



HDI Risk Consulting

Risicoanalyse

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Property

NV Westerscheldetunnel
Westerscheldetunnelweg 1
4454 PD Borssele



Netherlands
51.44, 3.75

Datum bezoek:
04.10.2021

Bezocht door:
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Risicoanalyse

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Property



Engineering



Marine



Motor

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1 Inleiding

HDI Risk Consulting (HRC) is a department of HDI-Gerling and globally conducts risk surveys on the subjects of property damage & business interruption, transport and liability. Please visit our website www.hrc-services.nl for more information about our services.

Our visit on the 4th of October concerned a survey for the property damage insurance. The survey consisted of a general conversation about the tunnel and its utilities and technical rooms (over its policy related risks and prevention), a tour around the tunnel and an exit meeting. The traffic tubes themselves could not be inspected from the inside, as traffic was present. Regarding business interruption only basic data has been collected, as this exposure was not part of the survey. No testing was performed. All information is based on visual observation, unless stated otherwise.

In this report the relevant or applicable results of the survey have been described.

Aanwezigen:

N.V. Westerscheldetunnel

- Hans Huige, Onderhoudsdeskundige E&M - KAM Coördinator
- Richard Witsel, Onderhoudsdeskundige ICT en contractbeheer

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- Davy Geene, Senior Risk Engineer



2 Algemene beschrijving / Procesbeschrijving / Wijzigingen

2.1 General description

The Westerscheldetunnel is the connection between “Zuid-Beveland” and “Zeeuws-Vlaanderen” in the province of Zeeland, the Netherlands. With a length of 6,6 kilometers it's the longest tunnel for road traffic in the Netherlands. Apart from two tunnel tubes there are several utilities, above ground structural works and roads. The tunnel is open for motorized road traffic only: no pedestrians or cyclists. NV Westerscheldetunnel is the operating company, which is owned (100%) by the province of Zeeland.

Some 7,3 million “passages” per year, which equals an average of some 20.000 per day.

The Sluiskiltunnel has two tubes, each 1,1 kilometers long. Each tube has two lanes. The total length of the tunnel, including ramps is 1,3 kilometers and the deepest part is more than 33 meters below sea level. The diameter of the tunnel is approximately ten meters and equal to that of the Westerscheldetunnel.

2.1.1 Location data

The Westerscheldetunnel is located between “Ellewoutsdijk” and “Terneuzen”. Being part of the N62 motorway it includes several kilometers of above ground traffic road. Adjoining premises consists of farmland (above ground parts) and water. At a few kilometers distance the chemical plant of DOW is present. A high-voltage cable is provided nearby the tunnel.

The Sluiskiltunnel is located under the Canal of Ghent to Terneuzen.

2.1.2 Building(s)

In total NV Westerscheldetunnel includes some 19 kilometers of the motorway N62, including several structural works (viaducts, culverts, and the like), tollgates, traffic signing, lighting etc. The Westerscheldetunnel itself is 6,6 kilometers long. The Sluiskiltunnel is 1,3 kilometers long. In fact, the tunnels consist of two separate tubes (diameter 12 meters), located at some 15 meters distance from each other. Every 250 meters there is a connection between both tubes. At its deepest point the Westerscheldetunnel is some 60 meters below NAP of the Westerschelde, the Sluiskiltunnel is some 33 meters below NAP. Minimum coverage of the tunnels with soil is some 15 meters.

The tubes have been made by a drilling method. The tubes are made of concrete segments, - 8 for a full ring -, fitting exactly to each other. The so-formed tube walls are 45 centimeters thick. Additionally the walls have been covered with a fire resistant lining of 4,5 centimeters thickness (“Fendolite” – tested/rated 3 hours). Every 250 meters a connection has been made between the “East” and the “West” tube. This connection facilitates emergency escapes. Also there are cable connections for utilities (electric feed, traffic management). The entry to the connection is protected (both sides) by a fire resistive door (3 hours tested – rated). The doors are closed and locked and can be opened from the control room only. The connection itself is made of concrete too.

The Westerscheldetunnel has 15 E-rooms: 13 below the road and one at each tunnel entry. The E-rooms have been connected by a long corridor-cable tunnel under the road (in each tunnel). The corridor/cable tunnel is subdivided by fire resistive walls near each E-room. The passage way is protected by automatically closing fire doors. All technical rooms are surrounded by concrete walls and access is through heavy steel doors. All internal walls within the tubes are made of heavy concrete. Doors have been made of steel. The general construction class is rated as fire resistive.

The Sluiskiltunnel has two E-rooms at the tunnel entries.



2.1.3 Organization and safety management

Some 50 people are employed. The majority works (in shifts) at the toll gates and related activities. Furthermore there is maintenance and calamity staff (24/7), financial, administration and management (office hours).

All works are regulated/controlled through a work permit system.

Tunnels and equipment are subject to rigid system of largely prescribed maintenance and inspections. Every month, during one night, one of the tubes is closed for inspection and maintenance. The Sluiskiltunnel is completely closed every three months. Maintenance is outsourced. However both tunnels have their own educated and experienced staff to plan and evaluate the work.

There is a total smoking ban, with the exception of designated smoking areas outside the service building and central office. Smoking in cars driving through the tunnel is not forbidden.

2.1.4 General fire hazards

In the Westerscheldetunnel, electricity is supplied from the public grid at 10 kV. At both ends (North and South) 3 feeders enter one of the tunnel tubes. Each feeder feeds three E-rooms. In every E-room there is a 10 kV-690V transformer and a 690V-400V transformer. All transformers are of the dry type (Westerscheldetunnel). The Sluiskiltunnel has 4 transformers, oil filled. Oil is checked every year. At 400V level cross connections have been made from one tube towards the other. This in order to feed at least half of the tunnel signaling and ventilation in case of a failure.

The electricity grids of both tunnels is maintained according to NEN-EN 50110/1 and NEN 3140 by third parties. An emergency generator and UPS are present at the Sluiskiltunnel and the Tolplein. Thermographic scans are included every year.

Both tunnels are powered by high-voltage from both sides of the tunnels. Furthermore there is a diesel driven emergency power set near the office building at the toll plaza (not visited). The Sluiskiltunnel has one diesel driven power set (2 tanks x 4.000 dm³ + 1 tank van 1.500 dm³).

Gas supply (for comfort heating of the offices) is supplied by the public grid. In 2022 there will be no gas connection anymore. Heating will be done by a thermal energy pump. The Sluiskiltunnel has no gas connection.

2.1.5 General fire prevention

Hose reels are present in every emergency unit (every 50 meters in each tunnel). Automatically foam is added to the extinguishing water. Handheld extinguishers are present in every emergency unit in the tunnel.

Except for the traffic tubes all technical rooms, shafts, offices etc. have been equipped with automatic fire alarm: conventional spot type. Alarms are transmitted to the central control room. The central server room is equipped with aspiration smoke detection. Fire in one of the traffic tunnels will indirectly be detected through a system that detects (too) low traffic speed. When such is the case automatically an alarm is generated in the control room and monitors automatically display a view of the situation. Also any action in one of the emergency units in the tubes (even removal of a nozzle or extinguisher) is detected and rises an alarm in the central control room. Furthermore temperature detection in all E-rooms (Westerscheldetunnel).

Furthermore, in the Westerscheldetunnel 'sniffers' are present and every kilometer air is sampled (measurement of air quality and sampling the NOx-value) with notification to the control room. No automatic sprinklers have been installed.

Westerscheldetunnel: automatic gas (FM²⁰⁰) extinguishing is present in the central server and MRA-rooms: both in the service building "South" as well as in the main building near the toll gate. The second control room is provided with an aerosol extinguishing system (FirePro). Two server rooms of the Sluiskiltunnel are provided with Novec systems.

The nearest public fire station to be alerted are the fire brigades of the municipalities of Borssele and Terneuzen. The emergency organization of the tunnel regularly trains with these fire brigades. Annually a specific tunnel fire training course in Switzerland is attended.



All tubes are equipped with a fire main, feeding the Storz-connections for the fire brigade at each emergency unit (every 50 meters in each tube). The fire main is fed from a dedicated basin on each side of the Westerscheldetunnel (120 m³ each) by 4 pumps. The Sluiskiltunnel has one basin (240 m³) with 2 pumps.

2.1.6 Other risks and prevention

Cash is generated at the tollgates of the Westerscheldetunnel only. This is automatically transported to the vault under the office at the toll plaza / central control room. Access to this area is through rooms/areas that are protected by an automatic burglary alarm. Other attractive goods are the office furniture (burglary alarm present) and equipment in the technical rooms. Access to the technical rooms is detected (reed contacts) and rises a signal in the central control room.

Several cameras are present. Images can be saved.

2.2. Process description

The “production process” consists of road traffic traveling through the tunnel. Supporting activities are toll collection, traffic control and maintenance.

Road traffic:

Not all road traffic is allowed in the tunnel: the tunnels are category C-tunnels, which generally means that explosives or LPG and the like are not allowed in this tunnel. Tank lorries containing flammable liquids however are allowed (see site RDW for complete list). Since January 1, 2010 the European Tunnel classification system is applied. The tunnels are classified a category “C” tunnel.

Toll collection (only Westerscheldetunnel):

Toll is collected at the north entry/exit of the Westerscheldetunnel only. This is partially automated (tags) and partially still cash based.

Traffic control:

Extensive traffic control is present. A central control room is located in the office building near the toll gates. Monitors connected to the CCTV system are present. The control room is permanently occupied by 2 persons minimum. The CCTV is present throughout the tunnel tubes and the roads leading to the tunnel. In the event of traffic traveling below a present speed, views of that are automatically shown at monitors in the control room. The traffic managers can interfere in the traffic by switching several road signs indicating speed, lane to be used etc. All signals and data are processed and stored in the ICT-room below the control room. Complete and automatic mirroring of these data is done in the service building South of the tunnels.

2.2.1 Standard process risks and protection

In the cable corridor under the road (only Westerscheldetunnel) is a special cart for transport of people and equipment. This electrical cart is driven by electricity. Batteries are charged in the parking place (in the cable corridor).

2.2.2 Special process fire risks and fire protection

All tubes have been equipped with cellars at their two deepest points. Water, but also spillage in case of a calamity, is drained to these cellars. The spillage is some 3 m³ per 24h. Every 3 years the course of the spillage is checked. The equipment in the cellars has been designed for flammable liquids. The cellars have ample capacity for a truckload.

2.3 Changes

- All 3.600 fixtures will be replaced for LED lighting (before the end of this year), this applies (not yet) to the lighting in the tunnel tubes.
- There are 4 new electric service mobiles present (custom made).



3 Samenvattende beoordeling

Based on the division between insured values, occupancy, risks and prevention HRC rates this company to be a technical good risk.



4 Risicoverbeteringsmaatregelen

Indien er vragen zijn bij deze risicoverbeteringsmaatregelen of bij welk aspect van brandbeveiliging ook, aarzel dan niet om ons te contacteren.

Onze risicoverbeteringsmaatregelen die de brandveiligheid in uw locatie zouden verbeteren worden hierna opgesomd. Deze risicoverbeteringsmaatregelen zijn gebaseerd op de informatie verkregen tijdens onze inspectie.

De risicoverbeteringsmaatregelen zijn onderverdeeld in drie categorieën (A, B, C), gedefinieerd als volgt:

<i>Prioriteit</i>	<i>Definitie</i>
A	essentieel veiligheids- en/of beveiligingsniveau ■ Maatregelen om een acuut brand- of explosierisico te vermijden of een verhoogde waarschijnlijkheid op brand of explosie te reduceren ■ Maatregelen om een hoge blootstelling aan een materiele schade of bedrijfsschade te reduceren ■ Maatregelen om grote tekortkomingen in essentiële brand- en/of explosiebeveiligings-systemen of in procesveiligheidssystemen te verhelpen
B	standaard veiligheids- en/of beveiligingsniveau ■ Maatregelen die niet tot de prioriteit A behoren, maar noodzakelijk zijn om veilige condities en een standaard veiligheids- en/of beveiligingsniveau te corrigeren, aan te passen of te behouden
C	best practice, optimaal veiligheids- en/of beveiligingsniveau ■ Maatregelen om een bestaande toestand of beveiliging te verbeteren, om een optimaal veiligheids- en/of beveiligingsniveau te bereiken of om in een langetermijnplanning op te nemen

In geen geval hebben de voorgestelde risicoverbeteringsmaatregelen voorrang op welke verplichtingen of eisen dan ook, opgelegd door enige wet of voorschrift.

De risicoverbeteringsmaatregelen zijn zuiver adviserend en het besluit en de verantwoordelijkheid voor implementering blijven bij de verzekerde.



4.1 Status van de risicoverbeteringsmaatregelen

<i>Ref. Nr.</i>	<i>Risicoverbeteringsmaatregel</i>	<i>Prioriteit</i>	<i>Status</i>
2015-01	Electrical system	A	closed
2015-02	Hand extinguishers Westerscheldetunnel	B	closed
2015-03	Outside storage	A	closed
2015-04	Combustible material roof technical rooms	A	closed
2015-05	Fire hose reel	A	closed

4.2 Actuele risicoverbeteringsmaatregelen

Geen actuele risicoverbeteringsmaatregelen.



5 Bijlagen



Tolplein



6 Detailed information

6.1 Construction, complexes, fire areas

Complex	Fire-area	Occupancy	Value [Mio. EUR]*	Area [m²]	Building	Share of group of buildings in the fa [%]	Floors [below/above ground]	Roof						Load bearing structure	Exterior walls	comb. facade	comb. inter. constr.	Lightn. protect.
								Surface	Insulation	Lining	Load bearing structure	Gravel, Slabs	Greening					
I	1	955000	700,0	66.000	A	100	2/1	none	none	concrete	concrete			concrete	concrete			

*Value distribution of the fire areas estimated by HDI



6.2 General fire hazards

6.2.1 Ignition sources

Smoking policy

<i>Complex: I</i>	adequate
<i>Controls</i>	non-smoking signs: good, smoking areas: good, disposal of cigarettes: overall good, reaction to violations: disciplinary action

Hot work

<i>Work shop</i>	none
<i>Hot work procedure</i>	yes, good procedure and implementation
<i>Post hot work fire detection</i>	mobile/temporary fire detection and/or fire watch and/or fixed protection system

Inspection of electrical equipment

<i>Inspection of electrical equipment</i>	annually, by: other certified inspector last inspection: overall good thermographic imaging: yes portable electrical appliances: yes
<i>Complex: I</i>	isolation of power: none battery charging units: adequate portable electrical appliances: adequate electrical equipment in general: adequate

Additional considerations

<i>Complex: I</i>	mobile heating equipment: none; risks: no; shrink wrapping: adequate; other ignition sources: none
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6.2.2 Arson and security, neighbors

Arson and security

<i>Arson and security risk</i>	average, standard
<i>Basic protection</i>	fully fenced: no additional measures: no lighting: yes gate surveillance: yes access control: yes
<i>Yard storage</i>	storage close to fence: no yard storage: yes
<i>Guarding</i>	no guards
<i>Complex: I</i>	wall storage: none

Neighbors

<i>Exposure</i>	vehicle impact
<i>Distance</i>	> 5m

6.2.3 Utilities

Electrical power supply

<i>Electrical power source</i>	public power supply: 100%
<i>Transformers</i>	with oil fire separation: EI90 safety measures: temperature control or Buchholz-protection fire detection: no fixed fire protection: no
<i>High voltage rooms</i>	☒ EI 90 / EI 30-C ☐ fire detection ☐ deficiencies
<i>Low voltage rooms</i>	☐ separated ☐ fire detection ☐ local application protection

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The electricity grids of both tunnels is maintained according to NEN-EN 50110/1 and NEN 3140 by third parties. An emergency generator and UPS are present at the Sluiskiltunnel and the Tolplein. Thermografic scans are included every year.

Both tunnels are powered by high-voltage from both sides of the tunnels. Furthermore there is a diesel driven emergency power set near the office building at the toll plaza (not visited). The Sluiskiltunnel has one diesel driven power set (2 tanks x 4.000 dm³ + 1 tank van 1.500 dm³).



Comfort Heating

<i>Type of heating / Fire separation</i>	central heating / fire area
<i>Heating medium / fuel</i>	water by natural gas; outlet temperature: <150°C
<i>Safety- and protection systems</i>	☒ ignition control ☒ flame failure detection ☐ gas detection
Gas supply (for comfort heating of the offices) is supplied by the public grid. In 2022 there will be no gas connection anymore. Heating will be done by a thermal energy pump. The Sluiskiltunnel has no gas connection.	

6.2.4 Special hazards

<i>Kind of hazard</i>	Oil and tire storage areas etc in I.1
<i>Risk level of special hazard</i>	negligible
<i>Relevance of special hazard</i>	< 1% Increased impact on BI: no
<i>Technical protection measures</i>	not relevant
<i>Fire protection measures</i>	automatic basic protection
<i>Structural protection measures</i>	EI90



6.3 Fire detection and fixed protection

6.3.1 Fire detection

<i>Complex.Fire area</i>	<i>Extent of detection</i>	<i>Type of detection</i>	<i>Alarm transmission</i>	<i>Inspection</i>
<i>I.1</i>	10 %	single line detectors	direct line to permanently manned station	yes

6.3.2 Fixed fire protection

Installation information

<i>Installation standard</i>	
<i>Testing</i>	no testing
<i>Maintenance</i>	no maintenance
<i>Inspection</i>	no inspection or not to standard

<i>Complex.Fire area</i>	<i>Type</i>	<i>Area protected</i>	<i>Additional area needing protection</i>	<i>Suitability *</i>
<i>I.1</i>	inert gas	10 %	0 %	suitable

* The suitability of an extinguishing system does not include conclusions about the effectiveness as well as possible deficiencies (compare revision report).

6.3.3 Spark Extinguishing Installation

none

6.3.4 Smoke vents

<i>Complex</i>	<i>Extent of venting</i>	<i>Release mechanism</i>
<i>I</i>	0 %	none



6.4 Fire fighting equipment and facilities

6.4.1 Fire extinguishing appliances

<i>Deficiencies</i>	☐ less than required ☐ poor signage ☐ poor accessibility ☐ inadequate extinguishing agent ☐ poor maintenance
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6.4.2 Fire fighting water supplies

<i>Fire main a)</i>	Diameter of 100 mm at 3 bar (no ring)
<i>Extinguishing water pipe b)</i>	Diameter of 0 mm at 0 bar (no ring)
<i>Hydrants</i>	3 hydrants with diameter of 100 mm
<i>Additional fire fighting water</i>	stream, 288 m³/h for 3 hours
<i>Fire water retaining basin</i>	not necessary

6.4.3 Public fire brigade

<i>Responding fire brigade</i>	volunteer fire brigade and part professional in Borssele; intervention time of 10 min; distance of 5 km; classification of public fire brigade: 2,0 ☒ good road access to site ☒ good accessibility on site ☒ key box ☒ fire brigade familiar with the site, ☒ periodic on site training ☒ mutual aid with neighbours
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6.4.4 Works fire brigade

<i>Works fire brigade</i>	yes classification of works fire brigade following VDS 2034: F1 intervention time in minutes: 2 protection level of works fire brigade: 5,0
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6.5 Organisation and safety management

<i>Organisation and safety management</i>	☒ alarm plan ☒ site hazard drawing / fire brigade plan ☒ fire safety handbook incl. disaster plan ☒ escapes route plan ☐ fire safety officer ☐ with CFPa certificate or equivalent ☒ training of staff ☒ safety instructions for contractors ☐ self audits fire protection ☒ certification ISO 9000 ☒ fire protection concept ☒ certification ISO 14000 ☐ management systems ☒ business continuity plan ☐ explosion protection document safety management concept: fully attitude of site management: excellent progress with recommendations: excellent progress qualification of staff: well qualified with excellent education and long term experience involvement of insurance engineers: yes
<i>Housekeeping</i>	best rating: excellent worst rating: excellent
<i>Regulatory obligations</i>	According to the dialogue partner of the insured, there are no open regulatory obligations.

6.6 Loss history

<i>Number and amount of loss</i>	Number of losses in the last 5 years: 0 Average loss: 0 Mio. EUR
<i>Cause</i>	not relevant
<i>Reaction to loss</i>	not relevant



7 PD- / BI-PML

The PML-estimates (Probable Maximum Loss) are the basis for making underwriting decisions.

The loss scenario that leads to the PML-estimate is based on information received from the insured and the impressions gathered during the survey and it reflects the information (technical, economical and insurance related) at the time of the survey.

Changes that occur after that time (e.g. ownership, increase or decrease in sums insured or changes in coverage) may lead to a different scenario and a different PML-estimate. For that reason the effect of changing parameters on the PML-estimate should be reviewed regularly.

PML-estimates are without any exceptions non-binding.

7.1 Definition of Technical PML

Technical PML is defined as the probably highest PD- and / or BI-loss that could occur under worst case conditions from one fire/explosion incident, when all risk mitigating measures, like fire detection systems, fixed extinguishing systems, fire walls or fire brigades completely fail to operate.

The scenario is based on a "free-burn" which is only limited by spatial separation and / or the lack of combustible material. With regard to spatial separation spread of loss due to explosions, smoke, fire water or contamination is considered.

The worst case scenario for occupancies, like chemicals, petrochemicals, LPG tank farms, which pose the risk of vapour cloud explosions due to the amount and kind of processed and stored materials, is a vapour cloud explosion and ensuing fires. The Swiss Re TNT model is utilized to estimate such technical PMLs. Special incidents like air crash, terrorism, arson at the same time in different areas, or natural catastrophes are not taken into account. Exceptional consideration of these perils needs to be explicitly stated.

Positions for PD uplift and BI uplift as well as positions for various costs that might be agreed in the insurance contract are not taken into consideration.

7.2 Technical PML-estimates

The technical PMLs for NV Westerscheldetunnel, location Borssele, are estimated to be:

- Technical PD-PML:	85,0 Mio. EUR
- Technical BI-PML:	0,0 Mio. EUR
- Technical Combined PML:	85,0 Mio. EUR

The loss estimates are non-binding.