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# Summary of Methods used to compile Construction Output Statistics in Northern Ireland

## Introduction

The Quarterly Construction Enquiry (QCE) collects information from Northern Ireland businesses in the construction industry. The survey's results provide measures of quarterly changes in the volume of construction output and estimates of the value of output for the construction sector in the Northern Ireland economy. The results are used by National Accounts in the calculation of the output measure of UK Gross Domestic Product, and also by the Northern Ireland Composite Economic Index (NICEI).

Indices are produced for the following construction categories:

- Overall Index of Construction
- Index of New Work
- Index of Repair and Maintenance
- Index of Housing
- Index of Infrastructure
- Index of Other Work

In addition, the value of construction output by sector at current prices and constant price seasonally adjusted is also produced.

## Statutory Requirement

The survey is statutory under the provisions of Article 5 of the Statistics of Trade and Employment (Northern Ireland) Order 1988.

## Coverage of the QCE

The QCE runs on a 13 week cycle. At the beginning of each quarter (in January, April, July and October), a sample of construction firms engaged in construction activity in Northern Ireland and public bodies which carry out their own construction work are asked to provide information on construction output during the previous quarter.

## Output

Construction Output is defined as the following:

- Cost of materials firm used
- Labour costs
- Overheads
- Profits
- Costs associated with demolition and site preparation
- Payments made to subcontractors

The following is not included as output:

- VAT charges
- Payments made to consultants or architects

In all returns, work done by sub-contractors is excluded to avoid double-counting since sub-contractors are also sampled.

This definition of output and treatment of sub-contract work is consistent with the definition used by the Office for National Statistics (ONS) in their Monthly Business Survey for Construction.

Firms are asked to provide construction output broken down by the following subcategories:

New Construction Work (for which firm is directly employed by client i.e. main contractor)

- All construction work on new housing and non-housing structures and roads
- Improvements, alterations, extensions to non-housing structures and roads
- Demolition and site preparation

Repair and Maintenance Construction Work (main contractor only)

- Any repairs, maintenance, improvements, house/flat conversions, extensions, alterations and redecoration etc. to existing housing
- Any repairs, maintenance or redecoration on existing non-housing buildings or structures

## Sample

The sampling frame used to select the sample for the Northern Ireland Quarterly Construction Enquiry is the Inter-Departmental Business Register (IDBR).

The IDBR is a business register which contains information on all businesses in the UK which are VAT registered or operating a PAYE scheme. The register is located in the Office for National Statistics (ONS) Newport, but the NI element of the register is maintained within the Economic and Labour Market Statistics (ELMS) branch of the Northern Ireland Statistics and Research Agency (NISRA), DoF. The IDBR is the sampling frame used for the vast majority of Government statistical surveys to businesses. The IDBR covers most of the economy including the Agriculture, Construction, Production and Service sectors in Northern Ireland. It does not, however, include very small businesses which fall below the VAT and PAYE thresholds. The facts and figures are drawn together from two main sources: the IDBR and the Department for Business Enterprise and Regulatory Reform- Enterprise Directorate. IDBR figures inevitably include some enterprises reported as active that were actually de-registered for VAT purposes, or may have closed at the time results were extracted. Similarly, the IDBR will exclude some new start-ups because of delays in notification.

The main data held for each business are: name; address; standard industrial classification (SIC(2007)); number of employees; employment and turnover (updated either from annual returns to HM Customs and Excise or from inquiry information).

SIC 2007 is an international classification system that categorises businesses by the type of economic activity in which they are engaged. SIC (2007) Divisions 41-43 of the IDBR relate to Construction activities. This includes general construction and specialised construction activities for buildings and civil engineering works.

The Northern Ireland element of the IDBR contains around 10,000 construction firms classified under Divisions 41-43. All of these construction firms are eligible for inclusion in the Northern Ireland Quarterly Construction Enquiry with the exclusion of Division 41.1 (Property Developers). This is consistent with ONS methodology in their Monthly Business Survey for Construction. The Office for National Statistics (ONS) has determined that since construction activity is virtually all sub-contracted by firms assigned to Division 41.1 (Property Developers) no construction output would be recorded by these businesses.

From a sampling universe of approximately 10,000 firms, a disproportionate sample of 700 construction firms is randomly selected to take part in the NI QCE. The sample is disproportionately stratified (into six strata) using IDBR turnover as the stratification variable. This type of design ensures greater sampling efficiency and accuracy, particularly where there is extreme variability across the population (such variability is lessened within individual strata). The sample design also reduces the burden on small firms.

Previously, number of employees was used as the stratification variable in line with other business surveys. However, it was found, that there could be extreme variability in construction output reported by firms of similar sizes. As turnover is more likely to move in parallel with output, it was decided that using turnover as the stratification variable would result in more homogeneity in terms of construction output within strata.

As variability and turnover is very high within strata 5 and 6, a census of all these firms is taken in the QCE. This census element accounts for approximately three fifths of total construction turnover based on IDBR.

The remaining sample members are selected using the Neyman formula to maximise the precision of the sampled element of the survey and to minimise sampling error.

Of the remaining sample members, variability (of turnover) is least in stratum 1 and greatest in stratum 4. Consequently, a higher disproportionate sample is taken within strata groups as the turnover bands increase (see Table 1).

Table 1: 2018 Sample for the Quarterly Construction Enquiry

Stratum	IDBR Turnover £'000	IDBR Population (Divisions 41-43 excluding 41.1 (Property Developers))	Actual Sample
1	0-124	4,774	90
2	125-549	2,955	170
3	550-2,099	995	180
4	2,100-5,249	257	120
5	5,250-10,499	79	79
6	10,500+	94	94
<b>Total</b>		9,154	733

Once selected, firms are included in the survey on an ongoing basis. The sample is partially refreshed every 12 months to take account of firms going out of business, persistent non-response and movements of firms through the strata groups. Stratum 1 firms are totally refreshed every 12 months to minimise the burden on them.

Public sector organisations with Direct Labour Operatives (DLOs) are also included within the scope of the survey. This includes DfI Roads, NIHE and the local district councils. Whilst strictly not DLOs, the Ministry of Defence, the Police Service for Northern Ireland and the Northern Ireland Prison Service are included as DLOs and asked to provide information on construction work they have contracted out each quarter. To ensure that double-counting does not occur, construction firms are not asked to reveal details of projects which are of a security nature.

## Collection Design

The QCE uses both a paper-based questionnaire and a questionnaire sent by eform. As a last resort, firms may supply the information over the telephone.

The questionnaire is divided into five parts:

1. Employment Information
2. Value of Work carried out in Northern Ireland
3. Value of Work outside Northern Ireland
4. Comments or additional informal
5. Contact Information

Employment information is then divided into 5 categories:

- a. Full-time Males
- b. Part-time Males
- c. Full-time Females
- d. Part-time Females
- e. Total Employees

Value of Work carried out in Northern Ireland is divided into 2 categories:

- a. New construction Work
- b. Repair and Maintenance Construction Work

Where the above 2 categories are divided into 6 sub-categories:

- i. Housing – Public Sector Clients
- ii. Housing – Private Sector Clients
- iii. Infrastructure – Public Sector Clients
- iv. Infrastructure – Private Sector Clients
- v. Other Work – Public Sector Clients
- vi. Other Work – Private Sector Clients

Value of Work outside Northern Ireland is divided into 4 categories:

- a. Great Britain (England, Scotland and Wales) – **All** construction work carried out for Public Sector Clients
- b. Great Britain (England, Scotland and Wales) – **All** construction work carried out for Private Sector Clients
- c. Republic of Ireland – **All** construction work
- d. Rest of the World (all other countries) – **All** construction work

Construction firms are asked only to provide information for projects for which their firm is employed directly by a client as a main contractor. This is specifically designed to prevent any possible double-counting involving sub-contract work.

## Database and Preparation of Results

The information received from each firm is subject to rigorous input and output validation checks (each inputted figure is cross checked by another member of the QCE Team). The responses of firms in each strata are checked for internal consistency and quarter-on-quarter comparisons are carried out. Disparities are investigated with firms to ensure consistent returns.

Separate current price totals are produced for:

- New Construction Work
- Repair and Maintenance Construction Work
- All Work

These are further sub-divided into the following categories:

- Private Housing
- Public Housing
- Private Infrastructure
- Public Infrastructure
- Private Other
- Public Other

## Disclosure

Statistical disclosure control methodology is applied to output data. This ensures that information attributable to an individual firm is not identified in any published outputs. The Code of Practice for Official Statistics, and specifically the Principle on Confidentiality, set out practices for how data should be protected from being disclosed.

## Grossing

To compensate for non-response and the fact that not all firms in the construction industry are sampled, the returns for each stratum are extrapolated (“grossed up”) via the application of the following formula to provide estimates for the overall value of output figures for each stratum:

$$\text{Aggregate value of output in returns} \times \left( \frac{\text{Number of firms in population}}{\text{Number of returns}} \right)$$

As all public sector bodies with DLOs are sampled, these returns are not grossed.

## Deflators

Deflators (or Output Price Indices) are used to convert value figures at current prices to a base year price so that relative trends in a time series can be observed.

Presently, the Northern Ireland Construction Output Statistics are converted to a 2018 base year. NISRA receives Output Price Indices (OPIs) from ONS on a quarterly basis for each of the construction sectors specified below. These OPIs are at the UK level as regional OPIs are not available.

ONS receives a deflator for each of the sectors published from the Building Cost Information Service (BCIS) on a quarterly basis. The supplied deflators are Tender Price Indices.

These are converted to OPIs by ONS by applying weights to the received quarterly sector TPIs. Deflators are applied to the following sectors:

### **New Construction Work:**

- Housing Public
- Housing Private
- Infrastructure Public
- Infrastructure Private
- Other Work Public
- Other Work Private

### **Repair and Maintenance Construction Work:**

- Housing Public
- Housing Private
- Infrastructure Public
- Infrastructure Private
- Other Work Public
- Other Work Private

## Seasonal Adjustment

Data collected over time form a time series. Those analysing time series typically seek to establish the general pattern of the data, the long term movements, and whether any unusual occurrences have had a major effects on the series. This type of analysis is not straight forward when one is reliant on raw time series data, because there will normally be short term effects, associated with that time of year, which obscure or confound other movements. The purpose of seasonal adjustment is to remove systematic calendar related variation associated with that time of year, i.e. seasonal effects. This facilitates comparisons between consecutive time periods.

Seasonal adjustment is a statistical method used for removing the seasonal component of a time series. Seasonal factors are used to seasonally adjust Northern Ireland Construction Output Statistics where a seasonal variation has been found to exist. The constant (2018) price output values for each of the sectors reported on are seasonally adjusted using a seasonal adjustment software tool called X13-ARIMA.

The X13 ARIMA method, developed by Statistics Canada in 1980, uses Box Jenkins AutoRegressive Integrated Moving Average (ARIMA) models to extend a time series and is used extensively in statistical surveys. The program splits the series into a trend, seasonal, and irregular components. If the series is modelled additively, summing the three parts gives the unadjusted data. If it is modelled multiplicatively, the raw data is the product of the three components. The seasonal component cannot be found without knowing the trend component, yet the trend component cannot be found without knowing the seasonal component. Thus the programs perform a series of iterations, obtaining a better estimate for the trend and seasonality with each one.

The program fits an autoregressive integrated moving average model to the data, using forecasts for one year to improve the estimation of the seasonal factors at each end of the series.

Some construction categories were not found to be a candidate for seasonal adjustment.

**Seasonal adjustment** is applied to the following:

- All Work
- All New Work
- All Repair and Maintenance
- Index of Housing
- New Housing Private
- Other New Work Private Commercial
- Other New Work Private Industrial
- Repair and Maintenance Housing Private
- Repair and Maintenance Other Work Public
- Repair and Maintenance Other Work Roads (Infrastructure)
- Repair and Maintenance Housing Public

Seasonal adjustment is run each quarter on the accumulated data which makes up the time series. Seasonal adjustment takes into account the revisions made to past quarters.

## Production of Indices

An index number is a convenient form of expressing a series in a way that makes it easier to see changes in that series. The numbers in the series are expressed relatively with one number in that series chosen to be the 'base' (usually expressed as 100) and other numbers being measured relative to that base. For example, a value of 102.4 means that the level of output is 2.4% higher than the base year=100.

Indices are created by dividing the current quarter (constant price seasonally adjusted) value of construction output by the average of the base year (2018) and multiplying by 100.