SESSION 2.2B ROAD SAFETY ENGINEERING CONCEPTS– PART 2

CONDUCTING ROAD SAFETY AUDITS & APPRAISALS

PRESENTED BY: RTS & AGTT

January 2022

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PASSING LANES

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Passing Lanes

Road Safety Engineering Should Guide the Road User Safely

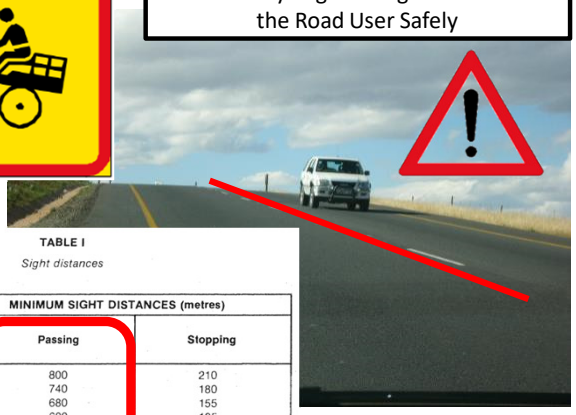

TABLE I

Sight distances

Design speed (km/h)	MINIMUM SIGHT DISTANCES (metres)	
	Passing	Stopping
120	800	210
110	740	180
100	680	155
90	620	135
80	560	115
70	490	95
60	420	80
50	350	65
40	280	50

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Passing Lanes – Road Safety Engineering not mechanistic

Road Safety Engineering Should Guide the Road User Safely

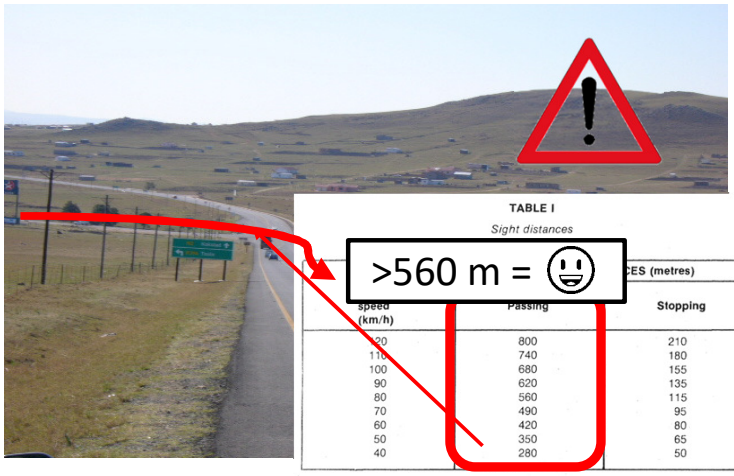

TABLE I

Sight distances

>560 m = 😃

speed (km/h)	Passing	Stopping
120	800	210
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Passing Lanes – More than a function of sight distance

Passing Lanes are not simply a function of sight distance

Bi-directional traffic volumes plays a critical role

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Passing Lanes – Taking traffic into account

To take traffic volumes into account, sophisticated analysis is required.

The American Highway Capacity Manual recommends calculating

- the % Time Spent Following;
- and Average Travel Speed

Research that was conducted by SANRAL showed that this method is inadequate because

- it significantly overestimates the percentage followers
- It does not take into account the specific, local behavior of traffic;

A new model was developed by SANRAL called the HTM model.

- The measure it uses is "Follower Density"
- It uses the % of followers and multiplies it with the traffic density

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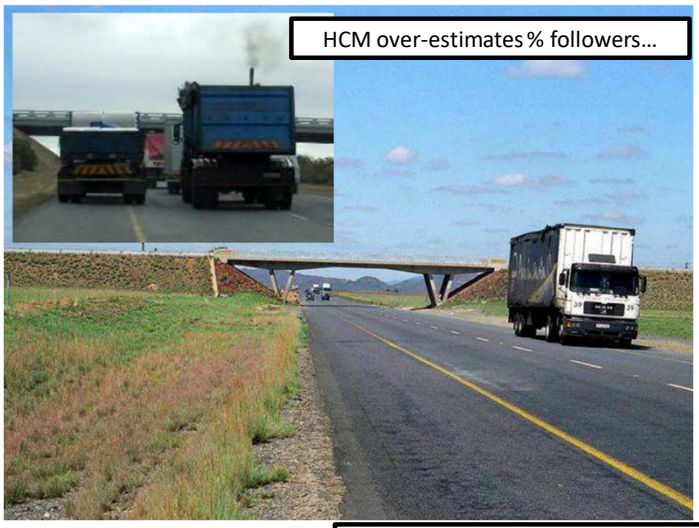
Passing Lanes – Local behaviour unique



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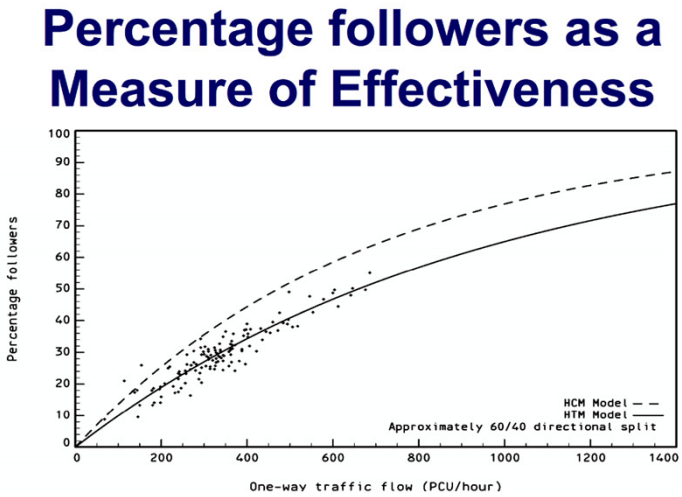
Passing Lanes – The SANRAL HTM Model



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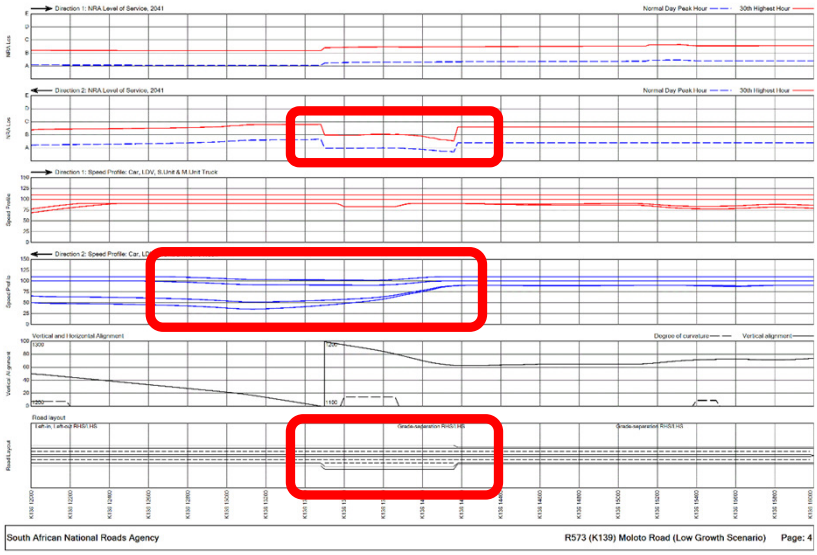
Passing Lanes – The SANRAL HTM Model



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RAILWAY CROSSINGS

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Railway Crossings

This is what the normal railway crossing look like in South Africa

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Railway Crossings

There are some crossings that now look like this

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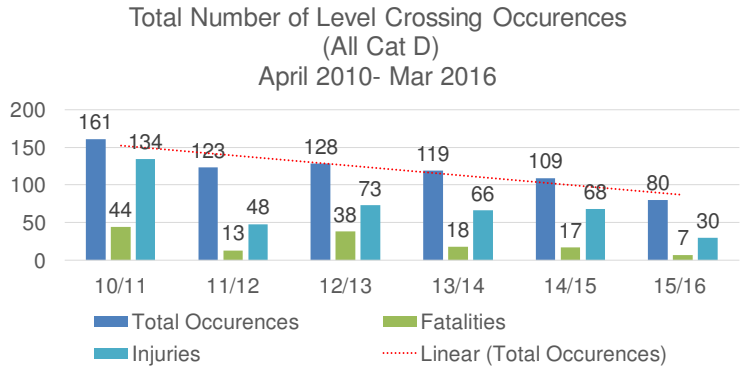
Railway Crossings



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Designing of Railway Crossings – SANS Codes

ISBN 978-0-626-27351-4

SANS 3000-2-2-1:2012
Edition 1
RSR 2-2-1:2012
Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Railway safety management

Part 2-2-1: Technical requirements for engineering and operational standards — Track, civil and electrical infrastructure — Level crossings

WARNING — Can only be read in conjunction with SANS 3000-2-1 and SANS 3000-2-2.

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Parameters: Classification of Level Crossing

SANRAL LEVEL CROSSINGS

1	2	3	4	5
Class [a]	**Description**	**Line of sight**[b]	**Minimum level of protection**[c]	**Recommended level of protection**
SSH	Single shunt line ≤ 10 km/h	N/A	1	Risk assessment outcome dependent
MSH	Multiple shunt lines ≤ 10 km/h	N/A	1	
SLS	Single low speed line ≤ 60 km/h	Excellent Adequate Restricted	2A 2A/3 4A	
MLS	Multiple low speed lines ≤ 60 km/h	Excellent Adequate Restricted	2A 2A/3 4A	
SHS	Single high speed line ≥ 60 km/h	Excellent Adequate Restricted	2A 2A/3 4A	
MHS	Multiple high speed lines ≥ 60 km/h	Excellent Adequate Restricted	2A 2A/3 4A	

1	2	3	4
Train speed km/h	**Stopping distance, X(m)**[a]	**Line of sight, S(m)**[b]	
		Crossing width 7,5 m	**Crossing width 15 m**
120	5	460	500
100	5	385	420
80	5	310	335
60	5	230	250

These conditions also apply for drivers who have stopped at a yield sign R2.

[a] Distance X(m) is the distance from the near side of the crossing from which drivers should be able to see distance S(m) along the rail line (see figures C.5, C.16 and C.17).

[b] Distance S(m) is the line of sight for the drivers of single unit trucks and trailers for 7,5 m and 15 m crossing widths.

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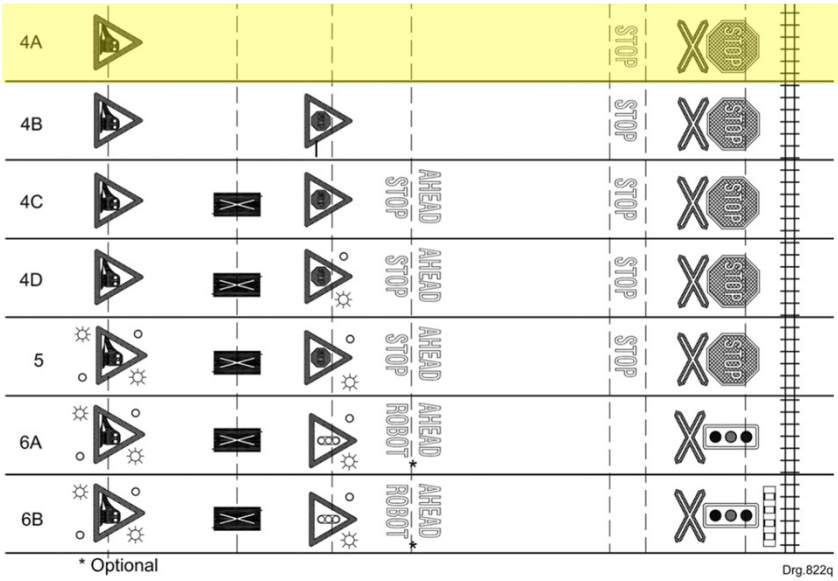
Parameters: Classification of Level Crossing

SANRAL LEVEL CROSSINGS



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Parameters: Roadmarkings

SANRAL LEVEL CROSSINGS

1	2	3
Road traffic operating speed[a] km/h	**C1**[b] m	**C2**[b], **optional** m
120	250	400
100	180	300
80	125	200
60	90	150
A further WM1 marking may be provided 60 m (rural) or 45 m (urban) from a yield or stop line.		

[a] Operating speed refers to the 85th percentile (or estimated 85th percentile) speed on the road approach to the crossing and not to the road design speed.

[b] Distances C1 and C2 are from the hazard to the centre of marking WM1. When the control is a stop control the WM1 marking at position C1 may be replaced by a stop-ahead word marking. In such instances the WM1 marking at position C2 shall become obligatory.

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Parameters: Advance warning signs

SANRAL LEVEL CROSSINGS

1	2	3	4	5
Road traffic operating speed[a] km/h	**Size** mm	**D2**[b] m	**D3** m	**D4** m
120	1 500	330	120	120
100	1 500	240	100	100
80	1 200[c]	160	80	80
60	900[c]	120	60	60
40	900[c]	80	60	60

The distances given in the table refer as follows:

a) D2: recommended minimum distance from hazard to advance warning sign (see figure 3.1 in chapter 3 of vol. 1 of the SARTSM:2001).

b) D3: minimum separation between consecutive regulatory or warning signs (see chapter 1 of vol. 1 of the SARTSM).

c) D4: minimum clear visibility distance to an advance warning sign.

[a] Operating speed refers to the 85th percentile (or estimated 85th percentile) speed on the road approach to the crossing and to the road design speed.

[b] Distance D1 in figure C.6 indicates a site specific distance between the near end of a curve and a crossing. If D1 is less than the appropriate value of D2 above, the sign should be located before the curve.

[c] A road authority may elect to use the maximum 1 500 mm size at all road crossings.

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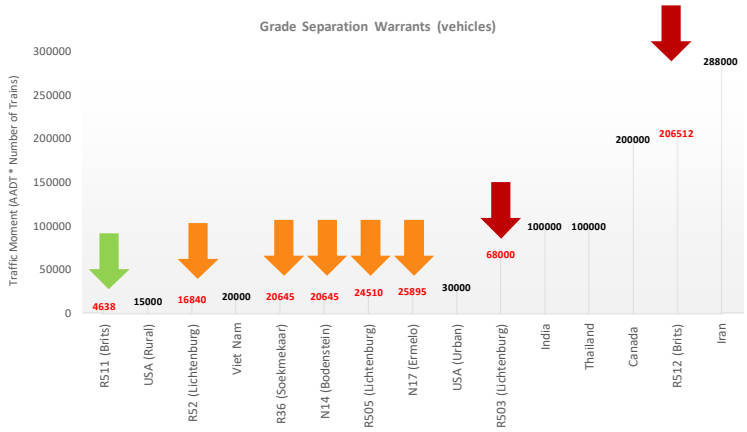
SANRAL LEVEL CROSSINGS

Safety Appraisal: International Best Practice – grade separation

- The Cross Product Rule Traffic Moment (TM): AADT x number of trains per day
- Used as a screening tool to determine the level of protection required / if grade separation is warranted.



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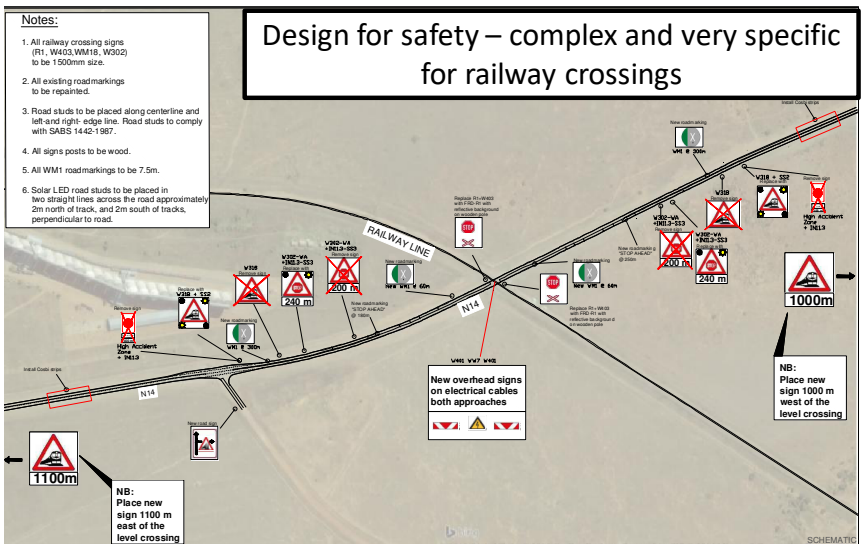
Classification of Railway Crossings

Design for safety – complex and very specific for railway crossings



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Non-Motorised Transportation (NMT)

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NMT

Design for safety – The Most Vulnerable Users

Road Safety Engineering Concepts – Part 2

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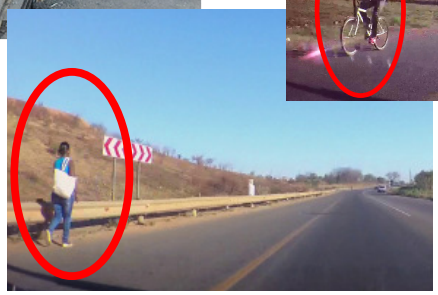
NMT

Road Safety Engineering Should Guide the Road User Safely



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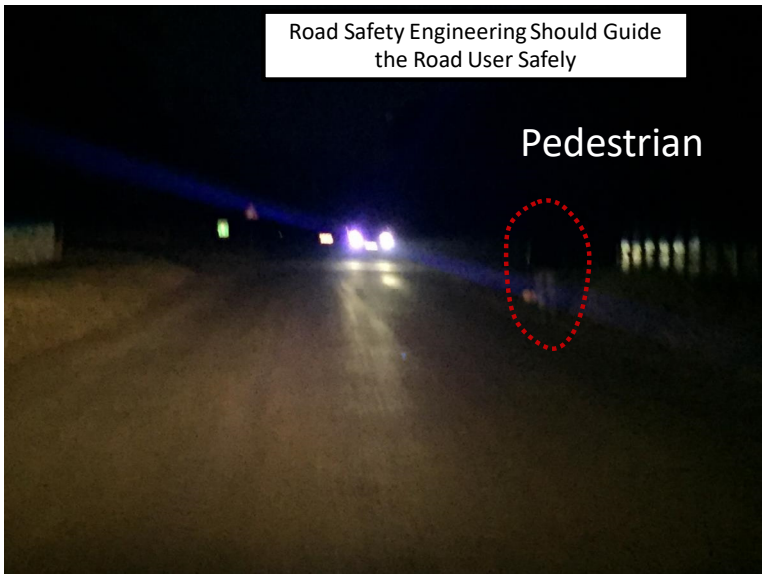
NMT

Road Safety Engineering Should Guide the Road User Safely



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Key aspects to consider for NMT safety studies

- The solution is not found in a guideline document
- Speed (differentials)
- Driver's sight at potential conflict points.
- Ability of NMT user and driver to make eye contact.
- Visibility of NMT road users at all times (day, night, adverse weather)
- Communication from the road environment of potential hazardous locations.
- Minimisation of conflict points between vehicles and NMT.
- Appropriate infrastructure to encourage/guide road users (driver's/NMT users) to act in a predictable manner.

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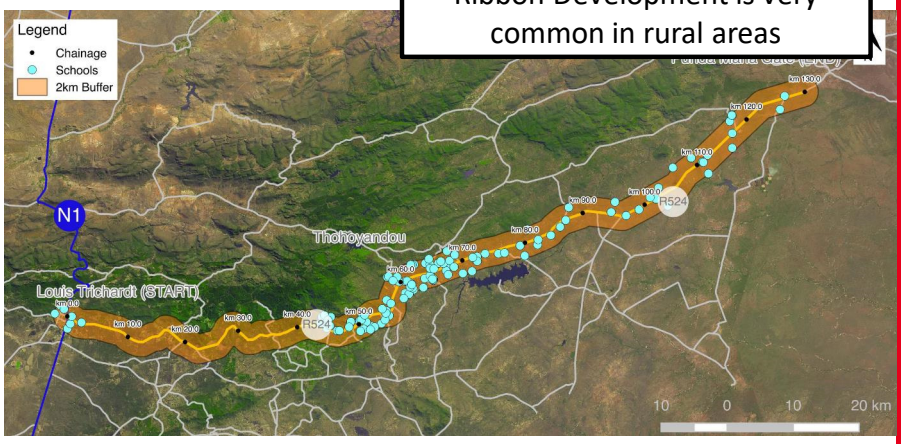
Data Collection: NMT safety

Ribbon Development is very common in rural areas



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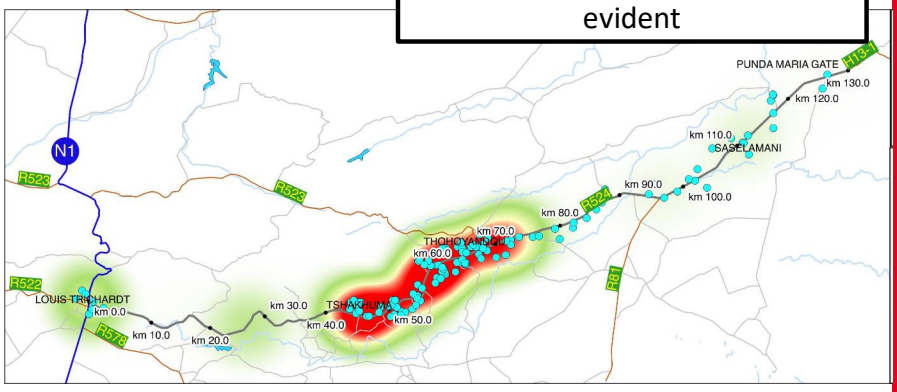
Data Collection: NMT safety

Engineer where the demand is evident



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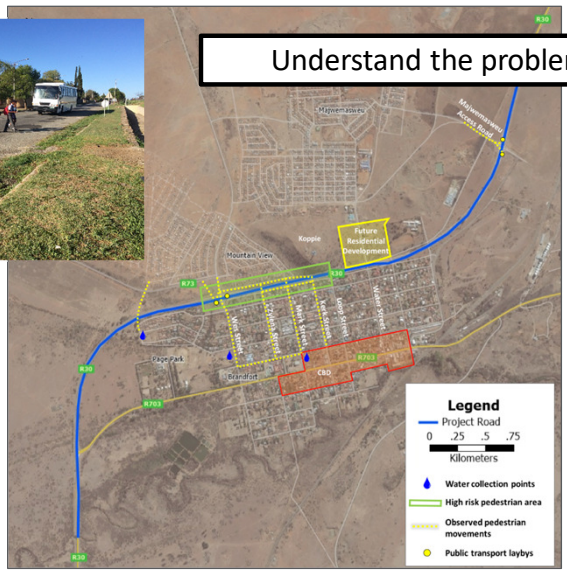
Data Collection: NMT safety

Understand the problem!



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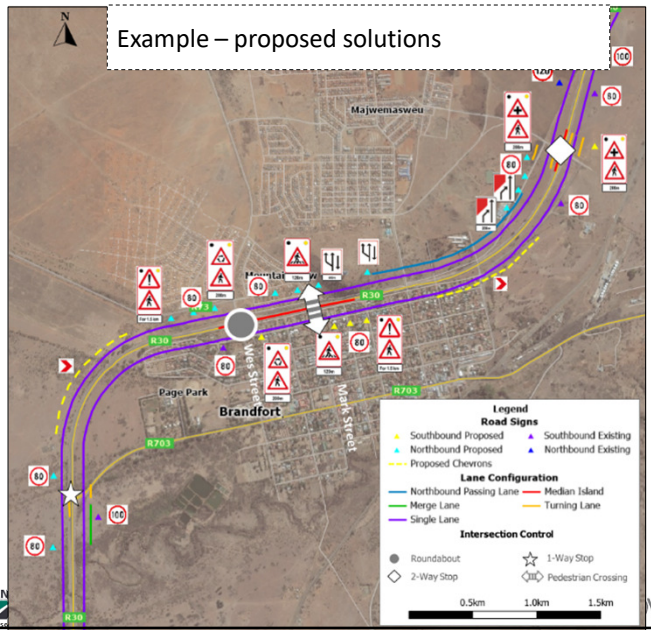
Engineering Solutions: NMT safety

Example – proposed solutions



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Engineering Solutions: People with Special Needs

???

Who?

How many?

Physical Impairment

Cognitive Impairment

Foreigners

Illiteracy

Pregnancy

Colour blindness

Etc

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Engineering Solutions: People with Special Needs

Road Safety Engineering Should Guide the Road User Safely

Age group	With disabilities N	With disabilities %	Without disabilities N	Without disabilities %	Total N	Total %
5–9	447 843	10,8	3 719 835	89,3	4 167 678	100,0
10–14	161 828	4,1	3 802 210	95,9	3 964 038	100,0
15–19	108 738	2,6	4 118 948	97,4	4 227 686	100,0
20–24	99 665	2,4	4 128 757	97,6	4 228 422	100,0
25–29	100 371	2,5	3 906 800	97,5	4 007 171	100,0
30–34	96 274	3,0	3 104 571	97,0	3 200 845	100,0
35–39	108 559	3,8	2 735 168	96,2	2 843 727	100,0
40–44	132 672	5,5	2 283 966	94,5	2 416 638	100,0
45–49	189 774	8,7	1 998 996	91,3	2 188 770	100,0
50–54	225 498	12,2	1 626 667	87,8	1 852 165	100,0
55–59	233 735	15,6	1 268 491	84,4	1 502 226	100,0
60–64	216 572	18,7	942 615	81,3	1 159 187	100,0
65–69	184 428	22,7	627 474	77,3	811 902	100,0
70–74	186 401	29,4	447 044	70,6	633 445	100,0
75–79	148 452	36,6	257 502	63,4	405 954	100,0
80–84	120 001	44,5	149 446	55,5	269 447	100,0
85+	109 319	[illegible]	96 256	46,8	205 575	100,0
Total	2 870 130	7,5	35 214 746	92,5	38 084 876	100,0

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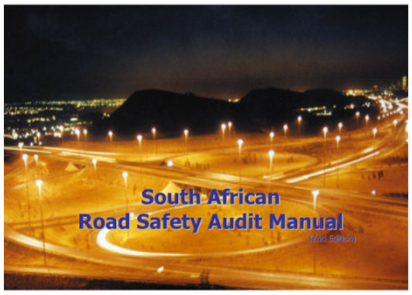
NMT Useful Resources

Road Traffic Management Corporation



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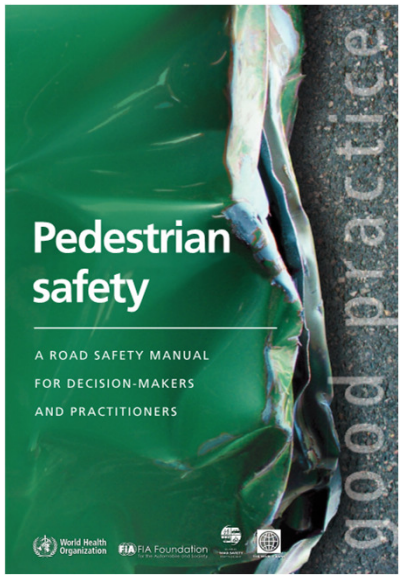

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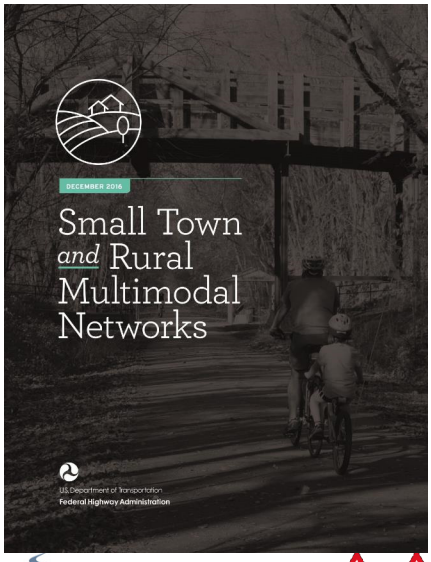

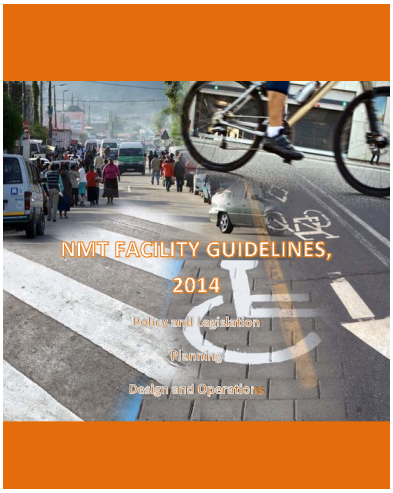

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Engineering Solutions: Other Aspects

Road Cross Section

- Number of carriag-eways
- Number of lanes and lane width
- Disused pave-ment
- Crossfall and superele-vation
- Medians and median ends
- Kerbs, Road shoulders
- Road verge, cut and fill

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Engineering Solutions: Other Aspects

Intersections

- Intersec-tion consis-tency
- Intersec-tion control
- Intersec-tion layout and gradient
- Auxiliary lanes
- Slipways
- Traffic circles
- Railroad crossings

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Engineering Solutions: Other Aspects

Bridges

- Bridge width and clearance
- Bridge rails

Road section continued over bridge? | Pedestrian walkways on bridge? | Horizontal and vertical clearances? | Visibility and readability ? | Safe for vehicles and pedestrians ? | Transition of barriers safe? | Bridge ends safe? | Reflectors on railing?

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Engineering Solutions: Other Aspects

Surface

- Skid resistance
- Loose material
- Pavement defects
- Headlight glare
- Potholes
- Edge drop-offs

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Engineering Solutions: Other Aspects

Barriers

- Temporary barriers
- Safety barriers
- Guardrails
- Pedestrian barriers
- Fences

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Engineering Solutions: Other Aspects

Traffic Calming

- Is traffic calming required for?
- Are the traffic calming measures effective?
- Are the measures safe?
- Traffic intrusion
- Speeding

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Engineering Solutions: Other Aspects

Roadside

- Parking and loading
- Public transport stops
- Refuse collection
- Law enforcement
- Truck stops and escape ramps
- Rest areas

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Engineering Solutions: Other Aspects

Road signs

- Traffic accommo-dation plan
- Road signs
- Pavement markings
- Road studs
- Speed limits and advisory speeds
- Traffic signals
- Street lights

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Engineering Solutions: Other Aspects

Developments

- Traffic generation
- Pedestrians and cyclists
- Development access control
- Off-street parking and loading
- Distractions at developments
- Hawkers

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Engineering Solutions: Other Aspects

Environment

- Day & Night and Weather
- Landscaping and plants
- Animals and stock

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Engineering Solutions: Other Aspects

Construction

Can project be constructed and maintained with safety?

Is it possible to amend design to allow better accommodation of traffic?

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END OF LECTURE

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