NTNU
Traffic Engineering
Research Centre

Some other Nordic challenges (intro to discussion)

SIDRA User meeting

Thon Hotel Vika Atrium, Oslo, 03.09.2018

Arvid Aakre

Traffic Engineering Research Centre

Department of Civil and Environmental Engineering, NTNU

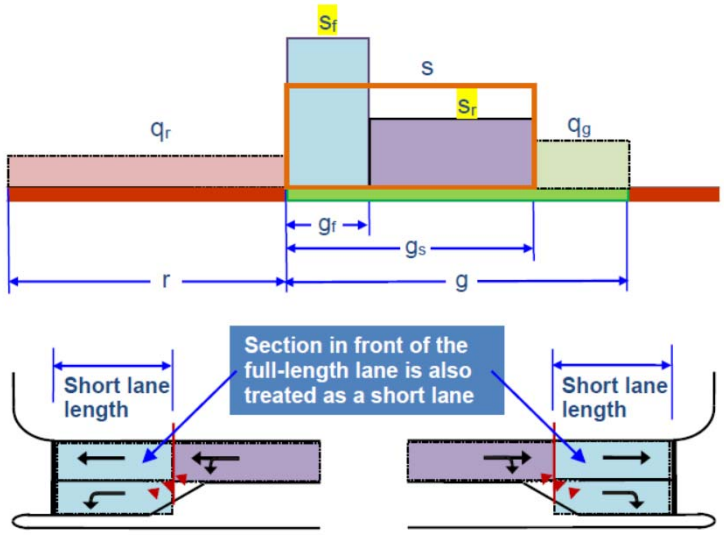
E-mail: arvid.aakre@ntnu.no

Content

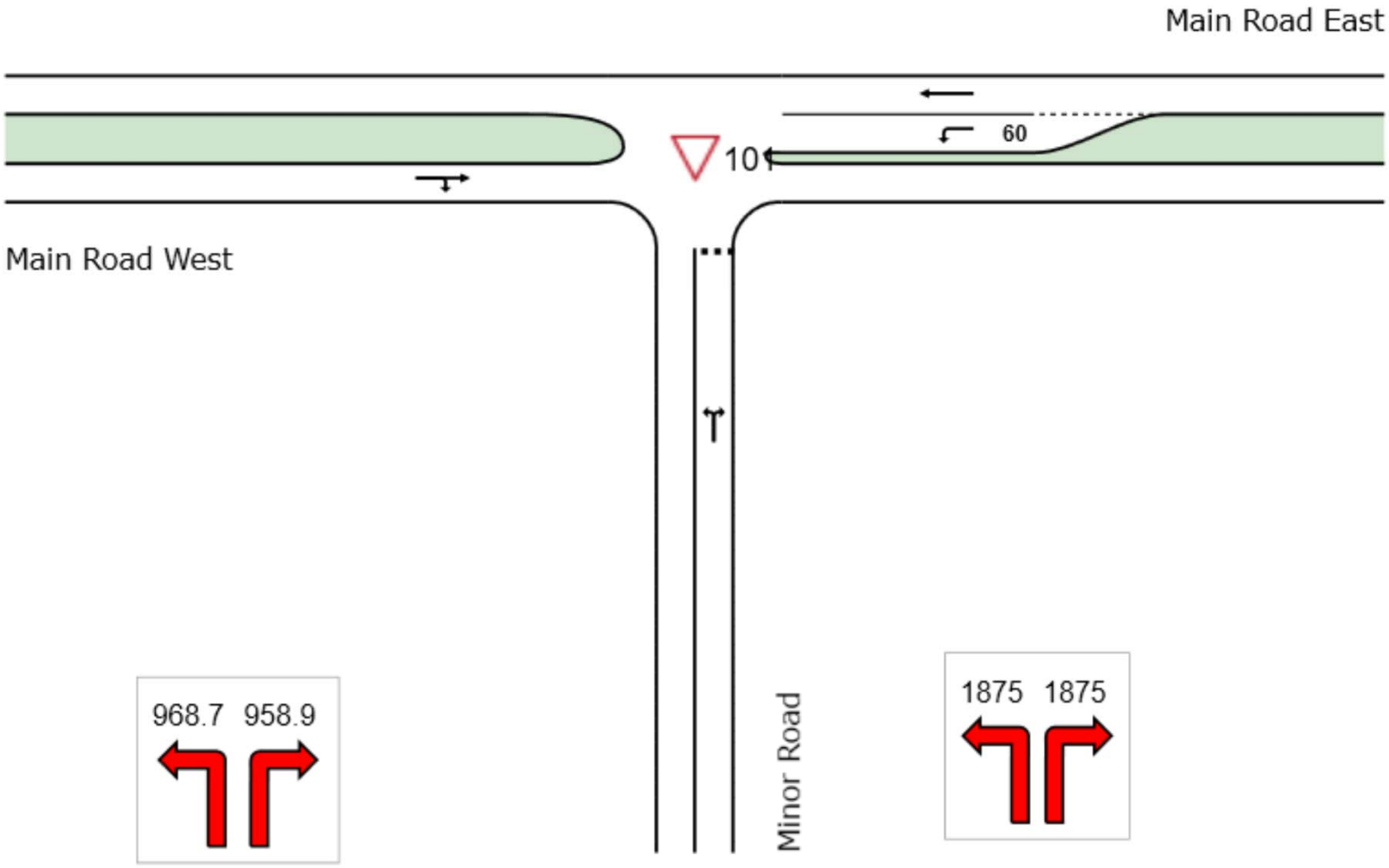
- Short lane modelling
- Zipper merge and driver behaviour
- New intersection types (Alternative intersections)
- Environmental impacts and modelling
- Priority and results by movement class
- Need for a Norwegian user model
- Default and recommended values, user defined templates etc
- Some other factors

Short lane modelling in SIDRA

- Short lane modelling in SIDRA follows in general a good procedure
- The queue discharge model for signalized short lanes seems to follow a logic system (see below)
- But in my opinion there are some problems at priority intersections (see example on the following pages)



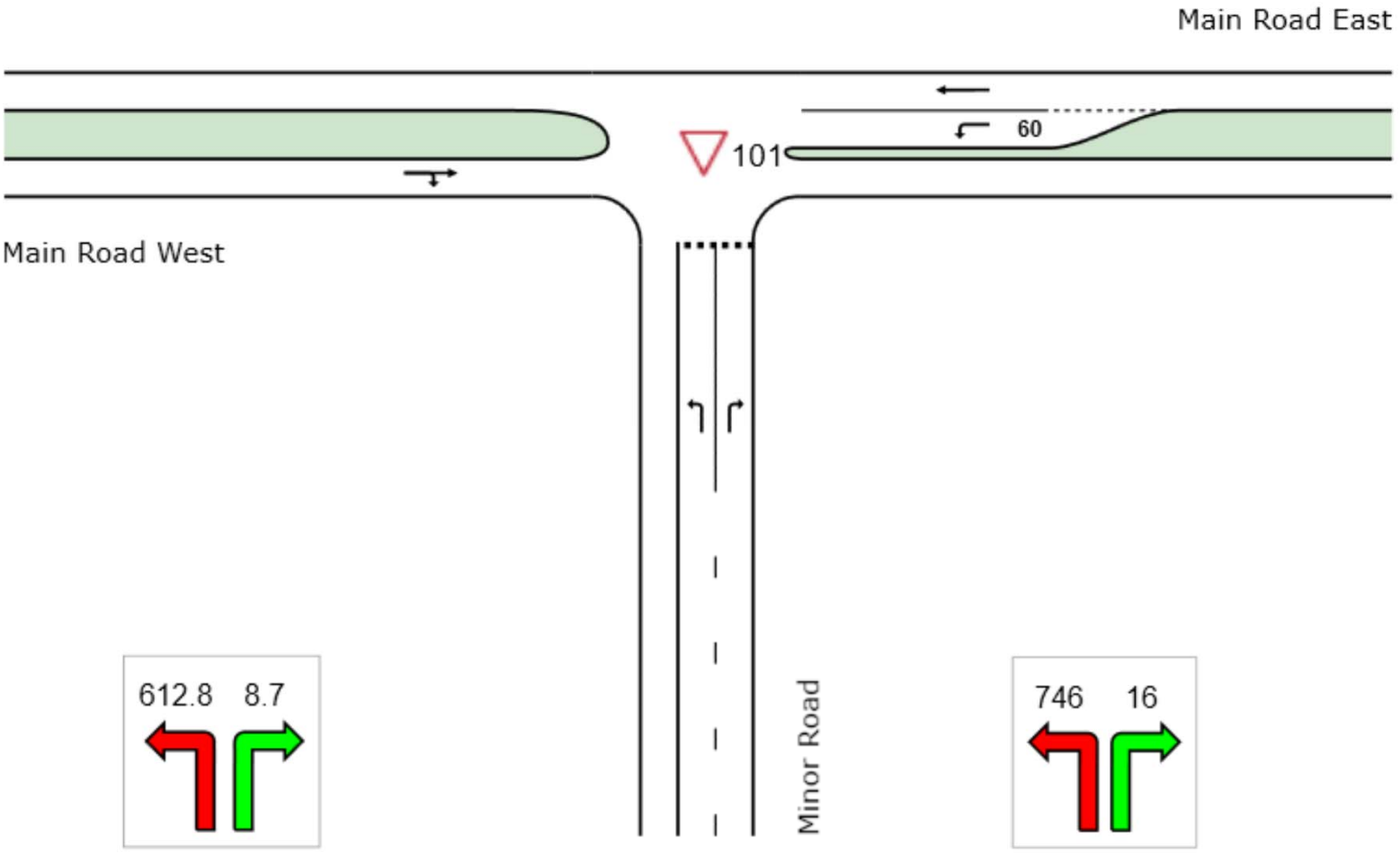
A single lane on minor road



Avg delay [sec]

95 % back of queue [m]

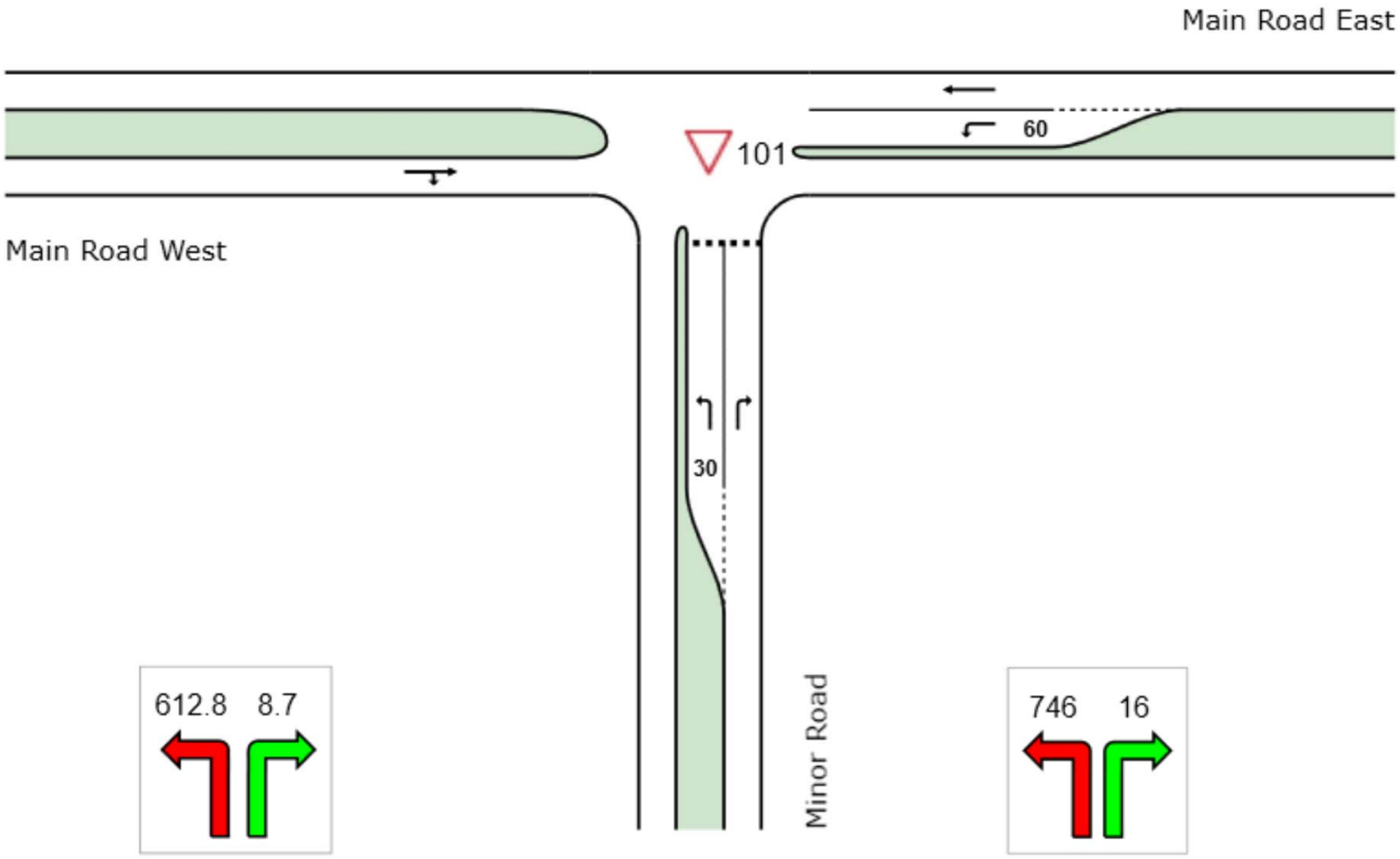
Two lanes on minor road



Avg delay [sec]

95 % back of queue [m]

Short left turn lane will give strange results ?



Avg delay [sec]

95 % back of queue [m]

Zipper merge

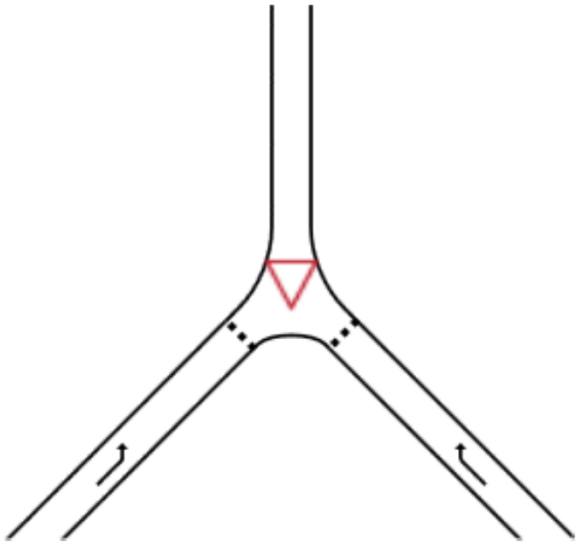
- Nearly all merging of traffic movements in Norway is done as **zipper merging**
  - Lone drop from 2 to 1 lane
  - Entry to a main road with acceleration lane
  - Other merging situations

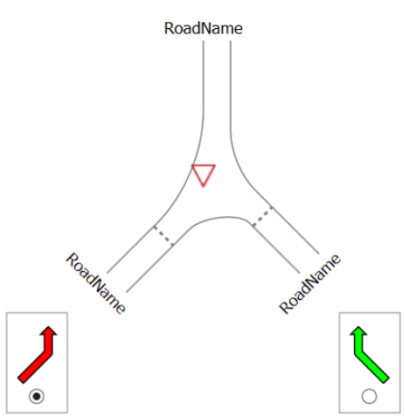
- The lanes have equal rights; 50/50 priority

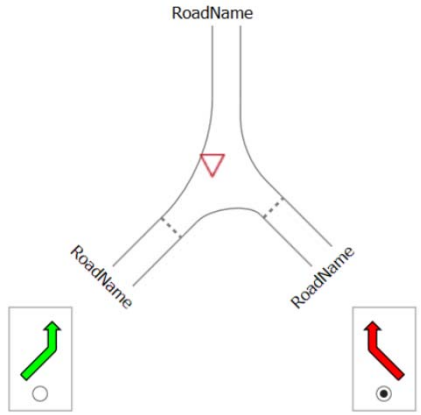
- The merging should be made within a certain area

Zipper merge and driver cooperation

- Zipper merge with 50/50 priority is hard to model in SIDRA
- SIDRA likes to define priorities between different movements
- How could this be modelled? Both flows give way to eachother
- What values could be used for critical time gap and follow-up time?







New types of intersections

- There are many new intersection types and principles available, for example:
  - Turbo roundabouts
  - ThrU-Turn Intersection
  - Displaced Left-turn intersection (DLT)
  - Median U-turn Intersection (MUT)
  - Restricted Crossing U-turn (RCUT)
  - Town Center Intersections
  - Quadrant Intersections
  - Diverging Diamond Intersection (DDI)
  - Continuos Flow Intersection (CFI)

- SIDRA is quite flexible, and it is usually possibel to model these new types of intersections

- But we need to get more experience on such modelling

Some master thesis about new intersections

Environmental impacts and modelling

- SIDRA has a power based model for calculation of fuel consumption and emissions

- Even if these models are «updated and calibrated for modern vehicles in 2014», there are large differences from country to country

Parameter	Description	Unit for Fuel	Unit for Emissions	Veh. Class	Fuel	CO	HC	NO_x
f_i	**Idling Rate** (fuel consumption or emission rate during idling) $f_i = 3600\ \alpha$	mL/h	mg/h	LV	1200.0	1620.0	340.0	300.0
				HV,TR	2300.0	25000.0	3000.0	44000.0
				B	2100.0	12000.0	6800.0	49000.0
A	**Drag Parameter** (drag fuel consumption or emission parameter, mainly related to rolling resistance) $A = 1000\ c_1$	mL/km	mg/km	LV	16.0	-138.0	-9.0	-14.0
				HV,TR	200.0	320.0	1.00	2820.0
				B	180.0	240	-5.00	350.0
B	**Drag Parameter** (drag fuel consumption or emission parameter mainly related to aerodynamic drag) $B = c_2 / 0.01296$	$(mL/km)/(km/h)^2$	$(mg/km)/(km/h)^2$	LV	0.00400			
				HV,TR	0.00900			
				B	0.00050			
β_1	**Efficiency Parameter**	mL/kJ	mg/kJ	LV	0.1000			
				HV,TR	0.0750			
				B	0.0900			
f_{CO2}	**CO_2 to Fuel Consumption Rate**	g/mL		LV				
				HV,TR, B				

M_v	Average vehicle mass	kg (lb)	Light Vehicles (LV)	1,600 (3,500 lb)
			Heavy Vehicles (HV)	15,000 (33,000 lb)
			Buses (B)	8,000 (18,000 lb)
			Bicycles (C)	90 (200 lb)
			Large Trucks (TR)	38,000 (84,000 lb)
			Light Rail / Trams (LR)	36,000 (80,000 lb)
P_{max}	Maximum Power	kW	Light Vehicles (LV)	120
			Heavy Vehicles (HV)	170
			Buses (B)	170
			Bicycles (C)	0.30
			Large Trucks (TR)	300
			Light Rail / Trams (LR)	360

Environmental impacts and modelling

- In the future environmental calculations might be more important than modelling of capacity, queue, delay etc

- We need to answer questions like:
  - Effect of ban diesel cars
  - Effect of replace old cars by new cars
  - Effect of electric vehicles

- It is possible to use movement classes and specify different parameters for each class, but it will require a lot of work...

- It could perhaps be useful if we could give a distribution on different vehicle types, EURO classes etc

- However, it might be difficult to calibrate the SIDRA fuel consumption and emission model for each of these classes...

Priority and results for movement classes

- We often want to give priority to different movement classes
- Priority to buses, pedestrians and bicycles are typical examples
- But there might also be other criteria and classes
- It should be possible to get results by movement class. This will probably be the case in SIDRA 9 ?

Some other factors to discuss

- Actuated traffic signals
- Default and recommended values for Nordic conditions
- User defined templates and models
- Need for a «Norwegian SIDRA model»
- Field observations, calibration and validation
- Other factors