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# 10<sup>th</sup> UIC World Congress on High Speed Rail & Trade Exhibition

*Sharing Knowledge for Sustainable and Competitive Operations*



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## Unballasted Railway Track

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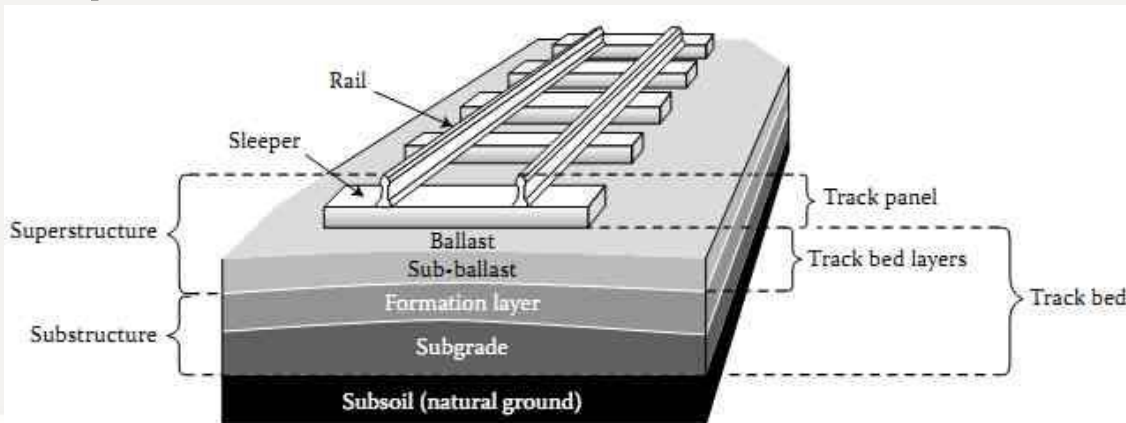
\*\*\* Turkish State Railways, Ankara, Turkey

May 08, 2018, Session 2.3 Railway System - Rail System Track Wheel on Rail System



# 1. INTRODUCTION

- The railway lines consist from rails and sleepers also known as **“road frame”**, crushed stone layers called as ballast and sub-ballast under the frame and different ground layers called as **“infrastructure”** under these and consist from some engineering works such as bridges, viaducts, tunnels and so on.
- Road frame and ballast layers are generally called as **“superstructure”**.



Source:



- **However, the ballast bed is the weakest member of the railway superstructure and requires the highest maintenance costs.**
- **Experiences at high speed lines had shown that the need for maintenance of ballasted lines is greater in terms of the time and cost aspects.**
- **In recent years using unballasted high speed railway tracks has become popular, because of the quality of ballast materials is mainly obtained from volcanic materials and the materials cannot be easily found everywhere and high transportation distance and etc.**



- In the past, investment costs in a new project was the most important decision-making parameter, but nowadays the total cost of the service life is more important.
- With this new vision, ballasted superstructures were losted their appeal as well as the advantages of unballasted superstructures.
- In this presentation it was aimed that, informations of the types of unballasted railway superstructure, their advantages and sample of the applications in various countries were given.



## **Ballast-less track exhibits the following benefits in comparison with the traditional ballasted track**

- Lower maintenance need during its life cycle. No need for tamping, ballast cleaning and track lining results to a reduced cost approximately 20-30% for repairs comparing to that in ballasted track.
- **higher availability,**
- **increased service life (50–60 years),**
- **higher lateral stability,**
- **reduction of weight and height of the track, and easier and heaper vegetation control,**



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- **No ballast splash problem,**
- **More economic bridge, viaduct, tunnel.**
- The higher braking forces enable for shorter braking distances
- **Excellent load distribution, thereby reducing the pressure on unconfined soil layers and the subgrade**
- Excellent riding comfort at high speed
- The lack of suitable aggregates for a ballasted track in a certain area can also lead to a slab track design.



**Unballasted tracks were developed to achieve the following objectives:**

Increase speed

Increase capacity

Reduce the number of track maintenance operations and thereby the costs for maintenance



## Disadvantages of Unballasted Rail Tracks 1

More investment cost than ballasted track

Higher noise radiation (5dB) due to the lack of noise absorption of the ballast bed

The mitigation of noise and vibration may further increase the costs of the slab track construction

Very expensive repair concepts and long term closures due to the curing and hardening procedures of the concrete





## Disadvantages of Unballasted Rail Tracks 2

Ballastless track requires homogeneous sublayers which are capable to carry the imposed loads with minor or no settlements. This means that in many cases and especially in earth structures special attention should be given in the foundation preparations. The high costs which are associated with the above mentioned fact is the main reason for the limited use of the slab track.

The frost protective layer in earth structures must be applied in any case and it is much thicker comparing to the ballasted one. This is a prerequisite in order to reassure a lengthy life cycle.

Transitions between ballasted track and ballastless track require special attention.

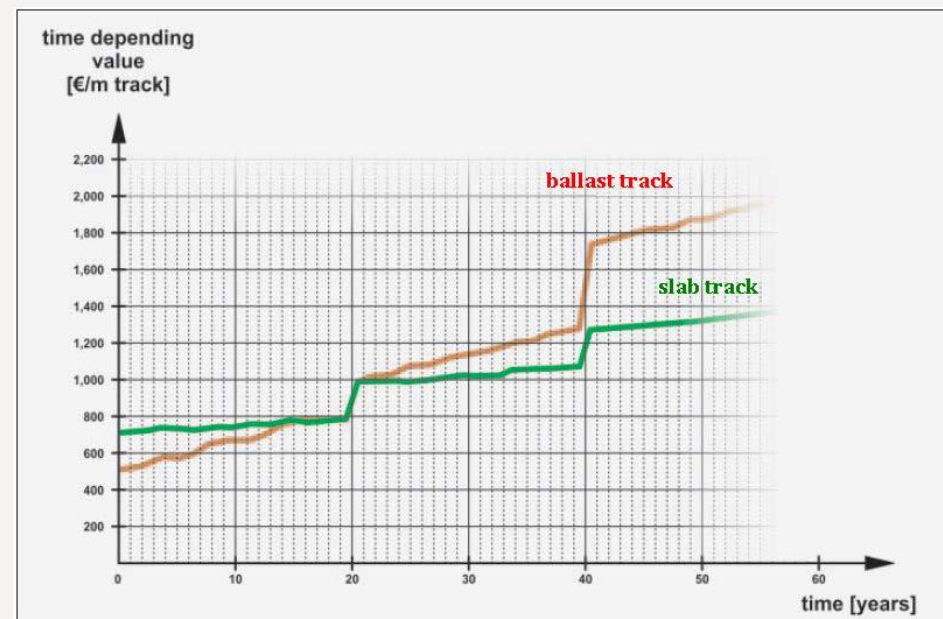
In many cases new mechanisms needed for production and repair.



## 3. Slab Track Cost

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- The advantage of slab tracks to perform for longer time without significant amount of maintenance comparing to conventional ballasted track has long been understood.
- Results from recent evaluations in this subject propose that slab track is in a long-term perspective, more economically efficient as shown in figure.





# Unballasted Railway Track Systems

## 1. Discrete Rail Support

### 1. Sleepers or Blocks encased in concrete

- Rheda
- Rheda-Berlin
- Rheda 2000Züblin
- Züblin
- Stedef
- SONNEVILLE-LVT
- Heitkamp
- SBV
- WALO

### 2. Sleepers on Top of Asphalt-Concrete Roadbed

- ATD
- BTD
- SATO
- FFYS
- GETRAC
- WALTER

### 3. Prefabricated Concrete Slabs

- Shinkansen
- Bögl
- ÖBB-Porr
- IPA

### 4. Monolithic Designs

- Lawn Tracks
- Hochtief
- BES
- BTE-BWG/HILTI
- PACT

## 2. Continuous Rail Support

### 1. Embedded Rail Structure (ERS)

- Deck Tracks
- INFUNDO Edilon
- BBERS

### 2. Clamped and Continuously Supported Rail

- Cocon Track
- ERL
- KES
- SFF
- Saargummi



# CONCLUSION

The construction costs of unballasted railway track maybe higher, but the reduced need for maintenance combined with the high structural stability and their longer lifespan, lack of suitable aggregates for a ballasted track, as well as the higher demands of the new high speed lines suggest that in many cases the use of slab track construction is more feasible. **Thank you !**

for your kind attention

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