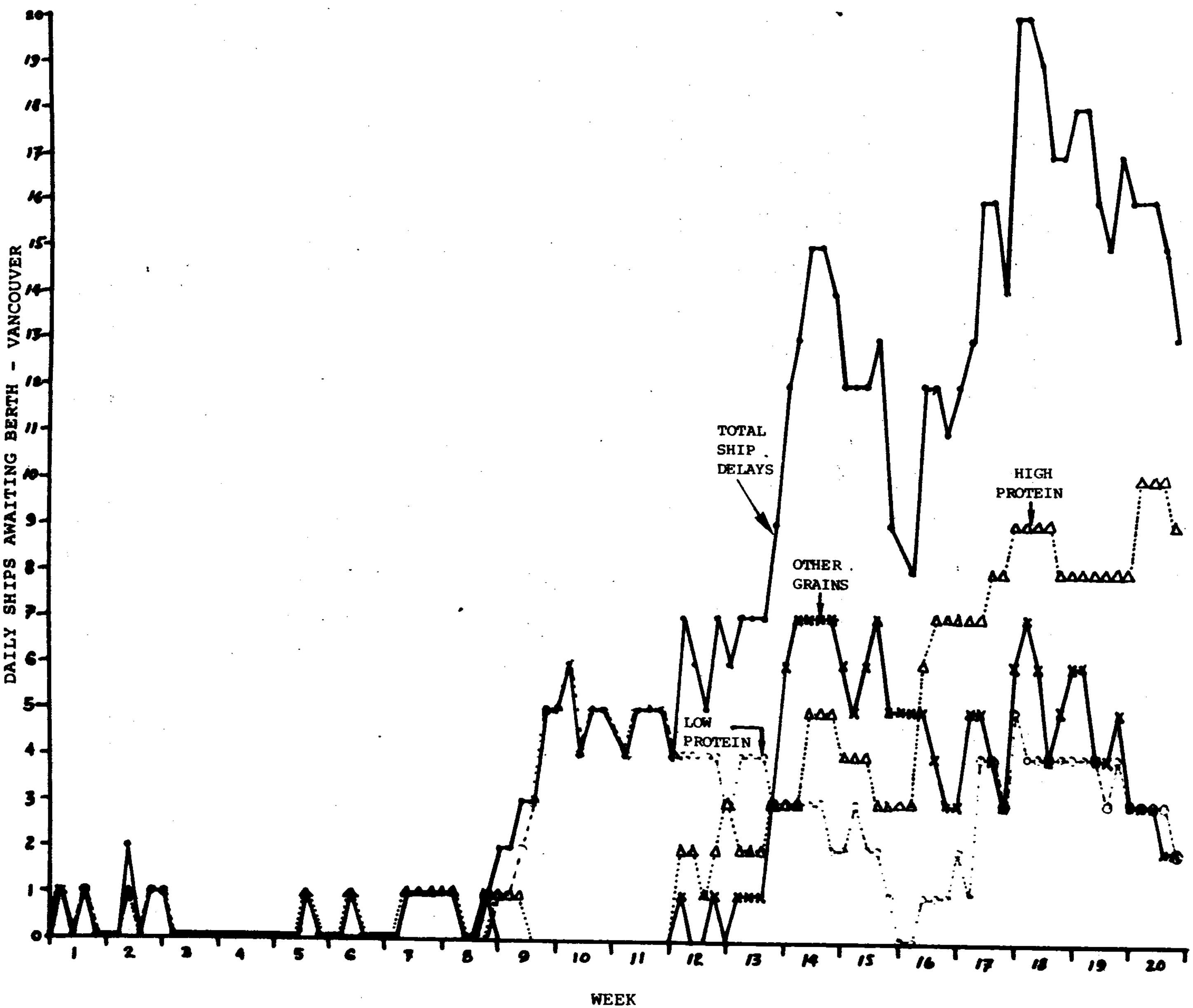
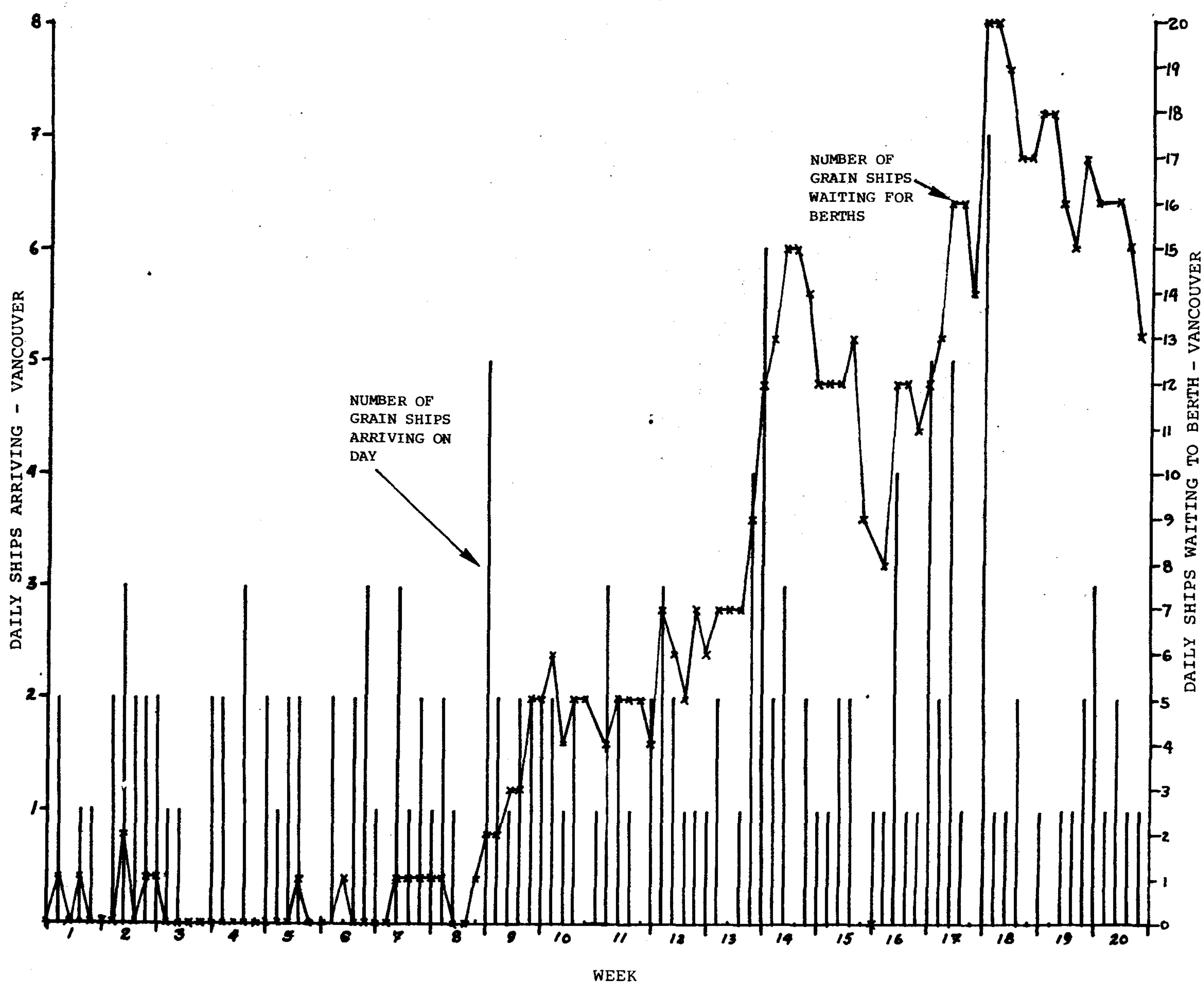


EXHIBIT IV-3

Vessel Arrivals vs
Vessels Waiting
Vancouver, 78/79 Crop Year



One hypothesis was that ship arrival patterns are biased by the day of the week or month. To test this, a sample was taken of 137 vessels arriving in weeks 5 to 22 of the 1978/79 crop year. This sample showed a slight drop off of arrivals over the weekend but otherwise no particular pattern by day of the week.

Likewise, an analysis was made of arrival patterns by working days of the month. Of the 137 vessels observed, 42 arrived in the first one-third of the month, 52 arrived in the next seven working days, and 47 arrived in the last one-third of the month. This suggests that there is not any systematic bunching in arrivals. When bunching does occur, as experienced in Vancouver during the last weeks of 1978, it appears to be random.

2. Ships Seeking High and Low Protein Wheat Waited Longer on the Average Than Ships Seeking Other Grains

An examination of the queue buildup in relation to daily vessel arrivals by grain type is discussed in Appendix B which indicates that, in the case of low protein and high protein wheat, queues appear to have been the result of not having the proper protein grade at elevators with available berths rather than the bunching of vessel arrivals. In contrast, the queue of vessels waiting to load other grains appears to be more closely related to bunching of arrivals. Since some of the other grains are handled by only one terminal elevator in Vancouver, one might expect to find longer queues with the other grains than with the wheat. On investigation, the queuing problems for other grains during this sample period were determined to be far less significant than for vessels loading high protein and low protein wheat. The following table reflects this intriguing situation.

VESSEL DELAYS IN VANCOUVER BY GRAIN TO BE LOADED

GRAIN TYPE	TOTAL VESSELS ARRIVING IN PERIOD	TOTAL VESSEL DAYS AWAITING BERTH[1/]	AVERAGE VESSEL DAYS IN QUEUE[2/]	TONNES BY TYPE (000)	AVERAGE TONNES PER VESSEL (000)
Low Protein[3/]	37	193	5.2	975	27
High Protein[4/]	36	263	7.3	514	15
Other Grains[5/]	86	176	2.1	1,356	16
Total	159	632	4.0	2,845	18

Vessels coming to Vancouver to load high protein during the first 20 weeks averaged 7.3 days (exclusive of weekend days) waiting for a berth. Vessels seeking low protein averaged 5.2 days in queue; however, ships to load other grains were delayed only 2.1 days. Although 54 percent of the vessels arriving in Vancouver in this period were to load other grains, they received only 28 percent of the delays.

1/ Does not include weekend days (20 week sample)

2/ In some cases, partially loaded vessels are shown as waiting for another berth to finish loading

3/ Low Protein group consists of 1R, 2R less than 13.5% protein plus 3R

4/ High Protein group consists of 1R and 2R greater than 13.5% protein

5/ Other grains include rapeseed, flax, durum, barley, etc.

3. FACTORS OTHER THAN BUNCHING OF SHIP ARRIVALS INFLUENCED SHIP QUEUES IN THE CASE OF LOW AND HIGH PROTEIN

In an attempt to understand the causes behind the buildup of vessels waiting in Vancouver for low and high protein during the weeks 9-20 of the current crop year, several questions, in addition to whether ship arrivals exceed berth capacity, were proposed for examination:

- Were terminal stocks sufficient to meet the demand?
- Did the terminal elevators unload cars quickly enough?
- Did the railways deliver enough cars?
- Was the country loading program sufficient to support this demand or were other types and grades or ports given preference?

Analyses of these questions are discussed in Appendix B.

In essence, a number of factors contributed to the buildup of vessels in Vancouver, particularly during the latter peak period. Additional vessel arrivals in an already congested port terminal delayed the high and low protein grains. However, it turns out that vessel loadings for other types and grades of grain were taking place at the same time. Also, terminal stocks were low considering demand. Part of this problem might have been rectified had stocks normally destined for the West Coast not been sent to Thunder Bay.

In addition, unloading rates were below normal due partly to the labor problems. Finally, the country loading programs for these types and grades were substantially less than required during the critical weeks.

The case study suggests several issues which are analyzed in greater detail in the remainder of the report, including the following:

- If ship arrival patterns are random, do the contracts provide adequate notification of estimated time of arrival (ETA)?
- Is the response time of the logistics system such that reasonable ETA's for ships can be used effectively to update planning of the flows to the port?

- Is the information on country stocks sufficiently precise as to grades and probable protein levels to permit matching car orders to expected ship arrivals?

- Are there enough cars?

- Are car shortages and shortfalls plus lack of sufficient forward planning and inadequate inventory management frustrating the planning process so completely that control is lost?

- Are car movements delayed due to low priorities for grain on congested main lines and yards and for locomotives?

- Can car unloadings and cleaning and drying at the terminal elevators be speeded up to increase throughput at the elevators and expedite ship loading?

- Are the other ports subject to the same concerns as Vancouver?

- Will future volumes make the present problems more acute?

4. A COMPUTER MODEL WAS DEVELOPED TO TEST THE DYNAMIC INTERACTIONS OF THIS SYSTEM

The Vancouver case study illustrates the many interfaces between the participants and the roles played by each in creating the problems which prompted the special emergency meeting of key participants in Vancouver in December 1978. To better analyze the dynamic interactions of the various elements, a computer model was developed to simulate the effects of alternative strategies on these key elements and on the operation of the overall system. Through the use of this model, it was expected that the impact of changes in parameters and operating strategies could be tested. By making a number of runs of this model, the effects of many different changes could be measured.

(1) Model Logic Was Developed Conforming to Reality

The grain transport and handling computer model which was developed covered the main elements of the grain handling and distribution system:

- Ordering and loading of cars at the primary elevator
- Railway movement
- Terminal operations and processing of grain in the port
- Ship arrival and loading.

This model simulates all significant elements of the grain handling system including capacity limitation due to limited car supply, the ability to deliver, load and pick up cars in the country, congestion and delays on the main lines, dispatch and holding yard limitations in the ports, and the capacities of the various processes within each terminal as well as ship loading. A more detailed outline of model logic is contained in Appendix C to this report.

(2) Four Runs of the Model were Made

The model was developed so that various adjustments/modifications in the parameters of the system and the demand placed on the system could be changed, either singly or in combination, and the impacts measured objectively. Four model runs were performed, all concentrating on the movement of grain through Vancouver although the model has been developed in such a way that it would be applicable to all ports. Exhibit IV-4 shows the principal input parameters used in the model runs and the major output statistics for the four major applications of this model.

EXHIBIT IV-4
Summary of Vancouver
Model Runs

	1978 BASE CASE	1985 CASE #1	1985 CASE #2	1985 CASE #3
INPUT PARAMETERS				
Annual Grain Volume (millions of tonnes)	7.4	14.0	14.0	14.0
Number of Railway Cars Available for Service CN/CP	3,496/3,070	3,496/3,070	5,215/5,054	5,215/5,054
Terminal Capacity	1978 Actual	1985 Projected	1985 Projected	1985 Improved *
Line Capacity (CN/CP Cars per day)	250/300	250/300	250/300	250/300
OUTPUTS				
Car Cycle Time (days) CN/CP	21/19**	19/17	26/21	24/19
Average Time Ships In Port (days)	12.9	53.2	40.4	32.7
Queue of Ships At End of Simulation	5	214	104	50
Average Percent Utilization of Terminal Processes				
Car unloading	62	49	59	53
Grain cleaning	62	53	74	66
Grain drying	46	53	70	61
Ship loading	53	39	56	37
Limiting Factor	--	Car Supply	Terminal Throughput	Line Capacity

* Capacities and hours of operation improved as shown in Exhibit IV-5

** Times excluding waiting times at primary elevators are 20 days and 18 days for CN and CP, respectively.

1. <u>A 1978 Base Case was Run to Validate the Model</u>

This first run of the model was a simulation of what actually happened in 1978. In this particular case, although the model allows cars to be added or removed from the system throughout the year, the car supply available was kept at the high (July) level for the entire year. Line capacities for the two railways were estimated to be approximately 250 grain cars per day on the CN route to Vancouver and 300 on the CP.

The results of this run indicate that the model does realistically represent the system. The estimated car cycle times are 20 days for CN and 19 for CP. When the additional waiting time at the elevators caused by the slightly higher than actual car supply is removed, the cycle times of 20 and 18 days, respectively, are very close to those measured in this project. On the average, ships were estimated to spend 12.9 days between arrival and departure, also a relatively realistic figure. The queue size varied from time to time; at the end of the period, there were only five ships. The overall percentage utilization of the various processes in all terminals is shown in Exhibit IV-4. These are underestimates of utilization because the facilities in an individual terminal may be 100% busy at the same time a facility in another terminal is underutilized.

2. <u>1985 Case 1 Indicated Increased Car Requirements</u>

In this run, the only major parameters changed from 1978 were the grain volumes required and the terminal capacities. The grain volume was set at 14 million tonnes, representing the top range of the high forecast for West Coast movement without construction of a major new terminal in Prince Rupert.

The throughput rates used for this model run were as follows:

1985 CASE 1 THROUGHPUT RATES

	SWP	AWP	PAC	UGG	PIO
Car Unloading (Cars/shift)	120	150	140	50 *	100
Grain Cleaning (tonnes/hour)	665	400	475	480	500
Grain Drying (tonnes/hour)	80	50	48	50	19
Ship Loading (tonnes/hour)	2,900	1,600	2,125	1,360	3,240

In this run the number of shifts worked per week in 1985 on each process in all elevators was similar to that during normal use in 1978. The number of shifts was as indicated below:

1985 CASE 1

	SHIFTS PER WEEK
Car Unloading	10
Grain Cleaning	15
Grain Drying	21
Ship Loading	5

The results of this model run indicated that by increasing volumes to 1985 levels without adding to car supply, the car supply became the major bottleneck. By the end of the simulation period, over 200 ships queued in Vancouver.

* Information supplied to study team. This estimate was later updated to 100 cars per shift. This would not significantly change the results of cases 1 and 2. For case 3, the imbalance between unloading and other operations was noted and the number of shifts doubled.

3. <u>1985 Case 2 Showed the Limitations Introduced by Terminal Throughput Restrictions</u>

In this case, the number of available cars in the West Coast portion of the system was changed from 5,600 to 10,300, with a much higher proportion of hopper cars than in 1978. This figure represents the Vancouver share of the total fleet that was estimated to be required in 1985 with no improvement in cycle times. Terminal capacities and hours of operation were as in the 1985 Case 1.

In this case, car supply was no longer the bottleneck. A large number of cars was waiting to be unloaded in the port. Terminal throughput rates were now the critical constraint. Because of this, car cycle times increased to 26 days for CN and 21 days for CP. By the end of the period, 104 ships were waiting in the port.

4. <u>1985 Case 3 Moved the Bottleneck to Main Line Capacity Restriction</u>

In this case, demand and car supply were as provided in the 1985 Case 2. To overcome the bottleneck of terminal capacity noted in Case 2 the hours of operation and some of the physical operating characteristics of the terminals were improved as follows:

<u>Shifts Per Week in 1985 Case 3</u>

	SWP	AWP	PAC	UGG	PIO
Car Unloading	14	10	10	20	10
Grain Cleaning	15	20*	20	15	15
Grain Drying	21	21**	21	21	21+
Ship Loading	7	14	7	10	5

---

* Cleaning rate also incrased to 600 tonnes/hour

** Drying rate also increased to 75 tonnes/hour

\+ Drying rate also increased to 50 tonnes/hour

Otherwise demand and car supply were the same as for the 1985 Case 2.

This case showed that if existing and committed Vancouver terminals were operated with existing shifts, if the other improvements were made, and if sufficient cars were available, this system would still not be able to accommodate the projected 1985 volume of grain. Ship queues are considerably reduced in this run to a range between 25 and 50 vessels waiting. While still excessive, queues of this magnitude presently occur. Examination of the computer run indicates that the system is only marginally in balance even with extra shifts, and extra facilities. Line capacity became the single most limiting factor in this particular model run.

(3) <u>The Model Identified the Need both for More Cars and Expanded West Coast Terminal Capacity — Added Cars Alone Will Not Be Enough</u>

The main finding of these model runs and related analyses was that running the Vancouver terminals "flat out", even with additional rail cars and committed expansion plans, would not meet West Coast grain delivery targets in 1985 at the top end of the high demand forecast. In the third 1985 case, the demand was almost reached, but this was before any consideration of interruptions because of weather, strike, or other problems included in the analysis.

Capital investment in additional West Coast terminal facilities therefore appears to be required if the risk of lost sales is to be avoided. The fact that rail line capacity appears to be a major bottleneck indicates that perhaps the new terminal facilities should be located somewhere other than Vancouver. This question is discussed more thoroughly in subsequent chapters of this report.

* * * * *

The model also proved to be a valuable tool in that the impacts of many different types of changes could be quickly assessed once the basic structure and parameters had been determined. The structure of the model is such that it can also be easily applied to other ports.

V. GRAIN CAR CYCLES

In the course of these analyses, much attention has been directed at developing a better understanding of car cycle times (load to unload to reload) for grain movements since on an overall basis the excessively long elements in the car cycle represent potential bottlenecks in the system. Analysis of car cycles provides insight into the location and nature of existing capacity constraints in both the rail and elevator systems, identifies shortcomings in the planning and allocation of cars, and permits quantification of these problems.

1. THE GRAIN CAR CYCLE IS USED AS A FRAMEWORK FOR ANALYSIS

The areas under analysis in this project and many of the basic issues involved in the movement of grain can be related through their effect on the events of the car cycle and the elapsed times between these events.

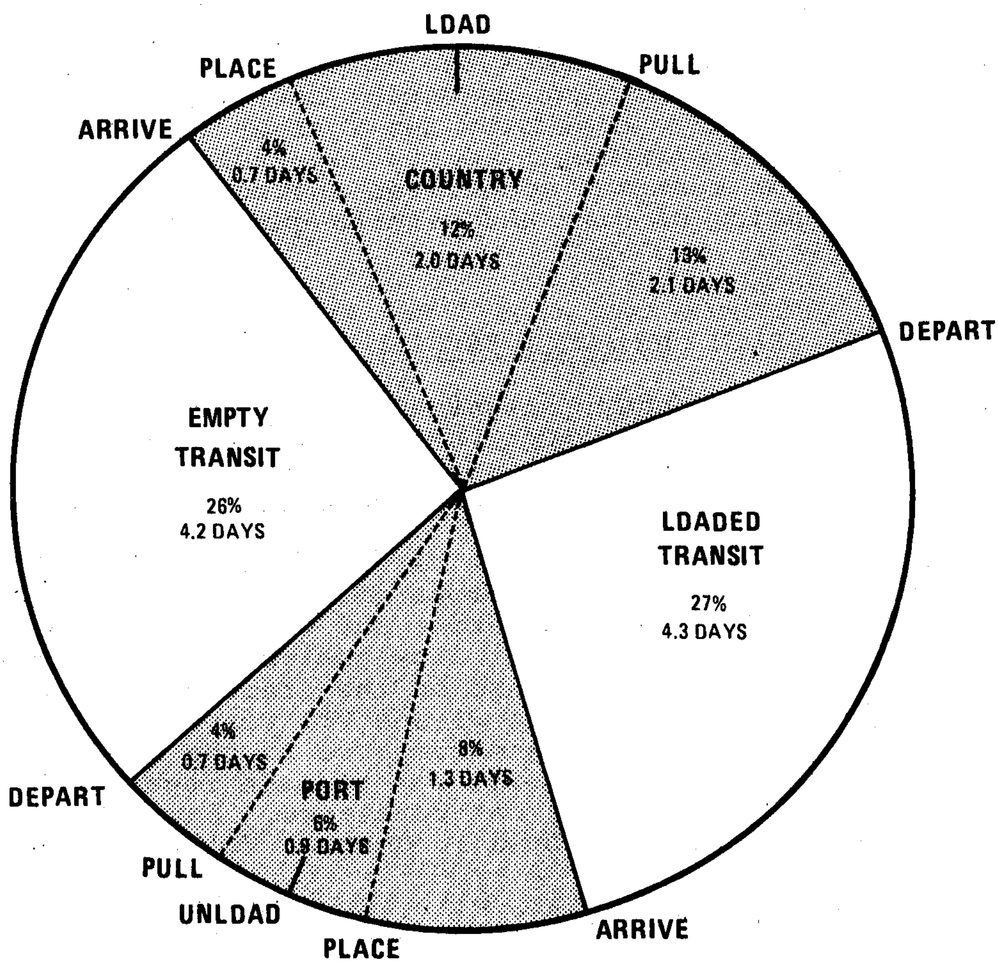
Analysis of the actual car cycle provides the means to rank the importance of various aspects of the car cycle in terms of where cars spend time and where improvements may be made based on specific car flow analyses. The effects of operations in the ports and on the Prairies on car cycles are discussed in Chapters VI and VII respectively. When the car cycle is evaluated and compared to the age of fleet and to the forecast, judgements can be made regarding car requirements and the timing of car purchases. Estimates of car requirements are presented in Chapter VIII.

The car cycle begins with an authorization from the Canadian Wheat Board to load a car. Upon authorization empty cars are directed to grain loading blocks initiating the cycle. The following sections define the car cycle components (see Exhibit V-1) in terms of where the activities are related, in the country, in transit, and at the port.

(1) Operations in the Country Areas Can Be Related to Five Events of the Car Cycle

The analysis of country operations focuses on producers, primary elevators, and railway local yard

EXHIBIT V-1
Grain Car Cycle Relationships



TOTAL CYCLE 16.2 DAYS*

*BASEO UPON CN THIRD QUARTER DATA (CN OATA BASE PROVIOES DETAIL OF COMPONENTS AS SHOWN, CP OATA BASE OOES NOT).

and train operations. The five events of the car cycle which relate to these analyses are:

- Arrival - This is the first country event in the empty car cycle and represents the transfer from main line control to local operations control by the railway.

- Placement - This event focuses on the railways' performance in delivering cars to primary elevators and represents a transfer of car control from the railway to the primary elevator company.

- Loading - This event is under the control of the primary elevator manager. When coupled with information on authorization, this event can be used to compare the type of grain and grade loaded to that authorized. Additional tabulations of car load information by origin/destination and type of grain provide a market profile. The load event signals the availability of the car for rail movement.

- Pull - This event begins the movement of the loaded car and focuses on the railway performance in pickup of cars from primary elevators.

- Departure - This is the last country event which represents the transfer of the loaded car from local rail operations to main line movement.

(2) The Main Line Operation of the Railway Can be Related to Four Events in the Car Cycle

The analysis of main line operations focuses on both the loaded and empty transit movement in terms of delays to cars due to main line capacity limitations and shortage of power between country points and the port area as well as delays at intermediate yards. The car cycle elements which relate to this analysis are:

- Departure of the loaded car from the country

- Arrival at the port area.

- Departure of the empty car from the port area

- Arrival in the country.

This analysis is also supported by examination of railway train sheets which list the number of trains on various segments, the elapsed times from point to point, and the location and duration of delays. Main line capacity and locomotive requirements are analyzed in Chapter VIII.

(3) The Port Area Analyses Can be Related to Five Events in the Car Cycle

The analysis of port operations covers elevator unloads, capacity, throughput, and off loads to vessels, and railway arrival of cars at the port yards through movement to the elevators. The five events in the car cycle which relate to this analysis are:

- Arrival - This is the first event in the port area cycle which represents the transfer of the loaded car from the railway main line movement to the control of railway terminal management. This event defines the inventory of cars available for the elevators.

- Placement - This event represents a transfer of control from the railway to the terminal elevator company and relates railway service and schedules to elevator operations.

- Unload - This event changes the status of the car from load to empty and represents the work by the terminal elevator. Unloads can be compared (by grain type and grade) to the authorizations to evaluate misshipments and misgrades. This unload event signals the availability of the empty car for rail movement.

- Pull - This event begins the empty car movement and focuses on the performance of the railway in pickup of empty cars from the elevators.

- Departure - This is the last event in the port cycle and represents the return of the car to the main line for the empty transit move to the country.

See Chapter VII for the discussion of port operations.

2. ACTUAL CAR CYCLE DATA FOR 1978 WAS GATHERED FROM THE RAILWAYS AND THE CANADIAN WHEAT BOARD

The data gathering phase of the car cycle analysis focused on developing a data base to permit quantification of the events in the car cycle.

Since there was no single source of data which provided a complete history of the car cycle to satisfy the goals of this analysis, information was gathered from the railways and the Wheat Board.

(1) Detailed Requests were Made of the Railways to Provide Data for All Grain Movements in 1978

Requests were submitted to CN Rail and CP Rail for the following information on car cycles by quarter for calendar year 1978:

- Origin—all country loading stations aggregated by grain blocks
- Destinations—unloading stations by port
- Commodity Type—all Board and Non-Board grains
- Equipment—car number and initial for grain box car and CNWX-CPWX covered hoppers.

Each railway was requested to supply the most detailed data available on the elements of the car cycle described in the previous section as well as summaries of cycle components:

- Transit time empty
- Time in country area
- Transit time loaded
- Time in port area

The railway data bases are significantly different and warrant an explanation. The CN utilizes a demurrage based system for monitoring all car movements. This system enables the CN to track cars through all the loaded and empty car cycle movements cited in Section 1 of this chapter. The CP does not utilize a demurrage based data system for grain car movements. As a result, certain components of their loaded and empty car movement records are aggregated. The aggregation inhibits analysis of certain components, at the port and country where arrivals and departures are used to define the times in those areas, without details of placement and pull.

The differences in reporting systems make direct comparisons of subsets of CP and CN country and port times inappropriate. The comparisons are valid, however, on an overall basis.

The railway specific data presented in a later section focuses on the third quarter times representing the higher volume period which establishes the requirements for number of cars.

(2) <u>The Wheat Board Provided Comparable Loaded Cycle Component Data for All Railways</u>

The Canadian Wheat Board (CWB) provided details on individual cars originated by the four railways; Canadian Pacific (CP), Canadian National (CN), Northern Alberta (NAR), and Great Slave Lake (GSL). The CWB records begin with the authorization to load a car and include the load and unload times by:

- Point of origin (block and railway)
- Grain (type and grade, loaded and unloaded)
- Destination (each port and all other destinations).

From this data comparisons can be made of the loaded portion of the cycle time—the authorized to load, authorized to unload, and the load to unload times.

The data gathered consisted of a sample of winter, spring, summer, and fall of 1978 from the Canadian Wheat Board block audit files.

The CWB data, presented in the next section, places the various port, season, and railway aspects of the car cycle into perspective.

3. THE LOADED PORTION OF THE CAR CYCLE DIFFERS BY DESTINATION, SEASON, AND RAILWAY

Analysis of the loaded component of the car cycle, as shown in more detail in Appendix D, was carried out as described below based on the Wheat Board data for CN, CP, NAR, and GSL. The analysis is structured by port, season, and railway, so that generalized comparisons can be made.

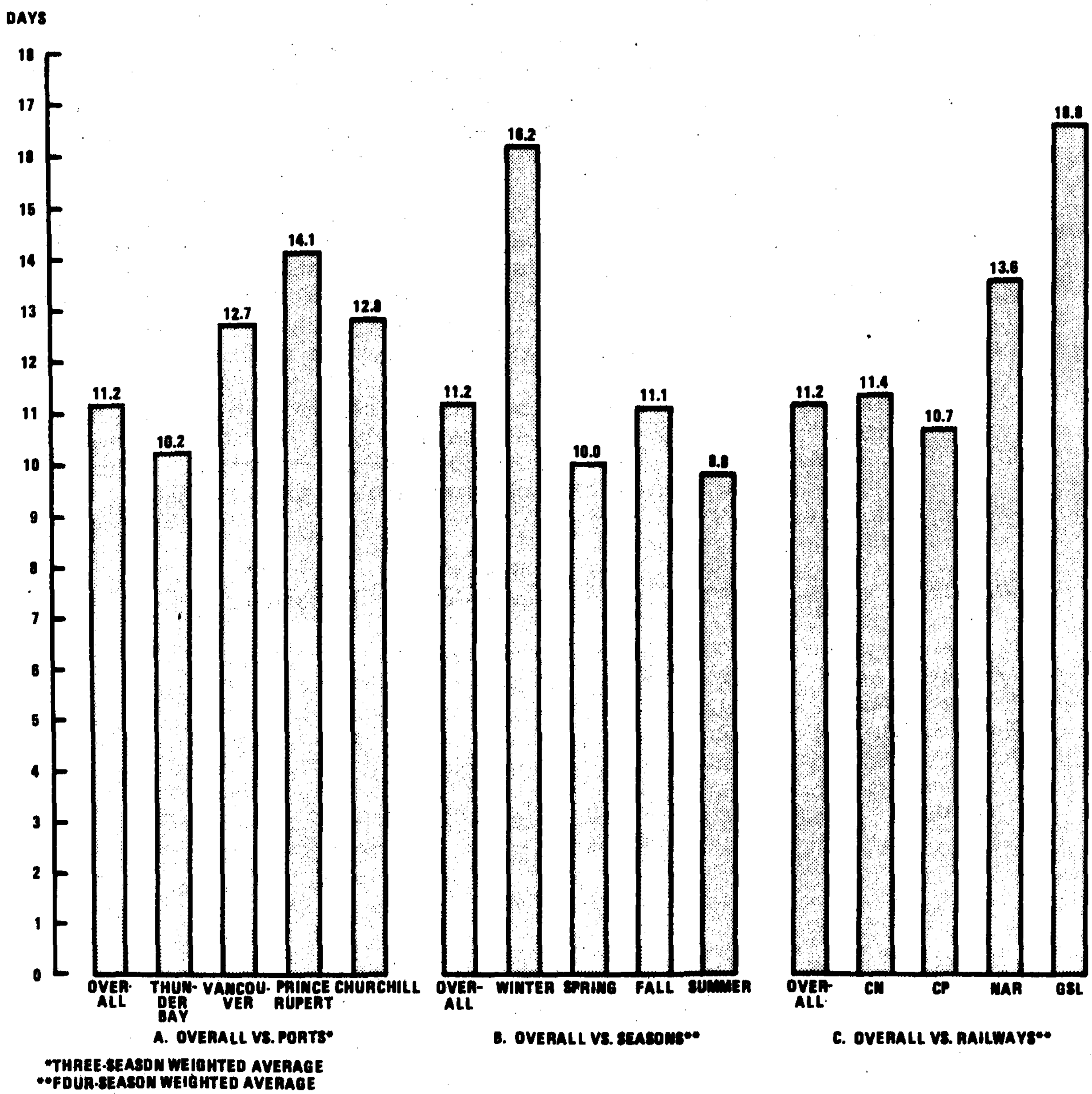
The average loaded portion of the car cycle time for all records in the sample was 11.2 days. This overall loaded car day index provides information useful in identifying delays in the loaded movement to the port. The problems and opportunities for improving car handling come to light by examining differences by destination (port), season and railway.

- Port comparisons—Exhibit V-2A shows a bar graph comparing the overall average (11.2 days) to the average loaded car cycle component by port. The table below shows the characteristics of the samples:

DESTINATION	AVERAGE DAYS*	NUMBER OF CARS	PERCENT OF SAMPLE
Thunder Bay	10.2	68,196	61%
Vancouver	12.7	30,653	27
Prince Rupert	14.1	4,858	4
Churchill	12.8	3,961	4
Other**	10.9	4,784	4
TOTAL	11.2	112,452	100%

* Weighted average.
** Domestic mills, etc.

EXHIBIT V-2 (A,B,C)
Loaded Component of Car Cycle



- Season comparisons—Exhibit V-2B shows a bar graph comparing the overall loaded portion of the car cycle (11.2 days) to the average by season. The table below shows the season sample.

SEASON	AVERAGE DAYS*	NUMBER OF CARS	PERCENT OF SAMPLE
Winter	16.2	17,769	16%
Spring	10.0	27,255	24
Summer	9.8	39,588	35
Fall	11.1	27,840	25
TOTAL	11.2	112,452	100%

  As expected, the time in the winter exceeds the average by five days and is more than five days greater than the times in the spring and fall and six days more than in the summer.

- Railway comparisons—Exhibit V-2C shows a bar graph comparing the overall loaded car cycle component to the averages by railway. The table below shows the railway sample:

RAILWAY	AVERAGE DAYS*	NUMBER OF CARS	PERCENT OF SAMPLE
CN	11.4	48,967	43%
CP	10.7	58,522	52
NAR	13.6	4,425	4
GSL	16.6	538	1
TOTAL	11.2	112,452	100%

  The relatively longer times for the NAR and the GSL are most likely due to the distance and the requirements for interchange of cars to reach destination. CP is less than the overall average of 0.5 days and lower than CN by 0.7 days.

  These analyses indicate the importance of considering the mix of ports and seasons when comparing car cycle times.

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* Weighted average.

4. THE RESULTS OF THE FULL CAR CYCLE ANALYSIS INDICATE SIGNIFICANT DIFFERENCES BY CAR TYPES FOR THE TWO MAJOR RAILWAYS

Overall loaded and empty car cycle times (load to load) were obtained from CN and CP. The data covers both box and hopper cars for each quarter during calendar year 1978. The analysis focuses on third quarter (July to September) results because during that period railway car cycle times were lowest and port unloads were highest. This indicates relatively high demand so that car cycles were less likely to be influenced by time spent waiting for a reload. Therefore, it is assumed that these recorded car cycle times reflect relatively normal operating patterns and not lack of demand. The third quarter is also of particular interest because all four ports (Vancouver, Prince Rupert, Thunder Bay and Churchill) were in operation.

(1) CN Annual Car Cycle Analysis is Based on a 44 Percent Sample of the Annual Grain Movements

The CN data includes approximately 78,240 car cycles or about 44 percent of the CN annual grain movements in 1978. Cycle times by quarter and car type vary as shown below:

TOTAL CN CAR CYCLE-DAYS

	Jan. Thru Mar.	Apr. Thru June	July Thru Sep.	Oct. Thru Dec.	Annual Averages
Box car	27.0	20.0	17.6	17.8	19.1
Covered Hopper	21.4	16.4	15.1	15.4	16.3

In terms of the number of loaded trips, the sample generally compares favorably with the population in that the third quarter has the highest volume as shown below:

CN LOADED TRIPS BY QUARTER, 1978

	JAN-MAR		APR-JUNE		JULY-SEP		OCT-DEC	
	No. Trips	%	No. Trips	%	No. Trips	%	No. Trips	%
Sample	7,448	9.5	24,318	31.1	24,396	31.2	22,087	28.2
Total	29,504	16.5	50,984	28.6	53,560	30.4	43,756	24.5

(2) The Details of the CN Car Cycles were Examined for the Third Quarter

For the third quarter of 1978, the overall car cycles for box cars and covered hoppers were 17.6 and 15.1 days respectively. The primary objective of this analysis is to identify opportunities for improvements in car cycle. The table below shows the differences by the various car cycle events.

CN RAIL
BOX CAR VS COVERED HOPPER
CAR CYCLE EVENTS

CAR CYCLE EVENT	BOX CARS (Days)	COVERED HOPPERS (Days)	BOX CARS VS COVERED HOPPERS
EMPTY TRANSIT			
. Depart to Arrive	4.7 Days	3.8 Days	0.9 Days
COUNTRY			
. Arrive to Place	0.5 Days	0.9 Days	(0.4) Days
. Place to Pull	2.1 Days	1.9 Days	0.2 Days
. Pull to Depart	2.2 Days	2.0 Days	0.2 Days
LOADED TRANSIT			
. Depart to Arrive	4.9 Days	3.9 Days	1.0 Days
PORT			
. Arrive to Place	1.4 Days	1.2 Days	0.2 Days
. Place to Pull	1.0 Days	0.8 Days	0.2 Days
. Pull to Depart	0.8 Days	0.6 Days	0.2 Days
TOTAL	17.6 Days	15.1 Days	2.5 Days

The 2.5 day difference between box and covered hoppers is primarily due to differences in empty and loaded transit times with box cars taking about one day longer in the loaded and empty portion of the cycle. The longer times for box cars are primarily caused by two factors: (1) box cars move from and to the more remote lines which have greater restrictions and less frequent train runs, while the covered hopper cars are assigned to the heavier volume lines (with better track) which receive more frequent service and are often closer to the main lines; (2) during transit, additional terminal time is required to service and inspect journal boxes (bearings) for box cars versus the hopper fleet which has roller bearing trucks.

The relative equality of times between box and covered hopper cars in the port and in the country segments indicates that the additional work in applying and removing grain doors has no significant effect on the car cycles. It would seem that there is sufficient time for railway and elevator personnel to handle this work in the normal period between the railway placement and the departure from the various ports and locations.

(3) Port Specific Times Were Developed

Focusing on the third quarter provided data for comparison of the four ports in terms of cycle times from:

- Arrival of the loaded car to placement at the elevator
- Place to pull
- Pull of the empty car to depart.

Exhibit V-3 shows the difference in port time in each of the ports served by the CN. The Thunder Bay and Churchill times are essentially the same (about two days). Vancouver and Prince Rupert times are about one day longer indicating opportunities for improvement. For Vancouver the longer times are caused by:

- Interchange of cars between the CN and CP (which added about 4 days to the third quarter car cycle for about 10 percent of the cars)
- More congested rail and elevator facilities compared to Thunder Bay
- Specialization of elevators for certain grains (i.e., SWP on the north shore for durum).

Prince Rupert delays in the arrival to place times are largely due to the more erratic ship arrivals and relatively small storage capacity of the elevator.

(4) CP Annual Car Cycles are Based on a 56 Percent Sample of the Annual Grain Movements

The 1978 (calendar year) CP data covers approximately 106,303 car cycles or about 56 percent of the

EXHIBIT V-3
CN Port Cycle Times

Event Pairs	CN PORT TIMES IN DAYS (3RD QUARTER)			
	Vancouver	Prince Rupert	Churchill*	Thunder Bay
Arrive (Load) to Place (Loaded car arrival in main yard until placed at terminal for unload)	1.5	2.2	.5	.7
Place to Pull (Terminal elevator unloads)	.9	.2	.6	.8
Pull to Depart (Unloaded car pulled by RR until leaves port yard)	.6	.8	1.0	.7
TOTAL DAYS	3.0	3.2	2.1	2.2

* Churchill times represent Fourth Quarter data since the Third Quarter was abnormally high (5.9 days) due to labor problems.

CP annual grain movements. Cycle times by quarter and car type vary as shown below:

TOTAL CP CAR CYCLE - DAYS*

	Jan. Thru Mar.	Apr. Thru June	July Thru Sept.	Oct. Thru Dec.	Annual Averages
Box Car	30.0	19.6	19.0	21.8	20.8
Covered Hopper	26.8	18.4	17.7	19.7	19.4

(5) <u>The Details of the CP Car Cycles were Also Examined</u>

For the third quarter of 1978, the overall car cycles for box cars and covered hoppers were 19.0 and 17.7 days respectively. The table below shows the differences by the various car cycle events.

CP RAIL
BOX CARS VS COVERED HOPPERS
CAR CYCLE EVENTS

CAR CYCLE EVENT	BOX CARS (Days)	COVERED HOPPERS (Days)	BOX CARS VS COVERED HOPPERS
EMPTY TRANSIT			
. Depart to Arrive	6.1 Days	6.0 Days	0.1 Days
COUNTRY TIME			
. Arrive to Depart	4.3 Days	4.0 Days	0.3 Days
LOADED TRANSIT			
. Depart to Arrive	5.2 Days	4.6 Days	0.6 Days
PORT TIME			
. Arrive to Depart	3.4 Days	3.1 Days	0.3 Days
TOTAL	19.0 Days	17.7 Days	1.3 Days

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* During the data retrieval process, the program could accept an upper limit of observations which the Thunder Bay samples exceeded. As a result, the overall cycle times are somewhat higher than if all observations or at least a comparable number of Thunder Bay to Vancouver observations had been calculated in the average.

The 1.3 day difference between box cars and covered hoppers is due primarily to the same reasons as those cited for the CN. However, the difference on the CP is 1.2 days less than on CN. This may be accounted for by the preponderance of restricted lines* on CN as compared with CP. Extra delays result on these restricted lines. Box cars are generally used on these lines. The number of restricted miles on the CN is twice that of the CP as shown in the table below.

RESTRICTED LINES

RAILWAY	RESTRICTED MILES	% OF PRAIRIE MILES
CN	4,402.9	48.4
CP	2,063.8	26.4

5. <u>AN ANALYSIS OF 14 GRAIN LOADING BLOCKS WAS UNDERTAKEN TO DETERMINE THE EXTENT OF OPPORTUNITIES TO REDUCE CYCLE TIMES</u>

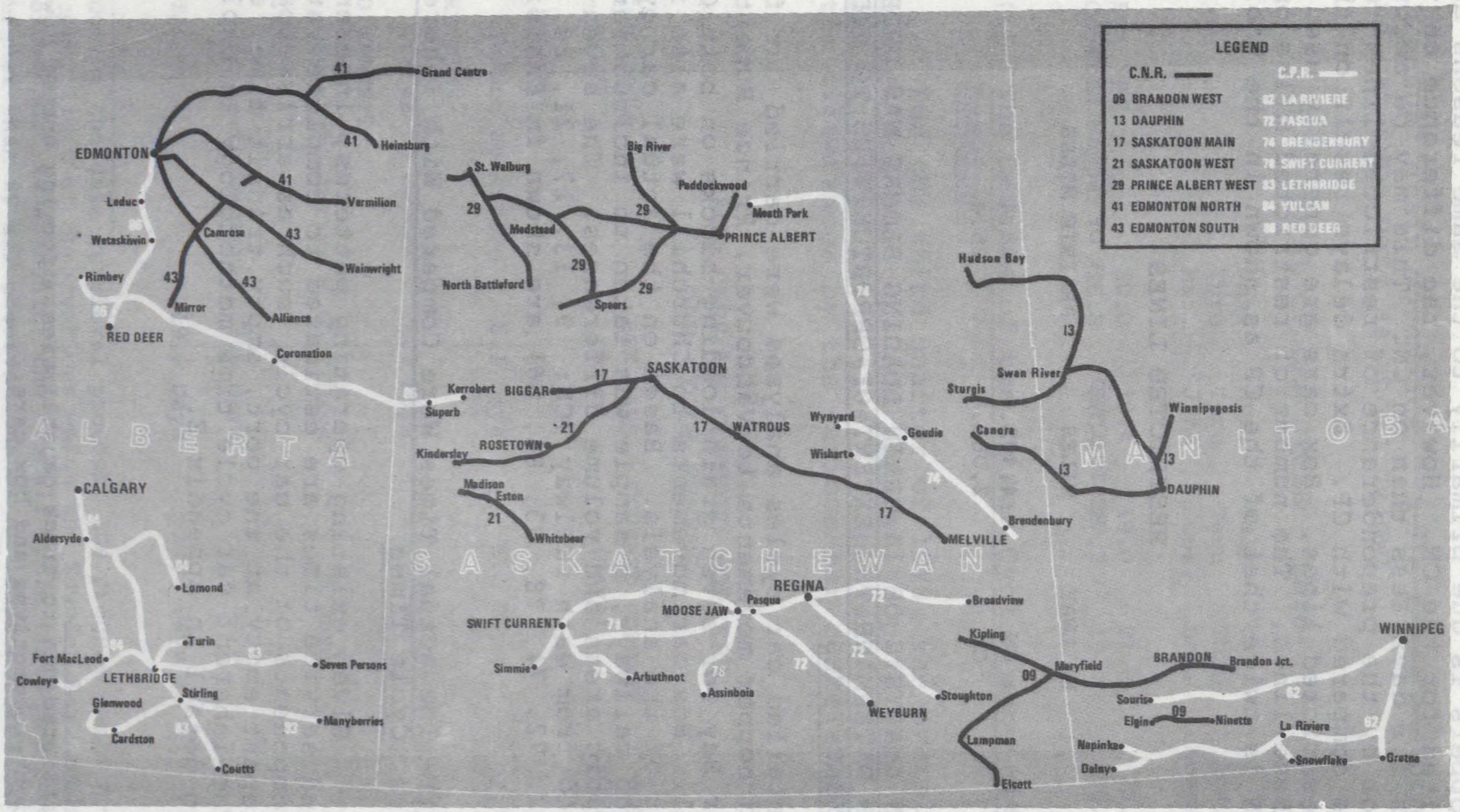
Detailed car cycles analyses were carried out for covered hopper movements to Vancouver, Prince Rupert and Thunder Bay for seven grain loading blocks on both CN and CP Rail. Box car movements to Churchill were also included as part of the analysis. Based on the actual car cycle data from the railways, a sample was taken to include various geographic areas and volume differences. The seven blocks selected from each railway (CN: 9, 13, 17, 21, 29, 41, 43; CP: 62, 72, 74, 78, 83, 84, 86) are shown in Exhibit V-4.

(1) <u>The Actual Times Were Compared With Inherent Cycle Times</u>

Given existing operating patterns, inherent transit and service times are estimated to complete various components of the car cycle (such as arrive loaded to depart empty at the port, empty transit time, etc.). The inherent car cycle time methodology is explained in detail in Appendix E.

* Restricted due to track capabilities affecting use of lower weight locomotives and box cars.

EXHIBIT V-4
Grain Block Map



The inherent cycle time analysis requires the following inputs:

- Service pattern data relative to train schedules; frequency of service by day and trick (shift); and special operating requirements for all grain block subdivisions. See Appendix F for the service pattern matrix.

- A table of Train & Engine (T&E) crews and locomotive resources and their respective assignments.

- Historic volume statistics including railway dispatching sheets related to the distribution of arriving and departing road trains at the port terminals and country serving yards as well as main line travel times.

- Onsite observations of country, main line, and port operations.

The operating times and patterns were reviewed with chief dispatchers and line officers across the railways and were acknowledged to be reasonable. Some of these times may now be subject to change due to alterations in operating practices, including some resulting from these analyses.

In general, the following assumptions were made in establishing the inherent car cycle times:

- Main line speeds were 20 to 25 miles per hour.

- Main line transfers between the ports and the country serving yards generally take place on any shift unless the current schedules are stated differently.

- With few exceptions, each event in the cycle was allocated at least eight hours.

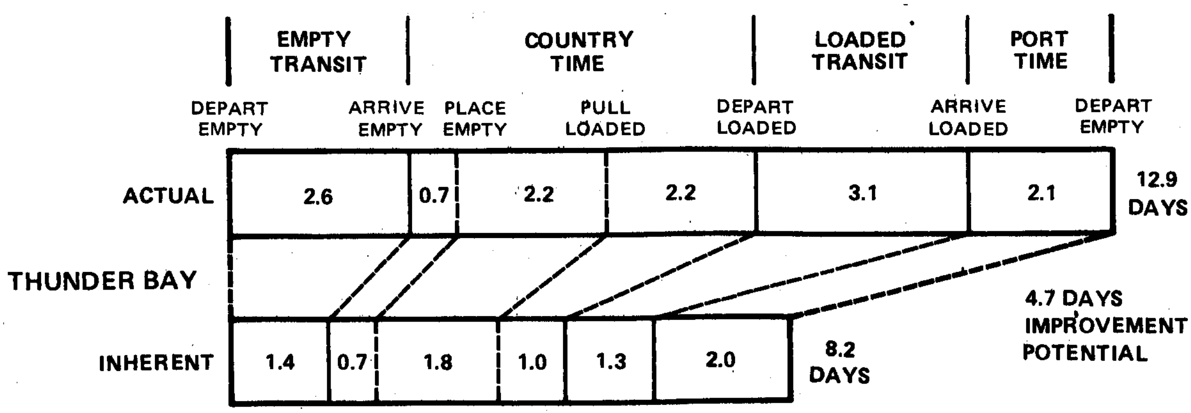
- An adequate supply of empty rail cars was available.

- There were enough loaded cars directed toward one port at the country serving yards to comprise a train load without delays for accumulating a loaded train.

- Weekend time spent in the ports or in country elevators was included.

The bar graph shown below, followed by a description, is an example of the analysis undertaken of an individual CN block car cycle which illustrates the methodology used:

BLOCK 9
COVERED HOPPER CARS



Brandon West (Block 9) is located in Southern Manitoba/Saskatchewan and is served mainly out of Brandon with an average service of twice a week to spot. There are eight train runs which usually place empty cars on third trick, tie up at the end of the line on first and pull (or "lift") loaded cars returning to Brandon on second trick. This is generally the most efficient country service pattern. The preponderance of shipments is to Thunder Bay. As a result, the inherent versus actual car cycle comparison was not undertaken for the other ports. Empty cars are transferred to Winnipeg where they are switched and subsequently moved to Brandon via wayfreight or general merchandise trains. In some instances, cars are run straight from Thunder Bay without switching in Winnipeg.

KEY IMPROVEMENT POTENTIAL

THUNDER BAY	DIFFERENCE BETWEEN INHERENT AND ACTUAL
Empty Transit	1.2 Days
Pull to Depart	1.2 Days
Loaded Transit	1.8 Days
Others	0.5 Days
TOTAL	4.7 Days

The current operating pattern should be reviewed to see if more direct movements of empty and loaded cars to and from Thunder Bay can be undertaken to improve transit times.

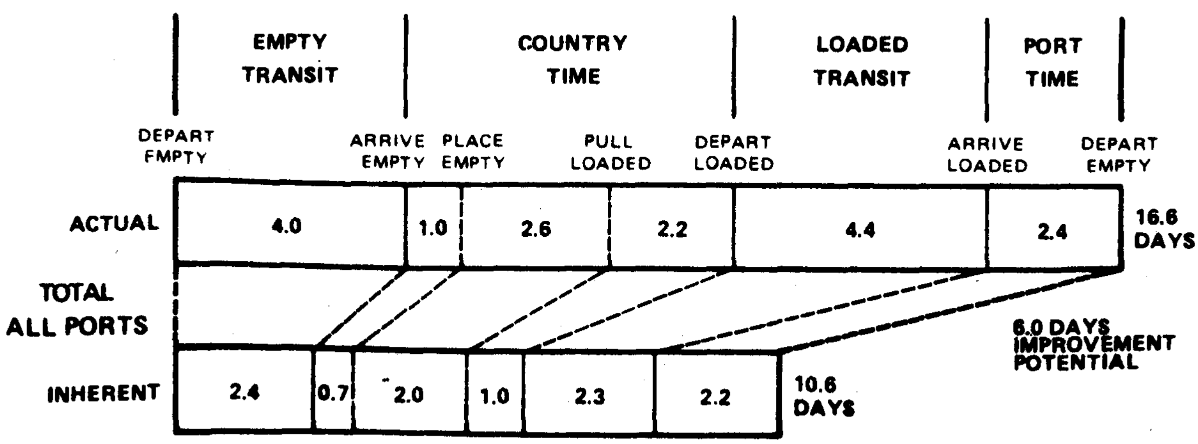
The remaining 13 blocks included in the analysis of the CN and CP sample are examined in Appendix G.

(2) Overall Car Cycles Should be Improved by 15 Percent

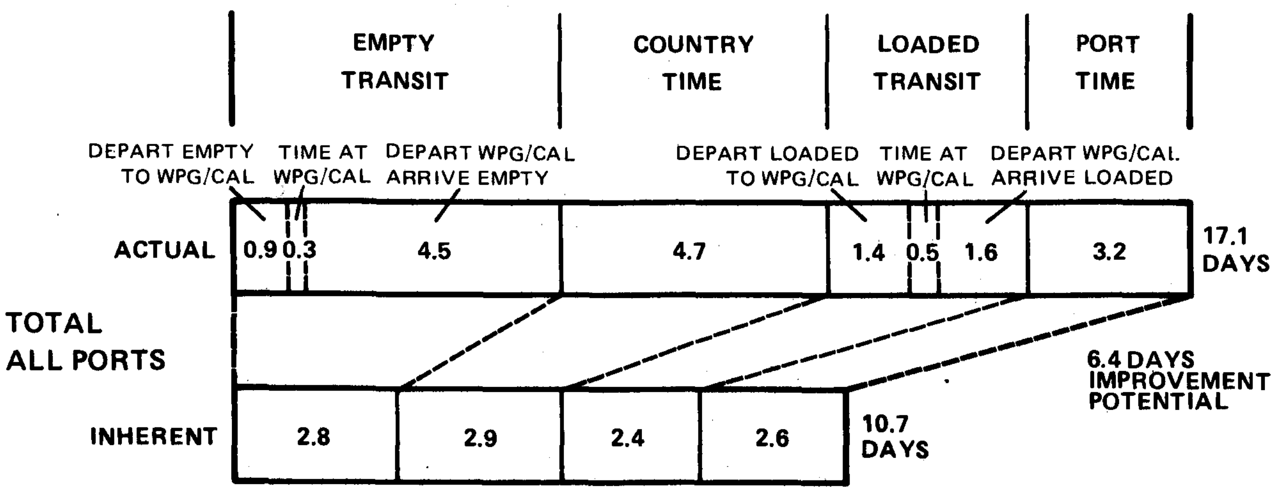
The results of the actual versus inherent car cycle analysis for the 14 block sample indicate a pattern where improvement potential exists for the country, main line and port areas and particularly for the loaded and empty transit components of the car cycle.

The following bar graphs show the overall comparison between the actual and inherent car cycles for the CN and CP samples.

CN
SEVEN BLOCK SAMPLE



CP
SEVEN BLOCK SAMPLE



The comparison between actual and inherent indicates a theoretical maximum potential savings of 6.0 days per car for the CN and 6.4 days for the CP.

This results in an average theoretical reduction for CN and CP combined of 6.2 car days. This improvement potential does not take into account special switching problems, equipment failures, derailments, weather, nor any other uncontrollable railway occurrences. The potential also assumes a well planned flow of loads and empties such that sufficient numbers of cars are available to justify efficient train runs for main and branch movements. Most importantly, it does not consider the ability of the ports to accept cars. Therefore, the 6.2 days probably represent an upper limit of improvement potential.

From the consultants' past experience, a "target" improvement rate of 40 percent reduction of the difference between actual and inherent is a reasonable expectation, assuming that a determined program of implementation is undertaken to reduce car cycles. This represents a 2.5 day savings or a 15 percent improvement in overall car cycles. The 15 percent improvement in overall car cycles equates to a savings for the grain fleet of approximately 4,000 cars by 1985/86.

Continuous monitoring should be conducted by the railways and grain companies and CWB to determine why cars do not move according to plan, within the resources available as well as the relationship of the planning and control system to support car management. Initially, more detailed analysis, similar to the samples analyzed here, should be performed for all 48 blocks.

Loaded and empty transit portions of the cycle time accounted for 62% of the total potential improvement in cycle times for the samples studied on both CN and CP. Therefore, special analyses were made of two factors, intermediate yard delays and distance, which were expected to account for some of the differences. The findings of these analyses are presented in the next two sections.

(3) Loaded and Empty Car Elapsed Times Were Developed for a Number of Yard Locations on the CN to Identify Specific Opportunities for Improvement

Further analyses were undertaken to specifically identify problem areas within the major components of the car cycle. Port time problems are presented in Chapter VII, while problems in the country operations are included in Chapter VI. An analysis was also performed on the loaded and empty transit delays which is highlighted below.

Utilizing information contained in CN data files, a list of marshalling yards where empty and loaded cars are handled or held and their respective average layover times has been prepared. The 1978 calendar year data was aggregated for loaded and empty grain cars by location. The results are shown in Appendix H.

Although there are certain deviations, a pattern exists by locations with relatively similar characteristics. Generally, the lower times for empties and loads occur in yards located on the main lines from Winnipeg to Edmonton where the highest frequency of train movements take place. The higher times generally occur in yards located on main lines.

A similar analysis was attempted on the CP; however computer based data was not available. Another approach was tried utilizing reports showing the location of cars on hand and their respective arrival and departure times. In a small sample analysis* undertaken

* Gathered from a sample of daily on hand reports for the period April 1979.

for Keith yard, located west of Calgary, cars stayed on certain holding tracks an average of 17 days. At this location, it appears that car control practices often result in movements based upon the last cars in the holding yard being the first out. If all grain cars contained the same grain, this would not necessarily present a major problem; however, since grains differ this practice should be reviewed and perhaps greater control should be exercised in selecting cars to be held back to ensure minimum disruption to plans. This intermediate yard delay could undo efforts to get the right cars to the ports on time.

(4) Differences in Loaded Transit Times by Block Are Not Accounted for by Distance Alone

The main predictor of car transit times is often expected to be the distance from origin to destination. This relationship of distance to time was examined on a detailed basis from every block to each port*. Exhibit V-5 provides a display of that relationship for loaded movements departing from country locations to unload at Vancouver.

The relationship between distance and loaded transit time appears to be:

Transit time = 4.08 days + .45 days per 100 miles

The operations analysis performed in this study indicated that block specific service patterns and main line train run frequencies from gathering points in the Prairies are also significant in accounting for differences in transit times by block/port pairs.

6. A CONCERTED EFFORT WILL BE NECESSARY TO REDUCE THE CAR CYCLE

With the scarcity of freight cars and significant future replacement requirements, it is of critical importance in determining the future investment in grain cars that ways of expediting the flow of cars through the entire car cycle be implemented. The railways share part of the burden of improving car cycles, but actions must be undertaken by the grain companies and the CWB to aid the process in the areas of their responsibility that directly impact the efficiency of grain car movements and handling. The following is a list of recommendations for improvements in car cycles that can be achieved in the near term and those that require further investigation for future action.

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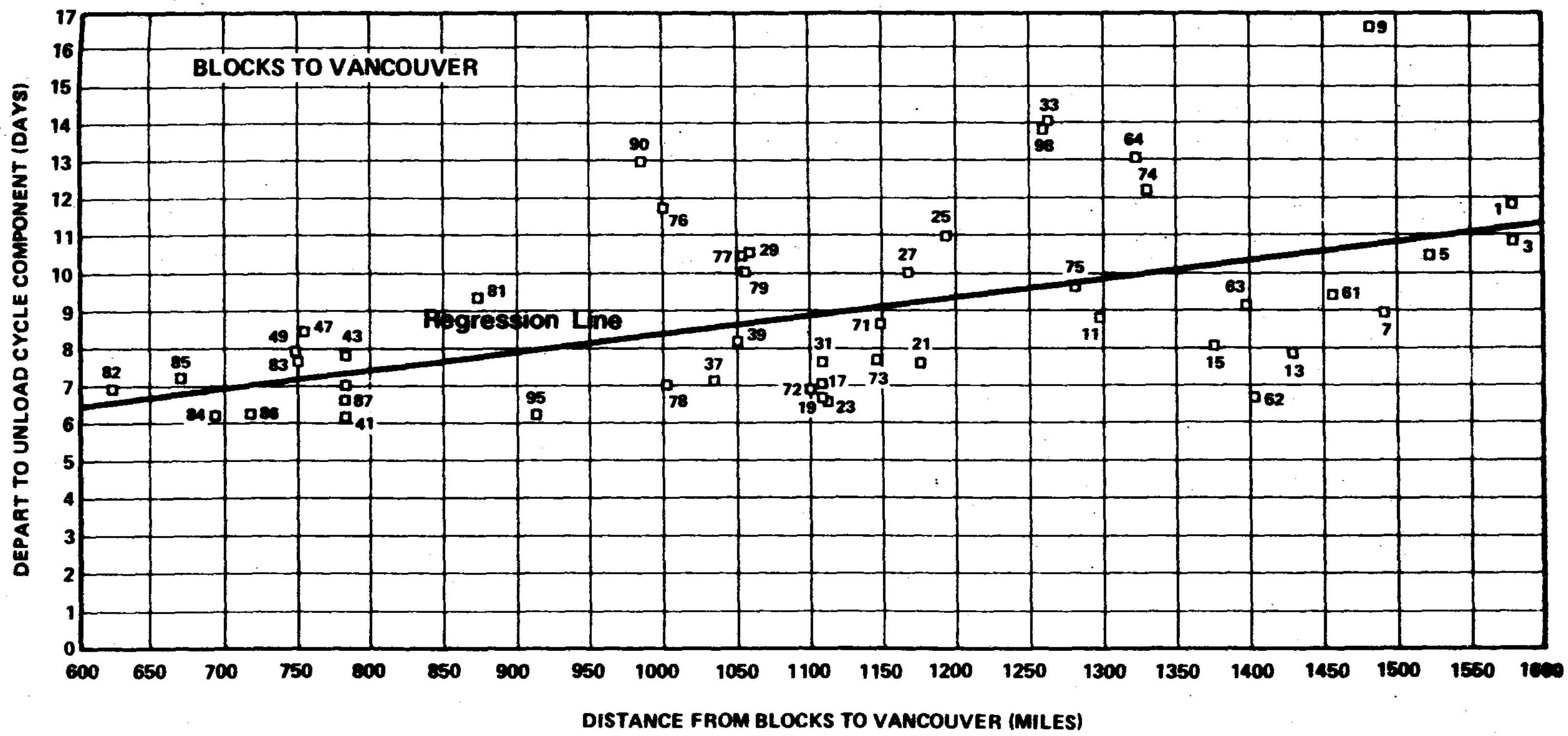
* CWB three season loaded car cycle sample.

EXHIBIT V-5
Relationship Between Distance
and Travel Time



Regression Line: Transit Time (Depart to Unload) = 4.08 & .45 days per hundred miles

(1) <u>Near Term Recommended Policy Changes Should Improve Car Cycles</u>

Several improvements can be made in car cycles in the near term generally through changes in policy rather than major investments.

- Where applicable, railway subdivision train runs should be realigned to place empty cars in the primary elevators on the midnight to 8 a.m. trick and return on the 4 p.m. to midnight trick for pulling the loaded cars. The benefits and feasibility of this recommendation as discussed in greater detail in Chapter VI, total 1.5 days with a reasonable expectation of 1.0 day to account for locomotive utilization and crew agreement conflicts.

- The elevator working hours in terms of weekends and shifts per day should be extended particularly in the terminal elevators at the ports and in certain circumstances in the primary elevators, reducing the time cars are held for placement.

- Extending hours at the terminal elevators improves car cycles by an estimated 0.7 days. Extending hours at country elevators should improve flows to a maximum of 0.2 days with a reasonable expectation of 0.1 days.

- The block allocation procedure should also be refined to expedite car movements. While the current block shipping system with the initial allocation to blocks which are then formulated for train runs generally works well, a useful refinement would be to apply the subdivision train run minimum requirements to the criteria for car allocations to blocks. Thus, the total cars out of a gathering point to a specific destination would, whenever feasible, be the number of cars required to satisfy the minimum for a main line train run. This would reduce delays associated with accumulating cars for solid or block trains. While the effect has not been estimated, it should be substantial.

(2) Other Improvements Will Also Reduce Car Cycle Times

Other changes which have not been quantified but could be significant include:

- Branchline rehabilitation and maintenance programs for weight-restricted lines which now severely affect car movements should be given top priority.

- The effect of the influx of producer cars should be considered so as to avoid burdening the car cycle with extra switching delays in the country and in the ports.

- Car orders for blocks and train runs should be placed for one port in a given week to the extent possible, resulting in reduced switching and train make-up delays.

- The movement of grain types that have an abundant geographical spread should be monitored to ensure a minimum crosshaul unless market strategy indicates otherwise.

- Increased reliability of estimated ship arrival times along with additional buffer storage capacity could enhance car movements through the port. Port congestion not only results in delays in car cycles at the port but also delays in main line transit and at holding yards (such as Keith) in the Prairies. These recommendations are discussed in Chapter VII.

The recommendations which have been quantified represent an improvement potential of 1.8 days. It is difficult to quantify the other car cycle savings that might result from the other recommendations; however, it is reasonable to assume that these recommendations should produce a car cycle savings of at least 0.7 days, which would equal the 2.5 day saving represented by the "target" for improvement.

The implementation of these or like improvements would reduce car replacements between now and 1985/86 by 4000 cars representing an investment at current prices of about $172 million.

7. BETTER COORDINATION OF CAR FLOWS WILL NOT ONLY REDUCE CAR CYCLES BUT ALSO IMPROVE DELIVERY RELIABILITY

Better management and control of cars should be instituted to avoid inordinate delays in serving or holding yards. This is especially acute when the cars held contain grain urgently needed in the port for ship loading. A particular problem arises when cars are placed in a holding yard and they remain in these locations while other cars, perhaps with less critical types of grain, pass by on movements to the ports or country locations. One method to alleviate this problem would be to incorporate a "first in - first out" inventory control mechanism for such car movements; however, that could introduce unnecessary switching if urgently needed grain types are not being held. A far more effective mechanism would be to establish close communications and cooperation between the railways and the block shipping staff to ensure that the right cars are being given priority for movement before needed cars are "buried" in a holding yard such as Keith. (Under statutory rates, the railways have no incentive to incur the added expense involved.)

In general, greater emphasis should be placed on continuous car cycle monitoring program for grain cars via a refined information control system. This may require the introduction of more events within the car cycle data bases now being utilized. Further, uniformity in car cycle reporting systems should be undertaken for each of the railways, with provisions to identify delays at locations en route.

8. ABILITY OF RAILWAY TO DELIVER CARS TO PORTS AND PORTS TO RECEIVE CARS DELIVERED SHOULD BE TESTED

During the third quarter of 1978, CN and CP Rail grain cars move through the port area on an average of 3.1 days, indicating a relatively efficient operation. However, questions have arisen as to the overall performance for loaded car movements. The railways contend that cars are held away from the port because of the inability of the elevators to unload cars. The elevators contend their acceptance rate for cars is greater than present railway delivery performance. The present information systems are not tailored to answer these questions and in fact tend to frustrate such analysis. In order to identify the cause and extent of the problem, a non-financial car control system similar to a demurrage reporting system, should be implemented on a test basis to measure the acceptance performance of the elevators and the delivery performance of the railways.

This should be on a non-financial basis to inhibit the occurrence of "game playing" among the participants. The test would require monitoring a series of company and railway actions related to the loaded car cycle. The process would be as follows:

1. Railways notify the CTC Car Coordinators that cars are available for placement on the following day. This information is initially telephoned by noon and includes the number of cars, type of grain by Board and Non-Board classification.

   After the phone call, the cars become "constructively placed"* and they are under the control of the responsible port personnel and are expected to be unloaded by midnight the following day.

2. CTC Car Coordinator informs the various companies of the cars available prior to a late afternoon meeting with the company and the terminal railway representatives.

3. Grain companies notify Car Coordinator as to their ability to accept placements over the next 24 hour period, thus documenting their acceptance of the loaded cars for placement.

4. Railway transmits a copy of train consists or on-hand reports which show location, car initial and number and grain type as verification of the constructive placement phone call. These documents are due prior to the afternoon meeting.

5. The companies and Car Coordinator make plans to unload the cars and coordinate with terminal railway management to set up service times.

6. Railway places loaded cars at elevator and maintains a log of "place times" including car initial and number.

7. Company completes unloading and notifies the railway that cars are available to be pulled.

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* The location of the cars does not necessarily have to be a port yard location (i.e., could be at Chase yard), but the railways must be committed to providing constructively placed cars at the time specified.

The company maintains a log of "release times" including car initial and number over the next 24 hour period, thus documenting the unloading of cars accepted.

8. Railway pulls the empty cars from the elevator and maintains a log of "pull times" by car initial and number.

The following infomation is available from the process:

- An audit trail of cars physically and constructively placed for each day.
- Daily logs of cars placed, released and pulled.

Analysis can be made of the elapsed times between constructive and actual placements. Measurements can be made of the terminal elevators rate of acceptance and compared to their recorded notification of ability to take orders. Release and pull times would be documented to determine where empty cars might experience delays in departing the terminal. The railways' performance could also be checked.

These analyses could be used to identify areas for improvement in railway and elevator operating practices and provide sufficient data for analyses of proposed capital improvements to expand rail and elevator capacity.

This task, along with management of the implementation of car flow improvements, should be under the direction of the Grain Improvement Task Force described in Chapter X. The role of the Task Force would be to review progress, audit reporting, and act as arbitrator for disputes.

* * * * *

In summary, there are improvements that can be instituted to improve car cycles. The railways have reported cycle time reductions of up to one day on some runs as a result of implementing recommendations from earlier progress reports in this operations analysis. However, the undertaking will involve the efforts of more than just the railways. The grain companies, the CWB, and in particular, the block shipping staff have major roles to play in improving car cycles. The approach to improvement will have to be taken in steps to develop an operating plan to minimize cycle times within the context of available resources and incentives. Specific improvements are discussed in detail in the subsequent chapters of the report.

VI. PRAIRIE OPERATIONS

This chapter discusses the various elements of Prairie operations and the interactions between these elements as they affect the grain logistic system's capacity and throughput.

On the Prairies, the main elements of the grain logistics system are:

- The producers, who grow grain, store it on-farm, and haul it to the primary elevators after the system has called it forward

- The primary elevators, where the grain is first graded and accumulated to be loaded in railway cars when it is required in the ports

- The branchline railway network over which empty cars are distributed to elevators and the full cars picked up and formed into trains for movement to the ports and domestic users of grain.

1. DECISIONS BY THE PRODUCER AFFECT THE GRAIN HANDLING AND TRANSPORT SYSTEM

Besides deciding which grains to grow, the acreage and intensiveness (amounts of fertilizers, etc.) and the timing of the various steps, the producer also decides how much to store, how much to dry, when to market, and where to deliver the grain.

Exhibit VI-1 shows the supply and disposition of the principal grains produced in Western Canada over the last eleven years. Carry-over volumes included over the grain stored in Western Canada (Thunder Bay and the west). This chart and the supporting statistical data (Exhibit VI-2) show that:

- Exports have overtaken domestic consumption in total tonnage. The maximum crop years for exports were 1972/73 and 1977/78.

- Most domestic consumption occurs in the West, much of it on the farm for animal feed and seed.

EXHIBIT VI-1
Supply and Disposition
of Western Canadian Grain

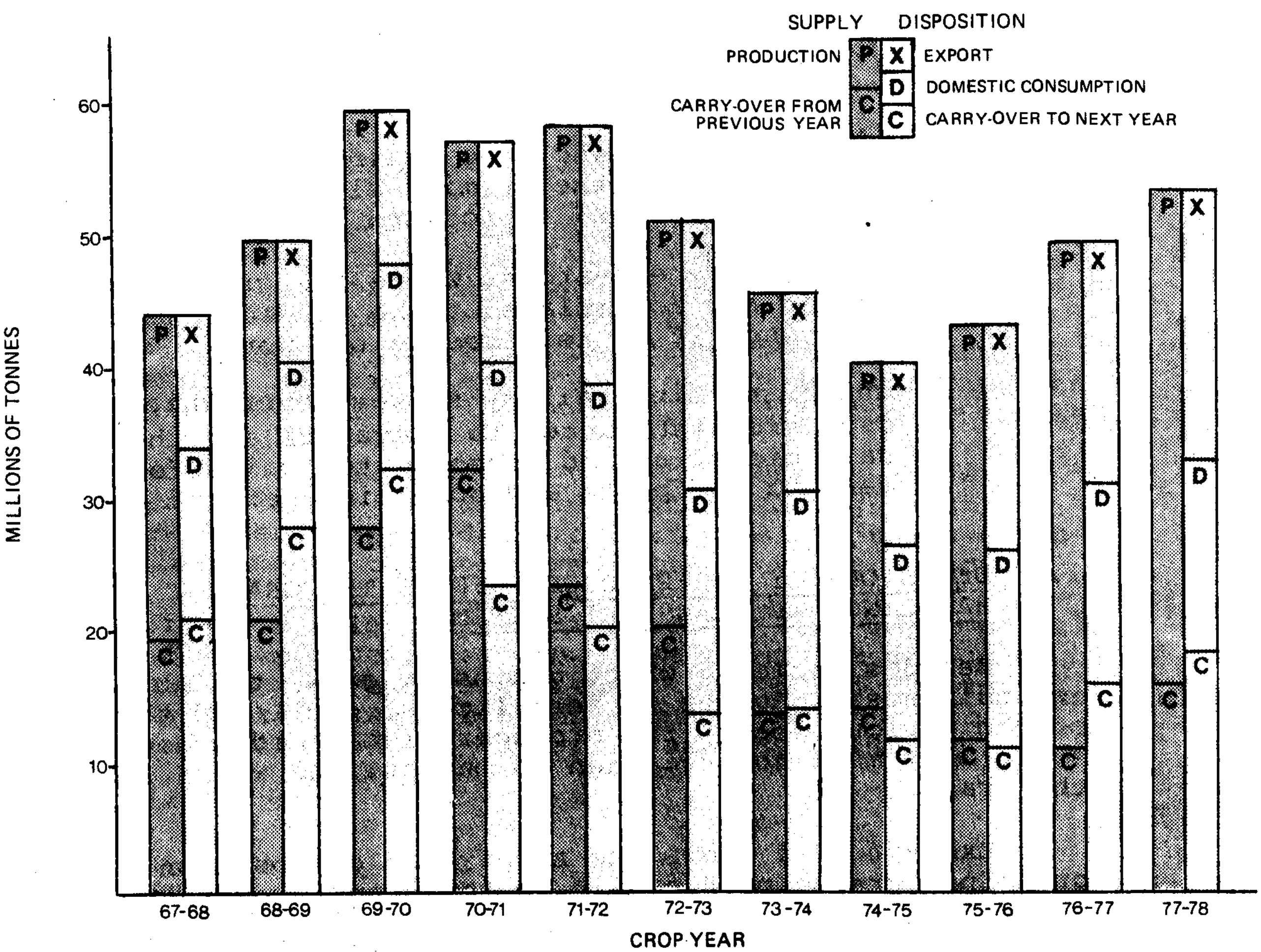


EXHIBIT VI-2
Supply and Disposition of
Principal Western Canadian Grain
(Thousands of Tonnes)

CROP YEAR	PRODUCTION	EXPORTS					DOMESTIC CONSUMPTION			CARRY-OVER ON JULY 31ST	
		Vancouver & Victoria	Prince Rupert	Churchill	Thunder Bay	Total	West	East	Total	On-Farm*	Total*
1966/67										7,929	18,984
1967/68	24,960	4,802	223	586	4,263	9,874	10,040	3,139	13,179	8,858	20,891
1968/69	29 060	4,821	133	615	3,131	8,700	10,368	3,098	13,466	14,341	27,785
1969/70	31,504	5,082	8	598	5,616	11,304	11,348	4,160	15,508	19,207	32,477
1970/71	24,610	6,333	327	637	9,411	16,708	13,001	3,743	16,744	13,436	23,635
1971/72	34,308	7,569	378	667	10,978	19,592	14,116	3,722	17,838	11,902	20,513
1972/73	30,613	8,233	803	638	10,502	20,176	13,423	3,959	17,382	5,646	13,568
1973/74	31,800	6,000	485	462	7,564	14,520	13,219	3,739	16,958	4,176	13,890
1974/75	26,172	4,817	564	498	7,834	13,713	11,170	3,725	14,895	3,261	11,454
1975/76	31,696	6,028	507	518	9,857	16,910	11,999	3,318	15,317	3,580	10,923
1976/77	38,453	6,965	383	735	9,985	18,068	12,567	2,620	15,187	9,073	16,121
1977/78	36,849	7,602	837	692	10,970	20,101	12,230	2,384	14,614	9,450**	18,255

* Excluding Peace River Area of B.C. ** Estimated.

Note: Total carry-overs are estimates for Western Canadian grains, excluding grain east of Thunder Bay and in Western mill bins.

SOURCES

1. Production and exports (except West Coast split) - Annual Report, 1977/78, Canadian Wheat Board
2. West Coast splits - "Grain Statistics Weekly," Canadian Grain Commission (for 1967/78 to 1975/76, as reproduced by Bryden Ltd.)
3. On-farm carry-over - "Statistical Handbook, 1978," Canada Grains Council
4. Total carry-over - "Grain Trade in Canada," #22-201, Statistics Canada and "Statistical Handbook," Canada Grains Council
5. Domestic consumption - 1967/68 to 1974/75 - "Grain Movement in Great Lakes to 1990," Appendices, Bryden Ltd; later years estimated from production, exports and carry-over.

- Carry-over of grain from one crop year to the next in the West in non-farm storage is relatively constant ranging from 7 to 11 million tonnes.

- Carry-over in on-farm storage fluctuates widely as the capacity of other types of storage is limited. It has varied from 3.3 million tonnes in 1974/75 to 19.2 million tonnes in 1969/70.

- Total carry-over into the 1970/71 crop year was almost 20 per cent greater than total production in that year. Production in 1970/71 was down from previous years. This suggests that producers cut back on seeded acres and production when carry-over is persistently high.

The exhibits show that on-farm carry-over from one year to the next is significant.

(1) On-Farm Storage for Over a Year's Harvest Must be Provided

Since the harvest is generally moved directly into on-farm storage, storage for more than one year has to be supplied on-farm. Except for advances received for unsold grain up to a fixed maximum, the producer does not receive income from stored grain and must pay all of the storage costs. This increased cost to the producer of holding grain on the farm creates the need for a system to equalize the opportunity among producers to ship grain and consequently receive payment for grain. This need is currently filled by the "quota" system which is discussed later in this chapter.

There are proposals to stockpile large quantities of grain to act as a cushion in case of poor harvests and to assist in the stabilization of international grain prices. The cheapest type of storage is on-farm. It would probably be desirable to keep Canada's share of such international stocks on the farm. If large additional stocks are required to meet international commitments, it would be appropriate to consider revised payments or incentives for on-farm storage.

Farm storage represents an initial surge capacity to the logistics system and therefore must be considered a system asset.

(2) <u>On-Farm Drying Should be Encouraged to Increase System Throughput</u>

In years when weather conditions cause a wet harvest, the amount of drying required in the port can be a constraining feature on system throughput in the terminal elevators. Hauling damp grain also adds non-productive tonnage. Since damp grain may be 6 per cent heavier than the same amount of "straight" grain but represents normally only 10 per cent or less of the total grain shipped, damp grain is a minor consideration in terms of transportation efficiency.

Under unusually damp conditions, more drying on the farm would result in greater throughput. At present the producer receives a lower price for delivering "tough" or "damp" grain to the primary elevator, providing some incentive for on-farm drying. However, the price spread is in general too small to encourage the purchase of driers for on-farm use.

Drying systems are now being marketed (including solar powered systems) which could reduce on-farm drying costs. In a year with a wet harvest, the availability of these devices would allow more total system throughput. Producers need to be encouraged—by price incentives—to dry grain on the farm.

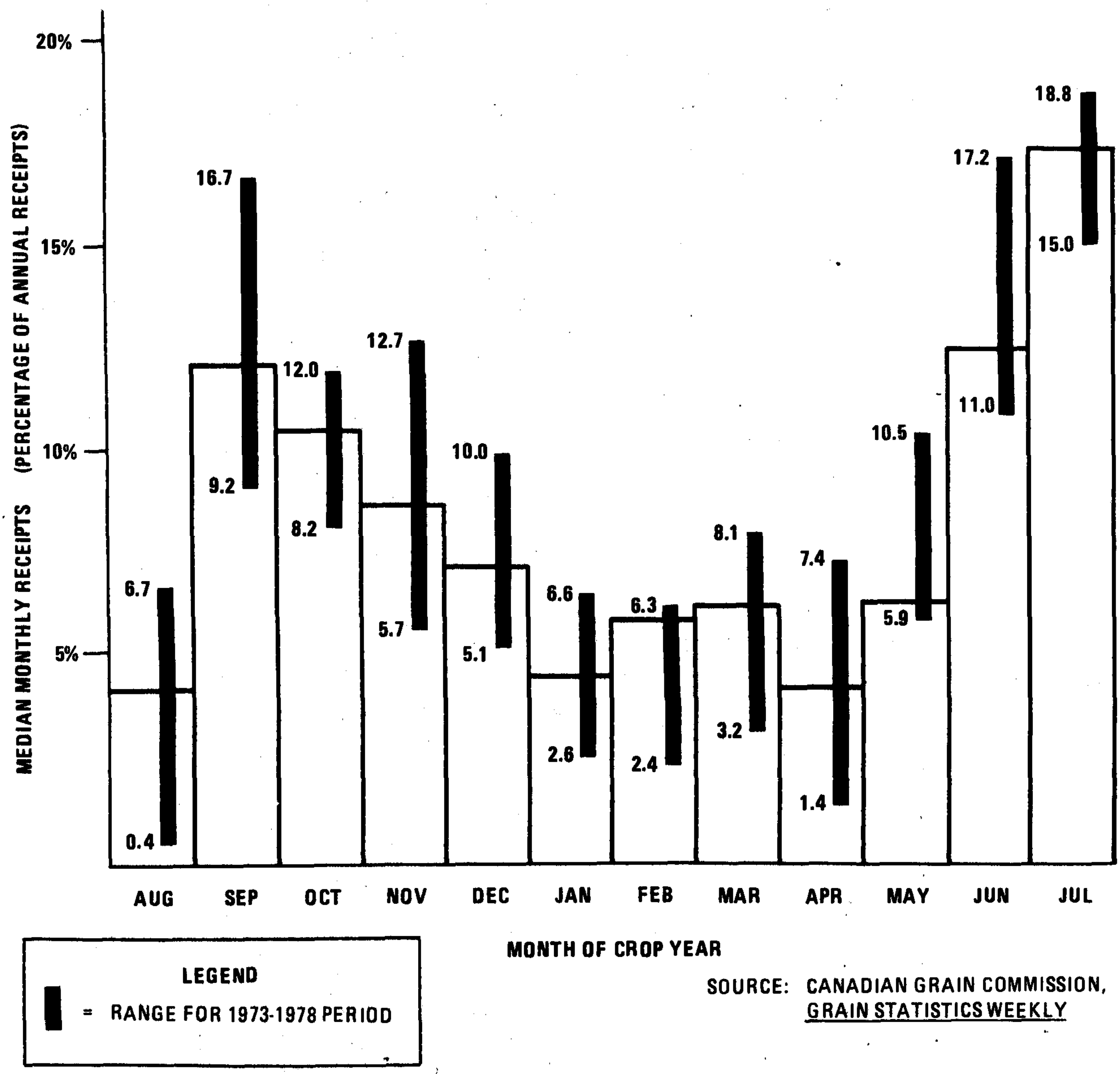
(3) <u>The Timing of Grain Deliveries Affects Throughput</u>

Within the volumes allowed by the quota system, the producer decides when to deliver to the primary elevators. Exhibit VI-3 shows, for the last five crop years, the average percentage of deliveries of grain to primary elevators by months of the year and the range of monthly deliveries over these years.

There are several periods in the crop year when producers may tend to hold back deliveries to primary elevators:

- Mid-November to mid-December, a period of 4 to 6 weeks, when producers hold back deliveries to defer income to the next year despite the deferred payment program.

EXHIBIT VI-3
Percentage Distribution of
Primary Elevator Receipts



SOURCE: CANADIAN GRAIN COMMISSION, GRAIN STATISTICS WEEKLY

- Depending upon the area and the severity of the winter, when roads are blocked by snow or by load restrictions.

- First of May to mid-May or later, a period of several weeks, when producers are fully occupied with planting.

- Mid-May to end of June, when producers may hold back deliveries until they can anticipate the yield in the current year. If a poor crop is expected, then they hold back deliveries in anticipation of higher prices in the following crop year.

- Mid-August to late September, a period of several weeks when producers are occupied with harvesting.

Exhibit VI-3 shows a preponderance of deliveries in June and July of each crop year. This is caused by three factors:

- The equalization of quotas in various areas across the Prairies, normally done by the Wheat Board near the end of each crop year.

- The desire of particular producers to have their grain included in the pool for the present crop year, so that final payments can be obtained sooner or in anticipation of a lower price the following year.

- Probably most important, the desire by producers to empty out as much storage as possible in order to accommodate the present year's harvest.

Although all of these reasons are understandable based upon the situation facing the particular producer, it would be more advantageous to the system as a whole and to the primary elevator operators if grain were to arrive in a more uniform manner. The peak months for shipments from the terminal elevators occur earlier in the spring so that this flood of grain into the primary elevators is not in phase with the export movement. An examination of overall primary elevator stocks also indicates that space is available earlier in the Spring after road weight restrictions are lifted.

The concentration of movement can be adjusted by changes in the incentives to deliver as seen by the producer. Efforts should be made to smooth this flow, including greater use and enforcement of terminating quotas. In the past terminating quotas have not always been fully enforced. A large quota, terminating perhaps around the end of May, would have a great impact on the smoothing of deliveries.

(4) <u>Increasing Use of Producer Cars Could Hamper Efficiency</u>

The number of producer cars has been increasing rapidly. This has been because of the increase in elevator tariffs as well as the result of the domestic feed grains' policy which has allowed producers with a large stock of unsold grain, but without any quota allowance remaining, to ship this grain to the eastern Canadian market in producer cars.

The Wheat Board has adopted a policy of only permitting producer cars to be placed in the same week that that particular grain is moving from the block. Producer cars do not in themselves use up car supply. From the point of view of railway efficiency, however, producer cars require increased switching in the country because of the necessity to place individual cars on sidings. They also require increased switching in the port because producer cars are billed to a specific terminal. Another problem is that a producer does not always have the ability to react quickly to the placement of a car and therefore load it promptly. In many cases, producers refuse cars which are difficult to load (particularly box cars). On the other hand, producer cars offer the producer lower costs because the primary elevator is bypassed.

The reintroduction of quotas on Off-Board feed grains which was scheduled for the beginning of the 1979/80 crop year may restrict the use of producer cars. For an individual producer to accumulate enough quota to load a car, particularly a hopper car, would be difficult unless he had a very large number of acres allocated to the particular grain or unless the quotas on Off-Board feed grains were set quite high. Thus, if these regulations come into effect, the number of producer cars will decline drastically. As was noted in the report of the Grain Handling and Transportation Commission (Hall Commission) the retention of producer cars is seen as allowing producers the flexibility of bypassing the primary elevator system if necessary; this potential is valuable to producers. Because of these factors, no action on producer cars is recommended at this time.

(5) <u>The Quota System Can Be Modified to Improve Overall Operations Related to Producers</u>

The quota system is an instrument through which the needed grains are called up from the producers. As such, it is a vital element in the entire control system. With respect to operations in the country, there are several observations and recommendations which can be made:

- Terminating quotas should be used to equalize the deliveries to primary elevators over the year to smooth out work load.
- The quota system could be used to encourage the delivery of dry grain when more of this is required to maximize throughput in the ports and could be used to ensure the delivery of tough and damp grain when dryer capacity is available through differential quotas.
- More knowledge of the actual size, grade, and condition of on-farm inventories would allow quotas to be set more precisely.

- The use of financial incentives for more timely deliveries should be explored; for example, premiums for timely delivery might be provided.

- The implications of a thorough on-farm testing and sampling system to accurately determine the state of on-farm inventories should be investigated before drastic changes to the quota system can be considered.

A Quota Review Committee, set up by the Advisory Committee of the Wheat Board, recently made its report. The Committee's recommendations are not revolutionary, but rather propose improvements to the existing system. The main recommendations of relevance to this analysis are:

- To reflect productivity and market deliveries, each producer who has completely filled his quota in previous crop years should receive a marketing bonus of additional quota acres in the current crop year.

- Regional quotas are justified by marketing requirements even though it may not always be possible to equalize quotas on all blocks at year end.

- Terminating quotas should be enforced more strictly.

- Producer cars should be subject to whatever quota applies to the same grain when moved through a primary elevator.

- Acreage for quotas should be calculated on total acres seeded rather than total acres on the farm so that more intensive practices are rewarded.

- A quota system should be established for feed grains to equalize opportunities for deliveries of this type of grain.

2. THE PRIMARY ELEVATOR SYSTEM IS BEING CONSOLIDATED

The mileage of rail lines operated has not changed greatly over the last few years. From 1971 through 1978 the total mileage decreased by five per cent. However, there has been a considerable amount of consolidation in the primary elevator system with a reduction of more than 26 percent in the number of elevators over the same period.

(1) The Number of Elevators is Decreasing

The decline in the numbers of licensed elevators over the last ten years is reflected in Exhibit VI-4. In many cases two or more licensed elevators owned by the same company are operated by one manager and are described as an "operating unit"; the number of "operating units" has shown a greater relative decrease. The number of stations handling grain has also decreased, by approximately the same proportion as the number of elevators. The number of operating units per station is decreasing indicating a decrease in competition.

Forecasts of these trends to 1985 were made in two ways:

- First, they were extrapolated by assuming that the trends would continue linearly (i.e., a constant change in the absolute numbers in each year) and by using an exponential extrapolation (assuming a constant percentage change in each year). These extrapolations are shown in Exhibit VI-5.

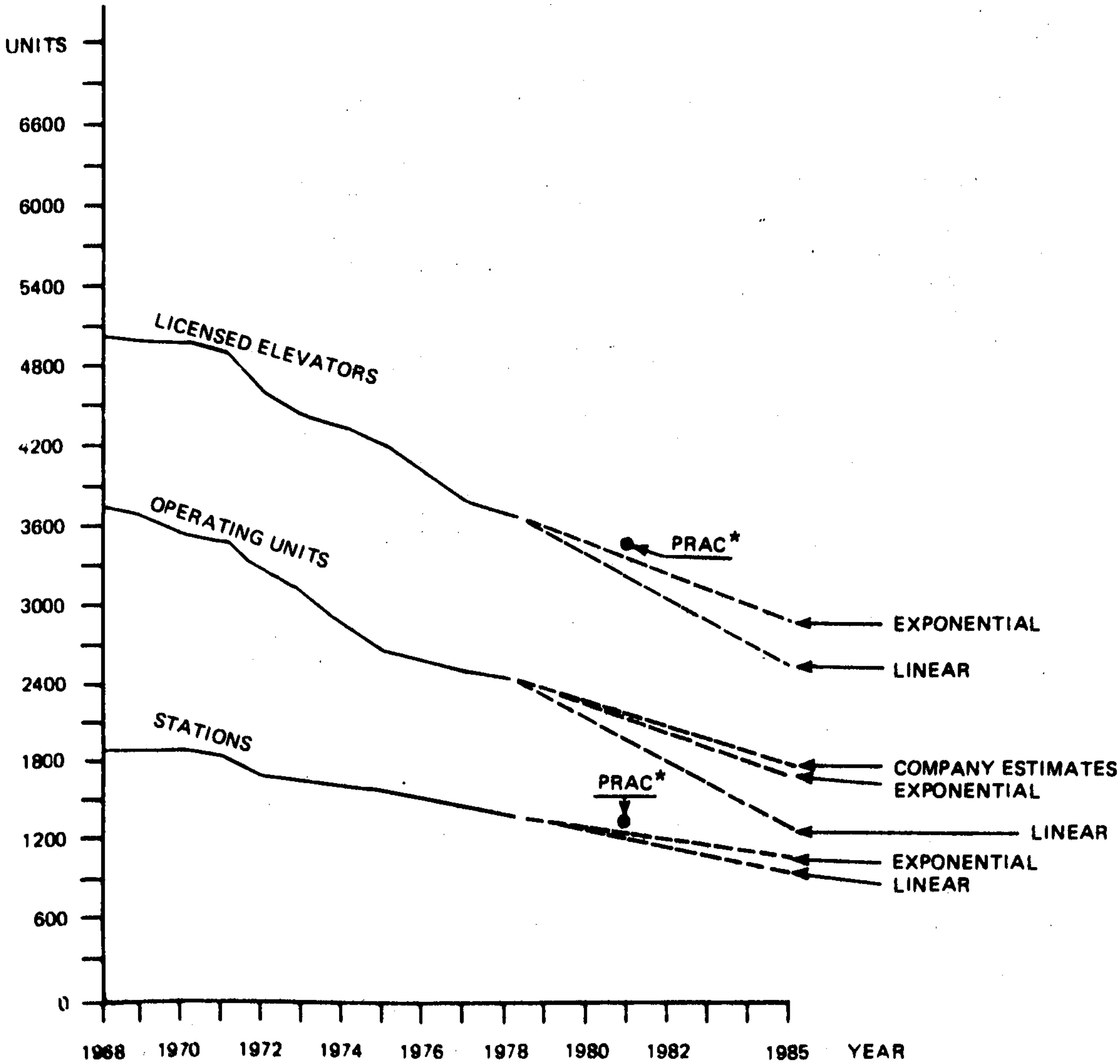
- Secondly, the major companies were canvassed to determine their plans in terms of expected total number of operating units; the total of these estimates for all companies is also shown in Exhibit VI-5. As can be seen, the companies' expected change in the number of operating units agrees closely to the exponential extrapolation.

Also shown in Exhibit VI-5 is the impact of the implementation of all of the PRAC recommendations on

EXHIBIT VI-4
Primary Elevator Statistics

As of August 1	Licensed Elevators	Operating Units	Stations	Average Operating Units per Station
1968	4999	3747	1923	1.95
1969	4983	3652	1917	1.91
1970	4970	3539	1908	1.85
1971	4848	3477	1835	1.89
1972	4567	3240	1672	1.94
1973	4384	3073	1617	1.90
1974	4293	2814	1594	1.76
1975	4164	2623	1556	1.69
1976	3963	2546	1495	1.70
1977	3739	2467	1417	1.74
1978	3658	2440	1394	1.75

EXHIBIT VI-5
Projections of
Primary Elevator System



*Estimates of reduction in the number of elevators and stations through line abandonment made by the Prairie Rail Action Committee (PRAC) in its report of January 1979.

the numbers of licensed elevators and stations. As can be seen, implementation of all the PRAC recommendations by 1981 would result in only a small part of the expected consolidation.

Accepting the exponential extrapolations as reasonable estimates, the number of elevators, operating units and stations on August 1st in 1971, 1978, and 1985 are as shown below:

Year	Number of Elevators	Number of Operating Units	Number of Stations	Operating Units Per Station
1971 (Actual)	4848	3477	1835	1.89
1978 (Actual)	3568	2440	1394.	1.75
1985 (Projected)	2588	1725	995	1.73

(2) Consolidation Has Been Caused by the Economics of Primary Elevator Operations

These trends in the number and size of primary elevators have resulted from a number of factors including:

- Elevator obsolescence
- Impact of improvements to the rural road network
- Introduction of high throughput elevator designs
- Improved safety and health standards which are costly to implement in older facilities
- Increased elevator labor costs.

All of these factors will continue to operate in the future. They will be reinforced by other factors such as unionization of elevator managers, and the potential impact of the hours of work legislation that has been scheduled for application to the primary elevator system. These measures will have a serious impact on the economics of the primary elevator operations and will accelerate the consolidation trends.

(3) Rail Line Abandonment Will Also Accelerate the Trend to Consolidation

The rail line abandonments resulting from the implementation of the recommendations of the Hall Commission and the Prairie Rail Action Committee will also cause consolidations. There are about 200 licensed elevators and 110 stations on the lines recommended by PRAC to be abandoned. Implementation of these recommendations would, therefore, increase the rate of consolidation.

PRAC recommended that producers who were forced by rail abandonment to truck their grain more than 20 miles to the nearest elevator should be compensated at the rate of one cent per bushel for each mile over 20 miles. If these recommendations are accepted, and, through the payment of compensation, producers are willing to truck farther, then perhaps further consolidation of rail lines may take place which would in turn accelerate or at least continue the trend of consolidation of the primary elevator system.

The impact of these line abandonments on railway operations is discussed later in this chapter.

(4) Producer Attitudes about Consolidation are Mixed

The impact of consolidation on grain companies and railway operations are almost entirely beneficial, resulting in greater throughput through individual facilities. However, the producer faces a potential disbenefit in the length of the haul required to carry grain to a primary elevator. There is little survey data available on producer attitudes. However, the Department of Agricultural Economics of the University of Saskatchewan recently conducted a survey of producer attitudes concerning competition between primary elevators and lengths of haul.

The results of this survey seem to indicate that many producers place a great deal of importance on the value of competition in improving the service provided by primary elevators and will drive farther to get it.

The results also seem to indicate that producers are not as sensitive to the length of haul as they are to the service provided and the degree of competition available. In other words, producers would probably accept a faster pace of consolidation if they were assured of good service and "competitive" grading and dockage estimates. (See Appendix S)

(5) The Proportion of Stations with Competitive Primary Elevators Has Stabilized

Some consolidation has resulted from single closures of elevators, while others have occurred where two firms make arrangements so that one would consolidate an elevator of the second company with its own existing facilities. One manager would operate both as a single operating unit; the second firm would take over a similar operation at another point. This process is known in the grain trade as a "saw-off". An examination of about half of the changes from 1973 to 1978 shows that there were 274 closures, 61 additions, and 66 market transfers ("saw-offs") between companies.

As shown in the table below, the percentage of stations where competitive services are offered decreased from 63 percent in 1966 to 47 percent in 1978.

PRIMARY ELEVATOR COMPETITION

AS OF AUGUST 1	NO. OF STATIONS	STATIONS WHERE COMPETITION EXISTS	PERCENT OF STATIONS WHERE COMPETITION EXISTS	AVERAGE COMPANIES PER STATION
1966	1952	1234	63.2	2.09
1967	1934	1224	63.3	2.03
1968	1923	1212	63.0	2.02
1969	1917	1155	60.3	1.94
1970	1908	1106	58.0	1.86
1971	1835	1068	58.2	1.88
1972	1672	766	45.8	1.62
1973	1617	755	46.7	1.63
1974	1594	706	44.3	1.61
1975	1556	700	45.0	1.61
1976	1495	684	45.8	1.62
1977	1417	656	46.3	1.62
1978	1394	654	46.9	1.61

There was a very sharp decrease from 1971 to 1972 when the elevators of the Federal Grain Company were taken over by the three wheat pools in each of their provinces.

Since 1972 the level of competition has been relatively stable. In the years ahead when much more consolidation will be taking place, competition at individual points will probably be decreased. This does not mean that effective competition will be removed, since the producer would still have the option of trucking grain to adjacent stations.

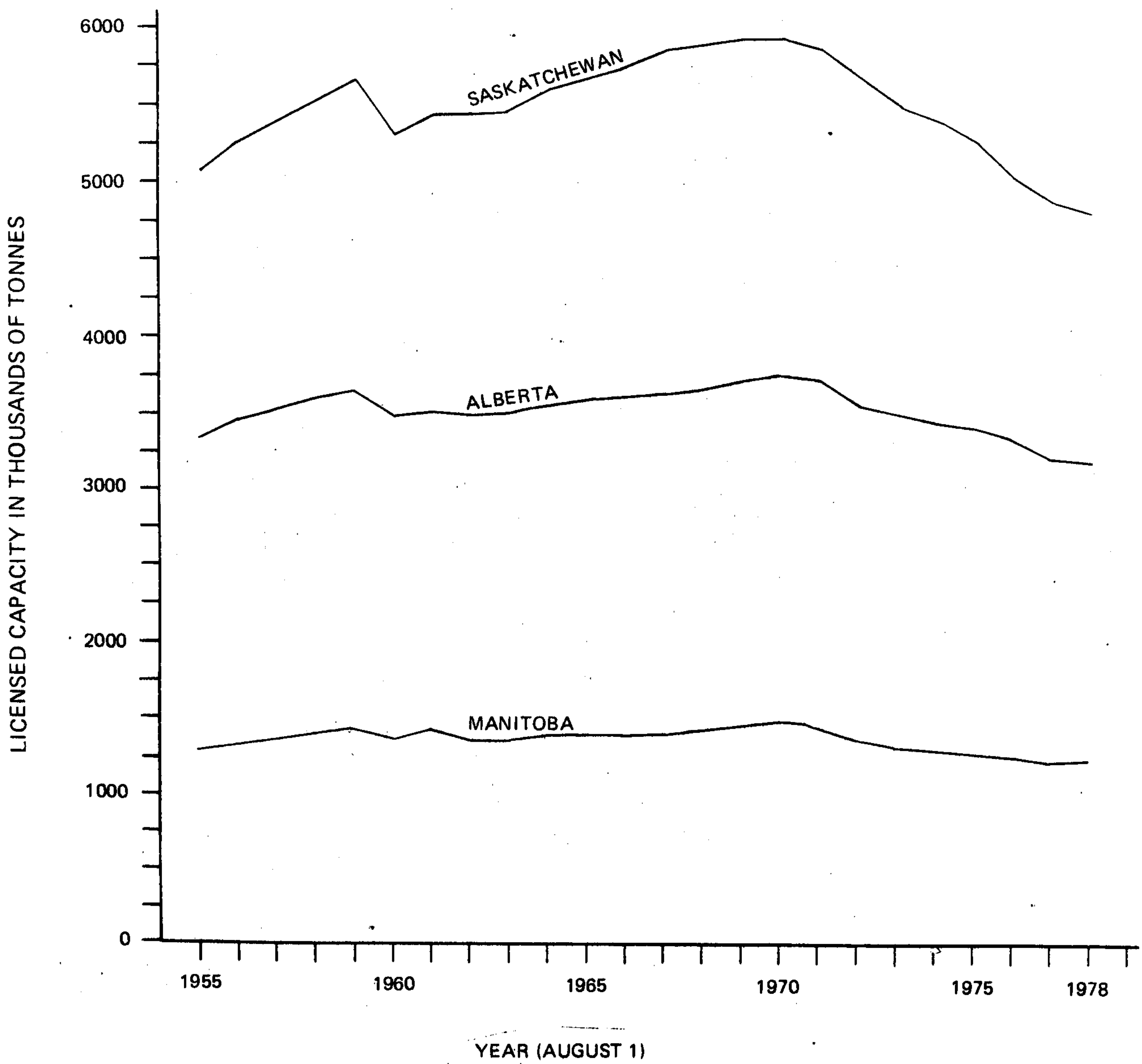
(6) The Average Size of Primary Elevators is Increasing

The effects of rail line abandonment on elevator consolidations will be relatively small compared to the rate of consolidation which is expected to occur due to cost changes and market forces and the development of new designs for high throughput facilities such as the new elevator being constructed by Alberta Wheat Pool at Magrath, Alberta.

While the number of elevators has declined steadily since 1940, total system licensed capacity moved upward until the late 1960's (see Exhibit VI-6). Since then, the decline in system capacity has been much less than the decline in the number of elevators. This was accounted for by a steady rise in the average capacity per elevator, through the closure of a large number of small elevators and the addition of some larger facilities.

An examination of some 61 additions and 274 closures over the period 1973 to 1978 shows the mean and median capacities of the facilities closed where 1,647 and 1,400 tonnes, respectively, and the mean and median capacity of the additions were 3,466 and 2,200 tonnes, respectively. The average capacity of the licensed operators has increased from approximately 2,300 tonnes in 1971 to 2,500 in 1978 and is projected to increase by 8 per cent to 2,700 tonnes in 1985.

EXHIBIT VI-6
Total Primary Elevator Capacity
By Province



The projected number of operating units for 1985 is less than half of the actual number in 1971. As noted, the average capacity per elevator is expected to increase by 8 per cent. At the same time the amount of grain handled by the system is expected to increase by over 50 per cent. Thus, over this period of time average turnover per elevator unit would be expected to triple. This is not likely to be a problem since the number of turnovers per year is generally seen as a function of the volume available rather than physical limitation. Car spotting capacity which is discussed later in this chapter may present a problem.

(7) <u>Variable Tariffs Could Accelerate Elevator Improvements</u>

At present, maximum primary elevator charges are regulated by the Canadian Grain Commission. The Grain Commission does not regulate minimum tariffs although all tariffs must be filed. Despite this freedom, grain companies generally charge uniform elevator rates for Board grains in all elevators. This has occurred for various reasons:

- The maximum tariffs are usually set just high enough to cover the system-wide costs of all elevators. The profits from efficient houses are therefore used to cover the cost of the less efficient.
- Some of the companies wish to charge all customers (members in the case of the co-operatives) the same prices no matter what type of facility is used.
- There is reluctance to compete in price because of the overall low level of profitability in the primary elevator system.
- The cost analysis required and tariff filing effort appears to inhibit the desire of the companies to set individual tariffs.

For all these reasons, there are few differences in tariffs and little incentive provided to the producer to haul his grain to a more efficient terminal. This lessens benefits to a company for construction of more efficient houses. With the development of new high throughput facilities and other improvements in elevator design, it is becoming necessary to attract higher volumes of grain to particular facilities.

More variable tariffs are therefore desirable and probably necessary to encourage investment in the primary elevator system. Variable tariffs would tend to accelerate the pace of consolidation and the replacement of obsolete primary elevators with newer, more efficient facilities. Variable pricing should be encouraged through changes in Grain Commission regulations to allow filing of tarrifs for classes of facilities. (New high throughput elevators also should be allocated substantial numbers of cars in the calculation of each company's share to encourage use of more efficient facilities).

These measures could encourage the companies to make investments in new facilities. The producer would be attracted to these more efficient facilities by lower elevator charges (and presumably better service) which should offset higher haulage costs. The lower elevator rates would reflect only the improvements in elevator efficiency. There may also be decreases in railway costs resulting as the number of points served decreases.

3. PRIMARY ELEVATORS SHOULD PRESENT NO MAJOR OVERALL CAPACITY CONSTRAINT

With the exception of car spots and the lack of a protein grading and identification system, the primary elevators should be able to handle the volumes expected over the next few years. However, several aspects of grading grain which do affect the efficiencies of the system are discussed in this section.

(1) The Multiplicity of Grades Has an Impact on Primary Elevator Efficiency

When more grades are handled in a particular elevator, more subdivisions of storage are required and the effective storage capacity is reduced. The stock sheets of a sample of about 200 primary elevators were examined to determine the numbers of grain and grade combinations carried. The results are shown on the following page.

NUMBER OF GRADES CARRIED IN SAMPLE OF PRIMARY ELEVATORS

NUMBER OF GRADES	ALTA.	Σ	SASK.	Σ	MAN.	Σ	TOTAL	Σ	PER CENT
< 5	8	8	0	0	0	0	8	8	4%
5 to 10	19	27	21	21	7	7	47	55	28%
11 to 15	24	51	36	57	9	16	69	124	62%
16 to 20	13	64	27	84	10	26	50	174	77%
21 to 25	3	67	13	97	5	31	21	195	93%
26 or more	0	67	2	99	1	32	3	198	100%
Total Elevators in Sample	67		99		32		198		

From this chart it can be seen that the median elevator is stocking 11 to 15 grades. The multiplicity of grades increases the subdivisions of storage which are required and reduces the effective utilization of storage space. A reduction in the number of grades would have benefits on primary elevator operations. It also has impacts on port terminal capacity and the operation of an inventory control system. The cost of maintenance of a large number of grades should be very carefully considered in relation to the resulting marketing advantages.

(2) Misshipments of Grain are a Problem

Primary elevator agents sometimes ship grades or types of grain other than those required (and ordered) to the ports. A comparative analysis of the types and grades of grain authorized with those unloaded at terminals was performed for a 12-week period in 1978. In this analysis differences between the authorization and grain types and grades unloaded were divided into three categories: a difference of one grade, differences of two or more grades, and differences in grain type. This classification scheme was used to account for "acceptable" grade substitutions. For example, Chinese contracts specify that a certain amount of 2 CWRS can be substituted for 3 CWRS. This scheme was also used to account for judgement mistakes by the agents assigning the grades. There can easily be one grade of difference between the grade assigned in this country and the final grade as determined by the Canadian Grain Commission inspectors in the port. The detailed results of this analysis are in Appendix I.

The analysis indicates that approximately 79 per cent of the authorized shipments are filled exactly as specified. Seventeen per cent of the shipments were unloaded and graded by Canadian Grain Commission inspectors with a single grade difference from the authorized, and three per cent of the shipments were of a different type from that originally authorized. The following table lists the results of this analysis by destination.

COMPARISON OF GRAINS AUTHORIZED VERSUS UNLOADED

	IDENTICAL	ONE GRADE DIFFERENCE	TWO+ GRADE DIFFERENCES	TYPE DIFFERENCE
Thunder Bay	74%	22%	3%	1%
Vancouver	86%	10%	4%	0%
Prince Rupert	91%	9%	0%	0%
Churchill	84%	13%	2%	1%
Weighted Average	79%	17%	3%	1%

Of the 21 per cent of authorizations which were not shipped as requested, some are a likely result of clerical errors or errors in grading. Differentiating between adjacent grades can be difficult. However, differences of two or more grades may be due to deliberate substitutions of orders by elevator managers. The percentage of deliberate misshipments (two or more grades and type differences) appears to be about four per cent of total shipments.

This level of deliberate misshipments does not appear to be a significant problem in terms of transport capacity. The system can absorb these differences without substantial cost. The level of single grade differences (17 per cent) appears higher than is desirable for normal inventory control. The one grade differences can affect the system if the Wheat Board is forced to substitute higher grades for lower, or if vessels are forced to wait longer for the right type of grain.

(3) Protein Grading Is A Specific Problem With the Present System

With the exception of protein level, the grades of grain being sold and exported match the grades and descriptions which are used to order grain from the primary elevators to the ports. The lack of a system to identify and segregate grain by protein level means that larger volumes than are immediately required must be shipped to the port in order to ensure that sufficient volumes of high protein grain are available. This is discussed in greater detail in Chapter IX.

4. PRIMARY ELEVATOR OPERATIONS MUST INTERFACE WITH RAILWAY OPERATIONS

Primary elevator and railway operations interact with each other in several ways. Those addressed in this section are:

- Scheduling Rail Operations
- Car Loading Delays
- Car Spotting Capacity
- Days of Week Worked.

The problems and possible improvements are described in the following paragraphs.

(1) Railway Services Are Largely Unscheduled

As primary elevator rationalization continues, increasing pressure will be applied to elevators to load more cars within the same period. Observations of primary elevator operations support the conclusion that car scheduling will become more important in every block. If managers are not prepared for loading on particular days, loading will take longer. In addition to lengthening car cycle time, elevator throughput may be decreased. This would have serious consequences throughout the grain handling system.

(2) Scheduling Rail Operations Would Improve Primary Elevator Performance

In only a few instances do the railways schedule empty cars for placement at primary elevators.* In most cases the only information an elevator manager has about upcoming shipments is the number and type of orders authorized for the following week.

When railways do not schedule empty car placement, elevator managers are limited in their ability to plan their operations. Following notification of its weekly authorization, a primary elevator manager must estimate which day(s) of the week empty cars will be delivered. Past patterns of service often provide guidance. From an elevator manager's perspective, accurate car scheduling is important for the effective operation of his elevator. If an elevator manager knows when empty cars will be delivered, producer deliveries can be postponed during loading so full attention can be given to loading activities. This would result in faster loading. Also, scheduling part-time assistance to match loading time would result in faster loading and more effective use of staff time.

It is possible for railways to schedule cars on most runs, since regular service patterns exist. The principal constraint is knowledge of the number of empties available for distribution. Reasonable estimates can be made based upon unloadings at the terminals. Although shortfalls will occur and some schedule changes may be made at the last minute, scheduling should help the primary elevators in their operations planning and may improve management of the rail operations as well.

(3) Pulling Cars More Quickly After Loading Could Improve Car Cycles

Currently, car loading delays at the primary elevators are not a major problem in most blocks. However, delays can be reduced thereafter awaiting a pull of the loaded car by the railway.

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* CP schedules blocks out of the Winnipeg Customer Service Centre and CN schedules some of the Dauphin block. Results of an analysis of Winnipeg CSC schedule adherence indicates that over 60 percent of the spots were two or more days off schedule.

1. Cars at Primary Elevators are Generally Loaded Within One Day of Placement

As shown in the table below, 70 percent of the shipments studied in a 12-week sample were loaded within one day of delivery at the primary elevator. (If weekend spots at the elevators are excluded, this percentage is higher.)

DISTRIBUTION OF PLACE TO LOAD TIMES AT PRIMARY ELEVATORS*

PLACE TO LOAD TIME (DAYS)	PERCENT OF SAMPLE	CUMULATIVE PERCENT
0	47	47
1	23	70
2	11	81
3	8	89
4	5	94
5	2	96
6	1	97
7	1	98
8	0.5	98.5
9	0.5	99
10 and over	1	100

* Based on 12-week sample of car distribution data.

The Saskatchewan Wheat Pool (SWP) also carried out a survey of loading times for a two-month period in the fall of 1975. In the SWP survey, car loading was completed on the same or following day in 75 percent of the cases. Although the lack of information creates operational problems for elevator managers, the car cycle is not seriously affected. While problems do not now exist, it is expected that this interface may become a serious problem within the next 5 to 10 years as increasing volumes are handled by a decreasing number of elevators. The railways may find it necessary to improve their scheduling efforts throughout all blocks. Scheduling should speed up service as well as assist in assuring that loading takes place promptly.

The variation in time required for loading between companies and between different seasons of the year was also examined. The results are shown in Exhibit VI-7. It should be noted that the CN and CP data are not directly comparable. CN records the date cars are actually placed at elevators; CP records only the date of arrival of the train. The Alberta Wheat Pool's (AWP) higher times were found to reflect greater representation of the AWP in blocks in Alberta. Blocks 41, 43, 45, 81, 82 and 86 had a significantly longer than average time between empty delivery and loading. The reasons for this are not readily apparent. Service patterns and frequency have some effect but this does not fully explain the differences.

2. <u>The Railways Pull Cars Between One and Two Days After Loading</u>

In the SWP survey, more than 50 percent of the cars loaded were pulled in two or less days. The 1978 sample of CN operations developed for this operations analysis, shows the average times for the winter, spring, and fall periods (load to release) being 1.75, 1.64, and 1.44 days respectively. Similar data was not available for CP as pull times are not recorded in the CP data base.

3. <u>Overall One Day Savings in Car Cycle Time May be Achieved by Increased Use of "Layover Turns"</u>

While the delays for loading at the primary elevators are not serious, the substantial delays subsequent to loading, awaiting pick-up by the railway does provide potential for car flow improvements. Each train run was examined to see if scheduling could be altered to minimize car turn-around time. For this analysis, this was assumed to be achieved by placing the cars on the midnight to 8:00 a.m. shift, resting the train crew during the day at the extremity of the run and picking up the loaded cars on the 4:00 p.m. to midnight shift on the return to the starting point. It was assumed that this change

EXHIBIT VI-7
Comparison of Primary Elevator Loading Delays

CN AVERAGE NUMBER OF DAYS
BETWEEN PLACING AND LOADING OF CARS

COMPANY	WINTER	SPRING	FALL
SWP	1.69	0.80	0.52
AWP	2.12	1.24	1.08
MPE	1.24	0.92	0.46
UGG	1.85	0.84	0.58
CAR	1.52	0.70	0.91
PIO	1.45	0.68	0.62
Others	1.74	0.65	0.74
All Companies	1.76	0.83	0.65

CP AVERAGE NUMBER OF DAYS
BETWEEN ARRIVAL AND LOADING OF CARS

COMPANY	WINTER	SPRING	FALL
SWP	2.22	1.43	1.26
AWP	2.38	1.71	1.75
MPE	1.50	1.47	1.27
UGG	2.17	1.50	1.29
CAR	2.84	2.40	1.64
PIO	1.87	1.43	1.13
Others	2.11	2.22	2.27
All Companies	2.20	1.57	1.39

would not be introduced if it involved an increase in frequency of service.

Of approximately 210 grain train runs currently in operation, 33 percent already have this "layover turn"* type of service in place, accounting for 21 percent of total country grain volume movements. All of the remaining runs were examined to see if schedules could be changed, and to determine the potential savings in car days. There were 126 train runs determined to have potential for change.** Weighting each change by the proportion of total volume generated by the train run, it was estimated that the adjustments of country service to this type for the remaining train runs, where determined feasible, would provide a 1.5 day savings in country cycle time overall, with the improvement of railway company as follows:

POTENTIAL IMPROVEMENT IN CAR CYCLES THROUGH REALIGNMENT OF HOURS OF SERVICE

RAILWAY	IMPROVEMENT POTENTIAL
CN	1.6 days
CP	1.5 days
GSL	1.3 days
NAR	1.0 days
All train runs	1.5 days

Assuming that for every third train run this type of improvement may not be possible because of locomotive utilization or crew agreement conflicts, a one day savings is a more probable estimate of the achievable improvement.

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* "Layover turn" service, train crew places empties on first evening, sleeps overnight at the end of the subdivision while cars are loaded and then pulls loads on following night.

** A list of those train runs is provided in Appendix F.

(4) Car Spotting Capacity Will Be A Problem at Many Elevators

Car spotting capacity was analyzed for a 25 percent sample of blocks (Blocks 7, 15, 23, 31, 37, 47, 63, 73, 77, 82, and 86). For each elevator in the sample, the maximum number of cars that could be loaded in a day was calculated, the limitation being either loading rate or car spotting capacity. This was compared with throughput (averaged for all elevators at a particular station), and the number of trains required to carry the 1977/78 volume was calculated. Approximately 30 percent of the houses in the sample appeared to need 50 or more trains per year to clear the present throughput, indicating that limitations on either spotting or loading were potentially impeding their ability to move grain at the 1977/78 volumes unless better than weekly service were provided. Of those houses presently requiring a service frequency of 50 or more trains, about 53 percent appear to be limited mainly by spotting capacity, some 26 percent by limited loading ability, and 18 percent by both. Increasing car spotting capacity is not always easy, particularly when the presence of adjacent elevators does not permit the lengthening of sidings, although in some cases parallel sidings combined with swinging spout extensions can be an acceptable alternative.

Not lengthening sidings or otherwise increasing car spotting capacity will tend to restrict the throughput of particular elevators. It also would require more frequent train runs thus increasing the burden of train operations to achieve the same level of throughput. Clearly, it is in the interest of both the railways and the grain industry to match car spotting capacity with desirable throughput, taking into account the expected frequency of train operations on each line. Obviously the problems involved in ensuring adequate car spotting capacity will vary by locality. Specific joint railway/industry committees should be set up by the Task Force (see Chapter X) to study this problem, particularly when adjacent lines are to be subjected to abandonments or adjacent stations may be consolidated. The costs of improvements might be shared by the railways, grain companies, and government on a negotiated basis.

(5) Primary Elevator Operations and Rail Services Should be Coordinated on a Seven-Day-a-Week Basis

Analyses were performed of the time between the spotting of cars and their loading by the day of the week on which the cars were spotted. The results of this tabulation are as follows:

AVERAGE PLACE TO LOAD TIMES BY THE DAY OF CAR PLACEMENT

DAY	TIME ON DAYS
Saturday	2.2
Sunday	2.2
Monday	1.3
Tuesday	1.0
Wednesday	1.0
Thursday	1.2
Friday	1.6
Weekly Average	1.4

As would be expected the spot-to-load times for cars that arrive on Saturdays and Sundays are longer than for those arriving on other days of the week. This is because these cars normally are not loaded until the next working day. If primary elevators were to load on the weekend and cars spotted on Saturday and Sunday were to have the same average place to load times as cars spotted on weekdays, then the average place to load times would be 1.2 days and the overall car cycle time would improve by 0.2 days on average.

While it would not pay in economic terms to schedule seven days working at all primary elevators on the Prairies, some weekend operation will be necessary to effectively utilize all resources in the system including locomotives, railway crews, and elevator personnel. It may be possible to achieve most or all of these car cycle savings with only minimal increases in elevator operating costs through careful coordination between local railway and elevator personnel.

If an efficient "layover turn" service is to be offered by the railways, crews, cars and locomotives should be utilized on a seven-day-a-week basis. Therefore, for those turns scheduled on weekends, the primary elevators to be served should also load on the weekends served.

5. BRANCH LINE ABANDONMENTS WILL HAVE AN IMPACT ON RAILWAY OPERATIONS

A total of 3,450 miles in Prairie rail network have been recommended for abandonment by either the Hall Commission or PRAC (this also includes 534 miles of line which have no grain delivery function). To date the Canadian Transport Commission has approved abandonment for approximately 1,401 miles and is presently reviewing the remaining 2,049 miles.

The recommendations of the Hall Report and PRAC suggest that a number of railway subdivisions would be abandoned either completely or partially. These proposed abandonments will eliminate railway costs in maintaining and operating these lines and should therefore reduce the branchline subsidies. Most significantly, the abandonment of these lines will mean that they will not require government capital expenditures for rehabilitation.

Although the same number of cars would be loaded (although at different points), line abandonment would permit the railways to reduce the number of train runs on low density lines. This will most likely result in reduced power requirements and improvements in car cycle times. An analysis was performed to estimate the impact of these abandonments on railway operating costs.

The recommended abandonments will also influence the railways' grain fleet requirements by type of car. Many of the subdivisions recommended for abandonment have 60 pound rails. Ties, structures and ballast are for the most part in poor condition. For these reasons, many of these lines have restrictions on the maximum axle loading allowed. If they are abandoned, the proportion of the Prairie railway system which can handle the heavier steel and aluminum hopper cars fully loaded will therefore increase.

(1) A Sample of Typical Subdivisions Recommended for Abandonment Was Analyzed

An analysis was performed for thirteen subdivisions recommended for abandonment by PRAC. Although this sample* does not necessarily represent all proposed abandonments, it does illustrate the nature of the impact of the abandonments on the railways. The subdivisions recommended for abandonment were divided into two groups: full abandonment and partial abandonment. The analysis was performed by estimating the transfer of required carloads to adjacent lines not scheduled for abandonment.

Using line capacity, service pattern and elevator proximity data, estimates of railway operational savings were made. The analysis concentrated on the number of train runs that could be saved through line abandonment. Since actual car cycle data was not readily available on a subdivision or train run basis, it was not possible to accurately estimate what savings, if any, would accrue in car cycle time as a result of the abandonments. A gross estimate of the car cycle effect was made by comparing service patterns of subdivisions planned for abandonment with those of lines expected to receive the diverted traffic.

(2) Findings Differ for Partially Abandoned vs. Fully Abandoned Lines

Analysis was made of 13 lines facing partial or full abandonment. Exhibit VI-8 gives the major results of this analysis. Producers on subdivisions facing total abandonment would probably haul their grain to elevators on adjacent subdivisions. Exhibit VI-9 illustrates the transfers to adjacent lines that might occur for the subdivisions in the sample. Exhibit VI-10 lists the estimated capacity and new volume for each subdivision in the analysis. In no case does the new volume approach the line capacities, although additional runs may be required on a few of the adjacent subdivisions

* The Hall and PRAC reports recommend abandonment of all or part of 81 subdivisions.

EXHIBIT VI-8
Savings From Fully Abandoned Subdivisions

Sample Subdivision	Abandonment Type	1976 Service Frequency	Mileage Reduction	Annual Estimated Trips Reduced	Annual Estimated Carloads Transferred To; (Adjacent Subdivisions)		Annual Estimated Trips Added to Adjacent Subs	Annual Estimated Net Trip Savings
CN Chelan	Partial	30	29.9	0	CN Chelan (remainder)	595	0	0
CN Preeceville West	Partial	123	41.5	0	CP Tisdale	476	0	0
CN Gravelbourg	Partial	61	51.2	0	CP Amulet	163	0	0
					CN Avonlea	67	0	0
					CP Gravelbourg (remainder)	387	0	0
CN Carman II	Full	53	39.9	53	CP Glenboro	870	0	53
					CP Napkina	870	0	
CN Bengough	Full	39	71.5	39	CP Assiniboia	1530	0-10	29-39
CN Endiang	Full	19	34.3	19	CP Lacombe	220	0	19
					CN Oyen	220	0	
CN Miami	Full	86	62.1	86	CP LaRiviere	2435	10-20	86
CN Hartney	Full	49	42.0	49	CP Estevan	250	0	39-44
					CP Glenboro	1255	5-10	
					CP Napkina	200	0	
CP Furness	Full	33	19.5	33	CN Wainwright	200	0	
					CN Blackfoot	200	0	33
					CN Lloydminster	200	0	
CP Big Gully	Full	22	24.4	22	CN Blackfoot	198	3-5	17-19
CP Kelfield	Full	33	27.9	33	CN Wainwright	234	0	33
					CP Kerrobert	234	0	
					CP Reford	234	0	
CP Wishart	Full	28	26.2	28	CP Wynyard	478	0	28
					CN Watrous	478	0	
CP Miniota	Full	48	71.6	48	CN Rivers	815	0	48

Source: Prairie Rail Action Committee Report and Canadian Transport Commission

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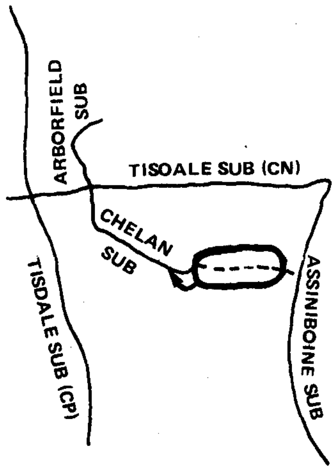
* Based on 1976 service frequencies obtained from Canadian Transport Commission.

EXHIBIT VI-9
Sample Distribution of Carloads
Among Adjacent Lines



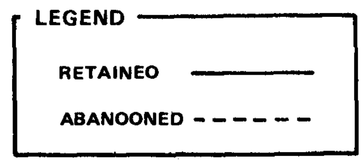


EXHIBIT A
DISTRIBUTION OF CARLOADS AMONG ADJACENT LINES
CHELAN ABANDONMENT

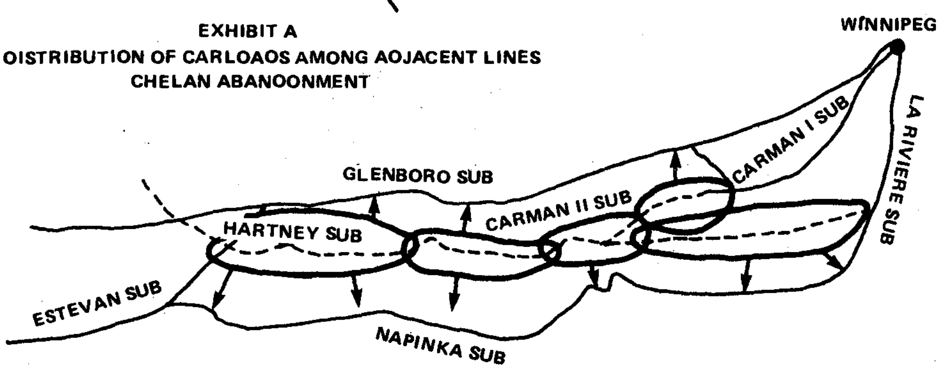


EXHIBIT B
DISTRIBUTION OF CARLOADS AMONG ADJACENT LINES
CARMAN II ABANDONMENT

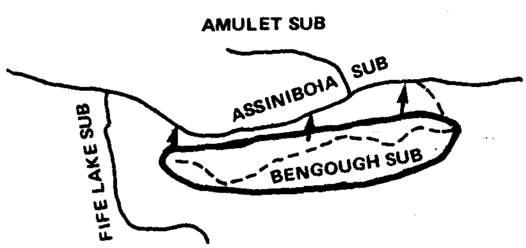


EXHIBIT C
DISTRIBUTION OF CARLOADS AMONG ADJACENT LINES
BENGOUGH SUBDIVISION

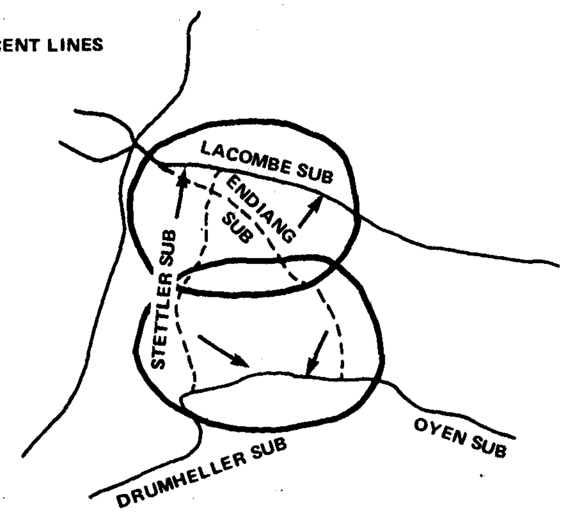
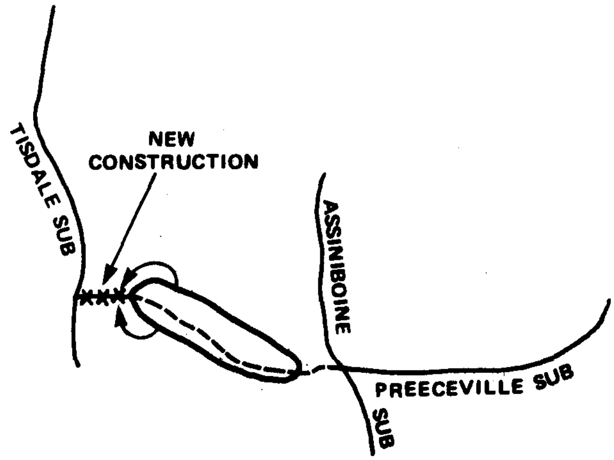
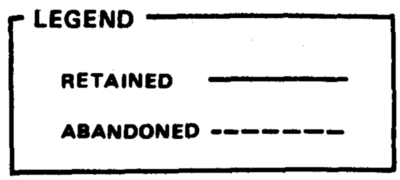


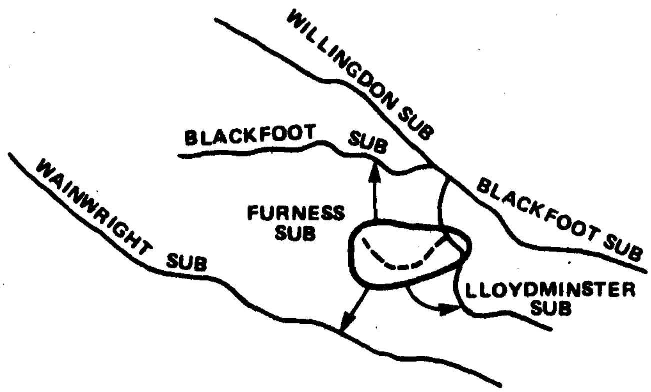
EXHIBIT D
DISTRIBUTION OF CARLOADS AMONG ADJACENT LINES
ENDIANG ABANDONMENT

EXHIBIT VI-9
(Continued)

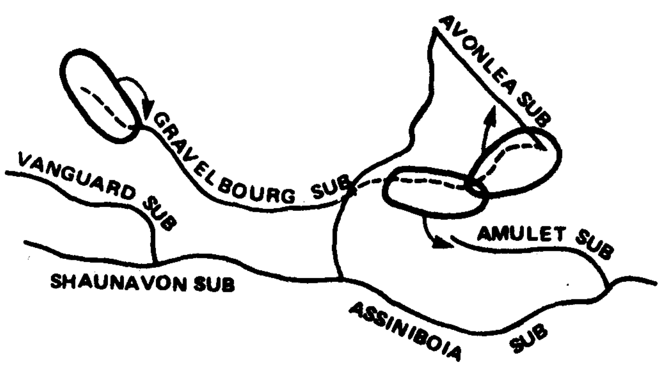




CN PREECEVILLE ABANDONMENT



CP FURNESS ABANDONMENT



CN GRAVELBOURG ABANDONMENT

EXHIBIT VI-10
Adjusted Volumes By Subdivision

Subdivision (Block)	Estimated Additional Cars Per Year	1977-78 Carload Volume	Adjusted Total Cars Per Year	Grain Car Capacity* Per Year At Current Level of Service (# of Cars)
CN Oyen (47)	220	2100	2320	6630
CN Tisdale (25)	476	2825	3301	10920
CP Glenboro (62)	2125	5215	7340	18100
CP Napkina (62)	1070	3950	5020	14460
CP LaRiviere (62)	2435	3585	6020	15600
CP Estevan (64)	250	3910	4160	17300
CP Assiniboia (70)	1530	5750	7280	15600
CP Lacombe (86)	220	675	895	4500
CP Amulet (71)	163	808	971	1560
CN Avonlea (35)	67	2362	2429	5460
CN Wainwright (39)	434	3230	3664	8840
CN Blackfoot (37)	398	4791	5189	3120**
CP Lloydminster (76)	200	3608	3808	17160
CP Keriobert	234	2927	3161	7800
CP Reford	234	702	936	1300
CP Wynyard	478	3654	4132	18720
CN Watrous	478	6339	6817	18720
CN Rivers	815	1701	2516	3120

* Function of operating frequency and train run maximums.

** Will require extra runs.

to handle the increased volume with a suitable level of service. These additional train runs were reflected in the estimates of train run savings given in Exhibit VI-8.

1. Partial Abandonment Will Not Result In Significant Reductions in Train Operations But Maintenance and Rehabilitation Savings Will Be Substantial

Partial abandonment will probably not cause any significant reduction in the number of trains operated. Elevators on retained portions of these subdivisions will require a level of service similar to what they were receiving prior to abandonment. For example, the Chelan Subdivision scheduled for partial abandonment was examined to estimate potential savings from reduced train mileage and reduced service runs. The estimated train mileage saving was 1,680 miles per year, but the analysis indicates that no significant operating saving other than train miles would be possible if the retained portion of the Chelan is to receive reasonable service; the same number of crews and locomotives would be required. The subdivisions recommended for partial abandonment by PRAC and the Hall Commission do not include any with "layover turn" service.

There will be only negligible savings in the number of locomotives and crews required. Partially abandoning subdivisions does not reduce crew and locomotive requirements, although maintenance and rehabilitation savings on the abandoned mileage will be substantial.

2. Full Line Abandonment Will Reduce Train Operating Costs Substantially As Well As Reduce Rehabilitation Requirements

For subdivisions to be totally abandoned, savings will accrue from reduction in train mileage, in rehabilitation and maintenance of way costs, and in crew and locomotive requirements. Exhibit VI-8 identified the mileage and trip savings from fully abandoned subdivisions. In the ten subdivisions proposed for full abandonment in the sample, the total savings would be 420 fewer miles of line to be maintained and a net saving of between 365 and 387 round trips by crews and locomotives.

(3) These Results Were Extrapolated to All Subdivisions Scheduled for Abandonment

All subdivisions recommended for abandonment were categorized according to full or partial abandonment. Exhibit VI-11 lists these subdivisions by category. Twenty-five percent are to be only partially abandoned. While the savings from line maintenance and rehabilitation will be significant, operating savings from reduced train operations on partially abandoned subdivisions will generally be negligible since present frequency will still be required to maintain a reasonable level of service on the retained portions.

For the 56 subdivisions to be fully abandoned, the estimated train mile reduction is approximately 165,000 miles per year (a total of 2,350 miles at an average of 35 round trips per year). It was estimated that 80 crew and locomotive days could be saved each week, although these crews could be needed in other freight or grain services. Based on findings from the sample subdivisions, these savings may be reduced by 10 to 20 percent due to increased train frequency required on lines adjacent to the lines abandoned.

An analysis of the impact on car cycle times was performed. Exhibit VI-12 shows the service frequency and patterns of the sample of subdivisions to be abandoned and of the adjacent lines which are expected to receive the diverted grain. For these lines, the service is expected to improve in five cases, to show no change in seven cases, and to deteriorate in one case.

(4) Analysis Performed to Estimate Car Type Requirements

It is expected that implementation of the recommendations of the Hall Commission and the Prairie

EXHIBIT VI-11
Categorization of Subdivisions
Proposed for Abandonment
By Hall and PRAC

Type I - Partial Abandonment

CN		CP
CN *Chelan*	CN Coronado	CP Melfort
CN Sheerness	CN Weyburn	CP Cardston
CN Robinhood	CN Rhein	CP Colonsay
CN Amiens	CN Erwood	CP Bromhead
CN Cudworth	CN *Gravelbourg*	CP Amulet
CN *Preeceville*	CN Elrose	CP Fife Lake
CN Central Butte	CN Avonlea	CP Matador
CN Pleasant Point		CP Langdon
CN Carberry		CP Suffield

Type II - Full Abandonment

CN		CP
CN *Carman II*	CN Meskanaw	CP *Miniota*
CN Stettler	CN *Hartney*	CP Lenore
CN *Endiang*	CN *Miami*	CP Varcoe
CN *Bengough*	CN Acadia Valley	CP Alida
CN Goodwater	CN Riverhurst	CP Lyleton
CN Corning	CN Main Centre	CP Snowflake
CN Notre Dame	CN Tonkin	CP Stewart Valley
CN Rossburn	CN Winnipegosis	CP Dunelm
CN Neepawa	CN Oakland	CP Colony
CN Bodo	CN Rapid City	CP *Wishart*
CN Ste Rose	CN Carlton	CP McMorran
CN Haight	CN White Bear	CP Carman
CN Kingman		CP Pennant
CN Dodsland		CP Vegreville
CN Wakopa		CP Alberta Central
CN Inwood		CP Crossfield
CN Ridgeville		CP Cassils
CN Lewvan		CP Woolford
CN Porter		CP *Big Gully*
CN Wawanesa		CP *Furness*
CN Cutknife		CP Asquith
		CP *Kelfield*
		CP Rosetown
		CP Shamrock

Note: Includes some lines already abandoned.

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* Underlined subs included in sample.

EXHIBIT VI-12
Service Pattern Adjusted For
Traffic Changes

	ABANDONED LINE		ADJACENT LINE		
Abandoned Line	Frequency Per Week	Place/Lift Trick*	Frequency Per Week	Place/Lift Trick*	Change**
CN Chelan	1-2	1/2	1/2	1/2	0
CN Preeceville W.	1	3/2	3 and 1-2	1/1	0
CN Gravelbourg	2	1-2/1-2	1-2	1-2/1-2	0
CN Carman II	3	3/2	1-3	1/1 and 3/2	0
CN Bengough	1-2	2-3/2	4	1/1	+
CN Endiang	1	1/2	1-2	1/1 and 1/1	+
CN Miami	1-2	3/2	3	1/1	-
CN Hartney	3	3/2	5-7	1/1	+
CP Furness	2	1/1	1-3	1/1	0
CP Big Gully	1	1/1	1	1/1	0
CP Kelfield	1	1/2	1-3	1/1 and 1/2	+
CP Wishart	1-2	1/1	1-3	1/1 and 1/2	+
CP Miniota	2	1/1	2	3/1	0

* Trick 1: 0801-1600
Trick 2: 1601-2400
Trick 3: 0001-0800

** + Service improvement
0 No Change in service
\- Service reduction

Rail Action Committee will change the car type requirements for the Prairie rail network. Car type requirements are defined by the load limitations of the subdivisions. Subdivisions which can accommodate up to 177,000 pound loads are limited to box cars; those which can accommodate up to 220,000 pound loads are limited to aluminum hoppers or light loaded steel hoppers; and those which can accommodate up to 263,000 pound loads are not limited. The load limitations are dependent upon the weight of the rail and any bridge limitations on the line.

As the rail network changes through rehabilitation and abandonment, the load limit split of the network will change. Optimal planning for the grain fleet required knowledge of the requirements for each type of car (box cars, aluminum hoppers, and steel hoppers). Based on the Hall and PRAC recommendations, the car type requirements of the rationalized network were calculated and compared to the current requirements. The details of the calculations are shown in Appendix J.

(5) <u>Findings Indicate Proportions of Hoppers and Box Cars Required in Rationalized Network</u>

Exhibit VI-13 compares grain car requirements by line capacity restrictions before and after rationalization. The volume of grain carried by type of line in 1977/78 is compared with the volume for a rationalized network. The results indicate that the proportion of tonnage that could be carried in hopper cars would increase from 49 percent to 53 percent, the aluminum or light loaded hopper share would increase from 42 percent to 44 percent and box car share would decrease from nine percent to three percent through abandonment.

On 23 CP subdivisions, the load limits will accommodate hoppers, but the railway is restricted to using box cars since some elevators on these subdivisions are not equipped with spouts for loading hoppers. It is expected that over the next five years as more hoppers become available, these elevators

EXHIBIT VI-13
Effect of Line
Rationalization on
Box Car Requirements

Line Capacity (Car Type)	Number of Tonnes Carried				Net Change (Millions of tonnes)	Percentage Change
	1977-78 Actual		1977-78 Rationalized*			
	Tonnes (Millions)	Percent Distribution	Tonnes (Millions)	Percent Distribution		
Steel Hoppers	12.5	49%	13.4	53%	+0.9	+ 8%
Light Hoppers**	8.4	34%	9.4	37%	+1.0	+12%
Boxes/Light Hoppers***	2.1	8%	1.8	7%	-0.3	-12%
Boxes	2.2	9%	0.8	3%	-1.4	-65%
Total	25.2	100%	25.4	100%		

* Based on Hall and PRAC recommendations.
** Light hoppers includes aluminum hoppers and light loaded steel hoppers. Also includes rehabilitation program of 15 subdivisions from boxcar loads to aluminum hopper loads.
*** Some CP lines are capable of handling light hoppers, but boxes only are run since elevators are not equipped with hopper spouts.
Totals do not match due to rounding.

will be retrofitted with hopper spouts. The projected volume on these 23 lines after rationalization is indicated in Exhibit VI-13 under the boxes/light hoppers category.

The results also indicate that movements on lines restricted to box cars would be down by 65 percent as the network is rationalized and hopper movements would increase by 20 percent. The CP lines restricted to light hopper loads but which currently use box cars because of loading spout constraints would see a decrease involume moved of 12 percent.

It has been estimated that lines expected to be rehabilitated would account for 7 percent of the volume. Lines undergoing rehabilitation would be capable of accommodating light hoppers.

(6) Conclusions Formulated from Line Abandonment Analysis

The conclusions that can be drawn from these findings are:

- Service frequency increases on lines adjacent to abandoned lines will be minimal; railway savings will occur due to reductions in trips, but will not be significant only for maintenance and rehabilitation.
- Complete subdivision abandonments will result in greater savings for railways than partial abandonments.
- PRAC and Hall recommended abandonments will probably result in only slight improvements in car cycle time.
- Fleet requirements in a rationalized network will be 53 percent steel hopper, 34 percent light hopper, and 3 percent box car.

6. PRAIRIE OPERATIONS CAN ADAPT TO THE HIGHER VOLUMES EXPECTED

The analyses presented in this chapter indicate that the system elements on the Prairies can be expected to handle the anticipated higher volumes. However, a number of incremental improvements could and should be made. In the main, these improvements involve improved information flow and coordination rather than involving large capital expenditures. Better coordination of the railway and primary elevator operations and the expanded use of "layover turns" could achieve a significant improvement in car cycles. These and other recommendations are summarized in the suggested implementation agenda given in Chapter XI.

VII. PORT OPERATIONS

Grain is shipped to market through eastern terminals at Thunder Bay and Churchill and western terminals at Vancouver and Prince Rupert. These terminals are, on occasion, experiencing difficulties in handling the present volumes of grain. Some of these difficulties are caused by interactions with other parts of the system (e.g., grain received of a type not immediately required, or a shortage of rail car arrivals in comparison with immediate needs). Given the significantly higher volumes of grain that may be anticipated in the years to 1985, questions are raised as to the ability of the terminals to handle the necessary volumes, even if the supply of rail cars and locomotives and the capacity of the main line and yards evolve to provide the additional capacity needed.

The analysis reported in this chapter examines:

- Whether the terminals in the east and west have sufficient facilities (both elevator and railway) to meet the demand that may be anticipated in the near future

- What additional increases may be indicated in physical facilities to unload, clean, dry, store and offload grain

- Whether additional facilities as needed should be constructed at Thunder Bay and Vancouver or whether greater use should be made of Churchill and Prince Rupert

- Whether further pooling, switching, interchanging, or terminal elevator specialization should be considered

- What controllable determinants of vessel arrival patterns exist that may be modified to influence the arrival patterns in order to increase the efficiency of the system to meet demand.

Members of the project team examined terminal operations at Vancouver, Prince Rupert, and Thunder Bay. Previous visits had been made to Churchill.

The facilities and operating practices, coupled with variations in demand and supply, were found in some cases to constrain system throughput.

1. VANCOUVER'S PROBLEMS ARE ACUTE

The problems in each port are quite different and present varying constraints on present and future throughput. The emphasis here is on the problems and possible improvements related to the west (particularly Vancouver) where potential export traffic constraints are especially acute.

Within the Port of Vancouver, CN and CP Rail are responsible for the movement of virtually all export grain. The British Columbia Railway (BCR) brings only about 1.5 percent of total grain traffic to Vancouver. Exhibit VII-1 is a map of the Vancouver area showing major railway facilities and terminal elevators. Exhibit VII-2 shows the average number of loaded grain cars per day which passed through Vancouver in the crop year 1977/1978. On an average day, 247 grain cars arrived by CP, 224 by CN, and six by BCR.

Four major terminal elevators are currently operating in Vancouver. CN services Pacific, United Grain Growers, and Saskatchewan Wheat Pool. CP Rail serves Alberta Wheat Pool as well as Pacific and United Grain Growers. The track capacity at each elevator is as follows:

VANCOUVER ELEVATORS	SERVED BY	TRACK CAPACITY CARS
Pacific #1 and #3	CN/CP	67
United Grain Growers	CP/CN	25
Alberta Wheat Pool	CP	42
Saskatchewan Wheat Pool	CN	70
Total		204

EXHIBIT VII-1
Vancouver Terminal Area

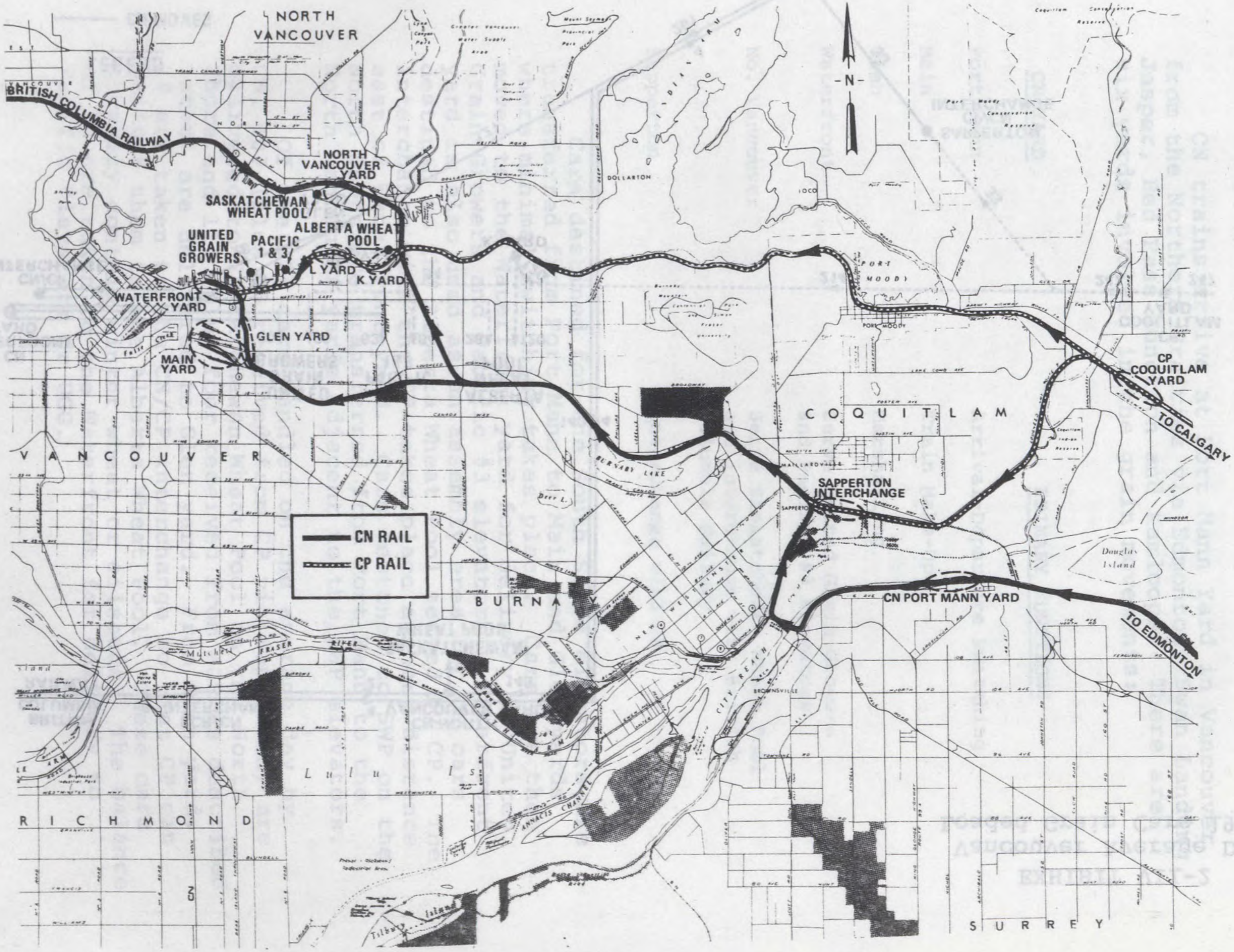
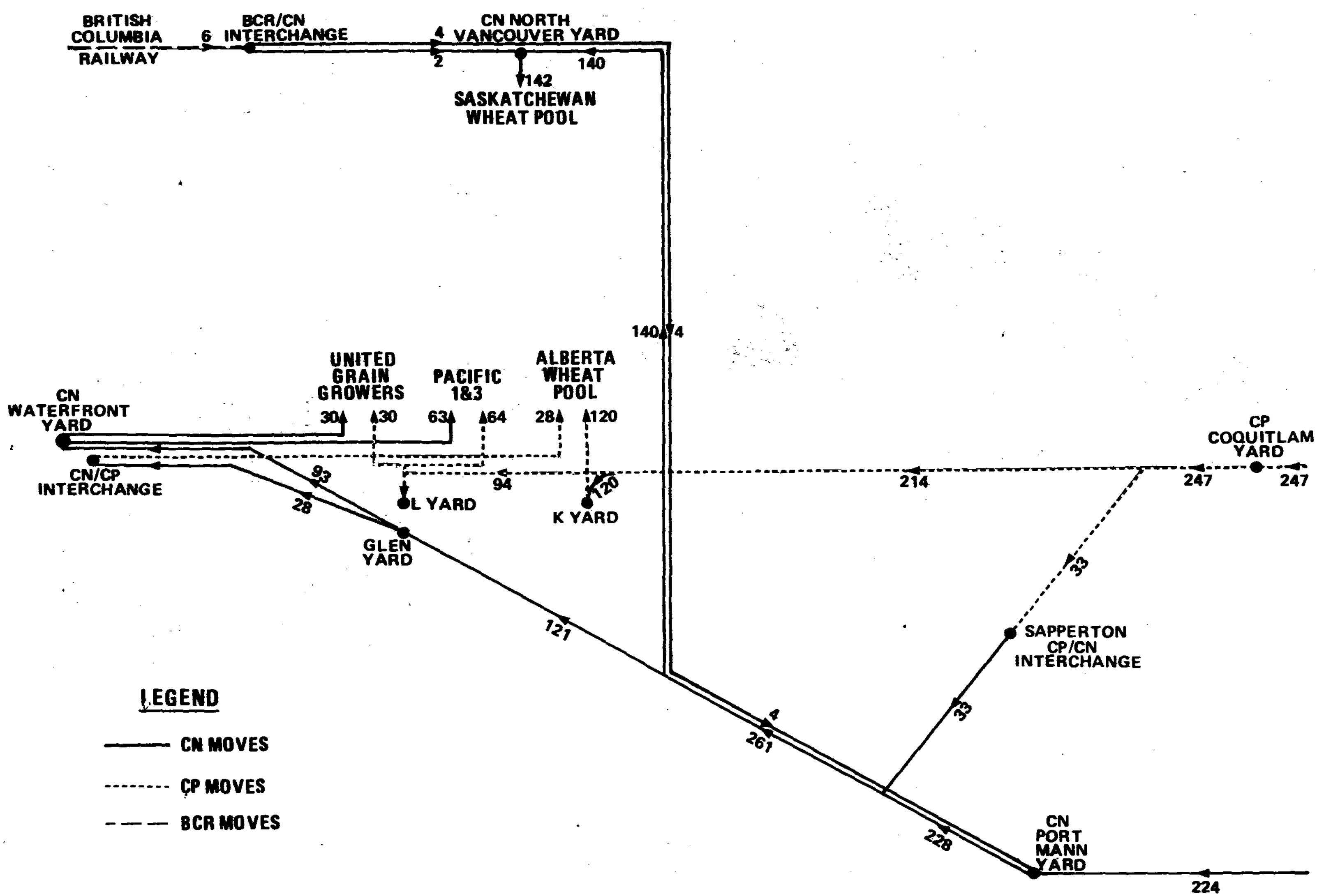


EXHIBIT VII-2
Vancouver Average Daily
Loaded Grain Cars 1977/78



(1) CN Serves Vancouver Through Port Mann Yard

CN trains arrive at Port Mann Yard in Vancouver from the Northern Prairies via Edmonton, Swan Landing, Jasper, Red Pass Junction and Kamloops. There are six yards involved in the grain movements:

CN YARD	PRIMARY FUNCTIONS
Port Mann	Arrival-Departure Switching
Main	Train Make-Up
Glen	Marshalling
Waterfront	Serve United Grain Growers and Pacific #3 elevators
No. Vancouver	Serve Saskatchewan Wheat Pool and interchange with British Columbia Railway
Sapperton	Interchange with CP

Cars destined for the South Shore elevators are transferred from Port Mann to Main and Glen yards where minimal switching takes place. Cars are then moved to the Waterfront yard for delivery to United Grain Growers and Pacific #3 elevators. Waterfront yard is also used as an assembly area for CN cars destined to the Alberta Wheat Pool served by CP. The interchange with the CP takes place a short distance east of Waterfront yard. Cars destined to SWP on the North Shore are transferred from Port Mann to the North Vancouver yards adjacent to the SWP elevators.

Of the 224 cars handled on the average day by CN, 107 (plus 33 received from CP via Sapperton) are delivered to Saskatchewan Wheat Pool on the North Shore and 117 (plus four received from BCR as described later) are delivered to Glen yard. From Glen yard, 28 are taken to the CN/CP interchange so that CP can deliver them to the Alberta Wheat Pool. These cars normally contain winter wheat or oilseeds. The balance of 93 are taken to the Waterfront for delivery to Pacific elevators or UGG.

Empty cars for eastbound departures from Port Mann are moved from the Waterfront yard to the Glen and Main yards where they are assembled in trainload lots. Subsequently, the cars are moved to Port Mann yard for final assembly and departure.

Cars routed to the Saskatchewan Wheat Pool elevator are moved from Port Mann over the Second Narrows lift span to the North Vancouver yard. En route from Port Mann, CP cars destined for SWP are gathered at Sapperton. British Columbia Railway cars destined for SWP and the other elevators are interchanged at North Vancouver. BCR cars destined to SWP are placed directly; those destined to other elevators are moved to Port Mann for distribution. Empties are assembled in trainload lots at the yard and are transferred to Port Mann for final assembly and departure.

There are 21 train crew starts per day at locations other than Port Mann. Of these, an average 15 crews daily are assigned to full or part-time grain handling service as follows:

CN RAIL-VANCOUVER
AVERAGE DAILY TRAIN CREWS

	TRICKS (SHIFTS)			
LOCATION	1ST	2ND	3RD	TOTAL
Main	1	1	2	4
Waterfront	2	2	1	5
N. Vancouver	2	2	2	6
TOTAL	5	5	5	15

Weekend service is quite extensive, as most of the crews work five days with relief on Saturday. Sunday work force reductions take place, but crews are available.

(2) CP Serves Vancouver Through Coquitlam Yard

The CP trains arrive from the Southern Prairies via Calgary, Golden, and Kamloops, to Coquitlam yard, Vancouver. The four CP yards where movement of grain takes place are:

CP YARDS	PRIMARY FUNCTIONS
Colquitlam	Arrival and Departure Switching
"K" Yard	Serve Alberta Wheat Pool
"L" Yard	Serve United Grain Growers and Pacific #1
Sapperton	Interchange with CN Rail

The CP cars destined for Alberta Wheat Pool are transferred from Coquitlam to "K" yard where they are switched and delivered to the elevator. The CP cars for CN delivery to Saskatchewan Wheat Pool are set off at Sapperton and empties are picked up on the return run.

Cars destined for the Pacific and UGG elevators are transferred from Coquitlam or "K" yard to the "L" yard where they are assembled and delivered to United Grain Growers and Pacific #1 elevators. Empties from these elevators return via transfer crews to Coquitlam where they are assembled for departure.

On the average, of the 247 cars arriving at Vancouver on a typical day, 33 were delivered to interchange tracks at Sapperton, so that the CN might deliver them to Saskatchewan Wheat Pool on the North Shore. Such cars would contain durum or oilseeds. The balance were normally taken to "K" yard for delivery to Alberta Wheat Pool, or to "L" yard for delivery to Pacific elevators or UGG. Depending on the specific situation, occasional use might be made of other waterfront yards.

There are 20 daily train crew starts at all locations other than Coquitlam. An average of nine daily train crews are assigned to full or part-time grain handling service as shown below. Weekend service is also provided.

CP RAIL-VANCOUVER
AVERAGE DAILY TRAIN CREWS

LOCATION	TRICKS (SHIFTS) 1ST	2ND	3RD	TOTAL
Vancouver Yard	1	1	1	3
"K" Yard	1	1	1	3
"L" Yard	1	1	1	3
TOTAL	3	3	3	9

2. TERMINAL ELEVATOR FACILITIES ON THE PACIFIC COAST MAY ACT AS A CONSTRAINT ON SALES

There are four terminal elevators now in operation in Vancouver and one in Prince Rupert. These handle virtually all grains passing through the West Coast. The capacity of these terminals to handle increases in grain volumes is discussed in this section.

(1) The Throughput Rate of Each Elevator Was Examined

Operating rates of the different elevator operations (unloading, cleaning, drying, and offloading) were obtained from the operators of each terminal elevator on an hourly, daily, monthly, and annual basis in order to analyze the practical throughput rates. Actual throughput volumes of these operations were also obtained at some elevators to determine the operating efficiencies experienced.

Exhibit VII-3 shows how the actual amounts processed through the elevators compared with what would be possible, based on the hourly rated capacity of each component. April 1978 had the highest throughput — 846,000 tonnes — of any month in the crop year 1977/78.

EXHIBIT VII-3
Capability of West Coast Terminals as Presently Operated 1977-1978

	TERMINAL ELEVATORS					
	SWP	AWP	PAC	UGG	RUP	TOTAL
KEY CAPACITY FACTORS						
Cars per shift unload capacity	100	90	140	50	65	445
Tonnes per hour cleaning	665	500	475	380	220	2,240
Kilotonnes storage	143	204	199	99	45	690
MONTHLY THROUGHPUT (KILOTONNES)						
Unloading ability at 10 shifts/week	269	242	376	134	175	1,196
Cleaning ability at 15 shifts = 120 hrs/wk	335	252	239	192	111	1,129
Limiting factor	UNLOAD	UNLOAD	CLEAN	UNLOAD	CLEAN	--
Monthly throughput limited by cleaning or unloading	269	242	239	134	111	995
Highest month 1977/78	219	265	238	94	123	939
April, 1978	219	232	238	87	70	846
ANNUAL THROUGHPUT (KILOTONNES)						
Annual capacity (kilotonnes)*	2,285	2,056	2,035	1,142	942	8,460
1977/78 elevator discharges	2,273	2,369	2,042	972	906	8,562
Number of turns of storage	15.9	11.6	10.3	9.8	20.1	12.4

* Based on average monthly throughput being 71 percent of monthly capacity (i.e. 8½ peak months per year)

Not every elevator had April as its peak month, however. If the peak months of all elevators had coincided, the system would have delivered 939,000 tonnes. If the cleaning facilities at each elevator had operated at their hourly capacity for 15 shifts each week, the elevators could have cleaned 1,129,000 tonnes. If the car unloaders had been operated at capacity for 10 shifts each week, they could have unloaded 1,196,000 tonnes.

There are a number of reasons why the total system cannot operate at the nominal throughput rates of its components. When grain storage is low, the elevator may be limited by what it can unload and by what is available to unload. When storages are full, the elevator may be limited in what it can clean and by whether ships are available for the cleaned grain which it has.

The following analysis:

- Compares what the West Coast can unload and clean with the high and low estimates of demand

- Considers whether there is adequate storage space

- Considers whether there are adequate drying facilities.

As may be computed from the above numbers, the combined set of elevators delivered a peak volume in April 1978 which was 75 percent of what they collectively could have cleaned (if operated at capacity at 15 shifts per week) and 71 percent of what could have been unloaded at capacity for 10 shifts per week.

Appendix K presents an analysis of the daily operations of elevators over an 18-day period. This analysis shows that the various elevator facilities operated at average rates which varied from 57 percent to 76 percent of their sustained capability. It has been assumed for this analysis that over the period of a month, it would be possible to operate the limiting facilities—cleaners or car unloaders—at 76 percent of their nominal throughput rate for a month.

Over the period of a year, other factors have to be taken into account. Ships are not available for loading at peak rates at all times. In peak months, a large number of ships are waiting, and there is a high probability that any available berth can be utilized by some ship requiring what that elevator has in stock. However, in the summer and early fall, there are not normally enough ships to require that all elevators run at their full capacity.

(2) Grain Cleaning Is the Primary Constraint On Elevator Throughput

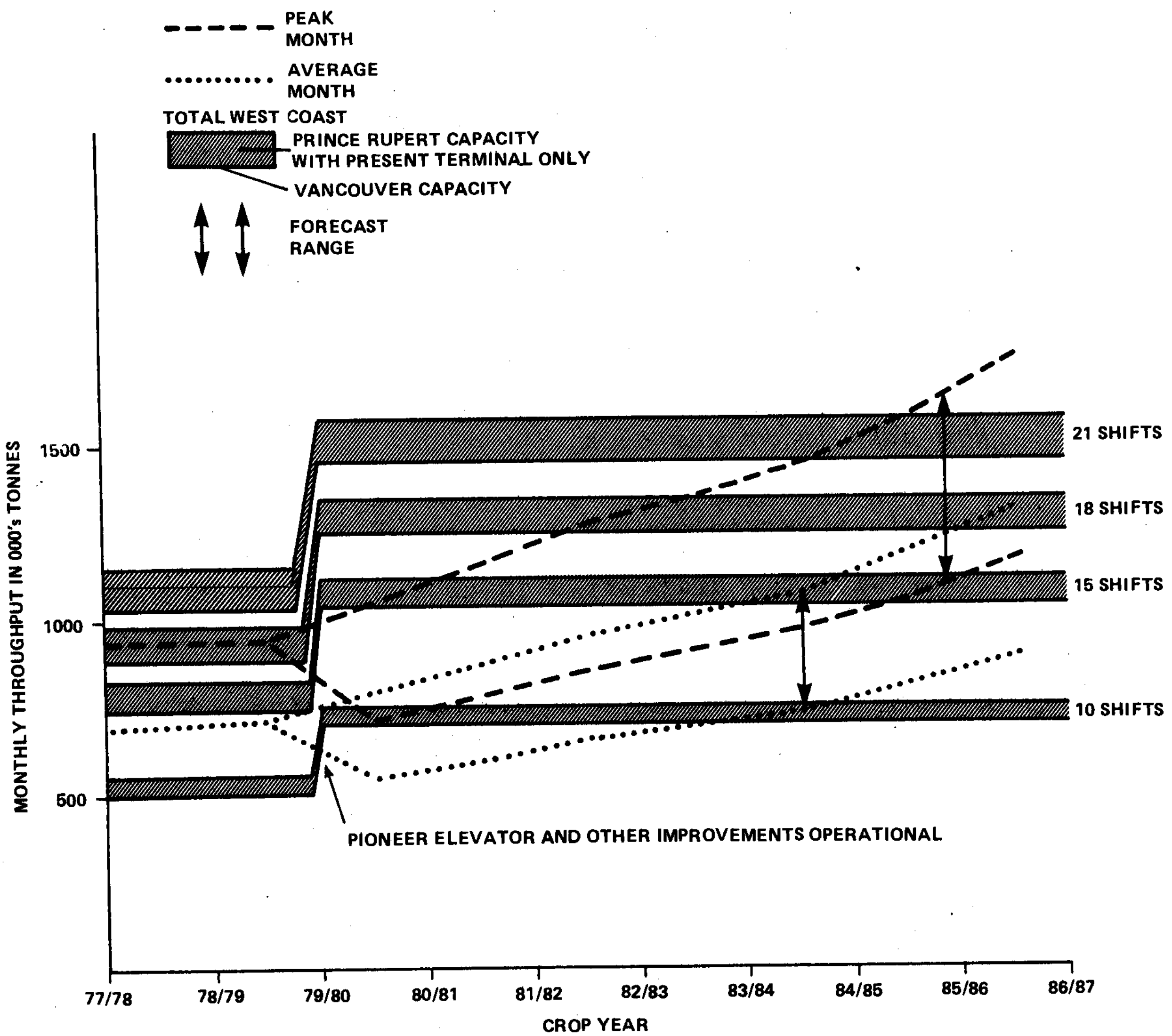
The analysis indicates that the cleaning facilities principally determine how much grain a terminal elevator can handle in any period of time. If all parts of a terminal operated 24 hours a day, it would normally be the cleaners which limited the throughput. However, as presently operated, with unloading on two shifts and cleaning on three shifts, the amount that can be unloaded in two shifts may be less than the terminal can clean in three, and the throughput of the elevator may be limited by the amount that can be unloaded. The analysis indicates that offloading to ships is not a limiting factor once the grain is at the terminal and the ship is at the dock.

In the crop year 1977/1978, the amount delivered by the elevators in the year was about 8.5 times what was delivered in the peak month of April. Expressed in another way, the deliveries in an average month equaled 71 percent of what was delivered in the peak month.

It is assumed that the throughput of the elevators will be determined by the cleaners working at 76 percent of their rated capacity (the maximum utilization of the facilities studied) for 15 shifts a week, and that the average month will remain at 71 percent of the peak month. Appendix J shows how much the West Coast elevator system will be able to deliver with the Pioneer Terminal completed and the other planned improvements to 1982. These will, on the above-stated assumptions, permit an annual throughput of 10.8 million tonnes.

Exhibit VII-4 shows what the elevators can process depending on how many shifts a week they operate. These estimates are then compared with the demands in the peak month and in the average month for the high and low forecasts. The detailed analysis supporting this is given in Appendix K.

EXHIBIT VII-4
Projected Elevator Throughput
Vancouver Plus Prince Rupert



*BASED ON 76% EFFICIENCY

Exhibit VII-4 also shows that as presently operated (normally 15 shifts a week), the expanded system will be operating at capacity in the peak month of a high forecast year by 1980/1981. If the elevators and railways operate at 18 shifts per week in the peak month of a high forecast year, dropping back to less than 15 shifts a week in an average month, then the system can handle the demand through to 1982/1983. The absolute limit (and probably unrealistic limit considering the need for maintenance) of 21 shifts a week in the peak month of a high forecast year is reached after the 1984/1985 crop year, and at that time 15 shifts a week would be needed in the average month.

(3) Storage Capacity is Limited

Limited storage makes it difficult to match grain supply with grain demand, and ships may have to wait for grain of the right kind to arrive. Storage may therefore affect vessel waiting time and demurrage, but it does not limit the amount of product that may be delivered ultimately, unless the waiting time becomes so long as to discourage future sales.

On the West Coast, the terminal elevators operate year round. Grain which is brought to the elevators is unloaded, cleaned, and offloaded to the ships on a continuing basis. Based on the present annual pattern of deliveries and volumes handled, the storage turns from 10 to 20 times a year. However, the elevators turning over 12 times or more a year (Saskatchewan Wheat Pool and Prince Rupert) are exceptions in that Saskatchewan Wheat Pool is just completing a major addition of storage (which will bring its turns per year to ten in the future), and Prince Rupert handles only one kind of grain.

Hence, a normal use of storage is from 10 to 12 turns per year, with a mean of 11, or one turn every 27 working days. This rate of turnover of storage is maintained through 1982 with present expansion plans, but after that more storage may be necessary if volumes continue to expand.

Not all of the nominal storage can be used, because partial bins are devoted to specific grains and inactive stocks. The effective limit of useable storage (which was judged to be 80 percent ten years ago) is now considered to be 60 percent to 70 percent with the numbers of kinds and grades of grain required to be stored. This has been confirmed by analyses of elevator storage as shown in Exhibit VII-5.

During peak periods, while an elevator is loading vessels, it is also assembling, cleaning, and drying grains for the next immediate arrivals. On average, the vessels at the berths will be half-loaded. Since the average loading time is four days, each elevator will require an average of two days' storage to complete the loading of ships at its berths, together with four days' storage to hold the grain for the next vessels for the berths. Thus, each elevator must utilize capacity equivalent to about six days throughput for its in-process inventory. This leaves little capacity for buffer stocks, to allow for any mismatch between the grades required by the vessels and those supplied by the cars, and little capacity to tolerate interruptions in supply, plant breakdowns, or exceptional peaks in demand.

It is evident that attempting to operate such a system with minimal buffer stocks requires good information on ship arrivals and their anticipated loading, and the ability to respond to this information with timely deliveries. In the absence of the capability to match elevator receipts with ship requirements, higher vessel waiting time and increased demurrage costs may be expected. The potential throughput of the system over the years, however, would not necessarily be reduced because of the seasonality of demand, in that potential to clean grain for later delivery may be accomplished during periods of low demand.

(4) Drying Rates May Be a Constraint During Years of Wet Harvests

Drying may be a bottleneck in some years when a wet crop is harvested. However, it is not anticipated that more than 25 percent of the volume will require drying, and in most years, the amount of moisture in the grain is such that less than 10 percent has to be artificially dried. Drying needs are, in this sense, different from unloading, cleaning, and offloading, which are operations which have to be performed on all the grain (or almost all of the grain in the case of cleaning). Therefore, drying is considered separately and is not taken as an absolute constraint on the system as a whole; however, it could be a problem in a wet year.

EXHIBIT VII-5

Average Vancouver Elevator Storage Capacity Utilization and Average Shipment Size (Crop Year 1978/79, weeks 1-20)*

	AVERAGE SHIPMENT SIZE	AVERAGE ELEVATOR STOCKS (TONNES)				
		SWP	AWP	PAC	UGG	TOTAL
GRAIN TYPE						
1/2 High Protein	14,286	6,550	6,912	9,564	933	23,959
1/2 Low Protein	14,000	11,246	12,320	16,588	4,575	44,729
3 CWRS	31,000	8,853	8,796	7,295	1,932	26,876
Other Wheat	24,000	12,833	30,111	19,698	3,821	66,463
Durum	20,063	17,378				17,378
Feed Barley	17,771	12,584	10,718	14,394	2,240	39,936
Rapeseed	12,058	9,517	12,205	21,085	5,000	47,807
Flaxseed	12,058	117	7,259		1,627	9,003
Rye	12,058	2,756		7,791	780	11,327
Other Grains	18,246	1,610		2,191	386	4,187
Total Stocks		83,444	88,321	98,606	21,294	291,665
CAPACITY						
Capacity Available		14,189	20,987	10,973	38,533	84,682
Total Practical Capacity		97,633	109,308	109,579	59,827	376,347
Nominal Capacity		143,050	204,430	199,200	99,320	646,000
Utilization Limit		68%	53%	55%	60%	58%

* SWP and AWP expanded their capacity after week 20.

Exhibit VII-6 shows how much grain West Coast elevators can dry based on varying numbers of shifts operated per week by dryers working at 76 percent of their nominal rate. This indicates that the dryers are presently capable of handling about 10 percent of the crop, or about 8 percent of the shipments in the peak month of a peak year, with the dryers operating 10 shifts a week. By drying around the clock, double these volumes could be dried.

Some addition to drying throughput is anticipated due to the new Pioneer Terminal and a new dryer which will go into operation at Prince Rupert. This will extend the drying capability to cover 1981/82 volumes at the same level of service. With an absolute upper limit of 21 shifts per week operating during the peak months of a high volume year, the proportions of the grain which can be dried are:

1978/1979:	16%
1980/1981:	18%
1982/1983:	15%
1984/1985:	12%

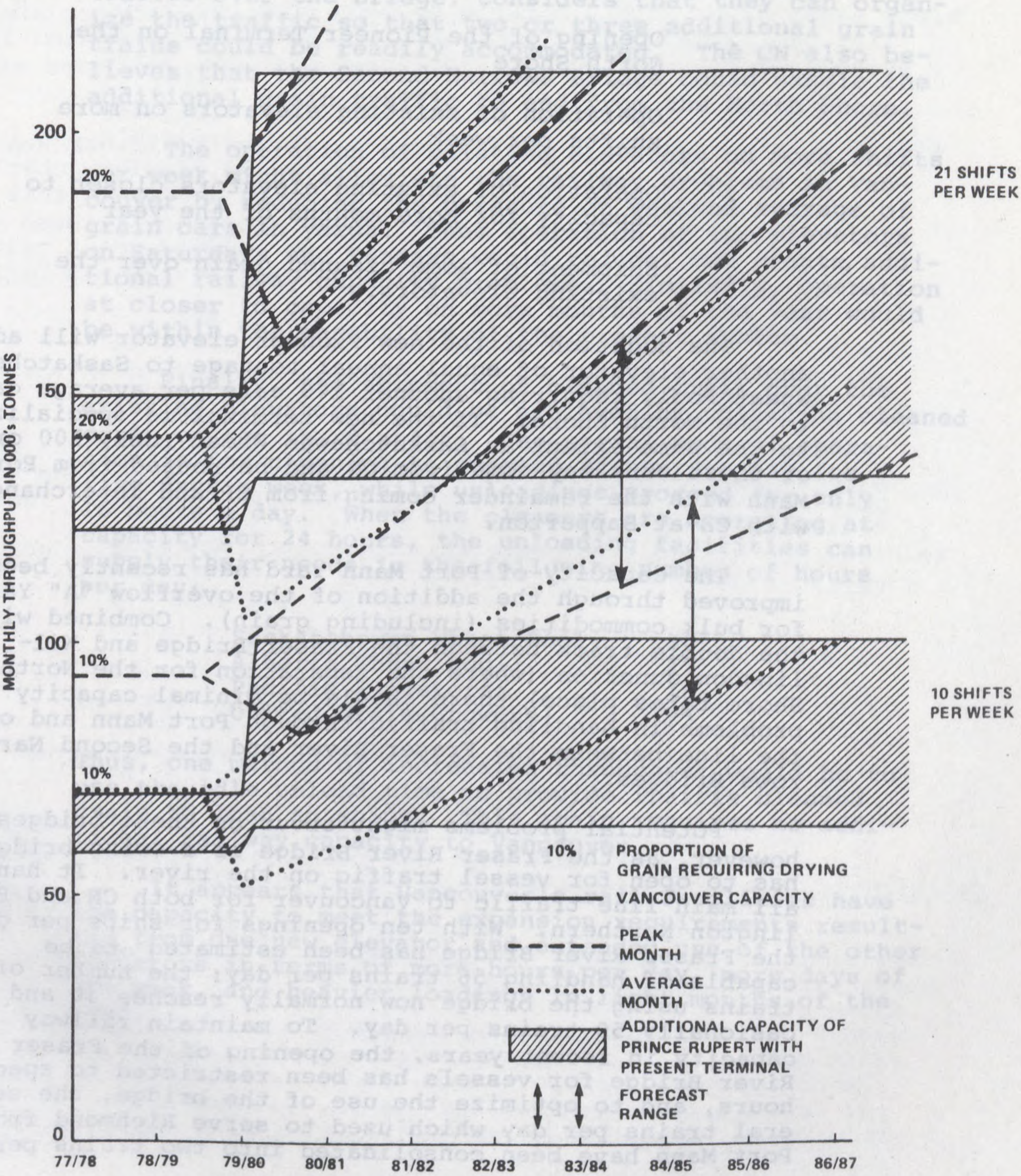
In recent years, the proportions requiring drying have ranged from less than 1 percent to 22 percent. Hence, if a wet year coincides with a high volume year, the terminals would be unable to dry the grain in a peak month now and, although the risk will be reduced with the Prince Rupert drying expansion in progress, it will increase each year after 1981/1982. Moreover, with the location of a relatively high proportion of the drying capacity in Prince Rupert, it may be necessary to route damp grain there which would otherwise preferably be routed to Vancouver.

Therefore, if protection is to be maintained against a wet year, it will be necessary to add further drying facilities at terminal elevators, or be prepared in a wet year to dry in the country to a much greater extent. This would imply services from the inland terminal elevators or expansion of on-farm drying.

(5) <u>Vancouver Terminal Rail Capacity is Adequate To Handle Growth to 1985</u>

From the observations and discussions with terminal area personnel from the railways, the rail

EXHIBIT VII-6
Drying Capacity of West Coast Termina



facilities in Vancouver seem to be adequate to support the volumes forecasted, even with the following changes:

- Opening of the Pioneer Terminal on the North Shore
- Operation of existing elevators on more shifts per week
- Operation of existing elevators closer to capacity for more months of the year
- Shipment of some cleaned grain over the existing elevators.

The addition of the new Pioneer elevator will add another elevator of equal annual tonnage to Saskatchewan Wheat Pool, requiring another 140 cars per average day to the North Shore. If the new terminal is specialized to the same extent as Saskatchewan Wheat Pool, 100 or so of these cars may come from CN and be routed from Port Mann with the remainder coming from CP and interchanged with CN at Sapperton.

The capacity of Port Mann Yard has recently been improved through the addition of the overflow "A" Yard for bulk commodities (including grain). Combined with the double track between the Fraser Bridge and Willingdon Junction (where the separation for the North Shore takes place), there should be minimal capacity problems in handling traffic through Port Mann and on the line between the Fraser River and the Second Narrows Bridges.

Potential problems might occur on these bridges, however, as the Fraser River Bridge is a swing bridge which has to open for vessel traffic on the river. It handles all main line traffic to Vancouver for both CN and Burlington Northern. With ten openings for ships per day, the Fraser River Bridge has been estimated to be capable of handling 56 trains per day; the number of trains using the bridge now normally reaches 40 and occasionally 50 trains per day. To maintain railway capacity in recent years, the opening of the Fraser River Bridge for vessels has been restricted to specific hours, and to optimize the use of the bridge, the several trains per day which used to serve Richmond from Port Mann have been consolidated into two trains per day to Richmond yard from which local distribution takes place. The CN, responsible for at least 80 percent of traffic over the bridge, considers that they can organize the traffic so that two or three additional grain trains could be readily accommodated. The CN also believes that the Second Narrows Bridge could handle the additional grain traffic to and from the North Shore.

The operation of existing elevators on more shifts per week might alleviate the railway problems in Vancouver by reducing the pressure on weekend storage of grain cars in yards. Thus, operation of the elevators on Saturdays and Sundays would reduce, not create, additional railway capacity problems. Similarly, operation at closer to capacity on more months of the year would be within the capability of the present system.

Finally, the shipment of cleaned grain over the existing elevators could be achieved by unloading cleaned grain on the third shift. The normal mode of operation is for cleaning to proceed 24 hours a day for five days a week, while unloadings proceed for only 16 hours a day. When the cleaners are operating at capacity for 24 hours, the unloading facilities can supply their needs in the following number of hours per day:

Saskatchewan Wheat Pool:	20
Alberta Wheat Pool:	17
Pacific Elevators:	10
United Grain Growers:	23

Thus, one method of increasing throughput would be to use the idle unload time to provide Prairie cleaned grain to load to ships. This again requires no additional railway capacity to Vancouver.

It appears that Vancouver's rail facilities have the capacity to meet the expansion requirements resulting from one new elevator and extended use of the other elevators in terms of more hours per day, more days of the week, and heavier loadings in light months of the year.

(6) Terminal Rail Capacity in Prince Rupert Will Have To Be Expanded

The present yard facilities in Prince Rupert are quite restricted. If a major new terminal elevator facility is constructed, additional on-site trackage will be required.

At present only CN cars are taken to Prince Rupert. If a major new terminal is constructed, it is probable that CP cars will also be required to travel to this port. This would require an interchange agreement between these two railways. The concept has been agreed to in principle by the two companies, with the final details now being worked out.

3. OPERATIONAL CHANGES CAN IMPROVE THROUGHPUT IN VANCOUVER TERMINAL

From the above analyses, the existing terminals as presently operated are estimated to be able to deliver 10,800,000 tonnes a year, the amount which is forecast for a high year by 1980/1981.

For the present facilities to be able to deliver more than this, it would be necessary to:

- Work more shifts per week at the existing facilities
- Smooth the flow of vessels through the year
- Ship cleaned grain over the elevators or other bulk terminals
- Alternatively, or in conjunction with the above changes, construct new facilities, preferably at Prince Rupert.

(1) More Shifts Per Week Should Be Operated to Increase Throughput

The elevators are presently reluctant to work more shifts per week because they fear they will run out of rail car supply. If they were assured of supply, then it could be possible to operate up to 20 shifts per week, with four crews each working five shifts per week.

The twenty-first shift could be used for maintenance. This would theoretically permit the elevators to handle one-third more than at present. Such an increase would handle forecast volumes to 1985. However, one full shift for maintenance may not be adequate to provide as high a level of service as at present. A more realistic estimate of the year to which the present elevators could handle the high-year forecast tonnages through increased shifts would be 1983.

(2) Port Supplies Should be Supplemented With Cleaned Grain to Expand Throughput

The provision of cleaned grain from inland terminals or from "new design" primary elevators with cleaning capabilities can supplement other supplies during the peak months of peak years. The cleaned grain can then be passed over the elevators up to the limit of the unload capacity, or can be handled by the bulk loading terminals. The limit to such an approach is thus the amount of grain which could be cleaned and stored in the Prairies. This is presently restricted because of the desire of the grain companies to generate the screenings on the West Coast to serve the higher-priced export market.

It would seem desirable to plan for the use of some cleaned grain from the Prairies to cover some demand in the peak months when the terminal cleaning system could not otherwise handle the volume. This could extend the capacity of the system to 1983. The inland terminal elevators could serve to store cleaned grain for such occasions.

(3) Smoothing Vessel Arrivals Would Increase Capabilities

The shipments in a year are at present about equal to 8.5 peak months. If ships could be scheduled to arrive uniformly through the year, with a sufficient number at anchorage at any one time to ensure a match between vessel needs and elevator stocks, annual shipment capability would be increased to 12 peak months. This is equivalent to operating with every month an average month. To do this would require more of the contracts to be sold for shipment in the less active summer and fall months. If this could be done, the system as presently operated could deliver the annual volumes to 1984. Complete leveling is hardly practical, but some infilling may occur purely due to the inability to ship in peak months. Such capacity-restrained leveling may extend the capacity to approximately 1981/82.

(4) <u>Construction of New Elevator Facilities Provides More Throughput Capability and Flexibility</u>

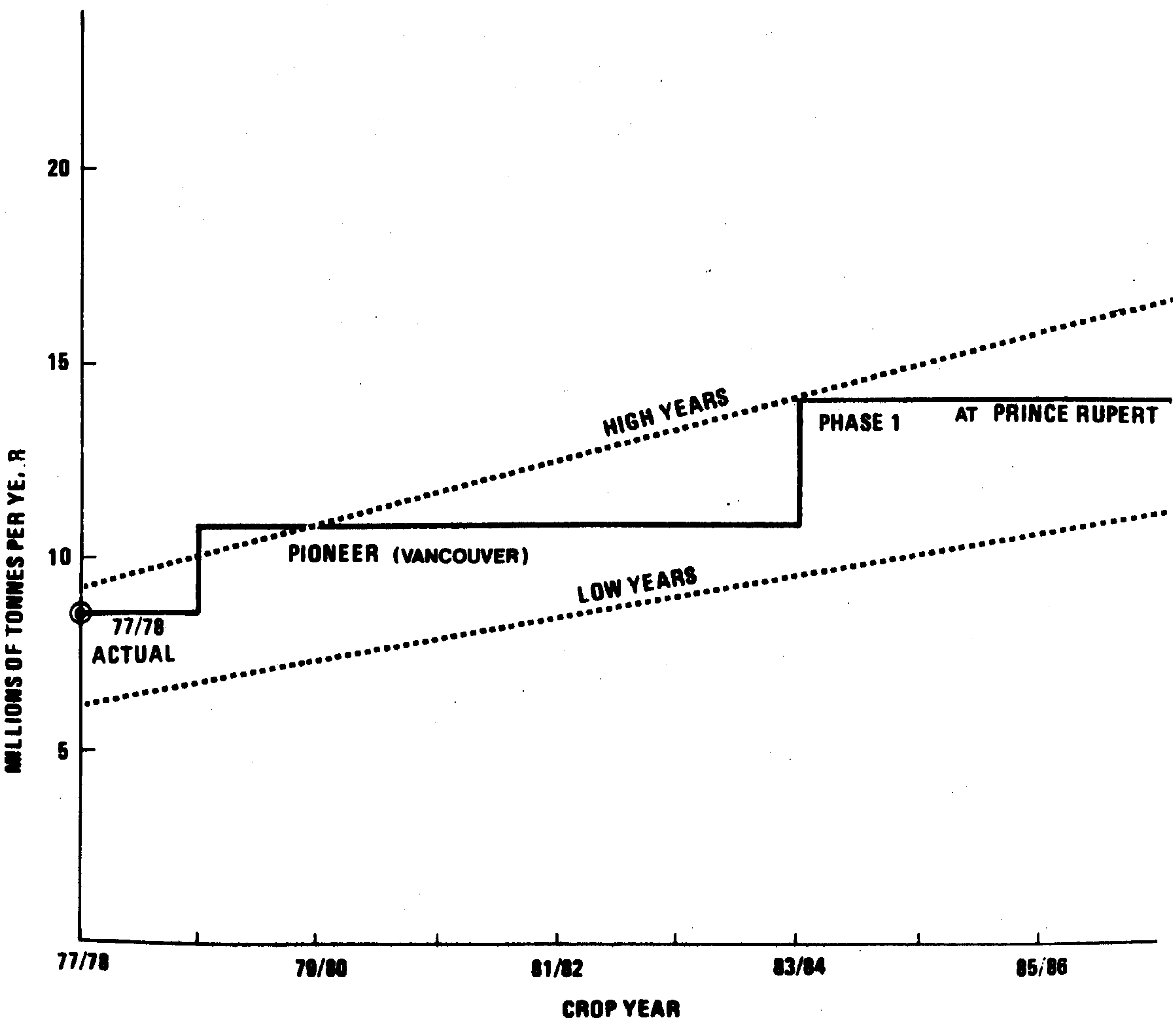
Given the limited ability of each of the above options to extend the capability of the present West Coast system much beyond 1984 (although perhaps to 1985 to 1990 in combination, if everything worked perfectly), the construction of new facilities is indicated. Given the anticipated high growth rate, more such facilities will be needed eventually to provide surge capacity for spot sales and schedule dislocations.

Exhibit VII-7 compares the annual demand (in high and low volume years on the high growth scenario) with the throughput which can be delivered by the existing facilities as presently used. In this comparison, therefore, the same annual pattern of sales demand is assumed and the same number of working shifts is used.

Also shown in Exhibit VII-7 is the expansion of the Pioneer elevator and a further supplement in the 1983/1984 crop year of 2.75 million tonnes in annual throughput. This additional throughput is envisioned in a proposal for a new Prince Rupert facility. This facility has been announced with a first stage storage capacity of 10 million bushels. Assuming 11 turns per year, this facility could be expected to have an annual throughput of 2.75 million tonnes.

It can be seen from Exhibit VII-7 that such a facility increases the capacity of the system as presently operated to a level approximately halfway between the volumes expected in low and high years. Over this period, some years will be "good", and the higher volume would have to be moved. The shortfall could possibly be met by additional ships or by forwarding of cleaned grain, as discussed earlier in this section.

EXHIBIT VII-7
Annual Capability
of West Coast Terminals



4. OPERATING PRACTICES (POOLING, SWITCHING, SPECIALIZATION) CAN ALSO AFFECT THROUGHPUT

Alternative methods of pooling grains, switching between elevators, interchanging cars between railroads or specialization of certain grains in certain elevators have been suggested as methods of increasing capacity.

Unfortunately, nearly all of these kinds of changes increase the capacity of one part of the system at the expense of a loss of capacity in another. For example, if each railway delivers its cars to the most convenient elevators which can receive them, then car cycle times are kept low; however, storage and elevator facilities may not be used to the maximum and there may be more vessel movements required to accumulate a load.

On the other hand, if the elevators specialize in the products which they can handle best and if low volume stocks are accumulated in one or two elevators only, elevator and storage capacity may be used most efficiently, but rail car movements may be increased and car cycles lengthened.

The decision to accumulate durum at Saskatchewan Wheat Pool, for example, requires CP cars carrying durum to be transferred to CN. The assignment of rapeseed from Northern British Columbia to Alberta Wheat Pool elevators requires transfers from BCR to CN to CP, whereas an assignment to Saskatchewan Wheat Pool would be made directly by CN on the North Shore.

At the present time, there is some elevator specialization, as seen in Exhibit VII-5. Durum is stored only in Saskatchewan Wheat Pool and winter wheat only in Alberta Wheat Pool. Rye is usually assigned to Saskatchewan Wheat Pool and Pacific elevators. Flax is usually handled by Alberta Wheat Pool and United Grain Growers.

Where there is no specialization, as in the case of 1 and 2 high protein wheat, the average stocks at each elevator are insufficient for the average shipment. However, at particular times, the stocks at some elevators may be low and at other elevators high, so it may be possible to assemble a shipment at one elevator. Cars may also be routed to a specific elevator to assemble a load for a waiting vessel, representing temporary specialization.

(1) Some Terminals Specialize in Particular Board Grains

At the present time, the amount of specialization in Board grains is not great, durum and winter wheat being the two principal categories, although any grain can be concentrated at any one elevator at any specific time if the CTC Grain Coordinators so direct. The number of grain cars interchanged for all reasons between railways (specialized Board grains or Non-Board grains) is not great, being on an average day 64 cars out of 477 arrivals, or 13 percent. The major problem caused by specialization occurs in the main yards of the two major railways, where trains have to be broken up even if there are only a few cars which cannot be delivered to the same elevator as the others.

Considered purely in terms of terminal capacity (as distinct from its effect on car supply through lengthening the cycles) there is no strong evidence to suggest changing the present level of pooling and specialization.

(2) Oilseeds and Non-Board Grains are Handled By Each Company

Oilseeds, being sold competitively on the open market, present certain problems peculiar to their handling. In the past, shippers were assigned cars by the Canadian Wheat Board if they showed proof of a sale. With this sytem, oilseeds moved with less delays than Board grains. However, this system is presently not automatic and cars may not be assigned to carry oilseeds if the CWB estimates that there are adequate stocks in the port.

Since the Wheat Board has been adopting this policy more forcefully, the total working time in port of oilseed vessels has increased, as seen in Exhibit VII-8, from 5.3 days in the first half of the 1978/1979 crop year to 7.4 days in the second half. This means that the working days for oilseeds have increased from 56 percent to 70 percent of that for Board grain; but ships for Board grain still take longer than those seeking Non-Boards.

Faced with increasing delays to oilseed vessels, and perhaps loss of contracts, there have been suggestions that oilseeds be pooled so that when there are adequate

AVERAGE NUMBER OF WORKING DAYS
IN PORT PER SHIP—WEST COAST

	TOTAL WAITING	LOADING	TOTAL IN PORT
28 AUGUST 1978—5 JANUARY 1979			
Wheats	5.6	4.1	9.7
Feed Barley	4.4	4.4	8.8
Board Grains	5.3	4.2	9.5
Oilseeds	1.1	4.2	5.3
1 MARCH 1979—31 MAY 1979			
Wheats	7.1	3.7	10.8
Feed Barley	5.6	3.9	9.5
Board Grains	6.8	3.7	10.5
Oilseeds	3.0	4.4	7.4

stocks in the port, ships may be loaded even when the particular seller does not have his stocks on hand at the time.

An industry committee has studied this possibility, but has not been able to reach agreement. The difficulty occurs because the price varies quite widely from time to time, and individual sellers make specific contracts at prices they have been able to negotiate. If a seller were unable to meet a contract because of insufficient oilseeds in the pool, he could face high penalties.

For example, if a ship arrived for 15,000 tonnes of rapeseed, which was not available during the lay days and the subsequent grace period (if any), then the contract could be voided. If the price has dropped $20 per tonne since the contract was written, the purchaser could perhaps negotiate the lower price when the oilseeds did arrive thereby losing the seller $300,000. Failing to reach a satisfactory agreement, the seller would find himself without a contract at all.

Any pooling system would have to deal with the question of responsibility for compensation for renegotiated contracts, or else permit the losses to fall where they may. To date, the industry has preferred to deal with the problem of port shortages by mutual ad hoc agreements and interchanges where each party is aware of his benefits and risks.

(3) Inadequate Tagging Causes Problems in Port Operations

One problem noted in the analysis of port operations is the number of cars arriving with missing or illegible tags which causes delays to terminal operation while the ownership and grain type in the car is determined, usually using the railways' computerized information systems. This problem could be overcome in one of two ways, by providing more permanent tags or by giving up the use of manually filled out tags stapled to the sides of cars and using the railway companies' or some other information system to keep track of each car's contents. The latter system could be introduced over the next several years.

5. TERMINAL RAIL OPERATIONS IN THUNDER BAY ARE OF LESS CONCERN THAN VANCOUVER

The CN and CP Rail are also responsible for the movement of grain in the Thunder Bay terminal. See Exhibit VII-9 for a map of Thunder Bay terminal.

Twelve elevators are currently operating in Thunder Bay:

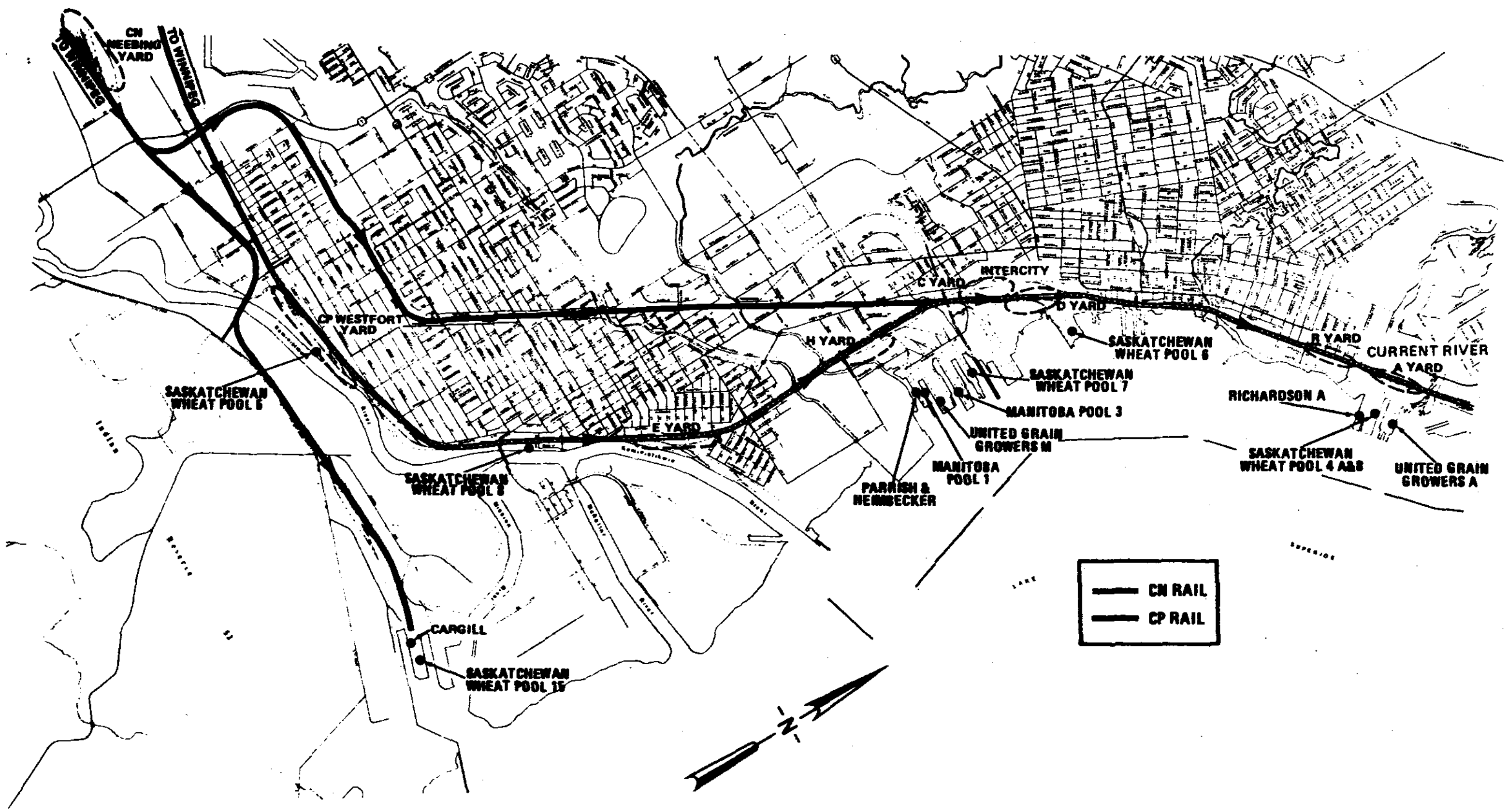
THUNDER BAY ELEVATORS	SWITCH BY	CAPACITY IN CARS
MPE 1	CP	54
MPE 3	CN	57
SWP 4	CP	160
SWP 6	CN	108
SWP 7	CN	231
SWP 8	CP	28
SWP 15	CN	85
UGG A	CN	89
UGG B	CP	75
RICH	CP	78
CARG	CN	51
P&H	CP	28
		1,044

(1) CN Serves Thunder Bay Through Neebing Yard

CN trains arrive from the Northern Prairies via Winnipeg, Superior Junction, and Conmee to Neebing yard in Thunder Bay. The functions of the four primary CN yards where grain is handled are:

CN YARDS	PRIMARY FUNCTIONS
Neebing	Arrival and Departure Switching
Mission	Serve Saskatchewan Wheat Pool #15 (SWP 15) and Cargill
"C-D" (Inter City)	Serve Manitoba Pool #3 (MPE 3), Saskatchewan Pools (SWP 6, 7, A,& B), and Interchange with CP "Inter City" elevators
Current River (A Yard)	Serve United Grain Growers "A" (UGG A) and Interchange CP Current River elevators.

EXHIBIT VII-9
Thunder Bay Terminal Area



Cars destined to the Mission elevators are sent from Neebing through Mission yard for delivery to Saskatchewan Pool 15 and Cargill elevators. Cars routed to the "Inter City" elevators (MPE 3, SWP 7, A, & B) are transferred from Neebing to "C" yard where they are switched and subsequently moved to "D" yard. The "D" yard is used to serve Manitoba Pool 2, Saskatchewan Pool 7, A & B, and to receive and place cars delivered to "D" yard by the CP for the elevators cited above. It also serves as the delivery point for CN hauled cars to the CP which are placed at the CP "Inter City" elevators. The "C" yard is also used to serve Saskatchewan Pool 6.

Cars destined for the Current River elevators are transferred to the "A" yard from "C" yard for delivery to United Grain Growers "A". All empty cars returning to Neebing for westbound departure move through "C" yard, then to Neebing.

There are 29 total daily train crew starts at CN locations within Thunder Bay. Weekend service to the elevators is also provided. An average of 20 train crews are assigned to full or part-time grain handling service for CN as follows:

CN THUNDER BAY
AVERAGE DAILY TRAIN CREWS

Location	TRICKS (SHIFTS) 1ST	2ND	3RD	TOTAL
Neebing	3	2	2	7
Mission	1	1	-	2
Inter City	3	3	3	9
Current River	1	1	-	2
TOTAL	8	7	5	20

(2) <u>CP Serves Thunder Bay Through Westfort Yard</u>

Trains on CP Rail arrive from the Southern Prairies via Winnipeg in Westfort yard. The functions of the CP yards where grain is handled are as indicated on the following page.

CP YARDS	PRIMARY FUNCTIONS
Westfort	Arrival and Departure Switching serve Saskatchewan Pools 5 & 8 (SWP 5&8)
"H" (Inter City)	Serve Manitoba Pool 1 (MPE 1), United Grain Growers M (UGG), Parrish Heimbecker (P&H), and Interchange to CN at "D" Yard
Current River ("R" Yard)	Serve Richardson (RICH), Saskatchewan Pool 4 (SWP 4), Interchange CN for the Current River elevators.

Cars destined for Saskatchewan Pools 5 and 8 are served directly from Westfort. Cars destined for the Inter City elevators are transferred from Westfort to "H" yard. From this yard, cars are spotted at Manitoba Pool 1, United Grain Growers M, and Parrish & Heimbecker. From "H" yard CP cars are also delivered to "D" yard for CN switching and CN cars are received for CP switching at the elevators listed above.

Cars destined for the Current River elevators are transferred from Westfort to "R" yard and then they are spotted at Richardson and Saskatchewan Pool 4. Empty cars are assembled and returned for westbound departures from Westfort at Current River and "H" yard.

There are 32 daily train crew starts at CP locations within Thunder Bay. Twenty crews are assigned to full or part-time grain service as follows:

CP THUNDER BAY
AVERAGE DAILY TRAIN CREWS

LOCATION	TRICKS (SHIFTS) 1ST	2ND	3RD	TOTAL
Westfort	3	3	3	9
Inter City	2	3	3	8
Current River	1	1	1	3
TOTAL	6	7	7	20

6. THUNDER BAY HAS ADEQUATE CAPACITY

Grain shipments eastward have not been and are not expected to be growing nearly as fast as shipments to the West Coast. As a result there do not appear to be as many critical problems.

One difference between Thunder Bay and Vancouver is that in Thunder Bay the CTC Grain Coordinator attempts, within each week, to equalize the cars unloaded at each terminal with the primary elevator originations of each grain company. This is in addition to the normal equalization of unloads between the two railways. Normally the elevators that have fallen behind in their allocation schedule have a Saturday shift to catch up.

In recent years a number of the smaller, older terminal elevators in Thunder Bay have been closed. Most of the other elevators have been modernized, not to improve storage capacity, but generally to increase handling rates.

(1) Terminal Facilities are Adequate at Thunder Bay

The table below shows the capability per month of the Thunder Bay terminals. This table is based on the 76 percent efficiency factor relative to rated throughput calculated for Vancouver and subsequently checked with the companies.

	Rated Capacity (Per Hour)	Capability Per Month (000's Tonnes) 6 Shifts Per Week	12 Shifts Per Week	18 Shifts Per Week
Car Unloading	675	868	1736	2604
Cleaning (Tonnes)	3600	720	1440	2160
Driving (Tonnes)	655*	133	266	399
Offloading (Tonnes)	21150	4230	8460	12690

* Based on 5% damp grain

Given the seasonal nature of the shipping season of about 260 days per year, it is not necessary to be able to clean at a rate equal to the shipping demand in a peak month. With an 8-1/2 month shipping season, it is possible to fill the storage with cleaned grain at the start of the season and gradually deplete it through the season to supplement the ongoing operation. On this basis, cleaning proceeds for 10 months a year.

Exhibit VII-10 compares capacity with the average demand over a ten-month year for the reason stated above. As shown in the exhibit, 12 shifts per week were adequate for 1977/78 which was a relatively low year. There is adequate capacity to 1985/86, if the number of shifts per week rises to 18 during peak periods.

It may be noted that there is a trend in Thunder Bay to abandon old storage and to modernize and upgrade cleaning and unloading facilities. To the extent that the improvements in processing at least make up for the loss of storage, this will still leave adequate capacity for handling the volumes to 1985/86.

(2) <u>Storage Capacity is Sufficient to Handle Projected Volumes</u>

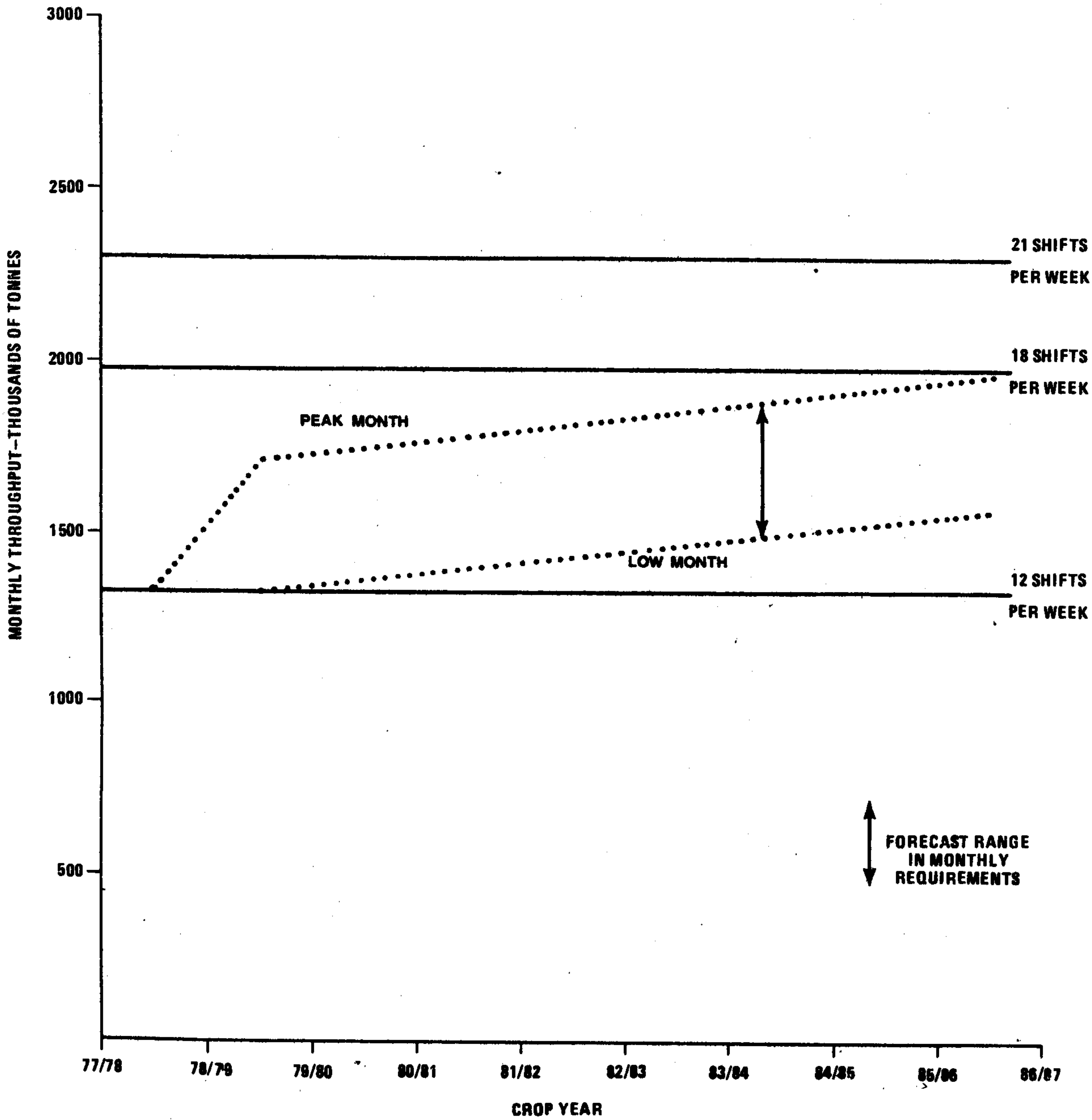
At Thunder Bay, grain is cleaned during the months when the shipping season is closed. When the season opens, stocks of cleaned grain are transferred by lakers to lower St. Lawrence ports, with some shipments (mainly Non-Board grains) loaded into deep-sea vessels directly. This system does not appear to press on the storage available.

A simulation of the storage system has been made, starting the season with initial stocks, gradually depleting them and refilling the elevators after the close of the shipping season. This analysis has confirmed that the storage is adequate.

(3) <u>No New Facility Construction is Needed at Thunder Bay</u>

Given the ability of Thunder Bay to meet the relatively slower eastward growth, and given the modernization programs of the companies, there appears to be no urgent reason to construct new facilities at Thunder Bay.

EXHIBIT VII-10
Projected Elevator Throughput-
Thunder Bay



7. CHURCHILL OPERATES EFFICIENTLY DURING ITS BRIEF SEASON

Although the annual throughput at Churchill is relatively low, during the brief season significant volumes are carried. The low utilization of the facility on a year round basis is offset in part by relatively high productivity when Churchill is operating. This results from careful scheduling and coordination by the CWB, CN and the National Harbours Board. Churchill's efficiency also reflects the high degree of specialization each year in handling only a few grades or types of grain.

There is currently a major research and rehabilitation program under way on the Herchmer Subdivision between Gillam and Churchill where the CN crosses a zone of discontinuous permafrost of unique characteristics, apparently unlike that found under any other railway line in the world. The resulting difficulties in stabilizing the roadbed and structures limits the use of covered hopper cars, with their high centre of gravity and propensity to develop harmonic oscillations on such track within certain speed bands. As a consequence, the use of covered hopper cars over this line, pending resolution of this roadbed stabilization situation, would risk a serious derailment problem. Therefore, unless the permafrost problem can be overcome, it will probably be necessary to maintain box cars for grain movements to Churchill even after the branchline rehabilitation program may have virtually eliminated the need for box cars elsewhere.

While this is a significant problem, the principal deterrents to the expansion of grain movements through Churchill are not railway constraints but lie in the field of restricted marketing opportunities, marine technology and marine insurance. These considerations are beyond the scope of this study.

Additionally, since the elevator at Churchill is operated by the National Harbours Board, the grain companies have less incentive to direct Non-Board grains through that facility.

Given the present problems in the use of Churchill, and since the most significant growth is anticipated through the West Coast, Thunder Bay is capable of handling the forecasted increase in volume to the East.

8. THE MOST CRITICAL PORT PROBLEM APPEARS TO BE WEST COAST TERMINAL THROUGHPUT AND STORAGE CAPACITY

The various analyses presented in this chapter indicate that there are several problems in terminal operations.

The most critical problems appear to be in the capability of West Coast terminals as presently operated or under construction to store and process the required volumes of grain. The analyses indicate that an additional terminal elevator facility will be required on the West Coast. Because of line capacity constraints en route to Vancouver, this facility should be constructed as proposed, in Prince Rupert. In contrast, no major new facility is needed in Thunder Bay or Churchill to handle the projected growth.

One other major problem identified is the lack of sufficient drying capability; this may be a problem in wet years and the best answer appears to be improved drying capability on the Prairies.

The other major recommendations in this chapter are summarized in Chapter XI.

VIII. CARS, LOCOMOTIVES, AND LINE CAPACITY

This chapter covers the present situation and future requirements for:

- Grain cars, either box or covered hopper
- Locomotives for grain service, branch and main line
- Line capacity.

The analyses cover both CN and CP requirements, based on the 1985 movement forecasts presented in Chapter III.

1. 1985/86 CAR SUPPLY AND REQUIREMENTS WERE COMPARED

Estimates of current and 1985 car requirements were developed and compared with the existing car supply. The car requirement estimate is based on 1978 car cycle turnaround times with and without "target" improvements in car cycle times between now and 1985. Factors that could result in improvements in car cycle times and consequent reduction in fleet size requirements have been described in Chapters V, VI, and VII.

(1) The Grain Fleet Will Decline by 34 Percent from 1979 to 1985

An inventory of the Canadian grain car fleet operated by the major railways was undertaken. The availability of these cars to 1985 was projected, based on railway company car fleet retirement estimates. The results of this analysis are summarized in Exhibit VIII-1, with additional detail in Appendix L.

EXHIBIT VIII-1
Grain Fleet at Year End
1977 to 1985

Grain Cars Available At Year End
(Net Serviceable Fleet*)

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985
BOX CARS**									
. CP	6,874	5,969	6,155	5,533	5,043	4,552	4,062	3,572	3,082
. CN	7,457	6,416	7,306	6,406	5,508	4,610	3,713	2,815	1,900
Total	14,331	12,385	13,461	11,939	10,551	9,162	7,775	6,387	4,982
GOVERNMENT HOPPER CARS									
. CP	4,159	4,159	4,159	4,159	4,159	4,159	4,159	4,159	4,159
. CN	3,601	3,601	3,601	3,601	3,601	3,601	3,601	3,601	3,601
Total	7,760	7,760	7,760	7,760	7,760	7,760	7,760	7,760	7,760
CWB HOPPER CARS	-	-	970	1,940	1,940	1,940	1,940	1,940	1,940
TOTAL BOX AND HOPPER CARS	22,091	20,145	22.191	21,639	20,251	18,862	17,475	16,087	14,682

* Total cars less an allowance for light repairs of 5 percent for box cars and 3 percent for hopper cars

** In addition the BCR operates approximately 220 cars in grain service.

The cars inventoried include three categories:

- Railway-owned box cars, including the rehabilitation of 3,000 additional cars which are assumed to be available in the 1979 year end fleet (2,000 for CN and 1,000 for CP)

- The government-owned fleet of hopper cars (8,000 cars)

- The purchase by the CWB of 2,000 covered hopper cars (1,000 expected to be delivered in 1979 and 1,000 in 1980).

The number of serviceable* cars available for grain at the end of 1977 was about 22,000 units. Taking into account expected retirement, and the impact of the box car rehabilitation programs now underway, the grain fleet is expected to stay at approximately 22,000 units to the end of 1979, assuming delivery in 1979 of the first half of the 2,000 covered hopper cars ordered by the CWB. The fleet currently consists of about two-thirds railway-owned box cars and one-third government-owned hopper cars.

The box cars in the fleet are relatively old, with an average age of 29 years for CP and 33 years for CN. As a result, the related attrition rates are quite high. Projections through 1985 based on railway company estimates of retirements indicate that the present fleet of railway box cars in grain service will decline from 13,000 in 1977 to less than 5,000 by 1985. The total fleet will decline from 22,000 units in 1977 to approximately 15,000 in 1985 (including the new CWB hopper cars).

(2) <u>New Car Requirements Will Range From 6,000 to 13,000 Cars</u>

The total rolling stock capacity required was estimated on the basis of the expected volumes of grain to be moved in the peak month of the 1985/86 crop year (see Chapter III) and the car cycles estimates from Chapter V.

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* Serviceable cars exclude those cars requiring significant repairs, i.e., those classified by the railways as "heavy" or "medium" repairs.

A base calculation was made to estimate the number of grain cars employed in the peak month of the 1977/78 crop year. In 1978, as shown in Appendix L, the peak month was July. In this month, the grain fleet was supplemented with other railway equipment, estimated by the project team to be approximately 900 cars. It was assumed that in 1985/86, a similar amount of general (i.e., non-grain specific) railway-owned equipment would be available to meet peak demands.

The resulting net new car requirements, if the total deficit in capacity were met with steel hopper cars carrying an average 80 tonnes with a three percent light repair ratio, are summarized below in terms of first year new cars required and total cars needed through 1985. More detail is provided in Appendix L. These requirements are in addition to the 2,000 cars already ordered by the CWB. The results of this analysis of the numbers of new cars required are:

FORECAST CYCLE	CROP YEAR NEW CARS FIRST NEEDED	NUMBER OF NEW CARS NEEDED BY 1985/86
Top Forecast Volumes and Actual Cycles	1979/80	13,300
Top Forecast Volumes and Target Cycles	1981/82	9,300
Mean Forecast Volumes and Actual Cycles	1979/80	9,400
Mean Forecast Volumes and Target Cycles	1981/82	6,000

(3) A Program of Acquiring 1900 Cars Per Year Is Recommended

In order to be able to meet transportation needs in a peak year, the car requirements associated with the top forecast volumes should be anticipated. Under this assumption the number of new cars required in each crop year is shown on the following page.

CROP YEAR	WITH TARGET CYCLES	WITH ACTUAL CYCLES
1979/80	-	1900
1980/81	800	1900
1981/82	1700	1900
1982/83	1700	1900
1983/84	1700	1900
1984/85	1700	1900
1985/86	1700	1900
TOTAL	9300	13300

The achievement of the target car cycle times is not guaranteed and will take several years to attain. In addition, the lead time between order and delivery is approximately one year so that the 1980/81 crop year is the earliest that additional cars can be delivered in significant numbers. Taking these factors into consideration the recommended course of action for the acquisition of new cars is as follows:

YEAR OF DELIVERY	NUMBER OF NEW CARS	CUMULATIVE TOTAL
1980/81	1900	1900
1981/82	1900	3800
1982/83	1900	5700
1983/84	1900	7600
1984/85	1700	9300
1985/86	To be determined as the results of the efforts to improve car cycles are determined and future grain movement projections become firm.	

Under this program the results of the efforts to improve car cycles should be reviewed so that additional car requirements for 1984/85 and 1985/86 can be determined. Of course, cycle times and grain volumes should be continuously monitored to determine if greater or fewer numbers of cars might be required, if improvements are faster or slower than expected, or if grain sales are higher or lower than assumed here.

The total cost of acquiring the 9300 new cars recommended in this program is approximately $400 million at the 1979 prices per car of $43,000. The cost of acquiring the maximum number of new cars required, 13,300, would be $572 million. The value of achieving only the target improvement in car utilization is therefore estimated to be $172 million at current equipment prices.

(4) <u>The 1985 Box Car Fleet Is Adequate to Handle Estimated Volumes to Churchill and to Serve Restricted Lines</u>

Information provided in Chapter VI indicates that after branchline abandonment and the anticipated rehabilitation of the network takes place over the next few years, only about three percent of grain volume will originate on lines restricted to box cars. By 1985/86, between 15 and 20 percent of the grain fleet capacity (depending upon the forecast level of traffic and the cycle times used) will be provided by the surviving box car fleet, indicating that there should be little problem in providing sufficient numbers of box cars. Similarly, the proportion of movements to Churchill in peak months is considerably below the proportion of surviving box cars indicating that there should not be a problem in providing sufficient numbers of box cars even if the Churchill line is still restricted to box cars in 1985/86.

(5) <u>Covered Hopper Cars Should Be Purchased</u>

Except for the Churchill requirement noted before, future increases to the grain fleet should be exclusively covered hopper cars. The advantages of such an approach versus box car rehabilitation are:

- Homogeneous fleet
- Faster loading and unloading
- Shorter cycle times
- More reliability
- Reduced cleaning requirements

- No grain door required — saving both material and labour

- Greater capacity

- Elimination of mechanically complex, labour intensive car dumpers.

Some disadvantages are:

- Light loading on certain lines.

- Higher near term cash requirements.

- Spout modification required on some primary elevators.

Exhibit VII-2 indicates that at costs of capital of eight percent or below (and the true cost of capital after discounting the impact of inflation is generally less than five percent), the purchase of hopper cars is equally or more cost-effective than the rehabilitation of box cars.

On balance, it is preferable to let the box car fleet fall out given the advanced age and condition of the fleet and purchase covered hoppers. As the branch-line rehabilitation and rationalization continue, under-utilization (by light-loading hopper cars) will diminish and the improvements in facility utilization are likely to offset the higher initial costs.

(6) Flow Smoothing Could Reduce Car Requirements

If a smoother flow of grain through the system over the year could be achieved, a substantial reduction in the number of cars required could be achieved. This hypothesis was tested by assuming a completely flat demand (one-twelfth of the year's demand through the Pacific ports and one-tenth eastbound movements).

EXHIBIT VIII-2
Comparison of Costs of Box Car Rehabilitation and Purchase of Hopper Cars

	Box Car Rehabilitation	Hopper Car Purchase
Capital cost	$7,000	$43,000
Economic life (years)	5	35
Interest rate	8%	8%
Annual cost including recovery of capital	$1,753	$3,690
Trips per year including allowance for light repairs	19.9*	23.4**
Average load (tonnes)	54	80
Delivery per year (tonnes)	995	1,872
Annual capital cost per tonne delivered	1.76	1.97
Cost per tonne of grain doors	.20+	-
Total cost per tonne	1.96	1.97

* Assuming an average cycle time of 17.4 days and an availability of 95%

** Assuming an average cycle time of 15.1 days and an availability of 97%

\+ Snavely estimated the cost of grain doors at $.16 per ton in 1977.

This assumption could reduce the peak month tonnage by 19 percent. The impact of this reduction in net new car requirements is shown below:

CAR REQUIREMENTS WITH LEVEL DEMAND

FORECASTS/CYCLES	NUMBER OF NEW CARS REQUIRED BY 1985/86
Top Forecast Volumes and Actual Cycles	7,900
Top Forecast Volumes and Target Cycles	4,700
Mean Forecast Volumes and Actual Cycles	4,800
Mean Forecast Volumes and and Target Cycles	2,100

This extreme (and practically speaking, not attainable) hypothesis reduces new car requirements considerably. But to meet demand in high volume years, 4,700 new cars are still required even if the target cycle improvements can be achived.

2. ADDITIONAL LOCOMOTIVES WILL BE REQUIRED TO HANDLE 1985 VOLUMES

The locomotive fleets of both CP Rail and CN were analyzed to determine general utilization and distribution practices, restrictions by subdivision, age of fleet by class of service, and retirement and acquisition trends by type of unit. The goal of the analysis was to identify future locomotive requirements. The analysis focused on current and projected volumes, as well as current and projected service patterns. The results presented in this section cover the number of road switcher units that are needed to provide adequate service for the grain blocks, and the number of main line road units required to haul the grain to the ports.

(1) CP Rail Locomotive Requirements for Grain Service Will be Approximately 266 by 1985

The overall CP Rail locomotive fleet used for all purposes consists of about 1,264 units, as summarized below:

CP RAIL

LOCOMOTIVE TYPE	NUMBER OF UNITS	PERCENT OF FLEET	AVERAGE AGE
Yard Switcher	221	18%	28
Road Service (First Generation)	491	39%	23
Four-Motor Road Service	94	7%	13
Six-Motor Road Service	458	36%	7
	1,264	100%	

Unit retirements through 1985 are estimated by CP Rail to be about 50 units. This reduction would be primarily from the yard switcher and first generation road service types which, on average, are 25 years old.

CP Rail is tentatively planning to acquire approximately 150 units by the end of 1985. It is expected that about 90 would be 4-axle units and 60 would be 6-axle units. The railway has indicated it will not make capital expenditures for the grain business under the current rate structure and it is presumed, therefore, that the locomotives to be acquired will be used in other services.

CP Rail presently plans to rebuild by 1985 about fifty GMD GP-9 type units for yard service only. The fleet available to serve lines with restrictions on maximum loads is aging and is thus being further reduced as older units drop out.

Track restrictions in the grain blocks served by CP Rail are shown below. Some subdivisions have additional restrictions over bridges or sections of extremely light rail. Appendix M contains detailed information on these restrictions.

RESTRICTIONS			PERMISSIVE LOCOMOTIVE TYPES			
NO. OF TRACK MILES	LOAD LIMIT (POUNDS)	SPECIAL LIGHT WEIGHT	FIRST GENERATION	4-MOTOR ROAD SWITCHER	6 MOTOR	NUMBER OF MAIN LINE UNITS AVAILABLE
185	181,000	x				6
400	230,000	x	x			491
1651	263,000	x	x	x		585
1714	263,000	x	x	x	x	1043

The load limit of 181,000 pounds on 185 miles of track that dictates the use of special lightweight units is caused by restrictions on the CN trackage divisions. There are six subdivisions with 400 miles restricted to the use of the 491 first generation units. About 26 percent of the grain block area miles allow the use of the 585 4-motor road switcher type units (491 first generation and 94 modern units).

1. <u>By 1985, Service to CP Rail Grain Blocks Could Require 34 Additional Units for Traffic Growth Alone</u>

Estimated locomotive requirements for grain block service were based on the grain service operating plan developed for each railway (see Appendix F). The calculations included:

- Frequencies of train runs
- Number of units per train based on elevator car spots on each subdivision.

The unit requirements were then estimated, based on frequency of runs, potential train size and time constraints of each run.

Current service patterns and volumes indicate that approximately 100 locomotives are required to serve the grain blocks. The 100 units consist of 51 locomotive sets* or 87 units (some train runs require more than one unit) with an allowance of 13 units for maintenance. The total additional number of units required to handle the projected volume growth in the grain block service area in 1985 would be 34 units. These total units (134) would cover the CP Rail grain blocks at anticipated volumes with the current level of service.

2. <u>CP Will Require 30 Additional Units for Main Line Grain Service</u>

The locomotive requirements to move grain on the main lines for both railways were estimated, based on car order volumes for the last week of August, 1978 from the Canadian Wheat Board Summary report. The week's volume was distributed by grain block and to the appropriate collection point.

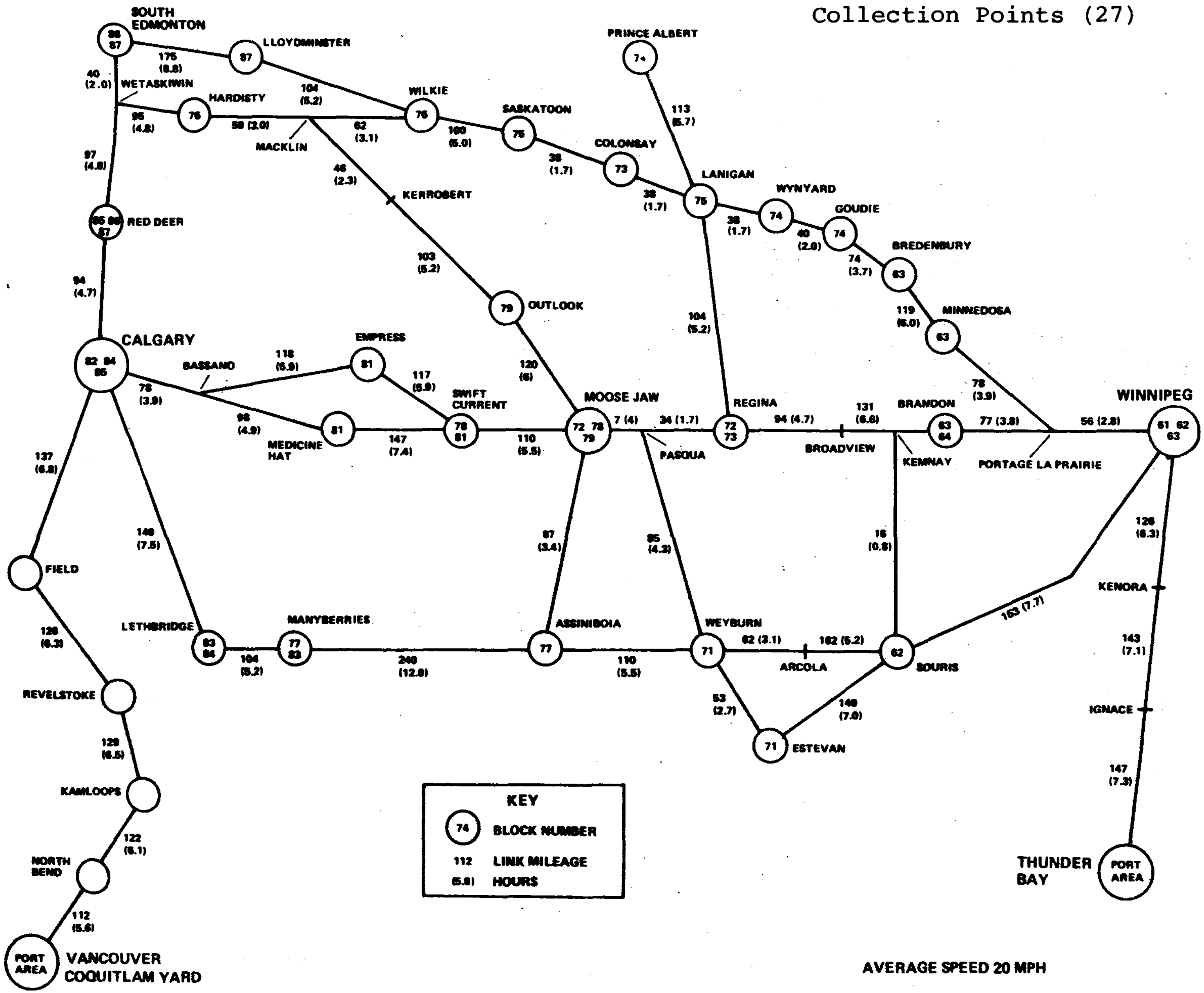
A network representing the CP Rail grain transport system is shown in Exhibit VIII-3. The network assumes two stages to the movement of grain:

- From collection points to the staging areas at Winnipeg and Calgary
- From the staging areas to the ports.

It is assumed that all these movements would be in solid grain trains and not regular, mixed, or local service to enable the allocation of unit requirements. Tonnage ratings and unit restrictions were evaluated in the allocation of power to each train. In the westward movement from Calgary to Vancouver, helper locomotive units were added from Calgary to Chase. Helpers for the Rogers Pass to Stoney Creek segment were

* Locomotive set is a diesel unit or combination of units operated from a single control.

EXHIBIT VIII-3
CP Rail Grain
Collection Points (27)



not included in the calculations. The helpers used between Rogers Pass and Stoney Creek will continue to be required unless a proposed grade reduction program is completed.

Weekly trains required for the loaded and empty movements to and from the collection points and ports were calculated to be 188 as shown in Exhibit VIII-4. This exhibit includes information on train sequence number, origin, destination, route miles, running time, number of cars, train gross tons, number of units allocated, and horsepower required. With a ten percent bad order ratio to allow for servicing and maintenance of these units, the current main line commitment came to 102 locomotive units. The number of units required for CP Rail main line grain haulage in 1985 is projected to be an additional 30 units for a total of 132 units.

(2) CN Locomotive Fleet Requirements for Grain Service Will Be About 238 Units by 1985

The present CN locomotive fleet used for all types of traffic consists of 340 yard and 1,747 road units. These units can be segregated into seven major categories as seen in the following table:

CN LOCOMOTIVE FLEET

UNIT TYPE	NUMBER OF UNITS	PERCENT OF FLEET	AVERAGE AGE
Yard Switcher	340	16	29
Special Lightweight	75	4	20
Lightweight	249	12	21
First Generation Road Switcher	506	24	21
Modern Road Switcher	228	11	7
Modern 4-Motor Road Freight	307	15	5
Modern 6-Motor Road Freight	382	18	9
TOTAL	2,087	100%	

EXHIBIT VIII -4
Main Line Locomotive Requirements
CP Rail (Weekly Volumes)

TRAIN SEQUENCE NUMBER	FROM	TO	MILES	RUNNING TIME (HRS)	CARS	TONS	UNITS	HORSE-POWER
1	Calgary	Vancouver	626	31.3	105	10,227	4	12000
1H	Calgary	Chase	357	17.8	0	0	2	6000
2	Calgary	Vancouver	626	31.3	105	10,227	4	12000
2H	Calgary	Chase	357	17.8	0	0	2	6000
3	Lloydminster	S. Edmonton	175	8.8	25	2,435	2	3000
4	Hardisty	Wetaskiwin	95	4.8	16	1,558	1	1500
5	S. Edmonton	Calgary	231	11.5	119	11,591	4	12000
6-8	Red Deer	Calgary	94(X3)	4.7(X3)	91(X3)	8,863(X3)	4(X3)	9000
9	Calgary	Vancouver	626	31.3	102	9,935	4	12000
9H	Calgary	Chase	357	17.8	0	0	2	6000
10	Outlook	Calgary	553	27.7	102	9,935	4	12000
11-12	Saskatoon	Calgary	507(X2)	25.4(X2)	70(X2)	6,818(X2)	3(X2)	7500
13	Souris	Regina	231	11.8	13	1,266	1	1500
14	Prince Albert	Lanigan	113	5.7	85	8,279	4	6000
15	Lanigan	Regina	104	5.2	105	10,227	4	12000
16	Regina	Calgary	474	21.7	121	11,785	4	12000
17	Moose Jaw	Calgary	433	19.6	118	11,493	4	12000
18	Moose Jaw	Medicine Hat	257	12.9	40	3,896	2	3000
19	Medicine Hat	Calgary	176	8.8	100	9,740	4	12000
20	Empress	Calgary	196	9.8	104	10,130	4	8000
21	Manyberries	Calgary	253	12.7	84	8,182	4	7000
22	Lethbridge	Calgary	151	7.5	96	9,350	4	7000
23	Lethbridge	Calgary	151	7.5	95	9,253	4	7000
24-34	Calgary	Vancouver	626(X11)	31.3(X11)	105(X11)	10,227(X11)	4(X11)	12000
24H-34H	Calgary	Chase	357(X11)	17.8(X11)	0 (X11)	0 (X11)	2(X11)	6000
35	Lloydminster	Wilkie	104	5.2	31	3,019	1	3000
36	Wilkie	Winnipeg	581	28.5	91	8,864	2	6000
37	Wilkie	Winnipeg	581	28.5	90	8,766	2	6000
38	Hardisty	Winnipeg	702	34.6	119	11,591	3	9000
39	Swift Current	Winnipeg	509	25.5	134	13,051	4	12000
40	Manyberries	Winnipeg	667	33.4	101	9,837	4	6000
41	Manyberries	Winnipeg	667	33.4	101	9,837	4	6000
42-44	Assiniboia	Winnipeg	427(X3)	21.4(X3)	99(X3)	9,643(X3)	2(X3)	6000
45	Weyburn	Winnipeg	317	15.9	100	9,740	2	5000
46	Weyburn	Winnipeg	317	15.9	100	9,740	2	5000
47	Estevan	Winnipeg	293	14.7	119	11,590	3	9000
48	Estevan	Winnipeg	293	14.7	120	11,688	3	9000
49	Souris	Winnipeg	153	7.7	107	10,422	2	6000
50	Souris	Winnipeg	153	7.7	106	10,324	2	6000
51-55	Moose Jaw	Winnipeg	399(X5)	20.0(X5)	108(X5)	10,520(X5)	3(X5)	9000
56	Regina	Winnipeg	358	17.9	120	11,688	3	9000
57	Colonsay	Winnipeg	443	22.1	125	12,175	3	7500
58	Lanigan	Winnipeg	405	20.4	121	11,785	3	7500
59	Wynyard	Winnipeg	367	18.7	85	8,279	2	6000
60	Goudie	Winnipeg	327	16.7	103	10,032	4	12000
61	Bredenbury	Minnedosa	119	13.7	50	4,870	2	6000
62	Minnedosa	Winnipeg	134	6.7	100	9,740	2	6000
63-65	Brandon	Winnipeg	133(X3)	6.6(X3)	119(X3)	11,591(X3)	2(X3)	4000
66-94	Winnipeg	Thunder Bay	416(X29)	20.7(X29)	130(X29)	12,662(X29)	3(X29)	9000

The present attrition rate on the CN Rail is very low and limited to only wrecked or fire damaged units. In the past two years, three units have been destroyed, two in 1978 and one in 1977. It is expected that this general trend will continue until at least 1985.

Many of the branches in CN grain blocks were constructed during an era of rapid railway expansion and built to very lightweight standards. These lines generally fall into five major weight restriction groups, as indicated in the following table.

RESTRICTIONS		PERMITTED LOCOMOTIVE TYPES					
NO. OF TRACK MILES	LOAD LIMIT (POUNDS)	SPECIAL LIGHT-WEIGHT	LIGHT-WEIGHT	FIRST GENERATION ROAD SWITCHER	MODERN ROAD SWITCHER	MODERN TYPES	NO. OF UNITS AVAIL-ABLE
2,391	160,000	X					75
432	177,000	X	X				249
1,269	220,000	X	X	X			830
312	263,000	X	X	X	X		1,062
4,701	Above 263,000	X	X	X	X	X	1,747

About 48 percent of the mileage in the CN grain block areas had locomotive restrictions. These restrictions do not permit the use of any modern power units.

The most restricted territories can be served by two distinct types of locomotives that were especially built for this service. The lighter and smaller group of locomotives is generally known as GMD-1 class. This is a special lightweight unit with a four-motor six-wheel truck to spread out the weight. There are currently 75 units in this class, which are on average 20.3 years old and serve 2,391 miles of 160,000 pounds loading limit trackage (26 percent of the CN Rail grain block area). The remaining light duty trackage can be served by a fleet of 249 units serving 2,823 miles.

The trackage limited to 220,000 pounds can be served by a total of 830 units or 47.7 percent of the CN's present road fleet.

The trackage limited to 263,000 pounds can be served by 1,062 units or 60.8 percent of the current road fleet. The balance of the trackage is unrestricted and therefore may be served by the entire CN locomotive fleet.

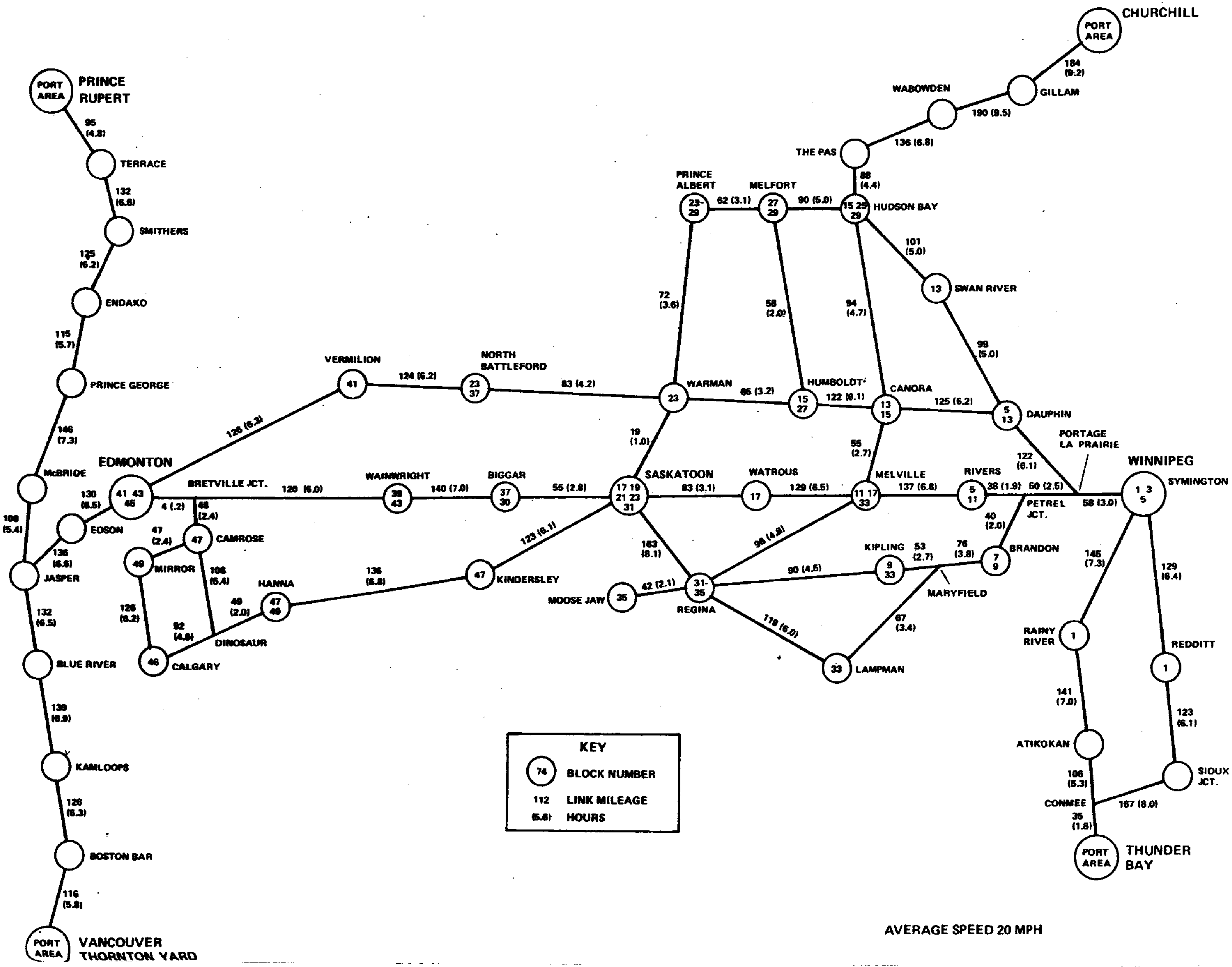
1. <u>CN Rail Grain Block Traffic Growth Will Require 35 Additional Units</u>

The CN's locomotive requirements for serving the grain blocks, based on the grain service operating plan (see Appendix F) are approximately 63 locomotive sets (102) units, allowing for normal maintenance and inspections without any substantial service impediments. An additional 35 units are required, totaling 137 units, to handle the projected 1985 grain volume projections. These units would cover the entire CN grain block service area at the present level of service.

2. <u>Main Line Locomotive Requirements for Grain Will Grow by 26</u>

The Canadian National locomotive requirements for main line haulage of grain from the collecting areas to the ports was calculated in the same manner as for CP. A representation of the CN Rail grain collective network for intermediate moves is shown in Exhibit VIII-5. The network assumes grain would be assembled for the intermediate move from the grain blocks to the marshaling areas at Edmonton in the west for the traffic going to Vancouver and Prince Rupert, Winnipeg in the east for traffic going to Thunder Bay, and Hudson Bay for the traffic going to Churchill. The units were allocated with respect to the restrictions that are presently in effect for each division. The traffic was then handled based on the weekly volumes from the collection points to the marshaling areas and on to the respective ports. Power was adjusted as dictated by restrictions. There were power changes at such points as Gillam en route to

EXHIBIT VIII-5
CN Rail Grain
Collection Points (30)



Churchill and at Prince George en route to Prince Rupert. An adjusted total of 190 loaded and empty train moves were needed for the week to handle the CN traffic from the grain blocks to the ports. Exhibit VIII-6 includes information concerning this calculation. These trains required 75 main line units for grain movement, including a ten percent bad order ratio to cover the units for servicing, inspection, and maintenance. The 1985 figure of units required for CN main lines would be 101.

(3) <u>125 Additional Locomotives Will be Required by 1985</u>

Total grain locomotive requirement for both railways for the present is 379 units; 202 units are used for collection within the grain blocks and 177 units are used for main line road haul. The total unit requirement in 1985 is expected to be 504 units; 271 units for serving the grain blocks and 233 units for main line movements. This represents an additional requirement of 125 diesel units to handle the anticipated grain growth. At an average cost of $850,000 per locomotive, total capital required is $106 million in 1979 dollars. In addition, as noted above, much of the present grain locomotive fleet is aging and some will probably have to be replaced by 1985. Assuming that 20 percent of the present fleet would have to be replaced, capital requirements increase to $171 million.

3. RAILWAY MAIN LINE CAPACITY WILL BE STRAINED

The question of the capacity of railway lines to handle present and future volumes of grain, as well as other traffic, was considered at length. Four lines in particular were examined in detail:

- CN Edmonton-Vancouver
- CP Calgary-Vancouver
- CN Prince Rupert line
- CN Churchill line.

In addition, the CN and CP lines to Thunder Bay were examined in a less detailed manner.

EXHIBIT VIII-6
Main Line Locomotive Requirements
CN Rail (Weekly Volumes)

TRAIN SEQUENCE NUMBER	FROM	TO	MILES	RUNNING TIME (HRS)	CARS	TONS	UNITS	HORSE-POWER
1	Swan Landing	Vancouver	649	32.1	97	9,448	2	6000
2	Swan Landing	Vancouver	649	32.1	97	9,448	2	6000
3	Edmonton	Vancouver	779	38.6	102	10,032	2	6000
4	Edmonton	Vancouver	779	38.6	102	10,032	2	6000
5	Edmonton	Vancouver	779	38.6	103	10,130	2	6000
6	Edmonton	Vancouver	779	38.6	99	9,643	2	6000
7	Hanna	Edmonton	200	20.6	39	3,799	3	3600
8	Hanna	Edmonton	200	20.6	40	3,896	3	3600
9	Mirror	Edmonton	97	5.0	56	5,454	3	3600
10	Kindersley	Edmonton	336	27.4	34	3,312	2	3600
11	Edmonton	Prince George	520	25.8	84	8,182	2	6000
12	Prince George	Prince Rupert	467	23.3	84	8,182	3	5000
13	Warman	Saskatoon	19	1.0	8	780	1	1500
14	Kipling	Saskatoon	253	12.6	15	1,461	1	1500
15	Saskatoon	Biggar	55	2.8	38	3,701	1	3000
16	Biggar	Vancouver	1,043	51.6	101	9,837	2	6000
17	Biggar	Wainwright	140	7.0	80	7,792	3	4500
18	Wainwright	Vancouver	903	44.8	100	9,740	2	6000
19	Wainwright	Prince George	644	32.0	100	9,740	2	6000
20	Prince George	Prince Rupert	467	23.3	100	9,740	2	6000
21	Melville	Canora	55	2.7	14	1,363	1	1500
22	Canora	N. Battleford	270	13.5	39	3,799	2	3000
23	N. Battleford	Vancouver	1,029	51.1	89	8,669	2	6000
24	Vermilion	Vancouver	905	44.9	113	11,006	2	6000
25	Hudson Bay	Prince Albert	161	8.1	15	1,461	1	1500
26	Prince Albert	Vermilion	279	14.0	53	5,162	2	3000
27	Humboldt	Hudson Bay	157	7.9	66	6,428	3	4500
28	Dauphin	Swan River	99	5.0	37	3,604	2	3000
29	Swan River	Hudson Bay	101	5.0	87	8,474	3	4500
30	Canora	Hudson Bay	94	4.7	70	6,818	3	4500
31	Prince Albert	Hudson Bay	161	8.1	93	9,058	4	6000
32	Prince Albert	Hudson Bay	161	8.1	93	9,058	4	6000
33	Prince Albert	Hudson Bay	161	8.1	93	9,058	4	6000
34	Melfort	Hudson Bay	99	5.0	75	7,305	4	6000
35	Melfort	Hudson Bay	99	5.0	75	7,305	4	6000
36	Warman	Hudson Bay	233	11.7	98	9,545	4	6000
37	Warman	Hudson Bay	233	11.7	98	9,545	4	6000
38-44	Hudson Bay	Gillam	414(X7)	20.7(X7)	142(X7)	11,360(X7)	2(X7)	6000
45-51	Gillam	Churchill	184(X7)	9.2(X7)	142(X7)	11,360(X7)	4(X7)	6000
52	Hudson Bay	Prince George	1,086	54.1	80	7,792	2	6000
53	Prince Albert	Prince George	925	46.1	80	7,792	2	6000
54	Prince George	Prince Rupert	467	23.3	80	7,792	3	5000
55	Prince George	Prince Rupert	467	23.3	80	7,792	3	5000
56	Edmonton	Vermilion	126	6.3	41	3,994	2	3000
57	Vermilion	Humboldt	272	7.6	54	5,260	3	4500
58	Humboldt	Winnipeg	427	21.4	79	7,695	2	3000
59	Humboldt	Winnipeg	427	21.4	80	7,792	2	3000
60	Moose Jaw	Winnipeg	441	21.1	75	7,305	4	6000
61	Moose Jaw	Winnipeg	441	21.1	75	7,305	4	6000
62	Regina	Winnipeg	399	19.0	75	7,305	4	6000
63	Regina	Winnipeg	399	19.0	75	7,305	4	6000
64	Lampman	Winnipeg	291	14.7	111	10,811	4	6000
65	Saskatoon	Winnipeg	475	23.8	125	12,175	2	6000
66	Saskatoon	Winnipeg	475	23.8	125	12,175	2	6000
67	Saskatoon	Winnipeg	475	23.8	125	12,175	2	6000
68	Watrows	Winnipeg	412	20.7	110	10,714	2	6000
69	Kipling	Winnipeg	277	14.0	100	9,740	3	4500
70	Melville	Winnipeg	283	14.2	105	10,227	2	6000
71	Melville	Winnipeg	283	14.2	105	10,227	2	6000
72	Rivers	Winnipeg	146	7.4	181	17,629	3	9000
73	Brandon	Winnipeg	148	7.5	118	11,493	2	6000
74	Brandon	Winnipeg	148	7.5	118	11,493	2	6000
75	Brandon	Winnipeg	148	7.5	118	11,493	2	6000
76	Melfort	Canora	193	9.7	15	1,461	1	1500
77	Canora	Winnipeg	305	15.3	102	9,935	2	6000
78	Hudson Bay	Swan River	101	5.0	45	4,383	2	3000
79	Swan River	Winnipeg	279	14.1	120	11,688	3	4500
80	Dauphin	Winnipeg	180	9.1	75	7,305	2	4000
81-101	Winnipeg	Thunder Bay	428(X21)	21.4(X21)	116(X21)	11,298(X21)	3(X21)	8000

The capacity of a line of railroad is the function of many factors, including:

- Allowable train speeds
- Variations in speed among trains
- Train schedules
- Train priorities
- Signal system type
- Signal spacing
- Length and location of sidings
- Capacity of cars and length of trains
- Gradient and helper requirements
- Crew availability
- Maintenance requirements
- Acceptable levels of delay.

(1) The Existing Levels of Line Congestion Were Analyzed

The complex interrelationships of these factors were examined for the lines in question. Inspections were made of critical portions of the physical plant to become familiar with the configuration and condition of the facilities, and discussions were held with senior operating officials, as well as officials responsible for day-to-day operation of the lines. These discussions centered on present capacity constraints and possible actions that could be taken to alleviate the constraints, given increases in traffic volumes expected by 1985.

In addition, dispatchers' sheets were examined and "stringline graphs" were produced to allow examination of the effect of the addition of extra trains to the operation on each line. In this way, an estimate could be made of how close each line was to its practical capacity, given the present facilities. Stringline graphs for each line were first prepared to represent operations for a 24-hour "design day." This design day was determined for both the CN and the CP by examination of sample train sheets from the highest volume months of 1978 as provided by both railways. From these sheets, a count of trains by day and by subdivision was made for each railroad. The day which had the highest total count of cars and trains for all subdivisions on the line being examined was selected as the design day. The design days used were:

CN Edmonton-Vancouver	January 13, 1978
CP Calgary-Vancouver	April 12, 1978
CN Red Pass Jct-Prince Rupert	December 7, 1978
CN The Pas-Churchill	October 6, 1978

All trains operating on the day selected were represented on the base stringline graphs as they were actually dispatched.

(2) <u>1985 Traffic Levels Were Projected</u>

A second set of graphs was prepared representing 1985 traffic levels on the CN and CP lines to Vancouver, as well as the CN Prince Rupert line. An overlay was prepared showing additional trains that would be required to handle the projected 1985 volume of traffic, assuming that the traffic would be handled in cars of the same relative capacity as those presently in use. Projections for bulk commodities such as coal, grain, potash, and sulphur were developed from a variety of sources (Westac, Railways, CWB). Assumptions used in the calculations to assess the traffic to be handled in 1985 were made as follows:

- 88 net tons (80 metric tonnes) of each bulk commodity are to be handled in each car

- The tare weight of each car was set at 30 tons per car and 90 cars of bulk traffic are to be handled in each bulk train

- A divisor of 300 was used instead of 365 to convert yearly tonnage data into trains per day in order to match the projected tonnage to the "design day" volumes used in the stringline analysis.

The estimated design day maximum number of CP trains to Vancouver for the 1985 volumes is 19 trains in each direction, reflecting an annual volume of 49.6 million gross tons westbound (including 6.5 million tonnes of grain). The 19 trains each way include one passenger train each day.

The Canadian National line capacity study covered the lines from Edmonton to Vancouver and from Red Pass Junction to Prince Rupert. Since CN has two routes available to the Pacific Coast, it was assumed that the two additional CN grain trains would move to the new elevator proposed to be built at Prince Rupert by 1985. The maximum 1985 volumes projected were 20.5 trains in each direction between Edmonton and Red Pass Junction, which is 47 million gross tons westbound (grain 9.7 million tonnes) and 16 trains per day in each direction from Red Pass Junction to Vancouver, which is 36.3 million gross tons westbound, including one passenger train.

Total West Coast traffic reaches 39.5 westbound trains divided among the routes as follows:

WESTBOUND TRAINS PER DESIGN DAY

	CP Vancouver	CN Vancouver	CN Prince Rupert
Present Trains (High Average)			
Grain	2	2	0.6
Other*	12	10	1.4
Passenger	1	1	0.5
Total	15	13	2.5
1985 Additional			
Grain	1	0	2
Other*	3	3	0
Total Additional	4	3	2
1985 Total	19	16	4.5

* Other traffic—coal, sulphur, potash, and general merchandise.

In dispatching the trains required in 1985, the base case average delay time at each crew change point was recorded and used as an average acceptable delay time at that point.

The en route delays encountered by the additional trains were delays attributable to their presence on the system. The number of potential meets that each train might encounter in its trip across the railroad was calculated. Some trains were meeting other trains at more than 50 percent of the available sidings.

Exhibits VIII-7 through VIII-11 present the results of an analysis of the stringline charts prepared for the various line segments. In most cases, the percentage of available sidings used for meets in 1985 and the average delay per meet were greater than in the base case. On both the CN and CP routes to Vancouver, trains were meeting other trains at from 40 to 50 percent of the available sidings. This would indicate that these lines are nearing practical capacity in the number of trains that can be handled.

(3) Time for Maintenance Operations Is Also a Major Factor

It should be noted that the above analyses did not take into account the track time that is required for normal maintenance procedures that are carried out in the summer months. The summer is usually the peak traffic season, and data provided by the railways indicate that large blocks of track time are given to maintenance forces in order to allow the required work to be performed in a timely and efficient manner.

Estimates of the effect of tracks out of service for maintenance for a single track main line railroad capable of handling 47 million gross tons per year (westbound) were analyzed. Thomas K. Dyer, Inc. Consulting Engineers were retained. They inspected facilities in the field and analyzed and evaluated present conditions on both CN and CP. Their analysis reveals that to maintain a railroad capable of handling 47 million gross tons per year, such as the CN between Swan Landing and Red Pass Junction, requires six months of maintenance-of-way work. During this six-month period, five hours of undisturbed track time for five days a week would be required. Actual track time may be longer at this time due to the major track building projects now underway.

EXHIBIT VIII-7
Line Capacity
CN Churchill-The Pas

	EASTBOUND - NORTH		WESTBOUND - SOUTH	
	% Of Sidings Used For Meets	Average Delay Per Train Per Meet	% Of Sidings Used For Meets	Average Delay Per Train Per Meet
PRESENT				
Passenger	10%	130 Minutes	5%	102 Minutes
Freight	4%	160 Minutes	5%	35 Minutes
All Trains	6%	145 Minutes	5%	75 Minutes

EXHIBIT VIII-8
Line Capacity
CN Red Pass Junction-
Prince Rupert

	EASTBOUND		WESTBOUND	
	% Of Sidings Used For Meets	Average Delay Per Train Per Meet	% Of Sidings Used For Meets	Average Delay Per Train Per Meet
PRESENT				
Passenger	No Meets	No Delay	8%	9 Minutes
Freight	12%	41 Minutes	11%	33 Minutes
All Trains	11%	41 Minutes	10%	27 Minutes
1985				
Passenger		No Delay	13%	9 Minutes
Present Freight	18%	41 Minutes	17%	33 Minutes
Added Trains	19%	51 Minutes	17%	27 Minutes
TOTAL All Trains	18%	48 Minutes	16%	27 Minutes

EXHIBIT VIII-9
Line Capacity
CN Jasper-Vancouver

	EASTBOUND		WESTBOUND	
	% Of Sidings Used For Meets	Average Delay Per Train Per Meet	% Of Sidings Used For Meets	Average Delay Per Train Per Meet
PRESENT				
Passenger	35%	18 Minutes	28%	15 Minutes
Freight	32%	26 Minutes	24%	25 Minutes
All Trains	33%	25 Minutes	29%	25 Minutes
1985				
Passenger	46%	18 Minutes	38%	15 Minutes
Present Freight	42%	26 Minutes	38%	25 Minutes
Added Trains	40%	29 Minutes	40%	24 Minutes
TOTAL All Trains	42%	26 Minutes	36%	25 Minutes

EXHIBIT VIII-10
Line Capacity
CN Edmonton- Jasper

	EASTBOUND		WESTBOUND	
	% Of Sidings Used For Meets	Average Delay Per Train Per Meet	% Of Sidings Used For Meets	Average Delay Per Train Per Meet
PRESENT				
Passenger	41%	18 Minutes	24%	11 Minutes
Freight	35%	29 Minutes	40%	26 Minutes
All Trains	36%	28 Minutes	39%	26 Minutes
1985				
Passenger	48%	18 Minutes	41%	11 Minutes
Present Freight	53%	29 Minutes	51%	26 Minutes
Added Trains	51%	39 Minutes	49%	35 Minutes
TOTAL All Trains	52%	32 Minutes	50%	28 Minutes

EXHIBIT VIII-11
Line Capacity
CP Field-Vancouver

	EASTBOUND		WESTBOUND	
	% Of Sidings Used For Meets	Average Delay Per Train Per Meet	% Of Sidings Used For Meets	Average Delay Per Train Per Meet
PRESENT				
Passenger	37%	20 Minutes	37%	10 Minutes
Freight	33%	40 Minutes	37%	38 Minutes
All Trains	33%	38 Minutes	37%	34 Minutes
1985				
Passenger	50%	20 Minutes	45%	10 Minutes
Present Freight	49%	40 Minutes	48%	38 Minutes
Added Trains	47%	28 Minutes	44%	35 Minutes
TOTAL All Trains	48%	34 Minutes	46%	30 Minutes

The Canadian National main line west of Red Pass Junction to Vancouver would require a minimum of four months maintenance-of-way time working a minimum of five hours a day, five days a week, to maintain the line to a standard capable of handling 36 million gross tons per year.

In analyzing the Canadian Pacific's main line between Calgary and Vancouver, which in 1985 will handle 49 million gross tons per year westbound, it is estimated that a minimum of six months of maintenance-of-way track time, consisting of five hours of undisturbed track time daily for five days a week, will be required. All of these times reflect minimum times to maintain the tracks to a level which will enable the structure to hold up to the weights that are projected to operate over it. If more maintenance time were available, more efficient use of labor and material would be possible. If these levels of maintenance were not adhered to consistently, the main lines would begin to deteriorate.

(4) <u>Rail Line Capacity to Vancouver Will Be the Most Limited</u>

The analyses of the line capacities on both CP and CN lines to Vancouver indicated that, in theory, they could probably handle the expected 1985 volumes, as projected with present facilities, if maintenance requirements and other interruptions (such as derailments) are not taken into account. Since both lines would be close to their realistic line capacities even without allowing for maintenance and, at the volumes projected, heavy maintenance would be required during the peak summer months, capacity to Vancouver must be considered scarce by 1985 at these projected volumes. Any additional traffic could also cause lengthy delays and jeopardize the total efficiency of either line. As traffic levels build in the future, time available for maintenance will be increasingly necessary and harder to obtain. Certain capacity improvements will have to be made for this reason alone.

The Prince Rupert line can handle the projected 1985 traffic with little problem without a major investment in facilities, although it would appear necessary to increase the length of some sidings on that line. Maintenance track time is a minor problem on a railroad with its projected density.

On the CN's Churchill line, there is no present line capacity problem. Line capacity is available to handle quite a few more trains than can be originated or terminated at the present terminals. Axle loadings are the limiting factor on the capacity of this line, as heavy grain hoppers cannot be used.

A detailed line capacity analysis was not carried out on the CN and CP lines from Winnipeg to Thunder Bay. Data supplied by the railways indicated that there was no serious problem in this area due to the nature of the terrain, the excellent facilities presently in place, and the availability of alternate routes. It should also be noted that the growth predicted for Thunder Bay is less than that projected for lines to the Pacific Coast.

(5) Further Capacity Improvements Can be Made

Theoretically, there is no limit to the expansion of capacity of a railway line, but the cost of capacity increases can skyrocket beyond a certain point. Low traffic, unsignalled railroads can be upgraded fairly easily by the addition of more or longer sidings and signal facilities. The practical problems of increasing the line capacity of single track railways in mountainous terrain are, however, much more formidable.

Both CN and CP Rail have been increasing the capacity of their lines to Vancouver for a number of years in response to traffic growth. Both lines are now equipped with modern signal systems, and sidings average seven to eight miles apart. The CN is increasing its line capacity by shorter signal spacing and siding lengthening. The present CN program is expected to cost $160 million.

On the CP line to Vancouver, short stretches of double track are in place, and CP Rail is now completing three grade reduction projects and is contemplating another major project involving a long tunnel at Rogers Pass. The expected cost of this project is $100 million. It appears from our analysis that the proposed grade reduction project at Rogers Pass would reduce some congestion from helper movements and reduce locomotive requirements. The required contribution from the grain industry toward this project should be analyzed in detail and negotiated between the parties involved.

There is no question that the capacity of both CN and CP lines to Vancouver can continue to be increased, but many of the cheaper capacity increasing projects have already been carried out. Each increment of capacity required in the future will become more and more costly.

One suggestion for capacity improvement of the CP and CN lines is for the railways to adopt joint use of their lines in the Fraser Canyon area between Kamloops and Vancouver. Under this proposal, one line would be used predominantly for westbound movements and the other for eastbound. This offers the possibility of a large increase in capacity, although capital costs will be high. The tonnages carried on the westbound line would be unprecedented and the resulting maintenance requirements would be a severe problem. It will be necessary to provide additional connections between the lines, in several cases involving new bridges across the Fraser River. The total cost of this project estimated three to four years ago was $148 million.

This proposal has been studied initially by Transport Canada and the railways, and is considered to be physically and operationally feasible; however, the economic and institutional feasibility as well as the maintenance requirements have not yet been determined. This proposal also does not overcome the capacity problems on the lines east of Kamloops.

4. MAJOR INVESTMENTS IN CARS, LOCOMOTIVES, AND RAILWAY LINE CAPACITY WILL BE REQUIRED

The analyses reported in this chapter indicate that substantial capital investments in railway facilities will be required over the next few years. The total capital investment estimates are:

	NUMBERS REQUIRED	CAPITAL COST ($ MILLION)
Cars	9,300 to 13,300	$400 to 572
Locomotives	125 to 201	100 to 171
Line Capacity Improvements	--	0 to 408
Total		$500 to $1,151

Given the statutory rate, it is unlikely the railways will provide the investment capital necessary to meet these needs as far as grain traffic is concerned.

IX. INFORMATION AND INVENTORY MANAGEMENT SYSTEMS

This chapter covers conclusions and recommendations regarding various information, car allocation, and inventory management issues. Background and a description of current operations can be found in Appendix N. The sections of the chapter present improvement opportunities, and recommendations. The recommendations presented in the last section are essentially independent of any organizational changes that might occur.

In order to provide a framework for evaluating the present system and for developing improvements, the following guidelines and goals were established. The information and inventory management system should:

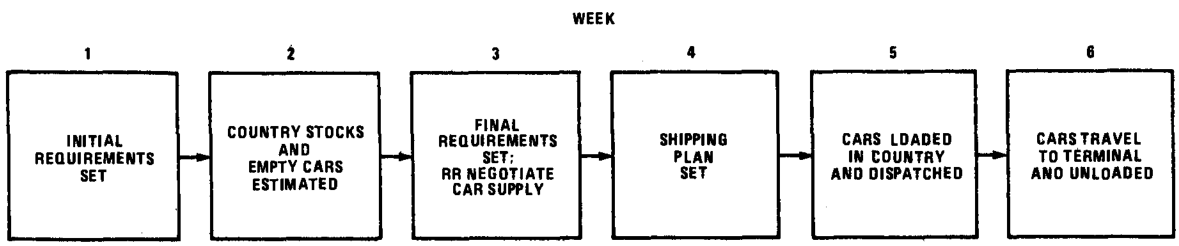
- Support efforts to optimize the use of facilities and equipment and to maximize the throughput of the grain logistics system.
- Serve the decision-making needs of the participants and focus on objectives and performance
- Facilitate understanding by all parties of roles, criteria, decision rules, problems, and performance while maintaining the security of proprietary information
- Provide information for management control to permit rapid and effective reaction to short-term problems, and to predict, anticipate and develop strategy for long-term problems
- Enable the evaluation of performance of various parts of the system, the system as a whole, and the success or failure of strategies.

The present system is deficient in meeting these objectives to an extent that warrants significant improvement.

1. ONLY FORTY PERCENT OF THE GRAIN SHIPPED TO THE PORTS MADE PLAN

At present, the management system does not work. Plans are not fulfilled on time. As shown below, the six-week planning operations cycle of the block shipping system assumes that the grain ordered during planning week 4 will be at the port for unloading by the end of planning week 6. As illustrated in Exhibit IX-1 (and shown in more detail by port, grain type, and block in Appendix O), only about 40 percent of grain is unloaded at the port by week 6, and the remaining

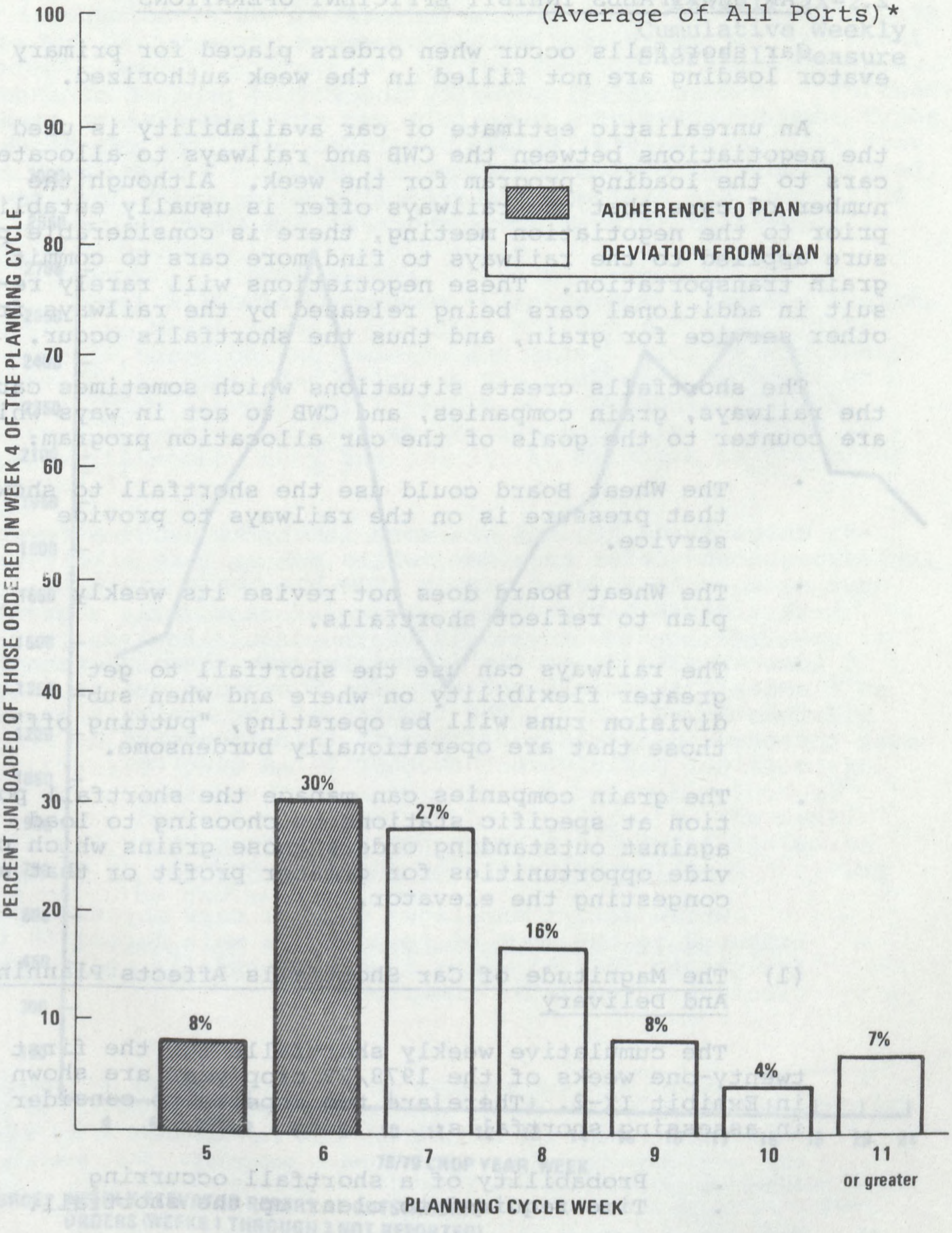
CONCEPTUAL ILLUSTRATION OF GRAIN TRANSPORTATION PLANNING CYCLE



60 percent arrives in a "tail" distribution during the subsequent 5 or 6 weeks. The chart illustrates that the delivery system responds much more slowly than programmed. Orders are filled over a period of 11 to 12 weeks instead of 6 weeks. It is clear that while shipments are assumed to be available as potential stocks to meet anticipated ship arrivals, the majority of cars will not be unloaded on time. The inability to deliver needed grains at the port results in demurrage payments and lost sales, as well as congestion which in turn reduces car utilization and compounds delivery problems.

Delivery to port according to plan can be enhanced through improvements to the information systems and management practices. The lack of compliance to plan is caused by an overestimation of car availability leading to car shortfalls, car cycle times not being explicitly incorporated in weekly delivery plans, and inadequate information and inventory identification. These three subjects are covered in the following sections.

EXHIBIT IX-1
Percent of Cars Unloaded
of Those Ordered
(Average of All Ports)*



* Source: Canadian Wheat Board Block Audit File, 3-month sample, 1978.

2. CAR SHORTFALLS INHIBIT EFFICIENT OPERATIONS

Car shortfalls occur when orders placed for primary elevator loading are not filled in the week authorized.

An unrealistic estimate of car availability is used in the negotiations between the CWB and railways to allocate cars to the loading program for the week. Although the number of cars that the railways offer is usually established prior to the negotiation meeting, there is considerable pressure applied to the railways to find more cars to commit to grain transportation. These negotiations will rarely result in additional cars being released by the railways from other service for grain, and thus the shortfalls occur.

The shortfalls create situations which sometimes cause the railways, grain companies, and CWB to act in ways which are counter to the goals of the car allocation program:

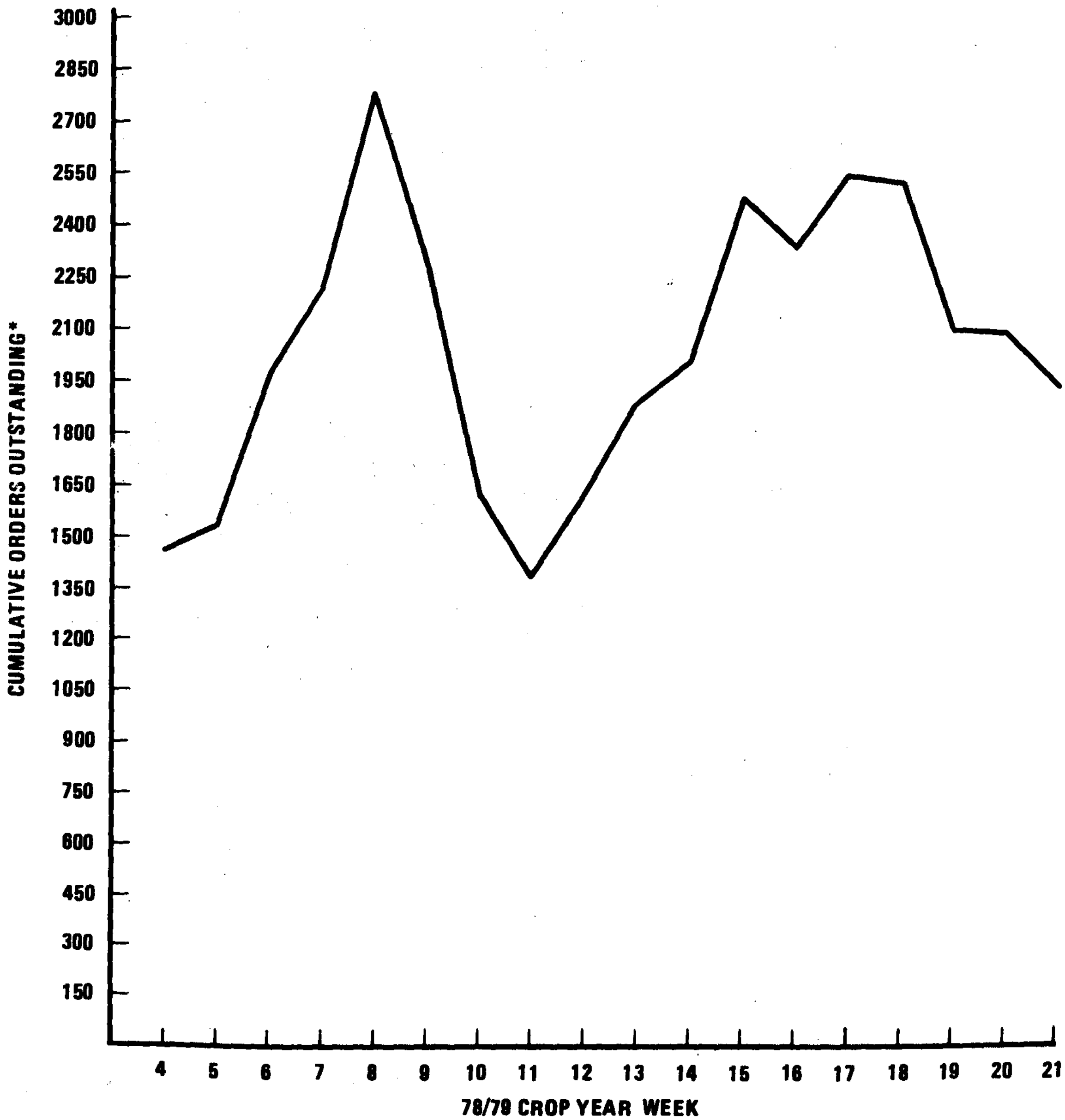
- The Wheat Board could use the shortfall to show that pressure is on the railways to provide service.
- The Wheat Board does not revise its weekly plan to reflect shortfalls.
- The railways can use the shortfall to get greater flexibility on where and when subdivision runs will be operating, "putting off" those that are operationally burdensome.
- The grain companies can manage the shortfall position at specific stations by choosing to load against outstanding orders those grains which provide opportunities for greater profit or that are congesting the elevator.

(1) The Magnitude of Car Shortfalls Affects Planning And Delivery

The cumulative weekly shortfalls for the first twenty-one weeks of the 1978/79 crop year are shown in Exhibit IX-2. There are two aspects to consider in assessing shortfalls:

- Probability of a shortfall occurring
- Time required to clear up the shortfall.

EXHIBIT IX-2
Cumulative Weekly
Shortfall Measure



*SOURCE: WEEKLY ELEVATOR REPORT OF OUTSTANDING ORDERS (WEEKS 1 THROUGH 3 NOT REPORTED)

The duration of shortfalls are extended by the companies' choice of which orders (current or outstanding) will be filled when faced with a shortage of cars.

A shortfall severity index (the product of the probability of a shortfall and time required to clear up the shortfall*) was developed using the CWB Block Audit file (3-month sampling, 1978). A high index corresponds to a major shortfall problem and a low index corresponds to a minor shortfall as shown below:

COMPANY	PROBABILITY OF SHORTFALL (%)	AVERAGE LENGTH OF SHORTFALL** (DAYS)	SEVERITY INDEX
Cargill	47	7.7	3.62
Pioneer	44	7.3	3.21
SWP	40	7.0	2.80
MPE	38	7.4	2.81
UGG	35	6.8	2.38
AWP	30	5.8	1.74

Cargill and Pioneer are more likely to receive fewer cars and defer an order, while AWP is less likely to do so. An inference made from the above table is that given a higher occurrence of shortfall, a greater deferrence of orders will take place. Analysis was undertaken to determine if orders were given preference under a shortfall position for Non-Board grains more than Board grain. The results of the analysis presented in Appendix P indicate that Non-Board's received a slight preference when shortfalls occurred.

(2) <u>Shortfalls Account for a One-Week Delay in Meeting Delivery for About 28 Percent of the Plan</u>

While actual shortages of rail cars may have contributed to the lack of response, a main factor in the failure to fulfill plans is car shortfalls, often reflecting unrealistic commitments.

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* For example, consider a sample of orders to a block; 50 percent of the cars for the orders were not spotted by the Friday of the authorization week and the average time for the cars to be spotted was seven days beyond to the following Saturday. The severity index would be 0.5 x 7 = 3.5.

** Days beyond authorized week of loading.

Approximately 28 percent of the authorized loading plan is not being executed each week and the effect on the Wheat Board's weekly program is, on the average, a one-week delay. An order may be deferred up to three to five weeks. Furthermore, the Wheat Board has only rough estimates of what types and grades of grain will be arriving at a terminal elevator. As shortfalls increase and orders are deferred and swapped, the Wheat Board loses track of which orders will be filled and shipped. As grades and protein levels increase, this problem becomes increasingly acute.

Shortfalls also increase the direct cost to the system. Since the Wheat Board's planning horizon for grain shipments is based on the loading and travel time from primary elevator to port, any delay in the placement of a car at the primary elevator will result in a schedule setback. Although terminal buffer stocks are normally utilized in these instances, they are costly to maintain in any great amount.*

Shortfalls are one of the principal reasons for requiring buffer stocks. If shortfalls were reduced, terminal elevators could use buffer stocks for other purposes such as spot sales and early vessel arrivals. Exhibit IX-3 provides an estimate of the effect on week of delivery if shortfalls were reduced. This estimate is based on a 23 percent improvement in plan performance.** This could be accomplished with a revision in the Wheat Board's weekly plan which would more accurately reflect the number of cars available. This could improve the planning and execution of car allocation, and eliminate the present method of carrying forward the balance of shortfalls to the next planning cycle. The 23% improvement in shortfalls would result in a 40% improvment in the number of cars arriving in ports by the week planned.

A number of related questions were raised, and analyses were performed to attempt to understand the

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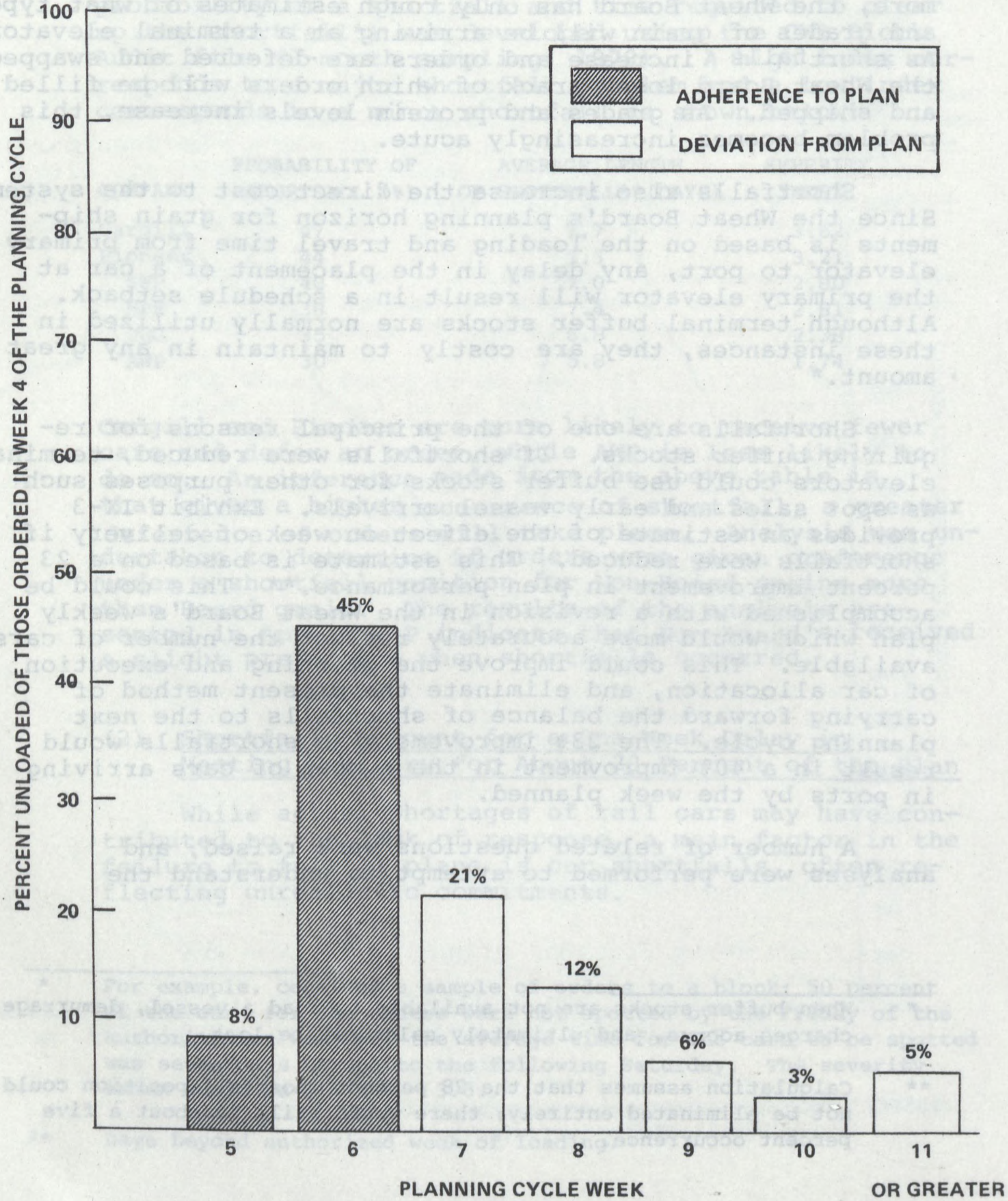
* When buffer stocks are not available to load a vessel, demurrage charges accrue, and ultimately sales may be lost.

** Calculation assumes that the 28 percent shortfall position could not be eliminated entirely; there would still be about a five percent occurrence.

EXHIBIT IX-3

Estimated Effect of 23% Improvement
In Shortfalls on Planning Cycle Execution



SOURCE: CANADIAN WHEAT BOARD BLOCK AUDIT FILE, 3-MONTH SAMPLE, 1978/79 nature of shortfalls. The results of these analyses are presented in Appendix P. Highlights are as follows:

- Shortfalls do not affect the loaded cycle time

- Preference for Non-Board over Board grain shipments under a shortfall situation differs by company and loading block.

- Stations at the end of train runs do not have any more shortfalls than other stations.

Ultimately, a shortfall extends the expected time from authorization to unload by a week. This affects the order planning process and eventually leads to shortages at the terminal elevators.

3. CAR CYCLE TIMES AND CAR MANAGEMENT PRACTICES

Another aspect of shortfalls with respect to poor plan performance is the underestimation of car cycle times by origin/destination and the lack of information on the status and distribution of empty cars.

(1) Transit Times Are Not Specifically Dealt With In Weekly Delivery Plans

The six-week planning operations cycle of the block shipping system is not sufficiently detailed in terms of the wide range of loaded transit from block origins to port terminals. As already shown, cars are loaded during week 5 and are expected to arrive at the terminal by the end of week 6. This plan does not explicitly take into account the time to build trains in the various country locations and the respective transit times from these points. The variance by block can be as great as a two-week difference in loaded cycle.*

* Based upon the loaded cycle analysis presented in Appendix D. The average loaded cycle time for Block 85 to Vancouver was 10 days (minimum of the range) while the same cycle average for Block 77 was 24 days (maximum of the range).

A more explicit process which deals with the actual loaded component of the car cycles from each block to each port would be substantially more effective in timing grain arrivals of the desired types and grades at specific terminals to meet specific vessels. Appendix O presents the planning cycle executed by block which could be incorporated as a planning guide.

(2) Management of Empty Car Distribution is Not Fully Integrated in the Planning Process

Information on empty car distribution by Prairie block areas is incomplete and contributes to off-plan response. The distribution of empty cars from the port back to country points is normally done by the railways. Theoretically, the information provided by the Wheat Board, usually on a Friday, is used to determine the likely distribution of car requirements in the week starting 10 days hence. The distribution of empties is done with little monitoring by the Wheat Board, and during the next week, the car allocation is firmed up. While there is some "bargaining" about the available car supply at various points, the railways may influence the actual car allocation by their distribution of empty cars.

The railways have an interest in maintaining nearly the same number of empties in the various locations in order to even out the work loads on the crews, and they, therefore, resist having changes of any magnitude from week to week in the distribution of cars.

Empties very seldom move from one country point to another to satisfy Wheat Board orders. The Wheat Board usually accepts the railways' original distribution. Until the empties are actually spotted, the Wheat Board Transportation Department has little knowledge of their progress.

4. THE PRESENT INFORMATION SYSTEM IS INADEQUATE TO CONTROL THE POSITIONING OF GRAIN FOR EXPORT DEMAND

The information available from the grain handling system on vessel arrivals, terminal stocks, car shipment contents, primary elevator stock, and indications of stock on farm within and outside of quota is not adequate to plan and control the block shipping cycle. The present system has gaps and unnecessary delays in both information and control. Processes are misunderstood resulting in errors and inaccuracies. The complexity of the process is shown on Exhibit IX-4, while more information on present practices can be found in Appendix N.

This section identifies problems outside of car shortfalls and car cycle management that also inhibit getting the appropriate grains to the ports at the correct time.

(1) Demand Formulation is Dependent on the Broad Contract Window as Vessel Arrival Notices Are Unreliable

An analysis was made of the pattern of vessel arrivals on the West Coast, and the different grains in demand and markets to identify factors which may be relevant in demand formulation, matching vessel arrivals with available stocks.

A 19 week sample in the 1978/79 crop year of vessel arrivals* at Vancouver was examined relative to contract windows. The results of the analysis indicate that arrivals are distributed accordingly:

- Early - Of these vessels 14 percent arrived in port and were "passed" before the first day of their contract period.

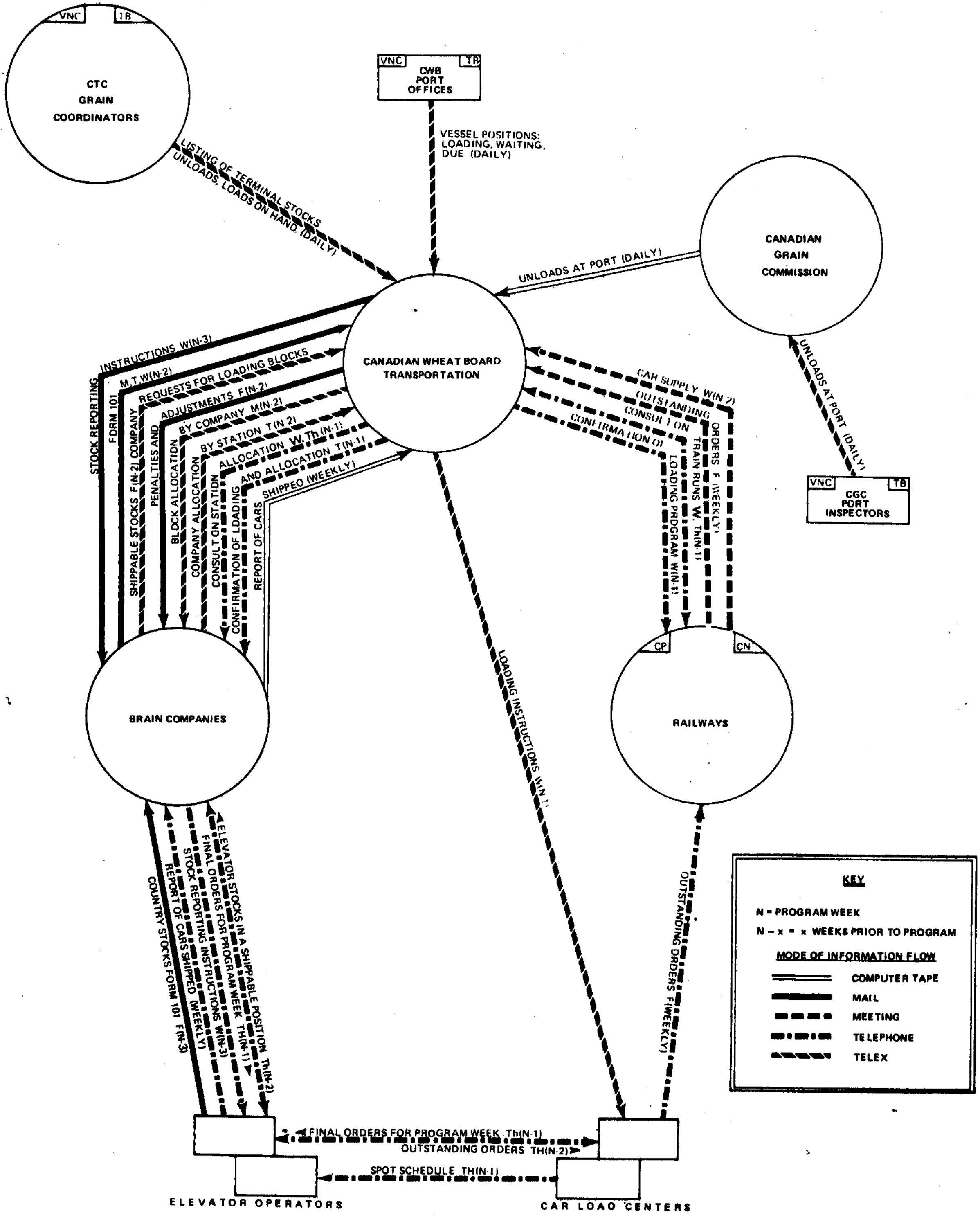
- Late - Another 15 percent arrived in port and were "passed" after the last day of their contract period.

- On Time - The remainder (71 percent) arrived and were "passed" within the 20 day contract period they nominated within the period.

* 58 vessels bound for Japan (38) and other countries (14) carrying mainly feed, barley and high protein wheat.

EXHIBIT IX-4

Allocation Shipping System Information Flow



1. Notice of Arrivals is Shorter Than the Time Required for the System to Deliver

Performance as shown on Exhibit IX-1 shows that, as a practical matter, orders require from four to eleven weeks to collect and deliver to port. The notice of arrivals is shorter than the ability of the system to respond with assurance.

The contracts for the Chinese wheat sales were made several months in advance and specify the quantities of each grade each month. The Chinese arrange to have the vessels there and normally nominate their specific vessels at least 20 days ahead; for planning purposes then the information on stocks needed in the port each month is complete.

However, for the Japanese shipments, the requirements in any one month are known only about one month in advance and the companies do not nominate vessels until 15 days ahead (as required by their contracts).

Clearly, it would be desirable if the Japanese trading companies nominated their vessels with the same length of notice as the Chinese, although there may be commercial reasons why this cannot be done. Such notice would be beneficial when the port is at or close to the limit of its ability to load grain. When total arrivals exceed the capability of the elevators to deliver, no amount of notice will eliminate ship waiting time.

The predictability of ship arrivals affects the ability of the Wheat Board to estimate demand for particular types of grain. A comparison was made between the estimated times of arrival and actual arrival dates for ships destined to Vancouver for the sample period. Over this period, it was found that the average discrepancy was 5.8 days, with the ETAs made six to eight weeks in advance. In 81 percent of the sample, the original ETA was modified at a later date. These later ETAs tended to be more accurate, as shown by the following data:

DISCREPANCY BETWEEN LAST ETA AND ACTUAL ARRIVAL

ETA*	DIFFERENCE IN DAYS
1st	5.8
2nd	4.0
3rd	3.0
4th	3.3

Ship arrivals for the full crop year 1977/78 were also examined, and it was found that the average discrepancy between the last ETA and the actual arrival date was 6.0 days.

2. <u>Better Information on Ship Arrival Times Would Improve the Grain to Vessel "Match"</u>

If the communication network in the shipping industry cannot provide accurate ETAs, an alternative is to adjust the short term forecasted demand based upon the above ETA variance or reliance on the broad-based contract window.

The timely transfer of existing ETA information must also be assured. The Canadian Wheat Board statement of vessels due is not always updated with information from the clearance association. A daily update is required to identify the relationship between the last ETA and actual arrival.

(2) <u>Information on Country Stocks is Sporadic and Not Timely</u>

Present reporting from farms, if it occurs, is sporadic. Country elevators report weekly. Deficiencies in the current system are attributable to reporting lags.

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* The data available does not identify the exact number of days prior to arrival that the ETAs were made.

Presently, the elevators report their total inventory weekly. From this, farm deliveries can be calculated. The amount of information reported from country elevators could be increased if movements from farm to elevator were recorded; this would simplify the determinations of the contents of country elevators. With an increasing amount of Canada's grain inventory located on the farm, better information on farm inventories and farm to elevator movements will be necessary.

Among the most serious data delays, involving information now being reported, are those which affect the data from country elevators. A week's lag is experienced in the reporting of car shipments, outstanding orders, stocks, and congestion that arrives at the CWB via the company head office.

Appendix N details the flow and timing of stock information through the system to its ultimate use in the allocation procedure. The summary of shippable stocks is relatively timely, but contains only a list of stocks requested by the Wheat Board.

The weekly elevator report with a week's lag, arrives through indirect channels and work steps. The elevator report, critical to the allocation process, provides the information to identify congested blocks and stations; its input is used to formulate the companies' proportion of the total allocation, based upon their 12-month market handling shares.

The transfer of these reports from company to Wheat Board is presently not consistent. Some companies batch in groups and transfer daily, while others batch for all elevators and then inform the Wheat Board once a week. Some reports are mailed, others delivered by courier. The Wheat Board then sorts the reports by companies, blocks and stations. The lag associated with this procedure could be reduced to a few hours or one day, if the Wheat Board received the information directly from the primary elevators and it was coded to automate the sorting process.

Communication to the primary elevators from the railway carload centers on new car allocations occurs at the same time that the grain companies can provide this information. The redundancy in communication between the two sources can result in misleading information and efforts are underway to eliminate this duplication.

(3) <u>The Identification of Grain Protein Levels Is Not Adequate to Plan Properly the Allocation Of Cars to Meet Export Demands</u>

The current information and management system is inadequate to deal with the identification, shipping, segregation, and blending of high protein wheat to meet current export demands.

The Wheat Board sells different protein contents at different prices. Protein content is an essential part of the marketing process.* However, this is not reflected in the price paid to the producer (except for especially high protein content, over 15 percent). More important is the fact that the method by which grain is called forward to the ports for shipment overseas does not adequately cope with protein levels.

The Wheat Board Transportation Department tries to overcome the lack of precise data on protein content in elevator stocks with a protein shipment strategy (described in Appendix N). It has proven less than effective, as evidenced by the fact that in weeks 38 to 41 of the 1977/78 crop year when only high protein (13.5 percent and above) wheat was required in Vancouver only about 57 percent of the cars of 1 CWRS unloaded contained 13.5 percent plus wheat. Put another way, for each 100 cars of high protein wheat that was immediately required for shipment, 57 cars were shipped as ordered and another 43 cars of lower protein content were also transported tying up railway cars, railway line, terminal processing and terminal storage capacity.

A downgrade option to CWRS 12.5 percent protein was in effect for January and February 1979 with the Japanese, to alleviate the clogging that would normally result, but this course of action may affect current and possibly future sales.

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* Wheat of the #1 CWRS 13.5+ protein comprised 38 percent of all wheat exported over the last five years and 23 percent of all grains.
Source: Canadian Grains Industry Statistical Handbook, 1978.

Misbilling, loss of car tags and reporting lags also contribute to off-plan performance. Loss of car tags and delays in entering car contents data into the railway car tracing system, and of contents records results in unavailability when cars arrive at terminal elevators; this causes delays, runouts, and misbilling.

(5) There is Insufficient Control and Data Exchange Among the Participants

Various parts of the transportation system operate from five to seven days a week, and from eight to twenty-four hours a day. Under the present system, control actions can affect the system at very few points, and then only once per week. This control strategy is inadequate to deal with day-to-day crises and situations which affect all participants within a few days.

Insufficient data exchange among the parties and the complexity of car allocation procedures currently in use by the Canadian Wheat Board prevent the railways and grain companies from having an adequate understanding of the current shipping situation. An atmosphere of misunderstanding and mistrust ensues and the credibility of the existing car allocation system is in jeopardy. This situation, together with the large amount of manual calculation in the car allocation process, suggests that the use of computers for the collection and transfer of information and the calculation of car allocation should be most seriously considered.

(6) There Is Insufficient Planning Beyond Weekly Operations

The existing procedures do not systematically forecast or anticipate demands on terminal elevators, locomotives, inventory, and movement requirements for more than one week at a time in the six week planning horizon. The development of future trends and the emergence of a long-term congestion or shortfall situation can not be fully projected, and there is little or no strategic planning for long-term use or improvement of facilities. Each week is treated as a separate planning problem, yielding short-term suboptimization at the expense of the long-term capacity. The inability of any of the participants to accomplish any effective advance plans results in a process that drifts farther from reality as the crop year continues on.

The present system can be improved:

- The information necessary is generally available, but not at the times, frequencies, places or in the forms necessary.

- Insufficient use is made of automation for:

  - Information assembly, distribution, and transmission

  - Calculation and allocation

  - Display of the data and results as a basis for decisionmaking

- There is insufficient cooperation among the participants and insufficient information exchanged to carry out integrated and cooperative forward planning and system management.

- There is insufficient effort on the part of the industry as a whole to improve the overall management system.

5. RECOMMENDATIONS WERE MADE

The following recommendations could be achieved regardless of any changes in the institutional arrangements contained in Chapter X.

(1) Improve Forward Planning and Monitoring

Improvements to the forward planning and monitoring of the block shipping process can be made in the short term through steps such as the following:

- Incorporate shortfalls in the weekly car allocation plan on a current basis

Information is also incomplete on the condition (touch/damp) of grain in on-farm storage by block. It is possible that the wrong grains may be called up, and delays in drying tough/damp grain at the terminal elevators may not be appropriately allowed for in some cases. An improved information system would direct tough/damp grains to those specific terminals with greater drying throughput capacity, with an overall increase in handling capacity at the port during years when harvest conditions make this a critical factor. (See Chapters VI and VII for discussion of the implications of this action plus the introduction of incentives for drying grain on the farm in critical years.)

(4) <u>The Status of Grain In Cars From the Country to Port Terminals Can Only Be Inferred Due to the Lack of More Finite Movement Information</u>

The estimate of potential stocks to meet demand in cycle week 6 depends significantly on the status of cars ordered, loaded and en route. (Cars ordered were previously covered under the shortfall analysis).

The estimates of cars loaded and en route complicates the plan because they include cars placed or loading as well as cars in transit. Further complications arise from the different reporting methods for cars en route. CP Rail labels a car en route at the time it is spotted, whereas CN Rail labels it en route once it has been loaded and released. These differences in recording reduce the accuracy of estimating potential stocks and make comparison of performance of the two roads misleading.

Inadequate identification of cars delayed en route (i.e., held for locomotive power) is also responsible for the inability to position grain for market. The causes, if ascertained, could aid in adjusting the plan on a realtime basis by incorporating the time to correct the delay. There is also the probability that orders for different types and grades of grain may not be shipped as specified. Differences can be caused by misshipments and misgrades as discussed in Chapter VI.

- Monitor cars in transit (empty and loaded) to and from ports on a more detailed basis to determine more accurately the execution of the plan

- Incorporate block specific origin/destination car cycles times in the planning for expected unload time at port

- Eliminate cumulative carryover of shortfalls and initiate alternative means of providing for equity in the allocation process

- Telex the weekly elevator report directly to the Block Shipping Staff who could then provide the companies with the same information in processed form

- Incorporate more reliable and timely transfer of vessel information in the demand formulation process

- Eliminate redundancies in communication and information (i.e., reporting of orders to elevators by the grain companies and railways)

- In general, involve all three major participants on a more cooperative basis.

(2) Create an Information System

An information system should be developed for the convenient storage, callup, and display of all vessel requirements, shippable stocks, stocks en route, etc., in order to enhance forward planning, decision making and the performance monitoring process. While the components and costs of such a system would require more detailed assessment, it is suggested that attributes such as the following should be included:

- Reduce communication and control delays by increased use of the telephone and telex for transmission of type and grade of grain in terms of shippable stocks, elevator congestion, outstanding orders, orders filled, etc.

- Increase the frequency of information flow from and among all three major participants in the block shipping system; this would enhance the participants' forward planning capabilities, allow them to monitor their own activities more effectively, and allow monitoring of the performance of the railways, grain companies, and Block Shipping Staff.

- Integrate major computer systems, establish a daily information exchange (including a car control mechanism) among the CGC, railways, CWB and grain companies, on a staged basis in accordance with the capabilities of the individual computer systems

- Introduce daily inventory recording from key country points, possibly through polled minicomputers or a simple voice telephone, including provision for the collection of protein grade information. A central facility for receiving the data and entering it into an overall data system should be set up, providing reporting summaries on a daily basis. The equipment required would be a general purpose computer utilizing uncomplicated programs

- Ensure that all parties to the movement of grain, allocation of cars, etc. could have inquiry facilities for the purpose of assessing the supply situation as represented by inventories on the farm and in country elevators without loss of individual privacy. This would require access to the central computer for summary totals of the day before and for current transactions. The equipment required would be normal inquiry terminals, over telephone lines.

Development of a working model of an automated grain testing and information processing system for use in primary elevators is now being undertaken in conjunction with the Canadian Grain Commission.*

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* Sponsored by the Grains Group and supported by the Department of Agriculture.

(4) Provide for Protein Identification and Grading In the Information System

The testing, recording, and reporting of protein content, subject to statistical restrictions and problems, must be generated to meet current and future export demands.

The major requirements for a data system which would also support the segregation of protein graded wheat are:

- A sampling system
- The recording of grades and quantities on the farm, at country elevators, in rail cars, and at terminal elevators
- Input of this information to the data system from all levels
- Programs to summarize the data
- Inquiry facilities
- Programs to calculate strategy to meet export needs on a week-to-week and day-to-day basis.

Work is also currently underway by the Protein Sub-Committee of the Wheat Board Technical group to develop an approach to enable protein identification and the pricing mechanism. A test implementation of one of the Sub-Committee proposals should be undertaken in order to evaluate the recommendations presented above.

(5) Improve the Inventory Management Process

The inventory management process can be improved through actions such as the following:

- Develop and use simulation models to help assess alternative inventory management approaches and decisions.

- Develop and apply a strategic planning model which could be used to assess capital investment alternatives on a cost/benefit basis and which would include simulation and forecasting capabilities as required.

Experience in a number of industries with complex distribution systems indicates that greater use of computer technology would be cost-effective for the transportation staff and other participants, by assisting in two important ways:

- Enhancing real-time information retrieval and display

- Providing simulation capabilities and forecasts as an aid to decisionmaking.

While computer-driven CRT displays are presently used to some extent by the CWB, the weekly car allocation process could be substantially enhanced by greater use of computerized displays, to provide a means of isolating and retrieving information on inventory positions, car status, and forecasted demand as required for the decisions.

The use of computer simulation models to assist in inventory management and related system management decisions is desirable as a means of testing alternative courses of action and taking into account more effectively the future consequences of current decisions. Those preparing a weekly car allocation plan should have available interactive computer models to "test" operating decisions to meet alternative conditions or objectives; for example:

- A "catch-up" mode, aimed at quickly replenishing stocks in a particular port of a particular grade/type of grain

- An "equity" mode, aimed at drawing grain from blocks and elevators which had not yet received a fair share of the demand to date

- A "Thunder Bay priority" mode, aimed at pushing certain types/grades of grain to Thunder Bay as quickly as possible

- A "Vancouver priority" mode, a "Prince Rupert priority" mode and a "Churchill priority" mode, with similar purpose

- An "all ports priority" mode, aimed at moving as much grain of certain grade/type to all ports as quickly as possible

- A "snow line priority" mode, aimed at moving grain out of subdivisions before they experience line closings

- A "routine" mode, aimed at normal deliveries.

Computer models would also be highly useful in helping to determine the most appropriate destination-distribution of empty rail cars as they are returned each day from the ports. As discussed in Chapter V, reductions in the car cycle are possible, and computerized car management techniques could contribute strongly to achieving such reductions, with important savings in car supply.

The CWB has plans for experimenting with a yearly planning model to incorporate all parameters in the allocation and inventory control system from assigned acres, quotas, and deliveries, through to yearly sales commitments. This type of approach must also be applied to short-term planning, utilizing decision rules, policy, constraints and capabilities so that the overall allocation to blocks can be generated, based on output parameters defined by the yearly planning model.

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Improvement in management practices and information systems is important in any plan to meet commitments for increases in Canadian exports to 1985, particularly with the trends toward more specific grades of high protein wheat. A reduction in the time to position grain at market and reductions in delays to vessels requiring that grain, are necessary if Canada is to improve sales and reduce capital investment. The information and management needs supercede the requirements for greater operating efficiency and additional plant and equipment which are proposed elsewhere in this report, and are the most important means of ensuring that the system, including new facilities, is operated as efficaciously as possible.

It is recognized that some of the above actions are more amenable to immediate implementation than others. For example, the development and application of computer assistance capability for inventory management decisions and of a system planning model are likely to take one or two years, (to produce fully tested and operational models), while the incorporation of shortfalls in the car allocation process and other aspects of improved information systems can be initiated almost immediately.

X. INSTITUTIONAL RELATIONSHIPS AND INCENTIVES

The institutional relationships which exist in the Canadian grain industry reflect its unique features: the statutory rates, and centralized marketing of wheat, oats and barley by the Canadian Wheat Board. These features have in turn led to complex organizational interfaces to make up for the lack of normal commercial incentives. These complex relationships account for many of the problems experienced in transporting grain and make it difficult to pinpoint responsibility and make changes.

The grain handling and transport system in Canada has adapted over time and today does a fairly efficient job of moving grain to the ports when compared with U.S. grain handling, which reflects more normal commercial relationships. Looking ahead, the issue in Canada is one of investing to provide the transport and handling system capacity needed in the foreseeable future or running the risk of lost grain sales. This issue is further complicated by the existing institutional relationships which do not provide incentives to make the investments required and also do not provide incentives for the efficient use of the system capacity. The stakes are high and adaptation through normal evolution will probably take too long to take advantage of opportunities. The remainder of this chapter discusses the institutional arrangements required to bring about necessary changes in grain handling and transportation in a timely manner. In the longer term, continuing institutional arrangements which will improve the efficiency of the grain transportation and handling system will be considered.

1. RISK OF LOST GRAIN SALES JUSTIFIES CREATION OF A TASK FORCE TO ACCELERATE CHANGE

The importance of this industry and the need for action cannot be overemphasized. In the 1977/78 crop year, Canadian grain exports earned about $2.6 billion in foreign exchange revenues for Canada. Agricultural and grain market experts agree that Canada is capable of producing enough grain to increase its exports by 50 percent by the mid 1980's. They also expect that world demand will probably provide a ready market for these exports at attractive prices.

While the investments to provide transport capacity needed to realize this potential are substantial, the economic justification of such investments is exceedingly strong. Additional export sales from only one "bumper" crop year between now and 1985/86 could well earn enough additional foreign exchange revenue to cover one-third the entire capital investment for the period.

Unlike many of its natural resources, Canada's grain is a renewable resource and, therefore, not subject to depletion. A growing world population will look increasingly to Canada as a source of food. In short, the economic and social arguments for moving to increase the capacity of the grain distribution system, in line with attainable production and demand increases, are overwhelmingly strong.

(1) <u>The Specific Interests of Principal Parties Are Not Mutually Compatible</u>

While on an overall basis Canada benefits from investment in grain movement capacity to reduce risks of lost grain export sales, the direct effects on the principal participants are not all positive. For example, even if the Federal Government or the Wheat Board makes all the investments necessary to acquire cars, at statutory rate levels the railways suffer significant out-of-pocket losses that increase with volume and, further, use up limited available capacity which they could otherwise use to move profitable traffic. And even if sufficient cars are made available by others to carry grain, the provision of locomotives will become a serious problem in the near future.

While the railways and the other key participants recognize that moving grain in a timely manner is in the national interest, and in fact strive to meet their public responsibilities, the fact remains that grain drains railway resources and attention from commodities and products which pay their way and earn a profit.

Likewise a proposal to clean grain on the Prairies, rather than in terminal elevators would reduce throughput constraints in the terminal elevators and could decrease feed prices on the Prairies (and in turn affect the development of the Canadian livestock industry). Additionally, cleaning in the country would save the cost (in capacity and rates) of shipping the screenings mixed with the grain to the ports. According to the Hall Commission, screenings represent about 2.5 percent of the volume shipped.* On the other hand, the grain companies might suffer lost profits on the screenings; higher cleaning costs at low volume country elevators would also result from such a plan. This might eventually lead to higher elevator tariffs. Therefore, the enthusiasm of various parties to implement a proposal to clean grain in the country is mixed.

Given the often incompatible interests of the parties in the short run, and their differing perceptions of the benefits (or disbenefits) of proposals in the long run, it appears that a neutral, catalytic force will be required to bring about the major changes needed.

(2) A Dedicated Neutral Task Force with a Strong Managing Director is Required to Provide Leadership for the Implementation of Improvements

In order to ensure that necessary changes will be made in spite of the sometime conflicting interests of the parties, it will probably be necessary to establish a special body or task force with a mandate to carry out the detailed programming and implementation of the changes recommended in this report. Such a task force would provide the impartiality and full-time attention required for this important task. It is recommended that a Grain Transportation Improvement Task Force should be empowered by the Federal Government to develop and implement specific improvement plans. The Task Force would work in close cooperation with the producers, the Canadian Wheat Board, The Canadian Grain Commission, the railways, and the grain trade. Ideally the Task Force should:

- Have a strong, highly respected and knowledgeable Managing Director appointed by the Minister Responsible for the Canadian Wheat Board on the advice of the industry. The Managing Director should be a person of stature in

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* Grain and Rail in Western Canada, The Report of the Grain Handling and Transportation Commission, Vol I, Minister of Supply and Services Canada, 1977, p.153.

the grain industry who would hire or retain the other full-time members of the Task Force and would establish a small organization and minimal support staff as required.

- Report to an Executive Committee appointed by the Minster Responsible for the Canadian Wheat Board. This committee would be made up of the Chief Commissioners of the CWB and the Canadian Grain Commission, the Presidents of one cooperative and one private grain company, and the Chief Executive Officers of the CN and CP. The Executive Committee should be chaired by the Minister. Arrangements should also be made for consultation with representatives of the four Western Provincial Governments.

- Have about ten senior staff members drawn from the railways and grain industry experienced in the complexities and requirements of grain transportation and marketing. These individuals should either be seconded from their current occupations or retained on a contract basis, such that they will be available full time over the lifetime of the Task Force.

- Have a limited and clearly defined lifetime, in the range of up to four years, and a schedule of activities emphasizing impartiality and action orientation.

- Report to the Executive Committee with a proposed action program, implementation schedule and estimate of funding requirements within 90 days of its creation. The Executive Committee and Task Force would, working with relevant industry participants, act to implement the approved recommendations. Where necessary, the Executive Committee would forward the Task Force recommendations and any proposed modifications by the Executive Committee to the Minister for necessary action to approve or modify any proposals requiring Federal legislation or major funding.

- Oversee and coordinate implementation of the program and report quarterly to the Executive Committee and Minister on progress and implementation.

This process would continue for a period of up to four years, following which the Task Force would disband or be replaced.

- Make recommendations to the Executive Committee and Minister regarding future changes and implementation requirements to improve the grain distribution system. In addition, recommendations should be made concerning the possible formation of a body to continue the process of change and its monitoring, either within one of the existing participating bodies in the grain industry or as a new group.

- Be selected carefully to minimize past, present or future conflicts of interest, recognizing the need, however, to secure people of the caliber and experience necessary. Actual conflicts, rather than perceived or potential ones, should be the primary concern.

- Be prohibited or at least discouraged from succeeding themselves in any organizations or functions growing out of the work of the Task Force. This should reduce concerns that the Task Force might become a new self-perpetuating bureaucracy, ensuring that any recommendations on future organizations would not be viewed as self-serving.

- The Executive Committee might continue in existence and would meet approximately quarterly (or more frequently at certain times, if required) in order to provide a top level forum for resolving problems and achieving improvements in the grain logistics system on a continuing basis. This Executive Committee could replace the existing Senior Transportation Management Committee of the CWB.

(3) <u>The Managing Director Of The Task Force Should Be A Person Of Stature In The Grain Industry</u>

To command the respect and attention of all participants, the Managing Director must be known and respected. His role would be to provide overall direction to the Task Force, make recommendations on the implementation program to the Executive Committee, make decisions on day-to-day operating matters under his jurisdiction regarding grain distribution, call meetings of participants in the grain logistics system and use his power, authority and persuasion to obtain agreement and cooperation, as well as act as an arbitrator in matters of dispute within the jurisdiction of the Task Force. In many respects the role of the Managing Director would be similar to that of a "Grain Czar".

(4) <u>The Senior Staff Must Have Experience In Grain Handling And Transportation</u>

Reporting to the Managing Director should be a Deputy Managing Director — Implementation, whose role would be to direct the day-to-day efforts of the Task Force and its support staff in the following:

- Planning and programming the implementation of improvements to the grain distribution system.
- Monitoring the implementation process and its impacts.
- Preparing reports to the Executive Committee.

This position should be filled by an individual with ten to fifteen years experience in grain distribution and related aspects of the grain industry. The Deputy Managing Director — Implementation should have proven analytical skills, as well as planning and executive abilities.

The other senior members of the Task Force should also be highly experienced in various aspects of grain production, handling, marketing and transportation with generally five to ten years experience in these fields. At least one member of the Task Force should be experienced in the development and effective use of management information systems, inventory management, and the use of mathematical and computer aids in these fields. The support staff would have secretarial, clerical and technical skills as required.

The above recommendations concerning the structure and role of the Task Force and its Managing Director are presented to suggest at least one way in which such a group might act as a catalyst to implement needed changes in the grain transportation system. While it is generally desireable to reduce rather than increase the number of participants in this process, there are indications that a stalemate of sorts exists in the relationships among the present participants and because of the differing interests, no one of the existing parties can bring about the necessary changes in the time frame required. Therefore, it is recommended that the Task Force be established, with strong leadership and an effective mandate along the lines outlined above.

2. OVER THE LONGER TERM INSTITUTIONAL ARRANGEMENTS SHOULD BE ESTABLISHED TO FOSTER ADAPTATION AND COOPERATION

Many of the existing institutional relationships do not foster cooperation and adaptation, but rather have led to a degree of suspicion and a pattern of fixing the blame rather than fixing the problem.

There are several institutional issues which have a significant effect on the relationship between the parties over the long run. Resolving these issues is necessary to achieve a long term relationship which will evolve naturally without a continuing requirement for studies, commissions, Task Forces, and "Czars" to accomplish necessary changes.

3. THE STATUTORY RATE IS THE PRIMARY SOURCE OF MANY GRAIN TRANSPORTATION PROBLEMS

Given the losses the railways are already sustaining on grain, as reflected in the findings of the Snavely Commission on the Costs of Transporting Grain by Rail, it is not surprising that for several years, the railways have not invested in plant improvements, locomotives and freight cars for the purpose of moving grain. Grain gets a "free ride" on such improvements as are made by the railways for their other traffic. In recent years, capital investments in railway plant and equipment primarily for grain traffic have come from the Federal Government and, more recently from the Wheat Board. Thus these investments come from the producers themselves. With continuing high inflation, the losses from handling grain sustained by the railways cannot be borne indefinitely by other traffic and will inhibit railroad investment necessary to support growth in other sectors of the economy.

(1) <u>Growth of Profitable Traffic Puts Pressure On Grain Movements</u>

The rapid growth in other commodity movements by rail, such as coal, sulphur, and potash is both a blessing and a curse for grain movement. While this traffic growth may have helped to offset the railways' losses on grain and possibly deferred a crisis, this same growth now puts increasing stress on existing facility capacity and motive power.

(2) <u>Railways Handle Grain Well Considering Economic Disincentives</u>

Given the losses sustained by the railways in the movement of grain and the increasing demand for available line capacity and power to move profitable commodities, it is surprising grain is handled as well as it is. In fact, the Canadian railways' handling of grain has improved significantly in recent years and present performance is quite good by North American railroad standards. This relatively good performance evidently results from social or political pressures; it is clearly not done for direct economic gain.

The railways' capabilities to continue the level of service now provided for grain are in doubt, unless the commodities which are paying their way are made to suffer to sustain the movement of grain. If economics prevail — and the statutory rates remain in effect without suitable compensation to the railways — grain will suffer.

(3) <u>Incentives are Lacking for Investment and Efficient Use of Rail Facilities and Equipment</u>

At present the railways have no incentive to invest in facilities and rolling stock to move grain. The social pressure to provide adequate service may be weakened if other commodities, which are paying their way, begin to suffer from the railways' limited physical and financial capacity resulting from losses on grain traffic.

The statutory rate on grain removes the normal economic incentives which lead to efficient use of resources in a free market situation.

The other principal players also have little direct incentive to use facilities efficiently. For example, the producers have limited incentive to drive farther with their grain and resist efforts of the grain companies to concentrate their elevators for handling and transportation efficiency. There is also no direct incentive to use rail cars efficiently except to avoid the loss of sales. The elaborate organization structure which has evolved to replace normal commercial incentives attempts to direct efficient use of facilities and equipment, with mixed success.

(4) While "Crow Rate" is Outside the Scope of This Analysis, Its Effect is Pervasive

The "Crow Rate" is so pervasive in the structure and operation of the grain logistics system that it cannot be ignored. More significantly, its influence on the overall efficiency and capital renewal of the Canadian grain production and transportation may eventually become in itself a major inhibiting factor in the growth of Canadian grain exports.

Although the recommendations presented in this report do not include action regarding compensatory rail rates because the terms of reference of this operations analysis specifically excluded this issue, the recommendations in this report are generally compatible with an adjustment in rates to provide a compensatory return to the railways.

It must be emphasized that the other institutional, operational and capital improvements recommended in this report, while essential to the realization of Canada's grain export potential, should not be seen as a substitute to resolution of the Crow Rate issue. The railways no longer have the economic or physical capacity to underwrite "the grain drain." If the Crow issue is not resolved, the problems outlined in this report will not be completely overcome and grain will suffer due to its low priority for movement. If this issue is resolved in a reasonable manner, the probability of success in implementing the recommendations presented in this report will be greatly enhanced.

4. CANADIAN WHEAT BOARD CONTROL OF BLOCK SHIPPING STAFF CAUSES TENSION—ESPECIALLY WITH RESPECT TO NON-BOARD GRAINS

One of the major institutional issues underlying the tensions between the participants is the role of the Canadian Wheat Board in managing the transport functions and thereby controlling the movement of Board and Non-Board grains. The conflicts of interest inherent in this role of the CWB seems to be more of a threat, than a reality. However, that threat coupled with the mystery which shrouds decision making by the Block Shipping Staff creates tension and distrust among the participants. The lack of mutual trust frustrates improvements and fosters bureaucratic "blame-fixing."

(1) CWB Marketing of Non-Board Grains and Open Marketing of Board Grains Were Considered and Rejected

Consideration was given to broad institutional approaches to avoid a conflict in CWB's roles. A more centralized approach under which the CWB would market Non-Board as well as Board grains, and a more decentralized approach under which there would be open marketing of Board and Non-Board grains were considered. Neither approach was found to be a desirable solution to the problem.

A more centralized approach would suffer from an inherent rigidity, a tendency to inequity because of the overwhelming power of one participant, and a basic incompatibility with the mixed market economy.

The disadvantages of a more decentralized approach are possible suboptimization and lack of overall anticipatory planning which sometimes accompany market systems. The market and price stability and equity provisions are too important to the producers to be drastically changed.

These broad alternatives were not pursued further because they represent massive changes with little assurance of any improvement beyond that possible with adjustments to the present system.

(2) Reassigning the Block Shipping Staff from the CWB to the Task Force Offers Several Advantages

The transportation staff within the CWB (detailed in Appendix Q) who now carry out the weekly application of the block shipping system are referred to here as the Block Shipping Staff. Three possible locations for the Block Shipping Staff were considered:

- Remain in their present location as part of the Canadian Wheat Board
- Relocate and report to the Chief Commissioner of the Canadian Grain Commission
- Relocate and report to the Task Force during the implementation period.

The possible advantages and disadvantages of moving this activity are outlined in Exhibit X-1. Significant considerations are highlighted in the following paragraphs.

1. Moving The Block Shipping Staff Would Reduce Friction

The current operating relationship is strained between the CWB Block Shipping Staff, (operating in its present context as part of the CWB), and at least some of the grain companies. Lack of communication regarding forward plans, arbitrary changes in the car allocations to companies for Non-Board grains, and retroactive imposition of car penalties, are some of the strong concerns expressed by company representatives in this context.

A new management, a new operating mandate, and a removal of the potential conflict of interest regarding Board and Non-Board car allocations resulting from the CWB's interest in marketing Board grains, would all tend to contribute to more positive and cooperative operating environment and would help to overcome some of the inventory planning and control problems. However, removal of the Block Shipping Staff from the CWB would impose a cost and would tend to be disruptive for a period of time. Additionally, such

EXHIBIT X-1
Issues Related To Relocation Of the Block Shipping Staff

POSSIBLE LOCATION OF BLOCK SHIPPING STAFF

A. PRESENT LOCATION AS PART OF CANADIAN WHEAT BOARD (CWB)

ADVANTAGES	DISADVANTAGES
1. Retention of nominal CWB control over grain deliveries to meet its marketing commitments.	1. Delivery control is inadequate, in part because of lack of cooperation from other participants due to operating "style" of CWB staff.
2. Simplifies coordination of the Quota Delivery System with the Block Shipping System.	2. Retains potential conflict of interest re Board/Non-Board car allocation owing to CWB's interest in marketing Board grains.
3. Avoids the disruption of a move or forming a new body.	3. Detracts from CWB marketing effectiveness owing to concerns regarding responsibility for poor performance on delivery of sales commitments.

B. RELOCATE TO THE CANADIAN GRAIN COMMISSION (CGC)

ADVANTAGES	DISADVANTAGES
1. CGC is more neutral re car allocation between Board and Non-Board grains.	1. Possible lack of cooperation due to bureaucratic rivalry between CWB and CGC.
2. Block shipping staff reporting to CGC would be more likely to receive cooperation from other participants simply because "under new management" without disadvantages A.1 and A.2 above.	2. Requires careful consideration of who should administer the Quota System and coordination between Quotas and Block Deliveries.
3. CGC enabling legislation appears to allow it to reassume this function which was transferred to CWB by Order-in-Council and could probably be similarly transferred back without new legislation.	3. Requires consideration of potential conflict of interest between Block Shipping control and Elevator Licensing authority or other CGC regulatory powers.
	4. Disruption of a move, but does not need formation of new body.

C. RELOCATE TO A NEW BODY: THE GRAIN TRANSPORTATION IMPROVEMENT TASK FORCE

ADVANTAGES	DISADVANTAGES
1. Advantages B.1. and B.2. as above, enhanced by added neutrality of a new body.	1. Same problem as B.2. above.
2. Does not suffer from disadvantages B.1. and B.3. above.	2. Same problem as B.4. above plus need to form a new body.
3. Relocation to a new body dedicated to improved grain distribution system with reliable forward planning and control, would allow CWB and grain companies to concentrate more effectively on marketing grain available for export and deliverable.	3. If transferred to report to Task Force might detract Task Force's implementation and monitoring role, but would give it added clout to initiate changes.

a move would require consideration of how to co-ordinate the block shipping system with the quota delivery system if they were the responsibility of two different agencies. One possible approach to this latter problem, should the Block Shipping Staff be moved, would be to have the new group also take over administration of the Quota System. The CWB might have reason to be apprehensive if both of these functions were removed from its control, regarding whether it would be able to meet sales commitments for Board grains. On the other hand, if the CWB were dealing with an independent body with the power both to call forward grain deliveries from the farms and to plan and control grain deliveries to the ports, it could be in a better position than currently to concentrate on its marketing function.

2. <u>Relocating to the Canadian Grain Commission Could Be Done With Existing Legislation</u>

An advantage of relocating the Block Shipping Staff to the Canadian Grain Commission as opposed to the Task Force, would be that the CGC enabling legislation appears to allow it to reassume the transport function. The function was transferred to the CWB by an order-in-council and the block shipping function could probably be similarly transferred back to the Canadian Grain Commission without requiring new legislation. This alternative, however, would require careful consideration of potential conflicts between the block shipping function and other regulatory functions of the CGC, and the apparent rivalry between the two agencies.

3. <u>The Neutrality of the Task Force Could Enhance Cooperation</u>

Relocation of the Block Shipping Staff to the Task Force would entail legislation and expense of moving the function to a new agency. The primary advantage of assigning the staff to the Task Force would be its dedication to improved distribution for all grains. Its neutrality would probably enhance the level of cooperation which it would receive from all of the other participants.

The combination of the day-to-day grain distribution functions of the Block Shipping Staff with the broader planning, programming, implementation, and monitoring responsibilities of the Task Force, would help to give this body and its Managing Director the degree of authority and control required to implement the urgently required improvements to the grain distribution system.

Should the Block Shipping Staff be relocated to report to the Managing Director of the Task Force, it could be directed by a Deputy Managing Director- Operations who would be of equal rank to the Deputy Managing Director- Implementation, and who would also report to the Managing Director. The Block Shipping Staff would probably be drawn in part from the existing Transportation Staff of the CWB, in order to utilize their expertise and provide continuity. The Deputy Managing Director Operations might be one of the senior persons in this group or someone with comparable training and experience. In order not to limit the flexibility of the Managing Director and to enable him to develop a lean and highly-trained Block Shipping Staff, he should have complete freedom to select which members of the existing CWB staff would be invited to join the Block Shipping Staff. Staff training courses in the use of sophisticated information systems and inventory management aids would be desirable as new systems come on line.

One of the missions of the Managing Director and the Task Force would be to determine the long-term role, organization and reporting relationships of the Block Shipping Staff.

4. <u>Assigning the Block Shipping Function to the Task Force Offers the Best Chance to Make Improvements</u>

On balance, relocation of the Block Shipping Staff to report to the Managing Director of the Task Force offers the most opportunity to effect change. The consultants' thinking on this question has evolved during the latter stages of the operations analysis, based upon discussions with representatives of the major participants in the block shipping process and other interested parties, and on a more extensive assessment of the advantages and disadvantages of each alternative. It is recognized, however, that this is a complex issue which requires further, more detailed, assessment by the parties involved and by the Task Force. An early decision on this matter by the Minister Responsible for the Canadian Wheat Board would settle this question in principle, and the Task Force could then focus on the timing and mechanics of the move (if this were the decision) as part of its detailing of the implementation program during the first 90 days of its existence.

(3) <u>Alternative Improvements To The Quota Delivery System Should Be Considered In An Effort To Gain Better Control Over Grain Flows</u>

Whether or not to modify and relocate the administrative responsibility for the Quota Delivery System is a complex issue. If the Block Shipping Staff is moved, responsibility for the Quota System might well be moved with it. If the Block Shipping System stays with the CWB, it would probably be best to leave the Quota System responsibility there also.

In reaching this decision, consideration should also be given to replacing quotas with a system under which the CWB would buy all Board grain stored on-farm following on-farm inspections and grading, after which Block Shipping Staff would forward farm-stored grains to primary elevators as required to meet sales commitments some weeks later at the ports. This would facilitate drawing down all elevators on a given set of rail lines each week in a manner designed to increase rail operating efficiency. Producers would be given an opportunity to deliver specified amounts/types/grades of grain to specified elevators within specified time limits, and would possibly receive compensation if this involved trucking more than a minimum distance. This highly centralized system has a number of important implications which would require detailed assessment. These implications include:

- Manner in which Non-Board grains would be treated

- Impacts on the role of the grain companies

- Implications for cash flow from the CWB to producers.

This concept is sketched out here not as a recommendation but to illustrate the type of institutional changes which could be contemplated beyond the evolutionary improvements recommended in this report, particularly if the Block Shipping and Quota System functions were combined in a body with no direct interest in marketing either Board or Non-Board grains.

5. CHANGES SHOULD BE MADE IN PRESENT PROCESSES TO PIN-POINT RESPONSIBILITY

Notwithstanding decisions made on the assignment of the Block Shipping Staff, improvements should be made in the processes involved.

Given the number of participants, the dual marketing of Board and Non-Board grains, and a common transport and handling system, the present management practices and interfaces do not permit the best operation of physical systems even under current constraints and loads. In particular:

- Responsibilities are not clear

- Responsibilities are not placed where appropriate motivation exists to carry them out effectively

- Objectives are not clear; there is no common understanding of goals

- Information and decision procedures are neither adequate nor do they look far enough ahead.

There is a need for an improved management system which will satisfy the sometimes conflicting demands of the system. To accomplish this, a number of proposed changes in institutional arrangements are presented below.

(1) The Weekly Planning Process Should Be Formalized

The railways, CWB marketing staff and grain companies' marketing and distribution staff should meet each week with the Block Shipping Staff to establish the car allocation plan. The goal would be to develop a set of documented relationships based on an "announced" plan rather than the nearly covert process now used. The use of a formal contract was also considered. Announcing the plan would be less rigid than drawing up contracts, but the very fact of announcing it would provide stronger incentives for performance than now exist, by clearly showing the responsibilities of each participant and providing a documented basis against which to measure subsequent performance in meeting the grain delivery plan. Clearly assigning responsibilities to the CWB, railways and grain companies and their reporting on performance would strengthen the incentives for all participants to meet the plan.

(2) Penalties and Bonuses Should Be Clearly Established

The changes made in the administration of the block shipping system would require development of a clear-cut set of rules guiding the administration of the company-CWB-railway negotiations. Consideration should be given to a system of penalties and bonuses (financial, car, or both) developed through discussions with the participants in the agreements. For example:

- Penalties to a company if it did not meet its announced commitments

- Bonuses to a company if it achieved specific target performance levels in delivering Board grains

- A bonus system as an incentive for railway performance according to plan; this would probably have to be a financial bonus system. For example, bonuses could be payable to the railway if car spots and pickups at country elevators were within "x" hours of the scheduled times. Similar arrangements could apply if grain deliveries to specific ports/terminals were within "y" hours of planned delivery times with a bonus paid to railways. The size of the various bonuses would be arrived at through negotiation. Such bonuses should not be construed as a substitute for changing the "Crow Rate," but rather as an incentive to improve railway performance where no incentive exists today. Such a bonus might motivate line managers on the railway to monitor grain movements more closely.

- The application of retroactive penalties should be eliminated unless clearly specified in the documented relationship. Arbitrary penalties also should be eliminated.

- The CWB might be subject to a "penalty" if it were not able to arrange the expected shipping to move the grain out of the company's terminal within the agreed period. This could take the form of a bonus of extra cars to the company to move Non-Board grain or to offset other car penalties levied on it. This might be an incentive for more CIF and less FOB shipping,* with resulting increases in control of ship arrivals and in foreign exchange by Canada.

- The rules would include a clear understanding of the timing and nature of information to be communicated between the parties, with the intent that the car allocation and shipping process would be made as open as possible.

- The administration of the block shipping system and documented relationships would be clearly logged and an audit trail established as a basis for subsequent review of operations activities and penalties.

It is recognized that the development of a more detailed structure of penalties could be very onerous at times, and safeguards would have to be included to protect participants from penalties stemming from lack of performance which was beyond their control. The use of rail car penalties appears to be generally acceptable to the grain companies. However, the companies state strongly that this is so only if clear cut rules for penalty imposition are established and published, and existing practices of retroactive and arbitrary imposition of penalties, without audit, are

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* FOB (free on board) means that the customer arranges the shipping while CIF (cost insurance freight) means that the seller arranges the shipping. Generally, most Board grains are shipped FOB Vancouver by the CWB, with the customers providing the marine shipping; both FOB and CIF arrangements are prevalent for non-Board grains.

discontinued. Car penalties may not be effective when cars are in short supply and grains from specific areas are required to meet sales commitments. Also if refinements are made to the quota system to call up grain in given geographic areas, it is likely that all companies will have to participate in order to get sufficient volumes from selected points.

Financial or car penalties and bonuses need further consideration. The rules for the existing car penalty system should be drawn up, promulgated and applied in a non-retroactive, non-arbitrary, auditable manner. Reliance should be placed on a greater degree of voluntary cooperation among the participants, based upon consultation, definition of responsibilities, and the publishing of weekly plans and performance levels by each participant. Revised penalty/bonus practices should be considered after the more immediate institutional changes are made.

(3) <u>Consideration Should Be Given to Permitting Grain Companies More Latitude in Car Allocation</u>

Consideration should be given to involving the grain companies more in the block shipping system by having the Block Shipping Staff allocate cars first to companies who would then allocate the cars to both blocks and elevators. The allocation of cars to companies each week could be based on a form of the Bracken formula, reflecting country receipts by each company (and therefore its sales expectations) during a recent time period. The Block Shipping Staff, CWB and companies would continue to apply the block shipping system in close consultation and negotiation with the railways such that car orders would be guided by the logic of feasible and efficient train runs.

One reason for this suggestion would be to allow the grain companies more control to meet delivery requirements for both Board and Non-Board grains while permitting more flexibility to employ their assets. Another reason is that this would facilitate more precise planning cycles and control of delivery times by the companies, taking into account the differences in elapsed times between each block and each port, such that the response time for the delivery of grain to the ports might be enhanced. With the growing proportion of Non-Board grains, it becomes more important that the planning and control of delivery from each block be closely integrated for both Board and Non-Board grain and the increasing company participation may help to accomplish this.

There are, of course, other approaches which could be taken regarding the company's role in the block shipping system. Insteady of allocating the cars first among companies and then to blocks, the present approach (first to blocks, then to companies) could be retained. This has the disadvantage of less involvement, control, and cooperation by the companies; and (potentially) a continuation of current practices whereby the allocation of Non-Board cars to each company fluctuates widely from week to week. The latter practice is particularly disruptive of company planning for the delivery of Non-Board grains. This problem would be reduced if the Block Shipping Staff were located outside of the CWB. These alternatives should be reviewed by the Task Force in light of the decision on the reporting relationship of the Block Shipping Staff. Additionally, consideration should be given to the effect of changes in the role of the grain companies in inventory control system development and possible changes in the Quota System previously suggested for consideration.

A third approach could be to allocate total cars each week between Board and Non-Board grains, based on the monthly forward planning meeting (outlined in the subsection following), and then have the Block Shipping Staff allocate cars for Non-Board grains to the companies, with the Block Shipping Staff continuing to allocate cars for Board grains among the blocks.

(4) <u>Forward Planning Should Extend Beyond The Six-Week Horizon</u>

The car allocation process and negotiations should be modified such that the Block Shipping Staff, the CWB, the grain companies, and the railway representatives would meet on a monthly basis, in addition to the regular weekly meetings. The participants would examine overall rail car supply for the upcoming three to six months, examine market conditions for both Board and Non-Board grain over the same period, and agree on the total number of rail cars likely to be required and available each week during the coming month and an appropriate allocation of rail car supply between Board and Non-Board grains. Confidential sales details which the CWB and grain companies would not want divulged to their competitors, would be communicated to the Block Shipping Staff on a privileged basis.

The monthly meeting would also broadly inform the grain companies of the overall grain movement picture for the upcoming months so that companies would be in a position to allocate primary elevator facilities among the various grains. The CWB, or the Task Force, would also establish and announce quotas to be called in the next months.

Under this arrangement, a grain company would be able to make commitments for both Board and Non-Board grains within the context of the overall allocation of cars and expected market and car supply conditions. Should the Block Shipping Staff or the railways subsequently alter this overall car supply/allocation beyond agreed tolerance limits for the month in question, provision could be made to adjust any penalties incurred by a company for non-delivery of Board grains during the period in question.

An important result of these modifications to the existing system would be to place added responsibility for the actual performance of inventory management on the participants. The proposed arrangement could still leave the CWB with overall responsibility and authority to administer the quota delivery system and carry out its basic role of marketing and establishing prices for Board grains while remaining a partner in the block shipping system.

(5) <u>The Advantages of Change Are Seen to Outweigh Potential Disadvantages</u>

The primary advantage of the proposed changes would be the provision of a more businesslike and impartial context within which the CWB, grain companies and railways would be able to carry out forward planning and inventory management. Conflicts between Board and Non-Board grain, and related conflicts between the participants could be reduced. In addition, advanced planning and timely achievement of delivery plans would increase efficiency of daily and weekly changes in demand

and/or supply conditions. It seems likely, however, that the agreed operating plan with appropriate bonus and penalty provisions, could be designed to cope with such changes while providing the much needed context for improved planning and control.

These and other possible advantages and disadvantages of the proposed arrangement require discussion and assessment, following which, details of a preferred arrangement can be developed. Decisions should be based upon more detailed consideration by the Task Force.

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The need for a Grain Transportation Improvement Task Force has been stressed due to the desire to accelerate changes and remove disincentives, such as the statutory rates, for the parties to change. It is recommended that the Task Force have a strong Managing Director with broad powers. It is further recommended that the Task Force plan and manage the implementation of an extensive program of changes based on the agenda of recommendations contained in this report. One of the priority decisions to be made is the reporting relationships of the Block Shipping Staff which now reports to the Wheat Board. It is recommended that this staff be assigned during the implementation period to the Task Force. Other institutional changes are recommended for early consideration by the Task Force.

XI. IMPLEMENTATION OF RECOMMENDATIONS

The preceding chapters of this report contain recommendations to improve the efficiency and responsiveness of the export grain handling and transportation system. The stakes in terms of potential lost sales and investment commitments may be several billion dollars between now and 1985/86.

1. LEVERAGE FAVORS INVESTMENT TO AVOID LOST SALES

As previously noted, if the potential sales projection developed by the CWB and used in this report proves realistic, the return on investment in providing the transportation capacity necessary to move the grain is very high and would justify investment in anticipation of demand. While the investments needed to provide capacity are substantial, in the range of $1.3 to $2.0 billion, the economic justification for such investments is exceedingly strong. For example, the Canadian Wheat Board states that it was forced to forego over one-half billion dollars in grain sales in 1977/78 due to the inability to deliver grain to the ports. This loss in grain sales in one year would offset about one-third of the total investment required over the next six years. The life cycle of the various required investments runs between 15 and 100 years, so it can be seen that the risks of lost sales are potentially greater than the risks of investment. The extra revenue that could be obtained by selling the harvest of only a few bumper crops would justify the total investment. The projected rate of growth, which would be constrained without the investments, should amortize the investment in a few above average years by the 1985/86 period.

The lead times on the necessary investments generally run from two to five years, so that some risks must be anticipated, but the leverage favors making the investments. In current inflationary times, the time value of money, even at high interest rates, is nearly offset by inflationary pressures on costs.

In those cases where investments must eventually be made, such as the replacement of box cars, and where the only issue is timing, it is better to be early with the investment to cover future volume needs and make the sale if a bumper crop materializes than to delay the investment commitment and forego the additional sales. Inflation all but eliminates the downside risk at the present time.

2. A TASK FORCE IS RECOMMENDED TO EXPEDITE CHANGES TO COVER FUTURE DEMAND

In Chapter X, it was recommended that a Task Force with a strong Managing Director be set up to expedite the implementation of changes recommended in this report to ensure that the risk of lost sales in the future is minimized. The Task Force would have as its principal mission the planning, coordination and management of an implementation program. Additionally, the Task Force might be assigned day-to-day responsibility for the Block Shipping Staff to facilitate the implementation of the several improvements suggested in those processes. If the Block Shipping Staff were assigned to the Task Force, its Managing Director would be essentially a "grain Czar" with broad powers to plan and carry out changes. The stress is already visible in the grain logistics system and the investment lead times involved suggest the urgent need for a strong Managing Director backed by hand-picked, highly qualified senior staff members on the Task Force, with direct control of the Block Shipping Staff.

3. INITIALLY THE TASK FORCE SHOULD FINALIZE ITS IMPLEMENTATION AGENDA

As soon as the Task Force is organized and the Managing Director and senior staff members have been appointed, it is suggested that they be given approximately 90 days to review the recommendations contained in this report, the comments made in response to this report, and suggestions from others reviewing the grain transportation system. Based on their review, the Task Force should develop an implementation agenda. This implementation agenda should include recommendations to be implemented in the near term, recommendations to be implemented over time, and those to be restudied before an implementation decision is made.

Additionally, they should develop a schedule, organization plan, and budget for the implementation program.

Recommendations for near-term capital expenditures and commitments by the Government should also be presented for early consideration.

The implementation agenda, as well as recommendations for capital commitments and funding requirements, should be submitted to the Executive Committee for review and amendments. It is suggested that the Task Force recommendations as well as any amendments recommended by the Executive Committee be forwarded to the ministerial level for final approval within an additional 30 days. This schedule, while tight, should allow enough time for careful consideration of the issues involved without undue delay. Upon obtaining concurrence or approval as necessary from the ministerial level, the Task Force should then be directed to manage the final implementation program.

While it is suggested that the Task Force develop its own agenda, the recommendations contained in this report are offered as a starting point and are presented in agenda form in the following general categories:

- Major capital expenditures to provide capacity to move projected grain flows
  - Grain cars
  - Locomotives
  - Terminal elevator capacity
  - Branchline rehabilitation
  - Main line capacity

- Operating changes to improve delivery performance at ports and to reduce investment requirements
  - Information planning and control systems
  - Country operations
  - Port operation
  - Grain car cycles
  - Institutional changes.

4. THE TASK FORCE SHOULD DEVELOP DETAILED CAPITAL EXPENDITURE RECOMMENDATIONS

Major capital expenditures will be necessary to provide the capacity to move projected grain flows in a timely manner. The exact magnitude of the investments required will depend on actual growth in grain and other traffic by ports, improvements in the efficiency of calling up grain for transport, improvements in loaded and empty car cycles, and the rate of retirement of locomotives and cars. Equally important is the question of who should make the investments. This may be affected by the introduction of compensatory grain rates, should this occur in the near term. All of these factors should be considered by the Task Force in developing its detailed capital expenditure recommendations.

The following table illustrates the magnitude of additional investments (in 1979 dollars) that may be necessary to provide the rail and terminal elevator capacity necessary to meet projections of grain movements for 1985/86.

POTENTIAL MAJOR CAPITAL INVESTMENTS
1979/80 to 1985/86

	(MILLION $)	
	LOW ESTIMATE	HIGH ESTIMATE
Grain Cars	400	572
Locomotives	106	171
Prince Rupert Terminal Elevator	100	100
Branch Line Rehabilitation*	700	700
CN Main Line Capacity**	-	160
CP Main Line Capacity**	-	100
Joint Fraser Canyon Operations**	-	148
	$1,306	$1,951

Expenditures ranging from $1.3 to $2.0 billion may be required between now and 1985/86. These estimates do not include additional major expenditures by the grain companies, since such expenditures most likely would be made on a return-on-investment basis.

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* Some of this amount already expended

** Not all attributable to grain.

The major capital expenditures are described below:

- <u>Grain Cars</u>: It is assumed that the Government or the CWB (but not the railway) will purchase additional grain cars. The requirements for grain cars in the low estimate assume that the target 15 per cent improvement in the utilization of grain cars has been achieved, reducing the investment otherwise required in grain cars by $172 million.

- <u>Locomotives</u>: The railways have indicated they will make no significant investments to support grain movements, including locomotive purchases required to handle added grain traffic. In addition to units required for the forecasted growth, the replacement of about 20 per cent of existing locomotives, used in grain branch and mainline service, will likely be required and is assumed in the high estimate.

- <u>Terminal Elevator Capacity</u>: The estimate for the new Prince Rupert terminal elevator, which is also recommended in this report, is $100 million. This would be basically a private sector investment.

- <u>Branchline Rehabilitation</u>: The $700 million program to rehabilitate branchlines has been committed and is assumed to come from the public sector.

- <u>Main Line Capacity</u>: Rail line capacity increases on the lines to the West Coast are expected to cost over $400 million for both railways. While the reviews of line capacity carried out in this operations analysis indicated that line capacity may be a constraint on flows through the Port of Vancouver, detailed computer simulations are needed to determine precisely how best to provide added capacity and what role, if any, the Government should play in financing such projects to improve grain flow. The line capacity improvement projects proposed by CN and CP may well be carried out to serve profitable movements; however, if grain does not pay its fair share, other sectors of the economy will in effect be taxed (through higher tariffs) to subsidize grain movements.

An early function of the Task Force should be to identify which commitments should be made in the near term and which need to be studied further. The Task Force should then analyze those commitments which need additional study to determine specific requirements by years for the programs and opportunities to reduce future investment commitments, such as improving car utilization. The financial and managerial role of the Government in general and the Task Force specifically should be determined in each case. The requirements for grain cars can be used to illustrate the issues to be considered by the Task Force in developing the capital investment program.

5. GRAIN CAR PURCHASES PROVIDE AN ILLUSTRATION OF INVESTMENT STRATEGY

In addition to purchases of cars needed to handle future growth, major investments will be required over the next several years to replace aging box cars now in the grain fleet. Given the statutory grain rates, the railroads would not be expected to make such investments, so that burden must fall on someone else. Recently the CWB has assumed a responsibility for purchasing new covered hopper cars for grain movement. The number of covered hopper cars ultimately required to move the grain to export position depends on:

- Future export demand for Canadian grain at the various ports
- Any improvements that can be made in the efficiency of calling grains forward to market position
- Any improvements that can be made in loaded and empty car cycles
- The rate of retirement of existing cars (net of any major repair programs).

(1) Acquiring 1900 Cars Per Year For Next Few Years would be Prudent

The effects of future developments, such as export demand, improvements in car cycles and in the flow of grain to the ports can be quite significant in terms of the projected investment in equipment. Improving the car cycle by 15 percent, the target suggested in this report, reduces car purchases by 4,000 cars, representing an investment saving of $172 million. However, a number of new cars are required under any circumstances; 3,800 are needed just to replace the box cars expected to be retired by 1985/86. Therefore, it is not a question of whether to acquire new cars or not, but the timing of an acquisition program. A program of replacing approximately 1,900 cars per year for the next few years is recommended.

The above car requirements are based upon the demand volume of the high forecast, a situation which would occur if good crops were obtained each year and world demand were sufficient to absorb them. If mean demand levels of the high forecast were experienced, the number of new cars required to 1985/86 if no car cycle improvements were achieved, would be 9,400 (at a cost of $409 million in 1979 dollars), while 6,000 cars (at a cost of $258 million 1979 dollars) would be needed to 1985/86 if a 15 percent reduction in car cycles were achieved.

It will be noted that the number of new cars required to meet top demand volumes with a 15 percent reduction in car cycles is approximately the same as the number required to meet mean demand volumes with no reduction in car cycles. It is, therefore, recommended that this number be used as the basis for car purchases during the next five years; that is 1,700 cars per year for the years 1979/80 through 1983/84 and 1,900 cars for 1984/85, for a total of 9,300 cars by 1984/85, in addition to the 2,000 cars now on order by the CWB.

Acquiring 9,300 cars in the next five years, coupled with the additional Prince Rupert terminal capacity, means that the top range of the high forecast can probably be met, such that sales would not likely be lost in those years if bumper conditions were experienced and car cycle improvements can be achieved.

On the other hand, if only the mean demand levels of the high forecast were experienced, close to this number of cars would still be required if the car cycle improvements are not achieved. In view of the uncertainties regarding the extent and timing of car cycle improvements, it would appear to be prudent to acquire cars at the rate of 1,900 per year at least for the next few years.

If 9,300 new cars are purchased, the total cost would be about $400 million at 1979 prices.

(2) Achieving Improvement in Car Cycles Will Require Action by All Participants - Not Just Railways

Achieving a 15 per cent improvement in car cycles will require concerted action by all participants, not just the railways. Most significantly, it will require that the various elements of the logistics system be more fully integrated. The dynamic surges which characterize the present, loosely integrated system account for many of the car delays now encountered. The cost of the present loose system will be $172 million for excess car purchases to 1983 if the target improvements are not achieved.

(3) Car Orders Need Not Await Efficiency Improvements

Developing and installing the information and control systems necessary to support a fully integrated export grain logistics system will take time. Given the high level of retirements anticipated over the next several years, it appears that cars can be ordered now in anticipation of future demand and retirements. By ordering early, at present inflation levels, the time value of the money committed is minimal as long as major future replacements are expected. Having cars on hand in anticipation of demand may increase the probability of such demand being realized. The leverage of demand compared with car investments favors making the investment. To the extent that car cycle improvements are made in the next few years, future car replacements can be reduced.

The other major capital expenditure programs should be analyzed by the Task Force in a similar manner.

6. TASK FORCE SHOULD DEVELOP DETAILED IMPLEMENTATION PROGRAM FOR IMPROVING OPERATIONS

The recommendations to improve operations contained in earlier chapters of this report are summarized here as part of the agenda to be reviewed by the Task Force in developing its implementation program. Generally, the recommendations focus both on improving delivery reliability in the port and expediting car cycles to reduce car investment requirements.

(1) Improved Information Planning and Control Systems Should Improve Delivery Performance and Reduce Car Requirements

Improvements to the forward planning and monitoring of the block shipping process can be made in the short term and longer term.

1. The Following Improvements Can Begin Now

- Monitor cars in transit (empty and loaded) to and from ports on a daily basis to determine more accurately the execution of the plan.
- Extend anticipated port inventory requirements over a number of weeks beyond the current planning horizon based upon block origin/port destination cycles.
- Eliminate cumulative carryover of shortfalls.
- Telex the weekly elevator report directly to the Block Shipping Staff who could then provide the companies with the same information in processed form.
- Incorporate more reliable and timely transfer of vessel information in the demand formulation process.
- Eliminate redundancies in communication and information (i.e., reporting of orders to elevators by the grain companies and railways).

2. Create an Information System for Longer Term Improvements

- Reduce communication and control delays by increased use of the telephone and telex for transmission of type and grade of grain in terms of shippable stocks, elevator congestion, outstanding orders, orders filled, etc.

- Increase the frequencies of information flow among the major participants in the block shipping system; this would enhance the participants' forward planning capabilities, allow them to monitor their own activities more effectively, and allow each participant to monitor the performance of the others.

- Integrate major computer systems to establish a daily information exchange (including a car control mechanism) between the CGC, railways, CWB and companies, on a staged basis in accordance with the capabilities of the individual computer systems.

- Introduce daily inventory recording from key country points, possibly through polled minicomputers or telephone, including provision for the collection of conditions, grade and protein level information. A central facility for receiving the data and entering it into an overall data system should also be set up.

- Provide more comprehensive and reliable information on the conditions, grades and quantities of grain by type stored on farms.

- Ensure that all parties to the movement of grain, allocation of cars, etc. have inquiry facilities so they can assess the supply situation as represented by inventories on the farm and in country elevators. This would require access to the central computer to summarize totals of the day before and to record current transactions.

Consideration should be given to integrating these monitoring and control elements into a Car Management System.

3. <u>Provide for Protein Identification and Grading in the Information System</u>

The major requirements for a data system which would support identification and segregation of protein graded wheat are:

- A sampling system
- The recording of protein levels, grades, and quantities on the farm, at country elevators, in rail cars and at terminal elevators
- Input of this information to the data system from all levels
- Programs to summarize the data
- Inquiry facilities
- Programs to calculate strategy to meet export needs on a week-to-week and day-to-day basis.

Work is currently underway by the Protein Subcommittee of the Wheat Board Technical Group to develop an approach to implement a protein identification and pricing mechanism. A test implementation of one of the Subcommittee proposals should be undertaken in order to begin testing the recommendations presented above. The Canadian Grain Commission is also doing research along these lines which should be considered.

4. <u>Introduce Use of Computer Simulation Models</u>

To assist in inventory management and related system management decisions, it is desirable to use computer models to "test" operating decisions to meet alternative conditions or objectives; for example:

- A "catch-up" mode, aimed at quickly replenishing stocks in a port with a particular grade/type of grain
- An "equity" mode, aimed at drawing grain from blocks and elevators which had not yet received a fair share of the demand to date

- A "Thunder Bay priority" mode, aimed at pushing certain types/grades of grain to Thunder Bay as quickly as possible

- A "Vancouver priority" mode, a "Prince Rupert priority" mode and a "Churchill priority" mode, with similar purposes

- An "all ports priority" mode, aimed at moving as much grain of certain grade/type to all ports as quickly as possible

- A "snow line priority" mode, aimed at moving grain out of subdivisions before they experience line closings

- A "routine" mode, aimed at normal deliveries.

Computer models would also be highly useful in helping to determine the most appropriate destination-distribution of empty rail cars as they are returned each day from the ports. Computerized car management techniques could contribute strongly to achieving reductions in car cycles, with important savings in car supply. Models are available which could be put in place fairly quickly.

(2) <u>Country Operation Improvements Can Enhance System Throughput</u>

Improvements relative to producers, primary elevators and railways would enhance the throughput of the system.

1. <u>Producers' Actions Need to be Integrated into the Overall Logistics System</u>

   - On-farm storage for over a year's harvest must be provided. There are proposals to stockpile large quantities of grain to act as a cushion in case of poor harvests and to assist in the stabilization of international grain prices. If large additional stocks are required to meet international commitments, it would be appropriate to consider revised payments or incentives for on-farm storage.

- Farm storage represents an initial surge capacity to the logistics system and therefore must be considered a system asset.

- On-farm drying should be encouraged to increase system throughput. In years when weather conditions cause a wet harvest, the amount of drying required in port can be a constraining feature on system throughput. Under these conditions, more drying on the farm would reduce this constraint. Producers need to be encouraged by price incentives to dry grain on the farm at those times.

- It would be advantageous for grain to be delivered to the primary elevators in a more uniform manner. The concentration of movements can be adjusted by changes in the incentives to deliver as seen by the producer. Efforts should be made to smooth this flow, including greater use and enforcement of terminating quotas.

- The quota system can be modified to improve overall operations related to producers.

  - More knowledge of the actual size, grade, and condition of on-farm inventory would allow quotas to be set more precisely.

  - Terminating quotas should be used to equalize the deliveries to primary elevators over the year.

  - The quota system could be used to encourage the delivery of dry grain when more of this is required to maximize throughput in the ports and could be used to ensure the delivery of tough and damp grain when dryer capacity is available through differential quotas.

  - The use of financial incentives for more timely deliveries should be explored; for example, premiums for timely delivery might be provided.

- The implications of a thorough "on-farm" testing and sampling system to determine accurately the status of on-farm inventories should be investigated before major changes to the quota system can be considered.

2. Primary Elevators Can Contribute to Improved System Performance

- Variable tariffs would accelerate elevator investment and improvements. There are, in practice, few differences in tariffs at present and little incentive is provided to the producer to haul his grain to a more efficient elevator. This lessens benefits to a company for construction of more efficient elevators and tends to burden the entire grain industry with reduced efficiency.

- Increasing the number of grades should be carefully evaluated because of the impacts on efficiency. When more grades are handled in a particular elevator, more subdivisions of storage are required and the effective storage capacity is reduced. A reduction in the number of grades would have benefits by increasing primary elevator operational efficiency and effective port terminal capacity, as well as simplifying the inventory control system. The cost of maintenance of a large number of grades should be very carefully assessed against the marketing advantages.

- Misshipments of grain should be reduced. Primary elevator agents ship grades or types of grain other than those required (and ordered) to the ports for about 21 per cent of the shipments. While many of these differences are handled by blending, or by flexibility in the sales contracts, efforts should be undertaken to monitor failures, improve training of elevator managers and, when necessary, levy penalties.

3. <u>Railway Related Changes Have an Impact on Overall Operation</u>

- Railway services to primary elevators should be on a scheduled basis. Although shortfalls will occur and some schedule changes may be made at the last minute, scheduling should help the primary elevators in their operations planning.

- An overall saving of 1.0 days in car cycle times may be achieved by realigning railway pickup and delivery service to the form of "Dayover Turns" which provide placement on the outbound trip, rest for the crew and the lifting of loaded cars on the return trip. While several train runs are scheduled on this basis now, more widespread use of "layover turns" would improve car utilization. Locomotive utilization and adequate facilities for resting the crew are significant considerations in establishing this type of service.

- Car spotting limitations should be addressed. Specific joint railway/ industry committees should be set up by the Task Force to address this problem, particularly when adjacent lines are to be subject to abandonments or adjacent stations to consolidation, and average loadings at remaining points will be increased.

- Branchline abandonments will have a positive impact on railway operations. The recommendations of the Hall Report and PRAC suggest that a number of railway subdivisions would be abandoned, either completely or partially. These proposed abandonments, especially if the complete line is involved, will eliminate railway costs in maintaining and operating these lines and should, therefore, reduce the branch line subsidies. In addition, the abandonment of many lines means that they will not require government capital expenditures or rehabilitation. The removal of lines from the network will free up equipment and other resources to rehabilitate and maintain the remaining lines.

(3) Grain Car Cycle Can Reduce Car Requirements and Increase Throughput

Improvements in car cycles can be achieved in the near term and long term.

1. Near Term Recommended Improvements

- Realign railway delivery and pickup service in the country, as discussed in the preceding section on Country Rail Operations improvements, thereby achieving a targetted reduction of one day in average car cycle time.

- Realignment of the work week in terms of weekends and shifts per day work, particularly in the terminal elevators and in certain circumstances in the primary elevators.

- Refine the block allocation system to apply the subdivision train run minimum requirements to the planning for car allocations to blocks, so that the total cars out of a gathering point to a specific destination would, whenever feasible, be the number of cars required to satisfy the minimums for a main line train run.

- Assign top priority to branch line rehabilitation and maintenance on weight restricted lines which now severely affect car movements.

- Consider the effect of the influx of producer cars with extra switching delays in the country and in the ports.

- Place car orders for one port for a given block and train run to reduce switching and train make-up delays.

- Ensure that crosshauls for grain types that have an abundant geographical spread are not occurring unless market strategy absolutely warrants.

- Put into place an improved system to direct, monitor and control the movement of empty cars from the ports to the areas in the country where they are required.
- Increase the reliability of estimated ship arrival times along with provision of additional buffer storage capacity.

2. <u>Long Term Recommended Improvements</u>

- Establish close communications and cooperation between the railways and the Block Shipping Staff to ensure that the right cars are being given priority for movement before needed cars are "buried" in a holding yard such as Keith.
- Introduce reporting on more events in the car cycle, such as delay time at locations en route within the current car cycle data bases and develop the railways' car cycle reporting systems on a more uniform basis.
- Develop a test program to measure the performance of the elevators in terms of acceptance and the delivery performance of the railways in the ports.

(4) <u>Port Area Improvements Can Increase Throughput</u>

Improvements in port elevator throughput can be achieved.

- Operating more shifts per week will increase throughput. The elevators are presently reluctant to work more shifts per week because they fear they will run out of rail car supply. If they were assured of supply, then 20 shifts per week could be operated with four crews working five shifts per week. The twenty-first shift could be used for maintenance. This would theoretically permit the elevators to handle one-third more than at present. Such an increase would handle forecast volumes to 1985. However, one full shift for maintenance may not be adequate to provide as high a level of service as at present. Therefore, 1983 might be a more realistic estimate of the last year to which the present elevators could handle the high-year forecast tonnages through increased shifts.

- Supplementing port supplies with cleaned grain should be attempted. Clean grain can be passed over the elevators up to the limit of the unload capacity, or it may be handled by the bulk loading terminals. The latter may present capacity and environmental difficulties, however. The limit to such an approach is the amount of grain which can be cleaned and stored in the Prairies. This is presently restricted because of the desire to generate the screenings on the coast to serve the higher-priced export market.

  It would seem desirable to plan for the use of some cleaned grain from the Prairies when the terminal cleaning system could not otherwise handle the volume. This could extend the capacity of the system to 1983. The inland terminal elevators could serve to store cleaned grain for such occasions.

- Grain companies should continue in their attempts to reach agreement on the "paper pooling" of Non-Board grains, particularly oilseeds, in order to allow more efficient use of terminal capacity for these products.

- Additional railway interchange will be required in the future, particularly on the West Coast to allow CP cars access to Prince Rupert. Remaining details of negotiations between CN and CP should be concluded as quickly as possible regarding equitable arrangements for interchanging.

- More uniform and predictable ship arrivals are desirable to smooth peaks, allow better matching of grain deliveries to vessel requirements and make better use of transportation and handling capacities. While it was beyond the scope of this operations analysis to estimate the extent to which more uniform vessel arrivals could be negotiated with Canada's grain customers, there are indications that some improvement could be achieved, at least on long-term contracts, and it is recommended that the CWB make this attempt. Efforts should also be made by the CWB and grain companies to provide greater lead time and accuracy in estimating time of arrival of vessels, so that the delivery system will have a greater chance of matching the demand requirements of specific vessels.

(5) Institutional Changes Are Necessary to Improve The Effectiveness of Operational Improvements

- Reassigning the Block Shipping Staff from the CWB to the Task Force offers more opportunity to effect change. This is a complex issue which requires further planning by the parties involved and by the Task Force. An early decision on this matter by the Minister would settle this question in principle and expedite its implementation.

- Consideration should be given to replacing the Quota System with a system under which the CWB would buy all Board grain stored on-farm following on-farm inspections and grading. The Task Force would then call forward farm-stored grains to primary elevators as required to meet sales commitments some weeks later at the ports. This could facilitate drawing down all elevators on a given set of rail lines each week in a manner designed to increase rail operating efficiency as well as improving the responsiveness of the system and maintaining an eventual basis of equity to the system.

- The weekly planning process should be formalized. The railways, CWB marketing staff and grain companies' marketing and distribution staff should meet each week with the Block Shipping Staff to establish the car allocation plan and agree on a documented grain delivery plan.

- Penalties and bonuses should be clearly established. The changes made in the administration of the block shipping system would require development of a clear-cut set of rules guiding the administration of the company-CWB-railway plans.

- Alternative penalties/bonus systems should be considered. Financial or car penalties/bonuses need further consideration. The rules for the existing car penalty system should be drawn up, promulgated and applied in a non-retroactive, non-arbitrary, auditable manner. Reliance should be placed on a greater degree of voluntary cooperation among the participants, based upon consultation, definition of responsibilities and the documenting of weekly plans and performance levels by each participant. Revised penalty/bonus practices should be considered after the above changes are made and the effects assessed.

- Consideration should be given to permitting grain companies more latitude in car allocation by having the Block Shipping Staff allocate cars first to companies, who would then allocate the cars to both blocks and elevators. Alternatives should be reviewed by the Task Force in light of inventory control and car management system development and possible changes in the Quota System previously suggested for consideration.

- Forward planning should extend beyond the six-week horizon. The car allocation process and negotiation should be modified such that the Block Shipping Staff, the CWB, the grain companies and the railway representatives meet on a monthly basis in addition to the weekly meetings described earlier. The participants would examine overall rail car supply for the upcoming three to six months, examine market conditions for both Board and Non-Board grain over the same period, and agree on the total number of rail cars likely to be required and available each week during the coming months. An appropriate allocation of rail car supply between Board and Non-Board grains would be made. Confidential sales details which the CWB and grain companies would not want divulged to their competitors, would be communicated as privileged information to the Block Shipping Staff.

* * * * *

It is hoped that the wide range of recommendations contained in this report and summarized in this chapter will serve as a starting point for the planning of the implementation program of the Task Force. With billions of dollars at stake and the long lead times necessary to implement some (but not all) of the recommendations, time is of the essence. The leverage favors early investment, but the issues involved, such as who should provide the funding, are complex. The key will be the appointment of a strong, action-oriented Managing Director and Task Force to deal with the issues in a timely manner.

Grain Transportation and Handling in Western Canada

Appendices

July 1979

Report for
The Grains Group
Department of Industry,
Trade and Commerce

GRAIN TRANSPORTATION
AND
HANDLING IN WESTERN CANADA

APPENDICES

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APPENDIX A

RANKING OF ISSUES BY THE INDUSTRY LIAISON COMMITTEE

During Phase I of this project, some 32 persons or organizations involved in the grain transportation system in Western Canada were visited. From the discussions held, a list of potential issues and opportunities was developed and presented to the Industry Liaison Committee. This committee provided input and advice on this project. Seven committee members submitted written comments on the preliminary list of issues. For each issue, committee members gave relative priorities and comments. Relative priorities were ranked using the letters A through F, with A indicating the highest priority. The rankings and the comments of the committee are presented in this appendix.

This survey includes the following topics:

- Facilities issues
- Operations issues
- Financial issues
- Institutional issues
- Major issues.

FACILITIES ISSUES

1. How much storage is required:

   - On farms?
   - In primary elevator system?
   - In inland terminals?
   - In the ports?

A	A	A	A	F	E	N/C*

Comments:

- Inventory capacity should be expanded on farm and on Pacific coast.

- We should not be concerned with actual amounts of storage, but with providing the institutional and financial incentives which encourage storage in the right place.

2. Do Non-Board and domestic feed grains take an unfair amount of storage?

Yes	B	No	Yes	No	No,E	No

Comments:

- Is a problem and will continue to be a problem until Non-Boards are brought under the authority of the Canadian Wheat Board

- Feed grains are constrained by limitations on space provided; system could also be used for Non-Board grains.

* No comment was made.

3. What is the right balance between scale of primary elevator operations and length of producer's haul?

15 Miles, Max 25 Miles	B	15 Miles	25 Miles Max	F	15 Miles, 25 Miles Only	N/C

Comments:

- The primary elevator system is being rationalized because of economic pressures and changes in the rail network; it is beyond the ability of this project to influence; therefore, we should be looking at institutional arrangements that encourage optimality.

4. Should grain be cleaned and final graded on Prairies?

  . Normally?
  . To provide surge capacity?
  . Using existing terminals?
  . By building more inland terminals?

No, F	C	No, Costly	No	Probably	C, No	C

Comments:

- It is much more efficient to concentrate these facilities in the ports.

- Export standards are too high and prevent effective cleaning on the Prairies although rapeseed is now cleaned in several locations.

- Rail stop-off charges now and in the future will mitigate against using inland terminals.

5. Are port facilities adequate, especially on the Pacific Coast:

- With presently operating system?
- With improved system?

Being Increased	B	Adequate	No,A	F	No,B	No

Comments:

- Facilities are being improved in Vancouver; consortium is considering a large new terminal in Prince Rupert.
- Decisions involve large outlays of money by others; we should be interested in trying to set up institutional framework that encourages rational decisionmaking.

6. Do railway lines have adequate capacity to meet expected growth in movement of grain and other commodities?

See Railways	A	No	N/C	F	B	N/C

Comments:

- This is a potential problem.

7. Can terminal rail facilities be improved?

See Railways	A	Yes	Yes	F	B	N/C

Comments:

- They obviously can be improved, but the major question is how can they be improved.

8. How many railway cars are required in future? Can some be released seasonally?

A	A	Need	Need	N/C	A	N/C

Comments:

- This appeared to be a major issue with almost everyone.

OPERATIONS ISSUES

1. Calling up grain from farmer:

   - Is quota system too blunt an instrument?
   - Should CWB or others keep track of amount and types of grain stored on farm and call up more precisely?
   - How would farmer react?
   - Would a system of truckers be necessary?

A	A	C	N/C	N/C	B	Differences Between Board and Non-Board

Comments:

- Some form of system to regulate the flow of grain into the primary elevators is required.
- Quota system generally seems to be effective for Board grains although there are some problems with Non-Board grains.
- The quota system is being reviewed by a committee now.
- Information regarding on-farm inventories generally adequate.

2. Should there be more assistance to farmer in determining what to grow?

F	F	No	No	N/C	C	N/C

Comments:

- This is beyond the scope of this project.
- Efforts in this direction have not been too successful.

3. Does quota system cause inefficiencies in farm operations?

Wait	F	No	No	N/C	C	Yes

Comments:

- We should wait for report of quota review committee.
- Quota system does cause impacts on producer's methods but in any case, producer can really only grow what can be sold.

4. Should companies be free to fill orders wherever they can, forgetting about block allocations?

No	D	No	No	Yes	B	Yes

Comments:

- This might improve the system but considerable coordination with the railways would be required to plan efficient train runs.

5. Should terminal elevators be operated individually to handle a range of products or should each specialize?

No	D	No	Perhaps	N/C	E	Happens Now

Comments:

- A considerable amount of specialization occurs now.
- Over-specialization can cause problems because of differing peak demands for various grains.

6. Can rail cycle times be reduced? Should more blocking of trains be done on the Prairies? More use of solid trains?

A	A	Yes	N/C	A	Yes	N/C

Comments:

- This is a major question, needs to be investigated thoroughly.

7. Should Non-Board grains be pooled?

No	No	No	Yes	Probably	No,E	No

Comments:

- With the present marketing system, pooling of Non-Board is not feasible; but if these grains were marketed by CWB, they would automatically be pooled.

8. Can the grading system be simplified? Can we work by blending to buyers' specifications?

No	A	Yes	N/C	N/C	A	Would Improve

Comments:

- There is a great deal of interaction between the grading system and marketing.

- Many people believe that fewer grades, more blending can meet customer's requirements.

9. Should expansion of exports be by eastward or westward movement?

N/C	F	F	N/C	N/C	A	N/C

Comments:

- Marketing considerations predominate in this question.

10. Can CWB analyses and functions be made more open and available for audit?

Extensive Now	F	No	Now Available	Must Be	A, Yes	N/C

Comments:

- There was a broad variety of opinions on this subject with some respondents believing that the Wheat Board was as open in its decision-making process as it could be, while others believe that it should explain and discuss processes and decisions in much greater detail and an audit trail should be available regarding certain decisions (e.g., car allocation penalties to grain companies).

11. Can sales and vessel forecasting be made more adequate and reliable?

N/C	C	C	Perhaps	A	A, Yes	N/C

Comments:

- This was seen as a desirable improvement if it were possible.

12. Does Bracken formula restrict growth and improvement in primary elevator operations?

No	C	No	N/C	Yes	A	Yes

Comments:

- The application of the Mants formula does allow some changes in the relative positions of the grain companies in primary elevator operations.

13. Does allocation formula for cars in ports reduce efficiency of terminal operations?

No	A	No	N/C	B	C,No	N/C

Comments:

- The formula for company allocation is used only in Thunder Bay where throughput capacity is better matched to requirements.

- Equalization between railways is necessary and desirable.

FINANCIAL ISSUES

1. Should terminal and primary elevator operations be financially linked? Does this linkage create inefficiencies?

Coordination Required	F	No	Coordination Efficient	Little Linkage Now	F	N/C

Comments:

- At present terminal operations subsidize primary systems.
- There is little linkage between primary and terminal operations for Board grains.

2. Should specific producers/road authorities be compensated for longer hauls brought about by rationalization of primary elevator systems? Should producers be compensated by reductions in handling and transportation charges?

No	F	No	If Necessary Only Temporary	No	F,No	N/C

Comments:

- Paying road haulage subsidies in any case would set a precedent, could be inequitable.
- Some adjustment might be necessary if primary elevators are closed, but we should not attempt to compensate for inherent geographic disadvantages.

3. Are financial incentives required to encourage:

- Storage at cheapest location (on farm?) and/or at best location to provide surge capacity?
- Throughput rather than storage in primary and terminal elevators?
- Timely producer deliveries of required types/grades of grain?
- Timely shipping of required types/grades from country points to "best" port/terminal?
- Reduced car cycle times: loading, pick-up movement, unloading, and return of empties?
- Better scheduling and coordination of terminal operations with shipments?

A	F	B	C	Yes	A	Yes

Comments:

- Many types of incentives would be desirable.
- The major problem is the source of the funds.

4. Can cheaper ocean freight rates be obtained through Prince Rupert by:

- Directing vessels arriving in ballast to Prince Rupert?
- Encouraging two-way movement?

F	F	No	N/C	N/C	D	N/C

Comments:

- This issue was generally thought to be beyond the scope of this project.

5. Should elevator companies be provided with incentives to make multiple car shipments? From whom, railways or CWB?

N/C	F	No	Yes	Yes	B	Yes

Comments:

- Many persons thought this would be desirable but the source of funds is difficult to identify with the Crow's Nest Pass rates in effect.
- In the past the railways have been reluctant to provide longer leads at primary elevators which would allow longer shipments.

6. Should railways be given financial incentives to use car fleet more efficiently?

   - Seasonal sharing of car fleet with other commodities?

A	F	No	No	Yes	B	N/C

Comments:

- Crow's Nest Pass rates restrict this possibility.
- Improved utilization of the car fleet will by itself give benefit to the railways.

INSTITUTIONAL ISSUES

1. Does the large number of participants and the impact of each on cost/efficiencies of others work against an overall system optimum; should we attempt to simulate market discipline or should we use system controls to achieve calculated "optimums"?

A	D	No	More Control	Controls Have Failed	D	D

Comments:

- Many participants would prefer market discipline to more controls.
- The problem is that costs and benefits of improvements fall unevenly among participants in the present system.

2. Should CWB take further control of transport down to allocation of cars to individual elevators? Or should the system be loosened, perhaps with transport functions removed from CWB?

No	D	No	No	Remove The Function	B,No	No

Comments:

- The first approach was not viewed with favor.
- The second approach was acceptable to some.

3. If transport functions separated from CWB, should they be handled by a separate agency:

- An association of grain companies or public authority?
- With broader, multimodal involvement?

No	F	No	No	Yes	B	N/C

Comments:

- See Issue #2 above.

4. Could terminal elevators be operated as a unit through a consortium at each port?

No	F	No	Yes	D	E	N/C

Comments:

- This would not increase throughput.
- There already is some specialization, particularly at Vancouver.

5. Could primary elevators be consolidated into one facility at each major country point, owned by a consortium with competition offered through competing companies' agents at each point rather than through competing facilities?

No	F,No	No	Probably Not	D	F	N/C

Comments:

- Very few advantages of this proposal were seen.
- It was stated that service competition is the most effective now, and this would remove this incentive for efficiency.

MAJOR ISSUES

1. Can quota system be improved or replaced so that producers have incentive:

   - To grow what can be sold?
   - To deliver when grain is required?

Wait	Wait	No	No	N/C	F	N/C

Comments:

- The Quota Review Committee will be making its report soon; we should wait for this.
- No other system is possible.
- Feedback of quotas on what is grown is ineffective.
- Quotas for Non-Board should be removed.

2. What pace/level of rationalization of the primary elevator system is likely or desirable?

   - Most efficient spacing of primary elevators
   - Pace of rationalization?
   - Can process be speeded by assistance, for road haulage, more responsive car allocation system, cost based on throughput rather than on storage?

F	F	F	F	F	E	N/C

Comments:

- The pace of rationalization depends upon the economics of operation, which this analysis can only marginally influence.

3. Do the CWB and other coordinating agencies know enough about inventories at all levels, on farms and in primary and terminal elevators?

Yes	C	Yes	N/C	Cannot Use	E	N/C

Comments:

- In general the CWB seems to know enough about farm inventories, but not about producers' delivery intentions.

- Some people contend that with the present system the Wheat Board could not make use of additional information in this area.

4. Can the present block allocation formula and coordination of orders with sales be improved?

A	A	Yes	B	Yes	A	Needs Improvement

Comments:

- There was general agreement that this system needs to be reviewed.

- Block boundaries have not been changed much since system was initiated.

5. Can railway operations be significantly improved by changes in operating practices? Will these reduce the rolling stock requirements?

Probably	A	N/C	N/C	N/C	A	N/C

Comments:

- This is a useful area but beyond the area of knowledge of most of the members of the Industry Liaison Committee.

6. Can terminal rail, storage and processing operations be improved by:

   - Blocking of trains by type and grade ?
   - Rationalization of switching and trackage in terminal areas ?
   - Specialization of terminals ?
   - Loosening the financial connection between terminal and primary elevator operations?

A	A	A	Probably	N/C	A	N/C

Comments:

- There probably are benefits in some of these areas.

- Institutional problems are the key.

7. Can additional capacity be provided in the system by initiating shipments from inland terminals:

   - Could provide surge capacity ?
   - Could use bulk terminals rather than more expensive grain terminal elevators ?
   - Would require cleaning and final grading on Prairies?

No	D	No	No	N/C	B	N/C

Comments:

- Many people thought that this proposal would almost certainly prove too costly.

8. Can the grading system be simplified? Can customers' requirements be met by blending?

Changes Already Made	A	A	N/C	Beyond Our Scope	A	N/C

Comments:

- Most people thought this to be an important issue.
- Buc it has implications in the marketing field which are beyond our scope.
- In the 1970's a reform was undertaken.
- Blending is already carried out on a large scale.

APPENDIX B
VANCOUVER CASE STUDY

To carry out the Vancouver case study covering the first 20 weeks of the current crop year, analyses were performed on data from several sources. The various data included:

- Vessels arriving
- Vessels loading
- Vessels waiting
- Terminal stocks
- Offloads to vessels
- Unloads
- Loads on hand in the port terminals
- Loads on wheels or en route to the port terminal
- Primary elevator stocks
- Car allocation programs
- Shortfalls.

Attempts were made to gather as much data as possible in computer tape form. However, certain of the data was available only in hard copy which was keypunched to tape. Subsequently, the data was prepared for computer processing by writing input programs, a merge program, and output programs. The data preparation work facilitates the listing of data by port and by grain type for each week.

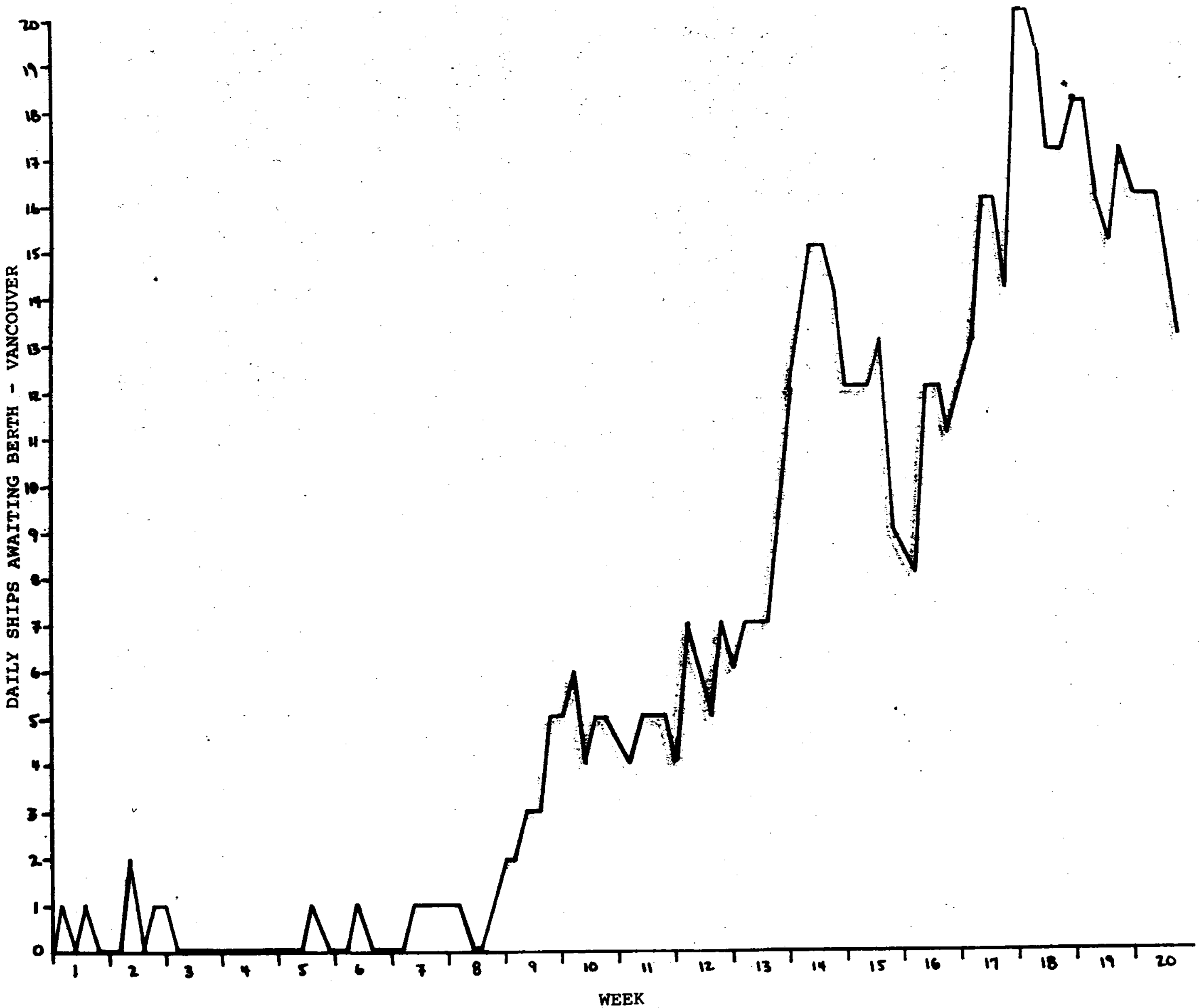
1. BUILDUP OF GRAIN VESSELS WAITING FOR BERTHS REFLECTS SEVERAL COMPLEX AND INTERRELATED PROBLEMS

As shown in Exhibit B-1, the number of grain vessels waiting for a berth was relatively insignificant in this current crop year until week 9. In week 14, the queue increased again, recovering in part during week 15. During weeks 16, 17 and 18 the queue grew; at the beginning of week 18 there were 20 grain vessels waiting for berths in Vancouver.

It was in week 19 that the Wheat Board called the special meeting to discuss the situation in Vancouver. The most immediate problem at that time appeared to be a drop-off in the unloading of cars at the terminal elevators as a result of labor problems in the port.

At that meeting it was also noted that for the first two months of the crop year, there had been few delays to

EXHIBIT B-1
Vessels Waiting
Vancouver
Crop Year 1978/79



vessels. It appeared that the buildup of vessels which started in the ninth week and continued to week 18 was the combined result of several factors:

- Bunching of vessels in that week
- Arrival of vessels for grains other than what was in the majority of bins in the terminal elevators
- Drop-off in unloads at the elevators immediately preceding the meeting.

2. GRAINS SOUGHT BY THE SHIPS IN QUEUE VARY THROUGH THE PERIOD

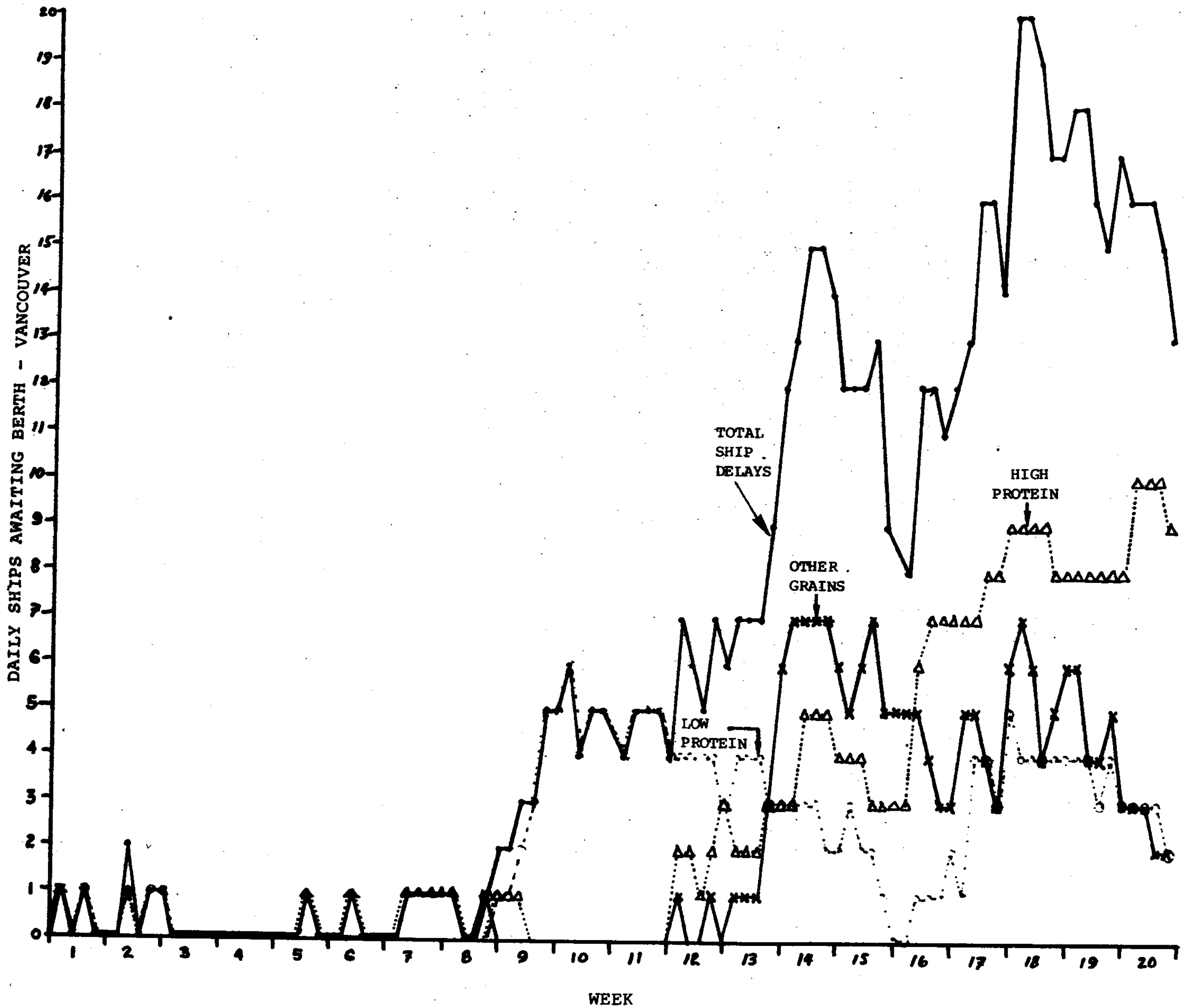
The chart shown in Exhibit B-2 illustrates that the grains needed by the vessels waiting varied through the period. The minor delays in the first eight weeks were primarily for high protein wheat destined for Japan; however, vessels waiting for low protein wheat for delivery to China experienced brief delays in weeks 1 through 3. The buildup of vessels waiting in weeks 9 through 11 was almost exclusively due to vessels waiting for low protein wheat. This low protein queue gradually declined until it briefly zeroed out in week 16, only to resume over weeks 17 and 19, and gradually drop down in week 20.

From week 12 on, there were vessels waiting for high protein, low protein, and other grains such as barley and rapeseed. The buildup in week 17 resulted primarily from a sharp increase in vessels waiting for other grains which leveled out in week 14 and then fluctuated through week 19 when it began to decline. Starting in the twelfth week, a queue of vessels for high protein wheat to meet Japanese contracts gradually began to build, with fluctuations until week 20 when it reached ten vessels.

Thus, there are two basic reasons grain vessels may be delayed awaiting loading:

- Vessel arrivals exceed berth capacity
- There are inadequate grains of the desired type in the elevators at the berths available.

EXHIBIT B-2
Vessels Waiting By Grain Types
Vancouver Crop Year 1978/79



(1) Vessel Arrival Patterns Affect the Buildup of Queues

If vessel arrivals are bunched, delays may be expected. Exhibit B-3 shows daily grain vessel arrivals with the number of vessels in queue each day. From this chart, it appears that in general up to three vessel arrivals per day could be handled without significant delay when the port was fluid as it was in the first eight weeks.

A queue started to build in week 9 with the arrival of five grain vessels in one day. It remained relatively stable until week 13 when ten vessels arrived in a two-day period. The next surge in the queue was caused by the arrival of four vessels in one day in week 16, followed by two days in week 17 with five vessels each, and the arrival of seven grain vessels on the first day of week 18. It was on that day and the day following that the queue peaked at 20 vessels waiting for berths.

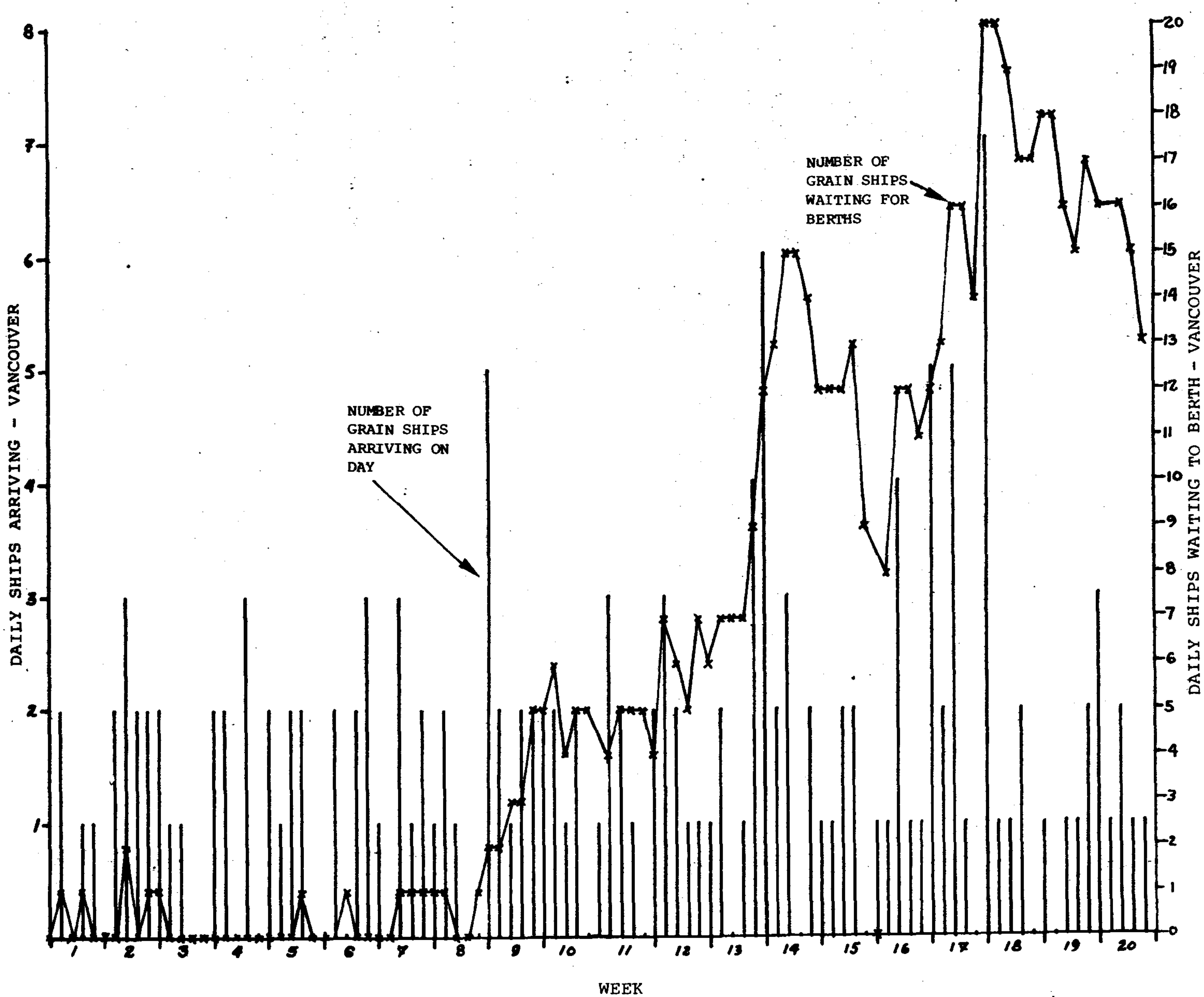
Analyses of daily changes in the queue and vessel arrivals indicate that on an overall basis, the bunching of vessel arrivals may be a problem if four or more vessels arrive on any one day. Except in these extreme cases, which represent only 7 percent of the days in the period, the fluctuations in the number of vessels awaiting a berth appear to be a function of factors other than a bunching of vessel arrivals.

(2) Day-of-the-Week and Day-of-the-Month Patterns Appear Random

One hypothesis was that ship arrival patterns are biased by the day of the week or month. To test this, a sample was taken of 137 vessels arriving in weeks 5 to 22 of the 1978/79 crop year. This sample showed a slight dropping off of arrivals over the weekends, but otherwise no particular pattern by day of the week. The reported Monday arrivals were about double those of any other day, but since these included arrivals on Saturday, Sunday and Monday, the implication is that arrivals on these three days were somewhat lower per day than on other days of the week.

Likewise, an analysis was made of arrival patterns by working days of the month. Of the 137 vessels observed, 42 arrived in the first one-third of the month,

EXHIBIT B-3
Vessel Arrivals vs
Vessels Waiting
Vancouver, 78/79 Crop Year



52 arrived in the next seven working days, and 47 arrived in the last one-third of the month. This suggests that there is not any systematic bunching in the context of parts of the month. When bunching does occur, as experienced in Vancouver during the last weeks of 1978, it appears to be random.

(3) Ships Seeking High and Low Protein Wheat Waited Longer on the Average than Ships Seeking Other Grains

An examination of the queue buildup in relation to daily vessel arrivals by grain type as illustrated in Exhibits B-4, B-5 and B-6 indicates that in the case of low protein and high protein wheat, queues appear to have been the result of not having the proper grain type at elevators with available berths, rather than the bunching of vessel arrivals. In contrast, the queue of vessels waiting to load other grains appears to be more closely related to bunching of arrivals. Since some of the other grains are handled by only one terminal elevator in Vancouver, one might expect to find longer queues with the other grains than with the wheat, but the queuing problems for other grains during this sample period were far less significant than for vessels loading high protein and low protein wheat. The following table reflects this intriguing situation:

VESSEL DELAYS IN VANCOUVER BY GRAIN TO BE LOADED

Grain Type	Total Vessels Arriving*	Total Vessel Days Awaiting Berth	Average Vessel Days In Queue**	Total Tons By Type	Average Tons Per Vessel (000)
Low Protein Red Spring Wheat	37	193	5.2	975	27
High Protein Red Spring Wheat	36	263	7.3	514	15
All other Grains	86	176	2.1	1,356	16
TOTAL	159	632	4.0	2,845	18

* Does not include weekend days.

** In some cases partially loaded vessels are shown as waiting for another berth to finish loading (period 20 weeks).

EXHIBIT B-4
Low Protein Arrivals vs
Low Protein Vessels Waiting
Vancouver, 78/79 Crop Year

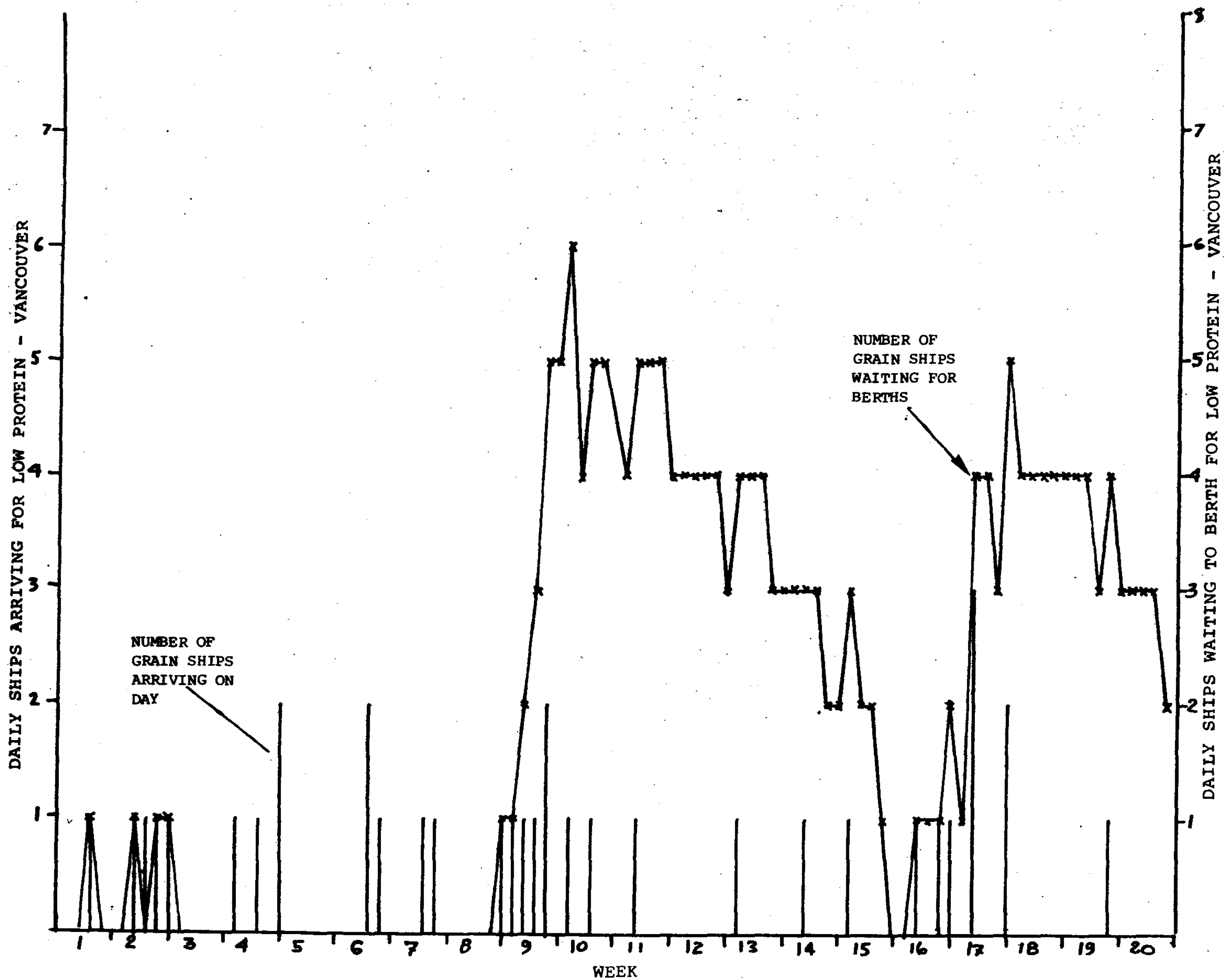


EXHIBIT B-5
High Protein Arrivals vs
High Protein Vessels Waiting
Vancouver, 78/79 Crop Year

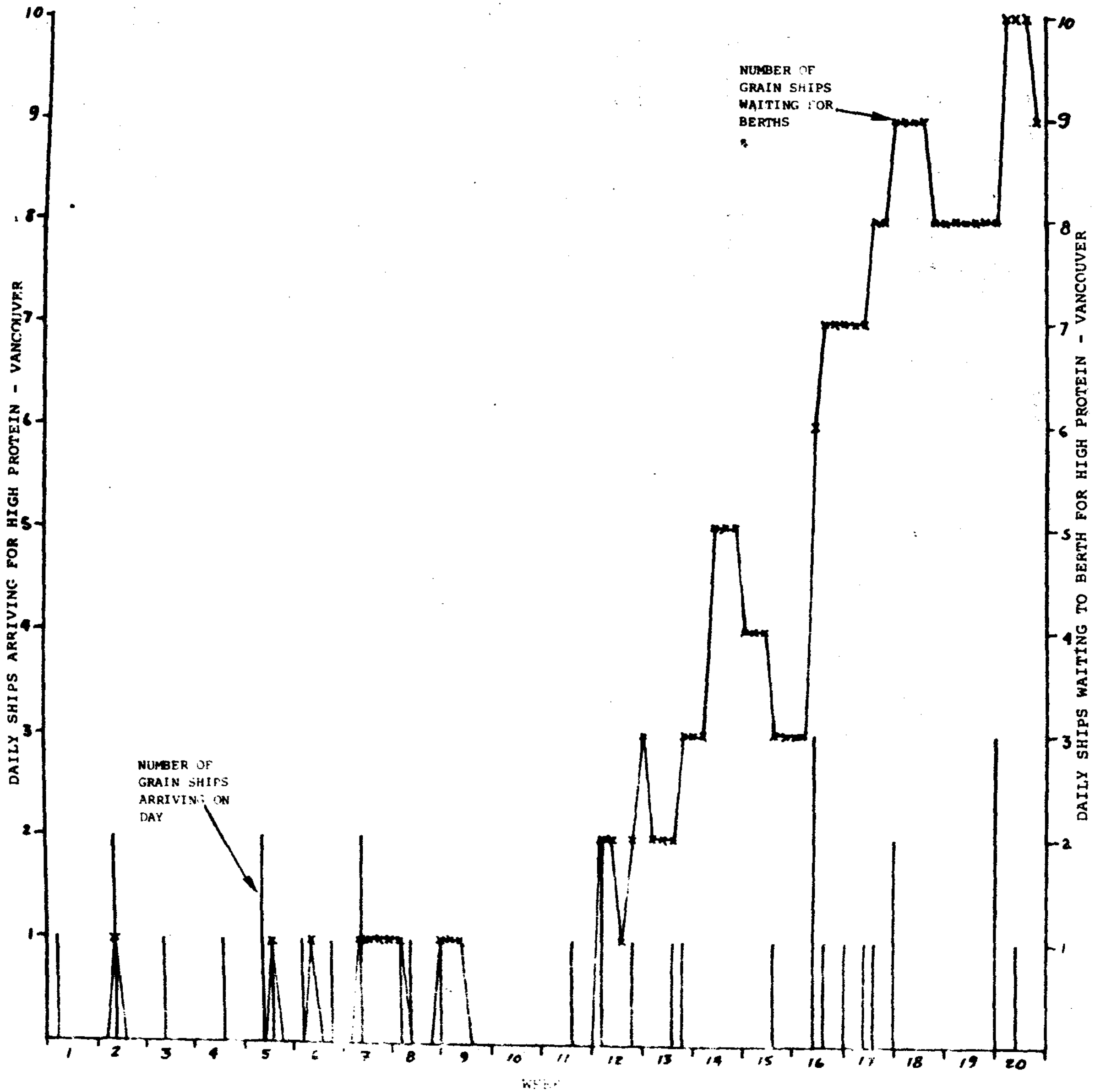
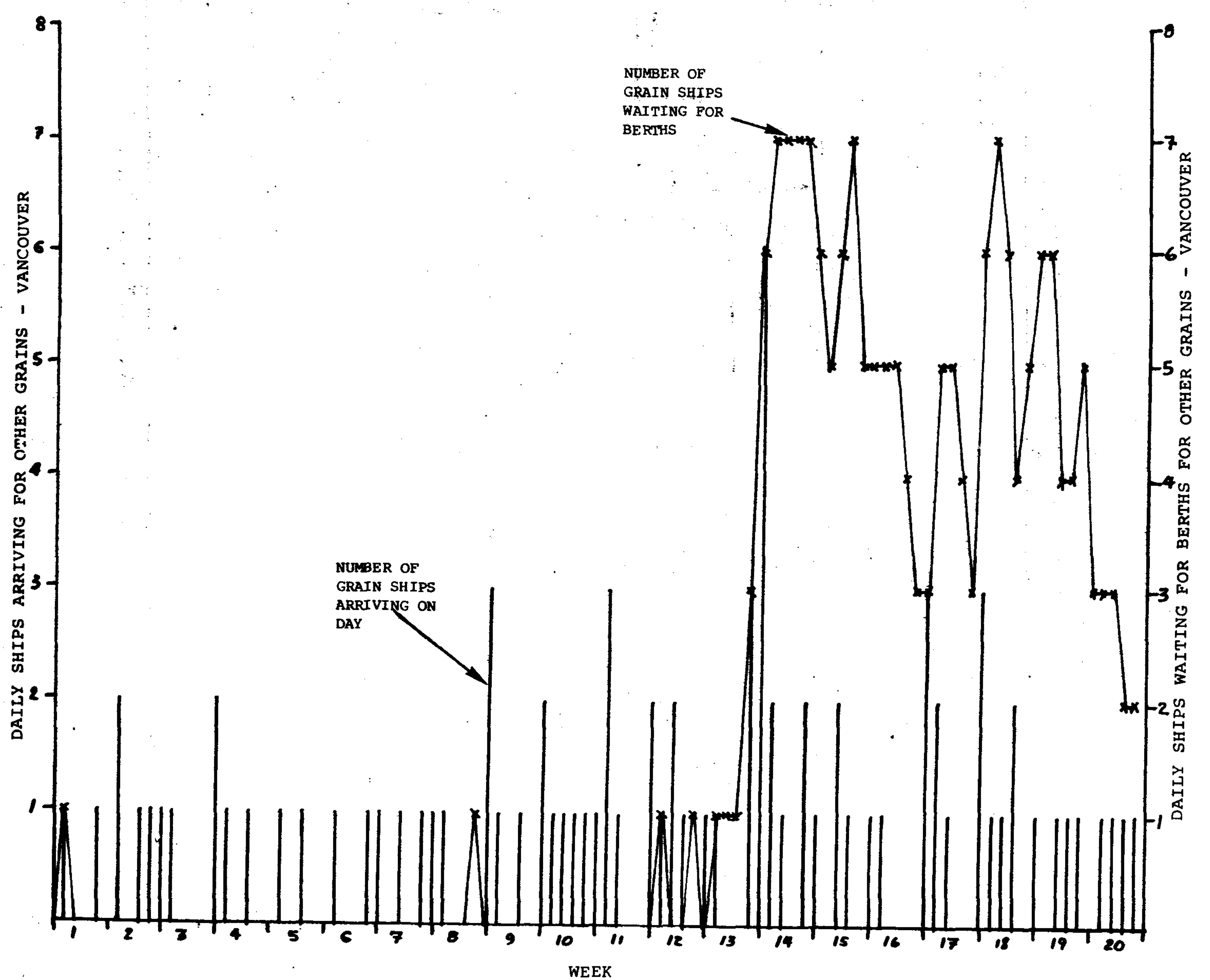


EXHIBIT B-6
Other Grain Arrivals vs
Other Grain Vessels Waiting
Vancouver, 78/79 Crop Year



Vessels which went to Vancouver to load high protein wheat during the first 20 weeks averaged 7.3 days (exclusive of weekend days) waiting for a berth. Vessels which sought low protein averaged 5.2 days waiting for a berth; however, ships to load other grains were delayed only 2.1 days. Although 54 percent of the vessels arriving in Vancouver in this period were to load other grains, they received only 28 percent of the delays.

3. FACTORS OTHER THAN BUNCHING OF SHIP ARRIVALS INFLUENCED SHIP QUEUES IN THE CASE OF LOW AND HIGH PROTEIN

In an attempt to understand the causes behind the buildup of vessels waiting in Vancouver for low (11.5/12.5-1CWRS, 11.5/12.5-2CWRS, 3CWRS) and high protein wheat (13.5-1CWRS, 13.5-2CWRS) during the weeks 9 to 20 of the current crop year, several hypotheses, in addition to whether ship arrivals exceed berth capacity, were proposed for examination:

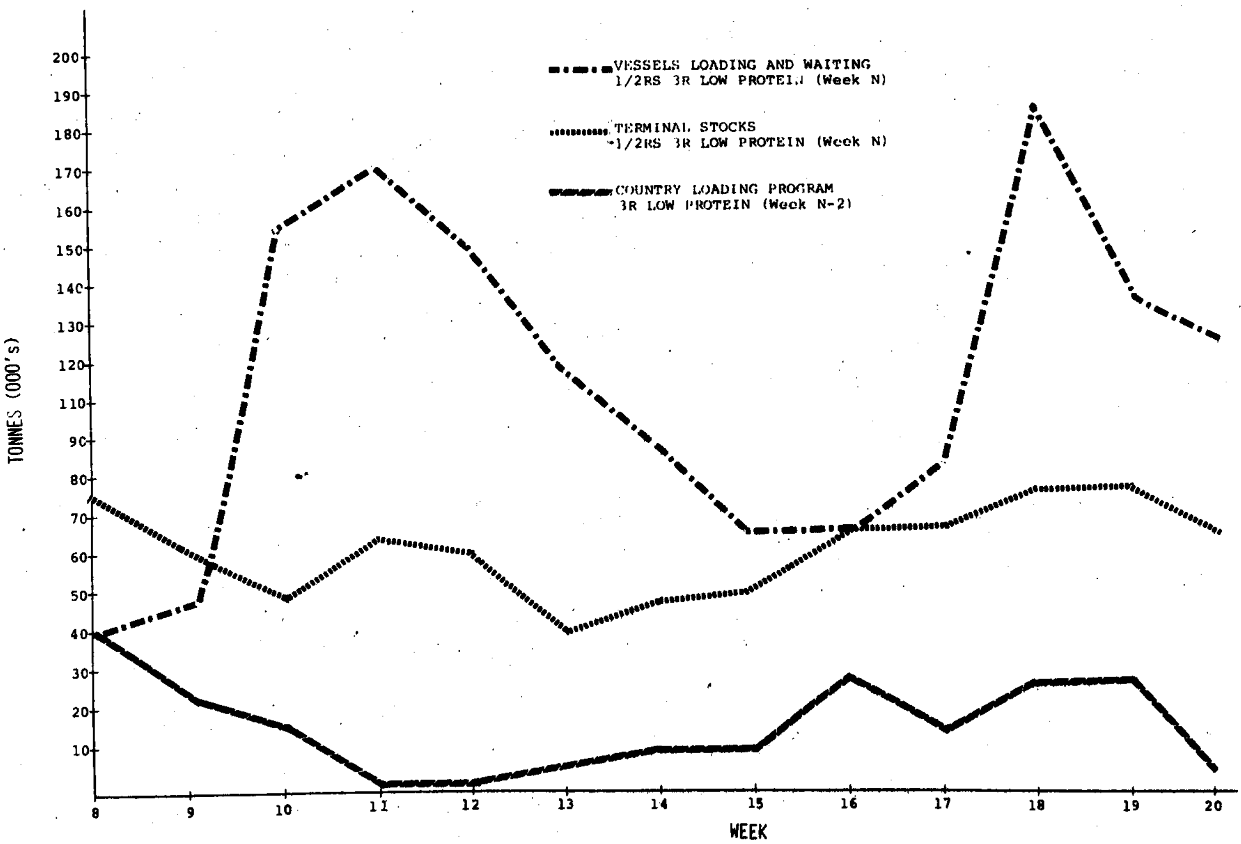
- Were terminal stocks sufficient to meet the demand?
- Did the terminal elevators unload cars quickly enough?
- Did the railways deliver enough cars?
- Was the country loading program sufficient to support this demand or were other types and grades or ports given preference?

(1) Low Protein Case Indicates Country Loading Program Was Inadequate

There were two critical peak periods when the vessels slated to carry low protein wheat experienced inordinate delays. The first peak period began during week 9 and continued through week 14. There was a hiatus of two weeks and the second peak period began during week 17 and continued through week 20.

As seen in Exhibit B-7, the terminal stocks inventory for these particular grain types and grades ranged over the first surge from a high of 65,000 tonnes to a low of 40,000 tonnes. During the next surge, stocks ranged from a high of 77,000 tonnes to a low of 63,000 tonnes. Based on vessel demands which ranged during the respective periods from lows of 50,000 and 85,000 tonnes to

EXHIBIT B-7
Vancouver Case Study
Low Protein 78/79 Crop Year



highs of 170,000 and 185,000 tonnes, it appears that the terminal stocks were not sufficient to handle the influx of vessel arrivals.

One of the obvious reasons for insufficient terminal stocks is the inability of the terminal elevators to unload rail cars. Therefore, an analysis was undertaken of daily rail car unloadings (plotted on a weekly basis) by grain type and grade for low protein and all types and grades of grain which can be seen in Exhibit B-8.

The average daily unload rate for low protein was relatively constant through week 14 when the unload rate rose to its peak in week 17. Assuming an average load per car of 62 tonnes for low protein grain, the daily unload rate was approximately 7,500 tonnes or 37,500 tonnes per week throughout the 11 week period.

This is roughly equivalent to one or two shiploads. On the other hand, average daily unloads for all grains including the low proteins was 433 carloads. At 60 tonnes per car, the daily unload rate was near 26,000 tonnes per day or 130,000 tonnes per week. This figure would approximate six vessel loads.

The preceding analysis seems to indicate that unloading rates for cars hauling low protein grain did not satisfy the terminal stocks replenishment demands. This could have been caused by two factors: (1) the unloading rate was less than normal, or (2) there were not enough cars available.

The unloading problem led to the question as to whether the railways delivered an adequate number of cars to be unloaded. To determine the railway deliveries, it was decided to analyze loads on hand in the same period. Loads on hand include those cars that have at least arrived at the major receiving yards within Vancouver or may be in place at the terminal elevators. Unfortunately, it was not possible to determine the loads on hand by grain type. Nevertheless, a fix on the actual numbers from which general conclusions can be drawn can be obtained. Exhibit B-9 shows the average numbers by day for the current crop year. Assuming an average load of 60 tonnes per car, the average tonnes on hand in rail cars varied between 66,000 and 99,000.

EXHIBIT B-8
Daily Average Rail Car Unloads
Vancouver, 78/79 Crop Year

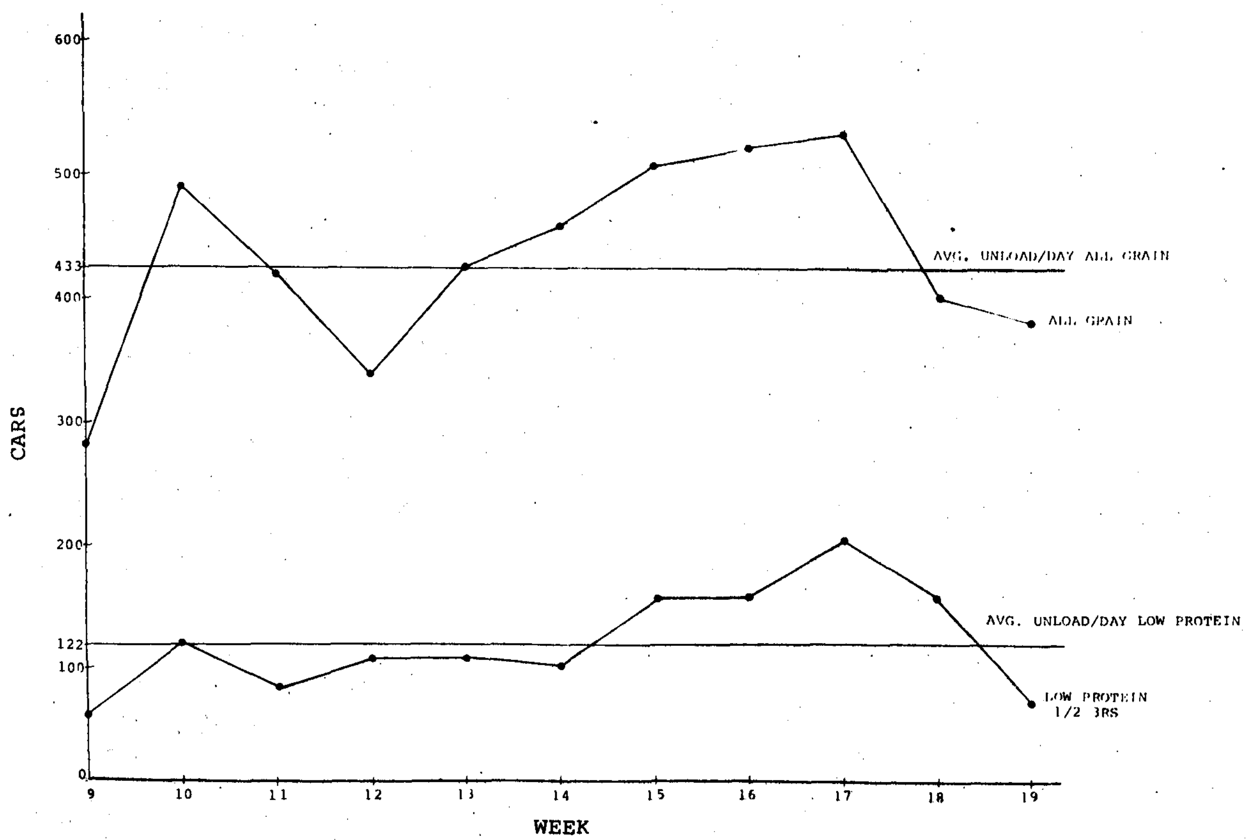
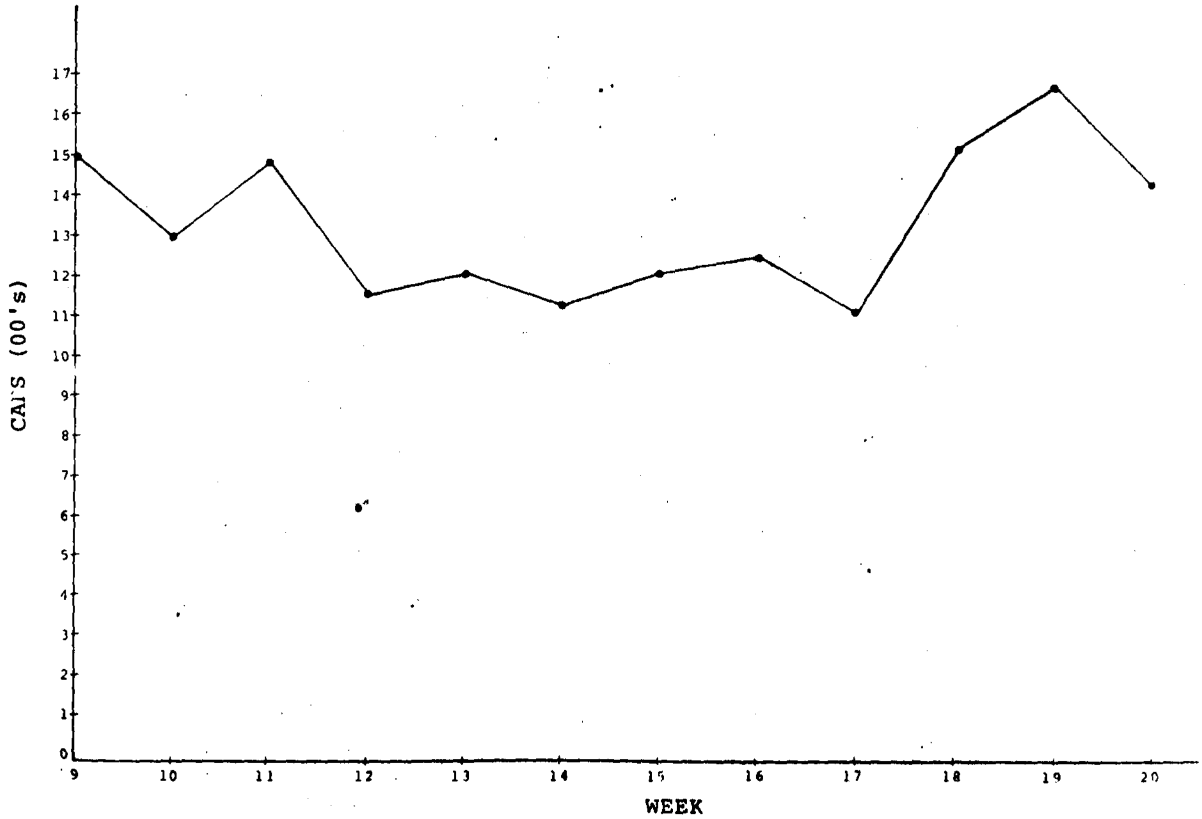


EXHIBIT B-9
Daily Average Rail Cars on Hand
Vancouver, 78/79 Crop Year



This analysis cannot answer the question as to whether low protein levels were satisfactory. Still, the loads-on-hand figures imply that railway deliveries were sufficient to meet normal unloading demands.

A means of understanding what might be contained in the loads on hand is to review the country loading program.

The country loading program as plotted on Exhibit B-7 takes into account an average two-week lag from authorized loading in the country to unloading at the port terminal by showing the country program two weeks earlier. The country loading program for 3CWRS wheat remained constant or declined during the surge periods. In the first instance, the program declined from a high of 40,000 tonnes in week 9 to a low of approximately 800 tonnes in week 13. Then it fell to its lowest level during the next week, but it rose sharply the following week. This loading program remained relatively fixed in the latter period at the 20,000 tonnes range except for week 20 when it fell to 5,000 tonnes.

The implication of this analysis is that the level of terminal stocks coupled with the declining country loading program was not sufficient to cover the increased demand brought upon by the influx of new ship arrivals.

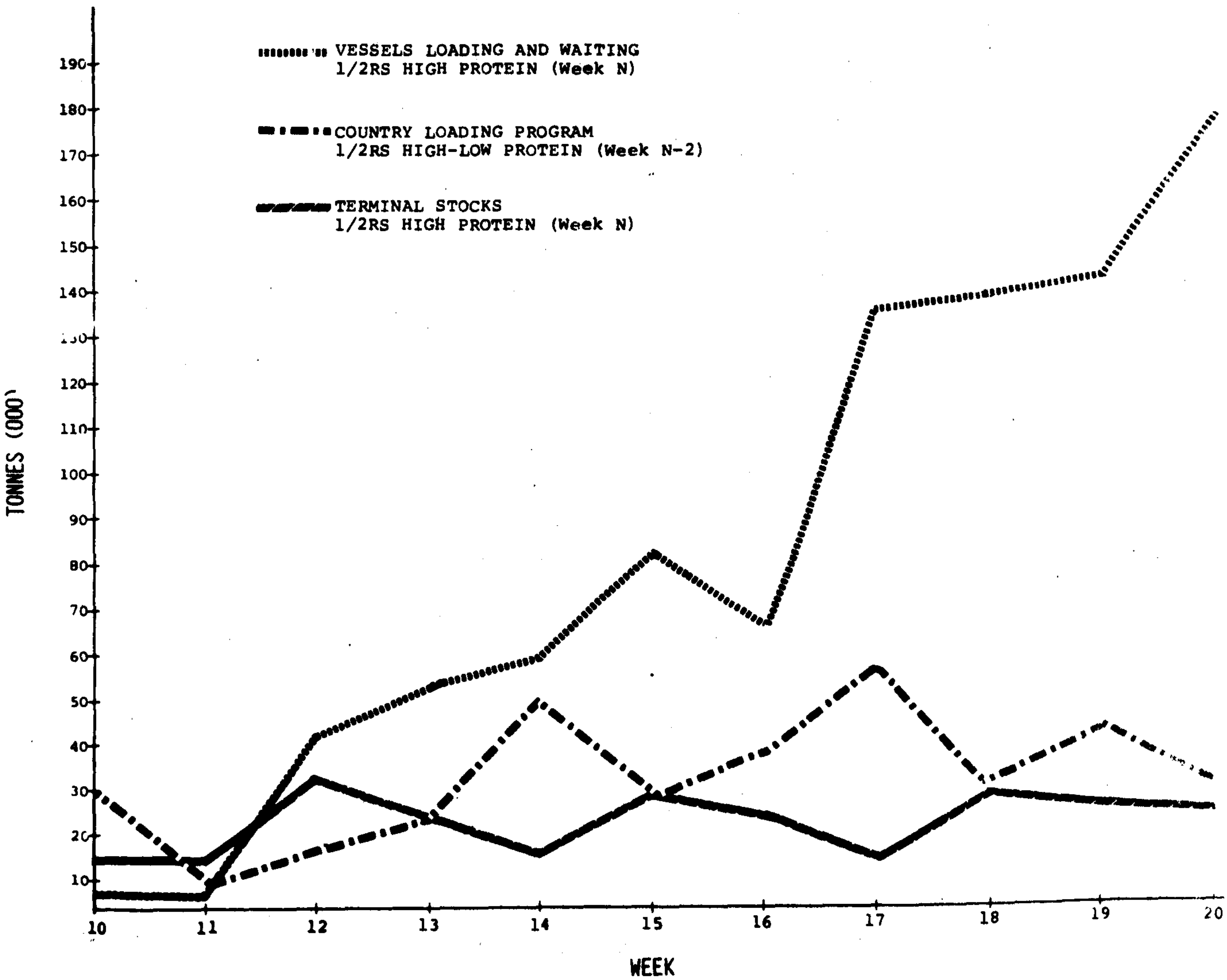
Considering the low level of terminal stocks, it does not appear that the country loading programs were increased enough to handle the surge at the port. This lack of response may have been due in part to allowing insufficient lead time in the weekly car ordering process and to discretionary looseness in filling planned car orders (due to car shortfalls), as discussed more fully in Chapter IX.

(2) High Protein Case Reflects Urgent Needs at Thunder Bay

A similar analysis was performed for high protein grains. Exhibit B-10 highlights the findings.

Problems similar to those impacting the low protein grain beset the high protein grain as well. Terminal stocks inventory was low compared to the vessel demand and the country loading program could not offset the

EXHIBIT B-10
Vancouver Case Study
High Protein 78/79 Crop Year



shortage. In fact, the program declined for part of the problem period. It should be noted that during this period country stocks normally destined for the West Coast were shifted to Thunder Bay. This decision was deemed necessary to fulfill commitments before the closing of the Great Lakes and the St. Lawrence Seaway.

4. THE VANCOUVER CASE STUDY ILLUSTRATES THE DYNAMICS OF THE GRAIN LOGISTICS SYSTEM

In essence, a number of factors contributed to the buildup of vessels in Vancouver, particularly during the latter peak period. Additional vessel arrivals in an already congested port delayed ships seeking high and low protein grains. However, it turns out that vessel loadings for other types and grades of grain were taking place at the same time. Also, terminal stocks were low considering demand. As previously mentioned, part of this problem might have been rectified if stocks normally destined for the West Coast had not been sent to Thunder Bay.

In addition, unloading rates were below normal due partly to the labor problems. Finally, the country loading programs and grain delivery rates for these types and grades were substantially less than required during the critical periods.

The case study suggests several issues which are analyzed in greater detail in the technical report:

- If ship arrival patterns are random, do the contracts provide adequate notification of estimated time of arrival (ETA)? This is discussed in Chapter VII.
- Is the response time of the logistics system such that reasonable ETA's for ships can be used effectively to update planning of the flows to the port, or must the cars be ordered before a reasonable ETA can be expected? This is discussed in Chapter IX.
- Is the information on country stocks sufficiently precise as to grades and probable protein levels to permit matching car orders to expected ship arrivals? This is also discussed in Chapter IX.

- Are there enough cars? This is discussed in Chapter VIII.

- Are car shortages and shortfalls, plus lack of sufficient forward planning and inadequate inventory management decision rules, frustrating the planning process so completely that control is lost? These factors are also discussed in Chapter IX.

- Are car arrivals delayed due to low priorities for grain movement on congested main lines and yards, and provisions of locomotives? This is discussed in Chapter VIII.

- Can car unloadings and cleaning and drying at the terminal elevators be speeded up to increase throughput at the elevators and speed of ship loading? This is considered in Chapter VII.

- Will future volumes make the present problems more acute? This is discussed in Chapter III.

- Are the other ports subject to the same concerns as Vancouver? This is covered in Chapter VII.

APPENDIX C

GRAIN TRANSPORT AND HANDLING MODEL

To better analyze the dynamic interactions of the various elements of the grain handling and transportation system, a computer model was developed to simulate the effects of alternative strategies on the various key elements and on the operation of the overall system. Through the use of this model, the impact of changes in parameters and operating strategies can be tested. By making a number of runs of this model, the effects of many different changes can be measured individually or in combination.

1. THE MODEL WAS CODED IN SIMSCRIPT

Various computer languages were investigated as to their suitability. SIMSCRIPT was chosen because it combined the advantages of a simulation language for speed coding, the ability to include Fortran inserts and the ability to use the same model on many different computers.

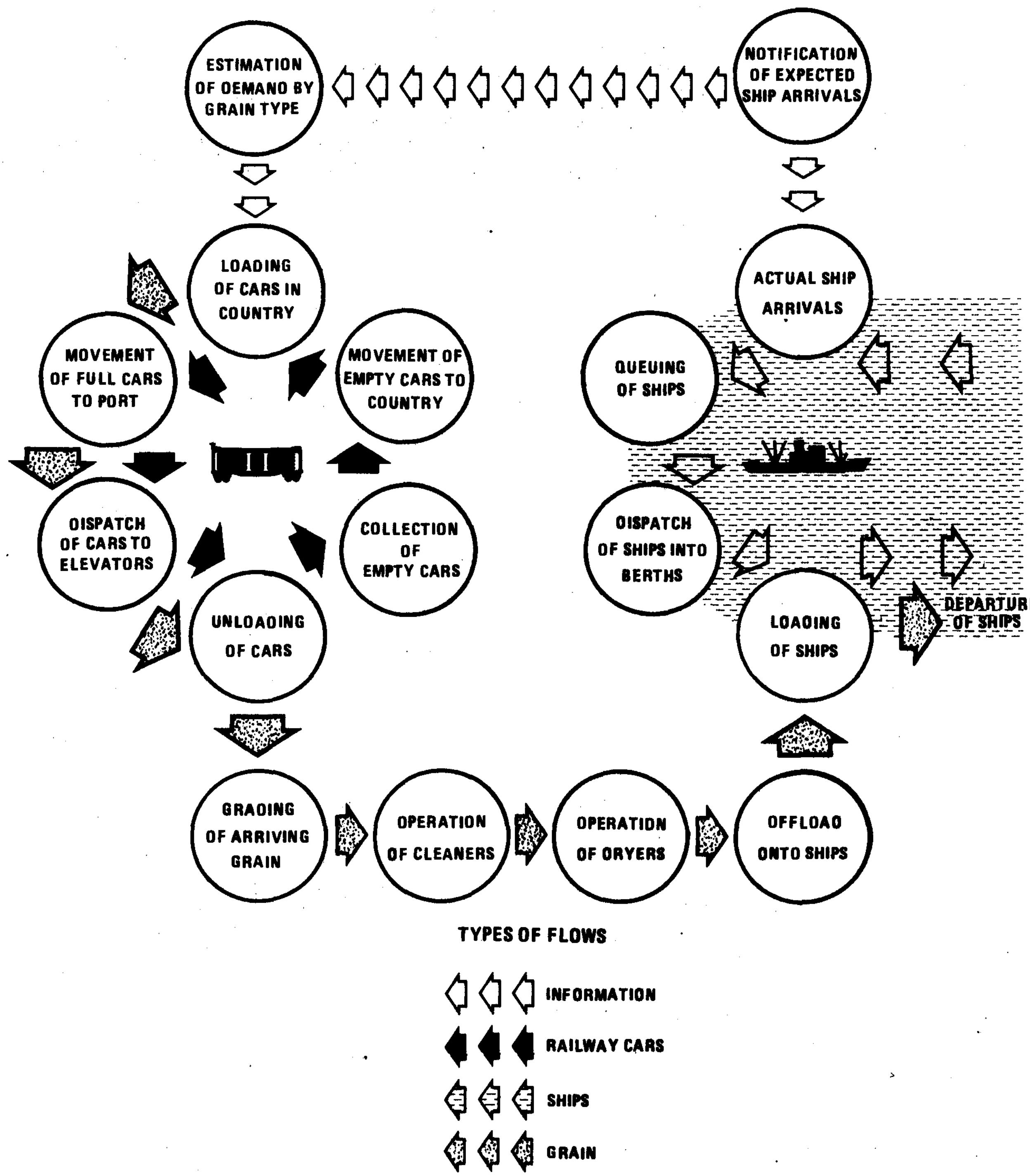
The resulting model turned out to be some 3,000 statements long, written entirely in SIMSCRIPT. The actual runs of this model were made on a Cyber 174 computer.

Although the basic logic of this system had to conform with the logic of the grain handling system, various elements of the system are defined by parameters which can be changed from run to run. This also allows the model to be used for various ports and in various years, with different combinations of facilities, without having to alter the model logic or recompile the code.

Exhibit C-1 shows the four basic flows within the model:

- Information flows, which combined with knowledge of the system status at any time, are used to estimate grain requirements and set the parameters for the loading program in the country
- Rail cars which are tracked through the system from loading to unloading and back to the country loading point again

EXHIBIT C-1
Principal Flows Within the Model



- Ships which arrive, either wait or are dispatched to a berth and are finally loaded with grain
- Grain which is loaded in the railway cars in the country, unloaded in the ports, passes through various processes in terminals, including cleaning and drying, and is loaded onto ships.

2. THE LOGIC OF THE MODEL

The model while detailed in its critical elements is nevertheless a somewhat simplified representation of a very complex system. It is organized into three major sections as follows:

- Country ordering and loading
- Railway movement
- Port operations.

(1) Country Ordering and Loading

The country part of the model calculates the cars to be loaded weekly in accordance with the demand by grain type as foreseen through expected ship arrivals over the next few weeks. The ordering process distinguishes between two types of demand, the tonnage required to fill ship orders over a given time horizon, and extra weeks of supply for specified grains which are shipped when railway car capacity is available. On a daily basis the actual number of cars loaded is constrained by the availability of empty cars, and the daily capacity of both the railways to spot and pick-up cars, and the primary elevators to load cars. Trains or cuts of cars with minimum and maximum numbers of cars specified for each railway are made up each day.

(2) Railway Movement

After loading, trains proceed to the port over two types of route, first the collection or feeder network of rail lines and then over the "main line." Travel time from the loading point to the main line is estimated by choosing a time randomly from an input distribution of times; this simulates the movement of grain cars from many different inland points and the apparent inconsistency in travel times between different groups of cars.

Once trains reach the main line no passing is allowed, and there are capacity limitations at various points along the lines. The line itself is broken into a number of sections (specified by the user); capacity limits on the number of cars which may enter each section within a 24-hour period and speed distribution are specified for each section.

Movements on the lines carrying cars back from the ports are simulated in exactly the same way. Similarly, the travel times of empty cars from the end of the main line to country loading points are drawn randomly from a specified distribution.

All of these parameters can be changed at any time during the period being simulated to indicate changes in status or seasonal variations. In addition a special subroutine, called "Avalanche," allows service to be interrupted on any line for a specified period.

(3) Port Operations

Port operations are simulated in five main areas:

- Dispatch of cars to elevators and unloading of cars
- Cleaning of grain
- Drying of grain
- Loading of grain onto ships
- Movement of ships into and out of the port.

Cars are dispatched to elevators in a way designed to minimize the interchanges between railways to the extent possible, although cars carrying "directed" grains must be unloaded at the terminals specializing in these grains. There are two dispatching algorithms available; the first sends cars to terminals (in proportion to the unload capacity and the space available) in the order in which they arrive, and the second dispatches cars by the relative priority (ships awaiting grain of that type) of the grain requirements by grade and type at each terminal. As the cars are unloaded two decisions are made on the contents. First, the grade and type of the grain is determined by a random draw from a probability distribution specified for each grain type ordered. And, secondly, the condition of the grain (dirty-dry, dirty-wet, clean-dry, or clean-wet) is similarly randomly determined from a specified distribution of probabilities. Empty cars are collected from the terminals and formed into trains to travel along the lines of each railway. Dispatch of full cars to the elevators and assembly of empty cars into trains takes place at times specified by the user. Unloading hours and rates are also inputs to the simulation. Cleaning in each terminal is set by two priorities: first, to keep the dryers busy; and, second, to clean grain required for ships already berthed at this terminal. Hours of operation and cleaning rates are specified for each terminal.

The dryers are scheduled in accordance with the priority to load ships in berth. Hours and rates are specified. Ship loading takes place again at specified rates and hours. If the grain is cleaned and dried, it is loaded onto ships. If more than one vessel is berthed at a terminal, the loading rate for each is reduced.

Dispatch of ships into available berths takes place only at specified intervals. Ships that can receive all or a greater part of their load at a particular terminal are dispatched into berths before ships which can receive a smaller proportion. Otherwise, the order of ships is set by their arrival order. Ships occupying a berth, but not loading, can be bumped out.

3. CONSIDERABLE INPUTS ARE REQUIRED

Because of the complex nature of the system being modeled, many different parameters are required as input. In addition to these input parameters, starting conditions must also be specified. The major parameters are:

- The number and types of grain to be considered. In addition, if a particular grain or grade is to be handled by only one terminal in a particular run, then the terminal handling it must be specified. Also, certain grains are used to fill inventory if excess railway capacity is available. The grains to be treated thus must also be specified.

- Demand calculation parameters. The model will attempt to order inventory for a specified number of weeks of expected arrivals and then, if rail capacity is still available, it will order an additional number of weeks of supply for the grain types specified as being eligible to be used to fill inventory. Both of these numbers of weeks are parameters and must be specified.

- Days of the week on which loading cars takes place in the country.

- Number of railway lines between the Prairies and the port to be simulated.

- For each railway, the maximum number of cars that can be loaded in a working day.

- The number of car types operated by each railway.

- For each car type, the name, loading capacity, and number of cars to be used in this model run.

- For each railway line, full and empty lines are treated as separate routes, the number of individual sections to be simulated on each line must be given as well as the minimum and maximum speed on each section of line.

- Entry restrictions giving the maximum number of the cars which can enter each section per day.

- For each railway, a distribution of travel times from the loading points to the beginning of the lines to the port. This simulates the process where cars are loaded at many different points and have varying travel times. There is a similar distribution that must be specified for each railway for travel times from the end of the line back to the country loading points.

- The number of ports to be simulated in one run.

- The number of terminal elevators in each port.

- For each elevator, the travel times from each railway for cars dispatched from the main receiving yard. Similarly, the travel time of empty cars from each elevator back to the railway companies must be specified.

- For each elevator, the offloading, cleaning, drying, and car unloading rates must be supplied as well as the day of week and hours of operation of each function.

- The number of times and the hours when full cars are dispatched from the receiving yards to the various elevators and when empty trains are formed up.

- The type of dispatch algorithm to be used.

In addition to the various parameters, a number of initial conditions may also be supplied to start the model run in a loaded position. These initializations may include:

- Inventories and condition of grain in each elevator

- Starting point of the railway cars, including the grain contained in each car if in the loaded part of the movement

- Ships present at the beginning of the simulation

- Expected demand at the beginning of the simulation.

4. COMPREHENSIVE OUTPUT IS ALSO PROVIDED

Two main types of output are produced by the simulation:

- Simulation statistics providing information on the activities of the various components of the model over a given period of time

- Snapshots giving the exact status of the system at a particular point in time.

The main information provided in the simulation statistics are:

- Cycle times for rail cars, both in total and for various segments of their operation
- The total amount of grain handled by the various components of the system, including loading, unloading, processed in the elevators, loaded into ships, and on departing ships
- The progress of ships through the system
- The degree of utilization of various processes in individual elevators.

The snapshot includes information on all cars including their exact location, the contents of each by grain type, and the location of all the trains. In addition the snapshot provides information on the number of cars which have entered a particular section of line to that point in the given day and the average speed of trains on each section of the line on the day. For each terminal elevator, the volume and condition of all grain is specified as well as the number of cars and their contents waiting to be unloaded. The status of all ships is also reported including those waiting in a queue, at berth and loading, and at berth idle. In addition to newly arrived ships waiting, there may be partially loaded ships which could not complete loading waiting in the queue.

5. FOUR MODEL RUNS WERE PERFORMED

Four runs of the model were made. These were sufficient to show that this is a valuable tool which can be used to assess the impact of various changes in methods of operation or in operational parameters of the system.

(1) A 1978 Base Case Replicated Actual System Performance

First a simulation of the actual behavior of the system in the year 1978 was made. This run used the actual ship arrivals in 1978 to represent demand and the car supply actually used in that year. Terminal capacities were those estimated by the consultant team during the course of this project. The results of this run indicated that the system was adequately represented by the various parameters used.

(2) Three 1985 Model Runs Were Made

For 1985 three runs of the model were made for operations to Vancouver and the lines to and from Vancouver. All of these runs assumed that top of the high volume of movement through the West Coast would be required and that there would be no major improvements in Prince Rupert; therefore, 14 million tons would be required to move through the port of Vancouver. For the first case, the 1978 car supply was used; for the next two cases, the increased 1985 car requirements as calculated for the top of the high forecast and present cycle times were provided. For the first two runs, the operational parameters of the terminal elevators in 1985 as estimated during the course of this study were used. In these runs it was found that these were not adequate for the volume of grain expected to be handled. Accordingly, in the third case, various operational improvements that were indicated by the results of the first two cases were assumed to be made. In all three cases, the 1978 line capacities were used.

The results of these three 1985 cases can be summarized as follows:

- In the first case, the car supply was not adequate, grain could not be moved to the port fast enough, and by the end of the simulation a queue of over 200 ships had built up.

- In the second case with an adequate car supply, it was found that the terminal throughput was not sufficient and by the end of the simulation a queue of 100 ships had built up.

- In the third case, the limiting factor turned out to be line capacity. In this case many railway cars were queuing on the lines. Ship queues were relatively stable ranging from 20 to 30 ships. At one point a queue of 50 ships was built up.

The results of these runs indicate that unless fairly major improvements are made to terminal facilities on the West Coast and/or to the rail lines leading to Vancouver, the volume of grain projected as the top of the high forecast cannot be handled even if adequate cars are supplied.

APPENDIX D

LOADED PORTION OF CAR CYCLE ANALYSIS

An analysis of the loaded portion of the railway car cycle was carried out, based on data provided by the Canadian Wheat Board (CWB). The CWB data is presented to place the various port, season, and railway aspects of the car cycle into perspective. The railway specific data as cited in Chapter V focuses on the third quarter times which represent the higher volume period which establishes the requirements for number of cars.

1. THE WHEAT BOARD PROVIDED LOADED CYCLE DATA FOR ALL RAILWAYS

The Canadian Wheat Board provided details on individual cars originated by the four railways: Canadian Pacific (CP), Canadian National (CN), Northern Alberta (NAR), and Great Slave Lake (GSL). The CWB records begin with the authorization to load a car and include the load and unload times by:

- Point of origin (block and railway)
- Grain (type and grade, loaded and unloaded)
- Destination (each port and all other destinations).

From this data comparisons can be made of the cycle time for cars authorized to load, authorized to unload, and the load to unload times.

The four season sample from the CWB included 112,452 loaded car records:

Season	No. Cars	% of Total
Winter	17,769	16
Spring	27,255	24
Summer	39,588	35
Fall	27,840	25
TOTAL	112,452	100%

SOURCE: Canadian Wheat Board block audit files, 4-month sample (winter, spring, summer, fall 1978)

The average loaded portion of the car cycle time for all records in the sample was 11.2 days. This overall car day index provides information useful in identifying delays in the loaded movement to the port. The problems and opportunities for improving car handling come to light by examining differences by destination (port), season and railway.

- Port comparisons—Exhibit D-1A shows a bar graph comparing the overall average (11.2 days) to the average loaded car cycle by port. The table below shows the characteristics of the samples:

Destination	Average Days*	Number Of Cars	% of Sample
Thunder Bay	10.2	68,196	61
Vancouver	12.7	30,653	27
Prince Rupert	14.1	4,858	4
Churchill	12.8	3,961	4
Other**	10.9	4,784	4
TOTAL	11.2	112,452	100%

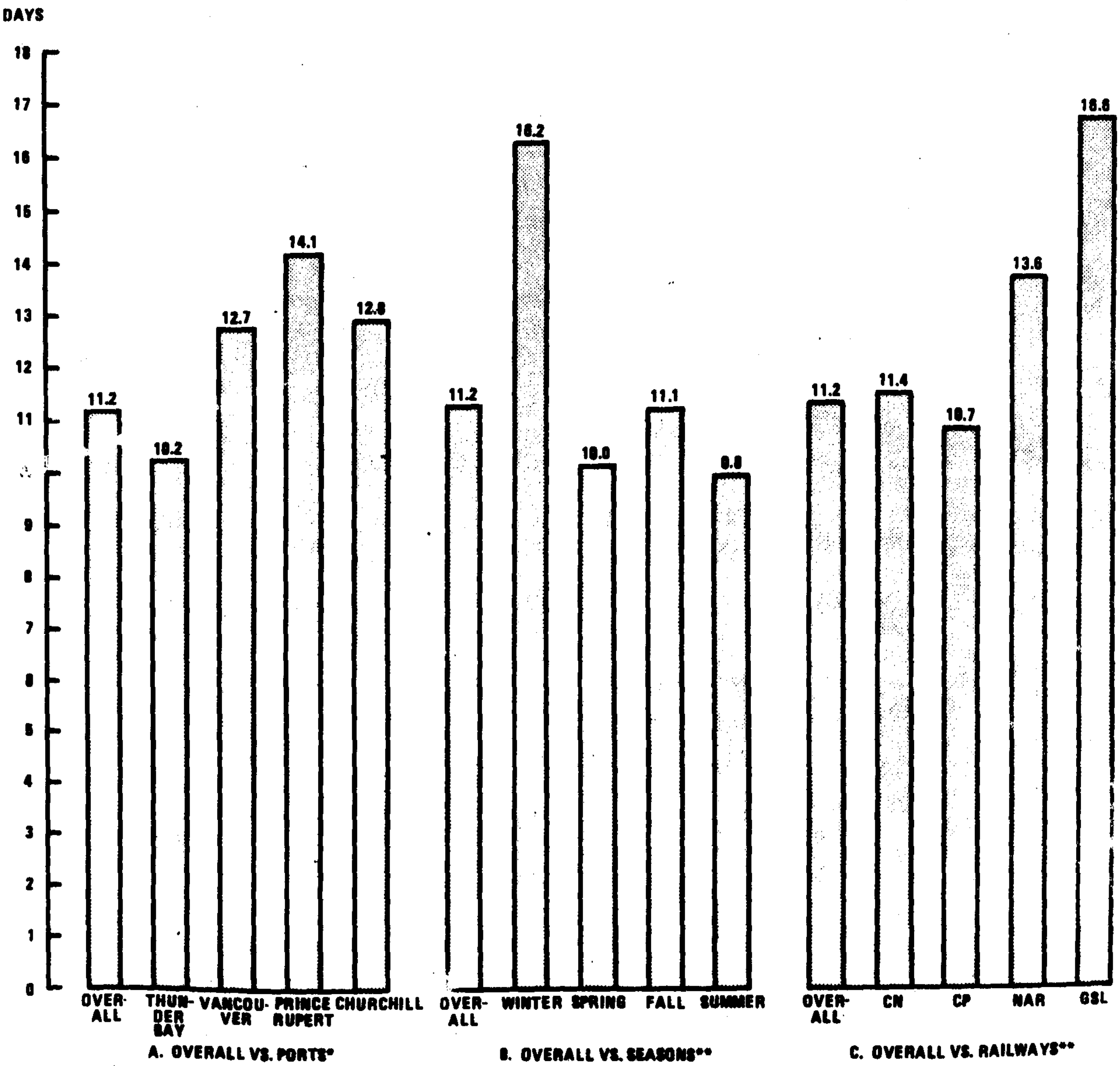
- Season comparisons—Exhibit D-1B shows a bar graph comparing the overall loaded car cycle (11.2 days) to the average by season. The table below shows the season sample.

Season	Average Days*	Number Of Cars	% of Sample
Winter	16.2	17,769	16
Spring	10.0	27,255	24
Summer	9.8	39,588	35
Fall	11.1	27,840	25
TOTAL	11.2	112,452	100%

As expected, the time in the winter exceeds the average—by five days or more.

* Weighted average.
** Domestic mills, etc.

EXHIBIT D-1 (A,B,C)
Loaded Component of Car Cycle



*THREE-SEASON WEIGHTED AVERAGE
**FOUR-SEASON WEIGHTED AVERAGE

- Railway comparisons—Exhibit D-1C shows a bar graph comparing the overall loaded car cycle to the averages by railway. The table below shows the railway sample:

Railway	Average Days*	No. of Cars	% of Sample
CN	11.4	48,967	43
CP	10.7	58,522	52
NAR	13.6	4,425	4
GSL	16.6	538	1
TOTAL	11.2	112,452	100%

  The relatively longer times for the NAR and the GSL are most likely due to the distance and the requirements for interchange of cars to reach destination. CP is less than the overall average by 0.5 days and lower than CN by 0.7 days.

In summary, the comparison of the 11.2 days overall average to the ports, seasons and railways shows:

- Port — Thunder Bay below the average loaded cycle (at 10.2 days)

- Season — winter elapsed times (16.2 days) are five days greater than the average

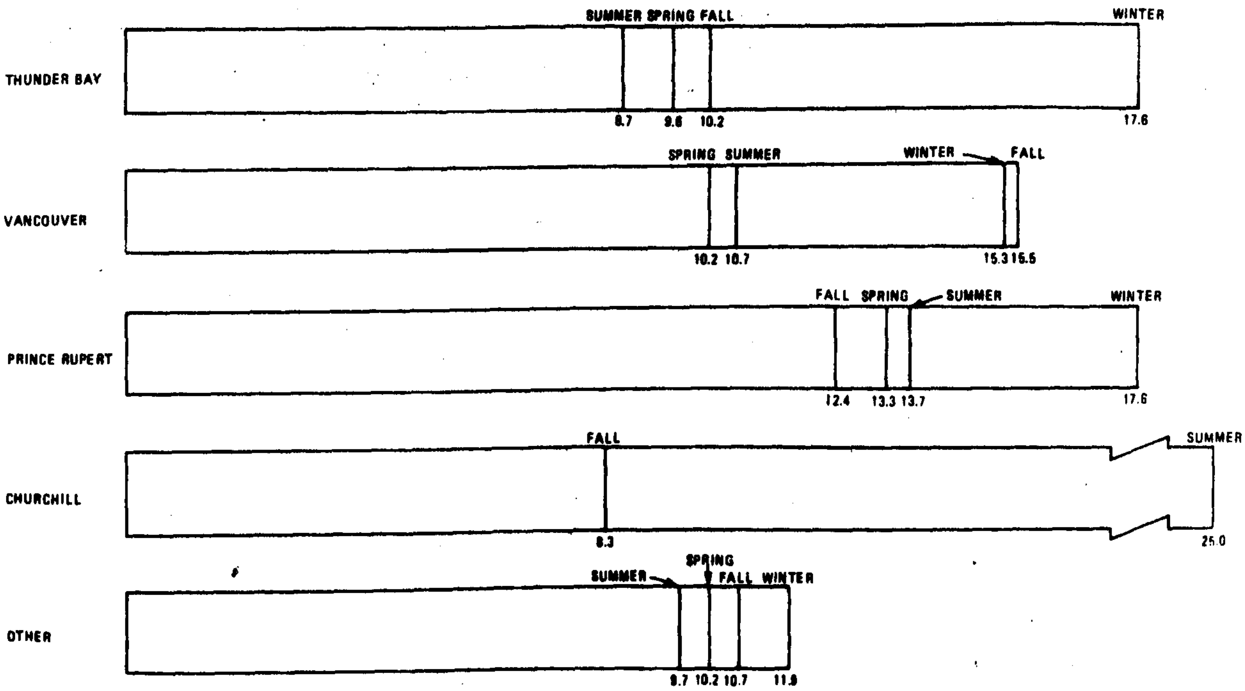
- Railway — CP cycles are less than the average by 0.5 days.

The following analyses cover differences in average loaded cycle time by port for the seasons and railways. The purpose of these analyses is to raise questions which may be answered by a detailed examination of the car cycle events.

- Port and season comparisons—by examining the information in terms of ports and seasons, additional insight is gained in understanding the loaded car cycle. Exhibit D-2 shows a bar graph of the port/season relationships.

* Weighted average.

EXHIBIT D-2
Loaded Car Cycle
Port and Season



The table below shows the averages by port:

	Winter	Spring	Summer	Fall	Port Average
Thunder Bay	17.6	9.6	8.7	10.2	10.2
Vancouver	15.3	10.2	10.7	15.5	12.7
Prince Rupert	17.6	13.3	13.7	12.4	14.1
Churchill*	-	-	25.0	8.3	12.8
Other**	11.9	10.2	9.7	10.7	10.9
Season Average	16.2	10.0	9.8	11.1	-

- Port and railway comparison—Exhibit D-3 shows a graphic presentation of the differences by destination and railway. This breakdown shows the following:

  - Thunder Bay (average 10.2 days):

	Days	% of Cars
CN	10.3	41
CP	9.9	58
NAR	14.7	1
GSL	16.3	-

Since the NAR and GSL are about one percent, their relatively long cycles take on less importance and probably reflect the distances involved.

  - Vancouver (average 12.7 days):

	Days	% of Cars
CN	12.6	36
CP	12.5	53
NAR	13.3	10
GSL	16.7	1

Except for GSL, the similarity of times seems to indicate that railway differences may not be important to the analyses of loaded cycles to Vancouver.

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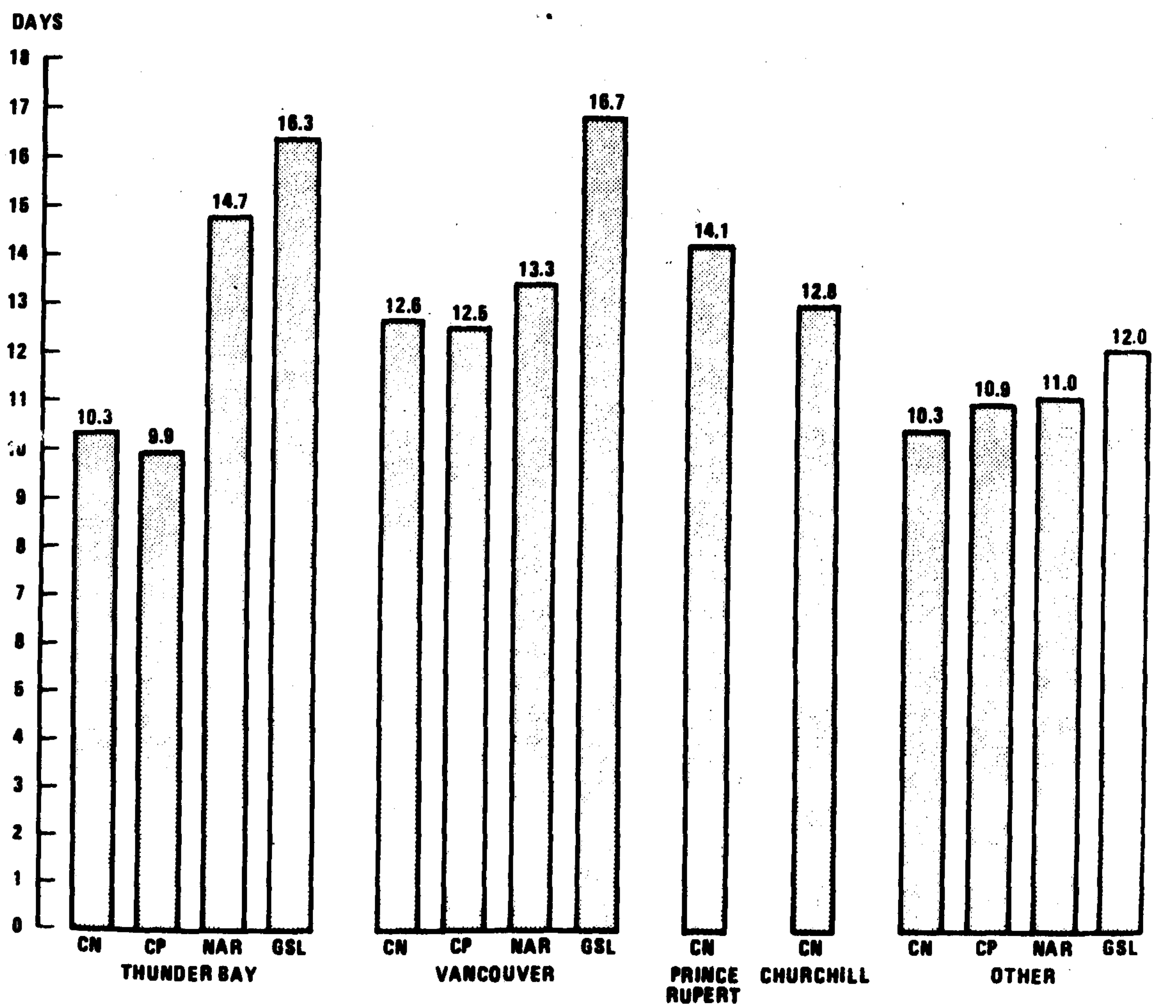
* Churchill data exists for only summer and fall periods.
** Domestic mills, etc.

EXHIBIT D-3
Destination/Railway
Loaded Component
Load to Unloaded Weighted Average
For Four Seasons



- Prince Rupert and Churchill are served only by CN.

- Other destinations* (average 10.9 days):

Railway	Days	% of Cars
CN	10.3	32
CP	10.9	65
NAR	11.0	3
GSL	12.0	-

There is very little variation in the elapsed times to other destinations when the data is examined by railway.

* Domestic mills, etc.

APPENDIX E

GRAIN CAR FLOW ANALYSIS

Grain car flow analysis can be defined as the study of elapsed car movement times from primary elevator to terminal elevator. It is fundamentally a comparison of the actual grain car movement times and those times which are deemed to be inherently possible given a normal assignment of railway crews (Train and Engine, T&E) for the country, port and main line operations. The actual grain car movement times are derived from the car movement records. The object of the analysis is to estimate the potential for improving the efficiency of current rail operations as measured by the duration of loaded and empty car cycles.

It is of critical importance to the future success of grain movement to identify ways of expediting the flow of grain cars. There are two basic components to this problem:

- Car movement times inherent in scheduling crews to perform activities necessary for the movement of traffic between primary elevators and port terminal elevators

- Delays in excess of these inherent times attributable to failing to perform needed car processing activities in a timely manner, by utilizing the earliest available scheduled T&E resource.

The inputs required to perform this analysis are directly related to these components of the problem.

- Actual freight car movement times, of which there are three basic parts:

  - Country Handling—from the arrival as an empty car in the country area, on the train run for placement in the block, to the pick-up of loaded cars from the block to the train marshalling yard for main line train movement

  - Over-the-Road or Transit Movement—the time spent by loaded and empty cars moving over the main lines between the country areas and the ports

- Port Handling—the time spent in the port from arrival in the main yard, through movement to the terminal elevator for unloading, to movement back to the yard for empty train makeup

- A set of T&E resources and their respective activity assignments including:
  - Moving trains over the road
  - Yard switching and/or classification
  - Transferring cars from yard to yard
  - Interchange moves within the terminal area
  - Elevator service schedules
  - Geographic configuration of facilities and assignment area

- Historic volume statistics related to:
  - The distribution of arriving cars from road trains and interchange, at the point of terminal entry, over the course of the business day
  - The distribution of cars departing by road trains and interchange, at the point of dispatch from the terminal, over the course of the business day.

The analysis is performed by comparing the actual car movement time for a large number of actual moves to the estimates of the time inherently possible for the same movements, given the specified T&E resource set. The difference between the two is assumed to be the maximum excess delay due to the inefficiency of the actual operation.

To make this comparison within a port, the port area is subdivided into numerous Crew Work Zones (CWZ's), which can be defined as locations having regularly scheduled service to an elevator or elevators. Each CWZ generally has a specific, identifiable sequence of activities by which cars are delivered to elevators after arrival, and taken from the elevator, after unload, for dispatch. Knowing the schedule for the availability of crews to perform the sequence of activities necessary, one can calculate an estimate of time required to complete the activities necessary to close out a movement cycle.

Each activity is assumed to take one trick to accomplish, although some exceptions are allowed. For example, if a car is transferred between two yards during the first trick, it cannot become available to begin its next activity until the next or second trick. This assumption permits one to construct estimates of elapsed time that are generous enough to reflect the complex nature of railroad operations.

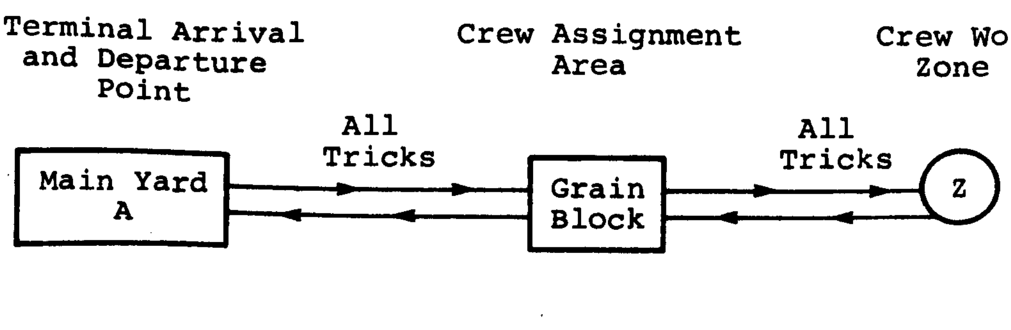
*   *   *   *   *

The following is an example of how to manually compute the inherent car flow for a hypothetical Crew Assignment Area (CAA), or starting location. The calculation of inherent car flow times from origin primary elevator to the destination elevator involves the same basic process strung out across Western Canada.

A Crew Work Zone (CWZ) is usually one of many served by crews from the same CAA. Each work zone should have a unique set of elapsed movement times reflecting its own service characteristics. All zones associated with a single CAA, however, should have similar inherent time values, and their times may be computed as a group for that Crew Assignment Area.

<u>Typical Assumptions</u>:

- Cars arriving at Main Yard A can be classified on any trick.
- Cars can be transferred between Main Yard A and the CAA-Sub Yard on any trick.
- Cars can be delivered or picked up on any trick for customers in the Crew Work Zone, Z.



Format for Computing Inherent Car Flow

A-1 Distribution of Main Yard Arrivals by Trick

Time	Trick	No. of Cars	% of Total
by 0300 hrs.	3	70	31.8
by 1100 hrs.	1	50	22.7
by 1900 hrs.	2	100	45.5
	TOTAL	220	100 %

A-11 Distribution of Main Yard Departures by Trick

Time	Trick	No. of Cars	% of Total
by 0700 hrs.	3	90	42.9
by 1500 hrs.	1	70	33.3
by 2300 hrs.	2	50	23.8
	TOTAL	210	100 %

Format for Computing Inherent Car Flow (cont.)

Inbound Cycle Matrix

Crew Assignment Area: Port Q   Crew Work Zone: Z

Place of Arrival: Main Yard A

Switching Schedule: 3 [X] 1 [X] 2 [X]

Transfer Schedule to CAA: 3 [X] 1 [X] 2 [X]

Service Scheduled for Zone Z: 3 [X] 1 [X] 2 [X]

Trick of Arrival	Day 1			Day 2			Day 3			No. of Elapsed Tricks
	3	1	2	3	1	2	3	1	2	
3	X	H	T	D						3
1		X	H	T	D					3
2			X	H	T	D				3

KEY

X = Arrived
H = Classified or Train Break-Up
T = Transferred
D = Delivered

Format for Computing Inherent Car Flow (cont.)

Outbound Cycle Matrix

Crew Assignment Area: Port Q   Crew Work Zone: Z

Place of Arrival: Main Yard A

Switching Schedule: 3 [X] 1 [X] 2 [X]

Transfer Schedule to CAA: 3 [X] 1 [X] 2 [X]

Service Scheduled for Zone Z: 3 [X] 1 [X] 2 [X]

Trick of Release	Day 1			Day 2			Day 3			No. of Elapsed Tricks
	3	1	2	3	1	2	3	1	2	
3	R	P	T	H	A					4
1		R	P	T	H	A				4
2			R	P	T	H	A			4

KEY

R = Released
P = Pulled
T = Transferred
H = Classified or Train Break-Up
A = Available for Departure

Format for Computing Inherent Car Flow (cont.)

To calculate inherent car hours for a Crew Work Zone, the following steps must be taken:

Inbound - one step

For each trick do the following:

[No. of Tricks Arrival to Delivery] x [Hours/Tricks] x [% of Arrivals for that Trick]

Example:

Trick of Arrival	Elapsed Tricks		Hours/ Tricks		From A-1		
3	3	x	8	x	.318	=	7.63
1	3	x	8	x	.227	=	5.45
2	3	x	8	x	.455	=	10.92
					TOTAL	=	24.00

Average Hours - Arrival to Industry Placement = 24.00 Hours

Outbound - two steps

Step I

For each trick do the following:

(a) Find trick for which cars become available for departure.

(b) Use the distribution of Main Yard departures to allocate the cars available for departure over trains leaving the terminal within 24 hours after completion of last classification or handling.

Format for Computing Inherent Car Flow (cont.)

Example

Trick of Release = 3

No. of Tricks - Release to Available = 4

Trick Cars Released Become Available = 1

Revised Elapsed Tricks for Cars Released Third Trick

$4 \times A\text{-}11_1 = 4 \times .333 = 1.33$

$(4+1) \times A\text{-}11_2 = 5 \times .238 = 1.19$

$(4+2) \times A\text{-}11_3 = 6 \times .429 = \underline{2.57}$

5.09 tricks

Trick of Release = 1

No. of Tricks - Release to Available = 4

Trick Cars Released Become Available = 2

Revised Elapsed Tricks for Cars Released First Trick

$4 \times A\text{-}11_2 = 4 \times .238 = .95$

$(4+1) \times A\text{-}11_3 = 5 \times .429 = 2.15$

$(4+2) \times A\text{-}11_1 = 6 \times .333 = \underline{2.00}$

5.10 tricks

Format for Computing Inherent Car Flow (cont.)

Trick of Release = 2

No. of Tricks - Release to Available = 4

Trick Cars Released Become Available = 3

Revised Elapsed Tricks for Cars Released Second Trick

$4 \times A\text{-}11_3 = 4 \times .429 = 1.72$

$(4+1) \times A\text{-}11_1 = 5 \times .333 = 1.67$

$(4+2) \times A\text{-}11_2 = 6 \times .238 = \underline{1.43}$

4.82 tricks

Average Hours - Customer Release to Departure
Main Yard = 40.03 Hours

APPENDIX F

GRAIN BLOCK SERVICE PATTERNS

This appendix presents a summary of rail service by grain block. This data, which was compiled in November-December 1978 reflects the service normally offered at that time. The appendix shows specific rail services offered by subdivision within blocks including the minimum and maximum car requirements for a train run, the on-duty point, the service area, and the normal frequency of service and tricks served. This data has been used in several analyses covered in this report.

The information is presented by railway and by Region as follows:

Exhibit F-1 - CN Prairie Region
Exhibit F-2 - CN Mountain Region
Exhibit F-3 - CP Prairie Region
Exhibit F-4 - CP Pacific Region

In addition, Exhibit F-5 provides a list of train runs which could be altered to provide better service to the primary elevators located along each line.

EXHIBIT F-1
CN Rail Prairie Regional Blocks Service Patterns

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX*	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
WINNIPEG NORTH 1	OAK POINT	1.1 0/25	SYMINGTON / GYPSUMVILLE	3/WK	1ST/1ST
	INWOOD	1.2 15/20	SYMINGTON / HODGSON	1/WK	3RD/1ST
	PINE FALLS	1.3 0/9	SYMINGTON / PINE FALLS	5/WK	1ST/2ND
	WINNIPEG	1.4 0/0	TERMINAL	1-2/WK	1ST/3RD
	REDDITT	1.5 0/12	SYMINGTON / REDDITT	2-3/WK	1ST/1ST
	SPRAGUE	1.6 0/17	SYMINGTON / RAINY RIVER	2/WK	1ST/1ST
WINNIPEG SOUTH 3	LETELLIER	3.1 30/40	SYMINGTON / RIDGEVILLE	7/WK	1ST/1ST
	MIAMI	3.2 50/70	SYMINGTON / NOTRE DAME	1-2/WK	3RD/2ND
	CARMAN NO. 1	3.3 25/40	SYMINGTON / ROSEISLE	1/WK	3RD/2ND
	CARMAN NO. 2	3.4 30/35	SYMINGTON / WAKOPA (TRACKS RECENTLY TAKEN OUT OF SERVICE)	3/WK	3RD/2ND
WINNIPEG WEST 5	RIVERS NO. 1	5.1 25/35	SYMINGTON / PORTAGE	2/WK	3RD/2ND
	GLADSTONE	5.2 35/60	SYMINGTON OR DAUPHIN / PORTAGE-DAUPHIN	1/WK	1ST/1ST
	RIVERS NO. 1	5.3 20/30	SYMINGTON / PORTAGE-RIVERS	2/WK	3RD/1ST
	OAKLAND	5.4 15/30	SYMINGTON / PORTAGE-AMARANTH	5-7/WK	3RD/2ND
BRANDON NORTH 7	RAPID CITY	7.1 30/40	SYMINGTON / HALLBORO-BEULAH	2/WK	3RD OR 1ST/ 2ND OR 1ST
	NEEPAWA	7.2 20/30	SYMINGTON / STE. ROSE	2/WK	2ND/2ND
	ROSSBURN	7.3 30/40	SYMINGTON / NEEPAWA-RUSSELL	2/WK	3RD OR 2ND/ 2ND

* MIN = the number of cars the railway has designated it will require to make a train run.
MAX = the maximum number of cars the railway can handle on that train run.

EXHIBIT F-1
CN Rail Prairie Regional Blocks Service Patterns (Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
BRANDON WEST 9	HARTNEY	9.1 25/45	SYMINGTON / BELMONT	3/WK	3RD/2ND
	CROMER	9.2 55/70	BRANDON / KIPLING	1-2/WK	3RD/2ND
	LAMPMAN	9.3 24/35	BRANDON / MARYFIELD	2/WK	1ST/1ST
	WAWANESA	9.4 15/29	BRANDON / WAWANESA	1/WK	1ST/1ST
	BRANDON	9.5 0/0	LOCAL	1/WK	1ST/2ND
	PLEASANT POINT	9.6 6/6	BRANDON / ROSSENDALE-EDWIN	NO LONGER IN SERVICE	
	MARYFIELD	9.7 0/0	LOCAL	1/WK	3RD/2ND
	LAMPMAN	9.8 0/0	LOCAL	1/WK	1ST/1ST
MELVILLE 11	MELVILLE	11.1 0/0	LOCAL	2/WK	1ST/1ST
	RIVERS NO. 2	11.2 30/40	MELVILLE / RIVERS	6/WK	1ST/2ND
	MELVILLE YKTN.	11.3 30/35	MELVILLE / YKTN.-JEDBURGH	2/WK	3RD/2ND
	YKTN. CANORA	11.4 30/50	MELVILLE / CANORA-WROXTON	2/WK	1ST/2ND
	YKTN. MACNUTT	11.5 30/35	TONKIN MACNUTT	2/WK	1ST/2ND
DAUPHIN 13	DAUPHIN	13.1 0/0	LOCAL	1/WK	1ST/2ND
	TOGO	13.2 60/75	DAUPHIN / CANORA	3/WK	3RD/2ND
	SWAN RIVER	13.3 0/0	LOCAL	1/WK	1ST/2ND
	COWAN	13.4 25/35	DAUPHIN / SWAN RIVER	3/WK	1ST/1ST OR 2ND/2ND
	WINNIPEGOSIS	13.5 0/12	DAUPHIN / WINNIPEGOSIS	2/WK	1ST/2ND
	PREECEVILLE	13.6 35/45	CANORA OR SWAN RIVER / SWAN RIVER-STURGIS	3/WK	3RD OR 1ST/1ST
	ERWOOD	13.7 25/35	SWAN RIVER / HUDSON BAY	6/WK	1ST/1ST

EXHIBIT F-1
CN Rail Prairie Regional Blocks Service Patterns (Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
KAMSACK 15	CANORA	15.1 0/0	LOCAL	5/WK	1ST/1ST
	MARGO	15.2 40/65	CANORA HUMBOLDT	4-5/WK	1ST/1ST
	ASSINIBOINE	15.3 15/24	CANORA STURGIS-HUDSON BAY	5/WK	1ST/1ST
	THE PAS	15.4 0/0	CANORA LOCAL-THE PAS	1/WK	1ST/1ST
	CANORA-KELVINGTON	15.5 35/50	CANORA KELVINGTON	1/WK	3RD/2ND
SASKATOON MAIN 17	WATROUS	17.1 50/60	MELVILLE WATROUS	1/WK	1ST,2ND OR 3RD/ 2ND
	WATROUS LOCAL	17.2 0/0	WATROUS	6/WK	1ST/1ST
	WATROUS	17.3 50/60	WATROUS BIGGAR	6/WK	1ST/1ST
	SASKATOON	17.4 0/0	SASKATOON P8,H C6H	2/WK	1ST OR 2ND/ 1ST
SASKATOON SOUTH 19	CONQUEST	19.1 50/70	SASKATOON DELISLE-BEECHY	2/WK	1ST/2ND
	ELROSE	19.2 60/80	SASKATOON TICHFIELD-ESTON W.END ELROSE E.END	3/WK	1ST/2ND
SASKATOON WEST 21	ROSETOWN	21.1 60/85	SASKATOON KINDERSLEY	3/WK	3RD/2ND
	KINDERSLEY	21.2 0/0	LOCAL	3/WK	3RD/2ND
	ELROSE·WHITE BEAR	21.3 40/50	KINDERSLEY WHITE BEAR	3/WK	1ST/1ST
SASKATOON NORTH 23	DUCK LAKE	23.1 0/35	SASKATOON PR. ALBERT	6/WK	1ST/1ST
	CARLTON	23.2 25/40	SASKATOON MENNON-CARLTON	2/WK	1ST/2ND
	HUMBOLDT	23.3 0/0	LOCAL	7/WK	1ST/1ST
	ABERDEEN	23.4 40/50	HUMBOLDT DIXON-ABERDEEN	2/WK	1ST/1ST
	LANGHAM	23.5	WARMAN N. BATTLEFORD	2/WK	1ST/1ST
	NORTH BATTLEFORD	23.6 0/0	LOCAL	2/WK	1ST/1ST

EXHIBIT F-1
CN Rail Prairie Regional Blocks Service Patterns (Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
PR. ALBERT EAST 25	PR. ALBERT	25.1 0/0	LOCAL	AS REQ. 8/WK	1ST/1ST
	TISDALE	25.2 60/70	PR. ALBERT / MELFORT W.END HUDSON BAY E.END	3/WK	1ST/2ND
	ARBORFIELD	25.3 20/30	PR. ALBERT OR HUDSON BAY / NEW OSGOODE-ARBORFIELD	1-2/WK	1ST/2ND
	CHELAN	25.4 30/50	HUDSON BAY / MURPHYS-RESERVE	1-2/WK	1ST/2ND
PR. ALBERT SOUTH 27	ST. BRIEUX	27.1 65/75	HUMBOLDT / BROOKSBY	4/WK	1ST/1ST
	CUDWORTH	27.2 30/50	PR. ALBERT / WAKAW N.END MEACHAM S.END	1-2/WK	1ST/1ST
	MESKANAW	27.3 30/50	ABERDEEN / MELFORT	2/WK	1ST/1ST
PR. ALBERT WEST 29	AMIENS SHELLBROOK-MEDSTEAD	29.1 45/60	PR. ALBERT / MEDSTEAD-TURTLEFORD	1/WK	1ST/1ST
	ROBINHOOD	29.2 30/40	N. BATTLEFORD / SPEERS-MEDSTEAD	1/WK	1ST/1ST
	N. BATTLEFORD	29.3 34/60	N. BATTLEFORD / ST. WALBURG-PARADISE HILL	3/WK	1ST/1ST
	PADDOCKWOOD	29.4 20/25	PR. ALBERT / PADDOCKWOOD	1/WK	1ST/1ST
	BIG RIVER	29.5 35/50	HOLBEIN / BIG RIVER	2/WK	1ST/1ST
	BLAINE LAKE	29.6 55/85	N. BATTLEFORD OR PR. ALBERT / KRYDOR-N. BATTLEFORD	2/WK	1ST/2ND
SASKATOON EAST 31	CRAIK	31.1 65/85	SASKATOON / REGINA	2/WK	3RD/2ND
REGINA SOUTH 33	GLENAVON	33.1 30/50 20/25	REGINA / KIPLING N.END CORNING BR. S.END	7/WK	1ST/1ST
	LEWVAN	33.2 30/60	REGINA / LAMPMAN S.END LEWVAN N.END	4/WK 2/WK	2ND/2ND OR 1ST/1ST
	WEYBURN	33.3 20/25	REGINA / TALMAGE-RADVILLE	4/WK	2ND/2ND
	GOODWATER	33.4 15/20	REGINA / RADVILLE-GOODWATER	2/WK	1ST/1ST
	BENGOUGH	33.5 45/60	REGINA / RADVILLE-WILLOWBUNCH	1-2/WK	2ND OR 3RD/ 2ND

EXHIBIT F-1
CN Rail Prairie Regional
Blocks Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
REGINA SOUTH (CONTINUED)	REGINA	33.6 0/0	LOCAL	2/WK	1ST/1ST
	QUAPPELLE	33.7 40/60	MELVILLE REGINA	1/WK	3RD/2ND
REGINA WEST 35	REGINA-M. JAW	35.1 0/25 25/30	REGINA M. JAW E.END MAWER W.END	1-2/WK 3/WK	1ST/2ND 1ST/2ND
	RIVERHURST	35.2 20/30	REGINA MAWER-RIVERHURST	1-2/WK	3RD OR 1ST/ 3RD OR 1ST
	MAIN CENTRE	35.3 25/30	REGINA MAWER-MAIN CENTRE	1/WK	1ST/2ND
	AVONLEA	35.4 50/70	REGINA M. JAW-RADVILLE	1-2/WK	1ST OR 2ND/ 1ST OR 2ND
	GRAVELBOURG	35.5 50/70	REGINA AVONLEA-NEIDPATH	2/WK	1ST OR 2ND/ 1ST OR 2ND

EXHIBIT F-2
CN Rail Mountain Region
Service Patterns

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
BIGGAR NORTH 37	PORTER	37.1 20/40	BIGGAR CANDO	1/WK	1ST/1ST
	BLACKFOOT	37.2 60/0	NO. BATTLEFORD VERMILION	1/WK	1ST/1ST
	CUT KNIFE	37.3 20/45	NO. BATTLEFORD GALLIVAN	NO LONGER IN SERVICE	
BIGGAR WEST 39	WAINWRIGHT EAST	39.1 65/85	BIGGAR UNITY E.END WAINWRIGHT W.END	2/WK E.END 1/WK W.END	1ST/1ST 1ST/1ST
	BODO	39.2 25/40	BIGGAR BODO	AS REQ. 1-2/WK	1ST/1ST
	DODSLAND	39.3 45/50	BIGGAR HEMARUKA	AS REQ. 2-3/WK	1ST/1ST
EDMONTON NORTH 41	VEGREVILLE	41.1 60/85	CALDER VERMILION	1-2/WK	1ST/2ND
	CORONADO	41.2 45/90	CALDER HEINSBURG	3/WK	1ST/1ST
	BONNYVILLE	41.3 20/30	CALDER GR. CENTRE	AS REQ. 1-2/WK	1ST/1ST
EDMONTON SOUTH 43	WAINWRIGHT WEST	43.1 65/85	CALDER WAINWRIGHT	1/WK	1ST/1ST
	CAMROSE	43.2 50/65	CALDER MIRROR	2/WK	1ST/1ST
	ALLIANCE	43.3 35/60	CALDER ALLIANCE	1/WK	1ST/1ST
EDMONTON WEST 45	EDMONTON	45.1	CALDER GOVT. ELEVATOR	5/WK	1ST/1ST
	EDSON	45.2 30/60	CALDER EDSON	2-3/WK	1ST/1ST
	SANGUDO	45.3 20/60	CALDER WHITECOURT	6/WK	1ST/1ST
	ATHABASCA	45.4 40/55	CALDER ATHABASCA	1/WK	1ST/1ST

EXHIBIT F-2
CN Rail Mountain Region
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
HANNA SOUTH 47	OYEN	47.1 60/85	HANNA KINDERSLEY	1-2/WK	1ST/1ST
	MANTARIO	47.2a 40/60	HANNA KINDERSLEY	1-2/WK	1ST/1ST
	ACADIA VALLEY	47.2b 20/20	HANNA KINDERSLEY	1-2/WK	1ST/1ST
	SHEERNESS	47.3 4/12	HANNA CESSFORD	NO LONGER IN SERVICE	
	DRUMHELLER	47.4 60/85	HANNA SARCEE YARD	1/WK	1ST/1ST
HANNA WEST 49	STETTLER-ENDIANG	49.1/2 40/60	HANNA CAMROSE	1/WK	1ST/2ND
	THREE HILLS	49.3 65/85	MIRROR SARCEE YARD	1-5/WK	3RD/1ST
	BRAZEAU	49.4 35/60	MIRROR ROCKY MT. HOUSE	3/WK	1ST/1ST

EXHIBIT F-3
CP Rail Prairie Region Service Pattern

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
KEEWATIN 61	KEEWATIN	61.1 8/11	WINNIPEG KEEWATIN	5/WK	2ND/2ND
	LAC DU BONNET	61.2 16/19	WINNIPEG LAC DU BONNET	1/WK	1ST/1ST
	EMERSON	61.3 1/42	WINNIPEG EMERSON	1/WK	1ST/1ST
	WINNIPEG TERMINAL	61.4 9/13	WINNIPEG LOCAL AREA	5/WK	1ST/1ST
	WINNIPEG BEACH	61.5 6/17	WINNIPEG RIVERTON	1/WK	1ST/1ST
	ARBORG	61.6 25/36	WINNIPEG ARBORG	1-2/WK	3RD/2ND
LA RIVIERE 62	LA RIVIERE	62.1 30/100	WINNIPEG LA RIVIERE	3/WK	1ST/1ST
	GRETNA	62.3 0/30	WINNIPEG GRETNA	2/WK	1ST/1ST
	SNOWFLAKE	62.4 9/22	WINNIPEG SNOWFLAKE	2/WK	1ST/1ST
	GLENBORO	62.5 61/116	WINNIPEG SOURIS	3/WK	1ST/1ST
	LYLETON	62.6 20/40	SOURIS DELORAINE DALNY	1/WK	3RD/2ND
	NAPINKA	62.7 65/139	SOURIS NAPINKA-CRYSTAL CITY CLEAR WATER	1-3/WK	3RD/2ND
CARBERRY 63	CARBERRY	63.1 30/60	WINNIPEG BRANDON	2/WK	1ST, 2ND, OR 3RD
	MINNEDOSA	63.2 18/38	PORTAGE LA PRAIRIE MINNEDOSA	2/WK	3RD/2ND
	LENORE	63.3 0/0	BRANDON FOREST LENORE	2/WK	1ST/1ST
	MINIOTA	63.4 18/35	BRANDON MINIOTA	2/WK	1ST/1ST
	BREDENBURY	63.5 25/85	WINNIPEG BREDENBURY	2/WK	3RD/2ND
	RUSSELL	63.6 12/23	BREDENBURY BINSCARTH-INGLIS	3/WK	3RD/2ND

EXHIBIT F-3
CP Rail Prairie Region
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
BRANDON 64	BROADVIEW	64.1 12/23	BRANDON / BROADVIEW	2/WK	3RD/2ND
	ESTEVAN	64.2 42/83	BRANDON / SOURIS N. END ESTEVAN S. END	5-7/WK N. END 4/WK S. END	1ST/2ND 3RD/2ND
	NEUDORF	64.3 69/161	BRANDON / VIRDEN-NEUDORF	1-3/WK	3RD/2ND
WEYBURN 71	ARCOLA	71.1 50/100	SOURIS / ARCOLA	1/WK	1ST/1ST
	KISBEY	71.2 10/40	WEYBURN OR REGINA / ARCOLA E. END STOUGHTON W. END	AS REQ E. END 2-3/WK W. END	1ST/1ST 1ST/1ST
	PORTAL-WEYBURN INLAND N. PORTAL ESTEVAN CITY HITCHCOCK-HALBRITE	71.3 10/40	WEYBURN / ESTEVAN	AS REQ. 2/WK	1ST/1ST
	BROMHEAD	71.4 20/70	ESTEVAN / MINTON	4/WK	1ST/1ST
	ASSINIBOIA	71.5 25/75	WEYBURN / ASSINIBOIA	4/WK	1ST/1ST
	AMULET	71.6 0/20	WEYBURN / AMULET CARDROSS	1-2/WK	1ST/1ST
PASQUA 72	INDIAN HEAD	72.1	MOOSE JAW / BROADVIEW	1-3/WK	2ND OR 3RD
	TYVAN	72.2	REGINA / STOUGHTON	AS REQ. 2/WK	1ST/1ST
	NORTH PORTAL	72.3 40/90	WEYBURN / MOOSE JAW	3/WK	1ST/1ST OR 2ND
BULYEA 73	BULYEA	73.1 35/70	REGINA / BULYEA-NEUDORF	2/WK	1ST/1ST
	LANIGAN	73.2 40/80	REGINA / LANIGAN	3/WK	1ST/1ST
	COLONSAY	73.3 30/60	COLONSAY / DILKE	5/WK	1ST/1ST
BREDENBURY 74	WYNYARD	74.1 0/120	WYNYARD / BREDENBURY	3/WK	1ST/1ST
	TISDALE	74.2 0/90	GOUDIE / NIPAWIN	3/WK	1ST/1ST
	WISHART	74.3 20/25	WYNYARD / WISHART	1-2/WK	1ST/1ST
	WHITE FOX	74.4 18/23	PRINCE ALBERT / NIPAWIN	3/WK	1ST/1ST

EXHIBIT F-3
CP Rail Prairie Region
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
SASKATOON 75	SUTHERLAND	75.1 0/120	SASKATOON WYNYARD	3/WK	1ST/1ST
	MELFORT	75.2 33/45	LANIGAN MELFORT S.END GRONLID N.END	1/WK S.END 3/WK N.END	1ST/2ND
	PRINCE ALBERT	75.3 0/75	LANIGAN PRINCE ALBERT	6/WK	1ST/1ST
	MEADOW LAKE	75.4 0/20	PRINCE ALBERT MEADOW LAKE	3/WK	1ST/1ST
	WILKIE	75.5 10/29	SASKATOON OR WILKIE WILKIE OR SASKATOON	AS REQ. 2/WK	2ND/2ND
	ASQUITH	75.6 22/25	SASKATOON (SUTHER-LAND SONNINGDALE	AS REQ. 1/WK	1ST/1ST
WILKIE 76	REFORD	76.1 20/25	WILKIE KERROBERT	AS REQ. 1/WK	1ST/2ND
	KELFIELD	76.2 20/25	WILKIE KELFIELD	AS REQ. 1/WK	1ST/1ST
	LLOYDMINSTER	76.3 0/110	WILKIE LLOYDMINSTER	3/WK	1ST/1ST
	FURNESS	76.4 17/20	LLOYDMINSTER PARADISE VALLEY	2/WK	1ST/1ST
	MACKLIN	76.5	WILKIE MACKLIN	AS REQ. s/WK	1ST/2ND
	HARDISTY	76.6 0/120	WILKIE[E] HARDISTY[W] HARDISTY[E] WILKIE[W]	7/WK	1ST/1ST
	BIG GULLY	76.7	LLOYDMINSTER HILLMOND	NO LONGER IN SERVICE	
ASSINIBOIA 77	FIFE LAKE	77.1 20/40	ASSINIBOIA CORONACH	3/WK	1ST/2ND
	COLONY	77.2 10/20	ASSINIBOIA KILLDEER	0-1/WK	1ST/1ST
	WOOD MOUNTAIN	77.3 25/50	ASSINIBOIA MANKOTA	2/WK	1ST/1ST
	SHAUNAVON	77.4 60/120	ASSINIBOIA SHAUNAVON	5/WK	1ST/3RD
	NOTUKEU	77.5 30/60	SHAUNAVON NOTUKEU-VAL MARIE	E W 5/WK	1ST, 2ND OR 3RD
	ALTAWAN	77.6 0/60	SHAUNAVON MANYBERRIES	E W 5/WK	1ST, 2ND OR 3RD

E EASTBOUND
W WESTBOUND

EXHIBIT F-3
CP Rail Prairie Region
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
SWIFT CURRENT 78	SWIFT CURRENT	78.1 N/A	MOOSE JAW E / SWIFT CURRENT W	2/WK E	2ND/2ND
			SWIFT CURRENT E / MOOSE JAW W	2/WK W	2ND/2ND
	DUNELM	78.2 N/A	SWIFT CURRENT / SIMMIE	2/WK	1ST/1ST
	EXPANSE	78.3 N/A	MOOSE JAW / ASSINIBOIA	1-2/WK	1ST/1ST
	VANGUARD	78.4 N/A	SWIFT CURRENT / MEYRONNE	2/WK	1ST/1ST
	SHAMROCK	78.5 N/A	MOOSE JAW E / SWIFT CURRENT W	2/WK E	2ND/2ND
			SWIFT CURRENT E / MOOSE JAW W	2/WK W	2ND/2ND
OUTLOOK 79	OUTLOOK	79.1 N/A	MOOSE JAW / TUGASKE / OUTLOOK	3-4/WK	1ST/1ST
	KERROBERT	79.2 N/A	OUTLOOK / KERROBERT	3/WK	1ST, 2ND OR 3RD
	MCMORRAN	79.3 N/A	OUTLOOK / MATADOR	1/WK	1ST/1ST
	MATADOR	79.4 N/A	OUTLOOK / MATADOR	1/WK	1ST/1ST

E EASTBOUND
W WESTBOUND

EXHIBIT F-4
CP Rail Pacific Region Service Patterns

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
MEDICINE HAT 81	EMPRESS	81.1 N/A	SWIFT CURRENT[E] EMPRESS[W]	1/WK[E]	3RD/2ND
			EMPRESS[E] SWIFT CURRENT[W]	2/WK[W]	3RD/2ND
	PENNANT	81.2 N/A	SWIFT CURRENT VERLO	AS REQ. 1/WK	2ND/2ND
	BURSTALL	81.3 N/A	SWIFT CURRENT[E] EMPRESS[W]	1/WK[E]	2ND/2ND
			LEADER-FOX VALLEY	1/WK[W]	3RD/2ND
	MAPLE CREEK	81.4 N/A	MEDICINE HAT[SP] SWIFT CURRENT[L] SWIFT CURRENT[SP] MEDICINE HAT[L]	1/WK	2ND/1ST
	HATTON	81.5 N/A	MEDICINE HAT GOLDEN PRAIRIE	1/WK	1ST/1ST
BROOKS 82	STRATHMORE	82.1 N/A	CALGARY STRATHMORE	1/WK	1ST/1ST
	BROOKS	82.2 N/A	CALGARY BROOKS	2/WK	1ST/1ST
	LANGDON	82.3 N/A	CALGARY COSWAY[W. END] E. COULEE[E. END]	2/WK	1ST/1ST
	ACME	82.4 N/A	CALGARY COSWAY-WIMBORNE	1/WK	1ST/2ND
	BASSANO	82.5 N/A	CALGARY BASSANO-EMPRESS	1/WK	1ST/2ND
	IRRICANA	82.6 N/A	CALGARY BROOKS STANDARD	2/WK	1ST/1ST
	ROSEMARY	82.7 N/A	CALGARY ROSEMARY- GEM	1/MOS	1ST/1ST
LETHBRIDGE 83	TABER	83.1 N/A	LETHBRIDGE MEDICINE HAT	2/WK	3RD/3RD
	CARDSTON	83.2 N/A	LETHBRIDGE GLENWOOD	1-2/WK	1ST/1ST
	WOOLFORD	NO LONGER IN SERVICE			
	STIRLING	33.4 N/A	LETHBRIDGE MANYBERRIES	2/WK	3RD/3RD
	COUTTS	83.5 N/A	LETHBRIDGE COUTTS	5/WK	1ST/2ND

E EASTBOUND
W WESTBOUND
SP SPOT
L LIFT

EXHIBIT F-4
CP Rail Pacific Region
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
VULCAN 84	ALDERSYDE	84.1 60/100	CALGARY / LETHBRIDGE	2/WK	1ST/1ST
	LOMOND	84.2 30/50	LETHBRIDGE / HAYS	2/WK	1ST/1ST
	TURIN	84.3 20/35	LETHBRIDGE / TURIN	1/WK	1ST/1ST
	MACLEOD	84.5 0/80	CALGARY / MACLEOD	2/WK	1ST/1ST
	CROWSNEST	84.6 0/35	LETHBRIDGE / CROWSNEST	1/WK	1ST/1ST
CALGARY 85	RED DEER	85.1 N/A	CALGARY / RED DEER	2/WK	3RD OR 2ND/1ST
	CROSSFIELD	NO LONGER IN SERVICE			
	ALBERTA CENTRAL	85.2 N/A	RED DEER / ALHAMBRA	AS REQ. 0-1/WK	1ST/1ST
RED DEER 86	LEDUC	86.1 N/A	S. EDMONTON N.END / RED DEER S.END / LEDUC	AS REQ. 2-3/WK	1ST/1ST
	HOADLEY	86.2 N/A	RED DEER	1-2/WK	1ST/1ST
	LACOMBE	86.3 N/A	RED DEER / LACOMBE-CORONATION	2/WK	1ST/2ND
	CORONATION	86.4 N/A	RED DEER / CORONATION-KERROBERT	1/WK	2ND/3RD OR 2ND
EDMONTON 87	WILLINGDON	87.1 N/A	S. EDMONTON / TWO HILLS W.END / LLOYDMINSTER E.END	2/WK	2ND/2ND
	VEGREVILLE	87.2 N/A	S. EDMONTON / WILLINGDON-WARWICK	AS REQ. 0-1/WK	1ST/1ST
	HOADLEY N.	87.3 N/A	S. EDMONTON / CALMAR-BRETON	1-2/WK	1ST/1ST
	WETASKIWIN	87.4 N/A	RED DEER / WETASKIWIN-HARDISTY	1/WK	3RD/2ND

EXHIBIT F-4
NAR and GSL Regional Blocks
Service Patterns
(Continued)

BLOCKS	SUBDIVISION	TRAIN RUN MIN/MAX	ON DUTY POINT / SERVICE AREA	FREQUENCY	TRICK OF SPOT/LIFT
NAR WEST 90	SY-12	90.1 N/A	MCLENNAN GIROUXVILLE	5/WK	3RD/2ND
	SY-13/14	90.2 N/A	TANGENT SPIRIT RIVER	5/WK	3RD/2ND
	VRI-12/14	90.3 N/A	MCLENNAN HINES CREEK	3/WK	1ST OR 2ND
	RA-11 AND TA-12	90.4 N/A	WOKING GRANDE PRAIRIE	5/WK	3RD/2ND
	RA-13/15	90.5 N/A	GRANDE PRAIRIE HYTHE	3/WK	2ND/1ST
NAR EAST 95	BD-1	95.1 N/A	DUNEVEGAN BARRHEAD	2/WK	1ST/1ST
	NY-1	95.2 N/A	DUNEVEGAN SMITH	2-3/WK	3RD/1ST
	SK-1/2	95.3 N/A	SMITH HIGH PRAIRIE	2-3/WK	2ND/2ND
	VR-1	95.4 N/A	BERWYN GAGE	3/WK	1ST OR 2ND
	B-1/2	95.5 N/A	DUNEVEGAN LAC LA BICHE	2/WK	3RD/1ST
GSL RAILWAY 98	GSL RAILWAY	98.1 N/A	ROMA JCT. HIGH LEVEL	2/WK	1ST OR 2ND

EXHIBIT F-5
Train Runs Which Show Potential for Country Service Improvements

CN		CP		NAR	GSL
1.1	27.1	61.1	77.5	90.5	98.1
1.2	29.3	61.4	77.6	95.1	
1.3	29.5	62.1	78.1	95.4	
1.4	29.6	62.3	78.2		
1.6	33.2	62.4	78.4		
3.1	33.3	62.5	78.5		
5.2	33.4	63.3	79.1		
5.3	35.1	63.4	79.2		
7.2	35.2	71.2	82.2		
9.3	35.4	71.3	82.3		
9.5	35.5	71.4	82.4		
9.8	37.2	71.5	82.5		
11.1	39.1	71.6	82.6		
11.2	39.3	72.1	83.2		
11.5	41.1	72.2	83.5		
13.1	41.2	72.3	84.1		
13.3	41.3	73.1	84.2		
13.4	43.1	73.2	84.5		
13.5	43.2	73.3	84.6		
13.6	43.3	74.1	86.1		
13.7	45.1	74.2	86.2		
15.1	45.2	74.3	86.3		
15.3	45.3	74.4	86.4		
17.2	47.1	75.1	87.3		
17.3	47.2	75.2			
17.4	47.4	75.3			
19.1	49.1	75.4			
19.2	49.3	76.1			
21.3	49.4	76.3			
23.2		76.4			
23.4		76.5			
23.6		76.6			
25.1		77.1			
25.2		77.3			
		77.4			

APPENDIX G

GRAIN BLOCK CAR CYCLE ANALYSIS

Detailed car cycle analyses were carried out for covered hopper movements to Vancouver, Prince Rupert, and Thunder Bay for seven grain loading blocks on each of the railways. In addition, the analysis covered box car movements to Churchill. Based on the actual car cycle data from the railways, a sample was taken to include various geographic areas and volume differences. Seven blocks (CN: 9, 13, 17, 21, 29, 41, 43; CP: 62, 72, 74, 78, 83, 84, 86) were selected from each railway. The actual cycle times were compared with cycle times reasonably inherent in the operations involved. Inherent time represents reasonable transit times possible to complete various components of the car cycle (such as arrive loaded to depart empty at the port, empty transit time, etc.) given existing operating patterns.

1. A SAMPLE OF SEVEN OF THE TWENTY-FIVE CN BLOCKS WERE EXAMINED IN DETAIL

Analyses were carried out on CN covered hopper movements for seven blocks (9, 13, 17, 21, 41 and 43) for movements to Vancouver, Prince Rupert and Thunder Bay. Analyses were also carried out on box car movements to Churchill. These grain blocks are shown on the map contained in the technical report. The descriptions and findings are cited below:

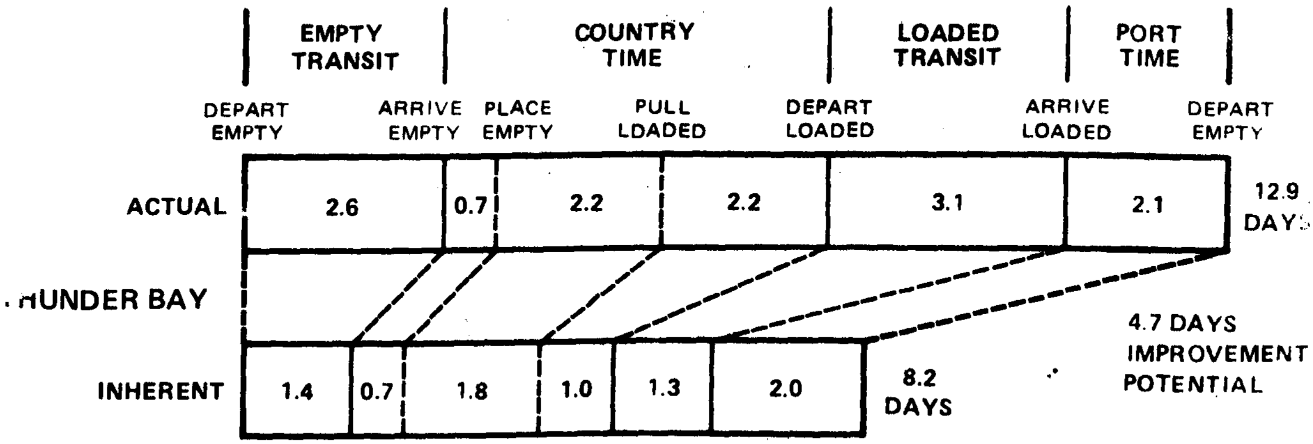
- Brandon West (Block 9) is located in southern Manitoba/Saskatchewan and is served mainly out of Brandon with an average service of twice a week to spot. There are eight "layover turn" train runs which generally place on third trick, tie up at the end of the line on first, and lift on second, which is the most efficient country service pattern. The preponderance of shipments are to Thunder Bay. As a result, the inherent versus actual car cycle comparison was not undertaken for the other ports. Empty cars are transferred to Winnipeg where they are switched and subsequently moved to Brandon via wayfreight or general merchandise trains. In some instances cars are run straight from Thunder Bay without a switch in Winnipeg.

Key Improvement Potential

Thunder Bay		Inherent vs. Actual
Empty Transit	-	1.2 Days
Pull to Depart	-	1.2 Days
Loaded Transit	-	1.8 Days
Others	-	0.5 Days
TOTAL		4.7 Days

Exhibit G-1 shows the comparison of inherent to actual car cycle times

EXHIBIT G-1
Car Cycle Times
CN Block 9



Dauphin (Block 13) is located in northern Manitoba/Saskatchewan and is served mainly out of Dauphin with some service from Swan River, with an average service of three times a week to spot. There are seven train runs that vary widely as to the tricks of service and whether turnaround or layover service is provided. The preponderance of shipments are to Thunder Bay and Churchill (in season). This block exhibits one of the largest geographical spreads in the Prairies. Considering its size, block 13 shows relatively good cycle performance to Thunder Bay which may be accounted for by frequency of empty and loaded car movements to and from Dauphin and the frequency of service for the primary elevators.

Key Improvement Potential

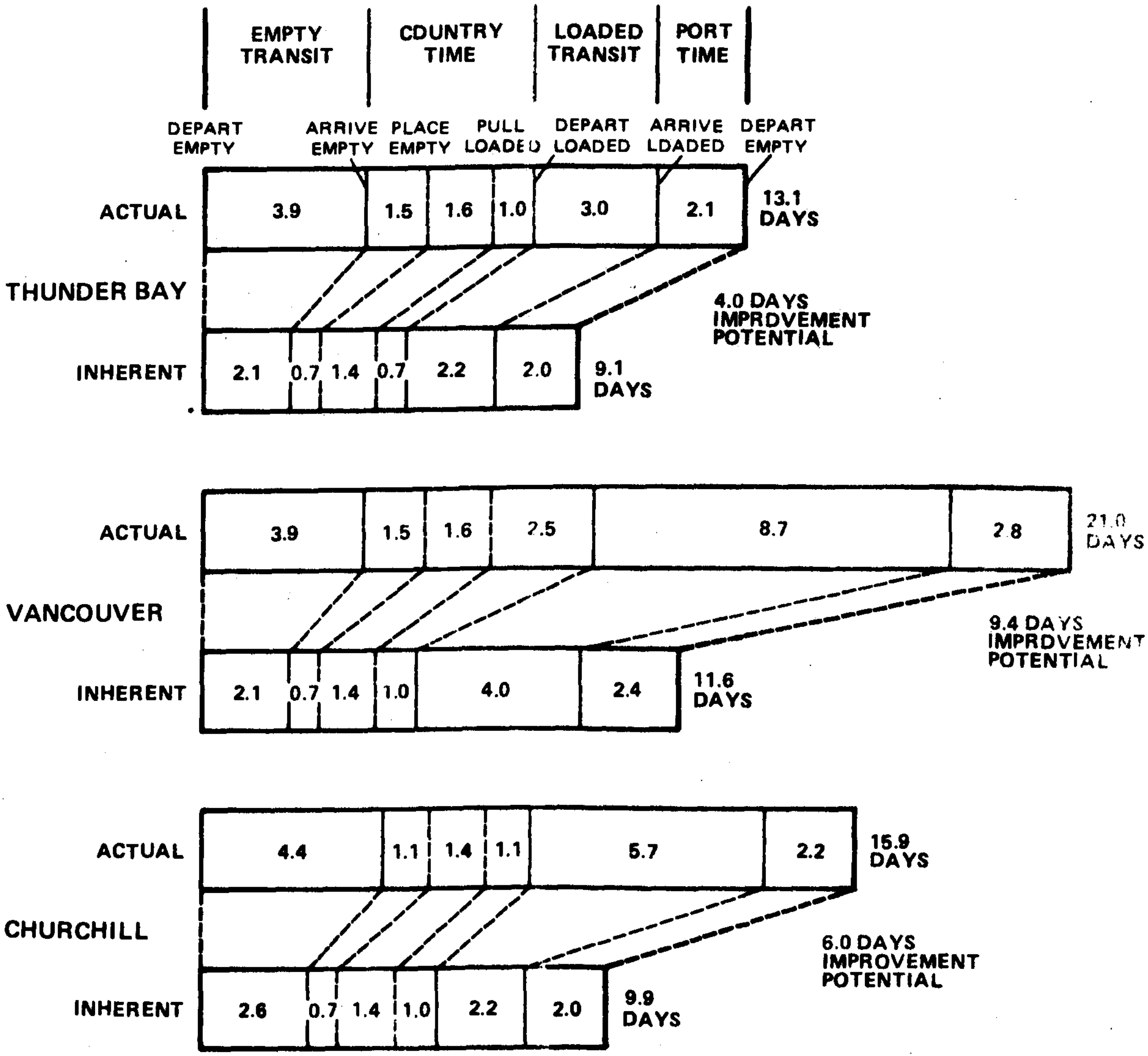
Thunder Bay	Inherent vs. Actual
Empty Transit -	1.8 Days
Loaded Transit -	0.8 Days
Others -	1.4 Days
TOTAL	4.0 Days

Vancouver	
Empty Transit -	1.8 Days
Pull to Depart -	1.5 Days
Loaded Transit -	4.7 Days
Others -	1.4 Days
TOTAL	9.4 Days

Churchill	
Empty Transit -	1.8 Days
Loaded Transit -	3.5 Days
Others -	0.7 Days
TOTAL	6.0 Days

Exhibit G-2 on the following page shows the comparison.

EXHIBIT G-2
Car Cycle Times
CN Block 13



- Saskatoon Main (Block 17) is located in central Saskatchewan with service on the main line from Biggar to Melville and with frequency of service ranging from one to six times a week. There are four train runs with service possible on any trick, and it varies as to whether it is on a thru freight or turnaround basis. This block and block 21 exhibit the best overall car cycle times to all ports for the CN sample. This may be accounted for by the high service level on the Saskatoon main line.

Key Improvement Potential

Thunder Bay	Inherent vs. Actual
Empty Transit -	1.1 Days
Loaded Transit -	1.2 Days
Others -	1.3 Days
TOTAL	3.6 Days

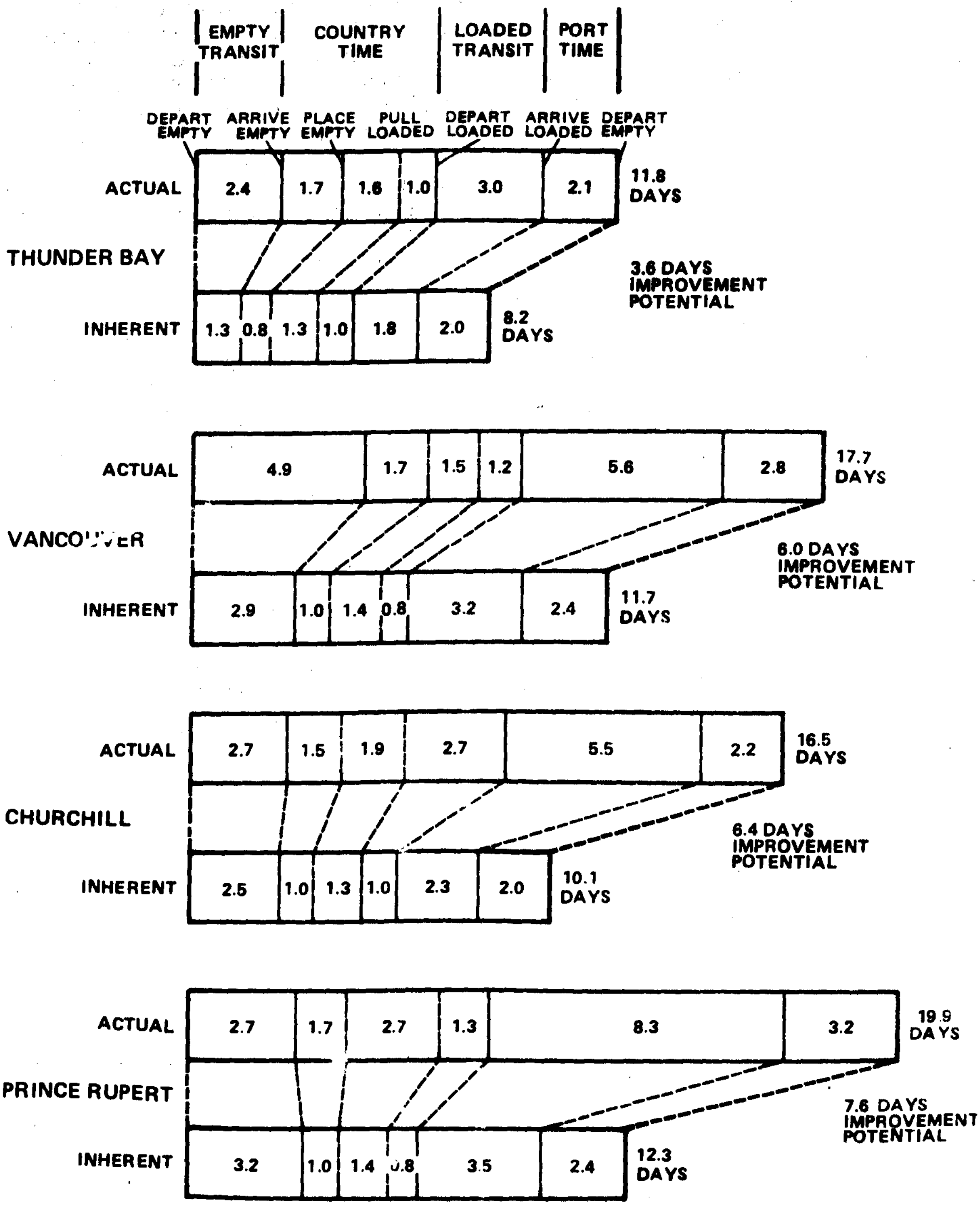
Vancouver	
Empty Transit -	2.0 Days
Loaded Transit -	2.4 Days
Others -	1.6 Days
TOTAL	6.0 Days

Churchill	
Place to Pull -	0.6 Days
Pull to Depart -	1.7 Days
Loaded Transit -	3.2 Days
Others -	0.9 Days
TOTAL	6.4 Days

Prince Rupert	
Place to Pull -	1.3 Days
Loaded Transit -	4.8 Days
Others -	1.5 Days
TOTAL	7.6 Days

Exhibit G-3 on the following page shows the comparison.

EXHIBIT G-3
Car Cycle Times
CN Block 17



- Saskatoon West (Block 21) is located in western Saskatchewan and is served from Saskatoon/Kindersley. The average frequency of service for the three trains is three times a week to the elevators. The majority of shipments from this block are to Thunder Bay with a good distribution to other ports. Block 21 cycles to Thunder Bay show the best performance and least potential car improvement of all the CN blocks sampled. This may largely be accounted for by the frequency of main line movements from Saskatoon, as indicated on block 17, and high level of train run pick up and delivery.

Key Improvement Potential

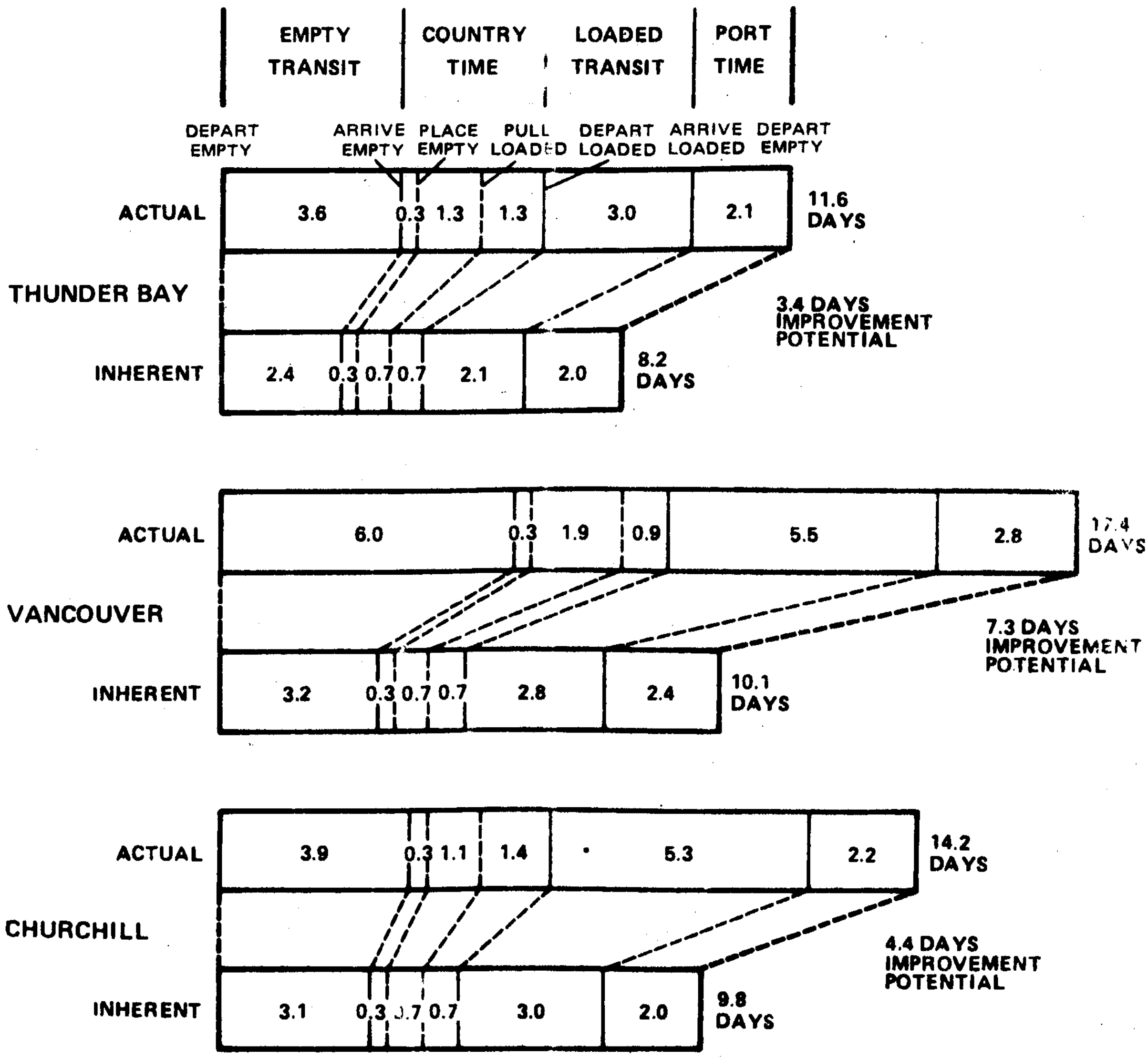
Thunder Bay	Inherent vs. Actual
Empty Transit -	1.2 Days
Loaded Transit -	0.9 Days
Others -	1.3 Days
TOTAL	3.4 Days

Vancouver	
Empty Transit -	2.8 Days
Loaded Transit -	2.7 Days
Others -	1.8 Days
TOTAL	7.3 Days

Churchill	
Empty Transit -	0.8 Days
Loaded Transit -	2.3 Days
Others -	1.3 Days
TOTAL	4.4 Days

Exhibit G-4 on the following page shows the comparison.

EXHIBIT G-4
Car Cycle Times
CN Block 21



- Prince Albert West (Block 29) is located in northern Saskatchewan and is served out of Prince Albert and North Battleford. The six train runs provide service normally once or twice a week as required. The train runs on this block are served first trick on a turnaround basis. Block 29 had the poorest car cycles in the seven block sample. This poor performance could be attributed to several factors:

  - Longest combined distances to ports
  - Restricted branch lines (locomotive units and hopper cars)
  - Infrequent and daylight service only.

Key improvement Potential

Thunder Bay	Inherent vs. Actual
Empty Transit -	2.9 Days
Pull to Depart -	1.4 Days
Loaded Transit -	2.7 Days
TOTAL	7.0 Days

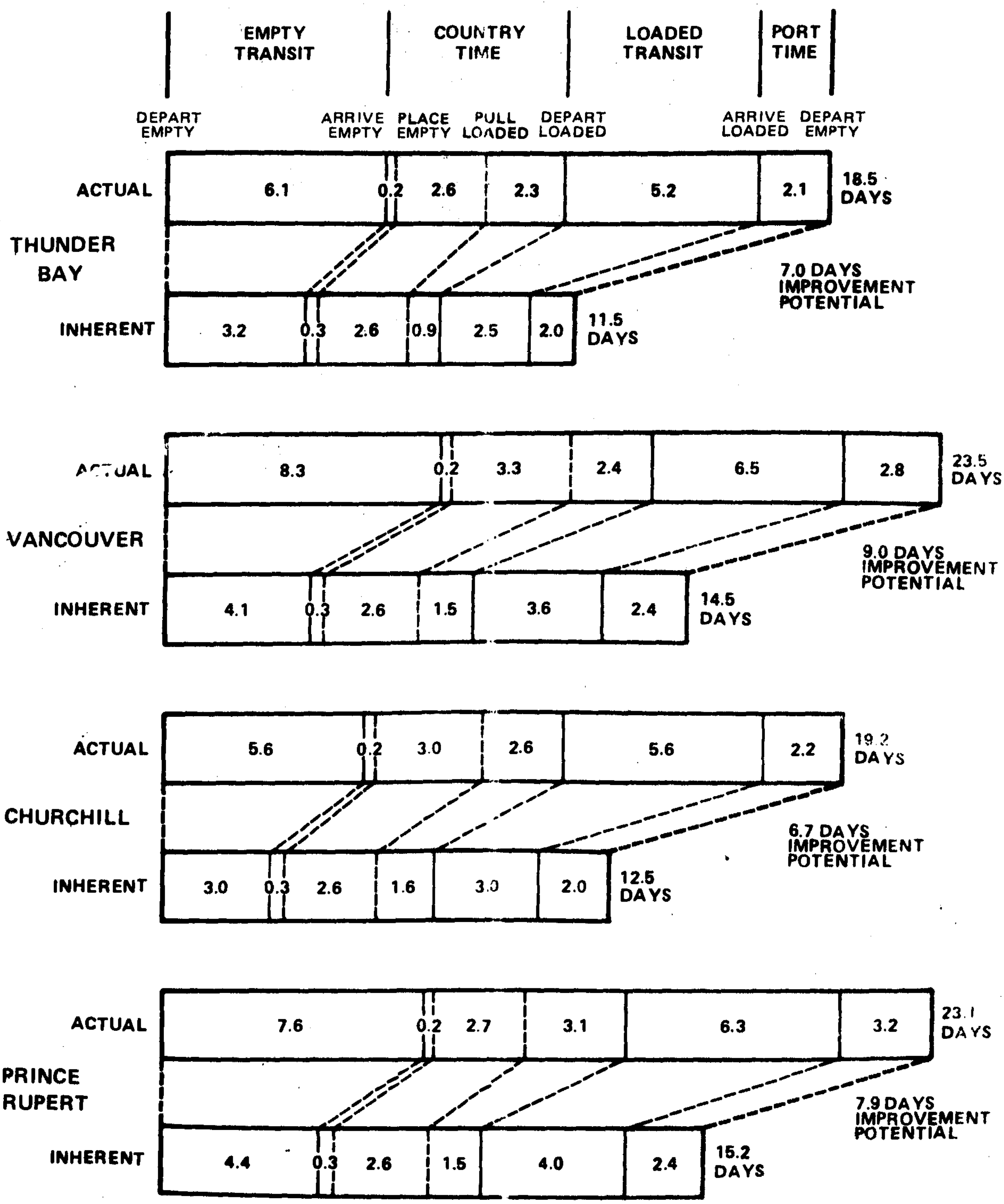
Vancouver	
Empty Transit -	4.2 Days
Loaded Transit -	2.9 Days
Others -	1.9 Days
TOTAL	9.0 Days

Churchill	
Empty Transit -	2.6 Days
Loaded Transit -	2.6 Days
Others -	1.5 Days
TOTAL	6.7 Days

Prince Rupert	
Empty Transit -	3.2 Days
Pull to Depart -	1.6 Days
Loaded Transit -	2.3 Days
Others -	0.8 Days
TOTAL	7.9 Days

Exhibit G-5 on the following page shows the comparison.

EXHIBIT G-5
Car Cycle Times
CN Block 29



- Edmonton North (Block 41) is located in northeastern Alberta and is served from Calder yard. The average frequency of service is twice a week. The three train runs are made on a layover basis and normally only first trick. This block has similar characteristics as that of block 43, including predominant shipments to west coast ports. There is one difference, however, that accounts for its poor cycle times to each port in comparison. Block 41 has the highest average country loading time of any block in the sample. This could be attributable to the locomotive restrictions on two of its train runs and the identified pattern of pick up and delivery.

Key Improvement Potential

Thunder Bay		Inherent vs. Actual
Place to Pull	-	1.7 Days
Pull to Depart	-	2.3 Days
Loaded Transit	-	3.0 Days
Others	-	1.2 Days
TOTAL		8.2 Days

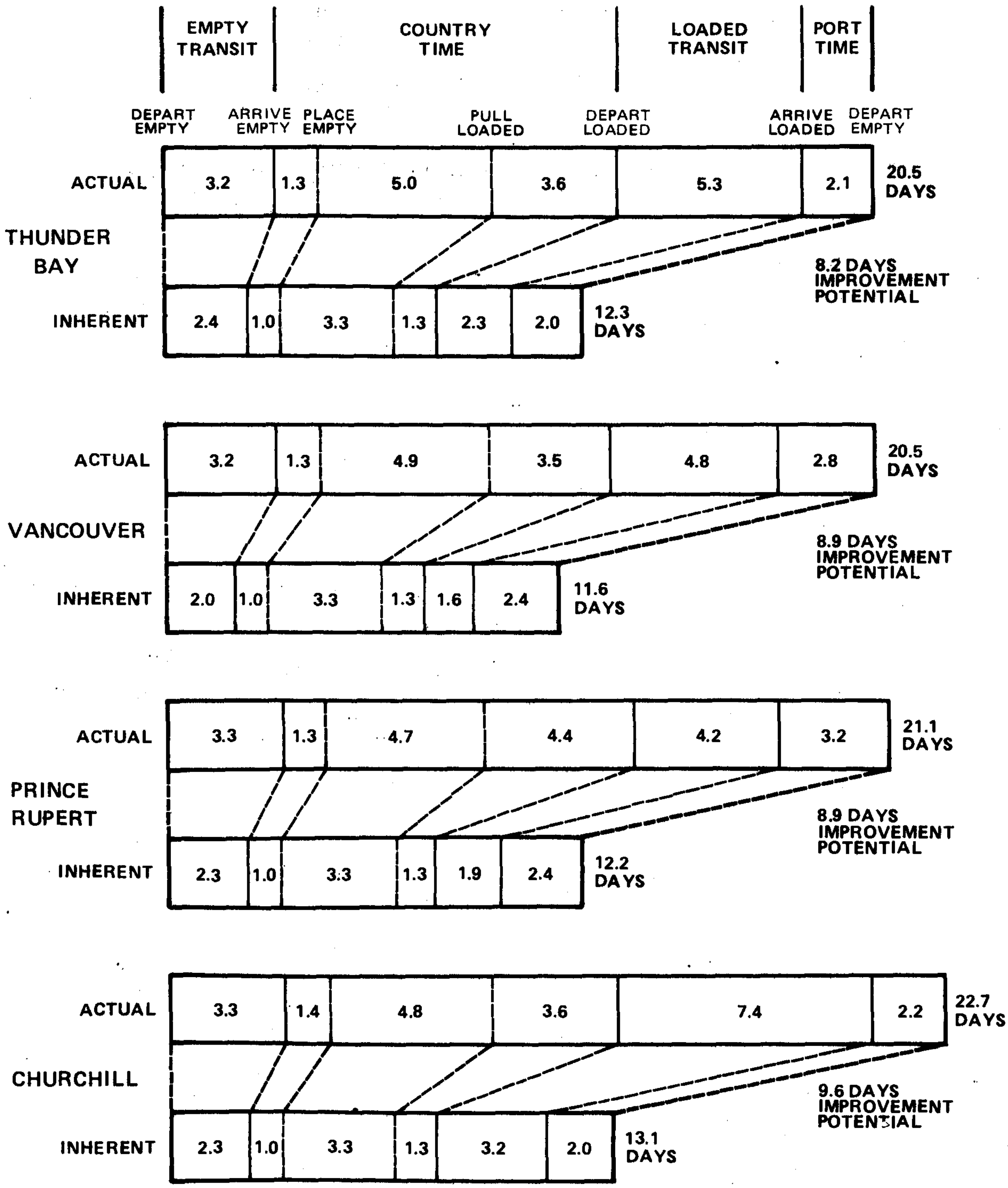
Vancouver		
Empty Transit	-	1.2 Days
Place to Pull	-	1.6 Days
Pull to Depart	-	2.2 Days
Loaded Transit	-	3.2 Days
Others	-	0.7 Days
TOTAL		8.9 Days

Churchill		
Empty Transit	-	1.0 Days
Place to Pull	-	1.5 Days
Pull to Depart	-	2.3 Days
Loaded Transit	-	4.2 Days
Others	-	0.6 Days
TOTAL		9.6 Days

Prince Rupert

Empty Transit	-	1.0 Days
Place to Pull	-	1.4 Days
Pull to Depart	-	3.1 Days
Loaded Transit	-	2.3 Days
Others	-	1.1 Days
TOTAL		8.9 Days

Exhibit G-6 on the following page shows the comparison.


EMPTY TRANSIT
COUNTRY TIME
LOADED TRANSIT
PORT TIME
DEPART EMPTY
ARRIVE EMPTY
PLACE EMPTY
PULL LOADED
DEPART LOADED
ARRIVE LOADED
DEPART EMPTY
THUNDER BAY
ACTUAL
3.2
1.3
5.0
3.6
5.3
2.1
20.5 DAYS
INHERENT
2.4
1.0
3.3
1.3
2.3
2.0
12.3 DAYS
8.2 DAYS IMPROVEMENT POTENTIAL
VANCOUVER
ACTUAL
3.2
1.3
4.9
3.5
4.8
2.8
20.5 DAYS
INHERENT
2.0
1.0
3.3
1.3
1.6
2.4
11.6 DAYS
8.9 DAYS IMPROVEMENT POTENTIAL
PRINCE RUPERT
ACTUAL
3.3
1.3
4.7
4.4
4.2
3.2
21.1 DAYS
INHERENT
2.3
1.0
3.3
1.3
1.9
2.4
12.2 DAYS
8.9 DAYS IMPROVEMENT POTENTIAL
CHURCHILL
ACTUAL
3.3
1.4
4.8
3.6
7.4
2.2
22.7 DAYS
INHERENT
2.3
1.0
3.3
1.3
3.2
2.0
13.1 DAYS
9.6 DAYS IMPROVEMENT POTENTIAL

- <u>Edmonton South</u> (Block 43) is located in eastern Alberta, served from Calder yard, with three train runs providing once or twice a week service as required. This block is serviced by wayfreights and thru freights on the main line to Biggar/Saskatoon. Service by thru freight and less restrictions could account largely for the better country service when compared with block 41.

<u>Key Improvement Potential</u>

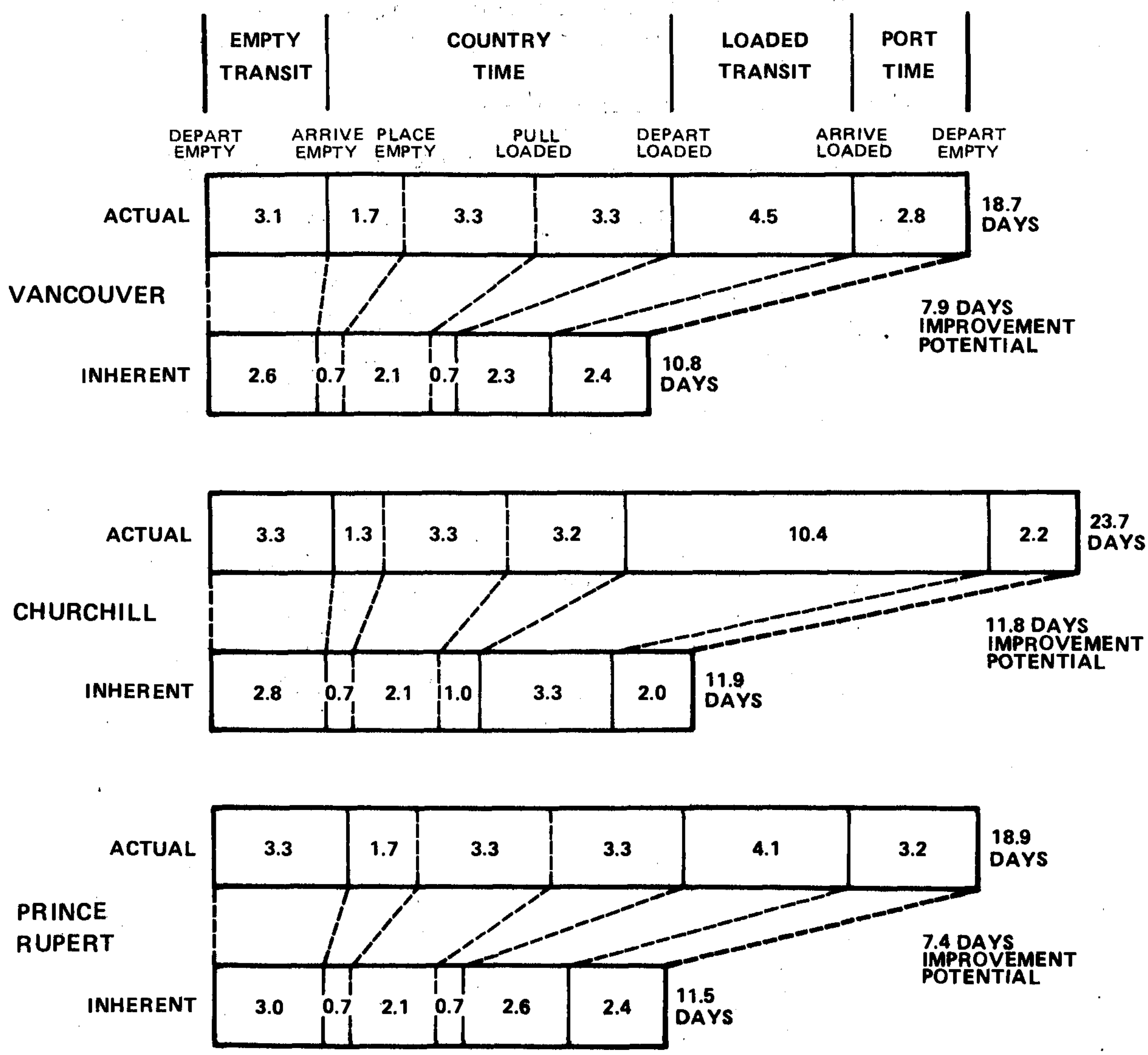
Vancouver	Inherent vs. Actual
Arrive to Place -	1.0 Days
Place to Pull -	1.2 Days
Pull to Depart -	2.6 Days
Loaded Transit -	2.2 Days
Others -	0.9 Days
TOTAL	7.9 Days

Churchill	
Place to Pull -	1.2 Days
Pull to Depart -	2.2 Days
Loaded Transit -	7.1 Days
Others -	1.3 Days
TOTAL	11.8 Days

Prince Rupert	
Arrive to Place -	1.0 Days
Place to Pull -	1.2 Days
Pull to Depart -	2.6 Days
Loaded Transit -	1.5 Days
TOTAL	6.3 Days

Exhibit G-7 on the following page shows the comparison.

EXHIBIT G-7
Car Cycle Times
CN Block 43

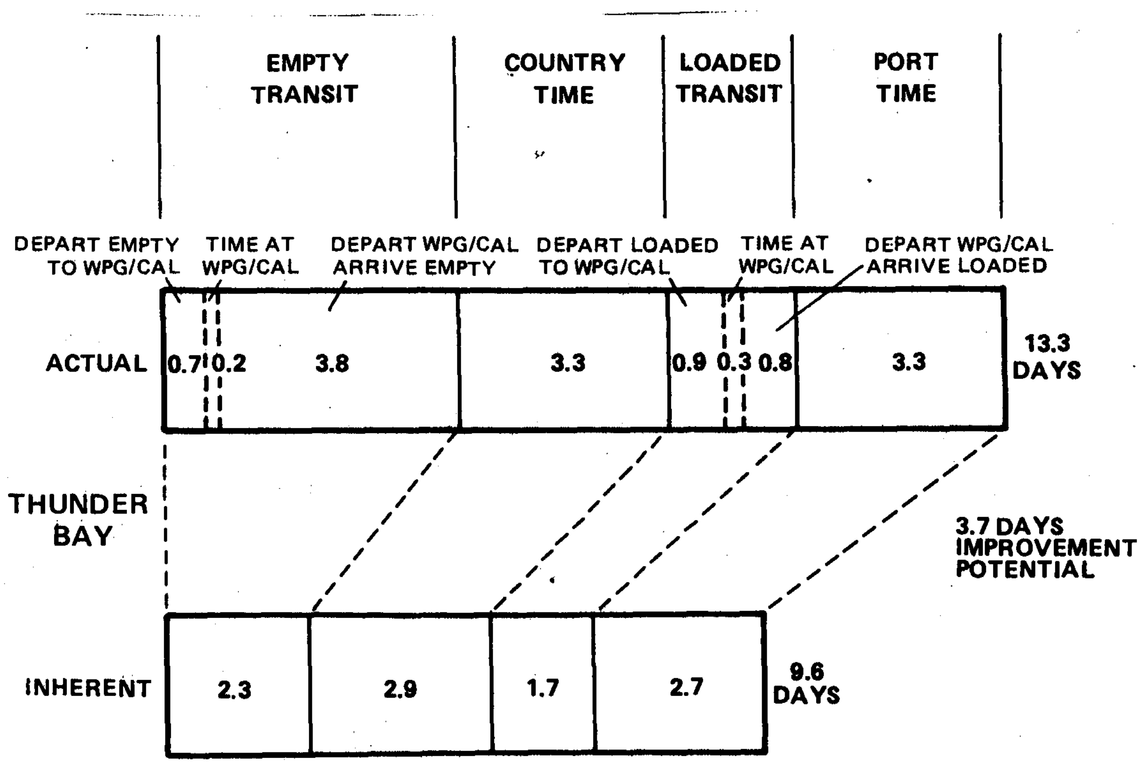


Key Improvement Potential

Thunder Bay		Inherent vs. Actual
Empty Transit	-	2.4 Days
Loaded Transit	-	
Port Time	-	0.6 Days
Others	-	0.7 Days
TOTAL		3.7 Days

Exhibit G-8 on the following page shows the comparison.

EXHIBIT G-8
Car Cycle Times
CP Block 62



The service to blocks 41 and 43 has recently changed to improve car flows. This change in operation entails matching service to the arrivals of empties from the West Coast on a more precise basis. Cars arriving on Thursday and Sundays in Calder, for example, would be spotted on these two blocks for the next day loading, and could be lifted the following day. Cars arriving on Friday and Saturday would be moved to outside points or through to Prairie blocks for their loading on Monday. Given that the country elevator agents are off Saturday and Sunday, this change in operating pattern should significantly improve car turnaround and terminal delays.

This type of planning could be extended throughout the Prairies on blocks where it may be applicable on both railways to place added control to the total movement through the system. This type of plan impacts the components of the car cycle with the greatest potential for improvement, providing greater coordination and control on both empty and loaded movements. This plan could be linked with a change in country pick up and delivery which could draw the operation closer to a "layover turn" basis, (i.e., spot third, trick tie-up first trick for loading, and lift second).

2. <u>A SAMPLE OF SEVEN OF THE TWENTY CP BLOCKS WERE EXAMINED IN DETAIL</u>

The analyses were carried out on CP covered hopper movements blocks (62, 72, 74, 78, 83, 84 and 86), to Vancouver and Thunder Bay. The blocks analyzed are reflected in the map in the report.

- <u>LaRiviere</u> (Block 62) is located in Southern Manitoba and is served from Winnipeg and Souris.* There are six train runs served an average of two times per week. Car replacement and lift generally takes place on the first trick. The preponderance of shipments are directed to Thunder Bay. Although this block is located closest to a port terminal, the improvement potential in empty transit time is great. This may be attributed to the extra switching time at Winnipeg prior to delivery to the grain block.

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* Block 62 is in two sections as a result of an out-of-service bridge between Crystal City and Clearwater.

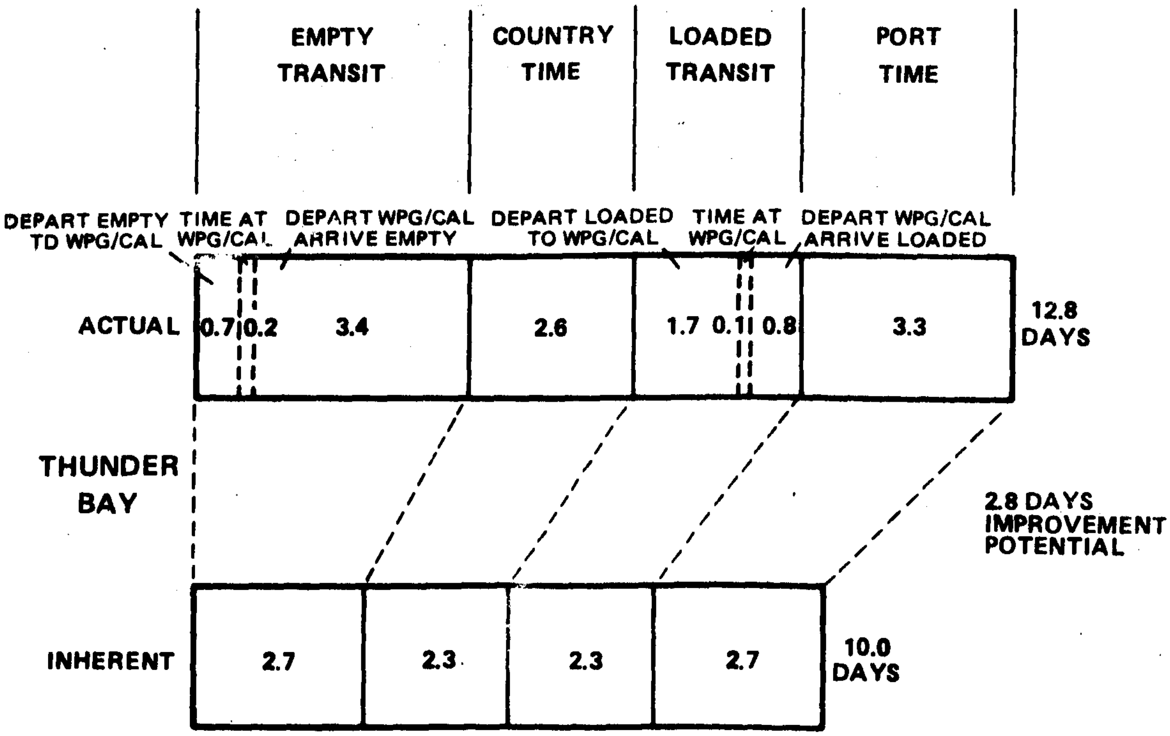
Pasqua (Block 72) is located in southern Saskatchewan and is served from Moose Jaw and Regina. There are three train runs which provide service an average of two times per week. Car placement and lift generally takes place on first trick, although one train run serves second or third trick. The preponderance of shipments are directed to Thunder Bay. As also identified in block 62, the empty transit time was significantly higher than expected. This block benefits from being able to receive direct run through service from Thunder Bay with stops en route only for crew changes. This practice should be followed wherever possible to reduce transit time.

Key Improvement Potential

Thunder Bay		Inherent vs. Actual
Empty Transit	-	1.6 Days
Port Time	-	0.6 Days
Others	-	0.6 Days
TOTAL		2.8 Days

Exhibit G-9 on the following page shows the comparison.

EXHIBIT G-9
Car Cycle Times
CP Block 72



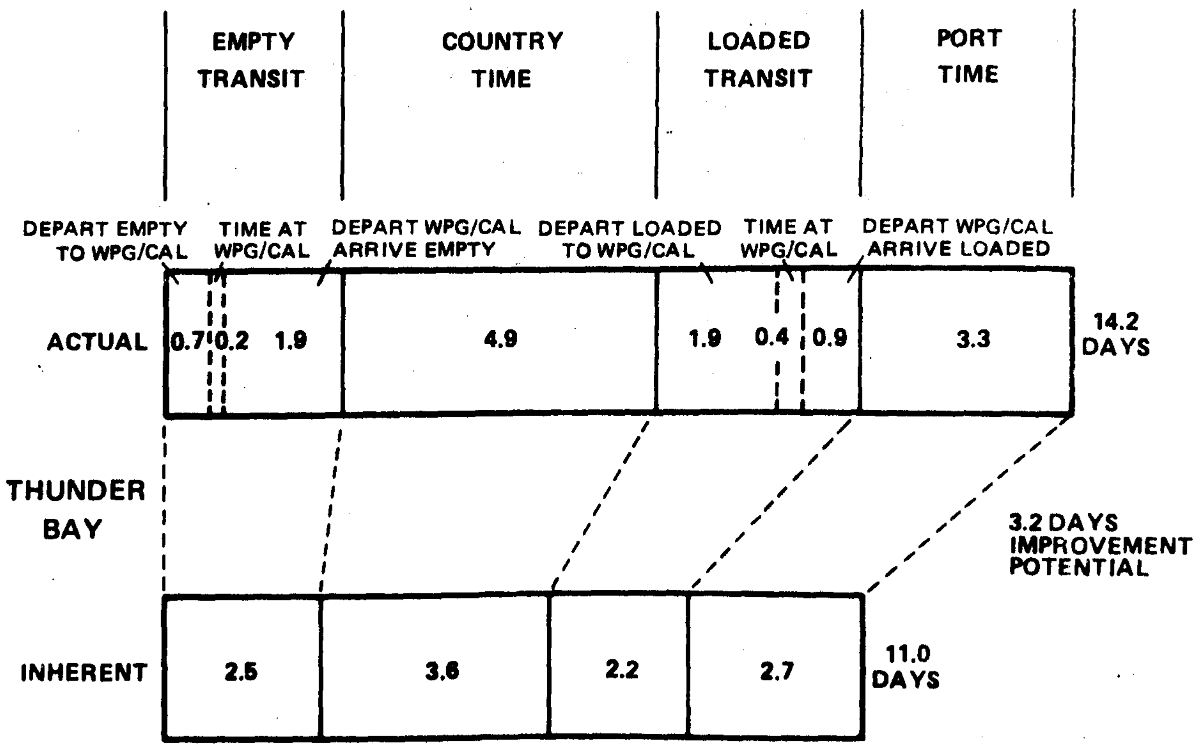
Bredenbury (Block 74) is located in northeastern Saskatchewan and is served from Wynyard, Prince Albert and Goudie. There are four train runs, three of which receive service three times per week and the fourth is served twice weekly. All are served on the first trick. The preponderance of shipments are directed to Thunder Bay. Trains are normally run to Wynyard and Goudie without receiving a switch at Winnipeg. Service to this area could be improved by ensuring that loaded cars return in the same manner to Thunder Bay if possible.

Key Improvement Potential

Thunder Bay		Inherent vs. Actual
Country Loading	-	1.3 Days
Loaded Transit	-	1.0 Days
Port Time	-	0.6 Days
Others	-	0.3 Days
TOTAL		3.2 Days

Exhibit G-10 on the following page shows the comparison.

EXHIBIT G-10
Car Cycle Times
CP Block 74



Swift Current (Block 78) is located in central Sasketchewan and is served from Moose Jaw and Swift Current. This was the only block having complete data for both Vancouver and Thunder Bay in the sample analysis. Service is generally two times per week with three of the six train runs receiving service on first trick and the other two on second. The 16.2 days improvement potential on shipments to Thunder Bay has been verified with CP personnel. It is conceivable that most empties would originate in Calgary rather than Thunder Bay. This might indicate long empty transit cycles on cars coming from Winnipeg. The block would benefit from full train movements of empties from Winnipeg or empty movements only from Vancouver. It is strongly suggested that the CP initiate efforts to determine the cause(s) of the inordinate delays experienced in movements to this block.

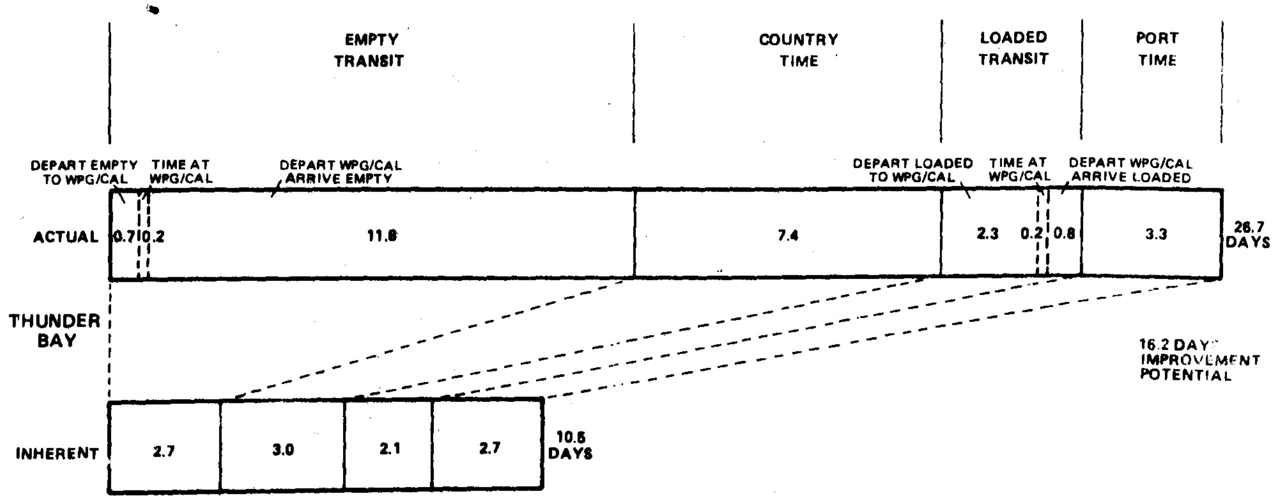
Key Improvement Potential

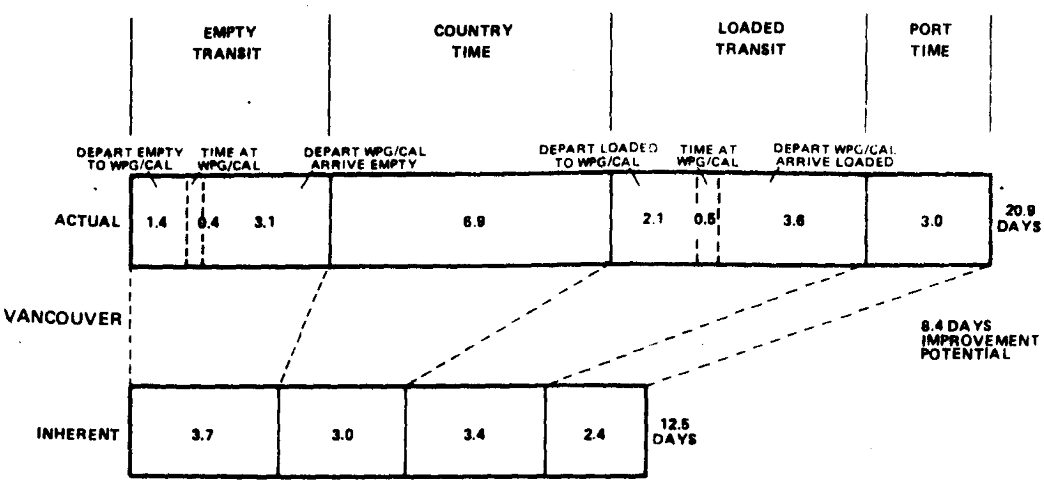
Thunder Bay		Inherent vs. Actual
Empty Transit	-	10.00 Days
Country Loading	-	4.4 Days
Loaded Transit	-	1.2 Days
Port Time	-	0.6 Days
TOTAL		16.2 Days

Vancouver		
Empty Transit	-	1.2 Days
Country Loading	-	3.8 Days
Loaded Transit	-	2.8 Days
Port Time	-	0.6 Days
TOTAL		8.4 Days

Exhibit G-11 on the following page shows the comparison.

EXHIBIT G-11
Car Cycle Times
CP Block 78





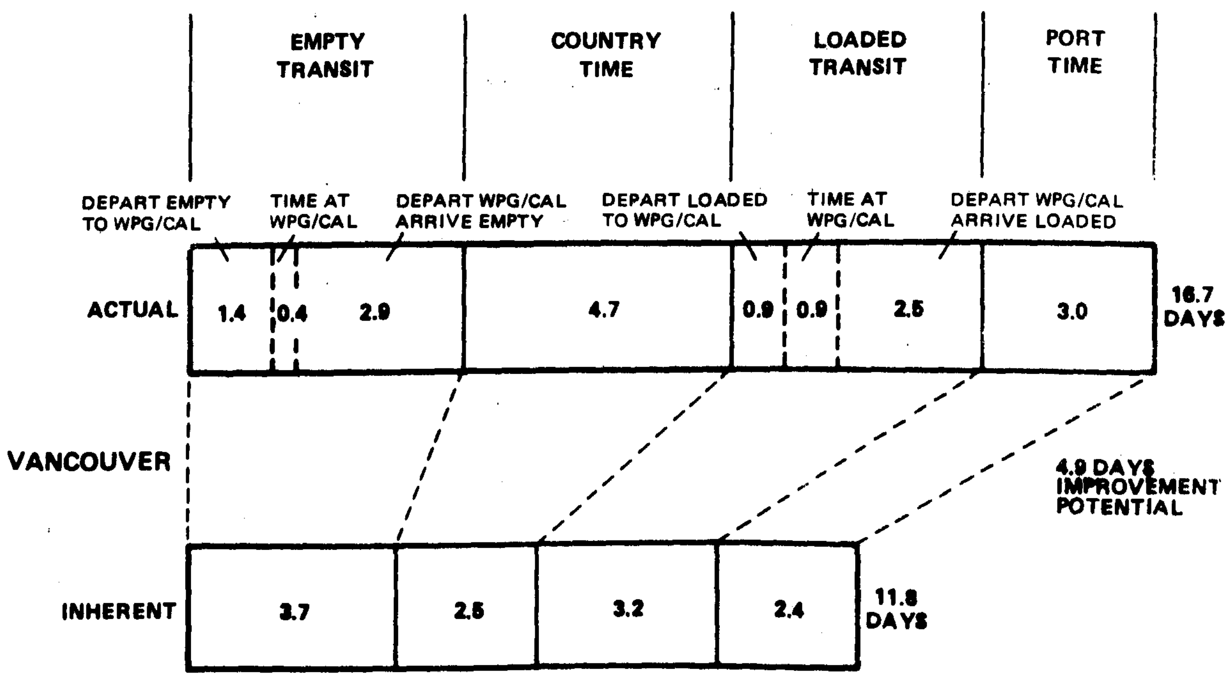
Lethbridge (Block 83) is located in southern Alberta and is served from Lethbridge. There are 5 train runs on this block with service generally twice a week, except for the Coutts train run which is served on a daily basis. The train runs are served on either the first or third trick. The majority of traffic is directed to Vancouver. Improvements would result from sending empty cars directly to Lethbridge on scheduled wayfreights or thru trains and upon arrival ensuring that the cars are switched for the next available subdivision run. Closer attention to pick up of loaded cars would also help to improve the cycle time.

Key Improvement Potential

Vancouver		Inherent vs. Actual
Empty Transit	-	1.0 Days
Country Loading	-	2.2 Days
Loaded Transit	-	1.1 Days
Port Time	-	0.6 Days
TOTAL		4.9 Days

Exhibit G-12 on the following page shows the comparison.

EXHIBIT G-12
Car Cycle Times
CP Block 83



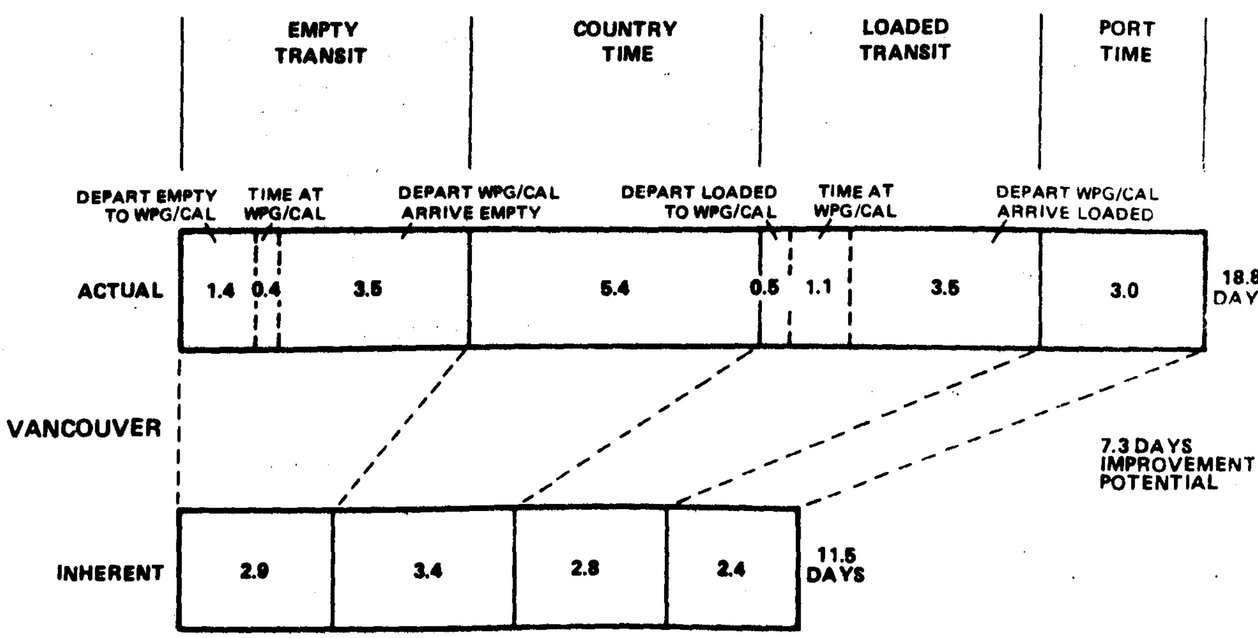
Vulcan (Block 84) is located in central and southern Alberta and is served from Calgary and Lethbridge. Service is generally twice weekly except on the Turin and Crowsnest subdivision which receive service once per week. The service is usually on first trick. The preponderance of shipments are directed to Vancouver. Considering that three of the five subdivision runs start at Calgary, empty transit times should be improved by placing the required cars at the elevators instead of letting them sit at places like Aldersyde. Movements to and from Lethbridge should be handled in the same manner as those going to block 83.

Key Improvement Potential

Vancouver		Inherent vs. Actual
Empty Transit	-	2.4 Days
Country Loading	-	2.0 Days
Loaded Transit	-	2.3 Days
Port Time	-	0.6 Days
TOTAL		7.3 Days

Exhibit G-13 on the following page shows the comparison.

EXHIBIT G-13
Car Cycle Time
CP Block 84



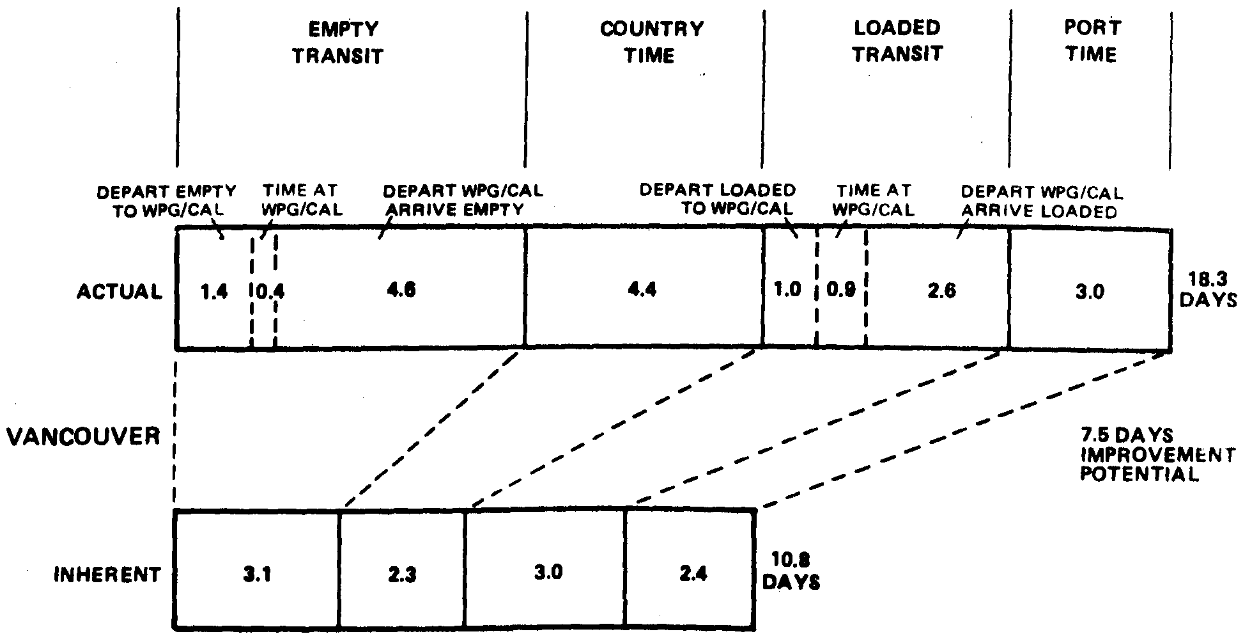
Red Deer (Block 86) is located in central and northern Alberta and is served from Red Deer. Three subdivision runs serve once per week on the first trick and the other on the second trick. The preponderance of movements are directed to Vancouver. Improvements in car cycles could be made by ensuring that empty cars reach the final serving yard without receiving en route delays from Calgary. Upon arrival, the cars should be switched for the next available run. Cars should also be picked up from the elevators as scheduled.

Key Improvement Potential

Vancouver		Inherent vs. Actual
Empty Transit	-	3.3 Days
Country Loading	-	2.1 Days
Loaded Transit	-	1.5 Days
Port Time	-	0.6 Days
TOTAL		7.5 Days

Exhibit G-14 on the following page shows the comparison.

EXHIBIT G-14
Car Cycle Time
CP Block 86



APPENDIX H

CN INTERMEDIATE YARD
ELAPSED TIMES

Location	Empty (days)	Load (days)
Jasper	0.33	0.26
Winnipeg (Symington)	0.85	1.12
Edmonton	0.63	0.83
Saskatoon	1.28	0.91
Dauphin	1.46	0.54
Melville	0.33	0.27
Brandon	0.56	0.69
Regina	1.87	1.25
Humboldt	1.26	1.48
North Battleford	2.30	1.50
Prince Albert	2.32	1.56
Canora	1.24	1.12
Biggar	1.71	1.03
Mirror	1.30	0.90
Hudson Bay	1.43	1.20
Vegreville	3.97	3.74
Alsask	1.59	1.61

APPENDIX I

DETAILED RESULTS OF MISSHIPMENT ANALYSIS

This appendix compares the authorized and unloaded grain types and grades in detail by port and grain type. This data was utilized in the misshipment analysis described in Chapter VI. Exhibits I-1 through I-4 list the results of the misshipment analysis, based upon the approach presented in the technical report. These results show the misshipments by grade and type for Lakehead (Thunder Bay), Vancouver, Prince Rupert, and Churchill. The source of this information was the CWB's Block Audit file for a three-month sample in 1978 (winter, spring, and fall).

EXHIBIT I-1
Comparison of Authorized
And Unloaded Grain Types and Grades

LAKEHEAD

Grain/Grade Authorized	Identical	One Grade Difference	Two or more Grade Difference	Type Differences
1 CWRS	79%	17%	4%	1%
2 CWRS	60%	33%	7%	
3 CWRS	85%	13%	2%	
1 Utility	83%	9%	8%	
2 Utility	53%	39%	7%	
3 Utility	86%	13%	1%	
1 Durum	81%	15%	4%	0%
2 Durum	51%	46%	3%	
3 Durum	50%	45%	5%	
1 Feed Oats	82%	15%	3%	1%
2 Feed Oats	45%	54%	1%	
1 Feed Barley	85%	13%	2%	1%
2 Feed Barley	26%	73%	1%	
TOTAL	74%	22%	3%	1%

EXHIBIT I-2
Comparison of Authorized
And Unloaded Grain Types and Grades

VANCOUVER

Grain/Grade Authorized	Identical	One Grade Difference	Two or More Grade Differences	Type Differences
1 CWRS	87%	4%	9%	
2 CWRS	70%	28%	2%	
3 CWRS	89%	10%	1%	0%
1 Utility	80%	9%	10%	
2 Utility	-	-	-	
3 Utility	89%	10%	1%	
1 Durum	80%	15%	5%	
2 Durum	58%	36%	6%	0%
3 Durum	46%	46%	8%	
1 Feed Barley	94%	5%	1%	0%
2 Feed Barley	30%	69%	1%	
TOTAL	86%	10%	4%	0%

EXHIBIT I-3
Comparison of Authorized
And Unloaded Grain Types and Grades

PRINCE RUPERT

Grain/Grade Authorized	Identical	One Grade Difference	Two or More Grade Differences	Type Differences
2 CWRS	51%	49%	0%	0%
3 CWRS	95%	5%	0%	
TOTAL	91%	9%	0%	0%

EXHIBIT I-4
Comparison of Authorized
And Unloaded Grain Types and Grades

CHURCHILL

Grain/Grade Authorized	Identical	One Grade Difference	Two or More Grade Differences	Type Differences
1 Feed Barley	90%	8%	2%	1%
2 Feed Barley	20%	78%	2%	
TOTAL	84%	13%	2%	1%

APPENDIX J

EFFECTS OF BRANCHLINE RATIONALIZATION

This appendix provides background material for the computation of car type requirements after network rationalization. The analysis was performed by estimating the transfer of grain from stations recommended for abandonment to stations on adjacent retained lines. Next, each subdivision was classified according to load limit (maximum car size) and a summary of the new volumes by car type was computed.

The rail rehabilitation program was also considered. This program is designed to upgrade grain dependent lines from box car limited lines to hopper limited lines (aluminum or light loaded steel hoppers). An optimistic projection of the rehabilitation program was made for three to five years in the future to estimate which lines would be upgraded to light hopper status. Exhibit J-1 lists the subdivisions expected to undergo rehabilitation in this period.

Exhibits J-2 and J-3 list the subdivisions recommended for abandonment by either Hall or PRAC. For each subdivision the abandoned station's and the adjacent subdivisions which pick up traffic are identified. These traffic transfers were based on projections made by the Hall Commission and PRAC, and on a review by knowledgeable persons in the grain industry.

The results of the redistribution were used to develop Exhibit J-4 which indicates the maximum size car and the estimated new volumes for each subdivision in the rationalized network. This table is based upon information supplied by both railways, the Canadian Wheat Board, the Canadian Grain Commission and Exhibits J-2 and J-3. New volume is defined as the 1977/78 volume minus the abandoned volume plus the transferred volume.

EXHIBIT J-1

Subdivisions Expected to Undergo Rehabilitation During the Next Five Years

CN Rail	CP Rail
Elrose	Arborg
St. Brieux	Hatton
Mantario	Rosemary
Conquest	
Preeceville	
Blaine Cork	
Brooksby	
Turtleford	
Athabasca	
Bolney Spur	
Cudworth	
Alliance	
Amiens	
Paddockwood	
Rhein	
Tonkin	
Battleford	

Source: CN Rail and CP Rail Branchline Rehabilitation Engineering Departments

EXHIBIT J-2
Distribution of Grain Traffic
for Subdivisions Slated for
Partial Abandonment

Subdivisions Recommended For Partial Abandonment	Traffic Transferred To	From Abandoned Stations
CN Amiens	CN Amiens	Shell Lake (H)*(50%)
	CN Blaine Lake	Shell Lake (H) (50%)
	CP Meadow Lake	Mount Nebo (H)
CN Robinhood	CN Robinhood	Livelong (H) (50%)
	CN Turtleford	Fairhohme (H)
		Livelong (H) (50%)
	CN Gravelbourg	Ardill (H)
		Neidpath (H)
CN Gravelbourg	CP Amulet	Spring Valley (H) (50%)
		Mitchellton (H)
	CN Avonlea	Spring Valley (H)
		Bayard (H)
CP Matador	CP Matador	Matador (H)
CP Colonsay	CN Craik	Dilke (P)**
		Holdfast (P)
		Penzance (P) (50%)
	CP Colonsay	Penzance (P) (50%)
CN Erwood	CN Erwood	Novra (P)
CP Melfort	CN Brooksby	Gronlid (H)
		Fairy Glen (H)
CN Cudworth	CN Aberdeen	Meacham (P) (50%)
	CP Sutherland	Meacham (P) (50%)
	CP Prince Albert	Red Deer Hill (P)
		St. Louis (P)
	CN Cudworth	Hoey (P)
	CN Duck Lake	Reed Deer Hill (P)
		St. Louis (P)
CP Amulet	CP Amulet	Cardross (P)
CN Weyburn	CP Tyvan	Talmadge (P)

* (H) Hall Commission
** (P) PRAC

EXHIBIT J-2
Distribution of Grain Traffic for Subdivisions Slated for Partial Abandonment (Continued)

Subdivisions Recommended for Partial Abandonment	Traffic Transferred To	From Abandoned Stations
CP Fife Lake	CP Fife Lake	East Poplar (P) Big Beaver (P)
CP Bromhead	CP Bromhead	Minton (P)
CN Chelan	CN Chelan	Weekes (P) Somme (P) Carranga (P)
CP Suffield/Lomond	No Traffic on Abandoned Portion	
CN Rhein	No Traffic on Abandoned Portion	
CN Sheerness	No Traffic on Abandoned Portion	
CN Avonlea	CP Amulet	Perry (P) Truax (P)
	CN Avonlea	Perry (P) Truax (P) Dummer (P)
CN Carberry	No Traffic on Abandoned Portion	
CN Coronado	CN Coronado	Heinsburg
CN Preeceville West	CP Tisdale	Kelvington (P) Nut Mountain (P) Lintlaw (P)
CN Pleasant Point	CP Glenboro CP Carberry	Rosendale (H) Edwin (H)
CP Cardston	CP Cardston	Glenwood (P) Hill Spring (P)
CP Langdon	CN Drumheller	Hesketh (P) Kirkpatrick (P) East Coulee (P)
	CN Three Hills	Carbon (P) Sharples (P)

EXHIBIT J-2
Distribution of Grain Traffic for Subdivisions Slated for Partial Abandonment (Continued)

Subdivisions Recommended For Partial Abandonment	Traffic Transferred To	From Abandoned Stations
CN Elrose	No Traffic on Abandoned Portion	
CN Central Butte	CP Outlook	Archydal (H) Grayburn (H) Rowletta (H) Lake Valley (H) Darmody (H) Mawer (H) Central Butte (H)

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
CN Carmen II (P)	CP Glenboro	Belmont Baldur Mariapolis Swan Lake
	CP La Riviere	Somerset
CN Stettler/Endiang (P/H)	CN Camrose	Edberg Meeting Creek Donalda
	CN Three Hills	Big Valley Rumsey Rowley Morrin
	CP Lacombe	Red Willow Stettler
	CN Drumheller	Dowling Scapa Endiang Byemoor
CP Alberta Central (H)	CN Brazeau	Benalto
CN Bodo (P)	CP Macklin	Cactus Lake Hearts Hill
	CP Hardisty	Reward
CN Ste Rose (P)	CN Gladstone	Ste Rose Rorketon
CN Haight (H)	CN Vegreville	Inland
CN Kingman (H)	CN Demay	Kingman
CP Crossfield (H)	CP Red Deer	Nier Madden Dog Pound Cremona
CP Cassils (H)		No Grain Delivery Pts.

(P) PRAC
(H) Hall Commission

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
CP Woolford (H)	CP Cardston	Woolford Whiskey Gap
CP Big Gully (H)	CN Blackfoot	Rex Greenstreet Hillmond
CP Furness (P)	CN Wainwright	Paradise Valley McLaughlin Rivercourse
	CN Blackfoot	Paradise Valley McLaughlin Rivercourse
	CP Lloyminster	Paradise Valley McLaughlin Rivercourse
CP Asquith (H)	CP Wilkie CN Langham	Arelee Sonningdale Struan
CP Kelfield (P)	CN Wainwright	Kelfield Handel Leipzig
	CP Kerrobert	Kelfield Handel Leipzig
	CP Reford	Kelfield Handel Leipzig
CN Dodsland (H)	CP Kerrobert	Millerdale Dodsland Beaufield
	CP Coronation	Hemaruka Sedalia New Brigden Esther
	CN Oyen	Hemaruka Sedalia New Brigden Esther

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
	CN Coronation	Loverna Dewar Lake Smiley Coleville
	CN Rosetown	Loverna Dewar Lake Smiley Coleville
	CN Watrous	Springwater Duperow Downe
CP Rosetown (H)	CN Watrous CN Rosetown	Federal Marriott Valley Centre
CN Cut Knife (H)	No Del. Pts	
CN Meskanaw (H)	CN St. Brieux	Yellow Creek (50%) Ethelton
	CN Tisdale	Yellow Creek (50%) Meskanaw
	CN Prince Albert	Crystal Springs
	CN Cudworth	Alvena
CP McMorran (H)	CN Rosetown	McMorran Totnes Bickleigh Gunworth Glamis
	CN Elrose	McMorran Totnes Bickleigh Gunworth Glamis
CN Shamrock (P/H)	CN Gravelbourg	McMahon Hallonquist Vogel Kelstern Shamrock Coderre Courval

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
	CP Swift Current	McMahon Hallonquist Vogel Kelstern Shamrock Coderre Courval
CN Carlton (H)	CN Duck Lake	Dalmeny Hague Rosthern Ducklake
CN White Bear (P/H)	CN Matador	White Bear Lacadena Tyner (50%)
	CN Elrose	Witley Isham Tyner (50%)
CN Acadia Valley (P)	CP Bassano CN Oyen	Acadia Valley (75%) Acadia Valley (25%)
CN Riverhurst (P)	CP Outlook	Riverhurst Lawson
CN Main Centre (H)	CP Swift Current	Thunder Creek Halvorgate Calderbank Gouldtown Main Centre
CP Stewart Valley (H)	CP Swift Current	Stewart Valley Leinan
CP Dunelm (P)	CP Vanguard	Duncairn Vesper Simmie
	CP Maple Creek	Duncairn Vesper Simmie

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended For Abandonment	Traffic Transferred To	From Abandoned Stations
CP Colony (H)	CP Wood Mountain	Killdeer Canopus
	CP Fife Lake	Killdeer Canopus
CN Bengough (P)	CP Assiniboia	Willow Bunch Harptree Bengough Hardy Ceylon
CN Goodwater (H)	CP Portal	Colgate Goodwater
	CP Tribune Spur	Colgate Goodwater
CN Corning (P/H)	CP Kisbey CN Glenavon	Handsworth Bemersyde Corning
CN Lewvan (P)	CP Tyvan	Rowatt Estlin Gray Riceton Colfax
	CP Portal	Rowatt Estlin Gray Riceton Colfax
CN Lewvan (P)	CP Portal	Lewvan Cedoux Bechard Talmadge Benson Huntoon Innes Griffin (CN)

EXHIBIT J-3
Distribution of Grain Traffic for Subdivisions Slated for Full Abandonment (Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
	CP Kisbey	Lewvan Cedoux Bechard Talmadge Benson Huntoon Innes Griffin (CN)
CN Notre Dame (H)	CP Glenboro	Notre Dame des Lourdes
CN Rossburn (P)	CP Bredenbury	Russell Silverton Angusville Rossburn Vista Oakburn Elphinstone Sandy Lake Erickson Clanwilliam Springhill
CN Neepawa (H)	CN Gladstone	Helston Kelwood
	CP Minnedosa	Eden
CN Hartney (P)	CP Glenboro	Fairfax Elgin
	CP Napinka	Ninette Dunrea Margaret Minto
CN Miami (P)	CP La Riviere	Smith Spur Lowe Farm Altamont Jordan Roland Kane Myrtle Rosebank Miami

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
	CN Carmen	Jordan Roland Kane Myrtle Rosebank Miami
CP Wishart (P)	CP Wynyard	West Bend Bankend Wishart Edmore
	CN Watrous	West Bend Bankend Wishart Edmore
CN Tonkin (H/P)	CP Tisdale	Tonkin Willowbrook Jedburgh
	CN Rhein	Macnutt Calder
CN Winnipegosis (P)	CN Cowan	Fork River Ethelburt
CN Oakland (P)	CN Gladstone	Oakland Longburn Amaranth
CN Rapid City (H)	CN Rivers	Moline Decker McConnell Isabella
	CP Bredenbury	Mentmore Cardale McConnell Isabella
CP Miniota (H)	CN Rivers	Forrest (CP) Floors Oak River Hamiota Crandall Miniota

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
CP Lenore (P)	CN Rivers	Wheatland
		Bradwardine
		Keton
		Lemore
CP Varcoe (H)	CP Minnedosa	Brookdale
		Moorepark
	CN Rivers	Brookdale
		Moorepark
CN Wawanesa (H)	CP Glenboro	Wawanesa
		Rounthwaite
CP Alida (H)		No traffic since March 1976
CP Lyleton (H)	CP Napinka	Lyleton (50%)
		Dalny
		Waskada
		Goodlands
	CP Estevan	Lyleton (50%)
CP Snowflake (H)	CP Napinka	Purves
		Snowflake
	CP La Riviere	Purves
		Snowflake
CN Inwood (H)	CP Arborg	Fisher Branch
		Broad Valley
CN Ridgeville (P)	CP Emerson	Ridgeville
		Fredensthal
CP Vegreville (H)	CP Willingdon	Warwick
	CN Vegreville	Vegreville (CP)
CP Pennant (P)	CP Empress	Roseray
		Hazlet
		Verlo
	CP Maple Creek	Roseray
		Hazlet
		Verlo

EXHIBIT J-3
Distribution of Grain
Traffic for Subdivisions
Slated for Full Abandonment
(Continued)

Subdivisions Recommended for Abandonment	Traffic Transferred To	From Abandoned Stations
CN Porter (P)	CN Watrous	Lett Salter Cardo
CN Wakopa (H)	CP Napinka	Neelin Glenova
CP Carmen (H)	No Delivery Points	

Exhibit J-4
Summary of Traffic Volume
After Rehabilitation

BLOCKS	SUBDIVISION	MAX LOAD	ABANDONED	THOUSANDS OF TONNES 1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
WINNIPEG NORTH 1	OAK POINT	A		50.9			50.9
	INWOOD	B	x	18.8		18.8	0.0
	PINE FALLS	S		7.6			7.6
	WINNIPEG	S		15.3			15.3
	REDDITT	S		9.1			9.1
	SPRAGUE	S		25.5			25.5
WINNIPEG SOUTH 3	NOTRE DAME	B	x	3.8		3.8	0.0
	LETELLIER	S		166.8			166.8
	MIAMI	A	x	236.0		236.0	0.0
	CARMAN NO. 1	B		120.5	37.0		157.5
	WAKOPA	B	x	12.2		12.2	0.0
	CARMAN NO. 2	B	x	54.9		54.9	0.0
	RIDGEVILLE	B	x	17.9		17.9	0.0
WINNIPEG WEST 5	RIVERS NO. 1	S		128.8	35.0		163.8
	GLADSTONE	S		183.3	67.7		251.0
	RIVERS NO. 2	S		128.8	101.9		230.7
	OAKLAND	B	x	36.6		36.6	0.0
BRANDON NORTH 7	RAPID CITY	B	x	54.5		54.5	0.0
	NEEPAWA	A	x	41.5		41.5	0.0
	ROSSBURN	B	x	142.1		142.1	0.0
	STE. ROSE	B	x	12.5		12.5	0.0
	CARBERRY	A	P	0.0		0.0	0.0

CODE: Max. Load

S - Steel Hopper
A - Aluminum Hopper or Light Loaded Steel Hopper
B* - Aluminum Hopper or Light Load, but Elevators Not Equipped to Handle Hoppers
B - Box Cars
R - Likely Candidate for Rehabilitation Upgrading to Light Hopper

Abandoned

X - Fully Abandoned
P - Partially Abandoned

Source: CN, CP Rail, Canadian Wheat Board, and Canadian Grain Commission, Exhibits -2 and -3.

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

				THOUSANDS OF TONNES			
BLOCKS	SUBDIVISION	MAX LOAD	ABANDONED	1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
BRANDON WEST	HARTNEY	B	X	76.7		76.7	0.0
9	CROMER	A		179.5			179.5
	LAMPMAN	A		97.9			97.9
	WAWANESA	B	X	18.2		18.2	0.0
	BRANDON	S		43.5			43.5
	PLEASANT POINT	A	P	3.7		3.7	0.0
	MARYFIELD	A		16.4			16.4
	LAMPMAN	A		65.3			65.3
MELVILLE	MELVILLE	S		40.4			40.4
11	RIVERS NO. 2	S		67.4			67.4
	YORKTON	B		45.2			45.2
	RHEIN	R	P	89.8	23.7	0.0	113.5
	TONKIN	B	X	18.8		18.8	0.0
DAUPHIN	DAUPHIN	S		72.8			72.8
13	TOGO	S		309.2			309.2
	SWAN RIVER	A		127.3			127.3
	COWAN	A		45.5	27.1		72.6
	WINNIPEGOSIS	B	X	24.4		24.4	0.0
	PREECEVILLE EAST	A		218.3			218.3
	ERWOOD	A	P	100.1	3.8	3.8	100.1
KAMSACK	CANORA	S		43.6			43.6
15	MARGO	S		256.2			256.2
	ASSINIBOINE	S		11.3			11.3
	THE PAS	S		32.7			32.7
	PREECEVILLE WEST	R	P	139.0		74.2	64.8
SASKATOON MAIN	WATROUS	S		479.9	49.9		529.8
17	SASKATOON	S		20.0			20.0
SASKATOON SOUTH	CONQUEST	R		219.3			219.3
19	ELROSE	R	P	202.4	28.7	0.0	231.1
SASKATOON WEST	ROSETOWN	S		354.0	36.4		390.4
21	KINDERSLEY	S		52.8			52.8
	WHITE BEAR	B	X	81.5		81.5	0.0

EXHIBIT J-4
Summary of Traffic Volume After Rehabilitation (Continued)

				THOUSANDS OF TONNES			
BLOCK	SUBDIVISION	MAX LOAD	ABANDONED	1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
SASKATOON NORTH 23	DUCK LAKE	S		92.1	91.9		184.0
	CARLTON	B	X	65.2		65.2	0.0
	HUMBOLDT	S		56.2			56.2
	ABERDEEN	S		92.1	9.5		101.6
	LANGHAM	A		127.9	21.2		149.1
	NORTH BATTLEFORD	S		46.0			46.0
PR. ALBERT EAST 25	PR. ALBERT	S		91.3			91.3
	TISDALE	A		43.5	19.7		63.2
	ARBORFIELD	A		84.3			84.3
	CHELAN	A	P	91.3	29.2	29.2	91.3
PR. ALBERT SOUTH 27	ST. BRIEUX/ BROOKSBY	R		222.6	31.2		253.8
	CUDWORTH	R	P	130.9	27.3	48.9	109.3
	MESKANAW	A	X	123.5		123.5	0.0
PR. ALBERT WEST 29	AMIENS	R	P	62.5	3.4	8.9	57.0
	ROBINHOOD	B	P	51.1	2.1	16.6	36.6
	TURTLEFORD/BOLNEY	R		170.5	3.6		174.1
	PADDOCKWOOD	R		34.1			34.1
	BIG RIVER	B		51.2			51.2
	BLAINE LAKE	R		204.6	3.4		208.0
SASKATOON EAST 31	CRAIK	S		274.0	64.4		338.4
REGINA SOUTH 33	GLENAVON	A		179.2	22.5		201.7
	CORNING	B	X	24.8		24.8	0.0
	LEWVAN	B	X	145.0		145.0	0.0
	WEYBURN	B	P	43.0		0.0	43.0
	GOODWATER	B	X	21.5		21.5	0.0
	BENGOUGH	B	X	80.6		80.6	0.0
	REGINA	S		3.0			3.0
	QUAPPELLE	S		152.1			152.1
REGINA WEST 35	CENTRAL BUTTE	B	P	80.2		68.8	11.4
	RIVERHURST	B	X	64.3		64.3	0.0
	MAIN CENTRE	B	X	42.9		42.9	0.0
	AVONLEA	B	P	120.0	34.9	35.8	119.1
	GRAVELBOURG	B	P	137.2	80.7	33.9	184.0

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

BLOCK	SUBDIVISION	MAX LOAD	ABANDONED	THOUSANDS OF TONNES			
				1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
BIGGAR NORTH 37	PORTER	B	X	33.2		33.2	0
	BLACKFOOT	S		362.7	11.9		374.6
	CUT KNIFE	B	X	0.0		0.0	0.0
BIGGAR WEST 39	WAINWRIGHT EAST	S		244.5			244.5
	BODO	B	X	84.0		84.0	0.0
	DODSLAND	B		133.6			133.6
EDMONTON NORTH 41	VEGREVILLE	S		281.7	90.4		372.1
	CORONADO	A	P	206.3	1.7	1.7	206.3
	BONNYVILLE	A		31.7			31.7
	HAIGHT	B	X	6.2		6.2	0.0
EDMONTON SOUTH 43	WAINWRIGHT WEST	S		220.6	13.0		233.6
	CAMROSE	S		132.3	38.4		170.7
	ALLIANCE	R		92.1			92.1
	KINGMAN	B	X	0.0		0.0	0.0
EDMONTON WEST 45	EDMONTON	S		19.9			19.9
	EDSON	S		58.8			58.8
	SANGUDO	S		15.2			15.2
	ATHABASCA	R		77.7			77.7
HANNA SOUTH 47	OYEN	S		159.2	17.5		176.7
	MANTARIO	R		48.6			48.6
	ACADIA VALLEY	B	X	29.8		29.8	0.0
	SHEERNESS	B	P	0.0		0.0	0.0
	DRUMHELLER	S		250.9	27.9		278.8
HANNA WEST 49	STETTLER-ENDIANG	B	X	96.2		96.2	0.0
	THREE HILLS	S		132.6	110.2		242.8
	BRAZEAU	S		82.4	15.7		98.1
KEEWATIN 61	KEEWATIN	S		15.1			15.1
	LAC DU BONNET	S		30.3			30.3
	EMERSON	S		94.7	21.2		115.9
	WINNIPEG TERMINAL	S		53.1			53.1
	WINNIPEG BEACH	A		30.3			30.3
	ARBORG	R		110.2	19.4		129.6

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

				THOUSANDS OF TONNES			
BLOCKS	SUBDIVISION	RESTRICTION	ABANDONED	1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
SASKATOON 75	SUTHERLAND	S		235.9	9.5		245.4
	MELFORT	A	P	288.2		14.3	273.9
	PRINCE ALBERT	A		96.1	5.8		101.9
	MEADOW LAKE	A		131.0	2.0		133.0
	WILKIE	S		69.9	15.7		85.6
	ASQUITY	B*	X	37.2		37.2	0.0
WILKIE 76	REFORD	B*		40.3	13.0		53.3
	KELFIELD	B*	X	40.3		40.3	0.0
	LLOYDMINSTER	A		291.9	12.4		304.3
	FURNESS	B*	X	34.5		34.5	0.0
	MACKLIN	A		178.4	33.3		211.7
	HARDISTY	S		178.4	18.6		197.0
	BIG GULLY	B*	X	11.4		11.4	0.0
ASSINIBOIA 77	FIFE LAKE	B*	P	147.6	34.6	28.4	153.8
	COLONY	B*	X	8.7		8.7	0.0
	WOOD MOUNTAIN	B*		191.0	6.2		197.2
	SHAUNAVON	A		416.1			416.1
	NOTUKEU	B*		147.6			147.6
	ALTAWAN	B*		78.2			78.2
SWIFT CURRENT 78	SWIFT CURRENT	S		387.5	46.9		434.4
	DUNELM	B*	X	34.3		34.3	0.0
	EXPANSE	S		154.7			154.7
	VANGUARD	B*		150.9	22.0		172.9
	SHAMROCK	B*	X	116.6		116.6	0.0
	STEWART VALLEY	B*	X	6.3		6.3	0.0
OUTLOOK 79	OUTLOOK	A		315.7	121.2		436.9
	KERROBERT	B*		168.0	62.2		230.2
	MCMORRAN	B*	X	30.5		30.5	0.0
	MATADOR	B*	P	86.6	54.4	7.1	133.9
MEDICINE HAT 81	EMPRESS	A		326.6	23.5		350.1
	PENNANT	B*	X	48.3		48.3	0.0
	BURSTALL	S		142.9			142.9
	MAPLE CREEK	S		129.3	45.5		174.8
	HATTON	R		4.8			4.8

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

BLOCK	SUBDIVISION	MAX LOAD	ABANDONED	THOUSANDS OF TONNES			
				1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
LA RIVIERE	LA RIVIERE	A		296.6	118.2		414.8
62	GRETNA	A		296.6			296.6
	SNOWFLAKE	B	X	32.4		32.4	0.0
	GLENBORO	S		422.1	159.1		581.2
	LYLETON	A	X	22.8		22.8	0.0
	NAPINKA	A		45.6	164.3		209.9
CARBERRY	CARBERRY	S		124.7	3.1		127.8
63	MINNEDOSA	S		55.4	12.6		68.0
	LENORE	B	X	19.6		19.6	0.0
	MINIOTA	B	X	46.8		46.8	0.0
	BREDENBURY	S		325.5	133.2		458.7
	RUSSELL	A		69.2			69.2
	VARCOE	B	X	17.1		17.1	0.0
BRANDON	BROADVIEW	S		261.1			261.1
64	ESTEVAN	S		261.1			261.1
	NEUDORF	A		269.1			269.1
WEYBURN	ARCOLA	S		272.2			272.2
71	KISBEY	B*		85.0	54.9		139.9
	PORTAL	S		217.8	108.7		326.5
	BROMHEAD	A	P	185.1	23.8	56.8	152.1
	ASSINIBOIA	A		228.5	116.6		345.1
	AMULET	B*	P	46.4	36.7	8.1	75.0
	TRIBUNE SPUR	A		33.0	9.0		42.0
PASQUA	INDIAN HEAD	S		353.8			353.8
72	TYVAN	A		233.2	52.5		285.7
	PORTAL NORTH	S		217.1			217.1
BULYEA	BULYEA	B*		246.7			246.7
73	LANIGAN	S		228.9			228.9
	COLONSAY	B*	P	186.6	7.9	72.4	122.1
BREDENBURY	WYNYARD	S		295.6	20.2		315.8
74	TISDALE	A		211.1	573.7		784.8
	WISHART	B*	X	54.9		54.9	0.0
	WHITE FOX	B*		79.9			79.9

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

BLOCKS	SUBDIVISION	RESTRICTION	ABANDONED	THOUSANDS OF TONNES			
				1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
SASKATOON 75	SUTHERLAND	S		235.9	9.5		245.4
	MELFORT	A	P	288.2		14.3	273.9
	PRINCE ALBERT	A		96.1	5.8		101.9
	MEADOW LAKE	A		131.0	2.0		133.0
	WILKIE	S		69.9	15.7		85.6
	ASQUITY	B*	X	37.2		37.2	0.0
WILKIE 76	REFORD	B*		40.3	13.0		53.3
	KELFIELD	B*	X	40.3		40.3	0.0
	LLOYDMINSTER	A		291.9	12.4		304.3
	FURNESS	B*	X	34.5		34.5	0.0
	MACKLIN	A		178.4	33.3		211.7
	HARDISTY	S		178.4	18.6		197.0
	BIG GULLY	B*	X	11.4		11.4	0.0
ASSINIBOIA 77	FIFE LAKE	B*	P	147.6	34.6	28.4	153.8
	COLONY	B*	X	8.7		8.7	0.0
	WOOD MOUNTAIN	B*		191.0	6.2		197.2
	SHAUNAVON	A		416.1			416.1
	NOTUKEU	B*		147.6			147.6
	ALTAWAN	B*		78.2			78.2
SWIFT CURRENT 78	SWIFT CURRENT	S		387.5	46.9		434.4
	DUNELM	B*	X	34.3		34.3	0.0
	EXPANSE	S		154.7			154.7
	VANGUARD	B*		150.9	22.0		172.9
	SHAMROCK	B*	X	116.6		116.6	0.0
	STEWART VALLEY	B*	X	6.3		6.3	0.0
OUTLOOK 79	OUTLOOK	A		315.7	121.2		436.9
	KERROBERT	B*		168.0	62.2		230.2
	MCMORRAN	B*	X	30.5		30.5	0.0
	MATADOR	B*	P	86.6	54.4	7.1	133.9
MEDICINE HAT 81	EMPRESS	A		326.6	23.5		350.1
	PENNANT	B*	X	48.3		48.3	0.0
	BURSTALL	S		142.9			142.9
	MAPLE CREEK	S		129.3	45.5		174.8
	HATTON	R		4.8			4.8

EXHIBIT J-4
Summary of Traffic Volume
After Rehabilitation
(Continued)

				THOUSANDS OF TONNES			
BLOCKS	SUBDIVISION	RESTRICTION	ABANDONED	1977-78 VOLUME	TRANSFERRED VOLUME	ABANDONED VOLUME	NEW VOLUME
BROOKS 82	STRATHMORE	S		11.1			11.1
	BROOKS	S		108.2			108.2
	LANGDON	S	P	84.6		50.0	34.6
	ACME	S		444.9			444.9
	BASSANO	A		40.4	26.4		14.0
	IRRICANA	S		88.3			88.3
	ROSEMARY	R		2.6			2.6
	CASSILS	B	X	0.0			0.0
LETHBRIDGE 83	TABER	S		286.2			286.2
	CARDSTON	A	P	135.6	14.1	7.4	142.3
	WOOLFORD	B	X	6.3		6.3	0.0
	STIRLING	A		173.2			173.2
	COUTTS	S		158.2			158.2
VULCAN 84	ALDERSYDE	S		124.6			124.6
	LOMOND/SUFFIELD	A	P	56.3		0.0	56.3
	TURIN	A		48.2			48.2
	MACLEOD	S		100.5			100.5
	CROW'S NEST	S		76.4			76.4
CALGARY 85	RED DEER	S		216.6	16.8		233.4
	CROSSFIELD	B	X	13.0		13.0	0.0
	ALBERTA CENTRAL	B	X	10.6		10.6	0.0
RED DEER 86	LEDUC	S		193.1			193.1
	HOADLEYS	S		44.6			44.6
	LACOMBE	S		54.4	23.8		78.2
	CORONATION	A		203.0	28.1		231.1
EDMONTON 87	WILLINGDON	S		254.6	4.5		250.1
	VEGREVILLE	B	X	19.8		19.8	0.0
	HOADLEY N.	S		60.1			60.1
	WETASKIWIN	S		240.4			240.4

APPENDIX K

PORT THROUGHPUT CAPABILITY ANALYSIS

This appendix provides the main parameters and statistics used in the analysis of port throughput capability discussed in Chapter VII of the technical report. The exhibits include the following data:

- Exhibit K-1: Vancouver Terminals - actual throughput compared with rated capability
- Exhibit K-2: West Coast - monthly pattern of elevator activities
- Exhibit K-3: West Coast - actual monthly throughput 1977/78
- Exhibit K-4: West Coast - monthly throughput capability 1979/80
- Exhibit K-5: West Coast - monthly throughput capability 1985/86.

EXHIBIT K-1
Vancouver Terminals
Utilization of
Elevator Facilities

Function	Total Rated Capability	Achieved Volume	Utilization
Car Unloads (Per Shift)	330* Cars	250* Cars	76%
Cleaning (Per Shift)	76,000** Tonnes	5,300** Tonnes	70%
Vessel Loading (Per Shift)	59,520 Tonnes	34,019 Tonnes	57%***
Storage	646,000 Tonnes	376,347 Tonnes	58%

Source: Daily elevator activity statistics, October 23 to November 10, 1978

* Does not include UGG.

** Based on AWP and PAC only.

*** Limited by cleaning throughput.

EXHIBIT K-2
Monthly Offloads by
West Coast Elevators
1977/78 (000's of Tonnes)

MONTH	SWP	AWP	PAC	UGG	RUP
August	167	213	113	98	17
September	155	142	101	60	30
October	186	151	171	98	18
November	191	201	190	95	34
December	140	145	136	67	74
January	154	204	210	60	59
February	171	201	169	79	106
March	206	225	177	78	121
April	219	232	238	87	70
May	187	232	185	94	123
June	197	265	207	71	103
July	202	219	200	67	69
Total	2,175	2,430	2,097	954	824

Source: Monthly Elevator Situation Report.

EXHIBIT K-3
Capability of West Coast Terminals 1977/78

	TERMINAL ELEVATORS					
	SWP	AWP	PAC	UGG	RUP	TOTAL
NOMINAL CAPABILITY						
Car Unloads Per Shift	100	90	140	50	65	445
Tonnes Cleaned Per Hour	665	500	475	380	220	2,240
Tonnes Dried Per Hour	80	50	48	50	50	278
Tonnes Offloaded Per Hour	2,900	1,600	2,125	815	1,080	8,520
EFFECTIVE MONTHLY CAPABILITY (000's Tonnes Per 5 Shifts Per Week)*						
Unloading	102	92	143	51	66	454
Cleaning	85	64	61	49	28	287
Drying	10	6	6	6	6	35
Offloading	370	204	271	104	138	1,087
PEAK MONTHLY THROUGHPUT (000's Tonnes)	219	265	238	98	123	943
Shifts Per Week (Peak Month)**						
Unloading	11	15	9	10	10	55
Cleaning	13	21	20	10	21	85
Offloading	5	7	5	5	5	27
AVERAGE MONTHLY THROUGHPUT (000's Tonnes)	181	203	175	79	69	707
Shifts Per Week (Average Month)**						
Unloading	9	12	7	8	6	42
Cleaning	11	16	15	9	13	64
Offloading	5	5	5	5	5	25

* Based on 76% efficiency.

** Computed shifts required approximate actual number of shifts worked during peak and average months.

EXHIBIT K-4
Capability of West Coast Terminals as Presently Operated 1979/80

	TERMINAL ELEVATORS						
	PIO	SWP	AWP	PAC	UGG	RUP	TOTAL
NOMINAL CAPABILITY							
Car Unloads Per Shift	100	100	100	140	50	65	555
Tonnes Cleaned Per Hour	500	750	500	475	480	220	2,925
Tonnes Dried Per Hour	19	80	50	48	50	150	397
Tonnes Offloaded Per Hour	3,240	2,900	1,600	2,125	1,360	1,080	12,305
EFFECTIVE MONTHLY CAPABILITY** (000's Tonnes at 5 Shifts Per Week)							
Unloading	102	102	102	143	51	66	566
Cleaning	64	96	64	61	61	28	374
Drying	2	10	6	6	6	19	50
Offloading	414	370	204	271	174	138	1,571
LIMITING FUNCTION	CLEAN*	CLEAN	CLEAN	CLEAN	UNLOAD	CLEAN	
EFFECTIVE MONTHLY CAPABILITY*** (000's Tonnes)							
10 Shifts Per Week	128	192	128	122	102	56	728
15 Shifts Per Week	192	288	192	183	163	84	1,102
18 Shifts Per Week	229	346	230	220	184	100	1,309

* Drying assumed not to be a limiting factor.
** Based on 76% efficiency.
*** Throughput capacity of limiting function.

EXHIBIT K-5
Capability of West Coast Terminals
As Presently Operated
1985/86

	TERMINAL ELEVATORS					
	PIO	SWP	AWP	PAC	UGG	TOTAL
NOMINAL CAPABILITY						
Car Unloads Per Shift	100	120	150	140	50	560
Tonnes Cleaned Per Hour	500	750	500	475	480*	2,705
Tonnes Dried Per Hour	19	80	50	48	50	247
Tonnes Offloaded Per Hour	3,240	2,900	1,600	2,125	1,360	11,225
EFFECTIVE MONTHLY CAPABILITY** (000's Tonnes at 5 Shifts Per Week)						
Unloading	102	122	153	143	51	571
Cleaning	64	96	64	61	61	346
Drying	2	10	6	6	6	31
Offloading	414	370	204	271	174	1,433
LIMITING FUNCTION	CLEAN*	CLEAN	CLEAN	CLEAN	UNLOAD	
EFFECTIVE MONTHLY CAPABILITY*** (000's Tonnes)						
10 Shifts Per Week	128	192	128	122	102	672
15 Shifts Per Week	192	288	192	183	163	1,018
18 Shifts Per Week	229	346	230	220	184	1,209

* Drying assumed not to be a limiting factor.
** Based on 76% efficiency.
*** Throughput capacity of limiting function.

APPENDIX L

ESTIMATES OF CAR REQUIREMENTS

The number of cars required to move a particular volume depends upon two major factors:

- Car cycle times
- Load per car.

The car cycle time is defined as the time required to make a complete round trip. Loads per car vary with the type of car used—box car, aluminum hopper, and steel hopper car. Each type of car has different carrying capacities and average load characteristics. Car requirements also vary in different seasons of the year. To estimate total car requirements, the peak month of period must be identified.

1. IN THE PEAK MONTH ALMOST 12 PERCENT OF THE ANNUAL MOVEMENT OCCURRED

Exhibit L-1 shows the number of tonnes unloaded from rail cars in the various ports by month in the 1977/78 crop year. It can be seen that July represented the greatest tonnage transported.

It is possible that a lower tonnage month associated with higher cycle times would represent a higher month for car requirements. However, in the winter months, the tonnage handled in Thunder Bay (and in Churchill) is very low because of the cessation of shipping. Therefore, peak car requirements will occur in the late spring, summer, and fall periods. As cycle times do not vary significantly over this period, the July proportions were selected as representative of peak car requirements.

2. CAR CYCLE TIMES WERE ANALYZED

The analysis of car cycle times to the port is described in Chapter V. The 1978 times, as calculated, are shown on the first line of Exhibit L-2. The second line shows the inherent cycle times, or the cycle times possible if all operations worked as they should. The third line of this exhibit shows the target cycles—the times thought to be reasonably attainable. These were calculated by assuming that 40 percent of the time savings between actual and inherent could be achieved.

EXHIBIT L-1
Terminal Receipts by
Month 1977/78

	THUNDER BAY		CHURCHILL		PACIFIC COAST		TOTAL	
Month	Thousands of Tonnes	Percent of Annual	Thousands of Tonnes	Percent of Annual	Thousands of Tonnes	Percent of Annual	Thousands of Tonnes	Percent of Annual
August	1,556	11.8	300	42.1	595	7.1	2,451	11.0
September	1,437	10.9	246	34.6	514	6.2	2,197	9.9
October	1,394	10.5	161	22.6	598	7.2	2,153	9.7
November	1,313	9.9	1	0.1	630	7.6	1,944	8.7
December	767	5.8			512	6.1	1,279	5.7
January	203	1.5			734	8.8	937	4.2
February	306	2.3			645	7.7	951	4.3
March	417	3.2			838	10.1	1,255	5.6
April	797	6.0			858	10.3	1,655	7.4
May	1,454	10.0			848	10.2	2,302	10.3
June	1,722	13.0			824	9.9	2,546	11.4
July	1,870	14.1	4	0.6	743	8.9	2,617	11.7
TOTAL	13,236	100.0	712	100.0	8,339	100.0	23,287	100.0

Source: Canada Grains Council, "Statistical Handbook 78"

EXHIBIT L-2
Comparison of Car
Cycles* (Days)

	Destination Port					
	Thunder Bay		Churchill	Vancouver		Prince Rupert
	CN	CP	CN	CN	CP	CN
3rd Quarter Cycle Times						
Actual	14.0	16.3	17.4	19.7	18.4	21.2
Inherent	9.3	10.2	10.8	11.6	11.6	13.5
Target	12.2	13.9	14.8	16.6	15.6	18.0

* Thunder Bay, Vancouver and Prince Rupert car cycles are based on hopper car times, Churchill times are box car cycles.

3. THE FUTURE OF THE PRESENT GRAIN FLEET WAS EXTRAPOLATED

Both major railways were asked to provide details on their fleets assigned full time to grain service. These fleets are of two main types: railway-owned box cars and Government hopper cars. The box cars are generally fairly old and the hopper cars are relatively new.

For each type, a retirement rate was calculated on the basis of information provided by the railways on past experience with this type of car. For box cars, this retirement rate is quite rapid with the CN fleet being depleted from 7,849 cars at the end of 1977 to zero by the end of 1985, and the CP fleet from 7,236 to 2,244. Box cars rehabilitated under the current program are expected to remain in service through 1985 and the Government hopper cars are also estimated to remain in service through this period.

The calculations begin with total "active" cars, i.e., the estimated fleet less cars identified as needing significant repairs. From this active fleet base estimates were developed for the expected out-of-service times for light repairs. An allowance of 5 percent of box cars and 3 percent of hopper cars has been made for this factor. The net cars available for service are then calculated.

All of these estimates are shown in Exhibit L-3 for CN Rail and L-4 for CP Rail. In addition to these cars the BCR uses approximately 200 box cars and 25 hopper cars for grain and carries slightly over one percent of the grain moved to Vancouver.

4. AVERAGE LOADS FOR EACH CAR TYPE WERE CALCULATED

The Snavely report* on 1977 operations gives the average load carried per car in that year. Expressed in tonnes, these are:

	CN	CP	Total
Box Cars	50.8	57.4	54.0
Railway Hopper Cars	78.1	61.5	70.7
Government Hopper Cars	75.7	80.9	78.7
Average	58.8	65.3	62.1

In estimating the capacities of the existing fleet, now and in the future, these tonnages were used. Many of the

* Snavely, King and Associates, "1977 Costs and Revenues Incurred by the Railways in the Transportation of Grains under the Statutory Rules," September, 1978.

EXHIBIT L-3
Grain Fleet
CN

	1977	1978	1979	1980	1981	1982	1983	1984	1985
BOX CARS									
Active* Cars	7,849	6,754	5,691	4,743	3,798	2,853	1,908	963	0
Net (5%)**	7,457	6,416	5,406	4,506	3,608	2,710	1,813	915	0
Rehabilitated Box Cars	-	-	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Net (5%)**	-	-	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Net Box Cars Available	7,457	6,416	7,306	6,406	5,508	4,610	3,713	2,815	1,900
HOPPER CARS									
Serviceable Cars	3,712	3,712	3,712	3,712	3,712	3,712	3,712	3,712	3,712
Net (3%)**	3,601	3,601	3,601	3,601	3,601	3,601	3,601	3,601	3,601
Net Serviceable Hopper & Box Cars Available	11,058	10,017	10,907	10,007	9,109	8,211	7,314	6,416	5,501

* Excluding heavy and medium bad order cars
** Allowance made for cars requiring light repairs.

EXHIBIT L-4
Grain Fleet
CP

	1977	1978	1979	1980	1981	1982	1983	1984	1985
BOX CARS	7,236	6,283	5,479	4,824	4,308	3,792	3,276	2,750	2,244
Active Cars*	7,236	6,238	5,479	4,824	4,308	3,792	3,276	2,750	2,244
Net (5%)**	6,874	5,969	5,205	4,583	4,093	3,602	3,112	2,622	2,132
Rehabilitated Box Cars	-	-	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Net (5%)**	-	-	950	950	950	950	950	950	950
Net Box Cars Available	6,874	5,969	6,155	5,533	5,043	4,552	4,062	3,572	3,082
HOPPER CARS									
Serviceable Cars	4,288	4,288	4,288	4,288	4,288	4,288	4,288	4,288	4,288
Net (3%)**	4,159	4,159	4,159	4,159	4,159	4,159	4,159	4,159	4,159
Net Serviceable Hopper & Box Cars Available	11,033	10,128	10,314	9,692	9,202	8,711	8,221	7,731	7,241

* Excluding heavy and medium bad orders
** Light repair estimate.

branchlines on the Prairies especially on CN have maximum weight restrictions. These are served mainly by box cars or aluminum hopper cars but in some cases by light loading steel hopper cars. It should be noted that by using the same average loading now and in the future, an implicit assumption is being made that the rehabilitation program for branchlines will keep pace with the dropout of box cars in the overall fleet.

Because of the diverse nature of the car fleet carrying grain, all the calculations of car requirements were performed using tonnes of capacity required. To convert these numbers to numbers of new cars that may be required in the future, an average steel hopper car carrying 80 tonnes (88 tons) per trip, was used. In fact, the same capacity could be provided by obtaining or rehabilitating a larger number of box cars or aluminum hopper cars with lower carrying capacity.

5. THE CAR REQUIREMENTS ANALYSIS WAS APPLIED TO THE 1977/78 SITUATION

The total rail car capacity available in July 1978 was estimated assuming the number of cars was halfway between the year end figures provided for 1977 and 1978 in Exhibits L-3 and L-4. When multiplied by the average load carried the total capacity of the grain fleet was estimated to be 1.33 million tonnes as shown in Exhibit L-5. This fleet is supplemented by other railway rolling stock in peak periods.

As the next step, the rolling stock capacity actually used in July 1978 was estimated. This is shown in Exhibit L-6. The total amount of rolling stock (expressed in tonnes of lift) capacity used by CN and CP was estimated to have been 1,378 thousand tonnes. These cars delivered 2,609 tonnes of grain to the ports. If the target and inherent car cycles had been achieved in 1977/78, the total capacities of rolling stock required would have been 1.18 million and 870 thousand tonnes of total lift, respectively.

The difference between the estimate of actual rolling stock used (1,378 tonnes) and of the capacity available

EXHIBIT L-5
1978 Grain Fleet Capacity

	CN	CP	Total CN and CP	BCR	Total All Railways
Railway Box Cars					
- Number in service	6,937	6,422	13,359	200	13,559
- Average load (tonnes)	50.8	57.4	-	50	-
- Capacity (thousands of tonnes)	352	369	721	10	731
Government Hopper Cars					
- Number in service	3,601	4,159	7,760	25	7,785
- Average load (tonnes)	75.7	80.9	-	75	-
- Capacity (thousands of tonnes)	273	336	609	2	611
Total Capacity (thousands of tonnes)	625	705	1,330	12	1,342

EXHIBIT L-6
1977/78 Peak Rolling Stock
Capacity Used (July)

	Thunder Bay		Churchill	Vancouver *		Rupert	Total
	CN	CP	CN	CN	CP	CN	
Tonnes Unloaded (thousands)	860	1,010	4	313	343	79	2,609
Average Cycle Time days)	14.0	16.3	17.4	19.7	18.4	21.2	-
Total Capacity of Rolling Stock Used (thousands of tonnes)**	388	531	2	199	204	54	1,378

* Excluding BCR shipments

** Total carrying capacity of rolling stock required =

$$\frac{\text{Tonnes carried in Month x Cycle time in days}}{\text{Number of Days in Months}} =$$

$$\frac{\text{Tonnes Unloaded in July x Cycle Time}}{31}$$

from the CN and CP "grain fleet" (1,330 tonnes) is 48 thousand tonnes. By railway company the differences are:

CN	18,000 tonnes
CP	30,000 tonnes
TOTAL	48,000 tonnes

Assuming that all of this deficit was made up with other railway-owned box cars (a very few railway-owned hopper cars were also used), and that these cars were loaded with the average tonnage, and requried the same allowance for light repairs as the "grain" box car fleet, total cars used in July 1978 was as follows:

	CN		CP		TOTAL CARS
	Net	Total	Net	Total	
Government Hopper Cars	3,597	3,712	4,159	4,288	8,000
Grain Fleet Box Cars	6,937	7,302	6,422	6,760	14,062
Supplement Box Cars	355	374	523	550	924
TOTAL		11,388		11,598	22,986

6. 1985/86 SURVIVING CAR CAPACITY WAS ESTIMATED TO BE 1,038,000 TONNES

The grain fleet identified by the railways is growing smaller as older box cars are retired. On the other hand, the box car rehabilitation programs now committed will ensure that some cars remain active. The capacity expected to be available in 1985/86 from the present grain fleet cars including the new CWB cars on order in service after making allowances for spares is calculated to be 1,038,000 tonnes as shown in Exhibit L-7.

EXHIBIT L-7
1985/86 Grain Fleet
Net Serviceable Cars
and Capacity Available

	CN	CP	CWB	TOTAL
Covered Hoppers				
. Number of Cars	3,601	4,159	1,940	9,700
. Average Load (tonnes)	75.7	80.9	80	-
. Fleet Capacity (thousands of tonnes)	273	336	155	764
Box Cars				
. Number of Cars	1,900	3,082	-	4,982
. Average Load (tonnes)	50.8	57.4	-	-
. Fleet Capacity (thousands of tonnes)	97	177	-	274
Total Capacity (thousands of tonnes)	370	554	155	1,038

7. 1985/86 TOTAL ROLLING STOCK REQUIREMENTS WERE ESTIMATED

The requirements for rolling stock in 1985/86 (actually July 1986) were estimated in the same way as for 1977/78. First the tonnage required in the peak month at each port in thousands of tonnes were estimated using the 1977/78 seasonal patterns, with the following results:

1985/86 Peak Month Unloads (in Thousands of Tonnes)

	Thunder Bay		Churchill	Vancouver		Prince Rupert	Total	Total
	CN	CP	CN	CN	CP	CN	July	Year
Top Range	1,217	1,429	5	556	610	140	3,597	34,500
Mean	1,021	1,200	5	491	539	124	3,380	29,750
Bottom Range	742	871	5	482	528	122	2,750	25,200

8. UP TO 13,000 NEW CARS COULD BE REQUIRED

Exhibit L-8 shows the total requirements (in tonnes) for rolling stock in the peak month of 1985/86. These requirements will be met in four ways:

- The surviving cars from the present grain fleet representing a capacity of 883,000 tonnes
- The use of the 2,000 cars now on order, at 80 tonnes average load with a 3 percent allowance for spares representing a capacity of 155,000 tonnes
- The railways supplementing the grain fleet with other railway-owned cars, estimated to be 48,000 tonnes in 1978 and to continue to be at this level through 1985/86
- The purchase of additional new cars.

The net amount of capacity to be provided by the acquisition of new cars, expressed in tonnes and in new hopper cars (assuming 80 tonnes average load and a 3 percent allowance for light repairs) are also shown in Exhibit L-8.

EXHIBIT L-8
1985/86 Peak Month Total Rolling Stock Requirements
(In Thousands Tonnes of Capacity)

1985/86 TOTAL REQUIREMENT FOR ROLLING STOCK (IN THOUSANDS OF TONNES)

	WITH ACTUAL 1978 CYCLES	WITH TARGET CYCLES	WITH INHERENT CYCLES
Top Range of Forecasts	2,115	1,808	1,334
Mean Forecast	1,812	1,548	1,143
Bottom Range of Forecasts	1,498	1,280	943

1985/86 NET NEW ROLLING STOCK EXPRESSED (IN THOUSANDS OF TONNES OF CAPACITY)

	WITH ACTUAL 1978 CYCLES	WITH TARGET CYCLES	WITH INHERENT CYCLES
Top Range of Forecasts	1,029	722	248
Mean Forecast	726	462	57
Bottom Range of Forecasts	412	194	-

1985/86 NET NEW CARS REQUIRED EXPRESSED IN HOPPER CARS

	WITH ACTUAL 1978 CYCLES	WITH TARGET CYCLES	WITH INHERENT CYCLES
Top Range of Forecasts	13,260	9,304	3,196
Mean Forecast	9,356	5,954	735
Bottom Range of Forecasts	5,308	2,500	-

These calculations assume that the existing proportional split between Vancouver and Prince Rupert is maintained. The impact of this assumption is relatively small. In the case of the mean forecast and the target cycle times sending a third of the total West Coast volume to Prince Rupert, this requires an additional 219 cars because of the longer cycle times.

The timing of these car acquisitions is shown in Exhibit L-9. It can be seen that with the mean forecasts, assuming that the target cycle times can be achieved, 1,313 new hopper cars a year would be required beginning in 1981/82. If cycles remain at current levels, 1,419 cars per year would be required beginning in 1979/80. With the higher range of volumes, between 1,732 and 1,907 cars per year are required. Of course, with a lower volume, less cars are required but it should be noted that sufficient capacity must be on hand to cover the "good years" if that additional traffic is to be moved.

9. SMOOTHING OF FLOWS COULD REDUCE THE TOTAL CAR REQUIREMENTS

To test the maximum possible impact of smoothing, the total tonnage of grain that would be moved in the peak month under the 1985/86 mean forecast and with a completely flat seasonal pattern (one-twelfth of the year's volume through Pacific ports and one-tenth of annual eastward movements), the 1985/86 rolling stock capacity requirements were reduced by 19 percent of the former number (1,247,000 tonnes of capacity required instead of 1,548,000 tonnes). The impact of this on net car requirements is that instead of 5,954 new cars being required, only 2,075 would now be needed.

EXHIBIT L-9
Timing and Programming of
New Car Requirements

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	TOTAL
Top Range of Forecasts								
with actual cycles	1,817	1,907	1,907	1,907	1,907	1,907	1,907	13,260
with target cycles	-	646	1,732	1,732	1,732	1,732	1,732	9,304
with inherent cycles	-	-	-	-	261	1,467	1,467	3,196
Mean Forecasts								
with actual cycles	841	1,419	1,419	1,419	1,419	1,419	1,419	9,356
with target cycles	-	-	702	1,313	1,313	1,313	1,313	5,954
with inherent cycles	-	-	-	-	-	-	735	735
Bottom Range of Forecasts								
with actual cycles	-	743	913	913	913	913	913	5,308
with target cycles	-	-	-	-	738	881	881	2,500
with inherent cycles	-	-	-	-	-	-	-	-

The impact of smoothing on other combinations of cycle times and forecast volumes is shown below:

	Total Capacity Required (thousands of tonnes)		Net New Hopper Cars Required	
	Without Smoothing	With Smoothing	Without Smoothing	With Smoothing
Top Forecast and Actual Cycles	2,115	1,699	13,260	7,899
Top Forecast and Target Cycles	1,808	1,450	9,304	4,691
Mean Forecast and Actual Cycles	1,812	1,461	9,304	4,832
Mean Forecast and Target Cycles	1,548	1,247	5,954	2,075

APPENDIX M

LOCOMOTIVE RESTRICTIONS

This appendix shows the locomotive operating restrictions by line segments for each subdivision in the Prairies for CP Rail and CN Rail. This data has been combined with mileage statistics as well as data on the average age and number of units available to operate on each line given the restrictions. The status of the line in terms of its consideration for abandonment is also noted.

EXHIBIT M-1
CP Rail
Locomotive Restrictions
Grain Block Area

Railroad	Division	Miles	Subdivision	From/To	Restrictions	Restricted Miles	Percent Of Division Miles	Branch Status*	Units Available (See Key)	Average Unit Age
CP	Alberta South	1,704.8	Pennant	Wickett/Verlo	DRF-22,24,25,30,36	24.5		12.3 Miles to be Abandoned 1981	491	22.5
			Hatton	Hatton/Golden Prairie		17.1			491	22.5
			Langdon	Langdon/East Coulee	DRF-30,36	91.6		37.0 Miles to be Abandoned 1983	585	21.0
			Acme	Cosway/Wimborne		27.3			585	21.0
			Bassano	Empress/Bassano	DRF-22,24,25,30,36	118.4			491	22.5
			Irricana	Bassano/Standard	DRF-30,36	36.5			585	21.0
			Pecten	Pecten/Brocket		30.4			585	21.0
			Stirling	Manyberries/Stirling		83.6			585	21.0
			Gardston	Stirling/Glenwood	DRF-22,24,25,30,36	73.6			491	22.5
			Lomond	Eltham/Hays	DRF-30,36	111.0			585	21.0
			Turin	Coalhurst/Turin		26.3			585	21.0
	DIV. TOTAL					640.3	37.5%	49.3 Miles (2.9%)		
	Alberta North	854.1	Willington	Lloydminster/Akenside		161.0			585	21.0
			Vegreville	Vegreville/Willingdon	DRF-22,24,25,30,36	24.1			491	22.5
			Coronation	Kerrobert/Coronation	DRF-30,36	116.5			585	21.0
			Lacombe	Coronation/Lacombe	DPA-15,17 DRF-30,36	106.9			548	22.2
	DIV. TOTAL					408.5	47.8%			
	Calgary	233.4	Crossfield	Collicutt/Cremona	DRF-22,24,25,30,36	27.4			491	22.5
	DIV. TOTAL					27.4	11.7%			
	Moose Jaw	1,935.7	Bromhead	Estevan/Minton	DRF-30,36	79.0		6.4 Miles to be Abandoned 1983	585	21.0
			McMorran	Milden/McMorran		60.5			585	21.0
			Matador	Matador/Gunnworth		43.0			585	21.0
			Stewart Valley	Baird/Stewart Valley	DRF-30,36	19.9			585	21.5
			Shamrock	Old Wives/Coderre	DRF-30,36	19.1		To be Abandoned 1981	585	21.0
			Vanguard	Neville/Player		27.0			585	21.0
			Dunelm	Simmie/Duncairn		15.2		To be Abandoned 1983	585	21.0
			Shaunavon	Bridge Near Crichton	DRF-30,36	.1			585	21.5
			Colony	Rockglen/Killdeer	DRF-30,36	24.6			585	21.0
			Wood Mountain	Wood Mountain/Mankota		34.6			585	21.0
			Altawan	Shaunavon/Manyberries	DRF-30,36	122.1			585	21.0
			Notukeu	Val Marie/Notukeu		96.4			585	21.0
	DIV. TOTAL					541.5	28.0%	4[illegible].7 Miles (2.1%)		
	Saskatoon	1,690.2	Wishart	Foam Lake/Wishart		24.2		To be Abandoned 1981	585	21.0
			Colonsay	Dilke/Colonsay		108.5		2[illegible].6 Miles to be Abandoned in 1983	585	21.0
			Asquith	Urban/Sonningdale		28.5			585	21.0
			Kelfield	Kelfield/Brass		27.9		To be Abandoned 1981	585	21.0
			Furness	Rivercourse/Paradise Valley		11.1		To be Abandoned 1983	585	21.0
			Big Gully	Lloydminster/Hillmond		24.1			585	21.0
			Meadow Lake	Prince Albert/Meadow Lake		93.4			6	20.0
	DIV. TOTAL					317.7	18.8%	8[illegible].8 Miles (5.1%)		
	Brandon	1,395.3	La Riviere	At La Riviere		.4			585	21.0
			Neudorf	Virden/Neudorf		126.2			585	21.0
			Russell	At Inglis		.8			585	21.0
	DIV. TOTAL					127.4	9.1%			
CANADIAN PACIFIC TOTALS		7,813.5				2,063.8	26.4%	1[illegible]5.8 Miles to be Abandoned (2.2%)		

* Summary of Prairie Rail Action Committee Recommendations, pending public hearings and CTC decision.

KEY

Units Available = Weight Restrictions

Units Available		Weight Restrictions
6	=	181,000 lb
491	=	230,000
585	=	263,000

EXHIBIT M-2
CN Rail
Locomotive Restrictions
Grain Block Area

Railroad	Division	Miles	Subdivision	From/To	Restrictions	Restricted Miles	Percent of Div'n Miles	Branch Status*	Units Available (See Key)	Average Unit Age
CN	Alberta North	2,328.1	Alliance	Alliance/Alliance Jct.	Only units 1000-1397	58.2			249	
			Athabasca	Athabasca/Morin Jct.		72.9			249	
			Battleford	Battleford/Battleford Jct.	Only units 1000-1076	7.8			75	20.3
			Bodo	Bodo/Unity		51.5		To be Abandoned 1981	75	20.3
			Bonnyville	Grand Centre/Abilene Jct.	No 4000-4017,5000-5610, 9400-9699	61.1			1,062	
			Coronado	Heinsburg/St. Paul Jct.		160.0		10.6 Miles to be Abandoned 1979	1,062	
			Dodsland	Biggar/Sedalia	Only units 1000-1076	134.5		38.9 Miles to be Abandoned 1980	75	20.3
			Haight	Vegreville/Inland		8.8			75	20.3
			Manning	Kemp River/High Level	Only units 1000-1397	80.9			249	
	DIV. TOTAL					635.7	27.3%	101 miles=4.3% of Div. Miles		
	Alberta South	828.1	Acadia Valley	Eyre Jct./Acadia Valley		23.7		To be Abandoned 1980	249	
			Brazeau	Ullin Jct./Brazeau		53.6			249	
			Endiang	Endiang Jct./Byemoor		34.6		To be Abandoned 1983	249	
			Mantario	Glidden/Alsask	No 4000-4017,5000-5610, 9400-9699	44.1			1062	
			Sheerness	Batter Jct./Cessford		46.8			1062	
			Stettler	Dinosaur/Ferlow Jct.	Only units 1000-1397	108.0		77.1 Miles to be Abandoned 1983	249	
	DIV. TOTAL					310.8	37.5%	135.4 miles=16.4% of Div. Mi.		
	Saskatchewan	3,023.2	Warman	Prince Albert/North Warman	No 2000-3240,4000-4017, 4900-6900,9400-9667	72.9			834	
			Aberdeen	North Battleford/Borden		51.7			834	
			Rosetown	Kindersley/Ridpath		47.4			834	
			Conquest	Conrose Jct./Beechy	Only units 1000-1076	94.3			75	20.3
			Elrose	Conquest Jct./Glidden		104.3			75	20.3
			Turtleford	North Battleford/St. Walburg		77.0			75	20.3
			Robinhood	Speers Jct./Fairholme		78.9			75	20.3
			Blaine Lake	Prince Albert Jct./Denholm		116.5			75	20.3
			Amiens	Amiens Jct./England		75.0			75	20.3
			White Bear	White Bear/Eston Jct.		34.3		To be Abandoned 1979	75	20.3
			Paddockwood	Paddockwood Jct./Paddockwood		23.9			75	20.3
			Big River	Big River Jct./Big River		56.5			75	20.3
			Cudworth	Totzke/Cudworth Jct.		108.0		24.6 Miles to be Abandoned 1981	75	20.3
			Meskanaw	Meskanaw Jct./Wakaw Jct	No. 2000-3240,4000-4017, 4900-6900,9400-9667	55.5			834	
			St. Brieux	Humboldt Jct./Thatch	Only units 1000-1076	52.2			75	20.3
			Brooksby	Naisberry Jct./Carrot River		51.1			75	20.3
			Arborfield	Crane/Arborfield	No 2000-3240,4000-4017, 4900-6900,9400-9667	19.4			834	
			Tisdale	Mutchler/Prince Albert		157.2			834	
			Chelan	Reserve/Crooked River		60.1		29.9 Miles to be Abandoned 1981	834	
			Tonkin	Macnutt/Jedburgh	Only units 854,1000-1076	101.2		15.7 Miles to be Abandoned 1983	76	20.3
			Rhein	Wroxton/Ross Jct.	Only units 1000-1076	37.8		13.6 Miles to be Abandoned ___**	75	20.3
			Glenavon	Kipling/McCallum	No 2000-3240,4000-4017, 4900-6900,9400-9667	87.5			834	
			Bengough	Bengough Jct./Willowbunch	Only units 1000-1076	71.5		To be Abandoned 1983	75	20.3
			Lewvan	Minard Jct./North Regina		116.9		9.1 Miles to be Abandoned 1980 107.7 Miles to be Abandoned 1983	75	20.3
			Northgate	Northgate/ Lampman		39.2			75	20.3
			Weyburn	Bengough Jct./Talmage		39.6			75	20.3
			Avonlea	Parry/Moose Jaw		57.3		22.0 Miles to be Abandoned 1982 1.4 Miles to be Abandoned 1983	75	20.3

* Summary of Prairie Rail Action Committee Recommendations, pending public hearings and CTC decision.
** Date of Abandonment: dependent upon construction of new link and transfer of ownership.

KEY

Units Available = Weight Restrictions

Units Available		Weight Restrictions
75	=	160,000 lb
249	=	177,000
830	=	220,000
1062	=	263,000
1747	=	over 263,000

EXHIBIT M-2
CN Rail
Locomotive Restrictions
Grain Block Area
(Continued)

Railroad	Division	Miles	Subdivision	From/To	Restrictions	Restricted Miles	Percent of Div'n Miles	Branch Status*	Units Available (See Key)	Average Unit Age
CN	Saskatchewan (Con't)	3,023.2	Gravelbourg	Gravelbourg Jct./Neidpath	Only Units 1000-1076	118.9		4.4 Miles to be Abandoned 1981	75	20.3
			Central Butte	Central Butte/Moose Jaw Jct.		53.3		7.4 Miles to be Abandoned 1979	75	20.3
				Moose Jaw Jct./Warell	No 2000-3240,4000-4017 4900-6900,9400-9667	39.0			834	
			Main Centre	Main Centre Jct./Main Centre	Only units 1000-1076	48.6			75	20.3
	DIV. TOTAL					2,147.0	71.0%	341.7 Miles=11.3% of Div. Mi.		
	Assiniboine	2,924.4	Oak Point	St. James Jct/Steep Rock Jct.	No 2000-3240,4000-4017, 4900-6900,9400-9667	129.7			834	20.3
			Oak Point	Steep Rock Jct./Gypsumville	Only units 1000-1076	27.0			75	20.3
			Inwood	Grosse Isle/Hodgson		80.9			75	20.3
			Steep Rock	Steep Rock Jct./Steep Rock	No 2000-3240,4000-4017, 4900-6900,9400-9667	12.1			834	20.3
			Pine Falls	Pine Jct./Pine Falls	No 1900-3745,4000-4017, 4400-6900,9400-9667	63.2			834	20.3
			Carman	Carman Jct./Graysville	Only units 1000-1076	50.5			75	20.3
			Miami	Morris/Belmont		102.2		To be Abandoned 1983	75	20.3
			Hartney	Belmont/Elgin		42.0		To be Abandoned 1983	75	20.3
			Cromer	Brandon/Kipling	No 2000-3240,4000-4017, 4900-6900,9400-9667	128.6			834	20.3
			Lampman	Maryfield/Estevan		93.4			834	20.3
			Carberry	Brandon Jct./Brandon		26.7			834	20.3
			Oakland	Delta Jct./Amaranth	Only units 1000-1076	53.4		To be Abandoned 1981	75	20.3
			Ste Rose	Ochre River/Rorketon		37.1		To be Abandoned 1983	75	20.3
			Neepawa	Petrel Jct./Rossburn Jct.	No 2000-3240,4000-4017, 4900-6900,9400-9667	24.3		4.2 Miles to be Abandoned 1983	834	20.3
			Rossburn	Rossburn Jct./Russell	Only units 1000-1076	104.3		To be Abandoned 1983	75	20.3
			Preeceville	Thunderhill Jct./Kelvington		113.6		41.5 Miles to be Abandoned 1983	75	20.3
			Erwood	Swan River/Hudson Bay	No 2000-3240,4000-4017, 4900-6900,9400-9667	101.1			834	20.3
			Cowan	North Jct./Swan River		98.5			834	20.3
			Winnipegosis	Sifton Jct./Winnipegosis	Only 1000-1076	20.8		To be Abandoned 1983	75	20.3
	DIV. TOTAL					1,309.7	44.8%	405.5 Miles = 13.9% of Div'n		
CANADIAN NATIONAL TOTALS		9,103.8				4,402.9	Total Car Miles Restricted = 48.4%	983.6 Total CNR Miles 10.8% to be Abandoned 22.3% of Restricted Miles to be Abandondoned		

KEY

Units Available	=	Weight Restrictions
75	=	160,000 lb
249	=	177,000
830	=	220,000
1062	=	263,000
1747	=	over 263,000

* Summary of Prairie Rail Action Committee Recommendations, pending public hearings and CTC decision.

APPENDIX N

PRESENT MANAGEMENT PRACTICES AND THE CAR ALLOCATION SYSTEM

A description of the car allocation process and the associated management practices is presented in this appendix. Opportunities for improvements in the information and management of this system are identified in Chapters IX and X. An overview of the information flow is presented in Exhibit N-1 of this appendix. This chart provides a means for identifying the areas in the allocation system that are highly interactive. The chart shows the timing and relationship of information used to formulate and execute the car allocation plan, the originators and receivers of information, and the communications methods.

The car allocation process provides the structure in which management practices and the information system can be examined. Exhibit N-2 provides a schematic overview of the car allocation process and timing relative to the actual loading of cars at the primary elevators. The exhibit shows total cars to be loaded in the country for the target week (identified as week "N") being estimated two weeks in advance, and allocation by block and station being accomplished in the week prior to loading. Programs for successive weeks overlap, so that the CWB, grain companies and railways are continuously engaged in several stages of the process at any one time. The following sections describe the present steps in the allocation process in terms of management practices and information. These events include the definition of demand for grain, the identification of stock positions, and the development and execution of the operating plan. The final section summarizes opportunities for improvement to the process.

1. <u>DEFINITION OF DEMAND FOR GRAIN</u>

Demand is formulated each week by Board and Non-Board requirements, for ports in the East and West.

A day-to-day flow chart of the CWB car allocation process from formulation of demand and establishment of car supply to the initial block allocation is presented in Exhibit N-3.

EXHIBIT N-1
Allocation Shipping System
Information Flow

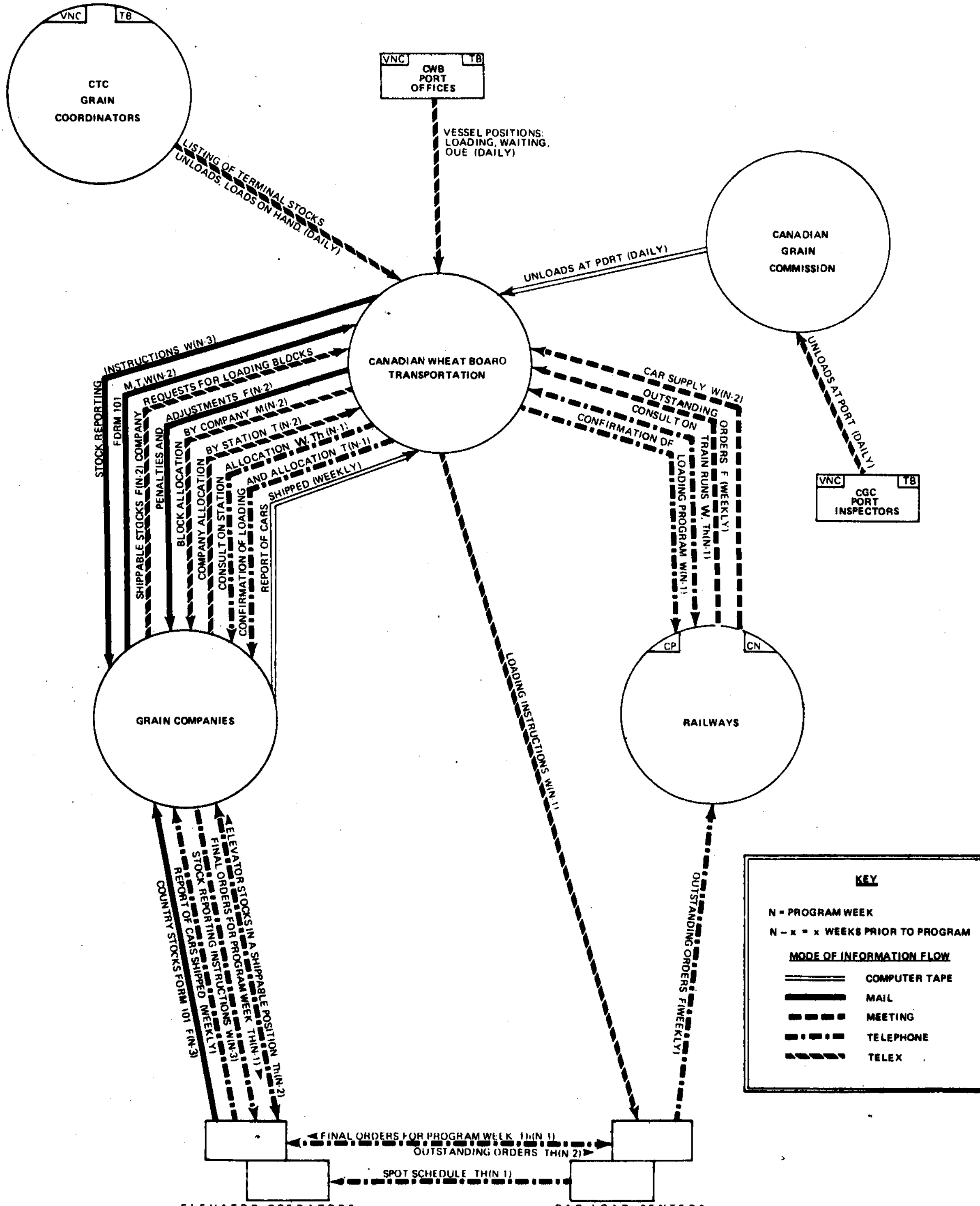


EXHIBIT N-2
Overview of Car Allocation Process

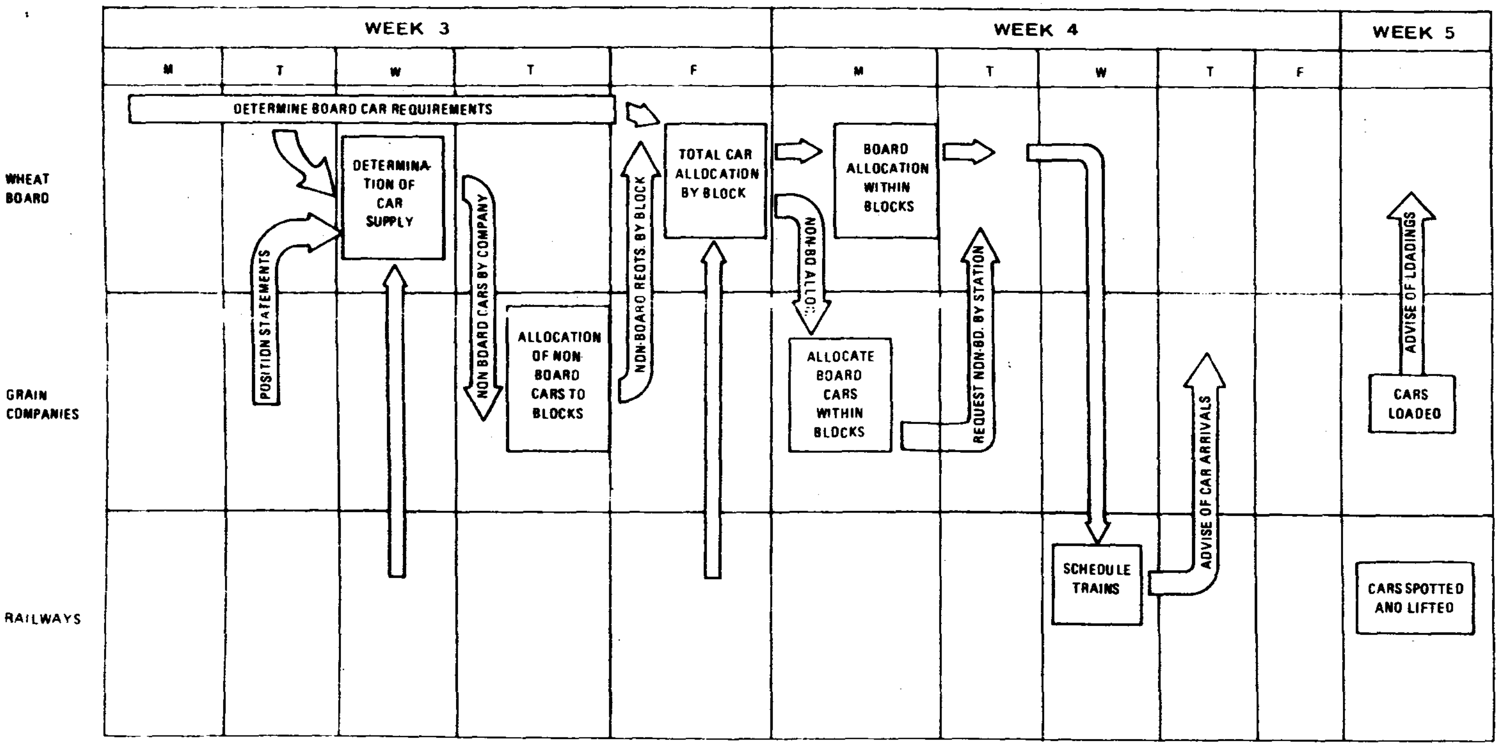
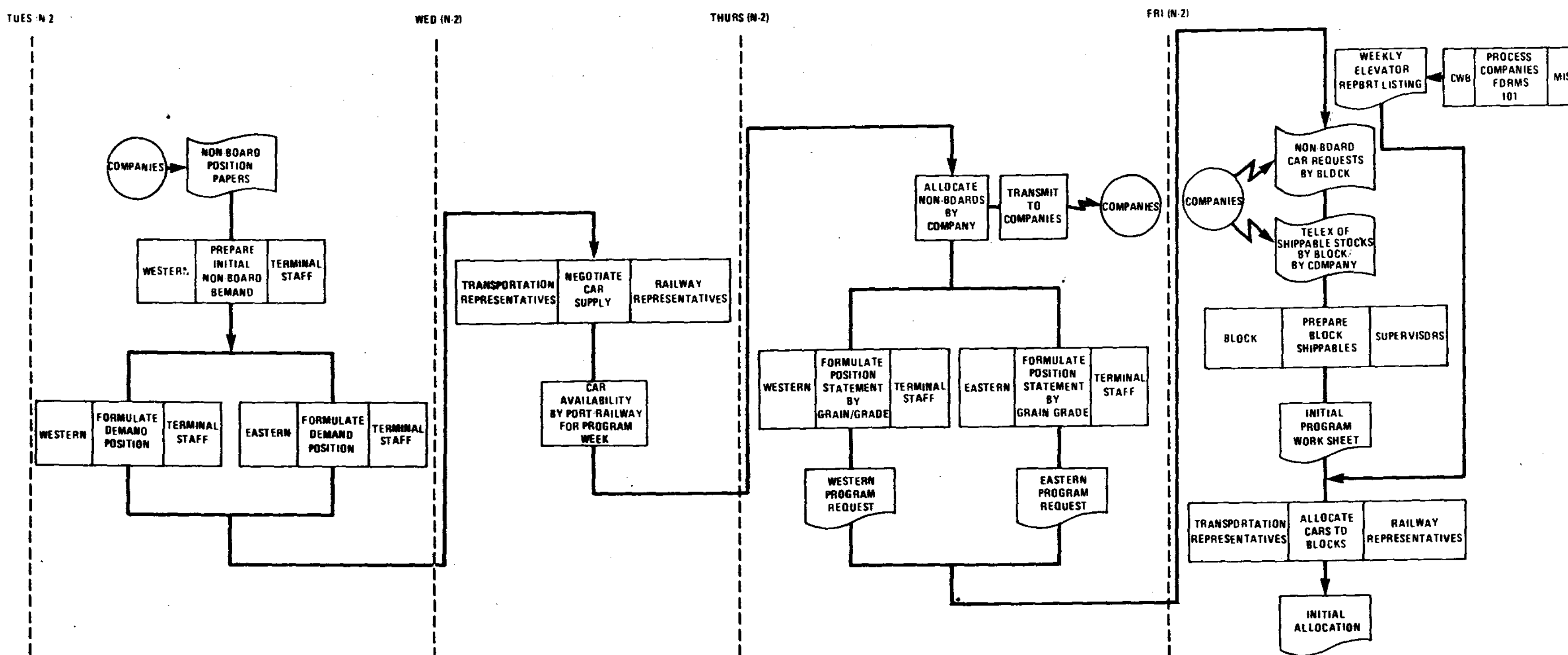


EXHIBIT N-3
Bulk Allocation to Blocks



(1) <u>Non-Board Grain Demand</u>

Demand for Non-Board grains is initially developed from position papers provided to the CWB by the grain companies. The position papers list sales commitments, vessel arrivals, and the car requirements for Non-Board grains.

Constant communication is maintained between CWB and the grain companies to refine the plan. Demand estimates can be adjusted from the continuous updating of the estimated times of arrival (ETA) for Non-Board grain ships. Consideration is given to the reliability of the companies' information on requirements and vessel ETA's to refine the plans.

(2) <u>Board Grain Demand</u>

The demand for Board grain is initially estimated on the basis of the monthly sales programs. Refinements to the demand estimate are made separately for West Coast (Vancouver, Prince Rupert and Churchill*) and for Thunder Bay.

The operation characteristics of Thunder Bay versus Western ports accounts for much of the difference in the demand planning process. Vancouver, Prince Rupert, and Churchill are direct demand centers (i.e. vessels at port represent demand), while Thunder Bay demand is based on requirements set in the St. Lawrence ports (Montreal, Sorel, Three Rivers, Quebec, Baie Comeau, and Port Cartier), as well as the Atlantic ports in winter months. The transloading characteristic for Thunder Bay demand adds about two weeks to the planning horizon to account for:

- Offloading to "lakers"/"salties" in Thunder Bay
- Transit to St. Lawrence ports
- Discharge of grain to river port elevators
- Offloads to vessels at river port.

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* Churchill is assigned to the Western Operation section in the CWB.

Laker vessels in the port do not represent demand since their contracts cover the number of trips and amounts to be carried for each month. The type and grade of grain for the vessel is not identified until the laker is assigned a berth. Therefore, determining what will be shipped depends upon the demand in the St. Lawrence River ports and the positions of stock. Grain is sometimes shipped to St. Lawrence River ports to reduce congestion in Thunder Bay elevators or to position stocks at the sales points.

Demand for Board grain in the West is defined primarily in terms of vessel nominations. The table following shows that the vessel nominations accounted for almost all of the sales loading program in Prince Rupert and Vancouver. The 17 percent difference in Vancouver for September (loading program to vessel nominations) may be accounted for by the "surge" loading to meet the Chinese Fleet in early October.

RELATIONSHIP OF SALES LOADING PROGRAM TO VESSEL NOMINATIONS

MONTH (1978)	VESSEL NOMINATIONS AS % OF LOADING PROGRAM			
	VANCOUVER	PRINCE RUPERT	CHURCHILL	ST. LAWRENCE
June	99	100	76	76
July	98	100	45	54
August	100	100	99	55
September	83	100	--	66
October	100	100	--	58
November	94	100	--	78

Vessel nominations are not as significant a factor in the East because the combined capacities of Thunder Bay and the St. Lawrence River ports allow time to build stocks that can be applied against longer term sales commitments. Vancouver, with much less capacity, requires a precise demand formulation that is critically tied to timely and reliable information of vessel positions. In the few cases where direct overseas shipments are handled from Thunder Bay (usually Non-Board sales) the vessels nominations are used to estimate demand.

The predictability of ship arrivals affects the ability of the Wheat Board to estimate demand for particular types of grain.

Upon formulation of demand, the potential stocks expected to be in market position for week 6 of the block shipping cycle are determined.

2. INVENTORY IDENTIFICATION AND CAR AVAILABILITY

In conjunction with a forecast of demand, the grain stocks already in the transportation system must be identified in order to satisfy sales commitments and define car requirements. The execution of the block shipping cycle must be accurately perceived and elements that generate variance adjusted for and incorporated. Inaccurate information on stocks and cars available results in imbalances in the system and results in insufficient stocks to meet the demand.

(1) In Week 3 of the Block Shipping Cycle, the Wheat Board Estimates the Potential Stocks to Cover Demand

The CWB examines stocks available to cover demand and to better ascertain the number of cars required in the loading program.

Information on the available stocks, unloads, cars on hand, cars en route, country loadings, and cars ordered is considered. The sources of available stock information are:

- Terminal stocks - CTC Grain Coordinator/ Grain Commission
- Unloads - Grain Commission/CTC Coordinator
- Cars on hand - Railways/CTC Coordinator
- Cars en route - Railways/CTC Coordinator
- Country loadings - Grain Companies/Railways
- Cars ordered - Wheat Board.

These components of potential stocks are compared to the demand formulated by the two methods (East and

West) discussed previously. For example, eastern requirements are calculated broadly, as shown below:

EASTERN STOCK POSITIONS
AND REQUIREMENTS IN TONNES
(Cycle Week 3)

	1CW 11.5%	1CW 12.5%	1CW 13.5%	1 Durum	Export Barley	Rape-Seed
POTENTIAL STOCKS						
Instore (Terminal Stocks)						
Thunder Bay	6,437	22,882	27,514	2,251	122,400	33,138
St. Lawrence	1,075	43,939	26,737	2,929	36,327	
En route (vessels)						
St. Lawrence	11,771	63,741	56,020	26,712	35,548	
Cars						
En route (cycle week 3)	22,597	226,096	203,500	26,603	56,286	7,830
Ordered (cycle week 4)	8,575	86,070	77,431	563		
TOTAL POTENTIAL STOCKS	50,445	442,728	391,202	59,058	250,471	40,968
Sales						
Export	45,670	19,190	210,380	41,990	226,530	38,887
Mils		106,230		16,420		
TOTAL DEMAND	45,670	125,420	201,380	58,410	226,530	38,887
LONG/(SHORT) POSITION*	4,785	317,308	189,822	648	23,941	2,081

* Total potential stocks minus demand.

The Winnipeg office of the Wheat Board receives daily reports on stocks by grade and elevator from their Vancouver and Thunder Bay offices. The information was originally collected by the CTC Grain Car Coordinators.

Since the Wheat Board must determine car requirements for a country loading program two weeks in advance of being spotted at primary elevators (see Exhibit N-2), it must consider stocks currently in transit to terminals. The Wheat Board has two primary sources for this information: rail cars-in-transit files, and a combination of car loading and unloading reports from various sources, principally the CTC car coordinators' compilation of railroad and terminal elevator positions.

The Wheat Board obtains copies from the railways each midnight of cars-in-transit files for cars loaded with grain. The record for each car contains the following information.

- Car number, waybill number and date
- Last railway reporting point
- Origin/destination
- Grain
- Days under load
- Days without moving.

A number of printout formats are available to sort and display these records for planning and monitoring. For instance, the number of cars having passed Kamloops within the past 24 hours can be determined when estimating a given day's arrivals at Vancouver.

The grain companies provide the Wheat Board with primary elevator loading reports which are compared to the cars-in-transit reports. This information is supplied by the primary elevator managers to the grain company and then assembled for the Wheat Board. In general, this information is not as timely as the railway car files since much of the loading information is sent by mail to the grain company head offices before being transmitted to the Wheat Board.

Approximately three days after unloading, the Canadian Grain Commission supplies a computer tape file of daily car unloadings by grain and grade at each port terminal. This also provides insight into empty car availability in following weeks.

Using all of the above information, the Wheat Board forecasts car arrival requirements at terminal elevators for two weeks ahead.

(2) Rail Car Availability is Negotiated by the Wheat Board and Railways

The Wheat Board terminal managers and railway representatives assess the number of cars available to meet demands through analysis of:

- Unloads
- Loads on hand at terminal
- Loads on wheels by location
- Country loadings
- Outstanding orders.

The information is used to negotiate the number of cars to be committed to the week N loading program. The railways use forecasts of empty cars, based on similar but more detailed information, to update the current week of operation, adjust for the following week, and estimate the new car orders that can be met in the program week. The railways will usually offer a car supply based on what is determined in these calculations. However, at the negotiating session with the Wheat Board's transportation managers, the estimates of availability are normally increased.

On Wednesday afternoon, representatives of the Wheat Board's Transportation Department meet with representatives of the railways to negotiate the number of cars which will minimize their cost (e.g., not require reassignment of crews or running extra trains). Since the Wheat Board has access to the railways' cars-in-transit files and loading and unloading reports from other sources, and since the railways keep a relatively constant number (about 22,000) of cars available for grain service, agreement is often reached fairly quickly and without detailed discussion. The result of this discussion is a table typically of the following form:

CARS TO:

	THUNDER BAY	VANCOUVER	PRINCE RUPERT	CHURCHILL	OTHER (DOMESTIC)
CN	2,000	500	300	0	300
CP	4,000	500	0	0	300

This represents the number of cars to be made available at as yet unspecified primary elevators in 10 to 14 days time. They are available for allocations as producer cars, or for Board or Non-Board grains.

There is considerable pressure at the Wheat Board negotiation sessions to force the railways to commit more cars for the program week than offered. If accepted by the railways, this will normally be reflected in the size of shortfall (fewer cars delivered versus authorized) experienced at the primary elevators in subsequent weeks.

3. DEVELOPMENT OF THE FINAL OPERATING PLAN

During the latter phases of the car allocation planning process, the coordination between the Wheat Board, the railways and the grain companies becomes critical to the development of a workable car allocation plan.

The Wheat Board has the major responsibility in the allocation of cars to blocks but is dependent on the grain companies to:

- Provide the information on stock positions to make the allocation
- Allocate the cars to their elevators
- Comply with the allocation once authorized.

The Wheat Board is also dependent on the railways to:

- Guide the planning to satisfy operating constraints

- Supply realistic car availability information for the program week

- Service the allocation once authorized.

(1) Block Allocation Decisions are Based on Shippable Stocks and Forecasted Demand

The Wheat Board block supervisors receive summaries of shippable stocks by block on each Friday from the grain companies. The shippable stocks information identifies the potential inventory for grains in demand. A preliminary block allocation sheet which includes the inventory levels by block is prepared. The source of country information for the block allocation is:

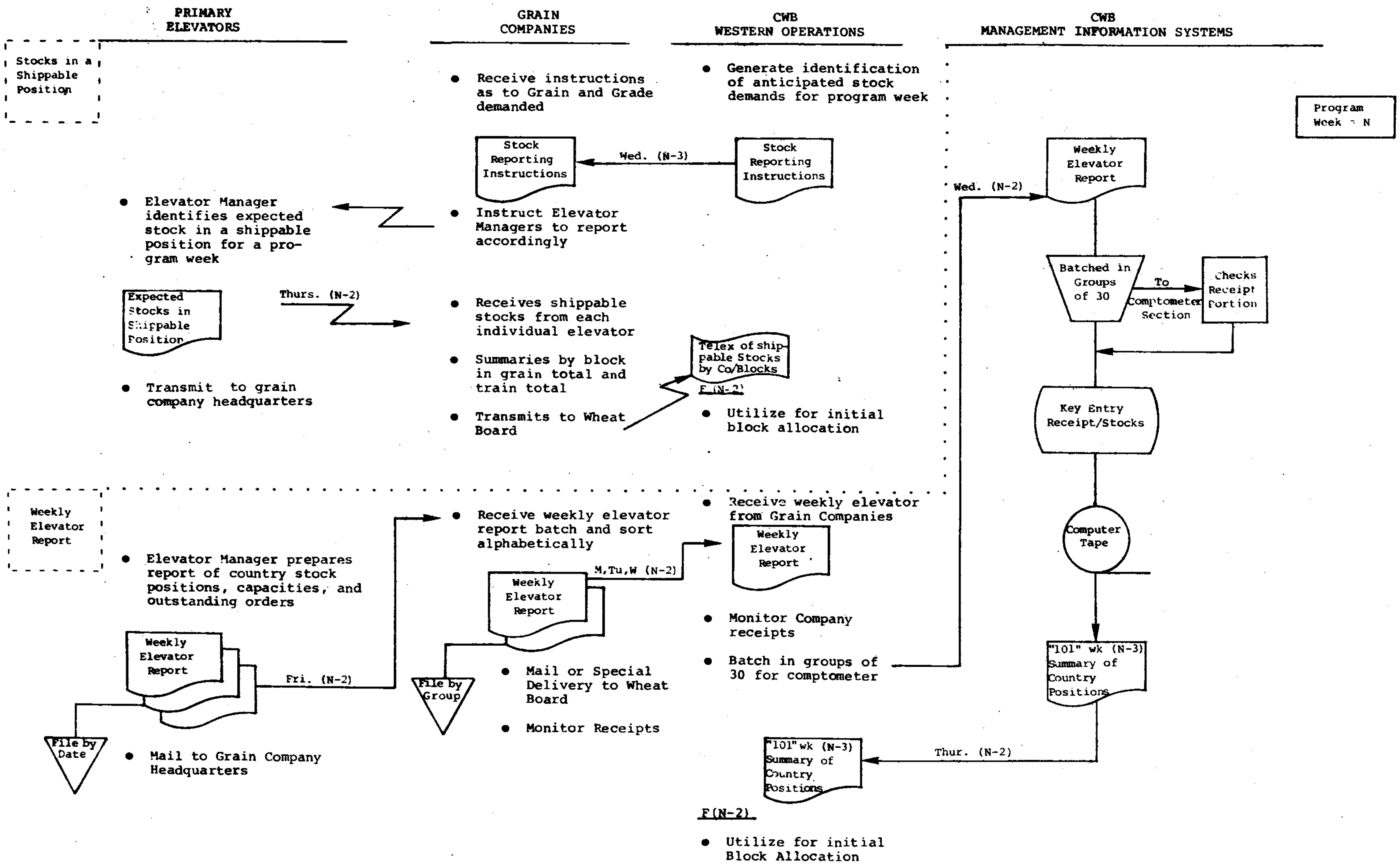
- Summary of Shippable Stocks—prepared on Thursday (10 days ahead of delivery week) the elevator operator requests a certain number of shippings, and anticipated receivings

- Weekly Elevator Report—prepared on Friday (17 days ahead of delivery week) the elevator operator fills out a report listing inventories by grain and grade, space available, previous week's receipts and outstanding orders.

Exhibit N-4 details the flow and timing of stock information through the system to its ultimate use in the allocation procedure. The summary of shippable stocks is relatively timely, but only lists stocks requested by the Wheat Board. The weekly elevator report arrives a week later.

The elevator report is critical to the allocation process for it is also the basis for formulating the grain companies' 12-month handling shares and for identification of congested stations and blocks.

EXHIBIT N-4
Stock Reporting Channels and Processing



The Wheat Board Transportation Department also tries to identify protein levels in the shippable stocks by:

- Asking the companies to identify the higher protein stocks
- When higher protein wheat is required, ordering from those areas which traditionally grow higher protein wheat
- Using last 10 car average protein reports by block origin prepared by the Canadian Grain Commission.

The Western Director of the Wheat Board and the block supervisors meet with railway representatives each Friday afternoon to agree on the bulk allocation of cars to blocks.

The strategies of allocation to blocks employed by the Wheat Board vary with respect to meeting shipping commitments at the port terminals. The usual procedure for car allocation follows this sequence:

- Port
- Non-Boards and producer cars
- Board grains
- Railway
- Blocks close to port
- Congested blocks
- Remaining blocks.

The procedure is not as rigidly structured as the format above may suggest. Many of the decisions and the actual allocation to blocks may have been made previous to this operational meeting.

The underlying assumptions behind the choice of blocks and grains data to be used are not explicitly stated, but a pattern generally emerges (e.g., a "search" for a particular grain shippable from points as close as possible to a particular port). It might be argued that the resulting allocations do tend toward a certain "objective", but there is no quantitative measure available to determine to what extent it is achieved or to what extent other objectives have been compromised.

(2) <u>Allocation to Companies and Stations is Complex</u>

The complexity of this aspect of the car allocation process particularly in the flow of communication and information is shown in the flow chart presented in Exhibit N-5. Most of the communications among the Wheat Board, grain companies, and railways surround the allocations to companies and stations as seen in Exhibit N-5.

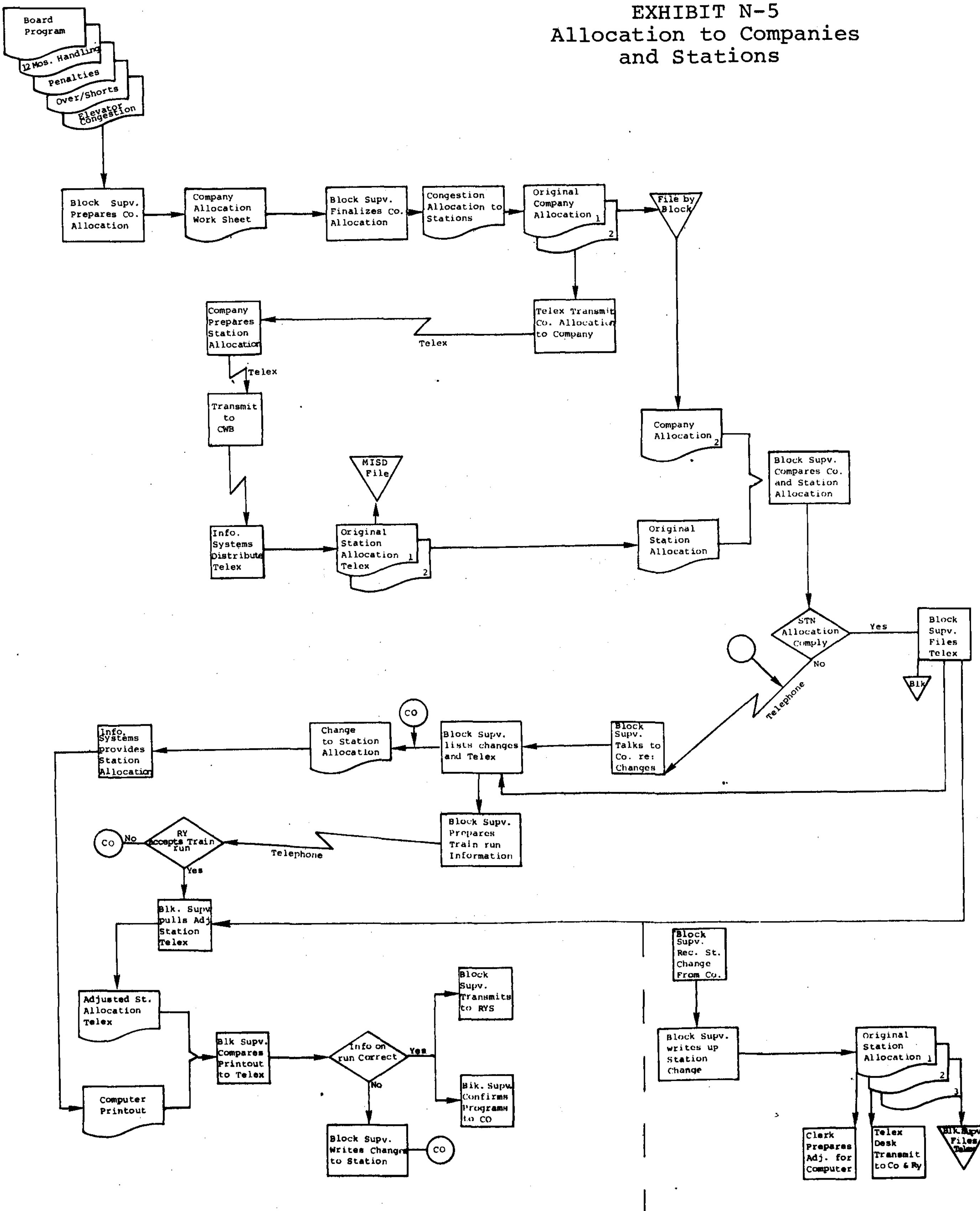
The sequence of events from initial block allocation to distribution of the final loading program includes:

- CWB allocation to grain companies by block on Friday afternoon after the bulk allocation, based upon the previous year's handling of Board grains only with penalty adjustments.
- CWB allocation to stations on Friday. When a block is within 30 percent of capacity the elevators in that block within 10 percent of capacity will be allocated cars to relieve congestion.
- Grain companies' allocations to stations on Monday in the week before the loading program, incorporating the CWB's allocation to stations to relieve congestion.
- CWB translation of the station allocations into train runs on Tuesday.
- CWB, grain companies, and railway communications on Wednesday and Thursday on various aspects of the final program:
  - Train run size
  - Grain availability update
  - Block and station reallocation.

Upon final agreement of the three participants on Thursday, the final loading program is set.

Upon receipt of the Wheat Board's final car allocation to country elevators, the railway carload centers prepare a weekly schedule for car spotting at the primary elevators within their jurisdiction. The schedule

EXHIBIT N-5
Allocation to Companies and Stations



shows the number of cars allocated to each elevator on a subdivision for the coming loading week as well as the shortfalls accumulated from previous weeks.

In consultation with the dispatcher for the service area, the carload center staff plans local train runs for spotting cars at the primary elevators. The shortfalls will be given first priority and then the current week's car allocation will be scheduled. It is the railroad's responsibility to keep track of the shortfalls by elevator for car distribution purposes.

Upon order placement in the loading program week, the car allocation implementation is complete.

APPENDIX O

PLANNING HORIZON ANALYSIS

This appendix presents in graphical form an analysis of deviation from plan for deliveries of various grain types to each port. The deviation from plan by origin block-destination port pair is also shown for all 48 blocks and four ports. The inability of the system to deliver grains to port according to plan is one of the major concerns of this study and is discussed in Chapter IX of the report.

EXHIBIT O-1
Planning Horizon Analysis
by Grain - Thunder Bay

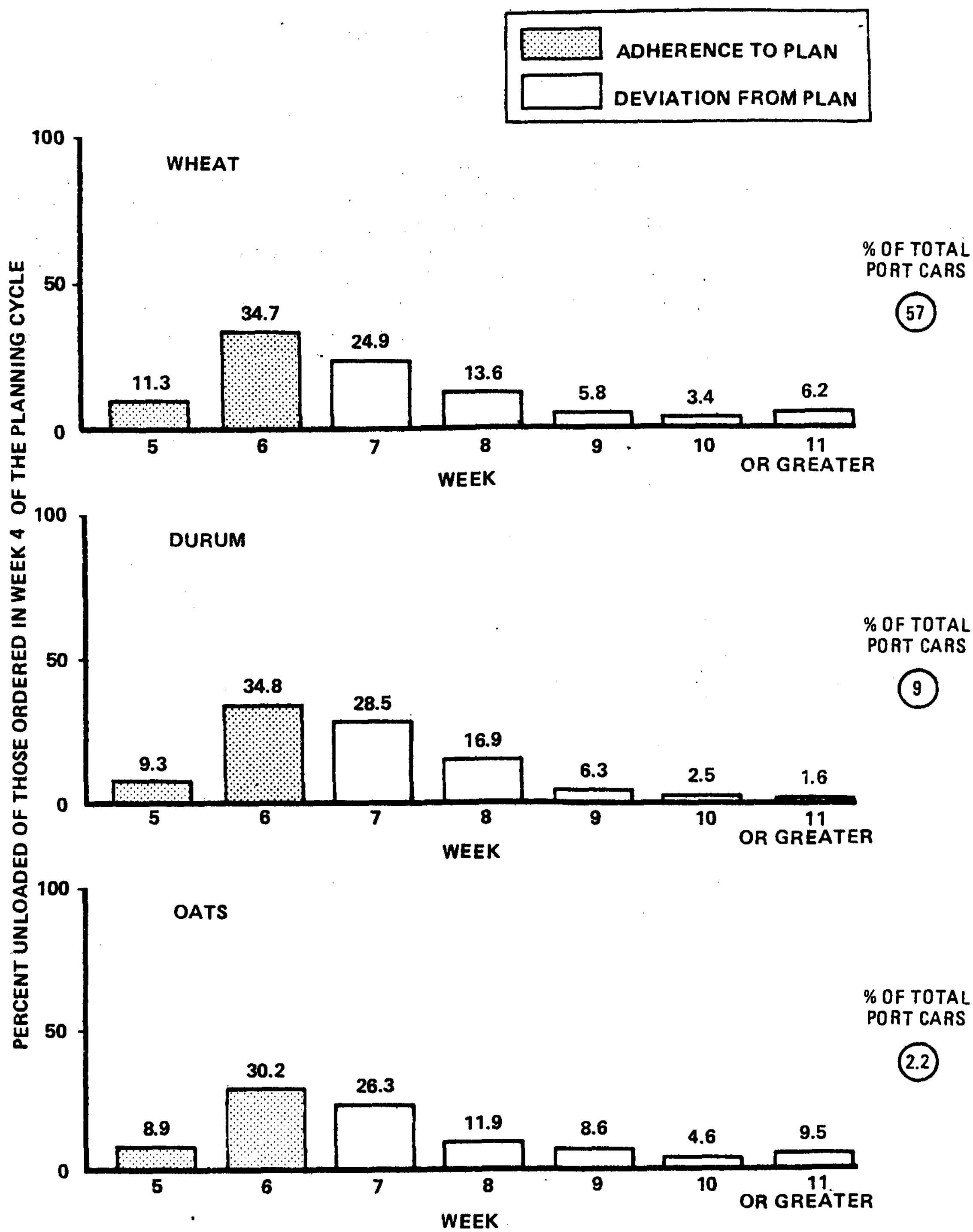


EXHIBIT O-1
Planning Horizon Analysis
by Grain - Thunder Bay
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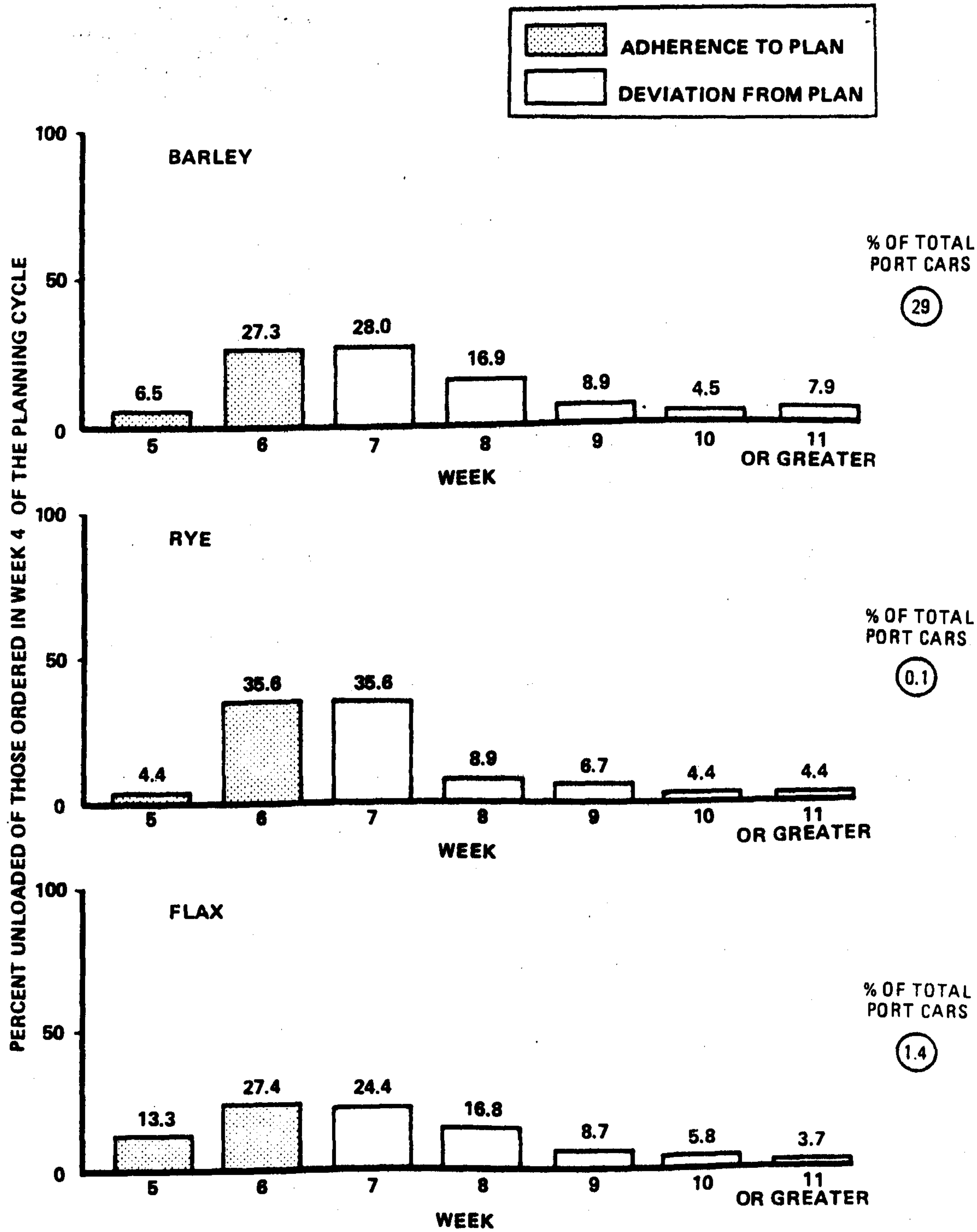

EXHIBIT O-1
Planning Horizon Analysis
by Grain - Thunder Bay
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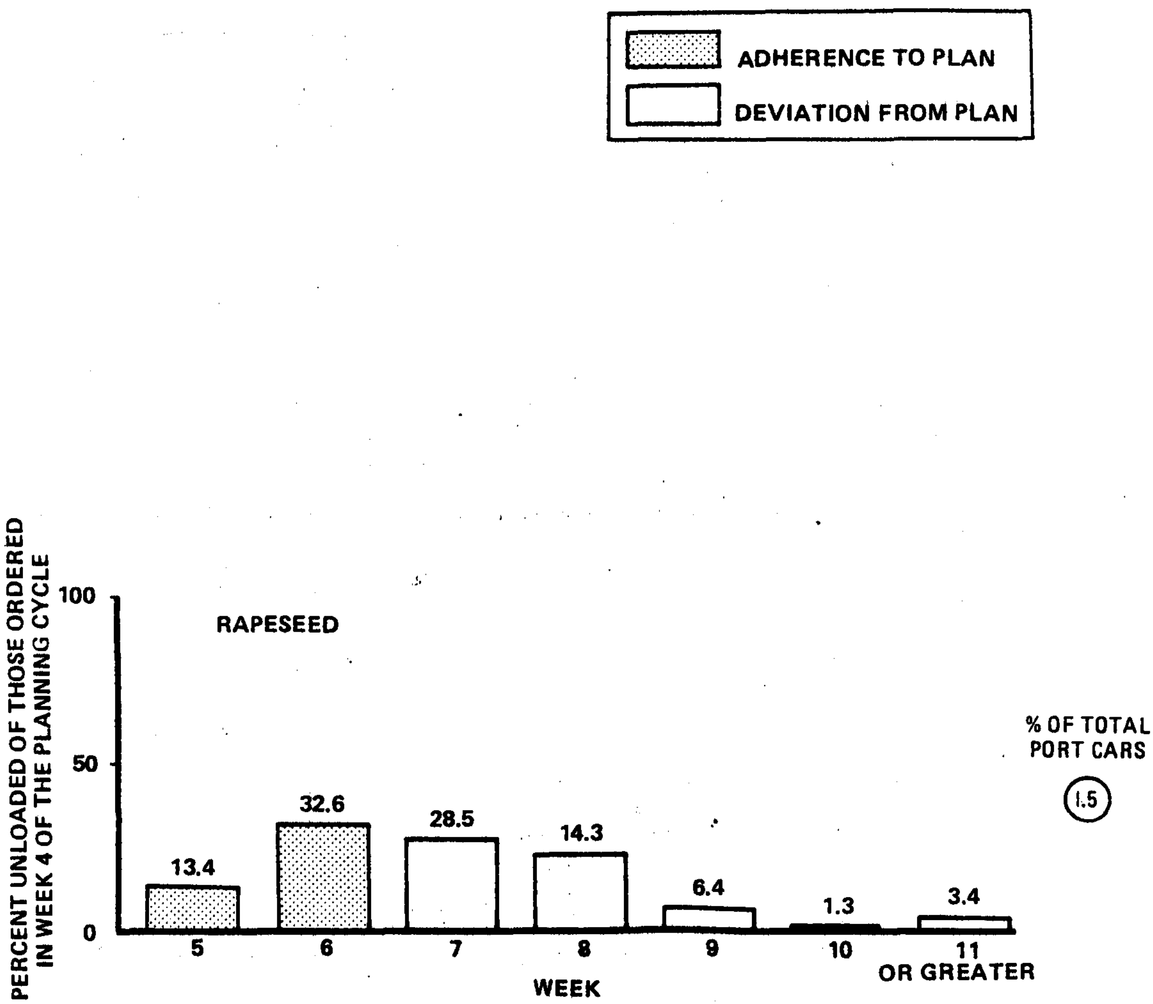


EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay

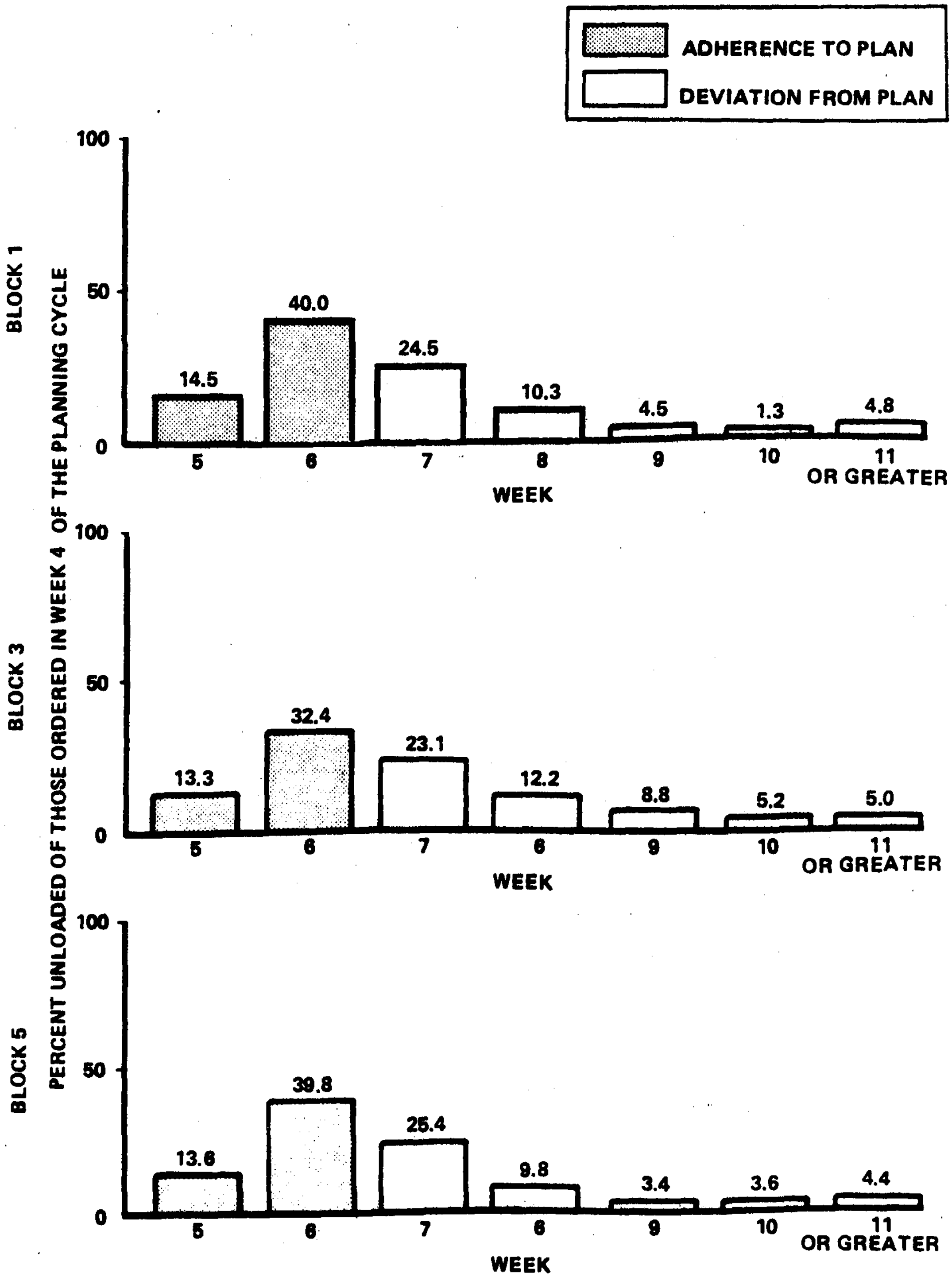
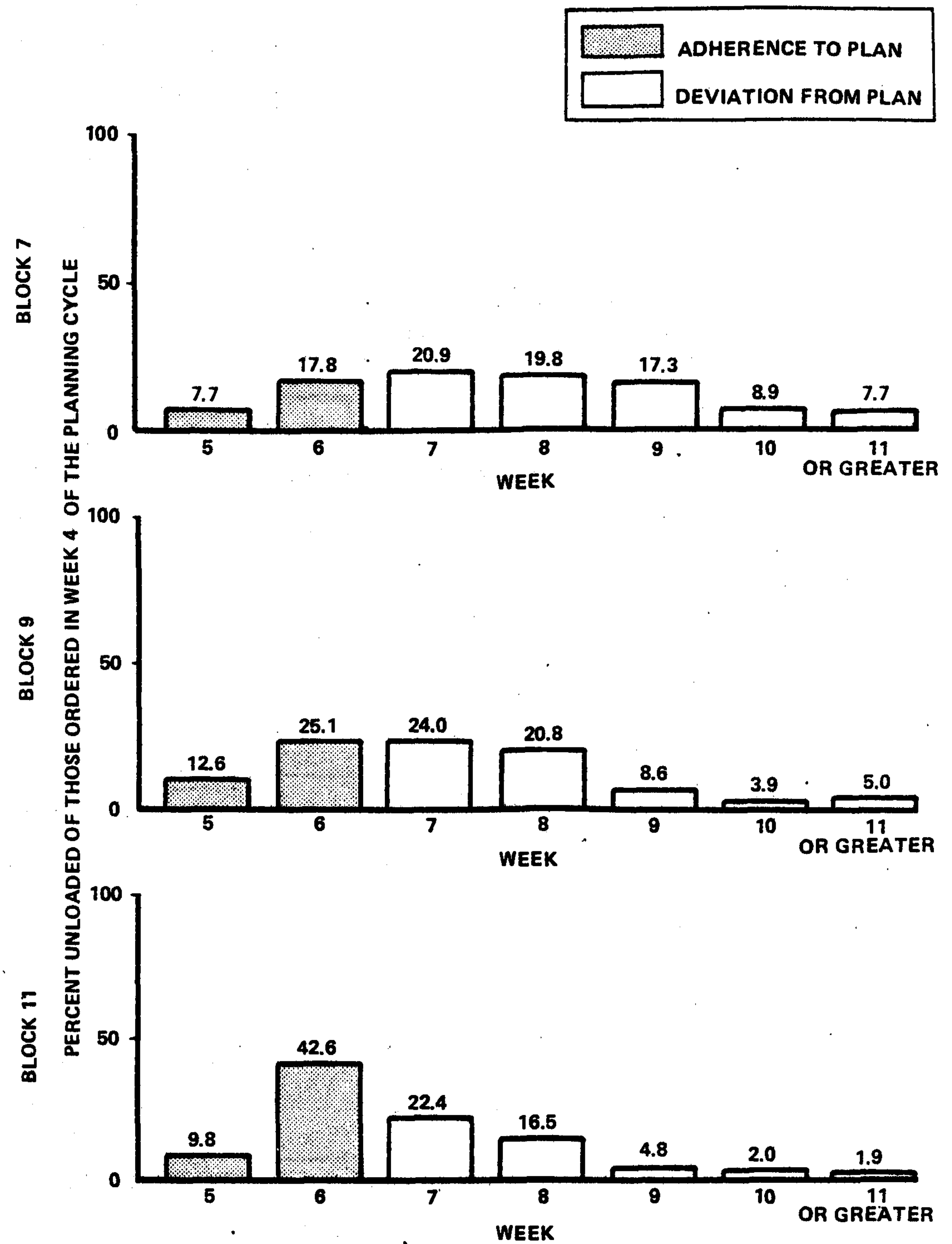


EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
(continued)



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Planning Horizon Analysis
by Block - Thunder Bay
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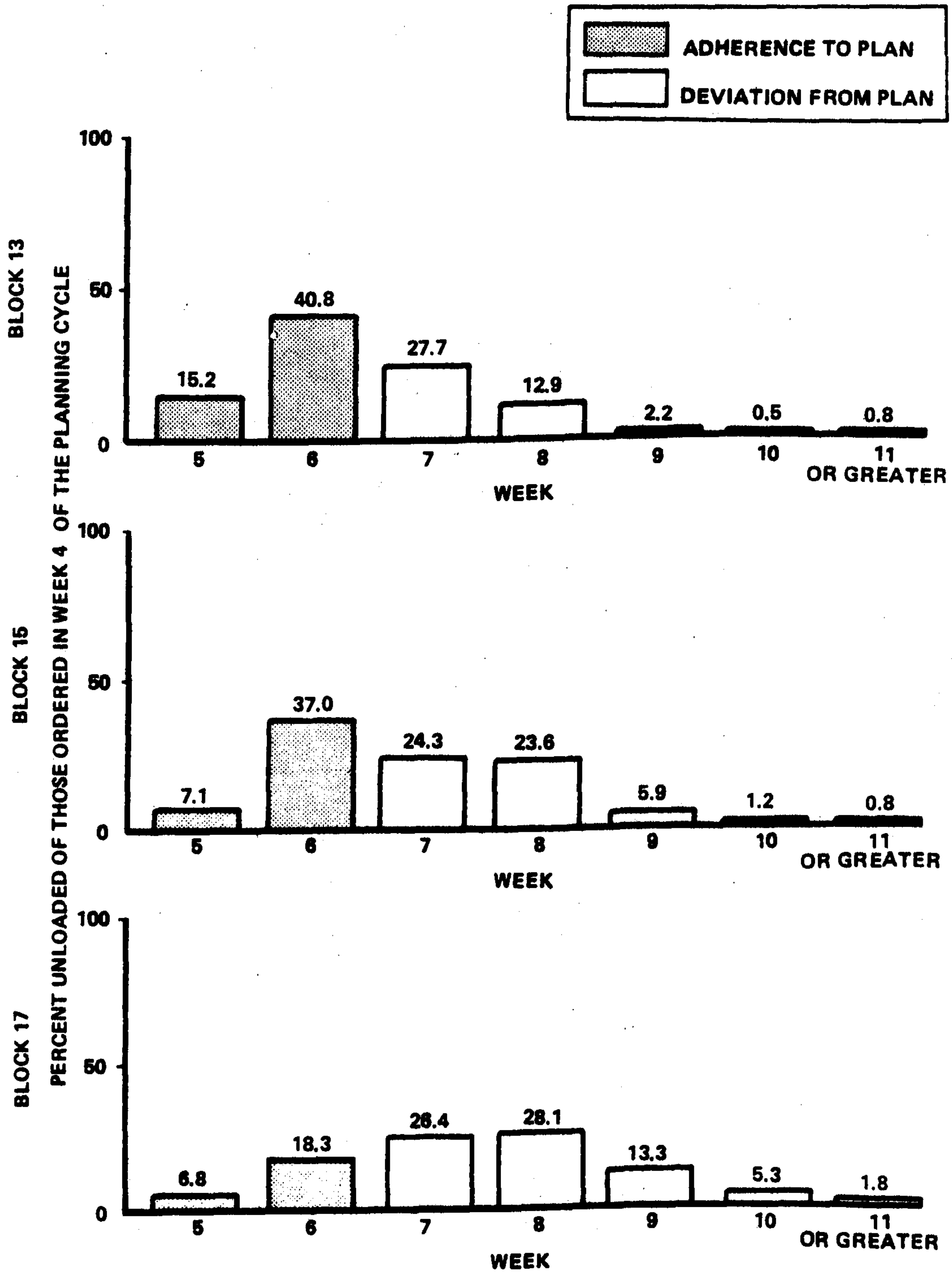

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
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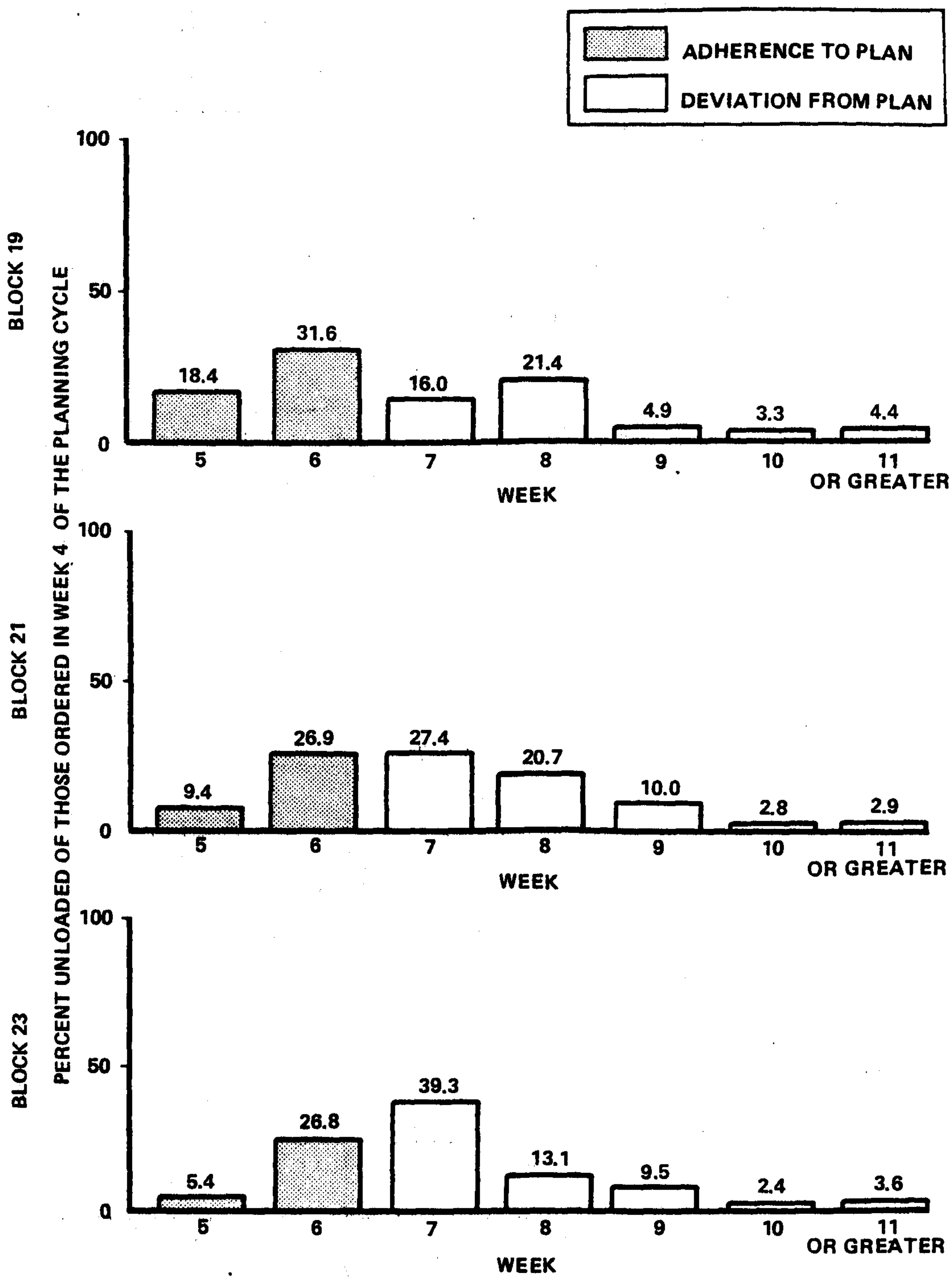

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by Block - Thunder Bay
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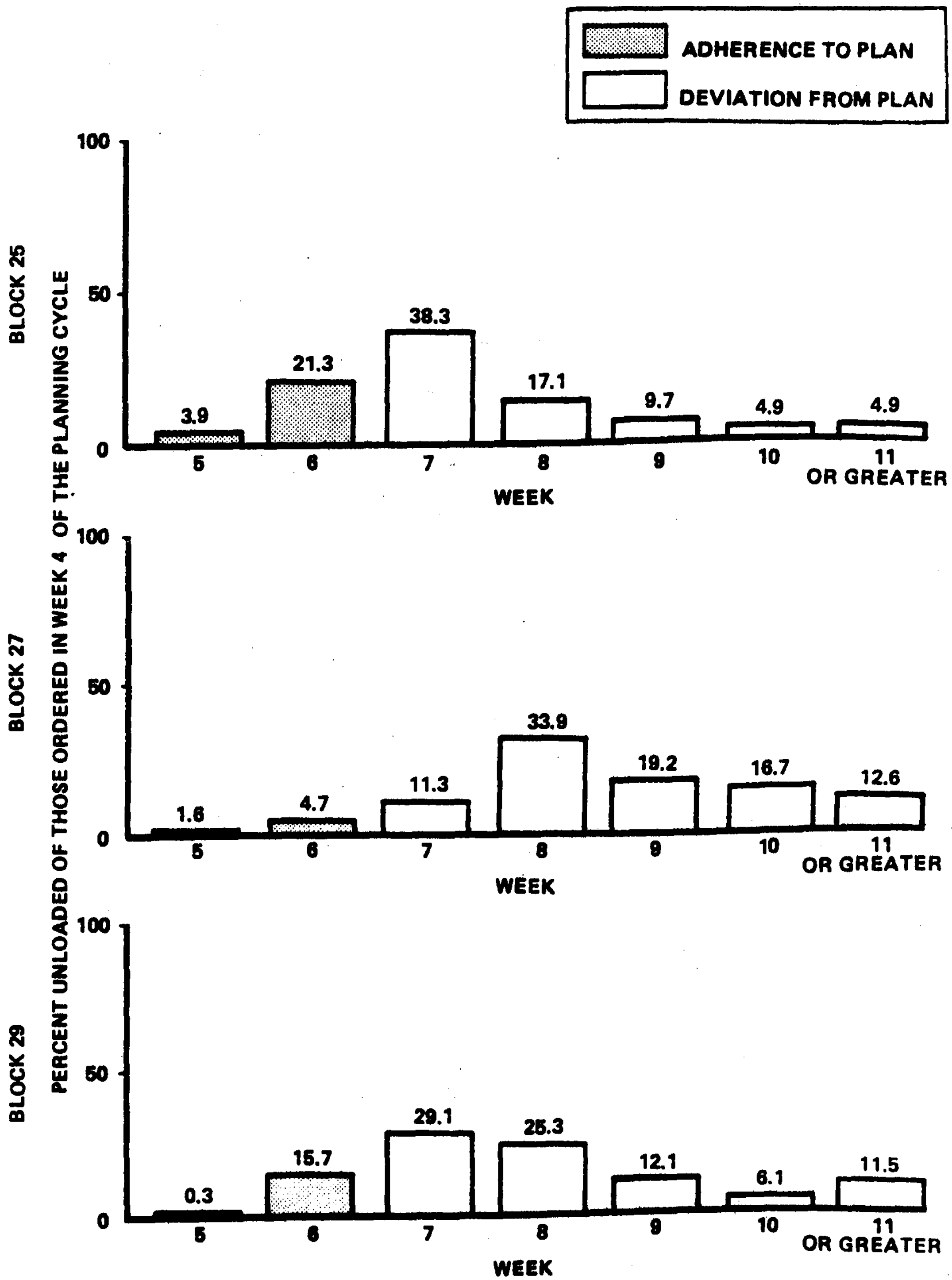

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Planning Horizon Analysis
by Block - Thunder Bay
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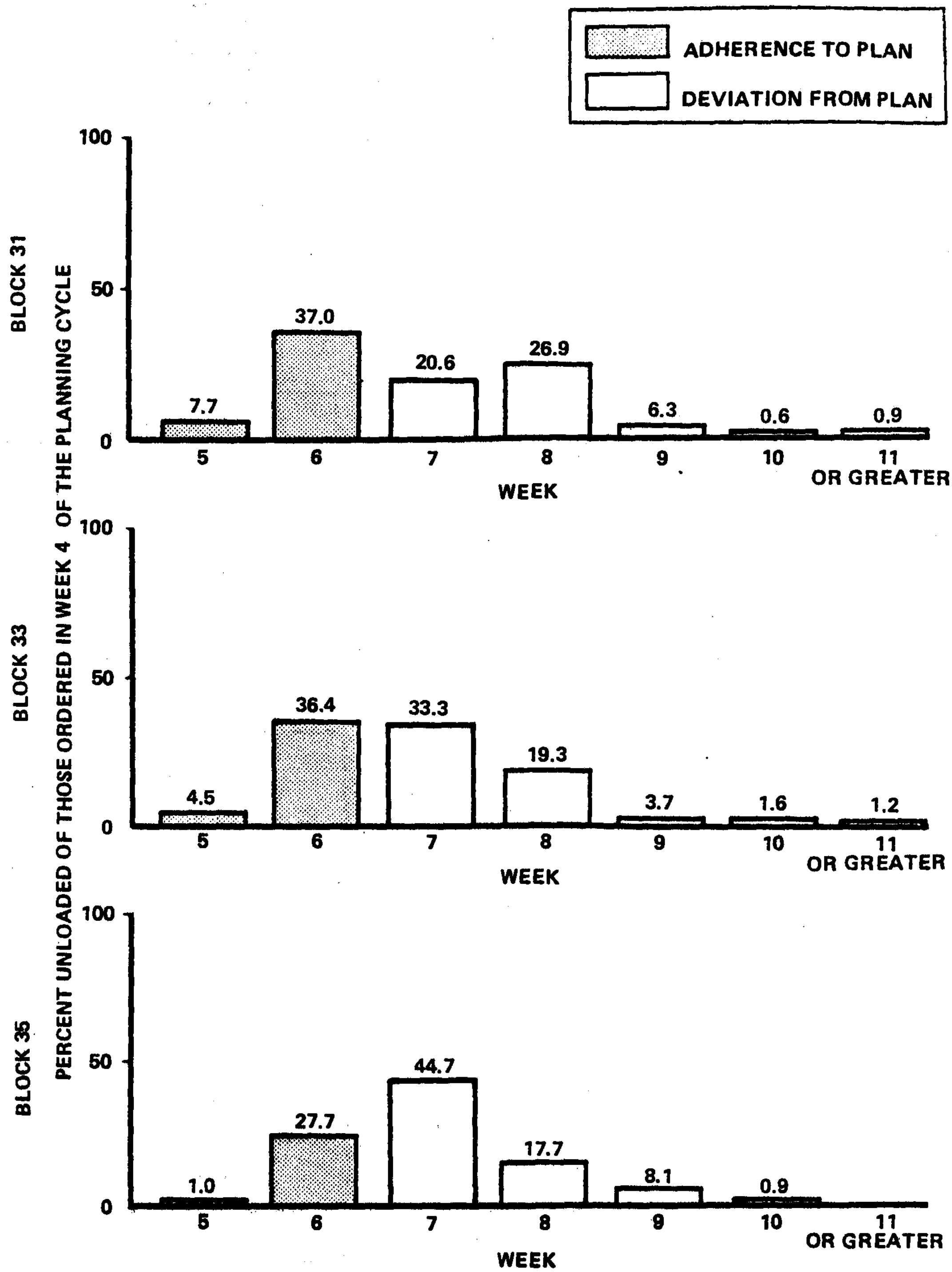

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
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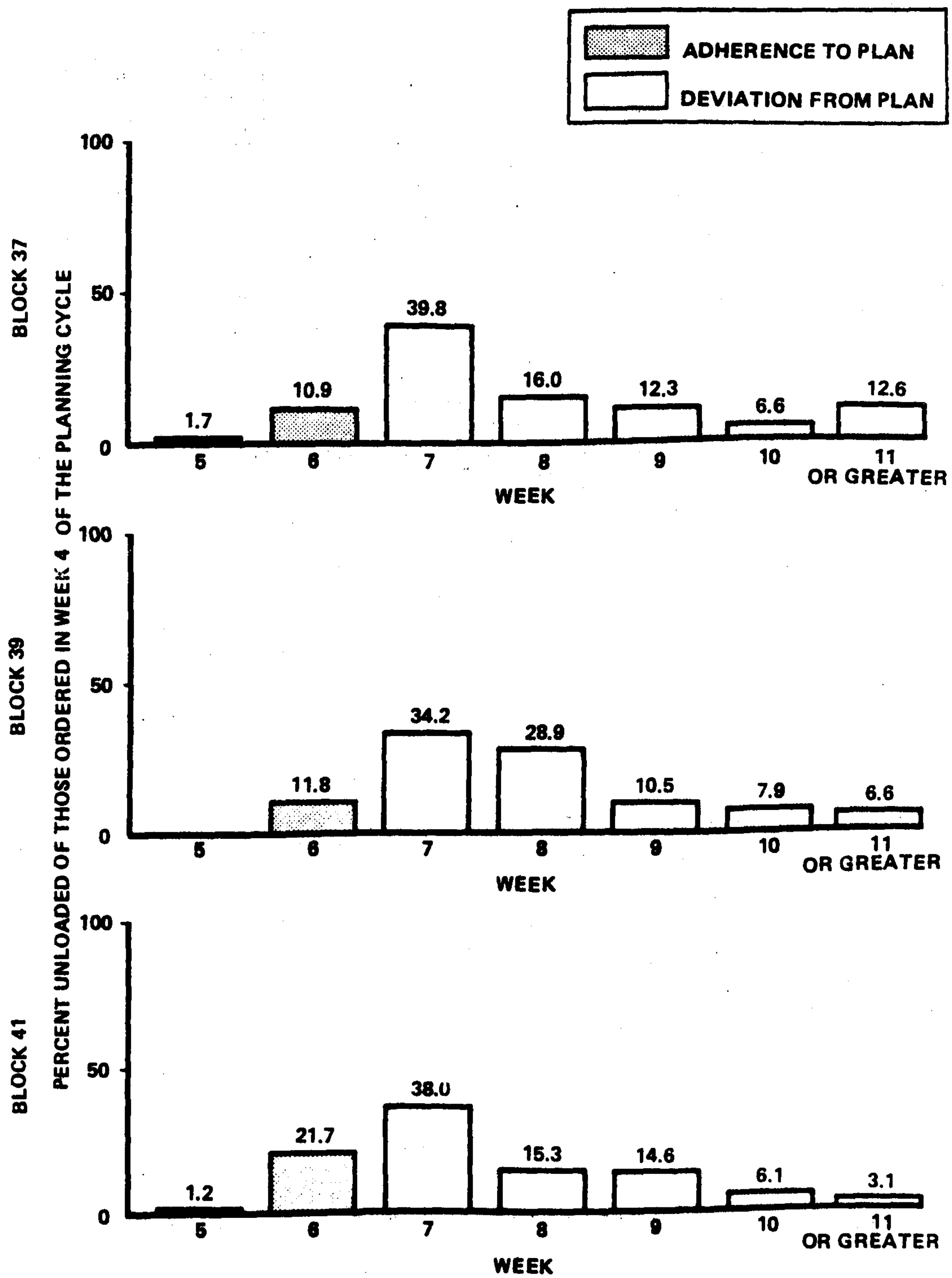

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
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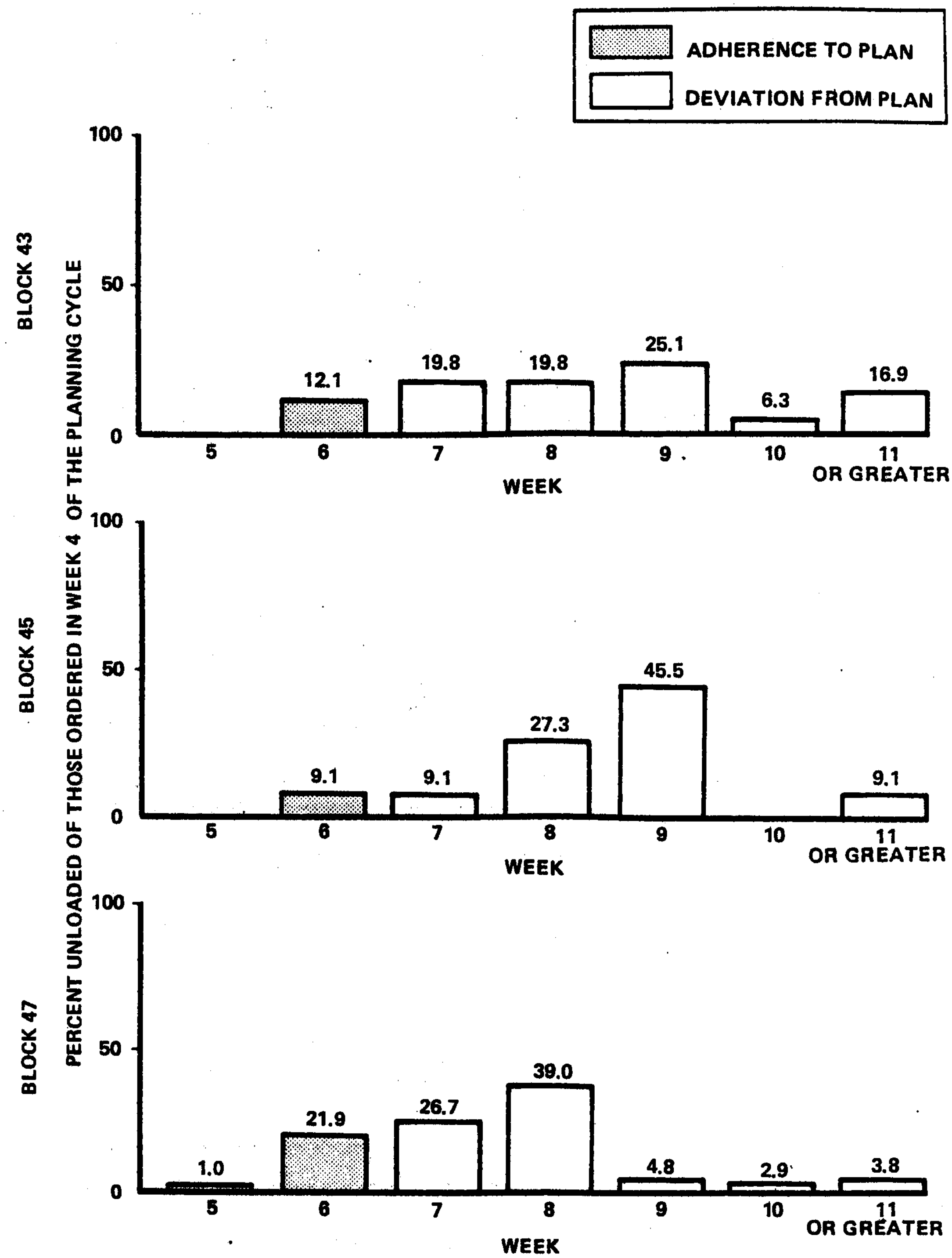

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
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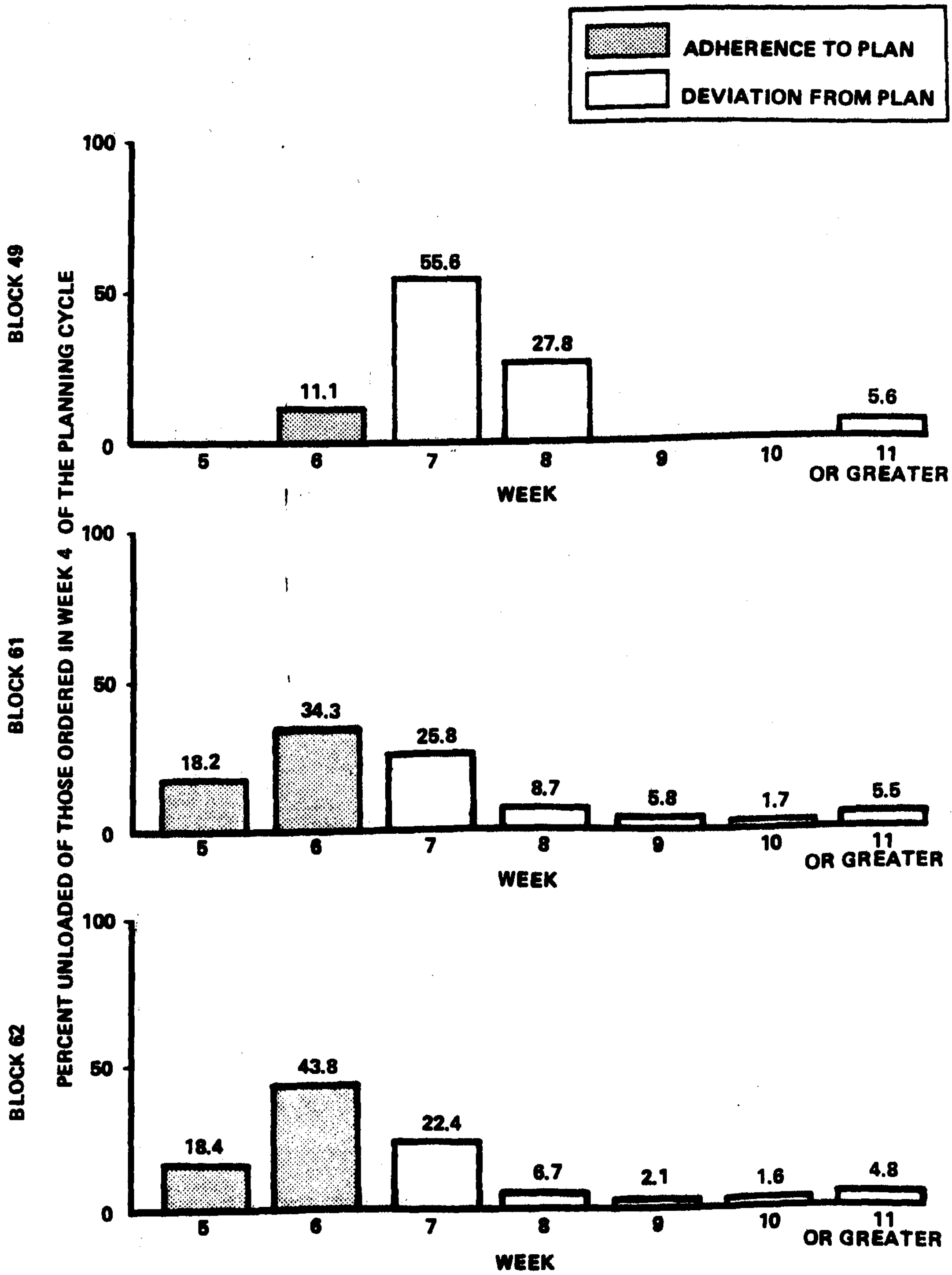

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
(continued)

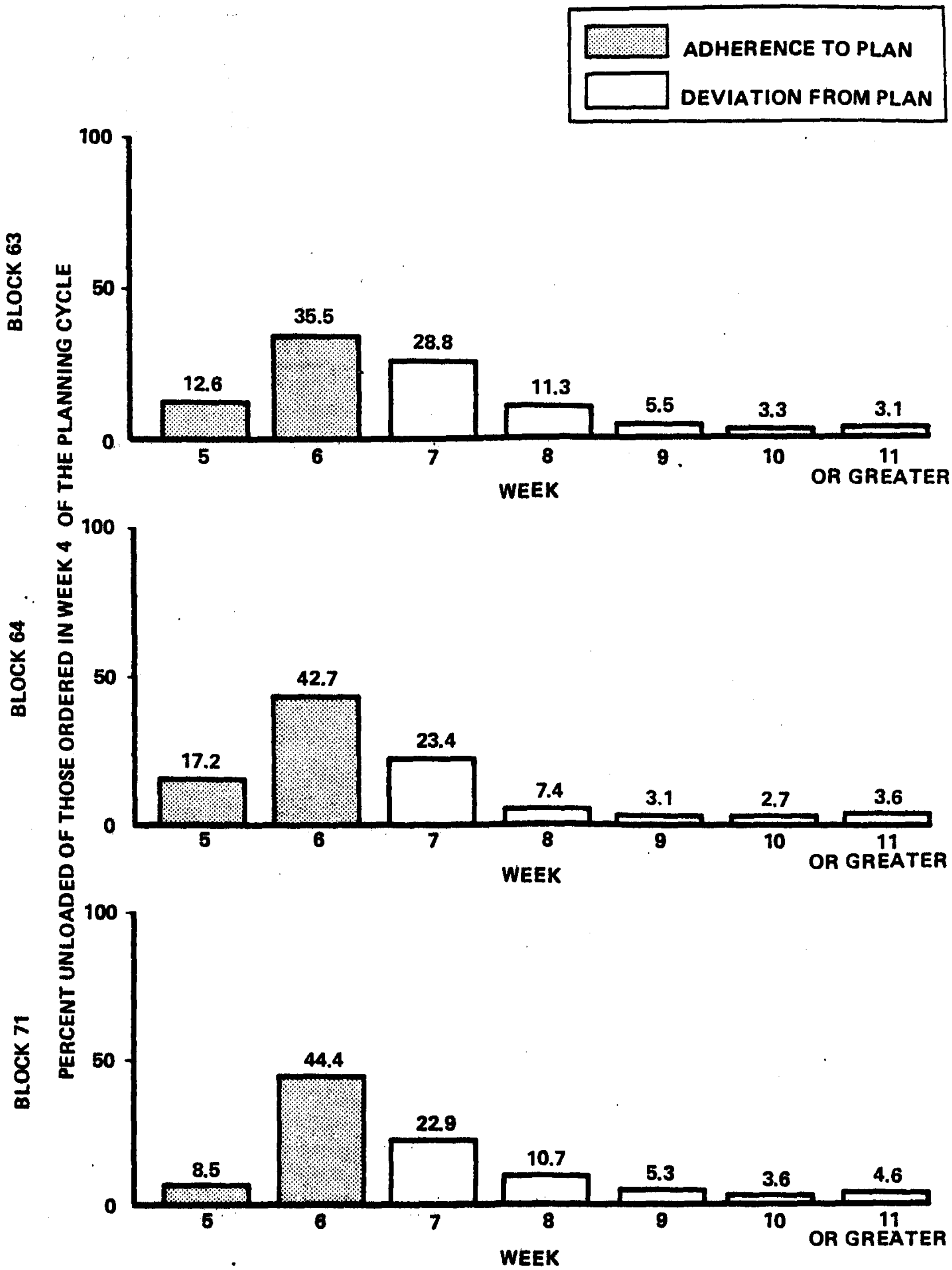

EXHIBIT O-2
Planning Horizon Analysis
by Block - Thunder Bay
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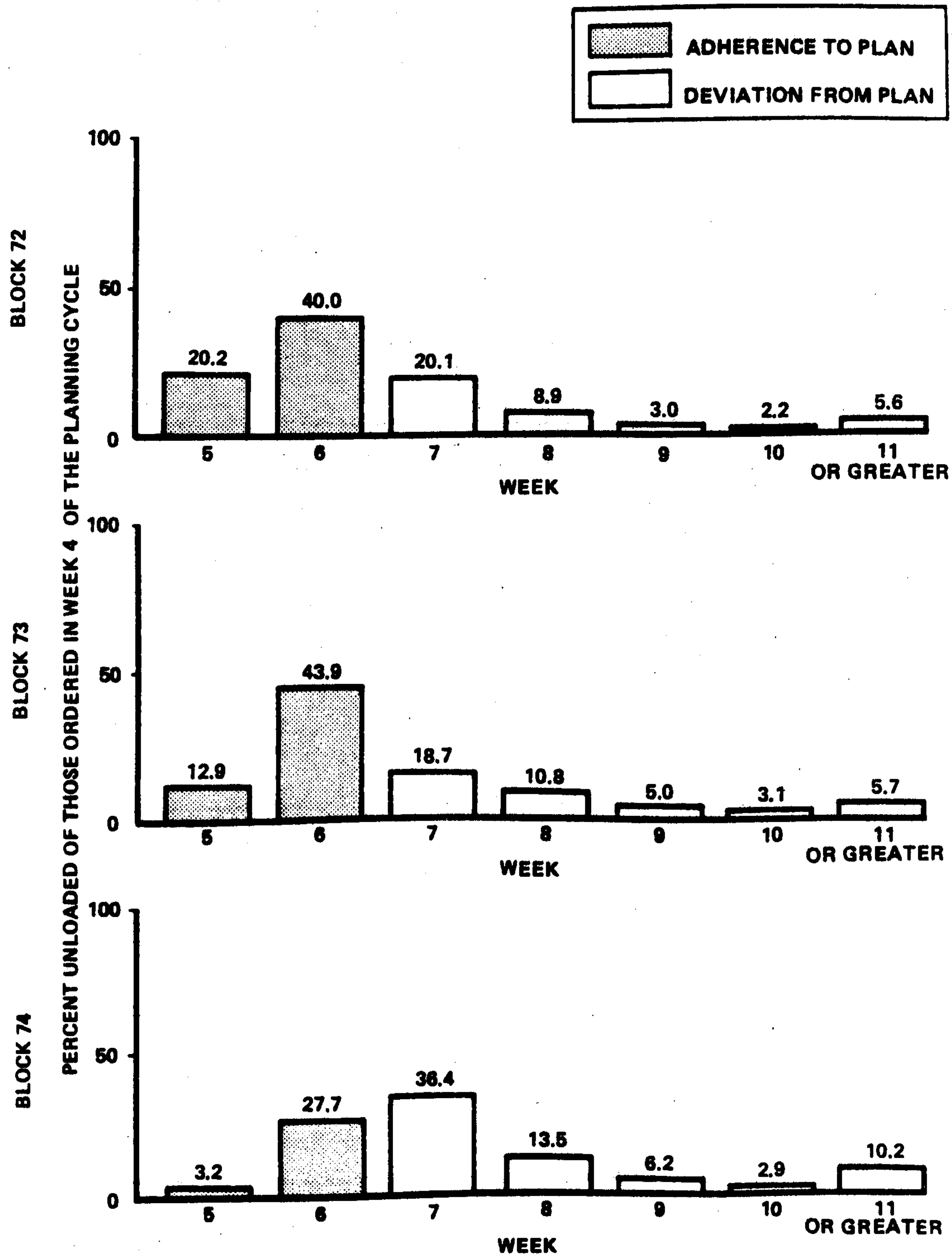

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by Block - Thunder Bay
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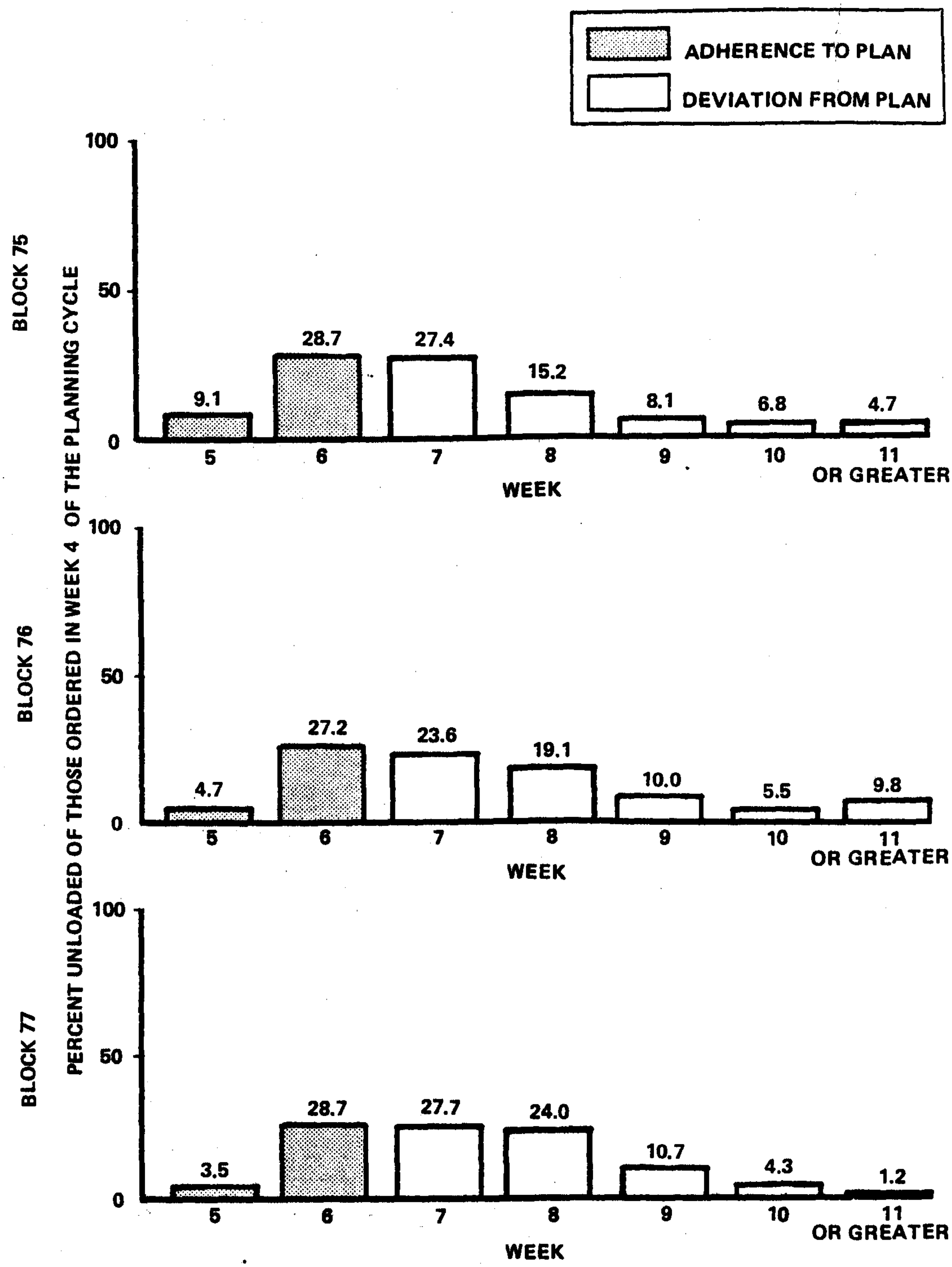

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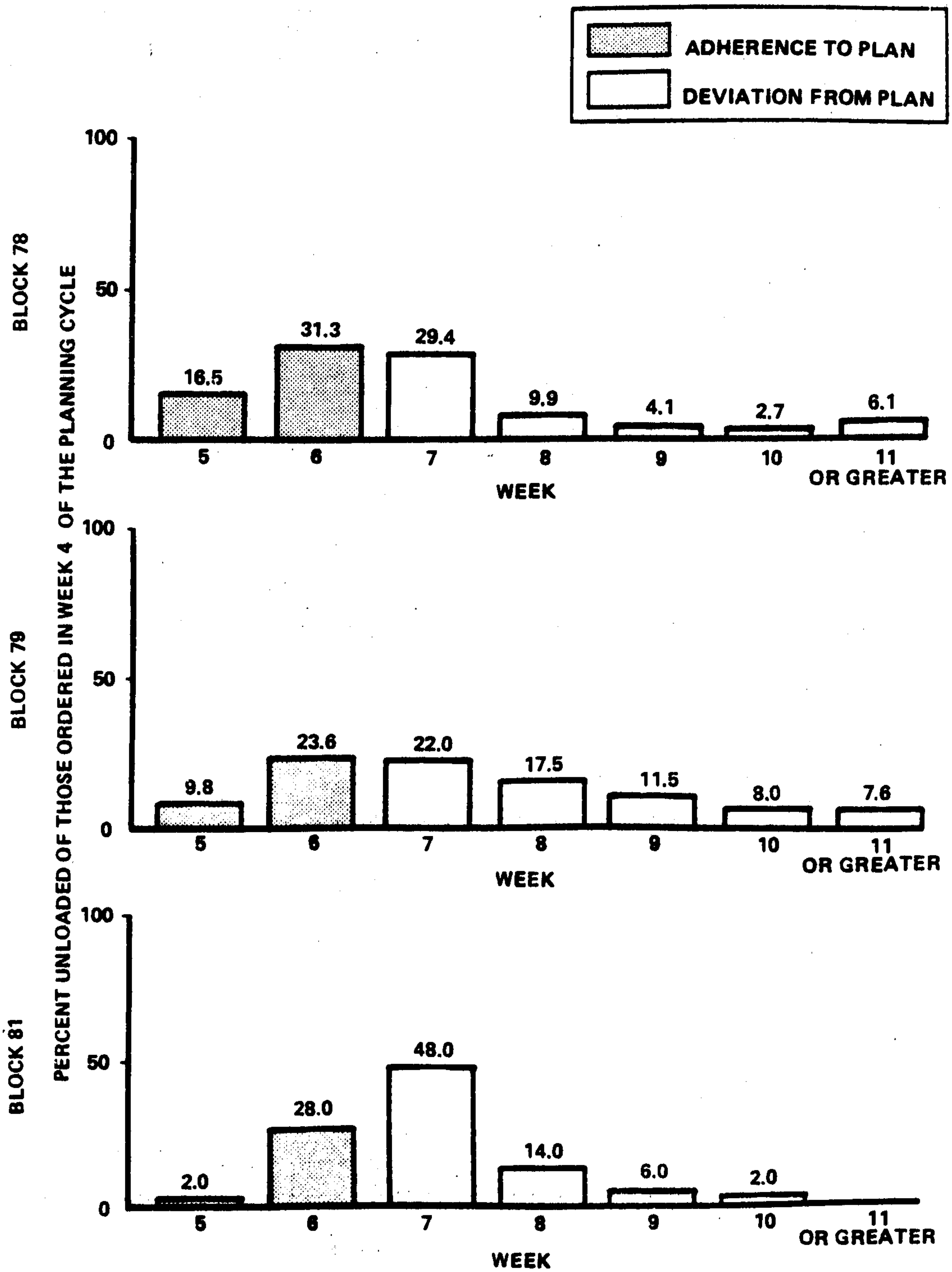

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Planning Horizon Analysis
by Block - Thunder Bay
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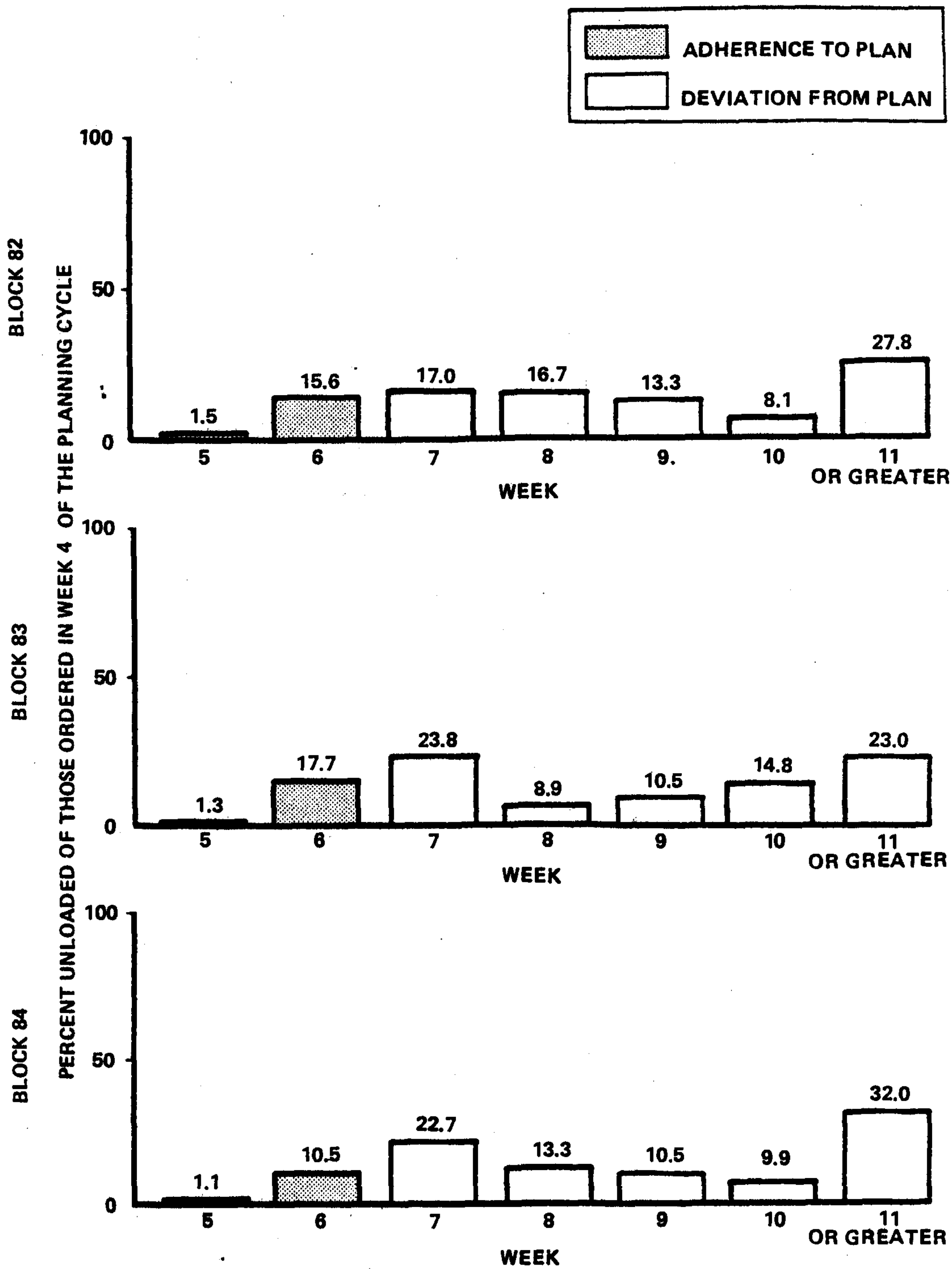

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Planning Horizon Analysis
by Block - Thunder Bay
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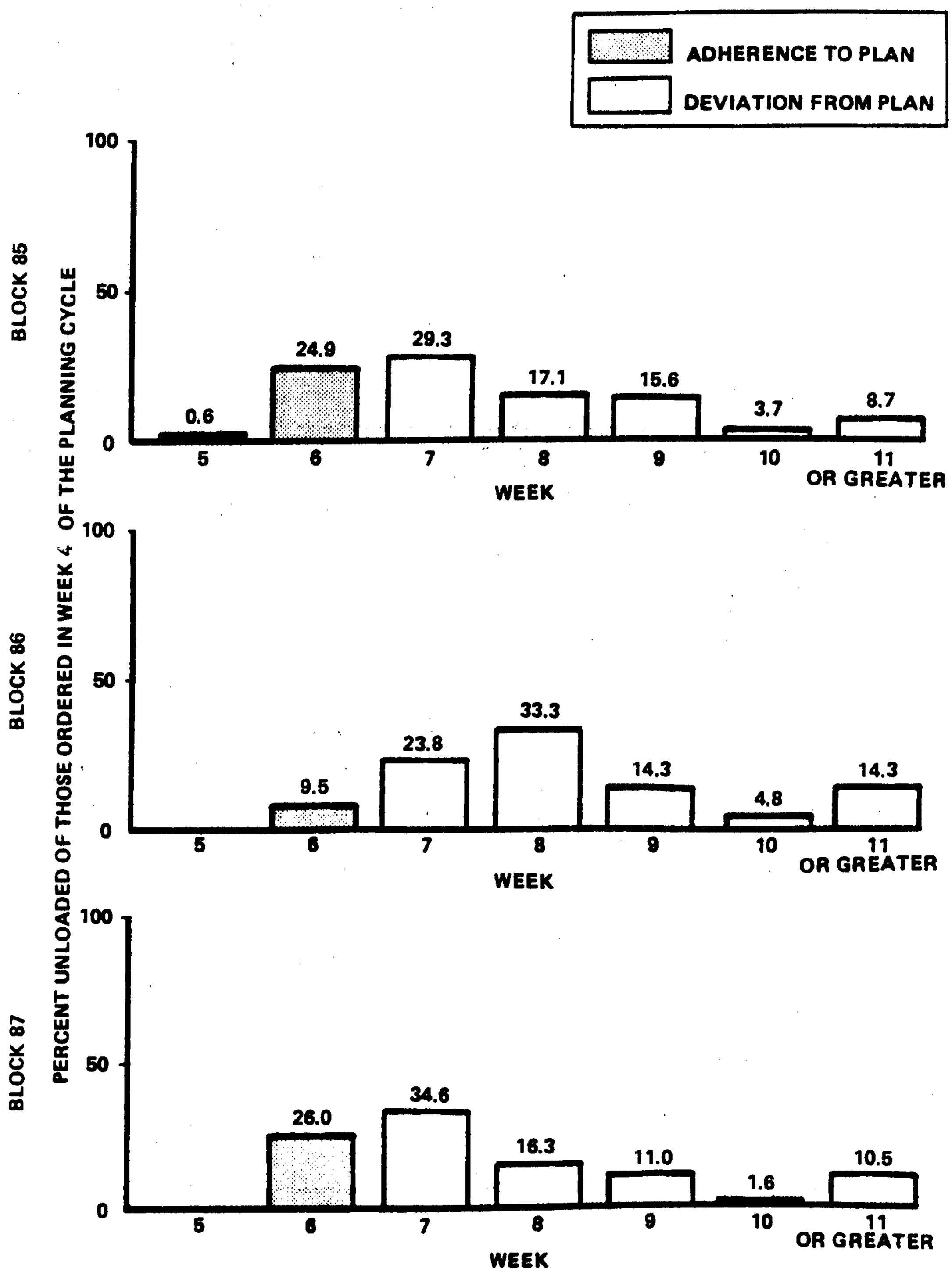

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Planning Horizon Analysis
by Block - Thunder Bay
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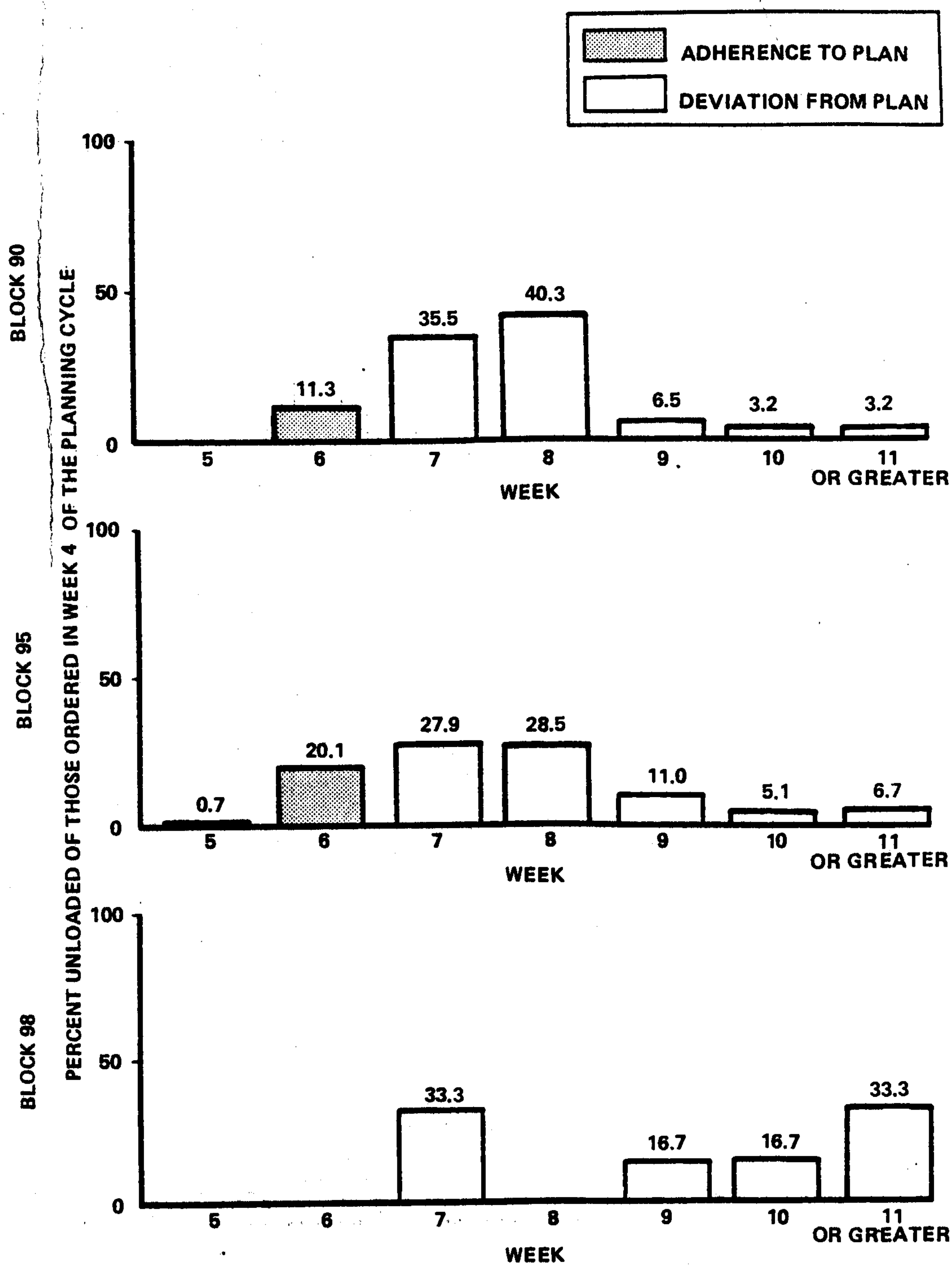
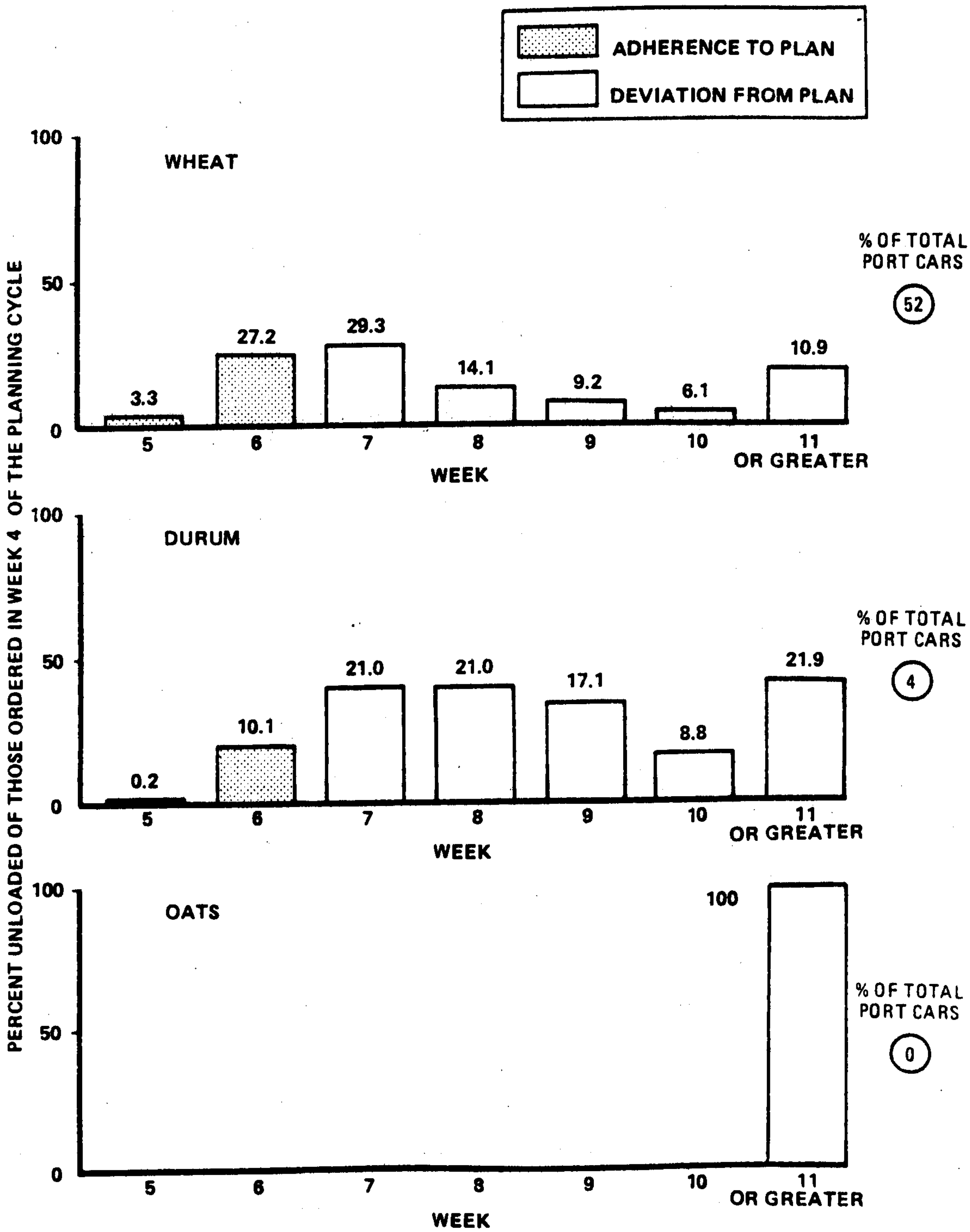


EXHIBIT O-3
Planning Horizon Analysis
by Grain - Vancouver



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Planning Horizon Analysis
by Grain - Vancouver
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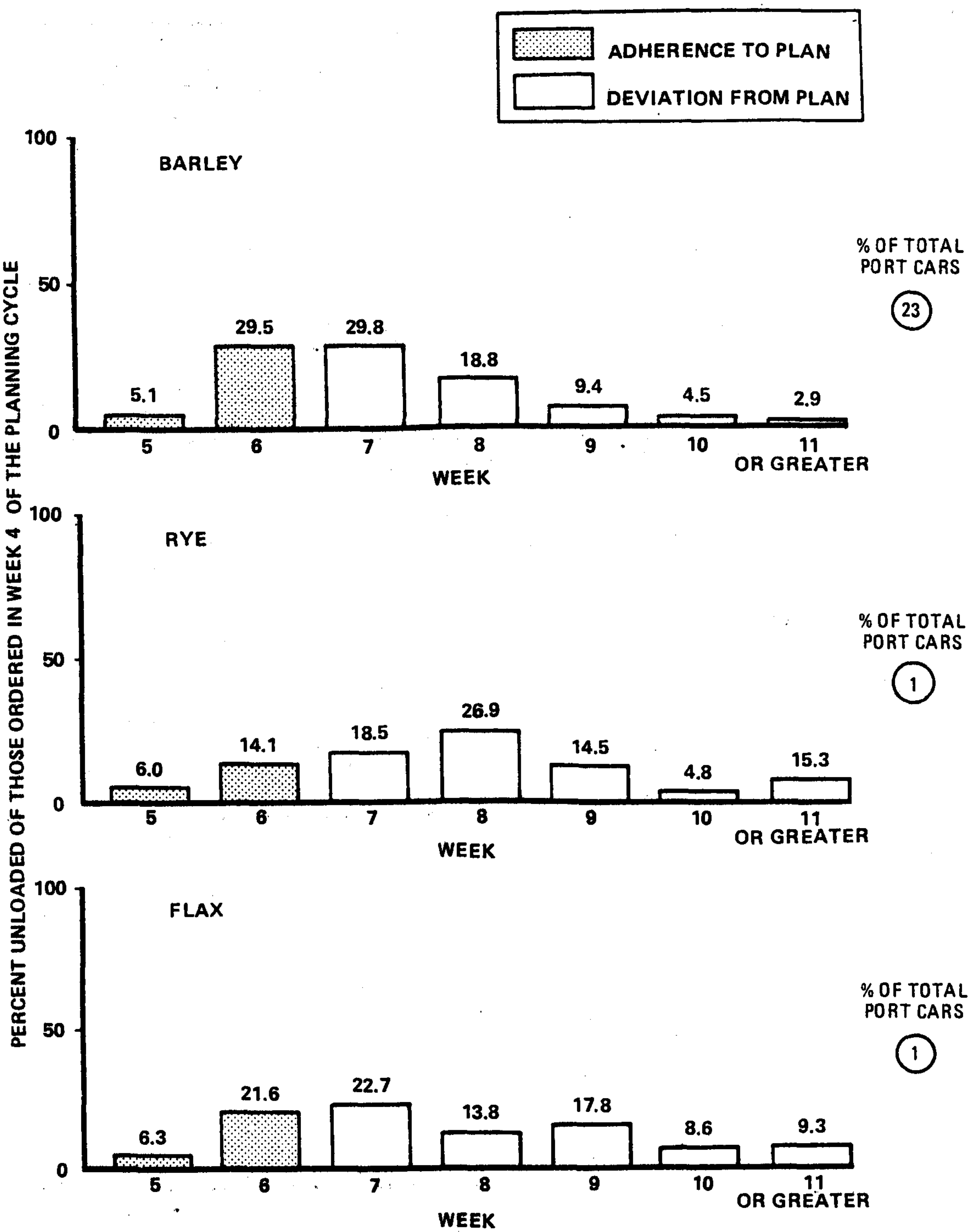

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Planning Horizon Analysis
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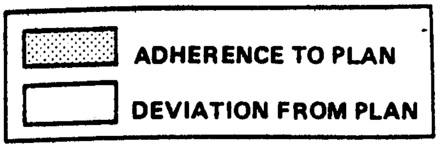


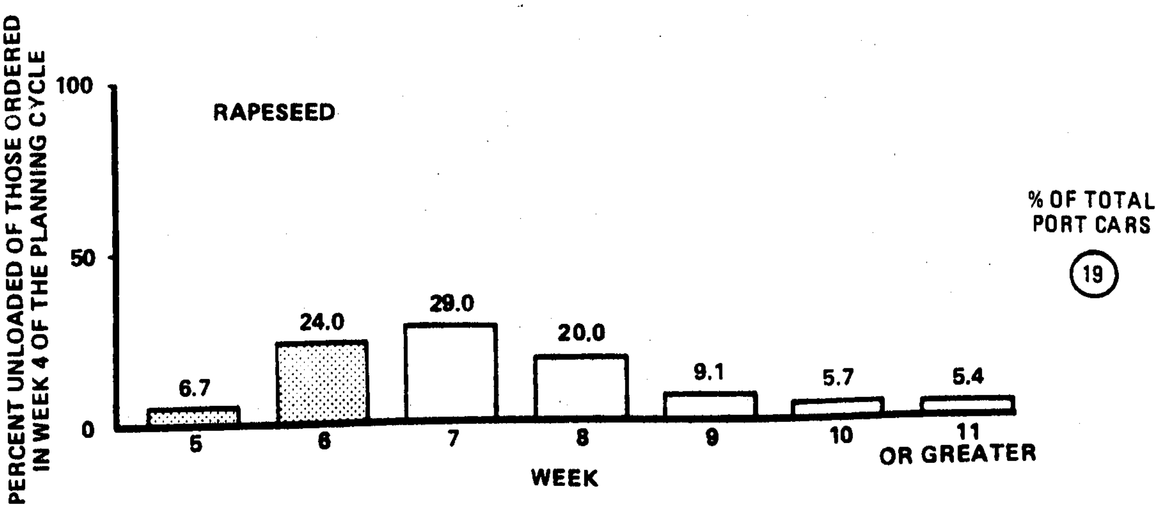
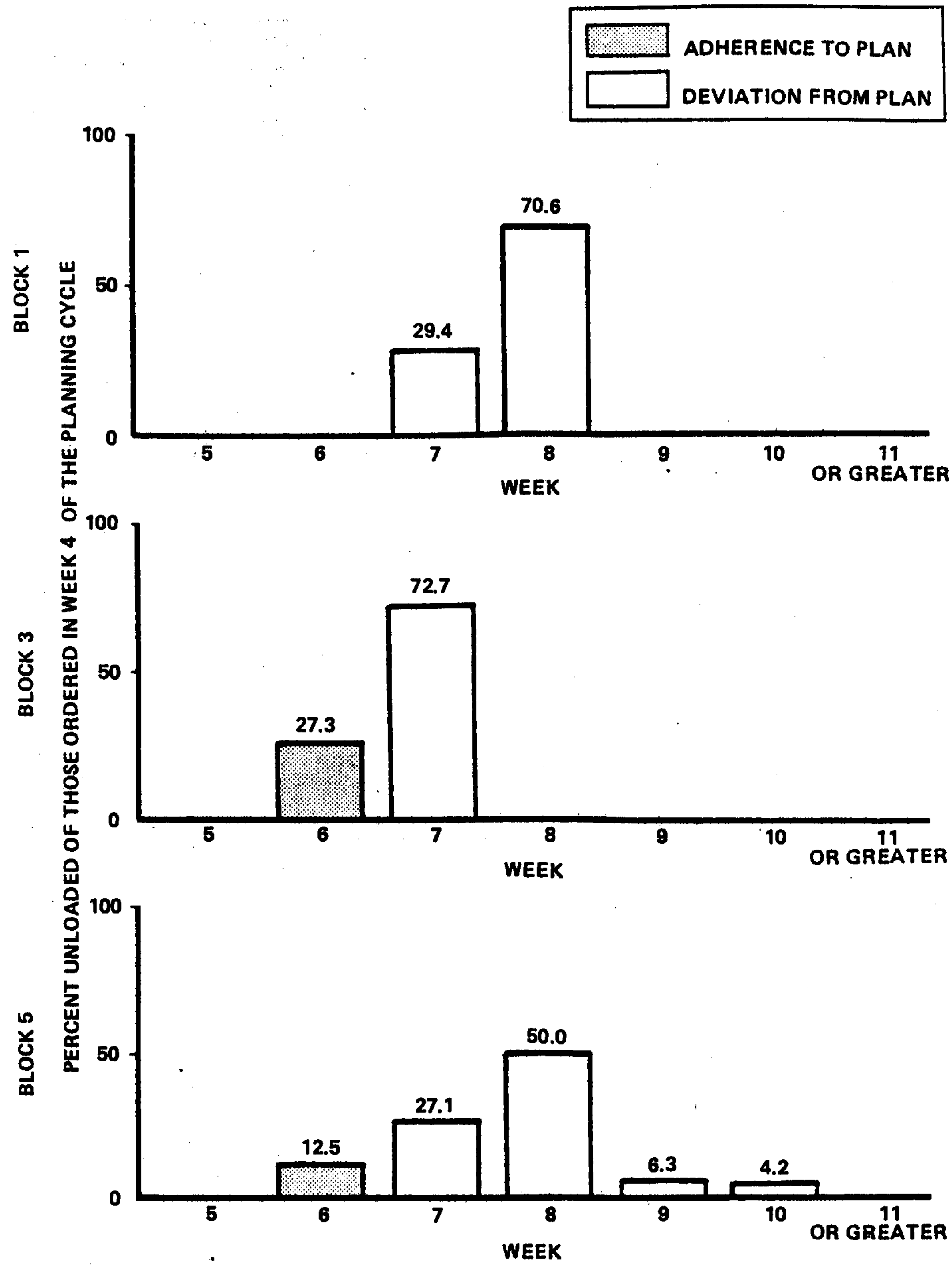


EXHIBIT O-4
Planning Horizon Analysis
by Block - Vancouver



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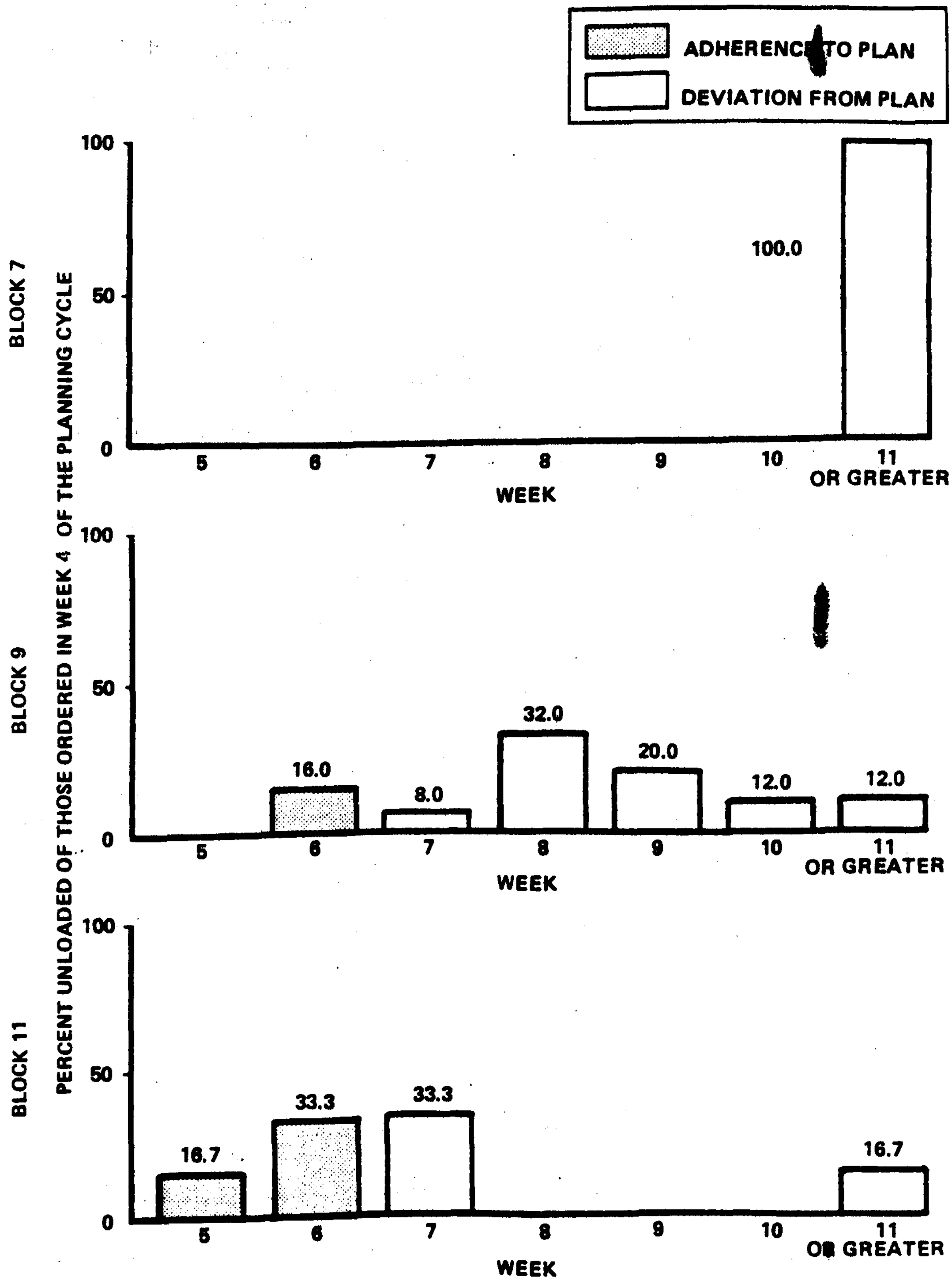

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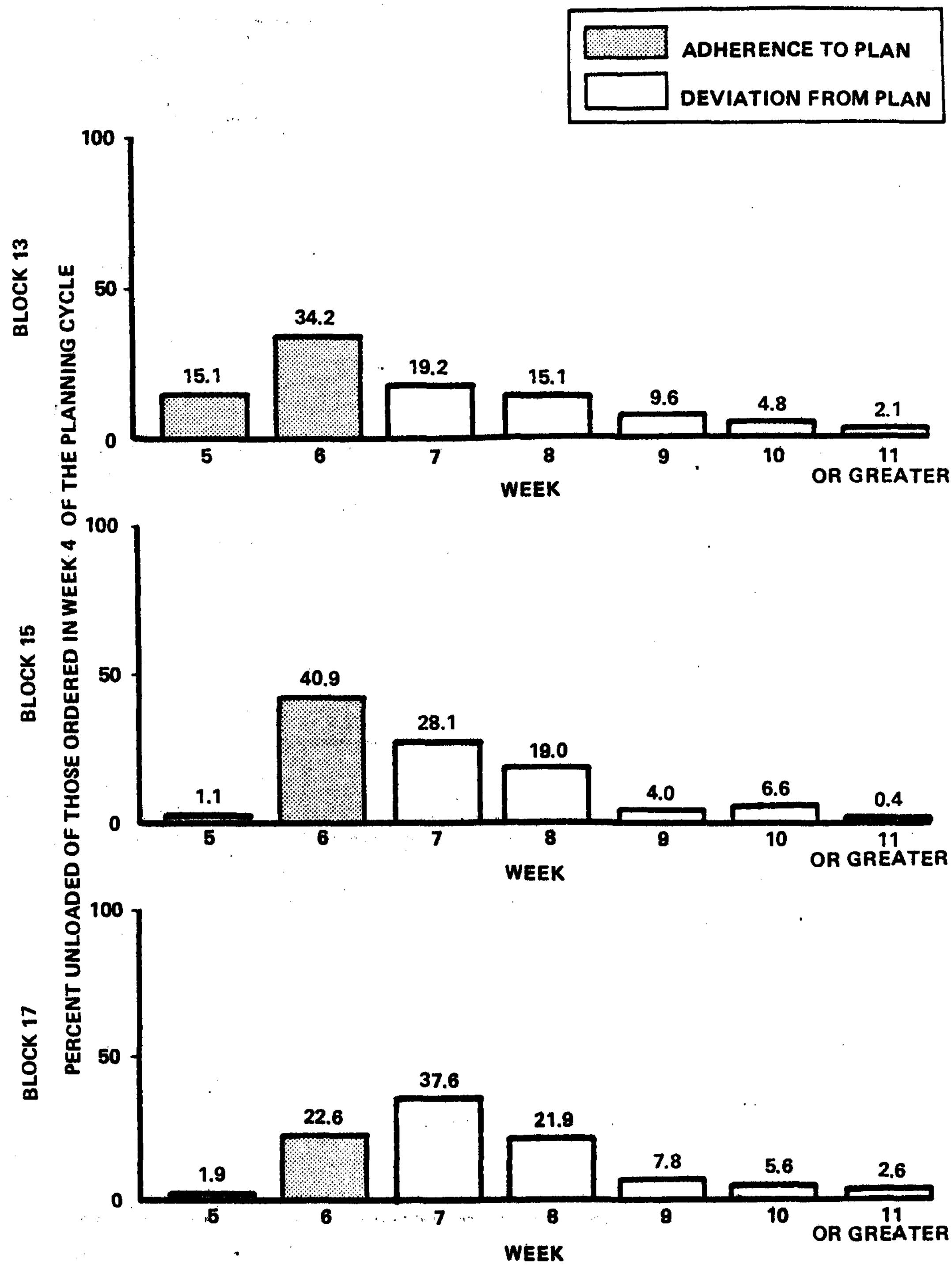

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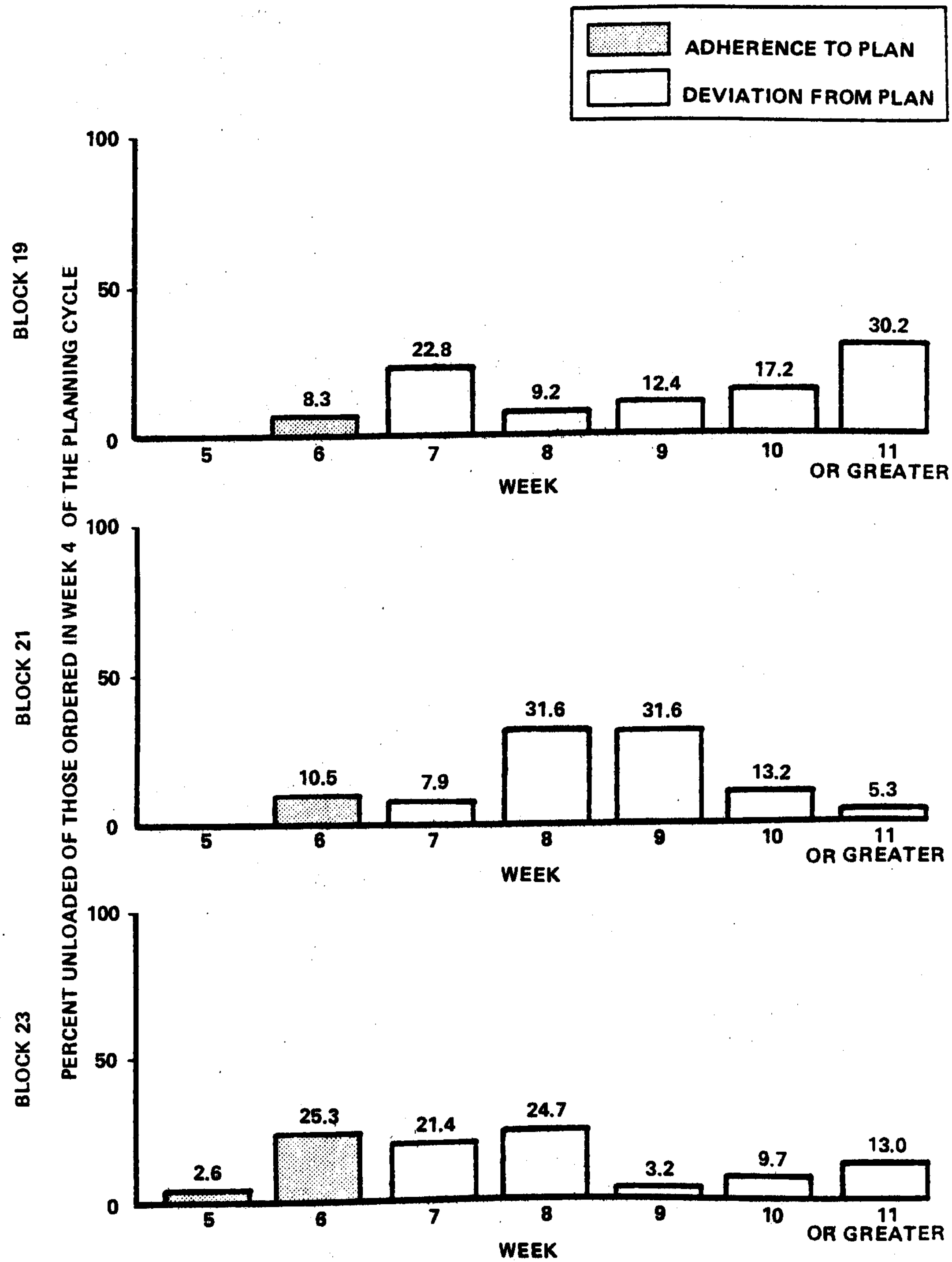

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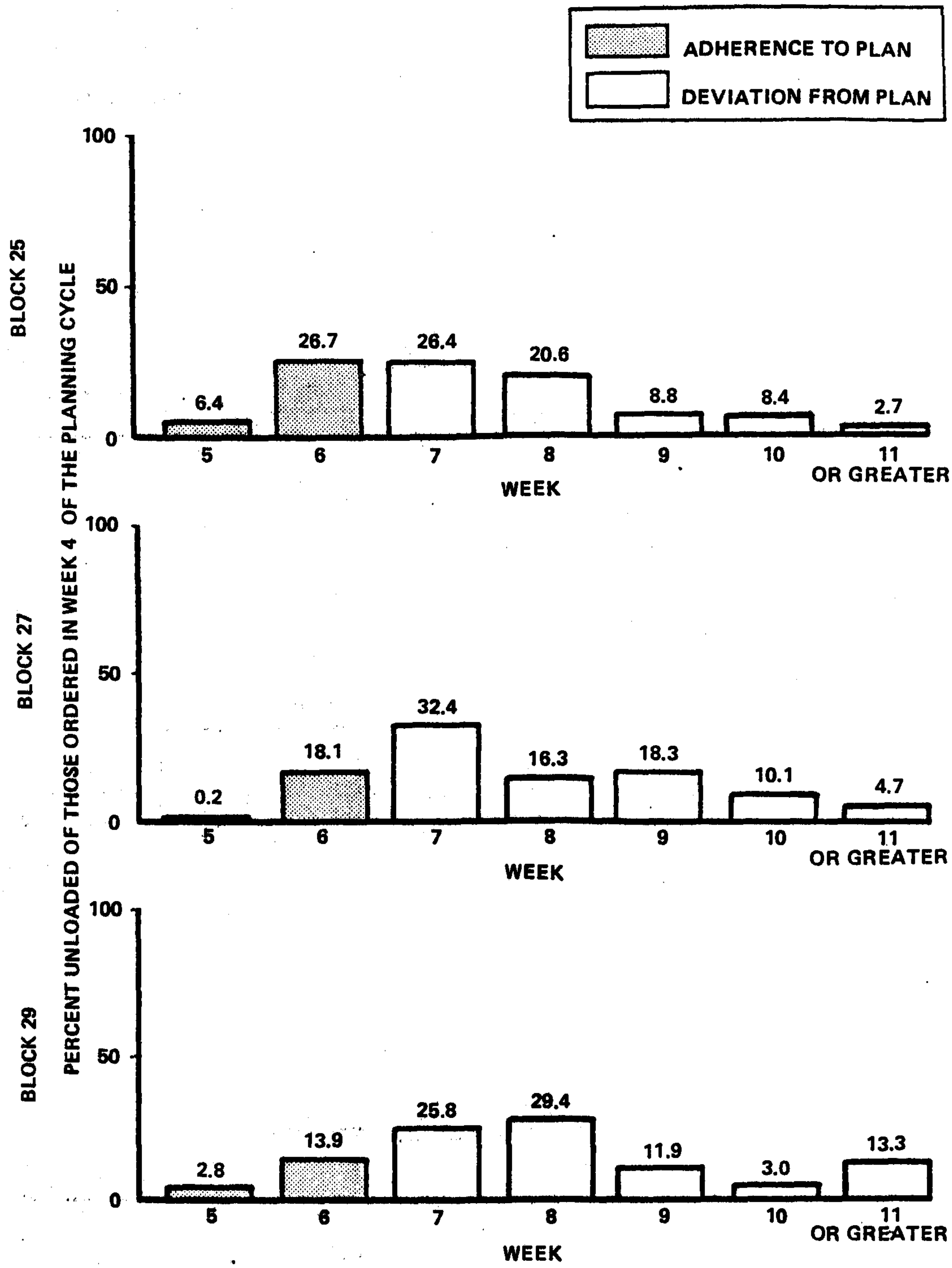

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by Block - Vancouver
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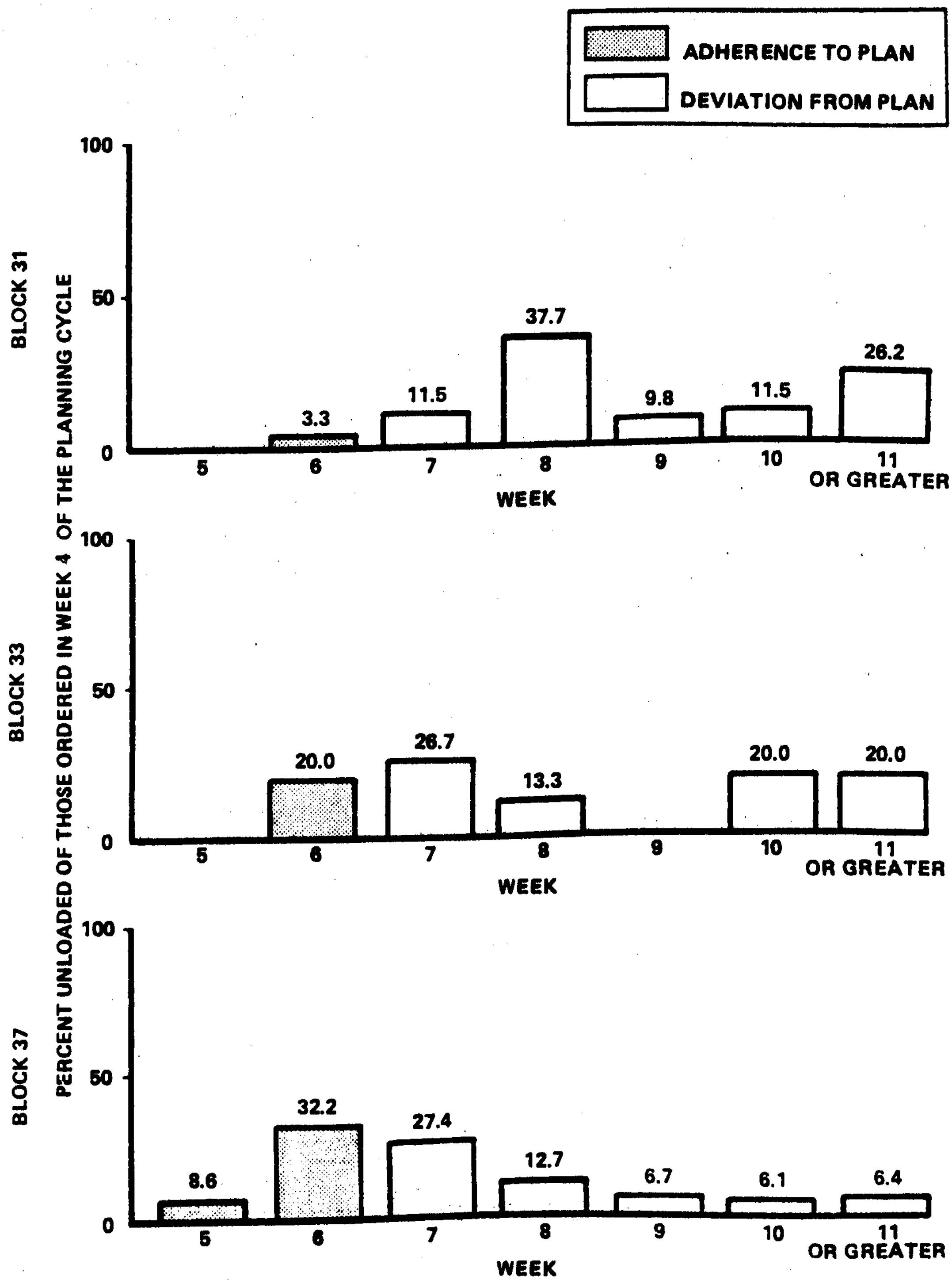

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Planning Horizon Analysis
by Block - Vancouver
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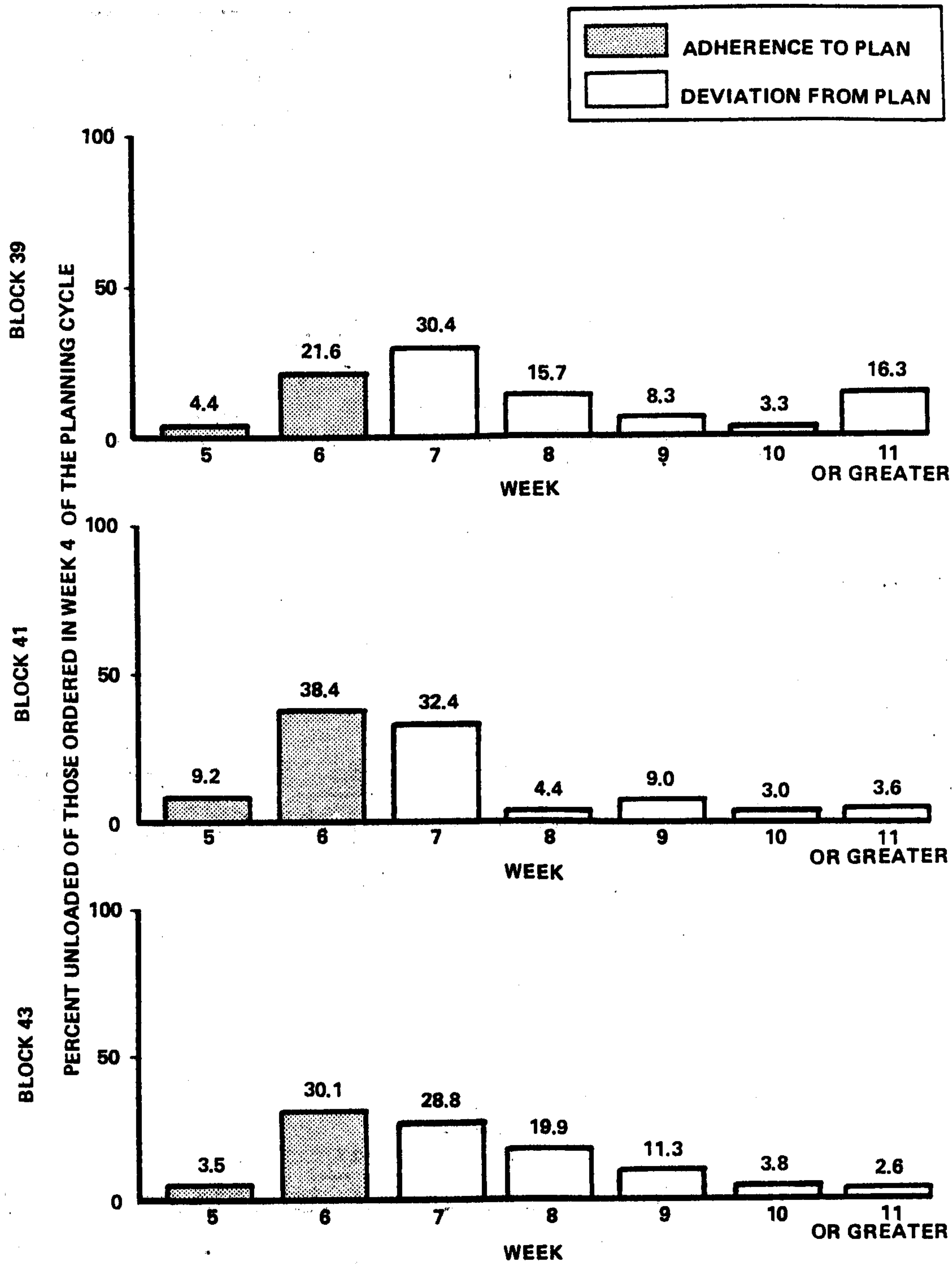

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Planning Horizon Analysis
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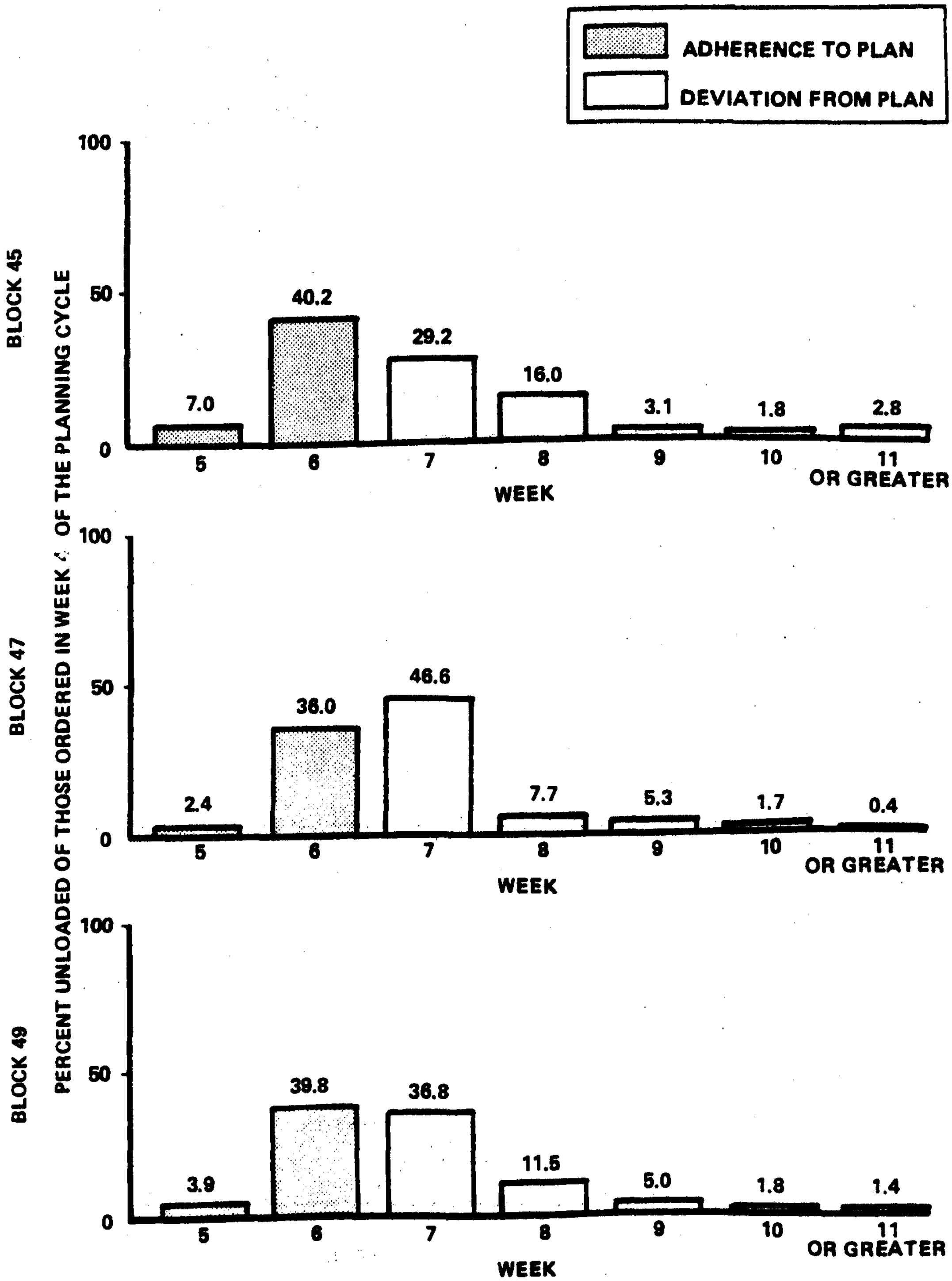

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Planning Horizon Analysis
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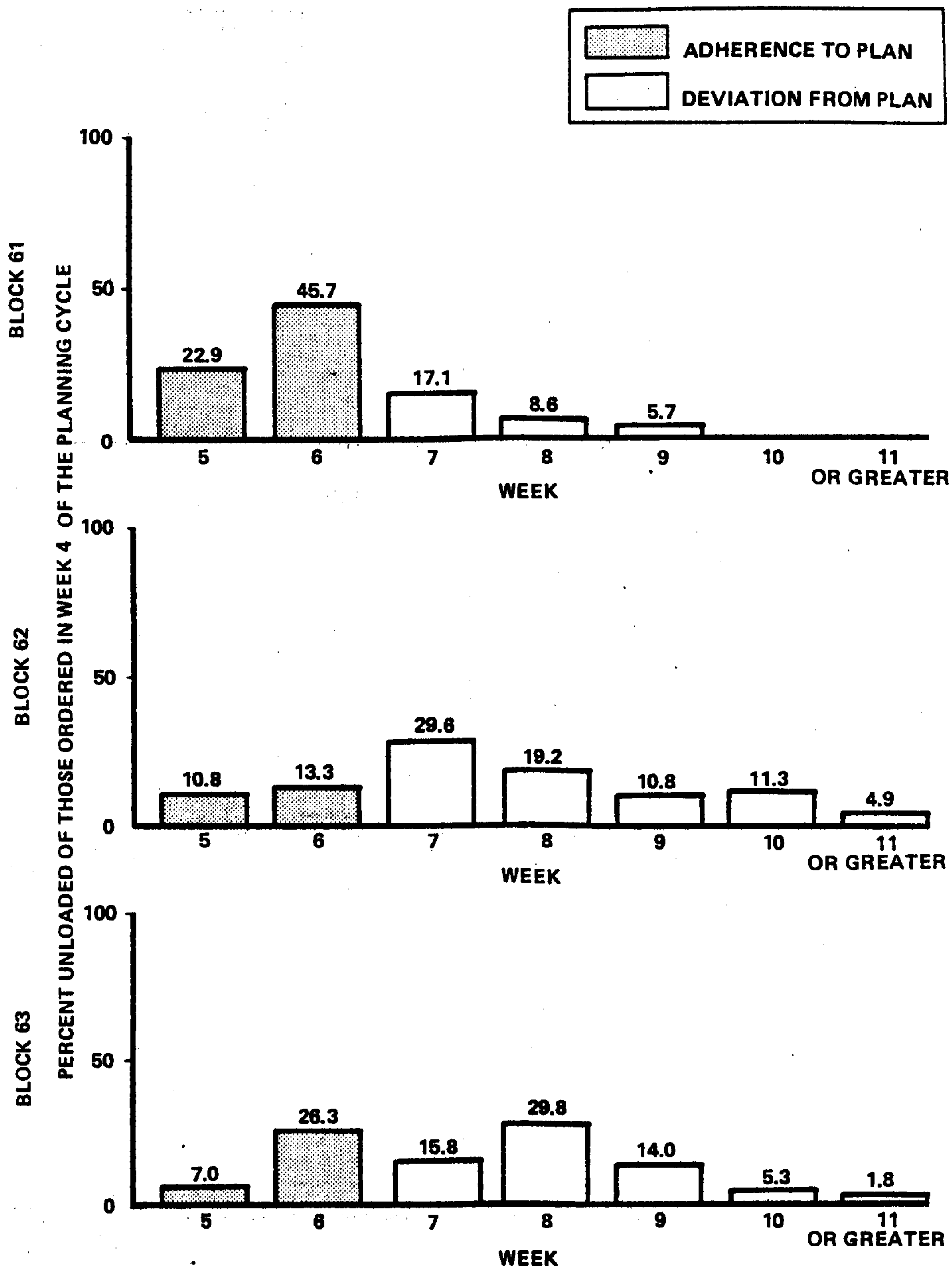

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Planning Horizon Analysis
by Block - Vancouver
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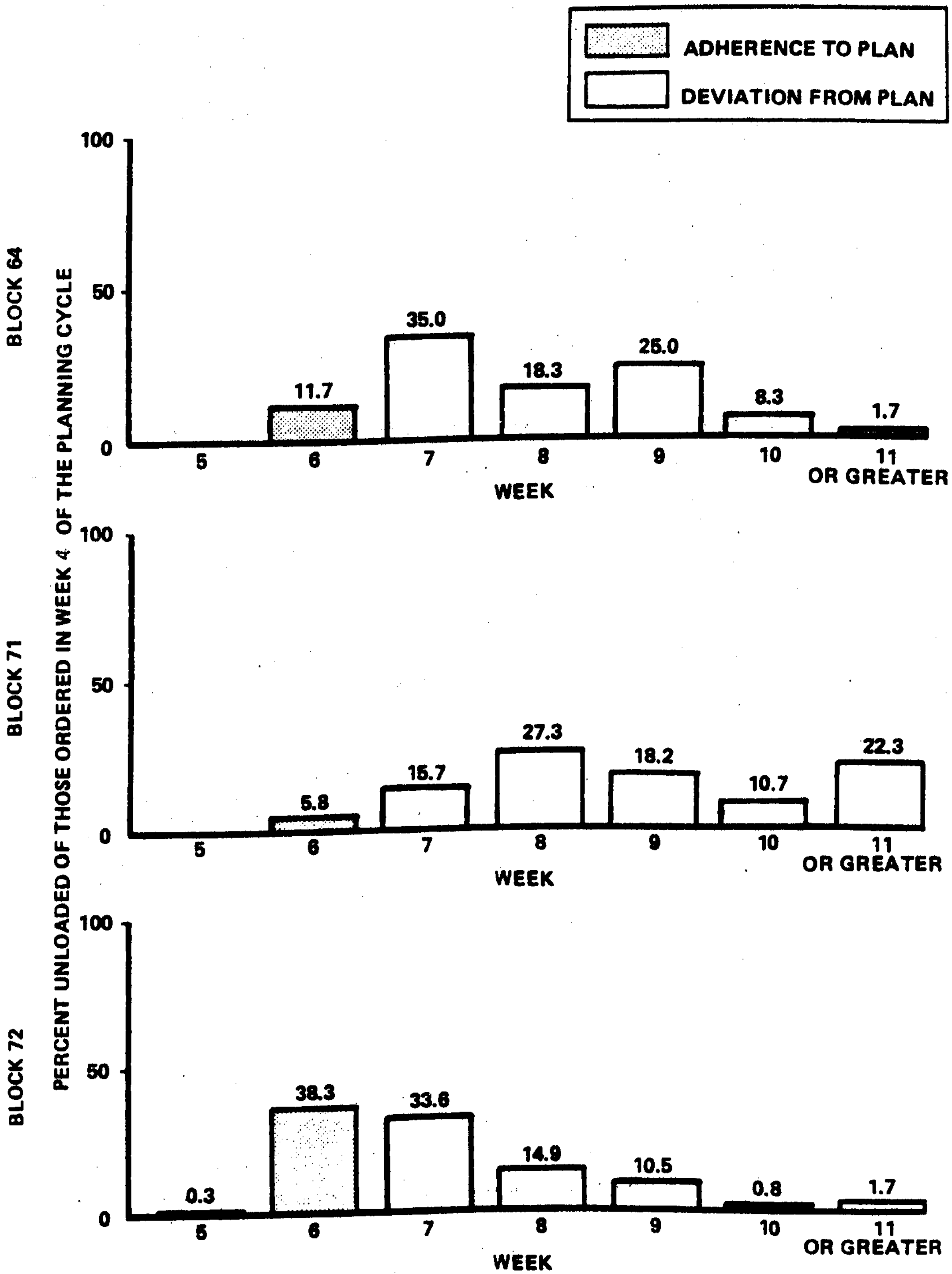

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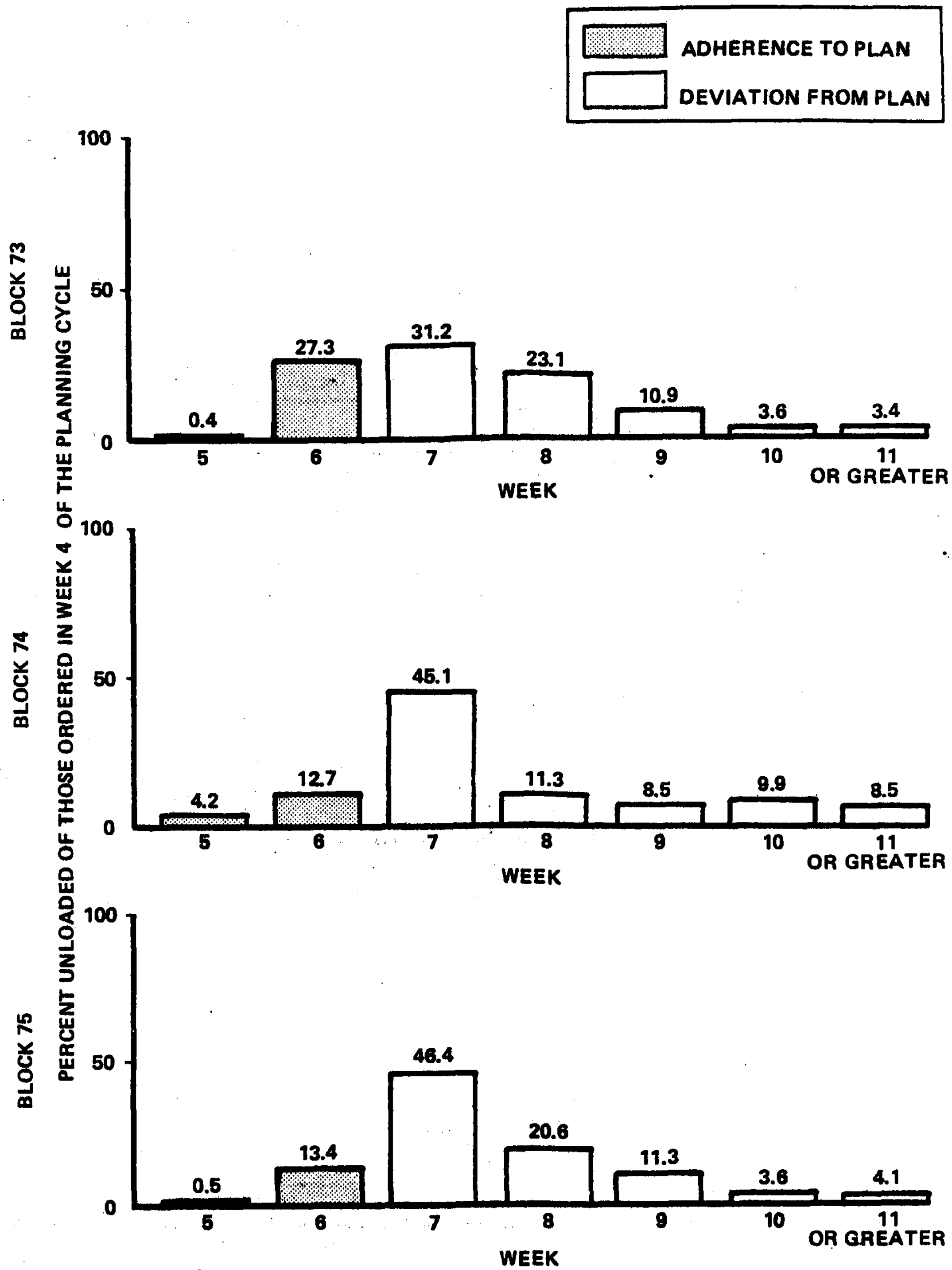

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Planning Horizon Analysis
by Block - Vancouver
(continued)

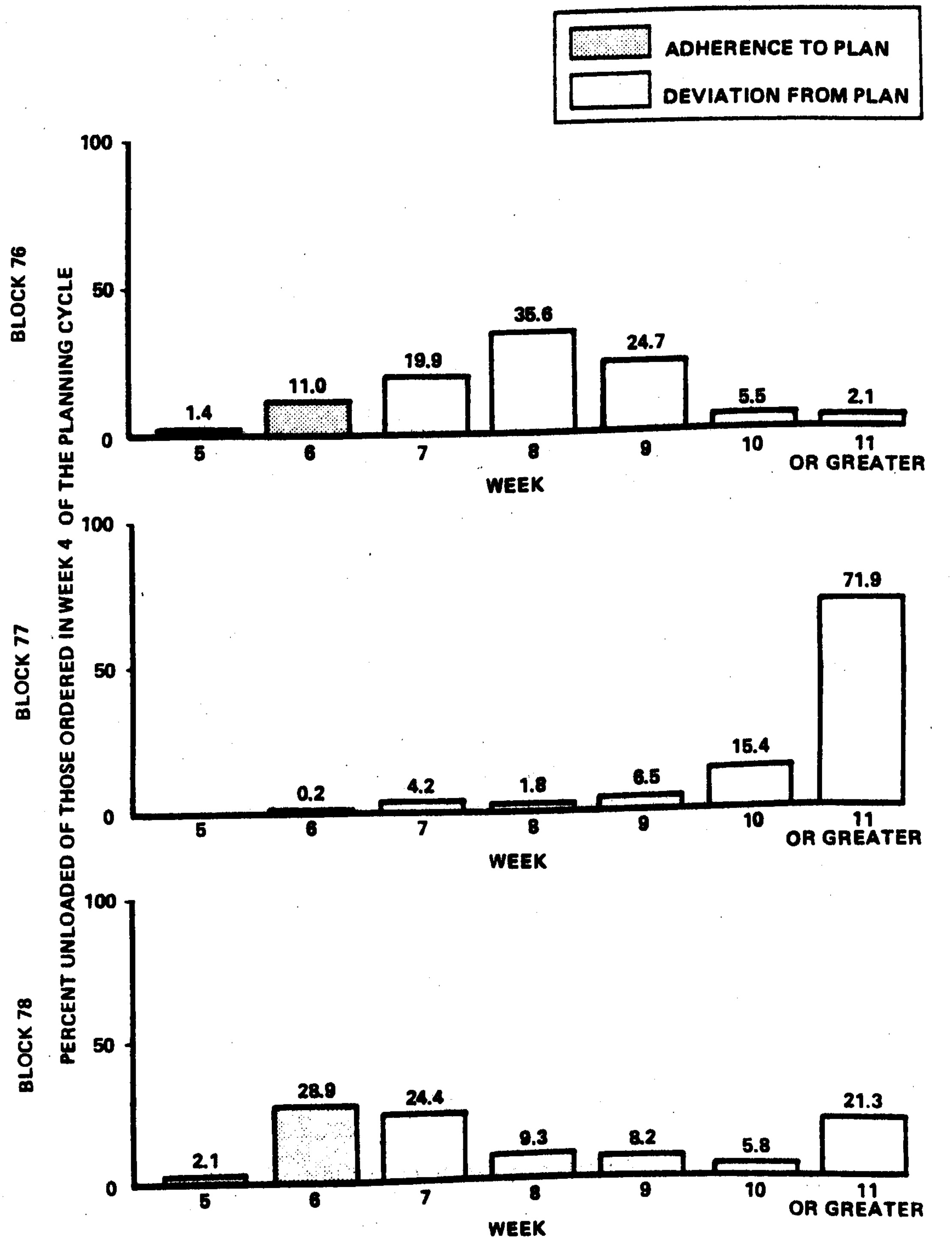


EXHIBIT O-4
Planning Horizon Analysis
by Block - Vancouver
(continued)

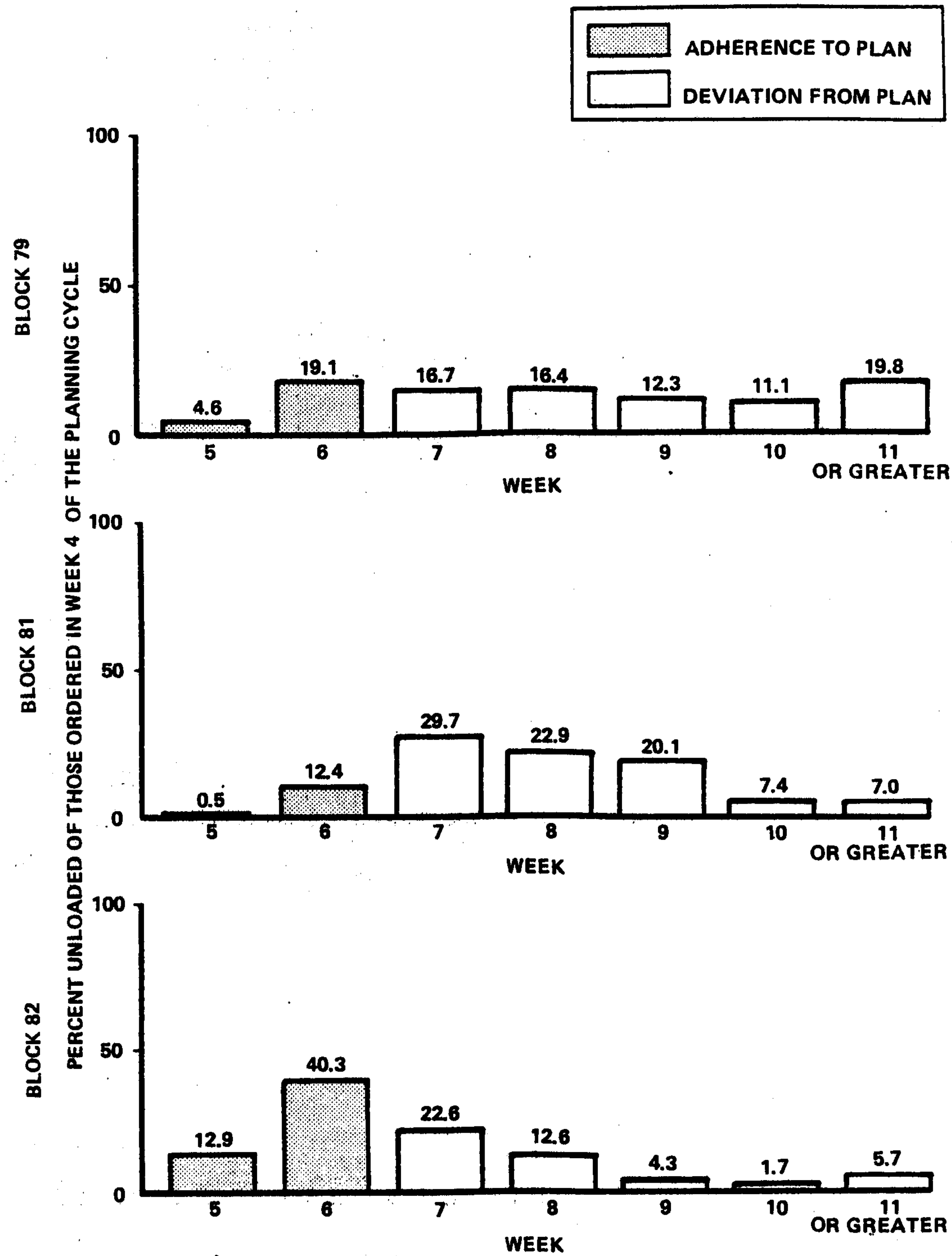


EXHIBIT O-4
Planning Horizon Analysis
by Block - Vancouver
(continued)

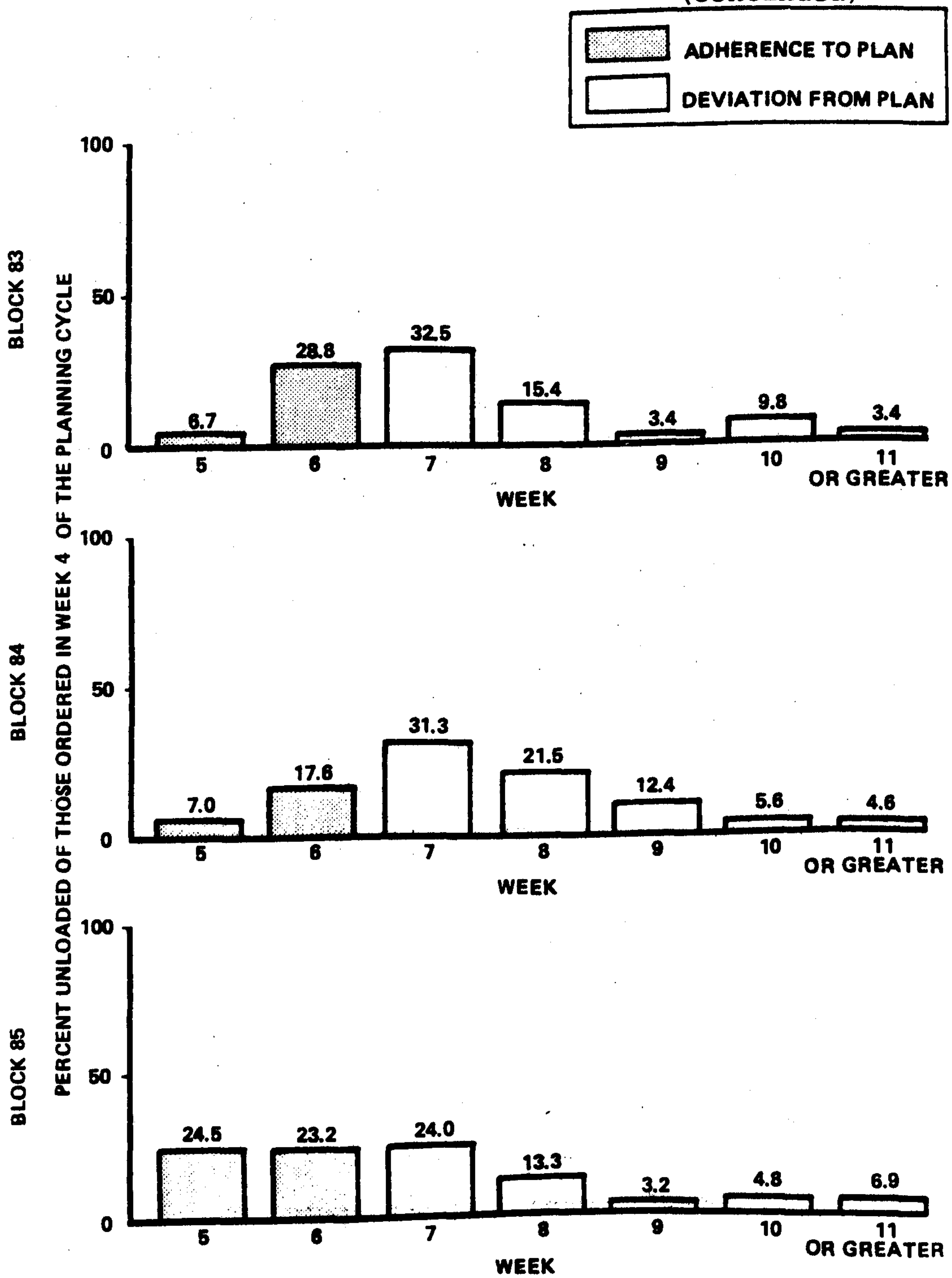


EXHIBIT O-4
Planning Horizon Analysis
by Block - Vancouver
(continued)

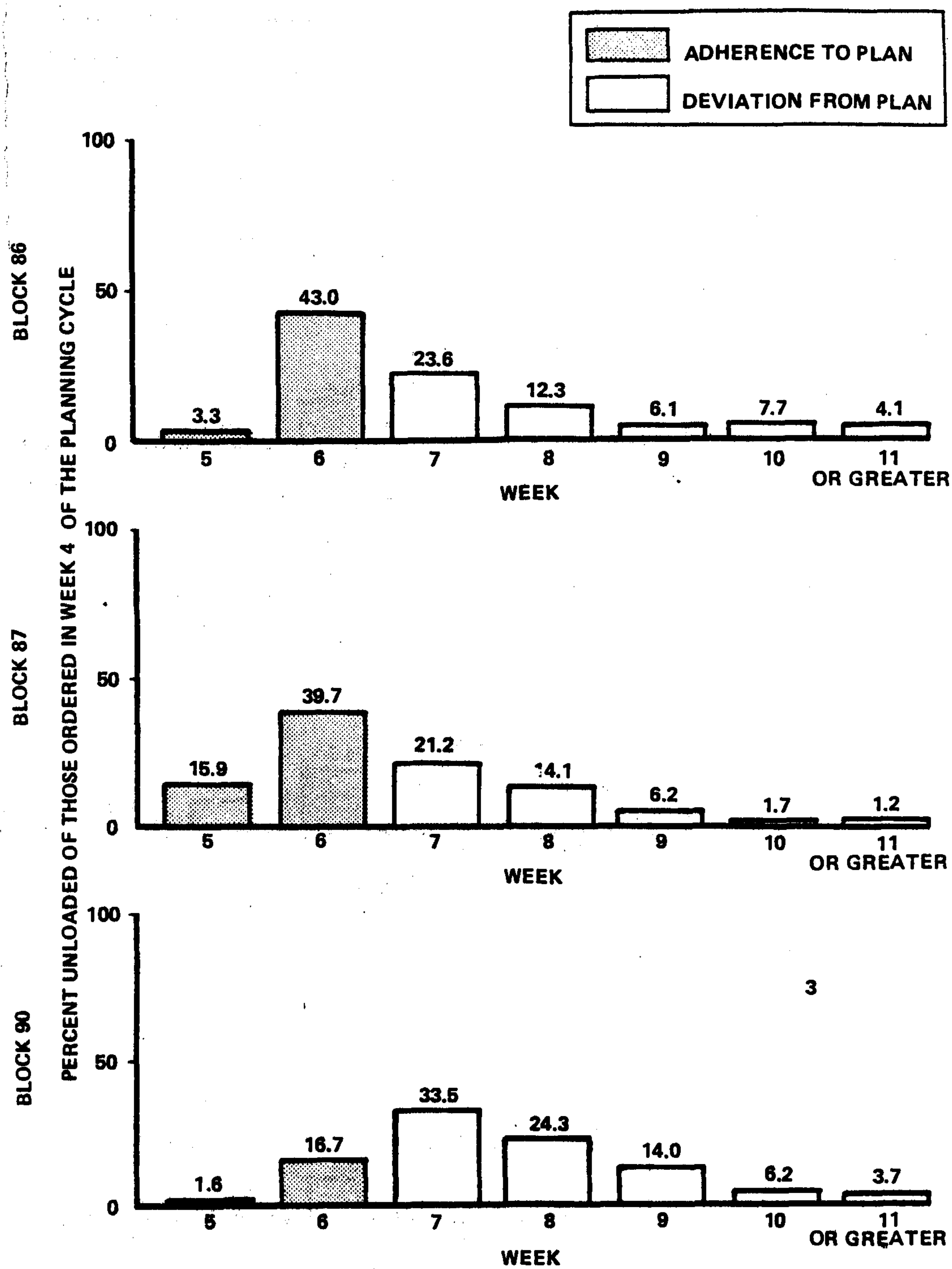


EXHIBIT O-4
Planning Horizon Analysis
by Block - Vancouver
(continued)

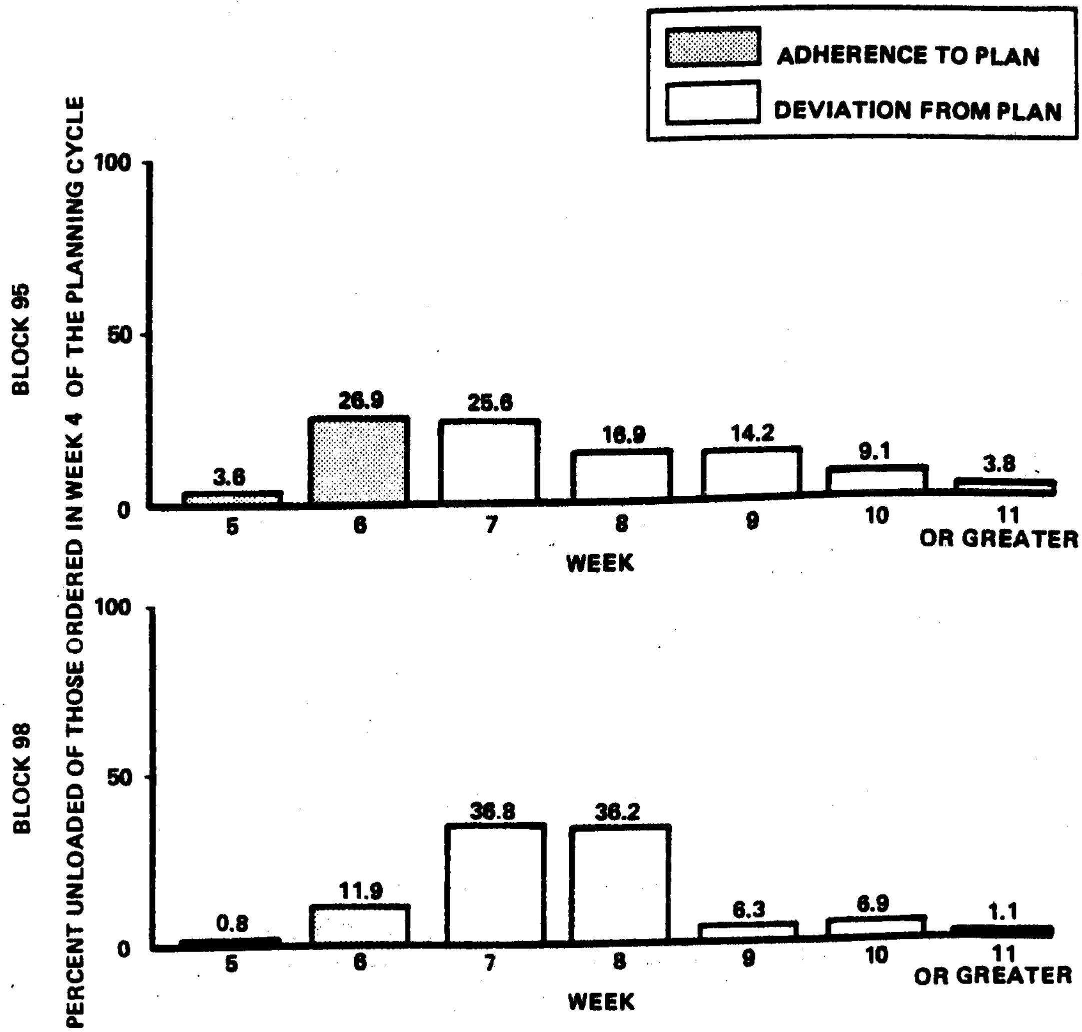


EXHIBIT O-5
Planning Horizon Analysis
by Grain - Prince Rupert

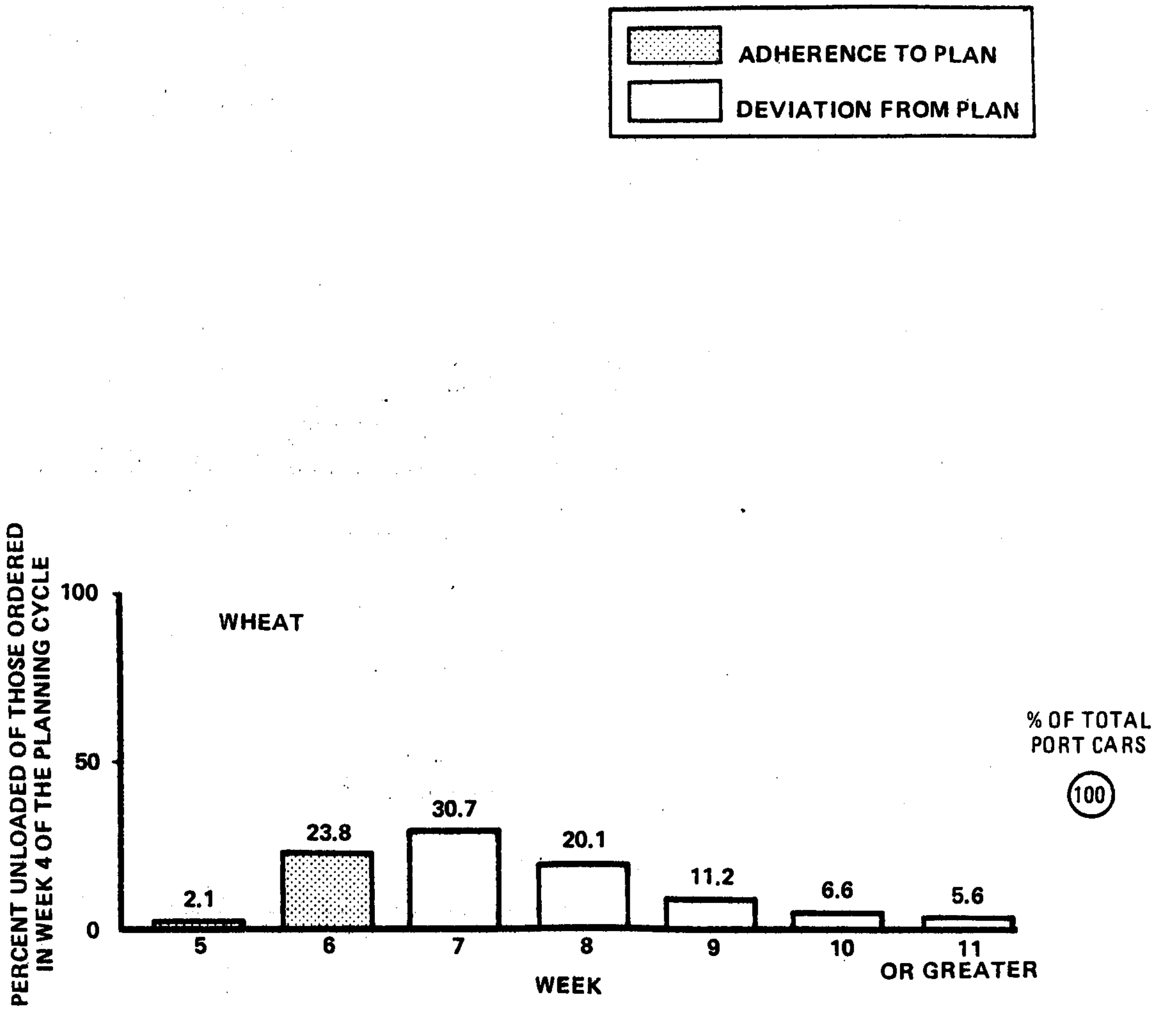
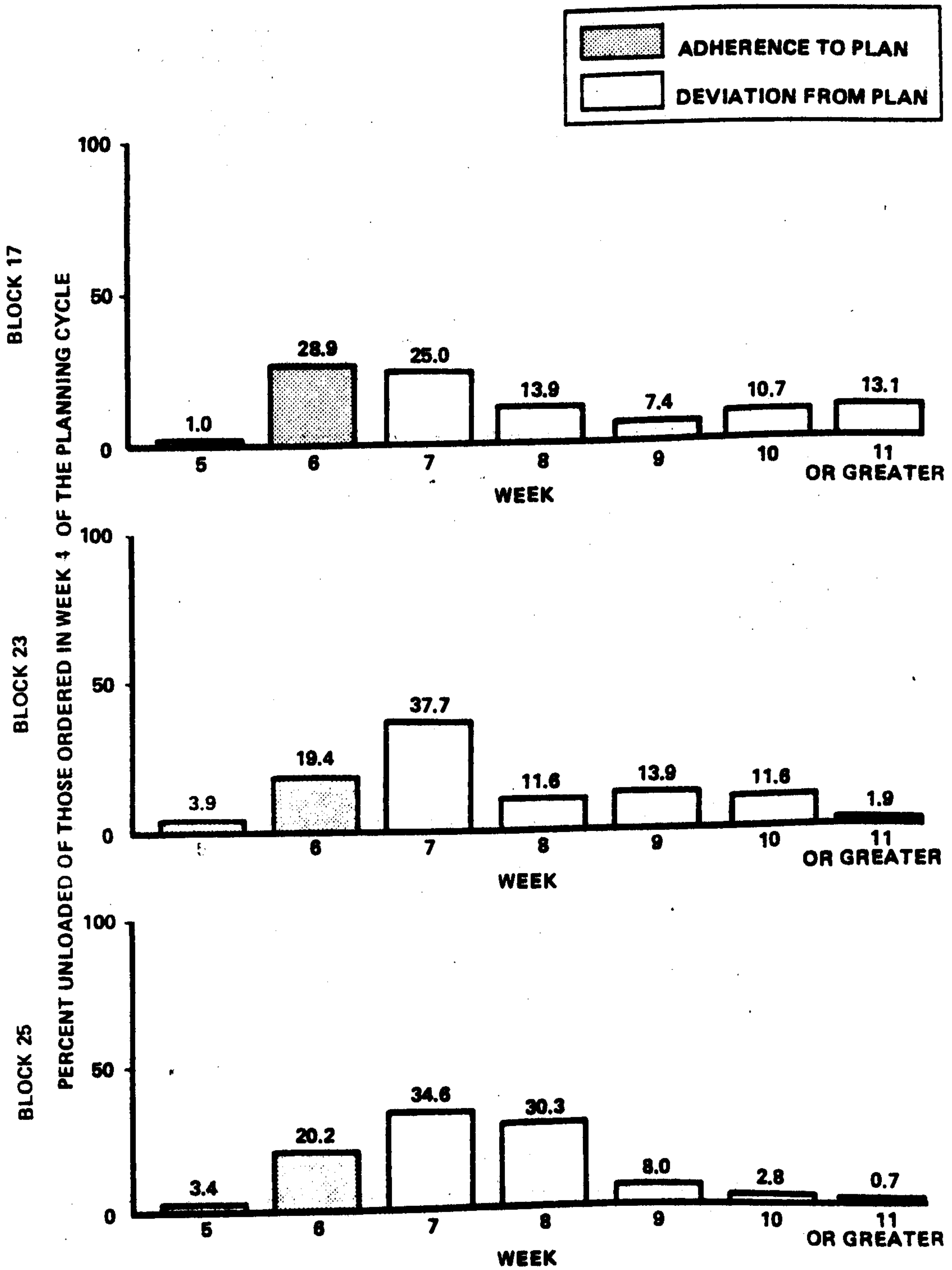


EXHIBIT O-6
Planning Horizon Analysis
by Block - Prince Rupert



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Planning Horizon Analysis
by Block - Prince Rupert
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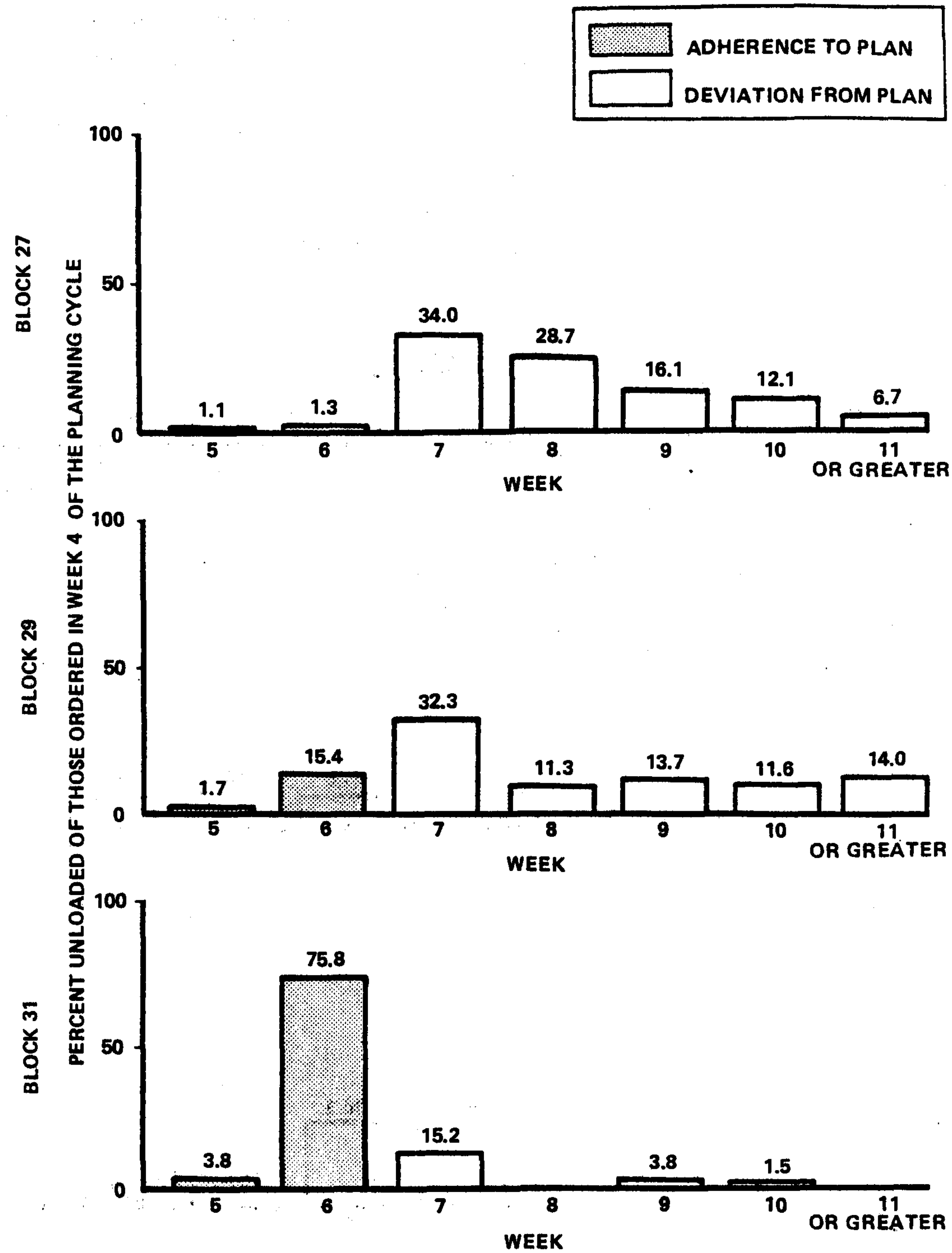

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Planning Horizon Analysis
by Block - Prince Rupert
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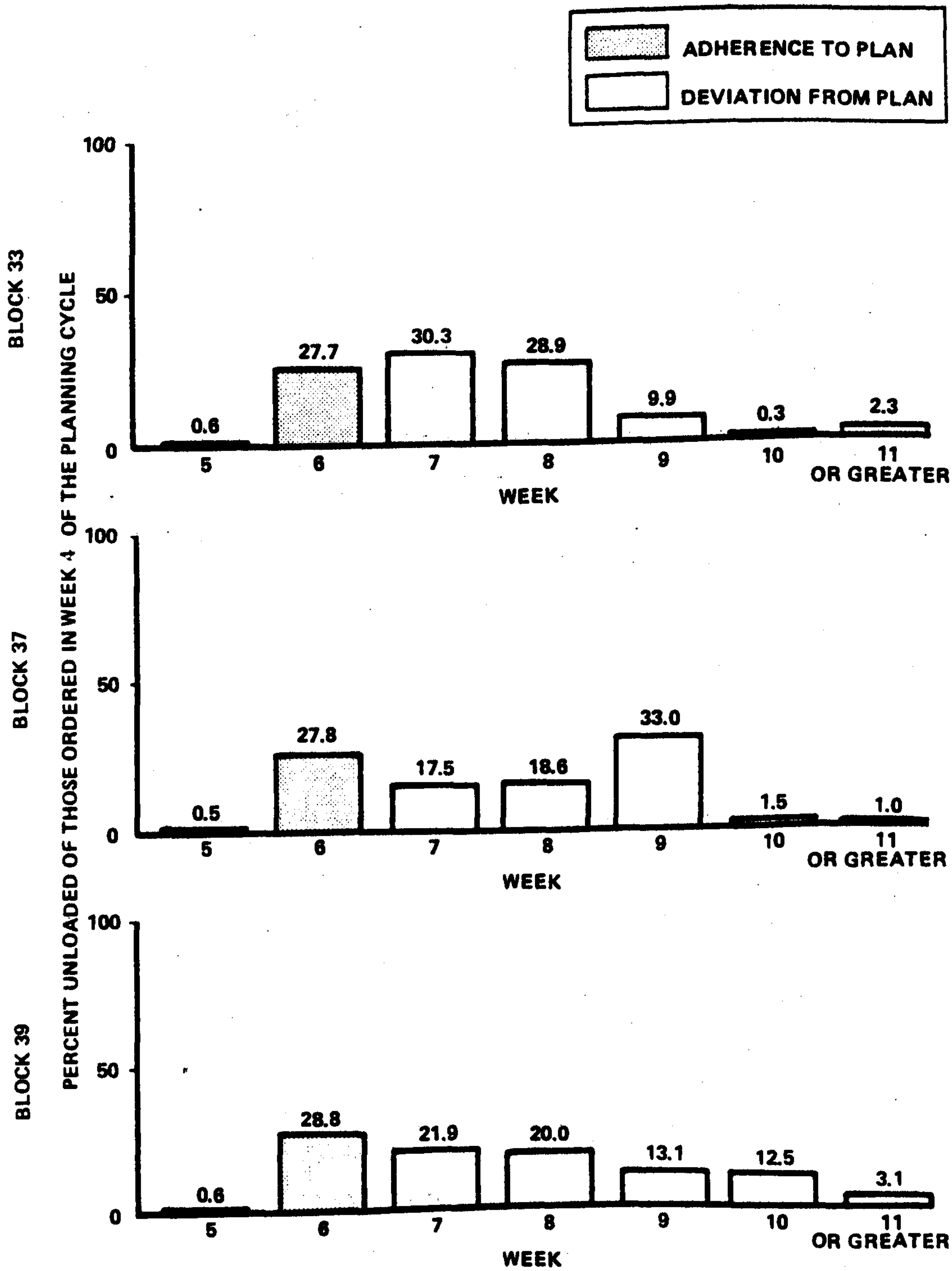

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Planning Horizon Analysis
by Block - Prince Rupert
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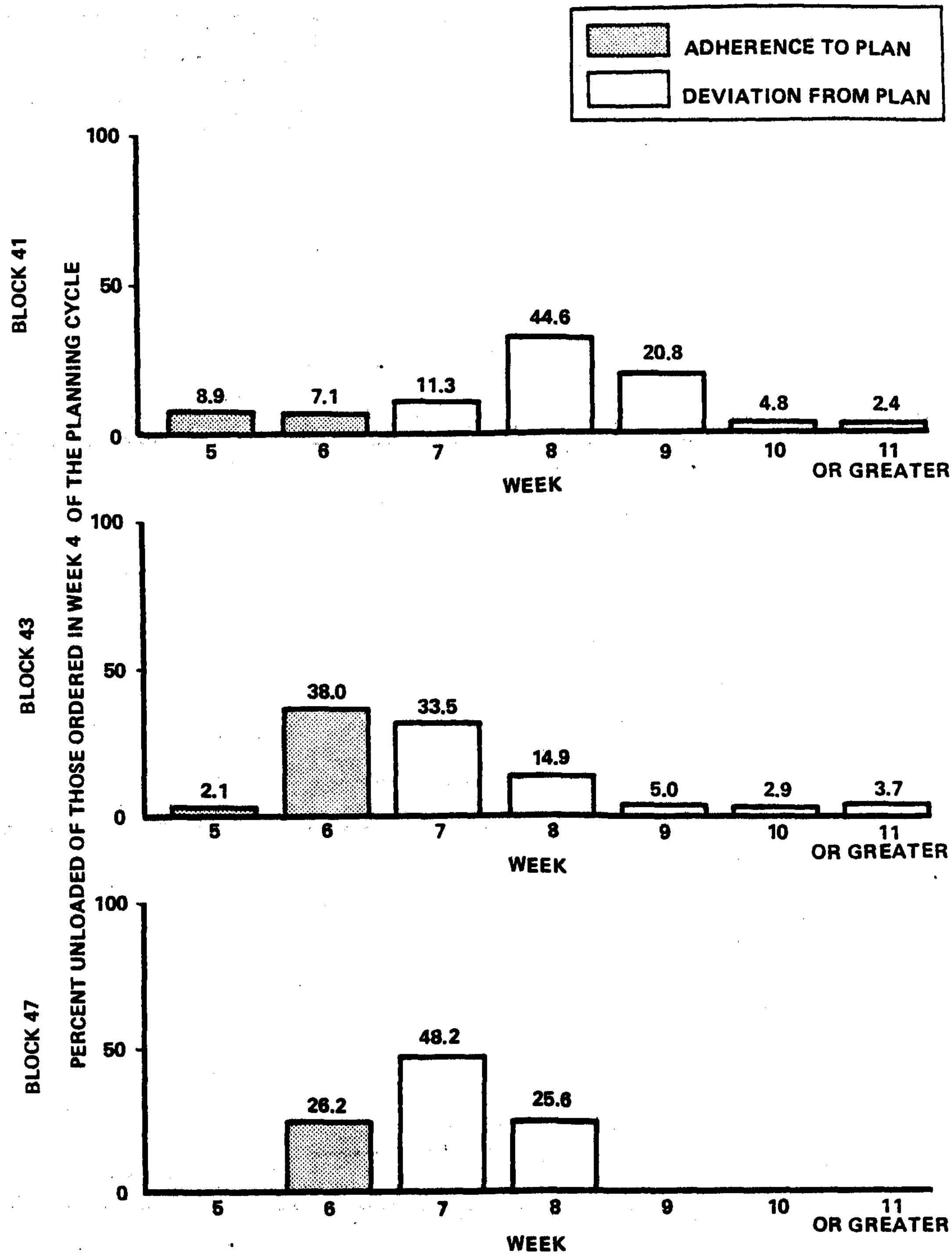

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Planning Horizon Analysis
by Block - Prince Rupert
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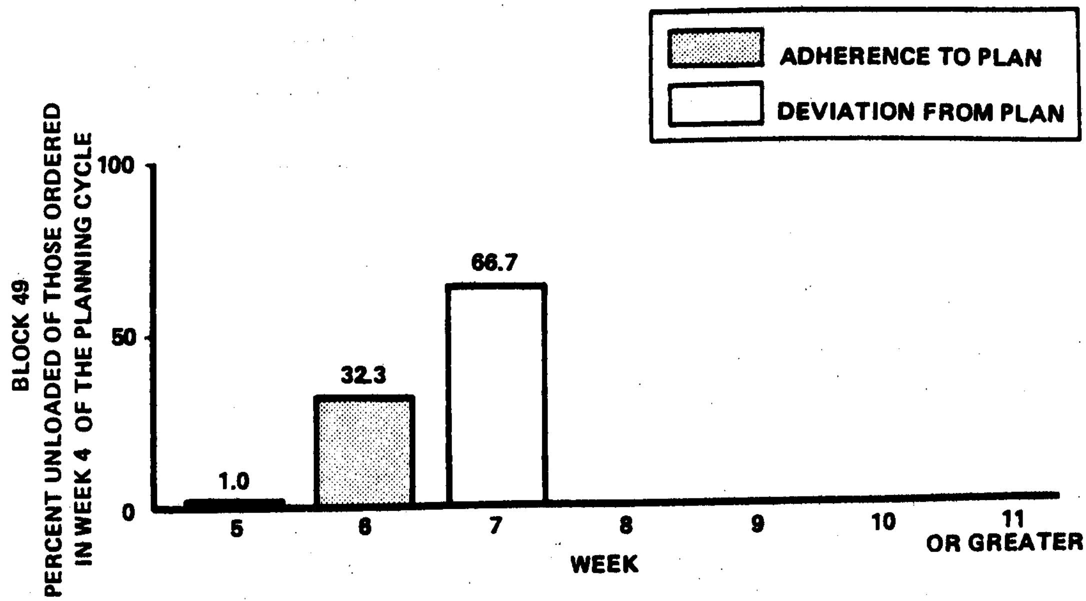

EXHIBIT O-7
Planning Horizon Analysis
by Grain - Churchill

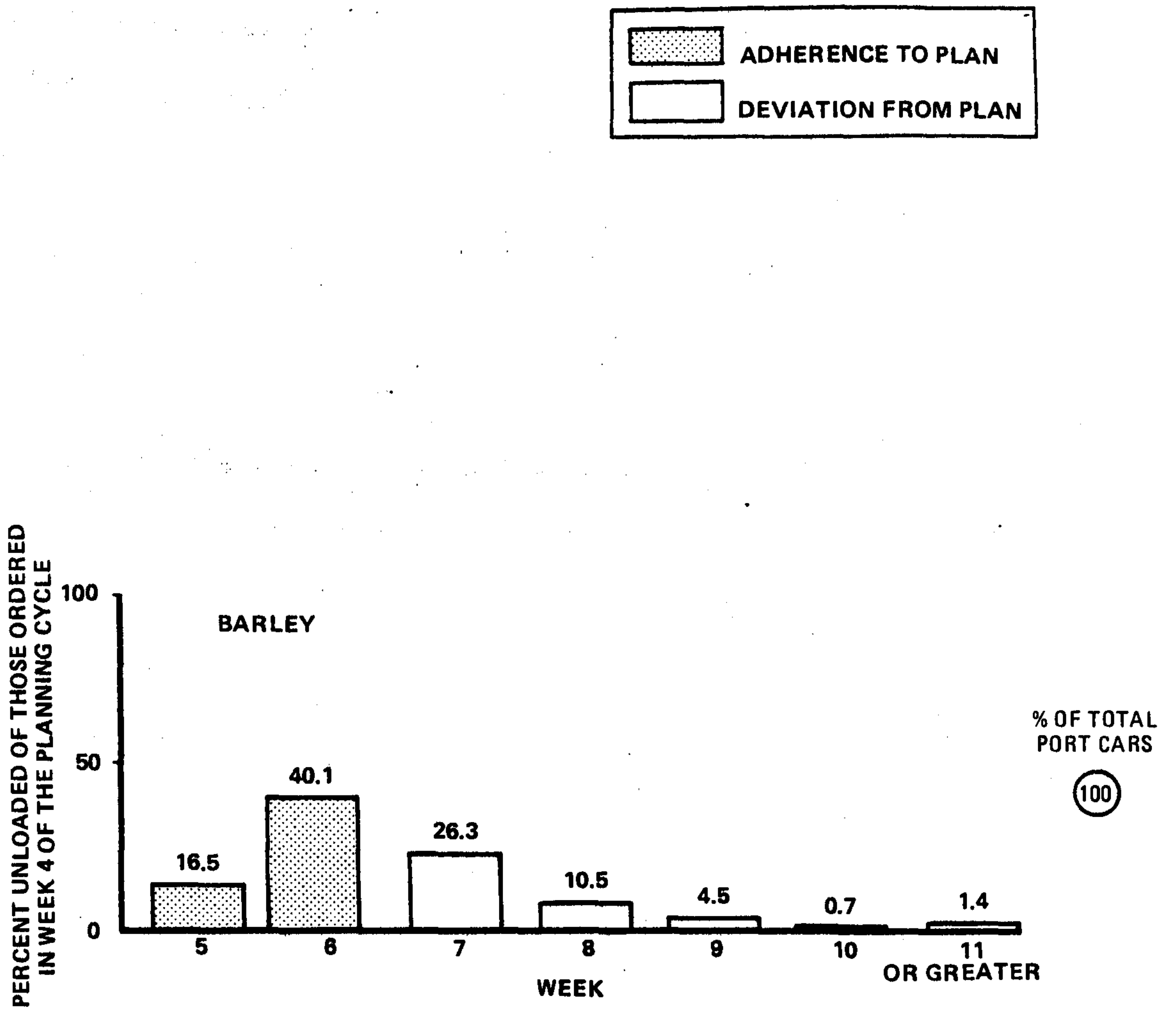

EXHIBIT O-8
Planning Horizon Analysis
by Block - Churchill

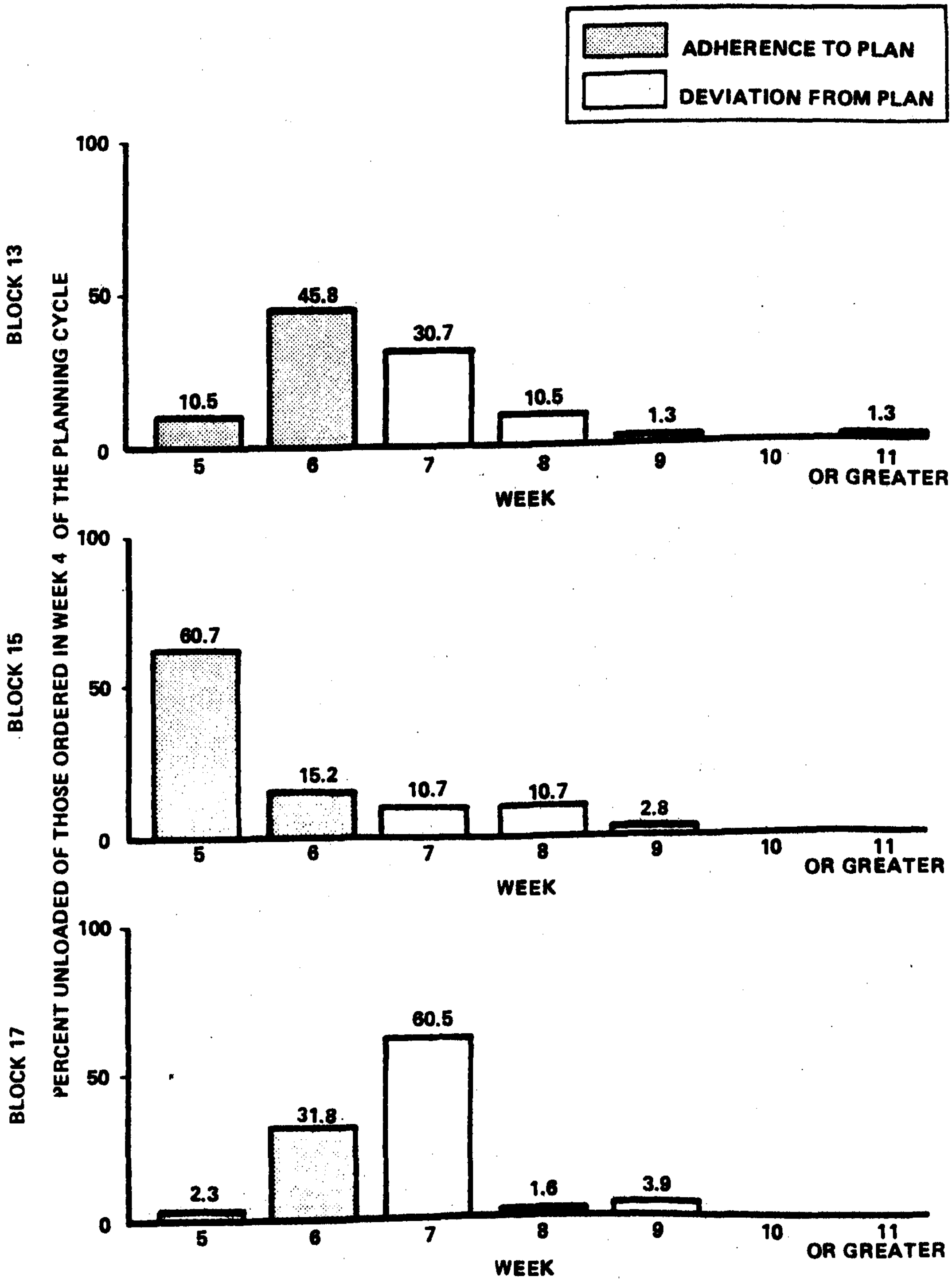

EXHIBIT O-8
Planning Horizon Analysis
by Block - Churchill
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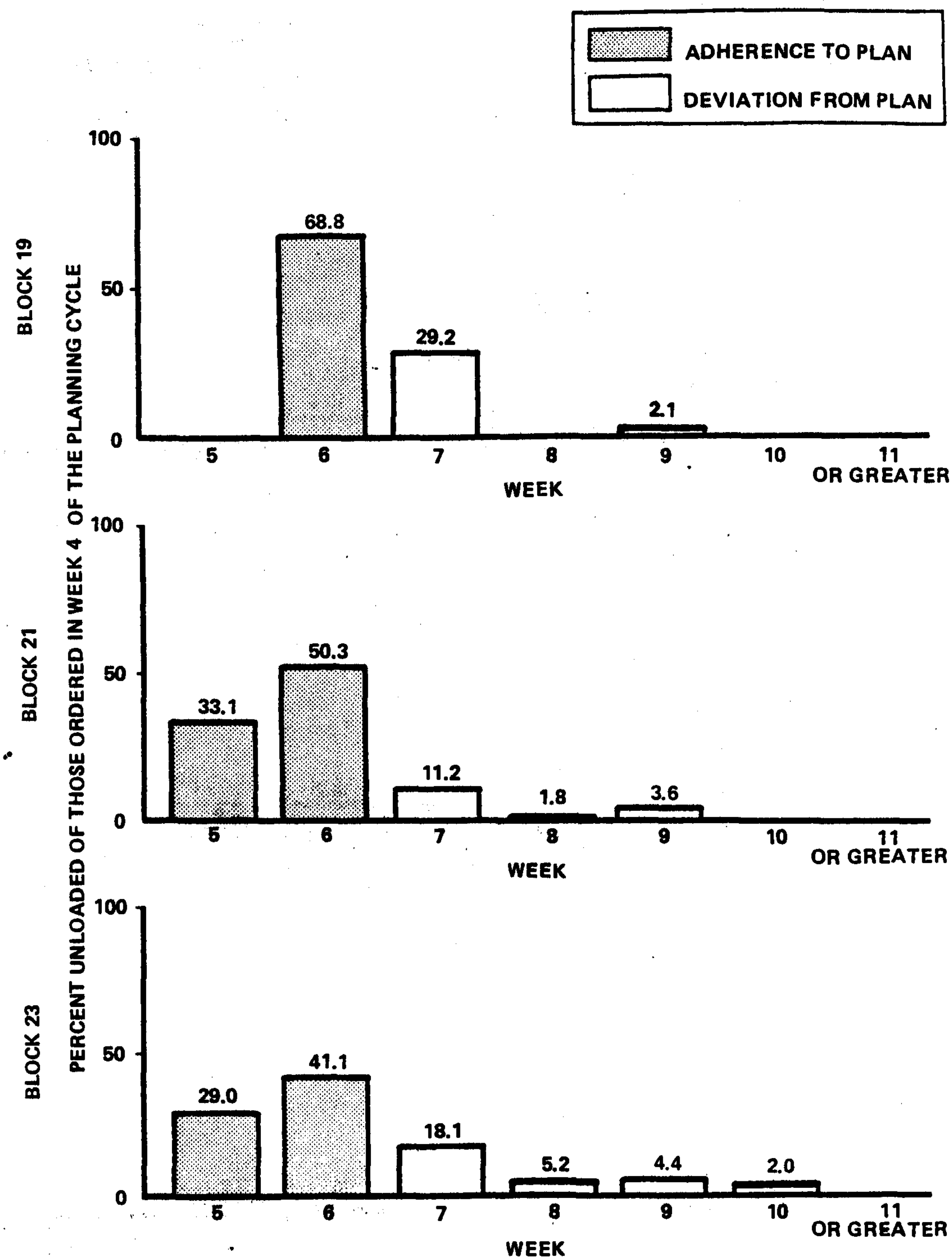

EXHIBIT O-8
Planning Horizon Analysis
by Block - Churchill
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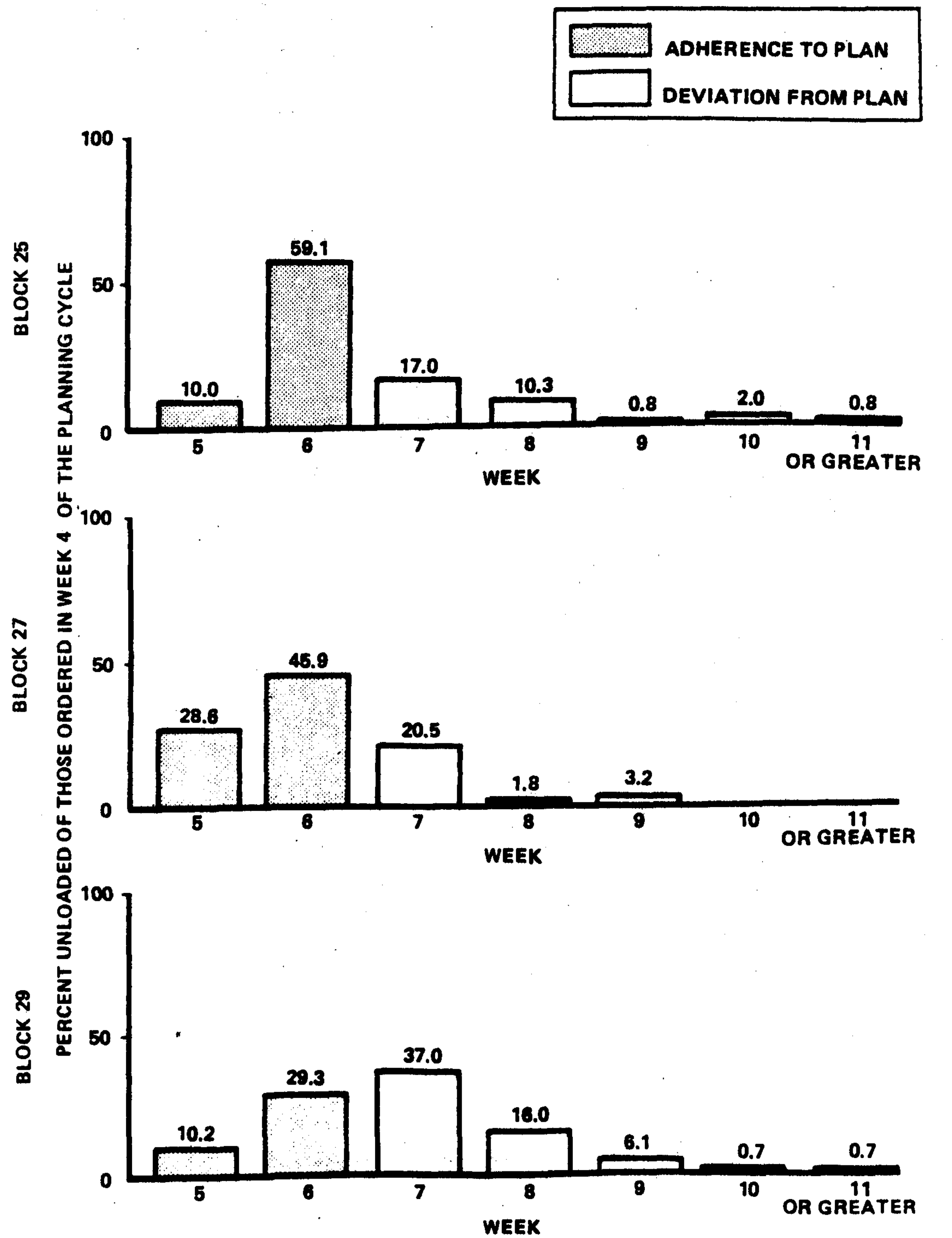

EXHIBIT O-8
Planning Horizon Analysis
by Block - Churchill
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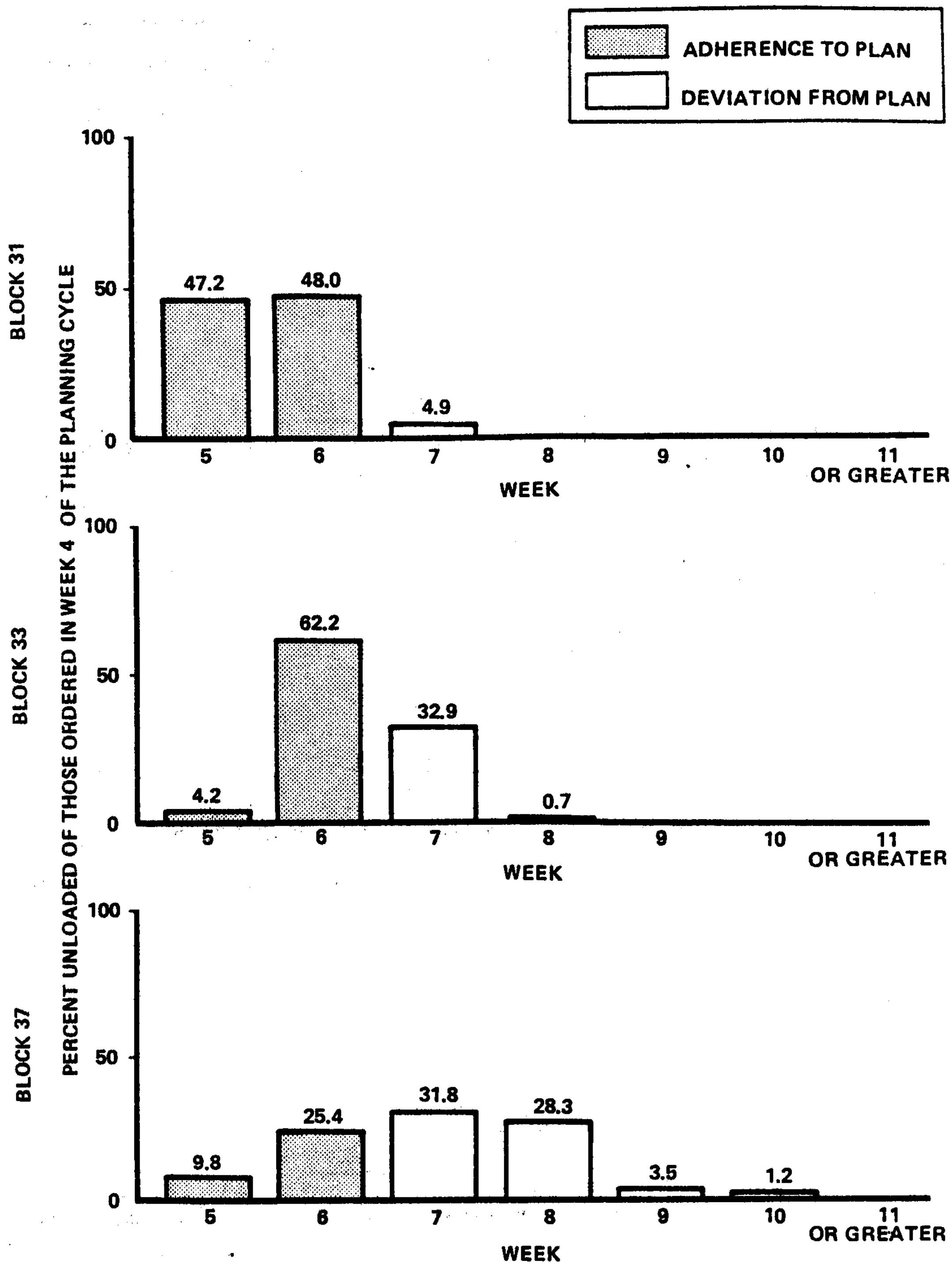

EXHIBIT O-8
Planning Horizon Analysis
by Block - Churchill
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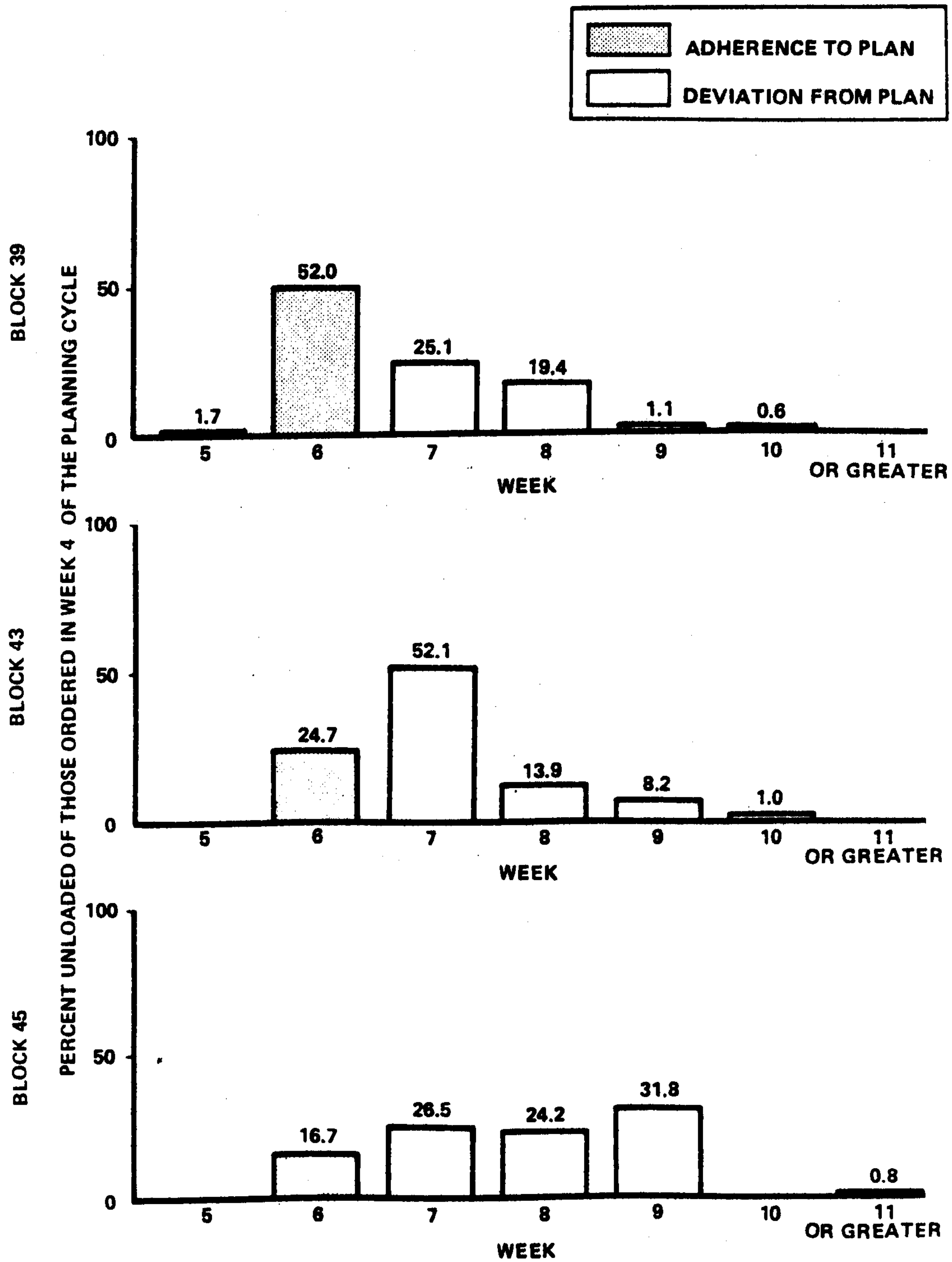


APPENDIX P

CAR SHORTFALL ANALYSIS

As discussed in Chapter IX of the report, car shortfalls are not accurately identified or incorporated on a real time basis in the existing planning system. This leads to increasing inaccuracies in the system as the season progresses. The accumulation of unfilled orders in the country due to car shortfalls means that the selection of country elevators at which to spot cars and the filling of car loading orders are at the discretion of the railways and the elevator managers. Their priorities, such as omitting difficult train runs, getting elevator space where needed, and shipping Non-Board grains, do not always coincide with system priorities. The frequent occurrence of shortfalls is the result of the CWB pressuring the railways for more cars, the railways' inability to delivery empties on time, and the elevator operators deferring orders.

This appendix provides more detail on the implications of car shortfalls.

1. ANALYSES OF SHORTFALLS SHOWS VARIANCE AMONG BLOCKS

In an attempt to understand how and why shortfalls occur, several analyses of shipment data were performed. The results of these analyses indicate that:

(1) Shortfalls Do Not Affect Loaded Car Cycle Time

When shortfalls occurred, the average travel time from placement at the primary elevator to unloading at the terminal did not differ from cases where no shortfall occurred. Another analysis of the data indicated that in blocks with frequent and lengthy shortfalls, the loaded cycle time was not significantly different from other blocks. Both of these tests indicate that shortfalls do not impact the loaded cycle time.

(2) <u>Shortfalls of Board Grains Occur No More Frequently Than Shortfalls of Non-Board Grains</u>

Due to the companies' interest in the timely shipping of Non-Board grain, it was expected that Board grains would be short more often than Non-Boards. This relationship was not found. Below are the results of analysis on a block-by-block basis which determine that there was no strong relationship between biasing shipments of Board or Non-Board grains under a shortfall condition.

	BOARD GRAINS		NON-BOARD GRAINS		
Primary* Elevator Shipment IF	Shipments	% of Total Orders	Shipments	% of Total Orders	TOTAL
Shortfall Occurred	16,776	91%	1,587	9%	18,363
No Shortfall Occurred	27,332	92%	2,334	8%	29,666
TOTAL	44,108		3,921		48,029

In fact, in some cases, Non-Board shortfalls were much more frequent than Board shortfalls. A similar analysis was performed to ascertain if orders for certain grains were outstanding for longer periods than others. Once again no relationship was found. The results of these analyses indicate that the type of grain does not affect the frequency or length of shortfall.

(3) <u>A Wide Variance of Shortfall Severity Exists Between Blocks</u>

Using the shipment data base, a comparison of shortfall severity (described in Chapter IX) was

* Source: Canadian Wheat Board block audit files, three month sample (winter, spring, fall 1978).

conducted. Exhibit P-1 lists the blocks according to shortfall severity. A few patterns emerge:

- Reciprocal blocks have fewer shortfall problems

- CN blocks tend to have more shortfall problems than CP blocks

- Shortfall severity does not appear to be related to type of line (main, secondary, main or branchline).

This ranking may be useful to the Wheat Board when programming high priority orders, and also should be analyzed by the railways for causes and possible countermeasures.

Exhibit P-2 provides a breakdown for each block of the severity index by its two components (probability of shortfall occurrence and average length of duration). On a block-by-block basis the primary component in determining the "severity" varies to some degree, but there is a parallel relationship established overall. (The higher the probability of shortfall occurrence, the greater the duration.)

EXHIBIT P-1
Comparison of
Shortfall Severity by Block

BLOCK	RR	NAME
Low Severity		
49	CN	Hanna West
47	CN	Hanna South
Medium Low Severity		
82	CP	Brooks
87	CP	Edmonton
98	GSL	GSL Railway
85	CP	Calgary
90	NAR	NAR West
13	CN	Dauphin
86	CP	Red Deer
72	CP	Pasqua
11	CN	Melville
71	CP	Weyburn
1	CN	Winnipeg North
73	CP	Bulyea
62	CP	La Riviere
35	CN	Regina West
41	CN	Edmonton North
83	CP	Lethbridge
25	CN	Prince Albert East
15	CN	Kamsak
Medium High Severity		
33	CN	Regina South
95	NAR	NAR East
63	CP	Carberry
43	CN	Edmonton South
64	CP	Brandon
45	CN	Edmonton West
75	CP	Saskatoon
81	CP	Medicine Hat
39	CN	Biggar West
78	CP	Swift Current
23	CN	Saskatoon North
19	CN	Saskatoon South
76	CP	Wilkie
79	CP	Outlook
74	CP	Bredenbury
High Severity		
5	CN	Winnipeg West
61	CP	Keewatin
84	CP	Vulcan
21	CN	Saskatoon West
31	CN	Saskatoon East
27	CN	Prince Albert South
37	CN	Biggar North
9	CN	Brandon West
Very High Severity		
29	CN	Prince Albert West
17	CN	Saskatoon Main
3	CN	Winnipeg South
77	CP	Assiniboia
7	CN	Brandon North

Source: Representative sample of shipment data in 1978 from CWB, CNR and CP Rail.

EXHIBIT P-2
Components of Shortfall
Analysis by Block

BLOCK	PROBABILITY OF SHORTFALL	AVERAGE LENGTH OF SHORTFALL (Days Beyond Auth. Week)	SAMPLE SIZE	SEVERITY (Prob. x Length)
CN				
1	.27	6.5	279	1.755
3	.50	9.0	951	4.500
5	.39	6.9	752	2.691
7	.54	13.1	542	7.074
9	.48	8.3	863	3.984
11	.35	4.9	459	1.715
13	.38	3.8	1963	1.444
15	.39	5.1	1211	1.989
17	.57	7.6	1637	4.332
19	.24	12.1	852	2.904
21	.47	7.7	987	3.619
23	.41	7.0	720	2.870
25	.33	5.9	1756	1.947
27	.56	6.5	1467	3.640
29	.52	8.1	1887	4.212
31	.51	7.1	692	3.621
33	.46	4.4	1730	2.021
35	.52	3.6	987	1.872
37	.43	8.7	807	3.741
39	.42	6.5	979	2.730
41	.32	5.9	1079	1.888
43	.37	6.4	1309	2.368
45	.39	6.6	614	2.574
47	.24	4.0	1203	0.960
49	.15	4.5	852	0.675
CN Mean	.43	6.8	26595	2.924
CP				
61	.27	6.6	519	1.782
62	.22	6.1	2126	1.342
63	.29	7.3	1412	2.117
64	.30	7.5	1718	2.250
71	.15	8.3	1603	1.245
72	.34	3.9	1357	1.326
73	.27	4.6	1158	1.242
74	.33	3.7	1079	1.221
75	.29	6.5	951	1.885
76	.33	7.9	739	2.607
77	.48	8.3	983	3.984
78	.26	6.3	1051	1.638
79	.31	9.4	712	2.914
81	.27	1.9	307	0.513
82	.16	6.8	171	1.088
83	.23	8.4	533	1.932
84	.35	6.3	132	2.205
85	.23	4.6	315	1.058
86	.35	6.2	464	2.170
87	.12	2.2	463	0.264
CP Mean	.28	6.1	17776	1.708
NAR				
90	.18	8.0	28	1.440
95	.49	6.4	245	3.136
NAR Mean	.46	6.5	273	2,990
GSL				
98	.24	4.4	353	1.056
GSL Mean	.24	4.4	353	1.056
Minimum (87)	.12	2.2	463	0.264
Maximum (17)	.57	7.6	1637	4.332
Mean	.38	6.5	44997	2.470

(4) Elevator Companies Have Varying Preferences for Shipments Under a Shortfall Situation

The following chart indicates differences among the grain companies in their handling of shortfalls.

PERCENT OF BOARD VS. NON-BOARD GRAINS
SHIPPED BY COMPANY UNDER SHORTFALL
AND NON-SHORTFALL CONDITIONS*

Company Shipments IF	SWP	AWP	MPE	UGG	CAR	PIO	TOTAL
Shortfall Occurred							
Board	96%	94%	89%	94%	75%	95%	91%
Non-Board	4%	6%	11%	6%	25%	5%	9%
No Shortfall Occurred							
Board	96%	91%	94%	91%	79%	94%	92%
Non-Board	4%	9%	6%	9%	21%	6%	8%

(5) Stations at the End of a Train Run Are No More Likely to Have Shortfalls Than Other Stations on the Line

An analysis of several train runs indicates that there is no pattern in shortfalls according to the location of the station on the line. Exhibit P-3 lists the shortfall severity indices for stations on several subdivisions. This analysis indicates that the railroads are not being selective in allocating cars along the line and further substantiates the conclusion that shortfalls do not affect the loaded cycle time.

* Source: Canadian Wheat Board block autit files, three month sample (winter, spring, fall 1978).

EXHIBIT P-3
Station Shortfall Severity Index by Location on Line

SUBDIVISION	STATION	SEVERITY INDEX
Hartney (C.N.)	Ninette	6.776
	Dunrea	9.030
	Margaret	6.370
	Minto	9.875
	Fairfax	13.580
	Elgin	10.551
	Hartney (End)	9.460
Cromer (C.N.)	Woodnorth	0.440
	Cromer	1.856
	Fairlight	4.032
	Kelso	3.467
	Vandura	4.167
	Langbank	4.185
	Inchkeith	7.700
	Kipling (End)	2.559
	Parkman	2.240
	Carlyle	1.254
	Willmar	0.348
	Browning	1.040
	Steelman	0.925
	Elcott (End)	1.404
Bredenbury (C.P.)	Bredenbury	2.339
	Saltcoats	4.057
	Yorkton	3.519
	Orcadia	0.200
	Springside	3.084
	Theodore	3.485
	Insinger	4.296
	Sheho	3.885
	Tuffnell	2.555
	Foam Lake	3.526
	Leslie	2.512
	Elfros (End)	6.440
Tisdale (C.P.)	Wadena	7.522
	Hendon	2.971
	Fosston	5.176
	Rose Valley	0.826
	Nora	4.222
	Archerwill	0.743
	Sylvania	5.365
	Tisdale	1.471
	Pontrilas	0*
	Codette	1.377
	Nipawin (End)	1.760
White Fox (C.P.)	White Fox	2.617
	Love	2.428
	Garrick	3.000
	Choiceland	2.217
	Smeaton	0.762
	Shipman	3.249
	Weirdale	1.551
	Meath Park (End)	3.536

Source: Representative sample (winter, spring, fall) of shipment data in 1978 from CWB, CNR and CP Rail

* Low volume station.

2. SHORTFALLS FRUSTRATE DELIVERY PERFORMANCE

The above analyses support the following conclusions in regard to shortfalls:

- Shortfalls are costly to the Wheat Board since they result in:
  - Poor delivery performance at ports
  - Utilization of buffer stocks
  - Vessel demurrage charges
  - More opportunity for elevators to defer orders
  - Longer program lead times.
- Railroad shortfalls are a result of unrealistic programming of orders by the Wheat Board and a lack of monetary incentive for the railroads to commit sufficient transportation resources to grain movements.
- Shortfalls are not dependent upon the type or grade of grain ordered.
- Shortfall implications for Board vs. Non-Board grains differ by company and by loading block.
- Stations at the end of train runs do not have any more shortfalls than other stations.

APPENDIX Q

CANADIAN WHEAT BOARD
GRAIN TRANSPORTATION DEPARTMENT

The overall structure of the Canadian Wheat Board Grain Transportation Department is illustrated in Exhibit Q-1. This department is headed by a General Director who reports to the five Commissioners of the Canadian Wheat Board. The Directors of Western Operations, Eastern Operations, and Planning and Coordination all report to the General Director. The Grain Transportation Department consists of approximately 50 people, most of whom are located organizationally under the Director of Western Operations.

The Director of Western Operations' group is subdivided into four functional sections:

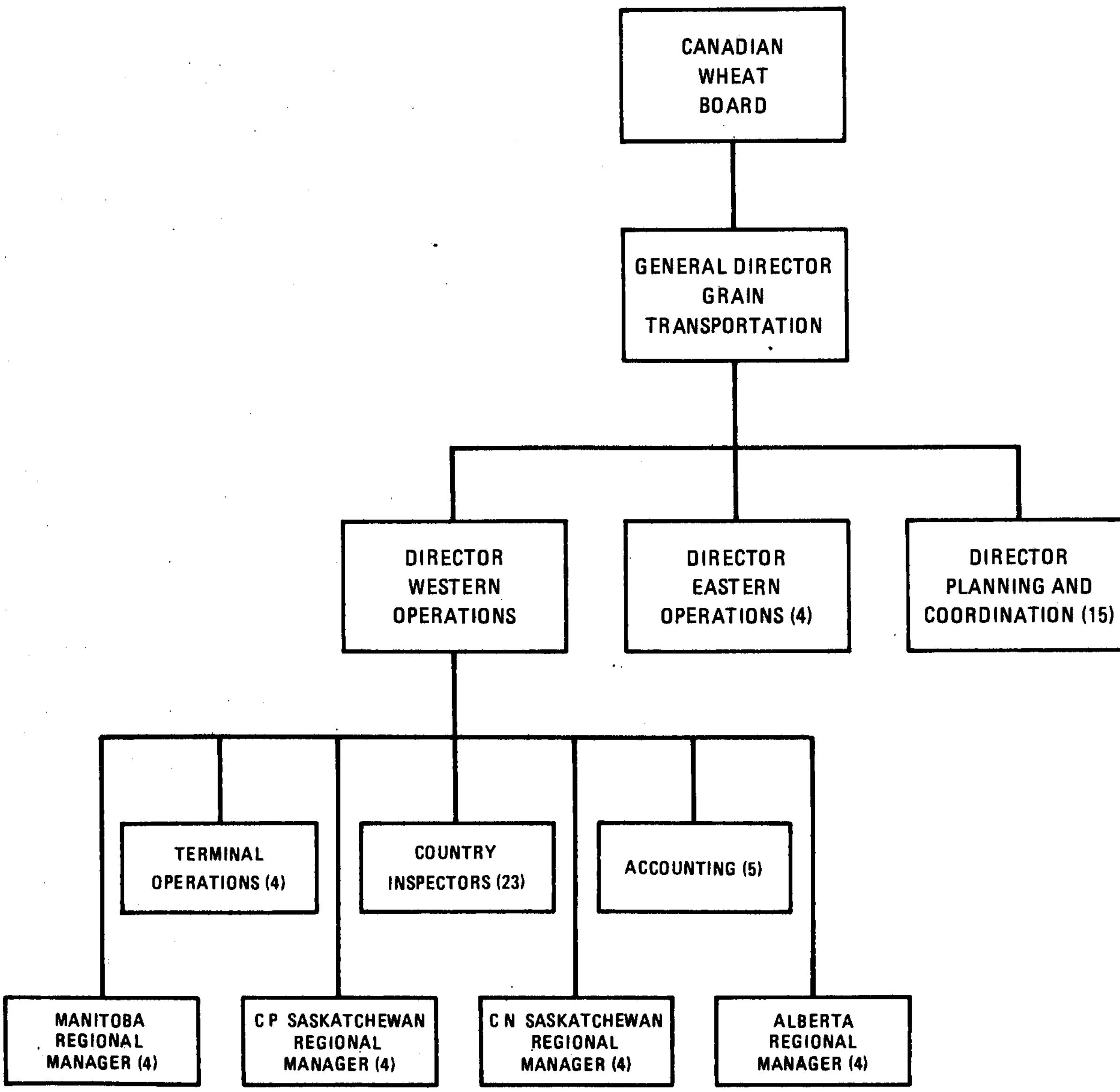
- Terminal Operations, responsible for monitoring the status of rail and ship movements in the ports of Vancouver, Prince Rupert and Churchill. There are four persons assigned to this section.

- Country Inspectors, responsible for investigating infractions of the Canada Grain Act at selected country elevators. These inspectors also act as Wheat Board public information resources in the country. There are 20 inspectors in the field and three persons at headquarters to supervise operations.

- Accounting, responsible for all Wheat Board accounts payable in the country, a country elevator audit program, quota allocations, and accounting of country stock positions. There are five persons assigned to this section at headquarters.

- Regional Managers, responsible for interfacing between the railroads and grain company headquarters for the authorization of car orders, block allocations by company, and coordination of the number and frequency of train runs. There are four regional managers, one each for Manitoba, CP Rail in Saskatchewan, CN Rail in Saskatchewan, and Alberta. Each manager has a staff of three.

EXHIBIT Q-1
Organization Chart
Grain Transportation Department
Canadian Wheat Board



The Director of Eastern Operations, St. Lawrence, and Atlantic Ports is responsible for monitoring ship arrivals at Thunder Bay and the translation of these arrival dates into stock requirements for the terminal elevators at Thunder Bay. There are three staff persons assigned to assist the Director of Eastern Operations.

The Director of Planning and Coordination is responsible for gathering statistics to support the distribution functions of the Wheat Board, analyzing the results, and planning development projects. This group administers questionnaires to the primary elevator managers once every four months, and manages the protein content of wheat shipped from the ports. There are 14 people assigned to the Director of Planning and Coordination.

APPENDIX R

REVISED CAR ALLOCATION PROCEDURE

This appendix outlines how car allocation and inventory management could work with the proposed changes to the management information systems covered in Chapter IX and the institutional arrangements covered in Chapter X. The Block Shipping Staff is discussed here in a general operating context regardless of the organizational location.

The overall demand requirements, car availability, and Board/Non-Board split for car allocation would be based on inputs from the monthly forward planning meeting as described in Chapter X. The quotas to be called for the month would also be planned in that meeting. The first two weeks of operation planning for the block shipping cycle would remain essentially the same as it is done today. To update the decision process, the CWB Marketing Department would provide the Block Shipping Staff with a sales program, at the same time the grain companies furnish Non-Board demand positions. The car order estimates would be continually modified for the planning week in order to develop refined estimates in order to avoid car shortfalls. The more detailed adjustments to the car allocation plan would occur in weeks 3 and 4 of the cycle as follows.

1. <u>THE WEEKLY CAR ALLOCATION PROCESS WOULD BE STRUCTURED INTERACTIVELY</u>

During the third week of the cycle, the Block Shipping Staff would meet with the CWB, railways and grain companies. The focus of this meeting would be on:

- Specific allocations of cars in week 4
- Cars available in week 5
- Requirements in weeks 6, 7, and 8.

The participants would provide the following inputs to these meetings:

- Block Shipping Staff—Position papers on port terminal inventories, vessel arrivals expected, domestic market requirements, and country inventory from the proposed information system (see Chapter IX)

- CWB Marketing—Weeks 6, 7, and 8 volume estimates for movement to market position of Board grain

- Grain Companies—Weeks 6, 7, and 8 volume estimates for movement to market position of Non-Board grain. Also updated information on primary elevator stocks expected to be in a shippable position

- Railways—Cars expected to be available in cycle week 5 and status of current country loading program. Also, identification of specific problems such as lines out of service and changes in general operational patterns.

Confidentiality of detailed information would not be revealed to persons or organizations outside the Block Shipping Staff, and only the final plans would be distributed to the participants.

The process as initiated by the meetings in week 3 carries through to the end of week 4 with completed allocation of cars for week 5, including:

- Producer car requests
- Board and Non-Board grains
- Company
- Blocks
- Stations.

Automated information aids, as discussed later in this section, would be used in each stage of the allocation process. The status of the process in week 3 would be as follows:

- Demand priorities would be established for Board and Non-Board grains for each of the ports, along with domestic market requirements.

- Railways would offer the total cars available based upon car fleet locations and expected cycle times.

- Based upon the plan established, allocate cars to:

  - Ports
  - Board and Non-Board grains.

- The available cars would then be divided among the companies on the basis of the car allocation formula (i.e., the "Bracken" formula, modified as may be necessary), with car penalties factored appropriately.*

- The Block Shipping Staff would allocate orders to stations to relieve congestion for those elevators that are within 10 percent capacity in blocks within 30 percent of capacity (the formula recently instituted).

- Each company would then confirm the number of cars needed for its Non-Board and Board movements in accordance with the split determined at the monthly meeting.

- The Block Shipping Staff would then check each company's Board and Non-Board allocation to assure that the overall split matched the final demand and car availability negotiated.

- There would be a process of discussion and negotiation with the aid of "real time" information displaying inventory status, requirements, etc. wherein each company distributed its Board and Non-Board grain cars by block.

- Each block would then be "targeted" for a week to unload based upon current car cycle performance to destinations, estimating deliveries to ports in block shipping cycle weeks 5, 6, 7, and 8.

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* Penalties in the form of reduced car allocations would no longer be carried forward to the next week. If the penalty cannot be applied to the company in the block where it was incurred, the Block Shipping Staff would apply it in that week to the company in another block.

- On Friday of week 3, each company would have its allocation of Board and Non-Board grain cars by block

- Weekly negotiations, demand and supply formulation, and car allocations are documented and distributed to the railway companies and CWB.

2. THE FINAL LOADING PROGRAM WOULD BE GENERATED IN WEEK 4 OF THE BLOCK SHIPPING CYCLE

Week 4 would begin with the allocations and plans to be refined as follows:

- Companies would allocate on a station-by-station basis within the block and interact with Block Shipping Staff to make any adjustments to come up with final allocation

- Companies and Block Shipping Staff interact with railway operating personnel to finalize subdivision train runs and establish empty car distribution plan by region/blocks

- Companies distribute final loading program to elevators

- The companies would be required to submit to the Block Shipping Staff the shipping documents against the loading orders

- Final loading and delivery program established.

The remainder of this section discusses the potential for an information display system and automation of the car allocation and inventory control process.

3. AUTOMATED DISPLAY SYSTEM

A system for the convenient storage and display of all vessel requirements, shippable stocks, etc. should be used to enhance the decisionmaking process based upon the recommendations in Chapter IX. Automated routines would assist in the investigation of the possible impacts of allocation decisions and indicate how effectively a given allocation was achieving an objective.

(1) Demand Information Aids

Information is transmitted daily to the CWB from ports on the current vessel situation (ETA's, arrivals, nominations, loadings). Based on this information and historical analysis of vessel performance by flag and type of vessel and grain carried, a computer system could provide the following displays:

- The "terminal position report" indicating "maximum likelihood" requirements (i.e., using median or modal arrival times for ships by flag, type, grain) and "worst case" (say, all arrivals assumed early in proportion to their expected standard deviations such that the cumulative joint probability distribution function has a value of 0.05 or 0.10)

- A table of car requirements by grain/grade by number of weeks since or until it is required at the port. This will permit a rapid overview of the entire situation and aid the adoption of an explicit strategy to meet crises.

Example:

Vancouver Cars Required to Meet

	1CWRS	2CWRS	2CWRS
6+ week backlog	20	0	10
5 week backlog	40	25	50
4 week backlog	80	55	75
Current week	160	170	180
+1 week	150	220	300
+2 week	175	180	310

(2) <u>Supply Information Aids</u>

Assuming that primary elevator shippable stock information were available to the computer system, and that historical trends of railway car cycle times from given blocks were available to it, the following types of displays could be produced:

- Deliverable carloads by block by grain/grade
- Deliverable carloads by cycle time from port, e.g., Thunder Bay carloads by travel time:

  Example:

	NUMBER OF CARLOADS		
	1CW	2CW	....
7 days out	160	180	
6 days out	140	120	
.			
.			
.			
.			

- Specification by block of availability from previous table:

  Example:

  Input: Specify 7 days out of Thunder Bay for 1CW

  Output:

BLOCK	NUMBER OF CARS 1CW
62	5
63	10
73	8
	.
	.
	.

- Assuming elevator capacities are logged in the system, crosstabs of congestion and travel time to ports could be produced.

  Example:

  7 days from Thunder Bay - 1CW
  Congested blocks 63, 73
  Uncongested block 62
  6 days from Thunder Bay - 1CW
  .
  .
  .
  .

(3) Allocation Planning Aids

Allocation planning could be assisted by a computer model to satisfy two or more optimizing rules. For example:

- Maximize deliveries at ports. The computer model, given the number of available cars at each port and the car cycle times, could calculate an allocation table to maximize delivery of required grain to ports regardless of congestion or "equity" to companies or elevators

- Maximize equity. The computer could calculate an allocation based on the Bracken formula (or others) to maximize shipping opportunity, regardless of vessel constraints

- The computer could be instructed to proceed on either of the two bases alone or both combined, but subject to certain constraints.

In these cases, the planned allocations could be compared to agreed-upon allocations. Indices of "efficiency" or "equity" could be calculated.

APPENDIX S

RESULTS OF SURVEY OF PRODUCERS

The producers' attitude towards the potential lengthening of hauls is of major importance in the issue of consolidating the primary elevator system. These hauls may be longer due to consolidation and/or the desire for competitive facilities. The Department of Agricultural Economics of the University of Saskatchewan recently conducted a survey of producer attitudes concerning competition. In this survey producers were asked about their perception of the value of competition in gaining better grades, better dockage, and improved service. A number of questions also concerned their satisfaction with present elevator operations. Because of financial assistance provided by this project, the Department of Agricultural Economics accelerated the processing of this survey to permit inclusion of the results of this report.

Exhibit S-1 shows the degree of satisfaction of producers with the service received at the delivery points they now use, stratified by the number of companies located at that point. It can be seen that producers carrying grain to multiple company points are more satisfied in every respect except for quota, which is not a function of primary elevator operations.

Next, the producers were asked a series of questions concerning their perception as to whether the presence of competition assists in improving grades, dockage allowances, and service given by the agent. The responses to these questions are shown in Exhibit S-2, stratified by the number of companies and elevators located at the current delivery point. It can be seen that in general about three-quarters of the producers surveyed thought that competition was of value in these aspects. As might be expected producers who currently haul to more competitive points gave a higher value to competition than those who haul to single company points.

Producers were asked if submitting the same grain to different companies or to different agents of the same company

EXHIBIT S-1
Average of Producer Satisfaction
Indices Related to Number of Companies
Operating at Usual Delivery Point*

VARIABLE	NUMBER OF COMPANIES				
	1	2	3	4	ALL
HOURS	2.06	1.82	1.79	1.64	1.89
GRADES	1.98	1.95	1.74	1.67	1.90
DOCKAGE	2.21	2.12	1.86	1.83	2.09
WAITING TIME	2.12	1.85	1.77	1.71	1.92
AVAILABILITY OF SERVICES	2.02	1.79	1.75	1.71	1.86
SKILL AND EFFICIENCY OF AGENT	1.83	1.64	1.40	1.57	1.66
INTEGRITY OF AGENT	1.68	1.50	1.33	1.36	1.53
STORAGE SPACE	2.95	2.58	2.48	2.05	2.66
CAR AVAILABILITY	3.33	3.14	3.13	2.90	3.19
QUOTA	2.96	3.12	3.23	3.13	3.08
AVERAGE	2.314	2.151	2.048	1.957	2.178

* Respondents were asked to rank their satisfaction with existing levels of service according to the following scale:

1 = Always satisfied
2 = Almost always satisfied
3 = Sometimes satisfied
4 = Rarely satisfied
5 = Never satisfied

would result in differences in the grade given or in the percentage of the dockage. The results of these questions are shown below:

	Given By Agents of Different Companies	Given By Different Agents of The Same Company
Difference in Grades	0.54 grades	0.35 grades
Difference in Dockage	1.16%	0.82%

Producers feel that there are differences between agents but that there are more important differences between different companies.

Finally, each producer was asked what additional distances he would be prepared to haul for better grades, better dockage or better service. The responses are shown in Exhibit S-3. In general, producers indicated a willingness to haul an additional two to seven miles to receive better grades, dockage or service. Given that the producers in the sample responding to this questionnaire now hauled an average of 8.1 miles, these distances would represent increases of between 25 and 90 percent.

The study also estimated the value of competition per bushel of grain marketed. This was done in four different ways, by asking producers directly, by calculating how much further they were willing to haul and valuing this in monetary terms, by estimating the difference in grades between agents and companies and associating this with the price difference per bushel and by estimating the differences in dockage and converting this into a price per bushel. The average value of competition calculated by these four methods was slightly over five cents per bushel. This represents an additional haul, at 0.69 cents per bushel mile (as estimated by PRAC), of slightly over seven miles. Based on this assessment, it would be economical for producers to haul about 90 percent further than they do now, rather than giving up the benefits of competition.

With respect to this project, the results indicate that producers are not nearly as sensitive to length of haul as they are to other factors, such as the service provided and the degree of competition available. In other words producers would probably accept a faster pace of consolidation if they were assured of good service and "competitive" grading and dockage estimates by agents.

EXHIBIT S-3
Attitudes of Producers
to Longer Hauls

A - Additional Distance Farmer Prepared to Haul for Better Grades. (in miles)

Number of Companies	Number of Elevators			
	1	2	3	4
1	4.922	4.657	2.733	7.154
2	---	4.530	4.265	4.563
3	---	---	3.943	3.875
4	---	---	---	5.977
MEAN	4.922	4.573	3.734	4.894

B - Additional Distance Farmer Prepared to Haul for Better Dockage. (in miles)

Number of Companies	Number of Elevators			
	1	2	3	4
1	4.211	4.324	2.067	5.769
2	---	3.930	4.204	4.042
3	---	---	3.226	3.292
4	---	---	---	5.047
MEAN	4.211	4.083	3.308	4.179

C - Additional Distance Farmer Prepared to Haul for Better Service. (in miles)

Number of Companies	Number of Elevators			
	1	2	3	4
1	3.700	4.581	1.800	5.154
2	---	3.790	3.776	3.535
3	---	---	3.811	3.396
4	---	---	---	5.093
MEAN	3.700	4.029	3.322	3.972

EXHIBIT S-2
Evaluation of Effects
of Competition

A - Response to question "Would the presence of two or more competing companies result in better grades?"

1 = Yes   0 = No

Number of Companies	Number of Elevators 1	2	3	4
1	.600	.716	.667	.846
2	--	.690	.735	.718
3	--	--	.830	.646
4	--	--	--	.884
MEAN	.600	.689	.734	.749

B - Response to question "Would the presence of two or more competing companies result in better dockage?"

1 = Yes   0 = No

Number of Companies	Number of Elevators 1	2	3	4
1	.633	.743	.600	.923
2	--	.720	.735	.718
3	--	--	.887	.708
4	--	--	--	.861
MEAN	.633	.723	.748	.765

C - Response to question "Would the presence of two or more competing companies result in better service?"

1 = Yes'   0 = No

Number of Companies	Number of Elevators 1	2	3	4
1	.711	.851	.733	.923
2	--	.770	.755	.845
3	--	--	.793	.813
4	--	--	--	.907
MEAN	.711	.801	.748	.855