QUANTITY AND PRICE INDEXES FOR CONSTRUCTION

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Construction has traditionally constituted one of the problem areas in the preparation of industry price and quantity statistics within the system of national accounts of most countries. The difficulty stems from what is considered to be the unique character of construction projects. This has unnecessarily impeded the calculation of output price indexes and has resulted in the use of various input-based prices as proxies for output prices.

One of the objectives of the development of the system of construction price statistics described in this paper is to permit deflation of the outputs of construction industries in order to produce industry output data in constant prices in a manner consistent with measures for the rest of the economy. This is a more promising approach to improving constant price industry and expenditure measures within the SNA framework than attempting such improvements through the collection of a vast array of quantity data.

Construction industries sell specified configurations of materials-in-place which are, to borrow the jargon of other fields, sub-assemblies of some total system. As in other areas of industrial pricing, some of these products are simple and some are complex. Trade contractors sell these sub-assemblies or commodities mainly to an owner-builder or to a general contractor who, in turn, resells the trade contractors' commodities along with whatever sub-assemblies the general contractor has produced. These sub-assemblies, when combined with, for example, the relevant outputs (or sub-assemblies) of manufacturers, the design services of service industries and the purchasers' own contributions, yield the wide variety of plant and structures which constitute the various classes of gross fixed capital formation, which are not typically solely the outputs of the construction industries.

The resulting contractors' selling price indexes will provide deflators for the whole range of outputs of the various construction industries. These will become part of the system of industry selling price indexes from which relevant indexes for the various goods and services can be selected and combined with appropriate weights to yield arrays of deflators for the highly complex capital expenditures of business, institutions and government.

Ultimately this integrated system of construction industry statistics will permit the preparation of gross output and value added measures, in both current and constant prices, to be calculated for the construction industries as an integral part of the Canadian System of National Accounts, as well as provide a key element for improving the deflation of fixed capital formation.

INTRODUCTION

Construction has traditionally constituted one of the major problem areas in the preparation of industry price and quantity statistics within the system of national accounts of most countries. The difficulty lies with what is considered to be the unique character of construction projects. This has unnecessarily impeded the calculation of output price indexes and has resulted in the use of various input-based prices as proxies for output prices.

It can be argued that a large part of the difficulty stemmed from the fact that statisticians have generally approached construction within the context of estimating expenditures on gross fixed capital formation, that is to say, from the point of view and employing the concepts and definitions required for "capital-in-use" categories. As a result, it is the total capitalized value of a fixed asset class that statisticians by and large have been attempting to price and quantify, rather than the goods and services produced by the group of construction industries. This has been the case in spite of the fact that in the majority of cases

the capitalized value of an asset does not represent one actual market transaction but is derived by aggregating all of the values of the transactions between the purchaser of the asset and contributing producers from several industries, only one of which may be construction. Examples of services purchased directly by the owner of the asset and capitalized would be such business services as architectural and engineering services, legal services, management and communication services, and financial and insurance services. Each of these would normally be provided (and sold) by distinct producing units classified to separate industries within the Standard Industrial Classification System (S.I.C.). The statistical problems, if any, involved in pricing or quantifying the outputs of these other industries are outside the scope of this paper, which is concerned with approaches to the measurement of prices of outputs of construction industries. In using the contractors' selling price indexes to develop deflators for capital expenditures, or for the revaluation of capital stock, explicit account has to be taken of these additional transactions as well as of the contribution to the value of the asset made by the owner's own labour force, the value of materials purchased directly by the owner (and provided free to the contractor), and so forth. In this context, it is also necessary to face the issue as to whether the value of a fixed asset as shown on the purchaser's books represents the unit price of a unique product produced by the purchaser-user, or whether it represents the collectivity of unit prices of a number of goods and services which have been individually purchased by him. The latter approach is advocated in what follows, so that price indexes designed to be used as deflators for fixed capital formation categories (within a producer cost rather than a purchaser valuation framework) would have to be built up from a whole range of industry selling prices of which the construction contractors' selling prices would constitute only one set of building blocks, albeit a highly important one. This potential use of construction contractors' selling prices clearly has certain implications for sample selection and coverage but it should not be allowed to dominate or overrule the requirements of the primary objective which is to accurately price the goods and services produced by the establishments classified to each of the various construction industries, particularly the special trade contractors. Such a step-by-step approach should help to simplify and reduce to more manageable portions the difficulties inherent in developing price indexes in an area of considerable statistical complexity.

To repeat, one of the primary objectives of the development of the system of construction price statistics described in this paper is to permit deflation of the outputs of construction industries in order to produce industry production data in constant prices in a manner consistent with existing output measures for the rest of the economy. Such constant price measures will in turn permit the estimation of meaningful productivity measures for this important and volatile segment of the economy.

The development of such a comprehensive system of value-volume-price data, by industry, has long been of concern to Statistics Canada—in response to a variety of users' demands, covering both micro- and macro-needs. The initial thrust in the development of industry measures was directed to the manufacturing and primary industries. Development work has shifted to the other industries

in the economy, that is, the construction industries and service-producing industries. This shift has been in recognition of the increasing importance of these industries, concomitant with continuing strong users' demands.

The salient characteristics of the Canadian construction industry are discussed below from the point of view of industry price index development, since direct quantity measurement is ruled out as too costly because of the size and complexity of the industry. The paper also deals with the various approaches to pricing that are being used in the area of construction and their historical and conceptual links with other price systems. The uses of the construction industry price indexes for deflation purposes are discussed next and some examples of presently available price indexes are provided. In conclusion, some of the areas where further work is required are indicated. Excerpts from a tentative construction classification system for pricing purposes are contained in the Appendix.

1. Characteristics of the Canadian Construction Industry from a Price Index Perspective

The characteristics of the activity of each of the construction industry groups from a pricing perspective need to be discussed in some detail. The techniques, concepts and approaches used are largely dependent on the particular interpretation of the activities of the individual producers and their interrelationships. The following provides an outline of the industry as viewed for pricing purposes.

The main activity of the construction industry can be said to be the transformation or assembly of materials and services into recognizable configurations or "commodities" (i.e., work-put-in-place or materials installed). These are frequently sold as such to the user either directly by the producer or indirectly through a general contractor who may resell them without further modification.

Size and Structure of the Industry

In the performance of these activities the construction industry in Canada has increasingly tended to structure itself along fairly clear-cut lines of specialization. Preliminary results of the work on the census of construction—carried out by the Construction Division of Statistics Canada during the last decade and presently nearing completion—indicate that the nearly 100,000 establishments constituting the construction industry group (SIC 6) can be subdivided into two main industry groupings—specialized trade contractors and general contractors. These can be further subdivided into just over 40 component industries, all but 4 of which are on the special trade contractor side. Table 1 provides a tentative delineation of the industry structure of the construction industry group as indicated by the census work to date.

In 1974 the construction industries contributed slightly over 7 percent to Canada's aggregate Gross Domestic Product at factor cost of $129 billion. Within construction (estimated gross revenue $20 billion) the value added to gross revenue ratio is around 0.45, compared with 0.31 for manufacturing (gross

TABLE 1

DELINEATION OF CONSTRUCTION INDUSTRY FOR CENSUS ENUMERATION[1]

Construction Industry				
General Contractors		Trade Contractors		
Building	Engineering	Mechanical	Electrical	Other
Residential Non-Residential	Highway Road Bridge Other Heavy Engineering[2]	Plumbing Wet heating and air-conditioning Dry heating and gas piping Sheet metal Commercial refrigeration Process piping Environmental controls Automatic sprinklers Millwrighting and rigging Thermal insulation for heating and cooling systems		Wrecking and demolition Water well drilling Septic systems Excavating and grading Pile driving, shoring, under-pinning Form work Steel reinforcing Concrete: poured and precast Dampproofing Structural steel erection Masonry: brick, block, stone, etc. Tiling and terrazzo Carpentry Insulation Roofing: shingling, sheet metal, built up tar and gravel, etc. Ornamental and miscellaneous fabricated metal Siding: aluminum and other metallic, vinyl, etc. Glass and glazing Lathing, plastering, stucco and drywall Acoustical and decorative ceiling tiles and panels Flooring: hardwood strips and parquet, resiltiles and sheet, carpet, etc. Painting and decorating Elevators and escalators Asphalt paving Fencing Equipment rental with operator Other

[1] *Source*: Construction Division, Statistics Canada.

[2] Includes sewer and water main, marine, pipeline, oil refinery, hydro-electric and other types of heavy engineering construction.

revenue $95 billion). This difference may be due largely to a greater degree of inter-establishment shipments within manufacturing. On the other hand, the labour content appears to be substantially higher in construction. The construction labour force is estimated to be well over half a million workers.

The construction census data available to date represent partial coverage of each of the construction industries, although the degree of coverage varies. Of the total estimated number of establishments of 100,000, only about one quarter were included in the 1974 census surveys. However, it is estimated that this coverage represented over three-quarters of the total gross operating revenue for the construction industries. The data pertaining to the large number of missing small businesses are in the process of being tabulated from taxation records.

A brief examination of the structure of the industry reveals that the vast majority of establishments—whose primary source of income, as reported to Revenue Canada-Taxation, was from construction activity—were unincorporated businesses (in 1974 there were nearly 70,000 returns with a total gross revenue of $2.5 billion). The remaining 30,000 were incorporated companies with a gross revenue of $17.5 billion. However, only about 10 percent of the total number of reporting units are estimated to have a gross operating revenue in excess of $500,000. The average income size within this group appears to be in excess of $1 million for nearly all of the individual trades. This will constitute the target group for most future direct surveys, as it would be too costly to survey the large number of small businesses directly either for value or price information on a regular basis, particularly because of the volatile nature of this universe. Since administrative records only yield certain key data such as gross business income or revenue, direct sample surveys will have to be used to supplement these data for the smaller establishments in order to yield such basic information about this important segment of the construction universe as employment. This is particularly important in the case of those special trade contractor industries where the large numbers of small establishments play a predominant role.

It was expected that most of the work on the 1975 census of construction would be completed during 1977, the main exception being the delineation of industry boundaries between the construction operations of real estate developers and general contractors. Lack of resolution of the boundary with real estate developers seriously affects the estimation of residential general contractor output. There are also some industry boundary problems between manufacturers-installers and construction contractors which need to be explored further.

Characteristics of construction commodity outputs

In Canada, special trade contractors, and to a lesser degree general contractors, produce a whole range of identifiable construction commodities. A simple example might be the supply, placing and removing of specified varieties of formwork, such as formwork for foundations, slabs, columns, etc. The general contractors, in addition, perform separately identifiable project management functions, particularly in the case of non-residential building construction and some types of engineering construction. Thus, general contractors can be

characterized in most instances as being producers of components or sub-assemblies of plants or buildings rather than of the completed structure. The one main exception to this is the large residential general contractor who assembles and markets completed structures for which a recognized market price exists and where the same type of unit is put on the market in successive time periods.

Examples of some of the principal outputs of the construction industries which are being used for pricing surveys are provided in Appendix I. The nature of the commodity outputs is discussed in more detail in what follows.

Construction trade contractors account for between 40–50 percent of the gross revenue of the construction industries. As can be seen from the tables shown in the Appendix, trade contractor outputs consist mainly of the field assembly or installation of materials. They normally supply and install materials but sometimes general contractors or owners will supply the materials. Some of these construction activities can be measured relatively easily as to value, quantity and price. In many cases the construction activity can be described by type of material placed—e.g. "price per square foot for the supply and placing of 12″×12″ vinyl floor tiles". In other cases the type of structure is used as part of the specifications as in "brick work in industrial chimneys"—which is a simplified way of saying "high-rise, high-quality brick work installed with continuous curvature and tapering, where the delivery of materials and craftsmen to the work location is time consuming and danger pay premiums are considerable". It follows that often a structural description is used in the industry not to indicate that the trade produces the structure but because the structural description says, to those in the industry, much about the complexity of work required. An industrial chimney is, of course, the sum of the outputs of many other trades in addition to the output of the masonry trade. (Concrete and excavation work are required and, depending upon the design, the structural metal trade can also be of importance, to cite only the activities of the main trades.)

In more complex areas of construction, unit prices and quantities for specified construction activities or for their sub-components tend to disappear. This is a function of the custom nature of the design and the length of the components list which goes to make up a given construction activity. The estimating sheet, with its list of materials, crew times and costs, machine times and costs, and overhead and profit charges, has much in common with the work-order one encounters in any manufacturing establishment where non-standard goods are made for customers. In these instances one obtains a price per unit of job specified. It thus becomes critical to select representative jobs such that reliable estimates of average price change are obtained for all units of output. The work done by mechanical, electrical and elevator contractors tends to fall into this category. A typical commodity might be "supply and placing of passenger elevators of specified speeds and capacity".

Trade contractors are viewed as construction specialists. They may specialize in placing bricks or laying floor tiles or installing electrical systems, but rarely do they perform more than one speciality, and, with the exception of mechanical contractors, they do not sub-contract out to a significant extent. Indeed, for trade contractors, sub-contracts amount to less than 10 percent of

gross revenue. However, institutional changes are taking place. For example, a kind of interior finishing contractor is emerging who places drywall, carpeting, floor tile, demountable partitions and possibly ceiling tiles—all trades which are necessarily done at the present time by separate trade contractors. This may mark the emergence of a finishing trade generalist who for renovation work may behave as a general contractor and perform or let speciality work.

General contractors account for 50–60 percent of construction industry gross revenue. They manage the construction jobs, which means that they often arrange for sub-contractors to do specified portions of the work; they obtain necessary permits to allow construction to begin and they often open the job site. They schedule and supervise the construction and are responsible for paying the sub-contractors. These activities are often described as the project-assembly function, which is often further described as having two main components; project management and project supervision. It is intended to specify and price varieties of both components. Their own construction activity may be restricted to building the hoardings and erecting safety fences or the general contractor may do much of the excavating, the concrete or the carpentry work of a project. The general contractor does not necessarily perform the same construction activity on all jobs he undertakes: on a two-storey primary school job he may choose to do the concrete work; on a 20-storey office building he may sub-contract the concrete work to the trades. (In the case of some of the large residential general contractors who assemble and market completed structures for which a recognized market price exists, the contractor may have set up a separate establishment which manufactures components such as roof trusses and his construction activity may be restricted to scheduling and supervising the trades who erect the houses and to marketing the structures).

The relative importance of the general contractors' trade construction activity has declined during the last decade with the result that the trade contractors are now often the main producers of many construction goods and services. Thus the general contractor has become a major purchaser of special trade contractors' outputs. Project assembly, supervision and management roles now form a larger proportion of general contractor activity. Although considerable variation exists among general contractors, those specializing in road construction purchase very little by way of sub-contract services while those specializing in non-residential construction let more construction work than they perform themselves. Many specializing in residential construction let out most of the specialized work to trade contractors.

As there is usually nothing fundamentally different about the construction activity of the general contractor and the matching construction activity of the various sub-trade specialists, the discussion relating to pricing sub-trade activities can also serve to describe pricing methodology for general contractors' special trade construction activity.

Most contractors are single establishment firms whose operations are confined to one area, e.g., they serve one city and its surrounding area. Indeed, it is fairly unusual in Canada for either the contractors or the purchasers of construction to organize the supply of construction services or the demand for these services on a provincial or national basis. Such extensions tend to occur in

specialized high technology areas, such as structural steel, precast concrete, elevators and pipe line construction. Some highway, road and bridge general contractors also have equations in more than one province. Not surprisingly, the average size of establishments also appears to be larger in the industries specializing in this type of construction.

In terms of the size of establishments, non-residential general building contractors appear to be less numerous and larger on average than those specializing in residential work. Highway, road and bridge contractors also tend to be larger and less numerous. Although average gross operating revenue, as indicated by partial census results, is considerably smaller for most trade contractors, in almost all cases a very high proportion of each industry's total gross revenue is earned by a relatively small number of reporting units. In the case of mechanical contractors, for example, 8 percent of the establishments account for over 60 percent of gross revenue for those establishments covered by the census programme so far. The inclusion of more very small establishments as coverage is completed can only serve to emphasize further the degree of concentration in this group of trade contractors.

Implications for pricing

The above-mentioned characteristics of the construction industry clearly will have an impact on the price collection programme.

First, the regional nature of the industries' operations dictates that prices have to be region-specific. This suggests that a relatively large sample size is required in order to yield good coverage. In the early stages of the surveys, the pricing programme has had to concentrate on selected large metropolitan areas. It should also be noted that the pricing boundary is the transaction price and it is assigned geographically to the city where the construction establishment whose output is being priced is located, not to the location of the job site.

Second, in contrast to the above, the apparent high degree of specialization simplifies the price collection process to the extent that this implies there is relatively little need to sample the secondary activities within the industries. This does not, however, simplify the process of collecting representative prices for the commodity classes (or varieties within these classes) within the main activity (specialty) of each industry. At the moment very little statistical information is available concerning the commodities produced[1] or their relative importance by industry, except for the information that has been assembled as part of the price survey work.

Third, the relatively small size of construction firms, the variability of the products produced, and the boom or bust nature of demand for the output of the industry all conspire to delay the installation of detailed management information systems, particularly by the medium and small size firms. As a result, price setting by job will often be largely intuitive and based on recent experience of prevailing price levels in the market. In the case of the larger firms, the volume of work is sufficiently large that the contractor delegates the costing function to cost estimators who usually include in the estimate a preferred or prevailing

[1] A similar dilemma presently exists on the input side of the industries.

profit level which, however, is often modified by the contractor. As a result, the estimated costs are available but the actual production costs and selling prices for each product are not necessarily recorded. It is only for the very large construction firms that one expects to find any consistent record keeping which in any way approaches the record keeping of the larger manufacturers who have established and who maintain management information systems as a matter of course.

Clearly, this imposes certain constraints on the manner in which both values and prices can be collected, i.e. it limits, at least initially, the universe from which data can be collected. Fortunately, the high percentage of gross revenue originating from a small number of larger firms should tend to reduce the degree of overall error resulting from surveying only the larger firms. It also dictates flexibility in the design of survey formats and approaches. This has resulted in price surveys which are variable as to periodicity, technique and content, the latter being mainly a function of the way in which most establishments in any one industry do their estimating.

In Canada, the only major construction industry with standard nomenclature for outputs is road construction, where the provincial highway department is the major client of most road contractors in any given province. Government road contracts have had a high degree of stability as to format and the contractors have for years been asked to quote unit prices for specified construction activities (e.g., supply and place 24″ concrete culverts) all of which has had an impact on the records kept by both the companies and the purchasers and has greatly eased the price statisticians' task.

2. Construction Selling Price Surveys

Contractors' selling price indexes presently published or under development relate to the outputs of some general contractor industries and important special trade industries. Prices collected are for main classes of outputs and are most often those relating to work on non-residential building construction. Present price survey coverage varies considerably by industry but may be said to relate to about one-half of the value of the gross revenue of the general and special trade contractors. These surveys probably yield no more than one quarter of the important varieties which should be priced in full surveys. Present contractors' price surveys include upwards of 1,000 respondents and coverage is gradually being expanded.

Selection of reporting units

The starting point for the selection of industry selling price samples should ideally be a weighting diagram showing all the commodities produced by each establishment, with both the establishments and the commodities ranked by size in terms of revenue or shipments. For many industries such a display of the basic information will indicate that while the largest producers usually produce the most important commodities, a price sample which is restricted to the top

commodities and producers would not be adequate to accurately represent the price movements for the total production of the industry. This is so because some of the main commodities may be produced only by smaller establishments, or, alternatively, some of the secondary commodities may have significantly different price movements. The latter point is of even greater significance if the industry selling prices are to be used as building blocks for the deflation of intermediate inputs or final demand categories.

In the case of manufacturers' selling price indexes, the selection of appropriate commodity-establishment elements is relatively straightforward because of the existence of detailed commodity data collected as part of the annual census of manufactures which permit the preparation of tables showing their relative importance.

For the construction industries the industry-establishment definitions are only now being completed and output information by commodity is not presently available. In addition, no data are available below the provincial level.

In such circumstances, the Statistics Canada cost estimators concerned with developing price surveys have to rely on major purchasers and on contractors' associations to identify major contractors in any given small area or city. Until such time as the industry-commodity universes have been fully developed through census-related sample survey work, price surveys will have to be based on samples of establishments residing in selected cities and belonging to designated industries. It should be noted that the surveys (and prices) are defined by establishment location and not by job site location. The location of the job site or location of main customers may, however, enter through the specification of the terms of sale, just as the class of customer and destination of shipments forms part of the specification for pricing the products of manufacturing establishments in a manufacturing industry selling price context.

In the absence of the values of construction industry output detail for a metropolitan area, population has been used to establish rough priorities for some surveys which include metropolitan areas such as Montreal, Ottawa, Toronto, Calgary, Edmonton and Vancouver. In other surveys, building permit data are used to select cities and establishments within cities.

Until more information is available about the nature of the contractor who works outside the metropolitan areas, it is difficult to speculate about how and when large contractors from smaller centres will be incorporated in the surveys. Even within the metropolitan areas, price sample coverage by industry will vary considerably, largely because of the high proportion of smaller establishments in certain trades which probably tend to do a lot of repair work related to residential construction, such as domestic plumbing, painting, carpentry, etc. In addition, present price surveys do not cover explicitly some activities of large construction establishments, such as project management, equipment rentals and wholesaling. On an industry basis, the present pricing programme surveys directly some outputs of large residential general contractors and indirectly main outputs of road contractors. Some surveys of non-residential general contractors are underway for selected special trade construction activities, such as concrete work.

In summary, for general contractors the important omissions relate to: a) small contractors who probably specialize in installation-only activities and in repairs and maintenance; and b) larger contractors specializing in marine, water and sewer work in pipeline construction.

For selected trade contractor industries, important establishments provide prices of main commodities within six major cities. These can be said to be of a type utilized in non-residential building and can be used along with other prices to assemble deflators for selected capital expenditure categories. It should be stressed that it will not be possible to derive aggregate price indexes for metropolitan areas, let alone provincial or Canada totals for either individual industries or total construction until the weighting and the price coverage problems have been resolved.

The periodicity of the present construction price surveys varies all the way from monthly to annual, with the largest number conducted either quarterly or semi-annually. It is unlikely that pricing frequency can be increased in the short run because of the intermittent nature of some of the construction activities included in present price surveys.

Pricing Techniques

Just as the price surveys of the construction industry are necessarily conditioned by the nature of the activities of the industry, so will they be conditioned by the state of the art in the area of price measurement. The following provides a brief outline of the main influences of methodologies used in other price surveys upon construction contractors' selling price index work.[2]

Statistics Canada, by the early 1960's, had evolved a reliable set of commodity price indexes relating to the main outputs of more than 100 manufacturing industries extending back to 1956. While the industry selling price indexes (ISPI's) were not designed to yield adequate regional coverage and did not cover complex or unique commodities, the results proved that by and large manufacturers with shipments in excess of several millions of dollars could provide, through mail questionnaries, reliable selling prices pertaining to new orders.

Concurrently with the development of industry selling price indexes, there was interest in developing some capital expenditure price indexes. This preceeded any development work in the area of construction industry output pricing. As it turned out, the methodological developments in the capital expenditures area had a major impact on survey methodology subsequently used in construction industry surveys.

The first survey to be undertaken related to road construction. The prices used in the indexes were taken from the contract records of the provincial highway departments, the components of which are contractors' selling prices. The prices were charted to reveal their price/quantity relationship and variations from a trend line. Editing guidelines were established to remove from the price averages those contracts which upset the usual rules of reasonable price

[2]For a sample of the actual questionnaires used in these surveys, the reader should contact one of the authors.

comparability.[3] Although the indexes were designed primarily for deflating capital expenditure categories, the component indexes are, in fact, equally applicable to a portion of the output of highway, road and bridge general contractors, in provincial highway construction. The indexes derived from these price averages are published from 1956 and are noteworthy because of their sharp cyclical behaviour as can be seen by reviewing Table 2. This came as no surprise

TABLE 2

HIGHWAY CONSTRUCTION: CONTRACTORS' SELLING PRICE INDEXES AND INDEXES OF SELECTED INPUTS

	Estimated Contractors' Selling Prices[1]		Selected Input Price Index[2]	
	Index	% Change	Index	% Change
1957	80.9	−7.1	62.8	4.5
1958	73.0	−9.8	64.1	2.1
1959	73.2	0.3	65.4	2.0
1960	72.1	−1.5	67.3	2.9
1961	65.0	−9.8	67.7	0.6
1962	67.6	4.0	67.0	−1.0
1963	72.2	6.8	68.3	1.9
1964	76.2	5.5	71.3	4.4
1965	83.0	8.9	74.3	4.2
1966	89.4	7.7	78.4	5.5
1967	86.0	−3.8	82.4	5.1
1968	84.8	−1.4	86.1	4.5
1969	88.7	4.6	90.8	5.5
1970	92.7	4.5	95.0	4.6
1971	100.0	7.9	100.0	5.3
1972	105.1	5.1	106.3	6.3
1973	118.3	12.6	115.1	8.3
1974	158.7	34.2	137.7	19.6
1975	177.5	11.8	164.8	19.7

[1] *Construction Price Statistics*, Statistics Canada Catalogue No. 62–007.

[2] Included are prices for labour, materials and equipment used. Prices Division Tabulation. The weighting diagram was adapted from the U.S. data and pricing relations are assembled from existing labour, material and equipment price indexes for construction.

to the construction industry but one still occasionally encounters users who find it difficult to accept the fact that the road contractors can raise prices 30 percent in one year—and lower them 20 percent in another year, this mainly being the response of the industry to changes in demand or anticipated changes in demand. While the fact had major implications for those planning budgets, it also confirmed the pitfalls inherent in using partial input price indexes to deflate capital expenditure categories or industry outputs. Clearly, the use of such input

[3] This process of editing arrays of bid prices and averaging them is described as a technique of utilizing controlled unit costs or simply as "unit cost technique". The editing process prevents shifts in quantities from being counted as price change. New varieties are not permitted to affect price movements. If sufficient contracts of the new variety are set, a new commodity will be introduced.

price indexes as proxy indicators of price change could cause errors in estimates both as to trend and as to major turning points.

Although it was not realised at the time, road construction was to be almost the only type of construction for which it was possible to derive price indexes from administrative records. This of course is subject to change and the rate of change may be very much accelerated by the present interest of accountants in current cost or value accounting which, if the re-evaluations are done in some detail, should yield data of use to price makers in both the companies concerned and in Statistics Canada.

Some work on regression studies for houses was also undertaken and these studies have been conducted intermittently for a number of years. Concurrently, an attempt was made to give recognition to the fact that some residential general contractors had organized themselves into what might be described as manufacturer-builders. This permitted the manufacture of standard components: formwork for basements, wall, window and door sections, kitchen cabinets, staircases, roof trusses and so on. In the process of reducing on-site fabrication, they eliminated custom building and instead produced houses which were available on the market for some number of months. More importantly to the price index statistician, this permitted the setting up of selling price lists for new houses. Given the size of these contractors, it was originally envisaged that they would be asked to respond to mail surveys as do comparably sized manufacturers. However, in practice, it was found that the prices had to be collected by field staff.

Concurrently with the price surveys just described, development was underway on a system of price indexes for electric utility construction. This work was undertaken at the request of and with the technical assistance of the Canadian Electrical Association, an organization which represents electric utilities. The price surveys associated with the project yielded some useful insights and methods.

It was discovered, after detailed discussions with the engineering staffs of both the utilities and the manufacturers, that model pricing was their preferred method of providing price estimates. As a result, the utilities provided summaries of specifications used in recent transactions and the manufacturers provided and continue to provide annual estimates of selling prices for the equipment as specified.

When a new specification is required to better represent classes of equipment actually being installed, the utilities and manufacturers again consult and a new model is introduced into the surveys. It was also discovered that the same technique of model pricing could be used by the fabricated steel producers who reported prices for steel towers for transmission lines.

To varying degrees, each one of the above surveys had yielded some useful methodological insights and provided a vehicle for testing various techniques from which the contractors' selling price programme eventually benefited. Not least important was the recognition that flexibility in selecting the most appropriate technique for pricing was required in order to improve results. The various approaches presently used within the contractors' selling price system are listed below and some of their advantages and disadvantages are discussed.

(a) *Standard goods pricing.* In many areas of industrial pricing, large volumes of data for standard goods can be collected and converted into price indexes relatively inexpensively. Usually such surveys are directed to marketing staffs who can retrieve prevailing price levels for identical goods from readily available company documents. It follows that standard goods pricing can be applied to those areas of construction where construction activities are fairly standard. Because of respondent resistance to completing schedules, the capture of all important varieties may be inadequate and there could be a tendency for some discounts to escape the attention of the statistical agency. The standard goods pricing approach is a technique which cannot be applied successfully either for more complex goods or where there is volatility in discounting practices.

(b) *Prices selected from administrative records.* The main problem in preparing price indexes from price data derived from administrative records (such as the data pertaining to highway construction) is that the source documents are obviously designed for purposes other than price collection. This imposes certain constraints on what the price statistician can do with data derived from such sources. Even normal follow-up procedures and clarification of certain issues become difficult under these circumstances.

Administrative records are also the main source of price data related to the regression studies for new housing price indexes for Vancouver where mortgage company reports are being used to obtain purchase prices for houses. These are being subjected to regression studies of a type similar to those conducted by the U.S. Bureau of the Census in their derivation of new housing price indexes. The regression or hedonic pricing method is used to deduce estimates of price change from arrays of data by estimating the impact of changes in the configuration of characteristics of goods sold. It is a statistical variant of the controlled unit cost technique but has the disadvantage of requiring a large number of observations, and it is often found, even with the large arrays of data required, that the estimated coefficients are sometimes unstable across samples and over time. When the characteristics are a set of discrete alternatives, this method reduces to something similar to a set of associated movements of unit values.

(c) *Model Pricing.* This is the technique used for collecting prices of complex, intermittently sold goods or for collecting prices of goods which are sold more frequently but where the producers do not have documentation on project costs which is of direct use to the price index statistician. It can be regarded as a vehicle for specifying a representative commodity and providing a fixed format for recording component costs of production for materials purchased, fabrication and installation costs, and relevant overhead and profit charges.

One of the main problems associated with model pricing of complex goods is that many sub-components and assemblies must be sampled in such a way that the aggregative price movement derived from the samples is representative of the price movement for the commodity being priced. Changes in source of supply, changes in basic assembly technique and changes in machine and man-hour times are factors which all must be reviewed carefully by both the respondent and statistical agency. This review is necessary to ensure that the con-

ventions followed in preparing the model pricing faithfully reflect the real world practices and costs.

The assumptions vis-a-vis profitability must also be watched carefully. There is a tendency, particularly when competitive conditions are worsening, for respondents to report a preferred level of profit as opposed to an actual level of profit.

It should be stressed that model pricing is a technique suitable for use in price surveys only when marketing and design engineers or cost estimators and contractors are going to be involved in the preparation and the completion of the questionnaire. Indeed, in contractors' selling price surveys all derivation of specific survey documents and important liaison with the respondents is undertaken by the cost estimators within Statistics Canada who work in close consultation with their contractor respondents and contractors' associations. They are responsible for the derivation of bills of quantity,[4] where none are available from respondents. They establish the pricing categories and select representative components from the bills of quantities. This is done by selecting real world jobs and sampling to reduce the length of the materials and installation list, or alternatively, it is necessary to synthesize a short representative list which is then checked for representativeness against real world jobs either empirically or judgmentally. For example, there is no assurance that a specification which is satisfactory for one city is satisfactory for other cities although recent survey experience suggests there is more uniformity in specifications than was originally anticipated. However, this may be largely a reflection of the level of commodity sampling presently being captured: only the most usually occurring activities are currently being priced and these appear to be similar. Local differences may emerge more when the less common activities get included in the price samples.

In terms of choosing a variety to price, the problems are similar in both manufacturing and construction—the statistician requires specialist advice as to the nature of an appropriate specification or specifications which will adequately represent all varieties or potential varieties. The model of a product variety chosen specifically requires detail as to materials and labour to be used as well as an estimate of profit and overhead. Once the types and quantities of materials are specified they can be easily priced and a value derived. It is generally more difficult for the respondent to adequately estimate labour costs since he must determine the correct quantity before applying prevailing crew costs. This is complicated by the fact that long production runs or repeated activities are not a characteristic of the industry. The respondent also has to review transactions explicitly and assess the prevailing market in order to capture adequately a reliable estimate of profitability. The problem which is not common with manufacturing firms is the lack of quantitative data within the construction industries which assist the selection of specifications to be priced. At this point

[4]Quantity surveyors or cost estimators produce bills of quantities from architects' drawings and specifications. In North America, these are occasionally produced by one group of surveyors or estimators for a client or the client's architect. The resulting information can then be made available to all trades and general contractors who bid the job. More often, in North America such a bill of quantities is not produced centrally although, depending on the methods of estimating, portions of the bill will reside in the offices of the various subtrades and general contractors who bid the job.

the knowledge of the Statistics Canada cost estimators who work with the respondent becomes essential for the success of the project. This is because their experience with a broad range of construction projects gives them a good knowledge of the potential array of job configurations. The estimator also knows, or can find out by checking with the design staffs of major purchasers or consultants, the prevailing or most common configurations within a given market.

This is in contrast to surveys of manufacturers where the required technical knowledge is usually borrowed. This borrowing is only possible because of the large size of such establishments and the fact that the manufacturers usually provide some technical advice to their customers, their customers often providing them only with functional as opposed to exact specifications. Thus, model pricing is safely used only when there is sufficient rapport between the statistical agency, the main users of the data, and the respondents, so that the respondents are prepared to invest sufficient time in preparing accurate answers.

One can summarize the benefits of the above techniques by observing that the utilization of standard ISPI pricing techniques is possible where there are establishments selling readily available "shelf" or standard goods in large volume. The selection of prices from administrative records can be undertaken where large volumes of such observations occur consistently in the financial records of the respondents. Usually such data systems are only generated by major corporations or government agencies. Model pricing is the technique devised to handle the outputs of those establishments where consistency and volume do not produce anything akin to standard specifications and price lists.[5]

As in all price surveys, to the extent that ideal conditions do not prevail, the estimates will suffer. In the contractors' selling price surveys as presently constituted, the variety coverage is not adequate. In addition, the respondents' estimates of labour usage and profit must be evaluated carefully. Another major disadvantage is the time required to complete the form in some of the more complex pricing areas.

3. Some Construction Industry Price Index Uses

In addition to the use of contractors' selling price indexes in the context of general economic analysis, there are two major areas within the SNA where construction contractor selling price indexes can readily be used: a) for the deflation of the outputs and some of the inputs of the various construction industries and b) in the deflation of gross fixed capital formation categories.

The main intended use of the system of industry selling price indexes for construction contractors is to convert from current to constant prices the values of output or production reported in the annual census of construction and related sub-annual surveys.

[5]It should not be concluded that a price list is a desirable source of price data. The price-index maker clearly requires transaction, not list, prices. However, the existence of a price list can be taken as an indication of volume and standardization of products. All these features yield an environment in which it is easier for a price-index maker to obtain the transaction prices required.

Progress towards this ultimate goal has been considerable both in the area of developing the construction industry revenue and expense data and in developing the system of contractors' selling price indexes.

The main benefit emanating from the new price index system will come from the replacement of the commonly used input price indexes by those specifically devised to convert current price output values into constant price measures. It is extremely difficult to construct sensitive input series because of the very detailed information on inputs required in order to achieve this, even in the absence of productivity change. There is evidence that the available contractors' selling price indexes are more accurate as to trend and respond more sensitively to short term changes in supply and demand than the traditionally used input price indexes. To state the obvious, the partial fixed-weighted input price indexes are poor substitutes for output prices.

This is illustrated in Table 2, where the movement of road contractors' prices can be compared with the movement of an input price index for highway construction. Two points can be made here. First, the underlying trends of the two series are different, and, second, the year to year changes are often different both as to magnitude and direction. While there is some reason to believe that road contractors' prices may exhibit the most volatile movements in the construction area, there is sufficient empirical evidence to suggest that similar, if less dramatic differences between input and output prices will also prevail in other areas. For example, Table 3, for New Housing, including land, shows the sharp

TABLE 3

PRICE INDEXES—NEW HOUSING CONTRACTORS' SELLING PRICE INDEXES AND PARTIAL INPUT INDEXES

	New Housing Price Indexes[1] for Selected Cities						Partial Input Price Indexes[2]
	Montreal	Toronto	Ottawa	Winnipeg	Calgary	Edmonton	
Indexes							
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1972	107.6	110.2	112.7	105.2	110.0	109.1	110.1
1973	125.8	137.6	138.2	128.4	126.4	132.6	123.2
1974	177.7	171.6	171.2	163.5	162.3	172.8	134.7
1975	190.3	171.0	178.3	177.5	195.0	205.3	144.0
1976	200.9	180.7	192.5	199.8	243.1	245.8	160.5
Percentage Change							
72/71	7.6	10.2	12.7	5.2	10.0	9.1	10.1
73/72	16.9	24.9	22.6	22.1	14.9	21.5	11.9
74/73	41.3	24.7	23.9	27.3	28.4	30.3	9.3
75/74	7.1	−0.4	4.1	8.6	20.2	18.8	6.9
76/75	5.6	5.7	8.0	12.6	24.7	19.7	11.5

[1]Large residential contractors' selling prices for single detached, semi-detached and row condominium houses: Table 13.1, New Housing Price Indexes, Construction Price Statistics, Catalogue No. 62-007 and 62-008. Content varies by city. Land is included.

[2]Price indexes for labour and materials used in single detached house construction: Table 7.1, Input Index for Residential Construction, Construction Price Statistics, Catalogue No. 62-007 and 62-008.

differences in movements between contractors' selling prices and a partial input price index based on materials and wage rates calculated at the national level. While the precision of the quality change evaluations for the output prices is not entirely satisfactory, results of the survey captured the substantial price increases which took place during 1973 and 1974 and displayed the expected regional variation in price movement. In 1974 the input price index rose at an annual rate of only 9 percent, while the contractors' selling price indexes showed their largest annual increases which varied from 41 percent in Montreal to 24 percent in Ottawa. It is unfortunate that we are not yet able to complete the analysis by providing contractors' purchase prices for land. The availability of separate price indexes for land would permit a variety of applications of these price indexes which are presently difficult, including the use of the new housing prices as deflators within the system of national accounts.

Another major use of the contractors' selling price indexes will be as building blocks in developing deflators for the various categories of gross fixed capital formation which form part of the GNE estimates.

Gross fixed capital formation in the SNA consists of: investment by governments and business in additions to the stock of durable fixed capital assets which yield a flow of services over a period of time extending into the future, and which are gradually used up by the wear and tear involved in general public use or in the process of producing future goods and services.[6]

Gross fixed capital formation is defined to include outlays on durable tangible assets with a lifetime use of one year or more. Only *new* construction and *new* machinery and equipment are included. Excluded from gross fixed capital expenditure are outlays for military purposes; outlays for land, mineral deposits and timber tracts. On the other hand, included are capital costs involved in the preparation of sites, land improvements, mining development and exploration costs involving the acquisition of tangible assets, and construction and drilling costs, replacements and major alterations of capital installations, as well as various associated expenses which are capitalized along with the cost of acquired fixed assets including such things as architectural, legal and engineering fees, some financing costs, and transfer costs on the sale or purchase of existing fixed assets. Gross fixed capital formation originates as investment spending by governments for such broad classes of expenditure as schools, hospitals, roads, harbours, airports and housing, and by business for both building construction and engineering construction and machinery and equipment. It should be noted that the term "business" includes individual home owners and such non-commercial institutions as universities, churches and charitable and welfare agencies.

Although in practice it is sometimes difficult to obtain a clean split between the capitalized value of the construction and the machinery and equipment portions of, for example, engineering projects, an allocation between these two categories is made for purposes of the SNA.[7] The following discussion will confine itself solely to what we consider to be the most efficient way of develop-

[6]National Income and Expenditure Accounts, Volume 3, Catalogue No. 13-549E, Statistics Canada, 1975, p. 84.

[7]We would, however, advocate a review and revision of existing classification systems and definitions.

ing meaningful deflators for the construction component of fixed capital formation.

Capital expenditures for construction can be divided into three main categories which are of roughly equal importance: residential building, non-residential building and engineering construction. In 1974 expenditures on residential construction for Canada were almost equally divided between single dwelling unit construction and multiple unit construction. About half of the value of all non-residential building construction was classified to the category commerical buildings, the leading purchasers being finance, insurance and real estate industries. Similarly, expenditures on institutional and industrial building construction were about equal in 1974. Manufacturers and institutions were the big purchasers. Within engineering construction, roads and utility facilities were the largest categories of expenditure, followed by gas and oil facilities and water and sewer facilities.

A "price" for an element of capital expenditures exists only within the records of the purchaser and, except for parts of new residential construction, it is rarely subject to evaluation through market transactions. In the general absence of such market prices the price index statistician steps back from the owner's total acquisition cost of capitalized plant and buildings to pick up the closest available real world selling prices for the components of plant and equipment, i.e. the work contracted for or done by the construction industries as well as other industries. Ideally, where an adequate price library exists, relevant selections of contractors' selling price indexes and other component commodity price indexes would be aggregated in configurations representative of the varieties of structures or plant. An example of this is presented in Table 4. As noted earlier, the final price of an asset will normally include a number of important elements originating in industries outside of the construction industry, e.g. business services and manufacturing. For this reason a price index library from which prices can be drawn to construct deflators for fixed capital formation categories (or for intermediate inputs into construction industries, for that matter) needs to contain commodity specific industry selling price indexes for nearly the entire spectrum of industry groups in the economy. Such a price library should also include estimates of price change for goods and services produced for own use, e.g. the construction activity of an owner-builder.

Even a cursory examination of any of the capital formation categories leads one to expect the existence of a number of price movement classes. In discussing the nature of recently constructed buildings and plant with industry specialists it was decided to expand the existing classes to include some important technical characteristics associated with the buildings. The result of this suggested expansion can be seen in Appendix II. In many instances the classification appears to dwell on the characteristics of the frame of the building but this must be recognized as technical short-hand. The single unit wood frame house will not usually be installed with smoke sensors, communication systems or elevators to cite some less obvious differences between a single unit wood frame house and a 12-storey concrete frame apartment building.

The obvious difference between a heavy industrial building and light industrial building is the massiveness of the steel frame of the building. For

TABLE 4

A HYPOTHETICAL SET OF PRODUCTION AND FINAL DEMAND ACCOUNTS IN WHICH THE ECONOMY PRODUCES AND CAPITALIZES ONE BUILDING

Production, by Industry of Origin[1]					Gross Fixed Capital Formation for Purchasing Industry Y		
			Construction				
Industry Group	Manufacturing	Business Services	Trade Contractors	General Contractors	Industry Y Secondary Production of Owner	Building Type X Capitalized Value[2] $	%
	Concrete Products Industry for Precast Concrete $650,000					650,000	9.1
	Other Manufacturer installers $275,000			Non-Residential Building General Contractors for Project Management Site Supervision $510,000 for Excavation $120,000	[3]	275,000	3.9
		Architects $50,000				50,000	0.7
		Engineers $25,000				25,000	0.4
		Quantity Surveyors $25,000				25,000	0.4
		Lawyers $20,000				20,000	0.3
						510,000	7.1
			Mechanical $1,850,000			1,850,000	25.9
			Electrical $750,000			750,000	10.5
			Structural Trades $980,000			120,000	1.7
						980,000	13.7
			Elevators $800,000			800,000	11.2
			All Other trades $1,080,000			1,080,000	15.1
						7,135,000	100.0
Transactions to be priced[1]	manufacturers selling prices to general contractor	consultants' selling prices to clients	trade contractors' selling price to general contractor	general contractors' selling prices to owner	owner-builder's selling prices to himself		

[1] The transactions to be priced pertain to the goods and services produced by the industries or industry groups shown in the columns of the table. In order to facilitate exposition, the individual commodities for which price indexes will be derived are not identified, except in the case of precast concrete, project management, site supervision and excavation.

[2] Indexes would be derived from the transactions identified in the production accounts. In addition to the industry output price indexes being used to prepare constant dollar estimates of gross output for the producing industries, they would be utilized to prepare a fixed weighted index for building type *X*. The component price indexes would be weighted as per the ratios provided in the last column of the table to sum to the total capitalized value of the building—$7,135,000.

[3] In this example it is assumed that the purchasing firm does not capitalize any salary or overhead costs incurred in the course of purchasing the building, or do any of its own construction. Frequently, there will be entries in this column.

heavy industrial buildings, the main purpose of the framework is to support vessels, drums, boilers and other equipment and almost incidently to hold up the roof and provide a frame for the exterior cladding. The latter two functions may be the only functions of the frame of a light industrial building. Foundations as well as electrical and mechanical systems are all usually more complex in the heavy industrial building.

These differences in function result in differences in design which in turn result in the use of different mixes of construction commodities and other goods and services which are aggregated to the various asset classes of the main codes of accounts. These differences cause the price analyst to expect differences in price movement for the different asset classes or "structures" to use the term commonly used by statisticians.

Some of these points can be illustrated with reference to the residential construction category for which a wide variety of pricing techniques can be utilized, the use of each one being dictated by such considerations as availability of administrative records and the characteristics of the construction industry, as well as by the characteristics of the particular asset class being priced.

One possibility is to borrow, particularly for large multi-unit apartment construction, component indexes from the existing contractors' selling price library. Such indexes could be assembled with weights appropriate for apartment construction. As the price library presently consists mainly of sub-assembly indexes of a type used in non-residential construction, the use must be defined as a proxy use and given corresponding attention. Such an index for apartments should nevertheless provide improved estimates of price change, particularly in the short run. However, because labour costs for sub-assemblies appropriate for non-residential use probably vary substantially compared to residential construction, the resulting trend may be subject to error and require occasional adjustment.

As the possibilities of pricing directly small apartments and non-mass-produced single dwellings are remote because of the difficulty of obtaining adequate samples within this part of the universe, a reasonable approach might be to impute the price movements of multi-unit wooden frame structures to single-unit structures.

As indicated in an earlier section, some large general contractors and some real estate developers sell complete single unit dwellings and units in row structures. As the relative importance of the contribution of the other industries to the total capitalized value of each dwelling unit is low, it is reasonable to assume that the contractors' selling price series for these structures will provide reasonably accurate estimates of the price movement for houses purchased from large builders,[8] although, in principle, in preparing capital expenditures price indexes for housing, the price index statistician requires final demand price indexes which are derived from a number of price series which encompass all elements of purchasers' cost including lawyers' and brokers' fees as well as the costs for the "structure" itself. It should also be repeated that in no other major area of capital expenditure will a contractors' selling price index for a completed

[8]The main deficiency of the proxy series for national accounting purposes is that it includes land. What is required to remedy this deficiency is a contractors' or developers' purchase price index for land, appropriately lagged.

structure be incorporated directly as a capital expenditures price index without further aggregation with other commodity prices. This is because new plant or buildings are rarely marketed in this completed form.

To reiterate, what is marketed are the "cost components"[9] and it is the "cost components" which are priced. The decision to purchase is not made on the basis of knowing the purchase price of the capital asset but on the probable aggregated cost of all components. The price index statistician, who cannot expect to do better than the purchaser, is thus compelled to follow the purchaser's costing path thereby selecting whatever prices can be associated with the major components of cost to be used as weights for the price index. This is accomplished by working from the purchaser's main codes of accounts estimates to obtain annual expenditures on main assets, broken into as many categories of "cost components" as possible. The end result of this process is a set of weights which implicitly reveals the industry of origin of goods and services necessary to complete the installation as well as the values themselves. To obtain these estimates it may be necessary to hold discussions with architects, engineers, contractors and manufacturers as well as the purchaser. The weighting system thus produced is then applied to the component price indexes and it is assumed that the resulting weighted average price change is a reasonable approximation of price change for the capitalized value of the asset.

Table 5 shows estimated output price movements for a "Light Industrial Building" (which were derived in the manner just described) along with conventionally used input prices.

4. Summary and Conclusions

In summary, construction industries sell specified configurations of materials-in-place which are, to borrow the jargon of other fields, sub-assemblies of some total system. Trade contractors will sell these sub-assemblies or commodities mainly to an owner-builder or to a general contractor who, in turn, will resell the trade contractors' commodities along with whatever sub-assemblies the general contractor has produced. These sub-assemblies, when combined with, for example, the relevant outputs (or sub-assemblies) of manufacturers, the design service of service industries and the purchasers' contributions, yield the wide variety of plant and structures which constitute the various classes of gross fixed capital formation and not typically the outputs of the construction industries.

The contractors' selling price system, when fully developed, will yield deflators for the whole range of outputs of the various construction industries. These in turn will become part of a system of industry selling price indexes from which price indexes for specific commodities (goods and services) can be selected and combined with appropriate weights to yield deflators for capital expenditures by business and government. We believe that this is a much more promising approach to improving constant price industry and expenditure measures within the SNA framework than attempting such improvements

[9]Cost components are defined as special aggregations of commodity outputs or the sum of the individual transactions in goods and services flowing from the construction industries as well as any other industries which make up the total capitalized value of the asset.

TABLE 5

BUSINESS GROSS FIXED CAPITAL FORMATION: NON-RESIDENTIAL CONSTRUCTION: PRICE MOVEMENTS BASED ON CONTRACTORS' SELLING PRICE INDEXES AND ON SELECTED INPUT PRICE INDEXES

	Contractors Selling Price Indexes for a Light Industrial Building[1]	Price Indexes of Selected Inputs for Non-Residential Construction[2]
	(Percentage Change at Annual Rates)	
73/72	19.4	9.3
74/73	22.8	17.5
75/74	5.4	9.5
76/75	2.3	9.8

[1]Prices Division tabulations (land is excluded from these tabulations). This gross fixed capital formation category deflator was prepared utilizing a weighting pattern for a representative light industrial building. The assumption was made that the construction industries performed all the trade construction activities as well as project management. The price movements for the business services components have a low weight in this class of building and they were imputed on the basis of total measured price movements. The further assumption was made that production equipment, furniture and motor vehicles were included in other accounts within the records of establishment gross additions to capital.

[2]Non-Residential Input Index from Table 8.1 of *Construction Price Statistics*, Statistics Canada Catalogue No. 62-007. The index includes manufacturers' selling price indexes for materials usually involved in non-residential building construction projects and basic union wage rates for main trades.

through the collection of a vast array of quantity data. However, a considerable amount of development work still needs to be undertaken in order to complete the system.

Some of the unresolved problems and the major remaining areas of work in the context of the contractors' selling price system should be noted here. In order to complete the delineation of the construction industry universe, it will be necessary to resolve boundary problems between the construction industries, real estate developers and manufacturer-installers. In the case of the Other Heavy Engineering Industry Survey, development is incomplete and a great deal more attention will have to be devoted to this important and complex industry before problems are fully resolved.

Another area which needs to be investigated is the nature of the services provided by the 90,000 or so small contractors. If their activities are significantly different from those of large contractors, survey methodology should be evolved to obtain estimates of the outputs and of price changes for this segment of the construction universe.

Methodologies and surveys for collecting value weights for the commodity detail, preferably on an annual basis, must also be developed. Similarly, methodologies need to be devised to provide timely estimates of production for the set of construction industries on a sub-annual basis.

The number of establishments included in contractors' selling price surveys must be expanded and the number of commodities and varieties to be priced needs to be increased. Also, the industry selling price library in general needs to be expanded to include all goods and services.

Finally, there are still some special conceptual and measurement problems

which must be resolved, such as the treatment of land for purposes of constructing deflators rather than for pricing the transactions of real estate developers.

Clearly, a great deal of development and field work still needs to be done and it will take many years to complete the system of price and quantity measures described in this paper.

Ultimately this integrated system of construction industry statistics should allow the preparation of improved gross output and value added measures, in both current and constant prices, to be calculated for the construction industries as an integral part of the Canadian System of National Accounts, as well as provide a key element for improving the deflation of fixed capital formation. Such industry value-volume-and-price measurements will provide policy makers and analysts with an essential ingredient to an understanding and evaluation of the growth performance and the interrelationships of these highly volatile segments of the economy.

APPENDIX I

EXCERPTS FROM A TENTATIVE CLASSIFICATION SYSTEM FOR OUTPUTS OF THE CONSTRUCTION INDUSTRIES

Industry Title	Commodity Groups
Residential building (general contractors)	Structures—include only sales of identical units (excluding custom building) single units multiples rows apartments Construction activity, other than that associated with identical unit structures excavation concrete masonry carpentry—rough Management services project management project management and supervision
Concrete, poured and precast (trade contractors)	Concrete placement foundations slabs & beams slabs on grade suspended slab flat pans waffle metal deck columns rectangular, by strength circular, by strength walls by strength Concrete finishing floors other Precast concrete: prestressed components, precast panels, etc.

APPENDIX II

PARTIAL LIST OF GROSS FIXED CAPITAL FORMATION CLASSES FOR PRICING PURPOSES

Functional Class	Sub-divisions
Single detached, residential	(wood frame)
Semi-detached, residential	(wood frame)
Row, residential	(wood frame or masonry bearing, up to $3\frac{1}{2}$ floors)
Multiple-unit, residential[1]	masonry bearing 4–6 stories
	7 or more stories
	concrete frame 4–6 stories
	7 or more stories
Light Industrial Buildings	(usually single storey factories or plants, no special foundations, perhaps including small office units)
Heavy Industrial Buildings[2]	(e.g. mill buildings, cement plant structures)
Storage Structures	single storey
	refrigerated
	non-refrigerated
	multi-storey
	parking garages
	other
Hotels, Motels	walk up motels and small hotels (masonry wall bearing)
	large hotels
Restaurants	separate structures
	leasehold improvements
Office Building	1–3 stories (masonry wall bearing)
	4–6 stories (concrete frame)
	7 and over stories (concrete frame/structural steel frame)
	frame)
Stores, retail & wholesale	1 and 2 stories, shopping centres
	leasehold improvements (partitions, shop fitments, electrical fixtures)
Multi-purpose	office and retail—7 floors and over, including parking facilities and possibly hotels, apartments, club and recreational facilities
Theatres and Recreational Facilities	performing arts building
	sports building and club facilities
	arenas
	swimming pools
	multi-purpose recreational and social buildings
Education Facilities	classrooms
	1–3 stories
	4 stories or more
	research and laboratory facilties
	library and archival buildings
Health Care Facilities	active treatment hospitals
	wooden frame
	fire resistant
	teaching hospitals
	convalescent and chronic care facilities
	rural clinics and nursing stations

[1]It will probably be necessary to distinguish further between private family apartments, senior citizens and student accomodations.

[2]This is a heterogeneous class of great complexity which strains the economists' traditional treatment of construction subdivided between non-residential construction and machinery and equipment. A heavy water plant, a pulp and paper plant and steam electric generating stations all have structures which usually support and sometimes shelter. They all have production equipment and linking systems, such as conveyors (excluding structures)–which can be termed equipment, and/or piping—which may be termed construction.