TRB Annual Meeting 2024, Session 3068, 8 January 2024
Multimodal Operations and Capacity of Roundabouts
in the US and Beyond

SIDRA Multimodal Capacity and Performance Analysis for Roundabouts

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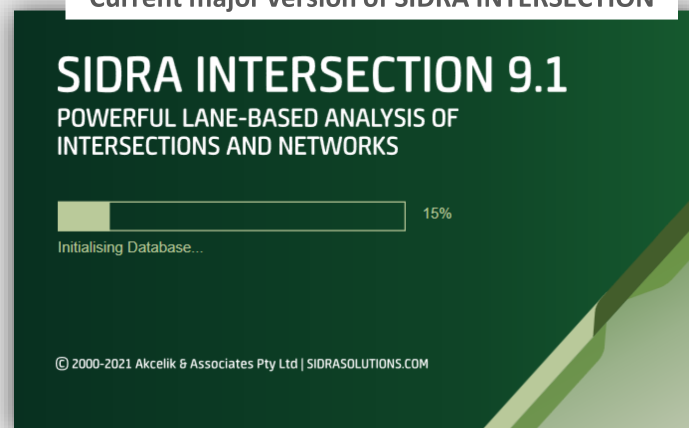
Presentation Contents

This presentation will summarize the following features of **SIDRA INTERSECTION**:

1. SIDRA Capacity and Performance Output by Movement Class, Pedestrians and Persons
2. Multimodal Gap Acceptance Capacity Model in SIDRA
3. SIDRA Roundabout analysis method features relevant to "gaps in HCM" (includes: HCM Edition 6 Extended Roundabout Capacity Model)
4. SIDRA Site and Network Templates for Roundabouts
5. A detailed study of the HCM roundabout capacity model with suggested addition of geometry effects
6. Movement and Place approach in Australia

Current major version of SIDRA INTERSECTION



SIDRA Multimodal Roundabout Capacity and Performance Method

1. SIDRA Capacity and Performance Output by **Movement Class, Pedestrians and Persons**
   - Example with a Bus Bypass Lane
   - Pedestrians

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Vehicle Movement Classes

- Light Vehicles
- Heavy Vehicles

} Traditional (HCM)

- Buses
- Bicycles
- Large Trucks
- Light Rail / Trams
- Six User-Defined Classes

Combined with the lane-based method, Movement Classes allow modeling of Bus Priority Lanes, Bicycle Lanes, and more detailed analysis including gap acceptance model by Movement Class

RH versions of photos from Sydney, Australia

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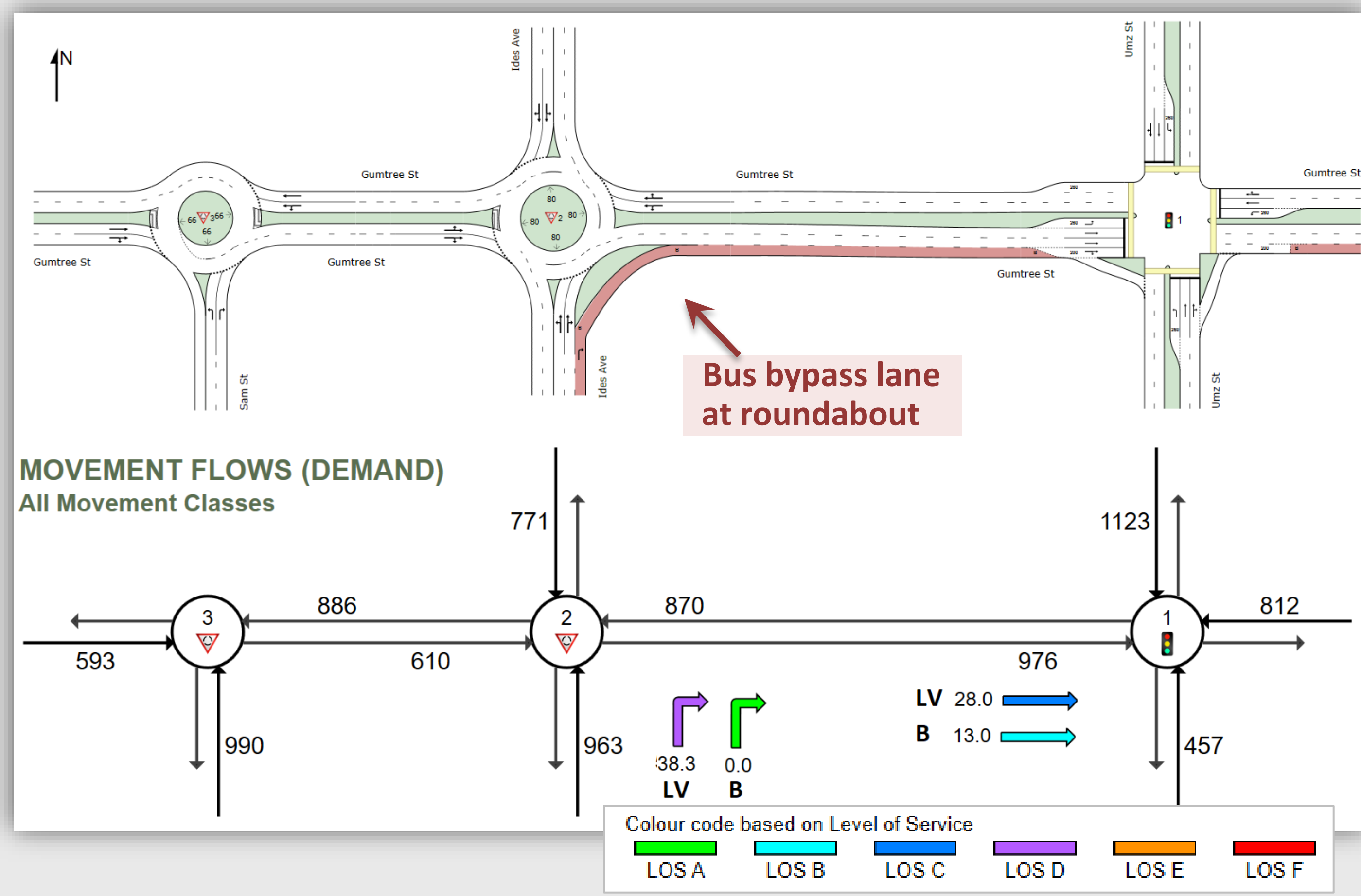
Example:
Two Roundabouts and a Signalized Intersection



Demand Flows (veh/h) include **BUSES** and **TAXIS** **(User Class)** using Bus Lanes

Average Delays (sec) shown

Mickleham Rd - Broadmeadows Rd
Melbourne, Australia

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Output Reports and Displays by Movement Class, Pedestrians and Persons

INTERSECTION SUMMARY

Site: 2 [Site 2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Network: N1 [Network 1 (Network Folder: Network)]

Roundabout Corridor with a Signalised Intersection
Site Category: Existing Geometry
Roundabout

Intersection Performance - Hourly Values

Performance Measure	Vehicles:	All MCs	Light Veh	Heavy Veh	Buses	Taxis	Persons
Travel Speed (Average)	mph	19.7	19.6	19.8	35.0	35.0	20.7 mph
Travel Distance (Total)	veh-mi/h	1315.6	1266.9	31.6	6.8	10.2	1775.1 pers-mi/h
Travel Time (Total)	veh-h/h	66.7	64.6	1.6	0.2	0.3	85.6 pers-h/h
Desired Speed	mph	40.0	40.0	40.0	40.0	40.0	
Speed Efficiency		0.49	0.49	0.49	0.88	0.88	
Travel Time Index		4.37	4.34	4.38	8.62	8.62	
Congestion Coefficient		2.03	2.04	2.03	1.14	1.14	
Demand Flows (Total)	veh/h	3430	3296	80	22	33	4743 pers/h
Arrival Flows (Total)	veh/h	3430	3296	80	22	33	4743 pers/h
Percent Heavy Vehicles (Demand)	%	3.0					
Percent Heavy Vehicles (Arrivals)	%	3.0					
Degree of Saturation		0.896	0.896	0.896	0.045	0.045	
Practical Spare Capacity	%	-5.1	-5.1	-5.1	2056.9	2056.9	
Effective Intersection Capacity	veh/h	3830	3679	90	478	718	
Control Delay (Total)	veh-h/h	27.74	26.62	1.12	0.00	0.00	33.30 pers-h/h
Control Delay (Average)	sec	29.1	29.1	50.2	0.0	0.0	25.3 sec
Control Delay (Worst Lane by MC)	sec	39.1	39.1	39.1	0.0	0.0	
Control Delay (Worst Movement by MC)	sec	59.5	38.7	59.5	0.0	0.0	59.5 sec
Geometric Delay (Average)	sec	0.0	0.0	0.0	0.0	0.0	
Stop-Line Delay (Average)	sec	29.1	29.1	50.2	0.0	0.0	
Idling Time (Average)	sec	19.1	18.9	39.7	0.0	0.0	
Intersection Level of Service (LOS)		LOS C	LOS C	LOS E	LOS A	LOS A	
Average Back of Queue - Veh (Worst Lane)	veh	5.7	5.7	5.7	0.0	0.0	
Average Back of Queue - Dist (Worst Lane)	ft	144.7	144.7	144.7	0.0	0.0	

Results for **Vehicle Movement Classes**, **Pedestrians** and **Persons**

Results for **Persons** are calculated using **Vehicle Occupancy**

Defaults:

LVs: 1.2 persons/veh

Buses: 30 persons/veh

Pedestrians: 1 person

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Output Reports and Displays by Movement Class, Pedestrians and Persons

ROUTE TRAVEL PERFORMANCE

➡ Route: R101 [Bus Route]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Network: N1 [Network 1 (Network Folder: Network)]

New Route
Network Category: Existing Geometry

The results for All MCs are for the MCs that travel the whole Route.

Route Travel Performance

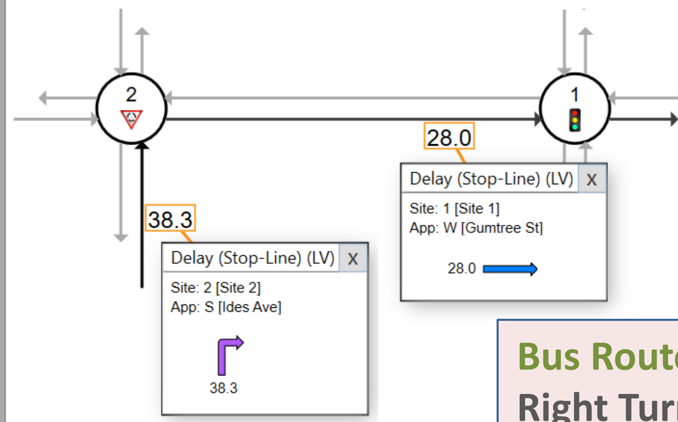
Performance Measure	Vehicles:	All MCs (Route)	Light Veh	Heavy Veh	Buses	Taxis	Persons
Travel Speed (Average)	mph	21.0	20.3	17.8	32.3	32.3	25.5
Travel Distance (Average)	ft	4253.3	4255.7	4255.7	4234.0	4234.0	4243.4
Travel Time (Average)	sec	138.1	142.8	163.4	89.4	89.4	113.4
Desired Speed	mph	40.0	40.0	40.0 [5]	40.0 [5]	40.0 [5]	
Route Delay (Average)	sec	61.7	66.4	86.9	13.0	13.0	38.1
Route Stop Rate		2.02	NA	NA	NA	NA	1.21
Route Level of Service (LOS)		LOS C	LOS C	LOS D	LOS A	LOS A	
Speed Efficiency		0.53	0.51	0.44	0.81	0.81	
Travel Time Index		4.72	4.53	3.82	7.85	7.85	
Congestion Coefficient		1.90	1.97	2.25	1.24	1.24	

5 User-Specified Desired Speed

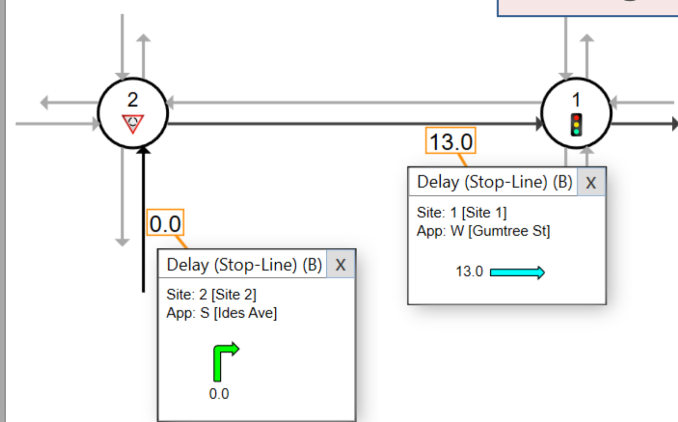
Route Travel Movement Performance

Mov ID	Turn	Mov Class	Trav Dist ft	Midbl. Delay sec	Trav Time sec	Aver. Speed mph	Aver. Delay sec	Prop. Queued	Eff. Stop Rate	Aver. No. of Cycles	Dem. Flow Rate veh/h	Arv. Flow Rate veh/h	Deg. of Satn
Site ID: 2 Site Name: Site 2													
South Approach													
18	R2	All MCs	1674.4	0.0	67.0	17.0	34.5	0.87	1.25	2.16	478	478	0.896
		Light Vehicles	1676.7	0.0	70.9	16.1	38.3	NA	NA	NA	413	413	0.896
		Heavy Vehicles	1676.7	0.0	91.5	12.5	58.9	NA	NA	NA	11	11	0.896
		Buses	1656.5	0.0	32.6	35.0	0.0	NA	NA	NA	22	22	0.045
		Taxis	1656.5	0.0	32.6	35.0	0.0	NA	NA	NA	33	33	0.045
Site ID: 1 Site Name: Site 1													
West Approach													
2	T1	All MCs	2578.9	0.0	71.0	24.8	27.2	0.88	0.76	0.88	803	803	0.631
		Light Vehicles	2579.0	0.0	71.8	24.5	28.0	NA	NA	NA	750	750	0.631
		Heavy Vehicles	2579.0	0.0	71.8	24.5	28.0	NA	NA	NA	10	10	0.631
		Buses	2577.6	0.0	56.8	30.9	13.0	NA	NA	NA	22	22	0.198
		Taxis	2577.6	0.0	56.8	30.9	13.0	NA	NA	NA	22	22	0.198

Movement Class: Light Vehicles



Movement Class: Buses



Bus Route:
Right Turn at Roundabout & Through at Signals

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About Pedestrians in SIDRA (General)

- Modeling pedestrians at Roundabouts, Two-Way Sign Control, Unsignalized (Zebra) Crossings as well as Signalized Intersections and Crossings.
- Pedestrian movement characteristics (crossing speeds, opposing pedestrian factor, etc.).
- Effect of pedestrians on vehicle movement capacity and performance.
- Output reports and displays for vehicles (by Movement Class), pedestrians and persons (as discussed in previous slides).

Source: ITE Journal

Vehicles Yielding to Pedestrian Movements

- **Pedestrians crossing Roundabout Entry Lanes:**
  HCM Method is used (HCM Edition 7, Chapter 22, Section 3, Computation Step 6)
- **Pedestrians crossing Roundabout Exit Lanes: SIDRA method**
- **Midblock Pedestrian Crossings**

Roundabout Pedestrian Effects
Site: Site 5

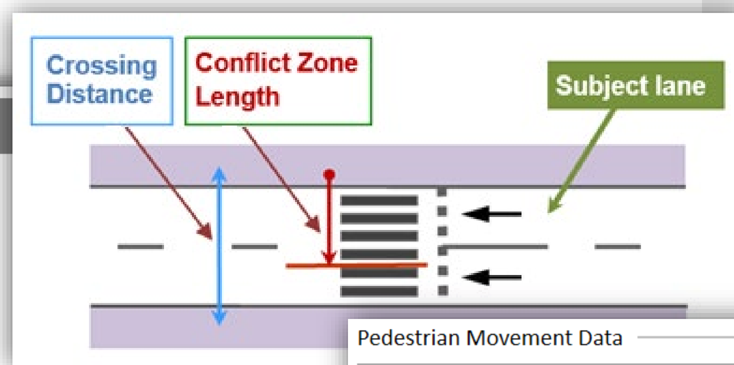
Roundabout Corridor with a Signalised Intersection
Site ID: 5
Roundabout
Peak Flow (Analysis) Period = 15 minutes (Site)

ROUNDABOUT ENTRY

Lane	Turn	Pedestrian Flow Rate ped/h	Adj.Flow Rate ped/h	Opposing Ped.Factor	Circulating Flow Rate veh/h	Circulating Flow Rate pcu/h	Adjustment Factor
South: Sam St							
1	L2	200	200	1.00	385	396	0.892
2	R2	200	200	1.00	385	396	0.892

ROUNDABOUT EXIT

Pedestrian Flow Rate ped/h	Adj.Flow Rate ped/h	Opposing Ped.Factor	Conflict Zone Length ft	Critical Gap sec	Follow-up Headway sec	Exit Lane Capacity veh/h	Exit Flow Total veh/h	Exit Flow Average veh/h/lane
South: Sam St								
200	200	1.00	16.00	3.72	2.23	1393	352	352



Pedestrian Movement Data

	Full Crossing
Movement ID	2P
Crossing Distance	
Conflict Zone Length	Program
Opposing Pedestrian Factor	1.0
Practical Degree of Saturation	Program
Walking Speed (Average)	4.3 ft/sec

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2. Multimodal Gap Acceptance Capacity Model in SIDRA

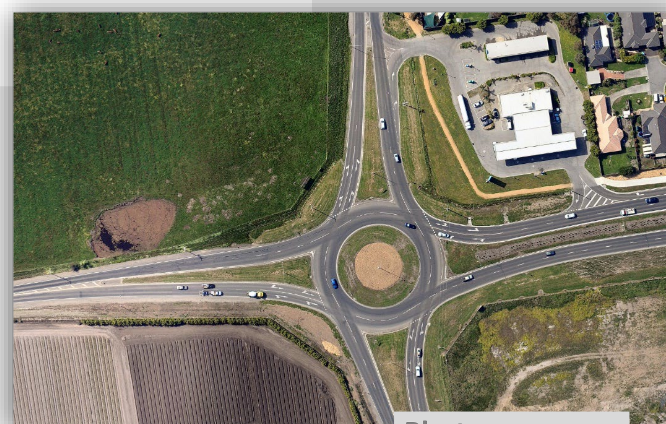


Photo: *nearmap*

Multimodal Gap Acceptance Capacity Method (Gap acceptance by Movement Class)

SIDRA Method

- A unique gap acceptance capacity model by gap acceptance cycles is used.
- The gap acceptance capacity model applies the Critical Gap and Follow-up Headway parameters to each Movement Class separately.
- For lanes that include more than one Movement Class, the shared lane capacity equation is used to combine the Movement Class capacity values for the lane.
- The model enhancement applies to all gap acceptance situations (roundabouts, sign control, signals, pedestrian crossings).
- This method replaced the use of flow-weighted average values of critical gap and follow-up headway values of Movement Classes to calculate the shared lane capacity.

AKÇELIK, R. (2018). Gap Acceptance Cycles for Modelling Roundabout Capacity and Performance. Paper presented at the 15th Scientific and Technical Conference, Transport Systems - Theory and Practice, Silesian University of Technology, Katowice, Poland

Vehicle Movement Class Effects

Gap Acceptance Factor

In the SIDRA model, this adjusts the Critical Gap and Follow-up Headway values for Opposed Movements.

Opposing Vehicle Factor

This adjusts the Opposing / Circulating Flow Rate to a pcu value (limited to LVs and HVs in the HCM model)

Explained in the next slide

Movement Class	Site Type	SIDRA Standard Model		SIDRA HCM Model	
		Gap Acceptance Factor	Opposing Vehicle Factor	Gap Acceptance Factor	Opposing Vehicle Factor
Light Vehicles	All Site types	1.0	1.0	1.0	1.0
Bicycles	All Site types	1.0	0.5	1.0	0.5
Heavy Vehicles, Buses	Signals	1.5	1.5	2.0	2.0
	Roundabout			2.0	2.0
	TWSC			1.3	1.3
	AWSC			1.5	1.5
Large Trucks, Light Rail / Trams	Signals	2.5	2.5	3.0	3.0
	Roundabout			3.0	3.0
	TWSC			2.0	2.0
	AWSC			2.3	2.3

Movement Class Effects in SIDRA and HCM models

The SIDRA method applies the Gap Acceptance Factors to the Follow-up Headway for each Movement Class first. It uses them in the capacity equation applied for each Movement Class. Options are available to select the capacity equation to use.

The Movement Class capacity values are combined for the lane (shared lane formula).

Unlike the SIDRA method, the HCM method calculates the entry lane capacity, Q for Light Vehicles (in passenger car equivalents, pce), and then adjusts it for Heavy Vehicles only:

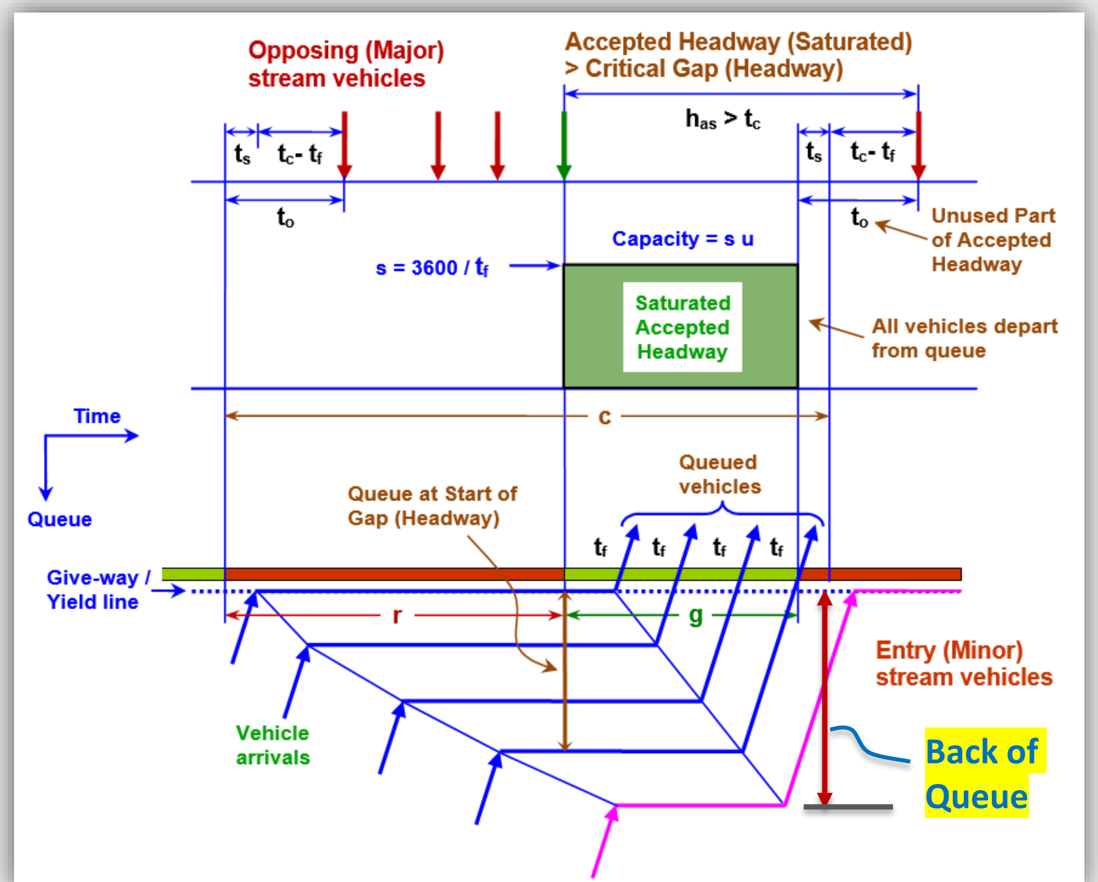
$$Q = f_{HVe}\, f_p\, A\, exp(-B\, q_m)$$

where parameters A and B are related to follow-up headway (t_f) and critical headway (t_c) parameters: $A = 3600 / t_f$ and $B = (t_c - 0.5\, t_f) / 3600$.

Parameter f_{HVe} is a flow-weighted average of *Gap Acceptance Factor* values of Light and Heavy Vehicles in the lane.

Parameter q_m is the opposing (circulating or exiting) flow rate in pce/h (adjusted using *Opposing Vehicle Factor* values of Light and Heavy Vehicles in the circulating or exiting stream).

Gap Acceptance capacity model by gap acceptance cycles (basis of the SIDRA Standard method)



- Used for the Back of Queue model
- Recent research developing a gap acceptance survey based on gap acceptance cycles (report in review)

t_f = Follow-up Headway (sec)

t_c = Critical Headway (sec)

t_s = Lost Time (sec)

$s = 3600 / t_f$ = Saturation Flow (veh/h)

r = Effective Blocked Time (sec)

g = Effective Unblocked Time (sec)

c = Gap Acceptance Cycle Time (sec)

u = g / c = Unblocked Time Ratio

Q = s u = Capacity

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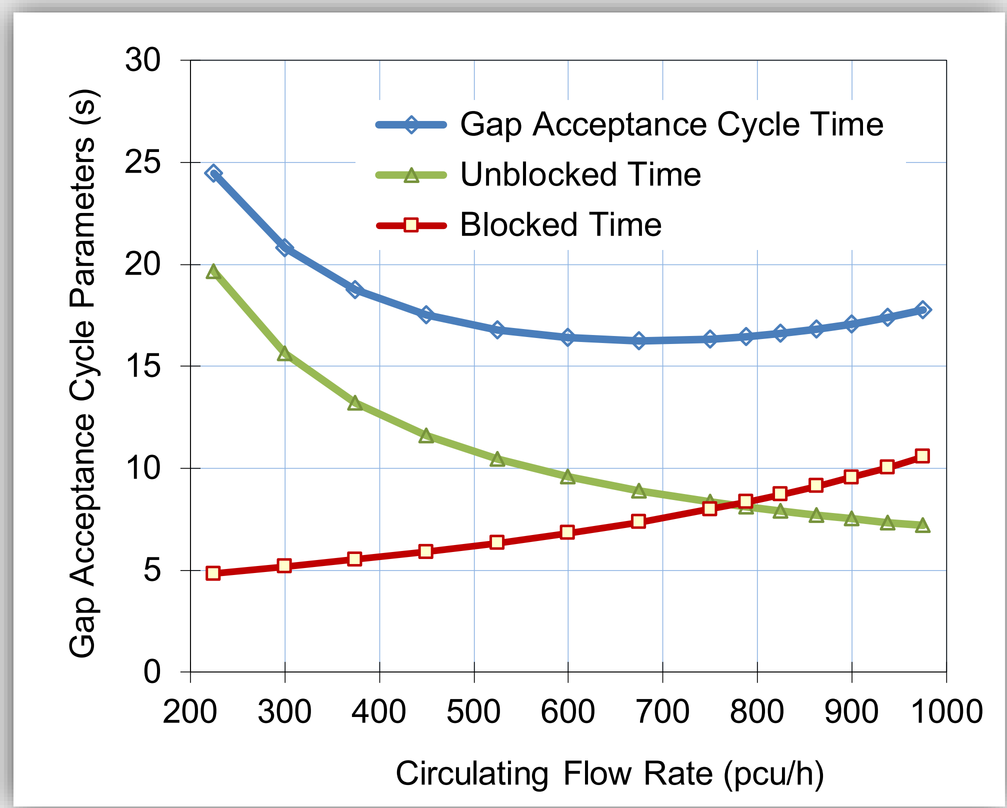
Gap acceptance cycle parameters

Blocked and unblocked times and the **gap acceptance cycle time** as a function of the circulating flow rate for the case of arrival flow rate of 300 veh/h



SIDRA Multimodal Roundabout Capacity and Performance Method

3. SIDRA Roundabout analysis method features relevant to "gaps in HCM" (includes: HCM Edition 6 Extended Roundabout Capacity Model)

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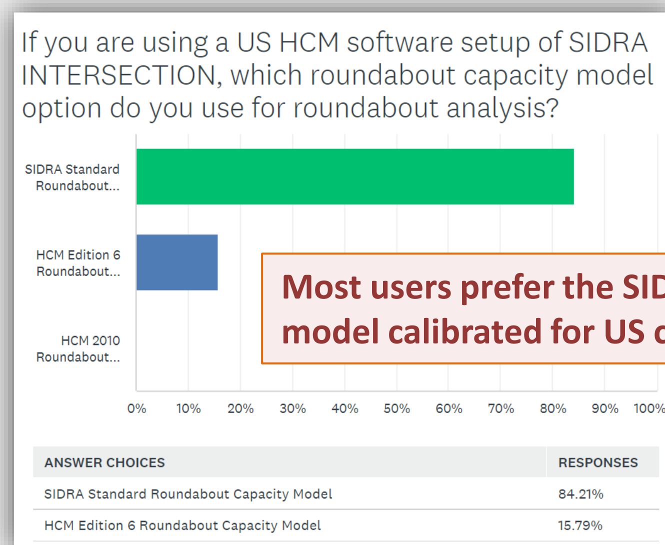
SIDRA for HCM

Refer to:
https://www.sidrasolutions.com/software/sidra-intersection/highway-capacity-manual-hcm-sidra-intersection

The most popular roundabout analysis software in the USA

According to the TRB document Roundabout Practices, A Synthesis of Highway Practice (NCHRP SYNTHESIS 488), SIDRA INTERSECTION is the most widely-used software tool in the USA for roundabout analysis.

[Download from https://www.nap.edu]



Most users prefer the SIDRA Standard model calibrated for US conditions

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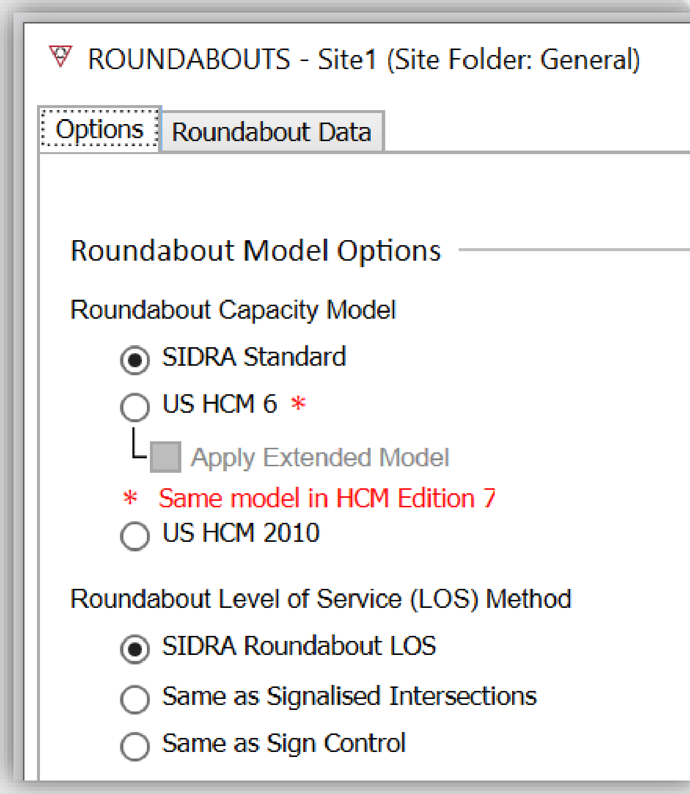
Methods used in SIDRA (not in the HCM)

- **Lane-based** Intersection and Network modelling
- **Back of Queue** model for **all traffic control types**
- Effect of **roundabout geometry** on capacity
- **Geometric Delay** method
- **Capacity constraint** for oversaturated lanes
- **Unbalanced flow** conditions
- **Short Lane** modelling of complex cases
- **Vehicle path** model for stop-start traffic (**emissions**, fuel consumption, operating cost models)
- **Movement Classes** (as explained in previous sections)



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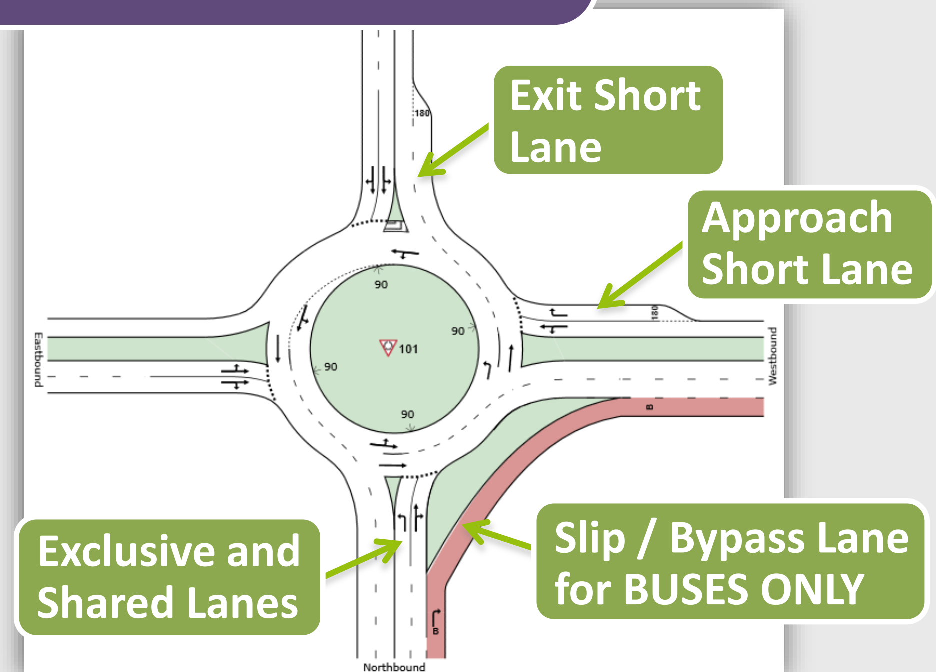
Lane-based model with approach and exit short lanes

LANE-BASED MODEL

More realistic and reliable than modeling by approaches and lane groups.

- **General:**
  Unequal lane flows, De facto exclusive lanes, Short lanes, Slip/Bypass lanes
- **Roundabouts:**
  Unequal circulating lane flows, Dominant and Subdominant lanes
- **NETWORK (Corridor) Model:**
  Lane back of queue, lane blockage, capacity constraint, midblock lane changes, signal platoon arrival and departure patterns, extra bunching

Individual approach, exit and circulating lanes have different characteristics



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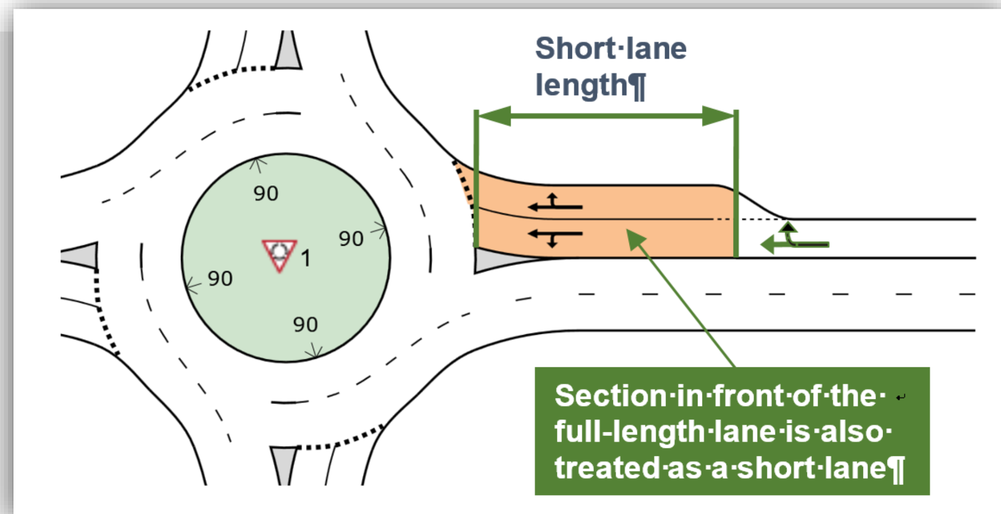
Short Lane Capacities at Roundabouts

- Capacities are reduced after short lane queues are discharged at signals with long green times and long signal cycles.
- In contrast, short gap acceptance cycles at roundabouts and two-way sign control give large short lane capacities.
- Unique Back of Queue and Gap Acceptance Cycle models are used in SIDRA INTERSECTION.
- The model is flow-dependent rather than pure geometric model of FLARES in the UK (TRL) model.



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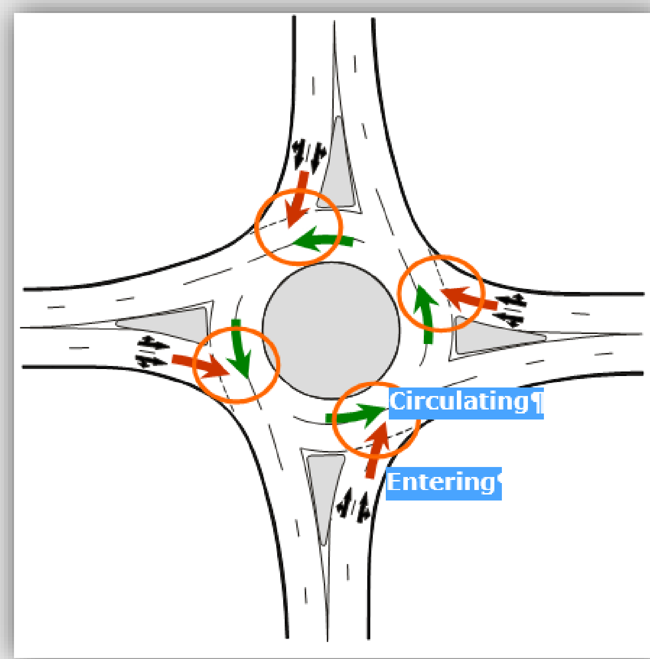
Capacity model with roundabout approach interactions

Roundabout is analyzed as a closed system with interactions among roundabout entries

NOT as series of T intersections ...

- Capacity constraint
- Bunched headway distribution model for the circulating flow
- Unbalanced flow conditions
- Lane balance of circulating flow rates

Not in the HCM.



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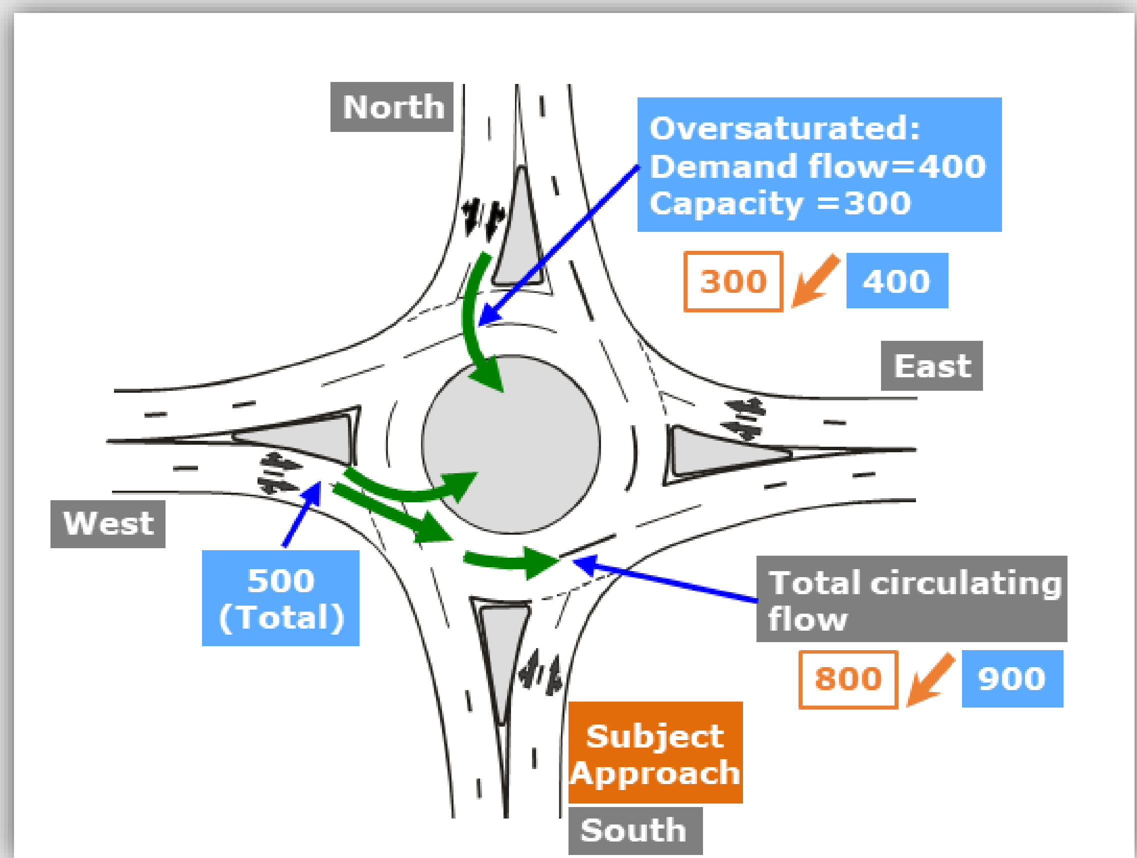
Capacity Constraint



NOT in the HCM Roundabout Capacity Model

Capacity Constraint:

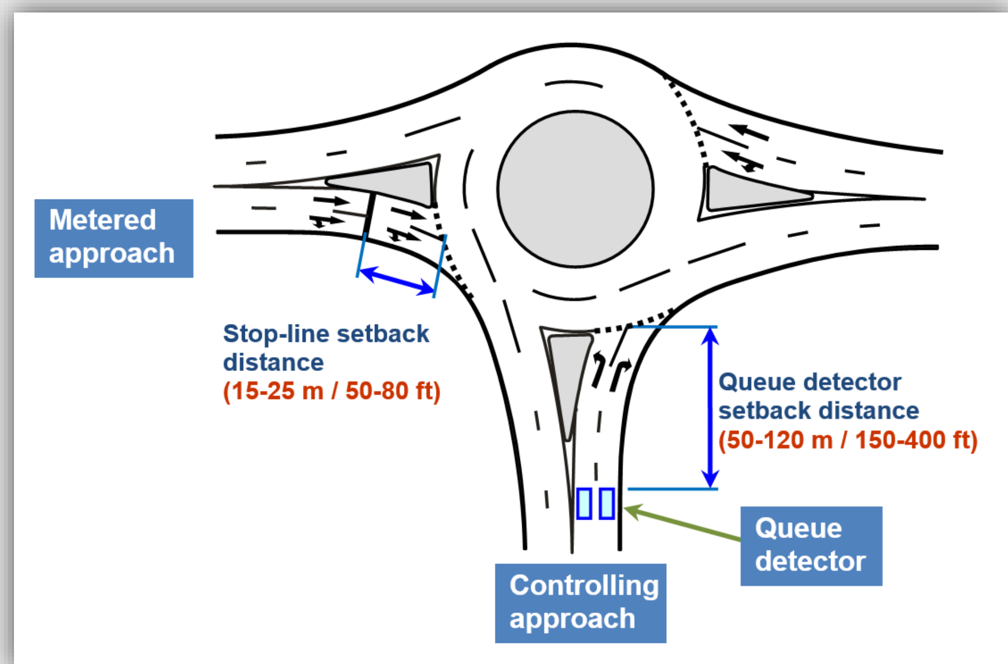
Circulating flow rate is reduced if any upstream entry lane is **oversaturated**, i.e. **demand exceeds capacity** and therefore **Entry Flow Rate = Capacity**.

Example:
Circulating flow for South approach = 500 + **300** = **800** (reduced due to **capacity constraint**)

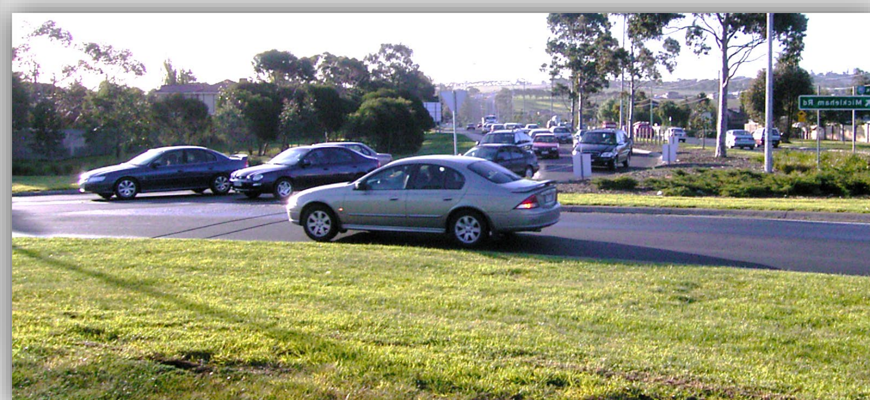
Roundabout Metering Signals

Congestion caused by **UNBALANCED flow patterns** at roundabouts can be alleviated using metering signals

NOT in the HCM



AKÇELIK, R. (2011). **Roundabout metering signals: capacity, performance and timing.** Paper presented at the 6th International Symposium on Highway Capacity and Quality of Service, Transportation Research Board, Stockholm, Sweden.
www.sidrasolutions.com/publications



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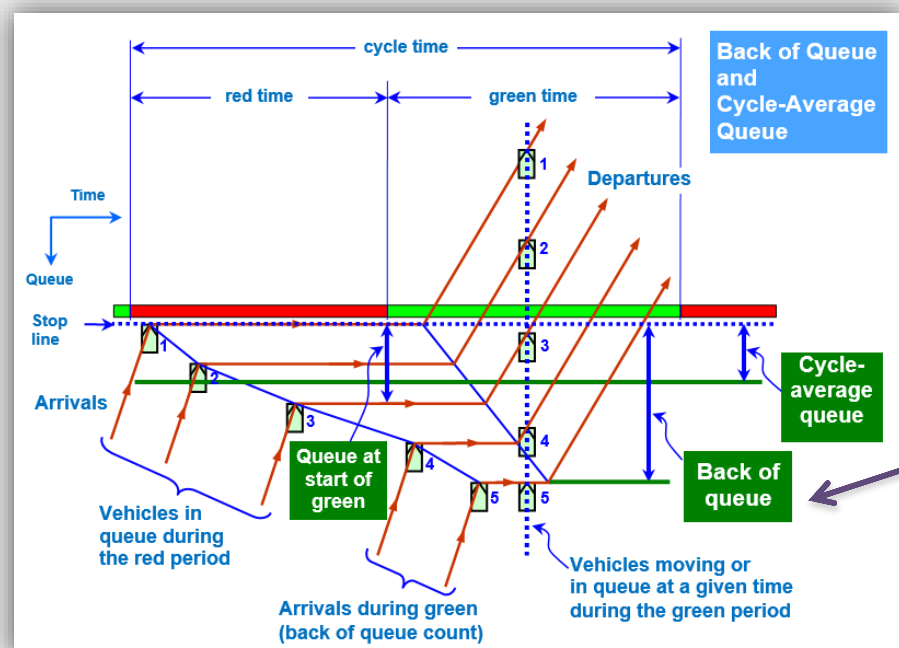
Importance of Back of Queue model

MODEL CONSISTENCY for different intersection types (definition of **Delay**, **Back of Queue**, **Stops**, etc).



NOT in the HCM

Gap-acceptance cycles method helps to model **Back of Queue** and **Stops** for Roundabouts and Sign control.

Back of Queue important for **Short Lane** and **NETWORK** Modeling

Back of Queue Percentile and **Probability of BLOCKAGE** values are based on Back of Queue estimates for individual lanes

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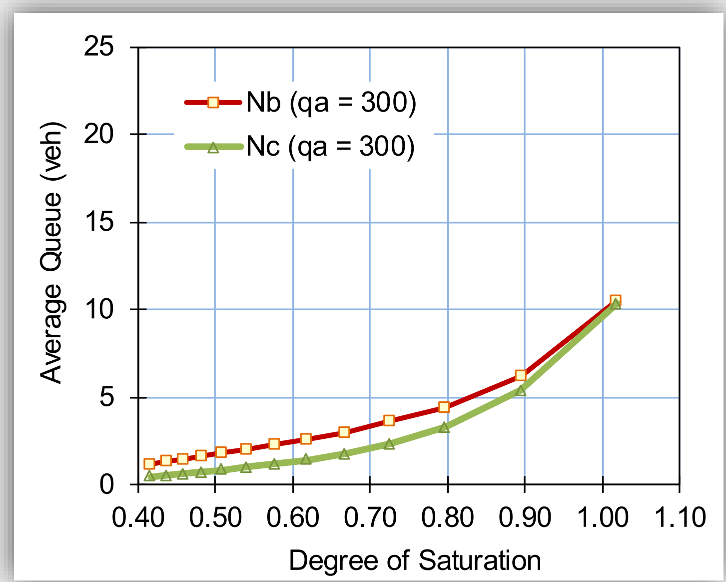
Comparison of Back of Queue and Cycle-Average Queue

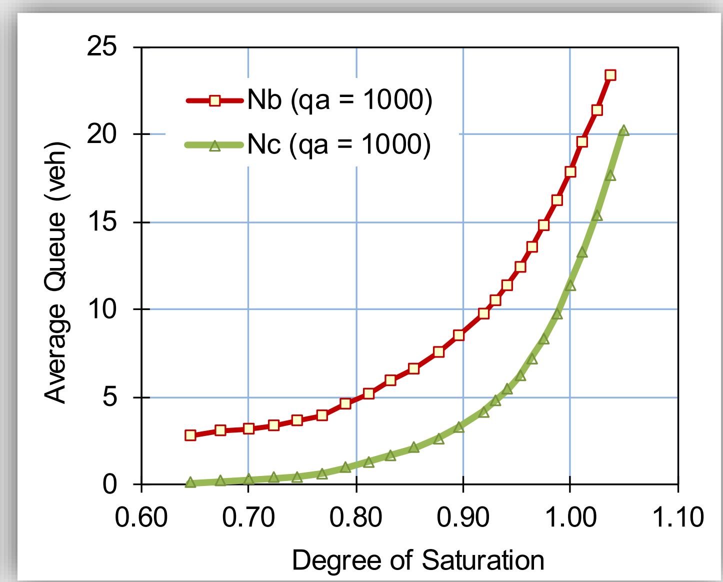
The difference between the values of average back of queue and cycle-average queue increases with increasing arrival flow rate.

For roundabouts and sign control, HCM uses:

Cycle-Average Queue = Arrival Flow Rate x Average Delay.

Average Back of Queue (Nb) and Cycle-Average Queue (Nc) as a function of the degree of saturation.





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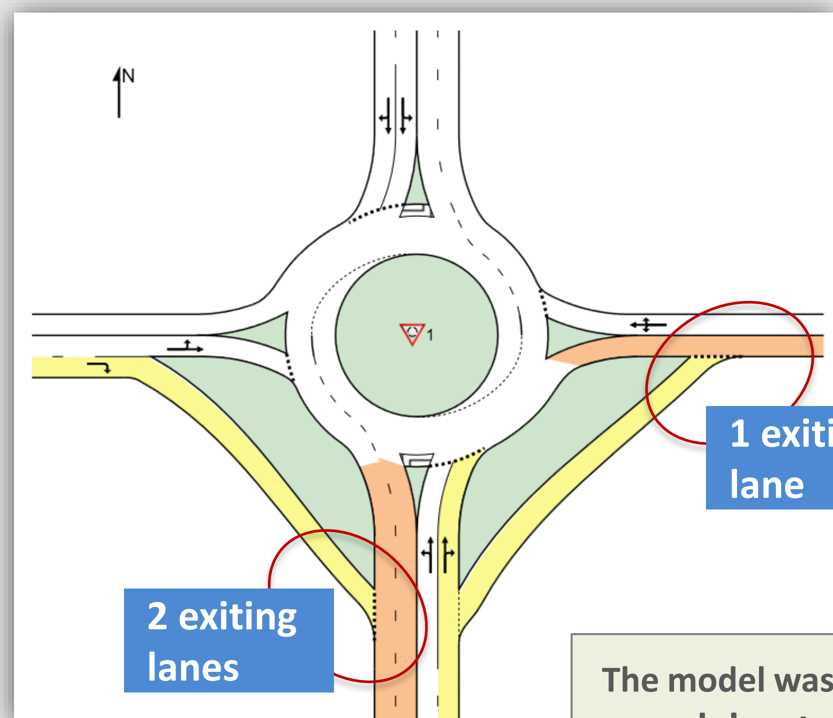
HCM Edition 6 Extended Roundabout Capacity Model



SIDRA HCM 6 Extended roundabout capacity model provides the ability to specify more detailed parameter values that **distinguish different lane configurations.**
(including three-lane entries).

This has an advantage over the HCM 6 model in providing the ability to calibrate **SLIP/BYPASS LANE capacities independently of entry lane capacities.**

The model was developed for SIDRA INTERSECTION based on the results of roundabout surveys carried out by Wisconsin DOT.

CAMPBELL, J.R., OLSSON, S.M and STERNKE, C.R. (2021). Using Vehicle Tracking Software to Validate Roundabout Capacity Models. ITE Journal 91 (12), pp 43-49.

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4. SIDRA Site and Network Templates for Roundabouts

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Site and Network Templates for Roundabouts

Site templates

- MUTCD Roundabouts
- Raindrop Roundabout
- Turbo Roundabout
- Pedestrian Hybrid Beacon (PHB) Crossing

Network Templates

- Double Roundabout Interchange
- Double Teardrop Roundabout
- Roundabout with Signalised Pedestrian Crossings
- Roundabout with Zebra Pedestrian Crossings
- Divergabout
- Roundabout with Bicycle Circle (Dutch Roundabout)

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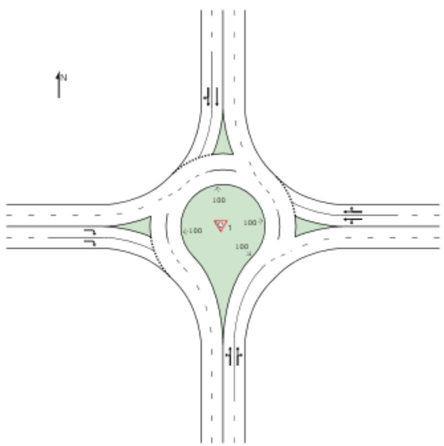
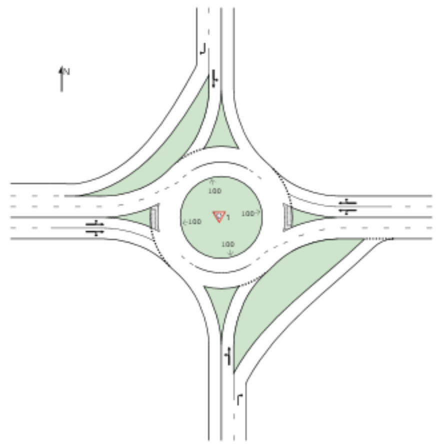
SIDRA Site Templates for Roundabouts

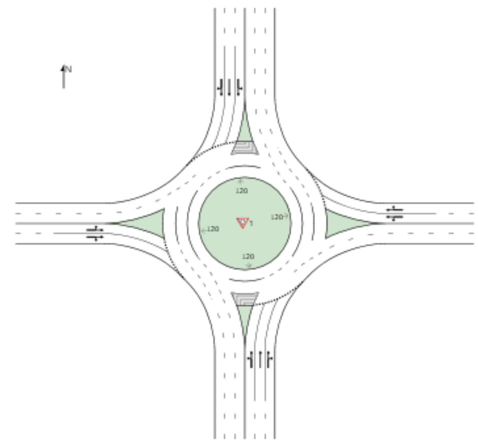
Raindrop Roundabout US
Roundabout with Raindrop (Teardrop) Design



Rou 4-way 2-Lane with Bypass Lanes US
Roundabout with give-way / yield and continuous slip / bypass lanes (1 & 2-lane circu...



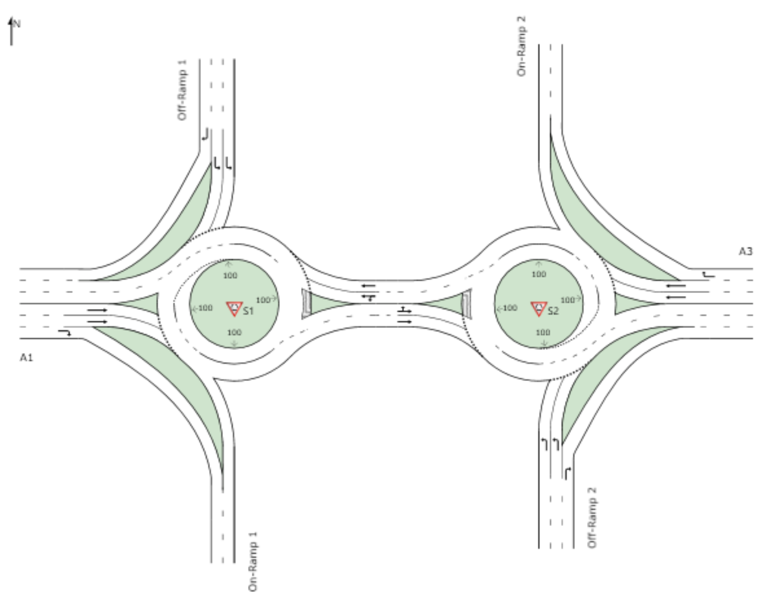
Rou 4-way 2&3-Lane US
Roundabout with 2 & 3-lane approaches and circulating road



SIDRA Network Template Examples for Roundabouts

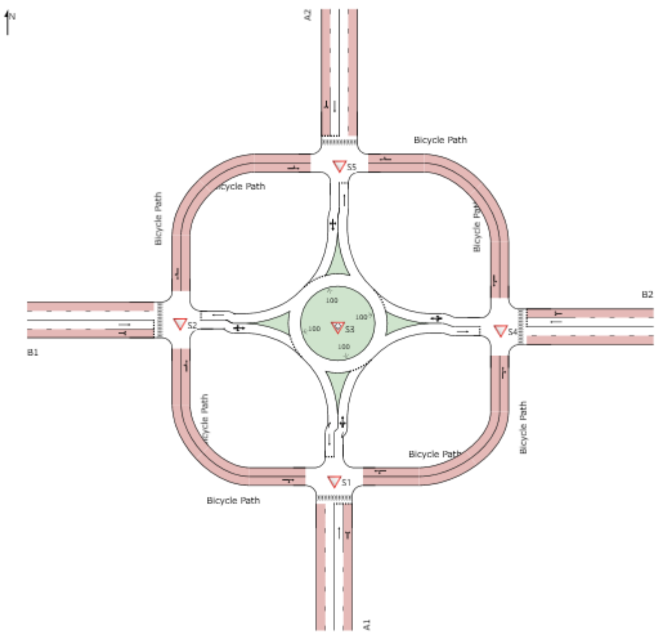
Double Roundabout Interchange US

Double Roundabout Interchange



Roundabout with Two-Way Bicycle Circle US

One-Lane Roundabout with Two-Lane Two-Way Bicycle Circle
Also referred to as Dutch Roundabout



SIDRA SOLUTIONS

SIDRA Multimodal Roundabout Capacity and Performance Method

5. A detailed study of the HCM exponential roundabout capacity model with suggested addition of geometry effects

SIDRA SOLUTIONS

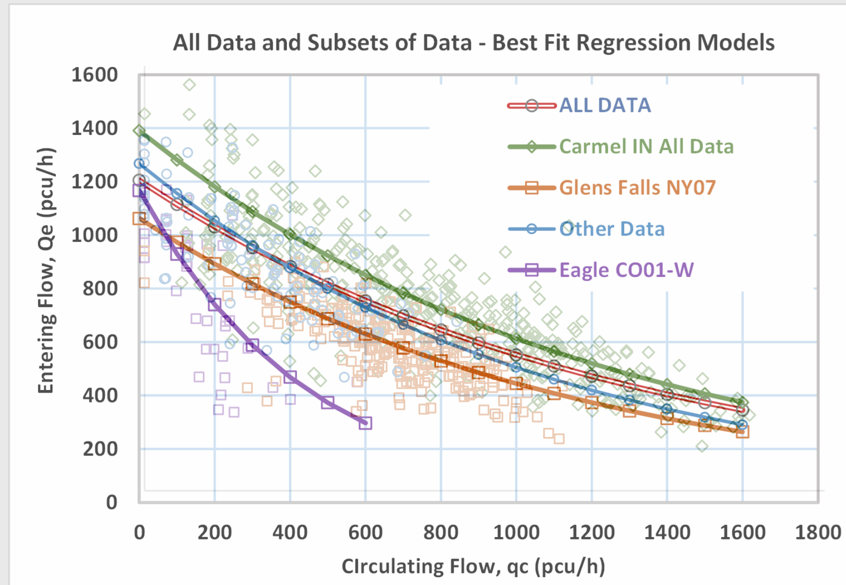
A study of the HCM Edition 6 roundabout capacity model

We conducted a detailed study of the HCM exponential (Siegloch M1) and linear roundabout capacity models.

Two reports and the Roundabout Conference 2022 presentation are available for download from http://www.sidrasolutions.com/Resources/Articles

AKÇELIK, R., SHIRKE, C., BESLEY, M., ESPADA, I. and BILLINGHURST, D. (2022). A Comparative Analysis of Exponential and Linear Roundabout Capacity Models Using HCM Research Data. Technical Note. Akcelik & Associates Pty Ltd, Melbourne, Australia.

AKÇELIK, et al (2022). A Comparative Analysis of Exponential and Linear Roundabout Capacity Models Using HCM Research Data. Presentation at TRB 6th International Conference on Roundabouts, Monterey, California, USA, 15-18 May 22.



SIDRA SOLUTIONS

HCM model with a Basic SIDRA Geometry Method

Alternative model calibration methods were applied to the HCM (Siegloch M1) Exponential model with a new Basic SIDRA Geometry Method added and the TRL-Kimber Linear model with geometry parameters.

The original estimates from these models are referred to as default models.

Basic SIDRA Geometry Method

Follow-up headway: $t_f = f_e \, f_a \, f_r \, t_f'$

Critical gap (headway): $t_c = 1.8 \, t_f$

Average roundabout geometry parameters were used in the analyses.

Environment (Calibration) Factor, default: $f_e = 1.05$ (single lane roundabout)

Entry Angle Adjustment Factor: $f_a = 0.94 + 0.000026 \, \phi_e^{1.6}$

Entry Radius Adjustment Factor: $f_r = 0.95 + 3.28 / r_e$

Unadjusted Follow-up Headway (seconds): $t_f' = 3.18 - 0.0061 \, D_i + 7.8\text{x}10^{-6}$

ϕ_e: entry angle (degrees), r_e: entry radius (feet), D_i : inscribed diameter (feet).

Best fit and anchored regression models

The capacity estimates from anchored regressions indicate that the exponential model estimates can stay close to the best fit regression estimates for medium to high circulating flows.

The reducing slope of the exponential model helps it to adopt to the changes in the observed data. Results show small increases in RMSE values for the anchored regressions for the exponential model.

Further research needed.

	A	B	t_f	t_c	t_f / t_c	RMSE	
Exponential (Siegloch M1)	1205	0.00078	2.988	4.302	0.695	180	
A (t_f) parameter anchored							Increase in RMSE
Exponential (Siegloch M1)	1384	0.00099	2.601	4.865	0.535	191	5.7%
Exponential model with SIDRA Geometry							
SIDRA Geometry default, f_e = 1.05	1363	0.000954	2.641	4.755	0.556	188	4.6%
Calibrated: f_e = 1.07	1337	0.000972	2.693	4.845	0.556	187	3.6%

A study of the HCM Edition 6 roundabout capacity model
Main Conclusions - 1

Roundabout geometry types

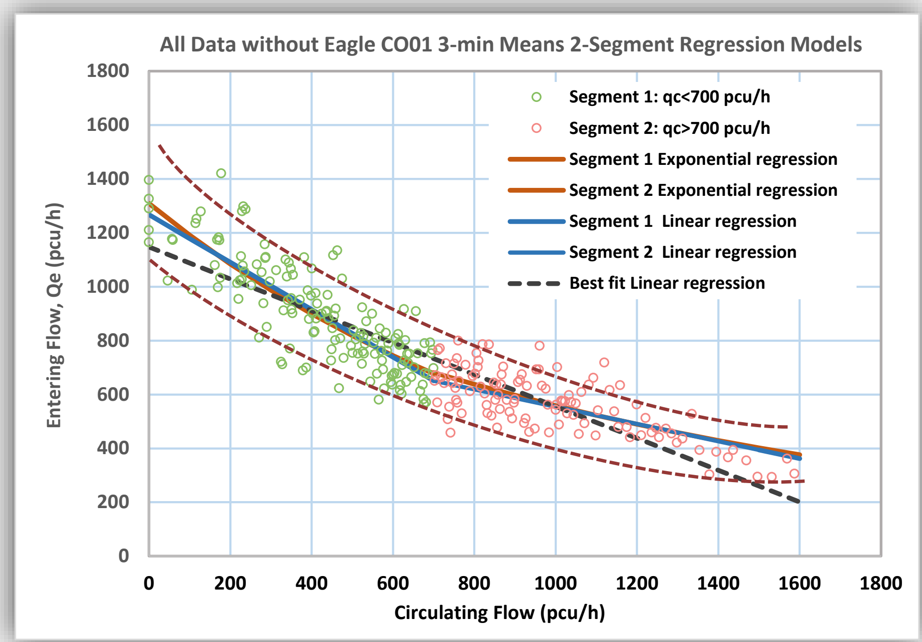
Analyses of calibration methods for subsets of data using both the **HCM (Siegloch) exponential capacity model with the Basic SIDRA Geometry Method added** and the **TRL-Kimber model** supported the finding by Johnson and Lin (2018) that roundabout geometry parameters may have a combined (aggregate) effect on capacity of different **roundabout geometry types**.

A study of the HCM Edition 6 roundabout capacity model
Main Conclusions - 2

Our preferred model

The **assessments from various perspectives** conducted using the **HCM single-lane roundabout capacity research data** reported in our reports demonstrate the **non-linear characteristic of roundabout capacity data**.

They are found to **support the HCM exponential (non-linear) roundabout capacity model** over the **linear model form** which has **shortcomings in estimating capacity at low and high circulating flows**.



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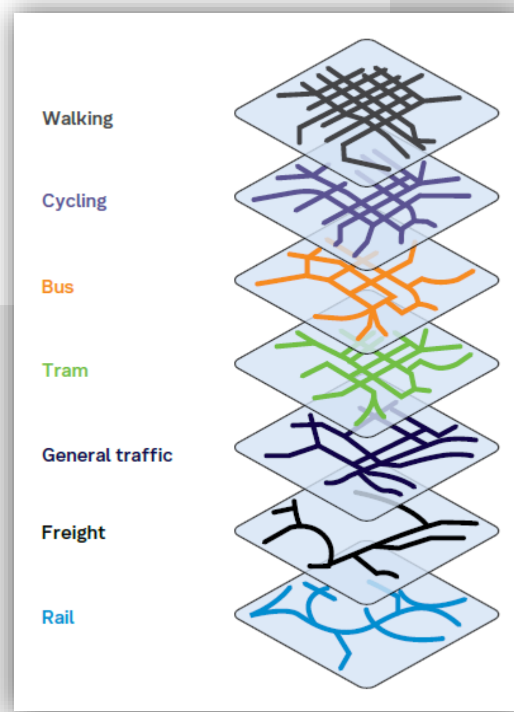
6. Movement and Place



SIDRA SOLUTIONS

About this presentation

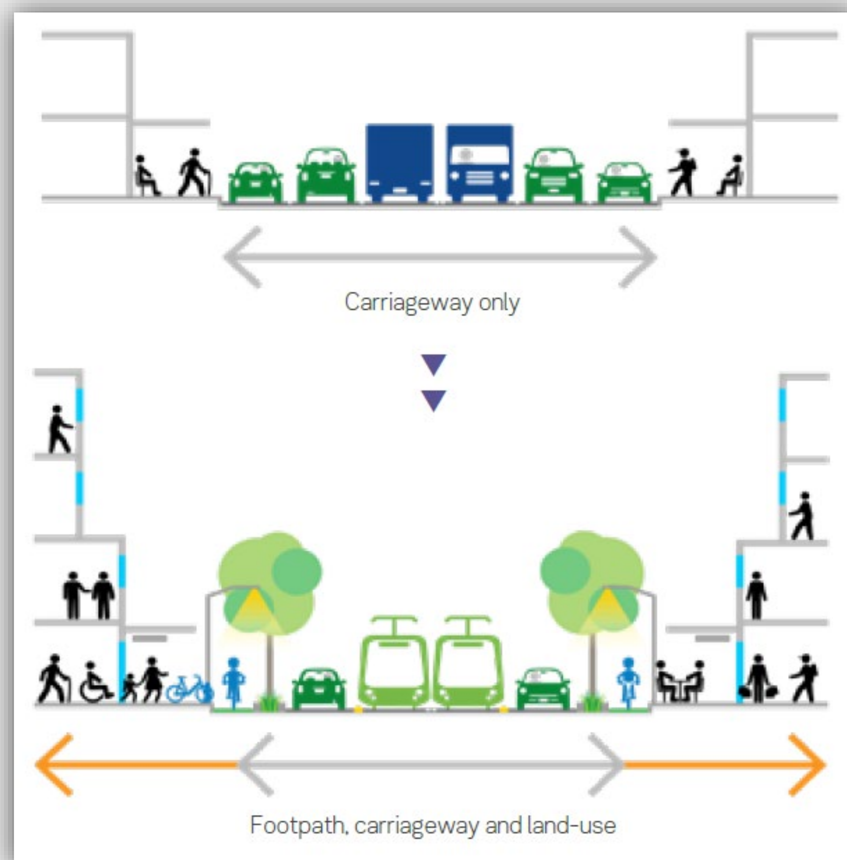
" From Functional Classification ...

Still in use today, functional classification systems group roads and streets by their capacity to keep vehicles moving.

... to a Movement and Place approach

The Movement and Place Framework takes a future-focused, multi-modal approach to network planning. It takes into consideration the diverse role places play in planning the types of transport modes appropriate to a local road or street.

In this language, roads and streets are defined by the context of a local place and assigned various 'movement' and 'place' classifications. "



Source: DOT Victoria (2019). ***Movement and Place in Victoria***.

Movement and Place

A "Place" (a shopping strip) in Melbourne, Australia as indicated by 40 km/h speed sign

DOT Victoria (2019). Movement and Place in Victoria. Department of Transport, Melbourne, Victoria. Developed in partnership with VicRoads.

TfNSW (2023). Design of roads and streets - A guide to improve the quality of roads and streets in NSW (Movement and Place). Transport for NSW, NSW Government.

END OF PRESENTATION

Thank you!