ROUTE SELECTION IN THE NEW HIGH-SPEED RAILWAY LINES & DESIGN CRITERIA
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

B. DESIGN CRITERIA ABOUT PROJECTS
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

1) PLANNING THE CONSTRUCTION OF A NEW HIGH SPEED RAILWAY LINE

In Turkey, the new railway line construction is planned by High Planning Council. Prime Minister is the head of the council. One of the member is Transport, Maritime Affairs and Communication Minister. Before planning any new high speed railway lines economical, technical, social aspects and city’s needs are evaluated with transportation master plan strategy.

The new railway line should connect two main cities to each other, and the transportation function of the new line is evaluated before design phase.

- For passenger transport
- For freight transport
- Both of them

• In Turkey, railway which are faster than 200 km/hour constructed for only passenger transport.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

1) PLANNING THE CONSTRUCTION OF A NEW HIGH SPEED RAILWAY LINE

In Turkey, when new high speed railway lines are planned to construct these criteria are considered.

a. Main cities that will be connected to each other and the other cities on the route are evaluated together.
b. Passenger potential
   - Domestic
   - International/touristic
c. Evaluation of existing conventional lines
   - Coordination of existing railway lines and high speed railway lines.
d. Topographical conditions
   - Rough, mountainous, flat surfaces
   - Agricultural areas
   - City/urban settlement
   - River and water resources
e. Considering other transportation facilities (conventional railway lines, highway, motorway, airline, light rail transit, waterline etc.)
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

a) Main cities that will be connected to each other and the other cities on the route are evaluated together.

For Example: Ankara-İstanbul High Speed Railway Line pass through Eskişehir, Bilecik, İzmit cities
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

b. Passenger potential
   - Domestic
   - International/touristic

Passenger potential is evaluated through statistics, pre feasibility study’s, city’s population, growth potential, transportation master plan.
c. Evaluation of Existing Conventional Lines

- New high speed railway lines are designed to be compatible with existing conventional railway lines

(For example: There is one existing conventional railway line between Ankara-İstanbul high speed railway line)
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

d. Topographical conditions

- Rough, mountainous, flat surfaces
- Agricultural areas
- City/urban settlement
- River and water resources
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

e. Considering other transportation facilities (conventional railway line, highway, motorway, airline, light rail transit, waterline etc.)

- Conventional rail line
- Highway
- Motorway
- Airline
- Waterline/Maritime
- Light Rail Transit
2) PROJECT WORKS

* After the new high speed railway lines pre route is determined; Transport, Maritime Affairs and Communication Ministry starts the project works. Turkish State Railways is responsible for them on behalf of Transport, Maritime and Communication Ministry.

* Project works performed in a few stages:
  • Feasibility study,
  • Environmental impact assessment report,
  • Project design stage
  • Construction Tender
  • Construction
  • Test and Inspection
  • Operation and Maintenance
2) PROJECT WORKS

A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

1. Feasibility Study:

• According to feasibility studies, project starting and finishing points are determined.
• The cities that will be connected by the new railway line is determined.
• Data are collected and 3D models of the high speed railways are created.
• In feasibility study, the macroeconomic and microeconomics effects are mentioned. Macroeconomics consists of economical contribution and social, cultural effects to country. Microeconomics consists of evaluation of investors and operators.
• The new high speed railway lines are incorporated into the national development plans.
2) PROJECT WORKS

2. Environmental Impact Assessment (EID) Report:

- EID report is prepared after the feasibility study.
- In this report, effects of the high speed railway line’s on environment is considered (on natural life, wildlife, agricultural areas, forests, natural resources etc.).
- This report is approved by Ministry of Environment and Urbanization.
- After this report is approved by Ministry of Environment and Urbanization project design stage starts.
PROJECT WORKS;
3. Project Design Stage

At the beginning of this stage topographical, earthworks, transportation (former highway, light rail transit, motorway plans) and geological studies (geological data and maps) are carried out on the existing data

a) Topographical maps are collected for related route
b) Planning the railway corridor starts on the existing maps (in scale of 1:100.000, 1:50.000)
c) At least three alternative corridors are prepared in 1:25.000 scale
d) Landslide, fault and geological maps are considered together with topographical maps
e) Afterwards, the field trip is planned. All maps, field data, alternative corridors are discussed together on the field.
f) Final 1:25.000 scale corridor is selected with a report that includes comparison of alternative corridors. Same stages apply through 1:5.000 scale maps.
g) 1:5.000 scale route is selected with a report that includes comparison of at least three alternative routes.
h) Geotechnical investigations starts after finalizing 1:5.000 scale route.
i) High speed railway route is finalized in 1:2.000 scale after finishing geotechnical reports.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
a) 1:25.000 Topographical maps are collected for alternative corridors
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. b) Project design stage

Planning of the corridors starts with 1:100,000 and 1:50,000 scale maps.
3. c) Alternative corridors in 1:25,000 scale study
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. d) 1:25.000 scale geological maps

All alternative corridors are discussed on geological, active fault and landslide maps.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. d) 1:25,000 scale landslide maps

A corridor alternative on a landslide map. Prevention measures takes place on design stage.
PROJECT WORKS;
3. e) Site investigation

1:25,000 scale alternative corridors investigated in the field. Engineering structures are evaluated with field datas, and existing maps. (tunnels, viaducts, overpasses etc.) Also effects of high speed railway line to agricultural areas, expropriation costs and hydrolics are evaluated together.
### Evaluation Criteria of The Design

<table>
<thead>
<tr>
<th>Evaluation Criteria of The Design</th>
<th>Alternative Corridor -1</th>
<th>Alternative Corridor -2</th>
<th>Alternative Corridor -3</th>
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<tbody>
<tr>
<td>Design Geometric Properties</td>
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<td>3</td>
<td>3</td>
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<tr>
<td>Constructibility of The Design</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>Energy Efficacy of The Design</td>
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<td>3</td>
<td>5</td>
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<tr>
<td>Total Cost of The Design</td>
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<td>3</td>
<td>5</td>
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<tr>
<td>Social Benefits of The Design</td>
<td>4</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Environmental Compatibility and Sustainability of The Design</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Point</strong></td>
<td><strong>24</strong></td>
<td><strong>18</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

At least 3 alternative corridors are compared with each other in this report. Every evaluation criteria has sub criteria and can have 1 to 5 points according to the sub criteria. Alternative corridor which has the maximum point is selected for 1:25,000 corridor. Same stages apply for selecting 1:5,000 scale alternative routes.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. g) Detail 1:5.000 Scale Mapping With GPS
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. g) 1:5,000 scale high speed railway route is finished.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1:5.000 scale route.

Geotechnical investigation plan is prepared.
A. ROUTE SELECTION
IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigation starts after 1/5.000 route is finalized.

Geotechnical investigation profile is prepared.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5,000 scale route.

Borings and trial pits starts with the approval of geotechnical investigation program.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5,000 scale route

CPT soundings performed during geotechnical investigations.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS:
3. h) Geotechnical investigations starts after finalizing 1/5,000 scale route

Geophysical investigation are planned in design stage. (MASW, Seismic reflection, ground penetrating radar, microtremor study’s etc. takes place in this stage)
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Pressuremeter Test are performed for engineering structures.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Some example of core recovery after rotary drilling in clay soil.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Boring logs are prepared on the field. It gives maximum details for soil and rock cores.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Applying Geological Strength Index on the field for different rock masses
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Roughness profiles of discontinuities are measures on the field.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Geotechnical investigations starts after finalizing 1/5.000 scale route

Dip/dip angle of the discontinuity sets are measured on the field.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Pre geotechnical analysis are carried out before the final route is accepted.

Kinematic analysis are carried out for the high speed train route. This analysis shows us potential failures on the route.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Pre geotechnical analysis are carried out before the final route is accepted.

After all the datas are collected on field and laboratory more detailed analysis are made for cuts, embankments and engineering structures.
A. ROUTE SELECTION
IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Pre geotechnical analysis are carried out before the final route is accepted

Settlement analysis are carried out for embankment and engineering structures
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Pre geotechnical analysis are carried out before the final route is accepted.

Tunnels modeled and solved in finite and discrete element analysis.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. h) Pre geotechnical analysis are carried out before the final route is accepted

Liquefaction analysis are made for the route.
A. ROUTE SELECTION IN THE NEW HIGH SPEED RAILWAY LINES

PROJECT WORKS;
3. i) 1:2.000 scale route (final route)

1:2.000 scale route is finalized with geotechnical reports
1) GENERAL DESIGN PRINCIPLES

- In Turkey high speed railway lines are used only for passenger transportation.
- Design Maximum Speed: 250 km/h
- Design Longitudinal Inclination: %0.16
- Design Maximum Superelevation: 130 mm
- Design Maximum Axle Load: 22.5 ton
- Track Gauge: 143.5 cm
- Rail Type: UIC-60 (60,50 kg /m)
- Rail Length: 36 m
- Design Maximum Embankment Height: 15 m
- Design Maximum Cut Depth: 35 m
B. DESIGN CRITERIA ABOUT PROJECTS

Cut Design Criteria

Maximum cut depths planned as 35m in the design stage.
Embarkment Design Criteria

Maximum embankment heights planned as 15m in the design stage.
Overpass designed mostly for roads and railways crossing railway lines and pedestrians.
**B. DESIGN CRITERIA ABOUT PROJECTS**

**Culvert Design**

Culverts are designed mainly after hydrolic reports. In this report culvert dimensions are calculated from hydrolic properties of the region.
B. DESIGN CRITERIA ABOUT PROJECTS

Underpass Design

Underpasses are designed for mostly road and railway passes, agricultural needs and city’s demands.
B. DESIGN CRITERIA ABOUT PROJECTS

Bridge Design

Bridges are designed for hydrolics, agricultural areas, road and railway passes.
Tunnels are designed for cuts deeper than 35m, environmental protection areas, prevent expropriation costs, urban passes etc.
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Finished High Speed Railway Lines
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Completed High Speed Railway Lines
Some Examples Of Completed High Speed Railway Station
THANK YOU FOR YOUR ATTENTION