

## Introduction

### General

An Inflation Report and Inflation Bulletin (summary version containing specific and relevant information) has been prepared by ChandlerKBS and is updated periodically. These documents provide price change forecasts for

- Tender Prices
- Land and Property Capital Values

This document provides guidance on how to use the data set out in the Inflation Bulletin, specifically in relation to how to establish inflationary values and when to use single point inflation estimating (producing a single value) or when to use a range (an upper and lower value for inflation). This guidance has been supplemented with worked examples.

Inflation represents one component of projects costs that are to be assessed in the preparation of robust cost estimates and this User Guide, the Inflation Bulletin and Inflation Report are intended to supplement and support this assessment. Where the NTA are an Approving Authority, Sponsoring Agencies remain obligated to comply with the Project Approval Guidelines and Cost Management Guidelines. These documents provide detailed guidance on how to develop robust project cost estimates.

### What is Tender Price Inflation

Tender Price Inflation represents the changes in prices in which Contractors offer to carry out the works. It takes account of risks that have been transferred to the Contractor, market conditions current at that time and the market's general approach to Profit Margins. For Tender Price Inflation, ChandlerKBS has analysed data to produce forecasts for highways (rural and urban), civil engineering and rail type projects.

### What is Land and Property Price Inflation

Land and Property Price Inflation represents the changes in the market value of purchasing different land types. Unfortunately, the data availability in Ireland is quite limited to provide forecast land value changes. ChandlerKBS engaged the professional services of Avison Young to provide Land and Property Price Forecasts. Avison Young has used the Capital Values of property to forecast price changes, as this represents a reasonable proxy against which land value changes can be measured. However, prior to relying on this information, individuals are expected to familiarise themselves with the Avison Young report contained within the Inflation Report.

### Which Index To Use

Guidance on which index (Cost Price or Tender Price Index) to use when assessing construction price inflation is set out in the Inflation Report. However, as an organisation, the NTA has a preference of using the Tender Price Index.

### The Project Types

Within this Inflation Bulletin, ChandlerKBS has prepared indices for different 'Project Types'. A high-level definition of each of these Project Types has been identified below in Table 1 for reference purposes:

Project Type	Description
General	A catch-all description that is intended to represent infrastructure construction 'generally'.
Highways (Rural)	A project that involves traditional highway construction works (e.g. earthworks, drainage, pavement works etc) and may incorporate some aspects of sustainable and active travel within a rural environment (i.e outside of towns and cities).
Highways (Urban)	A project that involves traditional highway construction works (e.g. earthworks, drainage, pavement works etc) and is likely to incorporate or a significant aspect of which may relate to sustainable and active travel within an urban environment (i.e within towns and cities).
Civil Engineering	Projects that are based primarily on civil engineering designs and plans, including bridges, utilities, water and waste water projects, drainage projects etc but excluding highways and rail projects.
Rail	Projects that involve the construction or alterations to railway lines. Rail projects that are primarily building or Signalling and Track works should not be considered as part of this Project Type.

Table 1: Descriptions of Different Project Types

## Application of Inflation Forecasts

### Step-By-Step Approach

To assess the allowances that are to be made for future price changes, the following steps are essential:

1. Determine the appropriate assessment methodology. There are various methods of assessing inflation. This may include, but is not limited to:
  - Inflation to mid-point of construction.
  - Inflation progressively assessed throughout construction using expenditure profiles that have been generated using S-Curve analysis techniques (or other techniques).
  - Inflation progressively assessed using expenditure profiles that have been generated using cost loaded programmes.

The above assessment methodologies are listed from least to most robust. Users should use the more robust methods as projects progress through the project life cycle, for projects that are of a greater scale and complexity or are being delivered over a longer duration.

2. Establish the value that is to be inflated (the Base Date value) and when it is to be inflated to (the Forecast Date). Depending on the methodology adopted, there may be multiple values that are to be inflated from the Base Date to the Forecast Date.
3. Identify the Index Value (refer to Inflation Bulletin) at the Base Date and at the respective Forecast Date(s).
4. Using the formula below, establish the Adjustment Percentage(s) for each of the values that require inflating.

$$\frac{(\text{Index Value at Forecast Date} - \text{Index Value at Base Date})}{\text{Index Value at Base Date}} \times 100 = \text{Adjustment Percentage}$$

5. Apply the Adjustment Percentage(s) to the Value(s) established at Step 2 to establish the inflation value. If multiple values have been inflated, the user will be required to combine all the inflation values in order to establish the cumulative inflation value for the project.

### Refinement of Inflation Assessments (Possible Additional Step)

Within the Inflation Bulletin (and Report), inflation forecasts are presented in yearly increments. This has the potential to create two issues if not addressed:

- Where a Forecast Date (the date costs are being inflated to) is part the way through a calendar year, applying the entire inflation forecast for that year is likely to result in an over estimation of the inflationary cost. This issue is exacerbated the further the Forecast Date is from the end of the calendar year.
- During the construction period (this is not an issue for the period pre-construction) it would not be appropriate to apply the entire annual forecast price change to the spend for the entire year. This is because inflation will occur progressively throughout the year.

In order to prevent or mitigate the impact of the above, the following is recommended:

- Preferably, inflation is assessed at shorter intervals (e.g. monthly or quarterly) with the annual price change factored to account for the shorter intervals.
- Where construction spend spans an entire calendar year, the total annual inflation value is factored by a percentage to establish the inflation value that should be included in the cost estimate (e.g. 60% of the annual inflation value).

### Worked Examples

Worked Examples identifying how to calculate inflation allowances as a monetary value are provided in this User Guide.

## **Inflation As a Range or Single Point Estimate**

### **Reporting Inflation as a Single Point Estimate**

It is normally suitable to calculate inflation as a Single Point Estimate where projects will be completed in the short to medium term (i.e within 2 years of the estimate being produced), the scope and nature of the project is relatively simple, or alternatively, where it is an Organisation's policy. The NTA's Cost Management Guidelines currently require the production of a single point estimate for inflation, however it has adopted the 'range approach' where considered appropriate (e.g. BusConnects).

When an Organisation report inflation as a single point estimate, we would suggest using the base inflation data for the relevant Project Type.

### **Reporting Inflation as a Range**

It may be appropriate to calculate inflation as a range for larger programmes of work (such as BusConnects) or where completion of the project is programmed several years after the base date of the estimate. Alternatively, it may be part of an Organisation's policy to report cost estimates in a range.

In instances where a range is being reported, it is our opinion that the estimator should use the lower and upper boundary of the inflation forecast from the relevant Project Type.

## Single Point Inflation Estimate (Worked Example)

In this section we have provided worked examples of how to prepare a single point estimate for inflation based on two different methods:

- Inflation to the mid-point of the project.
- Inflation based on expenditure profiles (project S-Curves).

In both scenarios we have used the base point identified in the indice ranges for the relevant Project Type to carryout our inflationary adjustments.

### The Project

The Project is a 2-kilometre-long upgrade of a carriageway being delivered in an urban area. The base cost estimate has been prepared at the end of 2022, construction is due to commence in early 2023 and completion is programmed to be achieved in mid-2025. The construction cost of the project at the base date is €15,250,000.

### Inflation to the Mid-Point

A five-step process has been identified in this User Guide. We have followed this process to identify the potential inflationary allowance for this project:

1. Inflation to the mid-point has been selected as the first method of assessing inflation.
2. The value to be inflated is the entire construction cost of €15,250,000.
3. The Index value at the base date (2022), using the Tender Price Index for Highways Urban in the NTA Bulletin, is 126.50. The Index Value at the forecast date (mid-point of construction – Q1 2024) is 146.30.

As the indice for the forecast date is part the way through a year, an arithmetical adjustment is required to establish the proportion that costs will have changed to that point in the year. In this case, Q1 2024 is 25% of the movement experienced in 2024.

4. The below formula has been used to establish the Adjustment Percentage:

$$\frac{(146.30 - 126.50)}{126.50} \times 100 = 15.65\%$$

5. After multiplying the Adjustment Percentage (15.65%) to the value to be inflated (€15,250,000), it results in an inflation value for this project of €2,386,625.

Using this methodology, the inflation allowance that has been established for this project is €2,386,625.

### Inflation using S-Curve Generated Expenditure Forecasts

S-Curve expenditure profiling is based on the general understanding that project expenditure will:

- Start fairly slowly for the first approximate 10 to 20% of the project duration.
- After this initial period, project expenditure is more extensive and is incurred at a reasonably consistent rate.
- This consistent rate continues up until the last 10 to 20% of the project duration, after which expenditure slows progressively until completion.

ChandlerKBS has developed an S-Curve Expenditure Profiling Tool. Using this tool for the project of the nature and duration described we have forecasted the following expenditure profile:

Period	Duration Complete (%)	Cumulative Expenditure (%)	Cumulative Expenditure (€)	Expenditure In the Period (€)
Q1 2023	10%	3.77%	€574,925	€574,925
Q2 2023	20%	9.58%	€1,460,950	€886,025
Q3 2023	30%	20.02%	€3,053,050	€1,592,100
Q4 2023	40%	33.50%	€5,108,750	€2,055,700
Q1 2024	50%	48.58%	€7,408,450	€2,299,700
Q2 2024	60%	65.37%	€9,968,925	€2,560,475
Q3 2024	70%	78.98%	€12,044,450	€2,075,525
Q4 2024	80%	90.83%	€13,851,575	€1,807,125
Q1 2025	90%	96.52%	€14,719,300	€867,725
Q2 2025	100%	100.00%	€15,250,000	€530,700

Table 2 - Expenditure Profile

The primary difference between an inflation assessment of this nature and the inflation assessment to the mid-point, is that the cost breakdown is significantly more detailed and therefore the inflation assessment is more thorough. The same 5 step process is followed, however this is carried out on the expenditure per Quarter.

When this type of assessment is being carried out, it can be advisable to use Microsoft Excel (or other available software) due to the number of separate calculations required. A summary of our inflation assessment for the example project has been provided in the Table 3 below:

Period	Expenditure in the Period (€)	Index at Base Date	Index at Forecast Date	Adjustment Percentage	Inflation (€)
Q1 2023	€574,925	126.50	130.87	3.45%	€19,835
Q2 2023	€886,025	126.50	135.23	6.90%	€61,136
Q3 2023	€1,592,100	126.50	139.60	10.36%	€164,942
Q4 2023	€2,055,700	126.50	143.96	13.80%	€283,687
Q1 2024	€2,299,700	126.50	146.30	15.65%	€359,903
Q2 2024	€2,560,475	126.50	148.64	17.50%	€448,083
Q3 2024	€2,075,525	126.50	150.98	19.35%	€401,614
Q4 2024	€1,807,125	126.50	153.32	21.20%	€383,111
Q1 2025	€867,725	126.50	154.89	22.44%	€194,717
Q2 2025	€530,700	126.50	156.47	23.69%	€125,723
<b>Total</b>					<b>€2,442,750</b>

Table 3 - Inflation Assessment Summary Using S-Curve Expenditure Profile

Using this methodology, the inflation allowance that has been established for this project is €2,442,750

## Range Inflation Estimate (Worked Example)

In this section we have provided worked examples of how to prepare a range estimate for inflation based on two different methods:

- Inflation to the mid-point of the project.
- Inflation based on expenditure profiles (project S-Curves).

In both scenarios we have used the lower and upper boundary of the indice ranges for the relevant Project Type to carry-out our inflationary adjustments.

### The Project

The Project is a 3-kilometre-long upgrade to an urban corridor. The base cost estimate has been prepared at the end of 2022, construction is due to commence in early 2028 and completion is programmed to be at the end of 2031. The construction cost of the project at the base date is €45,000,000.

### Inflation to the Mid-Point

#### Range Valuation Point 1

A five-step process has been identified in this User Guide. We have followed this process to identify Range Valuation Point 1:

1. Inflation to the mid-point has been selected as the first method of assessing inflation.
2. The value to be inflated is the entire construction cost of €45,000,000.
3. The Index value at the base date (2022), using the Tender Price Index for Highways Urban in the NTA Bulletin, is 126.50. The Index Value at the forecast date (mid-point of construction – Q4 2029) is 173.72.
4. The below formula has been used:

$$\frac{(173.72 - 126.50)}{126.50} \times 100 = 37.33\%$$

5. After multiplying the Adjustment Percentage (37.33%) to the value to be inflated (€45,000,000), it results in an inflation value for this project of €16,798,500.

Using this methodology, the lower valuation in the range for inflation has been established for this project as €16,798,500.

#### Range Valuation Point 2

A five-step process has been identified in this User Guide. We have followed this process to identify Range Valuation Point 2:

1. Inflation to the mid-point has been selected as the first method of assessing inflation.
2. The value to be inflated is the entire construction cost of €45,000,000.
3. The Index value at the base date (2022), using the Tender Price Index for Highways (Urban) in the NTA Inflation Bulletin, is 126.50. The Index Value at the forecast date (mid-point of construction – Q4 2029) is 202.93.
4. The below formula has been used:

$$\frac{(202.93 - 126.50)}{126.50} \times 100 = 60.42\%$$

5. After multiplying the Adjustment Percentage (60.42%) to the value to be inflated (€45,000,000), it results in an inflation value for this project of €27,189,000.

Using this methodology, the first valuation in the range for inflation has been established for this project as €27,189,000.

## Inflation using S-Curve Generated Expenditure Forecasts

S-Curve expenditure profiling is based on the general understanding that project expenditure will:

- Start fairly slowly for the first approximate 10 to 20% of the project duration.
- After this initial period, project expenditure is more extensive and is incurred at a reasonably consistent rate.
- This consistent rate continues up until the last 10 to 20% of the project duration, after which expenditure slows progressively until completion.

ChandlerKBS has developed an S-Curve Expenditure Profiling Tool for both Inflation Range Valuation Points 1 and 2. Using this tool for the project of the nature and duration described we would forecast the following expenditure profile:

### Range Valuation Point 1

The range for inflation that has been established for this Project for inflation is €16,798,500 to €27,189,000.

Period	Duration Complete (%)	Cumulative Expenditure (%)	Cumulative Expenditure (€)	Expenditure in the Period (€)
Q1 2028	6.25%	2.11%	€949,500	€949,500
Q2 2028	12.50%	4.85%	€2,182,500	€1,233,000
Q3 2028	18.75%	8.68%	€3,906,000	€1,723,500
Q4 2028	25.00%	14.20%	€6,390,000	€2,484,000
Q1 2029	31.25%	21.82%	€9,819,000	€3,429,000
Q2 2029	37.50%	30.38%	€13,671,000	€3,852,000
Q3 2029	43.75%	39.07%	€17,581,500	€3,910,500
Q4 2029	50.00%	48.58%	€21,861,000	€4,279,500
Q1 2030	56.25%	59.44%	€26,748,000	€4,887,000
Q2 2030	62.50%	69.46%	€31,257,000	€4,509,000
Q3 2030	68.75%	77.64%	€34,938,000	€3,681,000
Q4 2030	75.00%	85.84%	€38,628,000	€3,690,000
Q1 2031	81.25%	92.03%	€41,413,500	€2,785,500
Q2 2031	87.50%	95.93%	€43,168,500	€1,755,000
Q3 2031	93.75%	97.84%	€44,028,000	€859,500
Q4 2031	100.00%	100.00%	€45,000,000	€972,000

Table 4 - Expenditure Profile



The primary difference between an inflation assessment of this nature and the inflation assessment to the mid-point, is that the cost breakdown is significantly more detailed and therefore the inflation assessment is more thorough. The same 5 step process is followed however this is carried out on the expenditure per Quarter.

When this type of assessment is being carried out, it can be advisable to use Microsoft Excel (or other available software) due to the number of separate calculations that need to be made. A summary of our Range Valuation Point 1 for inflation for the example project has been provided in the table below. This valuation is based on the Tender Prices Index for Highways Urban Inflation Bulletin, specifically the lower bound indices for Highways Urban:

Period	Expenditure In the Period (€)	Indice at Base Date	Indice at Forecast Date	Adjustment Percentage	Inflation (€)
Q1 2028	€949,500	126.50	165.25	30.63%	€290,832
Q2 2028	€1,233,000	126.50	166.44	31.57%	€389,258
Q3 2028	€1,723,500	126.50	167.63	32.51%	€560,310
Q4 2028	€2,484,000	126.50	168.85	33.48%	€831,643
Q1 2029	€3,429,000	126.50	170.05	34.43%	€1,180,605
Q2 2029	€3,852,000	126.50	171.27	35.39%	€1,363,223
Q3 2029	€3,910,500	126.50	172.50	36.36%	€1,421,858
Q4 2029	€4,279,500	126.50	173.72	37.33%	€1,597,537
Q1 2030	€4,887,000	126.50	174.98	38.32%	€1,872,698
Q2 2030	€4,509,000	126.50	176.24	39.32%	€1,772,939
Q3 2030	€3,681,000	126.50	177.50	40.32%	€1,484,179
Q4 2030	€3,690,000	126.50	178.76	41.31%	€1,524,339
Q1 2031	€2,785,500	126.50	180.06	42.34%	€1,179,381
Q2 2031	€1,755,000	126.50	181.35	43.36%	€760,968
Q3 2031	€859,500	126.50	182.65	44.39%	€381,532
Q4 2031	€972,000	126.50	183.94	45.41%	€441,385
<b>Total</b>					<b>€17,052,687</b>

Table 5 - Inflation Assessment Summary Using S-Curve Expenditure Profile

Using this methodology, the Inflation Range Valuation Point 1 that has been established for this project is €17,052,687

## Range Valuation Point 2

The expenditure profile for Range Valuation Point 2 is the same as that for Range Valuation Point 1. The only difference between the assessments is the indices that are being used. In this case, it is the upper bound percentages of the Tender Price Index for Highways Urban.

A summary of our Range Valuation Point 2 for inflation for the example project has been provided in the table below:

Period	Expenditure In the Period (€)	Indices at Base Date	Indices at Forecast Date	Adjustment Percentage	Inflation (€)
Q1 2028	€949,500	126.50	189.50	49.80%	€472,851
Q2 2028	€1,233,000	126.50	191.37	51.28%	€632,282
Q3 2028	€1,723,500	126.50	193.25	52.77%	€909,491
Q4 2028	€2,484,000	126.50	195.12	54.25%	€1,347,570
Q1 2029	€3,429,000	126.50	197.07	55.79%	€1,913,039
Q2 2029	€3,852,000	126.50	199.03	57.34%	€2,208,737
Q3 2029	€3,910,500	126.50	200.98	58.88%	€2,302,502
Q4 2029	€4,279,500	126.50	202.93	60.42%	€2,585,674
Q1 2030	€4,887,000	126.50	204.96	62.02%	€3,030,917
Q2 2030	€4,509,000	126.50	206.99	63.63%	€2,869,077
Q3 2030	€3,681,000	126.50	209.02	65.23%	€2,401,116
Q4 2030	€3,690,000	126.50	211.05	66.84%	€2,466,396
Q1 2031	€2,785,500	126.50	213.16	68.51%	€1,908,346
Q2 2031	€1,755,000	126.50	215.27	70.17%	€1,231,484
Q3 2031	€859,500	126.50	217.38	71.84%	€617,465
Q4 2031	€972,000	126.50	219.49	73.51%	€714,517
<b>Total</b>					<b>€27,611,465</b>

Table 6 – Inflation Assessment Summary Using S-Curve Expenditure Profile

Using this methodology, Inflation Range Valuation Point 2 that has been established for this project is €27,611,465. In summary, the range for inflation that has been established for this Project is €17,052,687 to €27,611,465