

# International Comparison Program

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# Construction and Civil Engineering

## Approach and Data Requirements

*Draft version*



**Operational Guide**

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# Construction and Civil Engineering<sup>1</sup>

## 1. Introduction

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The International Comparison Program (ICP) is responsible for the production of Purchasing Power Parities (PPPs) for both national GDP and for sub-components of GDP. PPPs are alternatives to market exchange rates and are intended to reflect price level differences across countries more accurately. One of the sub-components of GDP is Construction, part of Gross Fixed Capital Formation. This chapter of the Operation Guide describes the approach to the calculation of construction PPPs for the ICP 2011 round.

Construction is described in the report of the ICP 2005 results as “comparison resistant”. It is difficult to identify a range of comparable and representative construction products or projects across all countries. As a result the methods adopted for the calculation of PPPs are largely based on theoretical products or projects and require adjustments to bring them to a common basis. Designing the data collection, collecting the price data and processing it requires thus specialist skills and knowledge.

The approach outlined in this chapter applies to construction work undertaken by formal construction contractors using modern materials; informal construction<sup>2</sup> is not part of the standard ICP price survey. Like other price indicators, the calculation of PPPs requires a list (or lists) of items, prices for these items and weights. The challenge is to identify appropriate lists and reliable sources of prices and weights.

## 2. Objective

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The purpose of the ICP is to produce PPPs for major components of the economy, including construction. Construction PPPs are currency converters that permit comparisons of construction volumes across countries to be made. The intention is to compare quantities – not values – of construction output. PPPs for construction represent prices paid by end users, the customers for construction works. The Table 1 below presents the covered Basic Headings (BHs) by the construction survey.

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<sup>1</sup> This chapter is prepared by Marko Rissanen, based on the material drafted by Jim Meikle and Imeddine Jerbi.

<sup>2</sup> Regarding informal construction, relevant expenditure values should be included in the country’s national accounts.

**Table 1:** Construction expenditure

Code	Aggregate or BH
150000	<b>GROSS FIXED CAPITAL FORMATION</b>
150200	CONSTRUCTION
150210	RESIDENTIAL BUILDINGS
150211	<u>Residential buildings</u>
150211.1	Residential buildings
150220	NON-RESIDENTIAL BUILDINGS
150221	<u>Non-residential buildings</u>
150221.1	Non-residential buildings
150230	CIVIL ENGINEERING WORKS
150231	<u>Civil engineering works</u>
150231.1	Civil engineering works

### 3. Approach in Brief

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The approach to the calculation of construction PPPs is based on 50 basic and common resources for construction work selected to correspond with the main inputs to national construction output. These resources are grouped into the three sub-headings as follows:

- Materials: 38 material inputs
- Equipment: 5 types of equipment hire rates
- Labor: 7 categories of construction labor

The 38 material resources are allocated to the three Basic Headings (Residential and Non-residential buildings and Civil engineering work) so that items such as concrete and steel reinforcement appear in all three BHs while other items, sheet roofing and sanitary ware, for example, appear only in Residential and Non-residential building BHs. Respondents to a national survey indicate with an asterisk the importance of individual items in that BH.

An unweighted CPD is to be used to calculate PPPs for the above mentioned sub-headings. Each BH has thus three sub-heading PPPs: for Materials, Equipment and Labor. BH PPPs will be calculated as weighted averages of the sub-heading PPPs using Resource Mixes as weights. Resource Mixes are typical proportions of resources (Materials, Labor and Equipment) used in construction projects relating to the three BHs (Residential and Non-residential building and Civil engineering work). Information on the Resource Mixes are collected in the price survey and established also centrally by the Global Office using income groups as a proxy for the resource allocation.

BHs PPPs based on the input prices will be adjusted to outputs using mark-ups and allowances for professional fees collected in the price survey. National construction PPPs are calculated by aggregating BH PPPs using expenditures on construction BHs as weights.

#### 4. Review of Alternatives

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A number of methods for deriving construction PPPs have been developed over the years. Some of these are still in use and some have been abandoned; all, including the proposed approach, have shortcomings: none of them are perfect. This section briefly reviews the main features of the methods. They are:

- Project (bill of quantity) based approaches used by Eurostat and OECD, adopted by member, associate and candidate countries of the EU and member and associate countries of the OECD. There are issues concerning the representativity of the projects selected and the extent to which all construction is represented but the main concern is probably with the cost of the exercise.
- The method used by the CIS states. This involves the collection of unit prices for construction inputs which are then applied to model projects with quantity weights for materials and products and labour (but not for equipment). The models are representative of ‘standard’ project types although they are less complete than the OECD-Eurostat bills of quantities; the projects are then weighted to represent Basic Headings and all construction output.
- The Basket of Construction Components (BOCC) approach used in the 2005 ICP round involves a combination of basic inputs and more complex work items that were to be weighted on the advice of local experts. There were difficulties with the establishment of weights and confusion over the mixture of basic and complex items.
- Unit rates are estimates of the total price of projects expressed as an amount per m<sup>2</sup> of built floor area in the case of buildings and m<sup>2</sup> or linear meters in the case of civil engineering work. There is, however, uncertainty across countries about the rules of floor area measurement and what is included/ excluded in the rates.

The CIS method is closest to the proposed approach but is less explicit about resource mixes and mark-ups. The Eurostat-OECD method involves a large amount of effort and cost in implementation and, for that reason alone, probably cannot be considered for the ICP survey. The BOCC method was unsuccessful in 2005 largely because the relationship between simple and complex items was unclear and it was not possible to obtain reliable system weights. Square meter rates are useful but inadequate as a basis for the calculation of PPPs. All of the project based methods have the problem of reflecting tender rather than outturn prices and the extent of ‘cost drift’ varies significantly across countries. The main advantages of the proposed approach are that it is relatively simple to collect the necessary price and supporting data and it is relatively inexpensive to implement.

It should be noted that construction output, or tender or bid, prices reflect construction prices at a point in the future when resources will be purchased and work undertaken; they are, therefore, price forecasts – the actual base date depends on the duration and nature of the project. Resource prices, the prices collected in the proposed approach, are current at the date they are collected.

## 5. Selecting Items

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As with other PPP calculations, the exercise requires a set of “product baskets” to be identified to serve as the basis for weights and prices. The criteria for selection of material and product items in the baskets are as follows:

- Common across most countries in terms of use in construction
- Significant in terms of value used in construction in most countries
- Simple to describe and likely to be understood in most countries.

Numbers of items and individual items were selected by reference to input-output tables and lists of items used in published construction price features.

The table in Annex 1 sets out the three categories of items selected for materials and products, and for equipment and labor. Items in the table marked with an asterisk are identical to basic items in the ICP 2005 BOCC survey documentation; this will allow an “overlap” with the 2005 method. The table in Annex 2 allocates materials and products to Basic Headings on the basis of their likely use in that type of construction work.

## 6. Establishing Weights

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Three types of weights need to be considered:

- Weights for the items<sup>3</sup> that represent the three Basic Headings (Residential buildings, Non-residential buildings and Civil engineering) – these are indicated by the respondents of the construction survey
- Weights for the sub-headings i.e. Resource Mixes (materials, equipment and labor) in each Basic Heading – these are reported by the respondents of the construction survey or determined centrally for groups of countries by the Global Office; and
- Weights that represent National Accounts expenditure values for each Basic Heading – these will be provided by the national statistical offices.

Resource mixes of materials, equipment and labor for the three Basic Headings in different groups of countries are dependent on the skills and technology available in a country and other factors, and average values can vary from country to country and, within countries, across types of work. There can be trade-offs between the skill levels and the price of labor (highly skilled labor is usually expensive but the quantity of workers required is relatively low, and vice versa) but that is not always the case. There

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<sup>3</sup> It has been further decided that prices for the three groups of materials and products, labor and equipment will be unweighted.

will also be trade-offs between the quantities of labor and equipment inputs (capital/ labor substitution) but there is relatively little information on that in most countries.

In most countries and in most types of work (although not necessarily in civil engineering work), materials and products represent the greatest proportion of construction value (typically, 50 – 75%) and, in building work, labor represents the next greatest (20 – 40%) and equipment the smallest proportion (5 – 20%). In civil engineering work, the relative significance of labor and equipment can be reversed and materials and products may not be the most significant component.

Input-output and Supply and use tables provide a useful indication of the labor input to all construction work via ‘compensation of employees’ in value-added and, in some countries, where there are multiple columns for construction, the labor inputs to different types of work can be calculated. But tables are not available for all countries and are often not up to date, and, even when they are, they usually only provide information on all construction, not Basic Headings. And tables provide even less, and less reliable, information on the equipment inputs to construction.

The Table 2 below gives an example of the estimated Resource Mixes for the three income groups (Upper, Middle and Lower) and three BHs (Residential construction, Non-residential Construction and Civil Engineering).

**Table 2:** Estimated Resource Mixes

Income Groups	Residential Construction			Non-residential Construction			Civil Engineering		
	M	E	L	M	E	L	M	E	L
<b>Upper</b>	60	10	30	60	10	30	50	25	25
<b>Middle</b>	60	5	35	65	10	25	35	30	35
<b>Lower</b>	70	10	20	65	15	20	50	35	15

In the CIS survey, quantities are provided for materials and products and one type of labor (and no equipment). Factors are provided by countries to adjust labor quantities relative to a base quantity. Based on 2005 data, the proportions of labor in total project value for a sample of projects varied between 13 and 37% in nine countries, similar to the range in the pilot survey. Model projects and enterprise surveys can also provide useful information on resource weights.

Approximate value weights for labor inputs can be derived from Input-output and Supply and use tables for at least some countries, and other estimates of resource breakdowns can be derived from enterprise surveys and the like. All of these various sources provide a sound basis for calculating value weights for resource mixes in construction Basic Headings.

The value of construction work in each Basic Heading will vary from country to country and from year to year. In larger more mature economies there may be long term regular patterns in construction investment but, in smaller and less developed economies, the mix can vary substantially from year to year. Civil engineering tends to be the most variable of the Basic Headings, particularly in smaller or less

developed countries, where a dominant type of work can influence the mix in any year – roads and tunneling, for example, will have relatively low material content but is not likely to be undertaken every year. Countries go through phases of construction investment depending on some combination of the state of the general economy, government policy, the volume and nature of development aid programs, and other factors.

Construction expenditure data that indicates the mix by value of the different types of construction produced each year is usually available from national statistical offices or other government departments, and this type of data is usually relatively up to date and in categories that can be matched to the three Basic Headings. Assessments will also need to be made of what output is included in, and excluded from, official figures.

## **7. Pricing Rules**

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Prices provided should be those paid by construction contractors to their suppliers. In the case of materials and products, that will typically be the prices paid, after discounts, to manufacturers or intermediaries (agents or merchants), including all non-recoverable taxes and respectively excluding all recoverable taxes, such as the Value Added Tax (VAT); in the case of equipment, it should be the rental charges paid to hire companies or internal hire rates; and, in the case of labour, the cost to the contractor of employing the workers. Informal payment arrangements for labour are common in construction - for example some payment is in the form of wages, subject to taxes and on which employers' costs are incurred while other payments are in cash - and respondents should bear this in mind when determining what an 'average' wage is.

Prices should be provided for items that are commonly available and commonly used in the country; they should not be provided for items that match the item description precisely if that involves pricing a "special" item, either not generally available in the country or only available at a premium price.

Countries are requested to provide annual and national 'average' prices in national currency. Annual averages mean prices that are an average over the survey year (mid-year prices are acceptable) and that average different price levels across the country, across different types and sizes of projects. While striving to select appropriate average prices, country respondents should remain mindful of the following rules:

- Geographical location: Construction prices can vary across countries, as a result of local resource and distribution costs, geographic, seismic or climatic conditions, local market conditions, etc, particularly in large countries and sometimes these variations can be significant. Respondents should consider the extent of geographical variations when pricing items and make a judgement on what is a realistic national average.
- Site context: Construction prices can vary depending on detailed site conditions, for example, constrained city centre sites, greenfield sites adjacent to urban areas and remote sites that are difficult to access; when pricing items, respondents should assume reasonable site contexts with good access.



- Size of projects: The size of projects can influence the cost of resources, particularly materials and equipment – large quantities and long periods of hire, for example, can reduce unit costs and vice versa. Prices should be provided for medium-sized projects, that is, projects which are not unusually small or unusually large.

Purchaser prices for materials and products, equipment hire and labour will be sought from expert construction respondents in each country. A single average price will be sought for each item. Respondents will also be asked to provide mark-ups for each of the Basic Headings to cover general and preliminary items and contractors' overheads and profit and an allowance for professional fees for each of the Basic Headings.

In addition to input prices, mark-ups and allowances for professional fees, the survey form will ask for unit output prices for different types of work representing the three Basic Headings. These will be used as checks on the main survey data. Respondents will also be asked to indicate with an asterisk the importance of each material or product in each basic heading in their country.

## **8. Implementation**

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For the implementation of the 2011 ICP Construction survey a specific Excel questionnaire is provided. The Questionnaire is discussed below in the section 8.1. Additionally the following materials are available for the conduct of the survey<sup>4</sup>:

- Operational Guide (this chapter)
- Construction Materials Catalogue
- Additional guidance for the conduct of the survey
- Notes on Selection Criteria for National Experts
- Presentation on Construction & Civil Engineering Operational Aspects

### **8.1. Construction Questionnaire**

The 2011 Construction Questionnaire provides the item specifications for the 50 basic and common resources for construction work and templates for the price and metadata collection. The Questionnaire has 7 worksheets as follows:

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Most of these materials are available on the World Bank ICP Website at:  
<http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/ICPEXT/0,,contentMDK:22580648~menuPK:7070032~pagePK:60002244~piPK:62002388~theSitePK:270065,00.html>

1. **Introduction:** To report general information on respondent; base date for prices; and geographical base of national average price level
2. **Notes:** Notes and guidance for the conduct of the survey
3. **Materials:** To provide unit prices for the material inputs; importance information; and comments
4. **Equipment:** To provide unit prices for the equipment hire; and comments
5. **Labor:** To provide unit prices for the labor costs; comments; and supplementary information on labor rates
6. **Project Prices:** To provide optional information on the unit cost for project prices for validation purposes
7. **Support:** To provide information on the Resource Mixes; contractors' mark-ups; and professional fees

Annex 3 presents the respective worksheets and the related guidance.

The project prices are an optional component of the construction survey. The construction PPPs are to be calculated using input prices for material prices, equipment hire rates and costs of labor. Project prices, if and when reported, are used as a validation check for the input based PPPs. The reported project prices should be annual average prices. Further, mid-year prices can be treated as annual averages. The Project prices questionnaire refers additionally to a midpoint in a range of prices. This means that in case a country has a range of mid-year prices for a given project, the middle price should be selected and reported. In practice it may be useful to request the countries to provide several prices per location and then take the midpoint (or average) per location which would then be used to determine the national midpoint or national average.

Resource Mixes will be estimated centrally by the Global Office using income groups as a proxy for the resource allocation. However, a country may decide to provide country specific estimates for the Resources Mixes.

## 8.2. Timeline

The price collection for the 2011 ICP Survey is to be carried out during July - October 2011, followed by the intra-, inter- and global validation as presented in the Table 3 below.

**Table 3:** Timeline for the Construction survey

	2011						2012					
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	Q3			Q4			Q1			Q2		
CONSTRUCTION												
Price collection and intra-country validation	Once											
Submission (NCs to RCs)												
Inter-county validation												
Submission (RCs to GO)												
Global Validation												

## Annex 1: List of resources

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### CONSTRUCTION MATERIALS AND PRODUCTS

Aggregate for concrete *	Clean, hard, strong crushed stone or gravel free of impurities and fine materials in sizes ranging from 9.5 to 37.5mm in diameter.
Sand for concrete and mortar *	Fine aggregate washed sharp sand
Softwood for carpentry	Sawn softwood sections for structural use pre-treated (to national standards) e.g. 50mm x 100mm
Softwood for joinery	Dressed softwood sections for finishing e.g. 18mm x 120mm
Exterior plywood *	Exterior quality plywood 15.5mm thick in standard sheets
Interior plywood *	Interior quality plywood 12mm thick in standard sheets
Chipboard sheet	Interior quality chipboard 15mm thick in standard sheets
Petrol/ Gasoline	Standard grade for use in motor vehicles
Diesel fuel	Diesel fuel for use in construction equipment
Oil paint	Oil based paint suitable for top coat finishes to timber surfaces
Emulsion paint	Water based paint suitable for internal plaster surfaces
Ordinary Portland cement *	Ordinary Portland cement in bags or bulk delivery
Ready mix concrete *	Typical common mix 1:2:4 cement:sand:20-40mm aggregate, 20N/mm <sup>2</sup>
Precast concrete slabs	Precast concrete paving slabs 600 x 600 x 50mm thick
Common bricks	Ordinary clay bricks (suitable for render or plaster finish) e.g. 215mm x 100mm x 65mm thick (715 bricks/m <sup>3</sup> )
Facing bricks	Medium quality self finished clay bricks for walling, e.g. 215mm x 100mm x 65mm thick (715 bricks/m <sup>3</sup> )
Hollow concrete blocks	Hollow dense aggregate concrete blocks, 7N/mm <sup>2</sup> , e.g. 440mm x 215mm x 140mm thick (76 bricks/m <sup>3</sup> )

Solid concrete blocks	Solid dense aggregate concrete blocks, 7N/mm <sup>2</sup> , e.g. 440mm x 215mm x 140mm thick (76 bricks/m <sup>3</sup> )
Clay roof tiles	Clay plain smooth red machine-made or similar tiles per m <sup>2</sup> of roof surface area e.g. 265mm x 125mm tiles
Concrete roof tiles	Concrete interlocking tiles per m <sup>2</sup> of roof surface area eg 420mm x 330mm tiles
Float/ sheet glass	Standard plain glass, clear float, 4mm thick
Double glazing units	Factory made hermetically sealed, medium sized units 0.5 to 2.0 m <sup>2</sup> with 4mm glass, 12mm seal
Ceramic wall tiles	152 x 152 x 5.5mm thick white or light coloured for medium quality domestic use
Plasterboard	12.5mm paper faced taper edged plasterboard in standard sheets
White wash hand basin	Average quality white vitreous china domestic wash hand basin for domestic use, wall hung (excluding taps, trap and pipework)
High yield steel reinforcement *	Reinforcing bars up to 16mm diameter (excluding cutting and bending)
Mild steel reinforcement *	Reinforcing bars up to 16mm diameter (excluding cutting & bending)
Structural steel sections *	Mild steel I beams approximately 150mm deep and approximately 19 kg/m
Sheet metal roofing	Twin skin roofing panel comprising color coated steel or aluminum profiled sheeting outer layer, 100mm insulation, internal liner sheet,
Metal storage tank	Metal storage tank capacity 15m <sup>3</sup> , thickness of steel, 5mm, typical size, 3.75m x 2m x 2m
Cast iron drain pipe	150mm diameter with mechanical coupling joints
Copper pipe	15mm copper pipe suitable for mains pressure water.
Electric pump	Electric pump for pumping water, temperature range, 5 – 80oC, flow rate 10 liters/second, head pressure, 150 Pa
Electric fan	Electric exhaust fan for interior installation, flow rate, 1,000 liters/ second, head pressure, 250 Pa

Air-conditioning equipment	Air cooled liquid chiller, refrigerant 407C; reciprocating compressors; twin circuit; integral controls cooling load 400kW
Stand-by generator	Diesel generating set for stand-by use, three phase 24V DC, 250KVA output
Solar collector	PV solar panels peak output 650W, supply panels only, typically 4.5m <sup>2</sup> total area
Electricity	Typical average commercial tariff

### CONSTRUCTION EQUIPMENT

Wheeled loader and excavator	1.0m <sup>3</sup> loader capacity, 2.35m wide shovel, 6.0m max. dig depth
Tracked tractor	Crawler dozer 159kW with 'U' blade
Skid steer loader	Tipping load, 2,000kg, travel speed, 11.1km/hr
Tandem vibrating roller	Self propelled 5 tonne double vibratory
Compact track loader	Rated operating capacity, 864kg, travel speed, 11.4km/hr

## CONSTRUCTION LABOUR

General (unskilled) laborers [1] *
Bricklayer [2] *
Plumber [2] *
Carpenter [2] *
Structural steel worker [2] *
Electrician [2] *
Machine (equipment) operator [2] *

[1] This group of construction workers undertakes simple and routine tasks in support of activities performed by more skilled workers. They have usually received little or no formal training. Examples of tasks that they might undertake include loading and unloading materials, digging and filling holes and trenches, spreading gravel and related materials, cleaning and tidying sites and site facilities.

[2] This group of skilled construction workers has received training in their trade comprising one or more of an apprenticeship, on the job training or training in a technical college or similar institution.

**Annex 2: Materials and products used in Basic Heading work types**

<b>Material or product</b>	<b>Use in residential building</b>	<b>Use in non-residential building</b>	<b>Use in civil engineering works</b>
Aggregate for concrete	X	X	X
Sand for concrete and mortar	X	X	X
Softwood for carpentry	X	X	X
Softwood for joinery	X	X	
Exterior plywood	X	X	X
Interior plywood	X	X	
Chipboard sheet	X	X	
Petrol/ gasoline	X	X	X
Diesel fuel	X	X	X
Oil paint	X	X	
Emulsion paint	X	X	
Ordinary Portland cement	X	X	X
Ready-mix concrete	X	X	X
Precast concrete slabs	X	X	
Common bricks	X	X	X
Facing bricks	X	X	
Hollow concrete blocks	X	X	X
Solid concrete blocks	X	X	X
Clay roof tiles	X		
Concrete roof tiles	X		



Float/ sheet glass	X	X	
Double glazing units	X	X	
Ceramic wall tiles	X	X	
Plasterboard	X	X	
White wash hand basin	X	X	
High yield steel reinforcement	X	X	X
Mild steel reinforcement	X	X	X
Structural steel sections	X	X	X
Sheet metal roofing	X	X	
Metal storage tank		X	X
Cast iron drain pipe	X	X	X
Copper pipe	X	X	
Electric pump		X	X
Electric fan		X	
Air-conditioning equipment	X	X	
Stand-by generator		X	
Solar collector	X	X	X
Electricity	X	X	X

## Annex 3: 2011 Construction Questionnaire

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### 1. Introduction Worksheet

1 Country:	<input type="text"/>
2 Currency:	<input type="text"/>

#### Survey respondent

3 Name:	<input type="text"/>		
4 Employer:	<input type="text"/>		
5 Type of employer:	<input type="radio"/> consultant <input type="radio"/> academic <input type="radio"/> research <input type="radio"/> government <input checked="" type="radio"/> other <input type="text"/>		
6 Contact details:	<input type="text"/>		
7 Telephone no:	<input type="text"/>	8 Email address:	<input type="text"/>

#### Purpose of the survey

The purpose of this survey is to collect mid year national average prices as paid by contractors for resource inputs to construction work. The prices will contribute to the preparation of Purchasing Power Parities (PPPs) for construction as part of a worldwide exercise coordinated by the World Bank and called the International Comparison Program (ICP). PPPs are currency convertors (as an alternative to market exchange rates) that permit comparisons of construction volumes across countries to be made.

#### Base date for prices

Prices should be averages for the year 2011 or mid year prices.

- 9 Please tick one box only  Prices averaged over the year  Mid year prices

#### National average price level

The geographical base for this survey should be the national average for the country but, if this is not the case, please enter below the geographical base used in the survey and an adjustment factor to bring prices to a national average

*Eg 0.98, 1.00, 1.05 etc.*

- 10 Geographical base  11 National average factor

#### Completion of the survey

Please refer to the Notes page for detailed instructions on completion of the survey.

## **2. Notes Worksheet**

### **General notes**

i. The intention is to identify, and collect prices for, locally available, commonly used materials and products that are equivalent, if not identical, to the items described in the survey documents. The following notes are intended to assist in selecting and pricing the survey items.

### **Item descriptions and units**

ii. Specified materials and products: Item descriptions in the survey are intended to provide a clear description of the item to be priced. There is, however, a tension between the tightness of the specification and the content of the item to be priced – the tighter the specification, the more country-specific it becomes. If a precise match to the specified material or product is not commonly available or used, the nearest commonly available and used equivalent should be priced and an appropriate note inserted in Column 10.

iii. Proprietary products: Generally, item descriptions in the survey do not use proprietary names but respondents can provide proprietary names in Column 10 if that simplifies the note.

iv. Detailed dimensions of materials: Generally, metric dimensions are stated in the survey documents but these can be replaced by Imperial – or other – dimensions if these are more common in the country. Detailed dimensions of material and products will vary, both between and within countries, for example the dimensions of bricks and blocks or timber sections. Survey respondents should select the nearest locally available and commonly used equivalent to the item described in the survey – and where that varies from the survey description it should be noted in Column 10.

v. Units of measurement: Again, metric units are generally used in the survey documents but other units can be inserted. Alternative units of measurement can also be provided, for example, m<sup>2</sup> for plywood is preferred but a price per sheet indicating the dimensions of the sheet (length and width) is acceptable; similarly, cement is indicated as per Tonne but per kg or per 50kg bag is acceptable. The items and units should be as normally used in the country. Preferred units are indicated in Column 4 (column 3 in the case of labour) ; alternative units should be inserted in Column 5 (column 4 in the case of labour) and, if any notes are required, these should be inserted in Column 10.

vi. The units indicated for equipment hire are ‘per hour’ but if other units are normally used, for example, ‘per day’ or ‘per week’, these should be indicated in column 5. If the units are per day or per week, please indicate in Column 8, the typical numbers of hours worked per day or per week. It is assumed that equipment will be hired with an operator; if this is not the case, please indicate this in Column 8.

vii. The units indicated for labour are ‘per hour’ but if other units are normally used, these should be indicated in column 4 and the typical numbers of hours worked per alternative unit stated in column 5.

### **Prices**

viii. Prices provided should be those paid by construction contractors to their suppliers. In the case of materials and products, that will typically be the prices paid, after discounts, to manufacturers or intermediaries (agents or merchants), including all non-recoverable taxes; in the case of equipment, it should be the rental charges paid to hire companies or internal hire rates; and, in the case of labour, the cost to the contractor of employing the workers. Informal payment arrangements for labour are common in construction - for example some payment is in the form of wages, subject to taxes and on which employers’ costs are incurred while other payments are in cash - and respondents should bear this in mind when determining what is an ‘average’ wage. There is space for notes or pricing after the material, plant and labour sections and it is important that these are completed by respondents.

ix. Prices should be provided for items that are commonly available and commonly used in the country; they should not be provided for items that match the item description precisely if that involves pricing a ‘special’ item, either not generally available in the country or only available at a premium price.

x. The survey seeks annual and national 'average' prices in national currency. Annual averages mean prices that are an average over the survey year (mid-year prices are acceptable) and that average different price levels across the country, across different types and sizes of projects. The following notes are intended to help respondents select appropriate average prices for their country.

xi. Geographical location: Construction prices can vary across countries, as a result of local resource and distribution costs, geographic, seismic or climatic conditions, local market conditions, etc, particularly in large countries and sometimes these variations can be significant. Respondents should consider the extent of geographical variations when pricing items and make a judgement on what is a realistic national average.

xii. Site context: Construction prices can vary depending on detailed site conditions, for example, constrained city centre sites, greenfield sites adjacent to urban areas and remote sites that are difficult to access. When pricing items, respondents should assume reasonable site contexts with good access.☒

xiii. Size of projects: The size of projects can influence the cost of resources, particularly materials and equipment – large quantities and long periods of hire, for example, can reduce unit costs and vice versa. Prices should be provided for medium-sized projects, that is, projects which are not unusually small or unusually large.

### 3. Material Worksheet

#### Construction materials and products

Respondents should indicate by inserting an asterisk, in columns 7, 8 & 9, the importance of each item in the work categories R - residential, NR - non-residential and C - civil engineering. Importance here means in common use. Items that are available but are not commonly used should not be asterisked.

*see pricing notes*

1	2	3	4	5	6	7	8	9	10
Ref	Item	Specification notes	Preferred unit	Alternative unit	Unit price	R *	NR *	C *	Notes and comments
1	Aggregate for concrete	Clean, hard, strong crushed stone or gravel free of impurities and fine materials in sizes ranging from 9.5 to 37.5mm in diameter.	m3						
2	Sand for concrete and mortar	Fine aggregate washed sharp sand	m3						
3	Softwood for carpentry	Sawn softwood sections for structural use pre-treated (to national standards) eg 50mm x 100mm	m3						
4	Softwood for joinery	Dressed softwood sections for finishing eg 18mm x 120mm	m3						
5	Exterior plywood	Exterior quality plywood 15.5mm thick in standard sheets	m2						
6	Interior plywood	Interior quality plywood 12mm thick in standard sheets	m2						
7	Chipboard sheet	Interior quality chipboard 15mm thick in standard sheets	m2						
8	Petrol/ Gasoline	Standard grade for use in motor vehicles	litre						
9	Diesel fuel	Diesel fuel for use in construction equipment	litre						
10	Oil paint	Oil based paint suitable for top coat finishes to timber surfaces	litre						
11	Emulsion paint	Water based paint suitable for internal plaster surfaces	litre						
12	Ordinary Portland cement	Ordinary Portland cement in bags or bulk delivery	tonne						(metric tonne = 1000kg)
13	Ready mix concrete	Typical common mix 1:2:4 cement:sand:20-40mm aggregate, 20N/mm2	m3						

14	Precast concrete slabs	Precast concrete paving slabs 600 x 600 x 50mm thick	m2																	
15	Common bricks	Ordinary clay bricks (suitable for render or plaster finish) eg 215mm x 100mm x 65mm thick (715 bricks/m <sup>3</sup> )	m3																	
16	Facing bricks	Medium quality self finished clay bricks for walling, eg 215mm x 100mm x 65mm thick (715 bricks/m <sup>3</sup> )	m3																	
17	Hollow concrete blocks	Hollow dense aggregate concrete blocks, 7N/mm <sup>2</sup> , eg 440mm x 215mm x 140mm thick (76 bricks/m <sup>3</sup> )	m3																	
18	Solid concrete blocks	Solid dense aggregate concrete blocks, 7N/mm <sup>2</sup> , eg 440mm x 215mm x 140mm thick (76 bricks/m <sup>3</sup> )	m3																	
19	Clay roof tiles	Clay plain smooth red machine-made or similar tiles per m <sup>2</sup> of roof surface area eg 265mm x 125mm tiles	m2																	
20	Concrete roof tiles	Concrete interlocking tiles per m <sup>2</sup> of roof surface area eg 420mm x 330mm tiles	m2																	
21	Float/ sheet glass	Standard plain glass, clear float, 4mm thick	m2																	
22	Double glazing units	Factory made hermetically sealed, medium sized units 0.5 to 2.0 m <sup>2</sup> with 4mm glass, 12mm seal	m2																	
23	Ceramic wall tiles	152 x 152 x 5.5mm thick white or light coloured for medium quality domestic use	m2																	
24	Plasterboard	12.5mm paper faced taper edged plasterboard in standard sheets	m2																	
25	White wash hand basin	Average quality white vitreous china domestic wash hand basin for domestic use, wall hung (excluding taps, trap and pipework)	each																	
26	High yield steel reinforcement	Reinforcing bars up to 16mm diameter (excluding cutting and bending)	tonne																	
27	Mild steel reinforcement	Reinforcing bars up to 16mm diameter (excluding cutting and bending)	tonne																	
28	Structural steel sections	Mild steel I beams approximately 150mm deep and approximately 19 kg/m	tonne																	
29	Sheet metal roofing	Twin skin roofing panel comprising colour coated steel or aluminium profiled sheeting outer layer, 100mm insulation, internal liner sheet,	m2																	



#### 4. Equipment Worksheet

##### Construction equipment hire rates

*see pricing notes*

1	2	3	4	5	6	7	8
Ref	Item	Specification notes	Preferred unit	Alternative unit	Unit price with operator	Unit price without operator	Notes and comments
1	Wheeled loader and excavator	1.0m <sup>3</sup> loader capacity, 2.35m wide shovel, 6.0m max. dig depth	hour				
2	Tracked tractor	Crawler dozer 159kW with 'U' blade	hour				
3	Skid steer loader	Tipping load, 2,000kg, travel speed, 11.1km/hr	hour				
4	Tandem vibrating roller	Self propelled 5 tonne double vibratory	hour				
5	Compact track loader	Rated operating capacity, 864kg, travel speed, 11.4km/hr	hour				

6 Please provide any other useful comments on the local construction equipment market:




## 5. Labor Worksheet

### Labour rates

Labour rates should reflect the cost to the contractor of employing the labour and should include, in addition to pre-tax wages to the worker, any additional costs to the employer for accident/ health insurance, pensions, etc. Labour rates should also include any 'off the books' or 'envelope' payments that are typically made to construction workers in your country. Please indicate in the Notes and comments column typical employment conditions for different types of workers, for example, permanently employed, daily paid, etc.

*see pricing notes*

1	2	3	4	5	6	7
Ref	Item	Preferred unit	Alternative unit	Number of hours	Unit price	Notes and comments
1	General (unskilled) labourers [1]	Hour				
2	Bricklayer [2]	Hour				
3	Plumber [2]	Hour				
4	Carpenter [2]	Hour				
5	Structural steel worker [2]	Hour				
6	Electrician [2]	Hour				
7	Machine (equipment) operator [2]	Hour				

Notes: [1] this group of construction workers undertake simple and routine tasks in support of activities performed by more skilled workers. They have usually received little or no formal training. Examples of tasks that they might undertake include loading and unloading of materials, digging and filling holes and trenches, spreading gravel and related materials, cleaning and tidying sites and site facilities.

[2] this group of skilled construction workers has received training in their trade comprising one or more of an apprenticeship, on the job training or training in a technical college or similar institution.

### Supplementary questions on labour rates

8 To help us ensure comparability with rates from other countries please confirm that the above rates are :-

Gross i.e. the cost of labour to the contractor as described above or Nett i.e. the rates paid to workers

select Gross or Nett

9 If you have reported Nett rates, please indicate the overall percentage adjustment for Gross labour costs against Nett labour rates

10 Please provide any other useful comments on the local construction labour market:


## 6. Project prices Worksheet

### Approximate project prices

Please provide approximate all-in unit prices for the project types listed below. Please also indicate below the table notes on the methods of measurement used. Generally, prices for buildings should exclude external works, furniture, loose or special equipment and fees for professional services. Prices for civil engineering works should allow for average excavation and earthworks in good ground. Where there is a known range of prices please take a mid point.

		Preferred unit	Alternative unit	Unit rate	Notes and comments
	<b>Residential buildings</b>				
1	Single storey average quality detached house masonry (brick or block) or timber frame	m 2 floor area			
2	Two storey attached house, mass market, centre unit in terrace/row of four units, otherwise as above	m 2 floor area			
3	Low rise apartment, mass market, concrete frame, brick or block infill, walk-up	m 2 floor area			
4	High rise apartment, average quality, concrete frame, brick or block infill	m 2 floor area			
	<b>Non-residential buildings</b>				
5	High rise office/ administrative building, ±20 storey, medium quality, air conditioned, concrete frame	m 2 floor area			
6	Medium rise office/ administrative building, ±10 storey, medium quality, air conditioned, concrete frame	m 2 floor area			
7	Primary school one or two storey, approx. 12 classrooms	m 2 floor area			
8	Factory/ warehouse building, single storey, steel frame and coated steel cladding and roofing	m 2 floor area			
	<b>Civil engineering work</b>				
9	Highway (not motorway) with tarmac surface on level good ground	m2			
10	Length of concrete sewer pipes, 0.5m diameter, average 2 m depth	m length			
11	Length of concrete sewer pipes, 1m diameter, average 3 m depth	m length			

12 In the space below please provide notes on measurement of floor area, for example: is floor area measured over or within external walls; does it include or exclude voids such as service ducts, stair voids and lift shafts; does it include the plan area of internal walls? In the case of shared apartment buildings, is the area of common parts – stairs, lifts, storage, corridors, etc. outside individual apartments – included; is the area of balconies included, in whole or in part; is the area of attached or underground parking included? Please also note any other special features of either methods of measurement or pricing.


Reported prices should not include costs relating to external works. External works are construction works often included in contracts, but outside the external walls of the building concerned. They will include things like boundary walls, footpaths, landscaping, car parking and utilities outside the building. They are excluded because they are site dependant and extremely variable in scope.

Item 3 “Low rise apartment”: Low rise apartment refers to a residential building with approximately 5 floors. If exact match is not found, the closest projects to a 5 floor apartment should be priced.

Item 4 “High rise apartment”: High rise apartment refers to a residential building with approximately 20 floors. If exact match is not found, the closest projects to a 20 floor apartment should be priced.

Item 9 “Highway”: Highway projects to be priced should be for major inter-city roads.

## 7. Support Worksheet

### Supporting Information

#### The mix of construction resources

What proportion of overall construction project value is taken by the main inputs to construction work (materials and products, labour and equipment) in the following types of projects? Other inputs – general site costs, head office overheads, profit, etc – should be spread across the main inputs. Please indicate approximate percentage values.

		Residential buildings	Non-residential buildings	Civil engineering works
1	Construction materials and products			
2	Construction equipment			
3	Construction site labour			
	Total project value	100%	100%	100%

#### Contractors' mark-ups

What percentages should typically be added to contractors' input costs to arrive at contractors' bid prices or construction purchaser prices? Please indicate approximate percentage values

	Cost headings	Residential buildings	Non-residential buildings	Civil engineering works
1	Total mark-up of which:			
2	General site costs and temporary works			
3	Head office overheads			
4	Profit			
5	Other contractors costs (please specify)			

#### Professional fees

What percentage additions should be allowed for both pre and post-contract services on different types of work? Professional fees will typically comprise pre- and post-contract services, including architectural and engineering design, technical supervision, project management and other specialist services, but national rules and practices must be taken into account. Please enter the total amount as a percentage of the contractor's cost (which will include the contractor's mark-up described above). The intention is to arrive at the end-user or purchaser price for construction work.

	Cost headings	Residential buildings	Non-residential buildings	Civil engineering works
1	Overall percentage addition for professional services			

2 Any other notes or comments?

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