

Updated June 2024

Quarterly Construction Enquiry Background, Quality and Methodology Report

Methodology Background

National Statistic	Designated as a National Statistic in March 2012	
What it measures	Measures of growth for construction output	
Frequency	Quarterly	
Geographic coverage	Northern Ireland	
Sample size	Approx 750 businesses	
Period available	Quarter 1 2000 to Quarter 1 2024	
Sample frame	Inter Departmental Business Register	
Sample design	Sample population is stratified by turnover with businesses with an annual turnover exceeding £5.25 million always being selected	
Weighting	Returns are weighted by one. Grossing factors which are computed for each stratum derived by dividing the total number of firms in each stratum population by the number of firms that returned for that stratum.	
Imputation	Imputation carried out for non-responders with an annual income exceeding £5.25 million.	
Outliers	No outlier treatment; all validated values are used in estimates	
Last revised	27 June 2024	

Contents

1	<u>Overview</u>	3
2	<u>Sampling</u>	4
3	<u>Questionnaire</u>	7
4	<u>Data Capture and Validation</u>	8
5	<u>Accuracy</u>	9
6	<u>Imputation</u>	12
7	<u>Grossing/Estimation</u>	12
8	<u>Deflation and Seasonal Adjustment</u>	13
9	<u>Uses and Users</u>	15
10	<u>Publications and Dissemination</u>	16
11	<u>Revisions</u>	17
12	<u>Impact of COVID-19 on data collection and estimates</u>	18
13	<u>Further Information</u>	19

1 Overview

This background, quality and methodology report relates to the Northern Ireland Quarterly Construction Enquiry (QCE), conducted by the Northern Ireland Statistics and Research Agency (NISRA), Department of Finance. The QCE is a statutory survey of construction firms operating in Northern Ireland collected under the [Statistics of Trade and Employment \(Northern Ireland\) Order 1988](#). The quarter-on-quarter change provides the most recent measure of how construction output is changing. Comparisons are also provided with the same quarter one year earlier where possible.

Each calendar quarter, (Quarter 1 January to March, Quarter 2 April to June, Quarter 3 July to September and Quarter 4 October to December) a sample of approximately 750 construction firms are asked to provide details of the value of construction activity they have undertaken in the specified period. The survey also covers public sector organisations which carry out their own construction activity.

The survey measures construction output carried out only in Northern Ireland.

QCE results are released in March, June, September and December (alternatively January) of each year via a statistical bulletin and a suite of tables which can be accessed via the [QCE website](#).

2 Sampling

2.1 Sample Design

The sample of construction firms for the QCE is selected from the Northern Ireland extract of the Inter-Departmental Business Register (IDBR). The IDBR includes all businesses registered for VAT and employers with employees in PAYE schemes. 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 sample for the QCE covers Sections 41-43 (Construction) of the [Standard Industrial Classification](#) 2007 on the IDBR. This accounts for around 10,000 construction firms, all of which are eligible for inclusion in the QCE with the exception of 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.

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 6. Consequently, a higher disproportionate sample is taken within strata groups as the turnover bands increase (see Table 1).

Table 1: 2023 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	4,906	84
2	125-549	3,534	179
3	550-2,099	1,164	179
4	2,100-5,249	290	115
5	5,250-10,499	111	109
6	10,500+	130	130
Total		10,135	787

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.

2.2 Sample Methodology

The QCE sample is selected using a Neyman Allocation which is an optimal form of allocation where the sample is allocated to achieve the smallest possible standard error of estimate of the population mean for a given size of sample, i.e. the highest precision of the estimate. This methodology ensures that consideration is given to the variability of the observations within the strata as well as the number of cases in the strata. This is important since strata with relatively large variation in the observations require a larger sample size to obtain a good estimate than do strata with less variability. The Neyman Allocation also has accuracy inbuilt.

Neyman Allocation selection Formulae:

$$n = \frac{(\sum_{i=1}^L N_i \sigma_i)^2}{\left(\frac{B^2}{4} + \sum_{i=1}^L N_i \sigma_i\right)}$$

Where n_i = the number of sampling units allocated in each stratum

$$n_i = n \left(\frac{N_i \sigma_i}{\sum_{i=1}^L N_i \sigma_i} \right)$$

Where:

L=Number of strata

N_i = Number of units in the population Stratum i

N = Number of units in the population

n_i = number of sampling units in stratum i

n = number of sampling units

σ_i = population Standard deviation stratum i

B = Bound error in terms of % of total

QCE carried out the Neyman procedure and the number of businesses per cell was then forwarded to ONS for them to carry out the selection procedure and return to us the selection files as detailed below in the sample set-up section.

3 Questionnaire

Construction output data is collected through the Quarterly Business Survey (QBS) which also collects turnover and employee jobs data. The questionnaires are available in both electronic and paper form. Samples of the QCE form can be found [here](#).

The questionnaire is divided into five parts:

Questionnaire section	Information collected
1. Employment Information	<p>Employment information is divided into 5 categories:</p> <ul style="list-style-type: none"> a. Full-time Males b. Part-time Males c. Full-time Females d. Part-time Females e. Total Employees
2. Value of Work carried out in Northern Ireland	<p>This section is divided into 2 categories:</p> <ul style="list-style-type: none"> a. New Construction Work b. Repair and Maintenance Construction Work <p>Where the above 2 categories are divided into 6 sub-categories:</p> <ul style="list-style-type: none"> 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
3. Value of Work outside Northern Ireland	<p>This section is divided into 4 categories:</p> <ul style="list-style-type: none"> 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
4. Comments or additional informal	Space for respondents to comment on significant changes in construction output or business activity
5. Contact Information	Space for respondents to update changes to contact details

4 Data Capture and Validation

4.1 Data Capture

Data are collected through the Quarterly Business Survey (QBS) which collects employee, turnover and construction output data. See [Section 3](#) for further information on the questionnaire.

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.

Businesses are asked to provide value of construction output over the specified quarter approximately 4 weeks after the end of that quarter. Forms are sent by post or despatched by e-form and contributors are asked to complete form within 2 weeks of receipt. Non-responders receive a written reminder at the beginning of week three. At the end of week four non-responders with a valid email address receive an email reminder. Finally, during weeks 4-8 all those who have still not responded are contacted by telephone to obtain employment data. The speed with which forms are returned can be affected by holiday periods but where possible QBS forms are addressed to named contacts to ensure as high a response rate as possible.

For all data collected, best estimates are accepted where precise figures are not available. The final response rate to the QCE is typically around 60% of all businesses selected for the survey. Data are received by post or eForm and scanned or uploaded into a database via the data preparation team at a third party contractor, ITS Ltd.

4.2 Data Validation

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 QBS team). The responses of firms in each stratum are checked for internal consistency and quarter-on-quarter comparisons are carried out. Disparities are investigated with firms to ensure consistent returns. See Respondent error in [Section 5](#) for more details on data validation.

Further validation of the QCE returns is carried out by cross checking against other survey and administrative sources, such as PAYE information from the IDBR, to ensure their accuracy.

5 Accuracy

The provision of accurate, timely data which meets the needs of users at minimal cost is at the heart of government statistics. There are two components to accuracy: sampling errors which occur when data from a sample are used to make inferences about the whole population and 'non-sampling errors' which affect data from sample surveys, as well as administrative and census data.

5.1 Non-Sampling Errors

Non-sampling errors should not be viewed as mistakes, rather they are the result of conscious decisions to produce timely, accurate data at minimum cost. Measuring non-sampling error is much more difficult than measuring sampling error because in many cases the reasons for the non-sampling error are not known, whereas sampling error is a direct result of the survey design and is under the control of the researcher. In some cases, it may not be possible to measure non-sampling error or to only give an indication of its possible effect on the survey estimates.

This section examines how accuracy of survey estimates can be measured and describes the different types of non-sampling error and their occurrence in the QCE.

Types of non-sampling error

Non-sampling errors - bias and variance - can be classified as follows:

Coverage error - the error which arises because some units are either excluded or duplicated on the sampling frame used to identify the population of interest. Coverage error arises because not all construction firms in scope for this survey are contained on the IDBR.

Firms not listed on the NI extract of the IDBR (for example, Great Britain/Republic of Ireland firms) who carry out construction work in Northern Ireland cannot be sampled and therefore the QCE does not capture the construction activity of these firms.

Non-response error – non-response can reduce the precision of survey estimates. Strategies for minimising non-response to the QCE include issuing email and paper reminders; telephone response chasing which is prioritised to target strata where coverage has not reached a specified target response rate; and capturing data returns over the telephone. In the QCE, imputation is used to estimate non-response for business with an annual IDBR turnover greater than £5,250,000 (see [section 6](#) for further information on imputation).

Respondent error – respondent error arises when a respondent returns an incorrect value. Various validation checks are also carried out by the QCE team to identify results that are extremely implausible but not impossible. This will take the form of validation against previous returns to identify any unusual increases and decreases. Contributors whose quarterly returns show an increase or decrease above a certain threshold are contacted and asked for an explanation (if they have not already provided one on their original returned QCE form) to ensure that the construction return is correct. Where a return does not make it through the “validation gate” and no explanation is forthcoming, these returns will be imputed for strata 5 & 6 until an explanation or corrected figure is provided by the business.

Questionnaire error – this error reflects the effect of question wording and form design on responses. Questionnaire error is minimised in QCE by including detailed completion notes and definitions on the questionnaire. Careful question and eform operation testing are also carried out in an attempt to minimise this error. A dedicated helpline is available to answer any questions or address any submission difficulties respondents may have.

Mode error – this describes the effect of different methods of administering a questionnaire on the recorded responses. Responses to the QCE are collected via paper and eform and whilst the variables on both forms are the same, the two modes have a slightly different format. Also, as the survey approaches the close date, figures are also accepted over the phone. It is recognised that these changes can affect the recorded responses.

Data capture error - Information recorded on a paper questionnaire may be inaccurately converted to a format which can be interpreted by a computer. QBS paper questionnaires are scanned into the computer system by a third party, ITS Ltd, and under the terms of the contract scanning errors must be below 2%, so errors of this type are minimal. Where errors are made, they are often identified and corrected (where appropriate) during the validation process. Also, over two thirds of businesses complete the QCE via eform, with the figures entered on the eform being uploaded straight to the system.

Processing errors - There is a risk that data may be entered incorrectly into the system. Processing errors are minimised through comprehensive input and output validation checks (each inputted figure is cross checked by another member of the QCE Team). The responses of firms in each stratum are checked for internal consistency and quarter-on-quarter comparisons are carried out. Disparities are investigated with firms to ensure consistent returns.

Measurement error - error that occurs from failing to collect true data values from firms. The definition of construction output is complex and it is possible that measurement errors result from firms returning turnover data or another measure of activity which better matches their accounting processes. To assist firms, the definition of output is provided in each part of the survey form. The responses of firms in each stratum are checked for internal consistency and quarter-on-quarter comparisons are carried out. Disparities are investigated with firms to ensure consistent returns. Firms are only required to make a return in construction categories that they carried out work in (for example, New Work Housing Private,

Repair & Maintenance Housing Private). It is assumed, therefore, that there is little or negligible item non-response in returned forms.

5.2 Sampling Errors

Sampling errors are due to only using a sample and not the entire population, therefore estimates from samples may not equal the unknown population value. The larger the sample, the smaller the sampling error.

Construction output estimates derived from the QCE are subject to sampling error. This occurs because the estimates are based on a sample rather than a census of all construction firms. Sampling error is minimised on the QCE through the use of a scientifically chosen sample (see [section 2.1](#)).

6 Imputation

Imputation is defined as a procedure for entering a value for a specific data item where the response is missing or unusable. This could be because it is missing due to non-response or unusable due to errors or inconsistent responses. Simplistically, imputation can improve the accuracy of the estimates by reducing non-response bias.

Imputed values for the QCE are calculated based on the contributor's previous returns and are applied to construction firms in the census strata only. Imputes are also applied to non-responding Public Bodies with Direct Labour Operatives engaged in construction activity. In both cases a median change value is calculated and applied to the most recent return.

7 Grossing/Estimation

Estimation is the process of approximating some characteristic of a population (e.g. total construction output for businesses with an annual IDBR output of under £124,000) when information on that characteristic is only available for a sample of the population. The QCE samples around 750 of all the VAT and/or PAYE registered businesses on the IDBR and uses "ratio estimation" methodology to calculate total construction estimates by annual IDBR turnover. Ratio estimation improves the weighting from sample values to population estimates by using known totals from auxiliary data; for QCE the auxiliary data are annual turnover data from the IDBR.

The IDBR holds information about every unit in the population, for example annual turnover for every VAT and/or PAYE registered businesses. If we can assume some kind of relationship between this information and the characteristic which we are trying to estimate, then we can incorporate the auxiliary data into our estimate. For instance the auxiliary variable displays the relationship between the sample and population employees at the time of sample selection. This is used to calculate a "grossing factor" which can be applied to the returned sample value for the current quarter.

QCE 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.

8 Deflation and Seasonal Adjustment

8.1 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 2019 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:	<ul style="list-style-type: none">• Housing Public• Housing Private• Infrastructure Public• Infrastructure Private• Other Work Public• Other Work Private
Repair and Maintenance Construction Work:	<ul style="list-style-type: none">• Housing Public• Housing Private• Infrastructure Public• Infrastructure Private• Other Work Public• Other Work Private

8.2 Seasonal Adjustment

Data that are 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 major effects on the series. This type of analysis is not straightforward when one is reliant on raw time series data, because there will normally be short-term effects, associated with the time of the year, which obscure or confound other movements. For example, retail sales rise each December due to Christmas. The purpose of seasonal adjustment is to remove systematic calendar related variation associated with the time of the year, i.e. seasonal effects. This facilitates comparisons between consecutive time periods.

Seasonal factors are used to seasonally adjust Northern Ireland Construction Output Statistics where a seasonal variation has been found to exist. The constant (2019) 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.

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. Figures for those output series which are not seasonal are now presented in chained volume measure (2019) prices only.

An analysis and breakdown of which QCE series are seasonally adjusted is contained within the [Seasonal Adjustment Review](#) paper. The latest review was carried out in July 2023; however, the models are usually reviewed on an annual basis.

9 Uses and Users

There is a wide range of users of QCE data both within and outside of government:

- The Office for National Statistics (ONS)
- The Department for the Economy (DfE) – in policy formulation and in response to external information requests. QCE data also feed into the [DfE Economic Commentary](#), which provides an overview of the condition of the NI economy.
- The Department of Finance (DoF) – in the calculation of the [Northern Ireland Composite Economic Index](#) (NICEI) which is an indication of the performance of the NI economy.
- Private consultancy firms
- Universities and academics
- Members of the general public
- Media outlets

Reports from the most recent user engagement session for Construction Output Statistics can be found on our [website](#). Additionally, results from the recent NISRA outputs consultation, which includes proposed changes to the QCE statistical bulletin can be found on our [consultation page](#).

10 Publications and Dissemination

10.1 Publication

QCE results are published quarterly (January, March, June, and September) via a statistical bulletin and range of tables. Publication dates are notified at least twelve months in advance via the [gov.uk release calendar](#). If there are any changes to the pre-announced release schedule, public attention is drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the [Code of Practice for Statistics](#). The latest publication schedule can be found on our [website](#).

10.2 Dissemination

Availability of electronic data

The following QCE data tables are available to download from the QCE [webpage](#), via Excel or ODS format:

- NI Construction tables, containing:
 - list of methodological updates
 - output represented by chained volume measure (based to 2019), seasonally adjusted index numbers by main sectors;
 - output represented by chained volume measure (based to 2019), seasonally adjusted index numbers by main sectors;
 - value of output by sector, chained volume measure;
 - value of output by stratum of firm, private contractors only; and
 - value of New Work output by type of work.
- Revisions Triangle – latest quarter

NISRA Data Portal

The NISRA Data Portal hosts a range of information and [QCE construction output estimates](#) by sector are available to access and download.

Ad-hoc data requests

Bespoke data tables can be produced if users request data that are not already available. Data requests can be made by contacting economicstats@nisra.gov.uk.

11 Revisions

Users require data that are timely and can be accessed as close to the event which the data measures as possible, and data of good quality, where the picture painted of that event is most accurate. A policy of accepting revisions enables statisticians to provide users with data close to the event, but also improve the accuracy of that data as other information becomes available. Revisions are therefore a standard practice when producing official statistics.

11.1 Revisions

QCE data relating to the previous four quarters are provisional and subject to change. These revisions occur primary in light of late responses to surveys as well as revised or incorrect estimates from firms.

The series is also revised due to revisions to deflators and seasonal adjustment factors which are both re-estimated every quarter. Further information on the seasonal adjustment process can be found in [section 8](#).

11.2 Revisions Triangle

QCE produces a [Revisions Triangle](#) – this is a summary table which indicates the size and direction of revisions. The table presents a summary of the differences between the first estimates published and those published 3 years later for the same reference period. It is intended to help users understand the extent to which estimates are revised over time.

Our [revisions policy](#) is also published online for users to consult.

12 Impact of COVID-19 on data collection and estimates

Due to restrictions in place for businesses, COVID-19 impacted on the data collection and validation of construction data, which are collected by the Quarterly Business Survey. The following table provides an overview of median coverage response rates for 2020, 2021 and 2022.

Response rate type	2022 (median*)	2021 (median*)	2020 (median*)
Coverage response rate (<i>returned turnover</i>)	62%	51%	45%

*median value achieved at QCE database closure of quarter 1, quarter 2, quarter 3 and quarter 4.

As a result of reduced coverage rates, construction output estimates may be subject to higher revisions than normal during the impacted quarters. These can be tracked through the [revisions triangle](#) which are published alongside the QCE publication.

13 Further Information

Further details about the methodology employed in the Quarterly Construction Enquiry can be obtained by contacting:

Northern Ireland Statistics & Research Agency
Economic & Labour Market Statistics Branch
Colby House
Stranmillis Court
Belfast
BT9 5RR

Telephone: 0300 200 7832

Email: economicstats@nisra.gov.uk

Website: [Quarterly Employment Survey](#)

X: [@NISRA](#)