Structural Analysis and Construction of a Cut-and-Cover Tunnel Slab Track: The GAZİRAY Experience

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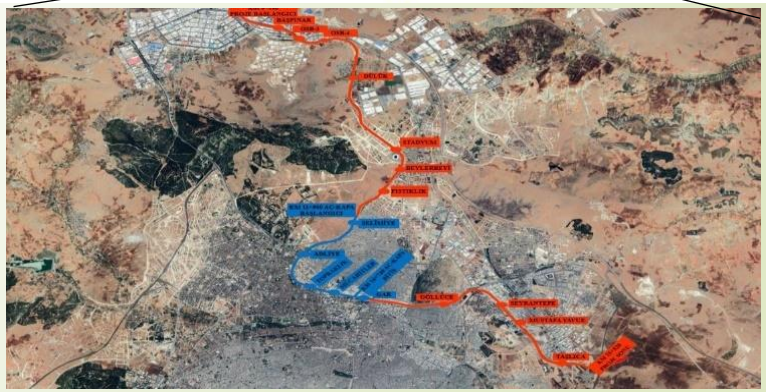
The GAZİRAY Project: An Urban Solution

- A major 25 km urban transport project (TCDD & Gaziantep Municipality).
- Our Focus: The 4,810-meter cut-and-cover tunnel section.

Why a Tunnel?

- Passes directly next to dense residential areas.
- Crucial for noise reduction and safety.
- Prepares for future high-speed train operation.

Feature	Detail
Cut-and-cover tunnel route length	4,810 m
Platform width	23.50 m
Minimum horizontal curve radius	500 m
Minimum vertical curve radius	15,000 m
Design speed	100 km/h
Maximum gradient	1.6%

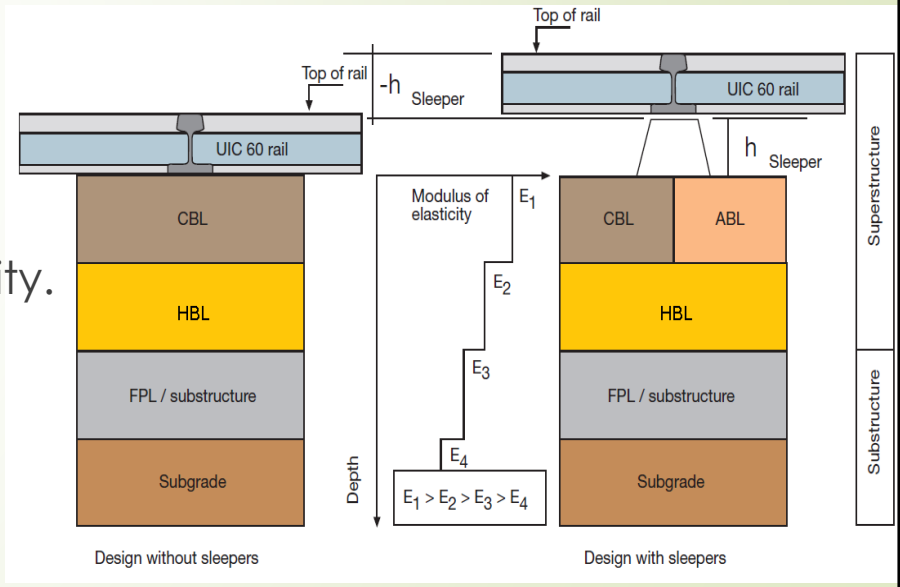


What is Slab Track and Why Use It?

What is it? A modern railway superstructure on a rigid reinforced concrete foundation (instead of traditional ballast).

Key Advantages:

- Significantly lower maintenance needs.
- High geometric stability and long-term reliability.
- Lower Life-Cycle Cost (LCC).

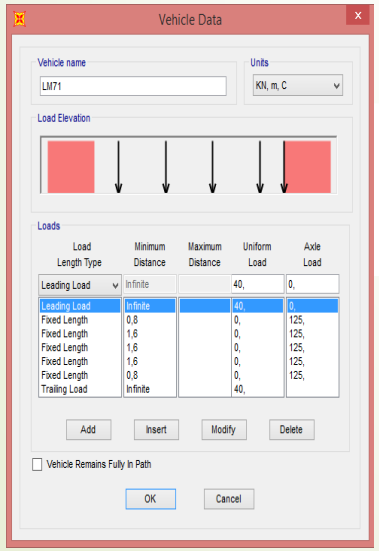


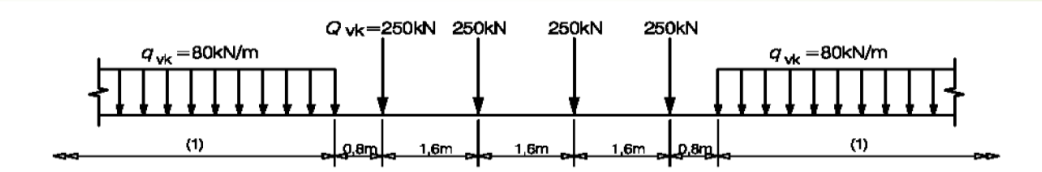
E. Darr. Ballasless Track: Design,Types, Track Stability,Maintenance and System Comparison.

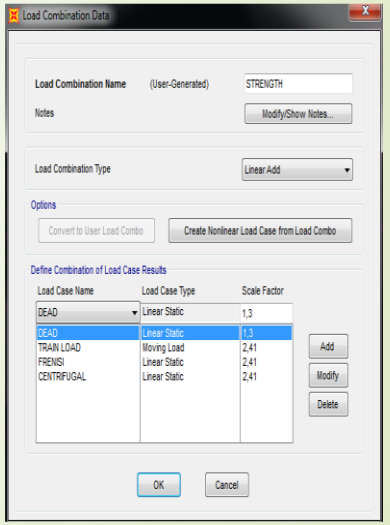
CBL-Concrete Bearing Layer
HBL- Hydraulic Bonded Layer
FPL- Frost Protective Layer
ABL- Asphalt Bearing Layer

Our Design & Analysis Method (Simplified)

- Software: Structural analysis performed using SAP2000.
- Loads: Designed for heavy international train loadings (UIC LM 71, SW/0).
- Materials: High-strength C30 Concrete and S420 Reinforcement Steel.
- Standards: Analysis based on EN 1990, EN 1991-2, and AASHTO.







Step 1: Building a Solid Foundation

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- The tunnel's stability was our first priority.
- Solution: A total of 7,845 bored piles were constructed.
- Pile lengths varied from 14m to 21m based on specific ground conditions.

Step 2: The Cut-and-Cover Structure

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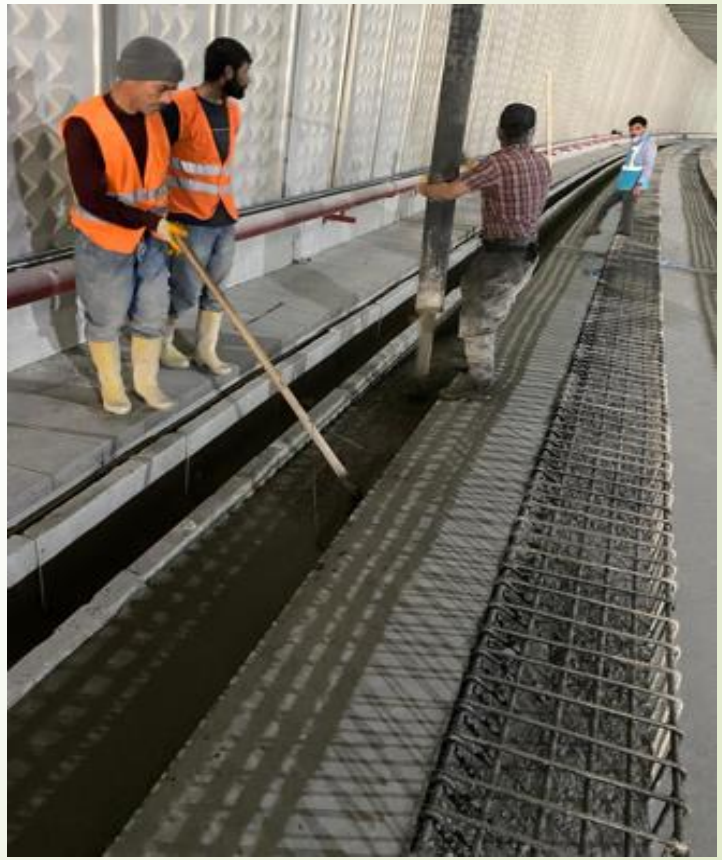
- Massive excavation: 1.8 million m³.
- Waterproofing and drainage systems applied.
- Installation of pre-cast girders to "cover" the tunnel.

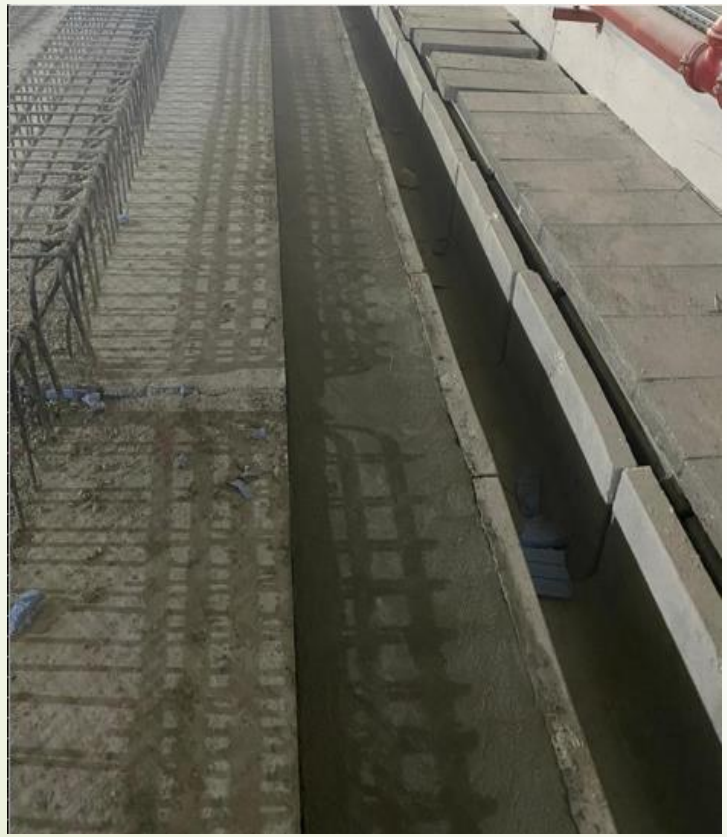
Step 3: Reinforcement & Concrete

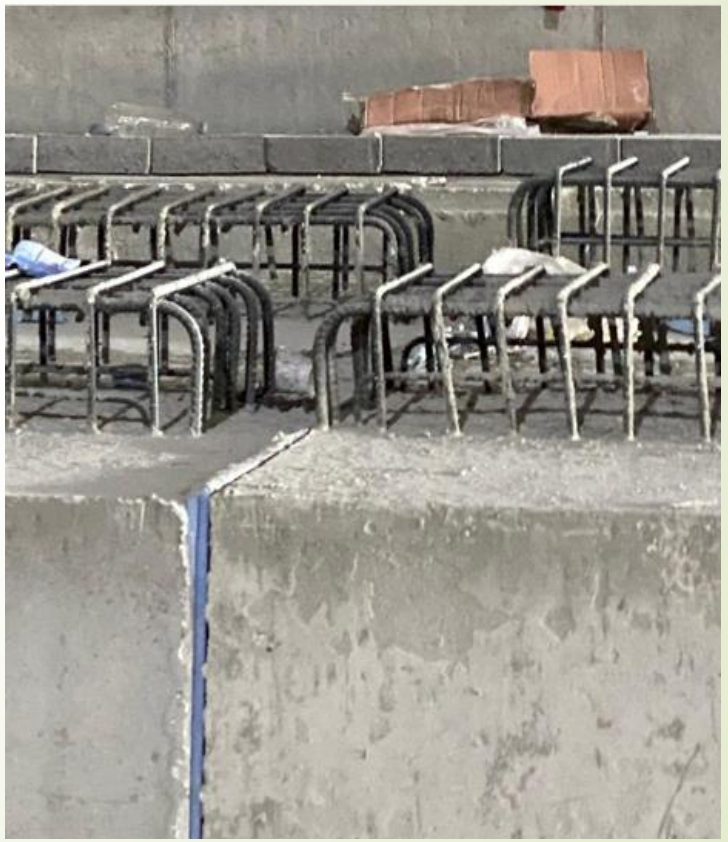
- C30/37 concrete was poured in continuous segments.
- Critical Tolerance: A surface tolerance of ±2mm was strictly maintained.



Step 3: Reinforcement & Concrete

- Double-row S420 steel reinforcement (Ø10-Ø16) was placed.
- Key Detail: Plastic spacers used to protect the signaling system.

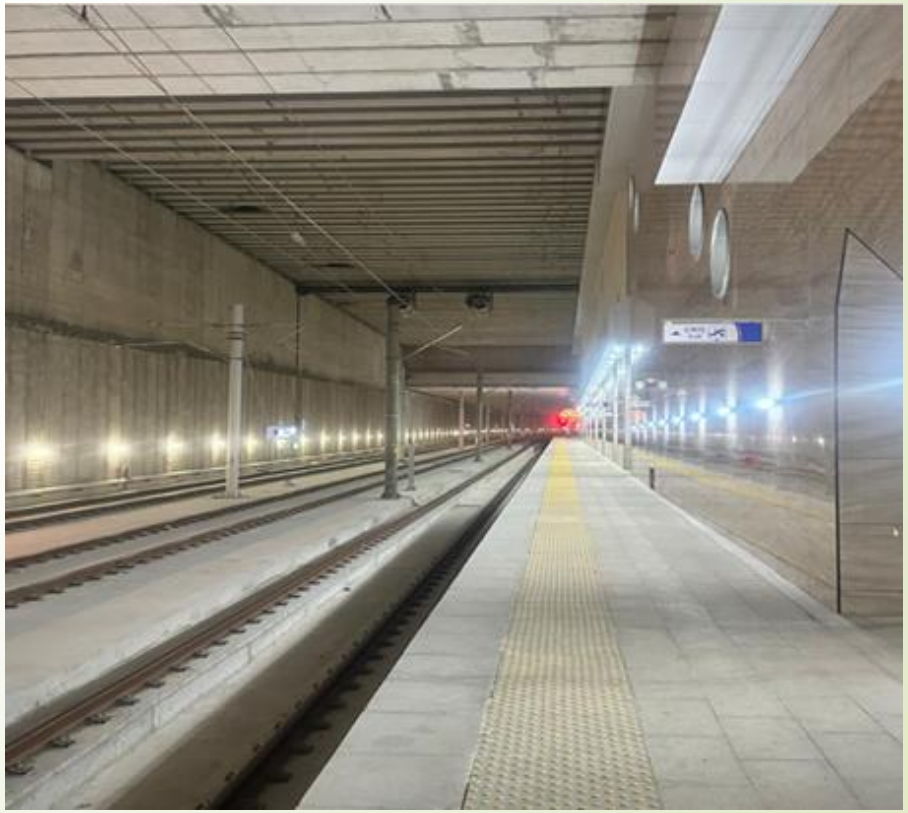




Step 4: Rail Fastening & Final Assembly

Why this system?

- Provides vibration damping and allows thermal expansion.
- Four 1/9 ratio switches were also integrated into the slab.



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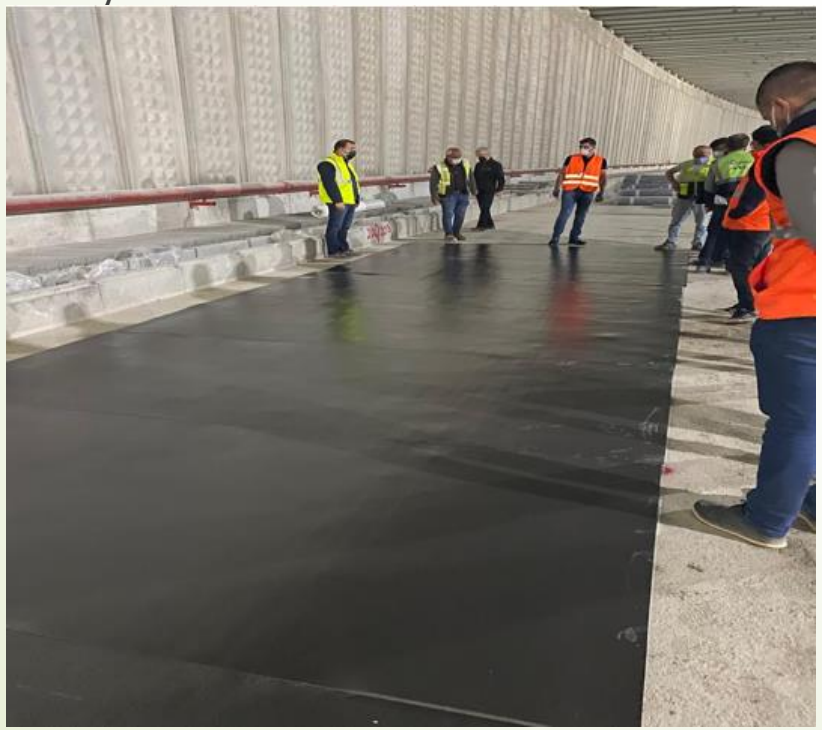
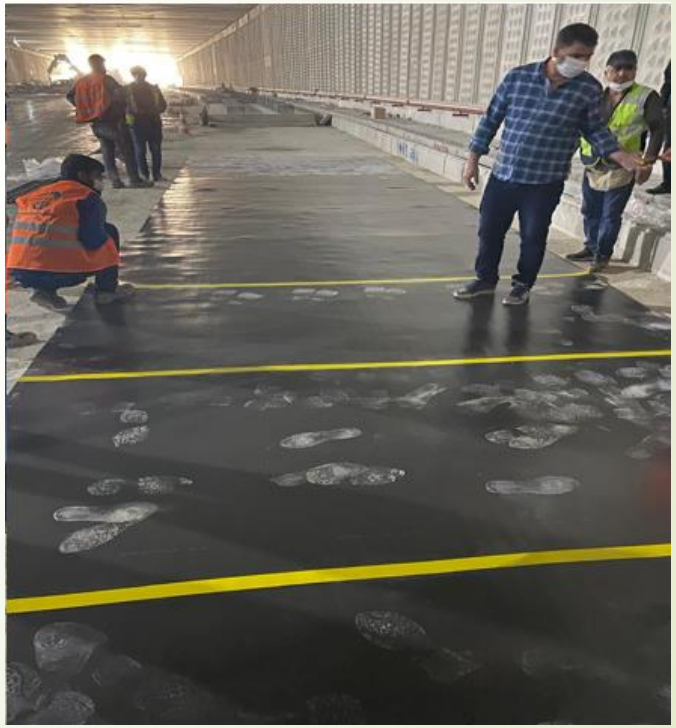
- 60E1 rails were fastened directly to the concrete slab.
- System Used: SKL14/W14 elastomeric fastening systems.

The "What If - Controlling Vibration "

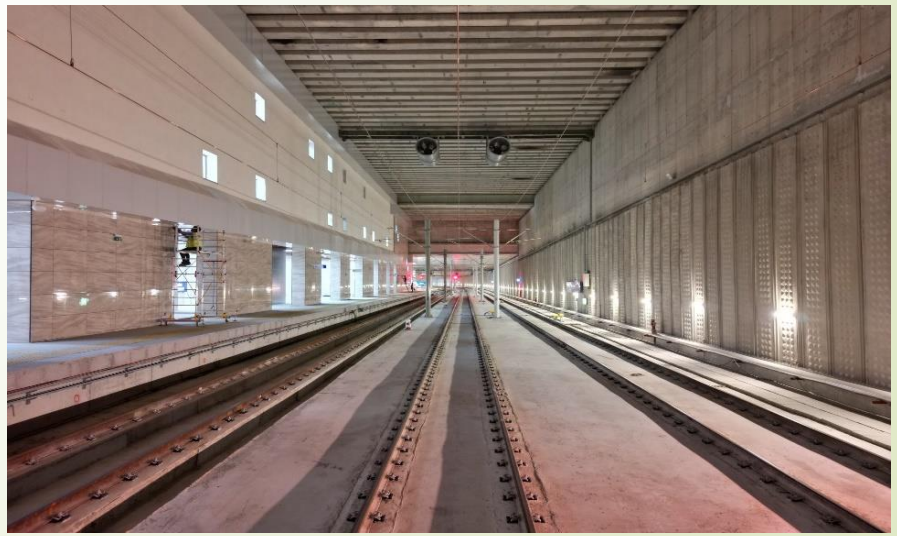
- The Problem: The line is extremely close to "sensitive" buildings (homes, schools).
- The Analysis: Conducted detailed vibration analysis for 37 critical sections.
- The Solution: Installed a special Mass-Spring System (vibration-absorbing mats) under the slab concrete in critical zones.





Conclusion: The GAZİRAY Experience

- Success: A successful application of a cast-in-place slab track in a challenging urban tunnel.
- Precision: The method provided superior geometric precision (±2mm).
- Mitigation: Vibration and noise were successfully controlled using elastomeric fasteners and the mass-spring system.
- Future-Ready: The system is robust and ready for future high-speed train operation.



Thank You

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