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PRICE INDEXES OF HIGHWAY CONSTRUCTION IN CANADA

Base-Weighted and Current-Weighted

(1956 = 100)

Reference Paper

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PREFACE

This publication introduces a new series of annual price indexes which measure the movement through time of prices paid by provincial and federal governments for highway construction done under contract. Both base-weighted and current-weighted indexes are presented herein for the period 1956 to 1959.

The highway indexes represent an important extension to an area not previously covered by price statistics. While compromise is an unavoidable component of price indexes it is noteworthy that in this series one major compromise which is common to most price indexes of construction work has been avoided. The bid prices which are indexed epresent the prices paid for units of work put in place. This is unlike the usual input type index upon which it is so often necessary to rely, wherein labour and material prices must be used to represent, as best they can, in-place prices. While it is believed that these series constitute an advancement in the field of price statistics, criticisms and suggestions for their improvement are welcomed.

The material for this publication was prepared in the Farm Prices Section of the Prices Division.

WALTER E. DUFFETT, Dominion Statistician.

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PRICE INDEXES OF HIGHWAY CONSTRUCTION IN CANADA

I. INTRODUCTION

In August 1961 a new series of index numbers of prices paid by provincial and federal governments for the construction of arterial and secondary highways in Canada was released by the Dominion Bureau of Statistics.¹ Annual base-weighted indexes for seven provinces and for the federal government² and a combined provincial-federal index were published for the period 1956-57 to 1959-60.3 The base-weighted indexes measure the movement through time of bid prices in contracts awarded for highway construction and express prices in each year as a percentage of prices in 1956. The weights used in the indexes are based on values of units of highway construction including materials supplied by the department to contractors in contracts valued at \$50,000 or more awarded over the four-year period 1956 to 1959.

Since August 1961, an additional series of annual current-weighted indexes of prices paid for highway construction has been produced for the same seven provinces, and the federal government. In addition a combined provincial-federal index was prepared. The current-weighted index in a given year expresses the cost of construction in the given year as a percentage of the cost of the same construction in the price-base year. The price-base year for the indexes is 1956. Thus, in the currentweighted indexes, the specific programme of highway construction in each year is costed first at prices in the year in which the contracts were let and secondly at prices in the base year 1956. Differences between the indexes of a given year and any other year, except the price-base year 1956, could arise partly because of price changes between years and partly because of differences in the "basket" or programme of highway construction. For this reason, the current-weighted indexes do not measure pure price changes between successive years. The current-weighted indexes are primarily designed for use in deflating current-dollar values of highway construction to derive a constant-dollar series of annual expenditure on contract highway construction which will reflect changes in the volume of highway expenditure.

Throughout the development of the indexes the Dominion Bureau of Statistics has received the close co-operation of provincial and federal government departments concerned with highway construction and the Canadian Good Roads Association. Demand for a Canadian price index of highway construction was first given formal expression in 1956 by the Association in a resolution passed by its Committee on Economics. Finance and Administration, recommending construction of a Canadian road cost price index. Subsequent discussions between the Dominion Bureau of Statistics and the Association established that essential cost and price data in contracts for highway construction were available in provincial and federal records and approval of the project in principle was secured from the provinces. Schedules for the reporting of cost and price data from contracts let for road construction were prepared and the flow of data from the co-operating provinces and the federal Department of Public Works began in late 1959.

Since 1959, contract cost and price data have been provided by seven provinces and the federal government covering fiscal years from 1956 forward. Because necessary data for three provinces have not been made available, it has not been possible to construct an All-Canada index. However, a combined index using the available provincial and federal indexes as components has been produced.

The following sections deal with the baseweighted and current-weighted indexes in that order. The nature of the indexes and the various technical features in their construction are reviewed and the indexes and weighting diagrams are presented in tabular form for the period 1956 to 1959. Patterns of movement of the various indexes are compared and broad categories of uses and limitations are discussed. A paper on the development of the base-weighted indexes was presented by the Dominion Bureau of Statistics to the 1961 Annual Meeting of the Canadian Good Roads Association in Banff, Alberta, and has been freely drawn on in this report.4

¹ Daily Bulletin, Dominion Bureau of Statistics, Ottawa, August 15, 1961. ² The federal government refers to the federal Department of Public Works.

A fiscal year which runs from April 1 to March 31 will subsequently be referred to using only the year in which the majority of the months lie. For example, 1956-57 will be referred to as 1956.

⁴ Price Indexes of Highway Construction in Canada, E paper presented by A.D. Holmes to the Annual Meeting of the Canadian Good Roads Association, Banff, Alberta, September 15, 1961.

H. BASE-WEIGHTED PRICE INDEXES OF HIGHWAY CONSTRUCTION

The Nature of the Indexes

The base-weighted price indexes of highway construction in Canada express prices paid in a given year by provincial and federal governments for highway construction as a percentage of prices paid in the base year 1956. More specifically, each provincial and federal index is designed to measure the effect of price change on the cost of a programme of highway construction represented by capital construction contracts valued at \$50,000 or more let by the particular provincial or federal government during a specified base period.

In this context, a programme of highway construction for a particular province is defined as the "basket" of common units of work put in place by contractors, as specified in contracts let by the province for new construction, reconstruction and betterment of highways during the four-year period 1956 to 1959. The units of construction are contract items such as an acre of clearing, a cubic yard of excavation, a ton of gravelling, or a ton of hot-mix bituminous paving. Also included are supply items, usually provided to the contractor by the department.

Prices used in the indexes are annual weighted averages of bid prices for units of construction work and for materials used in the construction. The former are bid by the construction contractor and the latter usually by the manufacturers of the materials provided.

Capital construction of highways is defined as including new construction, reconstruction and betterment work on grading, granular base courses or surface courses projects. Grading embraces clearing, grubbing, excavation and the placing of culverts. Granular base courses include the supply and placing of pit-run materials and screened or crushed gravels. Surface courses include bituminous stabilized base courses and portland cement concrete surfaces but are mostly bituminous hot-mix surfacing.

The term highway embraces all arterial and secondary roads under the jurisdiction of the province. Excluded are local roads, city streets, and development roads which are not typical of the type of road usually constructed by the province.

Similarly, the set of road building units, on which the index for federal government highway construction is based, consists of contract items in Trans-Canada Highway contracts and other highway contracts in National Parks let and supervised by the federal Department of Public Works during the same four-year period. Also included are road construction contracts let in the Northwest Territories and the Yukon.

Prices Used in the Indexes

The essential elements of any price index are prices of items and weights representing the relative importance which should be attached to the movement through time of prices of individual items or groups of items. In addition, a time base period during which prices are defined as equal to 100 and a weight base period for establishing weights to be assigned to items, are required.

The problem of pricing is the most important and difficult element in development of price indexes of highway construction and the solution of it conditions decisions about the other essential elements of such indexes. A thorough understanding of the prices used is therefore of first importance in the interpretation and use of the indexes.

Price is by definition the value in exchange of a specified unit of a commodity or service, at a specific time and location and under given conditions of purchase or sale. Further, for measurement of "price" change over time, it is essential that the prices being compared over time relate to an identical or equivalent quantity and quality of commodity or service. Thus, in a price index of highway construction only those items of highway construction can be included for which there is a measurable price through time for comparable units of construction under comparable conditions of purchase.

It is obvious that highways like other engineering construction projects are unique and complex goods for which comparable prices through time are a practical impossibility. Indeed, most highways are the result of successive improvements to previously constructed roads, and highway construction in any particular year represents a mixture of new construction and major improvements and betterments of existing roads.

Two solutions to the problem of pricing for price indexes of engineering construction may be distinguished, however. One is to price the material, labour and machinery inputs used in construction. Indexes based on such prices fail to take into account other elements of the price of the final output of the construction such as overhead costs including profits and losses and, more importantly, they do not reflect price changes in final output resulting from the changing technology of construction. The other solution to the pricing problem is to price the component work put in place in construction using bid prices on contracts let and supply prices of materials excluded from the bid prices but included in the construction. In this approach, overhead costs of contractors, including their profits and losses, and the price effects of changing technology in contract construction are reflected in the bid prices. Indexes, based on such prices, reflect closely the movement of prices paid

by the contract-letting agencies for the final product, i.e., new or improved highways. This approach has been used in development of the price indexes of highway construction in Canada.

Sources and Collection of Price Data

In Canada the bulk of highway construction in each province is done under contracts let by provincial and federal governments. It is usual for tenders to be called for specific road construction projects and for tenders submitted by contractors to include estimated quantities of work units to be completed, bid prices, and the estimated total cost of such work. The accepted tender becomes the contract and the individual bid prices in it become the fixed rate at which the work done by the contractor is paid. Thus data on estimated quantities, bid prices and total cost of construction become available in the contractletting process of the provincial and federal highway building agencies and constitute the basic ingredients for indexes of prices paid by governments for highway construction.

The necessary contract data are reported by cooperating provincial and federal governments on a special schedule designed for the purpose. A copy of the schedule is included in Appendix B. Separate schedules are completed for each contract awarded for new construction, reconstruction or betterment, valued at \$50,000 or more. Because contract detail varies among provinces, the schedule was designed to permit reporting of basic units of highway construction for which bid price and quantity data were usually available in provincial contracts, and to provide for reporting of costs relating to such units where available bid prices excluded them. Where costs were so excluded from bid prices, a price inclusive of such costs was calculated for the unit of construction.

Similarly, schedules were provided for reporting of quantity, price and total cost of "supply", i.e., specified materials which were usually supplied free to the contractor by the government department.

Comparability of Prices Through Time

All prices used in the index are weighted average prices. Averaging is a technique used to develop a continuous series of annual prices in which the movement from year to year reflects essentially price change. Individual contracts relate to particular roads at various locations throughout a province and over time no two contracts cover the same work on the same highway. Among locations there are many factors influencing the price of construction such as terrain, accessibility, weather, etc. Contracts also vary in size, in terms of quantity of work, and the combination of different kinds of work included. For these reasons, individual contracts and the units of work specified in each may be termed unique and differentials in bid prices among contracts reflect differences in the location and terms of purchase of the units of road construction. Any attempt to evaluate and remove such price differentials from individual contracts in successive years in order to isolate pure price change over time would be impractical. Over successive years, however, provincial road construction programmes could be expected to result in annual sets of contracts wherein construction would occur under fairly comparable over-all conditions of terrain, accessibility, and other factors which may render individual contracts unique. The averaging of bid prices over all contracts in a given year would, therefore, seem to be a logical method of securing comparable average bid prices through time for units of work in contract construction.

The effectiveness of such an averaging process was tested empirically for all major contract items in each province. Bid prices on individual contracts were plotted against known characteristics of the contracts such as value or quantity of the contract item, type of contract, value of total contract, and location of contract work. For some contract items in various provinces, it was found that price differentials did exist among classes of contracts. For example, in some provinces gravelling prices from grading contracts tended to be lower than gravelling prices on other types of contracts. Size of contract as measured by the number of units of a contract item also tended to be associated with differing levels of bid prices. Where the number of contracts per year was relatively large, the mixture of differential prices did not present a significant problem because the proportions of differing contracts were fairly constant from year to year. In other cases, variation in classes of contracts from year to year did introduce some nonprice changes in the averages of prices in successive years.

To avoid such non-price influence and ensure the comparability of annual average bid prices through time, classes of contracts were established within which bid prices were more homogeneous and in which non-price effects on weighted average bid prices within such contract classes were of minor consequence.

Stratification of Contracts for Price Comparability

The procedure of stratification can be illustrated by reference to the classification of the item earth excavation. Contracts on which earth excavation occurred, were divided in some provinces into two classes: one class wherein the quantity of earth was classified as low and the other class wherein the quantity of earth was classified as high.

In general, it was found that lower unit prices tended to be associated with contracts involving larger quantities of earth excavation. This is exemplified in one province in which over the four-year period the price of the high-quantity group averaged ten per cent less than that of the lowquantity group. This relationship held for three of the four years included in the index, the percentage differences being 10, 15 and 21. For the fourth year the high-quantity price was one per cent higher than the low-quantity price.⁵ Further, for high-quantity contracts, unit prices showed less dispersion than did prices on small-quantity contracts.

Under these circumstances, variation from year to year in the proportion of contracts occurring in each class could cause changes in the weighted average price over all contracts. This can be illustrated by carrying the example given above one step further. Over the four-year period the distribution of contracts between the two classes, in terms of the percentage of total value of earth excavation included in each, was as follows:

| A STATISTICS | Percentage distribution of value of earth excavation | | |
|--------------|--|----------------------------|--|
| | Low-quantity contracts | High-quantity contracts | |
| 1956 | 38 | 62 | |
| 1957 | 61 | 39 | |
| 1958 | 50 | 50 | |
| 1959 | 49 | 51 | |

If it is supposed that no price change occurred between 1956 and 1957 within each class, it can be seen from the above that the shift in weight combined with the price differentials which usually exist between high and low quantities would cause a change in the weighted average price which could not be called pure price change. In order that this type of non-price change will not affect the movement of the index, constant weights are assigned to each of the classes.

Criteria for classification of contracts varied according to the characteristics of the unit of construction to be priced. While the most common classification was "size" of contract, as measured by the quantity of the particular variety of construction work, a few other criteria have been employed. The contract stratification employed is explicitly stated in the last two columns of Table 4, page 25 in which the item classification system adopted for the index is presented.

In classification of contracts into homogeneous price groups, a few classes emerged in which the number of contracts were too few or too intermittent over the period for calculation of average price within the class. Such residual classes were excluded from price averages used in the index but the "weight" of contracts in each such class was added to the weight of a closely related class for which a price could be calculated. By this process of imputation of weight, the price movement of one class is used to represent the price movement of another class for which direct pricing is not feasible. Classes of contracts for which imputation was necessary are listed in the last column of Table 4.

To illustrate, Table 4 shows the following: in Newfoundland clearing remained as originally classified and as a result no residual data occurred; the additional classification for earth excavation was all inclusive (0-99,999 cubic yards and 100,000 cubic yards and over) and again no residual data occurred. However, in Nova Scotia no provision was made for indexing clearing, 75 acres or more, which occurred on grading contracts. Any such clearing which occurred would be imputed to grading contracts, 0-74 acres. This means that prices used in the index for clearing were derived from clearing bids of grading contracts, 0-74 acres in size, but the weights in the index were derived by combining clearing, 0-74 acres, and 75 acres and over.

To summarize: in principle, items included and priced separately in the index are units of construction work commonly specified on highway construction contracts, except where it has been found necessary for price comparability through time to establish two or more classes of contracts for such an item. Not all items have been so divided nor is the system of classification used to divide any given item the same for all provinces.

The amount of classification which could be adopted to reduce non-price change was limited by the number of contracts usually let by a province in a year. Because few provinces consistently let more than 50 contracts a year valued at \$50,000 or more and because every item is not reported on each contract, the amount of classification which could be introduced was clearly limited. It was found that, as long as the number of contract bids was five or more, recognizable grouping occurred. When there were fewer than five bids it was sometimes difficult to decide which prices were usual and which were unusual if any great price dispersion were occurring. The distribution of the number of bids averaged to obtain prices used in the index from 1956 to 1959 is shown in Appendix A. The data are presented for provinces, the federal government, and the combined provincial-federal total.

In the last column, relating to the combined index, it can be seen that for about a third of the prices the number of bids averaged was less than 5. For Newfoundland, Manitoba and the Federal Government the number of bids averaged was usually fewer than five.

In Newfoundland very few highway construction contracts were let in 1956 and 1957 which were valued at more than \$50,000. Since then the number of bids averaged has been rising and currently the number of bids is at a satisfactory level.

⁵ The differential in this particular year disappeared because of the inclusion of a very large fourlane contract which had a higher than usual price for earth excavation. As far as could be determined this contract was not unusual in any way which would justify its removal from the price basket. In other years there were similar contracts as to size, type and geographic location. For this reason, and because it is considered essential to refrain from arbitrary removal of unusual prices, the contract was retained in the price basket.

The Department of Public Works of the federal government lets a relatively small number of highway contracts over a widely dispersed area. In choosing between averaging a low number of bids and averaging together bids of markedly different character the former was chosen as the better compromise. Even so, it was not possible to establish as many classes as were needed to adequately minimize the influence of non-price change.

In Manitoba the highway department wanted the indexes produced on an area basis and this was the only province in which it was feasible to develop a satisfactory geographic classification system. As a result, in calculating prices, contract bids were usually classified by geographic location. Table 4, page 25 shows that additional classes were also superimposed on geographic location. While the number of bids averaged for annual prices was low it was thought that sufficient evidence of grouping existed to warrant adoption of a geographic system of contract classification.

The average number of bids is of less concern in the remaining provinces. Further, many of the prices in which the number of bids is below five have a high-quantity classification and bids in high-quantity classes consistently group closer together than do bids in low-quantity classes. This homogeneity lends greater confidence to an average based on a small number.

Also it can be seen from Appendix A that over the four-year period it was necessary to estimate five per cent of the prices in the index. The method followed to fill a gap in a price series is to select a complete price series which is known or expected to have similar price behaviour to the incomplete series. Price movement in the incomplete series is derived from the price movement of the complete series.

The most usual reason for estimating prices was because no contracts were let of the type needed for the classification system. It is clear from the table that the problem of missing prices was most acute in Newfoundland. All but one of the missing prices in Newfoundland occurred in the first two years. It was also necessary to estimate prices where new items were introduced into the index part way through the four-year period. This occurred in Nova Scotia where the placing and the supply of corrugated metal pipe were introduced as new items in 1958.

Other Factors in Maintaining Price Comparability

Before leaving the subject of the methods used to group contract bids it would be well to consider some of the problems encountered in maintaining the system through time. To give an example, it was found in Manitoba that the geographic location in which the grading contracts were let had an influence on the level of prices bid for earth excavation. Because of the very small number of grading contracts involving northern areas, prices have been based on southern contracts and the earth excavation index reflects the movement of prices in only those contracts which were let in the southern portion of the province. Recently there has been a shift to a higher proportion of work being done in the northern portion of the province. If the northern work continues persistently over the years it will be represented in the index after the first revision. In the interim, earth excavation prices will continue to be calculated from contracts let in the southern portion of the province and to the extent that southern contracts are not representative of the movement of prices in the whole province, the index will be less reliable than for the earlier years.

In the discussions of contract classification above it has been assumed that the same work-unit has been priced from year to year. In other words it was assumed that the province was expecting the same standard of work from the contractors and that the same types of materials were being purchased from year to year. When this continuity in standards does not occur, the effect of the changes on the bid prices must be evaluated so that the influence of this type of non-price change can be removed from the price series. This is one area where considerable development work remains to be done and research is underway to develop more precise techniques for ensuring an adequate flow of information about specification changes.

The problems of changing specifications may be illustrated as follows. Two questions have to be answered in handling specification changes: is the change a non-price change which should not be allowed to affect the movement of the price series; and if it is a non-price change, how should the change in specification be evaluated?

Suppose that a highway department decides that in future the contractor instead of the department shall pay the freight charges from the refinery to the job site. Obviously the asphalt supply prices before and after are no longer comparable because dreight has been removed from the series. The placing price for bituminous hot-mix is no longer comparable with previous periods, because a contractor will have to alter his bid for placing the mix to include the additional expenditure for freight. Four prices at the same point in time are needed to allow for the shift in contract terms:

- supply of asphalt, freight included (old specifications)
- supply of asphalt, freight excluded (new specifications)
- placing bituminous hot-mix, freight excluded (old specifications)
- placing bituminous hot-mix, freight included (new specifications)

At the point in time when the shift is made price movement is determined from prices derived from the old specification. For subsequent index calculations a new base price is estimated, based on the ratio of the old specification prices to the new specification prices. In the above example it is relatively easy to obtain an acceptable estimate of the value of the change in the specification. Suppose however that the department raises the quality of a particular specification by requiring the contractor to work to a finer degree of tolerance than before. While as yet, it has not been necessary to evaluate any specifications in this way it is hoped that it will by possible to obtain from the departments concerned their estimate of the value of this type of change in specification.

In both examples given above, the assumption is that the new specification was introduced at a particular point in time and that from that time forward all work was done to the new specification. In highway construction, however, a department sometimes rewrites specifications and then gradually introduces the new practice to more and more contracts over a period of years. Thus far it has been found impossible to devise a suitable method of taking this type of change into account until the new practice becomes fairly common among contracts.

Lack of Comparability of Prices Among Provinces

It must be understood clearly that the price indexes described herein do not measure differences in price levels among provinces. Prices collected from any particular department reflect the engineering and contract-letting practices of that department. These practices vary considerably from one province to another. The sort of variation which occurs can be illustrated by considering the index item of supply of corrugated metal pipe. The departments were asked to report data on the most commonly used size and type of corrugated metal pipe. One department reported 18-inch pipe, six reported 24-inch pipe and one reported 36-inch pipe. The gauge and types of finish reported also varied from department to department. Such variations cause differences in prices among provinces and the price differences are eliminated by setting all indexes equal to 100 in the price-base year 1956. The indexes then measure the movement of prices within each province from 1956 forward and do not measure differences in prices among provinces.

Time Base for the Index

The interim time base chosen for the index is 1956 which is the base year used for other recently developed price indexes published by the Dominion Bureau of Statistics.⁶ The history of the Ontario Department of Highways' Price Index⁷ suggests that 1956 was a high year on which to base the DBS series. On the other hand, the Ontario series indicates that at no time during the 1950's was there a period of price stability. This was felt to be sufficient justification for establishing the time base in conformity with other published statistics. The index, independently constructed and published by the Ontario Department of Highways, is as follows:

Ontario Department of Highways Index of Tender Prices Paid on Road Contracts 1950/51 = 100

| 1950/51 | 100.0 |
|---------|-------|
| 1951/52 | 135.9 |
| 1952/53 | 128.3 |
| 1953/54 | 107.8 |
| 1954/55 | 111.0 |
| 1955/56 | 129.4 |
| 1956/57 | 156.8 |
| 1957/58 | 135.4 |
| 1958/59 | 124.2 |
| 1959/60 | 129.1 |

Index Weights

Weights are assigned to each item in the index. The index is fundamentally a weighted average of the price movements of all items included in it, and the weight of an item represents the influence of the price movement of the particular item on the average movement of all items. The function of the weights in the index may be illustrated by a hypothetical example. If expenditure on earth excavation in a province in the base period is twice as large as expenditure on rock excavation, the effect of the price change in earth excavation on the combined cost of earth and rock excavation should be twice as great as the effect of the price change in rock excavation. Thus, if earth excavation prices have decreased by 50 per cent and rock excavation by 20 per cent since the base year, the effect on the combined costs of the same excavation in the current year is a decrease of 40 per cent. A simple average of the changes would be a price reduction of only 35 per cent. To illustrate with hypothetical figures:

| | Cost in base year | Price decrease | Cost in current year |
|------------------|----------------------|-------------------|----------------------------|
| the second | \$'000 | % | \$*000 |
| Earth excavation | 200 | 50 | 100 |
| Rock excavation | 100 | 20 | 80 |
| Totals | 300 | | 180 |

It is evident that the effect of price change is to reduce current cost to \$180,000 which is 60 per cent of the base year cost of \$300,000, a decrease of

⁶ The new official time base for DBS series is 1961. The Highway Construction Price Indexes will be revised to conform to this new base period within the next several years.

⁷ Annual Report, Department of Highways, Ontario. See pages 17 and 20 of the 1959-60 report for the year ended March 31, 1960.

40 per cent. Therefore, in terms of a price index the combined price index for earth and rock excavation in the current year should be 60, calculated as follows:

| | Current index | Base year weight | Weight x index |
|------------------|--------------------|---------------------|-------------------|
| | base year = 100 | \$'000 | '000 |
| Earth excavation | 50 | 200 | 10,000 |
| Rock excavation | 80 | 100 | 8,000 |
| Combined | 60 ¹ | 300 | 18,000 |

¹ The combined current index of 60 is derived by dividing the "weight x index" (18,000,000) by the sum of the weights (\$300,000).

In practice, weights are expressed as relatives totalling 100.

It is useful to emphasize here that the only change measured by the index in the illustration was price change. The weight assigned to the index (price relative) of each of the two items remained fixed over time. The index is a simple example of a base-weighted index.

In the base-weighted highway price indexes, weights of items are based on the aggregate value of the index items reported for contracts let in the period 1956 to 1959. An average of four years was selected for the weight-base period because of the appreciable variation in relative expenditures on important construction items among years. An indication of this variation can be seen from Table 2 wherein annual constant-dollar weights are shown.

For each index item, the aggregate contract values in each of the three years since 1956 were adjusted for price change since 1956 to express values in all years in terms of 1956 prices. The resulting aggregate expenditures were averaged over the four-year period, 1956-59, to derive an average annual expenditure on each item included in the index.[®] The average annual expenditure for each item was then expressed as a percentage of the total expenditure for all items. These relative annual average expenditures are the weights assigned to index items and constitute the weighting

⁶ Each value series was divided by its price relative series and averaged as follows:

$$\left\{ \begin{array}{ccccc} \frac{p_{56}}{p_{56}} q_{56} & \frac{p_{57}}{p_{57}} q_{57} & \frac{p_{58}}{p_{58}} q_{59} & \frac{p_{59}}{p_{59}} q_{59} \\ \hline p_{56} & \frac{p_{57}}{p_{56}} & \frac{p_{58}}{p_{56}} & \frac{p_{58}}{p_{56}} & \frac{p_{59}}{p_{56}} \end{array} \right\} \cdot / \cdot 4$$

diagrams for the indexes. As a percentage of the estimated value of all new contract construction work done over the four-year weight period, the aggregate value of contracts let on which the weighting diagrams were based ranged from 60 per cent in Saskatchewan to 83 per cent in Manitoba.⁹

The weighting diagrams for each provincial index, the federal index, and the combined index are presented in Tables 2 and 3. Weights below the level of contract items are not shown in the tables. In a few cases, some adjustment of the weights for particular items has been incorporated to avoid distortions arising from unusual temporary conditions.

Index Formula

The base-weighted index expresses the current cost of a fixed basket of units of highway construction and supplies as a percentage of the cost of the basket in a base period. The formula used in the index may be written as:

$$I_n = \frac{\sum p_n q_o}{\sum p_o q_o} \times 100 \text{ which may be transformed}$$
into the more convenient form

$$I_{n} = \sum \frac{p_{n}}{p_{o}} \left\{ \frac{p_{o} q_{o}}{\sum p_{o} q_{o}} \times 100 \right\}$$

where $I_n = index$ for year n

- Σ = summation over all items
- $p_n = price of an item in year n$
- p = price of an item in year o
- q_o = quantity of the item in the weight-base period
- $\frac{p_n}{p_o} =$ price in year n as a ratio of price in year o (in this case year o is 1956)
- p, q, = average value of a given item in the weight-base period 1956 to 1959

 $\frac{p_o q_o}{\sum p_o q_o} \times 100 = \text{ relative weight of a given item in the base period as shown in Table 3}$

⁹ The unreported residual consists of contracts of a type not indexed such as contracts for fencing, sodding, tree planting, for drainage ditches off the road allowance or for cast-in-place concrete culverts. Also excluded are grading, granular base courses and surface courses contracts which are valued at less than \$50,000. *A*vailable information indicates that if all contracts had been included rather than only those \$50,000 or over no great weight changes would occur for any index item except for granular base courses. A few provinces let large-quantity gravelling contracts the value of which is below \$50,000. It is believed that the price behavior of these unreported gravels is adequately represented by the published indexes.

Annual Base-Weighted Price Indexes of Highway Construction, 1956-59

In Table 1, page 22 the all-items index and indexes of its three major components are presented for each province and the federal government. The combined provincial-federal index and components also are included.

Combined Provincial-Federal Index. — The combined all-items index declined 8 per cent from 1956 to 1957, 12 per cent from 1957 to 1958 and rose less than one per cent from 1958 to 1959. This pattern was caused mainly by the behaviour of the grading and granular base courses indexes although the grading component declined more steeply and during 1959 showed a slight decline instead of an increase. Except for an increase of 2 per cent from 1956 to 1957 the index of surface courses moved similarly to the granular base courses component.

Newfoundland. - In Newfoundland, the all-items index also declined from 1956 to 1957. The 16 per cent decline was almost balanced in the following year by an increase of 14 per cent. From 1958 to 1959 the index fell 9 per cent. Again this movement was largely caused by the similar behaviour of the grading and granular base courses components. Also the pattern of stronger index movement in the grading component compared to the granular base courses component can be observed. One exception to the pattern was the 8 per cent increase in granular base courses which occurred from 1958 to 1959. The surface courses index declined during the whole period, the decline being one per cent from 1956 to 1957. 16 per cent from 1957 to 1958 and 11 per cent from 1958 to 1959.

Nova Scotia. — In Nova Scotia, the all-items index fell 8 per cent from 1956 to 1957, 4 per cent from 1957 to 1958, and then rose 6 per cent in 1959. This pattern of decline over the first three years and increase in the fourth year was repeated in all major components except for an 8 per cent increase in the grading component from 1957 to 1958. The rise was sufficient to dampen the 15 per cent decline which occurred in the surface courses component during the same period. A substantial increase in the price of rock excavation was the most important determinant of the increase in the grading index from 1957 to 1958.

New Brunswick. — The New Brunswick index moved similarly to the Newfoundland index with a saw-tooth pattern reflected in an initial decline of 2 per cent followed by an increase of 8 per cent from 1957 to 1958 and a subsequent drop of 13 per cent from 1958 to 1959. The 1956-1957 drop was caused by declines in granular base courses and surface courses which were almost balanced by an increase in the grading index. A rise of 5 per cent in the rock excavation index was mainly responsible for the increase in the grading index. The increase from 1957 to 1958 was common to all major components. In the grading component the increase was caused mostly by a strong increase in the earth excavation index and a weaker rise in the rock index. All major components fell from 1958 to 1959. Declines were most marked in the grading and surface courses components.

Ontario. — The Ontario index declined 12 per cent from 1956 to 1957, dropped a further 7 per cent between 1957 and 1958 and rose 5 per cent from 1958 to 1959. The pattern was followed in all major component indexes with decreases strongest in the grading index and least strong in the surface courses index. Conversely, the increase from 1958 to 1959 was strongest for the surface courses index and weakest for the grading index.

Manitoba. — In Manitoba, the all-items index rose 11 per cent from 1956 to 1957 and then declined 26 per cent from 1957 to 1958 and 4 per cent from 1958 to 1959. The increase from 1956 to 1957 was caused by the substantial rises in both the surface courses and granular base courses index (28 per cent and 14 per cent). The grading index declined one per cent during the same period. In all major components large decreases occurred between 1957 and 1958 (ranging from 22 per cent to 34 per cent). Declines continued in the following year but at a slower rate ranging from 3 per cent to 6 per cent.

Saskatchewan. - In Saskatchewan the all-items index showed similar movement to that of Manitoba although the index rose less steeply from 1956 to 1957 and declined more sharply from 1958 to 1959. The increase in the index from 1956 to 1957 was caused solely by a 15 per cent rise in the granular base courses index. The indexes for grading and for surface courses fell 8 per cent and one per cent respectively during the same period. Substantial decreases occurred in all major components from 1957 to 1958, ranging from 14 per cent in the surface courses component to 26 per cent in the granular base courses index. The decline in the index from 1958 to 1959 was caused mostly by a fall of 20 per cent in the granular base courses index. The surface courses index dropped only 3 per cent and was offset by an increase of one per cent in the grading index.

British Columbia. — The all-items index moved similarly to that of Nova Scotia and Ontario. The index fell 23 per cent through to 1958 and rose 2 per cent during the following year. Declines occurred in all major components from 1956 to 1958 with the least amount of decline occurring in surface courses (5 per cent) and the largest in grading (28 per cent) over the two-year period. The increase from 1958 to 1959 was caused by a strong rise of 14 per cent in the granular base courses index, and a lesser increase of 3 per cent in the surface courses index. The increases were nearly balanced by a decline of one per cent in the heavily weighted grading index.

Federal Government. - The Federal Government all-items index rose one per cent from 1956 to 1957. fell 36 per cent from 1957 to 1958 and declined a further one per cent from 1958 to 1959. The rise in the index from 1956 to 1957 was caused by increases in the grading and granular base courses indexes which were modified by a small decline in the surface courses index. From 1957 to 1958 all major component indexes declined. The reductions ranged from a sharp drop of 40 per cent in the grading index to a smaller but still appreciable decline of 18 per cent in the surface courses index. The one per cent decline from 1958 to 1959 reflected moderate declines in the granular base courses and surface courses indexes of 7 per cent and 12 per cent respectively, and a 2 per cent increase in the grading index.

Uses and Limitations

A clear understanding of the concept and definition of the indexes is essential to consideration of the uses and limitations of the price indexes of contract construction of highways in Canada.

Conceptually, the indexes measure the movements of prices paid by provincial and federal governments for highway construction done under contract, including materials supplied by the contract-letting agency to contractors for completion of such work. By definition, each index measures the effect of price change on the cost of an unchanging or equivalent programme of highway construction, represented by capital construction contracts valued at \$50,000 or more, let by a particular provincial or federal government during a specified base period for construction of arterial and secondary highways.

The indexes, therefore, measure only the effect of price changes on the cost of highway construction. They do not reflect changes in the cost of highway construction resulting from non-price changes such as changes in the quantities or qualities of highway construction from year to year.¹⁰ Nor do they necessarily reflect the price movements of non-contract construction such as own-account work of government agencies or maintenance work on highways.

¹⁰ The differences between a base-weighted price index and a cost index can be seen from the following formulae:

| Base-Weighted | Price Index: | Cost Index: |
|--------------------------------|--------------|--------------------------------|
| Σp _n q _o | | Σp _n q _n |
| $\Sigma p q$ | x 100 | $\sum p_q x 100$ |

In the base-weighted price index quantity is neld constant between the base period o and the current period n. In a cost index no component is held constant from period to period. As a result, both price and quantity changes can cause changes in the cost index but only price can cause change in the price index. One further restriction should be emphasized. While the indexes do indicate the trends of prices over time, they do **not** reflect comparative price levels at different geographic locations and cannot be used to compare price levels among provinces.

In spite of these restrictions and limitations, the indexes can be expected to be useful in planning and budgeting for highway construction programmes, in escalating or updating previously costed roadwork, in estimating replacement costs of previously completed roadwork, and as historical measurements of price trends in highway construction. While the combined index and the provincial and federal allitems indexes are useful as summary indicators of price trends in contract construction of highways, the component indexes for grading, granular base courses and surface courses are likely to be more relevant to particular uses such as planning, budgeting and estimating expenditures in terms of constant dollars.

In planning and budgeting for a programme of highway construction, it is essential that costs, necessary funds for implementation of the programme and timing of the several stages in completion of the programme, be integrated. Considerable time normally elapses between planning and doing and, while earlier estimates of quantities of various units of construction involved in the programme may not change, prices are subject to change, Estimates of prices at future periods when contracts are to be let are therefore an essential element of good planning and budgeting. Price indexes of the components of highway construction programmes provide a convenient and useful basis for required projection of price trends, for updating previously costed construction, and, in general, for answering the question "How many more or fewer dollars are required to pay for a given programme of highway construction because of changes in prices through time?" It will be evident also that the indexes will grow in usefulness as the period for which they are available increases, thus providing expanding bases for analysis of price trends and cycles.

The all-items base-weighted indexes are less appropriate, however, for use in the deflating of current-dollar expenditures on highway construction, i.e., measuring changes in highway expenditure in tems of constant dollars. The most appropriate indexes for this purpose are current-weighted indexes. Nevertheless, base-weighted indexes at a fine level of detail, such as earth excavation, bituminous hot-mix, etc., are reasonably appropriate for separate deflation of current-dollar expenditures on each such item. The aggregate of the resulting constant-dollar expenditure across all items would approximate the deflation of total current-dollar expenditure by the current-weighted all-items index.

III. CURRENT-WEIGHTED PRICE INDEXES OF HIGHWAY CONSTRUCTION

Nature of the Indexes

The current-weighted index expresses prices paid by provincial and federal governments for highway construction in a given year as a percentage of prices paid in the base year 1956.

Moreover, in the current-weighted index the weights attached to price change between the pricebase year and the given current year for the various units of construction reflect the given year's programme of construction. Thus, the weights themselves change each year in accordance with changes in the programme of construction. This is in contrast to the base-weighted indexes in which the weights are constant from year to year and are derived from the base-period programme of construction.

The current-weighted index measures the cost of the current year's programme of construction at current-year prices as a percentage of the cost of the same construction at base-year prices. Since the construction programme can and does vary considerably from year to year, the movement of the index through time may be caused by both changes in price and changes in the relative importance of the various units of construction included in the index. Accordingly, the current-weighted index usually does not reflect pure price change from year to year, as does the base-weighted index. It does reflect, however, the effect of price change since the base year on the cost of a given current year's programme of highway construction. Its principal use is in deflation whereby annual current-dollar expenditures on highway construction are transformed into annual constant-dollar expenditures, i.e., current expenditure valued at 1956 prices. The series of annual constant-dollar expenditures then reflects changes through time in the volume of highway construction expenditure.

One further advantage of the current-weighted index is that new items may be included in the annual recalculation of weights so long as an adequate base price can be estimated. The currentweighted index may then reflect the shift in weighting patterns which may be associated with the introduction of the new item.

Prices Used in the Indexes

Currently, the prices used are common to both the base-weighted and current-weighted indexes,¹¹ except that drainage items have been omitted from the current-weighted indexes because annual data on aggregate expenditure on pipe were not available for weighting purposes. Thus, for example, the price relative (price in the given year expressed as a percentage of the price in the base year) for the item low-quantity earth excavation in a given province was 81.8 in 1959. Similarly for the item highquantity earth excavation the price relative in 1959 was 64.2. These price relatives were used in both the current and base-weighted indexes. However, because the base weights for the low and highquantity items differ from the current weights, the excavation indexes, in which the two price relatives were combined, using base and current weights respectively, also differ as follows:

¹¹ See pages 8 to 12 for the discussion of the nature of pricing and prices incorporated in the indexes.

| (1956 = 100) | | | | | | | |
|-------------------|--------------|---------------|------------------|---------------|--|--|--|
| | Base-w | eighted | Current-weighted | | | | |
| | Low quantity | High quantity | Low quantity | High quantity | | | |
| Weight% | 45.5 | 54.5 | 42.9 | 57.1 | | | |
| Price relatives % | 81.8 | 64.2 | 81.8 | 64-2 | | | |
| Index | 7: | 2.2 | 7 | 1.8 | | | |

Price Indexes of Earth Excavation, 1959

Index Weights

In the current-weighted indexes the weights of the items in the index for a given year are derived from the value of the index items reported from contracts let in the given year. For each index item, the aggregate contract values in each of the years since 1956 were corrected for price change since 1956 and the resulting annual constant-dollar values were used to calculate for each year the percentage weights of each item in the index.¹¹

¹² See footnote 8, page 13. The method followed is the same except the steps of summing and dividing by four were omitted.

The weighting diagrams for each provincial index, the federal index and the combined index are presented in Table 2. Weights below the major component level are not shown in the table. Adjustments made in establishing the base weights for particular items for the purpose of avoiding distortions arising from unusual temporary conditions also were made in deriving the current weights.

In Table 2, page 23 the deviations (or the differences) of the current weights from the base weights are shown for the major components of the combined index and the provincial and federal indexes.

In the combined index most of the current weights were within ± 5 points of the base weights and no current weight deviated further than ± 10 points from its base weight. In other words the current weights were not, on the whole, conspicuously different from the base weights. The same pattern was repeated in British Columbia, Nova Scotia and Ontario.

A greater amount of deviation was found in Manitoba, the Federal Government and Saskatchewan. One-half or more of the deviations were within ± 5 points of the base weights but some of the current weights differed further from the base weights than ± 10 points. For example, in Manitoba in 1959 the current weight for grading was only about two-thirds of the base weight. Even greater variation was seen in the Federal Government surface courses weights. The 1956 current weight was about half as large as the base weight but the 1959 current weight was three times as large as the base weight. The current weights for 1957 and 1958 showed somewhat smaller shifts.

The greatest amount of deviation occurred in Newfoundland and New Brunswick where one-third or less of the current weights were within \pm 5 points of the base weights. The widest range in deviation occurred in the Newfoundland weights for grading. In 1956 the current weight for grading was about one and three quarters times as large as the base weight. The weights declined in 1957 and 1958 until, in 1958, the current weight was only about one-quarter of the base weight.

When the deviations were classified by major components it was found that the grading component was subject to the greatest amount of weight variation. About 60 per cent of the current weights varied more than \pm 5 points from the base weights. The surface courses weights showed less deviation with about one-third of the current weights differing more than \pm 5 points from the base weights. Granular base courses weights showed slightly less deviation than surface courses weights.

Index Formula

The index expresses the cost of a current year's construction at current-year prices as a per-

centage of the cost of the same construction at base-year prices. The algebraic form of the index is as follows:

$$I_n = \frac{\sum p_n q_n}{\sum p_o q_n} \times 100$$

which can be expressed in its convenient alternative form

$$\mathbf{I}_{n} = \Sigma \frac{\mathbf{p}_{n}}{\mathbf{p}_{o}} \left\{ \frac{\mathbf{p}_{o} \mathbf{q}_{n}}{\Sigma \mathbf{p}_{o} \mathbf{q}_{n}} \times 100 \right\}$$

where $I_n = index$ for year n

- Σ = summation over all items
- p = price of an item
- q = quantity of an item
- o, n = subscripts designating base year o and current year n.
- $\frac{p_n}{p_o} = \text{price in year n as a ratio of the price in year o. (In this index o = 1956.)}$
- $\frac{p_o q_n}{\sum p_o q_n} =$ the value of a given item in the current year divided by the value of all items in the current year, current quantities being valued at base-year (1956) prices.¹³

Annual Current-Weighted Price Indexes of Highway Construction 1956 - 1959

The annual current-weighted all-items index and its three major component indexes are presented in Table 1, page 22, for the provinces, the federal government and for the provincial-federal composite from 1956 to 1959.

It will be remembered from the discussion on the characteristics of the current-weighted index that it is not possible to isolate "price" movement from year to year with this index because quantities in the index as well as prices can change from year to year. Nevertheless, it is useful to compare the levels of the base-weighted and current-weighted series. For the combined all-items index, it can be seen that in 1959 the base-weighted and the currentweighted indexes were the same but in 1957 and 1958 the current-weighted index was lower than the base-weighted index-in 1957 only fractionally lower but in 1958 about five per cent lower. This divergence in the 1958 index was caused mostly by the behaviour of the grading index and its weight. Tables 1 and 2 indicate that declining

$$p_o q_n = \frac{p_n q_n}{\frac{p_n}{p_o}}$$

¹³ The constant-dollar (1956) value is obtained by dividing the annual expenditure for a given item by its price relative series:

grading price indexes were combined with higher than usual current weights for grading in Ontario, Manitoba, British Columbia and the Federal Government to cause the current-weighted series to decline further than the base-weighted series.

A comparison of the major component indexes of the combined index shows that in only two cases, grading in 1957 and granular base courses in 1959, was the current-weighted series higher than the base-weighted series. Among all the indexes presented in the table there is a marked tendency for the current-weighted series to lie below the baseweighted series. Nonetheless, Table 1 shows clearly that this is not always the order. Out of 143 pairs of base-weighted and current-weighted index numbers presented in the table there were 33 in which the current-weighted index was higher than the base-weighted index. Table 1 shows that the current-weighted grading index was more consistently below the base-weighted series than was the case for the two other major components. One of the reasons for this is the exclusion of the drainage items from the current-weighted grading indexes. The supply portion of this series represents about nine per cent of the weight of the base-weighted grading index. As the supply price index rose over the four-year period, the absence of this item has served to lower the current-weighted series.

For all indexes but Newfoundland, New Brunswick and the Federal Government, the currentweighted and base-weighted all-items indexes were at nearly similar levels during the four-year period. In Newfoundland the base-weighted indexes included estimates for the surface courses component in 1956 and 1957. As the level of this index was higher than the grading and granular base courses indexes the zero weights attached to the surface courses estimated prices in the current-weighted index placed the all-items index for this province at a level below the base-weighted index. In 1958 and 1959 the declining surfacing prices, accompanied by an increased weight in the current-weighted series, were mostly responsible for the reduction of the currentweighted series below that of the base-weighted series.

In New Brunswick rising prices, combined with increasing expenditure particularly in the grading series, have raised the current-weighted all-items index above the base-weighted series in 1957 and 1958. In 1959 the declining granular base courses and surface courses indexes, together with increased weights in these categories, drew the current-weighted all-items index below the baseweighted all-items index.

The Federal Government base-weighted and current-weighted indexes at the all-items level were strongly divergent in 1957 and 1958. In 1957, the cause was not apparent from the summary indexes; however, in that year the quantities of clearing and grubbing increased sharply and were accompanied by the largest increases in prices experienced in the indexes. Some of this increase was undoubtedly due to a shift in geographic location. These changes were reinforced by increases in the price and weight of earth excavation but were countered by declining prices and weights for rock excavation. From 1957 to 1958 prices in all major components fell sharply. The declines were greatest for the grading index and the decline was accompanied by increased quantities.

Uses and Limitations

Using the same basic definitions of capital expenditure as were used for the base-weighted indexes, the current-weighted highway price indexes are designed to measure the effect of price change between the base year and the current year on the cost of the current year's highway construction programme. The index only measures price change between the base year and the given year from which its weighting pattern was derived. The index cannot be used to measure directly the price change between any years except the base year and a given current year because the weighting pattern is not common to all years.

The main use of a current-weighted price index is to remove the element of price change from an aggregate value series so that in the deflated series quantities are valued in terms of the prices of the base period and the deflated series measures changes in volume only. Such separation of the price and volume changes is useful in assessment of the meaning of changes in the value of expenditures on highway construction.

The process of deflation can be carried out at the all-items level with a current-weighted index whereas with a base-weighted index, deflation should be done at the finest level of detail. The deflation process for highway construction data may be illustrated as follows:

$$\frac{V_n}{I_n} = \frac{\sum p_n q_n}{\sum p_o q_n} / \frac{\sum p_n q_n}{\sum p_o q_n}$$

where $V_n = current aggregate value of total expenditure$

- $I_n = current-weighted index$
- Σ = summation over all items
- p = price
- q = quantity

 $= \sum p_o q_n$

o, n = subscripts designating base year o and current year n

The series of constant-dollar values derived by this process may be converted easily to index form by expressing each year's value as a percentage of the base-year value. The resulting index is an implicit base-weighted volume index which measures pure volume change in highway construction from year to year.







TABLE 1. Base-Weighted and Current-Weighted Highway Construction Price Indexes, All-Items and Major Components, Combined, Provinces and Federal Government, Annually, 1956-59

(1956 = 100)

Note: The years referred to are fiscal years. For example, 1956 represents the period April 1, 1956 to March 31, 1957.

| | All-i | items | Major components | | | | | |
|-------------------------------|---|---|---|---|---|--------------------------------|---|--|
| in the second second | | | Gra | ding | Granular ba | ase courses | Surface | courses |
| | Base- weighted | Current- weighted | Base- weighted | Current- weighted | Base- weighted | Current- weighted | Base- weighted | Current- weighted |
| Combined: | | | _ | | | | | |
| 1956 1957 1958 1959 | 100.0 92.3 81.4 ^r 81.8 ^r | 100.0 92.0 77.2 81.8 | 100.0 88.5 76.8 ^r 76.4 ^r | 100.0 88.6 70.9 74.4 | 100.0 93.3 83.4 ^r 84.8 ^r | 100.0 91.8 82.6 85.0 | 100.0 102.2 91.7 93.2 ^r | 100.0 101.9 90.7 91.3 |
| Newfoundland: | | | -1516 | | 1.0 | | | |
| 1956 1957 1958 1959 | 100.0 84.1 95.6 87.3 | 100.0 79.3 89.8 84.4 | 100.0 78.2 99.6 83.1 | 100.0 77.3 97.8 83.3 | 100.0 83.9 98.3 106.0 | 100.0 83.9 98.3 100.4 | 100.0 ¹ 98.7 ² 82.8 74.0 | 100.0 ¹ 82.9 72.6 |
| Nova Scotia: | | | | | | - 2010 | | |
| 1956 1957 1958 1959 | 100.0 91.6 88.2 93.4 | 100.0 90.1 87.5 92.0 | 100.0 87.3 94.5 99.8 | 100.0 85.0 91.8 97.5 | 100.0 92.5 85.5 93.7 | 100.0 91.4 87.0 94.3 | 100.0 96.7 82.2 84.3 | 100.0 95.8 82.3 85.1 |
| New Brunswick: | | | | | | | | |
| 1956 1957 1958 1959 | 100.0 97.8 105.3 91.3 | 100.0 101.9 111.4 89.0 | 100.0 110.7 121.3 99.0 | 100.0 117.6 124.5 95.9 | 100.0 83.8 87.1 81.5 | 100.0 84.2 94.9 80.8 | 100.0 94.1 102.0 91.8 | 100.0 94.7 98.7 91.9 |
| Ontario: | | | | | 1.53 | | | |
| 1956 1957 1958 1959 | 100.0 88.5 82.1 86.1 | 100.0 88.0 80.4 85.5 | 100.0 84.3 77.6 80.4 | 100.0 81.9 75.1 77.6 | 100.0 87.8 82.4 86.0 | 100.0 88.0 82.2 86.0 | 100.0 99.4 91.9 99.3 | 100.0 99.7 91.7 98.0 |
| Manitoba: | | | | | | | | |
| 1956 1957 1958 1959 | 100.0 111.3 82.6 79.0 | 100.0 110.4 78.8 78.0 | 100.0 99.3 74.8 72.4 | 100.0 95.4 69.3 65.5 | 100.0 114.3 75.7 72.9 | 100.0 118.0 74.6 74.1 | 100.0 128.1 100.4 94.1 | 100.0 128.3 100.5 91.4 |
| Saskatchewan: | | | | | | | | |
| 1956 1957 1958 1959 | 100.0 102.8 79.7 72.8 | 100.0 102.1 79.0 69.6 | 100.0 92.3 71.8 72.3 | 100.0 88.5 66.9 66.4 | 100.0 115.4 85.9 69.1 | 100.0 115.5 86.0 69.5 | 100.0 99.0 84.8 82.6 | 100.0 99.0 84.6 82.6 |
| British Columbia: | | | | | - | | | |
| 1956 1957 1958 1959 | 100.0 85.1 77.2 78.6 | 100.0 86.2 75.7 76.2 | 100.0 81.1 72.5 72.0 | 100.0 81.7 71.8 69.3 | 100.0 94.8 87.5 100.0 | 100.0 93.1 86.5 102.0 | 100.0 98.8 94.9 97.7 | 100.0 98.8 94.9 96.7 |
| Federal Government: | | | - C. | | | | | |
| 1956 1957 1958. 1959 | $ \begin{array}{r} 100.0 \\ 101.4 \\ 65.2 \\ 64.4 \end{array} $ | $ \begin{array}{r} 100.0 \\ 114.1 \\ 57.5 \\ 63.4 \end{array} $ | 100.0 101.1 60.9 62.2 | $ \begin{array}{r} 100.0 \\ 117.8 \\ 52.4 \\ 56.9 \end{array} $ | 100.0 104.6 76.3 71.0 | 100.0 106.8 71.0 69.8 | 100.0 99.5 82.0 72.0 | 100.0 100.1 82.0 72.3 |

¹ Base price estimated. No expenditure on bituminous hot-mix pavement reported in 1956.
 ² No expenditure on bituminous hot-mix pavement reported in 1957. Price estimated for the base-weighted index.
 ^r Revised.

TABLE 2. Base Period and Current Period Weights' for Highway Construction Price Indexes Showing Deviation of Current Period Weights from Base Period Weights, classified by Major Components, and Combined, Provinces and Federal Government, 1956-59

Note: The years referred to are fiscal years. For example, 1956 represents the period April 1, 1956 to March 31, 1957.

| Battle Handle Hand | Major components | | | | | | | | |
|------------------------------|------------------|------------------------------|---|------------------|----------------------------------|--|-----------------|----------------------------------|---|
| | | Grading | | Granu | Granular base courses | | Su | face cour | ses |
| | Base weights | Current weights | Deviation |]Base weights | Current weights | Deviation | Base weights | Current weights | Deviation |
| Combined | % 55.3 | % | | % 25.6 | % | | % 19.1 | % | |
| 1956 1957 1958 1958 | | 51.5 51.8 58.6 45.1 | - 3.8 - 3.5 + 3.3 - 10.2 | | 28.3 29.8 23.6 30.1 | $\begin{array}{r} + & 2.7 \\ + & 4.2 \\ - & 2.0 \\ + & 4.5 \end{array}$ | | 20. 2 18. 4 17. 8 24. 8 | $ \begin{array}{r} + & 1.1 \\ - & 0.7 \\ - & 1.3 \\ + & 5.7 \end{array} $ |
| Newfoundland | 51.5 | | | 26.9 | | | 21.6 | | - |
| 1956 1957 1958 1959 | | 93.5 69.5 14.9 25.4 | + 42.0 + 18.0 - 36.6 - 26.1 | | 6.5 30.5 30.3 32.7 | - 20.4 + 3.6 + 3.4 + 5.8 | | 54.8 41.9 | $\begin{array}{r} - 21.6 \\ - 21.6 \\ + 33.2 \\ + 20.3 \end{array}$ |
| Nova Scotia | 40.6 | | | 30.2 | | | 29.2 | | 1 |
| 1956 1957 1958 1959 | | 38.0 38.2 39.8 31.6 | - 2.6 - 2.4 - 0.8 - 9.0 | | 35.2 34.3 28.7 31.9 | $\begin{array}{r} + & 5.0 \\ + & 4.1 \\ - & 1.5 \\ + & 1.7 \end{array}$ | | 26.8 27.5 31.5 36.5 | $ \begin{array}{r} - & 2.4 \\ - & 1.7 \\ + & 2.3 \\ + & 7.3 \end{array} $ |
| New Brunswick | 45.1 | | | 36.6 | | | 18.3 | | |
| 1956 1957 1958 1959 | | 34.9 50.7 54.1 31.0 | $\begin{array}{r} -10.2 \\ +5.6 \\ +9.0 \\ -14.1 \end{array}$ | | 50. 2 42. 4 32. 4 37. 2 | + 13.6 + 5.8 - 4.2 + 0.6 | | 14.9 6.9 13.5 31.8 | - 3.4 - 11.4 - 4.8 + 13.5 |
| Ontario | 47.3 | | | 32.5 | 1 | | 20.2 | | |
| 1956 1957 1958 1958 | | 39.2 40.9 50.2 38.5 | $ \begin{array}{r} - & 8.1 \\ - & 6.4 \\ + & 2.9 \\ - & 8.8 \end{array} $ | | 36.4 38.2 30.3 38.7 | + 3.9 + 5.7 - 2.2 + 6.2 | | 24.4 20.9 19.5 22.8 | $\begin{array}{r} + & 4.2 \\ + & 0.7 \\ - & 0.7 \\ + & 2.6 \end{array}$ |
| Manitoba | 47.2 | | | 23.2 | | | 29.6 | | |
| 1956 1957 1958 1959 | | 43.3 48.1 52.8 29.3 | $ \begin{array}{r} - 3.9 \\ + 0.9 \\ + 5.6 \\ - 17.9 \end{array} $ | | 24.7 20.0 20.1 33.5 | $ \begin{array}{r} + & 1.5 \\ - & 3.2 \\ - & 3.1 \\ + & 10.3 \end{array} $ | | 32.0 31.9 27.1 37.2 | + 2.4 + 2.3 - 2.5 + 7.6 |
| Saskatchewan | 42.6 | | | 40. 1 | 1 | | 17.3 | | |
| 1956 1957 1958 1959 | | 28.2 36.2 35.3 50.2 | $ \begin{array}{r} -14.4 \\ -6.4 \\ -7.3 \\ +7.6 \end{array} $ | | 48.6 41.6 44.9 37.2 | + 8.5 + 1.5 + 4.8 - 2.9 | | 23.2 22.2 19.8 12.6 | + 5.9 + 4.9 + 2.5 - 4.7 |
| British Columbia | 75.2 | | | 10.5 | | 4 | 14.3 | | - |
| 1956 1957 1958 1959 | | 72.8 68.9 79.8 76.5 | $ \begin{array}{r} - & 2.4 \\ - & 6.3 \\ + & 4.6 \\ + & 1.3 \end{array} $ | | 10.9 15.5 9.3 8.8 | $\begin{array}{r} + & 0.4 \\ + & 5.0 \\ - & 1.2 \\ - & 1.7 \end{array}$ | | 16.3 15.6 10.9 14.7 | + 2.0 + 1.3 - 3.4 + 0.4 |
| Federal Government | 76.0 | | | 13.3 | | - | 10.7 | | |
| 1956 1957 1958 1958 | | 74.2 74.5 77.9 56.4 | $ \begin{array}{r} - 1.8 \\ - 1.5 \\ + 1.9 \\ - 19.6 \end{array} $ | | 20.4 12.5 13.3 10.3 | $\begin{array}{r} + & 7.1 \\ - & 0.8 \\ 0.0 \\ - & 3.0 \end{array}$ | | 5.4 13.0 8.8 33.3 | $\begin{array}{r} - 5.3 \\ + 2.3 \\ - 1.9 \\ + 22.6 \end{array}$ |

¹ Base weights are derived from an average of values reported in the years 1956 to 1959.

TABLE 3. Base Period Item Weights for the Highway Construction Price Indexes, Combined, Provinces, Federal Government, 1956-59

New-New Federal Nova Saskat-British Manitoba Combined found-Bruns-Ontario Govern-Scotia chewan Columbia land wick ment per cent Grading 55.3 51.5 40.6 45.1 47.3 47.2 42.6 75.2 76.0 Clearing 1.7 1.4 1.1 0.5 1.2 0.7 0.6 3.2 3.2 Grubbing 1.2 0.7 2.4 1.4 1.4 1.3 0.2 0.4 1.7 Clearing and grubbing (not separable) 0.02 0.3 --------Earth excavation 30.5 28.8 23.4 24.3 23.8 39.2 34.0 40.8 36.8 Rock excavation 15.4 14.0 8.7 13.6 13.5 0.2 24.5 29.6 _ Drainage: Placing 2.4 1.5 2.0 1.2 1.6 1.3 1.8 1.2 1.7 Supply 4.8 3.5 4.2 4.8 5.9 5.5 3.1 3.0 5.6 Granular base courses 30.2 36.6 25.6 26.9 32.5 23.2 40.1 10.5 13.3 Pit-run 7.1 1.6 11.9 16.4 12.6 _ 1.1 Screened or crushed 18.5 25.3 18.3 20.2 19.9 23.2 40.1 9.4 13.3 Surface courses 19.1 21.6 29.2 18.3 20.2 29.6 17.3 14.3 10.7 Bituminous hot-mix: Placing 12.2 15.8 21.9 13.4 14.9 11.7 12.4 8.8 1.2 Asphalt supply 4.6 5.8 7.3 4.9 5.3 6.6 4.9 3.4 0.6 Stabilized base course: Placing 0.9 1.5 5.6 _ -0.6 Asphalt supply 0.5 _ 3.3 Portland cement concrete: Placing 0.6 7.7 -Cement supply 0.3 3.6 All-items index 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0

Note: The years referred to are fiscal years. Hence 1956 runs from April 1, 1956 to March 31, 1957.

PRICE INDEXES OF HIGHWAY CONSTRUCTION IN CANADA

| Province | | | | | | | | |
|-------------|-------------------------------------|--|---|--|--|--|--|--|
| | Initial item | Additional item | Imputed item ¹ | | | | | |
| ewfoundland | Clearing | | Part I have been | | | | | |
| | Grubbing | | | | | | | |
| | Earth excavation | 0-99,999 cu. yds. 100,000 cu. yds. and over | | | | | | |
| | Rock excavation | 0-29,999 cu. yds. 30,000 cu. yds. and over | | | | | | |
| | 24" CMP-Placing | | | | | | | |
| | 24" Concrete pipe - Placing | | plant in it then in the | | | | | |
| | 24" CMP - Supply | | man - Reality St. | | | | | |
| | 24" Concrete pipe - Supply | | A STATE OF A STATE DINGS | | | | | |
| | Pit-run gravels | | | | | | | |
| | Screened or crushed gravels | 0-99,999 tons 100,000 tons and over | | | | | | |
| | Rituminous hot-mix - Placing | 0-17,499 tons 17,500 tons and over | | | | | | |
| | Asphalt supply | | | | | | | |
| vova Scotia | Clearing | Grading contracts 0-74 acres Other than grading contracts | Grading contracts 75 acres and over | | | | | |
| | Grubbing | Grading contracts 0-59 acres Grading contracts 60 acres and over Other than grading contracts | | | | | | |
| | Earth excavation | Grading contracts 0-549,999 cu. yils. Other than grading contracts 0-99 999 cu. yds. | Grading contracts 550,000 cu. ye and over Other than grading contracts 100,000 cu. yds. and over | | | | | |
| | Rock excavation | 0 - 7499 cu. yds. 7500 - 74,999 cu. yds. | } 75,000 cu. yds. and over | | | | | |
| | 24" CMP - Placing | 400-1099 lin. ft. | 0-399 and 1100 lin. ft. and over | | | | | |
| | 18" Concrete pipe - Placing | 0 - 1624 lin. ft. | 1625 lin. ft. and over | | | | | |
| | Creosoted timber culverts - Placing | 0-87.4 MFBM 87.5 MFBM and over | and the second second | | | | | |
| | 24" CMP-Supply | A had a see in a life | La cal La servicio da rest | | | | | |
| | 18" Concrete pipe - Supply | | and a film and a second | | | | | |
| | Creosoted timber culverts - Supply | | | | | | | |
| | Pit-run gravels | 0 - 19,999 tons 20,000 - 74,999 tons 75,000 tons and over | | | | | | |
| | Screened or crushed gravels | 0-19,999 tons 20,000-59,999 tons | } 60,000 tons and over | | | | | |
| | Bituminous hot-mix - Placing | 0-24,999 tons 25,000 tons and over | | | | | | |

TABLE 4. Item Classification System, Highway Construction Price Indexes, Provinces and Federal Government

See footnote at end of table.

DOMINION BUREAU OF STATISTICS

| 2010 | Classification | | | | | | |
|---------------|--|--|--|--|--|--|--|
| Province | Initial item | Additional item | Imputed item ¹ | | | | |
| New Brunswick | Clearing Grubbing Earth excavation | 0-74 acres 0-99 acres 0-349,999 cu. yds. 350 000 cu. yds. and over | 75 acres and over 100 acres and over | | | | |
| | Rock excavation | 0-99,999 cu. yds. 100,000 cu. yds. and over | | | | | |
| | 36" CMP - Placing | | | | | | |
| | 36" Concrete pipe - Placing | | a second second second second second | | | | |
| | Creosoted timber culverts - Placing | The second second second | | | | | |
| | 36" CMP - Supply | | | | | | |
| | 36" Concrete pipe - Supply | | | | | | |
| | Creosoted timber culverts - Supply | | | | | | |
| | Pit-run gravels | 0-149,999 tons | 150,000 tons and over | | | | |
| | Screened or crushed gravels | 0-99,999 tons 100,000 tons and over | | | | | |
| | Bituminous hot-mix - Placing | 0-29,999 tons 30,000 tons and over | | | | | |
| | Asphalt - Supply | A PARTY AND | | | | | |
| Ontario | Clearing | | | | | | |
| | Grubbing | | | | | | |
| | Earth excavation | ELVOR DEFENSION | | | | | |
| | Rock excavation | Public Holds | | | | | |
| | 24" CMP - Placing | | | | | | |
| | 24" Concrete pipe - Placing | | | | | | |
| | 24" CMP - Supply | Contact and the second | | | | | |
| | 24" Concrete pipe - Supply | | | | | | |
| | Pit-run gravels | Granular base B Sand cushion | | | | | |
| | Screened or crushed gravels | Granular A 5/8" A 5/8" B | | | | | |
| | Bituminous hot-mixes - Placing | Surface courses Base courses | | | | | |
| | Asphalt — Supply | | | | | | |
| Manitoba | Clearing | Area 1 ² - 0 - 99 acres Area 2 ³ - 0 - 99 acres Area 3 ⁴ - 0 - 99 acres | 100 acres and over 100 acres and over 100 acres and over | | | | |
| | Grubbing | Area 1 - 0 - 99 acres Area 2 - 0 - 99 acres Area 3 - 0 - 99 acres | 100 acres and over 100 acres and over 100 acres and over | | | | |

TABLE 4. Item Classification System, Highway Construction Price Indexes, Provinces and Federal Government - Continued

See footnotes at end of table.

PRICE INDEXES OF HIGHWAY CONSTRUCTION IN CANADA

| Manitoba – Con. Clearing ar Earth exca Class A (C Screened of Bituminous Asphalt – S Portland co Portland co Saskatchewan Clearing Grubbing Earth exca | Initial item nd grubbing, not separable vation | Additional item Area 1 - 0 - 99 acres Area 2 - 0 - 99 acres Area 3 - 0 - 99 acres Without borrow - Area 1 Without borrow - Area 2 Without borrow - Area 2 | Imputed item ¹ 100 acres and over 100 acres and over 100 acres and over With borrow - Area 1 |
|---|--|--|---|
| Manitoba - Con. Clearing ar Earth exca Class A (C Screened of Bituminous Asphalt - S Portland ce Portland ce Clearing Clearing Earth exca | nd grubbing, not separable vation | Area $1 - 0 - 99$ acres Area $2 - 0 - 99$ acres Area $3 - 0 - 99$ acres Without borrow - Area 1 Without borrow - Area 2 | 100 acres and over 100 acres and over 100 acres and over With borrow — Area 1 |
| Saskatchewan Earth exca Class A (Class | vation | Without borrow – Area 1 Without borrow – Area 2 Without borrow – Area 2 | With borrow – Area 1 |
| Saskatchewan Clearing Saskatchewan Clearing Saskatchewan Clearing Saskatchewan Clearing | MP) - Placing | WITHOUT DOLLOW - WIEG 2 | With borrow – Area 2 With borrow – Area 3 |
| Saskatchewan Clearing Grubbing Earth exca | ma / - a racing | Area 1 Area 2 Area 3 | the second second |
| Saskatchewan Clearing Grubbing Earth exca | MP) - Supply | | |
| Saskatchewan Clearing Grubbing Earth exca | r crushed gravels | Area 10-149,999 tons | 150,000 tons and over and pit-run gravels |
| Saskatchewan Clearing Grubbing Earth exca | | Area 20-149,999 tons | 150,000 tons and over and pit-run gravels |
| Saskatchewan Clearing Grubbing Earth exca | 10 ⁴⁴ | Area 3 0 - 149,999 tons | gravels |
| Asphalt-S Portland ce Portland ce Clearing Grubbing Earth exca | plant-mix — Placing | Area 1 Area 2 Area 3 | |
| Saskatchewan Clearing Grubbing Earth exca | upply | Area 1 only | Area 2 and Area 3 |
| Saskatchewan Clearing Grubbing Earth exca | ement concrete - Placing | Area 1 | Area 2 and Area 3 |
| Saskatchewan Clearing Grubbing Earth exca | ement - Supply | Area 1 | Area 2 and Area 3 |
| Grubbing Earth exca | | 0-59 acres 60 acres and over | |
| Earth exca | | 0-59 acres 60 acres and over | |
| | vation | | review pork |
| Rock excar | vation | 0–349 cu. yds. 350 cu. yds. and over | |
| 24" CMP - | Placing | 0-499 lin. ft. 500 lin. ft. and over | |
| 18" Concre | ete pipe – Placing | 0-999 lin. ft. 1000 lin. ft. and over | Mark & House & House & House |
| 24" CMP | Supply | | the second in the |
| 18" Concre | ete pipe - Supply | | Short terms |
| Screened o | r crushed gravels | Consolidated sub-base gravels Stabilized base course gravels 0-139,999 tons | 200,000 tons and over |
| Bituminous | plant-mix - Placing | 0-69,999 tons | 70,000 tons and over |
| Asphalt S | | a the second sec | |

TABLE 4. Item Classification System, Highway Construction Price Indexes, Provinces and Federal Government - Continued

See footnotes at end of table.

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DOMINION BUREAU OF STATISTICS

| Decesie | Classification | | | | | | | |
|-------------------------------------|---|---|---|--|--|--|--|--|
| Province | Initial item | Additional item | Imputed item ¹ | | | | | |
| British Columbia | Clearing | 0-199 acres 200 acres and over | | | | | | |
| | Grubbing | 0-199 acres 200 acres and over | | | | | | |
| | Earth excavation | 0-999,999 cu. Yds. 1,000,000 cu. yds. and over | | | | | | |
| | Rock excavation | 0-249,999 cu. yds. 250,000 cu. yds. and over | | | | | | |
| | 24" CMP - Placing | | TARGET & S. M. MARY 1 Mary Street, St. | | | | | |
| | 24" CMP - Supply | Area 1 ⁵ only | Other than Area 1 | | | | | |
| | Pit-run gravels | 0-79,999 tons | 80,000 tons and over | | | | | |
| | Screened or crushed gravels | Grading contracts: 0-99,999 tons 100,000 tons and over Other than grading contracts 0-99,999 tons | 100,000 tons and over | | | | | |
| | Bituminous stabilized base courses - Road-mix - Placing and mixing | | and the first sealer | | | | | |
| Asphalt for stabilized base courses | | Area 1 only | Other than Area 1 | | | | | |
| | Bituminous hot-mix – Placing | 0-59,999 tons | 60,000 tons and over | | | | | |
| | Asphalt for bituminous hot-mix | Area 1 only | Other than Area 1 | | | | | |
| Federal Government | Clearing | Atlantic Alberta/ B.C. North West Territories and Yukon | | | | | | |
| | Grubbing | Atlantic Alberta/ B.C. | }NWT/Yukon | | | | | |
| | Earth excavation | 0-949,999 cu. yds. 950,000 cu. yds. and over | | | | | | |
| | Rock excavation | Atlantic Alberta/ B.C. | }NWT/Yukon | | | | | |
| | 24" CMP-Placing | | and the second se | | | | | |
| | 24" CMP - Supply | | and the same starting the | | | | | |
| | Screened or crushed gravels | Atlantic Alberta/B.C. | NWT/Yukon and pit-run materials all regions | | | | | |
| | Bituminous stabilized base courses - Placing | Alberta/B.C. | Atlantic and NWT/Yukon | | | | | |
| | Asphalt for stabilized base courses | Alberta/ B.C. | Atlantic and NWT/Yukon | | | | | |
| | Bituminous hot-mix - Placing | Atlantic | Alberta/B.C. and NWT/Yukon | | | | | |
| | Asphalt for bituminous hot-mix | Atlantic | Alberta/B.C. and NWT/Yukon | | | | | |

TABLE 4. Item Classification System, Highway Construction Price Indexes, Provinces and Federal Government - Concluded

¹ The price movement of imputed item is represented in the index by the item opposite which the imputed item is recorded.
² Area 1: The clay zone surrounding Winnipeg.
³ Area 2: The southern lake region which includes the area north and east of the clay zone (Area 1) and west of the prairie region, (Area 3) but south of a line extending for the most part along Township 25.
⁴ Area 3: The prairie region in western Manitoba but including Highway 10 to The Pas.
⁵ Area 1: Southwestern British Columbia including the lower half of Vancouver Island.



APPENDIX A. Number of Prices Used in Highway Construction Price Indexes in the Period 1956 to 1959; Percentage Distribution of Prices by Number of Bids Averaged; Provinces, Federal Government and Total

| | | New- found- land | Nova Scotia | New Bruns- wick | Ontario ¹ | Manitoba | Saskat- chewan | British Columbia | Federal Govern- ment | Total |
|-----------------------|-----|------------------------|----------------|-----------------------|----------------------|----------|-------------------|---------------------|----------------------------|-------|
| No. of prices | No. | 64 | 96 | 72 | 64 | 100 | 68 | 72 | 68 | 604 |
| No. of bids averaged: | | | | | 100-0 | - | | | | |
| None | % | 21.9 | 5.2 | - | - | 4.0 | 1.5 | 2.8 | 2.9 | 4.6 |
| 1- 4 | % | 56.2 | 5.2 | 33.3 | - | 52.0 | 11.8 | 11.1 | 54.4 | 28. 1 |
| 5-9 | % | 18.8 | 28.1 | 36.1 | 12.5 | 29.0 | 42.7 | 38.9 | 30.9 | 29.8 |
| 10-14 | % | 3.1 | 12.5 | 7.0 | - | 9.0 | 17.6 | 27.8 | 11.8 | 11.3 |
| 15 - 19 | % | - | 22.9 | 5.6 | - | 2.0 | 17.6 | 11.1 | - | 8.0 |
| 20 - 24 | % | | 10.4 | 8.3 | - | 1.0 | 5.9 | 5.5 | - | 4.1 |
| 25 - 29 | % | - 11 | 8.4 | - | - | 2.0 | 2.9 | 2.8 | - | 2.3 |
| 30 and over | % | - | 7.3 | 9.7 | 87.5 | 1.0 | - | - | - | 11.8 |
| Totals | % | 100. 0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100. 0 | 100.0 | 100.0 |

Note: The years referred to are fiscal years. For example, 1956 represents the period April 1, 1956 to March 31, 1957.

¹ For Ontario individual contract data were available only for 1959. In deriving data for the four-year period it was assumed that the number of contract bids averaged for 1959 was representative of the three previous years.

DOMINION BUREAU OF STATISTICS

APPENDIX B. Reproduction of Schedule Used for Collection of Highway Contract Data DOMINION BUREAU OF STATISTICS, OTTAWA - PRICES DIVISION

CONFIDENTIAL

Highway Contract Price Data

SCHEDULE A-GRADING, BASES, SURFACING, DRAINAGE CONTRACTS OVER \$50,000

| Province of | ΣΑ |
|-----------------------------|----------|
| Date of Award | |
| Project Designation | <u> </u> |
| Location of Work | |
| Functional Class of Road | _ΣA+C |
| Principal Type of Work | |
| Number of Traffic Lanes | |
| Mileage under Contract | |

| ltem Number | Item Description | Unit of Measure | Unit Price | Quantity | Total Cost (omit cents) | |
|----------------|---|-----------------------|--------------------------|-----------------------------------|----------------------------|--|
| 1 | | | \$. e | | \$ | |
| | CLEAKING AND GRUBBING | 116 | 1 | | | |
| 1 | Clearing and grubbing combined | acre - | 1 | | | |
| 2 : | Clearing only | 46 | | | | |
| 3. | Grubbing only | | | | | |
| 4 | Σq I+2+3 | | | | | |
| | ROADWAY EXCAVATION | | | | | |
| 10' | Excavation, common | cu.yd. | + | | | |
| 11 | Excavation, borrow | | 1 | | | |
| 12 ! | Excavation of other materials, earth, muck, awamp, (specify) | 19 | | | | |
| 13 | Haul or overhaul on kems 10-12 | XXX | EXERX. | | | |
| 14 | Furnish and haul of water for compaction, Items 10-12 | *** | xxxxxx | | | |
| 15, | Compaction of materials excavated, Items 10-12 | XXX | | ****** | | |
| ; 16 | $\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{i$ | cu. yd. | | | | |
| 17 | Σq 10+11+12 Σεc 10+11+12+13+14+15 | | | | | |
| 20 | Excavation: rock, solid rock | 44 | | | | |
| 21 | Haul or overhaul, hem 20 | XXX | XXXXXX | ****** | | |
| 22 | Σq 20 | cu. yd. | | | | |
| 23 | Σq 17+22 | 11 | | | | |
| 1 | | | | | The second second | |
| i | GRAVEL OR STONE SUB-BASE, BASE, OR SURFACE COURSES: | | 1 | | | |
| 301 | Pit run granular materlals | ton | 1 | | | |
| 31 | | | 1 | The second state and second state | | |
| 321 | Haul or overhaul, items 30-31 | XXX | TTTTT | * * * * * * * | | |
| 33 | Furnish and haul of water for compaction. Items 30-31 | XXX | X X X X X X | | | |
| 34 | Compaction of materials, Items 30-31 | XXX | | ****** | | |
| 1 35 | (So 30+31 Stc 30+31 | 100 | 4 | | | |
| 36 | $\sum_{\alpha=30+31}$ $\sum_{\alpha=50+31+32+33+34}$ | 11 | | | | |
| 40 | Screened or crashed gravel or stope | 11 | 1 | | | |
| 41 | tt ti ti ti ti ti ti ti | | | | | |
| 42. | 12 11 11 11 11 12 11 | 11 | | | | |
| FA 1 | Supply screened or crushed gravel or stone by department | 14 | | | | |
| 44 | Hanl or overhaul on Items 40-42 | * * * | E E E ¹ E E E | * * * * * * * | | |
| 45 | Encoded and hand of water for compaction, items 40-42 | XXX | | * * * * * * * | | |
| 46 | Comparison of insterials, Items 40-42 | XXX | X X X I X X | X X X X X X X | | |
| 1 47 | (So 40441442 Sec 40441442+43 | 100 | 1 | | | |
| 1 47 | S- 1011142 See 4041412414444446 | 11 | 1 | | | |
| 1 40 | 2 2/10 See 26 110 | 11 | 1 | | | |
| 49 | 249 20148 million 240 20 148 million 240 | | I | | | |
| t 1 | BITUMINOUS OR CEMENT STABILIZED BASE COURSES | | , I | | | |
| 50 | Granular material for stabilized base courses | ton | 1 | | | |
| 51 ! | Haul or overhaul on Item 50 | XXX | ***,*** | ****** | | |
| 52 | Supply of asphalt hy contractor for stabilized base courses* | tos | | | | |
| : 53 | ti ti "department " ti ti ti | 11 | | | | |
| 54 | Supply of cemest by contractor for stabilized base courses* | 11 | 1 | | | |
| 55 | se et es et department is es es announcement | 10 | | | | |
| 56 | Supply of screened or crushed gravel or stone by department | 11 | | | | |
| 57 | Spraying, spreading and mixing additive, for stabilized base courses | EXX | * * *,* * * | XXXXXX | | |
| 58 | Haul on additive | XXX | *** | | | |
| 59 | Compaction of stabilized base courses | XXX | XXX,XXX | ****** | | |
| 54 | Σα 50+52+53 | ton | 1 | | | |
| 58 | Σa 50+54+55 | - 11 | | | | |
| 1 50 | Σα·5A+5B | | i | | | |
| 1 50 | $\sum_{ac} = exp-storal: \sum_{ac} [a] + [23] + [a9] + [5C]$ | XXX | X X X X X X | TTTTTT | | |
| 1 30 | and and the state and a line i family for all | | | | | |

8201-3: 11-2-60 °If supplied by the department, please leave blank and enter on Schedule C.

PLEASE TURN OVER

SCHEDULE A - Concluded

| ltem Numb er | Item Description | | Unit Price | Quantity | Total Cost (omit cents) |
|------------------------|--|----------|---------------------------------------|---------------|--|
| - | | | \$ ¢ | | \$ |
| , SD | 2ac sub-total: 2tc 4 + 23 + 49 + 50st 2ac | | | | |
| | PLANT-MIX SURFACE AND BINDER COURSES | | | | |
| 60 | Bituminous plant-mixed material | top | 1 | | |
| 61 - | EI EE EI | 11 | | | |
| 62 ! | Supply bituminous material by contractor, items 60°-61 | 11 | | | |
| 63 | ** ** ** department * ** ** | 11 | | | |
| 64 | Supply screened or crushed gravel or stone by contractor, Items 60*-61 | 4.4 | | | |
| : 65 | te department, " " | | | | |
| 66 . | Haul on bituminous mixtures, Items 60-61 | | X X X X X X X X X X X X X X X X X X X | ****** | |
| D/ . | (No 60.61 See 60.61 | | | | |
| . 00 | Σα 60461 Στο 6046146246446546446 | ton | 1 | | |
| 70 | Portand compart concrete | I an and | | | |
| 71 | Supply Portland coment by contractor, hem 70° | Cu. yu. | E E | | |
| 72 | re te te department. Item 70 | 11 | | | |
| 73 | Supply screened or crushed gravel or stone by department. Item 70 | +1 | 5 | | |
| 74 . | Haul on materials for Item 70 | | IIIIII | * * * * * * * | |
| 75 | Sq 70 | CB. yd. | | | |
| . 76 | Σtc 69+75 | IXI | XXXIXXX | ****** | |
| | | | 1 | | |
| r | PIPE | | | | a la participa de la composicione de la composicion |
| 80 | Installation of 24" corrugated iron pipe | lin. ft. | 1 | | |
| 81 - | Supply of 24 ²⁴ corrugated iron pipe hy contractor ⁴ | 0 | 1 | | |
| 82 | te er tr ti ti ti department | | | | |
| . 83 | Σq 80Σtc 80+81+82 | 17 | | | |
| 84 | Installation of corrugated iron pipe | | | | |
| 85 | Supply of corrugated ison pipe by contractor | | | | |
| 0.7 | Supply of department | | 1 | | |
| 28 | Sn 83487 Sec 83 487 | 44 | 8 | | |
| | Installation of 24" reinforced concrete pine | lin ft | | | |
| | Supply of 24" reinforced concrete pipe by contractor" | 19 | 1 | | |
| 92 | er te es te es et es department | 10 | | | |
| 93 | Σq 90Σες 90+91+92 | 10 | | | |
| 94 | Installation of reinforced concrete pipe | 44 | | | |
| 95 - | Supply of " reinforced concrete pipe by contractor | 51 | | | |
| 96 | Supply of " " " " department | 11 | | | |
| 97 | Σq 94Σtc 91+95+96 | - 11 | | | |
| 98 | Σq 93+97Σες 93+97 | | | | |
| : 99 | Σq 88+98Σες 88+98 | 15 | | | |
| 1. | | | 1 | | |
| 94 | Installation of creosored timber culverts: cross section dimension | Mft.b.m. | | | |
| 98 | Suppry of creosored timber cuiverts by contractor | | L I | | |
| 90 | Se QA Sec QA 400 400 | | | | |
| 95 | Sar: [atSac tec (76+99+9D)] | *** | | IIIIII | |
| 1 | The second secon | | | | |
| λ1 | TOTAL COST REPORTED | *** | ***** | ****** | |
| 1 | | | | | |
| AZ, | Other miscellaneous costs, specify major items | | | | |
| | | | | | |
| 1.1.1 | | | | | |
| 1 | | | | | |
| 1 | | | | | |
| λ3; | TOTAL CONTRACT AMOUNT | III | ****** | ****** | |
| | "If supplied by the department, please leave blank and enter on Schedule C. | | | | |

Remarks concerning extraordinary features of work which have caused uncommon price or prices:

Name of Officer responsible for completion of schedule ...

Title





