

Workshop on project preparation process
with reference to EU and WBIF requirements

Scoping of Feasibility Studies

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(Refresher)

- To provide a **preliminary assessment of project's viability**
- To ensure a solid basis for undertaking a **feasibility study**
- To **define a corridor** for developing the project based on its objectives and the major constraints identified

! Definitions and concepts

- **Alternative** – an idea for achieving the objectives, which is not necessarily very specific or defined in much detail; alternatives are expected to have *qualitative differences*
- **Option** – a specific and well defined solution to achieve the objectives; options are expected to have *quantitative differences*

- To select an **option** which best complies with the project objectives
- To demonstrate the **economic feasibility** of the preferred option
- To demonstrate the **environmental feasibility** of the preferred option (possibly through EIA)
- To develop the preferred option to **preliminary design level**

PFS and FS – a comparison

(Refresher)

	Prefeasibility Study (PFS)	Feasibility Study (FS)
Definition	An overview study aimed at studying the objectives	Detailed analyses of economic and technical feasibility of options
Policy Analysis	Examination of macro aspects of the project	Not applicable in most cases
Economic Analysis	Simplified analysis to determine the scope of detailed FS	Precise and detailed analysis of two or more options; demonstrates the feasibility of the preferred option
Technical feasibility analysis	Mostly based on existing literature and studies	Detailed technical analyses, e.g. topographical, geotechnical, hydro-geological, hydraulic; costs estimation; environmental impacts
Options	Fundamentally different ; should be possible to differentiate between them using mostly qualitative criteria.	The options should be similar enough to allow comparison using quantitative criteria

Scope of Feasibility Studies (1)

Tasks to be specified in the Terms of Reference

- **FS-0** Project identification (*in case no PFS*)
- **FS-1** Site inspections, data collection and analysis
- **FS-2** Definition of options
- **FS-3** Topographical study
- **FS-4** Geotechnical study
- **FS-5** Hydrological/hydraulic studies
- **FS-6** Traffic study
- **FS-7** Climate change vulnerability and risk assessment
- **FS-8** Cultural heritage and archaeological study
- **FS-9** Preliminary Environmental Impact Assessment

Scope of Feasibility Studies (2)

Tasks to be specified in the Terms of Reference

- **FS-10** Identification of utilities
- **FS-11** Road Safety Impact Assessment (*if a road*)
- **FS-12** Preliminary Design
- **FS-13** Road Safety Audit (*if a road*)
- **FS-14** Cost estimates
- **FS-15** Qualitative risk analysis
- **FS-16** Economic analysis of options
- **FS-17** Comparison of options
- **FS-18** EIA procedure
- **FS-19** CBA of the preferred alternative

Definition of tasks in the Terms of Reference

Purpose

A short description of what we wish to achieve with the task

Scope

Specification of the activities that form the task

Inputs

Specification of the items of data that need to be collected in order to execute the task

Outputs

Specification of the items of data that will become available as a result of the task

Timing

Comments on when the conditions for the task to start and end

Purpose

- To **collect and review existing project information** and to assess current conditions.
- To conduct a collaborative **site visit** with project stakeholders, technical specialists and local project constituents

NB: If the FS be procured separately from the PFS, then a data collection task with scope similar to PFS-2 will be necessary



Scope and inputs – items of data to be collected

- Previous Studies
- Mapping
- Existing and planned infrastructure
- Detailed information about:
 - Utilities
 - Geotechnical conditions
 - Hydrology and Hydraulics
 - Existing structures
 - Environmental conditions

FS-2 Definition of options

Purpose

- To consider and recommend suitable **design standards and parameters** (e.g. design speed and cross-section width) to be used for the definition of options
- To define **geometry of two or more (alignment and technological) options** within the preferred corridor from the PFS



Scope

- To define suitable horizontal and vertical alignments, widths/numbers of tracks, design speed, etc.
- To identify the **standards and criteria** to be used for the **access points and intersections**
- To determine the **locations and types of intersections** with other infrastructure
- To identify the **main structures** for each option and specify their location, type, dimensions and main technological properties

Criteria for the options

- The differences between the options shall be **quantitative**
- The options shall be designed within **the same corridor**
- If possible and practical, the options in the different sections shall have **common starting and ending locations**, to allow them being compared section by section
- Within project sections, as many **feasible options** as necessary shall be developed, considering the constraints and the objectives

FS-2 Definition of options

Inputs

- Outcomes of the site inspections, data collection and analysis
- Technical design characteristics
- Geological, hydrological, traffic, environmental and other information collected as part of the PFS and the FS

Outputs

- Overall layouts at 1/25000
- Layouts in sections at 1/5000 including culverts and structures
- Longitudinal profiles of alignments at 1/5000 horizontal and 1/500 vertical
- Standard cross sections at 1/200
- Layouts of interchanges at 1/2000

Timing

- Work on the alignment options should start **immediately after commencement** of the FS
- The initial definition of the options can be expected to take about 1-2 months
- Refining the options based on the information acquired during the FS is an **incremental and iterative process**:

Development of options informs preparation of other studies and investigations, which in turn inform development and refinement of the options

FS-3 Topographical study

Purpose

- To collect and analyse data on ground features along the options and create a **digital terrain model (DTM)**
- To provide a **basis for preparation of preliminary designs** of the options
- To facilitate the **design of the preferred option**



Scope

- To obtain **existing topographic maps** and information
- To define the relevant **planimetry and altimetry systems and networks** to be used
- To plan, prepare and carry out **land surveys** along the corridor with sufficient width to record all ground features and enable design of all road elements
- To process, calculate and store all **topography data** in relevant format and system
- To prepare **site plans** in relevant scales and adequate technical documentation
- To provide a **basis for preparation of preliminary designs** of the options, including estimating quantities for right-of-way clearance and earthworks

FS-3 Topographical study

Inputs

- Layouts of the options being studied
- Aerial photographs at a scale of 1/20000 with a resolution of 0.5 m over the whole length of the options retained for the final feasibility study
- For preliminary design, the level of detail will be at a scale of 1/5000.
- Existing digital terrain models
- Mapping of landowner plots

Outputs

- **3D digital terrain model**
- Plans of the terrain along the options at a scale of 1/5000 covering a band width of about 500 m
- Boundaries of properties (including type of the land and area) would be established at a scale of 1/5000 for agricultural land and where possible at 1/2000 for urban areas or villages

FS-4 Geotechnical study

Purpose

- To collect and analyse data on **geotechnical conditions** (geological structure of soil, engineering-geological and hydro-geological characteristics) along the options
- To provide a **basis for preparation of preliminary designs** of the options
- To identify suitable **sources of natural material** for construction, if applicable
- To inform the **design of structures** (pavement, foundations, retaining walls, etc.) regarding the properties of the terrain
- To inform selection of the most appropriate **construction methods**



Scope

- To provide physical-mechanical, chemical and other relevant characteristics of rock masses and soils
- To establish seismological characteristics of the terrain
- To determinate causes for instability and provide information on potential problems for constructing the alternatives under consideration
- To determinate ground water and surface water conditions
- To identify potential sources of higher-quality materials within the area, and opportunities for optimising the subgrade, base and pavement design
- To establish a basis for the foundations of structures, tunnels and drainage structures along the alignments.
- To prepare surveys at selected locations such as at planned major structures and other difficult areas observed during the initial site reconnaissance

Inputs

- Layouts of the project corridor and options being studied
- Existing geologic, geomorphologic and hydrogeological maps
- Aerial photography and satellite imagery to interpret boundaries between terrain types, where changes in topography, geology, drainage pattern or vegetation occur
- Earthquake activity and climate maps
- All existing geotechnical information from previous studies and road construction activities in the area of the project
- Outcomes of site inspections

Outputs

- Main **hydro-geological characteristics** of the study area adequately mapped and reported incl. ground water table levels
- **Structural and chemical properties of the soils** and rocks along the alignments
- Existing and/or potentially **unstable soil conditions**
- Major **geological features** that will constrain the design
- Definition of **natural hazards**
- Inventory of **construction materials** would be developed – location of possible sources or sites for base, surfacing and topsoil materials
- **Seismic study**
- **Geological profiles** (in case of tunnels)

FS-5 Hydrological/hydraulic studies

Purpose

- To collect and analyse data on **hydrological and hydraulic conditions** along the options in line with respective national and European regulations and standards
- To facilitate **hydraulic sizing of bridges**, as well as the size and capacity of hydrotechnical, protection, stabilisation works
- To provide the parameters of surface and subsurface hydrological processes for all types of **drainage structures**, including allowances for climate change



Scope

- To make an analysis of all relevant mapping and related studies, including those made for flood mapping by municipalities, as well as available hydrological and pluviometric data
- To carry out hydrologic analysis and hydraulic analysis for structures

Inputs

- Layouts of the options being studied
- Large-scale topographical maps will be used to determine the drainage basins and catchment areas leading to the specific structures
- Rainfall data and existing hydrological data
- River basins data and information incl. existing and/or planned flood control measures
- Land use maps and other site data
- Flood data applicable to estimating floods at locations along the options

Outputs

- Presentation of current and future estimated **rainfall patterns**
- **Runoff volumes** estimations including 100 (50, 200)-year flood levels for various sites along the proposed alignments
- Determination of **hydraulic parameters** for structures and drainage designs
- Definition of **typical drainage structures**
- Identification of **locations, sizes and capacity** of required hydrotechnical, protection, stabilisation **works for river beds**
- Identification **protection measures** for adjoining earthwork embankments

Purpose

- To establish **existing and expected traffic patterns** and provide **precise estimate** of the amount of traffic, which would be diverted to each section of a new facility
- To inform the **comparison of options**
- To serve as input in the **CBA for the preferred option**



Scope

- To analyse the **existing traffic data**, existing national road transport models, etc.
- **Collect traffic data** through counts and surveys
- Develop a **project-specific transport model**
- To appraise the demand **with and without the project**
- To separate traffic into **existing, diverted and generated**

! Definitions and concepts

- **The demand model** forecasts the behavior of the population in terms of number of trips, their origin and destination, mode choice, choice of time and route, etc.
- The models forecast the **future demand** of transport services depending on:
 - the present conditions (represented by the **base year** model) and
 - **forecasted values** of social and economic parameters such as population, jobs, GDP, etc.

Inputs

- Existing **traffic counts and surveys**
- Existing **transport models**
- Social and economic data and projections
- Data regarding the geometry and condition of the **existing transport network**
- Future network development scenarios

Outputs

- **With and without project traffic forecasts for each link in the network** based on recent traffic data for each type of vehicle, and taking into account various macro-economic forecasts over project's reference period

FS-7 Climate change VRA

Purpose

- To improve project's **resilience to climate change**



! Definitions and concepts (1)

- **Climate change adaptation** – the process of improving the resilience of infrastructure to climate change
- **Climate change mitigation** – human intervention aimed at limiting the emissions of greenhouse gasses or improving their absorption rates
- **Climate proofing** – includes *both* climate change mitigation and adaptation; one of the three pillars of *sustainability proofing*, i.e.: climate, environmental and social proofing

! Definitions and concepts (2)

- **Extreme weather-related events** – the main subject of analysis within the framework of climate change vulnerability and risk assessments (examples to follow)
- Extreme weather-related events result in **negative impacts** on the components of infrastructure (i.e. of the *assets*), as well as on the users (i.e. on the *services*)
- Extreme weather-related events are directly linked to the changes of one or more **climate variables / indices**
(e.g. maximum volume of precipitation for 1 – 5 days during the year, number of days with snow cover, number of days with precipitation above a certain threshold, number of dry days, number of days with precipitation, average daily / monthly / annual temperature, minimum / maximum temperature, etc.)

! Definitions and concepts (3)

- **Vulnerability assessment** – combines *qualitative* measures of the sensitivity of the project to extreme weather-related events and its exposure to the events with the purpose to **identify the most important vulnerabilities**:

$$\textit{Vulnerability level} = \textit{Sensitivity level} \times \textit{Exposure level}$$

- **Sensitivity** – a measure of the strength of the negative impacts from the occurrence of an extreme weather-related event. It is determined **independent** of project's location
- **Exposure** – a combined measure of the **strength and frequency** of occurrence of an extreme weather-related event, considering project's location

! Definitions and concepts (4)

- **Risk analysis** – combines (usually) *qualitative* measures of the impact and probability of occurrence of extreme weather-related events, in order to identify the most important risks for the project:

$$\text{Risk level} = \text{Impact level} \times \text{Likelihood level}$$

- **Impact** – a measure of the strength of the negative impact of the occurrence of a risk (i.e. extreme weather-related event)
- **Likelihood** – a measure of the **probability** of occurrence of a risk (i.e. extreme weather-related event)

Scope

- To define a list of **extreme weather-related events**
- To determine the project's sensitivity, exposure and resulting **vulnerability** to the events
- To use a qualitative **risk analysis** to identify which events are the most important to address
- To identify and evaluate **adaptation measures** for each significant risk, and integrate them into the project design and/or operation to increase its resilience
- CC VRA results should be included in the EIA report

Inputs

- Historic data (statistics) on the **frequency and impact** of extreme weather-related events
- Historic data of **climate variables** (local/national data on precipitation, temperature, extreme weather indices, etc.)
- **Future projections** of the climate variables (may be at European level, e.g. PESETA II, if not available at national level)
- Knowledge of **project's specific location and conditions**

Outputs

- Identification of which extreme weather-related events the project is vulnerable to
- Identification and assessment of **key climate risks**
- Identification of **adaptation measures** for the key risks
- Establishment of appropriate **monitoring systems**

Purpose

- To **avoid and/or minimise impacts** of the project on cultural heritage or archaeological sites



Scope

- To do a **literature review** to identify cultural heritage and archaeological sites within the boundaries of the project
- To carry out **field investigations** to identify cultural heritage and archaeological sites within the boundaries of the project
- To define **conservation** or other measures
- To define **scope of monitoring** of the works

NB: Appropriate authorisations shall be sought, as well as the precise recommendations for the development and monitoring of the works.

Inputs

- Consultations carried out with the competent bodies in the affected communities
- Layouts of the options being studied
- Existing cultural heritage and archaeological mapping, studies and data along the options
- Aerial photography and satellite imagery to identify any potential sensitive sites
- Existing and available cultural heritage and archaeological information from previous studies and construction activities in the area of the project

Outputs

- Identification and evaluation of **all probable sites** and extensions of the existing sites
- Estimation of probable impacts, costs and durations of archaeological discharge periods for the options
- **Detailed study of the preferred alignment** including non-destructive (geophysical) and intrusive field surveys where necessary
- **Protective measures, corrective measures** or necessary compensatory measures will be established, including their economic valuation

Timing

- Must be carried out **as early as possible** after the options are defined, so that they can be adjusted in case they affect major sites
- A **detailed study** for the preferred option **may** be carried out after its selection
- Field surveys and investigations to be programmed for **early Spring or late Autumn** to avoid excessive vegetation

FS-9 Preliminary EIA

Purpose

- To identify and assess the **environmental impacts** of the options
- To provide input into the process of **selection of a preferred option** (FS-17)
- To provide input to the **formal EIA procedure** (FS-18)



Scope

- Examination of the **baseline and options** using a **detailed analysis** of environmental conditions and criteria
- This environmental study shall take into consideration all the **environmental factors** from the EIA Directive:
 - “(a) population and human health;
 - (b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
 - (c) land, soil, water, air and climate;
 - (d) material assets, cultural heritage and the landscape.”
- **Impacts on biodiversity**

Inputs

- **Environmental data** from environmental authorities
- **Aerial photographs** or satellite images
- Existing **settlements**, their population size, land use and infrastructure
- Known **archaeological sites** and other valuable historical sites
- **Sensitive areas** (e.g. areas of scenic beauty and sites of specific scientific interest)
- **Agricultural and land use** mapping

Outputs

- Assessment of possible **environmental impacts** of the options
- Input into the options appraisal and selection of a preferred option
- Identification of environmental **mitigations measures** and costs

FS-10 Identification of utilities

Purpose

- To prepare for dealing with **existing (or planned) utilities, which will (or may) be affected** by the options



Scope

- To collect information **from public sources** on existing surface and underground utilities and facilities
- To acquire information **from utility companies** to determine the type and location of the existing utilities
- For each option, establish the need of **relocations of utilities**, as well as any specific requirements of the owners
- Follow up on the information being received from utility owners and make sure that the team have up to date knowledge regarding the **limitations to the design**
- To obtain **principle endorsements** from the utility owners
- To inform in the preparation of preliminary design of the options all affected utilities, designs of their protections and/or relocations, any land acquisition needs arising

Inputs

- Existing utility maps, plans and agreements
- Identification in the field of the existing utilities
- Information received from utility owners

Outputs

- Identification of **major utilities** and/or special services
- **Description** of the utilities, including how they are likely to be affected
- **Identification of the owners** of each utility and contact information of representatives
- Description of any **existing utility agreements** or easements between the project developer and the owners of the utilities
- Description of **any special considerations** regarding utilities that are unusually sensitive or difficult to address for clearance prior to construction
- The **location of utilities** crossing the options on 1/5000 scale plans
- **Estimation of associated protection/relocation works** and other associated costs (e.g. land acquisitions)

Purpose

- To **assess the safety consequences** of changes (redistributions) of traffic over a road network due to the project
- To demonstrate, on a strategic level, the implications on road safety of different planning alternatives
- To contribute to the **appraisal of options**



Scope

As per the Road Safety Directive (**includes comparison of options and simplified economic analysis!**)

Inputs

- Layouts of the options
- Existing and proposed traffic flows, including pedestrian and cycle flows and use of public transport
- Seasonal and climatic conditions
- Possibility of seismic activity
- Network accident data

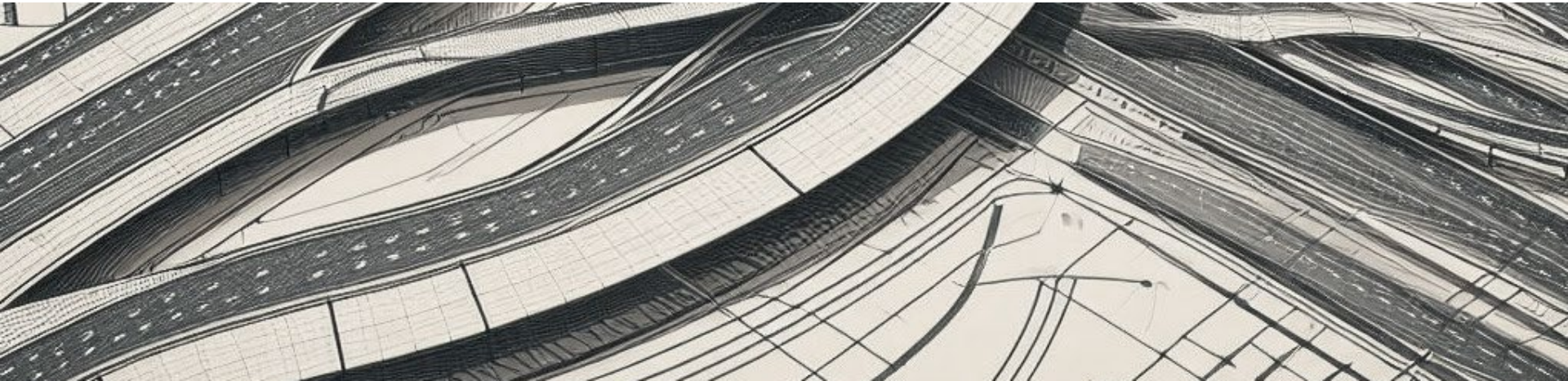
Outputs

As per the Road Safety Directive

FS-12 Preliminary design

Purpose

- To prepare preliminary designs of the **options**, which take into account the results of the previous technical studies
- To prepare a **preliminary design of the preferred option**



Scope

- Iterative process to:
 - **Review and amend the options** based on the terrain and other studies, forming the FS
 - **Identify slope stabilisation measures** for all options
 - **Estimate impacts** of all options for appraisal
- Supplement the preferred option with **detailed designs of slope stabilisation measures**
- Develop some secondary elements of preliminary design **only for the preferred option** (see outputs section)

Inputs

- Technical design characteristics and standards
- Initial layouts of the options
- Topographical, geotechnical, hydrological/hydraulic studies
- (RSIA and interim/final recommendations from RSA)
- Traffic studies
- Climate change VRA to be taken into account with the design
- Identified utilities
- Known historic and archaeological sites
- Information regarding environmental limitations
- Internal drainage design – collection and treatment of runoff water
- External drainage design – protection from permanent and periodic streams and water flow

Outputs – all options

- Overall layout at 1/25000
- Layout in sections at 1/5000 including main culverts and structures
- Longitudinal profile of alignments at 1/5000 horizontal and 1/500 vertical
- Standard typical cross sections at 1/200
- Overall layouts of interchanges at 1/2000
- **Identification** of slope stabilisation measures
- Identification and design of **site access roads** and connections to the existing road network
- Identification of **deposit sites**

Outputs – preferred option (1)

- Detailed cross sections at each 20 m
- Longitudinal profiles of links of interchanges
- Designs of **slope stabilisation measures**
- **Surface drainage** drawings
- Detailed **traffic management drawings**
- **Parcel plans** for land acquisition
- **Pavement design**, including comparison of pavement options (if road)

Outputs – preferred option (2)

- Other elements, e.g.:
 - topographical and geotechnical baseline reports
 - fire protection and safety
 - waste management plans
 - construction site management plans
 - ITS
 - landscaping
 - environmental monitoring plan
 - sound protection barriers and ecoducts
 - lighting, water treatment
 - relocation and reconstruction of existing roads, etc.
- **Requirements for the detailed design** (for the preferred option)

Outputs – structures

- General layouts of main structures at scale of 1/500
- Drawings showing foundation types and depths
- Cross-sections at scale of 1/200 (for the preferred option)
- Common structure details at scale of 1/200 (for the preferred option)
- Hydrologic and hydraulic data, calculations and analysis (for the preferred option)
- **Construction strategy** (for bigger structures and for the preferred option)
- Written description of the structure and nature of the crossed obstacle (for the preferred option)
- **Requirements for the detailed design** of big structures (for the preferred option)

Outputs – tunnels (1)

- Specification of tunnel characteristics (number of lanes, cross-section and lane widths, etc.)
- General layouts of main structural elements at scale of 1/500
- Cross-sections of the standard lining types at scale of 1/200
- Longitudinal profile at 1/5000, 1/500 (with indication of lining types to be used)
- Baseline geotechnical and hydrological report (for the preferred option) incl. hydrogeological profile)
- Baseline topographical report (for the preferred option)
- Portal layout drawings at 1/200 (for the preferred option)

Outputs – tunnels (2)

- Common structure details at scale of 1/200 (for the preferred option)
- Technical description including all relevant data on design of tunnel (for the preferred option)
- Risk analysis in accordance with Directive 2004/54/EC and a risk register (for the preferred option)
- Fire protection strategy (for the preferred option)
- Ventilation strategy (ventilation system type and requirements; for the preferred option)
- Lighting and electrical facilities (for the preferred option)
- Communication facilities (incl. radio broadcasting system, loudspeakers, CCTV etc.)
- Energy supply
- Maintenance and monitoring equipment and operational centre (where applicable)

Outputs – tunnels (3)

- ITS (for the preferred option)
- Tunnel dimensioning – confirmation that the cross-section selected can accommodate all systems required (for the preferred option)
- Construction strategy and prescriptions regarding the construction method (for the preferred option)
- Muck management strategy (expected muck properties, treatment needed, deposit sites, etc.; for the preferred option)
- Technical specification for tunnelling works
- Requirements for the detailed design of tunnels (for the preferred option)

Outputs – utilities

- **Outline design solutions** for relocating/protecting the utilities identified – explanatory notes and drawings at appropriate scale
- Estimation of associated protection/relocation works and other associated costs (e.g. land acquisition etc.)
- **Approvals of utility owners** of the outline designs
- Further requirements for the design and execution of the relocations (if any)

Timing

- The preliminary design of options can be finalised once all preceding studies are completed
- In reality, preparing the designs is an **incremental process**, which **develops in parallel** with the rest of the activities
- As indicated above, some secondary elements of the preliminary design do not need to be developed for all options, but **only for the preferred one** after it is selected

FS-13 Road Safety Audit

Purpose

- To assess **road safety impact** of the **preferred option** during the **preliminary design** stage in order to address potential safety hazards



Scope

As per the Road Safety Directive

Inputs

- A **site visit** to take into account the topography, local amenities, tie-ins of the scheme and any other relevant details
- **Accident history** of the location,
- Current and forecast **volumes** of motor vehicles, cyclists and pedestrians
- **Development plans** in the project area
- **Preliminary design** plans and drawings

Outputs

As per the Road Safety Directive

Timing

Concurrently with the preliminary design

FS-14 Cost estimates

Purpose

- To prepare **preliminary** cost estimates of **all options** based on their preliminary designs (for comparison)
- To prepare a **detailed** cost estimate of the **preferred option** based on its preliminary design (including its operation & maintenance costs as an input into verifying its economic viability)



Scope

- To estimate preliminary **construction quantities for major types of works**
- To estimate O&M costs
- To determine up to date **unit rates** (ideally from recent construction contracts)
- For the preferred option, provide a **detailed cost estimate**
- To quantify any possible risks and incorporate them into the estimates

Inputs

- Preliminary designs of the options

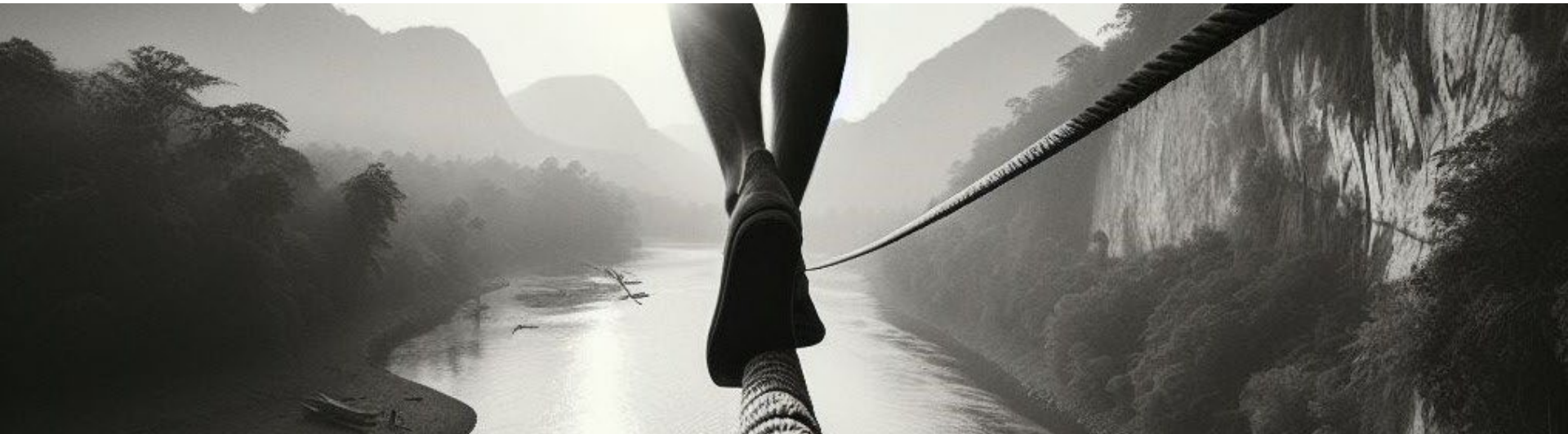
Outputs

- Cost estimates for the alternative options including O&M estimates
- Detailed cost breakdown for the preferred option by key work categories (i.e. earthworks, roadworks, structures, tunnels, pavements, drainage, utilities, protection measures, site installation, rest areas etc.)

FS-15 Qualitative risk analysis

Purpose

- To **identify significant risks** of the project
- To **formulate measures** to mitigate or avoid the risks



Scope

- It is considered **good practice** to carry out qualitative risk assessments during project preparation
- For projects to be co-financed from ESIF it is **mandatory** to demonstrate that risks have properly been taken into account when developing the project

! Definitions and concepts (1)

- **Risk** is an *event*, occurring with some *probability* within a *period of time*, and negatively affecting the adopted *objectives*
- **Quantitative risk analysis** – when for the purpose of defining risks the probabilities are determined using measured *frequencies* of the events, and the negative effects are *quantified* (e.g. in monetary terms)
- **Qualitative risk analysis** – when subjective levels of risk expectance are used (i.e. *likelihood* levels), and the negative effects are evaluated *qualitatively*

! Definitions and concepts (2)

- Risks can be compared by determining their *level* (i.e. *dis-utility*) – by multiplying the likelihood and impact levels:

$$\text{Risk level} = \text{Likelihood level} \times \text{Impact level}$$

(i.e. similar to von Neumann-Morgenstern expected utility of a risk occurring or not)

- It is important to define the *analysis period*, whereas risk levels may change with time and the notion of likelihood is time-dependent (although rarely done in reality)

cause ⇒ event ⇒ negative effects ⇒ impact

Inputs

- General information about the project and project area
- Preliminary design of the preferred option
- Selected procurement route
- Environmental information
- **Climate change vulnerability & risk assessment**

Outputs

- Qualitative risk analysis (list of adverse events, risk matrix, link with the sensitivity analysis, the negative effects on the project; risk levels)
- Interpretation of the risk matrix
- **Description of mitigation and/or prevention measures**



Example

Measures to avoid risks and/or mitigate their impacts

Example 1:

- Risk – public opposition
- Responsible – Employer, Contractor
- Measures – improved communication between the Employer and the Contractor
- Period – permanent



Too general definition of the measure, and it is not demonstrated how it would actually help.

Also, it is unclear if the entities mentioned indeed have the responsibility to implement the measure.



Example

Measures to avoid risks and/or mitigate their impacts

Example 2:

- Risk – public opposition
- Responsible – PIU, Public Relations Department, Engineer, Contractor
- Measures:
 - Establishment of a project monitoring committee with appropriate stakeholders. PIU to prepare order of appointment and send invitations to municipalities, NGOs, etc. by XX.XX.2023
 - Conduct coordination meetings between Engineer, Contractor and local authorities every 2 months (duty included in chapter X of the Employer's Requirements and Engineer's ToR)
 - Publishing monthly summaries of the progress of the Works on Employer's webpage (duty included in the Internal rules and procedures of the Public Relations Department)
 - Preparation and execution of a Publicity Action Plan by the Contractor (duty included in chapter Y of the Employer's Requirements)



Purpose

- To assess the **economic viability** of the options

(The task is equivalent to PFS-8. Only at this stage we expect the inputs to be more precise.)



Scope

The main economic benefits to be considered for all options are:

- reduction in **generalised costs** for movement of goods/people, i.e. **timesavings** and reduction of **vehicle operating costs**
- **accident** savings
- reduction of **GHG emissions**
- reduction of **non-GHG emissions and exposure to the emissions** (i.e. local air pollution impacts)
- reduction of **noise emissions**

Inputs

- Estimates of **investment and operating costs** broken down by years over the reference period
- The **residual value** of the investment (i.e. at the end of the reference period)
- Estimates of **demand** based on which the main economic benefits are estimated.

Outputs

- Main **economic costs and benefits** of the alternatives
- **Economic performance indicators:**
 - Economic net present value (ENPV)
 - Economic internal rate of return (ERR)
 - Benefit to cost ratio (B/C)

FS-17 Comparison of options

Purpose

- To select an option, which best fulfils the **project objectives**, and is expected to be:
 - economically and financially viable
 - environmentally sustainable
 - feasible (implementable)



Scope

- **Decision context:** define stakeholders, social values, strategic objectives
- **Objectives:** define project objectives (e.g. connectivity, sustainability, environment, social impact)
- **Decision alternatives:** identify and screen options based on their contribution to the objectives
- **Criteria:** derive from objectives, group by high and low-level objectives, include economic and environmental criteria
- **Evaluation framework:** decide weights, score ranges, scales, functions
- **Criteria weights:** choose method, verify preferences
- **Sensitivity analysis:** test robustness of weights and scores

Inputs

- Present value of the **economic costs and benefits** of the options
- **Environmental impact ratings** in tabular format for each option
- Performance of the alternatives contributing to **other objectives**

Outputs

- **Multi criteria analysis**, combining the economic indicators with the environmental impact ratings for each option
- **Sensitivity analysis** to assess the robustness of MCA

FS-18 EIA procedure

Purpose and scope

- EIA – to ensure **high level of protection** of the environment and human health
- Purpose of the task – to assist the employer in carrying out the EIA procedure (on the basis of FS-9)



FS-19 CBA of the preferred option

Purpose and scope

- To prepare the preferred option **for application for financing**
- Scope as per the requirements of the financing institution



- Inception Report
- Topographical Studies Report
- Geotechnical Studies Report
- Hydrological/Hydraulic Studies Report
- Preliminary Environmental Impact Assessment Report
- Climate Change Vulnerability and Risk Assessment Report
- Road Safety Impact Assessment Report
- Road Safety Audit Report
- Multi-Criteria Analysis Report
- Cost-Benefit Analysis Report
- Preliminary Design (of the preferred and other options)
- Reference Design (the Preliminary Design of the preferred option packaged for tendering in the next stage of project development)
- Final Report

Coffee break

