Ontario Construction Secretariat

A Guide to Construction Cost Sources

What Can They Tell Us About Competitiveness?

Executive Summary

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Background

Construction cost indicators are published by Statistics Canada, consulting firms, consulting engineers and quantity surveyors. However, only one of these publications, the *KPMG International Cost Comparison Analysis*, is intended as a guide to the relative cost competitiveness of locating various types of manufacturing operations in different regions. The other indicators are devised with a different intention, for example:

- The purpose of Statistics Canada's *Construction Cost Indices* is to track changes in the cost of construction **within** a location. Statistics Canada explicitly cautions users against employing its indices to estimate differences in the relative cost of construction across locations. The construction cost series published by the *Engineering News Record* has similar limitations.
- Other cost indicators, such as those published by Boeckh, Dodge, Hanscomb, R. S. Means, Saylor and Richardson are chiefly intended to provide assistance to those requiring preliminary estimates for undertaking particular types of construction, repair or renovation. The primary users of these cost indicators are general contractors, consultants (engineers, architects and quantity surveyors) and insurance adjusters.
- The *Hanscomb-Means International Construction Cost Index* provides only a rough estimate of the cost of constructing a standard industrial facility in various locations. The estimates are exclusive of land and site costs and do not take into account any costs associated with operating a manufacturing facility.

To properly assess what general conclusions can be drawn from the different construction cost indices, the Ontario Construction Secretariat (OCS) has compiled this reference guide that presents the key characteristics of each construction cost source separately and allows a convenient comparison of results. The cost sources included in this guide are:

- Boeckh Commercial, Institutional, Light Industrial Building Cost Guide
- Dodge Unit Cost Guide
- Engineering News Record
- Hanscomb's Yardsticks
- Hanscomb-Means International Construction Cost Index
- Helyar Construction Cost Guide
- KPMG International Cost Comparison Analysis
- R S Means Building Construction Cost Data
- Richardson Construction Cost Trend Reporter
- Richardson International Cost Index
- Saylor Current Construction Costs
- Statistics Canada Construction Price Statistics

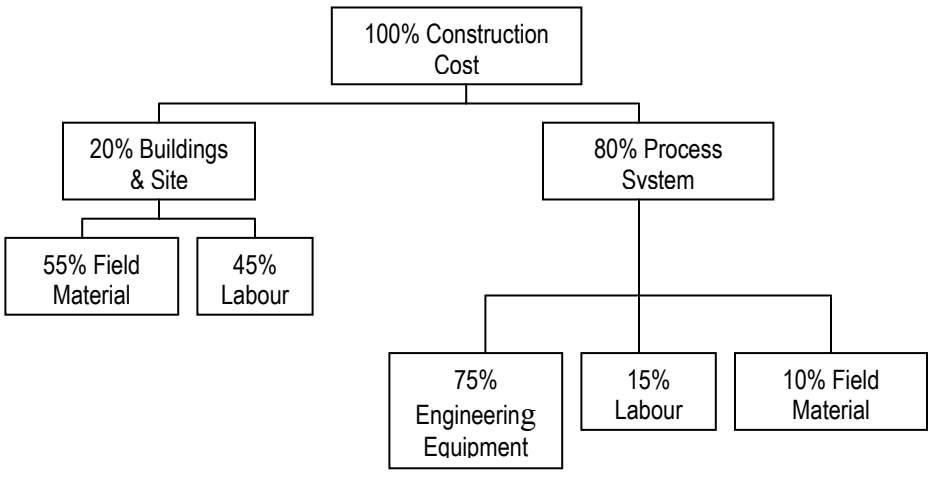
What General Conclusions about Competitiveness can be Drawn from Construction Cost Indices?

- While construction costs are a factor in competitiveness, decisions on the location of industrial facilities are determined chiefly by operating costs. It is estimated by Richardson Engineering that construction labour represents only 17% of total building and commissioning costs. This is not a high enough proportion for changes in construction labour costs to have anything more than a secondary impact on total construction costs. Moreover, construction costs, in themselves, are secondary to operating costs.
- Construction cost indices require a broad range of assumptions. The large number of assumptions that must be made diminishes the reliability of individual indices. If inferences are to be made, they should be made on the basis of confirmation by several indices.
- The inability of input indices to take account of changes in opportunity cost is a significant weakness. Changes in mark-up are a significant factor in tight demand conditions. Conversely, discounts on materials prices, easements from collective agreement terms and project targeting funds can be significant factors in periods of weak demand. Cost indices do not reflect these factors.
- Productivity factors are much more sensitive to the business cycle than is allowed for by the cost indices.
- There is wide diversity across the cost indices in their estimation of changes in construction costs over time. There is also wide diversity in their estimation of the ranking of locations in terms of their construction costs. The diversity in estimates among the input indices is such that these indices are of little practical value in assessing a location's competitive position. Among the output indices, the *KPMG International Cost Comparison Analysis* is the only measure which systematically incorporates an assessment of all factors relevant to a location decision for a manufacturing facility. There are no comparable comparisons for commercial construction.

How Important are Construction Costs in Competitiveness?

The *KPMG International Cost Comparison Analysis* provides a detailed analysis of the costs of acquiring, constructing and operating various types of manufacturing facilities in a number of locations. A technical appendix to the publication sets out detailed worksheets. From this analysis it is possible to derive estimates of the role of construction costs in the overall rate of return on invested capital. The *KPMG International Cost Comparison Analysis* is the only publication that provides a detailed, comprehensive and methodologically consistent analysis of regional competitiveness based on all factors relevant to a location decision. The KPMG analysis includes, among other factors, land costs, construction costs, operating costs (labour, raw materials, power, transportation to markets) and tax burden. It is clear from this analysis that initial construction costs pale in significance to operating costs as determinants of the ultimate rate of return on invested capital. Moreover, only some construction costs are judged to be sensitive to local factors. Other construction costs are determined chiefly at the national or international level. While locally sensitive construction costs are not irrelevant to overall competitiveness, a city or region cannot affect its relative competitiveness in any fundamental way by focusing on those costs. Operating costs and tax policy are far more significant determinants of competitiveness. At the international level, all factors pale in comparison with the importance of the exchange rate.

Richardson Engineering estimates the following cost structure for building and commissioning an industrial plant.



Source: Richardson Engineering Services

The estimates indicate that only 20% of construction costs arise from preparing the site and erecting the facility. The preponderance of construction costs (80%) arises from the installation of production equipment. Construction labour accounts for 45% of the costs of preparing and erecting the site[1] and 10% of the cost of commissioning the plant. Overall, the construction labour share of the total cost is only17%.

The *KPMG International Cost Comparison Analysis* suggests that construction costs are not a decisive determinant in regional competitiveness with respect to the location of industrial facilities. While construction costs are relevant to competitiveness, they are far less important than factors that impinge directly on operating costs, including tax policy. The Richardson Engineering analysis suggests that even within the context of construction costs, construction labour costs do not represent a large enough share of total costs to be the primary factor affecting location decisions.

[1] Note: the Richardson estimate of 45% is significantly higher than Statistics Canada's estimate of the labour share of construction costs. Statistics Canada's estimates of the labour share in construction costs averaged 32% for the period 1982-1992 (most recent data). Derived from Statistics Canada, CANSIM, Table No. 029-0026

How are Comparative Cost Indices Devised?

There are three types of indices:

- ***Input indices*** consist of a shopping cart of common materials, equipment, and trade labour hours. These inputs are taken as representative of all inputs into the construction process. For example, an input index may be based upon the cost of 100 m^3 of concrete, 50 hours each for a carpenter, mason, plumber, electrician, and an ironworker, and 200 hours each for a backhoe and a mobile crane. The costs for each item in the shopping cart are determined at every location covered by the index. Input indices do not require any assumptions related to the productivity of local labour. The quantities employed in the index are constant across locations. This means that some factors are not captured. Factors that are necessarily excluded from an input index are the impact of local building code requirements on the selection of materials, differences in the use of trades and differences in site requirements, e.g., piling or earthquake design features. While the use of input indexes is limited, they are the simplest to produce, require the fewest assumptions and contain the least error. Local costs are derived from collective agreements, labour contractors and materials distributors. Input indices are useful chiefly for understanding past trends in input costs. Input indices are less reliable, but still helpful to companies that need to compare input costs across locations.

- ***Output indices*** measure the cost of a completed structure. This is achieved in one of two ways. First, actual tender prices for projects may be collected. Because every project will have different parameters, the costs must be adjusted to account for the different project characteristics. This is a complex process involving numerous assumptions. For example, the footprint size and shape, the building height, interior finishes, the presence of underground parking, and ground conditions affect the cost of construction. Adjusting for these differences in design requires so many assumptions that the initial strength derived from using actual tender prices is considerably reduced. The second procedure is to estimate the cost of constructing a model building. The characteristics of the building are outlined and estimates are solicited from practitioners in each location. Indices produced by this procedure implicitly reflect location conditions. However, the procedure requires significant cost estimating resources. Firms that maintain these indices may not invest sufficiently in the estimating resources in each location to achieve a high degree of reliability.

- ***Hybrid indices*** focus on the installed costs of smaller building elements, such as foundation walls, insulation or roof membranes. Building elements are usually organized using MasterFormat. Hybrid indices are relevant chiefly at the level of trade contracting. Most publishers of hybrid indices caution against a simple adding up of building component costs to derive the notional cost of complete structure.

Summary of Construction Cost Indicators

Source	Labour (Input)	Materials (Input)	Equipment (Input)	Components (Output)	Basis of Location Indices	Time Series
Boeckh				✓	Input	✓
Dodge	✓	✓		✓	Input	
ENR	✓	✓	✓		Input	
Hanscomb	✓			✓	Input & Output	
Helyar				✓	Output	✓
KPMG				✓	Output	
Richardson	✓			✓	Output	
RSMeans	✓	✓	✓	✓	Input	✓
Saylor	✓	✓		✓	Input	✓
Statistics Canada	✓	✓	✓	✓	N/A	✓

What Assumptions are made in the Various Construction Cost Indices?

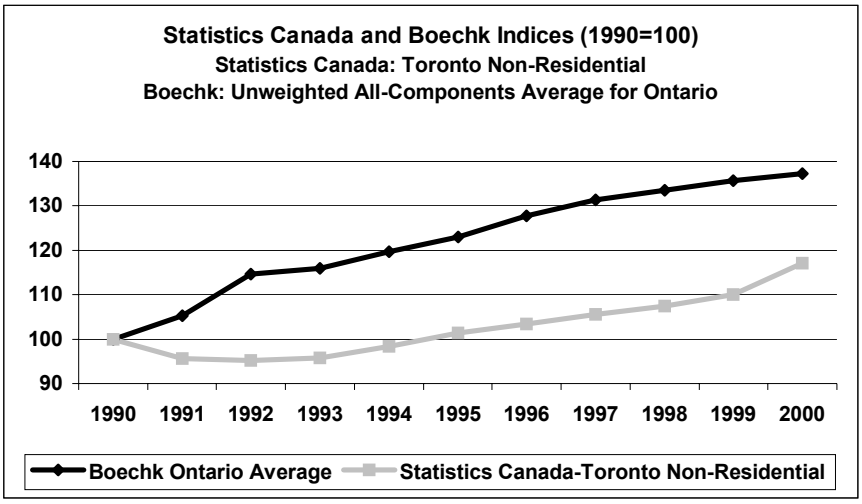
The underlying assumptions used to develop the various construction costs indices should be taken into account when drawing conclusions about cost trends or cost differences.

Labour	Input indices assume constant crew composition across locations. They do not vary the ratio of journeypersons to apprentices or the ratio of tradespersons to helpers. The productivity of crews is assumed to be the same in all locations and to be invariant over the business cycle. The assumption of constant productivity across locations is reasonable when there is an adequate supply of experienced tradespersons. However, when labour supply conditions are tight, contractors often employ workers with less experience and less skill. Output may decline. Re-work may be required. Supervision costs may increase. Workplace injuries may increase. Productivity factors related to the business cycle can affect costs by as much as 10%. The assumption of constant productivity can be unrealistic if one location is experiencing systemic shortages in skilled labour while another has no supply-side constraints. Productivity estimates are proprietary.
Opportunity Cost	Opportunity cost is the margin over (or below) normal costs when demand is significantly above (or below) the norm. Wages, prices and contractors' margins increase sharply and abruptly when the construction industry is at full capacity. Conversely, when he industry is in recession, wages, prices and contractors margins often decline significantly. Input indices rely on a constant opportunity cost for labour and contractors' services, though not for the cost of building materials. This can be extremely unrealistic during periods of buoyant demand and also during periods of slack demand.
Labour Costs	Input indices draw their labour costs from ICI collective agreements. For non-union contractors, the rates quoted by labour contractors are used. Input indices do not take account of easements from the terms of collective agreement or the impact of project targeting funds. Furthermore, most input indices use an invariant assumption across locations for payroll taxes and contributions.
Materials Costs	Some input indices use delivered prices that include discounts. Others rely on list prices.
Technology	Input and hybrid indices incorporate changes in construction materials and methods only after these are widely accepted by the industry. Technical specifications are typically constant for periods of up to ten years.
Site Costs, Code Requirements	None of the indices take account of site costs, such as the requirement for drainage or piling. Code requirements that may specify particular design features or materials are not reflected. This is especially important in earthquake zones where code requirements can add considerable cost.
Finishes	The indices all assume a standard finish. No account is taken of different architectural specifications. This is relevant chiefly in commercial construction.

How Consistent are the Indices in Tracking Changes in Construction Costs over Time?

The indices that publish time series often differ significantly on their estimation of the path of construction costs. The following graph compares Statistics Canada's estimate of changes in the costs of non-residential construction in Toronto with the indices published by Boechk. Attention should be directed to the period 1990-1995. Statistics Canada reports a decline in construction costs from 1990-1991 and thereafter a gradual recovery such that costs in 1995 were only marginally higher than in 1990. This reflects the decline in prices, wages and contractors margins. Boechk reports cost increases over this same period, such that construction costs were 23% higher in 1995 than they were in 1990. By implication, Boechk is reporting increases during this period in wages, prices and contractors margins.

Individuals familiar with the industry will be skeptical of the Boechk estimates. R.S. Means formula for estimating construction costs across Canada would suggest a similar pattern as Boechk and would elicit the same skepticism.



How Consistent are the Indices in Comparing Differences in Construction Costs across Locations?

Using location indices appears to be a gamble and the results will vary significantly depending on the index used. There is no obvious consistency between the different sources. Even where indices are in agreement on the ranking of locations, the degree of variance is significant. As can be seen in the following table, two indices report Vancouver as having higher construction costs than Toronto, while six report lower costs. Four indices find Toronto more costly than Houston, while two report the opposite.

City	Richardson	Dodge	Boeckh	Saylor	RS Means	KPMG	Hanscomb	Helyar	Average
Toronto	100	100	100	100	100	100	100	100	100
Montreal	96	91	89	89	92	100	98	98	94.1
Calgary	97	81	82	87	87	140	96	106	97.0
Vancouver	99	94	92	94	96	124	95	106	100.0
Houston	83	86	107	132	118	104			105.0
Atlanta	85	88	100	123	117	128			106.9
Cincinnati	96	101	115	132	122	140			117.6
Chicago	102	119	149	132	146				129.5
Los Angeles	110	115	141	148	144	140			133.2
Detroit	97	120	134	135	139	200			137.4
Boston	103	123	144	135	154	176			139.3
New York	132	155	180	153	176	172			161.4
Average	100.1	106.1	119.4	121.7	124.3	138.5	97.2	102.5	
Type of Index	Input	Input	Input	Input	Input	Output	Output	Output	