13th UIC Sustainability Conference

VIENNA 2016

Environmental friendly and cost effective high speed line design

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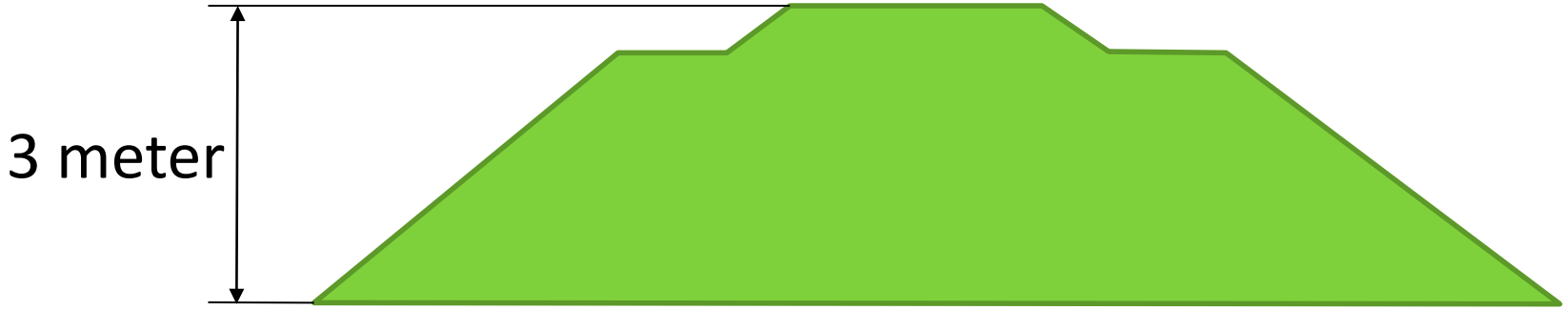
Problem and solutions

- It is expensive to build railways and time consuming.
  - Why is it importent to build new high speed lines?
  - How does construction design and production philosphy
    - reduce cost
    - protect environment
    - give more value for money
  - Disadvatages is posible advantages with new railway design

CR on embankment



Volume 100 %

Weight 139 ton/m

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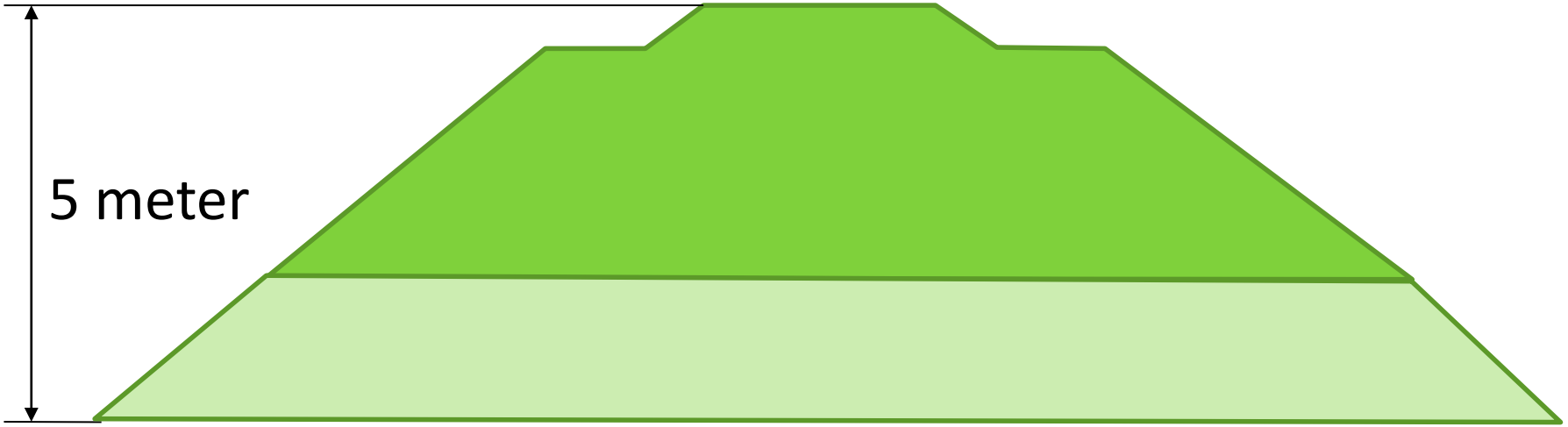
HSR on embankment



Volume 200 %

Weight 278 ton/m

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HSR on bridge element

Volume 28 %

Weight 57 ton/m

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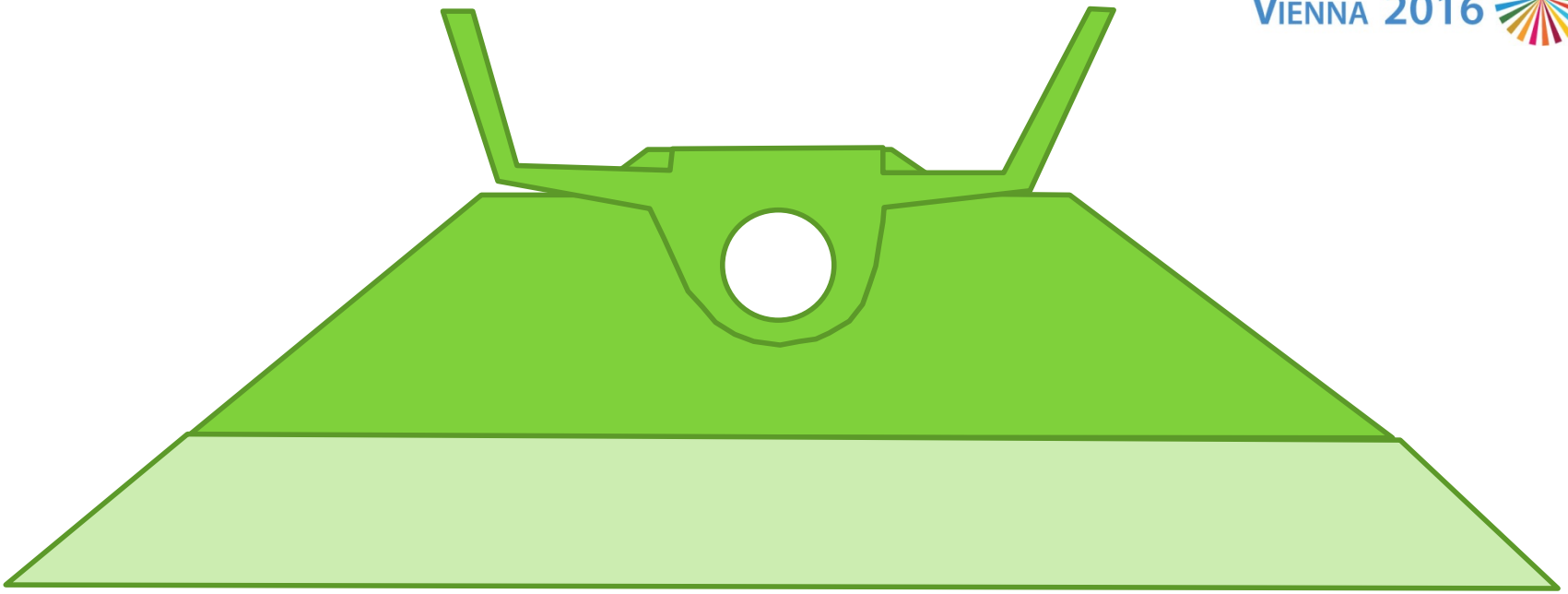
Embankment or bridge?



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Embankment or bridge?

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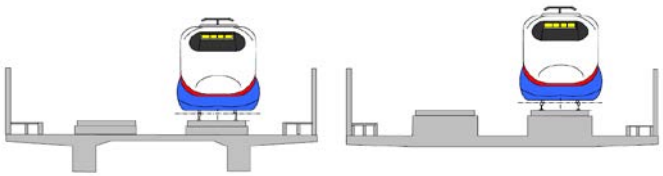
Embankment

- Settlement
- Barrier effect
- Need repairing resources
- Slab track is not applicable on embankment

Bridge

- High stability
- Crossing all obsticle
- Envrionmental friendly
- 50% less CO2
- Wildlife crossing



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Environmental friendly and cost effective

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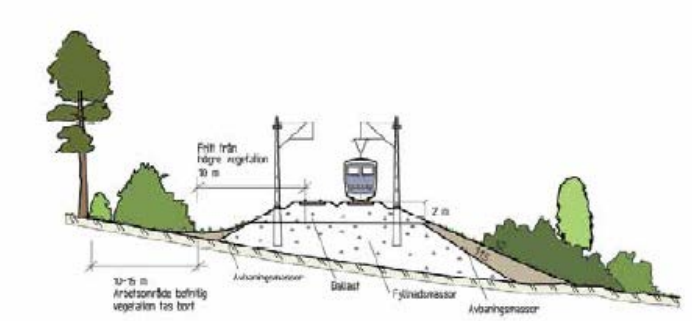
EMBANKMENT
Construction 20 years
Cost 170 bn SEK
Savings 0 bn SEK
7000 new jobs

BRIDGES
Construction 5 years
Cost 145 bn SEK
Saving 25 bn SEK
35 000 new jobs



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32 000 variables are analysed

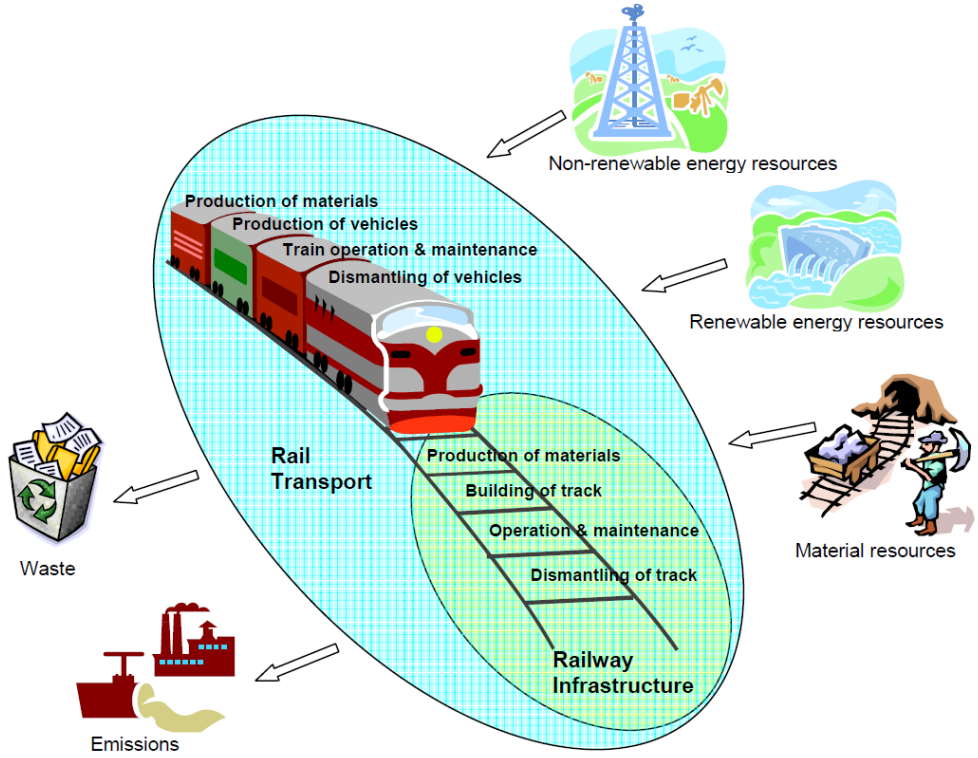

Figure 1 Overview of the product categories Rail Transport and Railway Infrastructure.

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Environmental LCC analysis

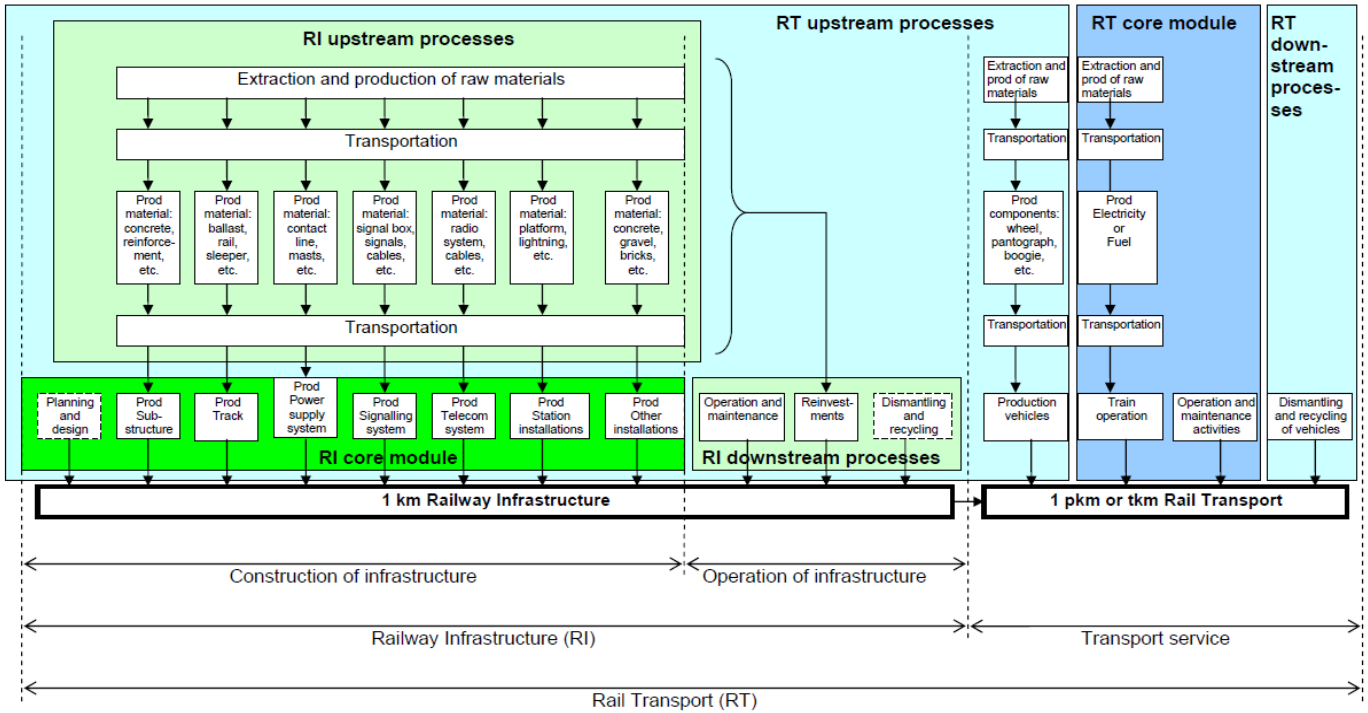

Figure 2 Flow chart of the product system for Rail Transport (RT) and Railway Infrastructure (RI).

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Development

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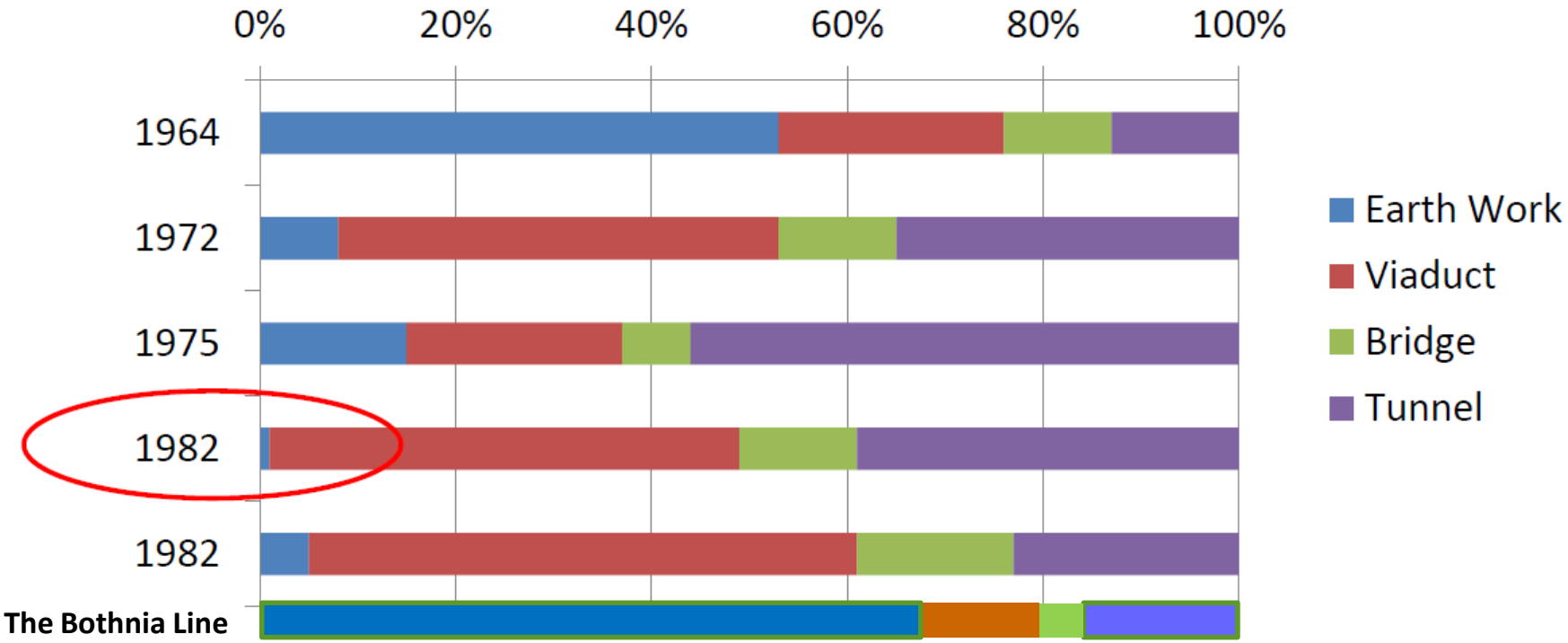
Japanese construction philosophy 1964 – 1982 and Swedish construction philosophy 2013



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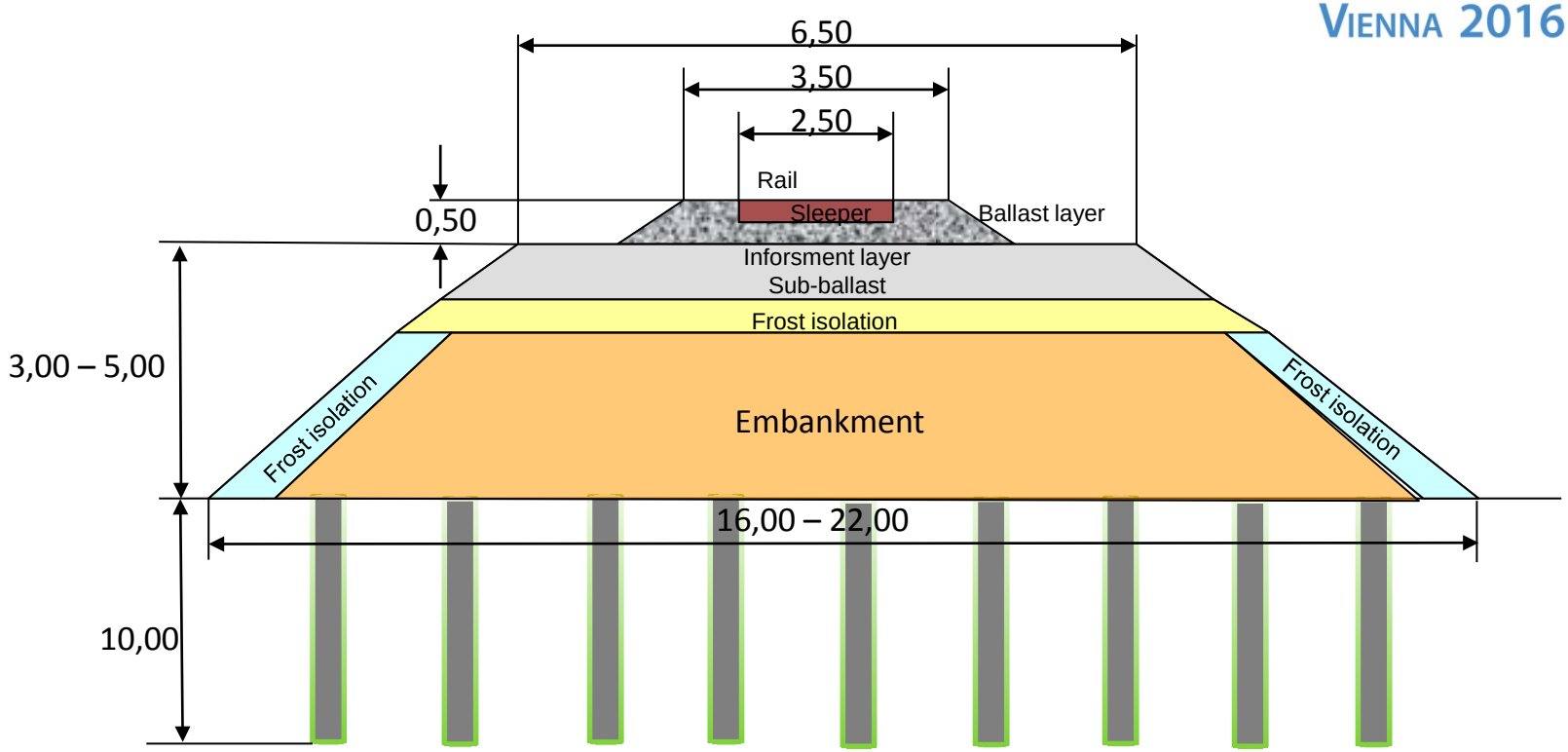
Ground inforcement HSR



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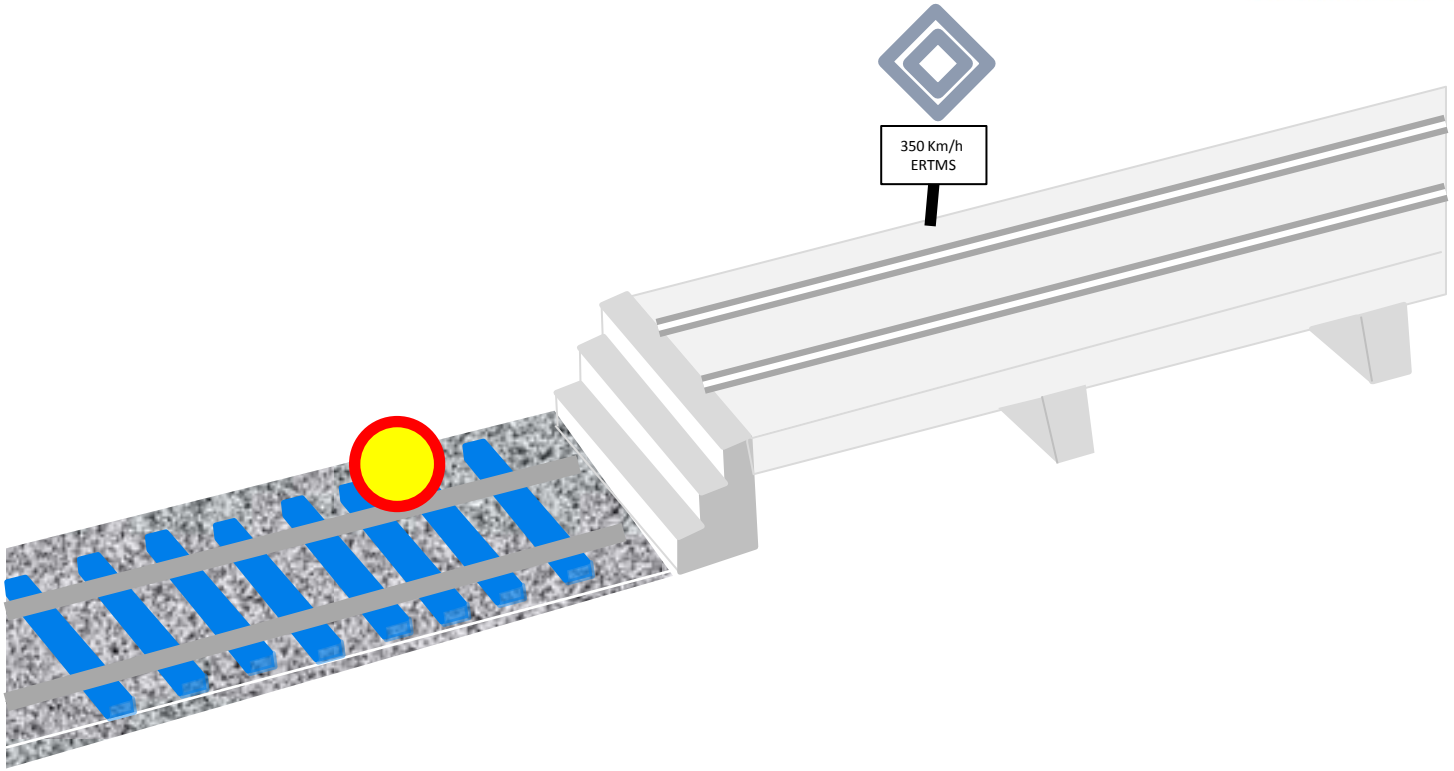
Stop embankment go for bridge



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Embankment

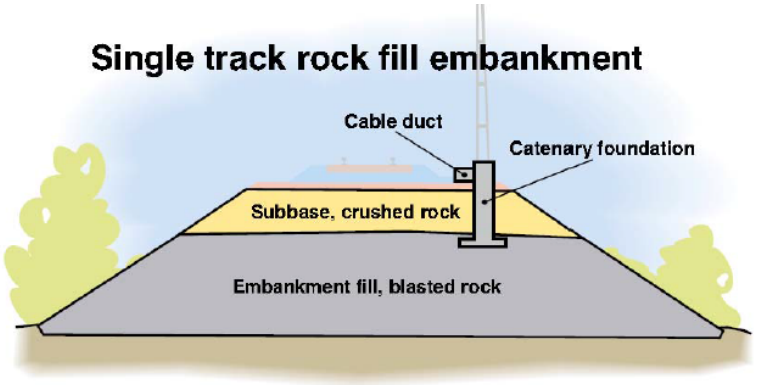
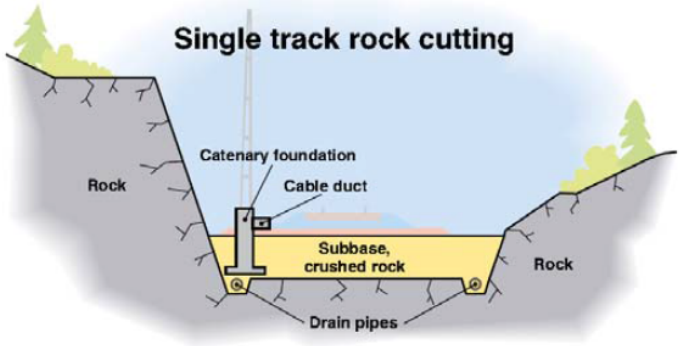


Figure 4 Schematic figure showing a railway foundation on flat land.



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Bridge


CONCRETE BEAM BRIDGE
Noise barrier
Concrete overlay
Concrete beam
Bridge pier

PREFABRICATED BRIDGE ELEMENT

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POSITIONING OF BRIDGE

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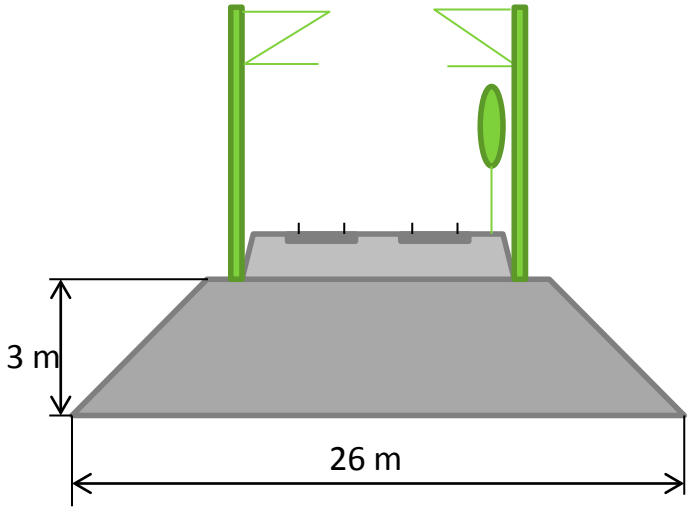
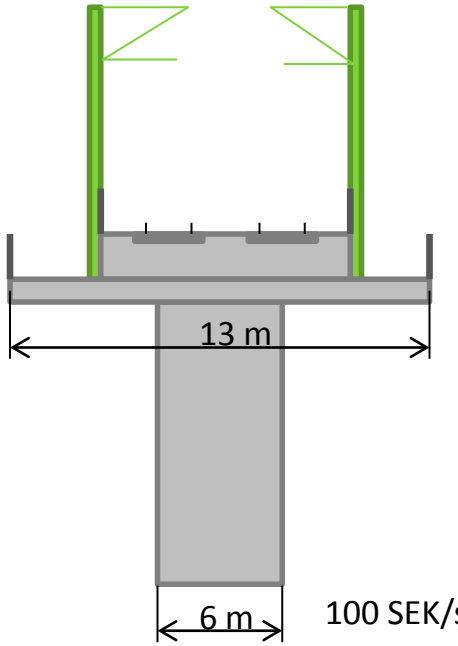
Use of land



4 000 SEK/spm

Conventionel Railway



100 SEK/spm

High speed Railway

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Land use

Conventionel Railway

High speed Railway

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Save money

System	Conventional rail	High speed rail	Comment
Electrification system	4 200 SEK/m	2 500 SEK/m	No fundaments
Signalling system	16 000 SEK/m		No signals
Track system	5 000 SEK/m	2 250 SEK/m	Sleepers in slab
Ballast	6 000 SEK/m		In bridge
Substructure	25 000 SEK/m		In bridge
Drainage system	600 SEK/m		In bridge
Noice, service road, snow	2 700 SEK/m		In bridge
Ground preparation	30 000 SEK/m	7 500 SEK/m	
Land use cost	4 000 SEK/m	100 SEK/m	
Bridge and slabb track		70 000 SEK/m	
Project managment	8 447 SEK/m	8 566 SEK/m	
TOTAL	**101 947 SEK/m**	**90 916 SEK/m**	**HSR chepest**

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Cost

POST	Conventionel railway	High speed line railway
Railway system	102 000 SEK/m	91 000 SEK/m
Distannce 2 x 600 km	122,4 billion	109 billion
Construction time	12 years	4 years
Intrest 4 %	59 billion	17 billion
Investment cost	**181,4 billion**	**125,0 billion**
Speed Time	> 250 km/h 4.00 hrs	400 km/h 2.00 hrs
Market	5 million trips	9 million trips
Market value per year	2,5 billion	4,5 billion
Repayment time	73 years	28 years

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Summary

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High speed lines on prefabricated bridge elements are extremly efficient.

- Reduktion of material use from 139 ton/m to 57 ton/m
- Less ground preparation work with 98%
- Fast construction time 500 km in 5 years
- 12% lower cost compared to embankments
- Less CO2 prints with 50%
- Less barrier effects for animals and nature
- Higher safety and security

Thank You – ”TACK!”

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