



SESSION 2.5 IDENTIFICATION OF ROAD SAFETY RISKS

CONDUCTING ROAD SAFETY AUDITS & APPRAISALS

PRESENTED BY: RTS & AGTTC

6 – 7 June 2023



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CONTENT

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Content

1. Background
2. The fallacy of auditing against standards
3. Identifying risk – key questions
4. The Role of Prompt Lists
5. Understand the context
6. Identifying risks

IDENTIFICATION OF ROAD SAFETY RISKS

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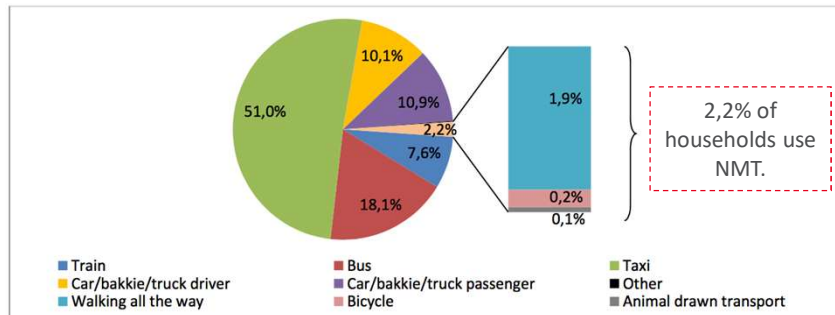
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BACKGROUND

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2013 Household travel survey - Main mode of transport of Households



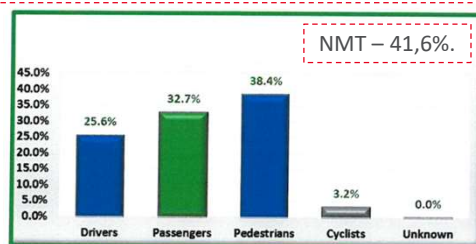
Source: Transport series volume I: Profile of on-motorised transport users (in-depth analysis of the National Household Travel Survey date), 2013



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South African Road Fatalities - 2016

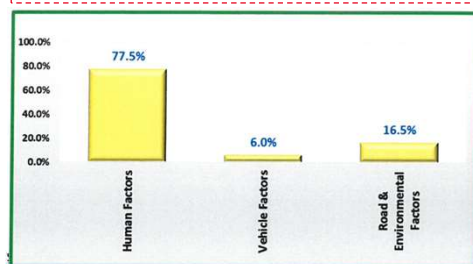
Fatalities per road user class - 2016



In 2016:
11 767 total crashes.
14 071 fatalities.

No of fatalities:
5 410 pedestrians.
451 cyclists.

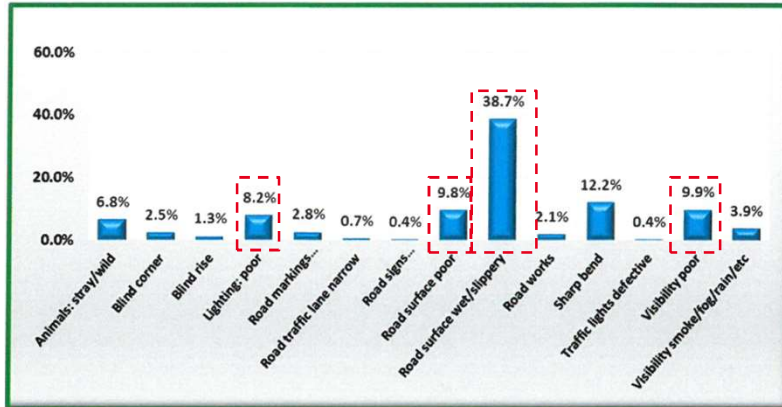
Contributing factors to road fatalities - 2016



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South African Road Fatalities - 2016

Causes of fatalities related to road and environmental factors - 2016



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Risk Factors Influencing Crash Involvement

Road user choices

- Inappropriate or excessive speed
- Travel in darkness
- Travel under influence/fatigued

Roads design factors maintenance

- Visibility,
- Radii,
- Crests/Sags (K-Values),
- Markings.

Vehicle factors

- Braking,
- Handling,
- Maintenance.

Road user factors

- Eyesight,
- Diabetes,
- Drugs, alcohol, medicine,
- Fatigue,
- Sex and age,
- Vulnerable users



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Likely Frequency and Severity of a Crash

Likelihood of a Crash	
Frequent	One or more per month
Probable	One or more per year (but less than one per month)
Occasional	Once every one to three years
Improbable	Less frequent than once in three years

Severity of Resulting Crash	
Catastrophic	Likely multiple deaths
Serious	Likely death or serious injury
Minor	Likely minor injury
Limited	Likely trivial injury to property damage



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Resulting Level of Risk

		FREQUENCY			
		Frequent	Probable	Occasional	Remote
SEVERITY	Catastrophic	Intolerable	High	High	Medium
	Serious	High	High	Medium	Medium
	Minor	High	Medium	Medium	Low
	Negligible	Medium	Medium	Low	Low

Risk	Suggested Treatment Action
Intolerable	The safety concern "must" be corrected, even if the cost is high
High	The safety concern "should" be corrected or the risk significantly reduced, even if the treatment cost is high
Medium	The safety concern "should" be corrected or the risk significantly reduced if the treatment cost is moderate, but not necessarily high
Low	The safety concern "should" be corrected or the risk reduced if the treatment cost is low



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Focus of risk identification

IDENTIFICATION OF ROAD SAFETY RISKS

To mitigate potential for fatal and serious crashes.

Remember frailty of the human body.

Minor risk could be addressed at no or minimal cost.

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THE FALLACY OF AUDITING AGAINST STANDARDS

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The fallacy of auditing against standards



Road Standard

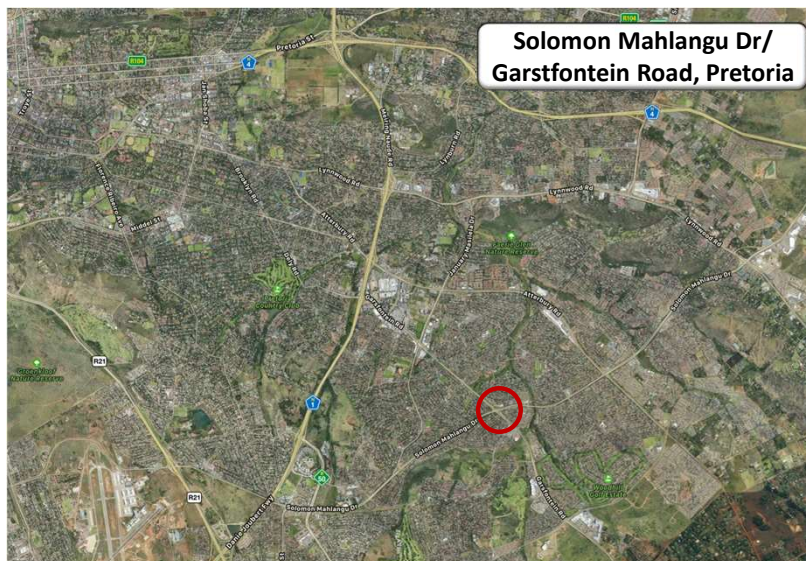
- Is measure of level of quality.
- Ensures a uniform driving experience.
- Implies that safety has been taken into consideration.



If standards makes roads safe, then why does crashes occur?

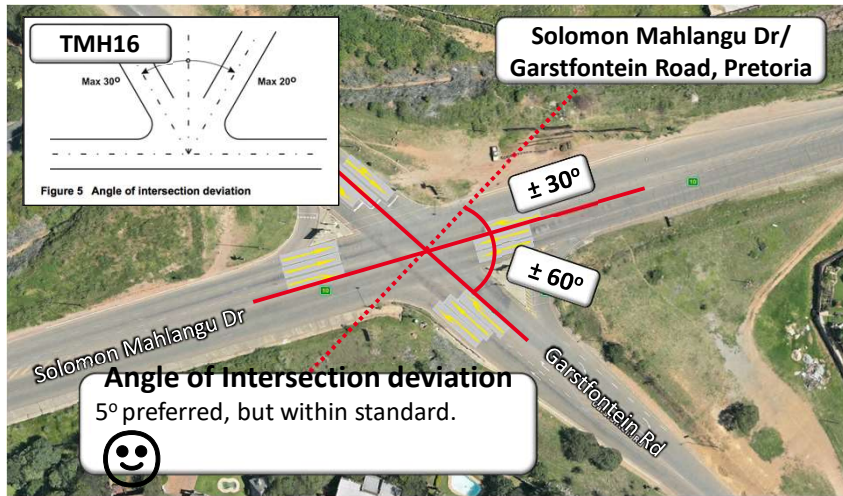
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The fallacy of auditing against standards - example



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The fallacy of auditing against standards - example

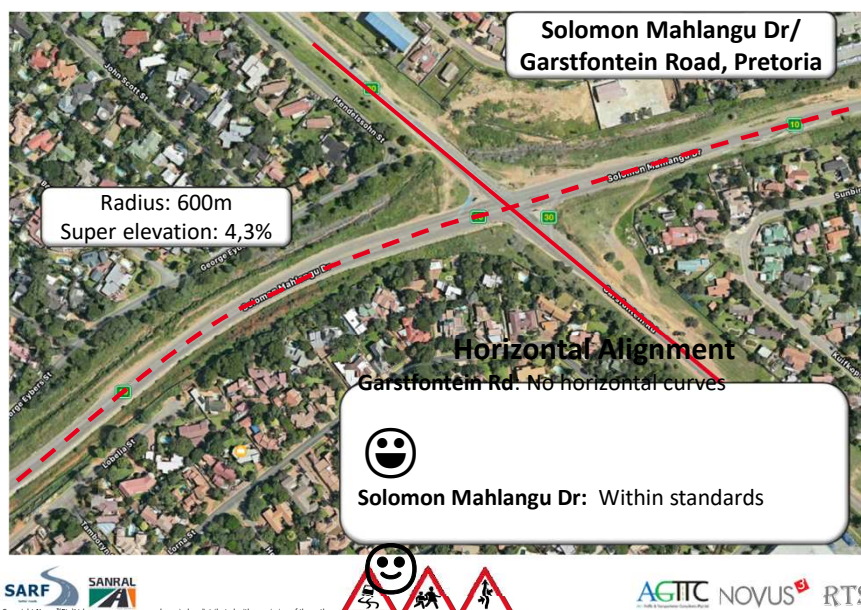


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The fallacy of auditing against standards - example

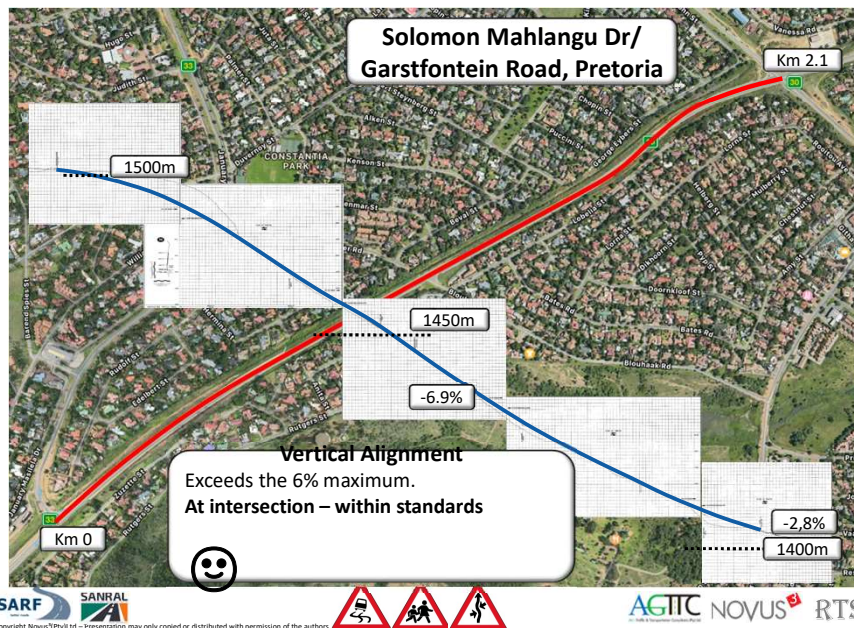


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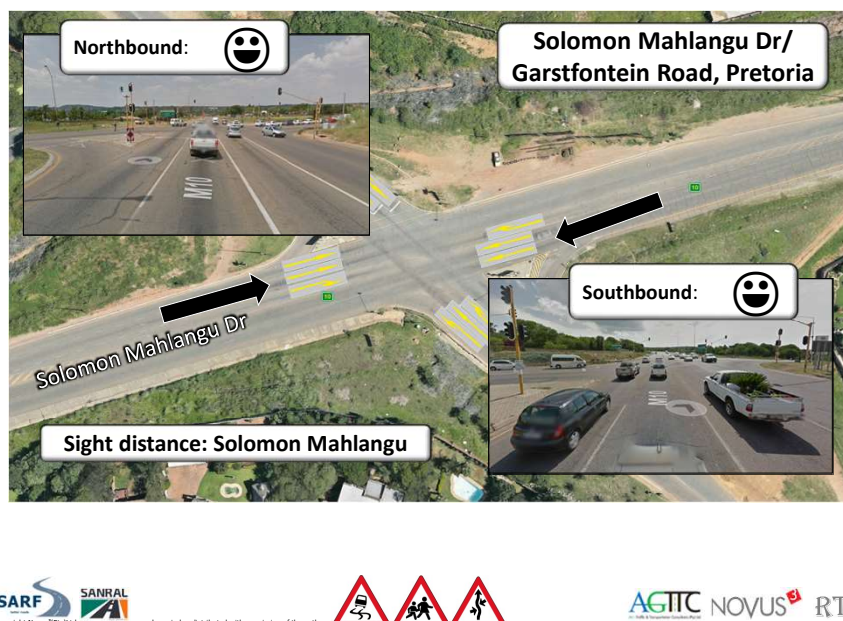
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The fallacy of auditing against standards - example



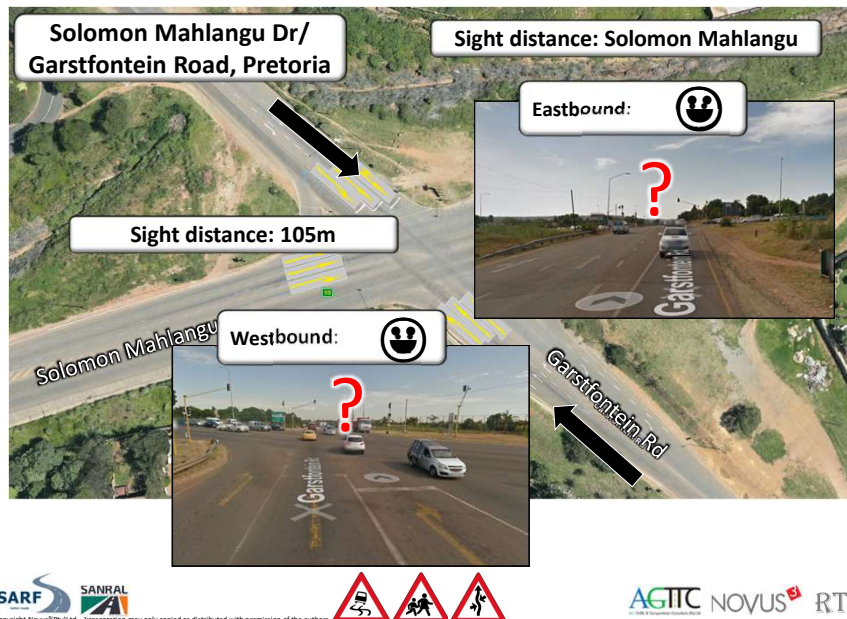
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The fallacy of auditing against standards - example



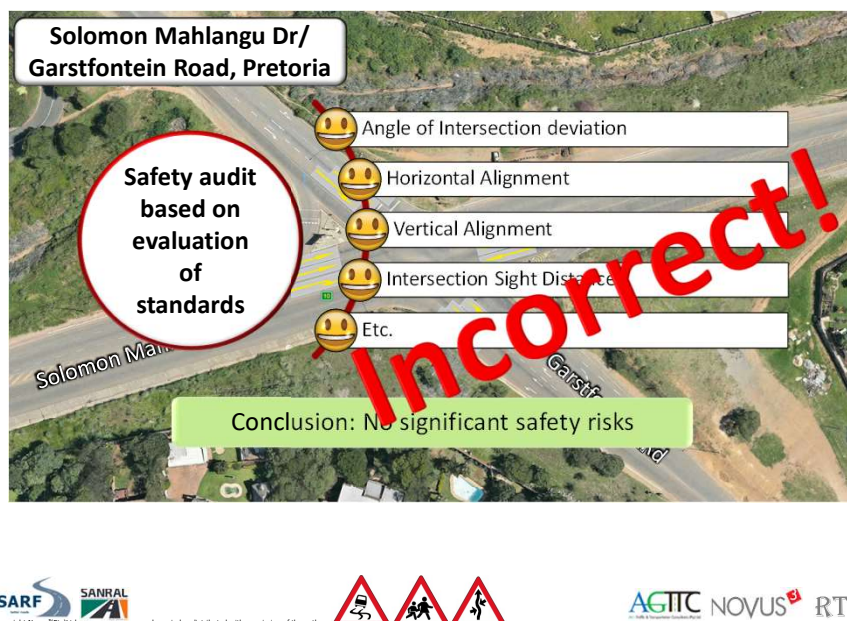
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The fallacy of auditing against standards - example



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The fallacy of auditing against standards - example



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The fallacy of auditing against standards - example

news24 archives
Breaking News. First.

Solomon Mahlangu Dr/
Garstfontein Road, Pretoria

2 accidents in same Pta spot

2006-05-12 19:06

Pretoria - Three people were killed and five injured in two accidents on Friday at the same intersection in Pretoria within half an hour, Tshwane emergency services said.

Pretoria.

"Three people died and five were walking wounded following the first accident at the intersection at around 10:30," said emergency services spokesperson Johan Pieterse.

The accident occurred when a truck crashed into three cars, dragging one of them for about 40m, he said.

"Three of the occupants in the car that was pinned under the truck and dragged died at the scene. One of them was taken to Pretoria Academic hospital in a critical state," said Pieterse.

The truck driver was among the five injured, he said.

"As emergency personnel were clearing up the scene, another truck came through the intersection and collided into two cars.

"Personnel had to scatter."

One person died and two people, including the truck driver, were slightly injured.



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The fallacy of auditing against standards - example

news24 archives
Breaking News. First.

Solomon Mahlangu Dr/
Garstfontein Road, Pretoria

Truck hits 8 cars at intersection

2011-04-15 13:19

Johannesburg - Eight people were injured when a truck hit eight cars at the intersection of Hans Strijdom and Garsfontein roads in Pretoria on Friday, said Netcare 911.

Spokesperson Jeff Wicks said the truck driver was critically injured and had to be freed from the wreckage before being taken to the Steve Biko Academic Hospital.

Seven occupants of the cars were seriously injured and were treated at the scene before being taken to state and private medical facilities, he said.

-Were you there? [Send us your photos](#)

Johannesburg - Eight people were injured when a truck hit eight cars at the intersection of Hans Strijdom and Garsfontein roads in Pretoria on Friday, said Netcare 911.



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The fallacy of auditing against standards - example

2003 to 2012 at least 9 fatalities

1 fatality per year

Mostly involving heavy vehicles

Also running the red light

One pedestrian and one cyclist fatality

A check of road design standards, does not mean a road is safe.

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IDENTIFYING RISK — KEY QUESTIONS

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Key questions which the auditor has to ask

Correct application of a standards must be checked.
However, in the context of the standard/ design/ solution ask:



"Who can be hurt in a crash on this part of the road/ project and how might that happen?"



"Does the road environment convey the correct message to the road users?"



"What can be done to reduce the potential for that crash, or to limit its consequences?"

Experience and competence of the Audit Leader and Team are critical.



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In this photo there are at least four road users:

1. Two drivers
2. Two pedestrians



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Key questions which the auditor has to ask



"Who can be hurt in a crash on this part of the road?"
Pedestrians when visibility is poor.



"What are the potential risks?"
No



"What are the potential risks?"
Improve street lighting, NMT facilities



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[illegible]

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Appraisals

[illegible]

Understand the Context

Road Safety Appraisal: Brandfort R30



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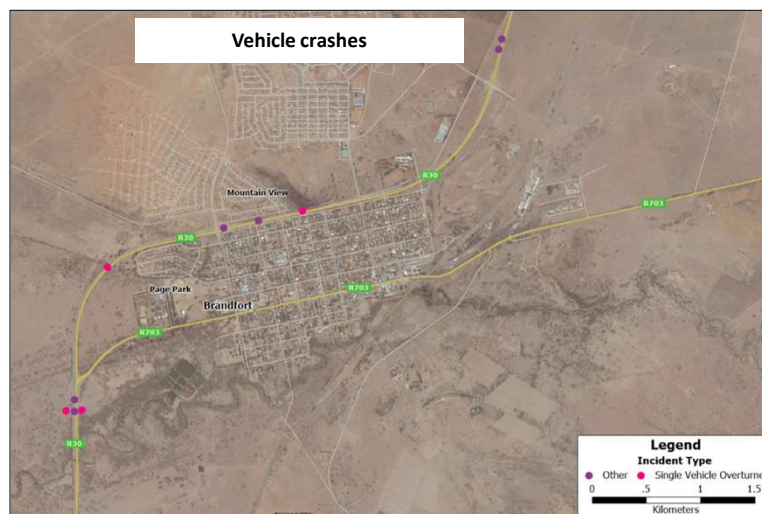


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Understand the Context

Road Safety Appraisal: Brandfort R30

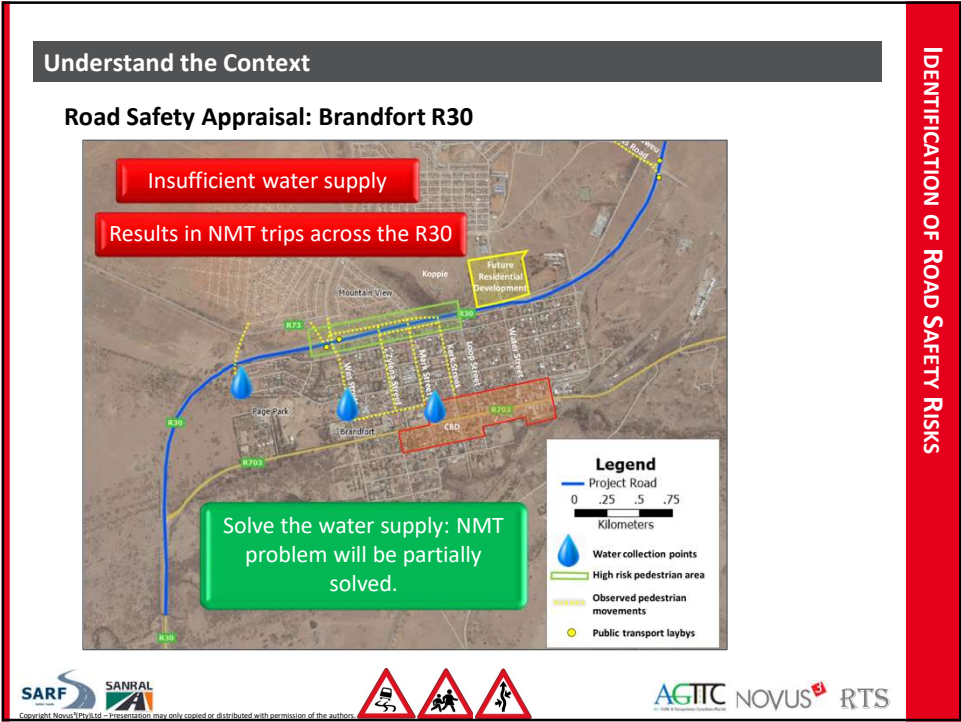


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SOLOMON MAHLANGU DR/
GARSTFONTEIN RD

TYPICAL ROAD SAFETY APPRAISAL RISKS

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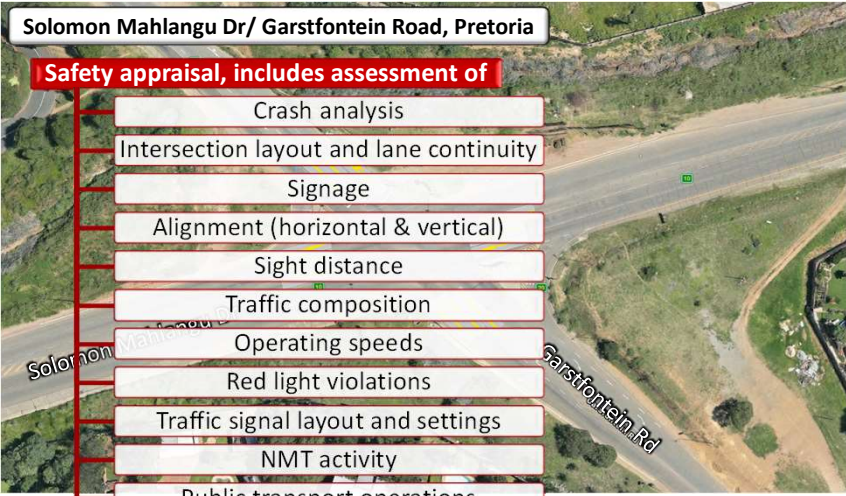
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Typical Road Safety Appraisal Risks – understanding the context



Solomon Mahlangu Dr/ Garstfontein Road, Pretoria




Safety appraisal, includes assessment of




- Crash analysis
- Intersection layout and lane continuity
- Signage
- Alignment (horizontal & vertical)
- Sight distance
- Traffic composition
- Operating speeds
- Red light violations
- Traffic signal layout and settings
- NMT activity
- Public transport operations
- Drainage



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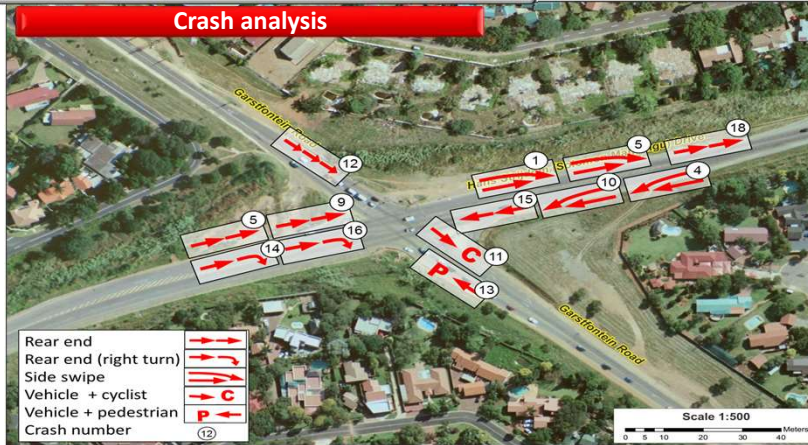
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Typical Road Safety Appraisal Risks

Solomon Mahlangu Dr/ Garstfontein Road, Pretoria

Crash analysis



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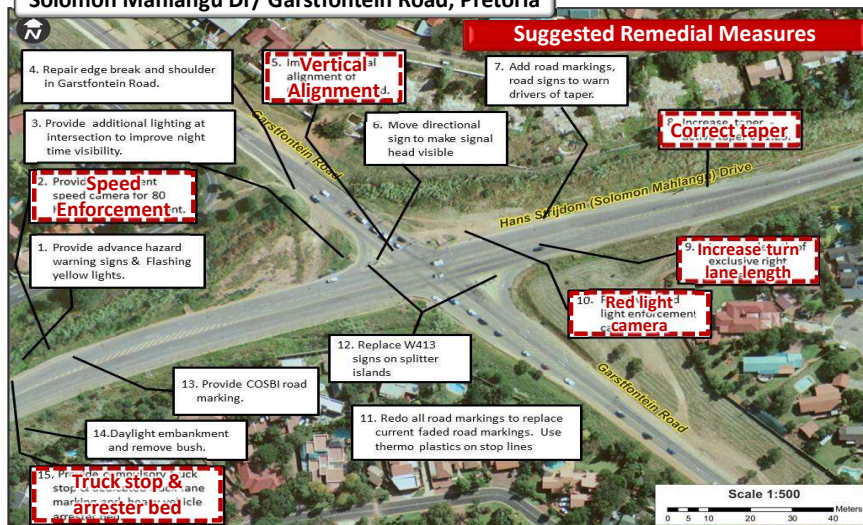
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Typical Road Safety Appraisal Risks

Solomon Mahlangu Dr/ Garstfontein Road, Pretoria

Suggested Remedial Measures



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Typical Road Safety Appraisal Risks

Solomon Mahlangu Dr/ Garstfontein Road, Pretoria

Short Term Interventions			Medium Term Interventions			Long Term Interventions		
1	Provide advance warning signs on southern approach		8	Improve vertical alignment				
2	Provide permanent downhill southern approach		9	Increase (sub)	5			
3	Enhance lighting to improve time visibility							Improve vertical alignment to enhance visibility on Garstfontein west approach
4	Repair edge break and shoulder in C				15			Provide a compulsory truck stop and dedicated truck lane marking & construct heavy vehicle arrester bed
6	Move directional sign obstructing the sign on southern approach on Solomon Mahlangu							
7	Advance warning signs & road markings of lane merge at taper on Solomon Mahlangu							
10	Re-activate the existing red light enforcement camera							
11	Replace all intersection lane road markings & mark all stop lines with thermo plastic							
12	Replace W413 signs on splitter islands							
13	Provide COSBI road marking							
14	Daylight embankment by removing bush to improve visibility on Solomon Mahlangu southern approach							

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No risk assessment was done – should be included.

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TYPICAL ROAD SAFETY AUDIT RISKS

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Typical Road Safety Audit Risks

Stage 1: Compact interchange concept layout

SARF SANRAL
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AGTIC NOVUS RTS

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Typical Road Safety Audit Risks

Stage 1: Compact interchange concept

Typical Risk: Sight distance?

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Problem:

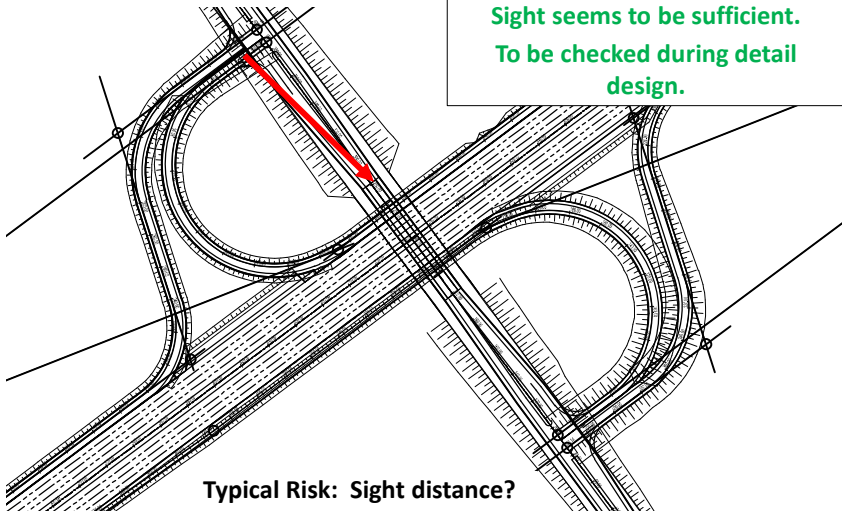
Vehicle approaching? Not sure!

Vehicle approaching? Yes!
Insufficient sight Due to bridge balustrade and guard rail.

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Typical Road Safety Audit Risks



Stage 1: Compact interchange concept layout









Sight seems to be sufficient.
To be checked during detail design.

Typical Risk: Sight distance?

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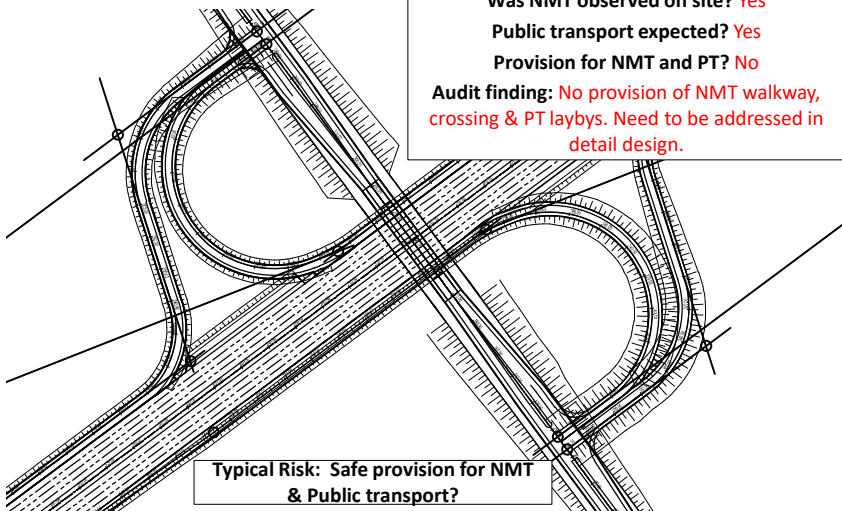




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Typical Road Safety Audit Risks



Stage 1: Compact interchange concept layout









Was NMT observed on site? **Yes**
 Public transport expected? **Yes**
 Provision for NMT and PT? **No**
Audit finding: No provision of NMT walkway, crossing & PT laybys. Need to be addressed in detail design.

Typical Risk: Safe provision for NMT & Public transport?

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N3 KEY RIDGE



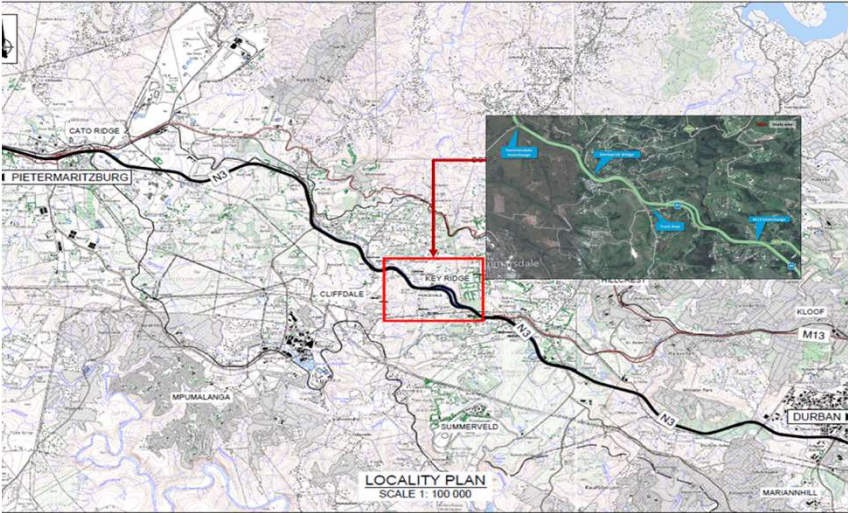
TYPICAL ROAD SAFETY APPRAISAL RISKS

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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative



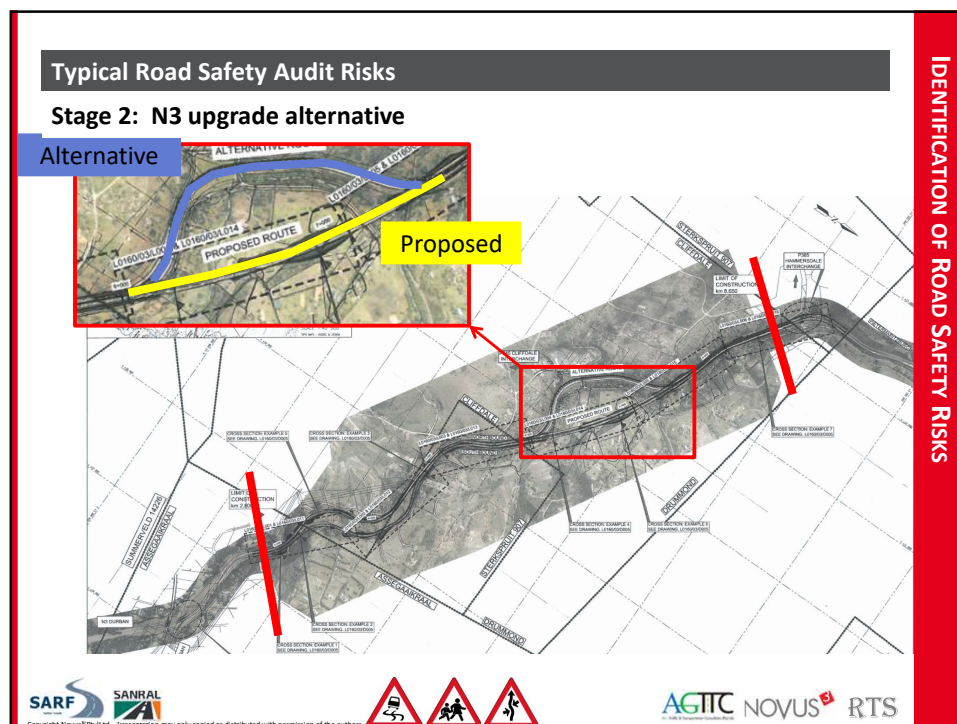
LOCALITY PLAN
SCALE 1: 100 000



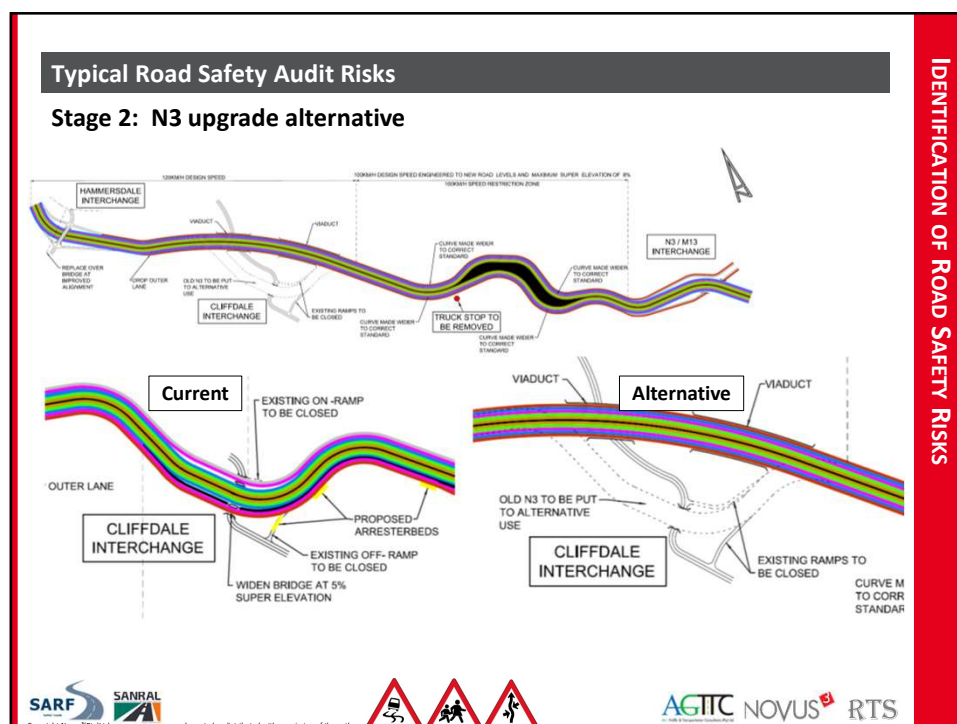
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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Speed differentials

2. Speed differential between heavy and light vehicles

Risk The horizontal and vertical geometry suggests that heavy vehicles would travel slower than cars. Designs imply two most left lanes are to be designated as truck lanes.

Should trucks be allowed to mix with general traffic, the following may occur:

- Heavy vehicles travel slowly may obstruct outer right fast lanes
- Cars may weave excessively around slower moving trucks
- Drivers may not be able to judge gaps

Likelihood	Severity	Risk
Probable	Serious	Intolerable

Recommendation:

- Designate two most left lanes as truck lanes for both directions
- Separate truck lanes from general traffic with a painted median at least 1.2m wide
- Prohibit heavy vehicles from the general traffic lanes
- Apply a reduced speed limit along the truck lanes



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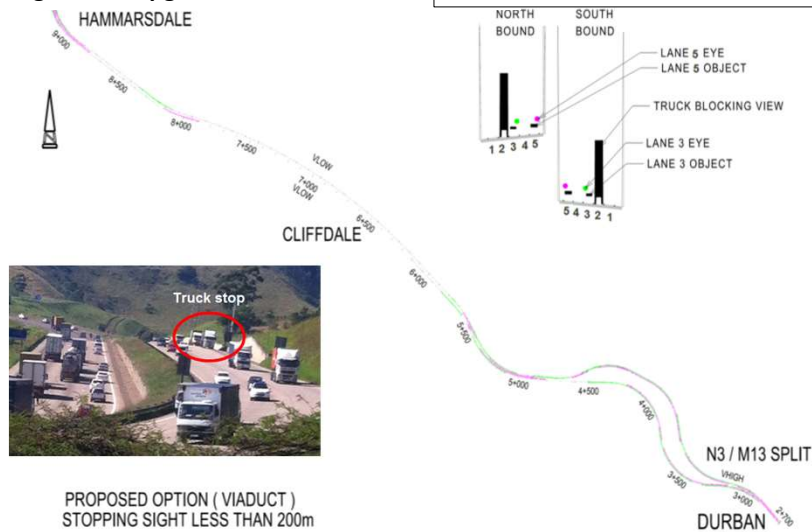


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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Insufficient sight distance



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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Insufficient sight distance

15. Inadequate sight distance

Likelihood	Severity	Risk
Probable	Serious	Intolerable

Recommendation:

- Decrease speed limit
- Introduce a painted median separating heavy and light vehicles
- Improve horizontal alignment on the inside of horizontal curves, especially where carriageways are separated by retaining walls or embankments



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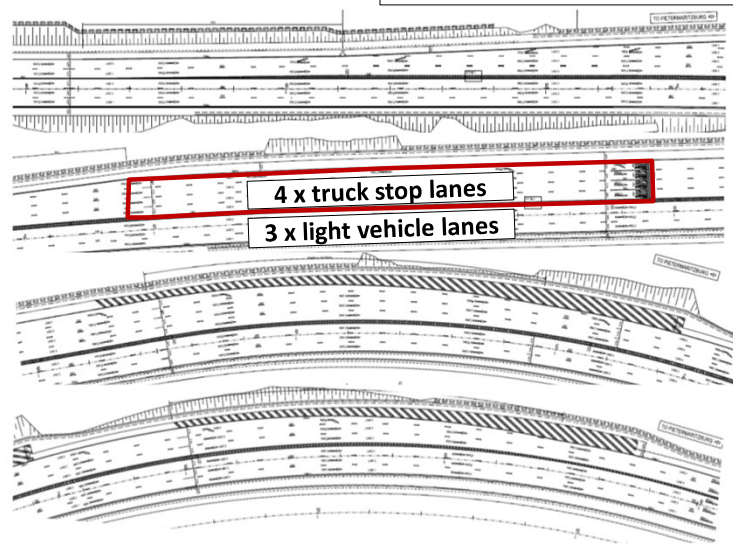


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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Insufficient sight distance



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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Police officer safety at truck stop

16. Vehicles colliding with police officer, parked police vehicle or truck at the truck stop

- | | |
|-------------|--|
| Risk | <ul style="list-style-type: none"> The current plans do not show any provision for police presence at the truck stop. Policing and enforcement of four parallel stopping lanes will be difficult. No location for a police car to park, police officers to monitor trucks stopping and trucks to be pulled over |
|-------------|--|

Likelihood	Severity	Risk
Occasional	Catastrophic	Intolerable

Recommendation:

Provide a designated location/s for:

- Police vehicles to park
- Police officers to observe truck stop operation (median island for protection)
- Trucks to be pulled over for inspection



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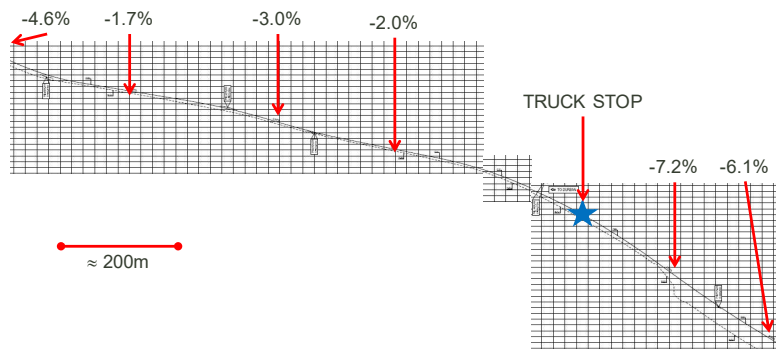


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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Gradient at truck stop location



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Typical Road Safety Audit Risks

Stage 2: N3 upgrade alternative

Risk: Gradient at truck stop location

19. Location of truck stop on steep gradient

Risk	<ul style="list-style-type: none"> The current plans indicate that the truck stop line is located on a gradient of ≈6-7% Trucks with faulty or no brakes would not be able to negotiate this gradient 	
Likelihood	Severity	Risk
Occasional	Catastrophic	Intolerable

Recommendation:
Relocate the truck stop and associated queuing areas east of the current proposed area (maximum 3%).

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DRAINAGE STRUCTURES

SANRAL TYPICAL DRAWINGS

ROADWORKS AND DRAINAGE

SEPTEMBER 2014

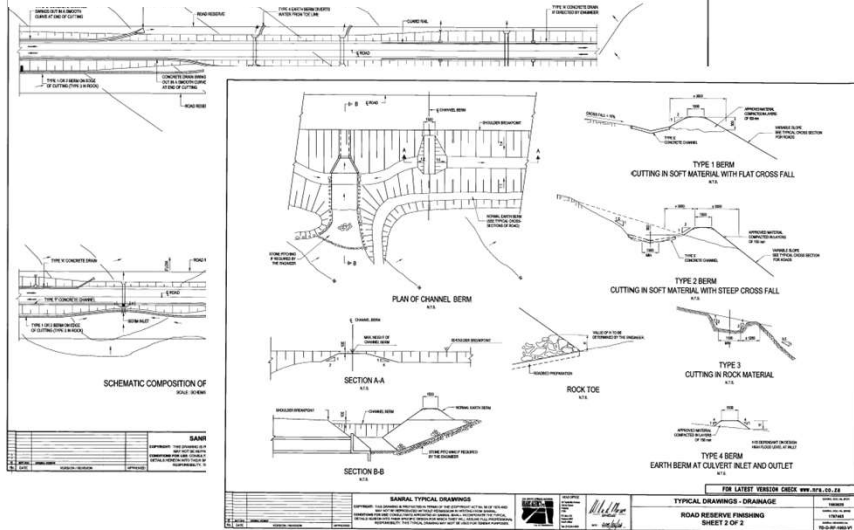
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Typical Road Safety Audit Risks

Stage 2/3: Stormwater drainage details



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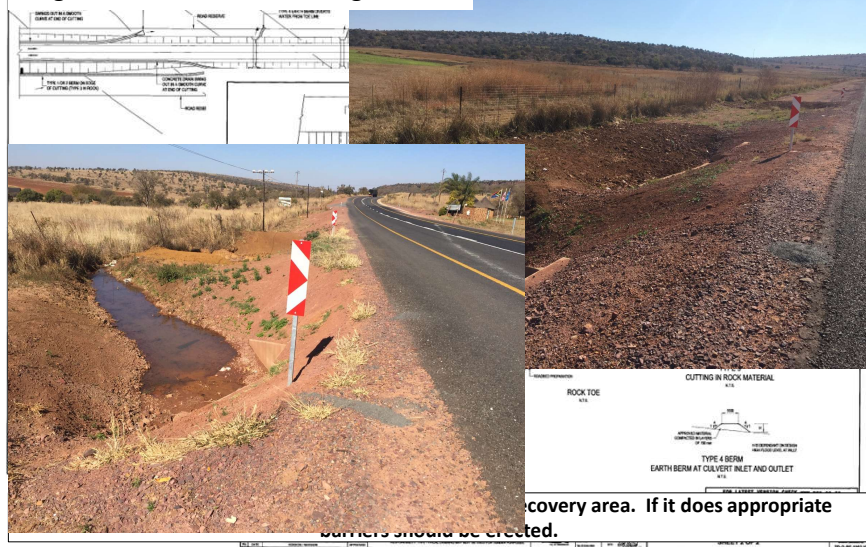


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Typical Road Safety Audit Risks

Stage 2/3: Stormwater drainage details



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Typical Road Safety Audit Risks


Stage 2/3: Stormwater drainage details






Drainage structures are a significant risk, if not considered during the design stage

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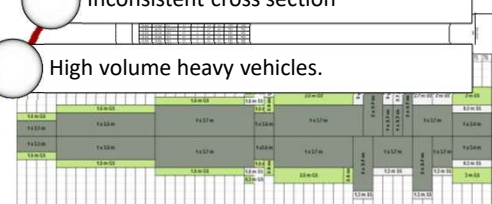
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Typical Road Safety Audit Risks

Stage 3: Rehab project scope

- Project scope included pavement rehab only.
- Upgrading, i.e. widening not allowed.
- Insufficient vertical sight at numerous locations.
- Narrow traffic lanes.
- Inconsistent cross section
- High volume heavy vehicles.

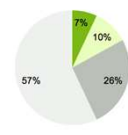


Combination of factors – significant safety risk.





Recommended change in project scope to allow upgrade – accepted by client.

Lane Width Percentages of Total Road Length



- 3.3 m lanes
- 3.4 m lanes
- 3.5 m lanes
- 3.7 m lanes

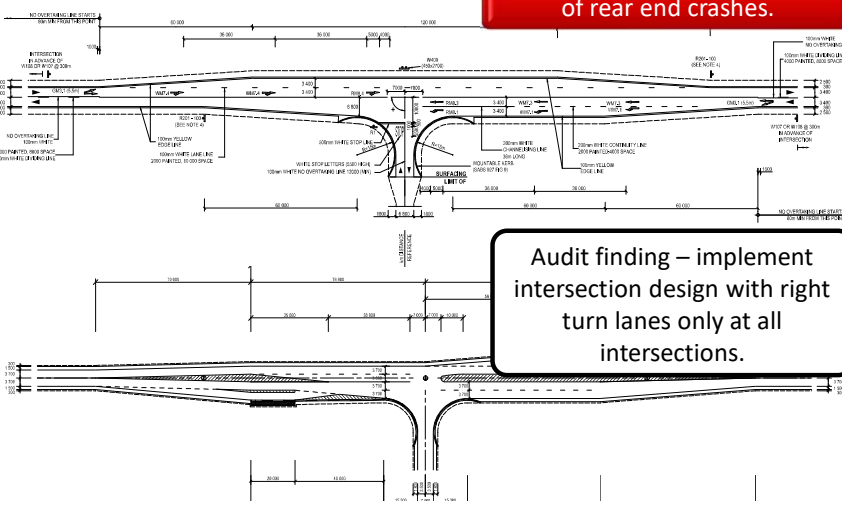




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Typical Road Safety Audit Risks


Stage 3: Unprotected right turns



Unprotected right turns – risk of rear end crashes.

Audit finding – implement intersection design with right turn lanes only at all intersections.





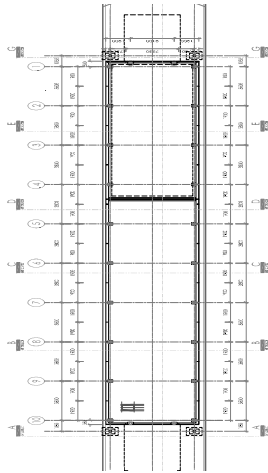
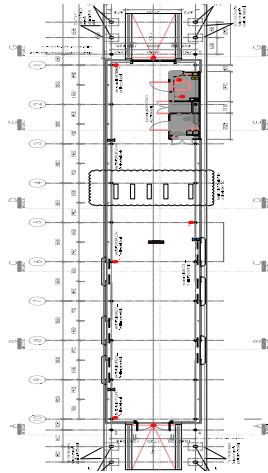
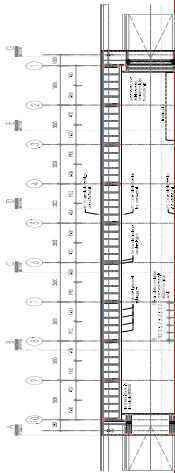
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or rear end crashes.


Typical Road Safety Audit Risks




Safety of Public transport facilities

intersection design
turn lanes on
intersection



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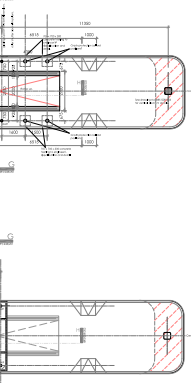
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or rear end crashes.


Typical Road Safety Audit Risks




Safety of Public transport facilities

intersection design
turn lanes on
intersection



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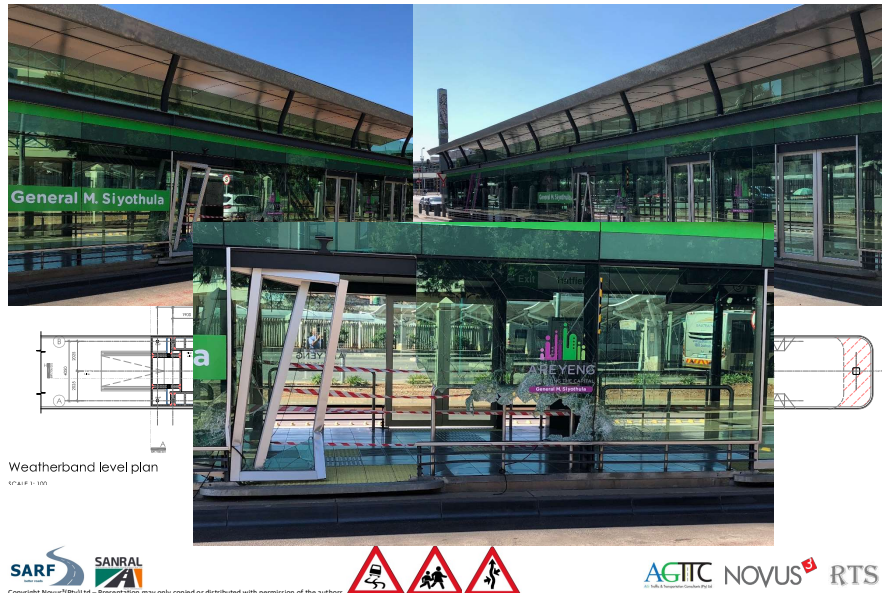
of rear end crashes.

intersection design
turn lanes on
intersection

Typical Road Safety Audit Risks

Safety of Public transport facilities

IFICATION OF ROAD SAFETY RISKS



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END OF LECTURE

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