



**Western Cape  
Government**

Transport and Public Works

## Spacings of unsignalised intersections in urban areas – an empirical approach based on operational and safety requirements

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### Western Cape Province



Geographical  
location



Cape Town



## Background

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- Road Access Guidelines, 2001
  - Developed for Western Cape Province, South Africa
  - RAG has been applied successfully for 15 years
  - Based on work and contact with USA researchers
- TRB Access Management Manual, 2003
  - International best practice
  - Informed review of RAG
- TRH 26, 2013
  - National guidelines for South Africa
- Access Management Guidelines, 2014
  - Replaces RAG in Western Cape Province




## Outline of paper

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- Objectives underlying access spacing
- Classification of roads
- Hierarchy of intersections
- Categories of driveways
- Criteria for determining access spacing
- Application of criteria to spacing guidelines
- Spacing distances adopted





**N2 Freeway in Cape Town – Class 1**

*In freeway design we limit access to freeways by grade-separated interchanges – at intervals typically of 3km to 5km apart in metropolitan areas.*

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**Lansdowne Road in Cape Town – Class 3 arterial**

*How frequently should access to high order arterials be allowed?  
What about driveways to private developments?  
What should we be doing to achieve systematic access control?*




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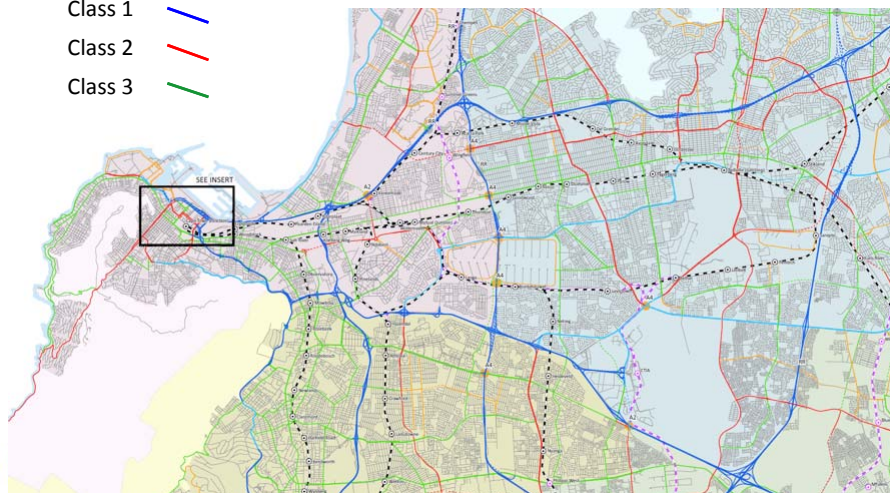
## Objectives underlying access spacing

- Adequate driver expectancy to allow safe operation for traffic along roads
- Systematic and consistent categorization of road system into hierarchy Classes 1 - 5
- Rational balance needed between "mobility" and "access" according to the class of road



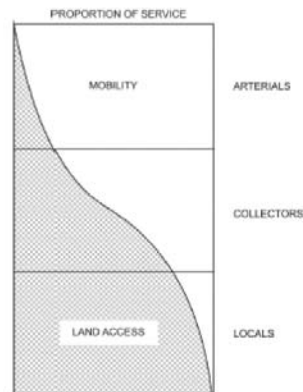
## Classification of roads

- Class 1 
- Class 2 
- Class 3 

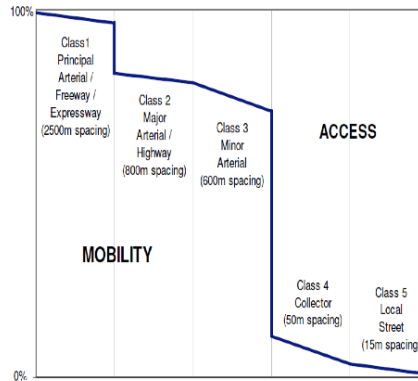


## Classification of roads

Traditional S

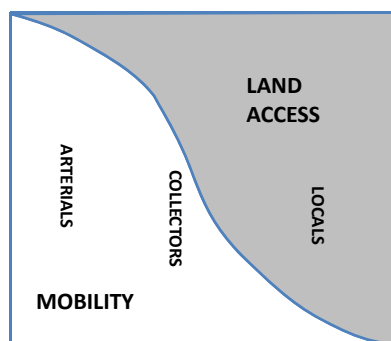


South African TRH26

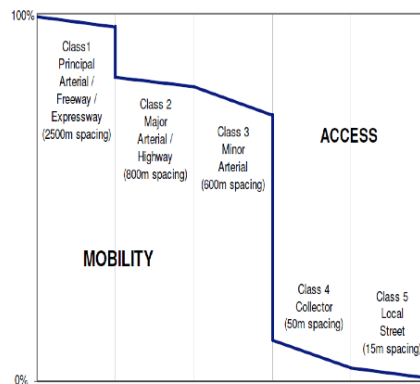


## Classification of roads

Traditional S



South African TRH26



## Classification of accesses

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- Defining our terminology
- “Intersections” and “Driveways”
  - “Intersections” link to public side roads
  - “Driveways” link to privately owned properties adjacent to the through road



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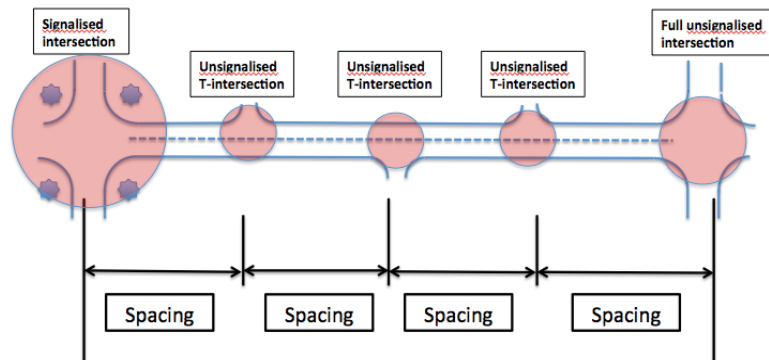
***..... intersections and driveways will have the same impact on traffic on the through road if the traffic characteristics are equivalent***





## Intersections

### *Hierarchy of intersection types*



## Intersections

### *Intersection connection principles*

- Where public roads of various classes form at-grade intersections with the through road, the class of an intersecting road:
  - may be same class as through road,
  - one class beneath, or
  - two classes beneath



## Intersections

Class of through route	Class of intersecting road	Class description
2	2	Major arterial
	3	Minor arterial
	4	Collector road
3	3	Minor arterial
	4	Collector road
	5	Local street
4	4	Collector road
	5	Local street
5	5	Local street



## Driveways

*Driveways are also have classes*

Driveway categories:

- Domestic equivalent driveway
- Low volume driveways
- High volume driveways

Equivalent driveway categories

- Equivalent collector road
- Equivalent minor arterial
- Equivalent major arterial





## Driveways

Driveway categories	Intersecting road class equivalent	Vehicles per hour (total in plus out of driveway)
Domestic equivalent driveway	–	≤ 5
Low volume driveway	–	≤ 30
High volume driveway	5	> 30
Equivalent collector road	4	> 150
Equivalent minor arterial	3	> 750
Equivalent major arterial	2	> 1500



## Driveways

### Rules for permitting driveways

Development intensity	Class 2	Class 3		Class 4		Class 5
	Major arterial	Minor arterial		Collector		Local
	DED + LVD + HVD	DED + LVD	HVD	DED	LVD + HVD	DED + LVD + HVD
CBD density areas						
Suburban density areas						

■ No "conventional" driveways permitted  
■ "Conventional" driveways are permitted

DED = Domestic Equivalent Driveways  
 LVD = Low Volume Driveways  
 HVD = High Volume Driveways



## Criteria for access spacing

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- Safety is No 1
  - Driver of vehicle on through road must have a safe " driver expectancy"
  - Accesses are potential conflicts to driver
  - There must be sufficient distance between successive conflicts
- Preservation of mobility function
  - Vital in the case of Classes 2 and 3 arterials
  - Not as important for Classes 4 and 5



## Safety principles

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- Drivers are not capable of multi-tasking
  - Can only deal with one conflict at a time
  - Intersections/driveways are potential conflict points
  - Driver must completely clear an intersection/access before giving attention to next conflict
- Urban conditions impose multiple distractions leading to potential conflicts and accidents
- Separation of conflicts can be quantified



## Candidate criteria

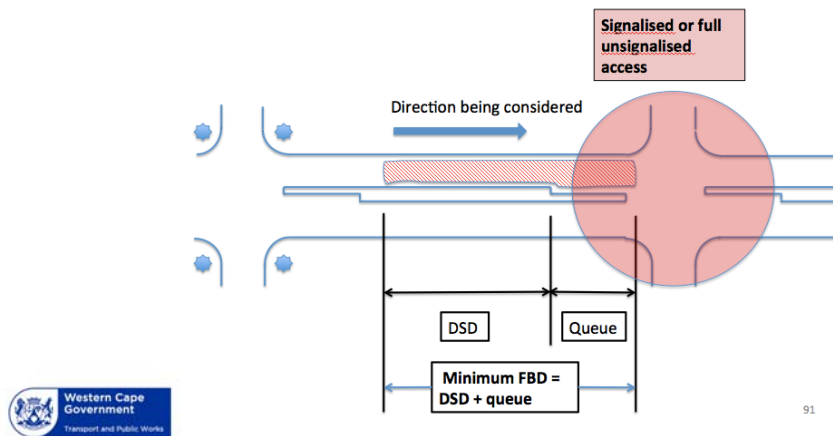
Candidate criterion	Based on vehicle maneuver	Base on vehicle conflict	Adopted for deciding on spacing in urban areas
Stopping sight distance		✓	X
Decision sight distance	✓		✓
Upstream functional boundary distance	✓		✓
Downstream functional boundary distance	✓		X
Left turn conflict		✓	✓
Egress capacity criteria	✓		X
Egress conflict		✓	✓
Communications criteria	✓		X
Weaving criteria	✓		X

## Decision sight distance

- Distance driver requires to safely perceive, decide and react to hazard ahead
- Components of decision sight distance
  - PIEV is distance covered during "perception-reaction" time
  - Distance covered during maneuvering, lane change or braking to stop

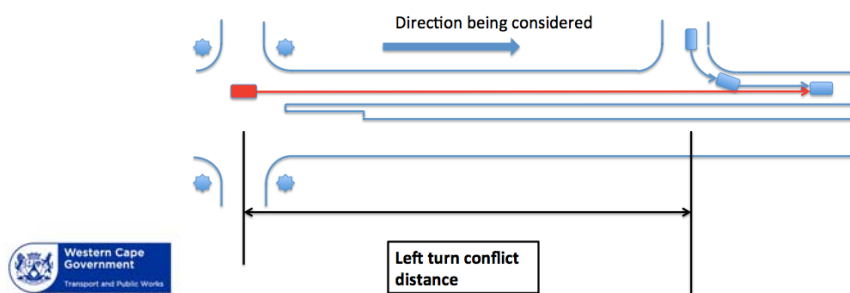
## Functional boundary distance

- Decision sight distance + queue



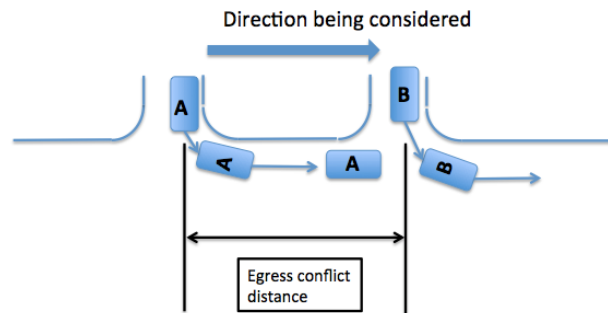
## Left turn conflict

- Distance required for driver on through road to react to vehicle turning out of side road
  - Maneuver consists of avoiding a conflict
  - Requires sufficient distance for PIEV and braking



## Egress conflict

- Successive driveways – 25m spacing
- Applicable only to lower order roads



## Application in AMG

- Largely based on AASHTO standards
- Adapted to South African conditions

Operating speed (km/hr)	Decision sight distance (m)	Left turn conflict (m)	Egress conflict (m)
40	120	45	25
50	160	60	25
60	205	82	25
70	240	107	
80	275	135	
90	320		
100	365		

## Decision framework

- Establish positions of major junctions
  - Existing and future signalized or roundabout intersections based on separate criteria
  - Unsignalized intersections must fit in-between
- Undertake evaluation for each direction
  - Barrier median has relevance
  - Full unsignalized intersection or left-in only
- Consideration of downstream intersection



## Spacing guideline distances

- Driveway spacing strictly applied to Class 2 and 3 arterials where mobility essential
- Standards relaxed for Class 4 and 5 access routes

Spacing		Class 2		Class 3		Class 4	
From	To	CDB	Suburban	CDB	Suburban	CDB	Suburban
Signal	Unsignal	235m	305m	180m	260m	90m	115m
Signal	Driveway	Not allowed	Not allowed	60m	Not allowed	90m	115m
Unsignal	Unsignal	235m	305m	180m	260m	90m	115m
Unsignal	Driveway	Not allowed	Not allowed	60m	Not allowed	90m	115m
Unsignal	Signal	235m	305m	180m	260m	140m	180m
Driveway	Unsignal	Not allowed	Not allowed	180m	Not allowed	40m	80m
Driveway	Driveway	Not allowed	Not allowed	60m	Not allowed	40m	80m
Driveway	Signal	Not allowed	Not allowed	180m	Not allowed	90m	115m

## Conclusions

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- Unsignalised intersections and driveways
  - Access frequencies dependent on Class of through road, considering whether primary function is mobility or access
  - Safety on through road is primary consideration
- Access Management Guidelines, 2014
  - Logical and structured
  - Decision tool for planning networks and access control
  - Aids road authorities to react to access applications for developments



Thank you