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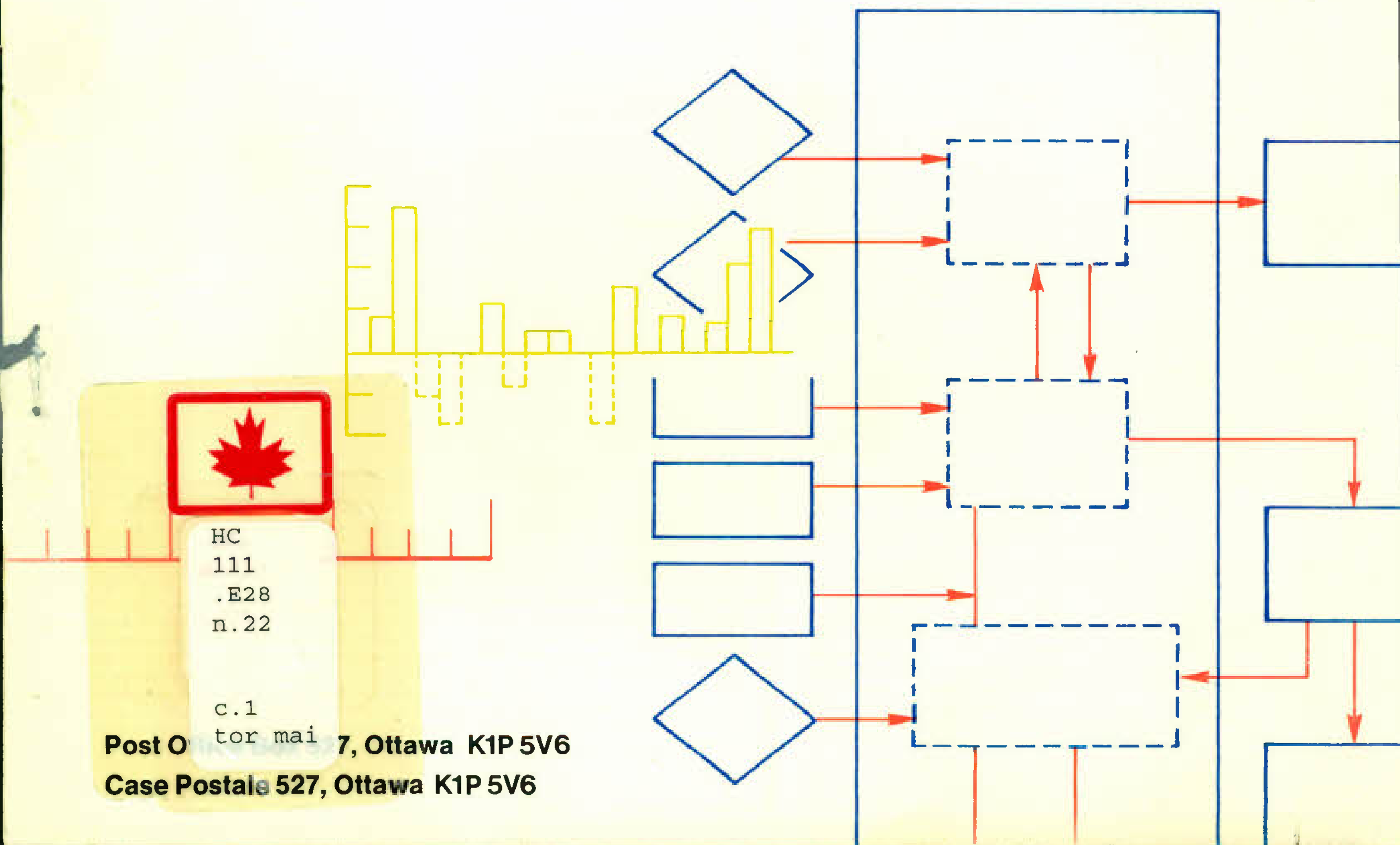

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DISCUSSION PAPER NO. 22

ACROSS MOUNTAIN AND MUSKEG: Building the Canadian Transportation System

by John T. Saywell

February 1975

RÉSUMÉ

Le document intitulé Across Mountain and Muskeg est une étude historique de la construction des réseaux de transport canadiens. Les divers chapitres sont consacrés au développement des chemins de fer, du transport routier, de la Voie maritime et des réseaux de pipe-lines, l'étude de chacun de ces modes de transport suivant la chronologie des événements. Quant aux aéroports, les recherches à leur sujet ne sont pas encore terminées. L'auteur s'efforce toujours d'examiner, dans une perspective historique générale, la nature de la demande, l'esprit d'entreprise, les investissements, la main-d'oeuvre et la technologie.

Malgré le grand échelonnement de ces travaux dans le temps, la géographie de notre pays a toujours présenté à l'industrie de la construction un défi constant bien qu'un peu moins menaçant. Tous les réseaux de transport mis en phase représentaient à leur époque une entreprise gigantesque. Même si l'homme disposait d'un équipement de plus en plus perfectionné et puissant, les Montagnes Rocheuses et les rivières, le Bouclier canadien et le muskeg (tourbière) ont été des adversaires formidables pour l'ingénieur et l'entrepreneur.

Sauf pour les canaux, à partir de celui de Lachine jusqu'à la Voie maritime, la mise en place du système de transport canadien s'est faite avant que la pays ait acquis la capacité de le réaliser. Les premiers chemins de fer

ont été construits par des entrepreneurs et ingénieurs étrangers, utilisant une grande quantité d'équipement et de matériel importés, faisant appel à une main-d'oeuvre spécialisée et non spécialisée formée en grande partie d'immigrants, et recourant surtout à des capitaux étrangers. Ainsi, ce n'est qu'après la Première Guerre mondiale que la construction de chemins de fer au Canada est devenue une entreprise entièrement canadienne, même si elle a continué (et continue toujours) à faire appel à beaucoup de main-d'oeuvre étrangère. Mais déjà à ce moment-là ses jours de gloire étaient révolus. D'autre part, même si les Canadiens -- avec l'aide d'une main-d'oeuvre souvent composée en grande partie d'immigrants -- construisirent et financèrent leurs propres routes, ils empruntèrent beaucoup des Etats-Unis, notamment des techniques d'ingénierie et de l'équipement. Ce n'est qu'après 1950 que les Canadiens commenceront vraiment à effectuer leurs propres recherches plutôt que de s'en remettre à des données américaines appliquées aux conditions canadiennes.

L'essor qu'a connu la construction de pipe-lines au cours des années 50 est un exemple plus récent, mais typique, de nos efforts dans le domaine du transport. Même si ce genre de canalisations existaient au Canada depuis le milieu du dix-neuvième siècle, la nécessité s'est présentée d'installer des conduites principales à partir de l'Alberta vers l'est et vers l'ouest, tâche pour laquelle notre pays n'était pas préparé du tout. Même si certaines entreprises étaient en mesure d'entreprendre l'aménagement d'un tel réseau, le Canada ne possédait pas les éléments nécessaires pour le réaliser : expertise en ingénierie, techniques de construction, capital, matériel et fournitures, ainsi que la main-d'oeuvre spécialisée. Ce sont des sociétés américaines ou leurs filiales nouvellement implantées au Canada qui ont construit les pipe-lines canadiens, durant les années 50, au moyen de canalisations et d'équipement de construction américains, de techniques américaines d'ingéniérie et de grande quantité de capitaux américains ou fournis par des filiales canadiennes de sociétés américaines.

Cependant, au cours de la décennie, de plus en plus de ces filiales s'établirent au Canada, les Canadiens acquirent de l'expérience dans la construction de pipe-lines de fort diamètre et nos entreprises manufacturières augmentèrent leur capacité de production de façon à fabriquer certaines de ces canalisations géantes et d'autres matériaux nécessaires. Par exemple, la société Bechtel, de San Francisco, venue s'installer au Canada pour mettre en place le pipe-line de l'Interprovincial, est devenue ensuite la Canadian Bechtel afin de jouer un rôle important dans la construction de la plupart des autres, et c'est encore elle qui s'occupe aujourd'hui de diriger le gigantesque projet d'aménagement hydro-électrique de la Baie James.

Pourtant, l'autonomie du Canada dans la construction d'installations de transport n'est pas encore complète. Le gazoduc de la vallée du MacKenzie exigera de grandes quantités de capitaux étrangers, ainsi que des milliards de dollars en matériaux, services et équipements importés (56.6 % seulement des matériaux seront en fin de compte d'origine canadienne). En outre, les intérêts étrangers représenteront respectivement environ 25 et 35 % des actions des consortiums qui seront probablement chargés des travaux d'ingéniérie et de la direction de la construction dans cette entreprise. Dans un mémoire présenté au gouvernement fédéral en 1975, la Canadian Arctic faisait une affirmation qui s'inscrira comme un truisme dans l'histoire de la mise en place des systèmes de transport : "Il faut reconnaître que dans la réalisation d'un projet de l'ampleur du gazoduc proposé, certains besoins pourront dépasser les possibilités canadiennes, particulièrement si d'autres grands projets ont des besoins semblables et concurrents."*

Même si aucune étude précise n'a été faite de la question, il semble que les grands travaux de construction dans le domaine des transports chevauchent souvent et coincident avec d'autres demandes importantes auxquelles doit répondre l'industrie de la construction. Par conséquent, dans ce domaine, cette industrie a toujours misé beaucoup -- même

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*Canadian Arctic Gas Pipeline Limited, National Economic Effects of the Applicant's Proposal, Section 14b, 1975, p. 19.

jusqu'à l'impossible -- sur les capitaux canadiens et a exigé un effectif de main-d'oeuvre que le pays ne pouvait normalement lui fournir. Les pénuries de travailleurs et les taux élevés d'immigration ont coincidé d'habitude avec les grandes phases d'expansion de notre système de transport, tout comme d'ailleurs les fortes importations de capitaux. Il en va toujours de même aujourd'hui.

SUMMARY

Across Mountain and Muskeg is an historical description and examination of the construction of the Canadian transportation system. Separate chapters are devoted to the history of railway, highway, seaway, and pipeline construction - the research on airports is still underway - and the discussion of each runs chronologically. However, an attempt is made in all cases to look at the nature of demand, entrepreneurial initiative, capital, labour and technology in a general historical way.

Despite the great spread in time the challenge of Canadian geography to the construction industry has remained undiminished, if slightly less forbidding. All transportation systems have been on an enormous scale, and each for their day represented a gigantic undertaking. Despite increasingly sophisticated and powerful equipment the Rockies and the rivers, the Shield and the muskeg have remained formidable opponents of the engineer and contractor.

With the exception of canal building, from the Lachine to the Seaway, the construction of the Canadian transportation system has been in advance of the country's capacity to build it. The early railways were built by foreign managers and engineers, using considerable foreign equipment and supplies, dependent upon large numbers of immigrant labour both skilled and unskilled, and spending largely imported capital. Not until after the first war, for

example, was Canadian railroad construction completely nationalized, although it continued (and continues) to rely heavily on immigrant labour. But by then its greatest period was over. While Canadians - with the assistance of an often largely new Canadian labour force - built and paid for their own highways, they borrowed heavily from the United States. Engineering and equipment was largely American, and it was not until after 1950 that Canada began to do very much of its own research rather than rely on American data applied to Canadian conditions.

The pipeline construction boom of the 1950s provides a more recent, but typical, illustration. Although there had been pipelines in Canada since the middle of the nineteenth century, the necessity to build trunk lines from Alberta to eastern and western Canada found the country totally unprepared. While it had some entrepreneurial capacity to launch pipeline schemes, it lacked the engineering, construction, capital, equipment and supplies, and skilled labour necessary to build them. Canada's pipelines in the 1950s were built by American firms, or Canadian subsidiaries of newly arrived American firms, using American pipe and construction equipment, relying on American engineering, and spending large amount of American capital, or capital provided by American subsidiaries in Canada.

However, over the course of the decade the American companies established branches in Canada, Canadians gained experience in big-inch pipelines construction, and Canadian manufacturers increased their capacity to manufacture some of the pipe and other necessary materials. For example, Bechtel of San Francisco, who entered the country to build Interprovincial, became Canadian Bechtel to play a leading role in building most of the others, and remained to manage the giant James Bay hydro project.

Yet the capacity is still not complete. The Mackenzie valley pipeline will require large amounts of foreign capital, billions of dollars of imported materials, services, and equipment - (only 56.6 per cent of materials for example will be Canadian in ultimate content) - and will have an estimated 25 and 35 per cent foreign component in the engineering and construction management consortiums likely to undertake the work. A Canadian Arctic submission to the federal government in 1975 reflected a truism of the history of the transportation construction: "it must be recognized that in a project of the size and scope of the proposed pipeline, some requirements may exceed Canadian capacity, particularly if other major projects have concurrent, similar requirements."*

Although no attempt has been made to do a precise study, it seems that major transportation construction projects often overlap with each other and coincide with other major demands on the construction industry. As a result the transportation construction industry has always placed heavy, indeed impossible, demands on the private Canadian purse, and it has also demanded a labour supply

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*Canadian Artic Gas Pipeline Limited, <u>National Economic Effects of the Applicant's Proposal</u>, Section 14b, 1975, 19.

beyond the country's normal capacity. Labour shortages, and heavy immigration, have usually coincided with major expansions of the transportation system, as have heavy capital imports. The present is not a refutation of the past.

PREFACE

Across Mountain and Muskeg is the second of a series of essays on the history of construction in Canada, written as background studies for the Economic Council's report Toward More Stable Growth in Construction.* Ultimately the essays may be worked into a monograph, but they are presented as discussion papers to benefit from informed criticism while research and writing continue on the rest of the study. I have taken a topical, rather than a thematic or chronological, approach to the history of construction, and other discussion papers will deal with the history of housing, hydro-electricity, pulp and paper, resource towns, the construction labour force, and the organization of the industry. Each essay is more or less self-contained, an organizational reflection of my conclusion that there is really no such animal as the construction industry. There is hydro construction, railway construction, and housing construction; but there is no comparability between the decisions leading to house building and the expansion of pulp and paper capacity, between iron ore developments that create new towns in Quebec-Labrador and the paving of roads on Vancouver Island. Nor do self-supporting saw-and-hammer builders and big project contractors or major urban developers possess even a common working vocabulary. Some conclusions

*The first, One More River, has been released as Discussion Paper No. 20.

will emerge from the series of essays and some aspects of each are left for an overall analysis, but for the moment each is released for comment as a self-contained discussion paper.

R A I L W A Y S

INTRODUCTION

Canadian historians have been almost anthropomorphic in writing of their railways. From the Champlain and St. Lawrence, which made its debut in July 1836 on sixteen miles of wooden rails, to the 60,000 miles of main line, sidings, spurs and marshalling yards in Canada today, the railway has been hero or villain, saviour or satan. Masked like actors in a Greek drama, the railways have been given almost human roles to play in the unfolding Canadian epic. To some historians they appear as the confirmation of the naturalness of the Canadian state or the legendary heroes of the battle against an almost inevitable annexation or a threatening internal disintegration; to others they assume the guise of ruthless exploiters of a frontier's innocence or the venality of politicians.

Perhaps aware that history, like women, finds much of its charm in mystery, the railways have been no friend of the empirical historian. Their records are scanty, their finances obscure, and the story of their construction almost as mute as the thousands of horses and labourers that cleared the right of way and laid the track.

Yet because the railways provide such striking visible illustrations of the Canadians' conquest of either geograph's enmity or American ambitions they have been given a place on the stage of Canadian history unrivalled by their counterparts elsewhere in the world. In the 1920s Harold Innis could suggest the symbiotic relationship between Canada and the Canadian Pacific, and a generation later Donald Creighton could make them synonymous. Yet even today when the rugged northern landscape no longer is the match for mid-twentieth century machines that the Rockies were for the Chinese coolies, the journalist tells us that "in the great railway drive on Canada's latent riches of the North, the achievements of Canadian construction are almost daily ringing up exciting chapters for the history books of future generations."[1/]

"The pioneer railway pushing into the wilderness, not just to pass through it, but to tame it, was an invention that Canadians might claim," wrote R. A. J. Phillips a few years ago.[2/] Most historians are more cautious, but Canadian railways have been credited with taming the wilderness, opening the west, revealing the north, and uniting the country. Yet the wilderness remained untamed by the simple passage of a railway around Lake Superior or to Hudson Bay; the west remained sparsely settled until the world conditions made its wheat marketable; the north may have been revealed but it was virtually untouched until American publishers needed Canadian paper, European scientists found a way to refine Canadian nickel, or an insatiable Japanese industry needed Canadian raw materials; and while rails may unite, the costs of heavy overhead and unused capacity have always been in the litany of regional protests against

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[1/] Financial Post, February 20, 1954

[2/] R. A. J. Phillips, Canada's Railway, (Toronto 1968), 1.

national policies and Laurention domination.

Railways deserve their place on the Canadian stage. But behind the mask lies a messenger, not a king.

THE BEGININGS

Transportation and communication had been and remained one of the most pressing, troublesome and expensive problems the country faced. The outward looking Maritimes had the sea at their gate, but inland transportation became increasingly essential. The Canadas had relied on the rivers since the days of the fur trade. The development of new staples and the competition from the American canals had compelled them to spend more than $17 million on the Montreal-Lake Erie canal system between 1820 and Confederation, only to see that vital transportation route threatened with extinction by the advent of the railway. To Montreal, a railway to the open sea seemed to be the best and most immediate response. As the Toronto Examiner reported in 1846, "the construction of this Railroad seems to be regarded in Montreal as a question of life and death. It is looked upon as the battleground on which the fight for the trade of Upper Canada and the Western States is to be fought....it seems to be taken for granted that the trade of the West will flow in that direction, if the Railroad be completed...."[3/]

But the Canadas seemed to lack the resources to build railways, and with the British government relucant to undertake the financing, all the talk yielded few miles of track. In 1850 an exasperated

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[3/] G. P. de T. Glazebrook, A History of Transportation in Canada, Carleton Library No. 11 (Toronto 1964), Vol. II, 154.

Thomas Keefer admonished his countrymen:

> Old Winter is once more upon us, and our inland seas are "dreary and inhospitable wastes" to the merchant and to the traveller; - our rivers are sealed fountains - and an embargo which no human power can remove is laid on all our ports. Around our deserted wharves and warehouses are huddled the naked spars, - the blasted forest of trade, - from which the sails have fallen like the leaves of autumn. The splashing wheels are silenced, - the roar of steam is hushed, - the gay saloon, so lately thronged with busy life, is now but an abandoned hall, - and the cold snow revels in solitary possession of the untrodden deck. The animation of business is suspended, the life blood of commerce is curdled and stagnant in the St. Lawrence - the great aorta of the North. On land, the heavy stage labours through mingled mud and frost in the West, - or struggles through drifted snow, and slides with uncertain track over the icy hills of Eastern Canada. Far away to the South is heard the daily scream of the steam whistle, - but from Canada there is no escape: blockaded and imprisoned by Ice and Apathy, we have at least ample time for reflection - and if there be comfort in philosophy may we not profitably consider the PHILOSOPHY OF RAILROADS. [4]

The boom of the 1850s

But British North Americans needed little urging, for the railway fever had struck. Between 1850 and 1867 more than 2,000 miles of track had been laid, much of it in the 1850s, at an estimated cost of $145 million.[5] In Nova Scotia 145 miles linked Halifax to the Bay

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[4] T. C. Keefer, Philosophy of Railroads and other essays, edited by H. V. Nelles (Toronto 1972), 3.

[5] Canada Sessional Papers, No. 73, 1868, 2.

of Fundy and the Gulf. More than 200 miles in New Brunswick tied Saint John to Moncton, Shediac and Sackville, while a short line ran from St. Andrew's to Canterbury and Woodstock, where it connected with lines from Maine. Montreal and Portland businessmen had secured a charter as early as 1845 and, while financing was difficult and progress slow, the line reached St. Hyacinthe in 1847, Sherbrooke and Richmond in 1851-52, and completed the connection with the track running north from Portland in 1853.

Meanwhile, the vital east-west artery was being threatened in the west. By 1853 the Great Western, a trunk line designed to link American lines by a short route north of Lake Erie and tap southern Ontario, was under construction from Windsor to Niagara, via London and Hamilton, and was completed by January 1854. The Buffalo and Lake Huron was chartered to run from Fort Erie to Goderich. Toronto's Northern Railway reached Barrie in October 1853 and completed the historic portage to Collingwood two years later. And charters for countless other lines from Canadian or American cities into northern and western Ontario were being sought or secured.

To complement the St. Lawrence waterway and provide the crucial railway link between Montreal and the west the Canadian government gave its backing in 1853 to the British contracting firm of Peto, Brassey, Jackson and Betts to build the Grand Trunk. The line was to run from Montreal to Toronto, and the company had the power to acquire the Portland-Montreal link with the sea and build east from Lévis to Trois Pistoles and even to New Brunswick. By 1860, through new construction and acquisitions, the Grand Trunk ran from Sarnia to Rivière du Loup and Portland, the Victoria Bridge, a 6,592-foot engineering construction marvel, bridging the river at Montreal.

The first railway boom set a pattern that was to be repeated time and time again. Alan McNab's "railways are my politics" became the principle if not the admission of generations of Canadian politicians. Firms designed to build railways - on the basis of an inflated prospectus, government guarantees, and municipal ambitions - rather than run them, sprung up overnight. Speculators profited from the merest whisper, often carefully contrived, of a railway, and a contemporary of the mania in Huron County wrote that "surveying and map-making, and handbill-printing and auctioneering, became profitable occupations, and the multitude of paper towns and villages exhibited on the walls of every country bar-room suggests the idea of a gallery of amateur landscape painters, or the more alarming idea that Canada is just about to resolve herself into one enormous city."[6]

More important, the first railway boom established the principle of government participation in railway construction, not as owner or operator but as financier. From the outset local capital was unable and foreign capital was unwilling to build Canada's railways. But the railway fever was caused by the bacteria unleashed when the Canadian government in 1849 agreed to guarantee bonds at 6 per cent covering half the cost of construction, and three years later allowed

[6] R. L. Jones, History of Agriculture in Ontario 1613-1880, (Toronto 1946), 203.

the municipalities to borrow money for investments in railways. By judiciously overestimating construction costs and yielding to the ambitions of cities and towns, the enterprising contractor, once under way, could often cover most of his costs. By 1867 the Canadian government had incurred a debt on behalf of the Grand Trunk, Great Western and Northern of more than $33 million and municipalities in Canada West had borrowed more than $6 million for railway enterprises from the loan fund, and floated more on the London market. No breakdown of the total financing of early Canadian railways has been made, but it is probable that the inability of the Canadian promoters of the Great Western to raise even 8 per cent of necessary capital in Canada was not uncommon.

While there was Canadian money in the railway and Canadian municipalities along the route made generous donations, the Great Western was almost totally financed by British bondholders and shareholders and apparently the million in stock subscribed by Erastus Corning and his American associates.[7/] While a group of Canadians, led by A. T. Galt, D. L. Macpherson and Luther Holton, claimed to be able to build the Grand Trunk, the sceptical Canadian government turned it over to Peto, a British firm whose access to the London capital market was far more certain.

The government was sceptical not only of the Canadians' ability

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7/ Ultimately the Canadians appear to have owned only one per cent of the stock. Despite the million dollars supposed to have been invested by Americans, the British seem to have been in control. See G. R. Stevens, Canadian National Railways, (Toronto 1960), Vol. II, 95ff.

to finance the line, but also to build it. The Grand Trunk was constructed by the British; the Great Western and many others by the Americans. The Canadian firm of Gzowski and Macpherson did secure a major contract from the Grand Trunk, and Canadians secured some contracts for wooden bridges and culverts, but on the whole Canadian participation in construction was limited to the local sub-contractors who usually went broke without completing clearing, grading, and filling their spread. As A. W. Currie observed Canadians "may have built canals and other public works but commonly they lacked the experience of firms in England where canal and road building and drainage works had provided the traditions, and to some extent the cadres for a small army of contractors....and more or less professional 'navigators,' a word soon shortened to 'navvies',..." The contractor enticed skilled and even unskilled labour from England with handsome salaries, bonuses, passage money, and the promise of cheap land once the work was completed. Moreover, Peto built Canada Works, an establishment created to provide locomotives, rolling stock, bridge parts and other supplies not available in Canada. Peto was proud of its efficient construction methods:

> In his popular Life of Brassey, Sir Arthur Helps pointed out that while railways in France were built by women carrying baskets of earth on their heads, the English firms used horses, wagons, steam-shovels, and drag-lines. These British methods were commonplace in North America and the Peto firm has been criticized for not realizing that labour in Canada was expensive, for following backward methods compared with American builders, and for unnecessarily adding to the cost of the road. Helps' explanation was

> that "toward the last, in consequence of the extreme cost of labour, the Grand Trunk employed steam excavators, not because they were cheaper than men, but because they supplied the want of labour, and enabled the railway to get on faster." In this way the amount of interest payable during construction was reduced. Helps adds that mechanical excavators were profitable only in very hard material. In view of the numerous other causes of over-capitalization on the Grand Trunk, the alleged failure of the contractors to use machinery as freely as American builders was not very significant. 8/

The first railway boom ended by 1860 with 2000 miles of track laid since the decade began. The following decade was one of uncertainty and financial distress, as railways wrestled with bankruptcy and the colonies suffered the discomfort of over-indulgence.

The return of good times that followed Confederation, however, brought a railroad boom which in miles laid, if not in impact, equalled the construction boom of the 1850s. Between 1867 and 1875 two thousand miles of new track were laid, and, despite the sharp recession after 1873, another two thousand were added by the end of the decade. Almost two thousand miles were built in Ontario as Hamilton, Toronto and Buffalo and the southern lines competed for the commerce that railway connections with the north would bring. By the end of the '70s the railway map resembled that of a century later, and new rails had penetrated north to the Ottawa Valley, Haliburton, Gravenhurst, Midland and Owen Sound, and to Kincardine and Port Elgin on Lake Huron. Quebec continued to lag behind, but another 175 miles

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8/ A. W. Currie, The Grand Trunk Railway of Canada, (Toronto 1957), 29-30.

bridged the American border and Montreal, and by 1879 the Quebec, Montreal, Ottawa and Occidental (North Shore) connected Montreal with Hull and Quebec.

The Intercolonial

Just as the North Shore would link the Quebec metropolis with the route to the Pacific, the Intercolonial was to begin the economic integration of the Maritimes and central Canada. The eastern trunk line was part of the Confederation agreement, and involved the purchase by Canada of existing major lines in the Maritimes and the completion of a through route from Halifax to Quebec. The long debate over the route ended with the victory of the supposed commercial and the undoubted military advantages of a northern route over the political pressure, backed by economic argument, to build closer to the American border. But if Sandford Fleming, the engineer in chief, won on the route, he lost to the politically sensitive Intercolonial Commissioners and Conservative government on the method of construction. Fleming favoured contracting for the entire route, but the appointed Commissioners were too well aware of the political advantages to be gained by employing a number of small contractors. As a result Fleming was forced to work with twenty-three contractors working twenty-mile sections. By the time the line was finished in 1876 only four of the contractors had completed their sections at the tendered price, none of them on time. The rest had gone bankrupt, and Fleming had to complete the sections using day labour. The line had taken twice as long to build as had been estimated and had cost $21.5 million, exceeding the British loan by 50 per cent and adding another railway burden to the general revenues of the Dominion. The politics of construction, however, were neither as costly nor as squalid as the politics of operations, the Intercolonial deserving its reputation for more than half a century of being the most political railway in the world.[9]

The use of local Canadian contractors represented the dubious coming of age of Canadian railway construction, for much of the pre-Confederation buildings had been supervised by the British or the Americans. While the 48,000 steel rails were imported from England, Canadian firms defeated the solitary American bid for the contracts for rolling stock. The cars were built in Toronto (150), Montreal (90), Chatham (50), Dorchester, New Brunswick (50), and Londonderry, Nova Scotia (60). Fifteen of the forty engines came from Glasgow, but Halifax built ten and the Kingston locomotive works the remaining fifteen.

9/ See Stevens, Canadian National Railways, I, 185-191.

TO THE PACIFIC

The North Shore and the Intercolonial provided political historians with ample subject matter, but it was the railway to the Pacific that captured the historians' imagination. The lure of western expansion was the bait that brought many a Canadian into the Confederation camp, but an all-Canadian route to the Pacific remained a doubtful proposition even after Sir George Cartier promised the British Columbians a railway. While the Canada of the 1870s lacked the financial, managerial and material resources to build the line, Ottawa was invaded by men anxious to secure what must have seemed to be a lucrative contract. Railway politics brought down the Macdonald government in the famous Pacific Scandal in 1873, and the Mackenzie government decided to proceed cautiously with a government-constructed line that would link existing waterways wherever possible. By 1878 the Liberals had finished two hundred miles between the Lakehead and Red River, and had spent a fortune on surveys, particularly to find a route from the foothills to the Pacific.

Macdonald returned to office in 1878 committed to a policy of economic nationalism built around a transcontinental railway, a protective tariff and western settlement. Although no sure way had been found through the mountains, he met British Columbia's secessionist clamour by awarding contracts in 1879 for a line through the treacherous Fraser Canyon from Yale to Kamloops, as well as two contracts for track west from Red River.[10/] Within a year, however, the Conservatives had found a syndicate willing to build the Canadian Pacific. Headed by George Stephen, president of the Bank of Montreal, his cousin Donald Smith of the Hudson Bay Company, and James J. Hill, the Canadian-American railroad builder, the C.P.R. was backed by European and American capital. The provisions of the contract signed in October 1880 seemed generous: $25,000,000 in cash and 25,000,000 acres of land, both of which could be claimed as mileage was completed; power to issue $25,000,000 in bonds secured upon the land grant to be deposited with the government, with the proceeds paid to the Company as the work progressed; all surveys and the government-built lines between the Lakehead and Red River, Port Moody to Kamloops, and Selkirk to Pembina when completed, the total value estimated at $37,785,320; government-owned land when available for townsites and the mainline, which was to be tax exempt for twenty years; exemption of construction materials and equipment from taxation and duty-free admission of construction materials; and, finally, the prohibition of any line south of the Canadian Pacific in the prairies for twenty years. In return the Company agreed to construct its sections of the line by 1891. Although Liberal critics

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[10/] The contracts from Port Moody to Kamloops were in fact held by Andrew Onderdonk. One contract from Red River to Portage was completed in 1879, but a second for another hundred miles west was never started. The C.P.R. had to rebuild the flimsy line to Portage, although the city was the end of the track and the site headquarters for the start of prairie construction. Winnipeg was the western base however.

charged that the government had sold a country for a railroad, the contract was approved by Parliament in February 1881.[11/]

The creation of the Canadian Pacific Railway involved operations on three levels: the building of the main line from Callander to the Lakehead and Winnipeg to Kamloops, as well as branches to feed the essential traffic into the main line; the acquisition of companies in eastern Canada, among them the Canada Central and the North Shore, which connected the main line to Ottawa, Montreal and Quebec, and track in Ontario to reach Toronto, western Ontario and Georgian Bay; and the securing of the necessary financing for acquisitions and

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[11/] The so-called monopoly clause was a subject of much heated discussion when the original contract was signed. George Stephen put the essence of the matter forcefully before Macdonald in October 1880: "Now what do you think would be the position of the C.P.R. or of the men bound to own and operate it, if it were stopped at Winnipeg, or at any point west of that, by a line or lines running towards the U.S. boundary. What would, in such a case, be the value of the C.P.R. line from Winnipeg to Ottawa? No sane man would give one dollar for the whole line east of Winnipeg. I need not say more at this point, as it must be clear to you that <u>any</u> and <u>every line south</u> of the line of the C.P.R. running towards the boundary line must be owned and controlled by the C.P.R., otherwise the C.P.R. would be strangled...." (PAC, Macdonald Papers, Stephen to Macdonald, October 18, 1880). A year later when the Northern Pacific threatened to build into Manitoba, Stephen reminded Macdonald of the railway's vulnerability: "As you are really the author of the C.P.R. as a national through line, it will have to look to you for the protection necessary to enable it to overcome the attempts of its enemies to kill it during its infancy and time of weakness." (<u>Ibid</u>., August 27, 1881) construction in Ottawa, Montreal, New York, and London.[12/]

Across the Prairies

Initially the Company threw its energy into the construction of the Prairie line. Not only would the relatively easy construction earn fast cash payments, but the main line and branch lines would open the west for settlement and the sale of land and the early carriage of freight and passengers would bring a quick cash flow. Within weeks a western headquarters was established at Winnipeg and the end of steel construction base created at Portage la Prairie, where the flimsy government line ended. As superintendent of the western section the C.P.R. hired Alpheus B. Stickney, former superintendent of construction on the St. Paul, Minneapolis and Manitoba Railway, a company owned by the same syndicate. General Thomas Lafayette Rosser, Confederate civil war hero and former chief engineer on the Northern Pacific, was imported as chief engineer.

[12/] The most useful sources on actual construction of the road, a subject usually overlooked by historians are the annual reports of the Department of Railways found in the Sessional Papers and a variety of other government documents. The most interesting and informative general secondary source is Pierre Berton, The Last Spike, (Toronto 1971). Harold Innis, A History of the Canadian Pacific Railway, (Toronto 1971), and J. Lorne Mcdougall, Canadian Pacific; A Brief History, (Montreal 1968), are the standard economic and financial histories. Donald Creighton, John A. Macdonald; The Old Chieftain (Toronto 1965) is the best study of railway-government interaction. Heather Gilbert, Awakening Continent; The Life of Lord Mount Stephen (Great Britain 1965) is a useful study of George Stephen's central role, and particularly useful for additional information on C.P.R. finances.

On May 2, 1881, the Company formally took over the government lines in Manitoba, and the first new sod was broken by Rosser at Portage la Prairie. Meanwhile, the Canadian Pacific had decided to hug the American border and build far south of the early surveys, and Hill had hired Major A. B. Rogers, an American locating engineer, to examine southerly passes through the Rockies.

But neither Stickney nor Rosser were up to the task. Each had an unfortunate predisposition to land speculation, and Stickney's modest 130 miles of completed railway during the 1881 construction season was less than Stephen desired. On Hill's recommendation, the Company asked William Cornelius Van Horne, the young general superintendent of the Chicago, Milwaukee and St. Paul Railroad, to look over the Prairie section. In November, Van Horne accepted the position of general superintendent and in turn hired Thomas Shaughnessy, a Milwaukee Irishman who had been general storekeeper on his old railway, to become quarter-master general in the new war against time and space.

In Van Horne the Canadian Pacific had found an extraordinarily rare combination of talents - intelligence, culture, industry, and decisiveness. Meeting the directors in January 1882, Van Horne strongly backed Major Robers, who argued that the Kicking Horse Pass was feasible; advocated or supported a decision not only to build the north shore line but to build it close to the shore of Lake Superior in the most direct route; and backed Stephen's intention to finish the line in five years by promising to build 500 miles across the Prairies in the 1882 construction season. In the same month he gave the contract for the Prairie line to Langdon and Shephard, an American firm with great experience and considerable resources behind it, and summarily dismissed Rosser.

Heavy spring flooding in 1882 gave Langdon and Shephard a few extra weeks to find several hundred sub-contractors, tap the United States for many of the 5,000 men employed on the line, and scour the United States and Canada for 2,000 teams of horses and mules. While they were responsible for the actual work of preparing the road bed, however, the entire operation was engineered and supervised by Van Horne and Shaughnessy, who, from their base in Winnipeg, created a North American and North Atlantic supply service that functioned over thousands of miles with almost split-second precision.

Winnipeg was the arsenal for the assault on the Prairies. Trains rolled along the St. Paul, Minneapolis and Manitoba and the Canadian Pacific's Pembina branch carrying steel rails from Germany and England, timber and ties from Ontario and Minnesota, cured meat from Milwaukee, axes, shovels, and scrapers from Canadian and American factories, and the 11,000 bushels of oats and 300 sacks of flour needed for man and beast each week. From Winnipeg the supply trains ran to the end of track on a regular schedule, each train carrying the material for one mile of track each trip.

Although the spring floods and gumbo, summer heat, the bitter fall and winter cold seemed to take the contractors by surprise, Prairie construction was relatively easy. A major concern was to elevate the embankment and engineer the slopes to prevent snow blockades during the winter and flooding during the spring. Few bridges posed major engineering problems. Most of the bridges were built on wooden piles or trestles, although the first crossing of the Bow was carried on an American-made steel bridge. Preparation for the bridges provided some winter work, as large stones were carried on a 'stoneboat' to the ice around the bridge piers. As the ice melted the stones sank to the bottom and riprapped the pier. Other crews were despatched to the mountains to cut timber and ties for the summer construction season.

Following the surveyors, bridge builders, and road bed gangs were the tracklayers, each gang composed of roughly 300 men and 35 teams. The procedure was primitive, but demanded an excellent organization to maintain the pace:

> The process of laying a line is accomplished with remarkable rapidity. A sufficient number of rails are laid on a hand-truck, together with pins, fish-plates, &c., but the sleepers are sent on in advance by horse-teams, and are thrown down by the side of the grade, and then placed in position. Each team takes thirty sleepers, fifteen of which go to each rail. Each one is put in place previous to the arrival of the hand-car which brings the rails along the completed portion of the line. These hand-trucks are each drawn by two horses, one on either side of the rails, at the top of the embankment. On reaching the farther end of the last two newly-laid rails, six men on either side of the truck each seize a rail between them and throw it down in exact position; a couple of others gauge these two rails, in order to see that they are correct; four men following with spikes place one at each of the four ends of the rails; four others screw in the two fish-plates; and another four follow

> with crow-bars, to raise the sleepers whilst the spikes are being hammered in. All work in order, and opposite to each other on each separate rail. After these come more men with hammers and spikes to make the rail secure; but the truck containing the rails, &c., passes on over these two newly-laid ones before this is done. All the men must keep in their places and move on ahead, otherwise they will be caught up by those behind them. 13/

Similar gangs followed or worked slightly aside or ahead of the track-layers, installing telegraph lines, section houses, and the stations for each townsite selected by the C.P.R. townsite officers. Like everything else, station-building was organized on an assembly line procedure, only it was the men who moved:

> The station buildings were erected by a series of gangs of workmen following each other. The first gang put up the framing, joisting and rafters etc., the second put on the sheeting, flooring, and roofing; and they were followed by the plasterers, joiners and painters. As each gang finished its particular class of work it moved westward, by which arrangement four or five stations were being built at the same time and each gang got through its own division of labour in time to allow the next one to come on. There were no delays or hitches in the work. The station house gangs work 125 miles behind the track layers and caught them at the end of the season. 14/

Work camps in the construction seasons of 1882 and 1883 were stretched across the Prairies from end of track to the foremost survey gang. Due to the hectic pace of construction most camps were mobile.

13/ W. Henry Barneby, Life and Labour in the Far, Far West; Being notes of a Tour in the Western States, British Columbia, Manitoba and the North-West Territory, (London 1884), 268.

14/ John Murray Gibbon, Steel of Empire; the Romantic History of the Canadian Pacific, (Toronto 1935), 240.

The typical camp was thirteen railway cars: one for the sub-contractor, seven two-storey boarding cars where eighty men slept in the upper storey and ate in the lower, and others for the blacksmith, cook, stores and carriage. If the pace slowed, the men moved into tent cities:

> The camp of each considerable outfit presented an almost military appearance. One or two large dining-tents, with the cooks' quarters and the office tent, where dwelt the sub-contractor, his bookkeeper - who also kept the men's time and ran the store of clothes, tobacco, etc. - and perhaps the foreman, were generally in the centre. All around stood orderly lines of small two-man tents, and at one side the big horse tents, and the rows of waggons. The food prepared by the cook and his 'cookees' was, though rough, generally good and plentiful. Beef and pork, beans and potatoes, bread and hot biscuits, syrup, tea and coffee, were the mainstays, heartily consumed three times a day. Early dawn brought the cry of 'Roll out, teamsters' from the 'corral boss,' and by the time the men had shaken themselves out of their blankets the horses - herded during the night by 'horse-wranglers' - had been driven in ready to be caught and given their feed of oats and water. Then breakfast, followed by the cry of 'Hook up' from the foreman, and the whole force would commence its first five-hour stretch of work. 'Unhook,' at noon, and dinner; another five hours work before supper; and then - the blankets, till the morning of a new day. 15/

The ten hour days - and more - were brutal, but the $2.00 a day for unskilled labour was better than working on the farm or in an eastern factory. A man with a team could gross $4.50 a day, although there were heavy charges for food and fodder.

15/ *Ibid.*, 238.

The speed of construction across the distant and isolated Prairies was feverish. By the end of October 1882, 629 miles of track had been located and 508 built, trains were running between Winnipeg and Regina, and 32 stations represented the embryo of 32 Prairie towns. Van Horne was determined to work even faster in 1883. The men were driven as never before. Even the surveyors were pressed by the dozens of subcontractors clearing the ground, while they were being pressed by the graders, who at times even vaulted the bridge-builders. Behind them and among them swept Van Horne's famous flying wing of 500 men moving in and out of trouble spots to prevent the incredible schedule from breaking down. The general manager himself seemed everywhere along the line those hot summers. His own energy and enthusiasm seemed catching, and the motley crew of 5,000 railway workers somehow seemed to turn the grinding chore into a daily game. Crews competed with crews, records were set and broken - at least until July 28 when an all-time record of 6.8 miles of completed track was laid. On August 18 the Canadian Pacific reached Calgary and the Prairie section was completed. It was, said one experienced observer, "unparalleled" in the history of railway building. "Sherman's march to the sea was nothing to it," proudly declared R. B. Conkey of Langdon and Shepard.[16/]

[16/] Berton, Last Spike, 108.

"200 Miles of Engineering Impossibilities"

By the fall of 1883 when Canadian Pacific tracks reached the foothills, the old historic fur-trade route from Montreal to the Rockies had been re-established in an age of new technology.[17/] In 1881 and 1882 the Company had acquired the routes between Winnipeg and Rat Portage from the government, and in 1883 took over the final construction of the line between Rat Portage and Port Arthur from the government contractors. The completion of the branch line from Sudbury to Algoma Mills on Lake Superior and the acquisition of the Ontario and Quebec in 1884 with the Toronto, Grey and Bruce connection to Owen Sound gave the railway a through rail and water route to the west. By the summer of 1884 the Company had a fleet at work on the Great Lakes. By the end of 1882 the old Canada Central, purchased in 1881 from Duncan McIntyre, vice-president of the C.P.R., had reached Lake Nipissing, and by the end of 1883 had pushed 100 miles west to Sudbury. All that remained was the 650 miles around Lake Superior from the end of steel at Sudbury to Thunder Bay, but part of it, said Van Horne, was "two hundred miles of engineering impossibilities."

While some preliminary work had been done since the decision to

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[17/] "Express Service from Prince Arthur's Landing [now Thunder Bay] commenced May 14, 1883 via the steamer 'Campana', connecting with Vickers Express which operated on the Toronto, Grey and Bruce Railway - this being the first all-Canadian Express service between Eastern and Western Canada." Canadian Pacific Facts and Figures, General Publicity Department, Canadian Pacific Foundation Library, 1937.

build north of Superior was made in 1881, real construction only began in the spring of 1883. Van Horne had decided that the line would hug the north shore of Lake Superior, enabling relatively easy supply to the hundreds of sub-contractors picking away at the solid wall of rock. The rock cutting was an enormous undertaking, even though Van Horne had decided to build high and use trestles and bridges to cut blasting costs and cross over muskeg. Between them, however, rock and muskeg kept an army of from 12,000 to 15,000 men busy for two years, working year-round to make the all-Canadian route possible. The work was so difficult that sub-contractors often would limit themselves to a mile or less. Three factories produced three tons of dynamite a day. Van Horne brought in steam shovels from the United States and assembled them at the site.

But the rock and the fills, the sub-zero winters and the summer insects, the squalor and loneliness of the isolated construction camps where men lived for months in log-huts, disease-laden bunk-houses, or holes in the ground were all less soul-destroying and intimidating than the muskeg. At times the track was diverted several miles to by-pass the treacherous muskeg; at times thousands of cubic yards of fill seemed to have found bottom and settled only to have disappeared the next morning; at times the crews covered it with a mattress of crossed-timber which floated on the surface and hoped that it would hold track until the seemingly endless task of filling it could stabilize the track bed.

It was not easy to persuade men to work north of Superior for a dollar to a dollar-and-a-half for a ten-hour day - in either summer or winter. But John Ross, one of the few Canadians to hold an important operational or construction position on the C.P.R., did recruit his army: some from Ontario and the Maritimes, some French Canadians in northern Quebec; many from among the Italians and other Europeans who were moving into the northern United States, or the few who stepped off the boats in eastern Canada. It was a motley crew, but the job was unlikely to attract the genteel. Life in even the best bunkhouses, where eighty men slept on double-deck bunks with hay-stuffed mattresses, and had an unbroken diet of salt-port, corned beef, molasses, beans, potatoes, and tea, was not an appealing occupation, even in those frontier days. Medical facilities were minimal, and scurvey broke out among the Italians, as it did among the Chinese in Andrew Onderdonk's mountain camps. Alcohol provided the inevitable relief, and both peddlars and purchasers defied the attempts of the police to patrol the camps. Over fifty whiskey pedlars were stretched out along the line from Callander to Spanish River; police and railway officials were easily bribed; and in Michipoten the former chief of police ran the gang that monopolized the local whiskey traffic.

By March 1885 the line was almost complete. The only major gaps lay between Dog Lake and Desolation Camp, the former close to where White River now stands. Track was not laid around Heron and Jackfish Bay and between Nipigon and Red Rock. And along the line from Biscotasing it sometimes ran in a temporary bed along crests of land while the cutting proceeded below, or floated on an uncertain raft over the muskeg. But by then the Canadian Pacific was again financially on the ropes. Men had not been paid, and supplies were difficult to obtain from skeptical creditors. It looked for the moment as if the Rockies and the Shield had defeated the best that Van Horne and George Stephen could muster.

But in the west, far north of the railway, Louis Riel had decided to challenge Canadian sovereignty in the Northwest Territories. When Van Horne worked his miracle and transported the Canadian army along the still unfinished line to bring down Riel at Batoche in the spring and summer of 1885, the Macdonald government again found the political force to come to the rescue and enable the C.P.R. to finish the line that took Donald Smith to Craigellachie that November. Said one who travelled north of Superior a few years later: "What has been done in that part of the line proves that nothing is impassable or impossible in engineering and construction."[18/]

Western approaches

Meanwhile the western mountains were yielding to the combined assault from west and east. Within a year of returning to office in September 1878, the Macdonald government had called for tenders on a line from the end of navigation on the Fraser to the present site of Kamloops. Almost a dozen contractors bid on the four sections, and

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[18/] Berton, Last Spike, 272.

in November contracts were awarded to three different concerns. None of them went to the American engineer, Andrew Onderdonk, whose bids were far from the lowest. By the middle of January 1880, however, Onderdonk had all four contracts in his pocket, Sir Charles Tupper, Minister of Railways, apparently much more willing than some disaffected Canadian contractors, to see Onderdonk buy out the successful bidders.

The thirty-seven year old Onderdonk was no fly-by-night political contractor, but an eminently successful civil engineer. Despite his youth he had already gained a reputation as a tough and experienced contractor, more than able to handle difficult field work and labour problems despite his genteel manner and polished appearance. Behind him was a syndicate headed by Darius Mills, a wealthy San Francisco banker, H. B. Laidlaw, Mills' New York representative, S. G. Reed, an Oregon railwayman, and M. P. Morton, of Morton, Bliss and Co., the New York branch of Morton, Rose of England, which was part of the Canadian Pacific syndicate. The government must have felt more secure in assigning contracts that in the end approached $15,000,000 to such a syndicate than to the inexperienced and financially shaky Canadian consortiums that hung around the Russell Hotel in Ottawa.

The section that Onderdonk ultimately was to build ran from Port Moody at the head of Burrard Inlet to Savona's Ferry on Lake Kamloops. Except for the lower Fraser, none of the line was easy to construct, but by far the most difficult was the section north from Yale to Lytton through the treacherous Fraser Canyon, particularly the 29 miles to Boston Bar. The Royal engineers and contractors on the Cariboo Road in the 1860s had blasted a road out of the cliff from Yale to Boston Bar for about $250,000. But a road hanging over the cliff, propped up with rough timbers and prayers, would not support the mechanized mule trains of the Canadian Pacific. Government estimates of the cost of railway construction through the Canyon were hardly generous: clearing and grubbing were scheduled at $30 and $80 an acre; solid rock excavation was estimated at $1.50 a yard or $750,000 in total; the 6,000 feet of tunnelling was to be done for $630,000, or $105 a foot; and tracklaying was entered in the schedule at $300 a mile, about the same as in the contract for a colonization road west from Winnipeg. Despite these seemingly modest estimates some tenders had been substantially lower than the government's maximum of $2.7 million.[19/]

Onderdonk arrived in Yale, his construction headquarters at the foot of the canyon, in April 1880. The first track was laid the next summer, but by the summer of 1882 only twenty-eight miles of track was down. By then much of the preliminary work had been done, however, and the transportation system and organization perfected, necessary sawmills and a dynamite factory built, and a labour force assured.[20/]

Labour was the one essential, and during the railway building

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[19/] Sessional Papers, No. 19, 1880, 27, 31-32.

[20/] The best source on the construction of the Canadian Pacific in British Columbia is Arthur Johnson, The C.P.R. and British Columbia 1871-1886, (M.A. thesis; University of British Columbia, 1936).

boom of the 1880s it was even more difficult to secure than it was to get rails from a hard-pressed British, German and American steel industry. During the peak period in 1882 and 1883 Onderdonk had about 6,000 Chinese and 3,000 whites working on the line. While he advertised as far afield as London, the bulk of the white labour - described unkindly but perhaps appropriately by the chief timekeeper as "any kind of human being who could handle a pick and shovel" - appears to have come from the United States, particularly from California.[21/] The skilled labour force was largely American, and if they were "some of the toughest characters on the coast, not a few of them being men who had done time at San Quentin," they often were surveyors, blasters, and machinists who had experience on American railroads. Canadians, Englishmen, Scandinavians, and Italians did work on the line, but they were less noticeable than on the Prairie and eastern sections, perhaps because the only route to end of track was from the Pacific.

The unskilled labour was largely Chinese, a sample in 1884 revealing that 85 per cent of the 3,500 Chinese were classed as unskilled, with the remainder serving as barbers, butchers, cooks and store employees, or independent merchants in the camps. Unskilled whites earned about $1.75 to $2.00 a day, while the Chinese were paid between $1.00 and $1.25. Assuming the same rate of efficiency the use of Chinese labour probably saved the contractor anywhere from

[21/] Cited in Gibbon, Steel of Empire, 267.

$3 million to $5 million (or 20 to 30 per cent of the contract), and provided a more stable labour supply.[22/] The first gangs of Chinese navvies came from the United States, where they had been used in railway building since the 1860s. But when that supply ran out Onderdonk fell back on direct recruitment in China. In 1882 he imported about 6,000 Chinese from China, even chartering two boats to bring the first thousand over. "We are now fully in the grip," wrote the Globe correspondent on June 1, 1882, "of Americans and Chinamen."[23/]

Although Emory's Bar was the head of navigation on the Fraser, where ships disgorged mountains of nails and fasteners, tools, provisions and labour, Onderdonk established his headquarters a few

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[22/] The assumption about equal efficiency is reasonably safe. Contemporary reports suggest the Chinese were far steadier, less physical than the Irish or Scandinavians who were often cited as the best at back-breaking work. While the Chinese suffered more from the cold, since they lacked a meat diet, they seemed to endure the heat and the insects better. There was also less down time from hangovers and AWOL. The countless tales of wild times in Yale never include the Chinese. And when Onderdonk dismissed his gangs in September 1885 a contemporary in Yale observed that "in two hours the streets were full of lunatics; they roared and raved and attempted to force their way into private houses. Twelve hundred Chinese arrived by the same train and went into the woods and cooked their rice. It is amusing to see the difference between Pagans and Christians." There was undoubtedly less turnover among the Chinese. One indication of turnover is provided by the numbers entering Victoria between 1881 and 1884: 27,256 whites, 10,387 Chinese from China, and 5,314 Chinese from Pacific ports. Not all of course worked on the railway, but a substantial number undoubtedly did.

[23/] Cited in Berton, Last Spike, 199. The Globe had continually charged the Canadian Pacific with being taken over by the Americans as builders and operators.

miles upriver at Yale, which soon attracted a suitable complement of land speculators, merchants, saloon keepers, gamblers and prostitutes, some of whom found it more profitable to follow the men as construction moved up the valley. At Yale Onderdonk built machine shops, which serviced the locomotives built in San Jose and by 1883 assembled one railway car a day, an engine house with a turn table, and a dynamite factory where sixteen men manufactured 1,200 pounds of explosives a day from Japanese brimstone and Chilean nitrate of soda. Tools and provisions for the advance parties were carried along the old Cariboo road, which often tumbled into the Fraser as his blasting crews attacked the canyon, or on the Skuzzy, a river boat specially built to carry supplies from Boston Bar to Lytton.

For the better part of three years Onderdonk's crews assaulted the Fraser Canyon. To blast the line from the mountain, surveyors and dynamite crews worked from rope ladders on the face of the canyon, and the blasts brought masses of debris and sides of the mountain crashing into the gorge. Other dynamite crews tackled the mountain from within, using steam and air drills and tons of dynamite to blast thirteen tunnels in the first twenty miles out of Yale. "There was a very heavy loss of life," recorded Engineer Cambie, "more especially upon the construction work through the canyons of the Fraser, where all work was in rock and where there was difficulty in getting good cover when shots were fired."[24/] His testimony was

[24/] Noel Robinson and Walter Moberly, Blazing the Trail Through the Rockies, (Vancouver 1915), 110.

born out by the Yale Inland Sentinel, which almost weekly recorded a death on the line. The death of Chinese workers, who were hastily buried by their colleagues, went unnoticed in the paper, but the accident rate of whites caused the paper to show due concern for the state of the local cemetery which, it argued, should not be neglected simply because it had been "rapidly filled up with victims and strangers from the railway works...."[25/]

Work on the 600 bridges and trestles on the Onderdonk spread also took its share of life and limb. Most bridges were built of wood cut to order at the Yale sawmill, or at two others built beyond the canyon. When these mills could not meet the demand, Onderdonk gave orders to sawmills on Burrard Inlet, despite the higher costs. The most impressive bridge, however, was not of wood. Designed by C. C. Schneider of New York and its structural iron built in Newcastle England, the bridge at Cisco was the first cantilever bridge of its kind in North America. The iron arrived via Cape Horn in December 1883 and reached the site in February 1884. When completed the 6,000 tons of iron rested majestically on solid masonry foundations ninety-six feet high.

By the time the bridge was in place, track was almost complete from Port Moody to Lytton and grading was underway on most of the line to Lake Kamloops. By January 1885 the Onderdonk spread was complete. The Rockies were no terror for the crews that had battled the canyon and Onderdonk accepted a new contract to build westward

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[25/] Cited in Berton, Last Spike, 193.

for the Canadian Pacific until, in September 1885, he ran out of rails at Eagles Pass.

But while the government may have been happy to see the western section completed, the Canadian Pacific was less than happy with its inheritance. Given the constraints of time and money the government clearly had allowed Onderdonk to bend if not break the specifications: grades were greater than permitted; curves could not be managed at reasonable speeds; treacherous reverse curves littered the line and there were few sections of straight track; cuts threatened to become canals and rock and snow slides wiped out sections of the line with alarming frequency; and trestles, wrote Van Horne, were "the worst I ever saw on a railway. In an attempt to strengthen them they have been patched and spliced in a most wonderful manner...." Government inspectors cast blind eyes at the line's shortcomings; they were, after all, the C.P.R.'s problem. While George Stephen angrily declared that the Company was "forced and cheated into accepting a temporary road, utterly unfit to be operated as a through trunk line," Van Horne admitted that he would not have built a railway through the canyon, in his words "one of the worst places in the world." The Company was to spend millions turning the "temporary" road into a trunk line, but Andrew Onderdonk had built it the beginnings of a railway to the Pacific.[26/]

[26/] Ibid., 307-09. After lengthy litigation the C.P.R. secured $579,225 compensation for a line so defective that estimates for its satisfactory completion as a through line ran as high as $10 million. See Gilbert, Awakening Continent, 189-90, 244-50.

To Craigellachie

As Onderdonk tidied up the last of the canyon run the summer of 1883, James Ross started out from the end of steel in Calgary towards the Rocky Mountains. Ross was a Scottish engineer who had started railroading in the United States in 1870 and had come to Canada later in the decade. In 1883 he had been placed in charge of the Canadian Pacific's construction of the Rocky Mountain section. A year earlier Ross might have wondered about the wisdom of hurling construction crews at the purple grey peaks that obstructed the horizon, for while the country had spent millions surveying and debating the route to the Pacific, it was not until July 1882, long after the decision of the Railway to head straight west from Winnipeg to the coast, that Major Rogers had found the pass through the Selkirks that bears his name. Earlier Rogers had supported the feasibility of the Kicking Horse - and by the end of the 1883 construction season Ross had at least demonstrated its feasibility. "Our track will....reach the summit of the Rocky Mountains," he wrote to Van Horne in November 1883 "besides, we have some work done on the Western slope down the Kicking Horse Pass. At present there are about 750 men employed in the Rocky Mountains, but it is our intention to reduce this force somewhat and confine our operations this winter to making ties and timber...."[27] At one time, apparently

[27] Sessional Papers, No. 31, 1884, 41.

uncertain about the recommendation of Major Rogers, Ross reassured Van Horne that he had studied the proposed route, as well as such alternatives as the more northern route through Howse Pass, "and am satisfied that we have the most direct practicable line for the Canadian Pacific Railway...." The "heaviest portion of our next season's work will be in the Kicking Horse Valley," he observed, "but it is so placed that we can distribute a large force upon it. The longest tunnel is 1,400 feet, and we can, if necessary, build a temporary line around the heaviest work."[28/]

To finish the line on schedule, James Ross had demanded 12,000 men, and long before the snow had run off the valley they were pouring in. Many of the 6,000 who showed up had been attracted by ads placed in Duluth newspapers. The completion of the Northern Pacific in 1884 provided a ready pool of assorted American Railway workers. Once again the Liberals could comment sarcastically that no Canadians need apply. It seems that few did. Eastern farmboys had little taste for the back-breaking, life-defying work of railway construction. But the Scandinavians and Finns seemed to relish it, and Italians formed the bulk of many a gang. Strangely enough, perhaps because of government sensitivity on the "alien" question or the lack of communication over the mountains, Onderdonk's coolies were absent in the Rocky section. Sub-contracting parts of the line were men later to join the ranks of Canada's industrial-financial elite: Herbert Holt, William Mackenzie, Donald Mann, and Jack

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[28/] Ibid.

Stewart. The work completed during that hectic summer, with the mountain air lit by thousands of camp and slash fires, was summarized by Collingwood Schreiber, the C.P.R.'s engineer in chief, on October 1, 1884:

> During last month (September) I made a tour of inspection throughout this section. Both the Kicking Horse and the Selkirk Passes impressed me as being most wonderful openings in the two great mountain ranges.... In surveying this immense wilderness, broken up, as it is, with mountain masses, I fully appreciated the difficulties encountered by Major Rogers, who must have spent many a hard day in his search for a passage for the railway; and I felt that success could never have been achieved but for his skill, pluck and determination to find a way through the Selkirks, if a way were to be found. Through the "Rockies" the work is not, on the whole, of such a character as the name would indicate, and I was much surprised to find long stretches of grading composed of gravel and loose rock, the solid rock work being generally limited to the canyons and to the shores of the lakes along which the line passes. There are a considerable number of tunnels between the summit of the Kicking Horse Pass and Savona's Ferry, the aggregate length of which may be summed up at 7,600 feet. Those to the east of the Beaver River, at the east foot of the Selkirk, are completed or nearly so, and work will be continued during the winter on the rest, so as to have them finished by next spring. The bridging, except at the crossing of the Saskatchewan River and the west crossing of the Columbia River, is light. Over both these streams structures of some magnitude are required. That over the former is completed, consisting of a very substantial iron superstructure, resting on abutments and piers of massive masonry. 29/

Schreiber's somewhat restrained words hardly describe the drama

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29/ Ibid., No. 25, 1885, 35.

that was unfolding in Kicking Horse Pass in the summers of 1884 and 1885. Scattered along the length of the line were the construction towns for the 12,000 men: shacks, tents, log huts, railroad cars on sidings - any structure that could keep out the rain, the cold, the fleas and mosquitoes. Every construction camp became a town, for the track moved so slowly that even the motley collection of shacks and huts took on an air of permanence. And despite the watchful eye of the Mounted Police, the camps were invaded or surrounded by the railway camp followers - the saloon proprietors, whiskey peddlars, and whores.

The hazards of life in camp were not only moral, but life was still safer than on the line, as the tunnel blasters and cliff cutters filled the air with flying debris. Rock and snow slides were terrifying, sending the greenhorn back down the line to the end of steel and home. Whole sides of the Selkirk mountains, white in winter and grey in the summer, slid into the valleys, taking trees, track, sheds, and camps with them. The C.P.R. might build the line, mumbled the workmen, but only a fool would hazard a trip through Kicking Horse and Rogers Passes with a mountain dangling over the line, forty glaciers waiting menacingly, and fifty feet of snow defying any of man's machines.

But finally the cutting, the tunnelling, the trestle and bridge building was done - or almost done. On October 10, 1885, Schreiber dutifully made his annual report:

> The action of the snow during last winter was carefully watched by the Government Inspecting

Engineer, as well as by the company's staff; and from the information obtained it was apparent that it would be necessary to locate the line so as to escape, so far as possible, the snow slides descending from the northern range of mountains.... Mr. James Ross, an able engineer and manager of the company's works of construction, set vigorously to work to solve the problem; and, by a clever piece of engineering, succeeded in gaining the necessary distance by taking advantage of the general contour of the country to form as it were, a double loop; thus touching the bottom lands clear of the most formidable snow slides, and without increasing the severity of the grades; and although this resulted in an increase of 3 miles to the length of the section, the general alignment, outside the loop was much improved. The sub-section from the Red River (opposite Winnipeg) to Donald Station at the foot of the east slope of the Selkirks, 1,022 miles in length, is under traffic. The latter point is 2,446 miles from Montreal.... From Donald Station to within 10 miles of the second crossing of the Columbia, a distance of 73 miles, the track is laid. From this latter point, for a distance of 36 miles, the grading and bridging are so far advanced as to ensure the laying of the track by the end of the current month. Thence to Savona's Ferry, a distance of 124 miles, the track is laid. Savona's Ferry is 2,680 miles from Montreal. Although the track is laid throughout with the exception of the 36 miles, just referred to, there remains considerable amount of work to be done before the road is completed. The permanent line alongside the 9 miles of temporary track near Mount Stephen has not yet been commenced, and between Donald and Savona's Ferry a good deal of finishing up will still be required. A tunnel in the Ille-cille-wait Pass is not quite finished, a number of truss bridges have yet to be built over rivers now crossed by temporary trestles. The station buildings, water service, &c., have yet to be provided; cuttings and embankments to be trimmed up and completed, besides a considerable amount of ballasting still to be done. It will, however, not take very long to get the road into fit condition for traffic, but I do not think it is the company's intention to operate it through

> the mountains this season; in fact I should not consider it wise to attempt to do so until the road is thoroughly completed, which will scarcely be before spring. 30/

On November 6 a small construction train with three flat cars left what was to become Revelstoke for Eagles Pass (near Sicamous) where Walter Moberly had found a route through the Monashee Mountains years before and two nesting eagles had provided the name. The next morning the track laying crew was at work, and by early morning the last rails were on the ties. Shivering in the cold wet air, the official party assembled at the spot to be called Craigellachie, where Donald Smith, the oldest of the C.P.R. directors, posed for the most famous photograph in the Canadian album. The last spike had been pounded, probably as firmly as many. But millions more were to be spent in the Rockies between Banff and Revelstoke before the C.P.R. really had bested the Rockies. A snow slide which killed 58 people in 1910 finally convinced the railway that Rogers Pass was too much for man. Unlike Jack Stewart, whose firm once again battled the mountains, the Duke of Connaught had little to do with the five-mile tunnel that cut through Mount Macdonald - but since he was the Governor-General, the longest double-track tunnel in North America was given his name.

30/ Ibid., No. 35, 1886, 11.

THE CANADIAN PACIFIC AND ECONOMIC DEVELOPMENT

"The Canadian Pacific Railway, as a vital part of the technological equipment of western civilization, has increased to a very marked extent the productive capacity of that civilization," wrote Harold Innis in the final paragraph of his history of the Canadian Pacific. "It is hypothetical to ask whether under other conditions production would have been increased or whether such production would have contributed more to the welfare of humanity."[1/] Yet such hypothetical questions are in part the stuff of which economic history and theory are made, and whatever their own deficiencies, the work of such American historians or cliometricians as Robert Fogel and Albert Fishlow reveal the limitations of Innis' account of the impact of the Canadian Pacific in the years after 1885.[2/] While that impact cannot be measured until a legion of economic historians and geographers

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[1/] Innis, Canadian Pacific Railway, 294.

[2/] Robert W. Fogel, The Union Pacific Railroad; A Case in Premature Enterprise, (Baltimore 1960) and Railways and American Economic Growth: Essays in Econometric History, (Baltimore 1964). Albert Fishlow, American Railroads and the Transformation of the Ante-Bellum Economy, (Cambridge 1965). Their conclusions are by no means accepted, however. Peter D. McClelland concluded that in "both works can be found a wealth of information concerning railroads and the multitude of strands that run between this single innovation and the fabric of American development. Their central question, however, - the net benefit to the economy from the existence of the railroads in 1859 or 1890 - remains essentially as they found it: - an unsolved mystery." "Railroads, American Growth and the New Economic History: A Critique," Journal of Economic History, XXVIII, No. 1 (March 1968), 102-123.

have accumulated and analyzed the data, some observations may be permissable about the economic impact of the construction of the Canadian Pacific.[3/]

Capital

The Canadian Pacific was the largest single source of capital investment in Canada before the turn of the twentieth century. Between 1870 and 1886, the capital cost of road and equipment was approximately $140 million, or $164 million if the capital cost of the leased lines is included.[4/] Of this sum, more than $15 million was spent by the federal government between 1871 and 1880. Between 1881 and 1886, the government spent another $17.5 million and the Railway an estimated $106.5 million, for a total capital investment on construction and equipment of approximately $124 million in six years. To this should be added at least another $75 million between

[3/] There is in much Canadian writing an assumed "axiom of indispensability," as Fogel puts it. In his review of Innis, for example, O. D. Skelton stated categorically that there "has been no factor in the economic development of Canada in the past fifty years so significant as the Canadian Pacific Railway. Canadian Historical Review, IV, No. 2 (June 1923), 180. The critical literature in Canada has just begun with Peter J. George, "Rates of return in railway investment and implications for government subsidization of the Canadian Pacific Railway: some preliminary results." Canadian Journal of Economics, I, No. 4 (November 1968), 740-762. See also his introduction to Innis, Canadian Pacific Railway.

[4/] George, "Rates of Return", 747.

1880 and 1886 for construction of other lines.[5] Canada was completely unable to provide the capital to finance such enormous railway construction.

When Macdonald and his minister of railways, Sir Charles Tupper, anxiously searched for capital for the road to the Pacific, Lord Lorne, the governor general, warned them of the dangers of too close a connection with a firm like Brassey of London. "I cannot help feeling somewhat nervous as to the possibilities involved in any unqualified tying of the country to a company which might be far stronger than the Hudson's Bay and as strong as the old East India Company," he admitted to Macdonald, but "if the money were got in New York, as I believe it might be, the Yankees could get such important interests to guard that it could well be justification of the United States to take charge of the whole of our railway and 'fertile belt', in case of difficulty."[6] While the final arrangement with the Canadian Pacific syndicate held out the dangers of the country being closely tied to a "gigantic vested interest" such as Lorne feared, the initial threat was not one of foreign control. Canadians held 50 per cent of the original $5 million stock issue;

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[5] The estimated capital cost of the leased lines was $24.5 million, much of which had been constructed in the 1879-85 period. There were also another 1000 miles built in Canada between 1881 and 1886 by other companies. Historical Statistics (I) indicates an increase in nominal capital from $318 million in 1875 to $362 million in 1879 and $653 million in 1886. A reasonable conclusion is that well over $200 million was invested in Canadian railways between 1880 and 1886.

[6] Public Archives of Canada, Macdonald Papers, Lorne to Macdonald, June 26, 1880.

J. S. Kennedy, a New York financier, held 10 per cent; Morton Rose and Company of London and other English interests about 15 per cent; and European financial houses, among them Kohn Reinach and Company of Paris and Frankfort and the Sociètè Gènerale of Paris, subscribed the remaining 15 per cent.[7/]

At the outset George Stephen, the syndicate's president, was optimistic about financing. The Company's portion of the road, he believed, could be built for \$45 million. With \$5 million subscribed and the \$25 million in cash from the government, he boasted that "we can provide the remaining \$15,000,000 from our own resources if we deem it necessary, or expedient, to do so."[8/]

Over the next five years the Canadian Pacific had to raise five times as much as Stephen expected, and the cliff-hanging drama of the annual and sometimes monthly financial crises of the railway when the company successfully devised one stratagem after another to bring a reluctant government and country to its aid is a frequently told tale. By 1886, with the main line complete, however, the company had raised between \$30 million and \$35 million through the sale of stock with a par value of \$65 million. An issue of \$35

[7/] The Canadian group was composed of George Stephen of the Bank of Montreal, Donald Smith, R. B. Angus, also of the Bank, and Duncan McIntyre, who held a controlling interest in the Canada Central then being built from Ottawa to Callander on Lake Nipissing, and James Hill. All but McIntyre were associated in the highly profitable St. Paul, Minneapolis and Manitoba railway. One of the principal British investors was Henry Northcote, Stephen's son-in-law.

[8/] Gilbert, Awakening Continent, 81.

million in government guaranteed bonds in 1885 enabled the company to pay off heavy government loans and complete the line. Government cash subsidies amounting to $30 million and the sale of land completed the essential financing for the initial construction and acquisition period.[9/]

Very little of the capital came from Canada. By the end of 1883 the last of the stock had been sold, and of the 550,000 shares 50 per cent was held by Americans, 30 per cent was held in Britain and Europe, and 20 per cent in Canada. But that 20 per cent was firmly in the hands of Stephen, Smith and their associates, and much of the stock in the United States and Britain was in the hands of men who had no desire to challenge Canadian control of the Company. From the outset Stephen had sought to avoid incurring heavy indebtedness through the issue of bonds, and had boasted that he would build the railway without "a dollar of money from London."[10/] But as many had predicted, London capital became essential and, much to Stephen's

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[9/] Following the initial subscription of $5 million, the shareholders authorized a distribution of $10 million par value stocks at 25 cents on the dollar. In 1882-83 the C.P.R. syndicate made a desperate deal with a group of American financial houses who took $30 million par value at 52½. The sale of more stock was made virtually impossible by a market crash in railway stock. Land sales totalled $7 million by 1883 and $18 million by 1887. On the finances see the annual reports of the Department of Railways; Gilbert, Awakening Continent; Berton, Last Spike; Innis, Canadian Pacific Railway; and J. Lorne McDougall, A Brief History.

[10/] Sir A. T. Galt, concerned that Americans would secure control of the Canadian Pacific, wrote Macdonald from London that "One thing I am sure of, and that is that the Canadian Pacific will never be finished without coming to London for money, and that it is bumptious folly for Stephen to neglect - as he has done - every means of conciliating this market." Cited in Gilbert, Awakening Continent, 118.

surprise, Baring Brothers took the entire $35 million issue, apparently finding that government-backed bonds carrying 2 to 3 per cent higher returns than British consols were attractive to British bondholders. While American capital had been crucial between 1881 and 1883, it was British capital that financed government and Company. Penelope Hartland has estimated that Canadian borrowing for railroads between 1880 and 1886 was $127 million, almost totally British, while Matthew Simon has concluded that British money calls for Canadian railroad securities (private, mixed and government) from 1878 to 1889 was £37.6 million.[11/]

By 1886, with an investment of perhaps $5 million of the total value of the road, the Canadian members of the syndicate were in control of a property with a book value of $175 million.[12/]

Labour

If Canadians had not financed the Canadian Pacific, neither had they built it. From Van Horne down the senior management was very heavily American, and John Ross, north of Superior, was the only Canadian in charge of a major construction operation. There were

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[11/] Penelope Hartland, Trends in the American Economy in the Nineteenth Century, Studies in Income and Wealth, Vol. 24, Conference on Research in Income and Wealth, (National Bureau of Economic Research 1960), 735; Matthew Simon, "New British Investment in Canada, 1865-1914," Canadian Journal of Economics, III No. 2 (May 1970), 241.

[12/] After 1886 common and preferred stock totalling 340 million by 1920 was sold, largely through London financial houses. By 1921 resident ownership was 48 per cent United Kingdom, 24 per cent United States, and 18 per cent Canada. Innis, Canadian Pacific Railway, 276.

Canadians with large sub-contracts - such as Holt, Mackenzie, Mann and Stewart - but even in engineering, surveying, and sub-contracting Americans were prominent and essential. It was less that Americans such as Onderdonk preferred to bring their engineers with them, - as Onderdonk did - but that the skilled manpower was not available in Canada. Nor was it available in the United States, and the shortage of skilled labour was a constant lament of those in charge of construction operations. As late as the spring of 1884, for example, Onderdonk was still complaining that he could not find in Canada or the United States good practical railway men, bosses, and sub-contractors.[13/]

An even greater problem, however, was the acute shortage of semi-skilled and unskilled labour. As early as 1881, before the peak construction period had been reached, Sir Charles Tupper, the Minister of Railways, told the Toronto Mail that "the question of labour has been a very serious one, both in British Columbia and on the works between Thunder Bay and Red River."[14/] In their search for men the company and the contractors advertised in American newspapers, and contractors' agents also recruited in the United States, where immigrant labour was more plentiful.[15/]

The difficulties of securing adequate supplies of labour, even

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[13/] An excellent account of construction in British Columbia is Arthur Johnson, The C.P.R. and British Columbia 1871-1886.

[14/] Ibid., 131.

[15/] See for example Evidence taken before the Royal Commission on the subject of Labour in its relation to capital in Canada, Vol. V, 1887, 252-53.

during a period of massive emigration, were understandable. An expanding industrial and agricultural economy in North America competed vigorously for the available manpower, and railroad construction in Canada offered neither comfort or wealth. Not even the construction camps on the prairies secured clean bills of health, while those north of Superior and in the mountains could seldom have passed a thorough medical examination. While wages for unskilled labour ranged from $1.25, when labour was plentiful, to $2.00 a day, room and board in the construction camps was from $4.00 to $5.00 a day. Commission investigators on labour problems during the construction of the Crow's Nest Pass line in 1898 reported unequivocally that while a labourer earning $1.50 a day would make $387 in a year, his costs for transportation from eastern Canada, room and board, clothes, and medical and mail fees would total $381.90, leaving him a profit of $5.10. If the work month averaged 26 days, instead of 21, and the wage was $1.75 a day, the labourer would end a year on the track with $115.50.[16]

The most difficult labour problem was faced by Onderdonk, who had little access to seasonal labour and whose operations were far from heavily settled areas in the United States or Canada. When work began in May 1880 Onderdonk employed 500 men, and by September over 1,600. In 1881 he needed 4,000 men, however, and acute labour shortages forced a slowdown. By 1881 he had begun to employ Chinese

[16] Return to the House of Commons of the Report of the Commissioners appointed to inquire into complaints respecting the treatment of labourers on the Crow's Nest Pass Railway. Sessional Papers, No. 90A, 1898, 17.

coolies who had come to British Columbia between 1876 and 1880, both from China and from San Francisco after the completion of the Central Pacific and the Southern Pacific Railway. In March he spent considerable time in San Francisco recruiting skilled and unskilled labour. Although the work force that poured into Yale that spring included many whites from the United States and some axemen from Quebec, many of the 6,000 men at work were Chinese. By 1882 Onderdonk had four ships under charter to carry 5,000 Chinese directly to British Columbia.[17/] The influx stirred opposition both in British Columbia and in eastern Canada. Onderdonk informed an anxious Macdonald that unless he could import Chinese labour the Canadian Pacific would not be finished for twelve years, and the Prime Minister in turn warned the Liberal critics in the Commons that "either you have this labour or you cannot have a railway" - a strange warning to a party that were lukewarm about the railway and constantly critical about the use of immigrant labour on it.[18/] To appease the critics of Asiatic immigration, the government appointed a Royal Commission in 1884. As might have been expected the Commissioners emphasized the importance of Chinese labour in the construction of the railway: "It admits of no question that without their labour, the construction and completion of the Canadian Pacific Railway would have been indefinitely postponed."[19/] The same

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17/ Johnson, C.P.R. and British Columbia, 133.

18/ Donald Avery, "Canadian Immigration Policy and the 'foreign navvy,'" (Unpublished Paper, University of Western Ontario), 12.

19/ Report of the Royal Commission on Chinese Immigration. Sessional Papers No. 54A, 1885, xiv.

could be said of other immigrants, whether recruited in Canada or the United States, and of the American skilled manpower that to a large extent directed construction.

Manufacturing

The Canadian Pacific and other lines built during the 1880s represented an enormous investment not only of money capital, but in capital goods as well. The railways demanded rails, fishplates and fasteners, nuts and bolts, locomotives and rolling stock, and tens of thousands of picks and shovels, scrapers and ploughs. The industrial capacity of the country was inadequate to supply the needs of railway construction, or the short-term impact at least on industrial development would have been greater. The earlier railway boom had stimulated the iron and steel and transportation equipment industry, but many of the firms established in the '50s and '60s seem to have disappeared after the boom collapsed or when the use of steel for rails and other components became common in the early '70s.

The National Policy tariff of 1879 paid particular attention to the iron and steel and transportation equipment industries. The tariff schedules were: fishplate 17½, car wheels 25, agricultural implements 25, nuts and bolts and nails 30, locomotives 25 (raised to 30 in 1883 and 35 in 1894). The shrewed C.P.R., extracting every advantage from the government, insisted that "all steel rails, fishplates and other fastenings, spikes, bolts and nuts, wire, timber and all materials for bridges to be used in the original construction of the railway," as well as all telegraphic wires and apparatus, would be admitted free of duty.[20/]

The timing of the introduction of the new tariff and the renewal of heavy railway construction make it difficult to determine the impact of railway construction on manufacturing, or conversely the effect of the tariff.[21/] Nevertheless, despite the necessity to import all the rails (as Canada had no capacity for making steel rails) and most of the heavy equipment used, the Canadian Pacific's exemptions, and the necessary supplying of the trans-mountain section from the Pacific, railway construction in the 1880s still must have had significant effects on the development of Canadian

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[20/] An Act respecting the Canadian Pacific Railway, 44 Victoria. 1881, Schedule, section 10.

[21/] Only an analysis at the level of the firm, if that, would determine what part the tariff and what part increased demand as a result of railroad construction played in the growth of the manufacturing sector. W. J. A. Donald, while skeptical of the value of protection, concluded that it helped develop the finishing side of the iron and steel industry, but had no effect on the primary industry. The Canadian Iron and Steel Industry, (Boston 1915), 107 ff. Lower and Innis conclude that "as a result of these heavy demands," that is for railway construction, "it is difficult to determine the effects of the tariff on the growth of the industry." H. A. Innis, and A. R. M. Lower, Select Documents in Canadian Economic History 1783-1885, (Toronto 1933), 600.

manufacturing.[22/] A peak labour force of more than 30,000 men using hand tools and agricultural-type equipment, protected by both the tariff and nature, unquestionably fattened the order books of eastern Canadian plants. Even more important, perhaps, was the increase in equipment and machinery for its repair and maintenance. By 1882 the Canadian Pacific operated 118 engines and 2,500 rolling stock; by 1886 the corresponding numbers were 372 and 9,000, and by

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[22/] With reference to American railroad construction, Leland H. Jenks wrote: "The demand for capital functioned in parallel to the demand for labor. I am speaking of real capital, of goods, of the picks and shovels, sleepers and steel rails, engines and rolling stock and bridgework and culverts and ordinary building material, which make up the physical plant of a railroad. The construction moment of railway history brought an initial demand for these durable goods. Hence there was a chance for the innovator in the lumbering industry, in quarries, in iron mills and carriage works. Indeed these industries were hard put to keep pace with railway construction. Until the later eighties, every boom period found American factories unable to meet the demand for rails, and there were heavy importations from England and Wales. As late as the nineties, over one fifth of the total output of pig iron in the United States was being rolled into railroad bars.

Much of this demand for durable goods turned eventually into a demand for labor in mine and quarry and mill, into wage payments to labor. And these wages too were spent for consumers' goods and meant widening markets, increased specialization, and, presumably, greater productivity.

Thus the initial impetus of investment in railway construction led in widening arcs to increments of economic activity over the entire American domain, far exceeding in their total volume the original inputs of investment capital. To this feature of modern capitalism, John Maynard Keynes and others have applied the term 'multiplier.' It is believed that for present day England the efficiency of the multiplier may suffice to double the impact of a new investment in construction. For nineteenth-century United States, its efficiency seems to have been considerably greater than that." "Railroads as an Economic force in American development," Journal of Economic History, IV, No. 1, (May 1944), 6-7. The impact in Canada would have been much less, however, because of the heavy importation of manufactured equipment and goods.

1890 had reached 484 and 14,000.[23/] While some locomotives were imported, the bulk of the engines and rolling stock were made either in the firm's Montreal plant, which began production in 1883, or elsewhere in eastern Canada.

Chambers and Bertram have estimated the increased value added for the iron and steel and transportation equipment industries between 1870 and 1890 as follows:[24/]

		Transportation Equipment	Iron & Steel
	Montreal	468,000	2,093,000
1870	Toronto	161,000	1,303,000
	Canada	4,320,000	13,621,000
	Montreal	839,000	2,647,000
1880	Toronto	173,000	2,791,000
	Canada	5,606,000	16,978,000
	Montreal	4,248,000	4,512,000
1890	Toronto	585,000	3,481,000
	Canada	10,698,000	27,744,000

Impressive though these figures are, the aggregate expansion on transportation equipment was accompanied by a marked increase in the number and size of rolling stock manufacturers; in 1870 there were five firms with an average output of $102,000, while twenty years later there were nineteen firms with an average output of $498,000.[25/]

[23/] Innis, Canadian Pacific Railway, 133, 149.

[24/] Edward J. Chambers and Gordon W. Bertram "Urbanization and manufacturing in central Canada, 1870-1890," in Slyvia Ostry and T. K. Rymes, eds., Papers on Regional Statistical Studies, Canadian Political Science Association, Conference on Statistics 1964 (Toronto 1966), 242-253.

[25/] Gordon W. Bertram, "Historical Statistics on Growth and Structure of Manufacturing in Canada, 1870-1957," in J. Henripin and A. Asimakopulos, eds., Papers, Canadian Political Science Association Conference on Statistics 1962 and 1963 (Toronto 1964), 116.

By 1890, as well, Montreal-Hochelaga clearly had become the centre of the railway supply industry.[26] There were six rolling stock firms in the city; the Grand Trunk and the Canadian Pacific had large manufacturing and repair plants; other firms specialized in the production of car wheels and axles; and three new bridge companies specialized in iron bridge fabrication and construction. There also was such a marked expansion in the capacity of Canadian rolling mills that "it was generally felt in 1893 and 1894 that the capacity of existing mills was more than ample to supply the domestic demand for most rolling mill products."[27]

Neither the tariff nor the increased demand had much effect on the primary industry. While scrap iron was used for some purposes and the Canadian government attempted to encourage the primary industry by a tariff on pig iron, most of the raw material was imported. Imports of pig iron (dutiable at $2 a ton) and billets, booms and slabs (dutiable at 12½ per cent) increased from an annual average of $400,000 (constant dollars) in the 1870s to $1.3 million in the 1880s, while imports of rolling mill products jumped from $1.6 million to $4.6 million a year in the same period.[28]

The history of Dominion Bridge offers a more intimate illustration of the effects of railway construction. During the 1870s the

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[26] Chambers and Bertram, "Urbanization and Manufacturing," 237. By 1890 Montreal-Hochelaga produced 39.7 per cent of the transportation equipment.

[27] Donald, Canadian Iron and Steel Industry, 120.

[28] Bertram, "Historical Statistics," 114.

Canton Bridge Company of Canton, Ohio, had been supplying iron structures for bridges in Ontario. In 1879 the company decided to locate a branch in Toronto, and established the Toronto Bridge Company. Unfortunately, company records do not reveal the precise reasons for the decision, but suggest that a growing replacement market, the new tariff, and the prospect of extensive railway construction together prompted the move. Although the first bridge built fell into the river at London, Ontario, business apparently boomed. By 1882 the Company decided that since most materials were imported, the best location for a plant was on navigable water. It was clear also that the Toronto plant was too small to handle both the volume of business and the size of the structural pieces being fabricated, and that the company needed substantial new capital investment. The locational problem was solved by moving to Lachine, a decision influenced as well by the realization that Montreal was to be the centre of decisions affecting railway construction, and the financial problem resolved by securing capital from Scottish and British interests which saw the company as a market for their iron and steel. In 1883 the company was reincorporated as Dominion Bridge, by which time it had contracts for Canadian Pacific bridges at Lake of the Woods and over the Assiniboia. A year later, $50,000 of additional capital was secured from a Sheffield manufacturer who had sold machines to the company, and in 1885 it secured a major contract from the Canadian Pacific for the bridge over the St. Lawrence. Already R. B. Angus of the Canadian Pacific had shown an interest in the company, and by the late 1880s he and James Ross, a C.P.R. contractor and emerging industrialist, had assumed a financial interest. The extent of that interest was revealed when Ross and Thomas Holt became directors, and finally in 1890 when Ross became president and Herbert Holt succeeded his brother as a director. Control of the company had moved from the United States to the United Kingdom to Canada, and rested firmly in the hands of men very closely associated with the construction of the Canadian Pacific and the industries that it helped to spawn. C.P.R. contracts would undoubtedly be even more likely in the future, and they were.[29/]

Western settlement

The Canadian Pacific was built not to induce manufacturing in central Canada, however, but to make possible the settlement of the west and the unification of the country. Alternatives were possible to achieve the first objective, and what Fogel calls the "axiom of indispensability" certainly can be contested. But once an all-Canadian route had been decided politically as essential for national unity, economic criteria ceased to be relevant, and the lavish government aid presumably was to offset the prematurity or even long-term lack of viability of the all-Canadian route. Given the political decision it is perhaps irrelevant to observe that what western

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[29/] Mary H. Shearwood, Whence Came This Dominion Bridge, n.d.n.s.

settlement needed was low transportation costs, not the Canadian Pacific - although if access to railways would have accelerated settlement, the west could have been honeycombed with lines linked to American railways for half the cost of building north of Lake Superior and through the Rockies.

Unfortunately there has been no satisfactory analysis of western railways and settlement in the 1880s.[30/] Generally, historians have accepted the premises of "construction ahead of demand" and a "necessary but not sufficient condition" for an extension of the agricultural frontier. Traditionally the pattern is portrayed as one of very slow settlement, interrupted by a semi-speculative boom in 1881-83, as the Canadian west awaited a change in world conditions, and Canadians - more than a million of them in the '80s - look to greener pastures or fatter pay cheques in the American mid-west or eastern factories. Placed in this setting the railway represented a premature enterprise.

Yet however modest the pace of western settlement before 1900 compared to that afterward, it was not insignificant. The population of Manitoba increased from 25,000 to 65,000 between 1871 and 1881, the largest influx by far arriving between 1879 and 1881 when railway connection with eastern Canada had been assured and had been achieved

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[30/] By far the best study is John H. Warkentin, "Western Canada in 1886," Papers read before the Historical and Scientific Society of Manitoba, Series III, No. 19 (1965), 85-116. The map showing railways and settlement is reproduced with Professor Warkentin's permission.

with the United States. By 1891 the population of Manitoba had jumped to 152,000, while about 50,000 had settled in the Northwest Territories. The growth in Manitoba did not compare unfavourably to that in North Dakota, where the population increased from 37,000 to 190,000 in the 1880s and by 1890 the line of settlement in North Dakota ran roughly south of the Manitoba-Territorial boundary and closely approximated the western fringe of continuous settlement in Canada. Further west, while Montana enjoyed double the population growth of the territories in the '80s, it owed its development not to agriculture but to mining, transportation, and cattle farming. Montana's farming boom occurred after the turn of the century, when the Territories were also inundated.[31/]

Disappointing though western settlement was, it might be argued that the Canadian Pacific was less a case of premature than of delayed construction, at least to the territorial border. The Canadian Pacific and small branch line companies by 1880 faced not a wasteland that needed to be settled, but substantial agricultural settlement that needed a railway. While the mainline pushed

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[31/] Growth of Manitoba and Northwest Territories and North Dakota and Montana 1870-1900 (000's).

	1870	1880	1890	1900
Manitoba	25	65	152	255
Northwest Territories	48	56	99	164
North Dakota	2.4	37	191	319
Montana	20	39	142	243

settlement west of Brandon towards the territorial border, the branch lines that ran northwest and southwest generally followed or coincided with agricultural settlement, although the construction of the lines undoubtedly encouraged a higher density of settlement. The agitation for branch lines in the early 1880s reflected the fact that by 1885 railways had not caught up with settlement; the Canadian Pacific was unable to work on all ends at once, although it did build or acquire lines which by 1886 reached Deloraine and Souris, while the Manitoba and North-western had run north from Portage to cross the border to Yorkton by 1890.

The weakness of the unqualified construction-ahead-of-demand argument in Manitoba can be seen also in the rapid use of services. By 1883 grain was being hauled more than 100 miles to the C.P.R. mainline at Brandon. Although some grain had been exported since 1876, until the mid-'80s the general market was internal, largely seed grain and food for new settlers. But by 1883 production exceeded local demand. Grain dealing had begun in Winnipeg in the 1870s and by the early 1880s eastern firms had agents in the field. A terminal elevator was built in St. Boniface in 1880, and the first country elevator was built by Ogilvie Milling at Gretna in 1881. Before long the country elevator - with a capacity of more than 25,000 bushels - lined the railway and replaced the older loading platforms. In 1885 the Brandon immigration agent reported seeing "farmers' teams heavily laden with grain, coming into town from every direction, and crowding on the avenue leading to the four large elevators, which were taxed to capacity to receive and ship the grain as fast as the farmers brought it in, it being by no means an unusual sight to see over 100 teams at once upon the street waiting to be unloaded."[32/]

Indeed, the railway found it difficult to provide the physical plant - rolling stock, platforms, elevators - and the demand for more branch lines came less from companies hoping to open up new lands than from settlers demanding easier access to transportation facilities. Rather than seeing the Canadian Pacific as a premature enterprise, Studness argues that earlier main line construction and more extensive branch lines in the '70s and '80s, and a land grant policy that did not tie up so much land for sale to people to whom even a dollar an acre represented a considerable and often impossible capital investment, would have accelerated western expansion and cut down even further the competitive attraction of the American west, where land was both free and continuous. Tyman reinforced that position by observing that while the slow growth of the mid-90s' was due to shortage of capital, bad harvests and low prices, in addition there was very little free land left in southern Manitoba. In 1892 there were only 2,809 quarter sections available for homestead and many of those in areas ill-suited to cultivation.[33/]

Moreover, anticipation or implementation of railway connections undoubtedly helped counter the emigration of Canadian-born to the

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[32/] John L. Tyman, By Section, Township and Range, (Brandon 1972), 50.

[33/] Ibid., 56.

American mid-west or north-central states. As Studness points out, 25,000 Canadian-born emigrated to Manitoba in the 1870s and 47,600 to the American north-central agricultural states. In the 1880s, a decade when emigration from Canada is supposed to have exceeded a million, only 50,200 went to the American agricultural frontier while 55,800 emigrated to Manitoba and the Territories, figures which strike sharply at the traditional view that the American west offered greater agricultural opportunities. Moreover, much of the Canadian-born emigration settled in American urban areas; half of the Canadian-born in fact settled in Minneapolis-St. Paul. In the '90s only 20,900 settled in the American west, while 54,300 moved westward in Canada. By 1890, with the exception of the Red River Valley, where settlement on the Canadian side was impeded by métis reserves while that in the Dakotas had been accelerated by the bonanza farming boom of the '70s, the density was higher in southern Manitoba than in North Dakota. Moreover, taking yield, price, quality and cost of production of wheat Studness concludes that wheat farming was more profitable in Manitoba than in the Dakotas, and that farmers had greater access to transportation facilities. Economic incentives were a barrier to emigration.[34]

West of Manitoba the dryer regions posed natural constraints on settlement in southern Saskatchewan and Alberta. In 1881 about 5,400

[34] Charles M. Studness, "Economic opportunity and the Westward Migration of Canadians During the Late Nineteenth Century," Canadian Journal of Economics and Political Science, XXX, No. 4 (November 1964), 570 ff. He includes the Dakotas, Minnesota, Iowa, Nebraska and Kansas.

white settlers lived in the Territories, almost all of them in the north central portions of the Saskatchewan valley. By 1885 there were 28,000, of whom 17,500 lived in Assiniboia, which extended from the Manitoba border to beyond Medicine Hat and was crossed by the C.P.R. Growth slowed during the rest of the decade and drought and bad crops forced many to abandon their homesteads or group colonies. But by 1891 there were more than 50,000 white settlers in the Territories, with Assiniboia and southern Alberta showing the greatest growth.

The Canadian Pacific and the branch lines also sparked what urban growth there was during and after the construction period, and by the location of townsites and divisional points generally determined the future urban growth of the west. By 1891 Brandon had 3,800 inhabitants, and Portage la Prairie 3,400 while Calgary had almost 4,000 and Vancouver had more than 13,000. By the turn of the century Regina and Moose Jaw had become important urban centres, while intermediate towns like Moosomin, Indian Head and Medicine Hat had about 1,000 people. Yet there also stretched along the line - every eight or ten miles in the Prairies - townsites that ranged from named surveyors' stakes to loading platforms and a section house to small communities with an elevator, a station, and the nucleus of a regional commercial enterprise. Generally their size diminished as the line moved westward.

For example, Elkhorn, Manitoba, twelve miles east of the Saskatchewan border, was selected as a townsite in 1882. After throwing up an 8' by 12' shack for its operator, the Canadian Pacific built a station and worksheds, apparently using prospective homesteaders as casual labour, and private enterprise erected a frame building housing a general store, post office and restaurant. Two hotels followed in 1883, and by the mid-'80s the town boasted several contractors, a school, a number of stores and a lumberyard. The first elevator - built by Ogilvie and a Mr. Power of Miniota - appeared in 1886, and by 1897 there were four grain elevators and a flour mill.

Grenfell, Saskatchewan, on the line south of the Qu'Appelle Valley, had a slower pace, but by 1900 had passed Elkhorn. Construction of the townsite began in 1883 and by the end of 1884 Grenfell had not only a station, but a hotel, several stores, an agricultural implements agent, school, post office, and church. The first elevator - a flat storage bin - was built by a local real estate agent interested in the grain trade in 1890, but by 1894 two standard elevators and a flour mill had been constructed. By that time the town had a bank, a drugstore, and a liquor store - thus ensuring its continuity. By the end of the decade lumber and brick yards, a sash and door factory, a cheese factory and creamery had further rounded out its urban and commercial significance.

The railway alone, however, was not adequate to sustain urban growth. Swift Current was picked as a divisional point not only because of its location midway between Moose Jaw and Medicine Hat, but also because the creek (hardly as dynamic as the name given to it) offered a water supply. The grading gangs reached the site in September 1882 and the rails passed in December. In the spring of '83, gangs of C.P.R. employees built a depot, freight shed and loading platform, section house and bunk house, the indispensable dining hall, and later a roundhouse and turntable. By 1884 there were two mixed trains a week, and Swift Current not only enjoyed the passing traffic but became the freighting centre for the trail north to Battleford. By 1884 the canvas-roofed structures of 1882-83 had been replaced by false fronted commercial buildings and half a dozen farm houses. But the boom period soon passed and the diminution and ultimate disappearance of the freighting trade by 1890 was no more than offset by the establishment of a large but ill-fated ranching venture by Sir John Lister-Kay in the late 1880s. For two decades the town lived virtually off the railway. In the entire area around Swift Current and Maple Creek lived only 1,009 people in 1891, an increase from 828 in 1885. The population of the town floated around 100 and the physical plant in 1900 remained the C.P.R. buildings, half a dozen businesses, two churches, and ten houses, some of them still little more than shacks. Not until 1903 did Swift Current begin to feel the quickening pace of western settlement; by 1907 it had become a Prairie boomtown and by 1911 had 1,852 inhabitants, while down the track Maple Creek had almost 1,000. The railway created Swift Current and endowed it with the most handsome of its gifts - a divisional point. It was a necessary but not sufficient condition for its growth.[35]

The messenger had arrived in 1882, but King Wheat had delayed his arrival in the western Territories for a generation.

[35] D. C. McGowan, "A History of Swift Current and District to 1907." (M.A. thesis; University of Saskatchewan, Regina, 1971).

BOOM YEARS 1900-1914

By 1886 trains were running over 10,000 miles of track in Canada. A decade later 5,500 miles had been added, much of it by the Canadian Pacific. In the west the C.P.R. added lines from Macleod to Edmonton, Lethbridge to the main line, Regina to Prince Albert, and many smaller branch lines to feed the main trunk. In central Canada the Canadian Pacific and the Grand Trunk competed for local and through traffic, national and continental, by buying existing lines and building new ones. In the east the Canadian Pacific acquired and built lines to give it access to St. John and Halifax, Portland and Boston.

Mackenzie and Mann

Perhaps unnoticed at the time, 120 miles of track, running from Gladstone on the Canadian Pacific to Winnipegosis, had been built in 1896 by William Mackenzie and Donald Mann. Twenty years later those two swashbuckling entrepreneurs controlled a 10,000 mile railway network composed of 221 lines running from Vancouver to the St. Lawrence, and almost 400 miles in the Maritimes. More than 7,000 miles had been built by Mackenzie and Mann; the remainder had been picked up at bargain-basement prices.[1/]

In many ways the Canadian Northern network had never been planned, but its topsy-like growth revealed a logical pattern. Whenever there was a defunct charter that carried a land grant, a cash subsidy or a government bond guarantee, Mackenzie and Mann usually could be found. The lines may have veered sharply from the route initially proposed, but the land grant was safely in hand and English investors avidly picked up provincially and federally guaranteed bonds. By 1902 the Canadian Northern had an intensive network in Manitoba, and had completed the line east to Port Arthur, the handsome land grants apparently being easily transferred to western farm lands. By then its northern lines were creeping into the Northwest Territories, and, when the federal government came through with a handsome guarantee, leaped forward to Prince Albert and Saskatoon and Edmonton in a single construction season in 1905. The company also had been active in the east, acquiring short lines in Nova Scotia, futilely eyeing the Intercolonial, and buying a number of lines along the north shore of the St. Lawrence from Hawkesbury to Quebec and north to Lac St. Jean. In Ontario the duo picked up a handsome land and cash subsidy from the Ontario government in 1905, when it acquired the charter of the James Bay Railroad, and by what the Canadian National historian calls

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[1/] The standard work on the Canadian Northern and Canadian National group of railways after 1896 is G. R. Stevens, Canadian National Railways, Vol. 2, Towards the Inevitable, (Toronto 1962) and also his shorter version History of the Canadian National Railways (Toronto 1973).

"some deft legal footwork" built not to the bay but to Sudbury and beyond.[2/]

The financial crisis of 1907 brought a temporary halt to Mackenzie and Mann, but by 1908-09 the boom had returned. In the next six years their expansion was enormous, their ambition even more so. Ontario and the western provinces provided land, cash and bond guarantees, and, not to be outdone, the federal government provided a guarantee of $35,000 a mile for a trunkline between Port Arthur and Montreal. Hundreds of miles of branch lines were added in the prairies, including lines to Athabasca Landing, The Pas, and towards Peace River. In Ontario the company built from Toronto to Montreal, where from its model townsite of Mount Royal it tunnelled to the downtown core. In 1910 construction started on the line through Yellowhead Pass to the Pacific, and the last spike was driven five years later.

When the government stepped in months later, the Canadian Northern owned or controlled 9,410 miles of main line track, and had about 2,000 miles under construction. The company claimed to have invested $494 million, including $100 million of capital stock

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[2/] Stevens, History of Canadian National Railways, 241. In November 1907, D. B. Hanna, a Canadian Northern vice-president stated that in 1897 the company had 3 engines, 80 cars, 20 employees, a payroll of under $17,000, a gross revenue of under $60,000, and traffic of 10,343 passengers and 25,700 tons of freight. Ten years later the company operated 3,345 miles of line, and had 237 engines, over 10,000 cars, 10,700 permanent employees, with a payroll of over $5 million; and carried 703,988 passengers and 1.8 million tons of freight. Canadian Annual Review of Public Affairs 1907 (Toronto 1908), 663.

owned by Mackenzie and Mann which had been issued without any cash consideration. The 1917 Royal Commission estimated that the maximum possible cost was $370 million and $402 million the cost of reproduction.[3/]

The actual process and methods of construction of the myriad lines that constituted the Canadian Northern are as obscure as the footwork that led to their creation. Donald Mann himself was an experienced railroad builder, and when he was not lobbying spent considerable time in the field. In the settled portions of the prairies the company relied heavily on local labour. According to G. R. Stevens: "British railway builders would have considered them haphazard; American contractors, slack and casual. They entered the countryside neither as intruders nor as lordly visitants from afar; instead they worked and behaved as though native to the scene. They bought what they needed locally and without fuss.... The actual construction had something of the air of a barn-raising about it; everyone was allowed to pitch in and do what he could. If farmers and their teams showed up, they earned a day's pay, just as though they were working on a roadway or on a school or on some other community venture. This casual labour soon became as skilled as the terriers and the gandy-dancers in the small specialist jobs,

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3/ Report of the Royal Commission to inquire into Railways and Transportation in Canada, 1917. Sessional Papers, No. 20g, XLIV. Since outstanding liabilities exceeded $400 million, the Commissioners observed that "the equity of the shareholders must be regarded as non-existent."

such as tidying up a gradient or setting a culvert."[4/]

Such a casual approach was perhaps appropriate for the prairies, where farmers were willing to take on off-season work, and new immigrants were anxious to secure a cash income. But even for the longer races across the prairie, such as that of 1905, or construction through northern Ontario or the western mountains, experienced contractors were essential. Among Mackenzie's and Mann's favourites was the Northern Construction Company, a subsidiary of Foley, Welch and Stewart, a firm in which Mackenzie and Mann had an interest. The Foley brothers were experienced railroad builders from Minnesota, Patrick Welch a Spokane contractor, and J. W. Stewart, a Scot who came to Canada in 1882 and emerged as one of the country's foremost railway builders. When the Canadian Northern let the contracts for the line between Yellowhead Pass and the Pacific Coast, Foley, Welch and Stewart secured all but a small fraction.

Laurier's madness

The actual work of construction can be much better seen by tracing the progress of the Grand Trunk Pacific and National Transcontinental. If the Canadian Northern reflected the boundless enthusiasm of private enterprise (solidly backed by the state), the

[4/] Stevens, History of Canadian National Railways, 177.

Transcontinental reflected the equally boundless enthusiasm of the Canadian government, an enthusiasm nourished by the political pressures on the Laurier government.

By 1903 the Grand Trunk's initial interest in building from the Great Lakes to the Pacific had emerged in a Grand Trunk-government agreement to build a main line from Moncton, through northern Quebec and Ontario to the Pacific at Prince Rupert. The government was to build the line from Moncton to Winnipeg and lease it to the Grand Trunk at 3 per cent of its construction cost, while the Grand Trunk Pacific was to build from Winnipeg to the coast with government guaranteed bonds worth $13,000 a mile on the prairies and 75 per cent of the construction cost on the mountain section. Unlike the Canadian Pacific and the Canadian Northern, which so assiduously picked up land grant charters, the Grand Trunk Pacific received no free land, even for townsites.

Although the Grand Trunk was supposed to have some supervision over construction of the eastern section, its right was more illusory than real. Having learned nothing from the experience in building the Intercolonial and determined to use construction to reward friends or punish enemies, the government placed the supervision of the road under politically appointed railway commissioners. Rather than contract the line - or even major sections of it - to one contractor, the government let the line in twenty-two different contracts under circumstances in which tendering "represented a travesty of competition," and six firms secured 90 per cent of the mileage.

"From this takeoff, the looting of the public purse proceeded apace," observed G. R. Stevens. "The main contractors for the most part were no more than middlemen; they subcontracted virtually everything at from 10 to 30 per cent below their tender prices. The subcontractors were allowed to estimate their own quantities and to distribute unit prices to their own advantage. Thus on Contract 18, the principal item was the removal of 655,400 cubic yards of moss, enough to cover every yard of the contract to a depth of two feet over a width of twenty feet. The actual existing volume of moss proved to be 15,000 cubic yards, which meant that the unit price was paid on forty-four times the amount of the material removed. Similar tactics were followed on all classifications of material, and fortunes were made on borderline differentiations."[5]

While the skyrocketing costs were scandalous, as the resulting Royal Commission demonstrated, there was equally no doubt that the original estimates were far too low for building a line through the rock and muskeg, over the rivers and around the lakes of the pre-Cambrian shield from Quebec City through northern Quebec and Ontario. Unlike the Canadian Pacific, which had easy access from Lake Superior, the line ran far to the north and "easy access to many of the sections was in itself a costly and arduous task, involving the slashing of hundreds of miles of bush trails; the employment of fleets of small steamers, launches and canoes; the building of light

[5] Ibid., 211-213.

railways around the portages and a narrow gauge line eighteen miles in length to bypass the rapids on the Nipigon River."[6] A construction engineer on the northern Ontario section described muskegs miles in length, giant sinkholes, and clay beds so fluid that "a steel bridge a thousand feet in length, after being completed and without any load upon it, turned over on its side as a result of a clay slide."[7] But the 20,000 to 25,000 men working during the construction season completed the line from Moncton to Winnipeg by the fall of 1913, with the exception of 2,000 yards across the St. Lawrence at Quebec.

Laurier once foolishly had estimated the cost of construction at $13 million, but Finance Minister W. S. Fielding had provided a more reliable estimate of $68 million. While tenders had come in at about Fielding's estimate, when complete the line had cost $160 million. The Grand Trunk wisely refused to take it over, for by the time it had fulfilled its obligation to pay 3 per cent of costs, the incurred debt would have been almost a quarter of a billion dollars.

To the Pacific Again

In the west the Grand Trunk Pacific ran a far more efficient enterprise. Four-fifths of the line from Winnipeg to Prince Rupert

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[6] *Ibid.*, 216.

[7] Stevens, *Towards the Inevitable*, 161.

was built by Foley, Welch and Stewart, including the entire mountain section. Sod was broken at Carberry, Manitoba, in August 1905. There was none of the driving intensity of the Langdon and Shepard march, but the highly organized construction machine moved steadily across the prairies, reaching Saskatoon in 1907 and Edmonton a year later. Construction crews on the prairies were organized "into units consisting of 120 men, each of which constituted a small mobile village, entrusted with the construction of a six mile sub-division on the prairies.... These groups were self-contained, each with their own tools, vehicles and craft animals, and their routines were remarkable for their elimination of wasted effort," as locaters, ditchers, trestle-builders, scrapers, graders, track-layers and ballasters were perfectly choreographed as a construction ballet undulating across the prairies.[8/]

The Grand Trunk Pacific had reached Edmonton before the final surveys were complete for the new northern route through the mountains to the Pacific. There surveyors and contractors once again faced the blunt obstacles of mountain and river. On the eastern margin the Cordillera reaches a height of nearly 13,000 feet, and has an average width of sixty miles. To the west stretches a terraced mountain trench, occupied by the Upper Fraser and Canoe rivers. Further westward looms the Cariboo range around which the Fraser twists and bends in its foaming impatient surge to the sea.

8/ Stevens, History of Canadian National Railways, 221.

The unrelenting mountain terrain is broken by the Interior Plateau, and to the north and west tower the Bulkley and Babine Mountains through which flow the Skeena, Bulkley, and Nechako rivers. Rising sharply from the sea are the massive snow-capped peaks of the Coast Range, broken only here and there by deep inlets and torrential rivers.

After the preliminary surveys had been completed, two unsolved problems remained. The first, a choice between three passes - the Peace River, the Pine River, and Yellowhead - finally was resolved in favour of the latter, commonly known as Tête Jaune Cache. The second involved the selection of the route from Telkwa to Copper River and was not finally settled until late 1908. Grand Trunk officials desired to build the line directly west from the mouth of the Telkwa to the Zymoetz River and down it to the Skeena, thus cutting out the long circuitous route down the Bulkley and the Skeena and by-passing the treacherous Kitsalas Canyon. But the government of British Columbia refused, arguing that the longer route would open up the mining and agricultural potentialities near Hazelton and the Rocher Deboule Moutains, while the overland line simply would wind its lonely course through unsettled and unexplored wilderness.

Construction began at both ends of the mountain section. Work started on the eastern section in the fall of 1909. Five years later, in January 1914, the steel reached Fort George. The terrain then became much easier and within three months track had been laid to

Nechako crossing, where the east-west parties were to meet. The first sod on the western section was turned at Prince Rupert on May 7, 1908. It was the 185 miles from Prince Rupert to Hazelton that presented the most difficult engineering job on the entire route. The Skeena falls 1,200 feet in the lower 120 miles and the last half of that distance is tidal. The railroad followed the bank of the river, cutting through walls of solid granite. Further up the river the Kitsalas Canyon proved that it was the enemy of the steamboat and railway alike, and before it was passed three tunnels had to be driven. From Prince Rupert to Hazelton there were thirteen tunnels in all and a six-span bridge. So difficult was the country that twelve thousand miles of trial lines and surveys were necessary to locate 168 miles of track. The mountain section, part of which Foley, Welch and Stewart refused to contract, but built on a cost-plus basis, had cost almost $66 million in direct construction and another $22 million in land, interest and other charges, for an average cost of $105,773 per mile. By April 1915 the line was complete.

The small party that gathered at Nechako Crossing on April 15 had neither a gold spike nor a case of champagne; indeed it lacked even a top hat. "Nevertheless, posterity may well lift a glass in toast to the venture" suggested G. R. Stevens, whose railways have never been awarded the construction accolades of the Canadian Pacific. "A railway which adhered to what may be regarded as an impossible specification had been driven through. Ten thousand men had gone out against well-nigh impregnable terrain. The bohunks, the groundhogs, the terriers, the gandy-dancers and the men of the pick-and-shovel brigade had paid the price of conquest - in upsets in the rapids, in falls from the cliffs, in premature explosions in the cuts, in avalanches, in blizzards and in floods. By their incredible endurance they had tamed the swift rivers and had broken the backs of the high mountains."[9]

Men, Machines, and Money

The men attacked the rock and muskeg, prairies and forests with tools and equipment that had improved since the 1880s. Steam shovels, a rarity on the Canadian Pacific, became common if not commonplace. On the mountain section of the G.T.P. at least eleven shovels ranging from 40 to 70 tons and capable of lifting several tons of rock were at work, although on a 200-mile section of the transcontinental near the Quebec-New Brunswick border only one steam shovel was employed in 1906. A contemporary wrote that "in the ballast pit the screeching of steam was heard from morning to night, as the cumbersome steam shovel, in slow, measured strokes, dipped its capacious maw into the bottom of the bank, and with a fearsome scrunching, scraped its huge steel teeth up the face of the cut to secure a good bite of spoil, then swing round and disgorge some

[9] Stevens, Towards the Inevitable, 193.

three tons of rock, gravel and clay into the empty trucks standing alongside."10/

Grading and tracklaying too had become more mechanized, at least on the bigger contracts. "The grading machine is an implement well worthy of watching at work," wrote F. A. Talbot, a visiting British journalist:

> It may be hauled by a steam traction engine, or be operated by animal power; in either case the result is the same. In general appearance it recalls a wheat-harvester. There is an inclined shoot, over which travels an endless chain of small scoops or buckets such as are used on conveyors. At the bottom, under the centre of the machine, is a sharp edge, acting in the same way as a plough. When the machine is set in motion, the plough tears up the earth and forces the spoil into the buckets as they pass by on the endless chain. They are swung up the inclined plane, and as they round the highest point discharge their contents into a capacious, horse-drawn hopper waggon, which ambles along at the same pace as the grader.... 11/

Improvements in organization and equipment for tracklaying cut the size of tracklaying gangs from the 300 common during C.P.R. construction to about 150. The machine was described by William Hard:

> It is a train of flat-cars. In the middle of these is a locomotive. Along each side of them runs a wooden trough, suspended in air, bottomed with rollers. From the cars, into the trough at the right of the train, men are throwing ties; into the trough at the left, rails. A steady current of ties and rails flows forward over the

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10/ Frederick A. Talbot, The Making of a Great Canadian Railway, (London 1912), 110.

11/ Ibid., 122.

> rollers of the troughs, forward all the way to the Machine. The Machine stands like a gallows frame at the front of the foremost car. Ahead of it, crosswise on the Dump, the ties fall, their right ends just touching the line of twine laid down for their guidance. Whereupon, with long wooden arms extending forward from its bony frame, with steel cables for tendons and compressed air clutches for hands, the Machine lifts the rails, swings them and lays them down on the ties to make the skeleton of the track. 12/

Although machinery had improved, most of the work of clearing, grading and laying and ballasting still was heavy manual work, and labour costs represented 70 per cent of the cost of construction. While patterns differed from place to place, depending upon the nature of the contract, the terrain, and the availability of labour, the standard procedure was a system of sub-contracting. "For instance, the Canadian Pacific Railway," the comptroller of the Canadian Northern told an investigating committee in 1914, "lets a contract to Foley, and Company to do certain work. They in turn let the work to someone else who in turn will probably let it to station men."[13/] In many areas the station men were the basic units for clearing and grading. A sub-contractor on the Grand Trunk Pacific described "Swansie the Tireless Swede," a station man on the Grand Trunk Pacific:

12/ William Hard, "Spiking Down an Empire" Everybody's Magazine (November 1909), 640.

13/ He added that Foley would secure a commission of from 5 to 8 per cent. However, Mackenzie and Mann were their own main contractors, he argued, and billed the Canadian Northern only for actual expenses of the sub-contractors and taking their own 10 per cent commission in stock. Royal Commission to inquire into Railways and Transportation, 1917. lix.

I have a contract to do five miles of the road. I can hire men to work for me. Can I make them work? Yes, I can. But can I kill them? I can not. I can try but they won't let me. The only man a man will let kill him is himself. Hence the station man.

The station man goes and gets a bunch of fellows dippy as himself and they make a gang, all equal partners. They come to me and say: 'We will chew the rock out of this hill and chuck it into this mighty river for so many cents a cubic yard.' I say: 'very well; get busy.' And do they? My dear old chap, ten station men will take out more rock in a month than twenty men, yes, sometimes more than thirty men, working for wages.

You see them working sometimes in the dark with banjo lamps, making you think the forest is on fire. And you always see them working all the time when it is light, from half past two and three in the morning till nine and ten o'clock in the evening.

All the requisitions this particular fellow Swansie and his bunch ever made on the contractor for food supplies were for meat. Just meat. Why, just meat? 'Got to work,' say Swansie. No time to boil porridge or make bread. No time to suck water with a carrot or tomato flavour which is all a vegetable is. Give him meat, every ounce the solid, right stuff. Dried meat, brined meat, smoked meat, canned meat, and if it comes fresh and raw, just gulp it like a dog. Total elapsed time preparing dinner-three minutes. Total elapsed time eating, nothing. Eat it while driving the stone boat. 'Got to work,' says Swansie....

And now the whole job is done. The cut is cut all the way through the hill. The contractor settles with them....

How much does Swansie and his gang get? Twenty-four hundred dollars apiece, net, clear cash. Two of the fellows bought 160 acres apiece of Saskatchewan farmland. Fixed for life.

> Quitters. But not the rest of them. And particularly not Swansie. He is a railway builder. 'Got to work.' 14/

From the station men to the ballasters the railway contractors consumed thousands of men. A spokesman for the National Transcontinental-Grand Trunk Pacific estimated that he would need 40,000 men for the peak construction season in 1908.[15/] The Canadian Northern and the Canadian Pacific were building almost as much new line, and the older railways were replacing and repairing hundreds of miles of track. A hundred thousand men probably were needed in the summer of 1908, and for many years thereafter. While labour shortages were acute after 1908, they also existed much earlier in the decade. In his report for 1906, Collingwood Schreiber reported that work on the prairie section of the Grand Trunk Pacific was not advancing as rapidly as expected because of "the impossibility of securing the requisite number of men for the work. So short of men are the contractors that in several instances many teams of horses were standing idle in the stables due to inability to secure teamsters.... The

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[14/] Stevens, Towards the Inevitable, 189.

[15/] Financial Post, February 15, 1908. A year earlier the Financial Post (February 9, 1907) provided the following breakdown of labour needs for the 1907 season: Mackenzie and Mann, 10,000; Foley, Larson & Company (National Transcontinental and Grand Trunk Pacific), 8,000; J. D. McArthur (N.T.) 7,000; Macdonald, MacMillan & Company (N.T.) 3,000; Canadian White Company (G.T.P.) 1,500; Canadian Pacific construction department, 10,000; track maintenance, surfacing, ballasting, 20,000. "Where this large force is to be obtained is the question which is giving concern to western contractors," observed the Post. "The information that so many workmen will be required and that they will be paid excellent wages is welcome news to the agents engaged in the work of inducing immigration, and to those who are interested in the growth and progress of the west."

supply is not within 40 to 50 per cent of the number of men required to carry out the contracts in hand."[16/]

The situation may have been more acute in other parts of Canada, for although the concentration of construction was heavy in the prairies, new and prospective settlers provided pools of construction labour. The prospective settler needed cash to supplement his meagre capital, while the homesteader often was anxious to secure some cash income during the first years. As the Edmonton Land Agent reported in 1913, the "large amount of railway building has been the means of distributing an amount of money through the country which at the present time is very beneficial to a number of settlers who have to depend largely on the employment they can procure to tide them over the first unproductive years of homesteading...."[17/] On the other hand the homesteader was seasonal and short-term in his employment, the prospective settler worked only until he had the required capital, and the farmers often outbid the railway for labour during ploughing and harvesting. In central Canada and British Columbia, the mine, factory, logging camp, and urban building vigoursly competed for skilled and unskilled labour. Between 1900 and 1909, wages for ordinary labour on the railway almost doubled, but the

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[16/] Stevens, Towards the Inevitable, 178.

[17/] Arthur S. Morton, History of Prairie Settlement, (Toronto 1938), 141.

labour shortage in most years remained serious.[18]

Recruiting a labour supply became a major concern of the railways and a major business for recruiting agents, who established themselves in all major Canadian (and some American and European) cities. While the unemployed and the transient among the local population provided some recruits, the agents paid particular attention to the immigrants who stepped off the boat or train.[19] (Some enterprising agents even attempted to board ship at Quebec to sign up men before the situation became more competitive in Montreal). Immigration certainly provided a large pool of prospective labour. In 1896, only 16,900 immigrants are believed to have entered the country. By 1903 the number had increased to 139,000, exceeded 200,000 in 1906, 300,000 in 1911 and 1912, and 400,000 in 1913. Between 1901 and 1911 the population increased from 5.4 million to 7.2 million, at least half of the increase the result of net migration, and another million arrived before 1914.[20]

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[18] In 1900 unskilled labour was paid between $1.50 and $1.75 a day. By 1909 the wages had increased to $2.50 and $3.00. In the summer of 1909 on their G.T.P. contract in the Rockies, Foley, Welch and Stewart paid unskilled labour $2.50 to $3.00, underground workers and axeman $3.25 to $4.00, steam-drill operators $4.50 to $5.00, and powdermonkies $6.00. Board averaged $5.25 a week. At the same time British Columbia mines paid around $4.00 for ordinary labour. Sessional Papers, No. 36, 1911, 144.

[19] See Edmund W. Bradwin, The Bunkhouse Man, (Toronto 1972), 54-61 for a good description of the agency system. See also Royal Commission to inquire into the Immigration of Italian Labourers to Montreal, Sessional Papers, 36b, 1905.

[20] Gross immigration figures vary widely. Keyfitz estimates immigration for the first decade at 1,782,000 and emigration at 1,066,000. McDougall's estimates are 1,111,000 and 317,000. Their net figures, however, are 715,000 for Keyfitz and 794,000 for McDougall. See M. C. Urquhart and K. A. H. Buckley, Historial Statistics, Series A 244-253, (Toronto 1965), 22.

While Canadian immigration policy after 1896 was directed towards acquiring an agricultural population, a significant percentage of the immigrants were unskilled workmen. One study suggests that while farmers and farm labourers (many of whom worked on the railway) comprised 37.4 per cent of all immigrants between 1906 and 1914, general labourers constituted 34 per cent. Of the unskilled, 37.3 per cent were from overseas and 28.4 per cent from the United States. While most of the British and Americans entering were skilled tradesmen or farmers, the unskilled represented a very high proportion of continental Europeans both from overseas and from the United States.[21/]

The histories of ethnic groups in Canada and the glimpses of railway construction indicate very clearly that foreign immigrants provided the bulk of the railway labour force. The general picture that emerges of the construction force is of the English-speaking as foremen, office staff, teamsters, and machinery operators and repairmen, with experienced Americans often the foremen and British tradesmen often manning the repair shops; the French Canadians, at least in the east, as location workers, axemen, and packers; the Scandinavians as excavation and rock workers; the Italians as expert in concrete and masonry and heavy construction generally; and the central and eastern Europeans, particularly the Slavs, as the predominent group on heavy manual construction. But no such breakdown can be more than very general, for there were foreign-born walking

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[21/] Cited in Avery, "Immigration and the 'Foreign' Navvy," footnote 2, 37.

bosses just as there were English-speaking muckers.

Working on the Canadian Northern in northern Ontario in 1911, J. R. Mutchmore, a frontier college student, described the varied composition of the construction camp and observed that "the real work of grade-building was let in one hundred foot sections, and generally to a group of newly arrived Slavs."[22/] Another Reading Camp volunteer at a Canadian Pacific camp in the prairies was assigned by the Swedish boss to "buck ties wid da Galicians - dat's the hardest job around here." "As is usual in railway construction," he observed, "the great majority of the men were foreigners. In this case 83 were Poles and 104 Ruthenians.... Only 10 were English-speaking, about 5 per cent of the whole camp." The ethnic composition was understandable, the young man wrote, because bucking ties or working on the "steel, jack, tamping and ballasting gangs" was not "sought after by Anglo-Saxons.... It is small disgrace to the English-speaking man that he shuns this job. The newly-arrived foreign immigrant has seldom any choice in the matter. In a strange country he must take the first thing that turns up."[23/]

While it is incontestable that foreign-born labour built the railways, it is difficult to be much more precise. However, in Bunkhouse Man Edmund Bradwin reports a survey taken between 1923 and 1926 of a large sample of men employed on "frontier works" as follows:

[22/] J. R. Mutchmore, Mutchmore, (Toronto 1965), 37.

[23/] Alfred Fitzpatrick, "Outnavvying the Navvies," Canadian Magazine, 47, (May 1916), 22-23.

English-speaking	20%	Italians	7%
French-speaking	11.3	Slavs	32
Scandinavians	24.7	Others	3.8

For the whole of Canada the figure for French-speaking during the construction period would undoubtedly be too high, and that for Italians in 1910-1914 undoubtedly too low. But that breakdown might represent a reasonable approximation of the railway construction labour force, a breakdown which would place almost all of the work force on the roadbed itself as an immigrant labour force.[24/]

In an attempt to secure an adequate supply of immigrant labour the railway companies advocated an open door policy, and repeatedly sought to circumvent immigration restrictions.[25/] Initially the railways favoured oriental immigration - "no transcontinental had yet been constructed without the assistance of oriental labour -" stated the general manager of the G.T.P. But given the attitude of Canadian trade unions and the white population of British Columbia,

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[24/] Bradwin, Bunkhouse Man. Support for the argument that the roadbed work force was heavily immigrant might be found in the 1941 census which indicated that 75 per cent of the railway maintenance crews were foreign-born, compared to 12 per cent in construction generally. In the 1923-26 survey the English-speaking were composed of 52 per cent Canadians, 39 per cent from the United Kingdom, and 9 per cent Americans. The Scandinavians were 31 per cent Swedish and 38 per cent Finnish. Almost half the Slavs were Ukranians. On a National Transcontinental spread in New Brunswick near the Quebec border in 1910-1911 there were 30 deaths. Five were French Canadians and one English-speaking Canadian. The remainder apparently were immigrants, among them 6 Italians, 4 Poles, and 3 Russians. (Sessional Papers, No. 37, 1912).

[25/] See Avery, "Immigration and the 'Foreign' Navvy," and also "Canadian Immigration Policy and the Alien Question, 1896-1919: The Anglo-Canadian Perspective" (PhD thesis; University of Western Ontario 1973).

oriental labour turned out to be politically impossible. The railways, therefore, looked increasingly to an influx of immigrants from central and southern Europe. While the Slavs were ideal for construction work, Donald Avery concludes that they were less than satisfactory to the railway because of their unfortunate desire to become farmers. Far more desirable were southern Europeans, above all Italians.

Italian railway workers had been used on the C.P.R. gangs in the 1880s, most of them recruited in the United States. In 1897 the commissioner of immigration urged the minister of railways to exert pressure on the C.P.R. to stop importing Italian navvies from the United States, presumably because they had no intention of settling on the land or even remaining in the country. But as a Royal Commission in 1903 revealed, the Canadian Pacific secured labour for its "extra gangs" through Italian labour suppliers in Montreal.[26/] However, since southern Europeans were not favoured by the official immigration policy and priorities, a conflict developed between the needs of railways and the policy of the country. Avery summarized the battle and its outcome:

> In the clash between the Immigration Branch and the Railroad companies, the federal politicians were inclined more often than not to support the interests of the companies. When the need arose, the 'open door' could usually be achieved by the large employers of labour through their political

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[26/] Sessional Papers, 36b, 1905. One C.P.R. official stated that in 1904 the railway hired 8,500 men for construction and maintenance gangs. Of these 3,144 were Italians, 1,200 from Montreal and 2,000 from the United States. The immigration department placed ads in Italian newspapers stating that 10,000 jobs were available.

leverage. This was clearly indicated in the period 1910-13 when Liberal and Conservative ministers acceded to the demands of the railway contractors for a relaxation of regulations pertaining to the immigration of navvies. During 1910, both the C.P.R. and the Grand Trunk Pacific exerted pressure on the government to admit "railroad labourers . . . irrespective of nationality . . . in fact the Grand Trunk Pacific contractors insisted that they had to have southern Europeans who were 'peculiarly suited for the work...' After Laurier had been approached by Duncan Ross, a lobbyist for the construction firm of Foley, Welch & Stewart, during his 'famous' tour of western Canada, the Dominion government caved in on the issue. By this time, of course, the prestige of the Laurier government was riding on the rapid completion of the Grand Trunk Pacific. In this situation, neither the objections of the Immigration Branch, nor the opposition of organized labour, nor the cause of Canadian racial purity could offset the influence of the contractors. Nor did the coming to power of the Conservatives in 1911 significantly disrupt the government-contractor relationship. The power of the business lobby was again clearly revealed in 1912. In that year the Immigration officials resumed their attempts to limit the number of southern Europeans entering Canada as railway navvies in response to increasing public complaints that those immigrants 'constituted a serious menace to the community.' However, the Minister of the Interior, Robert Rogers, was too good a politician to offend powerful vested interests. When it was brought to his attention by both Donald Mann of the Canadian Northern, and Timothy Foley, one of the leading contractors of the Grand Trunk Pacific, that the restrictions were unnecessary and indeed harmful, Rogers overruled his subordinates. The result was the free entry of alien navvies.

The admission of large numbers of southern Europeans, particularly Italian labourers, showed that the long standing goal of bringing into the country only the settler-labourer type of immigrant had been displaced by a policy of importing an industrial proletariat. Immigration statistics reveal that the percentage of unskilled labourers,

> as compared to the total male immigrants entering Canada, had increased from 31 per cent in 1907 to 43 per cent in 1913-14. In contrast, the percentage of agriculturalists decreased from 38 per cent in 1907 to 28 per cent in 1914. Similarly, the ethnic aspects of immigration policy revealed that there was a steady advance in the percentages of central and southern European immigrants from 29 per cent in 1907 to 48 per cent in 1913-14. 27/

The impact of railway construction in the first fifteen years of the 20th century had an impact on the economy which probably exceeded the boom of the '50s or the early 1880s. Between 1897 and 1915 the main lines of Canadian railways in operation increased from 16,550 miles to 34,882, while the total number of miles probably increased by 25,000.[28/] The biggest increase came between 1911 and 1915 when almost 15,000 miles of track were added. The nominal capital of Canadian railroads increased from $900 million in 1896 to a liability of over $1,800 million in 1915, and figures published by the Royal Commission in 1917 listed the book value of investment by the Canadian Northern, National Transcontinental and Grand Trunk Pacific alone at $850 million.[29/]

The investment of approximately $1.3 billion in Canadian railways between 1897 and 1915 again far exceeded the country's capital capacity. In fact very little was financed from Canadian sources.

[27/] Avery, "Immigration and the 'Foreign' Navvy," 22-24.

[28/] In 1901 Canada had one mile of track for every 300 inhabitants, and by 1916 one for every 185. Comparable figures for the United States by 1916 was 1:400, the United Kingdom 1:2000, and Australia 1:274.

[29/] Urquhart and Buckley, Historical Statistics, Series S I and S 69. Royal Commission to inquire into Railways and Transportation, 1917.

Buckley has estimated that $767 million in foreign capital went into Canadian railroads between 1900 and 1914, a figure which could be increased to $800 million from 1897. His own estimates provide a breakdown of $670 million from the United Kingdom, $50 million from the U.S.A. and $47 from other sources. Simon provides a comparable figure of 128.8 million pounds for new railroad issues between 1894 and 1914. Railways absorbed 29.5 per cent of all foreign capital investment in the period 1901-15, and foreign capital appears to have financed more than 60 per cent of new investment in railways.[30/]

The bulk of the remaining $500 million was supplied directly by government. By 1916 the Canadian Northern had received $38.9 million in subsidies and $25.9 million in loans, the Grand Trunk Pacific $70.7 million in cash and subsidies, and the National Transcontinental $160 million. Other railways, including the Canadian Pacific, received cash grants or subsidies, and other lines, such as the Ontario Northland, were built directly by governments. Very little capital was raised in Canada, with the exception of land sales which by 1916 totalled $34.4 million by the Canadian Northern

[30/] Kenneth Buckley, Capital Formation in Canada (Toronto 1955), 66; Simon, "British Investment in Canada." Simon estimated total British investment in Canadian railways at roughly $1 billion. Cleona Lewis estimated that Americans had $69 million invested in Canadian railways by 1914. America's Stake in International Investments, (Washington 1938). Fred Field's estimates of European investment by 1914 was close to Buckley's. FredW. Field, Capital Investments in Canada, (Montreal 1914), 118-127.

and (since 1881) $123.8 million by the Canadian Pacific.[31/]

The effects of the capital investment on the economy were enormous. Examining overall expenditure by the railways, Buckley has estimated total expenditure on new, repair and replacement construction at $1,366.4 million and total gross expenditure on new, repair and replacement equipment at $631 million - for a total expenditure of $1,997.4 million between 1896 and 1915.[32/] Of this total, almost half was spent in the five years from 1911 to 1915. The significance of such massive expenditures can be realized when railway investment represented 18.2, 26.5 and 26.8 per cent of total gross investment in Canada for each of the 1901-1915 quinquennia,

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[31/] The Royal Commission published the following tabulation of government aid to railways:

	Subsidies	Proceeds of lands sold	Loans outstanding or investment	Guarantees outstanding	Total
	$	$	$	$	$
Canadian Northern	38,874,148	34,379,809	25,858,166	199,141,110	298,253,263
Canadian Pacific	104,690,801	123,810,124	-----	-----	228,500,925
Grand Trunk Railway	13,003,060	-----	15,142,633	-----	28,145,693
Grand Trunk Pacific	726,320	-----	70,311,716	43,432,848	114,470,884
Grand Trunk Pacific Branch Lines	-----	-----	-----	13,469,004	13,469,004
National Transcontinental	-----	-----	159,881,197	-----	159,881,197
Intercolonial	-----	-----	116,234,204	-----	116,234,204
Prince Edward Island	-----	-----	9,496,567	-----	9,496,567
TOTAL	157,294,329	158,189,933	396,924,483	256,042,992	968,541,737

[32/] Buckley, Capital Formation, 136.

and the railways spent 23.4 per cent of the total national expenditure in durable physical assets between 1906 and 1915.[33/]

In 1969 Canada spent $3.3 billion on housing and only $239 million for new railway construction. Between 1867 and 1914, however, total expenditure on housing has been estimated at $2.2 billion, while $1.7 billion or 78 per cent was invested by railways. In seven years, 1882-1885 and 1907-08, railway investment exceeded that in housing, while from 1909 to 1914 they were nearly equal. Buckley provided the following quinquennial estimates:[34/]

	Housing		Railways		Gross Construction
	$	%	$	%	
1901-1905	222	32.6	124	18	681
1906-1910	468	32.5	381	26.5	1,439
1911-1915	568	28.3	537	26.8	2,007

Buckley also compared transportation and prairie farm investment for the same period:[35/]

	Gross Domestic Capital Formation	Farm		Railways	
		$	%	$	%
1901-1905	1,283	221	17.2	165	12.9
1906-1910	2,287	319	13.9	473	20.7
1911-1915	3,279	463	14.1	682	20.8

[33/] *Ibid.*, 10, 31.

[34/] *Ibid.*, 38.

[35/] *Ibid.*, 8.

The most obvious beneficiary of railway construction was, of course, the iron and steel industry. It would be foolhardy to attempt any precise statement concerning the impact of the railway on the iron and steel industry, and perhaps the simple statement of growth in demand and supply disguises more than it might reveal. Moreover, various sectors of the iron and steel industry were simultaneously assisted by tariffs, bounties, and even guaranteed purchases.[36/]

Yet increased demand for rail construction materials, equipment, and rolling stock was remarkable. Between 1891 and 1915, 20,000 miles of main track was placed in operation, and total new mileage approached 30,000. Net increase in locomotives was from 2,000 to 5,400, and in box cars from 37,000 to 146,000. Even these figures understate the demand, however, for old iron railways were replaced by steel, and where steel existed, old rails were replaced by heavier ones. Old engines and rolling stock were taken out of service and replaced by much heavier and more powerful equipment. Railways were responsible for 10 per cent of all investment in machinery and equipment between 1901 and 1905 and more than 15 per cent between 1906 and 1915.[37/]

The general growth of the iron and steel industry is readily apparent. The value added by manufacturing in 1900 was $29.8 million,

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[36/] Such as the federal government's decision that Canadian rails be used on all lines receiving a government subsidy. For the government contract to purchase rails which stimulated the construction of a steel rail plant by Algoma see Canada, House of Commons Debates, April 23, 1901, 3538 ff.

[37/] Buckley, Capital Formation, 10.

and in 1910 $76.5 million. The production of pig iron increased from 86,000 tons to more than one million in 1913, and the production of steel ingots and casting rose from 26,000 to 1,170,000 tons in the same period.[38/] Consumption of iron and steel products increased from an annual average of $40 million in 1881-1896 to around $170 million in 1910, and $250 million by 1913.[39/] While Canadian productivity in both the primary and secondary industry underwent a remarkable expansion - really the creation of the modern industry - imports of iron and steel products also rose dramatically from $13.4 million in 1896 to $33.5 million in 1900 and $164 million in the pre-war peak year of 1913.[40/] It would appear that by 1910 the Canadian industry was satisfying about 50 per cent of Canadian consumption - a figure it continued to hold until relatively recently.[41/] More directly related to railways, value added in the transportation equipment industry increased from $13.3 million in 1900 to $40.8 million in 1910, while steel rails, a handful of which were produced before 1904, increased from 40,000 in that year to 200,000 tons a

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[38/] Urquhart and Buckley, Historical Statistics, Q 95, Q 282-283.

[39/] Donald, Iron and Steel Industry, 293. One indication of the appetite of railways can be seen in the annual reports of the commissioners of the National Transcontinental which outline the contracts. In 1910-11, for example, the railway let contracts for over 60 bridges, almost 100,000 tons of steel rails, and placed large orders with Algoma, Nova Scotia Steel and Coal, Hamilton Steel and Iron, Stelco, and Montreal Rolling Mills for a wide variety of rail fastenings and other construction materials. Sessional Papers No. 37 (e), 1912.

[40/] Urquhart and Buckley, Historical Statistics, F 282.

[41/] Thomas Traves, "The Canadian Steel Industry," unpublished MSS, York University, 1974.

year later and 567,000 tons in 1913.[42/]

New Frontiers

From 1885 to 1897 the Canadian Pacific in the territories was in some ways a railway looking for western settlement. With the change in circumstances that created the wheat economy in the Canadian west around the turn of the century, railways and settlement began a symbiotic relationship that ended only with the last phase of western agrarian expansion in the 1920s. By 1899 there were only 54,831 homesteads in Manitoba and the territories. In the first six years of the new century there were 117,453 and by 1915 another 158,765. The population increased by more than one million in the same period. The railways kept abreast of settlement and population growth. In 1900 there were 3,700 miles of line on the prairies; by 1915 there were 13,000, more than 5,000 miles built between 1910 and 1915. Fifty per cent of all railway construction between 1900 and 1915 was on the prairies, and by 1915, 36 per cent of all Canadian railways were in the three prairie provinces. At the same time, however, the ratio of homesteads to miles of railway had changed from I:15 in 1899 to I:29 by 1906 and I:25 by 1915, while the ratio to population had held fairly steady at about I:115 throughout the period. Those

[42/] Urquhart and Buckley, Historical Statistics, Q 101, 286. Not until 1904 did Algoma and Dominion Iron and Steel in Sydney put their steel rail into operation.

essential instruments of the wheat economy, the country elevator, increased from 447 in 1900, to 1,830 by 1910 and 5,471 by 1930.[43/]

Provincial Railway Mileage

	1867	1900	1906	1910	1915
Canada	2,087	17,824	21,428	24,700	35,582
Ontario	1,275	6,812	7,338	8,230	10,702
Quebec	523	3,414	3,506	3,794	4,677
Manitoba	---	1,815	2,780	3,220	4,498
Saskatchewan	---	) 1,901	1,950	2,931	5,327
Alberta	---	)	1,235	1,488	3,174
Prairies		3,716	5,965	7,639	12,999
British Columbia	---	1,307	1,575	1,832	3,100
New Brunswick	196	1,428	1,498	1,521	1,962
Nova Scotia	93	927	1,291	1,350	1,367
Prince Edward Island	---	210	267	269	275

While the Canadian Pacific undoubtedly played a role in opening up the West, wheat boom railways clearly were the tenant in the symbiosis. The construction of branch lines certainly influenced the sequence and short-term pattern of settlement, providing as they did opportunities for construction employment and immediate access to shipping facilities. But the immigrants basically followed the lure of good - and not so good - land, fully expecting that traffic-hungry railways would follow settlement.

[43/] Vernon C. Fowke, The National Policy and the Wheat Economy (Toronto 1957), 117, 127. Cost of construction was about $6,000 for a 25,000 bushel country elevator.

The contrast between the 1890s and the first fifteen years of the new century is remarkable. Population density by 1901 closely paralleled the railways. Yet although the Canadian Pacific opened a line from Regina to Prince Albert in 1890, settlement had moved only thirty-five miles north of Regina, beyond which there were only three homesteads. In 1893 the Canadian Pacific had built a line from Moose Jaw to Portal on the border to capture American traffic to the Pacific. However, by 1901 every attempt to attract group or individual settlement had failed, and the track ran through virgin farmland, as the few settlers in the territories stayed clear of the dry belt of southwestern Saskatchewan. Ten years later the area had been transformed, as the growth of Swift Current revealed. In 1910 and 1911, for example, the Canadian Northern extended its line from Brandon to Radville, 100 miles north to Moose Jaw. Some settlement had preceded the railway and others paralleled or followed. By 1912, according to a Canadian Northern brochure, there were twelve towns along the 100-mile line.[44/] A few were little more than a loading platform and general store; most had one or two country elevators; three had banks and several had lumber yards and agricultural implement agents; five had more than 100 people; and Avonlea, the mid-way point, had four contractors as well as four implement warehouses, a bank, stores and a hotel. Most of the towns had come into existence in 1911 and had doubled in size in 1912.

[44/] Industrial and Business Opportunities in Western Canada Along The Line of the Canadian Northern Railway, 1913 ed.

While the railways did not bring the settlers, they unquestionably played a role. A Moose Jaw land agent reported in 1910-11, that a land rush had begun and immigrant trains were arriving almost daily: "With the assurance of railway facilities, the country south between here and the international boundary, is fast settling up."[45/] But the C.P.R.'s Moose Jaw-Portal line could not attract a homesteader in the 1890s.

While the description of railway construction has emphasized the east-west transcontinentals, the boom in railway development between 1900 and 1914 also coincided with the exploitation of the economic resources of the Canadian North, and of mineral and timber resources isolated from the older centres of settlement and transportation.[46/] The Canadian Pacific had made accessible the mineral deposits around Sudbury, known to geologists since mid-century but never tapped until construction crews bared the outcroppings and set off a wave of speculative claims-staking and ultimately the development of the properties. Between 1884 and 1892 the Quebec and Lake St. John had built from Quebec City to Chicoutimi, opening up new colonization lands along the route and accelerating exploitation of the forest resources. And in the early 1890s the Canadian Pacific began the counteroffensive for control of the rich mining areas in southern British Columbia, and by the end of the century had acquired the

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[45/] Arthur S. Morton, History of Prairie Settlement, (Toronto 1938), 144.

[46/] An excellent source on northern railway development and its effects is Morris Zaslow, The Opening of The Canadian North 1870-1914, (Toronto 1971).

Trail smelter and pushed the Crows Nest line from Lethbridge into the Kootenays. An entire region which previously had shown every sign of being permanently annexed to the American mining frontier was gradually, though not completely, acquired by Canadian interests.

After the turn of the century the penetration of the north was both more self-conscious and more widespread. Mackenzie's and Mann's Canadian Northern from Winnipeg to the Lakehead cut southeast to tap the rich timberlands and mineral deposits in the Lake of the Woods and Rainy River areas. From Sault Ste. Marie, F. H. Clergue, who was building a giant integrated forest-mining-manufacturing complex, sent his Algoma Central 77 miles north to his Helen iron mine, the first leg on its route to Hearst on the National Transcontinental.

The National Transcontinental was built as a northern line. From Quebec City it built to La Tuque on the upper St. Maurice (which had been penetrated earlier from Three Rivers north to Grand Mère by the St. Maurice railway), and then northwest through the wilderness of the shield - north of Rouyn, north of Lake Abitibi and north of Lake Nipigon to the prairies. Building of the line sparked forest industries, and in Abitibi the church and the Quebec government immediately launched major colonization schemes. By 1912 settlers were moving into Abitibi; by 1921 the population was more than 13,000 and Amos, La Sarre and Senneterre had emerged as respectable trading centres.

Ontario was even more ambitious and active in pursuing a policy of northern development. In 1902, in response to pressure from Toronto business interests and northerners, a harried Ontario government decided to build the Témiskaming and Northern Ontario from North Bay to Lake Témiskaming and beyond to open up the clay belt to agricultural settlement and expose the mineral riches of New Ontario. The line begun in 1902 might have helped the government win its election, but it certainly won for Toronto the mineral riches of Cobalt, when blasting crews uncovered veins of silver so rich they allegedly could be peeled from the rocks. Kirkland, Timmins and Porcupine followed. The stock-brokers' special immediately paid its way, and "on a winter evening about eight o'clock" the citizens of Stephen Leacock's Mariposa saw "the long row of Pullmans and diners of the nightly express going north to the mining country, the windows flashing with brilliant light, and within them a vista of cut glass and snow-white table linen, smiling negroes and millionaires with napkins at their chins whirling past in a driving snowstorm."[47] By 1908 the T. & N.O. had reached Cochrane, where it met the National Transcontinental, and the provincial government was investing heavily in colonization roads along the National Transcontinental from the Quebec border to Hearst and employing 4,000-5,000 men in 1913 and 1914. The railways not only sparked mining and agriculture, but also made possible the development of forest and pulp and paper industries. By 1911 the census division of Témiskaming had a

[47] Stephen Leacock, Sunshine Sketches of a Little Town, (Toronto 1960), 4.

population of 37,000, a more than tenfold increase since the turn of the century. Due in part to the Canadian Pacific, the population of northern Ontario had reached 100,000 in 1901. By 1911 it was 219,000 and, despite the war, 267,000 in 1921.

British Columbia had its dream of northern expansion. In 1912 Sir Richard McBride, who already had negotiated entry of the G.T.P. and the Canadian Northern, responded to Vancouver's imperialism and the general boom feeling by deciding to build the Pacific Great Eastern from Vancouver through the Caribou to Prince George, and ultimately to the Peace River territory and Alaska. The complicated arrangements with the Grand Trunk Pacific and the Great Eastern in Britain were secondary to the $20 million bond guarantee, which enabled the first $7.5 million to be easily oversubscribed in London. By 1917 the entire proceeds of $20 million in bonds had been spent by Foley, Welch & Stewart, but the track ran only the 176 miles from Squamish to Chasm and a few miles north from Quesnel and south from Prince George. With the company unable either to complete the line or run it, partly because the war had prevented the settlement of the land and the sale of townsites and more particularly because of corruption, a reluctant government took over the loan. After the war the government finished the 378 miles to Quesnel. But for a generation the P.G.E. - variously described as the Past God's Endurance or the Prince George Eventually - remained an embarrassement and a burden to successive provincial governments, whose efforts to unload a railway that began and ended nowhere on the Canadian

Pacific or the federal government were fruitless.[48/]

Alberta too had its dreams, and Edmonton watched anxiously as British Columbia and Saskatchewan chartered lines to tap the Peace River and the territories. None of the lines materialized, however, although by 1910 the 3,000 settlers in the Peace River district were demanding a railway and oil had been found near Fort McMurray on the Athabasca. Ultimately two companies, their bonds guaranteed by the Alberta government, headed north and northwest from Edmonton. Winnipeg contractor J. Duncan McArthur's Edmonton, Dunvegan and British Columbia reached the Athabasca (near Smith), in 1914 and then "month after month with its ties dunking in the muskeg the railway wound its way along the eighty miles of Lesser Slave Lake until leaving its west end.... it reached Peace River Crossing in 1916."[49/] By then there were 10,000 settlers in the Peace River district. The Alberta Great Waterways ran straight north, but within a year of its beginning the company defaulted. McArthur took over construction, and by 1914 had reached Lac La Biche, the end of cultivable land. By 1921 the line had moved another 175 miles through muskeg to the Athabasca near Fort McMurray. By 1921, however, the government was forced to take over both lines, and in 1929 sold them both to the Canadian Pacific and Canadian National jointly as the Northern Alberta Railways. However inglorious their political history, the railways

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[48/] On the P.G.E. see Margaret Ormsby, British Columbia: A History, (Toronto 1958), and Martin Robin, The Rush for Spoils: The Company Province 1871-1933, (Toronto 1972)

[49/] James G. MacGregor, A History of Alberta, (Edmonton 1972), 205-06.

to the Peace River and Athabasca had linked the Arctic waterways to the railway network of a country and continent.

THE LAST HALF-CENTURY

In the history books, this chapter in railway history is pictured as the hangover following the excesses of the boom years, as the country grimly sought to realize what it could by the nationalization of the two new transcontinentals and the creation of the Canadian National. However, $1 billion was spent in new construction between 1915 and 1930, and of the gross construction outlays in transportation between 1926 and 1930 the railways were responsible for 55.5 per cent, compared with the 24.6 per cent spent on highways. And despite the staggering development of the automobile industry railways were responsible for 47.6 per cent of the gross investment for construction and equipment between 1926 and 1930, while the automobile and its highways accounted for only 41.1 per cent.[1/]

The bulk of railway building in the 1920s continued to be on the prairies. Between 1917 and 1939 eastern Canada actually lost mileage, while more than 4,700 miles of new track were laid in the West. In addition to branch line extension and a substantial programme of repair and replacement construction, pre-war ventures were brought to a completion. The extension of the P.G.E. to Quesnel and the northern Alberta lines in the 1920s was a completion of the

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[1/] Buckley, Capital formation, 31-32.

ambitious undertakings of the pre-war boom years. Ontario also picked up where it left off before the war, and in 1921 began the extension of the T. & N.O. to James Bay. In 1921 a 60-mile extension facilitated the Abitibi hydro-electric project, and by 1932 trains arrived at Moosonee.

To the Bay

But the T. & N.O.'s Polar Bear express, a mixed train from Cochrane to Moosonee, was not the first railway whose whistle broke the stillness of Hudson Bay. That distinction goes to the Hudson Bay Railway, whose glorious political history runs back to 1880, when the first line to build to the bay was incorporated. By 1899 the charter was in the hands of Mackenzie and Mann, who seven years later actually began construction and by 1908 had reached The Pas and wisely decided to go no further. But the Laurier government was more responsive to the demands of western farmers for a road to the bay which theoretically, would cut down freight rates on European-bound grain and destroy the monopoly of the Canadian Pacific. Bidding for farmer support during the election of 1908, Laurier announced that surveyors were in the field and the Bay railway was assurred. Not to be outdone, Robert Borden replied that the Tories had been committed to the Bay railway since 1895.

The election over, little was done except to study the relative merits of Nelson and the future Churchill as an ocean terminus.

With the government's capacity for making wrong decisions, the tortuous Nelson harbour was selected. But with the election of 1911 approaching, Laurier announced after a western trip that a contract for the first 106 miles had been let to J. D. McArthur of Winnipeg. The victorious Conservatives immediately stopped work on the road, but under western pressure relented. By the end of the 1914 construction season, track had been laid to Mile 214 and grading had reached Mile 332, only 92 miles from Nelson.[2/]

First the war and then the unstable politics of the 1920s stopped all work on the Bay railway, and slowly the line was reclaimed by the wilderness. Only the fortnightly Muskeg Special to Mile 214 broke the northern silence. But to the trappers and the prospectors opening up Flin Flon, Sherridon and points north, the Muskeg Special was a blessing. However, in 1924 westeners formed the On to the Bay Association and the farm block - their fears about King's tariff policy allayed - turned to the railway. In 1926 King promised to complete the line.

Wisely, the government finally settled on Churchill as the terminus, and in the winter of 1927-28 sent Major J. Leslie Charles with a party of twenty-five men and sixty dog sleds to locate the new line. In four months the blueprint was complete. The following summer the construction crew moved in. Under the direction of Canadian National engineer Claude Johnson, 3,000 men, "mostly Swedes,

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[2/] See Zaslow, Opening of the Canadian North, 218-222. W. L. Morton, Manitoba a History. (Toronto 1957).

Russians, Belgians, and Finns" fought the muskeg to within 60 miles of Churchill. At the end of the summer construction season the engineers decided to gamble that winter could be an ally. With both the gravel pits and the muskeg frozen hard, the engineers decided to lay the rails on the frozen surface, and leave the ballasting till summer. In railway annals the Bay became the only major railway without a roadbed. But the job was done, and on April 3, 1929, the last spike was driven.

That day Claude Johnson related tales of men drowning in the freezing white waters of the Nelson, of endless days wading in the mire, of track disappearing in the muskeg, of men on advance parties freezing to death, and of the few days he was lost in the northern wilderness. "Next fall folks will be able to take a sleeping car to the Arctic Circle," he said. "But I doubt if there was ever a construction job that called for more guts in the winning through."[3/] And almost as much guts was involved in dredging the harbour, building a city on a foundation reclaimed from the sea by dumping hundreds of thousands of tons of gravel to create a new shoreline, and going deep into the water to find footings not frozen year round for the piles on which the enormous grain elevator was built. But the West had its road to the bay.

The '20s brought to an end the dynamic phase of railway building

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3/

in Canada. During the 1930s there was no new construction, and when new construction began again after 1945 it was totally different in kind, scale and impact.

Rails to resources

Beattyville and Bruce Lake, Schefferville and Chibougamau, Lynn Lake and Thompson, Pine Point and Fort Nelson - new names, new towns on the northern extensions of the Canadian railway map. While public attention has focused on the conflict between political interests and economic rationalization in southern Canada, more than 3,000 miles of new track has penetrated the Canadian north since 1945. With one notable exception, the new lines were built not for general developmental purposes but for a specific enterprise. A. V. Johnston, chief engineer for Canadian National, in 1964 summarized the nature of post-war railway construction:

> With such vast unpopulated distances, it may come as a surprise to learn that practically no railroads are being built today for the primary purpose of opening up the country for settlement. With the rapid development of both motor vehicles and roads it is not very long, after the country has been opened up and communities have formed, before they are interconnected with good roads, often paved. Practically all new-development railway lines built by Canadian National since 1945 have either been paralleled by a highway shortly after they have been finished, or in some cases, the highway was there first. Obviously the Railway is then left to haul the wheat, the pulpwood, the iron ore, and the coal, while the higher class traffic moves by truck on the highway. However, new railway branch lines have been built, since 1945, to make possible the exploitation of natural resources, more particularly mineral resources. In building these lines the Railway, in effect, acted as a partner of one or more large industries, in the development of the country. While it takes

> the position that it is ready to share the risks inherent in a new enterprise, it does require the fulfilment of certain conditions by the industry, and the establishment of a minimum measure of protection. 4/

While many lines were built by the companies themselves, about half have been constructed by the Canadian National. Johnston described the procedure and considerations involved in the decision to construct a resource railway.

> In the negotiations with a corporation which applies for a branch line to serve a new development, the Railway requires full disclosure of all the pertinent factors and information. It must be satisfied that raw materials are present in sufficient quantity to support operations over a long period, that markets are available, that the corporation has the ability to carry out definite plans for production by a specified date, and that at the designed scale of production, the project is likely to be profitable.
>
> To qualify for rail service, the development must be of such a scope that, should it succeed, it will generate sufficient traffic at stipulated freight rates to cover railway costs of operation and maintenance, to service the capital investment in the branch line, and to leave a satisfactory residue as a contribution to overhead and profit.
>
> When it has been concluded that the project can reasonably be expected to benefit both the corporation and the Railway, it is the usual practice to negotiate a traffic-guarantee agreement with the corporation. In this agreement, the Railway undertakes to obtain the necessary authority from the Federal Government to construct and operate the branch line in question, and the corporation, subject to construction of the line,

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4/ A. V. Johnston, "Some Economic and Engineering Aspects of the Construction of New Railway Lines in Northern Canada, with particular reference to the Great Slave Lake Railway," Speech from Canadian National Library dated 1964.

> commits itself to ship a specified minimum tonnage per year, for a specified period of years, outbound over the new line, and over existing lines, as far as the latter may extend towards destination, and to pay a stipulated penalty if the annual shipments fall below this minimum tonnage. 5/

The location and nature of the new lines can be seen in the following summary prepared by Canadian National of lines more than 6 miles long built between 1949 and 1969.

5/ *Ibid.*

NEW LINES 1949-1969

	DATE OPENED	MILEAGE	CAPITAL COST ($ Million)	DEVELOPMENT	CAPITAL INVESTMENT ($ Million)
CANADIAN NATIONAL [6/]					
Barraute - Beattyville	1949	39.2	1.1	Beattie-Duquesne Mines Limited	1
Sherridon - Lynn Lake	1953	143.9	17.0	Sherritt Gordon Mines Limited	45
Terrace - Kitimat	1955	46.0	11.0	Alcan Aluminum	600
Hillsport - Manitouwadge	1955	25.8	2.6	Geco	20
Sipiwesk - Thompson	1957	30.7	4.4	International Nickel	175
Beattyville - Chibougamau	1957	156.1	18.5	Campbell Chibougamau Copper Rand	25
Bartibog - Heath Steele	1957	23.1	2.4	Heath Steele	12
St. Felicien - Cache Lake	1959	131.1	17.0	Howard K. Smith Lumber Company	10
Optic Lake - Chisel Lake	1960	51.0	6.0	Hudson Bay Mining and Smelting	10
Chisel Lake - Stall Lake	1964	8.0	1.0	Hudson Bay Mining and Smelting	5
Stall Lake - Osborne	1968	12.0	2.8	Hudson Bay Mining and Smelting	5
Franquet - Matagami	1963	61.3	8.2	Matagami Mines	25
Nepisiguit - Brunswick Mining	1964	14.7	1.0	Brunswick Mining and Smelting	60
Whitecourt - Windfall	1964	23.2	2.4	Texas Gulf Sulphur	20
Sarnia - Sombra	1966	12.0	.8	C.I.L.	50
Great Slave Lake Railway	1966	430.0	75.0	Pine Point Mines - Cominco	35
Watrous - Guernsey	1968	18.0	2.0	Alwinsal Potash	60
Amesdale - Bruce Lake	1968	68.0	16.0	Griffith Mines	70
Fort Saskatchewan - Redwater	1969	12.0	2.6	Imperial Oil	50
Alberta Resources Railway	1969	230.0	100.0	McIntyre Mines Grand Prairie Pulp	40 50
Windfall Extension	1969	60.0	12.0	Pan American Petroleum Hudson's Bay Oil and Gas Hudson's Bay Oil and Gas Chevron Standard	13 25 20 40
CANADIAN NATIONAL TOTAL		1,598.1	305.8		1,466
CANADIAN PACIFIC [7/]					
Havelock - Nephton	1955	17.0	1.3	American Nepheline	--
Struthers - Manitouwadge	1954	40.0	3.8	Geco Mine	20
Brockett - Drywood	1955	21.4	1.2	Gulf Oil	
Brockett - Pectin	1961	10.8	.9	Shell Oil	
Bradenbury - Yarbo	1962	16.0	.7	International Minerals	60
Rimbey - Homeglen	1962	8.2	1.5		
Falconbridge Spur	1967		1.1	Falconbridge	
Neudorf Sub - Sylvitie	1968		1.4	Sylvite Potash	
Vanscoy - Cominco	1969	10.0		Cominco	63
(Sparwood - Fording	1969-71		10.5	Fording Coal Fields)	
OTHER					
Cartier Railway Company	1960	190.3	50.0	Quebec Cartier Mining Company	300
Pacific Great Eastern		443.0	108.5		
Quebec, North Shore and Labrador Railway	1954	357.0	127.0	Iron Ore Company of Canada	700
Romaine River Railway (Q.I. & T. Co.)		30.0	7.7	Quebec Iron and Titanium	50
Wabush Lake Railway		42.0	10.0	Wabush Mines	300
TOTAL CANADIAN PACIFIC - OTHER		1,185.7	325.6		1,493

6/ Information received from Canadian National Railways. Figures for C.N. lines are approximate.

7/ Canadian National information corrected with information supplied by Canadian Pacific, April 1974. Since 1969 the Canadian Pacific has built a $10.5 million line from Sparwood to Fording to serve the Fording, B.C. coal mines.

The one notable exception of the rails to specific resources was the Pacific Great Eastern, known since 1972 as the British Columbia Railway. By 1953 the "Prince George Eventually" finally arrived in Prince George, and three years later the southern end reached Vancouver. The completion of the original line was only the beginning, however, for the expected demand for northern resources, particularly if they were to be controlled from the Pacific, necessitated continued expansion into the rich forest and mineral and gas deposits of the northern interior. By 1958 the main line had been pushed north to Fort St. John and a branch built west from Chetwynd to Dawson Creek. The first leg of the north-western line from Prince George was completed to Fort St. James in 1968, and by mid-'73 more than 125 miles of track had been laid on the 450-mile line to Dease Lake scheduled for completion in 1975. Meanwhile, in 1971 the 250-mile link to Fort Nelson, 150 miles from the northern border, was finished.

The British Columbia Railway was not being pushed into an unknown wilderness, for northern British Columbia had been scoured for natural resources since the days of the gold rushes and Collins Overland in the 1860s, the Klondyke rush in the '90s, the construction of the Grand Trunk Pacific and, a generation later, of the Alaska Highway. But it was a territory whose resources could not be effectively exploited until the post-war demands for cheap bulk transportation made them marketable. The economic development of the area has been phenomenal in the post-war period, particularly since the mid-50s. Prince George, the hub of the northern development, had a population of 2,000 in 1941, despite its location on the Canadian National, and only 4,700 in 1951. But ten years later the population had jumped to 13,900, and by 1971 to 32,800. Fort St. John increased from 900 in 1951 to 3,600 and 8,200 ten and twenty years later. Fort Nelson increased from 950 in 1966 to 2,300 five years later, when the railway was completed. Capital investment in sawmills, pulp and paper mills, mines, hydro-electric power, industrial parks and urban development could be measured only in the billions.

The railway itself, as both cause and effect, finally could look its sad history in the face. Car loadings increased from a pitiful 5,000 in 1845 to 26,000 in 1953, when the line to Prince George had been completed, to 58,000 in 1960 and more than 150,000 by 1973. The freight carried increased five times between 1960 and 1973. Railway rolling stock kept pace, by 1972 numbering 82 diesels and 4,000 freight cars. In 1973 the company planned to add 18 diesels and 1,600 cars, and announced plans to build a $4.8 million car manufacturing plant at Squamish with an output of 800-1,000 cars annually.

The Triumph of machines

None of the northern railways was an easy construction task; even with the sophisticated equipment of the '50s and '60s. The age old enemies, rock and muskeg, river and lake, continued to battle surveyors and engineers. At the same time the roadbeds had to be far superior, for most routes had to carry 100 car trains bearing enormous weights and Onderdonk's curves and grades and the Bay's floating roadbed were not adequate. But the attack on nature took on a pathetic unevenness as giant bulldozers and diesel-powered shovels replaced picks, shovels, and scrapers. Winter created roads for freight trains hauled by tractors that could both service construction camps in advance of steel, and, as in the case of Lynn Lake, move entire towns hundreds of miles north in advance of the steel. Engineers still avoided the treacherous muskeg whenever possible, but by the 1960s soil engineers studied and bored until the muskeg no longer performed its customary tricks.[8/]

The airplane also became a major ally of the railway builder. In the early '50s aircraft were used for general reconnaissance, and by the 1960s aerial photography had become an essential ally of those responsible for locating the line, and even for the actual surveyors. Equally important, the airplane became an ally of the construction

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[8/] On the Great Slave Lake Railway, for example, a power auger mounted on a muskeg tractor made borings one to twelve feet deep every 1,000 to 10,000 feet. The findings were used to locate foundations for bridges and to determine the best location of the line. When one 30-foot fill had to be built over muskeg and soft organic silts the engineer had allies: "Piezometers and settlement gages were installed at various depths to provide important information on poor water pressures and rates of settlement as the work of building the fill proceeded. Slope indicators also were in constant use to gage the magnitude and direction of movements under the fill during its consolidation." C. M. Burpee, "Soils Engineers and Tracklaying Machine Build Spur Line in the Far North," Wood Preserving, (June 1970), 8-14.

force, most spectacularly on the construction of the Quebec, North Shore and Labrador railway.

In 1948, after the multi-national Iron Ore Comapny of Canada decided to exploit the rich iron ore deposits, the Quebec, North Shore and Labrador Railway was incorporated to build and operate the line from the St. Lawrence at Sept Iles to Schefferville, 360 miles north. Contracts for the $120 million line were given to a consortium Cartier of Montreal, McNamara of Toronto, Mannix of Calgary, and Morrison-Knudsen, an international heavy construction giant from Boise, Idaho.

The physical obstacles were less than the Rockies, north of Superior, or even the Bay. But the first hundred miles ran through steadily climbing country, before the Shield was penetrated and the terrain flattened. Initially the contractors planned to cut a road through to Knob Lake and truck in the heavy equipment and supplies. But speed was essential, and the contractors estimated a year could be saved by airlifting men and supplies to construction camps along the site. A string of landing strips was cut out of the bush along the survey, and Hollinger Ungava Transport, a subsidiary, overnight became the largest bush pilot operation in history. The twenty aircraft carried giant bulldozers and steam shovels, enough 25-foot logs for an entire dam, and steel for bridges and culverts. In the first nine months of 1953, the airline carried 138,000 passengers and 15 million miles of freight. Construction started in the fall of 1950 and the steel reached Schefferville in February 1954, eighteen months ahead of the original schedule.[9/]

The use of soil engineering, heavy construction equipment, and aircraft considerably eased the work of railway construction. Track-laying also was improved. There had been some mechanization between the construction of the C.P.R. and the railways after the turn of the century, but tracklaying had remained much the same from 1900 until the second war. Rapid improvements occurred even between the construction of the Lynn Lake line in the early '50s and the Great Slave Lake Railway in the mid-'60s. By then the unit comprised "a travelling crane powered by a diesel engine, an electric generator and air compressor to run the conveyors, impact wrenches and spike drivers.... The sleepers were brought forward by conveyors to the front of the Pioneer and placed in position on the sub-grade. The rails were moved ahead from the flat cars via the travelling crane on an overhead monorail and lowered on the sleepers. In winter, one normal shift of 50 men laid one mile of track, and, in summer, they could lay up to 1½ to 2 miles."[10/]

Yet the tracklayer still was tied to the track. All grading and bridges had to be complete before track could be laid, and workers enjoyed the competitive spectacle that provided some relief since the days Langdon's and Shepard's crews chased themselves across the

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[9/] See B. M. Monaghan, "The Location and Construction of the Quebec, North Shore and Labrador Railway," The Engineering Journal, (July 1954), 820-828.

[10/] Railway Gazette, August 6, 1965.

prairies. To prevent costly delays when bridges were not finished and to cut down on heavy labour costs, the C.N. determined to examine the feasibility of a portable tracklayer that could operate on the subgrade. C.N. engineers worked for several months in the winter of 1966-67 on a prototype, and Kleysen's Cartage of Fort Whyte, Manitoba, later built the Panelmaster to their specifications. Used on most Canadian National lines after 1967, the Panelmaster needed only 15 men to lay almost two miles a day.

> The panelmaster consists of a truck power unit, weighing 35 tons, having three transmissions to provide a multispeed variation ranging from less than one-tenth of a mile an hour, when constructing track, to 40 mph when traveling on the highway. The power unit tows a trailer on which the track is assembled. An eight-ton hydraulic crane with a telescopic boom is mounted at the rear of the truck. It lifts lengths of rails from the roadbed to a roller incline on each side of the machine. The rails move to the trailer on their own momentum, with the distance between rollers equal to standard track gauge. The crane also lifts tie bundles and other track material from the ground to storage bins on the trailer. The latter unit weighs about 18 tons and carries about eight tons of track material when working. Combined length of the outfit is 105 ft.
>
> The trailer unit has an automatic tie-inserter which injects ties into the jig so that they are equally spaced. When the rail is introduced from the incline, it is maintained at exact gauge. A hydraulic spiker and other power tools necessary for the rapid assembly of the rail, ties and fastenings, are mounted on the trailer.
>
> As the outfit moves along the sub-grade, it is said to be capable of turning out about a mile and three-quarters of completed track per day. A requirement is that all material be distributed

> along the grade in advance of the operation and pre-ballasting carried out prior to the distribution of the material and assembling of the track. 11/

Yet, despite new technology, railway construction and maintenance still demanded manual labour, and in the 1960s as in the 1880s and 1900s, Canadians were reluctant to work on the railroad. Construction crews, extra gangs for repair and replacement, and regularly employed sectionmen and trackmen still were heavily composed of pre-war and post-war immigrants.[12/] An employee on the Great Slave Lake railway reported that his gang was completely Portuguese and the only other Canadian was the head foreman, a 75-year-old Ukrainian Canadian who had worked on railway construction for the Canadian National for 44 years.[13/] The construction and repair crews, Jones stated, were recruited by Ralph F. Welch, who until 1957 had agents in Portugal and Italy but then found that the natural flow of immigration was adequate.

The Welch firm provides an interesting and appropriate link with the past, and an appropriate conclusion to a survey of railway construction in Canada. In 1878, 20-year-old Vincenzo Veltri arrived in the United States and worked on railway construction in both the United States and Canada before permanently settling in Canada some

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[11/]"Tracklaying 'Panelmaster' Speeds the Work, Cuts Labour Costs," Railway Track and Structures, (June 1970), 24-25.

[12/]Warren E. Kalbach, The Impact of Immigration on Canada's Population, 1961 Census Monograph, (D.B.S., Ottawa 1970).

[13/]Trevor Jones, "Great Slave Lake Railway - They Couldn't Have Picked a Better Name," Last Post, I, No. 1, (December 1969), 32-38.

time after 1885. In that year he was joined in the United States by his brother, Giovanni, and at some point the brothers became railway sub-contractors in Canada, providing labour and horses for both railway and mine construction. Giovanni described his career as a railwayman after his arrival in North America:

> From New York I went to Montana, where my brother Vincent was working as a foreman for Messrs. Keefer and Larson.... It was then that I started to learn the hard and dangerous trade of railroad building.
>
> During my not-so-short residence in the U.S.A. and Canada starting from labourer, I reached the position of a large contractor possessing and directing the enterprises with hundreds of labourers and hundreds of horses. If I am permitted a comparison, I could say that also Herbert Hoover started off as a labourer and attained the position of president of the United States. Those miraculous changes are frequent in the land of freedom, the North American Continent.
>
> The Italian government in acknowledgement of my deeds conferred to me the Cross of Chevalier of the Crown of Italy. Naturally my career has not always been adorned with roses. I suffered failure and delusions, have crossed danger and happiness.
>
> Many times I have been in danger of blowing up to the sky because of a sudden explosion in a mine. Many times I lost myself in the bushes with the danger of the cold and of being devoured by bears and wolves; how many times have I been on the edge of drowning in a lake or river. In one of my short appearances in Italy I had brought with me my first son, Raffaele. In 1913, I had the misfortune of losing my brother Vincent, who had been my master and guide, and then my associate and co-manager in the works....
>
> In 1931, we decided to return to Italy. My son, Raffaele, who remained in Canada, is continuing our construction business. From Italy,

> I have sent him thousands of workers with the help in this enterprise of my son, Vincent. 14/

Raffaele (Ralph) was born in Italy in 1894, but arrived in Winnipeg in 1904 and completed his schooling. In company with his father he started the R. F. Welch (English for Vestri) Company in 1918, a company explicitly established to provide labour gangs for the railways. The Welch RLFL Ltd., railroad builders, still are in business.

14/ A. V. Spada, The Italians in Canada, (Montreal 1969), 77-79.

H I G H W A Y S

HIGHWAYS

The wise construction company would have taken one look at Henry Ford's Model T and immediately added SPECIALISTS IN ROADS AND HIGHWAYS. Highway construction has been another multi-billion dollar business since the end of the First World War. Construction of highways, roads and bridges has cost an estimated $12 billion, and urban roads perhaps another $5 billion. Canadians have spent easily more than $20 billion on construction and repair to accommodate the automobile and the truck in the years since 1919.

The growth of the highway system was slow, and not until the 1930s did the outlay on road construction exceed that on railways. Between 1919 and 1945, only $1.1 billion was spent on new construction, and from the end of the Second War to 1959 another $3.5 billion. But in the 1960s more than $7 billion was poured into highway-expressway construction and $1.5 billion on urban streets, and annual expenditures now approach $1 billion a year. Unless public policy changes or energy shortages dictate the demise of the automobile that pattern of construction expenditure will continue.

The total highway mileage in the country has changed very little since 1919, increasing only from about 400,000 to about 500,000 miles. But what once was the classic Canadian road - unsurfaced earth - became gravel, and then hard surface. In 1919 there were less than 1,000 miles of hard surfaced road across

Canada. By the end of the '20s, there were 4,000 miles of hard-surfaced road, and gravel roads had increased from 34,000 miles in 1922 to 71,000 in 1930. By 1968, of 476,603 miles of roads, 72,500 were paved and 267,000 gravelled. The rest were earth - improved and otherwise. Urban streets by 1968 had 32,000 miles of paved roads (rigid and flexible), 14,150 of gravel, and 1,958 of earth.[1/]

While the statistics are impressive, Canadian road-building never has achieved the eminence of railways or dams in the annals of Canadian construction. No company boasts of its highway accomplishments, no glamour attaches to the engineer, and no bravado marks the highway construction worker. There are, of course, good reasons for this. When serious highway construction began technology was so far advanced that the problems were readily surmountable, however costly. Contractors building the Trans-Canada Highway through the Rockies had more to work with than primitive drills, mule trains and Chinese coolies. And the automobile was far readier to accept steep grades and sharp curves than the locomotive.

Nevertheless, geography has posed serious problems for engineer and contractor, for muskeg is muskeg and mountains are mountains. More important, it has posed problems for the taxpayer. Expenditure in Canadian roads is enormous for both construction and maintenance. Snow removal, rock slides, ice and frost account for millions of

[1/] Figures from Dominion Bureau of Statistics, Public Finance and Transportation Division, (Ottawa). In particular see The Highway and The Motor Vehicle in Canada 1937, (Ottawa 1939), and Road and Street Mileage and Expenditure 1968, (Ottawa 1970).

dollars a year which in milder climates could go into new highway construction or housing, or even stay in the taxpayers' pocket. On a per capita basis, Canada's highway system - like its railway network - must be among the most costly in the world.

Colonial Roads

The roads in Confederation Canada might have been the worst in the world. They had fought a long and losing battle with the rivers and lakes; they had been trampled almost to death by the railroad; and they had become the orphan of the politicians. The Indians were the first Canadian roadbuilders, or at least surveyors, and Indian portages and trails between rivers and lakes often became the modern highway. For years roads remained for the white settlers what they had been for the Indians, a supplement of the water routes. In the French period the St. Lawrence was central, "le chemin qui marche," and the roads were local phenomena, necessary only when the population density pressed the colonists away from the river. Sometimes for political or military reasons roads took on a non-commercial or social importance. The Temiscouta Portage or French path, an Indian trail linking rivers and lakes between Quebec City and Fredericton, was improved by the French officials to connect Quebec City with the sea during the winter. The north shore road between Quebec and Montreal, built between 1708 and 1735, was designed to give the government and military a route not dependent upon the vagaries of winds or weather. The same reasons apparently prompted the 1739 road from Montreal to Saint Jean via Chambly.

By the turn of the nineteenth century, the growth of settlement was making roads a more necessary part of the colonial equipment, even though the water systems often were the route colonization followed. The arrival of Loyalists and later immigrants necessitated road connections with the Eastern Townships to orient them towards the British colony rather than the state of Vermont. Pressure mounted for more roads, as merchants often associated poor roads with economic stagnation, but was caught up in the conflict between trade and agriculture, French and English, fear of taxes, and the debate over the canal and road cost-benefit analysis. The priority became canals, and the road remained tributary to the improved "chemin qui marche."

The story in Upper Canada was much the same. There too the first settlers gathered along the banks of the river, but the settlement pattern more quickly moved back from the water. In the first parliament of the new colony of Upper Canada, responsibility for the roads was placed in the hands of local authorities, particularly the justices of the peace, a system which "kept the roads of this province a disgrace to civilization for a century," observed Simcoe's biographer. The first major roads were military roads. By 1795 a road linked Kingston to Montreal, and by 1801 a right-of-way through the forest extended west from Kingston to Toronto and on to Ancaster, near Hamilton. By 1830 it was possible to travel overland from

Halifax to Amherstberg in Upper Canada, and Quebec-Montreal, Montreal-Kingston and Kingston-Toronto had regular stage services.

Local roads were left in the hands of local officials in both the Canadas. The assemblies did vote some funds for local roads, but the achievement was hardly worth the expenditure, and the small sums voted quickly established the pattern of highway building as a political reward. In Nova Scotia, for example, a variety of methods were used to finance road building, including a state coal monopoly, taxes on taverns, special lotteries and land taxes. Not until the 1870s were government funds voted for specific roads. The Grand Voyer in Lower Canada, or local officials elected to assume his responsibilities after 1832, or the local officials and the justices of the peace in the upper colony, were hopeless instruments for either local or regional road-building. Local taxpayers were willing to demand roads from the legislature, but unwilling to see local assessments or even to perform their own annual service on the roads, and local officials found it difficult to press their friends very hard.[2/]

Following the Union, Lord Sydenham planned to use some of the Imperial grant for public works to aid road construction, although most wound up in improvements to the canal and harbour system. There were significant improvements in the main trunk roads, however, and the carriage traffic along the north shore of the St. Lawrence and Lake Ontario and from Toronto and Montreal to the major centres

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[2/] Statute labour began with the French Canadian corvée. In Upper Canada one of the first statutes stipulated that the construction and maintenance of roads, bridges and fences and snow removal during the winter were the responsibility of the local inhabitants. The settler was forced to spend twelve days a year on the roads and provide his own equipment, while the owner of a team of horses and a wagon had to provide them and a driver for six days a year. Commutation was allowed in the Act of 1793 at the rate of three shillings for personal service and six shillings for a wagon and team. Local overseers were responsible, and they in turn were supervised by the Justices of the Peace. Statute labour was always difficult to enforce, and became less and less important, particularly after the advent of the Turnpike Trusts and increasing state involvements. Between 1890 and 1900, however, apparently one million man days of statute labour was performed on Ontario roads, an estimated 60 per cent of the total work done. In 1890 Malden in Essex abolished statute labour, and others soon followed or provided general commutation. (W. J. Fulton, "Dark Ages of the Road 1850-1890," Papers of A. W. Campbell, Department of Highways of Ontario Library, Downsview, Ontario.) In 1900 Ontario abolished statute labour and a year later with the Highways Improvement Act, one million dollars was provided by the provincial government. In 1915 when the Department of Highways was established in Nova Scotia, according to Guillet statute labour was appropriately called, "doin' a little sodin." (Edwin C. Guillet, The Story of Canadian Roads, Toronto 1968, 30.) In Quebec, Hamelin and Roby state that the corvée was not commutable. As late as 1899-1900 the report of the commissaire de l'Agriculture said of the corvée: "C'est à qui fera le moins de travail. On discute sur le chemin les questions du jour, et quand le soleil devient chaud, on recherche les places ombragées, enfin on arrive en retard sur le chemin pour commencer le travail." (Jean Hamelin and Yves Roby, Histoire Economique du Quebec 1851-1896, Montreal 1971, 148.)

was passable. Local roads continued to be an abomination. The major activity of the government after 1841, moreover, seemed to be to turn over the good roads to private enterprise. The Act of 1846, for example, listed seven roads, title to which was vested in the Crown. Most of these were toll roads and the department of public works farmed out the task of collecting the tolls, and presumably keeping the road in shape, to private contractors. Other "productive roads" it attempted to sell back to local authorities or private companies. In 1853 the department happily announced that all these roads had been sold, but unhappily they kept coming back into the hands of the department.[3/]

The earliest roads were little more than blazed right-of-ways, with some of the timber cleared but with the stumps annually sprouting new growths. Stump-pulling was not a labour of love, and there is some evidence that by 1800 York drunks were assigned to stump removal on Yonge Street.[4/] As settlement and wagon traffic increased, the roads were widened. But the only sure foundation came with winter, when the ice and snow bridged the rivers and swamps and covered logs and stumps. In Upper Canada each farmer along the road was responsible for marking the path with boughs, so that the midnight reveller could make his way home safely.

[3/] J. E. Hodgetts, Pioneer Public Service; An Administrative History of the United Canadas, 1841-1867. (Toronto 1955), 180-181

[4/] Guillet, Canadian Roads, 119.

The first improvement on the stump-ridden road came when "engineers" decided to use the timber to secure the foundation. Named after the material with which young boys were britched, the corduroy road was formed of logs nine inches and over in diameter and laid side by side, the sizeable gaps filled with dirt or gravel. As settlement grew, the logs were split and placed as close together as possible. But the corduroy road remained a travellers' nightmare:

> The road was scarcely passable; there were no longer cheerful farms and clearings, but the dark pine forest, and the rank swamp, crossed by those terrific corduroy paths.... and deep holes and pools of rotted vegetable matter, mixed with water.... I set my teeth, screwed myself to the seat, and commended myself to heaven....
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> We often sank into holes above the axle tree. A wheel here and there, or broken shaft lying by the way-side, told of former wrecks and disasters.... My hands were swelled and blistered by continually grasping with all my strength an iron bar in front of my vehicle, to prevent myself from being flung out, and my limbs ached woefully. 5/

It was a short step from the corduroy road to the plank road, which appeared to be less expensive than either the graded and gravelled or macadamized roads that were within the alternatives open to the colonies in the 1830s. Wood was inexpensive and readily available until the forests were cleared, whereas other road building surfaces were not, and the road need not always lie on a

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5/ Anna Jameson, Winter Studies and Summer Rambles in Canada, (London 1838), 119, 222-23.

graded surface. The plank road consisted of three-to-four-inch planks laid tightly against one another and nailed at right angles to stringers that sometimes were embedded in charcoal to prevent them from rotting too rapidly. A fine covering of sand, sometimes reinforced by tar or hot pitch, was added to reduce wear from the hooves, soak up light rains, and prevent seepage and rotting.[6/]

Grades were a problem, and it was costly to reduce hills to the desirable gradient of one foot in 20. On hills steeper than one in 16, the wear and tear on the plank roads doubled, and the builders had to weigh the cost of construction against the cost of maintenance. Maintenance was extremely costly. When there was little traffic the planks warped and rotted; when there was considerable the hooves and wagon wheels ultimately wore through the planks. Gradually the plank roads were replaced or fell into disuse, but in their heyday it was claimed that a stage could travel at an average of eight miles an hour on the plank roads and a team could pull a heavy load 30 to 35 miles a day without undue strain.[7/]

An early improvement over the corduroy road and ultimately the staple of colonial and post-Confederation road building was the graded or common road. Now known as improved earth or, up a category, gravel, the road was ditched and crowned about 13 inches above the ditch to shed water. According to Thomas Ray, one of the

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[6/] See Guillet, Canadian Roads, 68-69.

[7/] Ibid.

few engineers in Upper Canada in 1841, the centre of the road was to be harder than the edges by a ratio of 9:7 since horses' hooves caused 45 per cent of the wear and wheels only 35 per cent. Hills were usually graded down modestly and bridges and culverts built up. The common road was - and is - good in the winter, when the snow adds a hard surface, and reasonably good in the summer, but an abomination in spring and fall.

But the Canadas of the 1840s needed improved all-weather roads, and finally, in 1837-39 at a cost of $132,000, twenty miles of the lakeshore highway from Napanee to Kingston was macadamized. The process was simple and effective. A firm base was composed of large rocks, on top of which were placed successive layers of progressively smaller stones. On a final layer of crushed stone was poured a mixture of stone-dust and water, which served as the bonding agent and hardened into a form of concrete. But macadamized roads were expensive. A dirt colonization road in Quebec cost from $250 to $400 a mile, while macadamized roads cost between $3,167 and $7,538 a mile around Quebec and averaged $4,200 around Montreal.[8/] The roads proved to be too costly for local authorities, and even when built they seldom attained English standards. Only the turnpike trusts in Quebec, which built 155 of the 184 miles in existence in 1867, apparently reached the standards set by the English. Toll roads were seldom, if ever, profitable. Ten per cent of the tolls were to be returned to the government, but the fees were so small

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[8/] Hamelin and Roby, Histoire Economique, 151.

and the maintenance so high that the government had to assess the public. Krieghoff's Running the Toll reflects a favourite game not only of the habitant but of at least one governor.

What passed for macadamized roads usually was built up dirt covered with loose gravel or broken stone thrown from wagons in the hope that the traffic would spread it about and embed it in the dirt and mud. But where they were built the roads served their purpose well, and a report from Quebec in 1874 declared that they were more useful to the farmers than the railways:

> Les chemins macadamisés sont très souvent plus importants pour les cultivateurs que les chemins de fer. Ainsi, dans un rayon de dix lieues des marchés ou des grandes artères, les chemins macadamisés rendent de bien plus grands services, puisque le cultivateur peut, en tous temps et à toutes saisons, porter une forte charge sans fatigue ni danger pour ses attelages.... Je pourrais citer des cas où l'amélioration et l'augmentation véritable de la propriété dans les environs des chemins macadamisés récemment faits, est de $100,000 pour chaque $1,000 dépensés. 9/

Railroads had captured the imagination and won the day, however, and macadamization made little progress during the rest of the 19th century in Quebec, or anywhere else in Canada.

Nevertheless, the 1840s were the great years of road building in British North America. Horse paths through the forests became wagon roads. The trunk system was improved, moving from roads best travelled in winter when the surface was hard to thoroughfares that

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9/ Ibid.

could be travelled with a minimum of discomfort through much of the year. Had the railway not arrived just as British North America was beginning to develop its road system, almost totally diverting energy and resources at all levels, Canada might have reached the age of the automobile with a reasonable groundwork laid. But the earlier use of water transport and the coincidence of the need for improved transportation and the arrival of the railway meant that the highway remained the orphan of Canadian public policy. The half-century from 1850 to 1900 was the dark age of Canadian road building.

The Confederation Highway

The road system of the new Dominion probably was worse in 1867 than it had been a decade earlier. As the railway linked the major cities and towns, work on the trunk roads all but stopped, and funds that the colonies might have thrown into roads had been thrown into railways. The same was true of local governments, for there was not a hamlet that did not aspire to become a railway metropolis in the 1850s and 1860s. The great age of the stagecoach had passed, and Her Majesty's Mails became the prerogative of the railway wherever it ran.

The new Dominion could, in a manner of speaking, be crossed by road. Indeed, from Halifax to Quebec the traveller had a choice of two routes. The traveller on the best route - the Temiscouata - travelled by coach from Halifax to Windsor and Annapolis, crossed the Bay of Fundy to St. John, and took either boat or carriage to Fredericton. A fair road ran from Fredericton to within 20 miles of Grand Falls, but many travellers preferred the frozen river or a canoe to both the good road and the usually impassable last 20 miles to the falls. The Madawaska River and Lake Temiscouata - 80 miles by boat - probably was the easiest part of the trip, certainly easier than the 36-mile portage road from the lake to the St. Lawrence, most of which was highly impractical for wheels. From Rivière du Loup a road ran along the south shore to Lévis - and across the river by boat or sleigh, depending on the season, to Quebec. From Quebec to Montreal, Kingston, Toronto and the Great Lakes, the old trunk road still paralleled the new lines of steel.[10/]

But the Confederation traveller, who could sail comfortably from Collingwood or Sarnia-Port Edward to the head of the lakes, had only the old Northwest Company canoe route to follow to Fort Garry on the Red River. Already casting covetous eyes on the west and fearful of American annexation, the Canadians had introduced a postal service to Red River in 1858, but abandoned it two years later. At the same time, however, two expeditions were commissioned to examine the suitability of the territories for settlement, and determine whether an all Canadian land route was profitable or possible. The first group, under Captain John Palliser, suggested that the west was

[10/] The Temiscouata ran too close to the American border to satisfy the military. A second road - the Kempt - ran from Halifax to Shediac, along the coast to Chatham and Campbellton, and across the Gaspé to the St. Lawrence at Métis. See Guillet, Canadian Roads, 37.

unfit for settlement, and that an all-Canadian route was impossible. But the second, led by S. J. Dawson, suggested that a route was certainly possible. In fact, Dawson believed that a route from Fort William, following the old Kaministiquia trail, although a little longer than the Grand Portage, was the best. The many carrying-places along it could be turned into highways, while corduroy roads could be built across swamps and bridges over rivers. Large lakes could be crossed by steamboat and where the water was too shallow for boats it could be raised with dams. The entire journey, he estimated, could be completed in about three weeks, in which 131 miles would be overland and 367 miles by water.[11/]

The report lay on the shelf for a decade, but in 1868 he was commissioned to establish communication with Red River in anticipation of the Canadian takeover. Although Dawson began at once, construction was more difficult than he had expected and, not for the last time, Louis Riel hastened the completion of an east-west link. As soon as terms had been negotiated with the Manitoba delegates in the spring of 1870, word was sent to W. A. Browne, O.L.S., who had been employed by Dawson since 1868 in the construction of the road, that he had to have the road, the water stretches and the portages ready for Col. Wolseley and the Canadian militia who were dispatched to Red River as a "peace-keeping" force. But the road was not ready and the military was put to work. For six

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[11/] See D.H.O. File: "Special Highways - Dawson Route."

weeks Wolsely's men blazed the land route in an almost constant downpour of rain. Where portages could not be cut quickly enough, such as at Rat Portage, he took a more circuitous but nonetheless faster water route around it. Wolsely and the army reached Fort Garry on August 23, as Riel moved quickly across the river to St. Boniface. Meanwhile the civilians kept working, and the Dawson Road finally was complete.

From Red River west, the Dominion inherited the highway system of the plains. From the Red across the prairies and valleys to Prince Albert and Edmonton, and from Whoop-Up and McLeod north to forts Calgary and Edmonton ran the Indian trails and the rutted roads made by generations of métis carts. But west from the foothills ran neither road nor trail, only "les chemins qui marchent" flowing to the Arctic and Pacific.

When British Columbia joined Canada in 1871, however, the nation acquired its most spectacular highway. The transportation problems created by thousands of miners as they inched their way up the Fraser in the months following the great rush of 1858 is an epic of Canadian history. The hazardous trails along the cliffs or through the Caribou were inadequate for the gold colony. Governor James Douglas decided that nothing less than a 385-mile stagecoach road from Yale to Barkerville, through some of the toughest country in the world, would suit his purpose.

The Royal Engineers located the route, and undertook construction on some of the most difficult sections. Other sections were let to private contractors, among them Joseph Trutch, who built the unique suspension bridge at Spuzzum. Work started in the spring of 1862, and by November the engineers had blasted a six-mile cut out of the rock from Yale to Sailor's Bar at a cost of only $32,000, while Thomas Spence built the eight-mile stretch from the Bar to the suspension bridge at Alexandria at a cost of $36,000. Spence and Langvoidt completed a section from Boston Bar to Lytton, and another contractor virtually completed the road as far as Clinton. By the end of 1863, Trutch had completed the suspension bridge and the remaining difficult sections on the Fraser and the Thompson were blasted out and the road pushed north to Fort Alexandria. A year later it passed Quesnel and in 1865 reached Barkerville, the gold capital of the world. By the time it was finished the Caribou Road has cost about $2 million.[12/]

The polyglot labour force - miners who needed a grub stake, Chinese who found road work as profitable as working over the panned-out claims on the old 1858 riverbanks, and sappers of the Engineers - was no stranger than the variety of vehicles that poured up and down the road - men with packs, mule and ox trains, waggons hitched together piggy-back style, steam-powered tractors, and camels imported from Texas. But the class of the road were the two-and four-horse Caribou stages run by Wells Fargo and Barnard's famous BX line. In

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[12/] D. R. Burrill, The Wheel and the Road, (Ottawa 1951), 26. See F. W. Howay, The Work of the Royal Engineers in British Columbia 1858 to 1863 (Victoria 1910).

1863 two touring British gentlemen, Viscount Milton and Dr. Cheadle, journeyed down the Caribou Road with 170 pounds of gold and an armed driver:

> The road from Cook's Ferry to Yale .... is probably the most wonderful in the world. Cut out of the mountain side of the gorge, it follows the hills as they recede in 'gulches,' or advance in bold, upright bluffs, in constant windings, like an eternal letter S. The curves of ascent and descent are as sinuous as the lateral; the road at one time running down, by a series of rapid turns, to the very bottom of the valley, and then rising as quickly to pass the face of some protruding bluff, apparently a complete barrier to all advance, but past which it creeps, looking from below like a mere line scratched on the round front, 500 or 600 feet above the river. At these points the road is partly blasted out of the solid granite rock, and the width increased by beams of rough pine, which project over the precipice; but it is yet too narrow for vehicles to pass each other, except at certain points. There is, of course, no protecting wall; the road overhangs the precipice, and nothing is to be seen supporting the platform on which you stand - a terrible place to drive along....
>
> And what made matters look worse was, that our carriage was gradually coming to pieces. First one spring broke, and then another, and we bumped about on the axles. Next the splinter-bar gave way, and had to be tied up with a piece of rope. All these would have been trifling accidents had the road been of a different character, but when, to crown all, the pole snapped in its socket, and the wagon ran into the horses, we had good cause to be thankful that this had happened in the middle of a flat, just after crossing the suspension bridge. Had it occurred a few minutes sooner, we should doubtless have been precipitated headlong into the Roaring Canons....
> In about an hour the driver reappeared, accompanied by a friend, bringing a large covered wagon, drawn by two fine Californian horses. The fresh horses were put in as leaders, and we soon started with our four-in-hand, rattling along at a headlong gallop, for we had now two drivers, one who managed the reins, while the other vigorously plied the whip. The express-man had brought a bottle of whisky back with him, and he

> and his friend devoted themselves assiduously to it in the calmer intervals of their joint occupation.... Much of the road was as dangerous as any we had passed before, but the men shouted and whipped up, the horses galloped furiously, the wagon whisked round the precipitous bluffs, and tore down the steep descents in mad career. We reached Yale before midnight, having been little more than an hour doing the last fifteen miles of this fearful road. 13/

The road remained the vital link in the province's life until Onderdonk blasted much of it into the Fraser. But above Lytton the Caribou Road, with its glorious four-to eight-horse stages, remained in operation until it was replaced by the modern highway.

The Automobile 1900-1939

Although the period from the railroad age to the turn of the century has been described as the dark ages of the Canadian road, there were increased mileages and improved surfaces. But the costs of significant changes in policy or construction remained beyond the financial resources of local governments, and the taxpayers remained as hostile as always to increased local assessments.

Pressure for improved roads first came from an unexpected source. In 1878 John Moodie, who years later was to break up a Sunday picnic in Burlington's LaSalle Park by bursting into the grounds in his $1,000 Winton runabout, imported Canada's first bicycle from England.

13/ Viscount Milton and W. B. Cheadle, The Northwest Passage By Land, (London 1875), 336-37, 375-76.

Soon "boneshakers" and "penny farthings" appeared on city streets and country roads. In 1882 the Canadian Wheelman's Association was formed, and by the 1890s the craze had passed and the bicycle had become a standard means of transportation for those without horse and carriage. Supported by bicycle manufacturers, the Wheelmen pushed for better roads, and highway maps and signposts.

The real pressure started, in Ontario at least, with the formation of the Ontario Good Roads Association in 1894. Whether father, mother or mid-wife, Archibald Campbell was the dynamic force behind the association and much of the pressure for better roads in Ontario and Canada. Born in Middlesex County, Campbell became a surveyor and civil engineer in St. Thomas and by 1888 had read a paper on highway bridges. Three years later be became the city engineer in St. Thomas and in 1894 established the Good Roads Association with the assistance, among others, of Andrew Pattullo of Woodstock. The association persuaded the Ontario government to appoint an "instructor in road-making" and, possibly through the Liberal contacts of politically influential people like Pattullo, Archibald was offered and accepted the position.[14/] In his first report on highways in 1896, Campbell wrote that "the improvement in roads in Ontario has not kept pace with the development of the province in population, wealth, civilization nor commerce. This lack is seriously felt by all classes of society and has, within the past three years, created an almost revolutionary

[14/] D.H.O. File: "Archibald William Campbell."

movement in favour of better roads. Were economic methods instituted, millions of dollars would be added to agricultural values, and the mercantile and banking interests would be placed on a more stable basis."[15/] Four years later he was transferred from the department of agriculture to the department of public works as commissioner of highways. A year later the Ontario government passed the Highway Improvement Act and authorized the expenditure of $1 million annually for road construction.[16/]

"Good Roads Campbell" also fathered the Good Roads Train. In 1901 Campbell joined forces with H. B. Cowan, secretary of the Eastern Good Roads Association, to imitate the Good Roads Train experiment in the American mid-west. Loaded with the most modern road-building equipment, the train was to travel throughout eastern Ontario constructing one-mile sections of road for selected municipalities. As Cowan also was the editor of the Ottawa Valley Journal, the train was given great publicity.

All the road-building machinery and equipment was provided without charge by the Sawyer-Massey Company, which also supplied trained operators for some of the heavier equipment. The equipment used was the latest in the highway construction industry and consisted of one ten-ton steam road-roller; one traction engine; one stone crusher with loader, bins and a screen; one road grader; one

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15/ Cited in A. A. Walters, "In the Wake of The Good Roads Train," The Good Roads Train, (April 1967), 1.

16/ Guillet, Canadian Roads, 155.

five-ton reversible horse roller; two spreading waggons and a road plough; and water tanks, a wheel scraper and a drag scraper. The entire outfit cost a little over $6,000. The Canadian Portland Cement Company of Deseronto supplied cement. All labour and materials were to be supplied by the counties and townships within whose boundaries the model roads were to be constructed. Ironically, the Canadian Pacific, the Canadian Atlantic, the Grand Trunk and the Ottawa and New York railway companies supplied the transportation free of charge. Many municipalities were eager to join in the demonstration, but only 13 could be adequately serviced in the two-year experiment.[17/]

The revolution wrought by the automobile on everything from the economy to morality need not be retold. Its effect in Canada was enormous, for it provided an instant answer to the problem of distance, not only between cities but also between city and country. The early autos were expensive, as well as uncertain, and between 1898, when John Moodie interrupted the LaSalle picnic, and 1907, only 2,130 were registered in Canada. But in the next year Henry Ford revolutionized the industry with his $850 Model T, which by 1925 was selling at an all-time low of $350. By 1912 there were 50,000 motor vehicle registrations; by 1917, there were 464,000 of

[17/] D.H.O. File: "Good Roads Train." In 1901 model roads were built in Gananoque, Alexandria, Iroquois, Lansdowne, and the Ottawa fair. In 1902 the train visited Plantagenet, Eganville, Pembroke, Newington, Carp, Kemptville, Bell's Corners and Almonte.

which 8 per cent were registered as commercial vehicles.[18/]

The arrival of the automobile forced provincial governments to turn their attention both to control and to highway construction. The initial conservative reaction of an agrarian society soon was replaced by a somewhat more positive approach as politicians and bureaucrats wrestled with the new phenomenon. Between 1910 and the end of the war every provincial government reorganized its administration to create a department of highways, or a branch of public works specially charged with highway development. Gradually the provinces began to organize provincial highway systems as a provincial responsibility and provide financial assistance to the municipalities for road construction. For the first time in the country's history road construction began to feature prominently in provincial budgets.

The federal government too was not immune, although it seems not to have seen that a national highway or network of highways could have been deemed to have been for the general advantage of Canada, and certainly more than the "local works" assigned to the provinces in 1867. By 1914 there were in existence the Canadian Good Roads Association, the Canadian Highway Association (formed in 1910 but inactive after its 1912 Winnipeg convention), and the Canadian Automobile Association. And in May 1914, the Canadian and International Good Roads Congress held its first convention in Montreal.

[18/] G. P. de Glazebrook, A History of Transportation in Canada, Carleton Library No. 12, (Toronto 1965), 248.

While their attention was not focused on the central government, all of these national bodies did exert pressure on Ottawa to set national good roads standards and to think of a trans-Canada highway.

The polite pressure on Ottawa had some response. In the election of 1911 Robert Borden promised federal assistance for provincial roads, but his subsequent bill was defeated in the Liberal Senate.[19/] Five years later, Robert Rogers, the somewhat scandalous federal minister of public works, promised the Canadian Automobile Association that he would support a scheme for a Trans-Canada highway. Two years later, Sir Thomas White, minister of finance, stated that the federal government had an interest in highways, and observed that in the United States the federal government met all of the state appropriations for trunk roads on a 50-50 basis. Finally, in 1919, the Borden-Meighen government passed the Canada Highways Act authorizing an appropriation of $20 million to assist the provinces in the construction and improvement of a connected, co-ordinated system of main and market roads, with Ottawa paying 40 per cent of

[19/] "Taxes and Traffic: A Study of Highway Financing," Canadian Tax Foundation, Canada Tax Papers No. 8, (June 1955), 67; Guillet, Canadian Roads, 159. See also R. C. Brown and Ramsay Cook, Canada 1896-1921, (Toronto 1974), 196: "Bringing the bill before the Commons, the minister of railways argued that it "would also substantially improve the farmer's marketing potential by affording him better access to his markets. A striking feature of the Highways Bill - and of federal assistance to agricultural education - was that it proposed a new pattern in dominion-provincial fiscal relations. Up to 1911 all federal subsidies to provincial governments had been given unconditionally. The Highways Bill was the first proposal by the federal government to establish conditional grants to the provinces."

the "actual necessary and reasonable cost of the construction or improvement of such highway." Details as to the cost, timing, and methods of construction of all roads built under the act were to be worked out between the individual provincial governments and the minister of railways and canals.[20/]

Passed as part of a post-war national development programme, the act authorized the division of the appropriation among the various provinces with the proviso that they in turn would be allowed five years to earn the amount. A fixed grant of $80,000 was to be made annually to each province for five years, while the remainder was allocated on the basis of population. Because some of the provinces, Prince Edward Island for example, found difficulty in raising their share, the time was extended to 1926, and then to 1928, when all provinces had earned the entire amount.[21/]

By 1928 federal grants had helped give the country something approaching a Trans-Canada highway. But the country north of Superior, between Kenora and Nipigon, obstructed the highway builder as it had the railroad engineer. Although sections of road were built around the Lakehead and Sault Ste. Marie and some colonization roads existed, the motorist who wished to cross Canada by land had to cross the border at Emerson, where a good gravel highway ran north

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[20/] See Wilfrid Eggleston and C. T. Kraft, Dominion-Provincial Subsidies and grants: A study prepared for the Royal Commission on Dominion-Provincial Relations, (Ottawa 1939), 44-45.

[21/] For breakdown according to province see D.B.S., The Highway and The Motor Vehicle in Canada 1937, 2.

to Winnipeg. Dr. P. E. Doolittle was enthusiastic about Canada's "Coast to Coast Highway," and wrote a guide for the tourist and provided a convenient survey of Canadian roads in 1926:

> Up until a few years ago, the majority of the highways of Canada were in a primitive state, being of good quality through districts where natural road making material was abundant, and being indifferent or worse, where roads were remote from such material. But with the stimulus given to trunk highway development by the Dominion Government's grant of twenty million dollars to aid in such highway construction, all the Provinces have made great advances with their roads, until to-day there is not a Province in which good roads are not found, although in the Prairie Provinces many of them are still subject to weather conditions owing to the gumbo, or sticky clay, of which many miles are composed, not having yet received a waterproof coat of gravel or tar sands.
>
> The main highways in Nova Scotia are of the log-dragged, gravel-topped type, with broken stone or macadam foundation, and these, in a climate which has plenty of moisture, make ideal motoring roads.
>
> New Brunswick highways are of the same general type but with less permanent foundations, and as the motor truck has not yet extensively invaded this Province, these roads meet every requirement of the tourist.
>
> The Province of Quebec has many miles of hard-surfaced pavement and many more miles of the finest type of fine gravel-topped macadam roads, all of the latter being kept in excellent condition by constant dragging.
>
> Ontario is farthest advanced in its permanent topped highway development, having 1,881 miles of paved roads; 3,052 miles of macadam-surfaced roads and 31,224 miles of gravel out of a total of 67,790 miles of highway.

> Southern Manitoba has many miles of gravel, and is constantly extending this type of road. Saskatchewan, having the least gravel or road rock, and long distances to haul it for its main highways, is the farthest behind in permanent top development, but each year sees an extension of the surfaced highway, and it is not too much to expect that within a few years, from Halifax to Vancouver, there will be a continuous highway available at all seasons.
>
> Western Alberta is developing very rapidly gravel-topped roads, while all the roads in British Columbia are of a character, there being no gumbo in that Province, that renders them little or not affected at all by weather conditions. 22/

The commercial use of the automobile and the truck demanded radical improvements in highway construction. Not only had the surface to be all-weathered, but easy grades and curves and widened shoulders were essential to permit two-way traffic and accommodate the speeds attained in the '20s. The 1,000 miles of hard-surfaced roads in 1919 had grown to more than 4,000 by the end of the decade, while gravelled roads increased from 34,000 to 71,000 between 1922 and 1930. Provincial financing - using a variety of means, including licences and gasoline taxes - provided the funds, and a developing technology provided the means.

The first paved highway apparently ran six miles out of Montreal to Ste. Rose in 1910, but the first major concrete highway - and for its day one of the longest in the world - was built from Toronto to

22/ P. E. Doolittle, "Coast to Coast Highway," Maclean's, (July 1, 1926), 7-8.

Hamilton between 1915 and 1917.[23] The machinery was much the same as that displayed by Campbell and the Good Roads Train - steam-driven rollers and crushers and horse-drawn graders. There were, however, several innovations. The road was built of concrete slabs 18 feet wide, 6 inches thick at the edges and 8 inches thick at the centre. The aggregate was brought to the site by a narrow-gauge railway built for the purpose, and the cement was delivered by gasoline-powered trucks. While the mixer was run by steam, the batching was done by hand and long lines of wheelbarrows carried the concrete to the forms.

Although the pick and shovel, the man and the horse, dominated highway construction during the 1920s, mechanization increased, particularly on the trunk roads. The steam shovel on tracks was used in dam building as early as 1923 and presumably was used for highways as well. The manufacture of Adams graders began in Canada in 1929, although they had been imported earlier, and both Adams and the Dominion Road Machinery Company of Goderich manufactured self-propelled motor graders with solid tires, 16-foot blades, and leaning front wheels, as well as tractor-drawn varieties. The Adams company recommended that the new self-propelled machines be used for maintenance, and the tractor-drawn grader on new and heavy construction. Not until the late 1930s did the tractor-drawn vehicle begin to

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[23] Some sources state that the highway began in 1910, but it would seem to be after the Royal Commission of 1913 reported and the Ontario Highways Act of 1915 established a Department of Highways to create a system of King's Highways that the road was underway.

disappear.[24/]

Although the revolving drum truck mixer was used in the United States after 1927, its use does not seem to have been wide-spread in Canada until after the second war. The visual evidence for highway construction in the '30s shows mixed concrete being delivered and poured from trucks, but not the revolving-drum transit mixers. Photographic evidence also suggests that while the caterpillar was used in the 1930s, its use was not widespread. However, mechanization not only made the new roads possible, it also kept the cost of removing a yard of earth at about 40 cents between 1920 and 1960, despite the increased cost of labour.

Between 1919 and 1930 total highway construction expenditures reported totaled $450 million, the peak year being 1930, when more than $67 million was spent. Construction and maintenance expenditures did not fall off drastically during the Depression, and as much was spent on new construction between 1931 and 1939 as had been spent during the booming '20s.[25/] Highway construction had not kept pace with either the political demand or the sheer burden of traffic. Moreover, cars took Canadians across the border, and the more highly

[24/] Throughout the '20s and lingering through the '30s some rural roads in all parts of the country were often graded by horse-drawn graders, and sometimes by old squared timbers. See Guillet, Canadian Roads, 159-161.

[25/] Capital Expenditures on Provincial Highways in Canada in millions

1931	$66.2	1934	$46.1	1937	$69.5
1932	$50.	1935	$42.4	1938	$76.7
1933	$23.8	1936	$34.9	1939	$62.8

See Canada Year Book for 1934-35, 735; 1939, 663; 1945, 675.

developed American highway system was a constant reminder of the inadequacies of Canadian roads. An additional burden on Canadian roads was the rapid development of the trucking industry.

Trucks had been used in Canada since 1906, when a Toronto bottler used his chain-driven two-cylinder truck to haul water from a mineral spring ten miles away. Before, during and after the war the truck became an increasingly common carrier, much to the relief of the city street cleaners (although the horse-drawn delivery waggon still was common to most cities before 1950), but it was not until the 1930s that it emerged as an important intermediate distance carrier. In the late 1920s, Canadian business and industry apparently moved to the low-inventory system, thus cutting down on long-term investments and high storage costs, but demanding frequent and smaller deliveries. The truck was ideal, whereas the fixed-cost, bulk-carrying railway was not sufficiently flexible. The depression added to the railways' dilemma, for merchants and manufacturers were less willing or able to gamble on an uncertain economic climate and kept inventories even lower. Trucking increased rapidly, and the railways began to fight back by opposing aid to highway construction or insisting that truckers pay heavier costs to cover the capital investment in roads.

Finally, highway construction and improvement was ideal for unemployment relief. Not only did the federal government specifically include highway construction in its aid to the provinces, but the provinces themselves relied heavily on road construction to put men to work. Special consideration was given to roads to resources, and the federal government also entered into a 50-50 shared cost programme for the construction of roads to develop tourism.

The federal government was particularly interested in construction that would round out or develop the still incomplete and inadequate Trans-Canada highway. The war was not a year old when Premier Duff Pattullo finally opened the 193-mile federally financed Big Bend Highway. Eleven years under construction, a 119-mile gravel road joined Golden to Revelstoke, 57 miles apart, by following the loop of the Columbia. No road for softies, the Big Bend was an obstacle course to turn back the cowardly or punish the unwary with the driver continually dodging fallen rocks, navigating the steep grades and narrow curves, or gingerly testing bridges formed by felling large trees across a canyon and laying planks on top.

Completion of the Big Bend in June 1939 left only the northern Ontario section of the old Trans-Canada incomplete. In September, as the war broke out in Europe, a ceremony at Nipigon marked the opening of the 106-mile stretch between Nipigon and Geraldton. All that remained was the 157 miles from Geraldton to Hearst.

But if Ontario was the laggard on the early coast-to-coast route, it was the pioneer in developing the expressway. The Americans had begun the development of the express highway in the 1920s, and it was inevitable that the American example would be regarded as the solution to the heavy traffic along and around Lake Ontario. Traffic surveys showed that less than 2 per cent of the total mileage of the province, built as dual highway, would accommodate almost 50 per cent of the through traffic, and that distance, time and safety would be increased enormously. The heavily travelled routes either proceeded to border points or ran along the north shore of the lake and north from Toronto. The estimated need was 1,000 miles of dual lane highways, which in 1930 it was believed could be completed by 1960.

The most congested route was between Hamilton and Toronto, as it had been for decades. Neither the concrete highway nor the Dundas road could handle the growing car and truck traffic, and studies concluded that the cost of acquiring the right-of-way and dislocating local communities to widen either road would be prohibitive. The government therefore selected the alternative of constructing a completely new road, bypassing towns and villages but providing ample egress and access to lessen the effect on the local economy.

The work started on what was called the Middle Road, but later became the Queen Elizabeth Way in 1931, and the project was well under way when Mitch Hepburn defeated the Hendry government in 1934. The Liberals were even more committed to highway expansion than the Tories, but they were also more farsighted. Work was stopped as the government acquired more right-of-way to make possible a divided highway. R. M. Smith proudly wrote that

> every modern improvement known to highway engineering has been incorporated.... Separation will apply at all intersecting, heavily travelled roads and railways. Clover-leaf construction takes care of entrances and outlets to towns and

> cities.... Adjacent to cities, towns and villages, it has been the policy to lower the grade line of the divided highway to such an elevation that the intersecting streets passing over the highway will continue without interruption and with little change in appearance.... In keeping with the idea of safety, the highway will eventually be lighted.... It will be of cement concrete, four-lane construction, with the driving land eleven feet in width, the passing lane one foot wider. Separating the motorways will be a grassed area thirty feet in width. The shoulder of the roadway, fifteen feet in width.... While safety has been the keynote in the development of Ontario's first divided highway, it is not the only feature that received consideration. Graceful sweeping lines take advantage of topography and local countryside, the beautiful gardens west of Toronto touching the shores of Lake Ontario and Burlington Bay. Through Canada's fruitland to the waters of the magnificent Niagara River and its awesome and well-known Falls, the road passes, ever unfolding to the view of the traveller. Locally, he is pleased that roadside embellishment can become a reality, sodded slopes, planted boulevards (which will eventually become a positive defence against light glare for night driving) blend into permanent structures of concrete and steel artistically moulded into the landscape.... 26/

The road itself was laid in 10-foot strips, and engineers added more steel reinforcing to prevent the hair-cracking that had posed serious maintenance problems on other concrete highways. When the Queen Elizabeth opened in 1939, "there was nothing comparable in the world except for the German autobahns," declared E. C. Guillet, "The Pennsylvania Turnpike, the first modern freeway in the United States, was not begun until 1940.[27/] Small boys growing up in Saskatchewan and

[26/] R. M. Smith, "The Queen Elizabeth Way," Canadian Geographical Journal, (April 1940), 167-68.

[27/] Guillet, Canadian Roads, 162.

British Columbia were impressed as travellers from the east described Ontario's unbelievable highway. By 1939-40, the Queen Elizabeth had cost $9,767,000, and by 1956, $28 Million.[28]

Pacific defences

Naturally, highway construction declined during the war, and from 1941 to 1945 expenditures on maintenance were more than the $25 million to $46 million spent each year on new construction. One major highway construction project, however, did not feature at all in Canadian capital expenditure until it was purchased after the war.

Originally conceived as a commercial overland route through Northwestern Canada to Alaska, the Alaska or Alcan Highway was meant to supplement the existing water route from Seattle to Alaska. While the Canadian and U.S. governments reported in 1931 that they were in favour of building the road, little was done before the war except for an aerial survey undertaken by the Canadian government.[29] However, even before Pearl Harbour, a military route along the western

[28] D.H.O., File: "Queen Elizabeth Way."

[29] In 1935, the Acting Superintendent of Airways and Airports, Alexander David McLean, flew a reconnaissance survey across northern Alberta, the Northwest Territories, Yukon Territory, and Northern British Columbia. At that time the Canadian government was planning for the future and seeking the shortest and best airway across Canada to Siberia and then on to China. The route chosen went from the Peace River to Whitehorse by way of the Liard valley. Their route was confirmed with the establishment of a regular airmail service from Edmonton to Whitehorse about the same time. In the spring of 1939 a survey of the route was authorized and landing strips were installed. Don W. Thomson, "The Alaska Highway: the Canadian Role," North, (September-October 1967), 37.

"coast" of North America was regarded as vital to continental defence and while a number of routes were studied, the one strongly recommended by U.S. army engineers was that previously surveyed by the Canadians. Late in 1941 the Canada-United States Permanent Joint Board of Defence suggested immediate construction, but it was March 1942 before construction began. In 1930 it had been anticipated that the road would take five or six years to complete; in 1942 the military demanded that the route be opened in months.

The strategic military route had the unique distinction of being the only road in the world that was built as an integral part of an air travel route, since its main function was to service the chain of air fields throughout the Canadian northwest - Fort St. John, Fort Nelson, Watson Lake and Whitehorse - and link the production lines and airplane supply of North America with the Russian mainland. Alcan's secondary purpose was to serve as an alternative form of transportation to Alaska in the event that enemy action severed the ocean supply routes between the United States and Alaska.

Originally the Alcan project consisted of two roads, the highway and a tote road paralleling it to meet the immediate military needs and to serve as an access route for construction of the highway. The tote road was to be built by the military under Colonel James O'Connor and the main road was to be built by civilian contractors under the supervision of the Public Roads Administration Branch of the United States. R. J. Johnson and Viv Siddell, who had employed the use of aerial photography in Ontario for 10 years before the construction of the Alcan highway, were brought in to exploit their extensive experience in the area of constructing highways through such rugged terrain by the use of photogrammetry. The initial plan ran into problems as the PRA, used to building roads in federal parks according to detailed and precise plans, had trouble reverting to foot reconnaissance and aerial observation flights over the area. As a result, the army road was designated as the final Alaska-Canada highway.

U.S. army engineers began construction from numerous points along the right-of-way and moved the necessary supplies, equipment and men to the construction camps without the use of roads. On March 9, 1942, the first troops and equipment arrived at Dawson Creek, the end of the railway, and were rushed into the bush before the spring thaw turned the land into a quagmire and melted the frozen streams and river ice that were to be used as roads.

In six weeks the necessary supplies had been moved in, as 150 civilian farmers and builders and their trucks temporarily joined the U.S. army. Within seven months, 14,000 soldiers gouged out 1,523 miles of road across five mountain ranges, 129 rivers, and 8,000 mountain streams. The road was opened on November 20, 1942. The cost--$139 million. The length of the highway in Canada, including the Haines lateral - an original pioneer road - was 1,335 miles, of which 713 miles lay within British Columbia and 622 within the Yukon Territory.

Six months after the war the Canadian section of the highway was sold to the Canadian government. The Alaska highway ended the long isolation of northwestern Canada. In 1948 it attracted more than 2,000 tourists, while 7,000 commercial vehicles and a regular bus service used the gravel road. It took 700 soldiers and 950 pieces of equipment to maintain it and attempt to keep the dust under control while Yukon businessmen began canning genuine "Alaska Highway Dust" as tourist souvenirs. The Alaska Highway also served to bolster the economy of Edmonton. With the opening of the highway it became cheaper and quicker to buy foodstuffs and light consumer goods in Edmonton and ship by truck to Whitehorse than to use the sea and rail route from Vancouver.[30/]

Alcan was the most striking, but not the only, wartime highway. Almost as famous for a short time was the Canol road, paralleling a 500-mile pipeline from the oil fields at Norman Wells to a refinery at Whitehorse. When the refinery was dismantled, the Canol road met an ignominious end. Lesser known was the Prince Rupert Highway, built in 1944 to prevent isolation of the important Pacific seaport in case the Japanese destroyed the Canadian National line. Highway engineers faced the same perpendicular canyon walls as the railway engineers before them. Before the road was finished contractors had moved twice as much rock and fill on the 110-mile road from the coast to Hazleton as the army had on Alcan. The cost was $11 million, or

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[30/] Account of Alaskan highway based on Burrill, Wheel and Road; K. H. Siddall, Locating the Alcan Highway, (D.H.O. Library) and D. N. Johnston, "Alcan Highway location By Aerial Survey Photos," Association of Ontario Land Surveyors, (D.H.O. Library).

more than $100,000 a mile.[31]

The Trans-Canada

As with most other aspects of heavy construction history, the modern period is anti-climatic.[32] In the early years there is drama in the battle between man and nature, but by 1945 the struggle has the sickening inevitability of a bull fight. The horse disappeared, and the shovel became something to lean on. The 1950 tractor-drawn 10-cubic-yard scraper had become by 1965 a self-propelled and rubber-tired giant that carried 30 to 50 cubic yards at highway speeds. Bulldozers, on tracks or high pneumatic tires, and enormous gas shovels made short work of earth obstacles or blasted rock. Heavy pneumatic rollers compacted the surface quickly and solidly, and a flotilla of heavy cement bricks or asphalt layers laid a surface at almost a walking speed. On the whole, heavy equipment was imported from the United States.

New construction costs leaped from $80 million in 1946 to almost $1 billion by the late 1960s. Highway contractors had a bonanza as the Trans-Canada finally emulated the railway, as multi-laned freeways and tollways reached out from every urban centre,

[31] Burrill, Wheel and Road, 35.

[32] On the Trans-Canada and roads to resources see Canada Year Books for 1945-1973.

as urban expressways with their dazzling and sometimes aesthetically interesting maze of access roads and cloverleafs carried millions of Canadians to and from work, and as dozens of roads reached out in all sections of Canada to help tap northern resources and open new areas to settlement.

The trans-Canada pressure for a completed, and by the end of the war a better, Trans-Canada highway had never disappeared. Whether it was a greater sense of national pride - Ripley once had asked if there was "no highway across Canada" - or a strange desire to see more of the imperialistic easterners, much of the pressure came from the West. By the end of the war the federal government had adopted the Trans-Canada as part of the pack of reconstruction proposals placed before the provinces. Louis St. Laurent outlined the objectives of federal policy in April 1945:

> In familiar terms, our objectives are high and stable employment and income, and a greater sense of public responsibility for individual economic security and welfare. Realization of these objectives for all Canadians, as Canadians is a cause in which we would hope for national enthusiasm and unity.
>
> The government has clear and definite views on how these objectives can be attained. These views may be summarized very briefly as,
> <u>first</u>, to facilitate private enterprise to produce and prove employment;
> <u>secondly</u>, to promote bold action by the state in those fields in which the public interest calls for public enterprise in national development;
> <u>thirdly</u>, to provide, through public investment, productive employment for our human and

> physical resources when international and other conditions adversely affect employment.... 33/

The Trans-Canada Highway helped to meet all three objectives, and C. D. Howe informed the premiers that the federal government was willing to assist in the construction of transportation facilities of "national importance" in which he included the Trans-Canada Highway and international connections, railway grade crossings, and airports related to natural resources development.

In 1948 the federal government met with the provinces to discuss the possibilities of building a Trans-Canada highway, and in 1949 the House gave unanimous consent to "An Act to encourage and assist in the construction of the Trans-Canada Highway." Shortly after its passage, a second federal-provincial conference was held in December 1949 to set standards. Previous agreements between the provinces and the federal government had resulted in a variety of standards being undertaken in accordance with separate provincial needs. Similarly, the highways constructed did not always link up favourably with those of other provinces, nor did all the provinces approach the construction of their highways with the same vigour. As a result, the 1949 meeting established a set of minimum standards, a time schedule and an operating procedure. The results were arrived at through discussion and full participation with the representatives of all provinces.

Under the act, the federal government was to pay 50 per cent of the estimated $300 million cost of construction of the Trans-Canada

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33/ Cited in "Dominion and Provincial Submissions and Plenary Conference Discussions," Dominion-Provincial Conference 1945, (Ottawa 1946), 59.

Highway to the agreed standards. Provisions were made for the acceptance of an already existing road, if it was along the approved route and could be incorporated into it. If some work was required to bring it up to the required standards, funds were made available through the Trans-Canada Highway Act, while the provinces would be reimbursed to the limit of 50 per cent of their previous expenditures in the construction of the road since 1928. The highway was to be completed in seven years.

The design was for an all-weather, hard-surfaced, two-laned road from coast to coast capable of handling year-round traffic throughout its entire length. On sections that needed additional lanes to carry local traffic, the extra lanes were to be provided and paid for by the provincial government, while the federal responsibilities remained at two lanes plus shoulders. In cases where problems of terrain meant that deviations from the allowable standards would be necessary, the federal government agreed to continue its aid. The provinces were to be responsible for the selection of the route, subject to the approval of the federal government, which was to be the shortest practical east-west route through each province consistent with the needs of the province and the interest of Canada as a whole. To ensure a uniform base the federal government found it necessary to establish a road foundation section in another totally new division concerned with the plethora of construction problems encountered across Canada, the Trans-Canada Highway Engineering Division, which worked in co-operation with the provincial engineers.

Work commenced in the summer of 1950. The usual problems of muskeg, sometimes up to 50 feet deep, the miles of sticky "gumbo" clay during the rainy season in the Prairies, and the thousands of tons of explosives required to blast mile after mile of mountain wall in British Columbia were old and familiar construction problems. The obstacles encountered in the attempts to provide the desired curvature, sight distances and gradients in the Rockies were immense. Along a nine-mile stretch between Field and Golden, as the road races down to the valley, 4 million tons of rock and earth had to be blasted, bulldozed and excavated. Passing lanes for slow moving trucks, veer-off lanes for heavy transport trucks that could lose control coming down the steep inclines, and look-out areas for tourists made mountain construction no easier. The government also found it easier to build a new route through the Rogers Pass, 90 miles in length between Golden and Revelstoke, rather than bring the 196-mile Big Bend Highway up to the standards of the Trans-Canada Highway. Concrete retaining walls, snow sheds and other forms of avalanche control had to be provided, especially in Glacier National Park, where the average snowfall is 340 inches. An Avalanche Research Group was established to study the best methods of avalanche control.

Another unique problem was faced in Quebec. When the province finally decided to participate in the venture it shrewdly ran the highway through the heart of Montreal. Expensive land purchases, the increased costs of building a wider highway than agreed upon under the specifications set down in the Trans-Canada Highway Act, and the decision to build a complex, 19,000-foot, bridge-tunnel crossing the St. Lawrence River was a useful way of securing federal aid. The Louis-Hippolyte Lafontaine project alone cost $84,795,000, of which the federal government paid $53,775,000.

Under the original act, the Trans-Canada Highway was to be completed on December 9, 1956, but by the fall of 1955 the work was far from complete. At a federal-provincial conference in November 1955, Robert Winters pointed out that for a stretch of approximately 250 miles there was no Trans-Canada Highway of any kind, while almost 1,477 miles of the existing route was not paved. To ensure the speedy closing of the gaps, the federal government suggested that the provinces concentrate on the unpaved sections and leave any remaining sub-standard, but paved sections of the route for later reconstruction. Furthermore, to assist the provinces in their task, Ottawa increased the ceiling of the federal share from the previous $150 million to $250 million, and agreed to pay 90 per cent of the cost of construction of 10 per cent of the mileage in each province. On the remaining 90 per cent, the contribution would remain at 50 per cent of cost. Deadline for the completion of the Trans-Canada Highway was extended to December 31, 1960.

Four extensions and almost $600 million later the Trans-Canada finally was completed. On May 31, 1971, final payments totalling $824,999,950 were made to the provinces. In addition the federal government had spent $76,604,668 on portions of the Trans-Canada Highway which fell solely under its jurisdiction. Total cost of the

Trans-Canada Highway reached $1.4 billion. But the billion and a half dollars apparently gave Canada the longest single paved highway in the world. From Victoria to St. John's, the route was broken only by ferries connecting Vancouver Island, Prince Edward Island and Newfoundland to the mainland. Cape Breton joined Canada with the 4,000-foot Canso Causeway, a separate federal-provincial project that was completed during the construction of the highway.[34/]

The Trans-Canada was officially opened on September 2, 1962, where it crossed the Selkirks. Now Rogers Pass, the site once was appropriately known as "death pass" and equally fittingly was close to Craigellachie, where Donald Smith pounded the spike that closed the

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[34/] The Final Report under the Trans Canada Highway Act, Department of Public Works, Ottawa 1971, summarized the Trans-Canada as follows:

10 December 1949 to 31 May 1971

Province	Mileage	Prior Construction	Interim Construction	New Construction	Totals
Newfoundland	539	$ -	$ 156,445.	$127,291,882.	$127,448,327.
Prince Edward Island	71	288,383.	-	10,572,075.	10,860,458.
Nova Scotia	278	88,501.	-	78,265,921.	78,354,422.
New Brunswick	378	447,800.	193,576.	93,777,350.	94,418,726.
Quebec	375	-	-	175,298,766.	175,298,766.
Ontario	1,453	3,565,543.	299,790.	142,164,451.	146,029,784.
Manitoba	310	887,446.	17,543.	21,687,211.	22,592,200.
Saskatchewan	406	270,753.	3,103.	18,981,809.	19,255,665.
Alberta	282	475,943.	14,975.	24,819,952.	25,310,870.
British Columbia	552	3,190,102.	692,171.	120,548,448.	124,430,721.
National Parks	140				
TOTALS	4,784	$ 9,214,471.	$ 1,377,603.	$813,407,865.	$823,999,939.

Canadian Pacific.

It is impossible to calculate the benefits derived from the construction of a comfortable all-weather highway across Canada. The trucking and bus industries have been major beneficiaries, as have the Canadians who always dreamed of owning a roadside gas station, restaurant or tourist lodge. New communities sprang up in the wilderness. The isolated northern Ontario hamlet of Wawa, where the Lake Superior gap was closed, gained three motels, cabin camps, six service stations, a half-dozen stores and a bank within the first year of the road's completion. East of Winnipeg, more than $1 million was spent in a year on tourist motels. Vast expanses of Canadian wilderness were opened for the first time to its people. But maybe the chief benefit has not been economic at all. Perhaps Archibald Campbell hit it on the head when he argued that a Trans-Canada highway would enable the strung-out Canadians to get to know each other a little better, and know their country a little better too.

Roads to Resources

In one sense the Trans-Canada Highway <u>was</u> a road to resources, and in another, more accurate, historical sense, most Canadian roads have been roads to resources. Since the 19th century, provincial governments have by a variety of means built colonization roads, made special appropriations for northern development, and assisted mining and logging companies in building access roads to their resources. But in the 1950s, Roads to Resources became capitalized. Quoting Horace Bushnell, an American, John Diefenbaker assured Canadians in 1954 that:

> if there is any kind of advancement going on, if new ideas are abroad and new hopes rising, then you will see it by the roads they are building. Nothing makes an inroad without making a road.... The economic and social value of highways must be given top consideration in the development of any country.... Roads are essential to give access to the untapped wealth, mineral, forest and agricultural, of any country because they are most vital to integration and social and economic progress of a nation. 35/

Diefenbaker followed Bushnell's rhetoric two years after he became Prime Minister by instituting a Roads to Resources policy to assist the provinces in tapping the untapped wealth of the country. Some argued that the programme was an enormous success, for $145 million was spent on 4,100 miles of development roads; others more cynical, suggested that Ottawa simply paid for the roads the provinces would have built anyway. Undoubtedly, roads - or at least better roads - were built where they would not have been otherwise.

Every province would lay claim to important and costly roads to resources since the end of the war. Alberta would point to the

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35/ Speech given by John Diefenbaker to the Ontario Good Roads Association, Toronto, February 24, 1954. The federal government offered to pay 50 per cent of the cost of a resource road to a maximum of $1.5 million a year or $7.5 million over five years in any province, House of Commons Debates, 1958, 1389.

384-mile Mackenzie Highway from Grimshaw to Great Slave Lake, one of the earliest and longest northern penetrations jointly financed by Alberta (52 per cent) and the federal government (48 per cent). The road not only opened up the territory, enabling one trucker to carry refrigerated fish from the $2-million-a-year catch from Hay River for sale in New York, but later was to make the task of building the railway to COMINCO's smelter at Pine Point much easier. Newfoundlanders would argue that the Mackenzie Highway could hardly be compared to the task of building development roads along the rocky shores and through the rugged interior country of their island fortresses so that Gander and Saint John's, Musgrave Harbour and Flower Cave, Baie Verte and Wesleyville had a road system in common. The Upper Level Highway opposite Vancouver could hardly be classed as Roads to Resources, but the road to Squamish and the Terrace-Kitimat highway certainly could; and British Columbia could again cite the staggering costs of building highways along the coast or through the interior. And the federal government could observe that its $31 million road programme in the Northwest Territories and the Yukon, including a road from Dawson City to the deep water port of Fort MacPherson, at the mouth of the Mackenzie, need not yield pride of place to any provincial road to resources.

The history of Quebec's north shore road is almost entirely a response to resource development, and provides some commentary on the often alleged relation between the two. Baie Comeau and Clarke City had become important industrial centres before the colonization road was begun in the 1930s or opened to Baie Comeau in 1946. The extension to Sept Isles followed, rather than preceded, the development of the iron ore deposits of Ungava, although that was little consolation to a government which had to spend more than $25 million on the 150-mile extension in 1951. Accustomed to low wages in settled Quebec, the contractors found that road building had to compete for labour with high-paying construction and mining developments. They also found that deceptive tidal rivers and the rugged shoreline made the north shore the most expensive highway ever to have been built in Quebec. The road helped to develop new industries, among them tourism, which pleased some branches of government, but keeping the road open represented an unwelcome $2 million addition to the annual highways budget.

Far from Hay River and Sept Isles were the urban expressways and elaborate clover-leafs, the proliferation of four-lane superhighways and majestic bridges that dominated the landscape in metropolitan areas. If the prairie cousin desperately hugged the inside shoulder of the Big Bend in the 1940s, he was no less unnerved as he encountered for the first time the bewildering cacaphony of signs, service roads and access roads on the multi-laned, 70-mile-an-hour approaches to Montreal and Toronto, or even Vancouver and Winnipeg.

Planning in post-war Canada sometimes preceded events, but implementation usually followed. What was designed as a bypass, like Toronto's 401, was a city throughway before it was finished. The Laurentian throughway or Ontario's 400 to Muskoka, designed to whisk the city-dweller to summer and winter resorts, were commuter's bread and butter by the time the concrete had dried. Three lanes became four, and four became six, and six became clogged.

"Motorists Bring Profit to Farmers" ran a headline in a farm weekly in 1917. "City Motorists Become Burden to Farmers" ran another. Both were true: country and city were linked for good or ill; farmers sold their lands at prices that would have staggered their fathers for highways or dormitory sub-divisions or satellite communities made possible by the automobile and the expressway; and by 1974 the burden was less a group of stranded motorists begging a push or a meal, than the picnickers, snowmobilers or "hot dogs" who could turn a pastoral weekend into a Dali nightmare.

A Developing Technology

On the whole Canadians have managed to build their own highways, unlike the early railroads or pipelines. But they always had before them the science - including the political science of shared-cost programmes and the economics of taxation sources and tollways - the technology and the research of the United States. Gradually the Canadians became more or less autonomous, but it was a process that began only after the Second World War and still is continuing. As late as 1950 "there was little first-hand, detailed, factual information about Canadian roads," wrote E. C. Guillet. "In making plans the country's road builders had to depend almost entirely on data collected in the United States - and hope that it applied to Canadian conditions. It didn't always."[36] While provincial governments and some university engineering departments were concerned about highway planning and engineering, much of the initiative for the improvement of Canadian roads continued to come from the Canadian Good Roads Association, which was reorganized in 1950 "to meet the requirements of the post-war boom. Since its birth in 1914, membership had been restricted to governments and individuals; now it was extended to provide the widest possible representation within the highway industry, including related association, consultants, contractors, equipment dealers, manufacturers, and truckers.... Under a Technical Advisory Council ten committees carried out programmes in the fields of bridges and structures; construction and maintenance; economics, finance, and administration; geometric design; municipal roads and streets; pavement design and evaluation; road research correlation; soils and materials; traffic operations; and transportation planning."[37]

The research undertaken in the country reflected the permanence of Canadian geography, as well as the changing physical and economic pattern of use and construction: safety standards and the correlation of accidents and design; quality control during construction; the effect of de-icing agents on surfaces and bridges; the effect of lower car styles on visibility; the creation of washboard and its solution;

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[36] Guillet, Canadian Roads, 202.

[37] Ibid.

the use of straw, wire mesh or even foam plastic to float roads on a muskeg bed; the mixture of quicklime with prairie gumbo to create a hard surface; and insulation to lessen the damage of frost penetration. Highway engineering became a specialized profession, and transportation economics became a necessary, if underdeveloped, field of research and teaching.

Yet by 1974, despite the dangers of pollution and the threat of energy shortages, a new law of social physics had been hypothesized and proven true: in an affluent and car-happy society like Canada, the automobile and the truck expand to fill more than the highway space available. On January 22, 1974, the routes of the latest extension in the 400 series of superhighways were announced by the Ontario government. Gordon Carton, minister of transportation and communications, told newsmen (Globe and Mail, January 23) that "freeways do their part in easing the fuel crisis by allowing vehicles to use gasoline more efficiently." The estimated cost of the 23 miles was $53 million.

T H E   S E A W A Y

THE SEAWAY: "A MAGNIFICENT CONCEPTION"

The story goes that when asked if there had ever been "a sound economic reason" for the construction of the Seaway, Stephen Leacock exclaimed "To hell with economics, it's a magnificent conception and has got to be built." A magnificent conception it was - for well over three centuries; a magnificent engineering construction execution it was - in just under five years. Never before had man tamed the flow of a watershed of 700,000 square miles or built a ship canal that stretched two thousand miles inland from the sea. Nor had engineers and contractors ever carried through a project of such enormity in such a densely populated area. "My next canal will be dug across a desert, a thousand miles from the nearest human habitation," promised one harassed Seaway engineer.[1/] By the time it was finished the direct costs of the combined Seaway and Power development to the Canadian and American taxpayer was an estimated $1.2 billion, over two-thirds of which was Canadian. On the site alone the project had probably provided a hundred thousand man years of employment.

From the head of the Great Lakes to the Atlantic the St. Lawrence river system measures 2,347 miles. Where Lake Superior drains through St. Mary's River at the Sault there is a small drop of 21 feet, and where Erie flows to Ontario at Niagara the water falls 326 feet. The

[1/] Lionel Chevrier, The St. Lawrence Seaway, (Toronto 1959), 74.

flow is leisurely out of Lake Ontario and into the Thousand Islands. Just below Prescott the river once spilled over a natural rock barrier and began its 92 foot fall before it reached Cornwall and opened into Lake St. Francis. At the lower end of the lake the Cascade, Split Rock, les Cèdres and Coteau Rapids bring the St. Lawrence 82 feet closer to sea level. As the Ottawa enters from the north, the River widens into Lake St. Louis, before it again funnels through the Lachine Rapids and on to Montreal. Over the 183 miles from Kingston to Montreal the St. Lawrence falls 246 feet, more than half in the International Rapids between Prescott and Cornwall. Almost five hundred milles below Montreal is the new port of Sept Isles and five hundred miles down the estuary and gulf is the open sea.

The St. Lawrence lies at the heart of Canadian history. Its lowlands were its first settlements; its highlands held the natural resources to spark industrial development; and its tributaries provided the hydraulic power to work the colonial mills. To some it is a friend, the artery of good fortune; to others an enemy, the avenue for exploitation. But the River IS - not Cartier's road to Cathay, but the waterway through which French and English laid claim to much of a continent, and the base from which they tried to hold it. If the stroke of a diplomat's pen in 1783 truncated the hinterland, and the Bay at first bested the River for command of the west, the River and the men who lived along it have never forsaken the continental imperialism dictated by the glacial age.

Background

Since 1700 when the Sulpician Dollier de Casson went bankrupt trying to build a mile-long eighteen inch-deep canal around the Lachine Rapids men have looked up-river from Montreal or across Superior from the Lakehead and dreamed of a Seaway. From the late eighteenth century to Confederation governments and private investors, like William Hamilton Merrit and the Welland Canal Company, dug $20 million into the nine-foot canals that enabled low draught vessels to navigate the Great Lakes-St. Lawrence waterway.

The great age of canal building was over by the 1850s as the railway became the answer to every prayer. Yet the idea of the commercial empire of the St. Lawrence, historically founded on the waterways running into the heartland of the continent, died hard - or has not died at all. No sooner was the first federal government installed than it appointed a Royal Commission to report on the Canadian canal system. Unlike many later Royal Commissions it reported quickly, asserting unequivocally in 1871 that "nature has intended the St. Lawrence to be the great commercial highway of the West" and by "improving the Welland, we take the step pointed out to us by the unerring finger of Progress."[2/]

Unlike many Macdonald's government acted, for who could turn his back on the "unerring finger of Progress," particularly if it

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[2/] Royal Commission to Inquire into the best means for the improvement of the Water Communications of the Dominion, Sessional Papers No. 54, 1871, 18, 23.

promised to restore the St. Lawrence to effective competition with the Erie Canal, American railways, and the port of New York. Work began on an improved canal system at once, although it was not until 1903 that the enlarged 14-foot system was complete from the Lakehead to Montreal. The costs of construction placed a heavy burden on a government also committed to the construction of a railway to the Pacific, but Alexander Mackenzie's government was determined to maintain the pace of construction, after the sharp recession of the mid-70s, as a useful contra-cyclical public works project in Lachine and Niagara.

Between 1873 and 1887, $15 million was spent on the Welland, and $6 million on the Lachine. In Welland, at least, the results were at first disappointing, for with over $3 million spent by the end of June 1876 the Welland Tribune commented (November 17, 1876) that "the work on the canal enlargement is not producing nearly the benefit to the localities in which it is being done as was anticipated on account of the universal employment of improved labour-saving machinery. If for every dredge employed we had 300 or 400 Irishmen digging mud, times would be a great deal flusher than they are."[3/] Less than two years later, however, while the country approached the trough of the 1878-1882 business cycle the Tribune (April 12, 1878)

[3/] Judging from the census much of the labour was Irish. According to the 1871 census there were 285 Irish living in Welland and 805 in Thorold. Ten years later the census reported 511 Irish in Welland and 1,117 in Thorold. Census of Canada 1871, Vol. I, Table III, 259; Census 1881, Vol. I, Table III, 278.

boasted that "Welland is the liveliest town in Canada. The population has increased 800 in two years. What town of 3,000 can beat that record in these hard times?"

While direct employment on the canal was a major stimulus to the local economy the indirect effects were more lasting. The construction period saw the introduction of the first steam powered mill at Welland, as the canal was no longer permitted to provide water power, and equipment used on the canal provided opportunities for local foundries.[4/] But with the final million spent in 1887 much of the labour force disappeared, and industry in Welland joined the rest of the country in the general dullness of the 1890s.

With the completion of the "new" Welland, the re-routing of the Lachine, the construction of the Soulanges between 1891 and 1899, and the deepening of the other St. Lawrence canals by 1903 the river could carry ships with a 14-foot draught. Meanwhile, prospects of the transhipment of western wheat encouraged the Canadian government to build a canal on the Canadian side at Sault Ste. Marie. Opened for traffic in 1895, the canal boasted the largest lock in Canada - 900

[4/] Among those profiting was M. Beatty & Sons, an iron works and machine shop established in 1860. Again quoting the Tribune (January 20, 1876):

> These hard times it is pleasing to hear of an instance of prosperity and plenty of work, but such we have at Beattys Machine Shop in this town, which is so crowded with work that the men have been making three hours overtime regularly for some time past. The work consists of a new derrick for sub-contractors on Section No. 23 Canal Enlargement, and other work in connection with the machinery to be employed on the canal next season.

feet long, 60 feet high, and 18 feet deep.

While traffic increased significantly during the boom years, the size of upper lake shipping soon made the Welland obsolete and in 1913 work started on a new 25-foot canal. Interrupted by the war, construction began again in the '20s and in 1932 the $132 million canal was opened. With the American Sault canals deepened to 25 feet, even larger ships could now carry the iron and coal to feed Hamilton steel mills, or carry Thorold's paper to Chicago. Ports like Prescott and Port Colborne flourished as the large Lakers transferred their cargoes of grain or coal to the small Canallers that could navigate the 14-foot St. Lawrence canals. Beginning in the 1930s small ocean going vessels built in Europe for the Great Lakes trade had begun to appear in Great Lakes ports, but their numbers were small and they could only navigate the smaller canals partially loaded. The real pay load remained the bulk traffic on the Lakes.

In effect the old canal system was no fit instrument for the mid-twentieth century. As Captain John Murray said the old canals were "a bloody mess and a rotten nuisance."[5/] The ten miles and six locks at Cornwall took nine hours to travel, and the five locks at Lachine were a seven-hour endurance test. Lock equipment was frequently outdated, some of it even cranked by hand. There were delays and queues, as the traffic outdistanced the facility, and the masters knew only too well that an idle ship cost between one and three

[5/] Globe and Mail, November 6, 1952.

thousand dollars a day.[6/]

By the 1930s, however, Canadians and Americans had begun to talk of an international deep sea waterway into the heartland of the continent. Since the first European settlements in North America the Hudson-Mohawk waterway had competed with the St. Lawrence for the commerce of the interior, a competition reiterated in 1825 with the construction of the Erie Canal from Albany to Buffalo. But the American seaboard had turned to railways, and came to regard canals as competitors rather than colleagues. Nevertheless the government of the United States, reflecting broader national interests, and the government of Canada continually expressed their interest in a St. Lawrence Seaway. From the creation of the Deep Waterways Commission in 1895, the American government repeatedly confirmed its support of the idea, and Presidents Coolidge, Hoover, Roosevelt, Truman, and Eisenhower were its outspoken advocates. But the political pressures in the United States remained too strong, despite the formation in 1919 of a powerful American lobby known as the Great Lakes-Tidewater Association. The opponents to what by 1914 had become a joint transportation and power development were obvious. Led by American railroads they included the seaboard ports, the coal interests, private utilities, railway and mine workers, and even the isolationists who argued that the Seaway would open up the soft-underbelly of the United States to the Royal Navy. But by 1950 the alignment of forces had

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[6/] Financial Post, November 28, 1959.

changed: power, steel, defence, and the Canadian government had combined to defeat the National St. Lawrence Project Conference, otherwise known as the anti-Seaway, or anti-Iceway as they put it, lobby.

Although the power potential of the St. Lawrence River had been long known and surveyed by Ontario Hydro engineers in 1906, only a small plant at Massena, built in 1901, tapped the potential of the rapids, although the massive Beauharnois Power Canal used the lower rapids in 1928. As early as 1914 the United States suggested that the International Joint Commission study both the transportation and power potential of the international section of the river. By the 1920s both Ontario and New York state were increasingly concerned about hydro-electric power developments, and had applied to the I.J.C. for permission to build a dam. The famous Bowden-Wooten Report of 1926 clearly and monumentally demonstrated the feasibility of the Seaway and Power developments, and argued that the two were interrelated.[7/] By the end of the second war energy-hungry Ontario and New York were faced with power shortages and escalating costs, and by 1950 their two Hydro authorities had laid out detailed plans for a $650,000,000 joint project. Ontario's determination added fibre to the federal government's position, and New York's necessity helped alter the balance of power in the Congress.

By 1950 forecasts also predicted an alarmingly rapid rate of

[7/] Chevrier, St. Lawrence, 31-32.

exhaustion of the major American iron fields. The outbreak of the Korean War did nothing to suggest that steel production would diminish, while the fate of ore ships on the Atlantic during the second war underlined the need for a safe supply. Rich and accessible were the giant Ungava fields to be developed by the Iron Ore Company of Canada, a giant consortium of Hollinger of Canada and major American steel manufacturers, the other American and Canadian Steel companies. A Seaway that could handle enormous ore ships promised a cheap and plentiful supply of ore, and the American steel industry and its associated interests threw their weight into the Congressional battle.

Finally the Canadian Government, freed from the congenital hesitancy of Mackenzie King, forced the issue. By 1950 Prime Minister St. Laurent, pressed by Ontario and such members of the cabinet as C. D. Howe, Lester Pearson and Lionel Chevrier, adopted the policy of an independent Canadian action, and urged Chevrier to talk up the idea publicly. In an address at St. Louis University on June 6 the Prime Minister openly threw his support behind the Truman administration in attempting to secure Congressional approval, and warned that Canadians were getting "rather impatient." In September he advised the President that Canada intended "to go it alone," and secured Truman's support for unilateral action if Congress did not approve. In December 1951 and January 1952 the Canadian House of Commons gave unanimous approval to bills authorizing the Seaway and Power projects, and, following a spring visit from Pearson and

Chevrier, President Truman informed Congress that he had approved independent Canadian action. Eisenhower added his support and his political influence plus the realization that an all-Canadian Seaway and Power development was imminent finally shifted the balance of power. In May 1954 the President was able to sign the Wiley-Dondero Act. To the dismay of many Canadians, whose nationalism had responded to the go-it-alone policy, the St. Lawrence Seaway was to be a joint venture. Six months later a blast of dynamite signalled the start of construction.

Planning

The planning of the integrated Seaway Power development that affected every inch of the waterway between Montreal, Duluth and Thunder Bay was a task of staggering dimensions. The layman finds it difficult to comprehend the enormity and complexity of what was then, perhaps, the biggest engineering construction project in history. An entire river had to be dammed, channeled, and diverted without disturbing the regular waterflow more than a hairs-breadth five or five hundred miles away or interrupting river and lake navigation.

The planning had started long before. Ever since the Bowden-Wooten report engineers had studied the bed and flow of the St. Lawrence as intently as judges study the bodies of contestants at a beauty contest. The river had been endlessly measured, sounded, and photographed. In a variety of laboratories - the National Research Council in Ottawa, the new Seaway Authority lab in Montreal, the Waterway Experimental Station in Mississippi, and in Ontario Hydro's famous lab at Islington - hydraulic engineers had scaled and modelled and tested. The largest and most important laboratory was that of Ontario Hydro, which had been modelling since 1920 and was second to none in its experience of complicated hydro-electric engineering. In the end the complicated Hydro models were estimated to have saved $5,000,000. Far more important they made it possible to avoid costly - or fatal - mistakes, and enabled the Seaway authorities to draft an incredibly tight and interwoven schedule for construction in an unbelievably short time. The pre-planning alone made possible the rapid start of construction.[8/]

Planning and even construction involved more jurisdictions than had probably ever been involved in construction before; the two federal governments and their creatures the Seaway Authorities; the New York State and Ontario governments, and their power authorities; the province of Quebec; the municipal governments that would be affected along the length of construction; the International Joint Commission; the St. Lawrence Joint Board of Engineers, (three Canadians and three Americans to supervise construction); and the St. Lawrence Board of Control, whose major task was to watch over the water levels and the flow of water from Lake Ontario. But the

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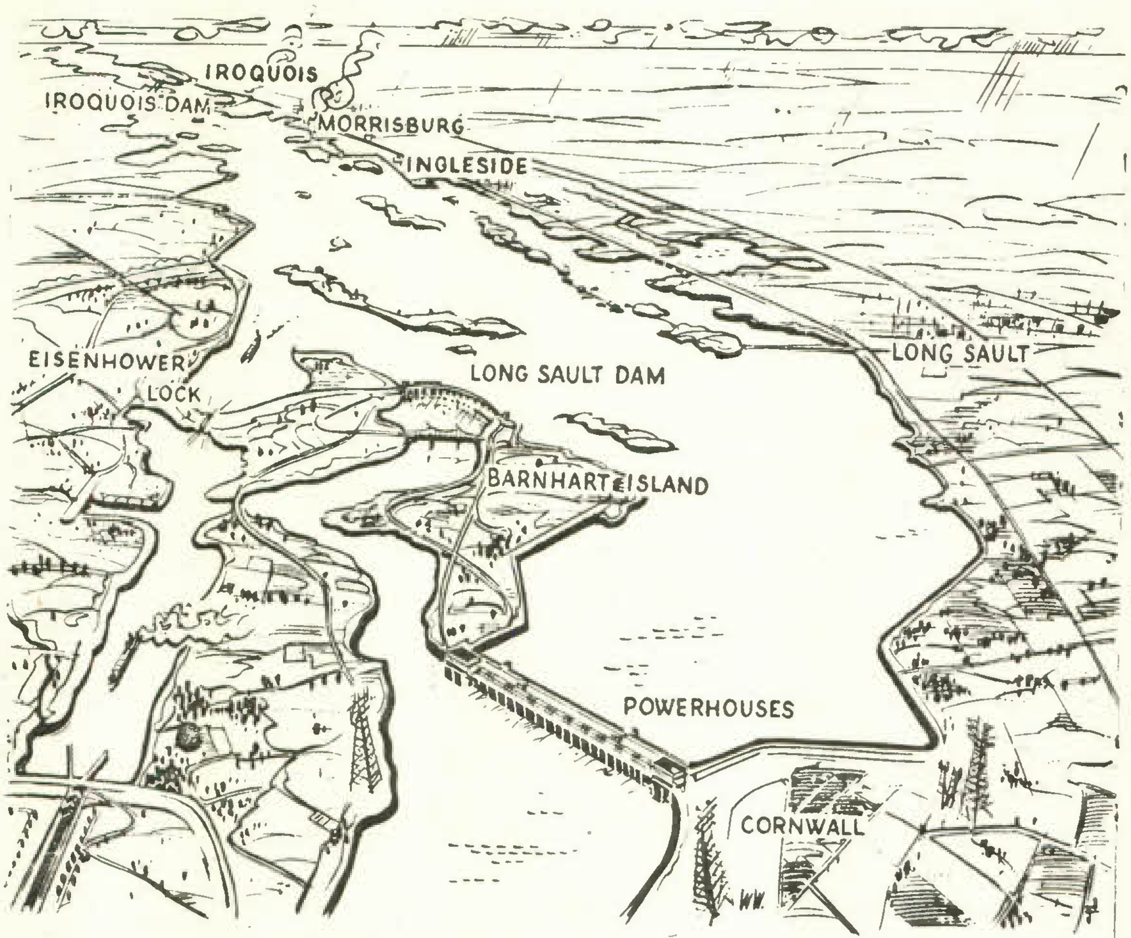
[8/] See a long article by Clark Davey in Globe and Mail, September 19, 1953.

integration was accomplished by the Seaway Authorities. The first contract was awarded in October 1954.

Both countries seemed anxious to maximize their share of the work, and the Seaway facilities available on their side of the border. In the end an accommodation was reached, although Canada insisted on building deep-sea facilities for Cornwall on the opposite shore from the real Seaway and let the Americans know that the basic construction design permitted a Canadian Seaway on the north shore at some time in the future. The final division of labour on the Seaway provided for the Americans to dredge the connecting channels above Lake Erie to a depth of twenty-seven feet; widen the south shore canals in the Thousand Island section; construct the ten-mile Long Sault Canal in the International Rapids, which with its two locks was to by-pass the St. Lawrence Reservoir above the Moses-Saunders Power Station; and build the superstructure of a new bridge between Massena and Cornwall. The Canadians were to build the sub-structure of the same bridge, an interesting if possibly inefficient joint venture; dredge and widen the Welland; widen other canals in the Thousand Islands; build the Iroquis Lock and a canal in the International Rapids and by-pass the upper Reservoir; and in the lower section (which was by far the most expensive Canadian contribution to the Seaway alone) deepen the Beauharnois Canal, by-pass the power station, construct a secondary canal to by-pass the Lachine Rapids, and make the necessary bridge alterations around Montreal.

The Power development, shared by New York and Ontario, used 81



INTERNATIONAL RAPIDS SECTION

feet of the 92-foot drop to create a power dam across the St. Lawrence which would take the full force of the River and generate 2.2 million horsepower. Estimated to cost $650,000,000 the entire complex involved building the Moses-Saunders dam from Barnhart Island to the Canadian mainland. The water to feed the giant plant, housing 32 generators and rising 167 feet from grouted bedrock foundations, was housed in a giant head pond created by flooding almost 20,000 acres of largely populated land in Canada, and 17,700 acres of farm and cottage land in the United States. Part of the cost of construction was the creation of forty miles of Canadian National track, new railway stations, bridges and highways, and the relocation of 6,500 people from eight communities in Ontario. On the American side only 225 farmers and 500 cottage owners were inconvenienced.

Construction

By the late fall of 1954 the grand design was more or less complete. The entire work was broken down into manageable contracts, and the specifications were carefully designed both to provide the contractors with the best knowledge available to the authorities and to incorporate the almost split second phasing of the various stages and completions of the spreads or functions contracted. Some contracts could extend over a long period of time; others had to be undertaken quickly and finished almost to the day. Yet it was clear from the outset that if power was to be delivered by 1958, as the power people insisted, the entire project had to be completed in record time.

Long before the design was complete the project had attracted the attention of a construction industry not yet overwhelmed by the boom in pipelines, giant hydro projects, the Trans-Canada highway, or rebuilding city cores. Initially there was some question about the ability of the Canadian industry to handle much of the construction. "Big Firms in Battle for Seaway Prize," wrote the Financial Post on August 23, 1952:

A major battle is shaping up between British European and U.S. construction interests, with Canada's construction industry in the middle for the glittering $500 million St. Lawrence seaway and power projects engineering prize.

So far, British interests appear to be out front - at least in planning, and in respect of foreign competition, are in a favored position; the government would like them to have a sizeable chunk of the deal, all things being equal.

For the moment, only the British position is reasonably clear. European interests have been nibbling - biggest interest is on the part of the Dutch, Germans and Italians, but so far this has not been translated into action. The Canadian industry seems reasonably sure its position is protected: it will get those parts of the deal it's equipped to handle. For some, it isn't.

For the moment, the U.S. industry isn't talking about its plans or hopes. For one thing, it's still hoping the end results will be a joint Canada-U.S. project: for another, it's close enough to the scene to put in a bid overnight on finalization of an all-Canadian deal. And it is certain, of course, to grab off all but small portions of the U.S. side of the power project.

One thing is reasonably certain, however: the U.S. industry won't be able to walk in and take over without sizeable investment in the Canadian industry; present plans are that the all-Canadian Seaway will be just that, as far as within Canadian construction capabilities from shifting of the first cubic yard of earth to driving of the last pile.

For British and European firms the story is somewhat different. Ottawa would be glad to see a good deal of the specialized equipment for the construction job come from these sources; in the case of the British, anyway, would probably facilitate investment in Canadian industry for actual engineering and construction or pave the way for British firms to carry out certain major phases.

The Canadian industry was determined to protect itself against foreign competition. When the federal government announced in September 1954 that tariff and excise duties would be removed on all materials and equipment used on three coffer dams, the Canadian Manufacturers' Association, the Canadian Construction Association, and the Canadian Association of Equipment Distributors, and the Ontario Road Builders' Association sent a joint letter of protest to the Prime Minister and members of the cabinet. The pressure was successful for the government later announced that the exemptions were limited to the first coffer dams.[9/] However, the reassured industry still admitted that heavy shovels, cranes and draglines, as well as rock-moving equipment and drilling equipment, would have to be imported from the United States.

Initially, the Financial Post at least seemed to feel that construction contracts would be awarded on both sides of the border without regard to nationality of the firm. Some American and British firms were more cynical and incorporated in Canada.[10/] By the summer of 1955 it appeared that nationality would be a key factor. The New York State Power Authority asked contractors to use American subcontractors, while Dr. L. H. Kearn, chairman of Ontario Hydro, outlined three "considerations" when he announced that the large

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[9/] Monetary Times, January 1955.

[10/] Or like Merritt Chapman and Scott of New York which bought C. A. Pitts General Contractors, took over Canadian companies or acquired an interest in them. Pitts got several large contracts, as did other newly-arrived American companies. Financial Post, July 2, 1955.

powerhouse contract had gone to the third lowest bidder;

> 1. The lowest price compatible with the completion of the work in accordance with the high standards required by the Commission and the necessity of meeting a scheduled date.
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> 2. The desirability of strengthening our Canadian fabric by doing the work with Canadian workmen and Canadian materials and equipment, recognizing at the same time that we are trading partner in the world market.
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> 3. The Commission is in business and has an obligation to stimulate Canadian business and industry.
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> These last two considerations are intangibles, but they are very important and the commission has endeavoured to arrive at a decision favorable to Hydro yet based on all considerations. 11/

The contract was awarded to Iroquois Constructors, a consortium of large Canadian firms, who agreed to lower their tender by $1.5 million to come within $2 million of the lowest tender. The lowest tender was from C. A. Pitts, an American subsidiary, and the second lowest from a consortium of American subsidiaries including Perini, Kiewit, and Morrison-Knudsen. Aware that the lowest tenders were from companies incorporated in Canada, Hearn observed that the critical question was the nationality of ownership not the nationality of the workmen or executives.

Before the project was completed 109 contracts for both construction and the supply of materials had been let in Canada. Many established Canadian firms were in the bidding, and firms large and

11/ Ibid.

small banded together on many contracts to form joint ventures rather than take the risk or expand the equipment and expertise necessary to tackle a major project single-handed.

Almost every section of the project posed its problems, and demanded its solutions. Some contracts were let before others, not only because the specifications were more complete but in order that excavation on one project could be used as fill on another. In general heavy excavation occupied much of 1955 and 1956, as one giant cofferdam after another bared the bed of the river. Concrete pouring was the keynote of 1956 and 1957. Equipment was installed in the powerdam and the locks in 1957 and 1958. By July the powerdam was ready, and a blast of dynamite broke the cofferdam above the plant and the St. Lawrence moved into its new quarters. Fifteen years later construction tales still grew taller, as engineers and contractors boasted how their particular spread was the most difficult of all. The most generalized problem was the tight integrated schedule, which demanded winter and night work under circumstances - temperature and soil conditions - that placed both men and machines at serious disadvantages. Another generalized problem was the unexpected difficulties posed by the glacial till, marine clay and sandstone faced by the excavators. Given the unprecedented volume of earth to be moved the contractors had to import heavier and larger equipment than had ever been used before in Canadian construction. But even the giant shovels and bulldozers, the enormous Euclid trucks, the 30-35 cubic yard scrapers, the massive dredgers and the powerful drills buckled under St. Lawrence conditions. Three editors of Heavy Construction News summarized the problems:

> Greasy glacial till afforded poor traction for all types of machines required to dig and move it. Wheel and crawler equipment suffered proportionately and the situation was wholly one which few contractors had encountered before in such magnitude.
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> One contractor found that his trucks and scraper equipment lacked traction so badly on wet glacial till that his production dropped drastically. His solution: a large supply of cinders which he rail and truck-hauled from Toronto at great cost to scatter over his machine routes to improve gripping power. He had almost as much equipment moving cinders as he did glacial till, but his traction problems were solved.
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> In dry weather, glacial till dust was so bad on many parts of the job that contractors were willing to pay a premium for oil in sealed tins (as opposed to open drums for bulk supply) simply because the smaller sealed tins afforded greater protection against grit contamination. The till dust blew into air intakes on the big machines, strangling supply lines, plugging vents and causing the equipment to cough, splutter and shudder to a halt. The till had one virtue: it proved valuable in providing an almost impregnable water barrier for over 21 miles of retaining dikes along the river in the international section.
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> Then there was marine clay. This left-over from about 7,000 years past - a time when a salt-water sea sparkled over most of the St. Lawrence and Ottawa River Valleys - earned the nickname "blue goop"....
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> When left alone in its natural state it looked fine; but when disturbed, the clay's high water content caused it to slosh, slide and ooze out of shovels, buckets and trucks. One contractor went bankrupt trying to handle the silly-putty nightmare. In hindsight both the contractors who moved it and the owners' engineers who were forced to set a tight work schedule to complete the job

> on time agreed that the marine clay should only have been worked in winter when it would have been firm enough to handle in a rubbery or brittle state.
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> Another challenge was Potsdam sandstone, hard on the shovel teeth, grater blades, tractor pads and rock drills. Steel tempered to last for months or years wore out in days, even in hours. A steady stream of equipment made its way back and forth for repair, and maintenance shops were set up on the site. The rock could be dynamited, but first it had to be drilled. This procedure proved painfully slow. Bits on compressed air drills were blunted in less than 10 feet and progress on blast holes averaged only about four feet an hour. Nevertheless, about 3 million yards of the material had to be removed at Quebec's Beauharnois Locks. 12/

New technologies, a little more sophisticated than cinder, were imported or developed to cope with construction necessities. In 1956 the jet-piercer was used for the first time in Canada. Developed by the Linde Air Products Company, a division of Union Carbide, the supersonic jet-fired gun shot a two-inch jet at the rock at five times the speed of sound. Boring at a speed of 25-feet per hour to a depth of 160 feet the jet-piercer was ten times faster than conventional drilling for blasting. To defeat the sandstone in the Beauharnois section one contractor apparently used the jet-piercer in combination with cold water. As the jet heated the rock to 4,000° F., a side attachment shot a stream of cold water into the hole. "In a shearing action the rock would shatter and escaping gas and steam would blow

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12/ Cited in Ronald E. Richardson, Walter G. Rooke and George H. McNevin, Developing Water Resources: The St. Lawrence Seaway and the Columbia Peace Power Projects, (Toronto 1969), 32-33.

cuttings to the surface."[13/]

The Seaway created the legend that Canadians are tough year-round construction workers. Ontario Hydro and experienced Canadian contractors, it was said, had developed the necessary techniques for all winter construction in sub-zero temperatures. There may be some truth in the legend, but it is more likely that the schedule on the St. Lawrence project compelled Canadians to work when they wished not to and to develop the necessary techniques. Authorities generally agree that the smaller and inexperienced Canadian contractors lacked the managerial and material - including equipment and manpower - resources of their south shore colleagues. Thus while the Americans could slow down or stop when the heaviest winter set in - and their labour force retreat to the Florida building boom - knowing they could double output in the spring, the Canadian beavers stayed stolidly at work.

The Canadians became expert at using blowtorches to thaw out equipment, diverting engine exhausts "through tubes under the haul-bed to try and keep the material movable," and spraying "insulating material on the dump unit to put a barrier between the metal and excavation." "I hope those fellows know what they're doing, our men won't pour if the temperature goes below zero," said one sceptical American engineer on the joint Moses-Saunders dam as he watched the cement being poured behind heated canvas shelters on the Canadian

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[13/] Ibid.

side in sub-zero weather. "The Canadians knew what they were doing," wrote Seaway President Lional Chevrier. "Their winter experience kept them at work. They even poured concrete in thirty and forty-feet lots - as opposed to the American additions of about six feet at a time."[14/] Whether it was experience or necessity Canadians did far more year-round work, proving to the sceptics that it could be done and helping to stabilize the level of employment on the project. Unlike American contractors the Canadian had little difficulty keeping crews at work. After all southern Ontario and Quebec were almost the warmest places in Canada for a construction crew to find work.

The accomplishment of the Canadian construction industry was enormous. The $1.2 billion project, of which $675 million was Canadian, was hardly the bonanza many expected it to be. Some firms went bankrupt, some lost money, and many filed claims totalling over $60 million against the Authority and Ontario Hydro. As the Engineering Journal reported: "bidders on early contracts on both sides of the river, particularly in excavation, bid work at prices generally far too low to show them a profit. This was due in part to their desire to become associated with a project destined to get much publicity, and in part to the lack of judgement with respect to the cost of handling the heavy marine clay and dense till foundations."[15/] The contractors on their part blamed inadequate

[14/] Chevrier, St. Lawrence, 83

[15/] Cited in Richardson, Rooke, McNevin, Developing Water Resources, 34.

data, hasty pre-bidding investigation because of the speed, the necessity for year-round work, and inflationary costs for both men and machines. But the Heavy Construction News editors were probably right in observing that:

> complexities were compounded by the fact that many Canadian construction companies were much smaller than they are now. And because they were smaller they lacked the modern management techniques which are essential to efficient, large-scale construction operations.
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> At the time, many firms in the field were still actively headed by their founders risen from the ranks as operators and construction workers. Too often, company heads at the time lacked the background which was so essential in pre-planning operations on a job of the magnitude of the seaway. Tending to function on a day-to-day basis, contractors of this general tradition suddenly found themselves in an unaccustomed world of engineered heavy construction far exceeding anything they had tackled previously. 16/

Among the hundred contracts some do seem to stand out: the Jacques Cartier bridge, the giant cofferdams, the creation of Lake St. Lawrence, the Moses-Saunders power house, and widening and deepening of the Welland Canal are interesting and illustrative.

International navigation requirements demanded a 120-foot clearance. But the first bridge on the Seaway - the Jacques Cartier in Montreal - had only a forty-foot clearance. Lionel Chevrier's description of the problem illustrates the difficulties created by divided jurisdiction repeatedly faced on the Seaway:

16/ Ibid., 35.

> This long low bridge.... had been one of the most heavily travelled bridges across the river for the last thirty odd years. So heavy was the traffic when seaway planners began surveying the bridge problem they found it would be impossible to interrupt traffic on this bridge for more than a few hours. Yet somehow an extra sixty feet of clearance had to be built into that bridge; nor could it be done by installing a vertical lift span, which consists of a movable section of the bridge that can be raised rapidly but which cuts off traffic in the raised position.
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> The bridge was owned by the National Harbours Board, a federal agency, which was only too anxious to help us to modify the bridge to suit our purposes. But the roads leading to the bridge were administered by the provincial highways department and we were not sure of the department's co-operation. The engineers and designers of the bridge, Dominion Bridge Ltd., ultimately worked out an ingenious method of raising the bridge fifty feet without interrupting traffic. But it was going to be an expensive operation. I took the plan to Premier Duplessis and proposed to him that while we would pay for the alteration of the bridge itself, his highways department should build the new approaches for it. I left the plan with him to consider.
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> A few days later at a press conference he attacked the plan, as well as another plan which we had for the Victoria Bridge, particularly the suggestion that his highways department should be required to pay anything for construction. I made several more attempts to get agreement without success. So we made plans to go ahead alone. 17/

The solution provided by Dominion Bridge, with Dr. P. L. Pratley who had designed the original 1929 bridge, was to raise the structure fifty feet and replace one span with a through-truss span with the supporting steelwork on top rather than underneath. Four 560-ton

17/ Chevrier, St. Lawrence, 65-66.

climbing jacks raised the spans six inches at a time, and concrete blocks were inserted. Every two feet concrete courses were poured on the piers. The entire operation proceeded so smoothly for over two years that the 46,000 daily motorists were seldom inconvenienced, although some of the delicate raising was done at night since the heavy traffic caused the bridge to tremble. Meanwhile the new span had been built in position on two runways upstream from the old and attached to it. Finally, on October 20, 1957 the two spans, weighing 3,100 tons, were moved 78 feet and the new fitted as snugly as the old. Traffic was diverted for only five hours as eighty men moved the spans and locked the new one in place.

Creating the ship channel through Laprairie Basin and by-passing the Lachine Rapids was a monumental task of excavation. Night and day giant Euclid trucks dumped their load further and further into the river, until at a predetermined point they turned and moved the line of fill toward the shore. The area enclosed by the cofferdam was pumped dry, and the ballasting, blasting and excavating went ahead with the trucks carrying the fill to the next cofferdam. Upstream at Caughnawaga and Iroquois the flow of the river was such that steel sheet pilings filled with tons of excavated rock had to be used for additonal support.

To harness the power for the Moses-Saunders dam between Cornwall and Barnhart Island the Americans built the Long Sault dam, to block off the other channel, and two Seaway locks, while the Canadians constructed the Iroquois control dam and lock at the beginning of the old rapids. When finished the International Rapids had become Lake St. Lawrence, which included the old river bed and almost 40,000 acres of Canadian and American farmland, and Canadian and American contractors had excavated 86 million cubic yards, deposited 19 million cubic yards of rock and earth for the dykes and cofferdams to allow building in the dry, and used three million cubic yards of concrete and 190 million pounds of steel. The million tons of concrete poured into the Canadian side of the Moses-Saunders dam itself was mixed at a completely automated plant above the powerhouse. Rock and sand came from a quarry three miles away owned by Hydro and operated by C. A. Pitts. Trucks carried the raw material to a conveyor belt that ran through a tunnel under the Cornwall Canal, where it was stockpiled before being carried to the hoppers. Cement brought by rail to the tunnel was blown through a six inch steel pipe to storage before it was fed out into the mixers.

Deepening the historic Welland was less glamorous, but the six contractors who secured the $22 million job faced the difficult problem of blasting the rock floor without shattering the retaining walls. Canadian Industries Limited developed an ingenious new method of blasting. Since air-filled spaces cushion explosive blasts, they utilized hermetically sealed cans in the drill holes. The cans absorbed the blast and the rock broke cleanly along the line of the holes. To blast rock in midstream without having to constantly move the drilling barge, the engineers fitted a compressor to the barge to provide a curtain of air bubbles along the ship's side. Up to a hundred tons of rock could be exploded within thirty feet without endangering the barge.

The old saw "necessity breeds invention" was more than true along the length of the Seaway. On almost every project scientists, engineers, contractors or workmen repeatedly devised new ways of solving old and new problems.

On July 1, 1958 Dr. Otto Holden, Ontario Hydro's chief engineer, blew up the cofferdam that held back the St. Lawrence above the powerhouse. Within two hours a crest six feet high reached the powerhouse and within three days Lake St. Lawrence had been formed for 44 miles above Cornwall. Ships were soon plying the new Seaway, although it was not until June 26, 1959 when the royal yacht Britannia brought Queen Elizabeth to meet Prime Minister Diefenbaker and President Eisenhower that the Seaway was officially opened.

Impact

There is no reliable way of measuring, nor is there any easy way of describing, the impact of the St. Lawrence Seaway and Power project on the country. Unquestionably it helped the Canadian construction industry come of age in the 1950s, gave employment to thousands of men on site, and provided a stimulus to the local economies and an enormous boost to the suppliers of construction materials and equipment.

Although the evidence is scanty the Seaway project aged the Canadian industry. The dimensions of the task forced Canadian companies to consider joint ventures. The experience was a reminder that old fashioned management had to adjust to new managerial techniques and complex flow-charts. The massive undertaking compelled them to use equipment far larger and far more expensive than many had encountered before. Most of the large Canadian engineering construction and manufacturing construction firms had a piece of the project. Occurring simultaneously with other major engineering construction projects, the Seaway helped to change the scale and, perhaps, the nature of heavy construction in Canada.

It also helped to create the skilled manpower for the future. On May 20, 1954 the Civil Service Commission advertised for 33 specialist engineers, and ultimately the Authority employed about 200.[18/] Ontario Hydro had to expand, as did the construction firms. An estimated 500 professional engineers worked on the project, many of them acquiring (as did their elders) valuable on-site engineering planning and job management skills. (Indeed, many contemporaries reported that the crying need was for people to fill the new area of planning and management.) Young engineers, accountants, job foremen or machine operators suddenly found themselves cast in a new role, leaping from junior positions to severely challenging desk or site responsibilities. "It wasn't a ladder of success in my case," said

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[18/] Toronto Telegram, May 20, 1954.

one senior member of a firm later, "it was an elevator."[19] Much of the professional and skilled labour came from Canada, but the Seaway had attracted international attention and there were considerable numbers of immigrant engineers and skilled workmen on the project.

With the tools available to Onderdonk on the C.P.R. the project would have taken decades, assuming it could have been done at all. But despite the estimated $100 million of machines at work on the Seaway in 1956 the project still employed an average of 15,700 men over the four years. In the peak period of 1957 an estimated 22,000 people were at work on all aspects of the work directly related to the engineering, supervision, and construction.

A central hiring bureau at Cornwall, with a branch at Morrisburg, was established by the National Employment Service to handle applications for jobs. Preference was given to locals from the permanently depressed areas of the north shore and eastern Ontario. Details of positions open were sent to NES offices across the country, combined with the warning that labour should not head to the Seaway without assurances that specific positions were available. Nevertheless, transient labour poured into the area and within a few months relief for the unemployed and unemployable increased 100 per cent.[20] (Rumours of $8 an hour to move flooded graves brought an army of unemployed gravediggers to Cornwall!) Police stations, welfare

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[19] Richardson, Rooke, McNevin, Developing Water Resources, 39.

[20] See Labour Gazette, December 1956, 1498-1502; Globe and Mail, December 29, 1954; February 5, 1955.

officers, and even branches of the Canadian Legion were taxed to capacity.[21/]

However, during the recession some valued the project almost as much as a job producer as a transportation and power project. The federal government had given it high priority as a counter-cyclical project in 1945, and in April 1954 the American Federation of Labour-Trades and Labour Congress had urged the government to "go-it-alone" in order to create more jobs.[22/] Even with the construction project underway the Parks programme was accelerated, not only to counter criticism that the tourist resources on the American side were further advanced, but also to relieve unemployment.[23/] (Not surprisingly an inquiry from the Jamaican government about the possibility of importing Jamaican labour did not receive a positive response.)[24/] Unskilled labour seemed plentiful enough, but there were frequent shortages of heavy machine operators, ten-ton truck drivers, and mechanics.

Of 4,300 men at work between Cornwall and Prescott in September

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[21/] Inevitably there were those who tried to capitalize on the employment opportunities on the Seaway. "Seaway Opportunities" made a short-lived killing by suggesting that it had an inside track in securing well-paid jobs. In return for a one dollar fee, however, the agency replied only with general information, a list of contractors, and the advice to register at the nearest National Employment Service office. Seaway Opportunities was finally denied use of the mails. See Globe and Mail, February 23 and 25, 1955.

[22/] Globe and Mail, April 26, 1954.

[23/] Ibid., September 16, 1955.

[24/] Ibid., November 1, 1955.

1956, 60 per cent were skilled and 10 per cent semi-skilled. Of the former over 85 per cent came from outside the district, while only 10 per cent of the semi-skilled were far from home. The unskilled were largely locally recruited. There was less than a 10 per cent turnover per month, and a policy of project seniority was adopted which helped to combat seasonal layoffs. In 1955 10 per cent were laid off from November to March, and a 20 per cent layoff was predicted for the winter of 1956.[25/]

Working conditions were generally uniform. The standard work-week was a forty-four hour, five-day week, although occasionally contractors were forced into a three shift six-day week. Time and a half for overtime after forty-four hours, and double time for Sundays and holidays was standard. Wage rates in 1956 paralleled thosein Toronto for skilled tradesmen and unskilled labour.[26/]

[25/] Labour Gazette, (December 1956), 1498-1502.

[26/] I have not explored labour relations on the site. Certainly, despite a no strike clause, work stoppages, if not strikes, were not infrequent, largely among the driver-owners who complained of the bad roads and high repair bills, long queues at the pits and disputes over standard yards of fill. The Teamsters appear to have played an important role in attempting to organize the site. T. L. Hills, The St. Lawrence Seaway, (London 1969), 126-27, writes: "The labour unions were not slow to attempt to capitalise on the great concentration of manpower at Seaway and Power sites. The International Brotherhood of Teamsters made a bold bid to organise the labourers working for the contractors in the Lachine section, but they were unsuccessful. Actually they campaigned quite successfully until they ran into Miron Freres Ltd., one of the largest and most powerful contractors working on the Seaway. A strike resulted, but after the forceful intervention of the Quebec Premier the Teamsters beat a rapid retreat. From this point the Canadian Labour Congress in Ottawa took over and a council was established, which bargained quite successfully for all labour. The contractors set up a similar organisation which worked in comparative harmony with the Congress council of unions." Canadian Labour, (June 1959) later boasted of four years of labour peace on the "largest construction job yet seen in Canada."

The weekly payroll infused new life into the north shore, particularly Cornwall, the construction capital. Outside the city an Ontario Hydro camp sprawled among orderly rows of lights in what had been a field. Up river were construction and trailer camps, housing workmen and their families. Contractors rented farms and houses for their offices. A depressed farming economy and lethargic Cornwall were turned almost overnight into the dynamic centre of a frontier construction economy. Cornwall wasn't Yale or the "end of track," but to older inhabitants the moral and social problems seemed much the same.

Cornwall itself saw the Seaway not as a construction boom, but as the beginning of a new era. Private builders put up apartment buildings and planned new subdivisions, while government agencies secured options on enough land for 1,500 homes. The Cornwallis Hotel added a $500,000 wing, two new motels were built, a new six storey Seaway Authority headquarters replaced the old post-office, a new supermarket and numerous stores lined the downtown streets. Portable schools handled the influx of children.[27/]

But other centres along the new Seaway were less fortunate. Seven of them and one-third of the city of Morrisburg disappeared beneath the waters of Lake St. Lawrence. Negotiating with the 6,500 people who had to be evacuated, dealing delicately with the descendants of those buried in the eighteen cemeteries in the oldest settled

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[27/] Financial Post, January 15, 1955.

portion of Ontario, and proposing and implementing alternatives to the historic sites that would lie at the floor of the new lake were tasks of enormous proportions.[28] And once the emotional and financial arrangements had been made, totally new communities, parks, wildlife sanctuaries and historic reminders had to be built. Many of the 6,500 moved into new homes and new communities, while the giant house movers employed by Hydro's Rehabilitation Programme, apparently from J. W. Hartshorne of New Jersey, moved 531 houses to their new locations. Using the 100-ton Hartshorne mover on specially designed roads, Hydro showed the press how it was possible to move a house a mile and a half to the new community of Iroquois as the family sat on the front porch. Before the house was on its new foundation, electricity and telephone were installed. Leaving after breakfast, the families arrived before lunch.[29] The new communities of Iroquois, Ingleside, and Long Sault were as much part of the project as the Moses-Saunders dam. Iroquois alone cost Hydro over $80 million. Upper Canada Village, commemorative parks, Indian artifacts from uncovered burial grounds, and a riverside parkland highway were other Seaway benefits. The Ontario Department of Travel estimated that tourist expenditures would average $10 million a year, roughly the equivalent of an industry with 1,500 employees.

The long term benefits of the power development to industrial

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[28] Globe and Mail, June 18, 1955.

[29] Ibid., September 20, 1955.

eastern Canada were unquestioned, as were the stimuli through tourism and some industrial development to the local economy. But both the generalized and local long-term benefits of the Seaway seemed to be anyone's guess, and some people's folly. Halifax and St. John were naturally fearful, and Prescott knew that its days of transhipment were over. But Montreal had apparently got over its earlier anxieties, and, like every siding along the Canadian Pacific, every city along the Seaway from Cornwall to Duluth billed itself as the inland ocean port of the future.

Almost everyone was prepared to put a price on the Seaway. One economic adviser predicted that the Seaway "will set off a chain reaction that will have a greater cumulative impact on Canadian growth than anything that has happened since the building of the trans continental railways."[30/] Lionel Chevrier categorically stated that the economic benefits would total $100 million a year.[31/] Prairie grain growers and Hamilton steel manufacturers for the first time found something in common, the former expecting to save $20 million, and the latter $250 million a year.[32/] Critics charged that the Seaway would stimulate competition, not productivity, and scoffed at the prospect of Seaway tolls paying off the cost in fifty years.[33/]

[30/] Macleans, (August 1, 1954), 54.

[31/] Financial Post, April 23, 1955.

[32/] Saturday Night, (November 7, 1959), 74.

[33/] See for example the statements of the vice-president of Canadian Westinghouse in Saturday Night, (March 12, 1955), 27-28.

Fifteen years later almost everyone was claiming to be accurate. To the outsider the evidence, on both sides, was difficult to evaluate, largely because it was impossible to separate general economic growth along the St. Lawrence corridor due to a host of economic developments from those that might have been caused, or accelerated, by the Seaway. For example, even the economic growth of Cornwall could not be directly attributed to the Seaway. While many construction workers stayed on, and a number of small service industries remained in anticipation of continuing Seaway business, growth was slow. The 1955 prediction was that Cornwall (population 35,000) would be the fastest growing port between Toronto and Montreal, and enjoy a 28 per cent population increase in ten years.[34/] As it turned out while population grew 31 per cent in eighteen years, the phenomenal period of growth occurred after 1962. Between 1962 and 1968, $42 million was invested in new industries, and almost $38 million was spent on plant expansion. In 1968 alone new companies invested $12 million and commercial development almost reached $11 million. But the same period saw significant expansion elsewhere, even without the various government inducements to industry to locate in eastern Ontario.[35/]

Montreal provided another interesting illustration. Lionel Chevrier stated that the Lachine Canal was built on the south shore

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[34/] Financial Post, January 15, 1955.

[35/] Chris Jermyn "St. Lawrence Seaway Commission," Canadian Geographical Journal, (November 1969), 79.

not only to avoid difficult constructions problems and avoid further congestion on the north shore, but also to develop the depressed south shore.[36/] Before the Seaway was finished land values had soared, and there seemed to be the beginning of major industrial developments. Between 1955 and 1964 the urbanization (as defined by the Montreal Planning Bureau) increased from 6 to 18 per cent, yet in the same period the increase north of Jesus Island was from 11 to 37 per cent.

Almost no one has argued that the Seaway sparked the expected - or at least the much proclaimed - industrial development. Canadian delegations toured Europe, particularly Britain, to argue the advantages of cheap power and inexpensive Seaway transportation.[37/] But the results appear to have been meagre. The Seaway may have altered location decisions - though one study suggested that not one new industry had located in Toronto because of the Seaway - but it appears not to have been a crucial factor in attracting completely new industries. After considerable research in 1968-9 a German geographer concluded that "Contrary to expectations, the Seaway did not attract very much industry. The Upper St. Lawrence Valley did not in any way become an industrial lane along a waterway that was able to guarantee the most favourable conditions for shipping as well as inexpensive hydro-electric power. Only a few industries settled there after 1959." Even in port cities, she added, "the expected

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[36/] Chevrier, St. Lawrence, 85.

[37/] Globe and Mail, April 29, 1955.

economic upswing was slow in materializing. Most of the ports were insufficiently prepared for the opening of the Seaway; in fact, many importers and exporters in the hinterland of the Great Lakes ports are only becoming aware of the advantages offered them by the new route via the St. Lawrence."[38/]

The increase in tonnage and the growth of new ports has often been taken as prima facia evidence of the positive impact of the Seaway. The following table provides the gross tonnage statistics for Canada's leading ports:

CITY	1954	1961	1966	1969	1970
Baie Comeau	-	3.4	8.4	4.9	7.6
Halifax	3.9	7.5	9.4	10.3	11.
Hamilton	5.6	7.7	10.7	11.1	12.8
Montreal	16.1	20.9	22.8	17.7	22.3
Thunder Bay	6.8	13.4	19.5	13.9	20.7
Port Cartier	-	1.3	9.4	12.3	16.
Quebec	3.1	4.7	6.3	7.3	8.5
S.S. Marie	1.6	5.7	5.0	4.3	5.7
Sept Isles	-	8.8	19.9	19.1	7.6
St. John	2.2	5.2	5.9	6.1	6.4
Toronto	4.7	5.2	5.7	6.4	5.1
Vancouver	11.4	15.0	21.6	24.	26.9 [39/]

Clearly the Seaway did not radically alter the trade pattern among Canada's leading ports. Montreal did not decline, but, on the other

[38/] Angelika Roemer, The St. Lawrence Seaway, its Ports and its Hinterland, (Germany 1971), 214.

[39/] Figures from Canada Year Book.

hand, it was not able to keep abreast of Vancouver as the insatiable appetite of Japan for Canadian raw and semi-finished materials nourished Pacific trade. Halifax and St. John were not destroyed, as many had anticipated. Moreover, the expected immediate increase in traffic did not materialize, although by the end of its first decade the Seaway was approaching the fifty million tons predicted for the Montreal-Lake Ontario section. Nor did the cargo pattern change significantly. It had been expected that 10 per cent of the traffic would be in general cargo. By 1968 this had risen to 16 per cent, largely because of American imports. But on the whole the Seaway remained less a Seaway than an inland waterway for the transportation of bulk commodity goods. Since 1959 iron and grain have accounted for more than two-thirds of the total cargo, and coal, petroleum and paper have constituted much of the rest.

It would even be difficult to argue convincingly that the growth of Baie Comeau, Sept Isles and Port Cartier were totally products of the Seaway. The Seaway provided only a marginal - and perhaps temporary - advantage to the shippers of iron ore. Without the Seaway Canadian ore would have moved to the Atlantic ports; indeed, it was not until 1966 that 50 per cent of the tonnage from these ports went inland via the Seaway. Nor does the future necessarily guarantee the continued use of the iron ore Seaway, for technological improvements are making the American railways - with a promised 300-unit train moving 30,000 tons - even more threatening competitors, and demanding ever-increasing improvements along the Seaway - such as the alterations completed and underway in the Welland Canal. But the opening of the $10 million dock at Sept Iles in 1968, which enabled 200,000 ton ships to load ore for eastern American ports, again threatened the comparative advantage of the inland waterway.

In fact, some observers still regard the Seaway as a continuingly dubious proposition, at least compared to the promises and expectations. The Seaway can handle the increasingly larger Lakers - the enormous bulk carriers called the 730's after their length - but they dare not pass the Gulf. And the giant new ocean tankers today weigh over 300,000 tons and need super ports to handle their bulk and 72 feet draught. To much of the world's shipping the Seaway again becomes an impenetrable inland water system. Improved facilities, trucking, solid pipelines, jumbo jets, and containerization all pose threats or challenges to the "new" Seaway of the 1950s.[40/]

Moreover, the distinction between the old Lakers and the old Canallers has emerged. Even larger vessels are being designed for the iron ore trade on the Upper Lakes (where competition from Ungava has led to extensive and positive research into making the taconite reserves competitive) which cannot penetrate the Welland Canal. As a result (as well as of land shortage in Hamilton) Stelco of Hamilton is building an integrated iron and steel complex at Nanticoke on Lake

[40/] The heavily subsidized Canadian shipbuilding industry benefitted enormously from the Seaway. Able to handle larger ships - all of which had to be Canadian under Canadian rules - the Seaway helped to force efficient shipping. By 1968 there were 38 new 730's, all built in Canadian shipyards.

Erie, where Ontario Hydro is building a $226 million thermo-electric plant using United States coal.

Finally, whatever economic benefits have materialized, it has been at an economic cost. The Seaway has never come close to paying its way, let alone pay off the investment over fifty years as was promised. Costs have remained too high, and tonnage has remained too low.

Professor John Munro has argued strenuously that the tolls should be raised to place the Seaway on its own bottom; otherwise it is simply a subsidy to some sections of Canadian society at the expense of others.[41/] But with the marginal nature of much of its operations, the Seaway officials know - and Canadian shippers, particularly in iron ore and petroleum, and manufacturers are quick to remind them if they forget - that an increase in tolls would keep the tonnage down and that, on the contrary, their abolition is essential if the Seaway is to remain competitive.

The St. Lawrence Seaway was the fulfillment of a national dream. It provided an immense stimulus to the Canadian construction industry, and to the economy as a whole. Its long term consequences are more difficult to measure, although its continual improvement and the constant expansion and improvements of port facilities continue to stimulate Canadian construction. But any transportation artery is at best a precarious thing. As the Canadian Pacific revealed it cannot

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[41/] John M. Munro, Trade Liberalization and Transportation in International Trade, (Toronto 1969), 179.

by itself open up new resources unless the circumstances are right. And when the circumstances change - it can begin its gradual return to its natural state.

In the mid-sixties Ronald Ritchie wrote:

> In one sense, perhaps too much was expected of the Seaway. From a fundamental economic point of view, it represents the creation of a new, lower cost transportation network. Canada has had experience with such projects before, and they have often had profound effects on the economy and the population of vast areas. In this case, however, the area was already served by an extensive network of reasonably efficient transportation systems. The competitive position of the new facility had, moreover, the disadvantage of being seasonal. In these circumstances, one should not expect miracles. Basically, however, the Seaway demonstrated the difficulties of complex long range economic forecasting. The Seaway was designed to bring Canadian producers - wheat producers, iron ore producers, manufacturers of all kinds - closer to their markets by reducing transport costs. Without economic transportation through the Seaway, Quebec-Labrador iron ore could scarcely compete at all in the blast furnaces adjacent to the Great Lakes. The Seaway by itself, however, has not been able to offset swings in the demand for steel, or technological changes which have made the competitive position of these Canadian ores more difficult than had been anticipated. Similarly, the record appears to show that Canadian grain movements depend more on particular shortages experienced by overseas customers than on small competitive cost advantages in transportation - although freight savings on grain are undoubtedly important to the final realization of the Western farmer. Petroleum was expected to be a third major commodity moving through the Seaway, but even in the early fifties it was hard to foresee the impact on these expectations of extensive competition from natural gas and of limitations which might be imposed by a national oil policy. At a time when this combination of economic pressures and political decisions is putting a stop to pipeline movement of petroleum products from Montreal west to Toronto, a seasonal seaway is not apt to find many

> oil tanker customers.
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> Now that we have nearly five years' actual results to study, we can probably make more accurate forecasts of the future of the Seaway - although due account must always be taken of the hazards of other changes which cannot easily be foreseen at this time. Judged in today's perspective, the Seaway is an important, but not decisive, factor in the economy of a huge interrelated area, an area closely knit by a variety of transportation links before the Seaway was begun. From the standpoint of planning, the Seaway may be less significant as an example of large scale economic planning in its own right, than it is as an important new fact to be taken into account in the individual plans of thousands of producers, purchasers, shippers, and harbour authorities. Taken as a whole, the sum of their economic plans may prove even more accurate than the forecasts by which the Seaway itself was justified. 42/

Almost a decade later there seems little reason to amend that judgment.

42/ Ronald S. Ritchie, "The St. Lawrence Seaway: An example of Economic Planning," Community Planning Review XIII No. 4, (March 1964), 38-39.

P I P E L I N E S

PIPELINES

When Imperial Oil blew in Leduc in February 1947 it heralded the beginning of the modern oil and natural gas industry. Within a decade the Alberta oil boom initiated and sustained a massive expansion in the construction of a highly specialized transportation system for the petroleum industry. As an efficient and economical means of transport, oil and natural gas pipelines replaced the conventional railway tank cars and lake tankers in the long-distance transportation of crude oil and petroleum products. By the end of the 1950s, Canada had passed through the great era of pipeline construction with more than 5,100 miles of crude oil and products trunk lines, roughly 6,500 miles of gas trunk lines, and the longest natural gas pipeline in the world.

The transportation of energy resources has been central to the continued industrial development of Canada. Availability of energy resources has clearly affected the development of Canada's disparate regions. The province of Alberta, rich in reserves of oil and natural gas, possesses the material requirements for industrial development and has benefitted greatly from the piping of energy resources to markets in eastern Canada and the U.S. mid-west. To sustain industrial growth, Vancouver and southern British Columbia and the cities of central Canada have been compelled to import oil and natural gas to complement their existing resources. In the overall effort to transport energy resources from the Alberta fields, oil and natural gas pipelines have overcome transportation resistances - the formidable barriers of distance and technical limitations - to the movement of materials essential to industrial development.[1/]

Early Pipelines

The great Canadian pipelining boom of the 1950s completely dwarfed the early developments in pipeline construction.[2/] As early as 1853 an enterprising Scotsman in Trois Rivières had constructed a 15-mile cast iron pipeline which formed the first natural gas line in Canada.[3/] The first Canadian oil pipelines were built in the oil field at Petrolia, Ontario, between 1862 and 1875. Following the development of a local storage and pipeline network at Petrolia,

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[1/] For a perceptive early study of energy resources and regional development, see John H. Dales, "Fuel, Power and Industrial Development in Central Canada," American Economic Review, XLIII (May 1953), 181-198.

[2/] See William Kilbourn, Pipe Line; Trans-Canada and the Great Debate: A History of Business and Politics (Toronto 1970).

[3/] See Eric J. Hanson, Dynamic Decade (Toronto 1958), 153. For the early history of pipeline construction at Petrolia, see Victor Ross, Petroleum in Canada (Toronto 1917), 16, 42; and Charles Whipp and Edward Phelps, Petrolia 1866-1966 (Petrolia 1966), 4, 10, 16, 30.

a number of gathering and trunk lines were laid in southwestern Ontario. As the technology improved, larger and longer pipelines with less leakage were built to carry oil and gas to industrial centres and border areas around the lower Great Lakes. In Western Canada, the discovery of natural gas in 1911 at Bow Island, Alberta, prompted the construction of a 16-inch, 180-mile pipeline to supply Calgary with the new fuel. The construction of this "Sixteen Incher" in 1912 was a minor breakthrough in pipeline technology, the world's longest 16-inch natural gas pipeline.[4/] The earliest oil pipelines laid in Western Canada linked Calgary with Canada's first major oil and gas field at Turner Valley at the close of the First World War. Throughout the 1920s and early '30s, oil and gas discoveries at Turner Valley continued, but the emerging petroleum industry remained without an economical means to supply the energy needs of industrial centres in eastern Canada.

The idea of building oil and gas pipelines to link Alberta's energy resources to eastern industrial centres originated in the 1930s. As early as 1931 a Belgian immigrant and mining engineer, Jan Bilterijst, proposed to the premier of Alberta that a pipeline be built to carry natural gas from the Turner Valley to eastern Canada.[5/] With the great advances in pipeline technology over the following

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[4/] But a slightly smaller "big inch" line had been pioneered in Cincinnati in 1909. Kilbourn, Pipe Line, 10.

[5/] Ibid, 13, 14.

20 years, the original 'pipe dream' became a more practical and economically feasible scheme. New methods of welding, strengthening and coating large-diameter pipe against high pressure and corrosion were discovered. Pipelines were laid in the United States under water and over mountains, through bog and swamp. The Second World War firmly established the pipeline as a practical form of transportation for the oil and natural gas industry. The 'Big Inch' and the 'Little Inch' oil pipelines in the United States, the 'Canol' pipelines from Norman Wells, North West Territories, to Alaska, and the 236-mile line from Portland, Maine, to Montreal had effectively compensated for the critical shortage of commercial shipping and the vulnerability of oil tankers to submarine warfare.[6] In 1948 the American Federal Power Commission (FPC) authorized a 1,830 mile, 30-inch line, then the longest and largest pipeline from the southern Gulf states to New York City. Advances in pipeline technology made the idea of building a trans-Canada pipeline from Alberta to industrial centres in Canada an economically and technologically viable project.

The discovery of oil at Imperial Leduc No.1 south of Edmonton

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[6] The Portland-Montreal pipeline was constructed in 1941 by Standard Oil of New Jersey from South Portland, Maine, to Montreal East. In 1946 the system was taken over by the four companies with refineries in Montreal - Imperial Oil with 40 per cent and British American, McColl-Frontenac, and Shell with 20 per cent each. When Petrofina opened a refinery in 1955 it acquired 10 per cent from the others, a year later. Royal Commission on Energy, First Report, (Ottawa 1958), 35-36.

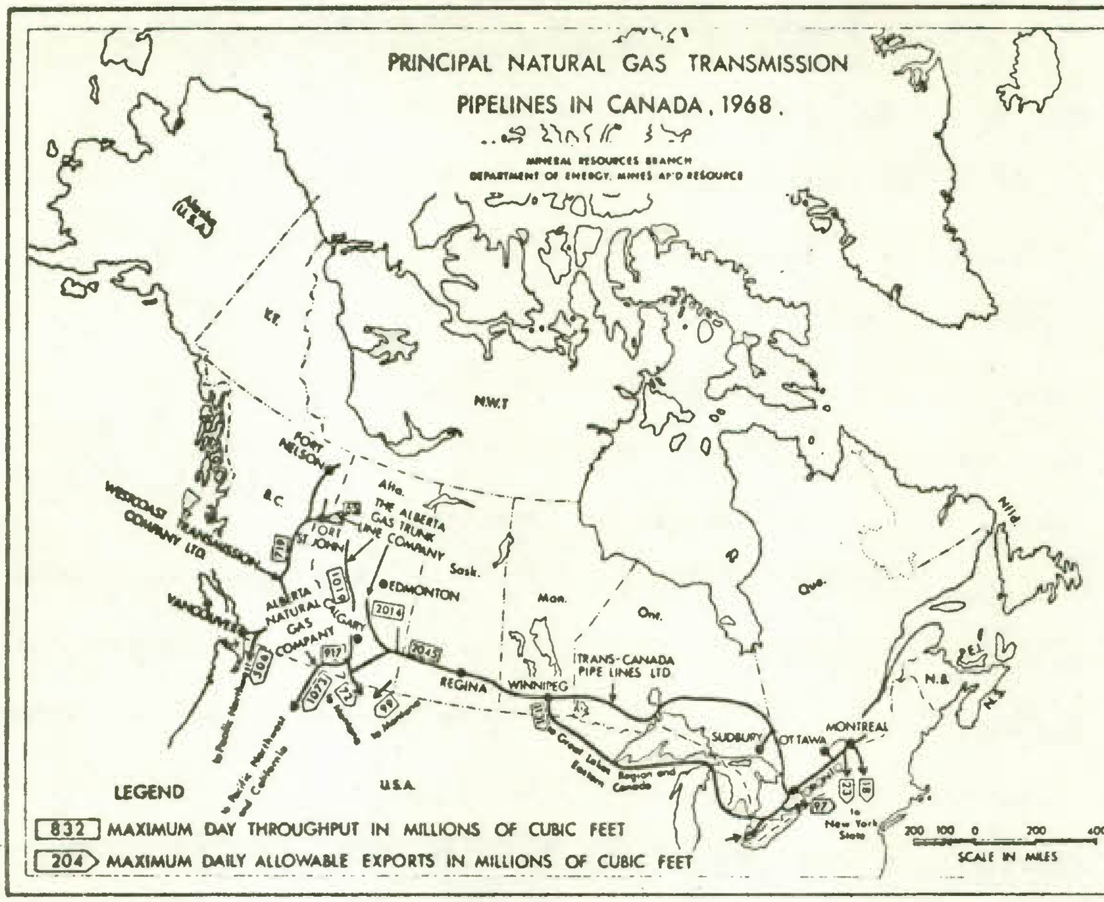
in February 1947 signified not only the beginning of a petroleum boom in Alberta, but the onset of a period of massive pipeline construction in Canada. The development of Leduc and the nearby Redwater oil field clearly established Alberta as one of the world's chief sources of oil and gas. The discoveries attracted a host of oil promoters seriously interested in piping Alberta oil and gas to outside markets. "Pipeline building to carry oil," the leading Canadian financial journal predicted in 1949, "will be big business in the years ahead."[7/]

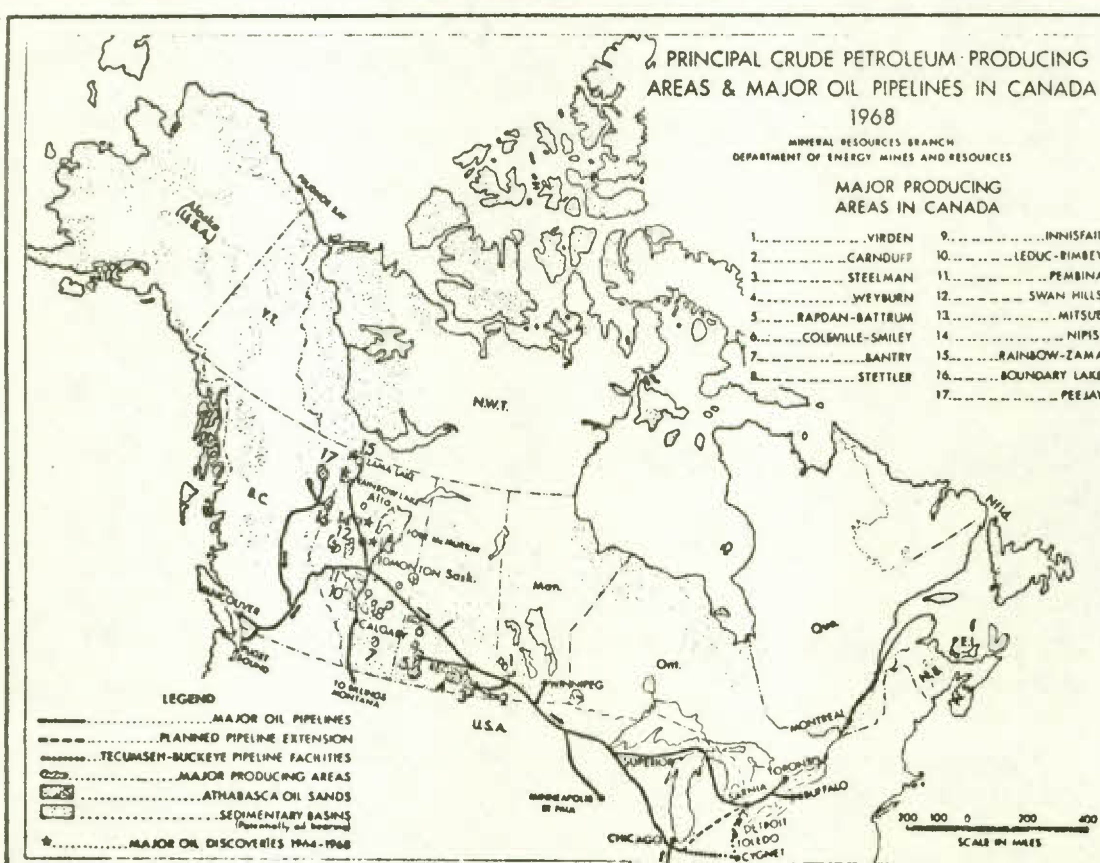
Interprovincial

Canada's first major pipeline was the Interprovincial, planned and constructed in the initial period of the Alberta oil boom. After the discovery of Leduc in 1947, Imperial Oil, the largest producer of crude oil in western Canada, initiated plans for a major pipeline to carry crude from the Edmonton area to refineries and the eastern rail connection at Regina.[8/] Pipeline promotors from Imperial recognized

[7/] Gordon M. Grant, "Where Will the Big New Oil Pipeline Go? A $64 Question for the Technicians," Financial Post, June 11, 1949. Alan Phillips, "Who Will Win the Great Gas Pipeline Stakes?," Maclean's LXVI (October 1, 1953), 18.

[8/] See Loren F. Kahle, "Interprovincial Pipe Line...A Cast History," Oil and Gas Journal, XLIX (September 21, 1950), 206, 338; and Anthony Gibbon, "Edmonton - Great Lakes Pipe Line Under Construction, "World Oil, CXXI (August 1950' 240. See also T. S. Johnston "Canada's First Major Pipe Line," Canadian Banker, LIX (Spring 1952), 90-2.





Source: J.W. Fraser and W.G. Lugg, Petroleum and Natural Gas Industry Canada 1963-1968 (Ottawa 1970).

that oil production in Alberta had been severely limited as a result of the absence of outlets to the refineries and markets of eastern Canada. To overcome the perplexing problem of geographic distance and the high cost of tank car transportation, a small group of pipeline pioneers planned to construct a 450-mile oil pipeline east to Regina and supply Alberta oil to the large Imperial Oil refinery at Sarnia, Ontario.

Early in 1949 the Interprovincial Pipe Line Company was formed to build the proposed oil pipeline east from Edmonton to the Regina refineries. After a special appeal from Imperial Oil, the government passed the Pipe Lines act in April 1949, giving the Board of Transport Commissioners authority over the building, tariffs and operation of pipelines in Canada. Subsequently the Interprovincial Pipe Line Company was chartered by a special act of parliament.[9/] Although the newly formed company was sponsored by Imperial, it retained only a one-third minority interest in Interprovincial, for its primary concern was exploration and manufacturing, not transportation.[10/] Meanwhile, an engineering design office had been established in Tulsa, the headquarters of many large pipeline operations and supply and engineering firms, where a few Canadian engineers arrived late in

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[9/] Hanson, Dynamic Decade, 156; and Johnston, "First Major Pipe Line," 92.

[10/] Gibbon, "Great Lakes Pipe Line Under Construction," 240. See also Hanson, Dynamic Decade, 156.

1948.[11/] With the preliminary work completed, the group moved to Edmonton in November 1949 to establish Interprovincial's headquarters. "Canada is witnessing only the beginning of a new era in oil development." declared Dr. O. B. Hopkins, the first president of Interprovincial. "Other pipelines will probably have to be built to provide markets for the ever-increasing flow of Alberta's wells."[12/]

During the second planning stage the major oil strike at Redwater, Alberta, provided the additional reserves to make a pipeline east of Regina economically sound. Pipeline planners became convinced that a major oil line could be constructed from Edmonton to the Great Lakes to supply most of the crude oil requirements of the huge Imperial Oil refinery at Sarnia. After detailed investigations and studies, the pipeliners selected Superior, Wisconsin, as the logical terminus for the most economical route from the standpoint of both construction and maintenance costs.[13/] As a result, a wholly owned subsidiary of Interprovincial, the Lakehead Pipe Line Company, was formed to own and operate an American extension of the pipeline from Gretna, Manitoba, to the port facilities at Superior.

[11/] Kahle, "Interprovincial Pipe Line...A Case History," 206. See also The Engineering Journal, XXXIII (October 1950), 869.

[12/] Kahle, "...A Case History, 206 and Gibbon, "Great Lakes Pipe Line Under Construction," 240.

[13/] Gibbon, "Great Lakes Pipe Line Under Construction," 242, 244; and Kahle, "A Case History," 208. To build a Canadian port on Lake Superior and extend the line to Fort William-Port Arthur (now Thunder Bay) would have cost an additional $10 million and been the most difficult spread on the entire line.

The estimated cost of the Interprovincial project was $90 million, of which $85 million was required for construction and a further $5 million for contingencies and working capital. The offering of 20 year 3-1/2 per cent bonds to insurance companies and other financial institutions in Canada and the United States raised approximately $72 million, $37 million payable in Canadian currency and $35 million in American. An additional $17 million was acquired by the sales of 21-year 4 per cent sinking fund debentures. Underwriters in Canada were offered $7.5 million, and the remainder was sold privately with Imperial Oil taking "a substantial portion." About $1 million was raised by the sale of 20,014 shares of $50 par value capital stock of which Imperial owned 10,000. Under a special financing arrangement Imperial Oil agreed to make up any deficiencies in Interprovincial's revenue incurred as a result of reductions in the throughput of oil, and guaranteed payment on outstanding bonds and debentures.[14/] Imperial also agreed in 1953, when the company was floating a $60 million bond issue, to use Interprovincial for its

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[14/] See Gibbon, "Edmonton - Great Lakes Pipe Line Under Construction," 242. For a more detailed analysis of the financial agreement with Imperial Oil, see Hanson, Dynamic Decade, 156-8. Hanson concludes that the "whole venture was a bold one, so much so that it is doubtful that enough capital could have been raised without the backing of Imperial Oil." (Dynamic Decade, 158). In 1953 Interprovincial floated a third bond issue of $60 million in the United States, and in 1954 another for $30 million. As of December, 1957 there were 5 million shares of which Imperial owned 33.22 per cent, British American 7.12 per cent and Canadian Oil, the only all-Canadian integrated oil company before its takeover by Shell, 1.98 per cent.

crude oil shipments as long as it shipped crude east.[15] The construction of Canada's first pipeline was largely initiated and financed by Imperial Oil.

Construction of the Interprovincial oil pipeline was one of the biggest building undertakings of 1950. Detailed soil and engineering research preceded the decision about route and equipment, American engineers fully realizing that a Canadian pipeline posed different problems than running a line through the American south. Even when the line was to run only to Regina the company faced an acute shortage of steel. Finally, through a complicated arrangement, British steel manufacturers agreed to ship about 40,000 tons of low-grade steel plate to the Steel Company of Canada, which, in turn, released a supply of special steel to permit Page-Hersey Tubes Limited to produce the 16-inch piping for the Edmonton-Regina section of the line. To fill the major contract for pipe, Page-Hersey constructed a completely new rolling mill at Welland for making pipe up to 16 inches in diameter, at an estimated cost of $4 million.[16] When Interprovincial made the decision to build to the Great Lakes, however, the increased throughput demanded a 20-inch pipe from Edmonton to Regina. While this pipe had to be imported, the contract with Page-Hersey was honoured by

[15] Royal Commission on Energy, First Report, 35.

[16] Johnston, "Canada's First Major Pipe Line," 93; and Kahle, "... A CaseHistory," 208.

using the 16-inch pipe between Regina, where there would be a sizeable takeoff, and Gretna. Imported 18-inch pipe was used from Gretna to Superior.

To build the entire 1,180 mile Interprovincial oil pipeline, a work schedule of 150 days was set in the summer of 1950 because of the short construction season in the Prairies. In order to meet the 150 day programme, construction was contracted in three divisions. The contract for the 450-mile section from Edmonton to Regina was awarded to Bechtel Corporation of San Francisco, in affiliation with Fred Mannix & Co. Limited of Calgary; the 340-mile leg from Regina to Gretna went to Williams Bros. Corp. of Tulsa; and the 360-mile section from Gretna to Superior was to be built by Anderson Bros. of Houston. As the Executive Vice-president stated: "These firms, with long experience in pipeline construction, had the technical 'know-how', the specialized machinery which was not available in Canada, and the trained personnel, who held key positions on the job." While experts came from the United States to direct the work, 80 per cent of the 1,500 men employed at the peak of pipeline construction were Canadian, usually hired locally along the route.[17/]

The Interprovincial pipeline presented several new problems in pipeline construction. The chief difficulties confronting designers and engineers were closely associated with the widely varying temperature

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17/ Kahle, "...A Case History," 338, 340.

range and weather conditions on the Prairies.[18] Temperatures below freezing prevailed along the route in western Canada for eight months of the year, falling to 50° below zero in winter and climbing past 100° in summer. After a study of soil temperatures, pipeline engineers decided to bury the pipeline with a full three feet of cover to provide sufficient protection against frost heaving in springtime, and at the same time prevent the oil from getting cooler than approximately 30° F. Similarly, the seasonal weather in western Canada effectively shortened the construction period each year. As a result of the late breakup of frost in May and early freezing around October, pipeline construction work was confined largely to the intervening five months. The long and cold winter on the Prairies compelled design and equipment changes in the heating of pipeline pumping stations and the company-owned aircraft which serviced the stations with maintenance personnel, tools and supplies.

In building the Interprovincial contractors learned the hard way, as had railway engineers in the 1880s, that the Prairies were neither as flat nor as dependable for load-bearing as they appeared to be from a cursory aerial survey.[19] Mud was the persistent enemy

[18] See Whitney G. Sexton, "Canadian Climate present problems for Interprovincial Pipe Line," Oil and Gas Journal, XLVIII (October 6, 1949), 176-7

[19] See Leslie Orr Rowland, "Construction Problems in Canada," Petroleum Engineer, XXVI (October 1954), D34, D36.

of speed in pipe-laying during the construction season in nearly all parts of the Prairie provinces. Affecting the operation of the ditching machines, muddy conditions led to the extensive use of backhoes in place of rotary ditchers to cross low spots where ground water accumulated. Pipe stringing was a constant problem in the bogs and swamps. In both Manitoba and Saskatchewan, long stretches of open water made it necessary to load as few as five joints of pipe on a large stringing truck and to attach two tow-tractors to swing the long trucks around the sharp right-angle corners of the country trails and through mud holes as much as four feet deep. In southern Manitoba, the pipe-gang trucks were replaced by track-mounted lorries towed by light tractors to traverse the muskeg. Ordinary tire chains were helpless in the sticky gumbo of the Prairies in extremely wet summer weather. In wet regions pipeline contractors were compelled to leave as little open ditch as possible to avoid heavy crumbling of the ground and the constant risk of bad water intrusion. To overcome the problem of fast-flowing water in the summer, pipeliners, like railroad bridge builders before them, put in river crossings through the ice in mid-winter when the flow reached its lowest point. First used successfully in crossing the North Saskatchewan River between Redwater and Edmonton, a later attempt to cross the South Saskatchewan at Outlook in the same way failed when thawing ice gave way and swallowed up several tractors and an entire mile of welded and wrapped pipe, and the contractors were forced to resort to conventional methods during the summer.[20]

The completion of the Interprovincial in a record-breaking 150 days was the fastest pipeline construction job ever undertaken. The contractors averaged roughly nine miles of construction for every day of favourable weather.[21] As part of the pipeline construction, six pumping stations were built along the line. The five stations in Canada were built by Bird Construction, a western Canadian firm, and the sixth at Clearbrook, Minnesota, was built by Walco Engineering & Construction of Tulsa.[22] At Superior, storage tanks with a capacity of 1.8 million barrels and loading facilities for 20,000 barrels an hour were constructed. Two giant oil tankers, the largest ever built in Canada, were constructed at Port Arthur and Collingwood by Canadian Shipbuilding and Engineering to carry the Alberta oil from the port of Superior to Ontario refineries.[23]

The construction of the pipeline employed 1,500 men, paid out approximately $27 million in wages, and used more than $6 million of specialized pipeline machinery and equipment. In full operation, the

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20/ *Ibid.*

21/ Kahle, "...A Case History," 340.

22/ *Ibid.*

23/ Gibben, "Great Lakes Pipe Line Under Construction," 240.

Interprovincial moved crude oil into huge storage tanks at Superior at a rate of 11,000 barrels a day rising to a high of 54,000 barrels a day during the summer months. As the first major pipeline in Canada, Interprovincial established a new economic link to carry Alberta crude oil to the refineries and industrial markets of eastern Canada.[24]

The first cargo of Alberta oil aboard the tanker Imperial Leduc reached Ontario on April 24, 1951. From the first tanker-load the throughput of the original line rose rapidly.[25] But since the Great Lakes were navigable only for about seven months of the year, the Interprovincial pipeline-tanker route was unable to provide an adequate and stable flow of oil into Sarnia. When the market in eastern Canada continued to expand, the Lakehead Pipe Line Company, an Interprovincial subsidiary, extended the American section of the Interprovincial system, the 543 miles from Superior to Sarnia through the United States. The 'Thirty-Inch' pipeline extension boosted the crude oil export throughput into Sarnia to nearly 150,000 barrels a day. Completed in 1953, the extension brought the entire system

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24/ Kahle, "...A Case History." See also "Highway for Oil, Landmark in Construction History," Financial Post, March 17, 1951; F. H. Love, "Story of Interprovincial," Petroleum Engineer, XXII (October 1950), D12-24; "Our Pipe Lines," Monetary Times, July 1950.

25/ Hanson, Dynamic Decade, 158. See also Bob Shiels and Cecil W. Smith, "Canadian Pipe Line Expansion," World Oil, CXXXIII (December 1951) 223.

to roughly 1,800 miles in length. Four years later the line was extended 156 miles to refineries at Clarkson and Port Credit. Interprovincial became the longest crude oil pipeline system in the western hemisphere.[26/]

The Trans-Mountain Oil Pipeline

Canadian pipeline construction following the completion of the Interprovincial brought a new period of growth to the oil and natural gas industry in western Canada. After the initial thrust of pipeline expansion, private promoters began to present a host of proposals for giant pipelines to the west coast of the United States.[27/] The major scheme to build a pipeline from the Alberta oil fields to the Pacific coast was the 24-inch, 712-mile line proposed by the Trans-Mountain Oil Pipe Line Company.

The Trans-Mountain pipeline was a high risk business venture.

[26/] The Superior to Sarnia extension necessitated the underwater crossing of Mackinac Strait with the 20-inch lines four miles long. By 1973 Interprovincial had three parallel lines from Edmonton to Superior, two lines from Superior to Sarnia (one under Mackinac and the second via Chicago), three looped lines to Port Credit, and a branch line to Buffalo. Total length was 5,350 miles. (Financial Post Corporation Service, 1973). By the beginning of 1975 Interprovincial was about to embark on an extension to the Montreal refineries as the Canadian government groped to find a national oil policy in the face of middle eastern and western Canadian oil diplomacy.

[27/] Shiels and Smith, "Canadian Pipe Line Expansion," 223.

The proposed route from Edmonton, Alberta, over the Yellowhead Pass, and down through the Fraser River valley to Burnaby, a Vancouver suburb, crossed some of the toughest terrain in North America. The British Columbia market absorbed only about 40,000 barrels daily in 1951 and remained too small to make the construction of a pipeline economical. The Pacific Northwest states offered a potential market of about 250,000 barrels a day, but possessed little refining capacity. The major drawbacks to the Trans-Mountain, however, were offset by the outbreak of the Korean War. The heavy commitment of men and materials to Korea created a critical crude oil supply situation on the American west coast and gave a powerful impetus to proposals from American oil companies for a pipeline to carry Alberta crude westward to American refineries.

The Trans-Mountain Oil Pipe Line Company was incorporated on March 21, 1951 by a special act of Parliament. The newly-formed company was granted a permit by the Board of Transport Commissioners in December 1951 to construct and operate a crude oil pipeline from Edmonton to the Vancouver suburb of Burnaby by an all-Canadian route. The pipeline, which would be roughly a 712-mile, 24-inch line, was scheduled for completion in August 1953. It was designed not only to serve the refineries in the Vancouver area, but to supply oil for the Pacific Northwest, California, and offshore markets.

The financing of the $80 million Trans-Mountain project was heavily dependent upon support from six major oil companies and

Canadian and American financial institutions. Two bond issues were sold in 1952 raising a total of $65 million, $35 million of which was payable in U.S. funds. A further $14 million was acquired by the sale of 1.5 million shares of capital stock.[28/] Six major oil companies purchased 670,000 of the shares: Canadian Gulf Oil Company, Imperial Oil, Shell Oil of Canada, Standard Oil of British Columbia (an affiliate of California Standard) each took 130,000 shares; Union Oil of California took 100,000; and Richfield Oil Corporation took 50,000. The S. D. Bechtel Corporation of San Francisco, the pipeline contractor, took 130,000 shares of common stock and 250,000 shares were purchased by 14 independent Alberta producers. The remaining shares were offered to the public in Canada and the United States. The six main oil companies and a number of small Alberta producers signed "deficiency agreements" with Trans-Mountain to guarantee payment for each stage of capital expenditure.[29/]

[28/] Harry C. Plummer, "Trans-Mountain Pipe Line Will Be $80,000,000 Project," Petroleum Engineer, XXIV (February 1952), D 18.

[29/] Hanson, Dynamic Decade, 162; and Wilson, "Alberta Crude Oil to Head West," World Oil, CXXXV (September 1952), 303-4. By the end of 1957 the capital structure of Trans-Mountain was composed of $94.8 million in bonds, over half payable in U.S. funds and almost $15 million in stock. By the spring of 1958 ten oil companies owned 41.4 per cent of the stock, Imperial and British American the largest shareholders with 8.64 per cent each. Union Oil had sold its shares, and Canadian Oil had acquired 20,000. (Royal Commission on Energy, First Report, 32)

Construction of the Trans-Mountain pipeline was a monumental engineering project. Canadian Bechtel, a subsidiary of Bechtel of San Francisco, was chosen as the pipeline contractor to design and supervise construction.[30] For more than a year before official approval, Canadian Bechtel studied alternative locations for the line, the economics of the project and the projected cost. Based on these studies the route selected paralleled the Canadian National Railway from Edmonton through the Yellowhead Pass to Kamloops, followed the Canadian Pacific from Merritt to Hope, and wound along the Fraser River to Burnaby. After detailed studies of recoverable reserves, potential market and defence requirements, Canadian Bechtel planned to construct a 24-inch pipline with three pumping stations and an initial capacity of 120,000 barrels a day. Major contracts for the tough job of pipe-laying were granted to two companies: Comstock Midwestern Ltd. of Toronto, which handled about 472 miles of work on the eastern and western ends of the line; and Mannix Ltd., of Calgary, which built roughly 221 miles of the centre section.[31]

Construction started in the fall of 1951. Clearing the 60-foot

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[30] See Plummer, "Trans-Mountain Pipe Line Will Be $80,000,000 Project," D18; and Wilson, "Crude to Head West," 302.

[31] "Trans-Mountain - Major Canadian Oil Outlet," Petroleum Engineer, XXIV (November 1952), D 41, D 43. See also Wilson, "Crude to Head West," 302; and Paul Reed, "Trans-Mountain Expands," Oil and Gas Journal, LI (August 4, 1952), 50-1.

right-of-way began in February 1952 and continued into the spring of 1953. Roughly 1,500 men were employed in clearing the rocky and forested right-of-way and in pipeline construction work. Of the entire pipeline work force, about 16 per cent of the men were engineers and specialists brought in from the United States to direct the construction project, a slightly smaller percentage than on the Interprovincial presumably because Canadians were gaining experience in 'Big Inch' pipelining.[32/] Since no Canadian facilities existed for fabricating 24-inch pipe, the steel pipe for the Trans-Mountain line was supplied by major American steel companies - the Consolidated Western Steel Division of U.S. Steel, Kaiser Steel Corporation, and A. O. Smith Corporation of Milwaukee. With the support and approval of Canadian authorities, the U.S. Petroleum Administration for Defence granted Trans-Mountain company permission to purchase steel under the Controlled Metals Plan. The pipe deliveries began in the spring of 1952 and continued in sufficient quantity to meet the construction schedule.[33/] Along the route between Edmonton and Vancouver, the steel pipe was transported by both CN and CP rail from fabricating plants to roughly 140 sidings, loaded on stringing trucks, and hauled into position for pipe-laying.

32/ Petroleum Engineer, (November 1952), D 46. See also Wilson, "Crude to Head West," 303.

33/ Ibid, D 45-6.

Unlike the earlier Interprovincial pipeline, the Canadian railways were used extensively to reduce truck hauling in the rough terrain along the right-of-way.[34/]

The Trans-Mountain route presented a host of formidable problems for pipeline construction. The route passed through 50 miles of prairie west of Edmonton, 200 miles of foothills-timber country to Jasper, 391 miles of mountainous terrain and two divides in the B.C. interior, and 70 miles of farmland from the lower Fraser Valley to Vancouver. In the Rockies, the problem of access through the heavy timber along the right-of-way was overcome by cutting "shoo-flies" up the steep slope of the mountainous terrain, then hauling the stringing trucks up with Caterpillar tow tractors. Muskeg was crossed by riprapping ahead of the ditcher, in the style of the old-fashioned corduroy roads. Availability of light timber along the right-of-way made this old technique the most economical solution, as the same riprap could be used for the rest of the equipment following the ditcher.[35/]

The two most formidable stretches of terrain were in the Coquihalla Canyon east of Hope and around Japer, where work frequently resembled chimney-building more than pipelining. In these rugged

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[34/] S. M. Blair and D. L. Roberts, "Trans-Mountain Oil Pipeline," Engineering Journal, XXXV (September 1952), 935.

[35/] Rowland, "Construction Problem in Canada," D 34 and D 36.

areas, ordinary mountain pipelining practices of laying lines along the tops of ridges or crossing over from one valley to the next were impossible because of the steep mountains. No other pipeline project had been built with such long side-hill cuts. Single cuts extended for a much as a mile and cuts totalled roughly 135 miles over the entire project. One clearing gang used 20 bulldozers - an all-time high in pipeline construction. Terrain in the Coquihalla Canyon and around Jasper was so rugged that ditching machines were completely given up for more powerful back hoes in pipeline excavation. Before the project was completed, the Trans-Mountain was jokingly being called the "Ripley Believe It or Not" line and the "Inch-by-Inch" line.[36/]

The mountainous terrain of the Rockies posed tough hydraulic problems. Special pressure problems were encountered between Yellowhead and Kamloops, where elevation dropped 2,600 feet in 300 miles, and down the Coquihalla Pass, where the drop was 3,600 feet in 30 miles. To overcome the critical hydraulic problems, two pressure-control stations were constructed at Vavenby and Hope. Pipeline experts estimated that these pressure-limiting devices, a unique feature of Trans-Mountain, saved about $5 million in the original pipeline investment by avoiding additional expenses for heavy-wall

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[36/] "Trans-Mountain Finishes Big Line," Oil and Gas Journal, LII (October 19, 1953), 76-7. See also "Trans-Mountain Oil Pipeline in Canada," Engineer, CXCVII (February 12, 1954), 240.

pipe to withstand high pressures during shutdown conditions in the lower sections of the system.[37/]

Pipe laying itself was limited to roughly five or six months in the summer and fall seasons of 1952 and 1953. Three pipe-laying groups or "spreads" went to work in the summer of 1952 and two additional spreads began in the fall.[38/] To prevent damage by land slides and provide adequate insulation, the Trans-Mountain pipeline was buried 30 inches below the surface and in rocky areas 24 inches. While the line traversed more than 400 miles of mountainous terrain, less than 5 per cent of the route was through rock. The line was sunk eight feet or more below the beds of approximately 72 rivers, streams and creeks. For the initial throughput of 150,000 barrels daily, four pumping stations were constructed. Begun in February

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[37/] Paul Reed, "Mountainous Terrain Poses Tough Hydraulic Problems for Trans-Mountain," Oil and Gas Journal, LII (April 13, 1953) 98-9. See also Oil and Gas Journal, LII (October 19, 1953), 77. The pressure-limiting stations performed different functions. The station at Vavenby, B.C., 165 miles west and 21,00 feet lower than Yellowhead pass, restricted the downstream static head by tight shutoff during no-flow conditions. An automatic shutoff valve at Vavenby operated to insure that static head downstream to the Thompson River crossing at Kamloops was reduced by 650 feet to a safe head of 2,160 feet. The other pressure-limiting station at Hope, drained the oil through a battery of relief valves to two 50,000 barrel tanks to maintain safe pressure conditions from Hope to the western terminus at Burnaby.

[38/] Wilson, "Crude to Head West," 303.

1952, perhaps the toughest major pipeline construction job ever was completed in 1953.

The completion of Trans-Mountain initiated an immediate wave of economic expansion in British Columbia. With the completion of Trans-Mountain, the refining facilities of Imperial Oil and Shell Oil were greatly expanded at Ioco and Burnaby. New refineries were erected at Kamloops by Royalite Oil, at Burnaby by Standard Oil of B.C., and at Anacortes, Ferndale, and Seattle by Shell Oil, General Petroleum Corporation and Pacific Oil & Refining Company.[39/] In 1954, a 27-mile branch pipeline was built to serve the General Petroleum refinery at Ferndale and a year later a 30-mile extension carried Alberta crude to the Shell facilities at Anacortes. The full effect of the Trans-Mountain pipeline not only brought continued expansion of refining facilities to B.C. and Washington, but also opened up a new export market for Vancouver - refined gasoline in Japan - gave a powerful impetus to a proposed natural gas pipeline from the Peace River district, and formed the basis for the growth of a petrochemical industry in the Vancouver area.[40/]

[39/] "Oil's 'Big Inch' Pipeline Starts Expansion Wave," Financial Post, March 20, 1954, and Oil and Gas Journal, LII (October 19, 1953), 76.

[40/] Financial Post, February 21, 1953, and March 20, 1954. British Columbia's refining capacity increased from 28,850 barrels per day in 1950 to 70,250 in 1956 and 128,500 in 1970. The percentage of Canadian capacity, however, was 8 per cent in 1950 and 9.3 in 1970.

Westcoast Transmission

The growth of Canada's oil arteries reached a peak in 1953. By the end of the 1953 construction season, the total mileage of trunk pipelines within Canada, and those outside Canada carrying exclusively Canadian oil, amounted to roughly 2,854 miles of crude lines and 832 miles of products lines.[41] At the end of 1953, Canada possessed about 3,700 miles of oil trunk line, but only 750 miles of main natural gas transmission lines serving the cities of western Canada and southern Ontario. But looking ahead to 1954, Leslie Orr Rowland, a pipelining expert, predicted an "expected boom" in natural gas and oil products pipelines.[42]

During 1954 the pipeline construction industry struggled through a prolonged transitional phase. Oil pipeline construction virtually stagnated and the proposed schemes for natural gas lines remained proposals.[43] Over the 1954 construction season, the only long-distance project undertaken was a 600-mile loop of the Interprovincial, designed as the last major step in a programme

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[41] For a more detailed analysis of the longest oil products pipeline, the 444-mile Trans Northern line from the refineries in east Montreal through the industrial heartland of southern Ontario to Hamilton, see Leslie Orr Rowland, "Canada's Longest Products System," Petroleum Engineer, XXV (January 1953), D 3-10.

[42] Leslie Orr Rowland, "Canadian Pipelining - 1954 Outlook," Petroleum Engineer, XXVI (January 1954), D 4-7.

[43] See "Oil Pipeline Construction Static, Gas Lines Next Phase," Monetary Times, January 1955.

to bring the capacity of the western section into balance with the new section between Superior and the Sarnia refineries. A 285-mile Canadian section of the United States Army products pipeline from Haines to Fairbanks, Alaska, was the only large products line laid in Canada in 1954.[44] Estimated gas pipeline expenditures in 1954 were only $28 million, roughly $12 million for gathering-transmission and $16 million for distribution lines.[45] At the close of 1954, the planned natural gas pipelines of the West Coast Transmission Company and TransCanada Pipe Lines, Ltd. were still on the drawing board, but Canada stood at the threshhold of a new phase of gas pipeline construction.

Following the completion of the Interprovincial pipeline in 1951, six major companies presented proposals for natural gas lines and applications to export Alberta gas to the Alberta Petroleum and Natural Gas Conservation Board. The most advanced plan for a gas trunk line was proposed by the Westcoast Transmission, a Canadian company incorporated in 1949 by Pacific Petroleums Ltd., the largest owner of natural gas reserves in the Peace River district. As the first natural gas pipeline proposed in Canada, the Westcoast

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[44] Rowland, "Canadian Pipelining - 1954 Outlook," D 5.

[45] See J. J. Wheatley, "Pipe Lines, Pipe Dreams - Prosperity?," Western Business and Industry, XXIX (May 1955), 45, 47; and "42 Million Spent Last Year: Total Will Pass $1 Billion," Western Business and Industry, XXX (October 1956), 74.

Transmission line was designed to pipe gas from the Peace River area through the interior of British Columbia to Sumas, Washington, and the Pacific Northwest states, with branch lines to Vancouver and interior British Columbia cities.

Plans for the construction of the Westcoast pipeline moved rapidly ahead in 1952. At the beginning of the year, Westcoast's application to export natural gas from the Peace River was approved by the Alberta Conservation Board and by the end of the year initial financing had been arranged. With the financing plans complete, Westcoast awaited only approval from Canadian authorities, and more critically, from the U.S. Federal Power Commission to import natural gas.[46/]

The Westcoast pipeline itself was built in two distinct stages. An extensive gathering system was constructed to deliver gas from the Fort St. John Field of British Columbia, an exclusive preserve of Pacific Petroleums, and the Peace River fields in Alberta, owned by several major companies, to the starting point of the main line near Dawson Creek, B.C.. In a second stage of construction, the 649-mile

[46/] The FPC proved to be a stumbling block. In June 1952 Westcoast applied for permission to import Alberta gas, but was turned down in June 1954 when the competing Pacific Northwest Pipeline of Houston received the go-ahead to supply the Pacific Northwest by a line from New Maxico. Late in 1954, however, Westcoast agreed to sell Pacific Northwest 300 million cubic feet a day at Huntington on the Canadian-American border. After a detailed survey of reserves the Alberta government amended the original export permit in May 1955 to allow the export of 1,080 billion cubic feet of natural gas over a thirty-year period. In November 1955 the FPC approved Pacific Northwest's plan to import natural gas. See Western Business and Industry, XXX (October 1956), 74, 76.

main line was built from Dawson Creek to cities in the U.S. Pacific Northwest, with a branch line to Vancouver.[47/]

Construction began late in the fall of 1955. Canadian Bechtel again took charge of the 649-mile, 30-inch pipeline project, and Ford, Bacon & Davis of New York were the engineers. Half of the 230,000 tons of steel pipe required was purchased in the United Kingdom and shipped via the Panama Canal to Vancouver. The huge order of British pipe made the construction project somewhat independent of a national steel strike in the United States, where the rest of the pipe was purchased. Pipe deliveries were kept well ahead of pipe-laying by a multiple transportation system utilizing barges, railway, and trucks from Vancouver to stockpiles in the field.

As the project manager, Canadian Bechtel set a two-year construction schedule for the Westcoast Transmission gas line. Four large contractors were awarded the construction jobs: Dutton-Williams Brothers of Calgary, the first 120-mile section from Fort St. John to the Pine Pass; Canadian Bechtel, the 210-miles from Williams Lake to the ascent of Pine Pass; Conyes Construction Corporation of San Pablo, a 209-mile stretch from Merritt to the Bechtel section at Williams Lake; and Mannix of Calgary, a tough 110-mile spread from

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[47/] Leslie Orr Rowland, "Canada's First Major Gas Line," Petroleum Engineer, XXVIII (December 1956), D 44.

the Sumas compressor station in Washington state to the upper end of the canyon at Merritt.[48/] After the early start in the lower Fraser valley in November 1955, clearing and grading, pipe-stringing and double jointing were continued during extensive winter work. The outstanding achievement of the 1956 construction programme was the completion of all pipe-laying on the Dutton-Williams 'spread". At the end of the 156 construction season, the Westcoast line was ahead of schedule, with roughly 434 miles of pipe in the ground and only about 226 miles left for 1957.[49/]

Westcoast faced critical construction problems similar to the earlier Trans-Mountain oil pipeline. On the 210-mile Bechtel Spread heavy rain hampered construction in the early part of the 1956 season and throughout 1957. On the south slope of Pine Pass, the Bechtel crews blasted through 15 to 18 miles of discontinuous but tough rock. All pipelaying in the 1957 season was done conventionally on the Bechtel section, except for two canyons at Ralston Creek and Bijou Creek that were too steep to bury the pipe. The Bechtel bending crew made as many as 80 per cent bends in some stretches of pipe and averaged 100 bends per day, up to 43 degrees for overbends and sags and sharp as 48 degrees on side bends. In the 1957 season, Bechtel

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[48/] Ibid., D 44-5

[49/] Leslie Orr Rowland, "Westcoast System Completed Ahead of Schedule," Petroleum Engineer, XXIX (October 1957), D 100.

crews averaged only one mile per day on pipelaying and wrapping and 9,000 feet was the best day on the pipe gang. On the Conyes "Desert" Spread, pipeline construction was continually slowed down by enormous stray boulders in the old glacial river channels of the British Columbia interior.[50/]

The most rugged and difficult section of the entire Westcoast route was the Mannix Spread, particularly the crossing of the formidable Coquihalla Canyon. Work along the steep canyon began in 1956 and was completed in 1957. Crossing of the Agassiz Mountain region near Hope in 1956 was a challenging task, as there was a 600-foot descent at Agassiz Mountain and a 2,800-foot jumpoff at Angel Mountain with a pitch of roughly 52 degrees and the only access was by barge across the Fraser River. To bypass the rough north end of the Coquihalla Canyon, which was used by Trans-Mountain, the Mannix spread cut through a largely inaccessible 4,700-foot rise at the Boston Bar Canyon Pass in the hectic 1957 construction season. Heavy timber was a major problem not only for the Mannix Section, and project engineers estimated that about 80 per cent of the pipeline was through dense forest. The cut timber was used extensively in many sections for riprap over muskeg and swamp.[51/]

[50/] Ibid, D 102-6

[51/] For a more detailed analysis of the pipelining problems on the Mannix Spread, see Rowland "Canada's First Major Gas Line," D 47; and "Westcoast System Completed Ahead of Schedule," D 106-7.

Launched in October 1955, the second pipeline conquest of the Rocky Mountains was completed in August 1957, two months ahead of schedule, and Westcoast began delivering natural gas under firm contracts in November 1957. In its initial operating phase, the Westcoast line had a capacity of 300 million cubic feet per day, with a projected capacity of 660 million cubic feet. Over the two big building years a summer peak of 2,200 men were employed in pipeline construction, mainly with the large crews engaged in clearing the heavily wooded right-of-way. The cost was $195 million for construction, with an additional $100 million expansion planned before the line went into operation.[52/]

Westcoast is a classic example of the fortunes made by the original promoters through the issue of common stock for no, or very little, cash consideration. More than half a million shares were issued to the promoters at 4.9 and 5 cents a share for stock which was first sold at $5 a share in 1956 and which since 1961 has not fallen below 11 and has sold as high as 32. Of the $195 million spent during the construction period, capital raised by sale of stock amounted to very little, at best something under $20 million. Between 1956 and 1958 Westcoast raised $173,750,000 through the sale of bonds, debentures and notes (the latter presumably maturing and being paid off by other issues). Only $35.8 million was raised

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52/ See "What It Took to Build the Westcoast Pipeline," Petroleum Engineer, XXX (June 1958), D 21.

in Canada, although an additional $40 million was purchased by two institutions with their head offices in the United States but using funds derived from Canada.[53/]

The Westcoast Transmission gas pipeline maintained - and extended - the wave of economic expansion generated by the earlier Trans-Mountain line. While Westcoast actually served the refineries and markets of the U.S. Pacific Northwest, the first gas pipeline had spinoff effects on the economic development of British Columbia. The branch line to Vancouver carried the vital natural gas for a growing petrochemical industry. More immediate economic benefits came to the Peace River district in northern British Columbia. The $30 million treating plant constructed at Taylor, near the end of the gas gathering system, became the largest industry in the entire Peace River area. In addition to the processing plant, Taylor acquired compressor station No.1 and a refinery built jointly by Pacific Petroleum and Philips Petroleum for the manufacture of propane and a complete range of motor and aviation fuels. In addition, Jefferson Lake Sulphur Company erected a plant in this emerging industrial centre to process hydrogen sulfide into sulfur at an initial rate of 300 tons a day. The Westcoast gas pipeline had not only opened up the American market to Peace River natural gas, but laid the initial foundations for localized industrial development in

[53/] See Royal Commission on Energy, First Report, 19. See also "Westcoast's Gas Pipeline Financing Plans Complete," Financial Post, November 15, 1952.

northern B.C.[54/]

TransCanada: Origins

With the discovery of large reserves of oil and natural gas in Alberta and British Columbia the idea of constructing a trans-Canada pipeline to transport gas to markets in eastern Canada and the American mid-west emerged as the central issue for the fledgling oil and natural gas industry in the years from 1947 to 1953. Two of the five promoters with applications for export gas permits before the Alberta Petroleum and Natural Gas Conservation Board proposed the building of an east-west pipeline across Canada.[55/] With the Conservation Board's 1952 approval of an export permit for Westcoast Transmission the main conflict in the Alberta gas industry lay between two rival companies - Western Pipe Lines and TransCanada Pipelines Limited, a subsidiary of Canadian Delhi Oil Company - competing for a licence to transfer large quantities of natural gas eastward to central Canada or to the American mid-west. For five years the struggle dragged on as the Alberta Board failed to act on east-west gas export applications, setting the stage for a prolonged public controversy over an all-Canadian east-west project.

[54/] Ibid. See also Rowland, "Westcoast System Completed Ahead of Schedule," D 108-12; and "What Gas Line Will Mean," Financial Post, March 17, 1956.

[55/] See Alan Phillips, "Who Will Win the Great Gas Pipeline Stakes?" Maclean's LXVI (October 1, 1953), 18-19, 81-2, 84-6. See also Kilbourn, Pipeline, 16-17; and "Trans-Continent Gas Pipe Would Be 'Biggest Inch'," Financial Post, February 19, 1955.

While the scheme for building an all-Canadian gas pipeline gained a powerful backer in C. D. Howe, the Minister of Trade and Commerce, it was primarily a result of competing business interest in the oil and gas industry.[56/] The first serious applicant for a licence to bring Alberta natural gas to the industrial markets of eastern Canada was L. D. M. Baxter, the president of a Winnipeg financial firm. With the assistance of H. R. Milner, an Edmonton lawyer and gas utility executive, and the heads of two large eastern investment firms, Baxter established Western Pipe Lines, which was incorporated on April 30, 1949 by an act of Parliament under the new federal pipeline legislation. Western proposed the construction of a natural gas pipeline from Alberta to Winnipeg with a connecting line to the American mid-west. In February 1950 the company made a formal application to the Conservation Board for the right to export gas for 30 years. The application was turned down when the Board's interim report appeared in early 1951, but the company was invited to apply again when Alberta's proven reserves outstripped her future gas requirements.

The second important promoter seeking to export Alberta gas eastward was Clint Murchison, a prominent Texas oil magnate. Murchison's branch company, Canadian Delhi Oil Company, was incorporated in August

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[56/] For an analysis which comes perilously close to a Great Man interpretation of the TransCanada pipeline, see Kilbourn, PipeLine, x-xi, 24-5.

1950 and its subsidiary, TransCanada Pipe Lines, in April 1951. TransCanada immediately became a fierce competitor of the Canadian group promoting the Western Pipe Lines project. Murchison's Canadian Delhi was the first company in Canada that sought solely to explore for natural gas. With great experience in gas exploration in the United States, the Canadian Delhi and TransCanada interests became the first major group to seriously propose building an all-Canadian pipeline the 2,240 miles from Alberta through the Laurentian Shield of northern Ontario to the eastern markets of Toronto and Montreal. If completed, it would have been the world's longest pipeline.[57/]

Throughout 1953 the province of Alberta repeatedly urged the two companies to merge and establish a pipeline route that would combine a large export sale of natural gas at Emerson, Manitoba, with an all-Canadian gas pipeline. In late 1953 the Alberta Conservation Board declared that further examination of new gas discoveries in the province revealed a surplus available for export to eastern Canada and the American mid-west. Early in 1954 representatives from the competing groups were invited to Howe's Ottawa office, where he too advised them to merge. Under a special working arrangement the province of Alberta and the federal government agreed to grant

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[57/] See Kilbourn, PipeLine, 25-6. See also Phillips, "Who Will Win the Great Gas Pipeline Stakes?", 19, 82.

export licences and permits in return for a merger of the two pipeline projects. Following the agreement, the Canadian government authorized the new company, TransCanada Pipe Lines, to transport natural gas from Alberta to eastern Canada provided the line follow an all-Canadian route. Approval was also given for the company to export gas to Minnesota from Emerson.

A major obstacle to the success of the TransCanada scheme arose with the entry into the pipeline controversy of another powerful American company, Tennessee Gas Transmission. In association with the Consumers' Gas Company of Toronto, Tennessee planned to build a pipeline from Niagara to Toronto. Following the decision of Consumers' Gas to import natural gas from the United States, the Federal Power Commission in the summer of 1952 approved the Tennessee's plan to pipe 60 million cubic feet of gas a day across the border at Niagara. Initially the Canadian government blocked the plan, but relented after Consumers' agreed to develop the market in southern Ontario and purchase gas at a comparable price from TransCanada once the all-Canadian line reached Toronto.[58/]

In May 1954 TransCanada received a permit to export gas from Alberta. The Alberta Conservation Board authorized the company to export 4.35 trillion cubic feet of gas over a period of 27 years at a

[58/] See Hanson, Dynamic Decade, 244; and Kilbourn, PipeLine, 29, 38, 41-2.

daily rate not to exceed 620 million cubic feet. In July 1954, the federal Board of Transport Commissioners granted initial approval for the construction of the line entirely through Canadian territory contingent upon the company's providing proof of its financing by the end of 1953 and completion of construction by the end of 1955.

TransCanada: Finance

Following the Transport Commissioners' approval, the major problem facing TransCanada was to secure the necessary financing. According to the permit issued by the Board of Transport Commissioners, TransCanada was granted the right to construct the all-Canadian line subject to the reconsideration of the northern Ontario route and the completion of financial arrangements by the end of December 1954. To strengthen the management of TransCanada, the former Alberta Minister of Mines, Eldon Tanner, was appointed president and Texas pipeline engineer Charles Coates was made executive vice-president. In order to gain financial support the company had to demonstrate that it would have sales contracts once the pipeline was completed, but in order to get sales contracts the company had to demonstrate that the project was financially feasible. At the same time Alberta gas suppliers favoured the vast and profitable American market and they feared that an adequate price for their gas could not be obtained if it had to be transported across northern Ontario.

A further difficulty arose when the province of Alberta formed a provincial gas-gathering system, Alberta Gas Trunk Lines. Since Alberta's provincial gas-gathering system was unable to supply a schedule of tariffs for the pipeline in the fall of 1954, TransCanada could not arrange purchase contracts with the major petroleum companies. As the initial financing deadline approached, the large Alberta oil and gas companies refused to tie themselves down to purchase contracts with such a doubtful risk as TransCanada. The company was further stymied in its attempt to secure sales contracts by the refusal of the American Federal Power Commission to decide upon TransCanada's application for exporting gas to the American mid-west. By the end of 1954 the project still was without financing and TransCanada had to ask the Transport Board for an extension until April 30, 1955.[59/]

In January the company removed a major obstacle by signing long-term contracts with the producers, but it was becoming apparent to the Trans-Canada executives that financing could not be completed in time for a spring start on construction. The company finally turned to the federal government and asked for a $275 million dollar loan. With this loan the company might have arranged its financing, let contracts, ordered pipe and built the line to Winnipeg before the winter began. Howe favoured the proposal but he was unable to convince cabinet and caucus.

[59/] Kilbourn, PipeLine, 54-60.

In March the government suggested that the company sell a sufficient number of its convertible debentures to the Industrial Development Bank to give it control of TransCanada. This proposal was rejected by TransCanada's promoters who argued that if the proposal was accepted the project would fall into government hands.

While financial negotiations progressed the Canadian government rejected a Tennessee Gas Transmission proposal to build a line southward from Winnipeg into the United States and supply additional quantities of gas for transmission to eastern Canada. In August 1955 TransCanada and Tennessee reached an agreement whereby TransCanada would sell 200 million cubic feet per day to Tennessee at Emerson, and Tennessee would supply TransCanada with up to 87 million cubic feet daily to enable the Canadian company to build up the Ontario market before construction of the main line from the west.[60/] Under a special agreement, TransCanada's directors arranged for Tennessee Gas Transmission to place a large order for steel pipe with U.S. Steel for the western section of the line and this arrangement made Tennessee a major shareholder in the pipeline enterprise.[61/]

The financial arrangements for the TransCanada pipeline scheme

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[60/] See Hanson, Dynamic Decade, 245; and Financial Post, August 20, 1955.

[61/] "Commission Probes Ways Pipelines are Financed," Financial Post March 1, 1958, 23.

became a set of complex business agreements. The uncertainty, the practicality and the financial feasibility of such a vast undertaking, once again the unprofitable line 'north of Superior', imposed restraints upon investment from financial institutions. After the government's refusal of the $275 million loan and TransCanada's refusal of the government's debenture purchase proposal, the Ontario and Canadian governments reached an agreement with TransCanada to establish a crown corporation for the construction of the difficult and unprofitable northern Ontario section from the Ontario-Manitoba border to Kapuskasing. The Northern Ontario Pipe Line crown corporation was formed in June 1956, with the federal government supplying two-thirds of the estimated $118 million construction cost. The crown corporation was to be leased and operated by TransCanada for 25 years, when TransCanada would have an option to purchase.

Yet the western part of the line and the section from Kapuskasing to Toronto and Montreal still lacked financing. Much of the anticipated capital was contingent upon the company's obtaining permission from the Federal Power Commission to export the 200 million cubic feet of gas at Emerson it had contracted with Tennessee Gas Transmission. It soon became apparent to the company that the Commission's decision would not be forthcoming for months - perhaps even longer. In May 1956 the St. Laurent cabinet met to discuss a proposal from TransCanada that the government loan the company about $72 million, roughly 90 per cent of the estimated cost of building the western section of the pipeline, at 5 per cent, to be repaid by March 31, 1957. If the company defaulted the government would assume ownership of the line. The main proponent behind the proposal was Howe. He and the executives of TransCanada realized that some financial arrangements would have to be made by June 7, the deadline for a spring construction start. Howe urged adoption of the proposal because it guaranteed construction of the western section of the line by the end of 1956, and at worst the government would acquire ownership for only 90 per cent of the cost.

On May 8 Howe announced in the House of Commons that it was the intention of the Liberal government to loan TransCanada $72 million to enable construction to begin by the June 7 deadline. The reaction from the opposition was spirited. Davie Fulton labelled the proposal a "treaty of surrender," and George Drew stated that the government loan was a general invitation to American financiers to come to Canada "to be financed to the extent of ninety cents on every dollar and still retain control under terms that would be entirely satisfactory to them." For a week the opposition attempted to delay passage of the bill until after the company's June 7 deadline. When it became clear that the likelihood of meeding the deadline was diminishing, Howe informed the House on May 14 that "it is obvious that some Honourable Members prefer to obstruct this motion rather than debate it. I beg to give notice that at the next sitting of Committee I shall move that further consideration of this resolution shall be the first business of the Committee and shall not further be postponed." Closure had been invoked. In the early hours of the morning of June 6 the bill was given its third and final reading and on June 7, a few hours before the contract between the government and TransCanada was to expire, the bill was given royal assent. By the end of the week, crews were ready to begin construction. At long last TransCanada had acquired the financing it required to begin construction.[62/]

With construction under-way, TransCanada continued to make major adjustments in its financing arrangements. In February 1957, the Board of Transport Commissioners granted renewed approval to the TransCanada project and set a completion date for the end of 1958. At the Board hearings TransCanada promoters revealed that 49 institutional investors, including 32 Canadian life insurance firms, trust companies and pension funds, had agreed to purchase $94.4 million of the first mortgage bonds of TransCanada Pipe Lines. Another $9.6 million of the first mortgage bonds were taken by TransCanada shareholders, and $30 million were pledged as collateral for a loan of that amount from three large American banking institutions. In addition to the first mortgage bonds, $112.3 million in packages of debentures and common stock to the four major promoting groups behind the pipeline.

[62/] See Dale C. Thomson, Louis St. Laurent: Canadian. (Toronto 1967.) 391-95, 406-7, 420-433; Kilbourn, PipeLine, 111-133; Hanson, Dynamic Decade, 245; "TransCanada Pipeline," Canadian Forum XXXVII (April 1957) 2-3.

As of January 31, 1957 the shares were distributed as follows:

American	%
Canadian Delhi	25.8
Hudson's Bay Oil & Gas	17
British American	17
Tennessee Gas	17
International Utilities	6.6
	83.4

Canadian	%
Wood Gundy	4.4
Montreal Trust	3
Power Corporation	2
Osler, Hammond	1.8
Other Institutions	5
People	.3
	16.5

Public financing through the sale of stock in Canada (where it had been agreed 51 per cent would be offered) and the United States was achieved in February, enabling TransCanada to meet the April 2 deadline for repayment of government advances.[63/]

Yet even after successful financing arrangements were completed and construction began, TransCanada found itself confronted with a new set of difficulties. The publication of the company's prospectus in February 1957 provoked a round of public criticism with the revelation that the company's two chief executive officers, when engaged in 1954, were given future options to purchase stock at the same price - $8 a share - that the sponsors of the company had paid, and that these

[63/] W. L. Dack, "Race for Men, Equipment Big Pipeline Challenge," Financial Post, May 5, 1956. See also Royal Commission on Energy, First Report, 62-63.

options were exercised during February 1957, when the company's stock was trading at approximately $20 per share. Throughout 1957 TransCanada provided fuel for the election campaign, work for the Royal Commission on Energy, and problems for the new Progressive Conservative government of John Diefenbaker. In October 1957 Prime Minister Diefenbaker insisted that his government was not bound by Howe's 1955 letter to TransCanada promising an export license for Canadian gas. Diefenbaker stated that he would await the findings of the Royal Commission before making a final decision. But the appointment of the commission, headed by industrialist Henry Borden, effectively removed TransCanada from the political arena for the balance of 1957 and through 1958. This development enabled TransCanada to move from a 'paper' company to an operating concern.[64/]

During 1957 and 1958, TransCanada underwent important changes in ownership and financial management. Two of the original partners in the TransCanada project, Hudson's Bay Oil & Gas and Tennessee Gas Transmission, began to reduce their common share holdings in the company.[65/] The presidents of Hudson's Bay and Tennessee, R. C. Brown and Gardiner Symonds, both resigned as directors and members of the

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[64/] "Canada Starts Probe," Oil and Gas Journal, LV (October 28, 1957), 71. See also Libourn, PipeLine, 158.

[65/] See W. L. Dack, "Canadians Own the Pipeline: Now What?," Financial Post, October 26, 1957, and "Canadians Gain Control," Oil and Gas Journal, LV (November 4, 1957), 80.

executive committee of TransCanada. In official statements, the American companies maintained that since financing had been successfully completed, their objective in coming into TransCanada had been fully realized. "Originally Tennessee Gas took a financial interest in TransCanada in order to put our shoulder to the wheel and help get the pipeline built," one of the press statements asserted. "Our action now is in line with our stated intention . . . that after TransCanada has become a going concern, we would divest ourselves of our interest. . . ."[66/] The shares sold by the two American companies were mainly acquired by the largest independent Canadian petroleum company, Home Oil of Calgary, a firm that had been turned down in its bid to obtain a large block of TransCanada's original shares. Home Oil acquired 12 per cent of the common stock and eventually the company's holdings reached a million and a quarter shares. By the end of 1957 Home Oil became TransCanada's largest shareholder, and the company president, R. A. Brown Jr., was appointed to the board and its executive committee.[67/] After further reductions in American holdings early in 1958, over 75 per cent of the TransCanada shares were owned by Canadians.[68/]

[66/] "Why Tennessee Sold Its Stock," Financial Post, October 26, 1957.

[67/] See Dack, "Canadians Own the Pipeline:" p.25; and Oil and Gas Journal, LV (November 4, 1957), 80.

[68/] Canadian Delhi distributed its 11 per cent of the stock to shareholders in 1965, and about 90 per cent went to Nesbitt, Thomson & Co. who sold it privately. Home gradually reduced its holdings. In 1972 Home had 500,000 shares and Canadian Pacific Investments had 1.2 million. By 1973 Canadian Pacific Investments owned 13 per cent and 88 per cent of the shareholders were Canadian residents. See Financial Post Corporate Surveys.

TransCanada: Construction

After two years of delay, construction of the TransCanada pipeline had begun on the section from the Alberta-Saskatchewan border to Winnipeg in June 1956. A company created for the task, Bechtel-Mannix-Hester, which combined Canadian Bechtel, Mannix and Oklahoma Contracting of Dallas, managed and supervised construction of the line. Construction was delayed shortly after it had begun by a steel strike at the East Orange, New Jersey, pipe subsidiary of the U.S. Steel Corp. cutting off the supply of 34-inch pipe. As a result of the steel strike and the delays in deliveries TransCanada completed only 235 miles of the 575-mile, 34-inch section from Burstall, near the Alberta-Saskatchewan border, to Winnipeg during the 1956 construction season.[69/] Since the delays were the result of strikes and not within the control of TransCanada, the company did not default on its loan to the government.

Construction moved into full swing in 1957 with work under-way on 12 spreads of the main line.[70/] During the peak of the construction period, TransCanada Pipe Lines and the Northern Ontario Pipe Line crown corporation completed roughly 1,400 miles of pipeline.

[69/] Charles S. Coates, "Investment of $300 Million to Transport Oil and Gas," Western Business & Industry, XXXI (June 1957), 50, 53. See also "Pipelines - Trans-Canada, Westcoast, Trans-Mountain," Western Business & Industry, XXXIII (August 1959), 52.

[70/] See Leslie Orr Rowland, "Trans-Canada Makes Rapid Strides in 1957," Petroleum Engineer, XXXIX (October 1957), D 51.

The 584-mile, 34-inch western section, begun in the short 1956 season, reached Winnipeg in 1957. Construction of the tough 400-mile, 30-inch stretch of the all-Canadian line to the Lakehead was completed on schedule. At the eastern end work was finished on 310 miles of 20-inch line from Toronto to Montreal, 33 miles of 16-inch line from Morrisburg to Ottawa, and 33 miles of 24-inch line from Toronto to Sheridan. By the end of 1957 the pipeline contractors had completed roughly 60 per cent of the project.[71/]

Construction of the line east from the Manitoba border north of the Great Lakes challenged even the gigantic and sophisticated machinery and equipment of the consortium. The roughest construction conditions in 1957 were confined largely to the 30-inch section from Ile des Chenes, 15 miles southeast of Winnipeg, to the Lakehead. On the Majestic spread, the first portion of the 30-inch line, the pipeliners ran into the famous muskeg of eastern Manitoba. On one eight-mile stretch of pure muskeg, Majestic contractors used 400 reinforced concrete clamp-on river weights a mile to traverse the 30-feet deep oozing mass. Pipe stringing through the muskegs and swamps of eastern Manitoba required double handling of the 60-foot factory double-jointed pipe. The stringing trucks loaded up at the rail points, and drove along the black-topped Trans-Canada Highway

[71/] "Delivery of Alberta Gas to Lakehead Cities a Reality," Petroleum Engineer, XXX (March 1958), D 66. See also Financial Post, March 2, 1957.

and up the access trails. At the drop-off point the pipe was transferred by crane to Athey wagons in lots of five joints each and the wagons were towed by tractors along the right-of-way. Timber cut from the right-of-way by the clearing gang was used to riprap extensively through all unstable ground in southern Manitoba. On the Majestic spread, the entire supply of 8,000 river weights was used up in the first 30 miles of swamp and muskeg.[72/]

The initial inroads into northern Ontario produced equally severe construction headaches. The first 57-mile section of the crown corporation's line extending east from the Manitoba-Ontario border was almost impenetrable igneous granite rock. On the crown line, the pipeliners blasted through a section of "125 per cent rock" and the first six miles of finished rock ditch required six weeks to complete. The suppliers of explosives calculated that the average consumption of dynamite over the crown job was 40 tons a mile of finished ditch. More heavy earth-moving machinery was used on the northern Ontario section than on any other spread. For almost all of the 315-mile crown corporation section completed in 1957, the pipeliners battled through solid granite, long treacherous stretches of muskeg, and tricky river crossings. At the fast-flowing Winnipeg River channels near Kenora, the operating loop for the most difficult dual-line water crossing on the TransCanada was completed late in 1957

[72/] See Rowland, "Trans-Canada Makes Rapid Strides in 1957," D 63-5.

after four hectic months of work.[73/]

While 1958 pipeline construction fell short of the record year of 1957 in Canada when $281 million was spent on pipeline construction, capital investment in construction fell only to $229 million. The combined mileage of all natural gas and oil pipelines built in 1958 amounted to about 4,200 miles, off only 16 per cent from the 1957 peak of 5,000 miles. The major shift from oil to natural gas pipeline construction, begun in 1956-7, continued in 1958. Natural gas pipeline construction outstripped oil for the second year in a row, with an estimated 3,600 miles of gas pipelines compared with only 600 miles for oil lines. In eastern Canada, virtually all of the 1,600 miles of natural gas pipelines laid in 1958 were associated with the TransCanada line.[74/]

The TransCanada project formed the largest single project in the 1958 construction season. Main line construction in 1958 involved a final 853-mile, 30-inch section in Ontario, the 367-mile stretch of the crown corporation's section from the Lakehead to Kapuskasing, and the final 486-mile portion of the TransCanada section from Kapuskasing to Maple. Work was divided into 12 separate construction

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[73/] Ibid., D 65-6; Petroleum Engineer, XXX (March 1958), D 66; Leslie Orr Rowland, "Kenora Crossing A Tough One!," Petroleum Engineer, XXX (March 1958), D 24-6.

[74/] See "Trans-Canada Goes Into Last Lap," Financial Post, February 22, 1958; and Petroleum Engineer, XXX (March 1958), D 66. See also Gene Kinney, "Trans-Canada Pipeline Nears Completion," Oil and Gas Journal, LVI (August 18, 1958), 204.

spreads, five on the crown line and seven on the last TransCanada section. Completion of the entire gas pipeline from the Alberta fields to eastern Canada was scheduled for the fall of 1958.[75/]

Throughout the winter of 1958, TransCanada clearing crews worked in rugged northern Ontario preparing right-of-ways to enable construction to begin early in the spring. Clearing and brushing were well-advanced in the winter of 1958, permitting rock ditch-drilling and pipe-laying to get under-way in early June. On the Trans-Canada main line the seven contractors pushed ahead through areas as different as the solid rock of the Shield and the rolling land of the south central Ontario clay belt. The crown section through northern Ontario entailed five contracting spreads and crossed not only solid granite rock, but also 150-mile stretches of muskeg, some of which seemed practically bottomless. Contractors for the Northern Ontario Natural Gas Company building a lateral line to Sudbury blasted a 4-foot trench through 88 miles of what experienced engineers called "the toughest pipelining country in the world." The 853 miles completed in 1958 were the most in Canadian pipelining history for a single construction season with big-inch pipe, exceeding by about 100 miles the total big-inch mileage on the TransCanada and crown corporation lines in 1957.[76/]

[75/] Leslie Orr Rowland, "Canadian Construction Off 16%," Petroleum Engineer, XXX (September 1958), D 31-3.

[76/] Financial Post, (February 22, 1958); Leslie Orr Rowland, "World's Longest Gas Line - Trans Canada - Is Completed," Petroleum Engineer, XXX (November 1958); Rowland, "Canadian Construction Off 16%," D 31-2; and "A 4-ft. Trench is Blasted Through 88 Miles of Hard Rock," Petroleum Engineer, XXX (September 1958), D 35.

In October 1958 a hip-booted welder, standing in a muddy ditch near Kapuskasing, made the "Last Weld" that joined the pipe into a continuous pipeline stretching 2,294 miles from Burstall, Saskatchewan, on the Alberta border, to Montreal. Like the Canadian Pacific Railway, the pipeline was a great physical accomplishment. At the peak of construction the army of pipeline workers numbered 5,000. Nine million cubic yards of earth and rock were excavated, and more than 650,000 tons of steel pipe were laid in the 2,294-mile ditch. The cost of the world's longest natural gas pipeline was $375 million.

TransCanada's Effects

The completed TransCanada brought a spurt of industrial development to both western and eastern Canada. At the outset, the line carried 275 million to 300 million cubic feet of natural gas to eastern Canada, and estimated Canadian sales were expected to reach about 600 million cubic feet by 1962.[77/] A leading engineering journal estimated that the TransCanada pipeline carried "the energy equivalent of four St. Lawrence seaway power developments" to homes and industries in an area encompassing three-fifths of the population of Canada.[78/]

[77/] Robert Marjoribanks, "Trans-Canada: Our Pipeline to Industrial Wealth," Financial Post, December 6, 1958.

[78/] "Canadian Pipeline Projects," Engineering Journal, XLII (January 1959), 69-70.

TransCanada stimulated further interest in oil and gas exploration. Over the next ten years, Carl Nickle, millionaire publisher of Calgary's Daily Oil Bulletin, predicted that the pipeline would attract "an extra two million dollars a day" to the Prairie economy for oil and gas exploration.[79/] Another major effect of the TransCanada pipeline was to provide a widespread supply of natural gas as a raw material for industrial development. Raw gas in the form of hydrocarbons became the basis for a growing chemical industry in Canada. To remove the gas from the ground and extract the hydrocarbons, petrochemical companies spent an estimated $250 million, largely in western Canada. British American Oil built a sulphur plant at the Pincher Creek gas field in Alberta; the Polymer Corporation erected a butadiene plant for the production of synthetic rubber at Red Deer, Alberta; Canadian Chemical Company built a $75 million plant to produce textile yarns and fibres at Edmonton; and a new $23 million plant to convert hydrocarbons into fertilizer opened at Medicine Hat. In eastern Canada, the chemical industry entered a new phase of expansion. Du Pont expanded operations in Brockville, using pipelined gas as a raw material to produce methane for home-heating. At Millhaven, Ontario, C.I.L. launched a new plant to make ammonia from methane. Chemical companies in Canada, boasted A. P. Craig, vice-president of TransCanada, in 1957, planned

[79/] Alan Phillips, "What the Pipeline will do for Canada," Macleans' LXX (September 14, 1957) 26, 66.

to spend roughly $200 million in the expansion of facilities to process natural gas.[80/]

But perhaps the principal effect of the TransCanada pipeline was the opening up of the industrial and home market to natural gas as an energy and heating fuel. The completion of the pipeline provided Canadians in eastern Canada with a more convenient source of heating fuel than coal and a less expensive fuel than oil. It was estimated that between 1940 and 1957 fuel-oil prices in the United States had risen an average of 115 per cent, while the price of natural gas had risen only by 15 per cent. Much the same pattern was evident in Canada during this period.

In eastern Canada, gas utilities selling high-cost gas made from coal shifted largely to natural gas. At the eastern end of the Trans-Canada, utilities companies, like Union Gas, Consumers' Gas of Toronto and Quebec Natural Gas Corporation, spent more than $200 million and laid about 300 miles of gas distribution lines to serve the towns and cities in Canada's most highly developed and rapidly growing industrial region.[81/] A significant growth in the demand for natural gas occurred in the development of markets in the industrial centres of northern Ontario served by Northern Ontario

[80/] Ibid., 66

[81/] Rowland, "Canadian Construction Off 16%," D 32.

Natural Gas and its affiliate, Twin City Gas Co.[82/] As a new energy fuel, natural gas began to make inroads into the long-standing markets for coal and oil in industry and home-heating. In natural gas, journalist Alan Phillips confidently predicted, the TransCanada pipeline had tapped "a hoard of new and versatile energy to power our continued expansion."[83/]

In Retrospect

The decade following the great oil discovery at Leduc in 1947 was an expansionary phase in Canadian pipeline building. Over the ten year period, a small, local pipeline network confined to the oil and gas-producing areas grew into a vast transportation system with 5,100 miles of crude oil and products trunk lines and 6,500 miles of natural gas main lines. At the end of 1958 with Interprovincial and Trans-Canada, Canada possessed the longest oil pipeline and the longest gas line in the world. The pipeline era witnessed changes in Canadian pipeline construction and underlined certain historic features of the Canadian construction industry.

[82/] Marjoribanks, "Pipeline to Industrial Wealth," 74.

[83/] Phillips, "What the Pipeline will do for Canada," Maclean's, 69.

Big-inch pipelines were constructed in Canada in the years following the great 1947 oil discoveries in Alberta. In the all-time record year of 1957, pipeline construction hit a peak of 5,000 miles and represented a construction investment of $281 million - 3.5 per cent of all capital investment in Canada.[84/] Canadian pipeline construction tapered off about 16 per cent in 1958 to roughly 4,200 miles, including 3,600 miles of gas pipelines and a mere 600 miles of oil lines. After the completion of the 2,294 mile TransCanada natural gas pipeline in late 1958, the bottom virtually dropped out of the Canadian pipeline construction industry. By the end of the 1950s, Canada possessed an extensive and developed pipeline system and the major markets for energy fuel had adequate pipeline capacity. Canadian pipeline construction moved from a wave of expansion to a period of slow-down and consolidation confined primarily to main line looping and secondary gathering and distribution lines.

Table I[85/]

Crude Oil Pipeline Mileage

Year	Mileage	Year	Mileage
1939	182	1959	7,945
1945	418	1960	8,435
1948	455	1961	9,554
1950	1,423	1962	10,037
1951	1,577	1963	10,607
1952	2,500	1964	11,744
1953	3,794	1965	12,315
1954	4,656	1966	15,705
1955	5,079	1967	16,863
1956	6,051	1968	17,550
1957	6,873	1969	18,055
1958	7,148	1970	18,588

[84/] D.B.S. Construction in Canada

[85/] Data from Canada Minerals Yearbook 1959, 506; 1970, 400.

Table II[86/]

Gas Pipeline Mileage

Year	Gathering	Transmission	Distribution	Total
1954	4,114a	-	5,216	9,330
1955	4,582a	-	5,683	10,265
1956	1,914	3,764	8,021	13,690
1957	2,136	7,233	12,087	21,456
1958	3,108	8,957	15,169	27,234
1959	3,307	9,940	17,162	30,409
1960	3,686	10,715	18,410	32,811
1961	4,876	11,218	19,546	35,640
1962	4,567	11,845	20,940	37,352
1963	4,693	12,388	22,459	39,540
1964	4,918	13,310	23,634	41,862
1965	5,029	13,806	24,525	43,360
1966	5,319	14,935	25,728	45,982
1967	5,376	15,613	27,305	48,294
1968	5,904	16,535	29,960	52,399
1969	6,516	17,928	32,179	56,623
1970	6,829	18,663	33,717	59,209

Pipeline building in the 1950s had a significant impact upon construction activity in Canada. Between 1951 and 1955, the construction of oil and gas facilities, including pipelines, accounted for 6 per cent of the $18 billion spent on new construction in Canada and

Table III[87/]

New Construction (Million)
1951 - 1960

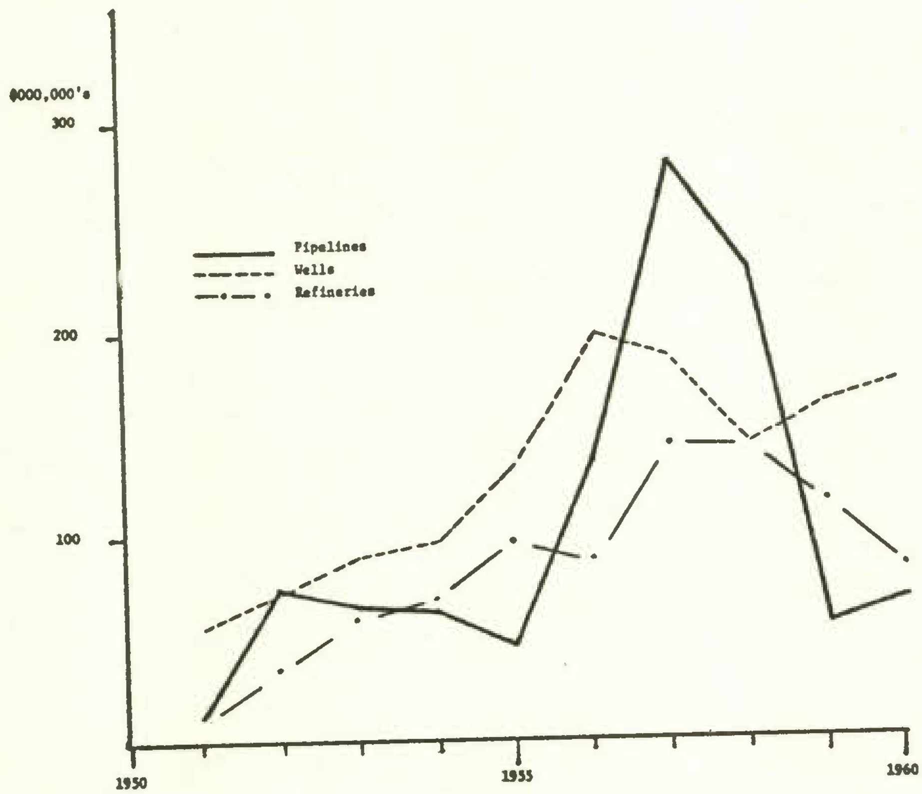
	1951-55	1956-60
Total Construction	17,967	28,051
Housing	5,472	7,967
Engineering	6,489	11,789
Pipelines	260	802
Gas and Oil Facilities	1,140	841

[86/] Ibid; 1961, 250; 1970, 356.

[87/] Data for total construction, building and engineering from M. C. Urquhart and K. A. H. Buckley, Historical Statistics, R 7-11; oil and gas data from D.B.S., Construction in Canada, various issues.

18 per cent of new engineering construction. Pipeline construction was 1.4 per cent of all new construction and 4 per cent of new engineering construction. From 1956 to 1960 construction of oil and gas facilities rose to 10 per cent of new construction and 24 per cent of new engineering construction. Investment in oil and gas wells of $880 million slightly exceeded the $802 million spent in pipeline construction, but the latter accounted for 2.9 per cent of all new construction and 6.8 per cent of new engineering construction.

Oil and Gas
New Construction 1951-1960



While the pipeline did not create the Canadian petroleum and natural gas industry, the existence of a low-cost transportation system profoundly altered its growth and impact. Without the pipelines to the Pacific Coast and central Canada, most of the country would have remained totally dependent upon water-born foreign crude, and the nation would have been even more hard-pressed to provide alternative forms of energy. In 1951, for example over 50 per cent of the crude used by Ontario refineries came from the United States. By 1956 only 15.5 per cent was imported; by 1959 imports had fallen to 3 per cent, and by 1970 to .3 per cent.[88/]

Like the Canadian Pacific before it, the major Canadian pipelines nourished the east-west axis, although unlike it they also were made economically viable by the existence of large markets to the south. Unlike the railroads, too, the crude oil pipeline system did not embrace Quebec and the Atlantic provinces, which continued to draw their supplies by tanker and pipeline from South America and the Middle East. The oil companies argued vigorously in 1957-58 before the Borden Energy Commission that Canadian crude could only be laid down at Montreal at a price disadvantageous to the consumer. Once again the familiar historical arguments rang across the land. As the final report of the Borden Commission observed:

[88/] Figures from Canada Year Book.

> The proposal to transport crude oil to Montreal raises many of the traditional arguments respecting national policy. What price should Canada be prepared to pay to strengthen the East-West lines of trade and communication? To what extent is it possible for Canada to shape her economic policies, without giving careful consideration to those followed by the United States, having regard to Canada's population, resources, and geographical location on the North American continent? Canada is not a natural economic unit. There have always been powerful centrifugal forces of an economic nature tending to separate the nation into regions and it has been necessary that these forces be resisted to some degree in order to build a nation from a group of widely separated regions. Confederation itself involved the construction of a transcontinental railway to link the outlying provinces with the central ones, even though cheaper transportation might have been obtained through the United States.[89]

But the determined national policy of the 1950s and 1960s was to pipe natural gas to Montreal and Ottawa, and to leave the refineries in Canada east of the Ottawa valley dependent on foreign crude. In 1973, however, Arab oil diplomacy put an end to the debate. In 1974-75 Canada tooled up for another boom in pipeline construction, as Interprovincial headed east once again.

Pipelines also provided access to the rich American market for crude oil and natural gas, and, to the extent that access made development possible, contributed to the phenomenal increase in production and exports. Increasing exports of oil and natural gas became a major industry and contributed significantly to an improved

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[89] Royal Commission on Energy, Second Report, 128.

balance of payments position.

Table IV[90/]

Crude Oil Production 1950-1970

Year	Production	Imports	Exports	Dom. Consumption
1950	29,044	78,649	-	107,693
1955	129,440	86,678	14,834	201,285
1960	189,534	125,560	42,235	272,859
1965	296,419	144,184	108,010	332,593
1970	461,207	207,633	240,894	427,946

Table V[91/]

Natural Gas Production 1950-1970

Year	Production	Imports	Exports	Dom. Consumption
1950	67,822	3,254	-	71,076
1955	150,772	11,166	-	150,372
1960	522,972	5,571	91,046	437,497
1965	1,236,798	15,673	403,909	848,563
1970	2,276,579	11,878	768,112	1,520,344

Yet despite the great benefits to the nation, the survey of Canadian pipeline construction underlines certain historic trends in the Canadian construction industry and the Canadian economy. Canadian capital either would not or could not build a new national transportation resource, and most of the total capital cost of construction came from the United States or American subsidiaries

[90/] Canadian Minerals Yearbook 1961, 279; 1970, 394.

[91/] Canadian Minerals Yearbook 1961, 245; 1970, 350.

in Canada. Not only was the capital imported, so too was the engineering and construction "know-how", as neither Canadian engineering nor construction firms had the experience or the equipment for big-inch pipeline construction. Even much of the skilled labour had to be imported with the equipment. Finally, neither the Canadian equipment manufacturing industry nor the steel industry could meet the demands of pipeline construction. The Canadian steel industry worked to capacity to meet pipeline orders, but in a sense they remained the "hewers of wood and the drawers of water" with its small feeder pipes, while the American industry slew the big-inch dragon.

The Canadians underwent another apprenticeship, and by the time the boom was over had made landed immigrants, if not citizens, of the giant American corporations, trained keypersonnel and enlarged their steel capacity.