



ASSOCIATION
INTERNATIONALE DES TUNNELS
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ITA
INTERNATIONAL TUNNELLING
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ASSOCIATION



5th International Seminar on Underground Space
Health & Safety in Underground Space
October 18th, 2019, Lisboa, Portugal

REFUBISHMENT OF THE SMOKE CONTROL SYSTEM AND EVACUATION STRATEGY IN THE BRUSSELS NORTH-SOUTH RAILWAY TUNNEL

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Società Italiana Gallerie
Italian Tunnelling Society



FGU Fachgruppe für Untertagbau
GTS Groupe spécialisé pour les travaux souterrains
GLS Gruppo specializzato per lavori in sotterraneo
STS Swiss Tunnelling Society



Agenda



Introduction : TUC RAIL in short

Presentation of the tunnel

Presentation of the project

Some works implemented

Conclusions



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Introduction : TUC RAIL in short

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Who is TUC RAIL ?

- **TUC RAIL, engineering and project management office** specialized in railway technology

Project Management

Studies

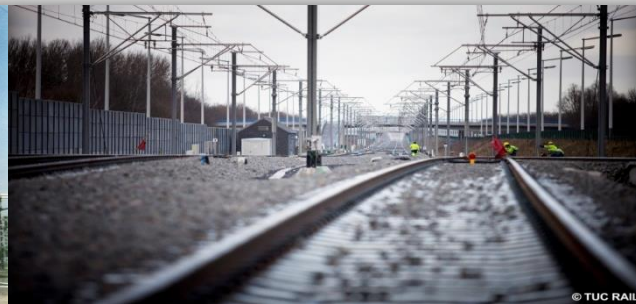
Monitoring of works



- **Construction of new infrastructures**
- **Adaptation and modernization of existing infrastructures**



Catenaries | High currents | signaling

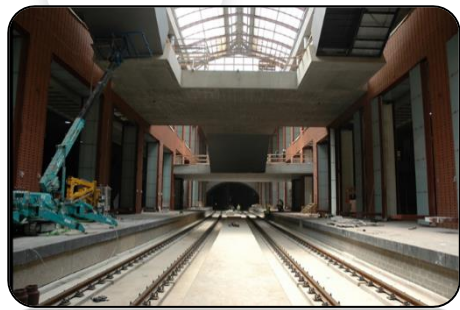




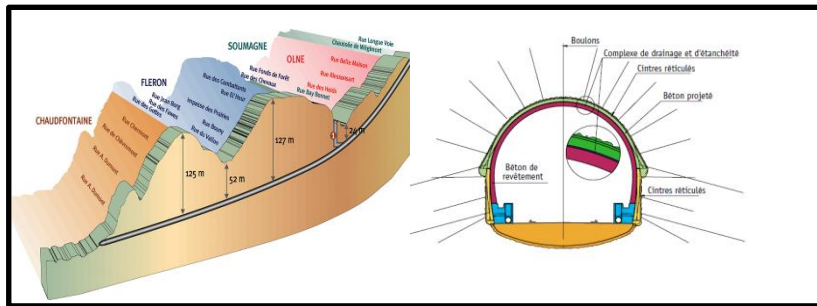
Steel bridges | Concrete bridges | Viaducts | Tunnels



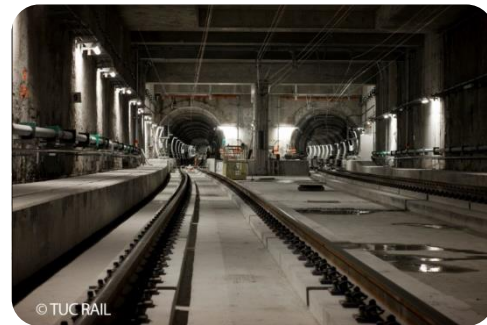
New railway tunnels (2007-2017)



North-South Link Antwerp



Tunnel Soumagne



Tunnel Diabolo



Liefkenshoek
Railwaytunnel



Schuman-
Josaphat
Tunnel

Recently: focus on modernizing of railwaytunnels, from 2015



Beverentunnel



Schuman-Josaphat

Kennedy
Railway
tunnel



North-
South Link
Brussels





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North-South Railway Tunnel



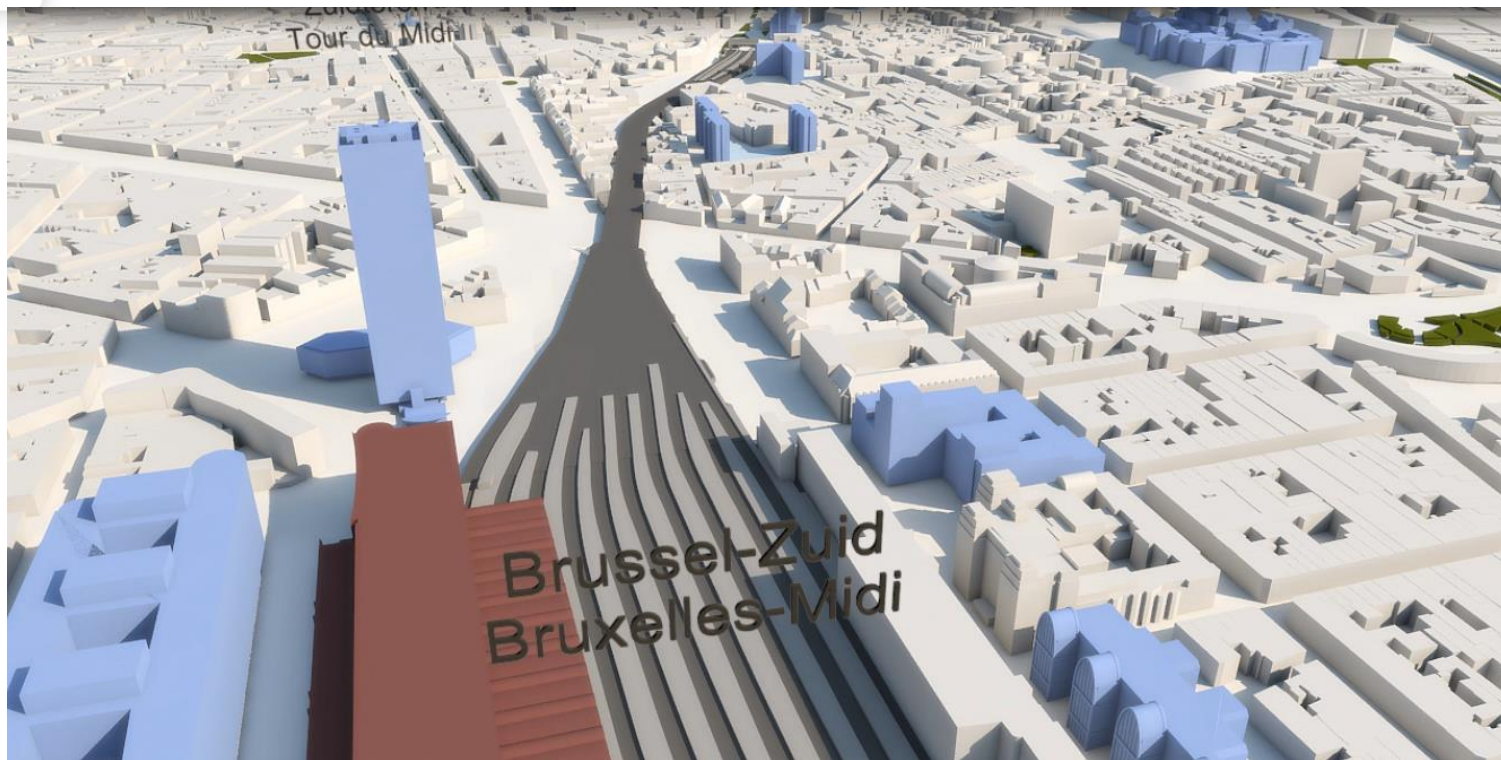


A few nummers

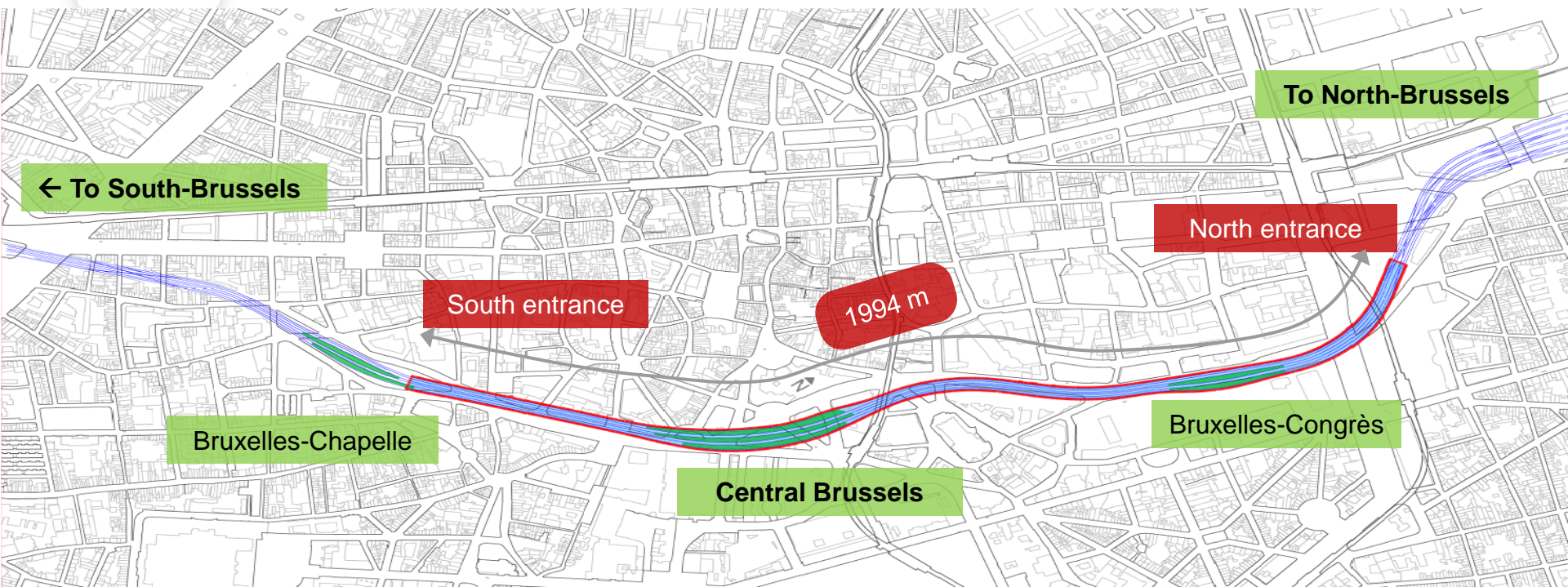
- Line 0 - per working day
1200 trains
flow de 365,000 passengers
- 57 % network travelers
- Rush hour:
90 trains / hours
1 train / 3 minutes / track
- Cascading effect at the slightest disturbance



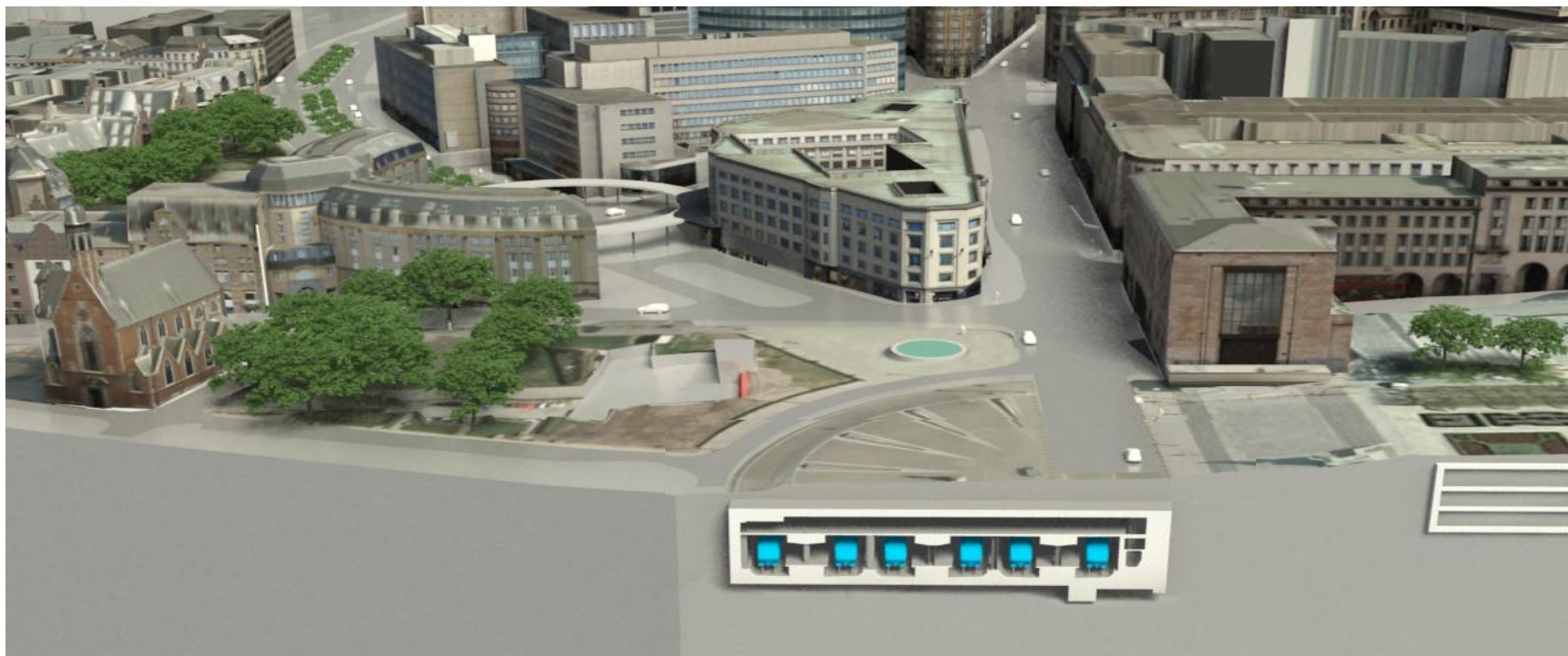
North-South Railway Tunnel



North-South Railway Tunnel



Cross section







Agenda



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Presentation of the tunnel

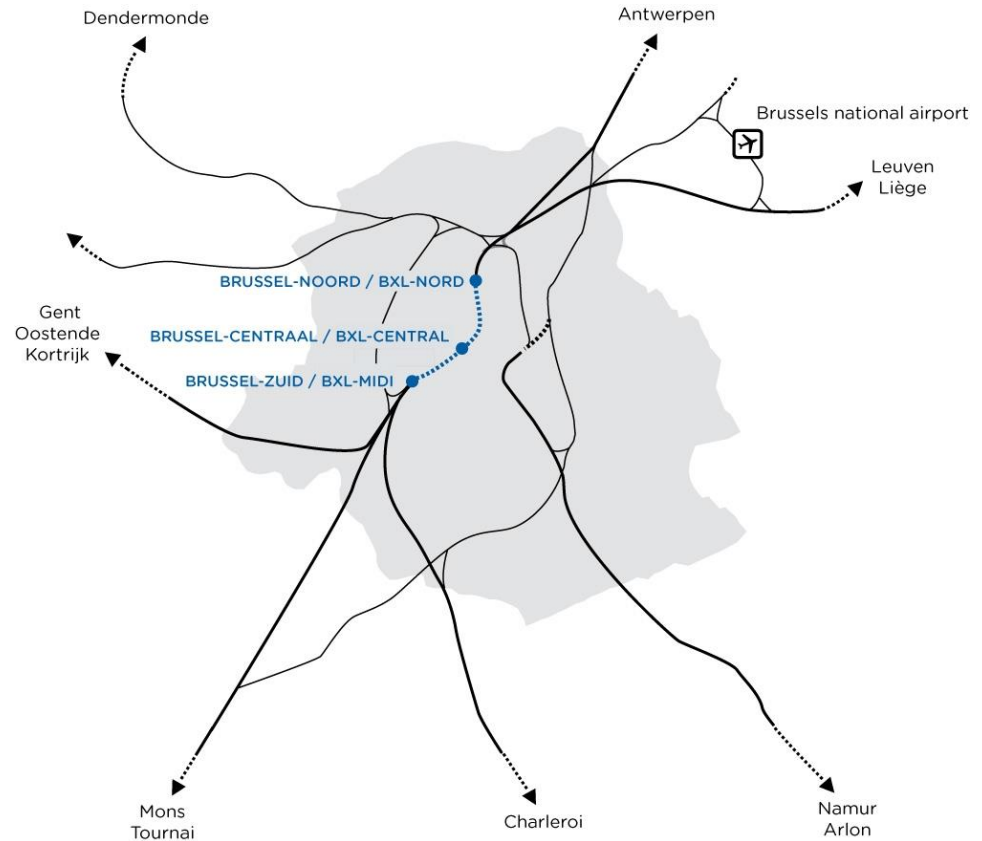
Presentation of the project

Some works implemented

Conclusions

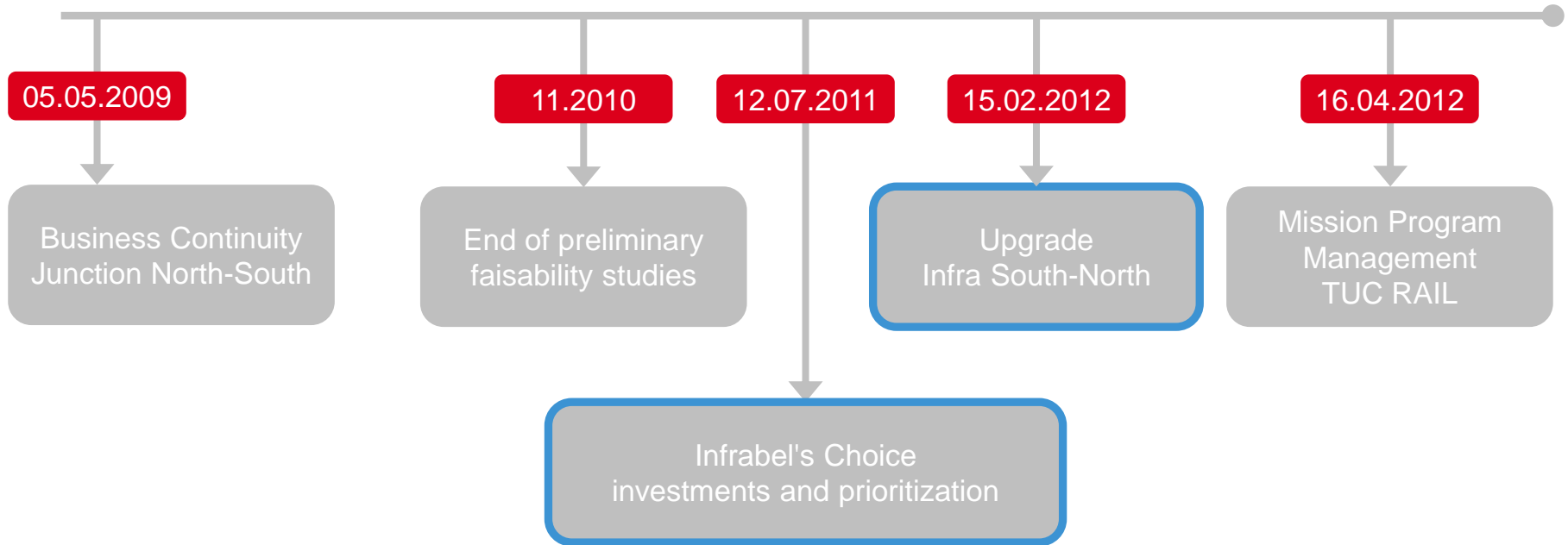
Objective:

Increased the levels of safety and reliability of the infrastructure on the North-South axis in Brussels



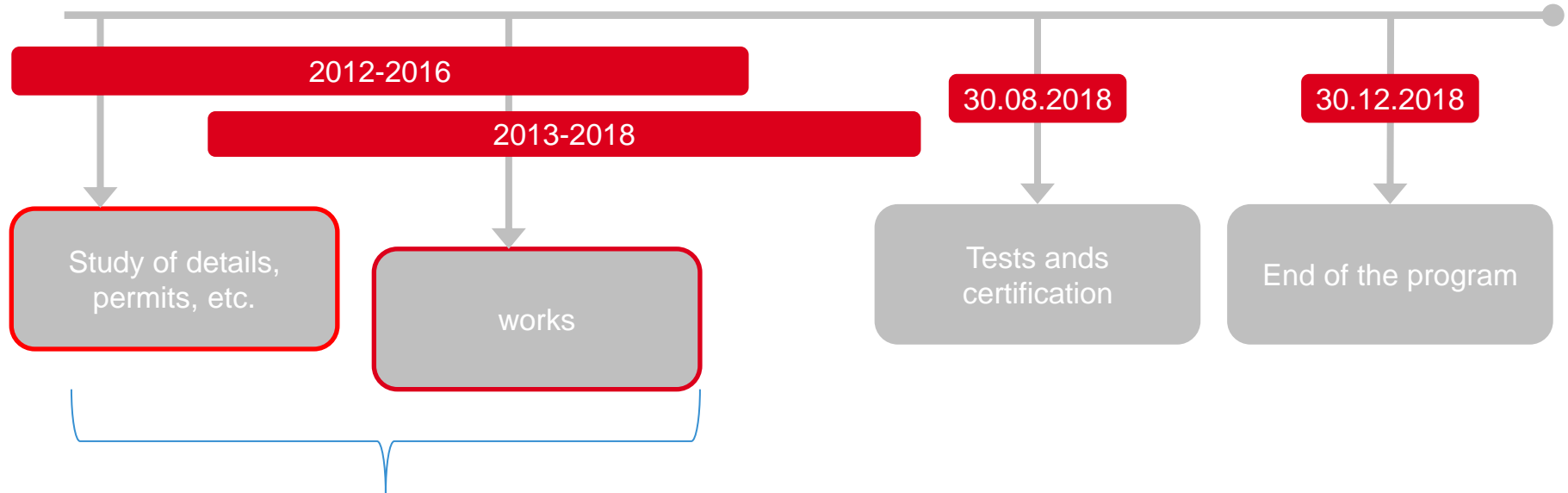


Planning



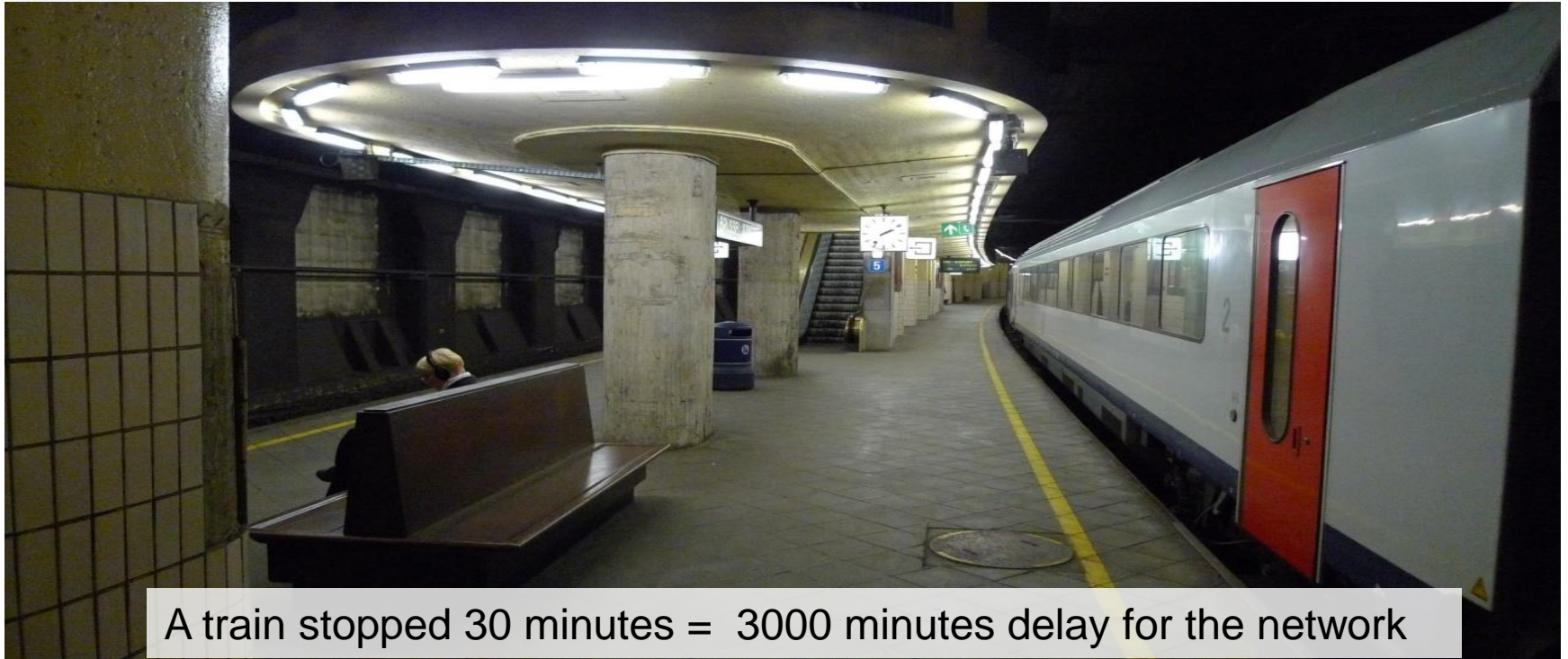


Planning



Different markets studied and coordinated by TUC RAIL:
TR300301, TR 300302 ... TR 300327

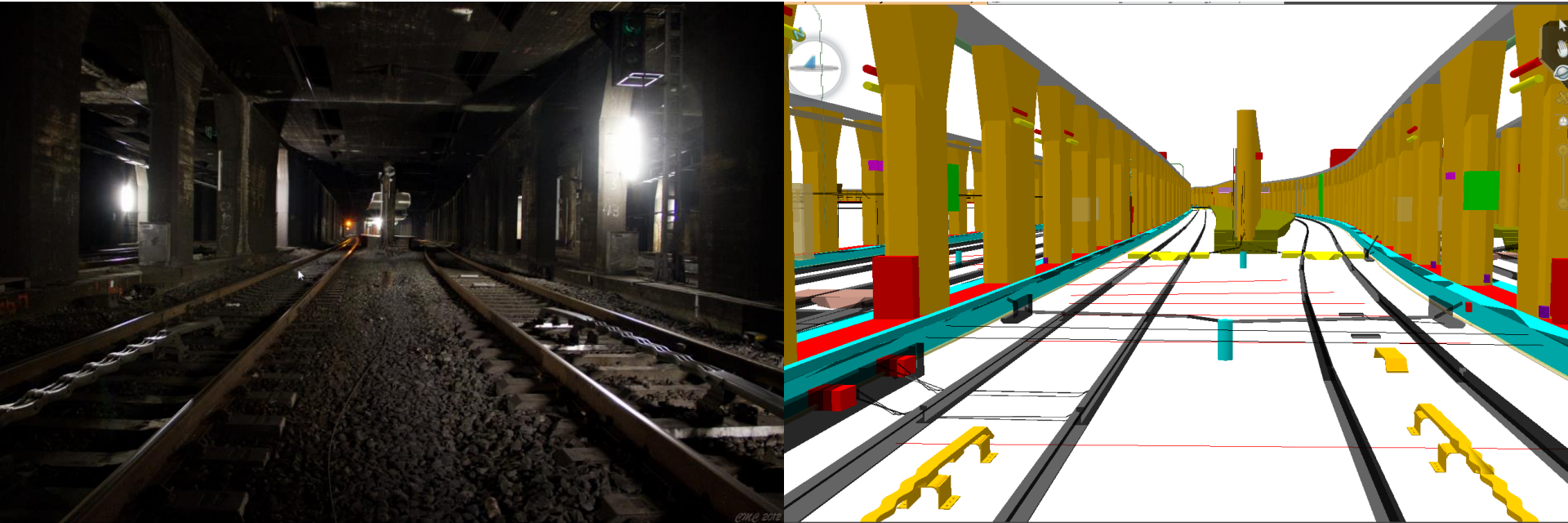
Main risk



A train stopped 30 minutes = 3000 minutes delay for the network

Using BIM in the North-South Railway Tunnel

- BIM (Building Information Model)





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Action 1: New emergency exit route

- Adaptation of emergency exit route and cable ducts



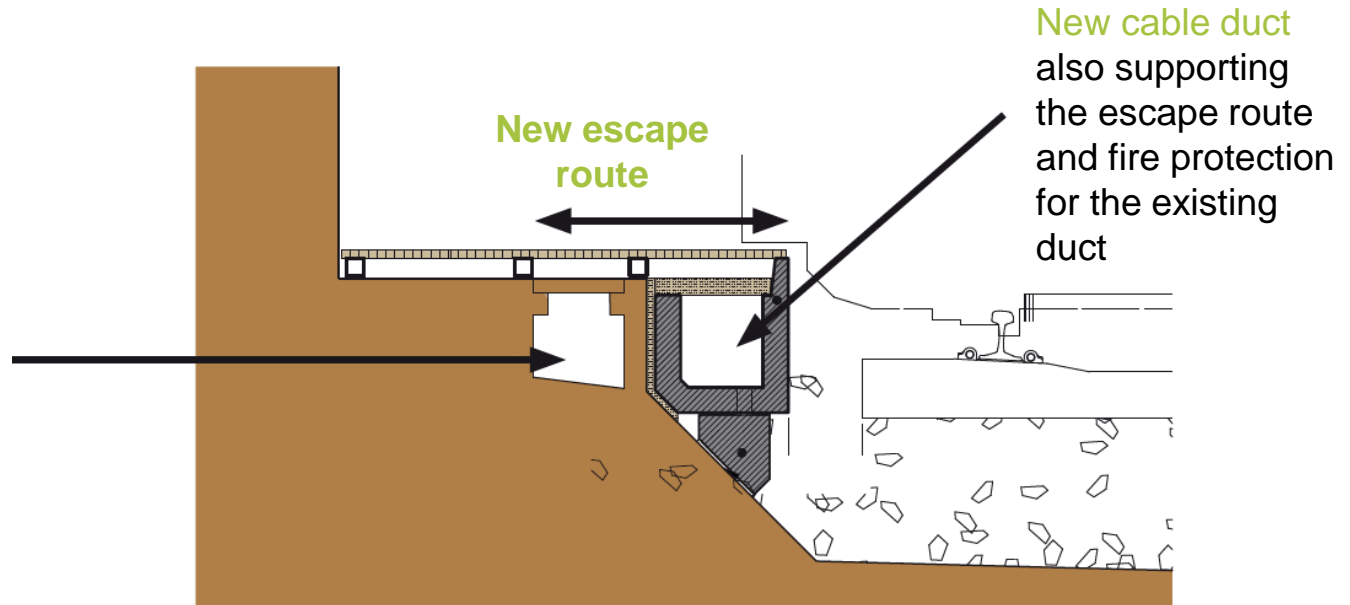
SITUATION BEFORE THE PROJECT : escape routes and cable duct



Action 1: New emergency exit route

- Schematic view of future cable duct and the new escape route

Existing cable duct to be used for the installation of safety cables to be protected from fire

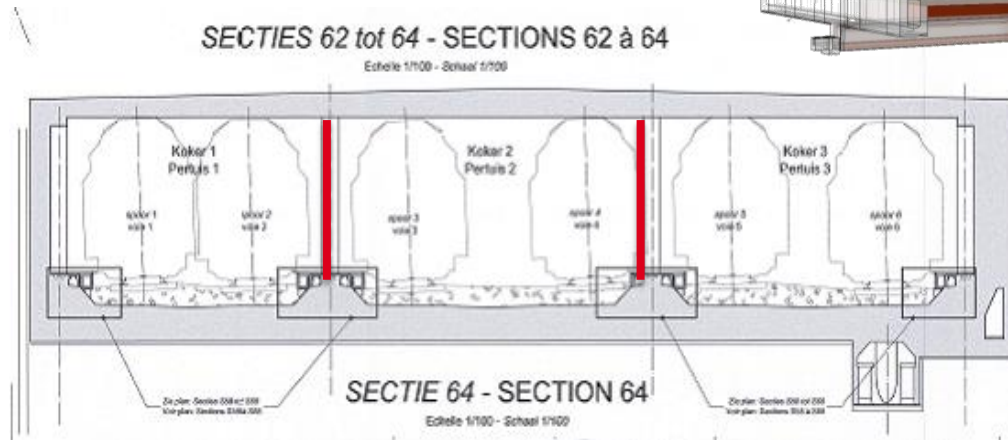
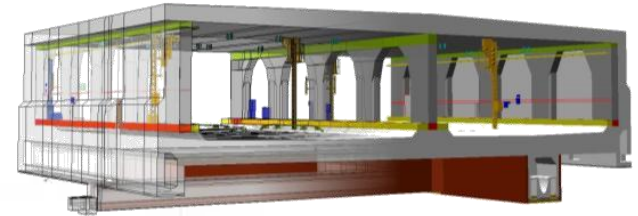


Action 1: New emergency exit route



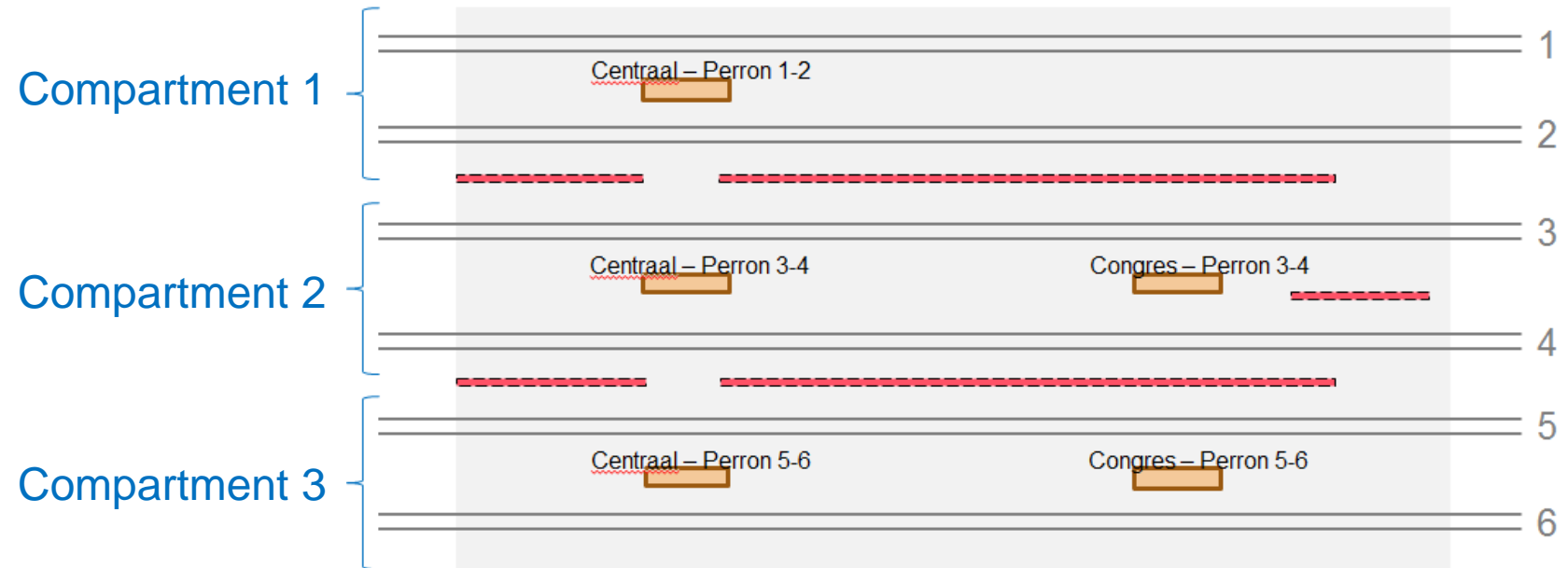
Action 2: partitioning

- Partitioning : separate the tunnel into three separate compartments with a fire-resistant wall



Action 2: partitioning

- partitioning : plan view



Action 2: partitioning



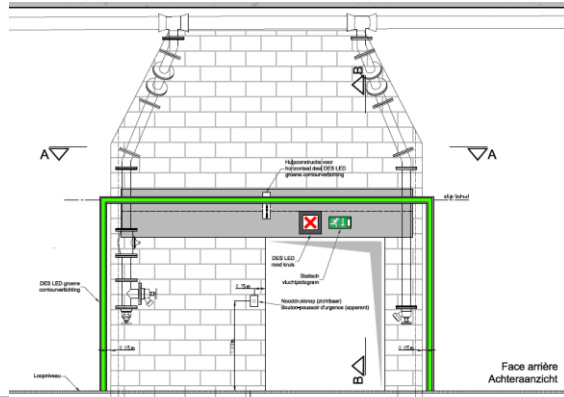
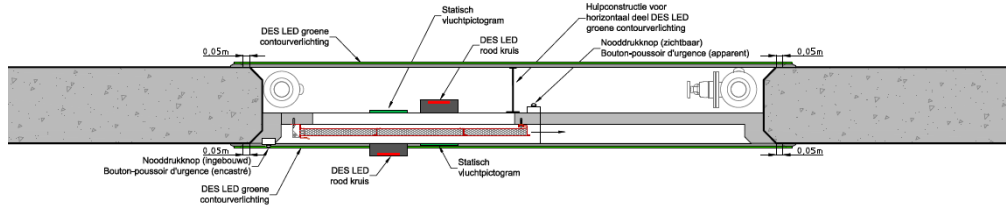
SITUATION BEFORE THE PROJECT
Open structure



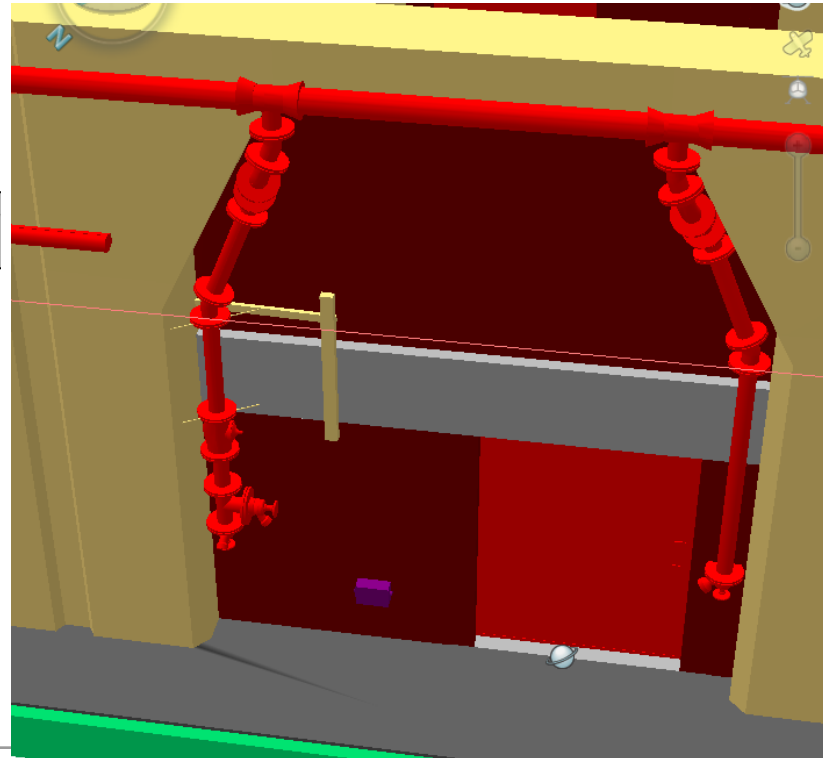
SITUATION AFTER THE PROJECT
Compartment and sliding door

Action 2: partitioning

Sliding door every 50m

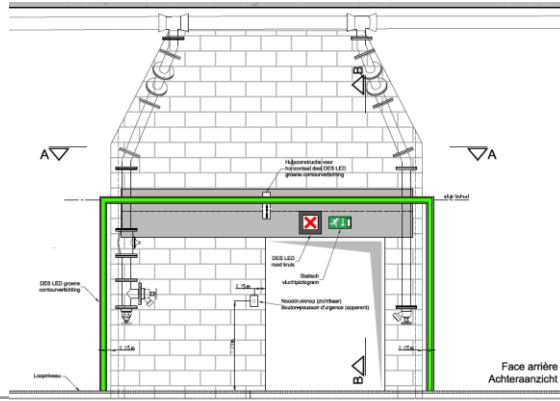
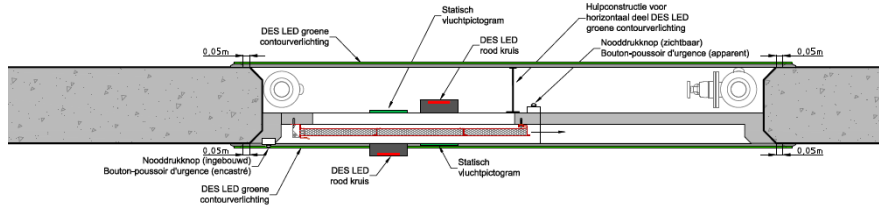


Coupe A-A
Sne de A-A



Action 2: partitioning

Sliding door every 50m



Action 2: partitioning

Erection in progress





Action 2: partitioning

▪ **Benefits of partitioning**

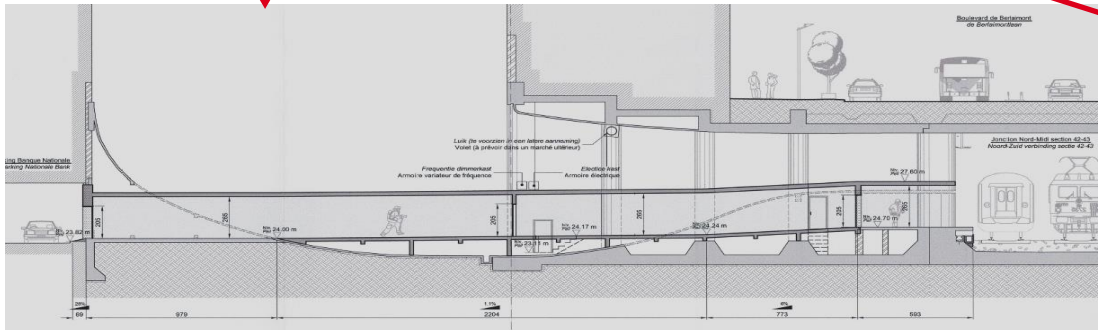
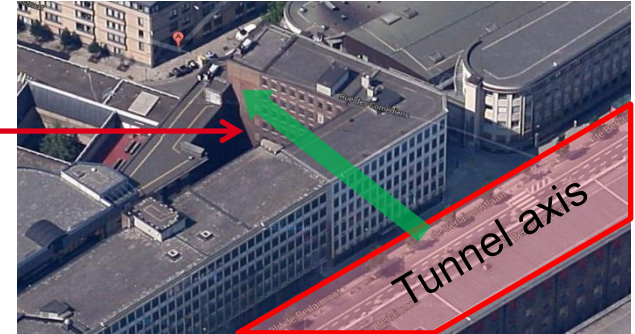
- **Evacuation in a healthy air:** with a train on fire, passengers go through the escape doors every 50 m and thus arrive a safe zone; they can then continue their evacuation away from smoke and heaten.
- **Easier intervention of the emergency services :**
 - Possibility to approach to the fire zone, via the neighbor smoke-free tunnel,
 - Reduction of search zones of people in distress (a smaller area)
- **Business Continuity :** the two unaffected tunnels could be put back into service quickly after a fire
- **Decrease of the cost of ventilation :** the necessary ventilation power must no longer brew a third of the tunnel section

Action 3: new emergency exit

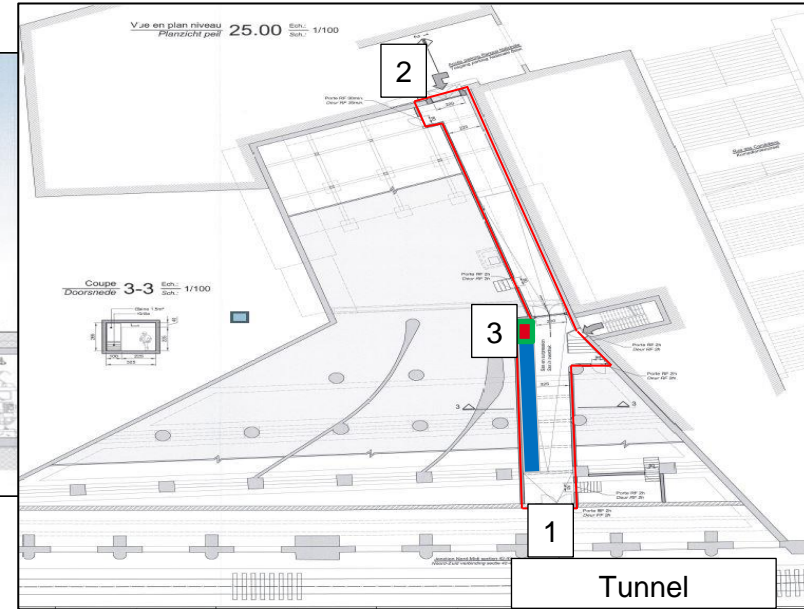
4

Access Comédiens Street (Fresh air inlet duct)

Realization of additional access to the tunnel



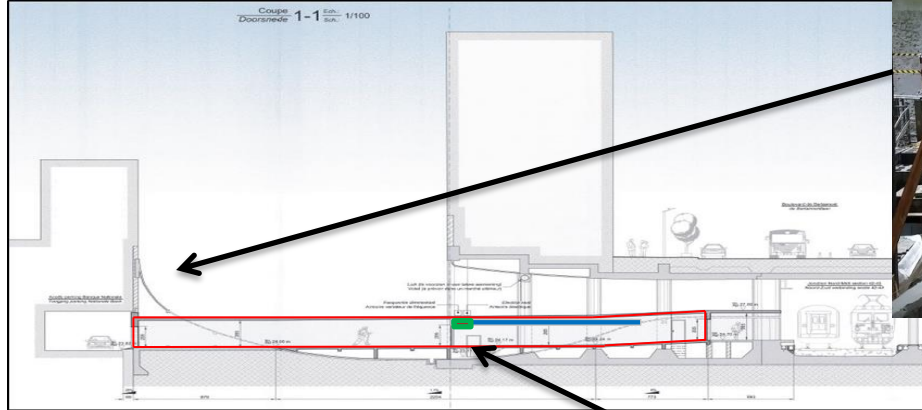
Action 3: new emergency exit



Comédiens Exit :

- firefighters access– emergency exit
- airlock
- double door

Action 3: new emergency exit

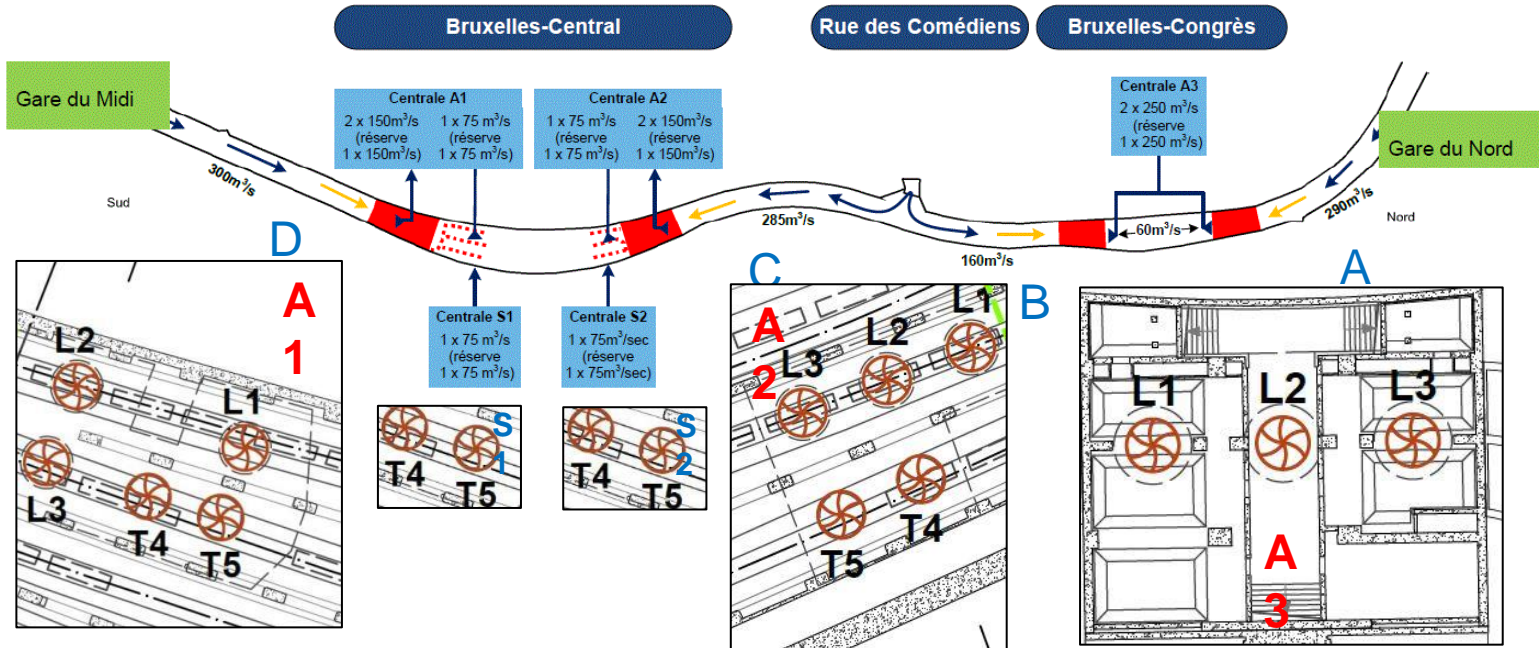


Comédiens Exit :

- firefighters access– emergency exit
- airlock
- double door

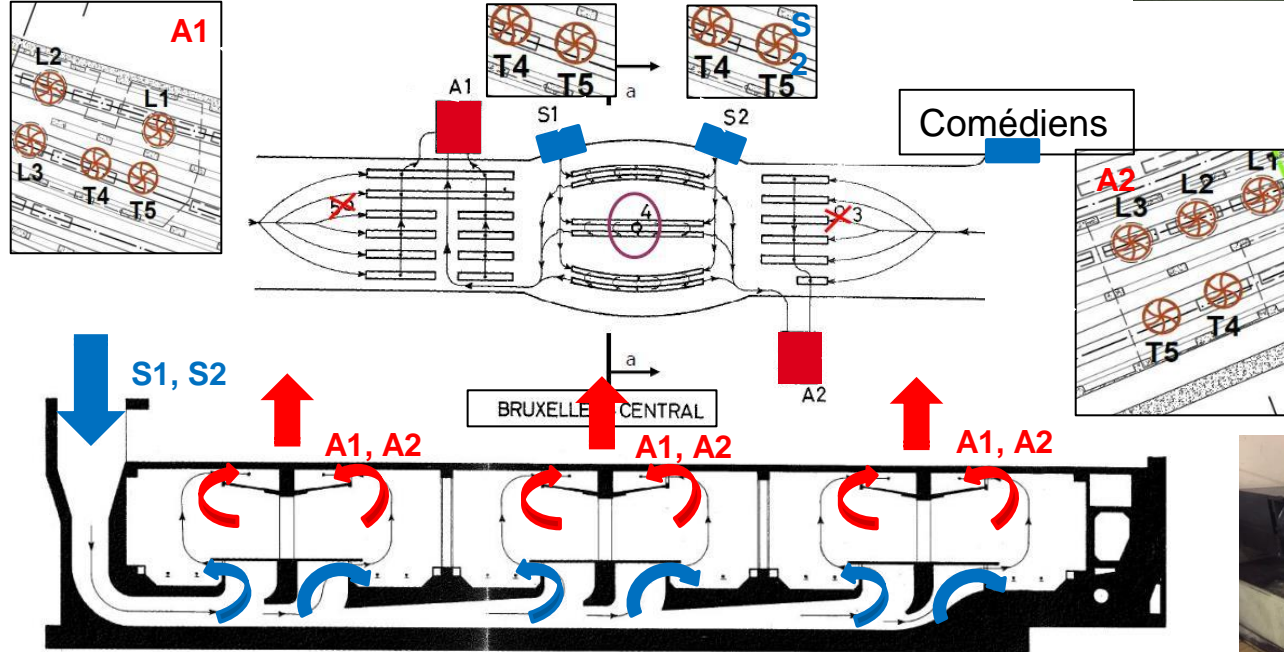
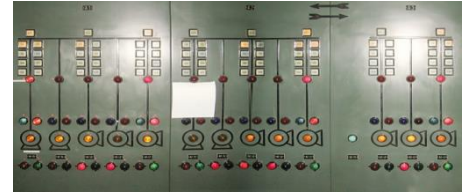


Action 4 : smoke and heat ventilation



Situation before the projects

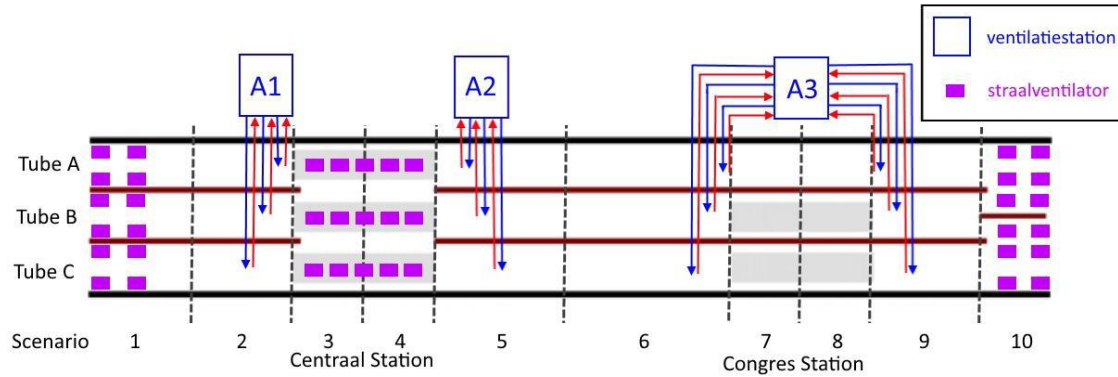
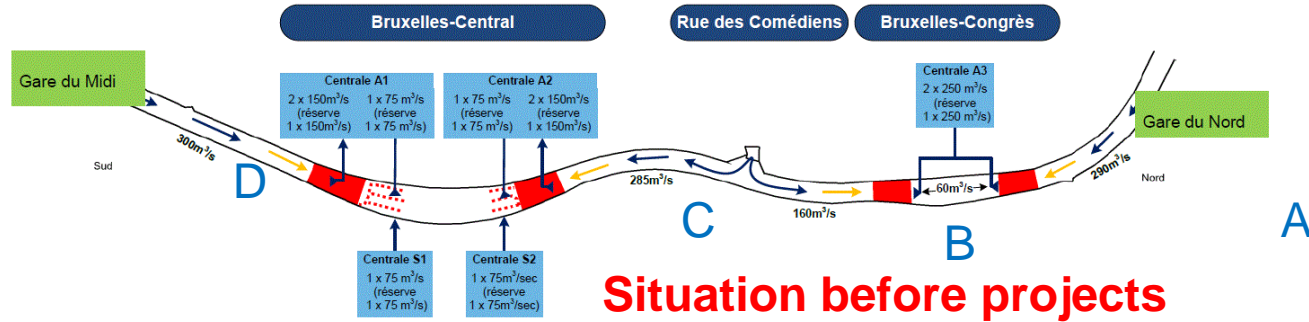
Action 4 : smoke and heat ventilation



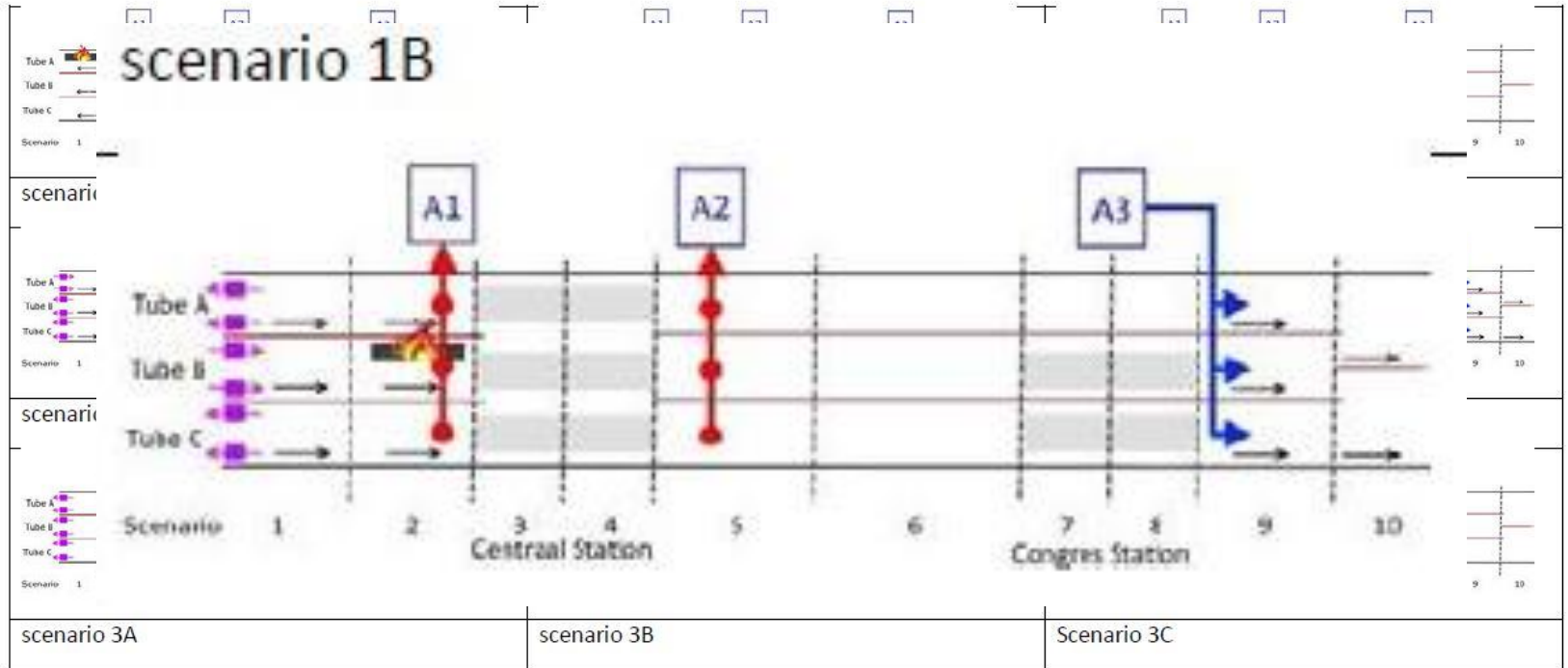
Situation before the projects

Coupe a-a

Action 4 : smoke and heat ventilation

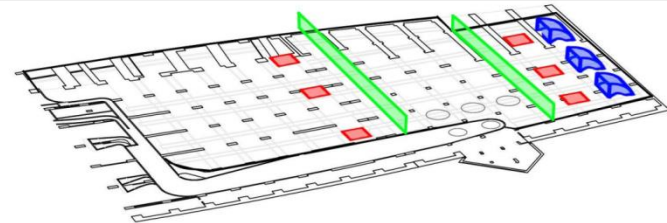
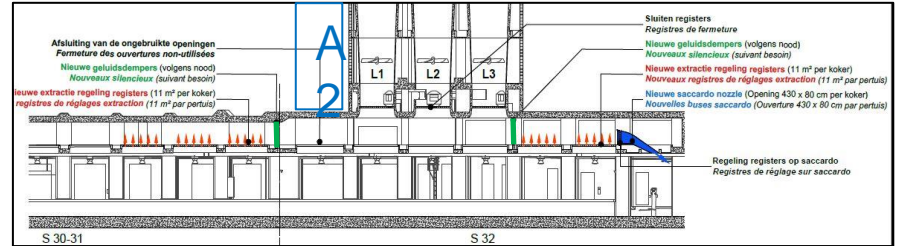
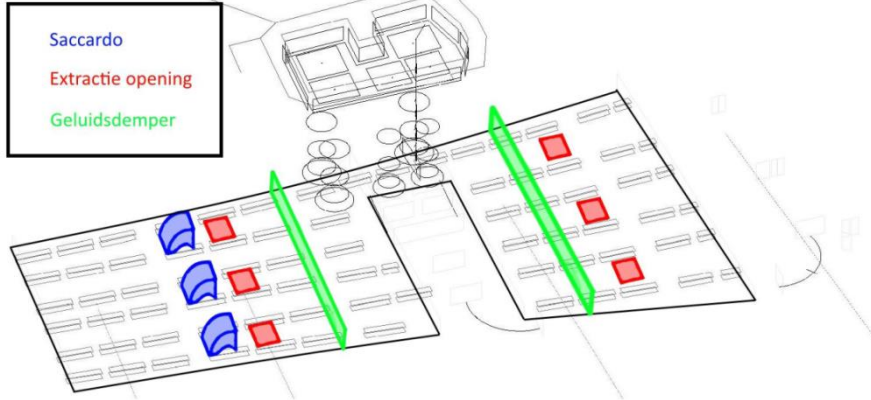
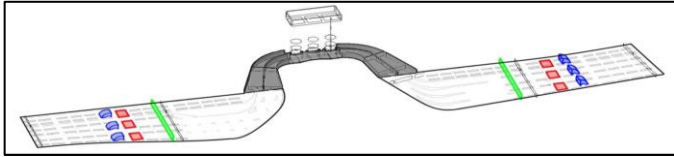


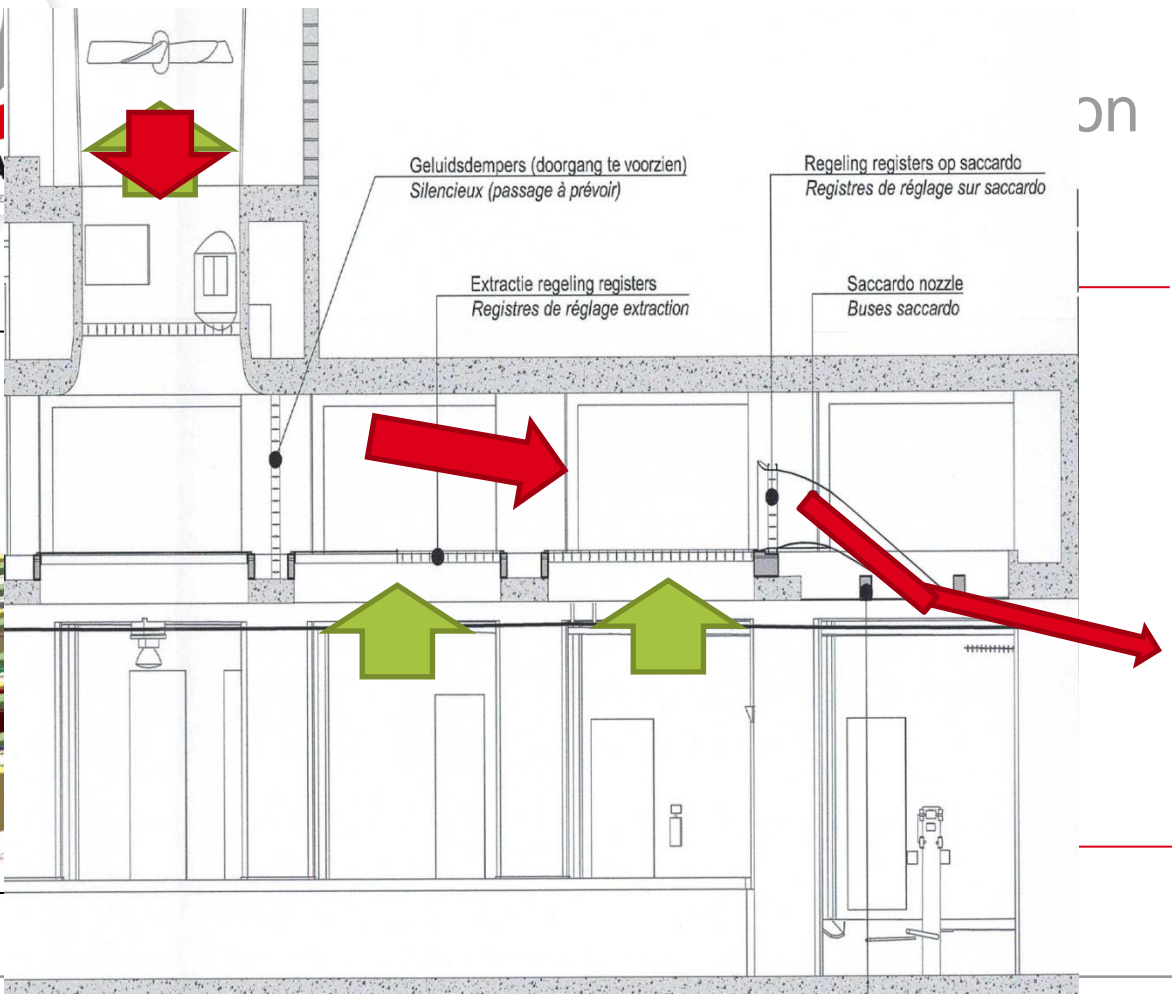
Action 4 : smoke and heat ventilation



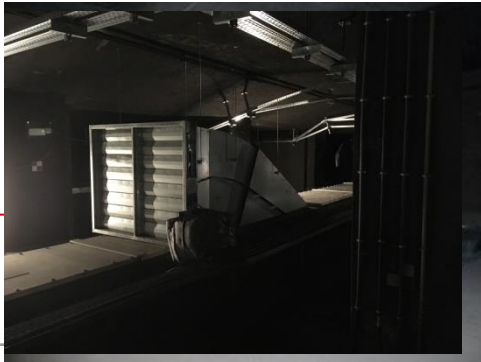
Action 4 : smoke and heat ventilation

plenums



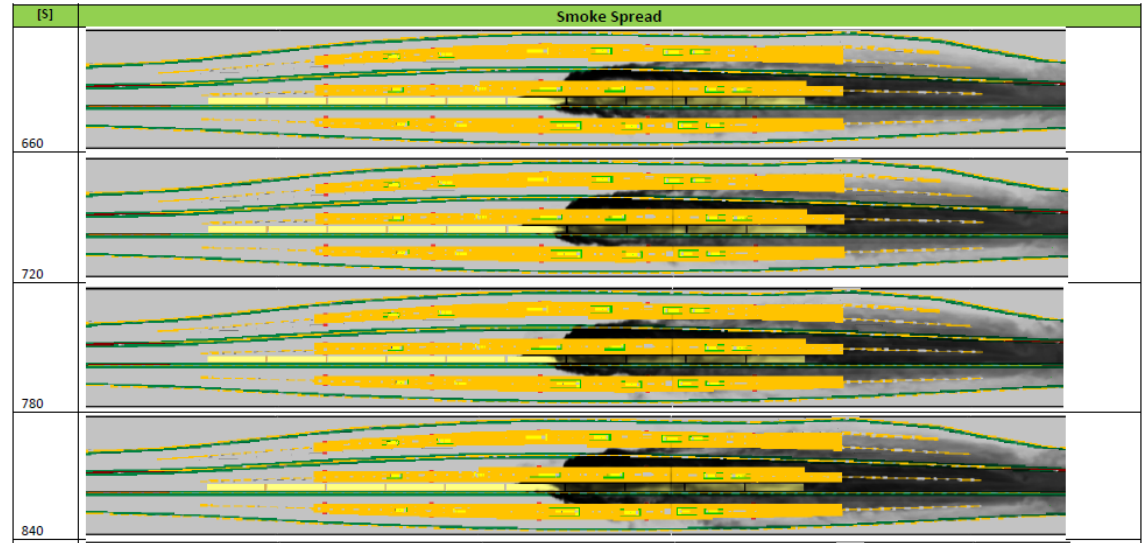
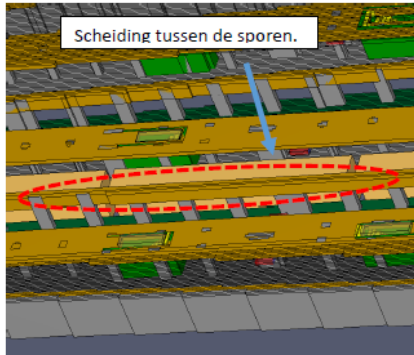
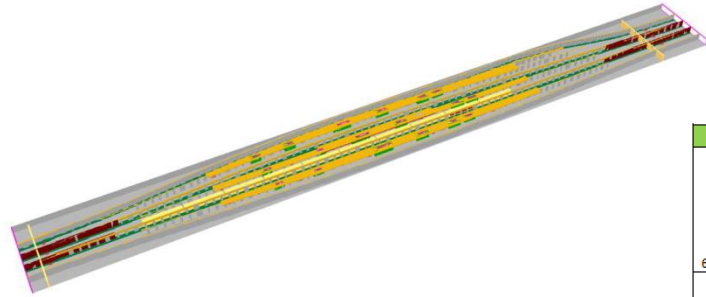


on



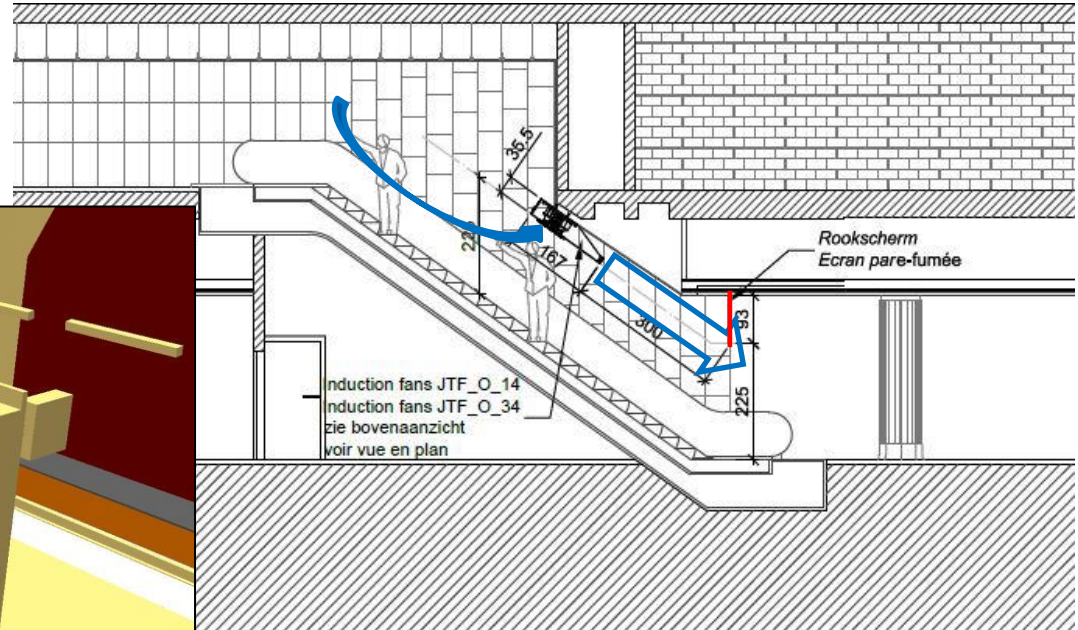
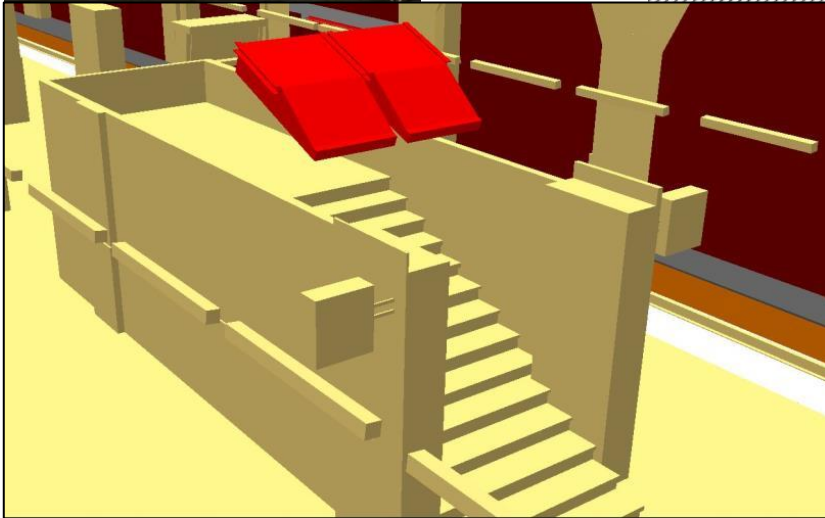
Action 4 : smoke and heat ventilation

In Brussels-Central station



Action 4 : smoke and heat ventilation

In Brussels-Central station





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Presentation of the tunnel

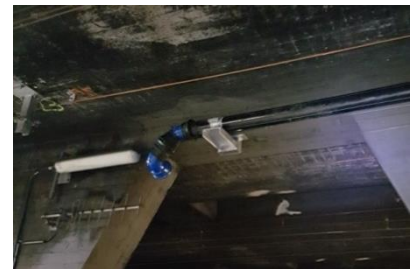
Presentation of the project

Some works implemented

Conclusions

Conclusions

- Many other actions are also part of the safety program:
 - road-rail access for firefighters
 - cameras
 - new lighting
 - fire hydrants
 - lorrie
 - ...
 - Other actions to increase reliability are also implemented
 - New signaling by tunnel
 - New catenary
 - ...
- => About 60 improvement actions are installed in the tunnel.





Conclusions: regulatory approval

- test in real situation: 2/12/2018.
- With a train *simulated* on fire
- with firefighters, rescue services, etc ... and volunteers' passengers (including me ;-))



Conclusions

Thanks to its experience in tunnels construction (Diabolo, Liefkenshoek, Schuman-Josaphat, etc.) and thanks to its human and technical resources (for example, BIM), TUC RAIL was able to meet the challenge of rehabilitation of the most important railway connection tunnel in Belgium.

