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Introduction

- **UIC High Speed Department** launched this study to provide the **guidelines** to be considered when **implementing** a High Speed Railway System-Network.

- The firms **SENER** (Spain) and **INGEROP** (France), with a **large experience in high speed railway systems** in their countries, have developed this Handbook which compiles, in a whole document, all phases that must be considered from the starting decision to the final construction and operation.

- At the end of each phase an **empowerment stage** allows to **decide** the convenience of **continuing** with next phases before incurring in additional expenses.

- All the stages can be **customized** to the requirement of each member but in any case all of them must be considered.
# Handbook Structure

## Emerging Phase
- **Stage 0.** Emergence
- **Stage 1.** Pre-feasibility Studies
  - 1.1. Ridership forecasting and transport services delivery
  - 1.2. Planning and Master Plan (including empowerment to continue)

## Feasibility Phase
- **Stage 2.** Feasibility studies
- **Stage 3.** Environmental Assessment
- **Stage 4.** Financial & Economic Analysis
- **Stage 5.** Multicriteria Analysis
- **Stage 6.** Preliminary Design
- **Stage 7.** Empowerment

## Design Phase
- **Stage 8.** Operation and Maintenance Planning
- **Stage 9.** Detailed design (including empowerment to continue)

## Construction Phase
- **Stage 10.** Construction Planning
- **Stage 11.** Construction
- **Stage 12.** Testing & Commissioning (including authorization to open to revenue service)

## Operation Phase
- **Stage 13.** Operation and Maintenance
- **Stage 14.** Ex-post evaluation
Handbook Structure

Structure for each Stage

- For each of the stages, the most relevant points have been identified:
  - GENERAL PURPOSE
    - Objectives of the stage: what is to be achieved in the stage
    - Key points: main aspects to be treated
    - Stage Inputs: Data, studies, regulations, etc. may be different from those coming from the previous stages
    - Stage Outputs: May be different from those needed from the former stages
  - SCHEDULING
    - Position in the general process: flow chart of the process, identifying the stage and the relations between other stages.
    - Stage Duration
  - MANAGEMENT
    - Actors involved: Stakeholders to identify positive and negative actions
    - Empowerment: How decision are taken and validated by whom
    - Risk: Main risks of the process and the mitigation measures.
Structure of the Handbook

- **EMERGING PHASE**
  
  - **Stage 0. Emergence:** To ensure that the project will eventually come to life.
  
  - **Stage 1. Pre-feasibility Studies:**
    
    - **1.1. Ridership forecasting and transport services delivery goals:** To estimate future ridership for each of the alternative corridors, as a result of a transport demand model that takes into account the current mobility.
    
    - **1.2. Planning and Master Plan:** To develop the first corridors approach for the new High Speed System and a first cost estimation.
Structure of the Handbook

**FEASIBILITY PHASE (I)**

- **Stage 2. Feasibility Studies:** To identify the most effective high speed rail options, with the level of investment that would be compatible with an economically, competitive and viable project with feasible technology.

- **Stage 3. Environmental assessment:** To take into account environmental issues as a key factor in project design and to prepare an environmental management plan.

- **Stage 4. Financial & economic analysis:**
  - To estimate the profitability of the project to assess the need of financial support (Financial Analysis).
  - To estimate the profitability of the project to assess social improvements due to the project (Economic Analysis).
Structure of the Handbook

- **FEASIBILITY PHASE (II)**

  - **Stage 5. Multicriteria analysis:** To contribute to the choice of a solution that balances the various requirements on the basis of shared criteria.
  
  - **Stage 6. Preliminary design:** To create the high-level design project.
  
  - **Stage 7. Empowerment:**
    - To give green light to the project.
    - To involve the various players in a decision-making process that will make possible the implementation of the project.
Structure of the Handbook

- **DESIGN PHASE**

  - **Stage 8. Operation and Maintenance planning:** To develop the Operation and Maintenance plans and estimate the operational and maintenance costs depending on the exploitation model.

  - **Stage 9. Detailed Design:**
    - To obtain an accurate definition of the project in line with the regulations and standards in force.
    - To prepare the works contracts.
Structure of the Handbook

- CONSTRUCTION PHASE

  • Stage 10. Construction Planning:
    - To ensure that all the stages in the construction process are under control and prepared for the new service.
    - To ensure compliance with the scheduled commissioning date.

  • Stage 11. Construction: To build an infrastructure and a system compliant with the safety, quality and environmental management objectives within the set deadlines.

  • Stage 12. Testing & Commissioning: To validate the system in order to obtain permission to place the new line in service.
Structure of the Handbook

- **OPERATION PHASE**
  - **Stage 13. Operation and maintenance:** To operate and maintain the High Speed system with adequate Reliability, Availability, Maintainability and Safety.
  - **Stage 14. Ex-post Evaluation:**
    - To establish whether project targets have been achieved.
    - To analyze and explain any disparities.
    - To draw conclusions for the future.
Implementation process

- **Emerging phase (1 to 5 years)**: Ridership forecasting, Transport services delivery, Main options, Sustainable strategy, Politic will & Response to a need
- **Feasibility phase (3 to 5 years)**: Financial & economic analysis, Functional solutions, Preliminary Design, Environment assessment, Acceptability
- **Design phase (2 to 3 years)**: Project Assessment, Program RAMS requirement, Detail design, Action definition, Negotiation
- **Construction phase (4 to 6 years)**: Financial commitment, Maintenance and Operating plan, Quality monitoring, Action realization, Temporary employments
- **Operation phase**: Traffic income, Operational and maintenance costs, RAMS assessment, RAMS validation, Environmental results & monitoring, Improvement of mobility

**ECONOMIC ASPECTS**
- Ridership forecasting
- Financial & economic analysis
- Project Assessment
- Financial commitment
- Traffic income
- Operational and maintenance costs

**FUNCTIONAL ASPECTS**
- Transport services delivery
- Functional solutions
- Program RAMS requirement
- Maintenance and Operating plan
- RAMS assessment

**TECHNICAL ASPECTS**
- Main options
- Preliminary Design
- Detail design
- Quality monitoring
- RAMS validation

**ENVIRONMENTAL ASPECTS**
- Sustainable strategy
- Environment assessment
- Action definition
- Action realization
- Environmental results & monitoring

**SOCIAL ASPECTS**
- Politic will & Response to a need
- Acceptability
- Negotiation
- Temporary employments
- Improvement of mobility

**Presentation Details**
- Luis, Bazán
- Railways & High Speed Lines Director, SENER, Spain
- Wednesday, July 11. Session: Project Management
Structure of the Handbook

**EMERGING PHASE**
- Stage 0. Emergence
- Stage 1. Pre-feasibility Studies
  - 1.1. Ridership forecasting and transport services delivery
  - 1.2. Planning and Master Plan (including empowerment to continue)

**FEASIBILITY PHASE**
- Stage 2. Feasibility studies
- Stage 3. Environmental Assessment
- Stage 4. Financial & Economic Analysis
- Stage 5. Multicriteria Analysis
- Stage 6. Preliminary Design
- Stage 7. Empowerment

**DESIGN PHASE**
- Stage 8. Operation and Maintenance Planning
- Stage 9. Detailed design (including empowerment to continue)

**CONSTRUCTION PHASE**
- Stage 10. Construction Planning
- Stage 11. Construction
- Stage 12. Testing & Commissioning (including authorization to open to revenue service)

**OPERATION PHASE**
- Stage 13. Operation and Maintenance
- Stage 14. Ex-post evaluation
### Example: Stage 3. Feasibility Studies

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>KEY POINTS</th>
<th>INPUTS</th>
<th>OUTPUTS</th>
<th>ACTORS INVOLVED</th>
<th>DURATION</th>
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</thead>
<tbody>
<tr>
<td>• Identify corridors</td>
<td>• Design Criteria</td>
<td>• Railway acceptance for Planning and Master plan</td>
<td>• Land acquisition</td>
<td>Railway Authorities</td>
<td>3-4 years</td>
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<tr>
<td>• Geotechnical investigation</td>
<td>• Right of Way</td>
<td>• Data collection</td>
<td>• Funding</td>
<td>Manufactures</td>
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<td>• Cost estimation</td>
<td>• Systems</td>
<td>• Roles and responsibilities for all participants</td>
<td>• Feasibility design</td>
<td>Environmental lobbies</td>
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<td>• Identity possible funds</td>
<td>• Stations &amp; terminals</td>
<td>• Requirements and programme information and approvals schedule</td>
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<td>Engineering companies</td>
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<td>• Identify opportunities for local/regional Governments</td>
<td>• Rolling Stock</td>
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<td>Governments</td>
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<td>• Define potential stations</td>
<td>• Procurement Strategy</td>
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<td>• Identify possible interoperable systems</td>
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<td>• Risks</td>
<td>• RAMS</td>
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Example: Stage 3. Feasibility Studies

Objectives of the stage

**Overall objective of a feasibility study**

The high speed rail feasibility study will:

- **Identify** possible underdeveloped train corridors and existing corridors to support a high speed railway network.
- **Establish** medium-term estimates of construction costs.
- **Undertake** geotechnical investigations in targeted areas to determine the need for tunnelling or alternative corridor alignments.
- **Identify** a list of potential projects that could be competitive with an economically competitive and viable project.
- **Survey** potential travel patterns to help define station location options and market analysis on the relative value of city centres and other city train terminals, including pedestrian services.

**Stage 3: Feasibility studies**

- **Task 3.1: Planning the Study**
  - **Objective:** To prepare the feasibility study methodology and plan the study.
  - **Tasks:**
    1. Define the scope of the study.
    2. Establish the methodology for the study.
    3. Plan the resources and timeline for the study.

- **Task 3.2: Feasibility Studies**
  - **Objective:** To conduct the feasibility studies for the proposed corridor.
  - **Tasks:**
    1. Collect and analyse data on the proposed corridor.
    2. Assess the technical and economic feasibility of the corridor.
    3. Identify potential environmental and regulatory issues.

**Feasibility factors based on the proposed corridor**

- **Key points**
  - **Key factors:**
    1. **Economic viability:** Assess the economic viability of the proposed corridor.
    2. **Technical feasibility:** Assess the technical feasibility of the proposed corridor.
    3. **Environmental impact:** Assess the environmental impact of the proposed corridor.

**Additional objectives**

- **Additional objectives for the feasibility study**
  - **Task 3.3: Finalizing the Study**
    - **Objective:** To finalize and present the feasibility study report.
    - **Tasks:**
      1. Review and refine the feasibility study report.
      2. Present the feasibility study report to the stakeholders.

**Key points**

- **Design criteria:**
  - **Rolling stock:**
    1. Technical and safety requirements.
    2. Commercial requirements.
    3. Operation and maintenance requirements.
    4. Type of service and accessibility.
  - **Railway infrastructure:**
    1. Railway network:
      - High speed and conventional railway networks.
      - High speed and intercity railway networks.
    2. Railway tracks:
      - Track geometry.
      - Track structure.
      - Track maintenance.
  - **Station and terminals:**
    1. Station layout:
      - Number of platforms.
      - Functional scheme.
      - Accessibility.
    2. Terminal layout:
      - Ticketing and security control.
      - Commercial areas.
Example: Stage 3. Feasibility Studies

Key points:

**LAND ACQUISITION PROCESS**

1. Identification of "key" parcels
2. Survey documents and legal description
3. Variation of land
4. Notification of land value

- Agreement
  - Payment to the State authorities
  - Object of the deed and registration
- Non-agreement
  - Identification of values according to law on an area by area basis

**Stage 3: Feasibility studies**

*RAIS Analysis during High Speed Railway System Implementation*

- Feasibility study
- Preliminary design
- Detailed design
- Procurement
- Construction
- Operation and maintenance
- Acceptance
- Test

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Example: Stage 3. Feasibility Studies

Inputs
- Railway Authority: Acceptance of Planning and tender. Pack stage and obtain a forecast of the demand.
- Data collection: Infrastructure, Geographical survey.
- Economic surveys: Investment analysis, Return on Investment.
- Legal information: Planning, Construction, Environmental.
- Operation, management, maintenance.
- Feasibility studies.

Outputs
- Main outputs of this stage are:
  - Final acquisition: based on RFIW (right of way).
  - Funding: Present the case for the implementation of the High Speed System (Construction, Operation, and Maintenance costs).
  - Feasibility Design.
Example: Stage 3. Feasibility Studies

**Stage 3: Feasibility studies**

**Actors involved**
- Environmental lobby
  - May affect the environmental constraints and could be opposed to the newly proposed high-speed system.
- Engineering companies
  - They will develop feasibility designs, showing the need for it.
- State governments
  - Political will developed financial means to promote high-speed development. Procurement strategies.
- Land acquisition procedures
  - Properties.
- Manufacturers
  - They will provide information for cutting-edge technology.
- Railway authorities
  - They will approve or reject the feasibility study.

**Empowerment**
- Validation by a Railway Authority before the next stage of studies may begin.

**Risks and mitigation measures**
- All these risk must be handed by public bodies.
- Political risk (stop and go)
- Delay due to the need for land acquisition.
- Land acquisition issues.
- Challenges to mitigate the risk:
  - Improve knowledge of the market.
  - Take pessimistic or optimistic traffic forecasts.
  - Wrong evaluation of the sensitivity to prices.

**Financial aspects of the stage**

**Cost analysis**
- OPERATIONS: Estimate value of works for infrastructure and rolling stock.
- OPEX: Operational and Autonomy cost. Depends on strategy defined.

**Usual packages of construction cost**
- Line construction
- Permanent way
- Earthworks
- Structures (bridges, tunnels, retaining walls, etc.)
- Laboratory and power supply
- Signaling and communications
- Stations
- Depots and sidings
- Road
- Utilities
- Other items

- Contractor administration cost
- Preliminary and General items
- Site supervision
- Testing and commissioning
- Inspection and spare parts
- Building stock investment
- Other cost
- Project management
- Design, including consultancy change (legal, advisory, etc.)
- Rail interface costs
- Topographical (ground investigation surveys)
- Statutory charges
- Programme construction risk allowance

**Usual packages of Operation and Maintenance Cost**
- Maintenance cost
- Infrastructure
- Civil works
- Systems
- Stations & terminals
- Rolling stock
- Maintenance machines
- Human resource
- Renewables
- Operational cost
- Personnel (On Board and Stations)
- Energy
- Training cost
- AFC systems (privacy, clearing, etc.)
- General cost
- T sanitation cost
Examples of new HS lines planning in the world

- **SPAIN:**

<table>
<thead>
<tr>
<th>Year</th>
<th>LAV Madrid-Sevilla (472 km)</th>
<th>LAV Madrid-Zaragoza-Barcelona-Frontera Francesa (804 km)</th>
<th>LAV Madrid-Valencia (391 km)</th>
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**Legend:**
- Phase I: Emerging phase
- Phase II: Feasibility phase
- Phase III: Design phase
- Phase IV: Construction phase
- Phase V: Testing & commissioning
- Beginning of service

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Examples of new HS lines planning in the world

- **FRANCE:**

<table>
<thead>
<tr>
<th>Year</th>
<th>LGV Nord 330 km</th>
<th>LGV Est 300 km</th>
<th>LGV Rhin-Rhône 140 km</th>
<th>LGV Bretagne 180 km</th>
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**Legend:**

- **Phase I:** Emerging phase
- **Phase II:** First green light
- **Phase III:** Preliminary design
- **Phase IV:** Public enquiry
- **Phase V:** Empowerment
- **Phase VI:** Detailed design
- **Phase VII:** Civil works
- **Phase VIII:** Trackworks
- **Phase IX:** Testing & commissioning
- **Phase X:** Beginning of service
...Thank you for your kind attention

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