Refurbishment of the Amsterdam IJtunnel

ITA COSUF Workshop Safety versus Economics, Cost-efficiency of tunnel safety measures

Bart Duijvestijn - Rome, 22 June 2012

ITA COSUF
ITA Committee on Operational Safety of Underground Facilities

Gemeente Amsterdam
Dienst Infrastructuur Verkeer en Vervoer

Refurbishment of the Amsterdam IJtunnel

Content

- Historic overview and building process
- Reasons for refurbishment
- Scope of work
- Safety versus economics from various perspectives (tunnel manager and societal view)

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Location of the Amsterdam IJtunnel

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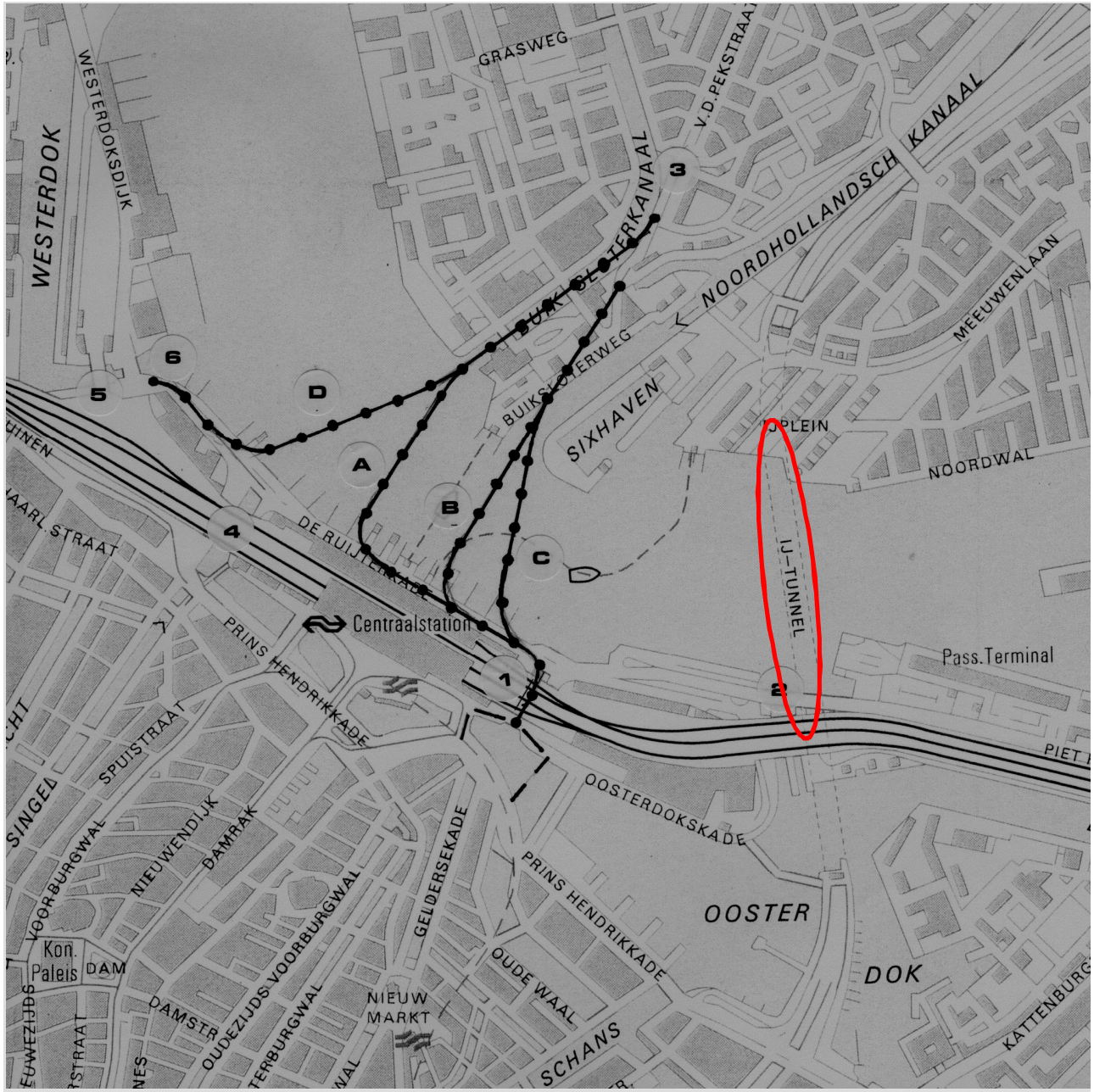
First plans for the project



Possible routes for the tunnel [1931]

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Design and construction

- 1957: No funding from the government
- 1961: Final decision, resume design

Design and construction

- 1968: Tunnel in commission

Characteristics of the IJtunnel

- Length 1,040 m (original length)
- 2 tubes, each 4.30 m * 9.21 m
- Maximum speed 70 km/h (original)
- Transverse ventilation system

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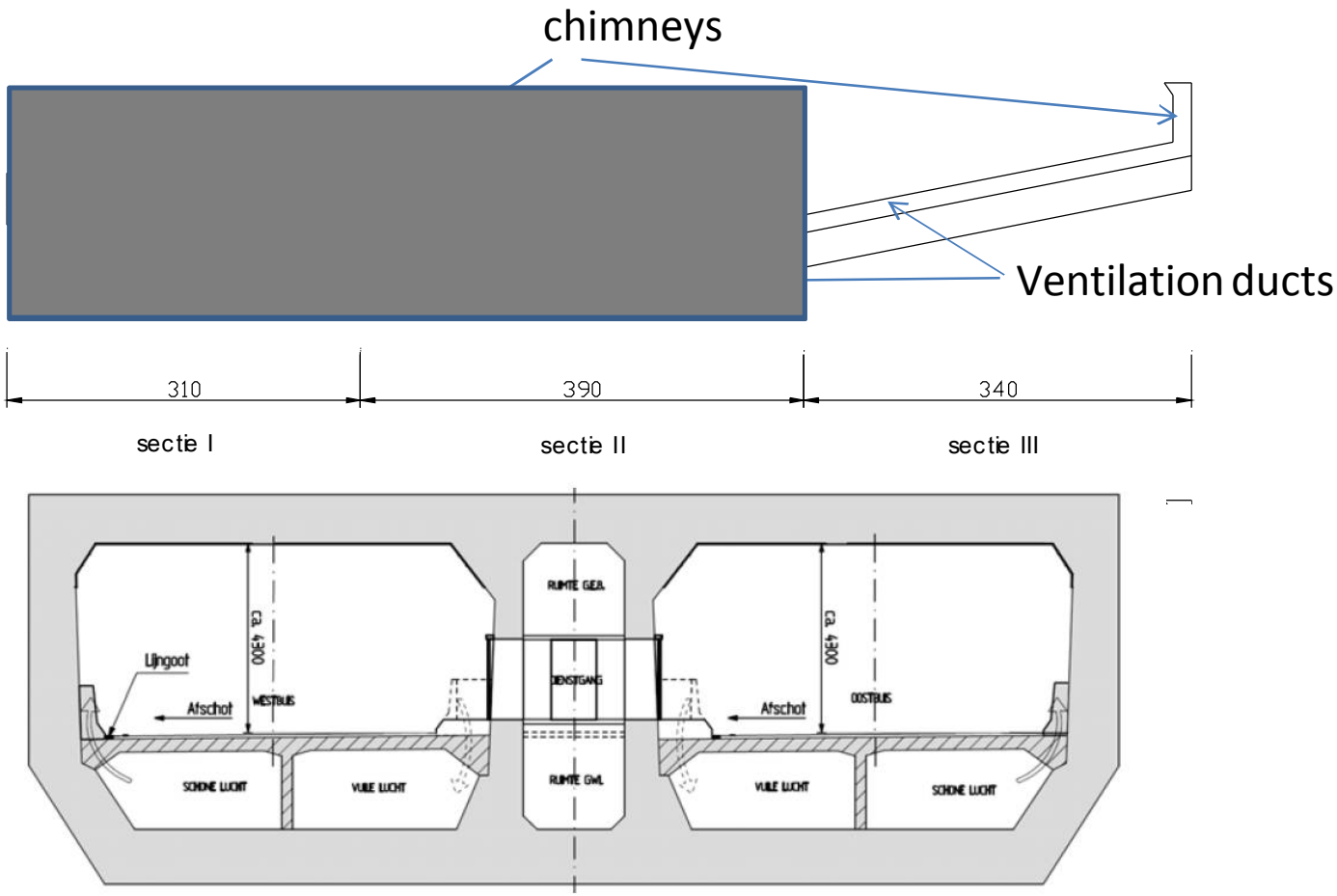
Geometry



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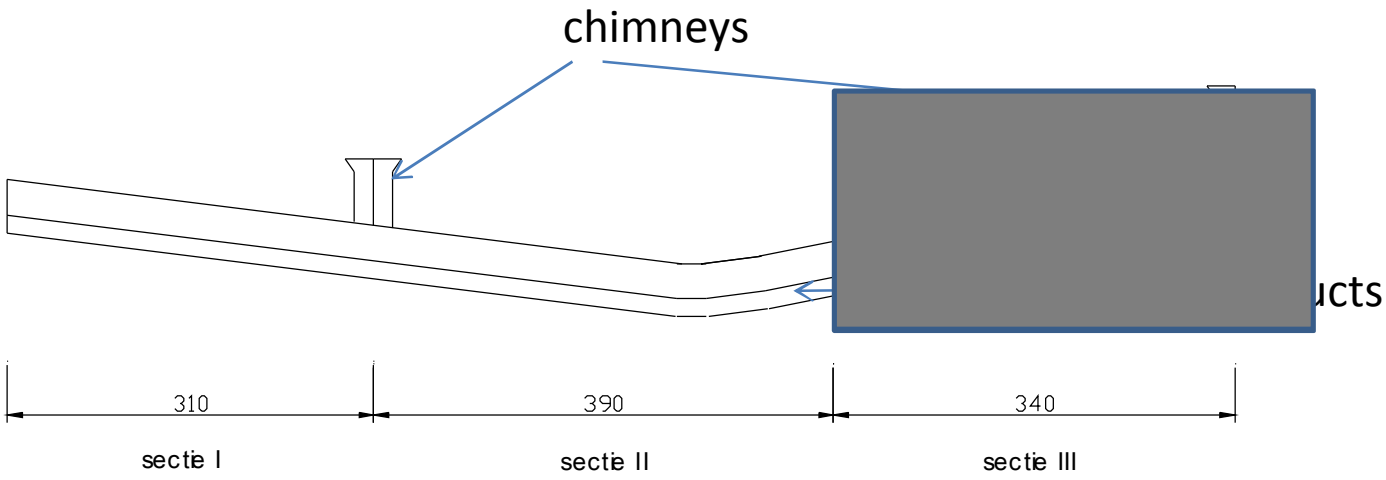
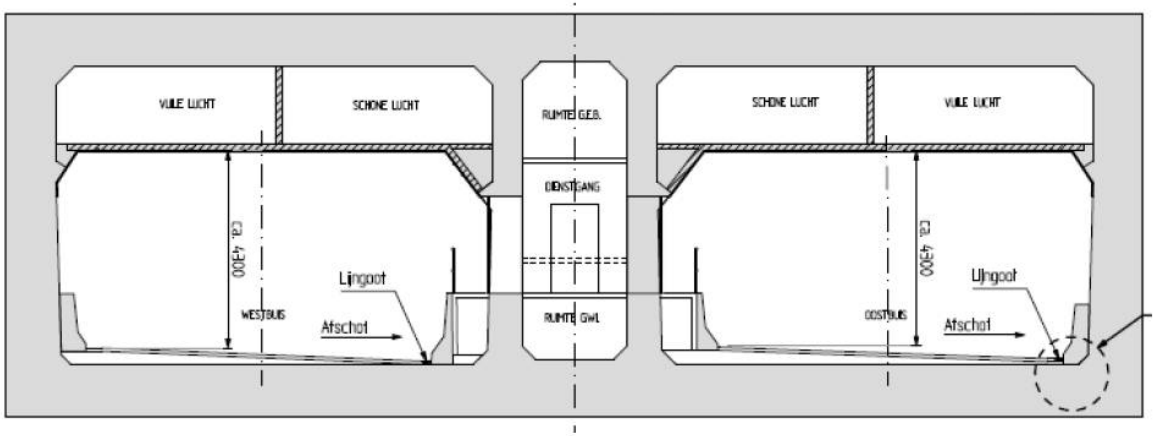
Geometry





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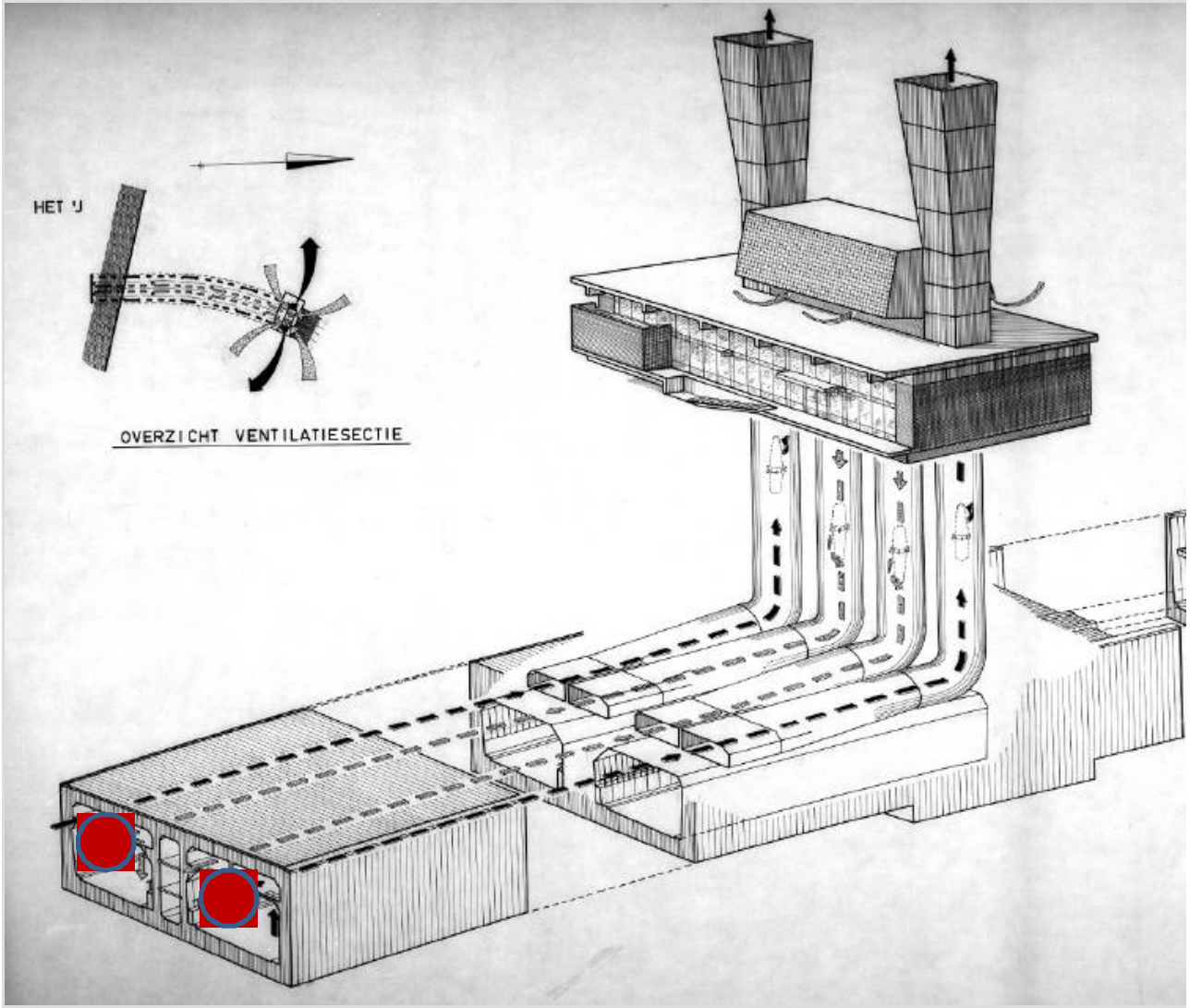
Transverse ventilation system



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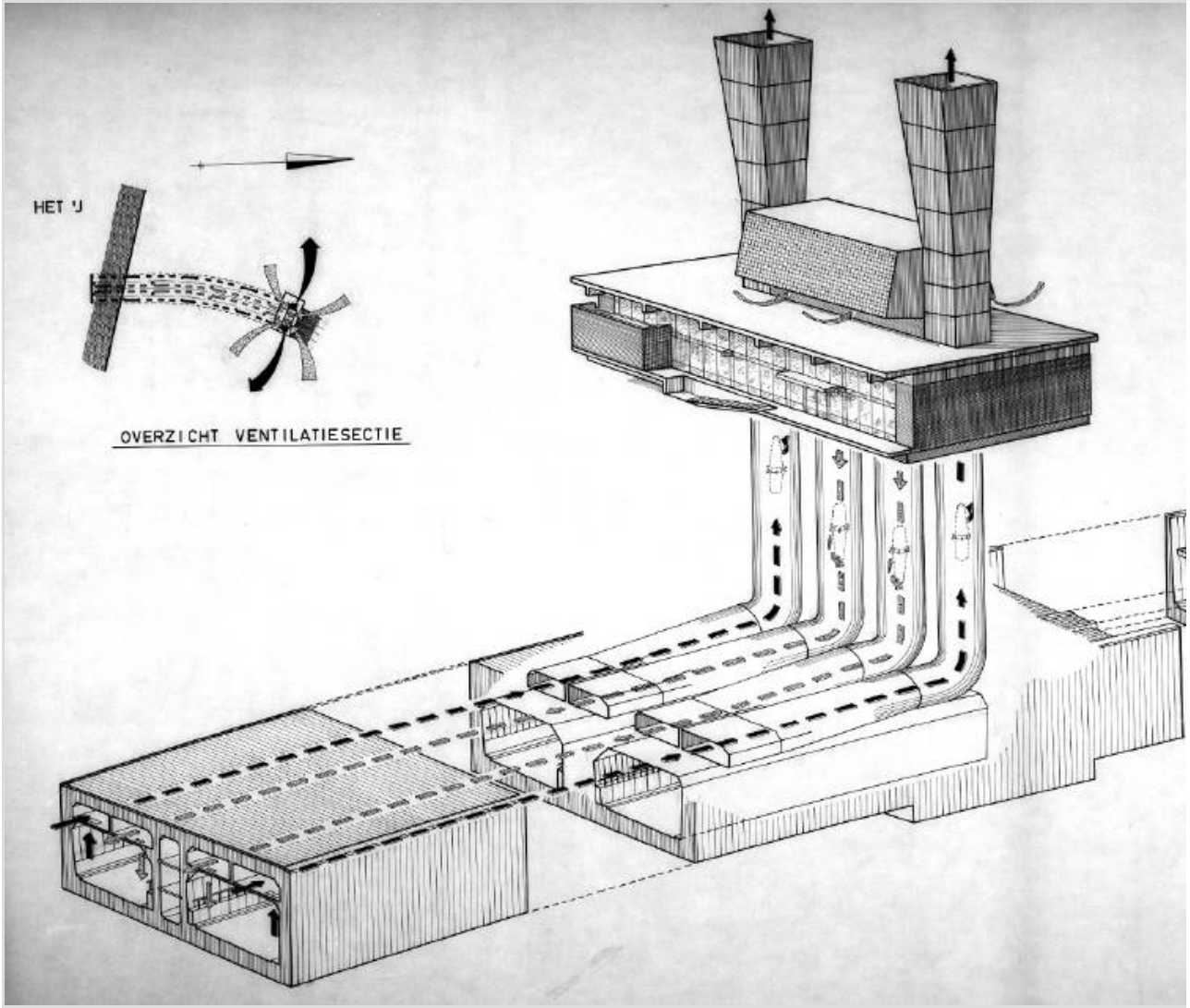
Transverse ventilation system



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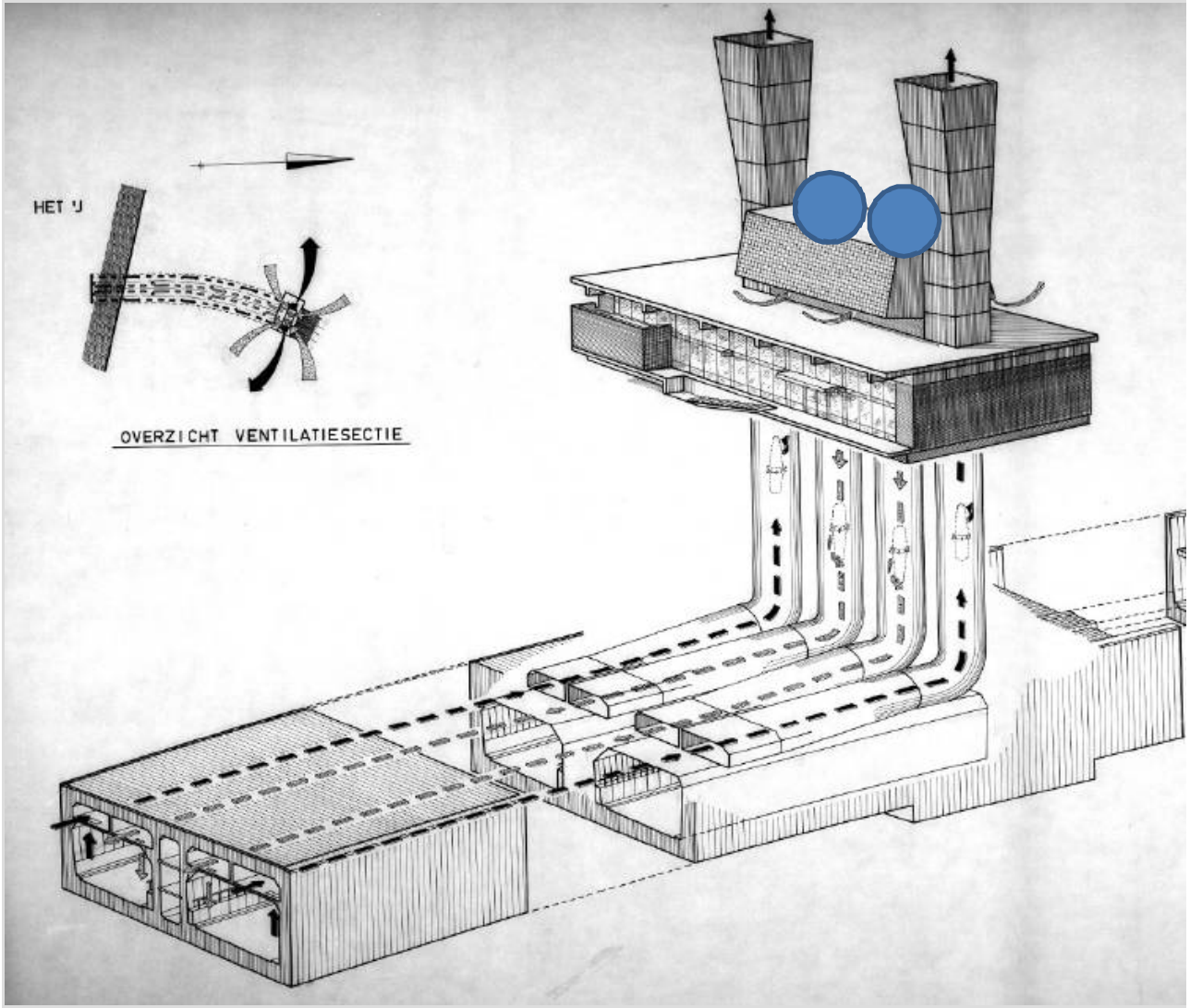
Transverse ventilation system



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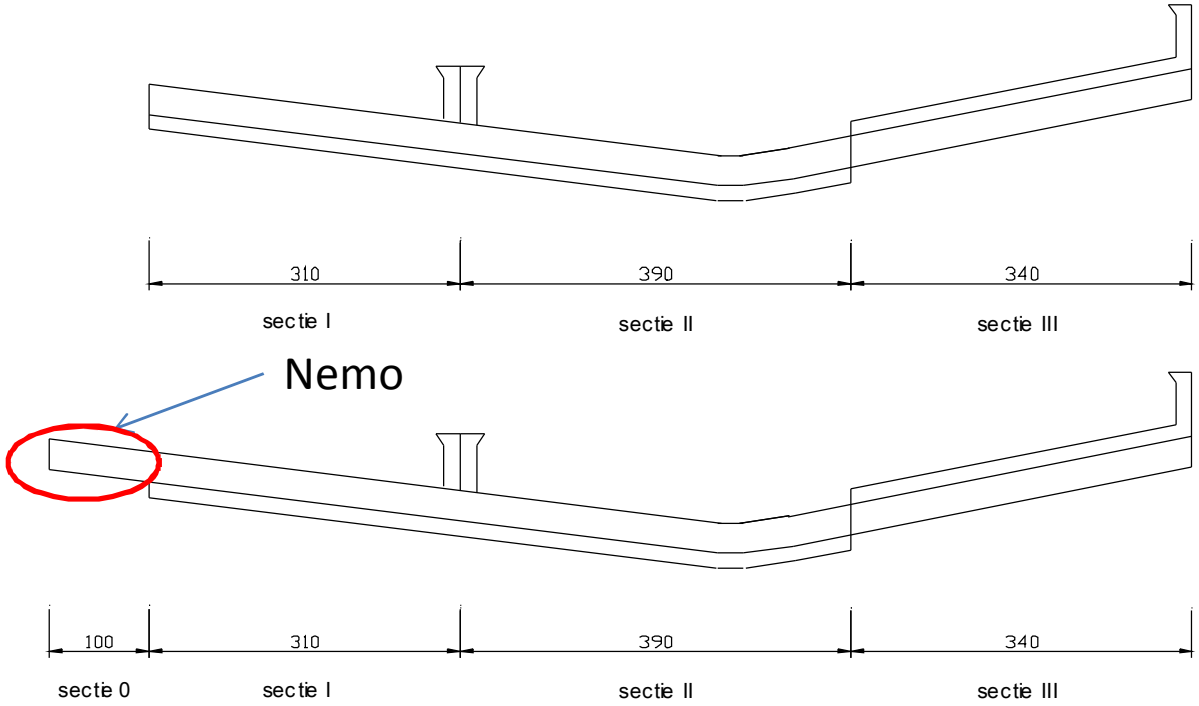
Extension of tunnel length

Nemo; 1997



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Slide 14

Use of the tunnel 2012

Because of the special urban location there are many bus and car travellers in the tubes during operation

- 7,393,440 vehicles each year

During rush hours:

- 2,107 vehicles
- 125 busses

- 500 – 1000 people in each tube at one moment

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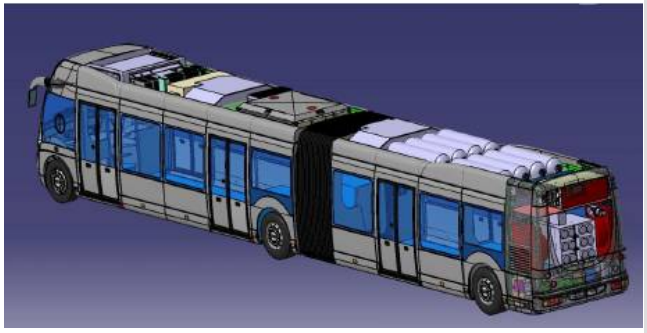

New energy sources for vehicles

- A test is on going with hydrogen busses
- Hydrogen tanks are situated on the roof of the busses
- For temperatures higher than 105 ^{o}C a pressure release valve is activated

➔ Hydrogen bus operation is tested on another route

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Needs after 44 years of operation:

Replacement of:

- Tunnel lighting
- Asphalt
- Wall covering (aesthetic)
- CCTV, tunnel broadcasting
- Operating system

Enhancement of the safety level:

- Higher requirements and new regulations
- Ventilation capacity is too low
- Length of escape route is too large
- Fire resistance of construction is too low

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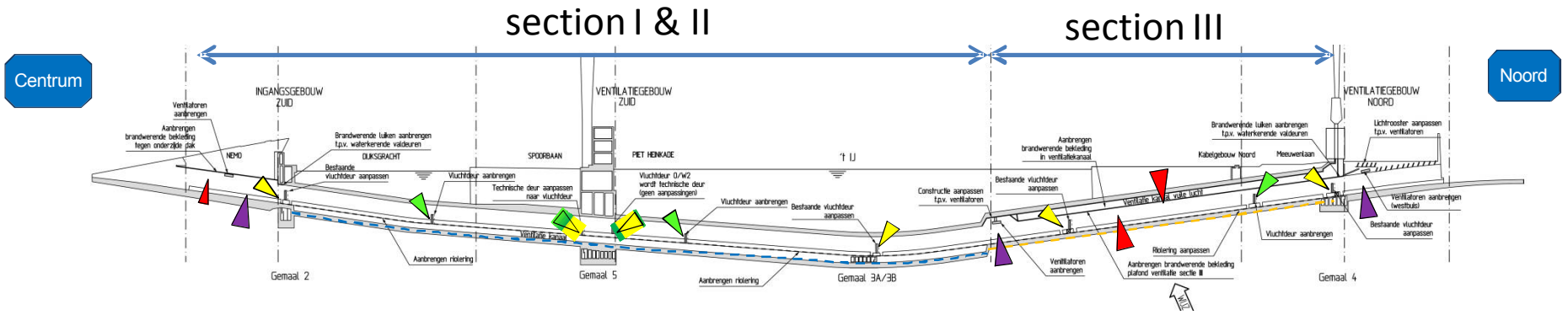
Overview of works



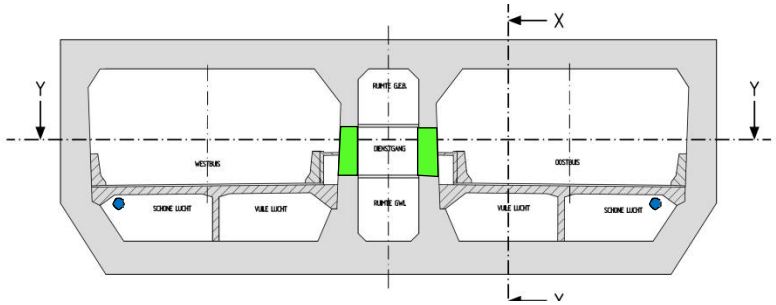
Fire protection of construction

Existing escape doors

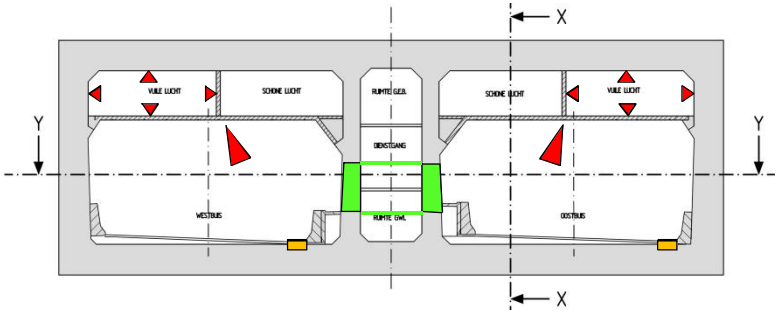
New escape doors

New tunnel ventilation

New drainage system



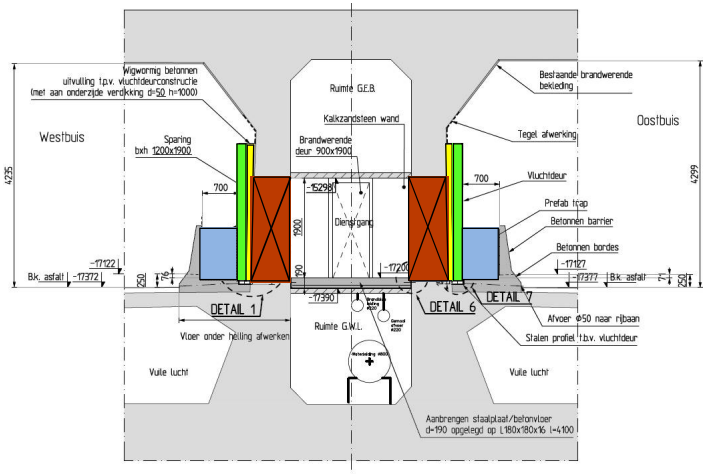
Cross section I & II



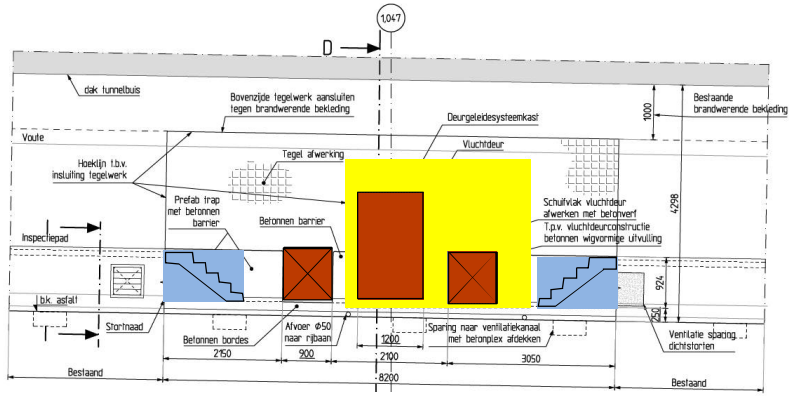
Cross section III

New escape routes

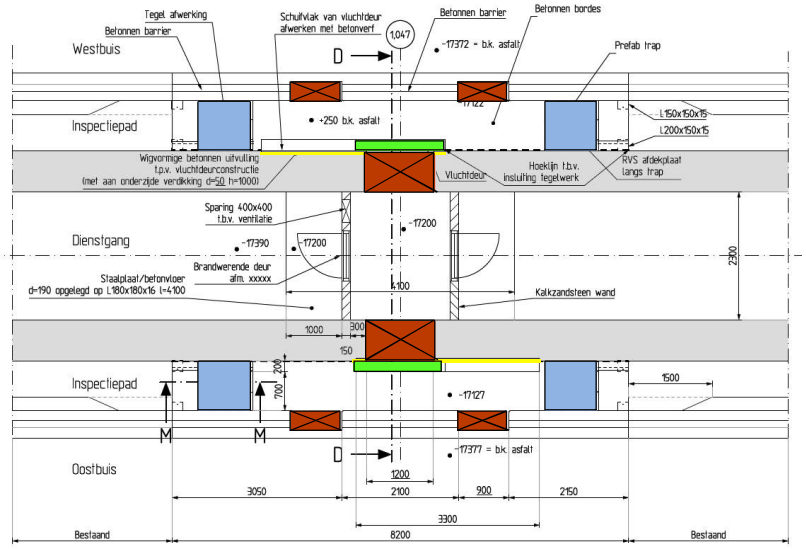
Doors on road level



Cross section



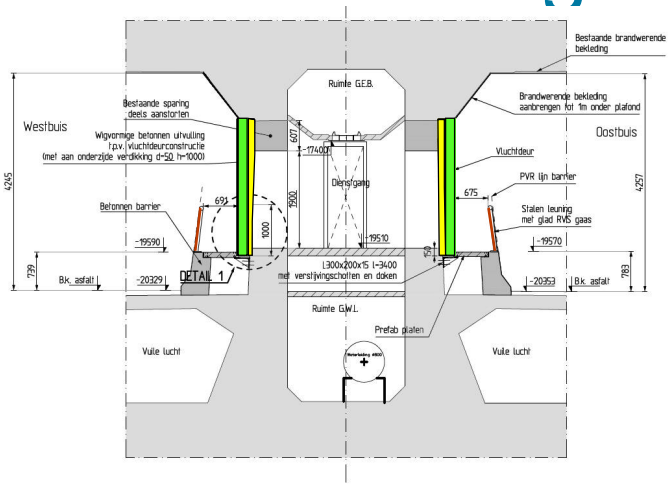
Side view



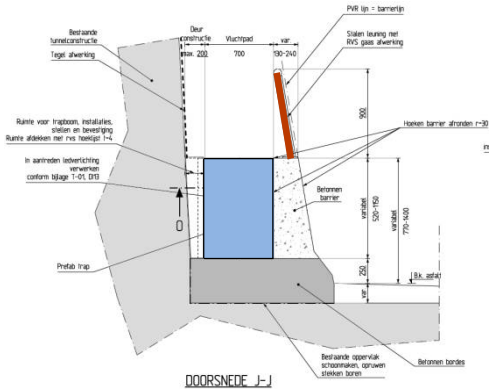
Top view

New escape routes

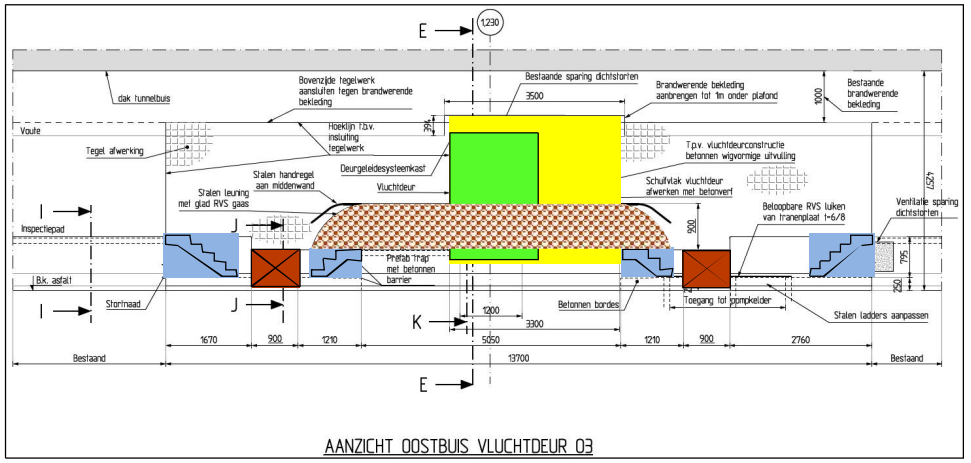
Doors on original level



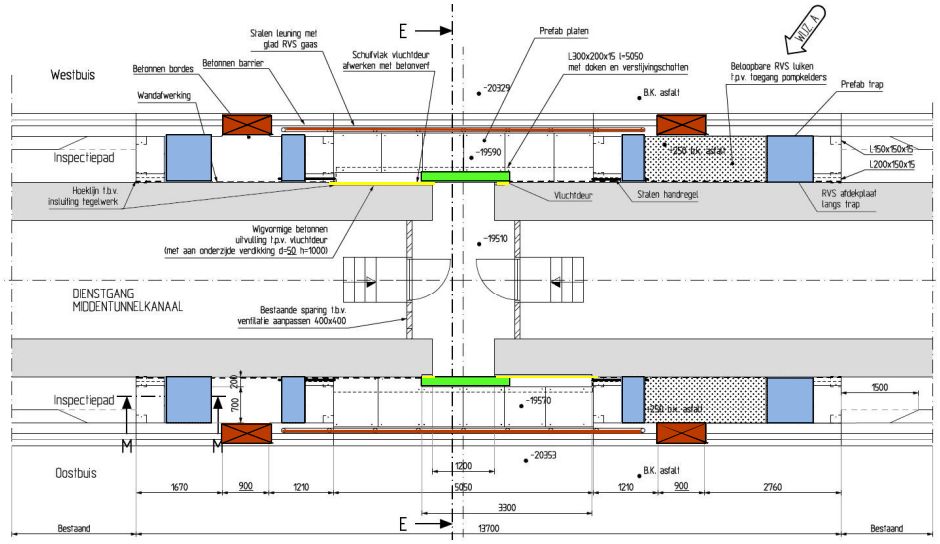
DOORSNEDE E-E



DOORSNEDE J-J



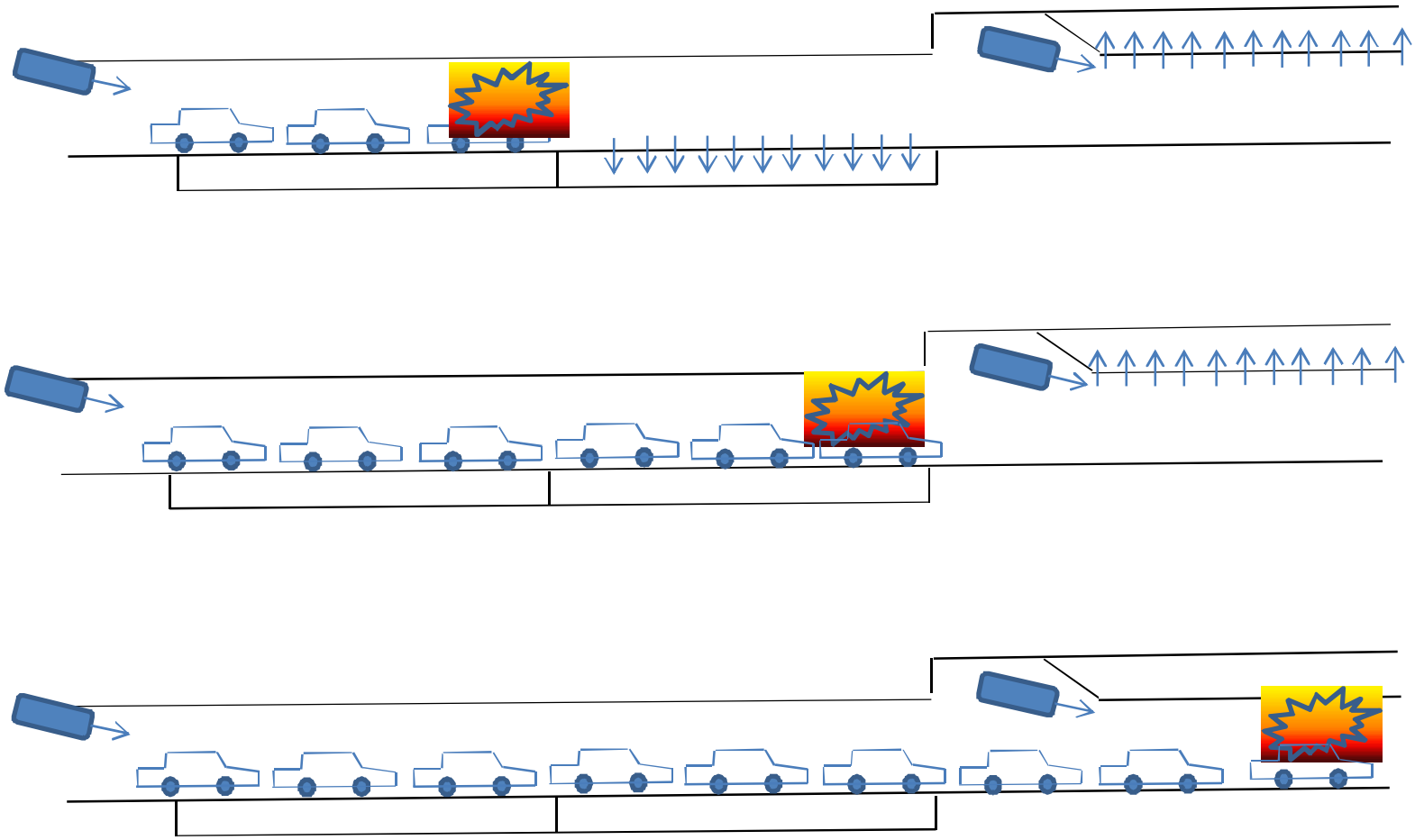
AANZICHT OOSTBUIS VLUCHTDEUR O3



PLATTEGROND VLUCHTDEUR O/W3

Hybrid ventilation system

A combination of transverse and longitudinal ventilation



Hybrid ventilation system

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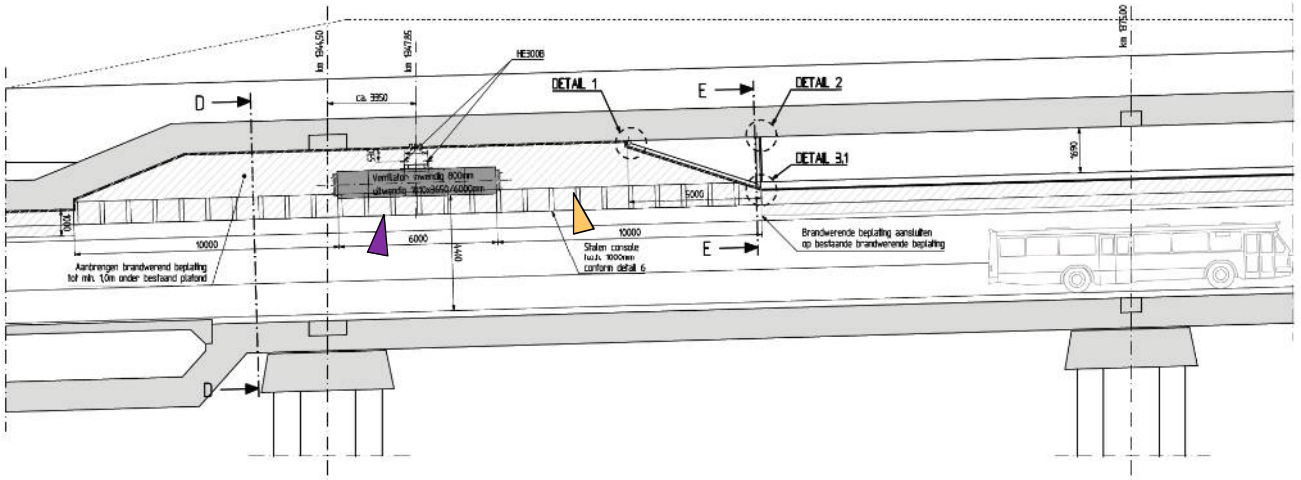
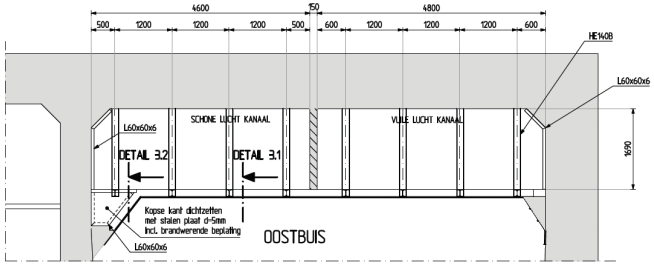
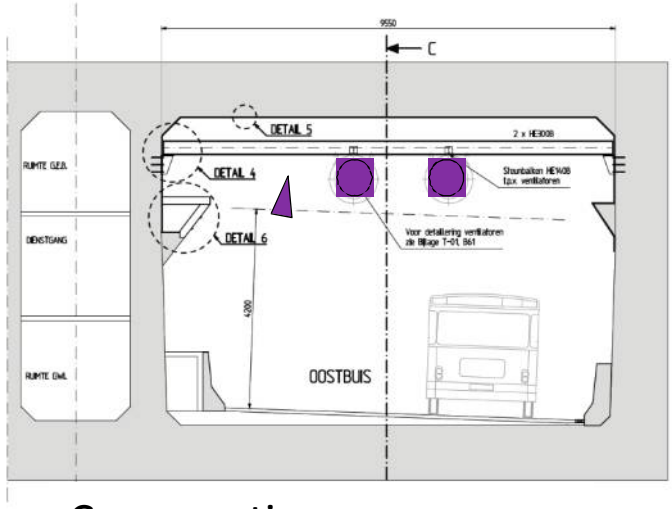


Side view

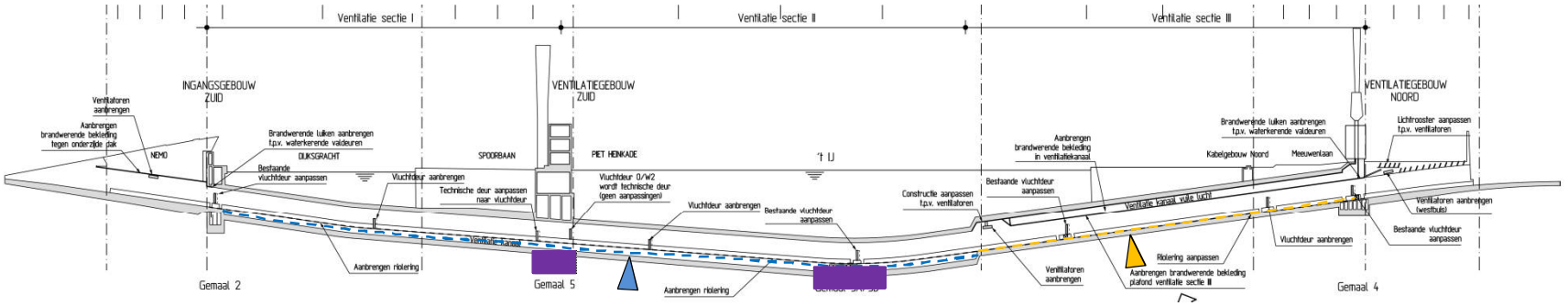


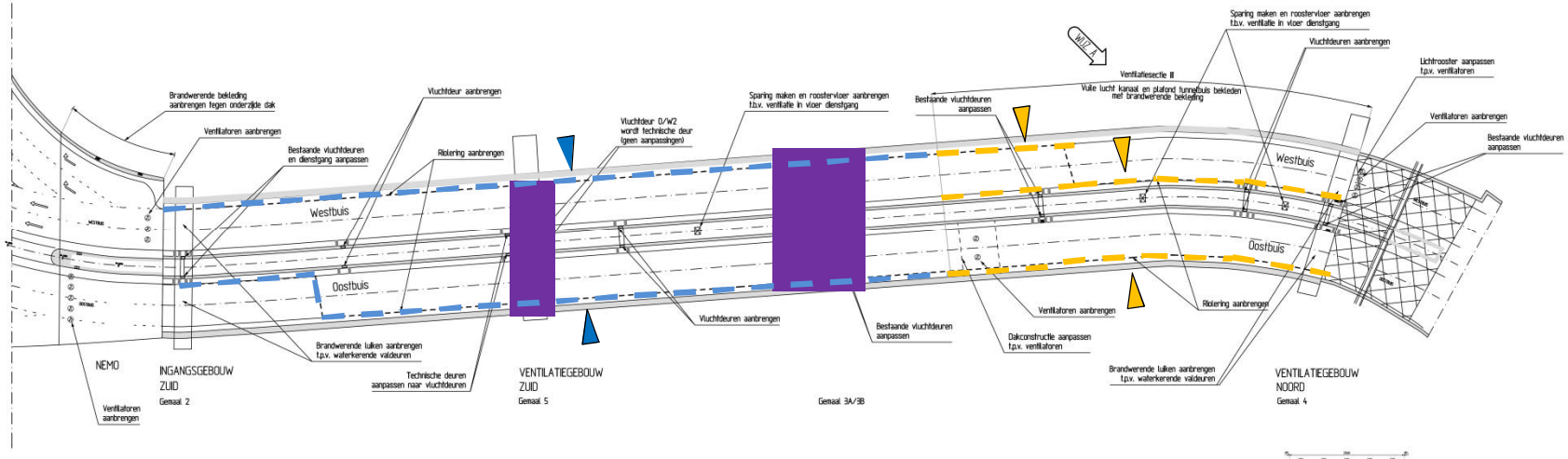
Cross section

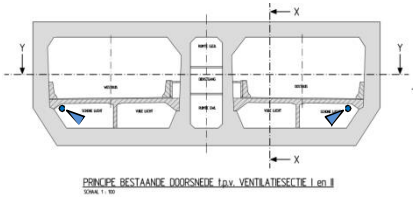


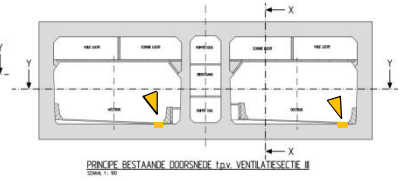
Cross section

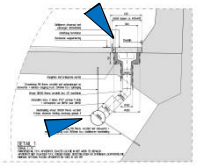
Drainage system

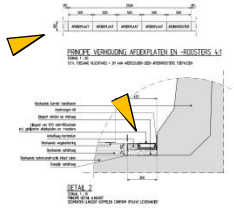












Safety versus economics

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Safety versus economics

Fire protection of construction

- Regulations demand a fire resistance with a minimum of 60 minutes
- Key cost driver is the labour, not the material

➔Fire resistance board is used with a fire resistance of 120 minutes

- Insurance of construction
- Self-rescue is not improved
- Extra possibilities for emergency services

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Safety versus economics

Peak shaving for tunnel ventilation

- Industrial consumers pay for the amount of energy and the maximum peak
- Incident ventilation leads to huge energy peaks
- The use of peak shaving leads to a slow and inefficient ventilation strategy

➔ No peak shaving is used any more

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Safety versus economics

Tunnel lighting

- It is not necessary to replace armatures in the tunnel
- In the central zone calculations show that led lighting is possible

➔ Existing armatures are changed, TL-lighting is replaced by led.
A direct cost saver due to less use of electricity, a decrease of 59% CO2

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Safety versus economics

Operating during the refurbishment

- The contractor works in one tube, the other one is used for bi-directional traffic
- For key users the tunnel should be available
- During the work the safety level of operation should be at least the same as before

➔ During the works the tunnel is closed for normal traffic, but open for public transportation and emergency services

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Safety versus economics

'Sluiting IJtunnel ramp voor bedrijven in Noord'

De zomersluiting van de IJtunnel, tussen 6 juli en 3 september, is rampzalig voor het bedrijfsleven in Noord.

Foto: mooste

Dat stelt de VEBAN (Vereniging van ondernemeners Amsterdam-Noord). De tunnel gaat niet helemaal dicht, hulpdiensten, taxi's, bussen en touringcars mogen er wel doorheen, maar vrachtwagens niet.

VEBAN-directeur Ivonne Koppers licht toe: 'Namens het georganiseerd bedrijfsleven hebben wij onze zorg over de gevolgen voor

BETROKKENEN

Eric Wiebes
Wethouder

Operating during the refurbishment

- The tunnel must be available
- Tunnel safety seems not to be an issue for business men who depend on tunnel availability

➔ Closure of IJtunnel seams to be a disaster for shops and companies

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Safety versus economics

Operating during the refurbishment

Extra safety measures are taken:

- Flexible poles to separate the lanes in opposite direction
- Gating of busses
- Instruction to bus drivers (professional drivers)

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Succes factors for refurbishment

- Take your time to check the as-built situation and make a ‘custom-made’ design
- Combine new techniques with existing infrastructure if they are not end of life
- Prepare and communicate with road planners and society

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Imagine the result

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