
Annex 3: Quantitative Questionnaire

Assessment of unit costs (standard prices) of rail projects (Capital Expenses)

1. Introduction

PricewaterhouseCoopers (PwC) and COWI are currently supporting the European Commission, Directorate-General for Regional and Urban Policy (DG REGIO) on the **assessment of unit costs (standard prices) of rail projects (Capital Expenses)**.

The primary aim of the project is to evaluate standard prices (unit costs) in the rail sector. This evaluation will assess the costs of projects in rail across the 26 Member States with rail systems of the European Union. The project will provide input to decision-makers for high-level evaluation of the costs of rail infrastructure programs and projects and assist authorities in charge of rail infrastructure programs and projects to communicate effectively to a wider set of stakeholders about project cost.

Support from stakeholders is a key element for the success of the project.

The aim of the Stakeholder Consultations (SC) is to collect information on the factors influencing rail infrastructure investments, on the technical characteristics of the rail infrastructure projects as well as on the estimated and final cost of stated projects. The data collected will be used for the elaboration of a methodological approach and for the identification and calculation the unit cost in rail infrastructure projects.

Specifically, the SC is functional to collect:

- **Qualitative information** on the external factors influencing cost in the rail infrastructure projects;
- **Quantitative information** on technical characteristics and costs of rail infrastructure projects in EU.

Attached to the invitation e-mail you can find:

- A link to the **online questionnaire** on the external factors influencing cost in the rail infrastructure projects;
- The **list of projects** for which the data is collected (*see attached: UCR_list of projects_country.doc*),
- An **excel questionnaire for each project included in the list**, to be completed with the relevant technical characteristics and costs information of the project.

We would kindly ask you to:

- Fill-in in the online questionnaire;
- Send back to us the list of projects including a reference person for each of them;
- Fill-in each excel questionnaire you received with the information on technical characteristics and costs of each project, based on the following instructions.

2. Instructions for completing the excel questionnaires

Within the excel questionnaires, the required information has been classified into **three different tiers**, corresponding to progressive level of detail. For each level, both *estimated costs* (reported in the feasibility study or assessed in the planning & design phase) and *final costs* (reported in the contracts) are required.

The questionnaire consists of nine consecutive sheets:

1. Cover page
2. Instructions
3. Tier 1
4. Tier 2
5. Tier 3 – Earthworks
6. Tier 3 – Equipment
7. Tier 3 – Tunnels
8. Tier 3 – Bridges
9. Tier 3 – Viaducts

Detailed instructions on which information should be provided in each sheet are included in the sheet itself.

The following figures outlined the structure of each sheet to facilitate the completion of the information.

2.1. Sheet 3: Tier 1

General characteristics of the project

| Tier 1 | |
|---|-----------------|
| General characteristics | |
| CCI Project Number | |
| Country | |
| Project name | |
| Railway line | |
| Mileage of the project | |
| Name of the Infrastructure Manager | |
| Start Construction (year) | yyyy |
| End Construction (year) | yyyy (expected) |

First breakdown of total estimated and final costs of the project

| Tier 1 | | | | | |
|---------------------------------------|---|---|------------------------|-----------------------------------|--------------------|
| Costs | | | | | |
| Category | Estimated Costs Data Source* | Base Year_ Estimated Costs | Estimated Costs | Base Year_ Final Costs | Final Costs |
| <i>Information to be included</i> | <i>Type of document</i> | <i>Year</i> | <i>M€</i> | <i>Year</i> | <i>M€</i> |
| Total investment costs | | | M€o | | M€o |
| Planning & Design | | | M€o | | M€o |
| Construction | | | M€o | | M€o |
| Ancillary | | | M€o | | M€o |

First breakdown of technical characteristics of the project

| Tier 1 | |
|--|--|
| Technical characteristics | |
| Category | Information to be included |
| Line categories | <input type="checkbox"/> Conventional pax <input type="checkbox"/> Conventional freight <input type="checkbox"/> Conventional Mixed <input type="checkbox"/> High Speed Pax <input type="checkbox"/> High Speed Mixed |
| Track gauge | <input type="checkbox"/> Standard 1435 mm <input type="checkbox"/> Russian 1520 mm <input type="checkbox"/> Spanish 1668 mm |
| Length | [km] |
| Type of work | New line |
| | Total km of new line deployed within the project [km] |
| | Mileage of subsections where new line is deployed (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Rehabilitation & Upgrading |
| | Total km of rehabilitated & upgraded line [km] |
| | Mileage of subsections where rehabilitation & upgrading works are carried out (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Signalling |
| | Total km of line equipped with signalling system [km] |
| | Mileage of subsections equipped with signalling system (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Electrification |
| Total km of electrified line [km] | |
| Mileage of subsections equipped with electrification (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] | |
| Design parameters: | |
| Design Speed | <input type="checkbox"/> less than 120 km/h <input type="checkbox"/> between 120 and 160 km/h <input type="checkbox"/> between 160 and 200 km/h <input type="checkbox"/> between 200 and 250 km/h <input type="checkbox"/> between 250 and 300 km/h <input type="checkbox"/> more than 300 km/h |
| Max. Slope | <input type="checkbox"/> < 15‰ <input type="checkbox"/> 15‰ - 25‰ <input type="checkbox"/> > 25‰ |
| Energy | <input type="checkbox"/> Electric <input type="checkbox"/> Diesel |
| Max Axial Load | <input type="checkbox"/> < 6.4 tons/m <input type="checkbox"/> 6.4 tons/m - 7.2 tons/m <input type="checkbox"/> 7.2 tons/m - 8.0 tons/m <input type="checkbox"/> > 8.0 tons/m |
| Number of tracks | Single |
| | Total km of single-track line [km] |
| | Mileage of single-track subsections (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Double |
| | Total km of double-track line [km] |
| | Mileage of double-track subsections (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| Other (please specify) | |
| Total km of line with the specified number of tracks [km] | |
| Mileage of subsections with the specified number of tracks (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] | |

| Tier 1 | |
|---|---|
| Technical characteristics | |
| Category | Information to be included |
| Train length allowed (in case of single track) | [m] |
| Number of turnouts/ switches | [#] |
| Predominant environment | Rural |
| | Total km of line in rural environment [km] |
| | Mileage of rural subsections (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Urban |
| Terrain | Total km of line in urban environment [km] |
| | Mileage of urban subsections (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Mountainous (higher than 600 m above sea level) |
| | Total km of line on mountainous terrain [km] |
| Predominant Hydro-Geology & Geotechnics | Mileage of the subsections on mountainous terrain (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Hilly (200 - 600 m above sea level) |
| | Total km of line on hilly terrain [km] |
| | Mileage of the subsections on hilly terrain (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Flat (lower than 200 m above sea level) |
| | Total m of line on flat terrain [km] |
| Environmental Constraints | Mileage of the subsections on flat terrain (please indicate the start and the end kilometric point for each subsection) [i.e. from km x.xx to km y.yy] |
| | Hydro-geology and geotechnics issues that sensibly impact the costs of the project, i.e. high or low groundwater levels, water flows with necessity of siphons, water management, low bearing foundation ground, landslide risk to mitigate, managing of the railway ditch system, etc. |
| Other constraints | Crossing/affecting protected areas, gorges, water springs and the like and in case of Tunnels also for the relevant disposal of their mucking |
| | Any relevant factors sensibly impacting the costs of the project, e.g. critical occurrence of suitable construction materials, namely for embankment and/or aggregates, etc. |

2.2. Sheet 4: Tier 2

Breakdown of Construction and Ancillary Costs

| Tier 2 | |
|---------------------|---|
| Costs | |
| Category | Cost |
| Construction | Civil Engineering Works - Civil Engineering Works Total Costs [M€] |
| | Tunnels - Tunnels Total Costs [M€] |
| | Bridges - Bridges Total Costs [M€] |
| | Viaducts - Viaducts Total Costs [M€] |
| | Minor/Hydraulic structures - Minor and Hydraulic structures Total Costs [M€] |
| | Earthworks - Earthworks Total Costs [M€] |
| | Interferences/Interfaces (roads and other) - Interferences and Interfaces Total Costs [M€] |
| | Stations, Yards and Structures - Stations Yards and Structures Total Costs [M€] |
| | Superstructure - Equipment Total Costs [M€] |
| Ancillary | Indirects - Indirects Total Costs [M€] |
| | Project Management and Supervision - Project management and supervision Total Costs [M€] |
| | Contingencies - Contingencies Total Costs [M€] |
| | Land acquisition - Land acquisition Total Costs [M€] |

Technical characteristics related to Construction works and Ancillary

| Tier 2 | |
|----------------------------------|---|
| Technical characteristics | |
| Category | Information to be included |
| Construction | Civil Engineering Works |
| | Tunnels <i>Tunnels number [#]</i> <i>Tunnels total length [km]</i> |
| | Bridges <i>Bridges number [#]</i> <i>Bridges Total Length [km]</i> |
| | Viaducts <i>Viaducts Number [#]</i> <i>Viaducts Total Length [km]</i> |
| | Minor/Hydraulic structures <i>Minor/Hydraulic structures Number [#]</i> <i>Minor/Hydraulic structures Type: pipe, box, small bridge, etc</i> <i>Minor/Hydraulic structures Functions: culvert, underpass, mixed, etc</i> |
| | Earthworks <i>Earthworks total length [km]</i> |
| | Interferences/Interfaces (roads and others) <i>Number of interfaces [#]</i> <i>Length of interfaces [km]</i> |
| | Stations, Yards and Structures <i>Number of stations [#]</i> |
| | Superstructure |
| | Ancillary <i>Type of ancillary works</i> |

2.3. Sheet 5: Tier 3 – Earthworks

Breakdown of costs for earthworks

| | | Tier 3 | |
|---------------------|--------------------------------|---------------------|--------------------------|
| | | Costs | |
| | | Category | Costs |
| Construction | Civil Engineering Works | Ground Level | - Ground Level Cost [M€] |
| | | Cuttings | - Cuttings Cost [M€] |
| | | Embankments | - Embankments Cost [M€] |

Technical characteristics of earthworks

| | | Tier 3 | |
|------------------------|--------------------------------|----------------------------------|--|
| | | Technical characteristics | |
| | | Category | Information to be included |
| Construction | Civil Engineering Works | Earthworks | Ground Level Length [km] |
| | | | Mileage of the subsections where earthworks at ground level are carried out [i.e. from km x.xx to km y.yy] |
| | | | Cuttings Length [km] |
| | | | Mileage of the subsections where cuttings are carried out [i.e. from km x.xx to km y.yy] |
| | | | Cuttings Height [m] |
| | | | Cuttings Predominant Material: rock, soil, clay, etc |
| | | | Embankments Length [km] |
| | | | Mileage of the subsections where embankments are carried out [i.e. from km x.xx to km y.yy] |
| Embankments Height [m] | | | |

2.4. Sheet 6: Tier 3 – Superstructure

Breakdown of costs of superstructure

| | | Tier 3 | |
|---------------------|-------------------------------------|---|--|
| | | Costs | |
| | | Category | Costs |
| Construction | Superstructure | Permanent way | - Permanent Way Cost [M€] |
| | | | |
| | | Power supply, distribution and OCL | - Power supply, distribution and OCL Cost [M€] |
| | | Signalling & Safety | - Signalling & Safety Cost [M€] |
| | | Telecommunication & PAS | - Telecommunication & PAS Cost [M€] |
| | Fencing, Noise barriers, etc | - Fencing, Noise barriers, etc Cost [M€] | |

Technical characteristics of superstructure

| | | Tier 3 | |
|-------------------------------------|--|---|--|
| | | Technical characteristics | |
| | | Category | Information to be included |
| Construction | Superstructure | Permanent Way | Permanent way typology: Ballasted/Slab Track |
| | | | Permanent way length [km] |
| | | Power supply, distribution and OCL | Voltage [kV] |
| | | | Power supply, distribution and OCL total length [km] |
| | | Signalling & Safety Systems | Signalling & Safety Systems length [km] |
| | | Telecommunication & PAS | Telecommunication & PAS length [km] |
| Fencing, Noise barriers, etc | Fencing, Noise barriers, etc length [km] | | |

2.5. Sheet 7: Tier 3 – Tunnels

Breakdown of costs for Tunnels

| | | Tier 3 | |
|---------------------|--------------------------------|------------------------------|----------------------|
| | | Costs | |
| | | Category | Costs |
| Construction | Civil Engineering Works | Tunnel 1 (Tunnel 2..) | - Tunnel 1 Cost [M€] |

Technical characteristics of Tunnels

| | | Tier 3 | |
|---------------------|--------------------------------|----------------------------------|---|
| | | Technical characteristics | |
| | | Category | Information to be included |
| Construction | Civil Engineering Works | Tunnel 1 (Tunnel 2..) | Tunnel 1 Length [m] Tunnel 1 Mileage [i.e. from km x.xx to km y.yy] For circular tunnel: Diameter [m] For non-circular tunnel: cross-section area [m ²] Envisaged construction method: <input type="checkbox"/> Classic (Drill & blast) <input type="checkbox"/> TMB (Tunnel boring machine) <input type="checkbox"/> NATM/ SEM <input type="checkbox"/> Submerged <input type="checkbox"/> Other (please specify) |

2.6. Sheet 8: Tier 3 – Bridges

Costs for bridges

| | | Tier 3 | |
|--------------|-------------------------|--------------------------|----------------------|
| | | Costs | |
| | | Category | Costs |
| Construction | Civil Engineering Works | Bridge 1 (Bridge 2..) | - Bridge 1 Cost [M€] |
| | | | |

Technical characteristics for bridges

| | | Tier 3 | |
|--------------|-------------------------|---------------------------|---|
| | | Technical characteristics | |
| | | Category | Information to be included |
| Construction | Civil Engineering Works | Bridge 1 (Bridge 2..) | Bridge 1 Length [m] Bridge Mileage [i.e. from km x.xx to km y.yy] Bridge 1 Height [m] Bridge 1 Type: Steel/Concrete Bridge 1 Typology: <input type="checkbox"/> Beam; <input type="checkbox"/> Cantilever; <input type="checkbox"/> Arch; <input type="checkbox"/> Suspension; <input type="checkbox"/> Cable stay; <input type="checkbox"/> Truss <input type="checkbox"/> Other (please specify) Bridge 1 Span [m] Bridge 1 foundations difficulty level [high, medium, low] |
| | | | |

2.7. Sheet 9: Tier 3 – Viaducts

Costs for viaducts

| | | Tier 3 | |
|-------------------|--------------------------|--------------------------------|-----------------------|
| | | Costs | |
| | | Category | Costs |
| Constructi | Civil Engineering | Viaduct 1 (Viaduct 2..) | - Viaduct 1 Cost [M€] |
| | | | |

Technical characteristics of viaducts

| | | Tier 3 | |
|-------------------|--------------------------|----------------------------------|---|
| | | Technical characteristics | |
| | | Category | Information to be included |
| Constructi | Civil Engineering | Viaduct 1 (Viaduct 2..) | <i>Viaduct 1 Length [m]</i> |
| | | | <i>Viaduct Mileage [i.e. from km x.xx to km y.yy]</i> |
| | | | <i>Viaduct 1 Height [m]</i> |
| | | | <i>Viaduct 1 Type: Steel/Concrete</i> |
| | | | <i>Viaduct 1 Span [m]</i> |
| | | | <i>Viaduct 1 foundations difficulty level [high, medium, low]</i> |

3. Definitions

Technical characteristics description:

- **Urban areas:** contiguous built-up areas where houses are typically not more than 200 m apart (discounting rivers, parks, roads, industrial fields, etc.);
- **Rural areas:** non-urban areas;
- **Terrain:** is intended as the main terrain typology crossed by the infrastructure;
 - **Mountainous:** terrain located 600 mt above the sea level;
 - **Hilly:** terrain located between 200 and 600 mt above the sea level;
 - **Flat:** terrain located below 200 mt above the sea level;
- **Bridge typology:**
 - **Beam:** bridge spans supported by an abutment or pier at each end;
 - **Cantilever:** bridge built using cantilevers;
 - **Arch:** bridge with abutments at each end shaped as a curved arch;
 - **Suspension:** bridge in which the deck (the load-bearing portion) is hung below suspension cables on vertical suspenders;
 - **Cable stay:** bridge with one or more towers (or pylons), from which cables support the bridge deck;
 - **Truss:** bridge whose load-bearing superstructure is composed of a truss, a structure of connected elements usually forming triangular units;
- **Foundations difficulty levels:**
 - **High:** foundation soil of low bearing capacity requiring indirect foundations i.e. by piles, sensible impacts of works for foundations on total construction costs of the structure (i.e. bridge or viaduct) e.g. cost for works related to foundations > 30% of total structure construction costs;
 - **Medium:** foundation soil of medium bearing capacity allowing for direct foundations of large dimensions and/or in the running water of rivers and the like, costs for work related to foundations have a lower impact on total structure construction costs e.g. 20 - 30%;
 - **Low:** Foundation soil of good/very good bearing capacity allowing for direct foundations of limited/reasonable dimensions, impact of works related to foundations on total structure construction costs e.g. < 20%.

Cost categories description:

- **Estimated costs:** Costs provided in the Application Form or other preliminary documents *N.B: Please, specify if derived from the Feasibility Study or determined in the design phase*
- **Final costs:** Costs included in the construction contracts
- **Total cost:** Includes the costs paid for Planning and Design, Construction and the Ancillary costs.
- **Planning and Design costs:** Include costs related to opportunity study, preliminary design, feasibility study, and final/detailed design.
- **Construction costs:** costs for the construction of main project components. It is presented in the project applications as well as reported in final implementation reports. They consist of several categories that are relevant for unit cost evaluations:

-
- *Civil Engineering Works Costs*: costs related to different categories, such as Tunnels, Bridges, Viaducts, Minor/Hydraulic structures, and Earthworks.
 - **Tunnels Costs**: Include total costs related to the construction of construction of the tunnel. i.e. the cost of the permanent way and equipment of the railway line passing through the tunnel should be excluded;
 - **Bridges and viaducts Costs**: total construction cost of each bridge and viaduct. The cost of the permanent way and equipment of the railway line passing through the structure should be excluded ;
 - **Minor/Hydraulic structures Costs**: Include costs related to the minor/hydraulic structures such as pipes, boxes, small bridges, etc.;
 - **Earthworks Costs**: Include costs related to tracking, roading, cleanfill sites, cut and fill operations, quarrying/ mining and transport and re-contouring, subcategorised as follows:
 - **Ground level Costs**: Include costs related to soil levelling and compaction;
 - **Cuttings Costs**: Include costs related to the cutting out of soil or rock along the railway line;
 - **Embankments Costs**: Include costs related to the creation of embankments layer of compacted soil that avoid changes in level required by the terrain along the railway line.
 - **Interferences/Interfaces (roads and other) Costs**: Include costs related to access way for passengers and goods, including access by road and access for passengers arriving or departing on foot.
 - **Stations, Yards and Structures Costs**: Include only costs related to the infrastructure (Station Yard included), i.e. costs related to the commercial activities are excluded as well as cost of the permanent way and the equipment of the railway line passing through the station.
 - **Superstructure Costs**: costs related to Permanent way, Power supply, distribution and OCL, Signalling and Safety, Telecommunication and PAS, Fencing and Noise barriers, etc.
 - **Permanent Way Costs**: Include costs related to subgrade, ballast, sleepers, rails and fastenings, switches/turnouts and related assembly, tune up and finishing operations;
 - **Power supply, distribution and OCL Costs**: Include costs related to the whole electrification system, thus also to OCL (Overhead Contact Line);
 - **Signalling and Safety Costs**: Include costs related to the equipment installed on the track, stations/control points for managing the train movement and for guaranteeing that passengers and freight can be transported with as low risk as possible;
 - **Telecommunication and PAS Costs**: Include costs for telecommunications and Public Address System installations on the open track, in stations and in marshalling yards;
 - **Fencing, noise barriers, etc. Costs**: Include costs to protective barriers, doors, or windows.
 - **Ancillary Costs**: include costs that do not belong to any of the previously stated categories, but have significant influence on the total project cost:
 - **Indirect Costs**: Other costs that can be attributed to the project;
 - **Project management and supervision Costs**;
 - **Contingencies**;
 - **Land acquisition**.