SOUTH AFRICA ROAD FEDERATION

Non-Motorised Transport Practitioner's Course

Session 4: Designing for Pedestrians

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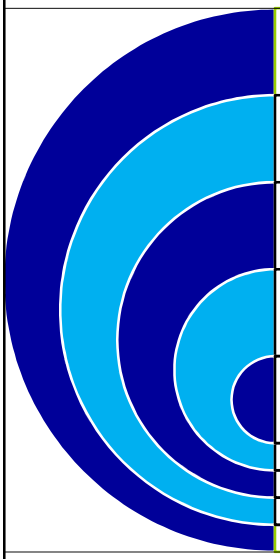


- Part 1: Design concepts
- Part 2: Design criteria
- Part 3: Pedestrian walkways
- Part 4: Pedestrian crossings (road, river, rail)
- Part 5: Amenities for pedestrians

Part 1: Design concepts

Design concepts to promote NMT modes

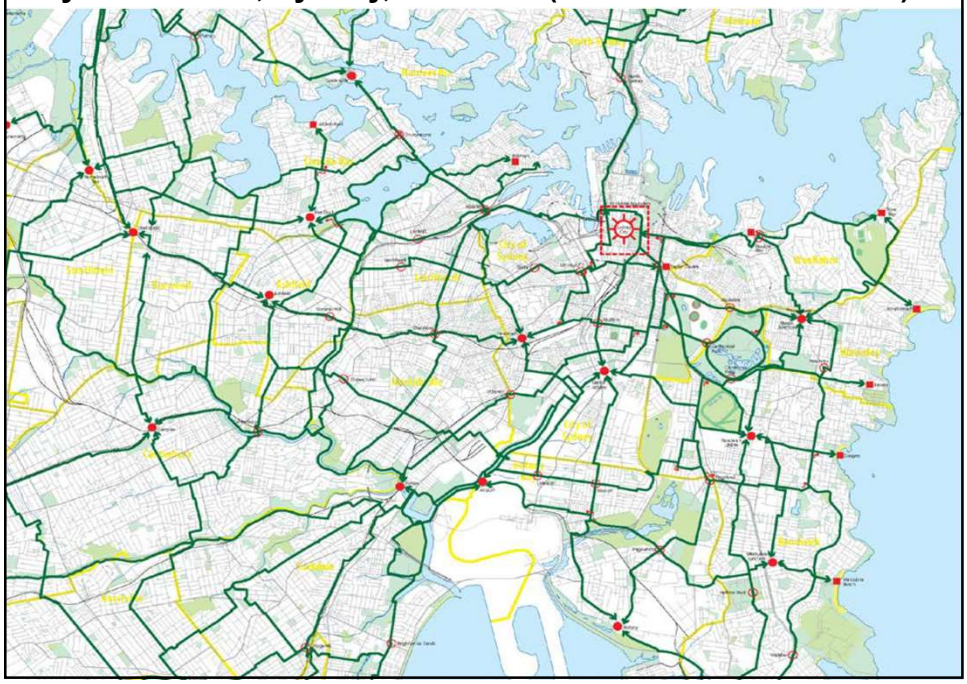
- Walkability/Cycle-ability
- Universal Access
- Modal Hierarchy/ Sustainable Transport
- Liveable Streets/Complete Streets/Context Sensitive Streets
- Transit Orientated Development
- First Mile/Last Mile
- Greenways
- Eco Cities/Sustainable Cities/Smart Cities/New Urbanism
- Crime Prevention Through Environmental Design - CPTED

International Design Trends favouring NMT

"Cities will continue to accommodate the automobile, but when cities are built around them, the quality of human and natural life declines. Current trends show great promise for future urban mobility systems that enable freedom and connection, but not dependence. We are experiencing the phenomenon of peak car use in many global cities at the same time that urban rail is thriving, central cities are revitalizing, and suburban sprawl is reversing. Walking and cycling are growing in many cities, along with ubiquitous bike sharing schemes, which have contributed to new investment and vitality in central cities including Melbourne, Seattle, Chicago, and New York".

Quote from: *The End of Automobile Dependence. HOW CITIES ARE MOVING BEYOND CAR-BASED PLANNING. Peter Newman and Jeffrey Kenworthy. Island Press, August 2014*

Cycle network, Sydney, Australia (Austroads AP-R492-15)



Design concepts for NMT modes

- **Walkability**

10 Strategies to promote Walkability

- Put cars in their place
- Mix land-uses
- Get the parking right
- Let transit work
- Protect the pedestrian
- Welcome bicycles
- Shape the space
- Plant trees
- Friendly & unique places
- Pick your winners

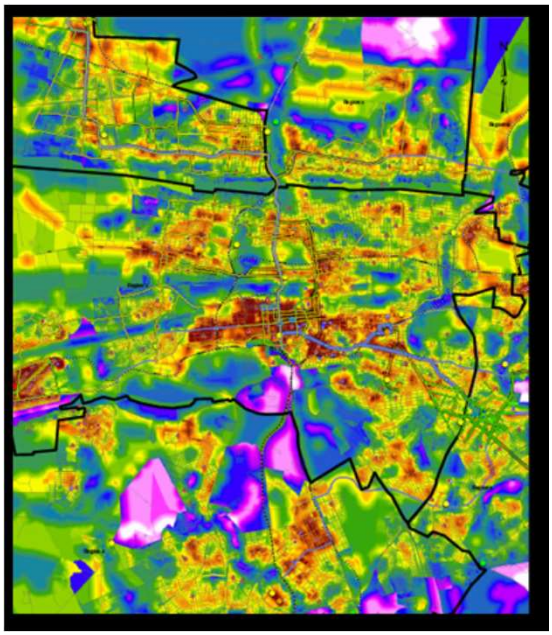
Jeff Speck – Walkable Cities

Design concepts for NMT modes

Walkability map of Tshwane

The places that are most walkable are shown in red.

The least walkable areas are in purple and blue.



Design concepts for NMT modes

- **Cycle-able communities**
- **Cycle highways**

Design concepts for NMT modes

- **Universal Access (roads, vehicles and buildings)**

Design concepts for NMT modes: Universal Access

Universal Access guidelines (1)

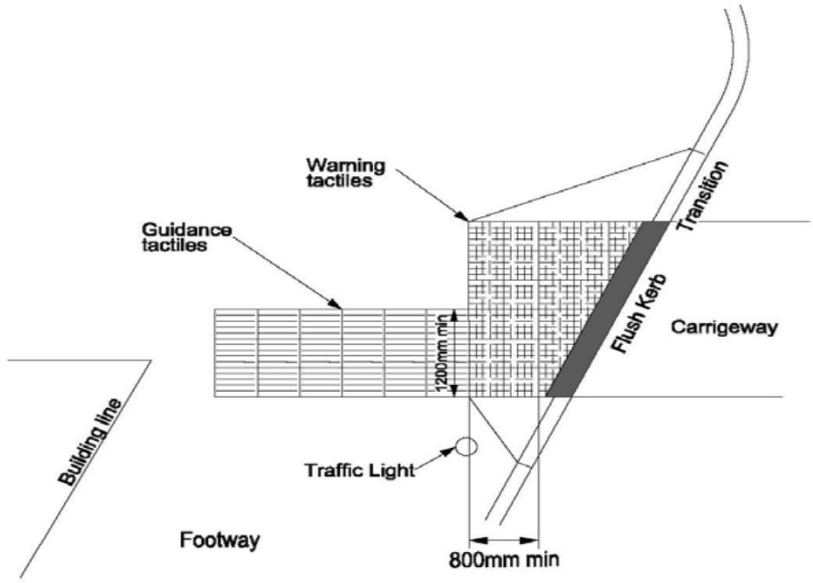
- **Equitable** - equal access to opportunities for people with diverse abilities.
- **Flexible** - accommodate a wide range of NMT users with different abilities.
- **Simple and Intuitive** - easy to understand.
- **Perceptible Information** - information should be communicated to the user regardless of the users' sensory abilities.

Design concepts for NMT modes: Universal Access

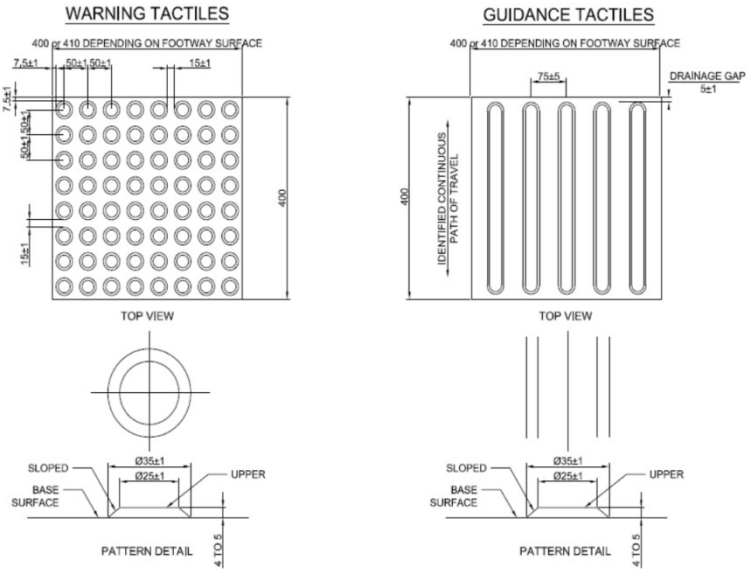
Universal Access guidelines (2)

- **Tolerant for Error** - minimise hazards for the users and the adverse consequences of accidental or unintended actions.
- **Low Physical Effort** - should be used efficiently, be comfortable and cause the most minimum fatigue.
- **Appropriate Size and Space** - appropriate for the size and space requirements, i.e. they should be within easy reach, approach, and use irrespective of the user's body size, posture or mobility.

Design concepts for NMT modes: Universal Access



Design concepts for NMT modes: Universal Access

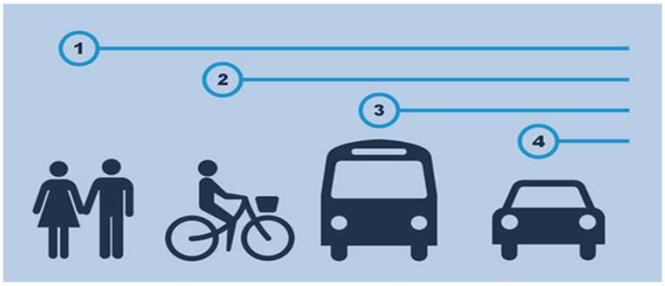


Design concepts for NMT modes: Universal Access

(SANS 784:2008 Design for access and mobility- Tactile indicators. Also See DoT NTR1)

Design concepts for NMT modes

- **Modal hierarchy/Sustainable transport**



Design concepts for NMT modes

- **Complete Streets (from Johannesburg Manual)**

Context Sensitive Design - CSD

- Design process not only considers physical aspects or standard specifications of a transport facility, but also the economic, social, and environmental resources in the community being served by that facility. CSD approach helps to ensure projects:
  - Are safe for all users.
  - Use a shared stakeholder vision as a basis for decisions and for solving problems that may arise.
  - Meet or exceed the expectations of both designers and stakeholders, thereby adding lasting value to the community, the environment, and the transportation system.
  - Demonstrate effective and efficient use of resources.

Context Sensitive Design - CSD

When community expresses desire for walkable environment,

CSS principles are applied to support and promote livable streets, neighborhoods and communities.

- Main characteristics:
  - Mixed land uses in close proximity to one another;
  - Building entries that front directly onto the street without parking between entries and the public right-of-way;
  - Building, landscape and thoroughfare design at pedestrian-scale;
  - Relatively compact developments (both residential and commercial);
  - A highly-connected, multimodal circulation network, usually with a fi ne “grain” created by relatively small blocks; and
  - Thoroughfares and other public spaces that contribute to “placemaking”—the creation of unique locations that are compact, mixed-use and pedestrian- and transit-oriented.

Design concepts for NMT modes

- **Transit Orientated Development**

Washington - High density, mixed use development within 400 – 800m from Rosslyn, Court House and Clarendon Metro Stations

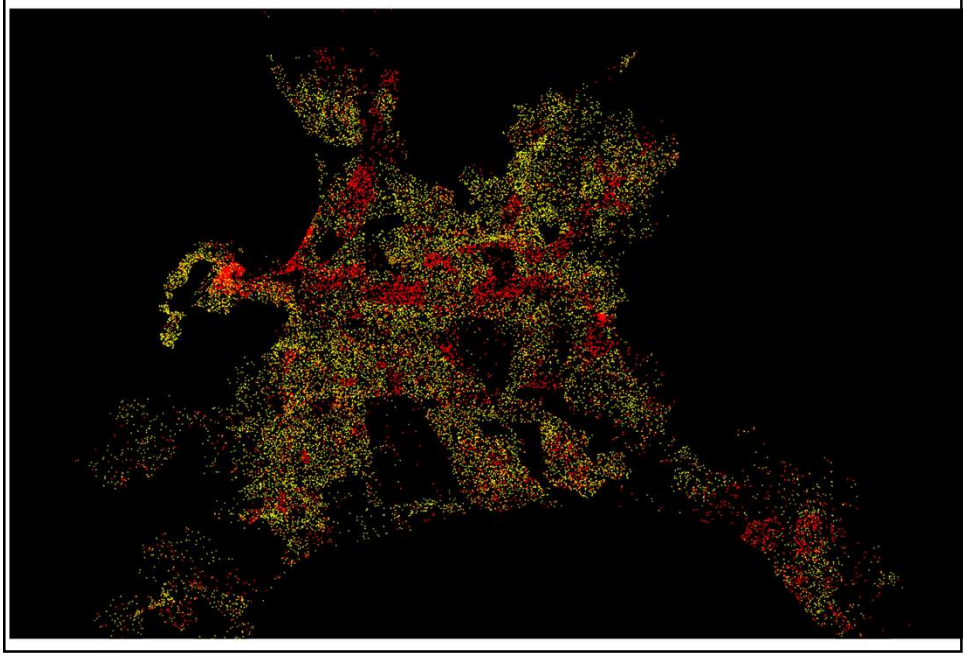
Transit Orientated Development - Cape Town

"TOD is an investment and performance driven approach for the City of Cape Town to deliver the following outputs:

- Increase "location efficiency" so that people can walk, cycle and use public transport. This can be achieved through a comprehensive approach to land use density, mix and intensity, as well as a focus on prioritised public transport
- Boost ridership and minimize congestion thereby ensuring that the public transport system becomes more viable
- Provide a rich mix of housing, shopping and transportation choices
- Deliver efficiencies in urban infrastructure
- Drive down the cost of the User Access Priority for both new and existing residents
- Create a sense of place".

Source: PowerPoint presentation by Gershwin Fortune, SATC 2015

Comprehensive TOD scenario development - Cape Town



Comprehensive TOD scenario development - Cape Town
Increased densities along Voortrekker Road

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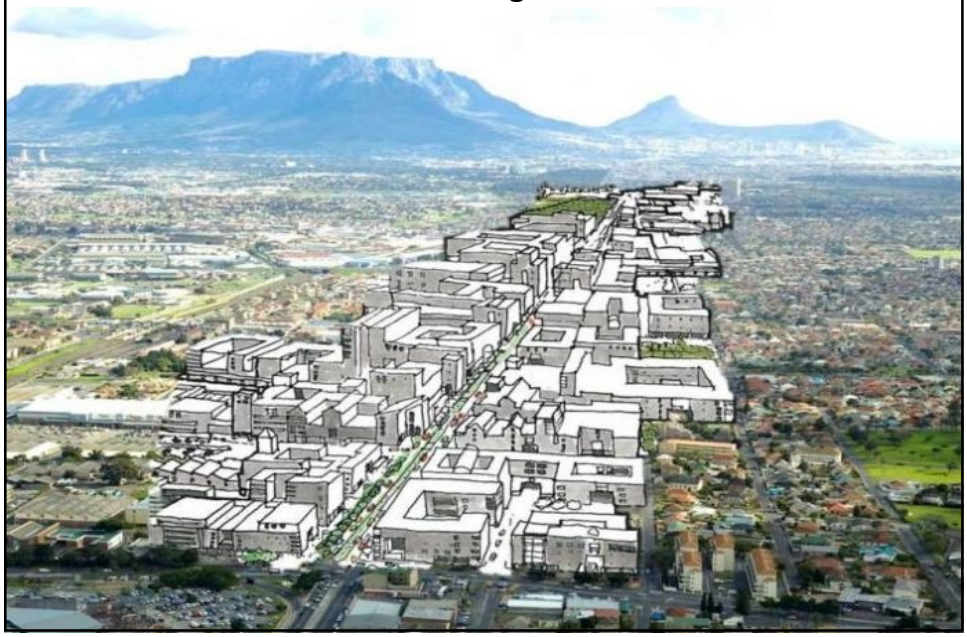
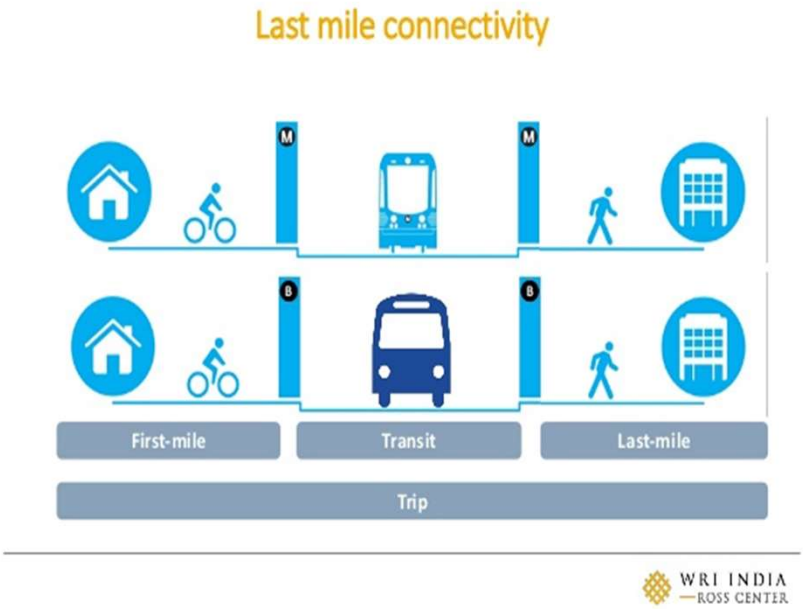
Increased densities along Voortrekker Road



Design concepts for NMT modes

- **First Mile/Last Mile**



Design concepts for NMT modes

- **Greenways along roads**

- **Greenways in public space**

Urban planning concepts promoting NMT

Eco Cities/Sustainable Cities/Smart Cities/New Urbanism

Enormous pressure on urban space and resources due to increased urbanisation worldwide.

Cities designed specifically to minimize its energy, water and food needs, reduce its emitting pollution. *Reduce- Renew- Recycle*

Some of the criteria of an ideal city relevant to transport are:

- Entirely carbon-neutral by promoting techniques - use and production of renewable energy.
- Established over a well-planned city layout that promotes walkability, cycling and the use of public transportation systems.

Crime Prevention through Environmental Design - CPTED

Part 2: Design criteria

Pedestrian groups

The pedestrian population divided into different groups for planning and design purposes:

- Adult pedestrians
- Pedestrians with special needs
  - Children
  - Older people
- The disabled
  - Visual and hearing impairments
  - Physically handicapped
  - Other medical conditions

Design criteria for pedestrians

Parameter	Accepted Minimum	Recommended Minimum	Optimal
Walkway width total separation	1.2 m	1.5 m	2.0 m subject to cap requirements
Walkway - partial separation	1.2 m	1.5 m	3.0 m subject to cap requirements
Walkway Max gradient	1:15	1:20	1:25
Min corner splay	2 m	3 m	5 m
Cross-fall/ Camber	1 : 50	1 : 50	1 : 50
Separation from traffic	120 km/h – 5 m 80 km/h - 2 m 60 km/h – 1 m	120 km/h – 7 m 80 km/h - 3 m 60 km/h - 1 m	120 km/h – 9 m 80 km/h – 4 m 60 km/h – 2 m

Walking speed and distance

- Walking speeds below are those of the average pedestrian. Many pedestrians walk faster or slower than the average. For design purposes, provision must be made for the slower pedestrian (typically the 15th percentile walking speed). The following speeds should be used for design purposes:
  - 1,2 m/s - Normal operating conditions.
  - 1,0 m/s - Significant proportion of pedestrians are elderly or disabled.
  - Above speeds also used for cyclist pushing their bikes across roads.

Sight distance requirements

- Provision of sight distance is crucial for traffic safety. Sufficient sight distance to be provided for pedestrians and cyclists to view safety hazards and react accordingly. Sight distance requirements considered in design of pedestrian and bicycle facilities:
  - *Stopping sight distances* required by cyclists to perceive a hazard and to stop safely.
  - *Decision sight distance* required by cyclists to view their environment and to make decisions.
  - *Gap acceptance sight distance* required wherever pedestrians and cyclists must cross a road or street by looking for gaps in traffic.

Walking distance

ACCEPTABLE WALKING DISTANCES

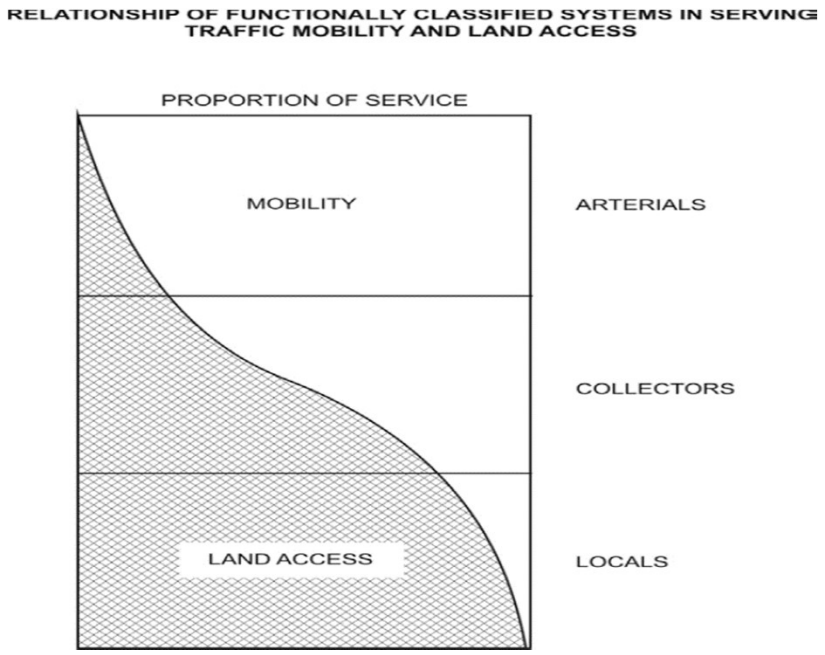
To road and street crossings	50 – 100m
Parking to building entrances	100 m
Public transport stops	300 m
Community facilities and parks	400 m
Commuter rail stations	500 m

Part 3: Pedestrian walkways

NMT facilities along roads

Road Infrastructure Strategic Framework for South Africa (RISFSA) - classification of roads

- NMT along Freeways with Controlled Access - Class 1
- NMT along High Speed Highways – Class 2
- NMT along Kerbed Arterials – Class 3
- NMT along Urban Distributors and Collectors - Class 4
- NMT along Access Roads – Class 5
- NMT routes – Class 6
- Bicycle Priority Streets
- NMT and Public open space



NMT separation by road class

Road Classification	Pedestrians	Cyclists
1 Freeway	Total Separation	Total Separation
2 Major Arterial	Total Separation	Total Separation
3 Minor Arterial	Total Separation	Partial Separation
4 Collector	Partial Separation	Marked Separation
5 Local Street	Partial Separation/Mixed Shoulder (Rural)	Partial Separation/ Mixed Shoulder (Rural)

Pedestrian walkways

NMT along Freeways with Controlled Access (Class 1)

- As a rule, *NMT alongside freeways with controlled access should be avoided*, due to high speeds and the need to prevent people from crossing the road or using the road reserve.
- Adjacent NMT *facility can be considered when no alternatives and NMT facility can be fenced off* from the motorised vehicles in a sustainable manner, while not detracting from safety related to accidental run-off-the road accidents.

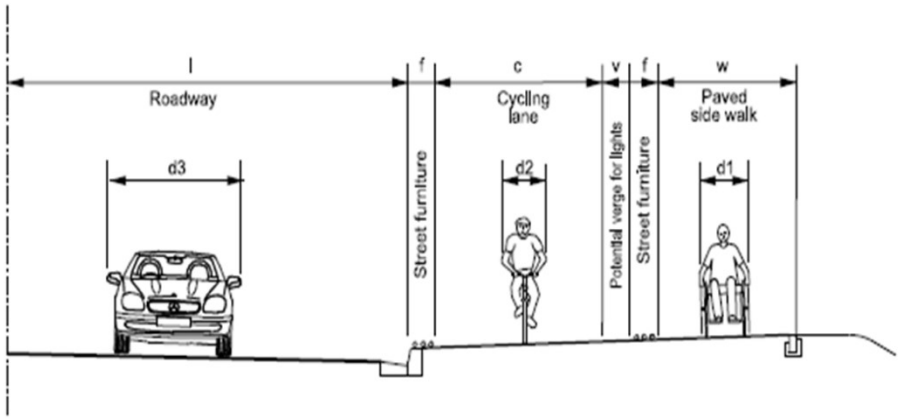
CURRENT SOLUTIONS

N2 GEORGE

Pedestrian facilities along roads

NMT along High Speed Highways (Class 2)

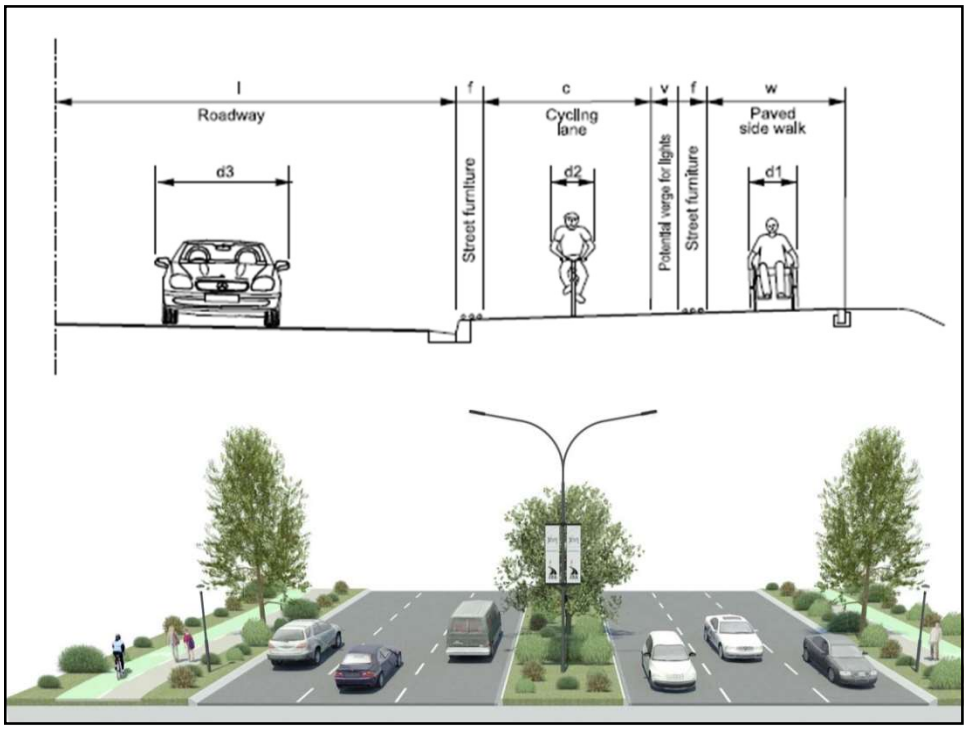
- Design of highway will normally include the *provision of a forgiving* *roadside allowing drivers to recover* or avoid serious injury in the event of a run-off-the-road accident.
- *NMT users to be totally separated* preferably from motorised vehicles to prevent serious accidents.
- Can be achieved by *placing the NMT ways at an appropriate distance from the edge of the road or by using a heavy barrier (guardrail)* to provide protection in the event of loss of control.



Pedestrian facilities along roads

Kerbed Arterials (Class 3)

- Slower operating speeds between 60 km/h to 80 km/h and *kerb represents a barrier between vehicles and NMT users*.
- Normal to place the *bicycle lane adjacent to the kerb and the pedestrian walkway just outside the bicycle lane*.
- In some circumstances where the sidewalks are narrow and cannot accommodate bicycle lane, the bicycle lane is placed on the same surface as the motorised traffic and partial separation is effected by a barrier.



Pedestrian facilities along roads

NMT along Urban Distributors and Collectors (Class 4)

- On urban collector with bicycle lanes, the bicycle lane is placed on the road surface and is only separated by road markings and signage.
- Urban distributors and collectors are designed to provide access to urban settlements/suburbs. They connect the accessibility spaces with the mobility network. Their emphasis should be on connectivity and not throughput.

Pedestrian facilities along roads

NMT along Access Roads (Class 5)

- According to COTO (2012), design speed in urban local access roads is 40 km/h. All design elements (most important is sight distances), are influenced by the design speed, allowing faster speeds than design speed, can result in a road safety risk.
- Design of access road should focus on the creation of pedestrian and bicycle-friendly environments, keeping the overall aim of 'access for all' in mind. Careful planning of various design elements, including parking, is required.

Pedestrian facilities through open space

NMT routes (Class 6)

Drainage of pedestrian facilities

Part 4: NMT road, river and rail crossings

NMT road, rail and river crossings

- Road crossings
  - Footbridges and subways
  - At-grade Pedestrian Crossing Facilities
    - Controlled Intersection
    - Controlled Midblock Crossing
    - Refuge islands
  - Cycle crossing facilities
    - Controlled Intersections
    - Uncontrolled Intersections
- Rail crossings
- River crossings

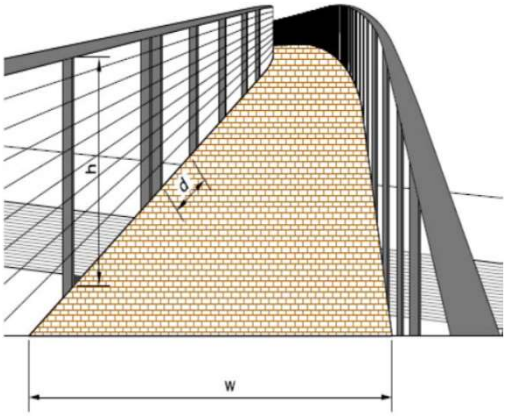
Footbridges and subways (1)

- Footbridges can be used to provide safe crossing facilities when at-grade crossing is forbidden or deemed too dangerous – Class 1 & 2.
- A serious concern regarding bridges is the total metres that need to be overcome while 'climbing' a bridge. In urban areas, the distance is typically 5 m. NMT bridges on highways, typically add a meter, i.e. have a 6 m height difference.
- **Principles:**
  - Width needs to accommodate at least two persons with wheelchairs/prams passing.
  - Cyclists will also need to use these facilities.

Footbridges and subways (2)

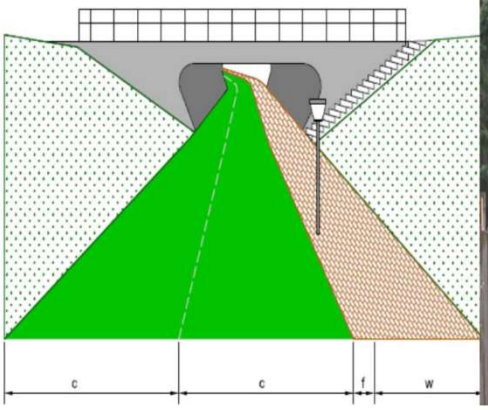
- **Positive Aspects:**
  - Safety for all modes of transport is guaranteed.
- **Negative Aspects:**
  - Construction is expensive.
  - Security can become an issue.
  - People need to be encouraged to use the facilities; otherwise, it will only create a road safety burden if these facilities are in an inconvenient location.

Design Examples: Footbridges and subways (3)



Design Examples: Footbridges and subways (4)

Design Examples: Footbridges and subways (5)



Best practice example: Grade separated intersection in Central Beijing, China

2012 Nikon Lakes

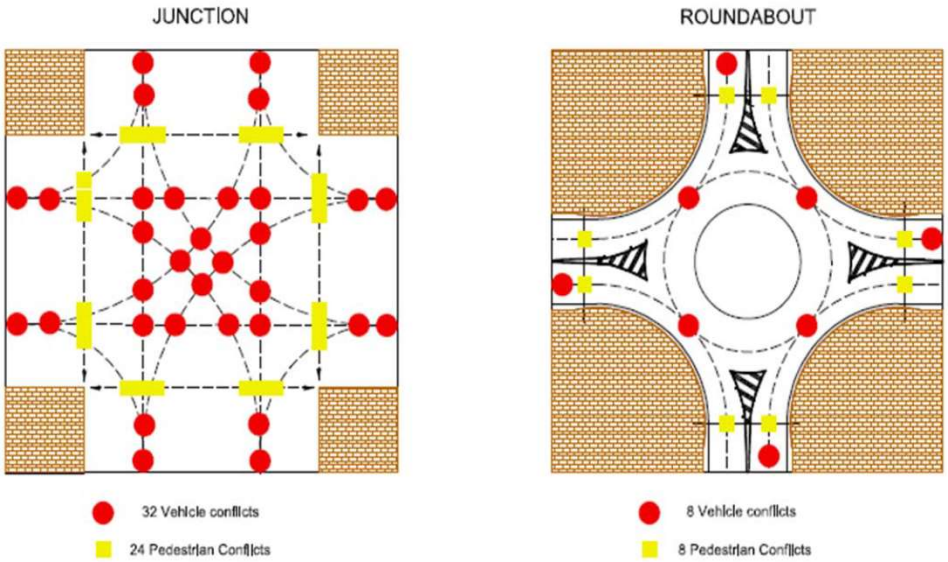
Photography by Andrew Rochfort

Pedestrian Crossing Facilities

- Controlled Intersections
- Controlled Midblock Crossings (Signalised or Yield Control)
- Refuge islands

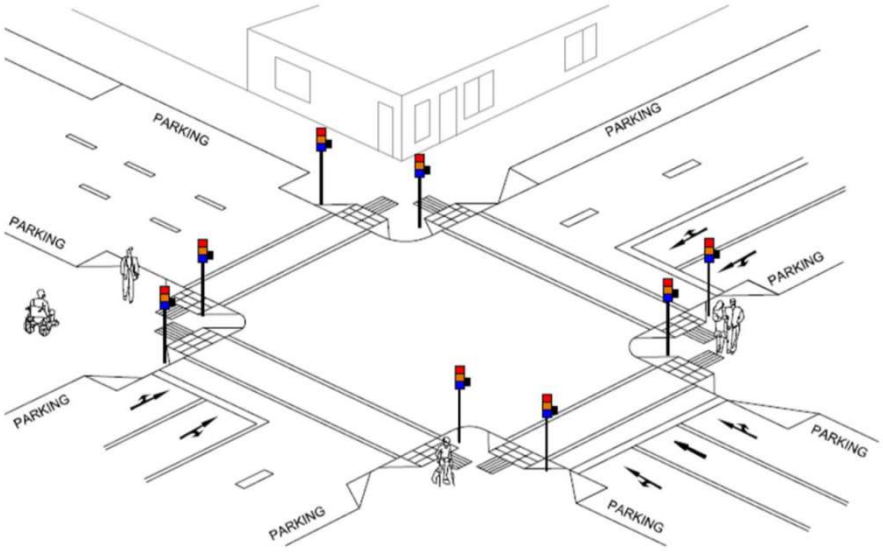
Pedestrian Crossing Facilities

- Controlled Intersection - Conflict points



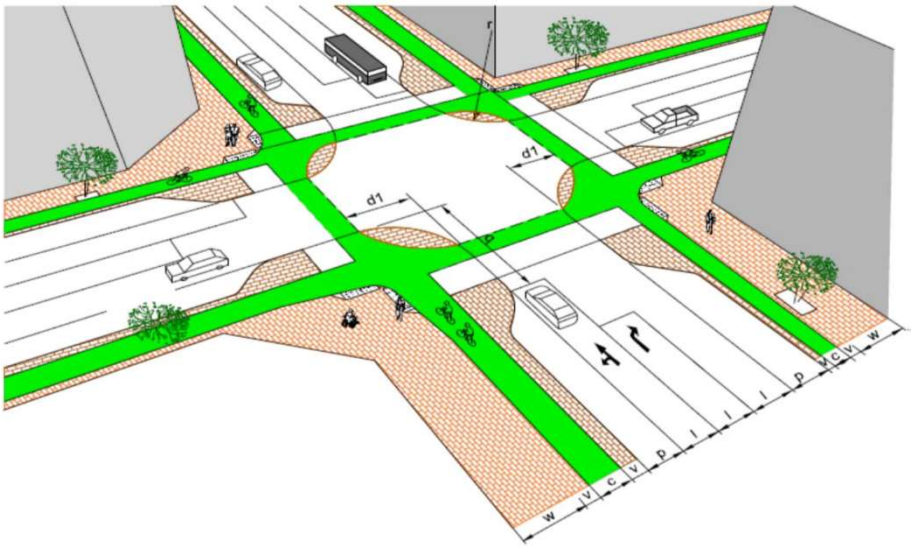
Pedestrian Crossing Facilities

Controlled Intersections



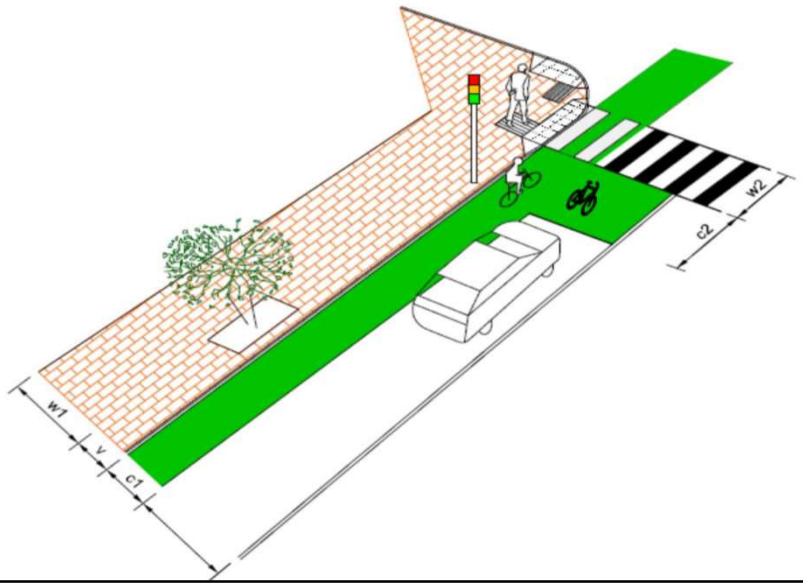
Pedestrian and Cycle Crossing Facilities

Controlled intersections: Pedestrian layout



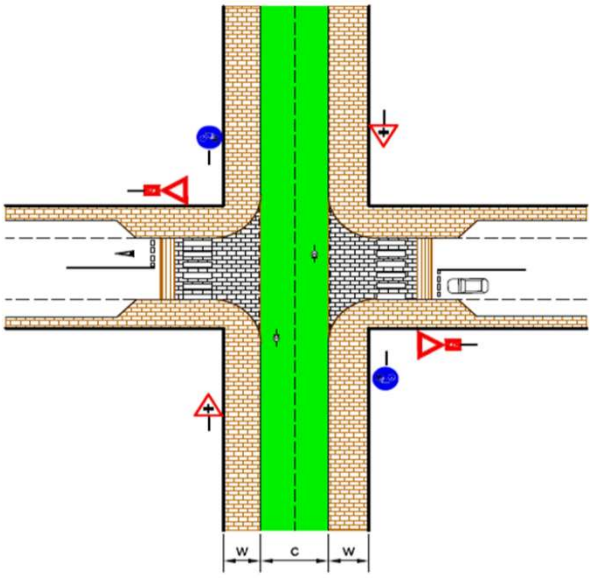
Pedestrian and Cycle Crossing Facilities

Controlled intersections: Pedestrians and Bicycle box



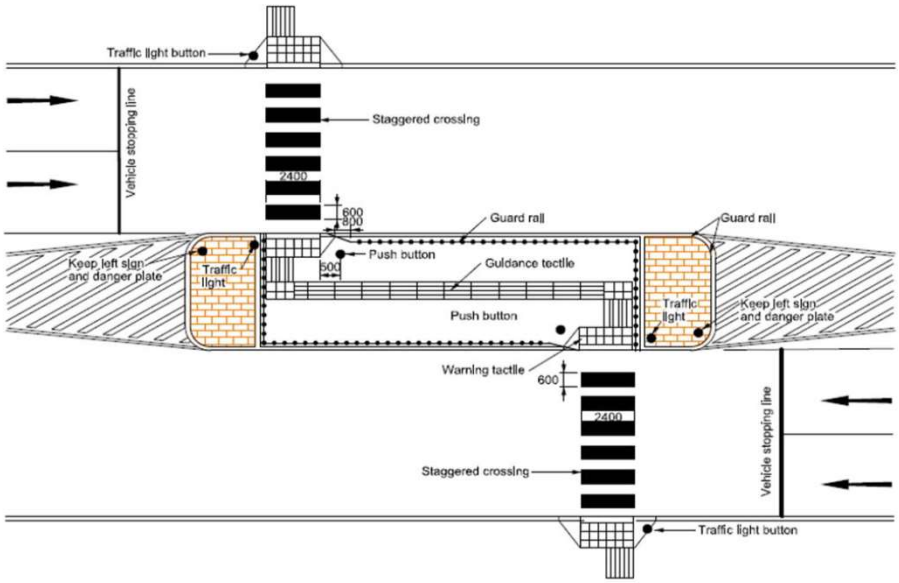
Pedestrian and Cycle Crossing Facilities

Controlled intersections: Pedestrian facilities at Bicycle Priority Intersect



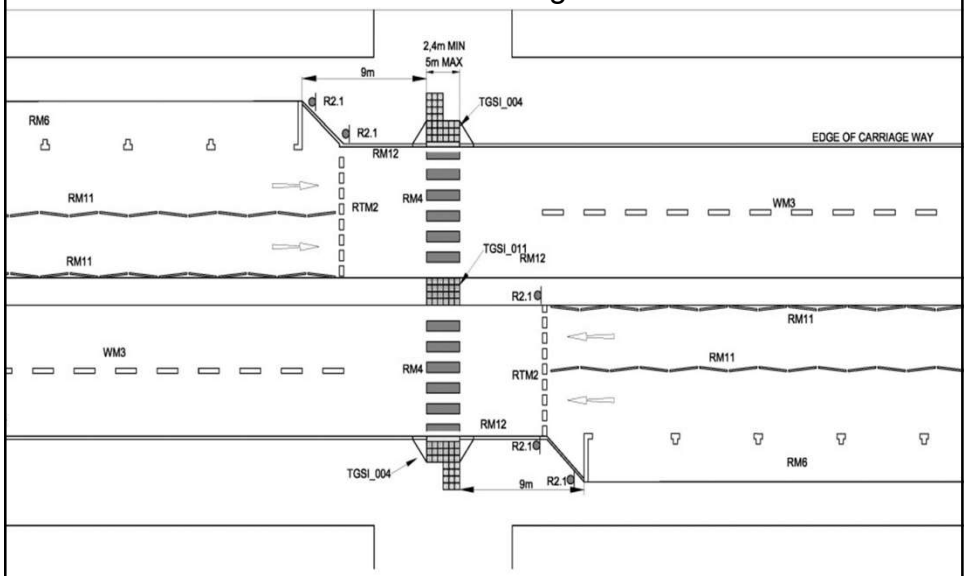
Pedestrian Crossing Facilities

Signal controlled midblock crossing



Pedestrian Crossing Facilities

Yield Controlled Midblock Crossings



YIELD-CONTROLLED MIDBLOCK CROSSING - PARKING ALLOWED WITH EXTENDED SIDEWALK

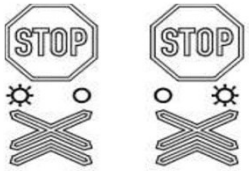
Pedestrian Crossing Facilities

Midblock Crossings details – Median islands

Rail Crossing Facilities

- Intersections with railway come with a *safety risk for motorised transport, as well as NMT*.
- *Trains have right of way* at any intersection and given the *high speeds that trains* travel at, sight distances for other road users are often not sufficient, and physically impossible to create.
- Railway crossings can be *controlled and uncontrolled*. Given the vast amount of accidents, *controlled intersections or grade separation are recommended*.

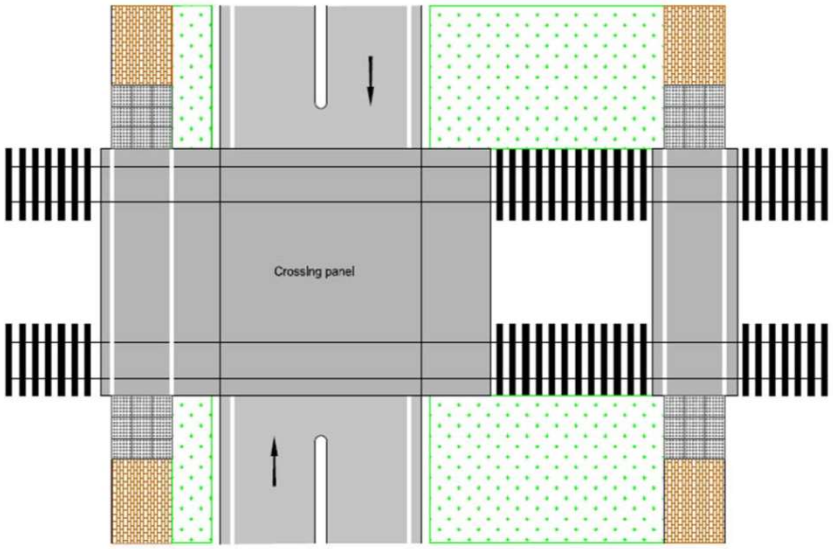
Current Rail Signals: SARTSM - Chapter 14



Train coming

No train

Rail Crossing Facilities



Rail Crossing Facilities

Rail Crossing Facilities

River Crossings

- In rural areas, *full rivers often hinder learners from accessing schools* and many *rural communities are cut off from basic socio-economic facilities and jobs*.
- Deliberate efforts have been introduced through the *Integrated Rural Mobility and Access (IRMA) programme* of the Department of Transport to link learners, and rural communities in general, to schools and other community services during the rainy season.
- Various pedestrian river bridges provided in Mpumalanga, KwaZulu Natal, Eastern Cape.

River Crossings

Part 6: Amenities for pedestrians

Amenities for pedestrians

- Lighting facilities
- Safety barriers
- Barricades and fencing
- Traffic calming
- Speed limits
- Vibro-tactile and Audible devices
- Other pedestrian and driver amenities

Lighting of NMT facilities

- Large number of commuters travel during the hours of darkness to work and home.
- Lighting of the road and street system increases pedestrian and cyclist security, safety and comfort and provides a pleasant environment. Lighting should therefore preferable be provided at all facilities used by pedestrians and cyclists, especially public transport facilities such as taxi ranks and bus stops and termini.
- The provision of lighting is particularly essential at the locations where security may be a problem. These locations include pedestrian and bicycle bridges and subways as well as at bicycle parking areas. Lighting has to be provided at night but some facilities may also require illumination during the day (such as subways).

Example of well-lit pedestrian crossing - Europe

Lighting and visibility of pedestrians

Upper left: High power LED

Upper right: Metal Halide lamp

Bottom: Sodium lamp (nearside) and LED (far side)

Solar street lighting

- Street lighting an important road safety measure – can reduce accidents by 50%.
- LED lighting more effective than sodium to improve conspicuity.
- Solar street lighting in towns and villages becoming a viable option.

Safety barriers/ Barricades and fencing

Traffic calming principles

Control of Speed

- Traffic calming very effective at addressing speeding problems.
- Most of the measures, however, only effective at a point along the road or street, and measures must often be repeated to be effective over a long stretch of road.

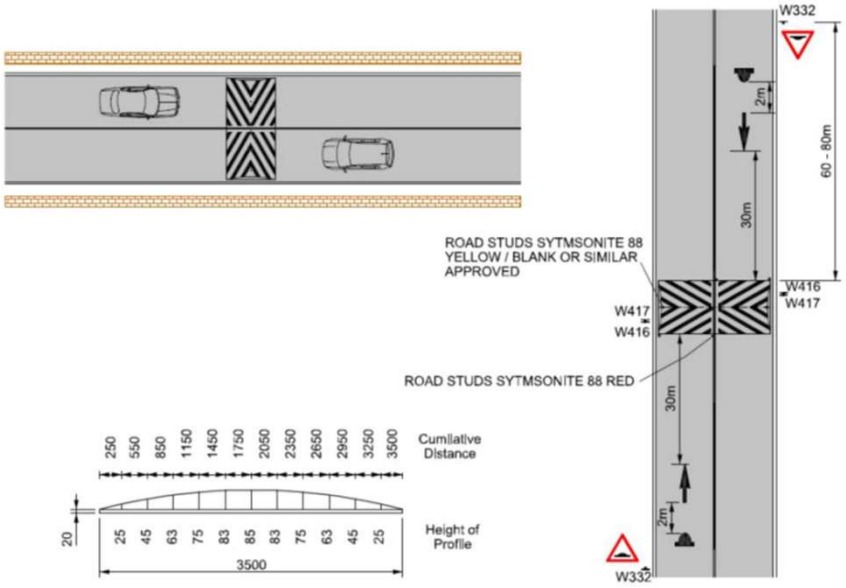
Manage Traffic intrusion

- Traffic taking short cuts through residential areas, lead to “traffic intrusion”.
- Traffic intrusion: high volumes of traffic on roads, poor quality of life.
- Can be discouraged by making it less convenient for drivers to travel through the area than around the area. Can be achieved by increasing both travel time and distance through the area that must be protected.

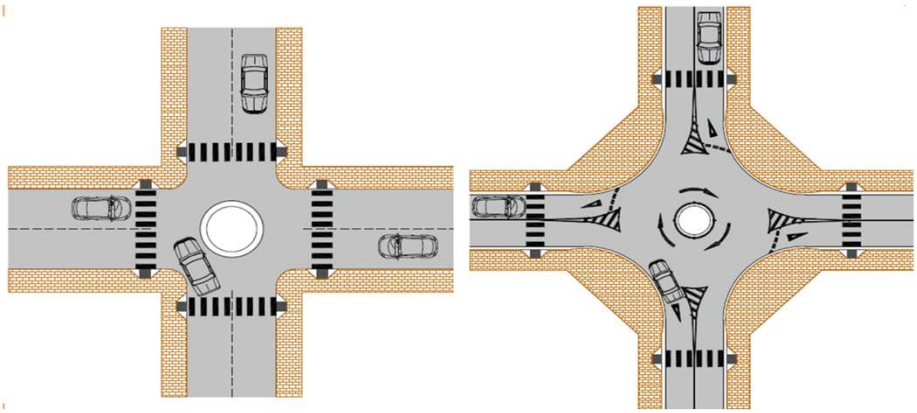
Traffic calming measures

- Speed hump/table
- Raised crosswalk
- Raised intersection
- Textured pavements
- Rumble strips
- Traffic (mini) circle
- Roundabout
- Chicanes
- Realigned intersection
- Neck downs
- Centre island narrowing
- Chokers
- ‘Road diets’
- Full closure
- Half closure
- Diagonal diverters

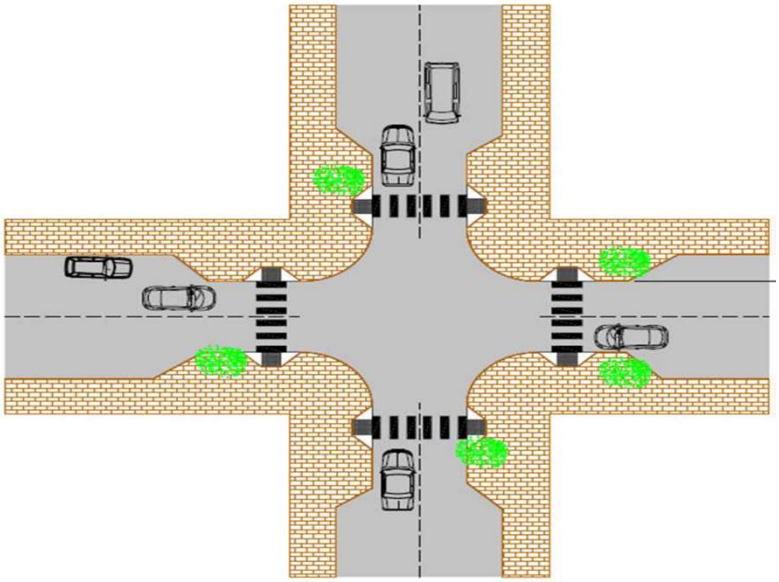
Traffic calming – Speed hump



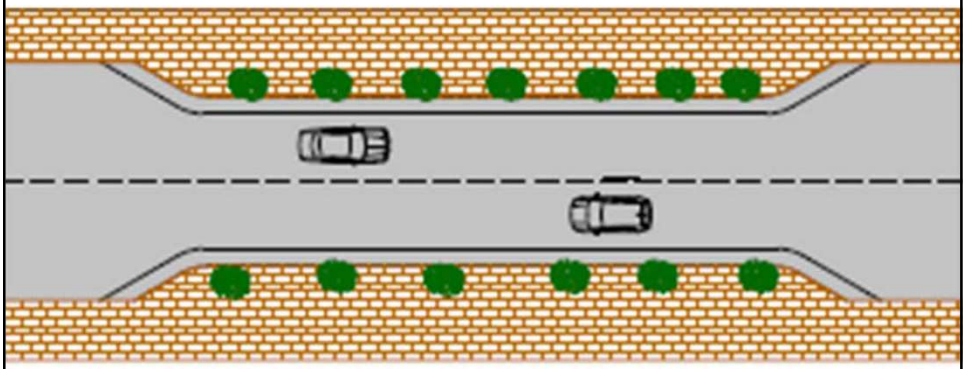
Traffic calming – Mini circles



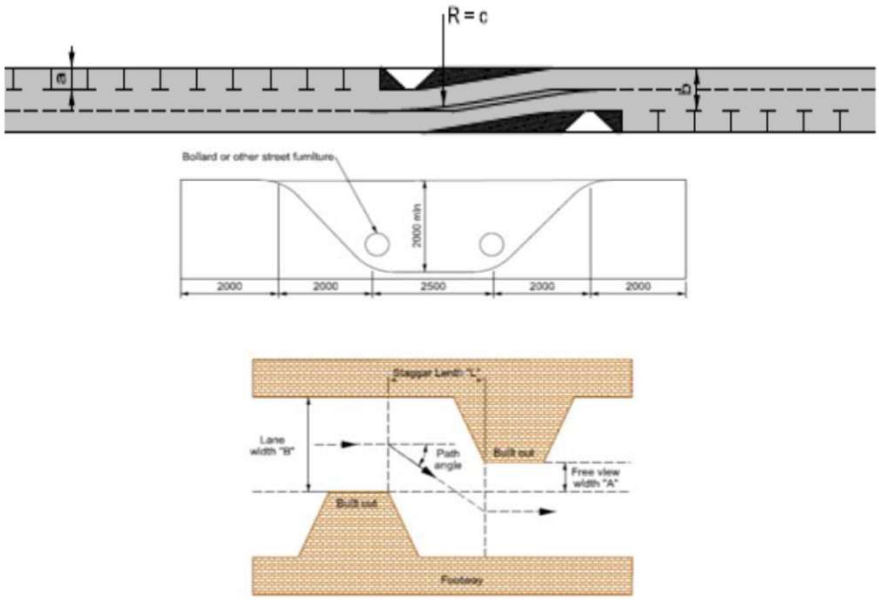
Traffic calming – Neck downs



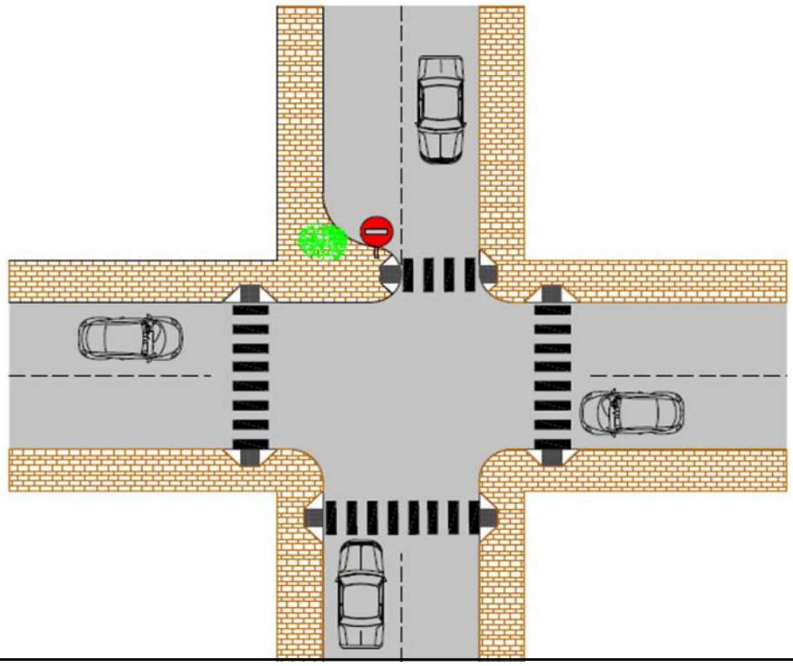
Traffic calming - Chokers



Traffic calming - Chicanes



Traffic calming – Half closure



Speed limits for pedestrian safety

DoT (1996) Guidelines for setting speed limits

- Recommended speed limits for various situations and conditions. The following speed limits are recommended when pedestrians are present on a road or street:
  - An 80 km/h speed limit is used when few pedestrians use a road. Public transport termini typically occur at isolated locations on such roads.
  - A 70 km/h speed limit is used when higher volumes of pedestrians can gain access to a road. Public transport termini occur regularly on the road or street.
  - A 60 km/h speed limit is used when relatively high volumes of pedestrians can gain access to a road.

Amenities for (disabled) NMT users

- Ramp kerbs and flush median island crossings.
- Positioning of roadside furniture (sign posts, dust bins, vegetation, etc.).
- Audible and tactile devices.
- Extended green pedestrian signal phase.
- Provision of road crossing facilities.
- Extension of sidewalks at crossings.
- Tactile strips along sidewalks.
- Street lighting.
- Ramped accesses to footbridges/subways.

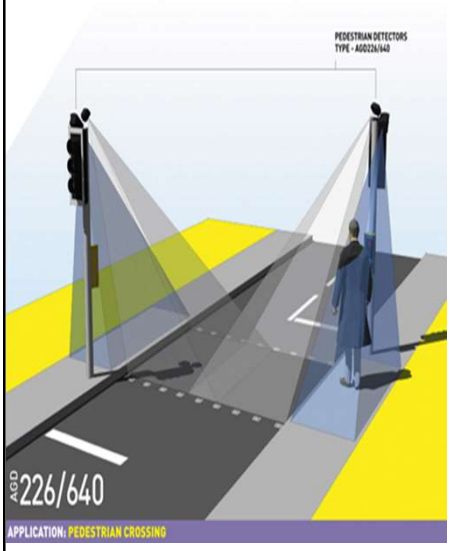
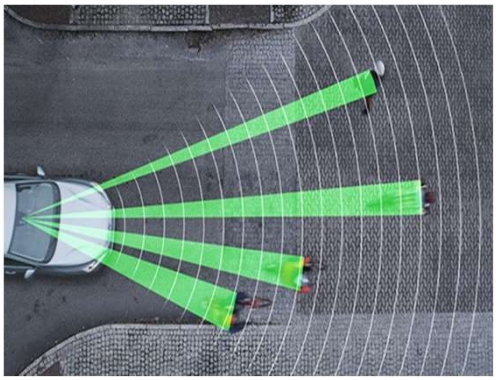
Vibrotactile and Audible devices

Vibrotactile devices

- Devices communicate information to pedestrians through a vibrating surface by touch, normally a vibrator attached to a signal post.
- Should be continuously vibrating to indicate to the pedestrian that it is in operation and not out of order.
- Two levels of vibration, one for green pedestrian signal, and second to indicate red or flashing red light signal.
- The vibrators should be installed on the same posts as the normal pedestrian push buttons.

Audible devices

- Indicate to visually impaired pedestrians that green man light signal is provided.
- Number of challenges:
  - Noise pollution.
  - Identifying which crosswalk has the walk signal.
- Address noise pollution by carefully adjusting the volume of the audible signal.
- Identifying which crosswalk has the walk signal can be addressed by using different tones or signals.

Other pedestrian and driver amenities

Other pedestrian and driver amenities