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# TII Publications

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## Project Appraisal Guidelines Unit 6.2 - Preparation of Scheme Costs

PE-PAG-02021  
December 2023

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## TII Publications



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# 1. Context

This PAG Unit provides guidance on the conversion of scheme costs estimates into a format to be used in the Cost Benefit Analysis (CBA) assessment of TII funded schemes. Specifically, the processes described in the document relate to the preparation of the input required for use with the Transport Users Benefit Analysis (TUBA) program, guidance for which is detailed in PAG Unit 6.3.

Guidance is given on how scheme costs are treated at different phases of the project and a worked example is presented. To assist in the process, spreadsheets for deriving the CBA input costs during appraisal and evaluation have been developed, which are available for download, along with other appendices described in this document, from the “Downloads” section of the TII Publications website under section PE-PAG-02021\_Unit 6.2.<sup>1</sup>

A number of Input Cost Spreadsheets are available for download as part of this PAG Unit for the following project phases:

- Phase 2 Option Selection (PAG Unit 6.2 Input Cost Spreadsheet - Phase 2 Option Selection.xlsm);
- Phase 3 Design and Environmental Evaluation/Phase 5 Enabling and Procurement (PAG Unit 6.2 Input Cost Spreadsheet - Phases 3, 4 & 5.xlsm); and
- Phase 7 Closeout and Review (PAG Unit 6.2 Input Cost Spreadsheet - Phase 7 Closeout and Review.xlsm).

It is important to note that all scheme costs used in the economic appraisal must be agreed with TII in advance of any CBA commencing (see Section 3 for further guidance).

For further guidance on the Estimation of Costs or Cost and Risk Management please refer to TII Cost Management Manual<sup>2</sup>.

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<sup>1</sup> <https://www.tiipublications.ie/downloads/>

<sup>2</sup> TII Publications – Cost Management Manual (PE-PMG-2044)

## 2. Components of Scheme Costs

### 2.1 Overview

Scheme costs used in the CBA assessment of National Road projects are categorised under the following 7 expenditure headings:

- Main Contract Construction;
- Main Contract Supervision;
- Archaeology;
- Advance Works & Other Contracts;
- Walking / Cycling / PT Connectivity / Asset Renewal;
- Land and Property;
- Planning and Design.

It should be noted that all scheme costs are inclusive of VAT, however VAT is removed as part of the scheme cost conversion process for use in the CBA assessment.

For a detailed description of the 7 expenditure headings, refer to Appendix A0 of the TII Cost Management Manual available on the Downloads section of [www.tiipublications.ie](http://www.tiipublications.ie) in the Appendices Workbook entitled “*PE-PMG-02044-02\_Appendices-Workbook-1-of-2\_12032021.xlsx*”

### **3. Maintenance Costs**

Investment in new transport related infrastructure may reduce the cost in relation to maintaining the existing infrastructure, therefore the difference in costs incurred from maintaining the Do-Minimum and Do-Something networks must be accounted for in the CBA assessment over the full appraisal period of the project.

Maintenance costs comprise of traffic related maintenance works such as reconstruction, overlaying, resurfacing works, etc. Traffic related maintenance costs will vary by National Road project and will need to be calculated on a scheme by scheme basis over the full appraisal period of the project.



## 4. Operation

The difference in costs incurred from operating the Do-Minimum and Do-Something networks must be accounted for in CBA. Routine and non-traffic related maintenance costs (e.g. structures, drainage, street lighting, verge maintenance, repainting lines, signals, signage etc) which are largely independent of traffic flows should be included in the appraisal.

Default non-traffic related maintenance costs by road type are provided in *PAG Unit 6.11: National Parameter Values Sheet*.

Operation costs would be particularly relevant on ITS and Tolling schemes where the costs associated with additional staff or independent operators should be accounted for where appropriate.

## 5. Timing of Costs

### 5.1 Dealing with Land Costs

An important general principle of CBA is that the cost of resources should be recorded at the time that the resources are to be used (that is, become unavailable for alternative uses), rather than when they are actually paid for. This issue is particularly relevant to land and property costs where the purchase of agricultural land, for example, may occur sometime before the time when farming of the land ceases.

In such instances the acquisition cost should relate to the year in which the land is taken out of current use, which for many schemes will occur in the first year of construction. However, there are situations when this is an inappropriate assumption:

- Where significant land or property is taken out of use before the first year of construction;
- Where the land and property costs of a scheme are unusually large; and
- For all schemes at Design when the simplifying assumption should be reviewed if better information is available.

Land and property costs consist of a number of different items and it is important to consider when each resource cost is likely to be incurred. This may mean that instead of making the assumption that land costs are incurred in the first year of construction, costs are disaggregated and each element is input at different stages of the appraisal period.

The following treatment for land and property costs is recommended:

- Scenario 1 – Land and property ‘on-line’, not farmed / unoccupied from purchase to construction. The costs to be input into the CBA appraisal are all acquisition costs and legal transaction costs, to be input at time of purchase, and any property management costs.
- Scenario 2 – Land and property ‘on-line’, farmed/occupied until construction begins. The costs to be input into the CBA appraisal are legal transaction costs, estimated costs of renting and property management costs, to be input at time of purchase, with acquisition costs input when taken out of use for construction of the road scheme.
- Scenario 3 – Land and property ‘off-line’, not farmed / unoccupied and later resold. The costs to be input into the CBA appraisal are the full purchase costs (acquisition and legal transaction costs) input when taken out of use, and resale value input when resold and returned to use.
- Scenario 4 – Land and property ‘off-line’, farmed / occupied and later resold. The costs to be input into the CBA appraisal are the transaction costs of purchase and property management costs, which should be input at time of acquisition.

### 5.2 Bygone and Retrievable Costs

Bygones are expenditures incurred prior to economic appraisal that cannot be retrieved as a result of any subsequent decision. A distinction should be made between expenditure that is genuinely a bygone, and that which is retrievable.

An example of a bygone cost might be the preparation costs that have been incurred in the design of a scheme in order to take it to the planning stage.

These costs are not retrievable, as they will have been 'sunk' regardless as to whether or not the scheme goes ahead. However, land and property costs are generally retrievable since it is usually possible to resell if the scheme does not go ahead. These costs should not, therefore, be treated as a bygone. Even if the property has actually been demolished the land on which the property stood will still have a resale value.

As per the DoT TAF, the CBA assessment is only concerned with costs about which decisions can still be made. On this basis, sunk costs may be excluded from the scheme cost estimate at the subsequent CBA Phase (e.g. as part of the Phase 3 and Phase 5 CBA). The rationale for excluding the sunk costs should be clearly set out in the CBA and Business Case report for the appropriate project phase. A sensitivity CBA should still be undertaken which includes the full scheme costs estimate (inclusive of sunk cost).

## **6. Shadow Pricing**

Current guidance from the Department of Transport (DoT) Transport Appraisal Framework (TAF) requires that a shadow price factor should be adopted for public funds. The TAF also mandates that economic appraisals in the transport sector should be estimated on the basis of a shadow price of labour. The values for both these parameters can be found in PAG Unit 6.11.

A worked example of the application of shadow pricing is provided in Section 10 of this Unit.

## 7. Applicability of Scheme Estimates

CBA is required at four distinct project phases:

- Phase 2 Option Selection;
  - Phase 3 Design and Environmental Evaluation;
  - Phase 5 Enabling and Procurement; and
  - Phase 7 Closeout and Review (a CBA is required for a sample of schemes at this stage).

At all stages of the appraisal process the best available information on scheme costs should be used in the CBA. Hence, depending on the phase, a different cost estimate is to be used in the economic evaluation of road schemes. At all phases, the costs used in the economic assessment must have been agreed by TII's Cost Estimation Unit.

The following terminology is used to describe the various types of cost estimates:

- Indicative Range of Costs - Estimates prepared during Phase 1 of the scheme (Concept and Feasibility). For some projects the preferred mode of transport may not be known at this early phase of the project lifecycle, so the indicative range of potential costs associated with meeting the objectives and solving the identified problems should be estimated.
- Option Comparison Estimate (OCE) - Estimates prepared during Phase 2 of the scheme (Option Selection).
- Target Cost (TC) – Required for PMG Phases 3 and 5. This is the realistic estimate of the Final Outturn for the project based on assumptions made, identified risks and defined scope of work inclusive of VAT and inflation. It does not take into account exceptional events happening on the project. Updated TC estimates may also be required at Phases 4 and 6 subject to changes in project (e.g. design change or significant cost changes).
- Total Scheme Budget (TSB) – Required for PMG Phases 3 and 5. This is the formal cost estimate for the project incorporating the identified core cost elements, an appropriate contingency in respect of these elements, and an allowance for future inflation to the completion of the project. In addition, a programme level contingency, known as “Programme Risk”, will be included to cover the situation of exceptional items occurring on isolated projects. Updated TSB estimates may also be required at Phases 4 and 6 subject to changes in project (e.g. design change or significant cost changes).

The risk related variance between the TC and TSB provides a means to take account of risk/uncertainty around cost estimates and scheme delivery and are used as cost sensitivities as part of the CBA process in line with the TAF guidelines.

At Phases 3 and 5 the CBA must therefore be run six times: one for each combination of traffic growth scenario ('high', 'central' and 'low') and cost estimate (Total Scheme Budget and Target Cost). The results of each of the six scenarios should be presented separately.

Additional scenario testing / sensitivity analysis may be required as part of Phases 3 and 5, in which case additional CBA runs may be necessary.

CBAs are required at Closeout and Review stage for a sample of schemes. The Design Office Project Manager (DOPM) should contact TII in advance of Phase 7 closeout stage to ascertain whether a closeout CBA will be required for their scheme.

Final outturn costs should be used as part of any Phase 7 CBA. The results of 'high', 'central' and 'low' traffic growth scenarios should be presented.

## **7.1 Contingencies**

The OCE, TC and TSB estimates described above all contain an element of contingency to account for project risk. There is no requirement for any further adjustment to be made to the approved estimates prior to developing cost data for input into CBA.

## 8. Converting Scheme Cost Estimate to CBA Format

### 8.1 Correcting for Inflation

Scheme costs are incurred over a period of years. All costs should, therefore, be allocated to appropriate years for input to the CBA process.

The effects of general inflation should be removed by application of the Consumer Price Index (CPI) to convert from the current year to the price base year. For example, an expenditure of €1.15m in 2023 at a CPI inflation of 15% from 2016 to 2023 would be equivalent to an expenditure of €1.0m in 2023 but based on 2016 prices. The user undertakes this calculation before costs are input to the CBA file.

The CPI is used to convert scheme costs to the price base year using the following expression.

$$\text{Cost at Price Base Year} = \text{Latest Available Costing} \times \frac{\text{CPI}_b}{\text{CPI}_q}$$

where:

q refers to the year and month corresponding to the rates used; and

b refers to the price base year

The latest information on the CPI should be obtained from the Central Statistics Office (CSO).

### 8.2 Correcting for Year of Expenditure

Costs also require discounting to account for the year in which they are accrued. Discounting of costs to the present value year is undertaken by TUBA software. In the above example, the €1.0m expenditure in 2023 is discounted to 2016 values by applying the discount rate of 4%<sup>3</sup>, leading to an expenditure of €0.68m in 2016 values and 2016 prices.

The discount rate (r) is used to convert a sum (S) received in year I to a value at the present value year (P) using the following expression.

$$\text{Present Value} = \frac{S}{(1+r)^{I-P}}$$

Discounting and the price base are discussed in detail in *PAG Unit 6.1: Guidance on Conducting CBA*.

### 8.3 Relative Price Factor

The process of accounting for the changes in the price of construction relative to movements in the general price index is undertaken by application of the Relative Price Factor (RPF). For all project phases, an RPF value of unity is applicable unless the TII direct otherwise.

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<sup>3</sup> The appropriate discount rate is subject to change and should be checked prior to use.

## 8.4 Indirect Taxation

All elements of scheme costs should be input into CBA net of indirect taxation and VAT. A different rate of VAT is applicable for the various expenditure headings. The current applicable VAT rates are provided in Table 6.2.1.

**Table 6.2.1 VAT rates**

<b>Base Cost Expenditure Heading</b>	<b>VAT</b>
Main Contract Construction	13.5%
Main Contract Supervision	23.0%
Archaeology	18.3%
Advance Works	13.5%
Walking / Cycling / PT Connectivity / Asset Renewal	13.5%
Land & Property	0.0%
Planning and Design	23.0%

## 8.5 Input to TUBA Format

Both costs and benefits are to be presented in CBA reports to a given base year. In addition, costs must be entered into TUBA in multiples of €1,000 and are generally input in factor prices of a given base year (i.e. exclusive of VAT and indirect taxes). Consequently, the cost figure inputted into TUBA is quite different to the TII estimates at each project phase.

The procedure to be used to convert cost estimates to TUBA format is largely the same for various project phases. The procedure is described below, with reference to the user inputs into spreadsheets that have been developed to assist in this task. Copies of these spreadsheets for Phase 2 (Option Selection), Phases 3/5 and Phase 7 (Closeout and Review) are provided as downloads to this PAG Unit.

These spreadsheets are available from the “Downloads” section of the TII Publications website under section PE-PAG-02021\_Unit 6.2.



## 9. CBA Procedures

The procedures for the calculation of scheme costs associated with each project phase are outlined below.

### 9.1 Phase 2 Option Selection

- Based on the information provided in the signed off Option Comparison Estimate (OCE) spreadsheet, the user enters the breakdown of the Base Cost into the seven expenditure headings as well as the Total Inflation Allowance and TII Programme Risk. All these figures are inputted in units of €1 million.
- The spreadsheet calculates the total OCE (the user should check this number to ensure that the figures were entered correctly).
- The user reviews the assumed labour content (labour as a % of total cost) for each expenditure category as well as the applicable VAT rate, making changes where appropriate. In the case of schemes with external funding (e.g. some PPP schemes, schemes with developer contributions or schemes with EU funding) the Government funding percentage may need to be lowered from 100%, in which case advice from the TII Strategic & Transport Planning team should be sought.
- User enters the CPI data for the month of the year when the price estimate was completed and the CPI data for the price base year.
- The user enters the applicable Shadow Pricing factors and RPF factor. Current guidance is to apply an RPF factor of unity for all appraisals.
- Using the data provided, the spreadsheet deducts the Total Inflation Allowance from the OCE to bring costs to a current base year and then, using the CPI data, rebases to the price base year.
- The spreadsheet applies the appropriate Shadow Pricing and RPF factors and automatically deducts VAT from the resulting figures.
- The user then allocates the proportion of each expenditure heading occurring over the years in which expenditure accrues.
- The spreadsheet then calculates the undiscounted costs for input into the CBA/TUBA, according to the year in which they accrue in multiples of €1,000 in base year factor prices.

### 9.2 Phase 3 Design and Environmental Evaluation / Phase 4 Statutory Processes / Phase 5 Enabling and Procurement

- Based on the information provided in the signed off scheme cost estimate reporting form, the user enters the Total Scheme Budget, Target Cost and the Inflation allocated to Target Cost into the spreadsheet. All values are to be entered in multiples of €1m.
- The spreadsheet calculates the un-inflated Total Scheme Budget and un-inflated Target Cost.
- The user enters the CPI data for the month of the year when the price estimate was completed and the CPI data for the price base year.
- The user enters the applicable Shadow Pricing factors and RPF factor. Current guidance is to apply an RPF factor of unity for all appraisals.

- The spreadsheet calculates the un-inflated Target Cost and un-inflated Total Scheme Budget for the price base year.
- The user enters the breakdown on the base cost expenditure into the seven expenditure headings. The sum of these expenditure items should exactly equal the un-inflated Target Cost.
- The user reviews the assumed labour content (labour as a % of total cost) for each expenditure category as well as the applicable VAT rate, making changes where appropriate. In the case of schemes with external funding (e.g. some PPP schemes, schemes with developer contributions or schemes with EU funding) the Government funding percentage may need to be lowered from 100%, in which case advice from the TII Strategic & Transport Planning team should be sought.
- The spreadsheet applies the appropriate Shadow Pricing and RPF factors and automatically deducts VAT from the resulting figures.
- The user then allocates the proportion of each expenditure heading occurring over the years in which expenditure accrues.
- Using the data in the scheme cost profile, the spreadsheet calculates the undiscounted costs for input into the CBA, according to the year in which they accrue in multiples of €1,000 in price base year factor prices. The spreadsheet produces two sets of cost data to enter into TUBA, one based on Target Cost and the other based on Total Scheme Budget estimate.

Note that for the Design and Environmental, Statutory Processes and Enabling and Procurement CBAs, six runs are required, one for each combination of cost (Total Scheme Budget and Target Cost) and traffic growth scenario ('High', 'Central' and 'Low'). A CBA based on Total Scheme Budget and 'central' traffic growth scenario should ordinarily be taken as the core appraisal scenario. Additional sensitivity CBA runs may also be required.

### 9.3 Phase 7 Closeout and Review

- The user enters actual expenditure figures into the spreadsheet for each single year of the project according to the expenditure item.
- The user enters the VAT rate that is applicable to each item of expenditure as well as the labour content (labour costs as a percentage of total expenditure) and Government funds percentage – the percentage of scheme expenditure incurred by either local government or the national exchequer. Shadow price factors, currently unity, are then applied to costs.
- The user enters the CPI index at expenditure year. The user re-bases the CPI data (with the price base year given the value of 1) and enters data into column provided.
- The spreadsheet calculates the outturn cost at each year, exclusive of VAT and at the price base year for each item of expenditure.
- The total factor cost at each year, at factor cost and at the price base year is entered into the CBA/TUBA, according to the year in which the expenditure occurs in multiples of €1,000 in price base year factor prices.

## **9.4 Residual Value**

A discussion on Residual Values is provided in Section 14 of *PAG Unit 6.1: Guidance on Conducting CBA*. In TUBA, the residual value impacts can be calculated by a separate assessment of benefits from year 30 onwards.

## 10. Worked Example

The following worked example describes how to convert the Target Cost and Total Scheme Budget estimates to a format suitable for entry into TUBA. The example presented here is for a hypothetical road scheme “Scheme A”, at Phase 3 Design and Environmental Evaluation. The corresponding spreadsheets for Phase 2 (Option Selection) and Phase 7 (Closeout and Review) are slightly different but follow similar principles and should be easy to interpret by the user.

The derivation of the TUBA inputs requires cost data from the scheme cost estimate reporting form, duly signed off by the TII’s Cost Estimate Unit. A sample scheme cost estimate is provided as Figure 6.2.1.

In using each spreadsheet, the user is only required to input values into the coloured cells. Outputs are then calculated automatically.

Based on the agreed cost estimates, the user enters values for Total Scheme Budget (a), Target Cost (b) and Inflation (c) allocated to Target Cost. The spreadsheet then calculates:

- Un-inflated Total Scheme Budget (d) = (a)-(c), and
- Un-inflated Target Cost (e) = (b)-(c).

**Table 6.2.2 Total Scheme Budget and Target Cost**

	€m
Total Scheme Budget	€128.00
Target Cost	€106.00
Inflation allocated to Target Cost	€9.00
Un-inflated Total Scheme Budget	€119.00
Un-inflated Target Cost	€97.00

For this simplified hypothetical Scheme A we have assumed a CPI for the price base year and month of cost estimate of 100.0. The shadow price factors for Government funds (1.3) and Labour (1.0) are then entered. An RPF factor of unity is then applied.

**Table 6.2.3 CPI, RPF and Shadow Prices**

CPI / Shadow Price / RPF	
CPI Index for month of cost estimate	100.0
CPI Index for base year	100.0
Shadow Price of Government Funds	1.3
Shadow Price of Labour	1.0
RPF Factor	1.0

The spreadsheet then applies the CPI data to rebase the un-inflated Target Cost and the un-inflated Total Scheme Budget to base year prices.

**Table 6.2.4 TC and TSB Calculation**

<b>TSB &amp; TC</b>	<b>€m</b>
Un-inflated Target Cost, base year	€97.00
Un-inflated Target Cost, base year, RPF applied	€97.00
Un-inflated TSB, base year	€119.00
Un-inflated TSB, base year, RPF applied	€119.00

The user then enters the un-inflated target costs under each heading of expenditure, the percentage of expenditure under each heading which Government funds accounts for and the estimated proportion of costs that are accounted for by labour. Default rates of Government funds (% of total expenditure), assumed labour content and applicable VAT rates are provided in the spreadsheet.

**Table 6.2.5 Base Cost Expenditure Data**

<b>Base Cost Expenditure Heading</b>	<b>€m</b>	<b>Government funds (% of total expenditure)</b>	<b>Assumed Labour content</b>	<b>% of total</b>	<b>Applicable VAT rate</b>
Main Contract Construction	€50.00	100%	30.0%	51.5%	13.5%
Main Contract Supervision	€5.00	100%	50.0%	5.2%	23.0%
Archaeology	€2.00	100%	50.0%	2.1%	18.3%
Advance Works & Other Contracts	€10.00	100%	30.0%	10.3%	13.5%
Walking / Cycling / PT Connectivity / Asset Renewal	€5.00	100%	30.0%	5.2%	13.5%
Land & Property	€20.00	100%	10.0%	20.6%	0.0%
Planning and Design	€5.00	100%	60.0%	5.2%	23.0%
Uninflated Target Cost	€97.00				

The spreadsheet automatically applies the Shadow Price factors for Government funds (1.3) and Labour (1.0). The VAT is then automatically removed from both the un-inflated Target Cost (price base year, RPF applied) and the un-inflated Total Scheme Budget (price base year, RPF applied).

**Table 6.2.6 Cost in Base year Prices**

	<b>TSB €m</b>	<b>Target Cost €m</b>
Main Contract Construction	€70.26	€57.27
Main Contract Supervision	€6.48	€5.28
Archaeology (all phases)	€2.70	€2.20
Advance works	€14.05	€11.45
Walking / Cycling / PT Connectivity / Asset Renewal	€7.03	€5.73
Land & Property	€31.90	€26.00
Planning and Design	€6.48	€5.28
<b>TOTAL</b>	<b>€138.90</b>	<b>€113.21</b>

Costs of each of the individual items are allocated according to the year in which they are expected to accrue. The proportion of expenditure (expressed as a percentage) within each category accruing in each year is taken to be identical to that in the un-inflated Target Cost profile in the scheme cost estimate reporting form. These percentages are entered into the spreadsheet under the 'Allocation of Costs to Each Year' heading.

Using this distribution, the spreadsheet automatically calculates the costs that are input to the CBA/TUBA, for both the Target Cost and Total Scheme Budget scenarios. These costs are undiscounted and in multiples of €1,000 at factor prices at the appropriate price base year. Discounting is undertaken within the TUBA programme.

For TUBA purposes, Advance Works & Other Contracts, Walking / Cycling / PT Connectivity / Asset Renewal and Archaeology costs are included within the 'Construction' cost category.

The output from the cost spreadsheets is presented as Tables 6.2.7 and 6.2.8 for the Total Scheme Budget scenario and Table 6.2.9 and 6.2.10 for the Target Cost scenario.

**Table 6.2.7 Total Scheme Budget (€ millions) – CBA Input Format**

Year	Main Contract Construction (€m)	Main Contract Supervision (€m)	Archaeology (€m)	Advance Works & Other Contract (€m)	Walking / Cycling / PT Connectivity / Asset Renewal (€m)	Land & Property (€m)	Planning & Design (€m)	Total (€m)
2022	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€3.2	€3.2
2023	€0.0	€0.0	€0.0	€0.0	€0.0	€8.0	€3.2	€11.2
2024	€28.1	€2.6	€1.1	€7.0	€2.8	€8.0	€0.0	€49.6
2025	€28.1	€2.6	€1.1	€7.0	€2.8	€8.0	€0.0	€49.6
2026	€14.1	€1.3	€0.5	€0.0	€0.7	€8.0	€0.0	€24.6
2027	€0.0	€0.0	€0.0	€0.0	€0.7	€0.0	€0.0	€0.7
	€70.3	€6.5	€2.7	€14.0	€7.0	€31.9	€6.4	€138.9

**Table 6.2.8 Total Scheme Budget (€ millions) – TUBA Input Format**

TUBA Cost Categories	Cost € ,000
Construction	€94,032
Supervision	€6,483
Land	€31,897
Planning	€6,483
Total	€138,895


**Table 6.2.9 Target Cost (€ millions) – CBA Input Format**

Year	Main Contract Construction (€m)	Main Contract Supervision (€m)	Archaeology (€m)	Advance Works & Other Contract (€m)	Walking / Cycling / PT Connectivity / Asset Renewal (€m)	Land & Property (€m)	Planning & Design (€m)	Total (€m)
2022	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€2.6	€2.6
2023	€0.0	€0.0	€0.0	€0.0	€0.0	€6.5	€2.6	€9.1
2024	€22.9	€2.1	€0.9	€5.7	€2.3	€6.5	€0.0	€40.4
2025	€22.9	€2.1	€0.9	€5.7	€2.3	€6.5	€0.0	€40.4
2026	€11.5	€1.1	€0.4	€0.0	€0.6	€6.5	€0.0	€20.1
2027	€0.0	€0.0	€0.0	€0.0	€0.6	€0.0	€0.0	€0.6
	€57.3	€5.3	€2.2	€11.4	€5.7	€26.0	€5.3	€113.2

**Table 6.2.10 Target Cost (€ millions) – TUBA Input Format**

TUBA Cost Categories	Cost € ,000
Construction	€76,648
Supervision	€5,585
Land	€26,000
Planning	€5,285
Total	€113,217



<b>SCHEME NAME</b>	<b>TII Ref.</b>	
<b>Road Authority</b>	<b>Project Status</b>	<b>Region</b>

<b>Mainline Scheme Length</b>	<b>Cross Section</b>	<b>Current Date</b>	<b>NTF Date</b>
<b>Grade Separated Junctions</b>	<b>No. of Bridges</b>	<b>Start Year</b>	<b>Completion Year</b>

<b>Total Land Acquired (ha)</b>	<b>Terrain</b>	<b>Ground Conditions</b>
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**Budget Forecast Type:**

Base Cost Expenditure Heading	Base Cost (Inclusive of Total Risk)	Current Risk Allocation to TC	Un-inflated Target Cost	Un-inflated Target Cost Profile						
				Pre 2020	2020	2021	2022	2023	2024	Post 2024
Main Contract Construction (incl VAT)										
Employer Risks on Construction										
Main Contract Supervision										
Employer Risks on Supervision										
Archaeology										
Pre-construction Archaeological Risks										
Advance Works & Other Contracts										
Employer Risks										
Walking/Cycling/Assett Renewal										
Land & Property										
Land Issues Risks										
Planning & Design (incl GI & Topo)										
Employer Risks on Planning & Design										
<b>Subtotal (Excl Inflation)</b>										

Target Cost With Inflation	Un-inflated Target Cost	Inflation on Target Cost	Target Cost Adjusted for Inflation	Target Cost With Inflation Profile						
				Pre 2020	2020	2021	2022	2023	2024	Post 2024
Main Contract Construction										
Main Contract Supervision										
Archaeology All Phases										
Advance Works										
Walking/Cycling/Assett Renewal										
Land & Property										
Planning & Design (incl GI & Topo)										
<b>Target Cost Totals</b>										

<b>TARGET COST</b>	<b>TARGET COST / KM</b>	
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Base Cost	
Total Inflation	
Programme Risk	
<b>TOTAL SCHEME BUDGET</b>	

Figure 6.2.1 Sample Cost Estimate Report

## 11. Reference Class Forecasting

### 11.1 Overview

Reference Class Forecasting (RCF) is an established method to address the root causes of cost and schedule overruns in projects. These root causes, including optimism bias and strategic misrepresentation, can lead to underestimation of projects cost, benefits and schedules, which can manifest itself in cost overruns at later phases of the project.

Within TII, RCF is used in the determination of Target Costs and Total Scheme Budgets (at Phases 3 – 5) and is used in parallel with the Quantitative Risk Analysis (QTRA) process. Full details of the theory behind Reference Class Forecasting, the development of the reference classes for National Road schemes and how Reference Class Forecasting is to be applied to National Road schemes, can be found in the document *Reference Class Forecasting; Guidelines for the use in connection with National Roads Projects*<sup>4</sup>.

### 11.2 RCF in Cost Benefit Analysis

Details in relation to the calculation and application of Reference Class Forecasting is provided in the TII Cost Management Manual<sup>5</sup>. If a decision is made to use Reference Class Forecasting in the calculation of the Target Cost and Total Scheme Budget (for Phases 3-5), then an alternative approach is required to convert the scheme cost for use in CBA/TUBA than previously outlined in Section 9.

The TII CBA Cost Conversion Spreadsheets for Phases 3-5 have been adopted for RCF and the following section provides guidance of the use of conversion of the cost for use in CBA/TUBA.

### 11.3 RCF - Phase 3 Design and Environmental Evaluation / Phase 4 Statutory Processes / Phase 5 Enabling and Procurement

If using RCF to calculate the scheme costs for use in CBA/TUBA then the following process must be followed under the RCF Input Worksheet of the TII CBA Cost Conversion Spreadsheet:

- Based on the information provided in the signed off scheme cost estimate reporting form, the user enters the Base Cost Estimate for each expenditure heading excluding risk. All values are to be entered in multiples of €1m.
- The spreadsheet calculates the RCF Base Cost for the Target Cost and Total Scheme Budget, by applying the Reference Class Forecasting factors<sup>6</sup>.
- The user enters the RCF Total Inflation Allowance (taken from the scheme cost estimate reporting form) and then the spreadsheet calculates the RCF Target Cost and Total Scheme Budget.
- The user enters the CPI data for the month of the year when the price estimate was completed and the CPI data for the price base year.
- The user enters the applicable Shadow Pricing factors and RPF factor. Current guidance is to apply an RPF factor of unity for all appraisals.

<sup>4</sup> <https://www.tii.ie/tii-library/policies/TII%20General%20Publications/RCF-Guidelines-for-National-Road-Projects.pdf>

<sup>5</sup> TII Publications – Cost Management Manual (PE-PMG-2044)

<sup>6</sup> RCF factors are hard coded (1.075 for Target Cost and 1.19 for Total Scheme Budget)

- The user reviews the assumed labour content (labour as a % of total cost) for each expenditure category as well as the applicable VAT rate, making changes where appropriate. In the case of schemes with external funding (e.g. some PPP schemes, schemes with developer contributions or schemes with EU funding) the Government funding percentage may need to be lowered from 100%, in which case advice from the TII Strategic & Transport Planning team should be sought.
- The spreadsheet applies the appropriate Shadow Pricing and RPF factors and automatically deducts VAT from the resulting figures.
- The spreadsheet calculates the RCF Target Cost and Total Scheme Budget for the price base year.
- The user then allocates the proportion of each expenditure heading occurring over the years in which expenditure accrues.
- Using the data in the scheme cost profile, the spreadsheet calculates the undiscounted costs for input into the CBA, according to the year in which they accrue in multiples of €1,000 in price base year factor prices. The spreadsheet produces two sets of cost data to enter into TUBA, one based on Target Cost and the other based on Total Scheme Budget estimate.

Note that for the Design and Environmental, Statutory Processes and Enabling and Procurement CBAs, six runs are required, one for each combination of cost (Total Scheme Budget and Target Cost) and traffic growth scenario ('High', 'Central' and 'Low'). A CBA based on Total Scheme Budget and 'central' traffic growth scenario should ordinarily be taken as the core appraisal scenario. Additional sensitivity CBA runs may also be required.





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