Unit 6: Network Performance Monitoring and Management

Module 6-1

Network Performance

Traffic Management Training Module

Austroads

Today’s presenter

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Outline of this Module

- Network Performance – Indicators and Measures
- Traffic Impact Assessment
- Monitoring Traffic Conditions
- Detection Technologies and Telecommunication

Network Performance – Indicators and Measures

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Network Performance

- Ability of a road network to facilitate smooth and safe movement of goods and people
- A vital component in measuring benefits of competing projects in economic appraisal

Network Performance Indicators:

- Analytical models

Network Performance Indicators and Measures

Indicator	Measure
Congestion and Level of Service (LoS)	1. Vehicle Hours Travelled (VHT) or Total System travel Time (TSTT) 2. Travel Time Variability 3. Average speed 4. Average journey delays
Emissions	1. Vehicle Kilometres Travelled (VKT) 2. Kilograms of CO_2 emissions
Safety	1. Number of crashes and/or incidents
Pavement Impact	1. Pavement deterioration

See Sections 4 and 5, Austroads (2020b)

Network Performance Indicators and Measures

TSTT (or VHT): Summation of travel time of all travellers in a network (measured in hours)

$$TSTT = \sum_{\forall l} t_l \,.\, x_l$$

Where

l: every link (road) in a network

t_l: travel time on link l

x_l: traffic flow on link l

Source: UE (2016)

Network Performance Indicators and Measures

Travel Time Variability: Day-to-day variability in the prevailing travel time on a given route (journey). Measured as Standard Deviation or Coefficient of Variation (CoV).

$$CoV = \frac{SD}{TT_m}$$

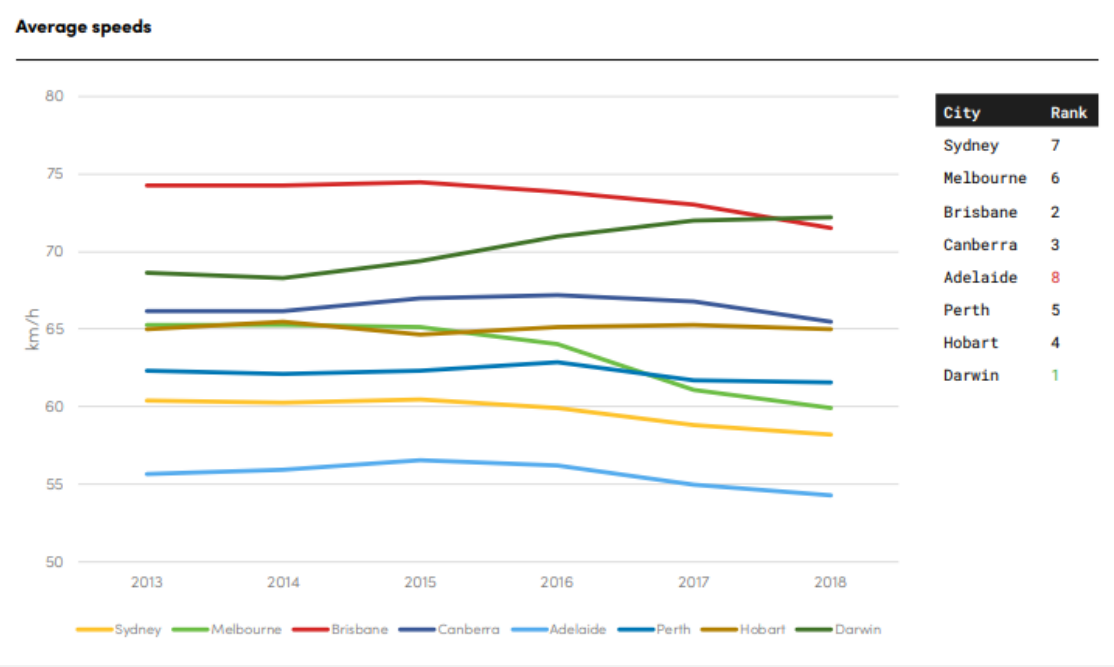
Where

$SD:$ standard deviation of travel time t_l: mean journey time

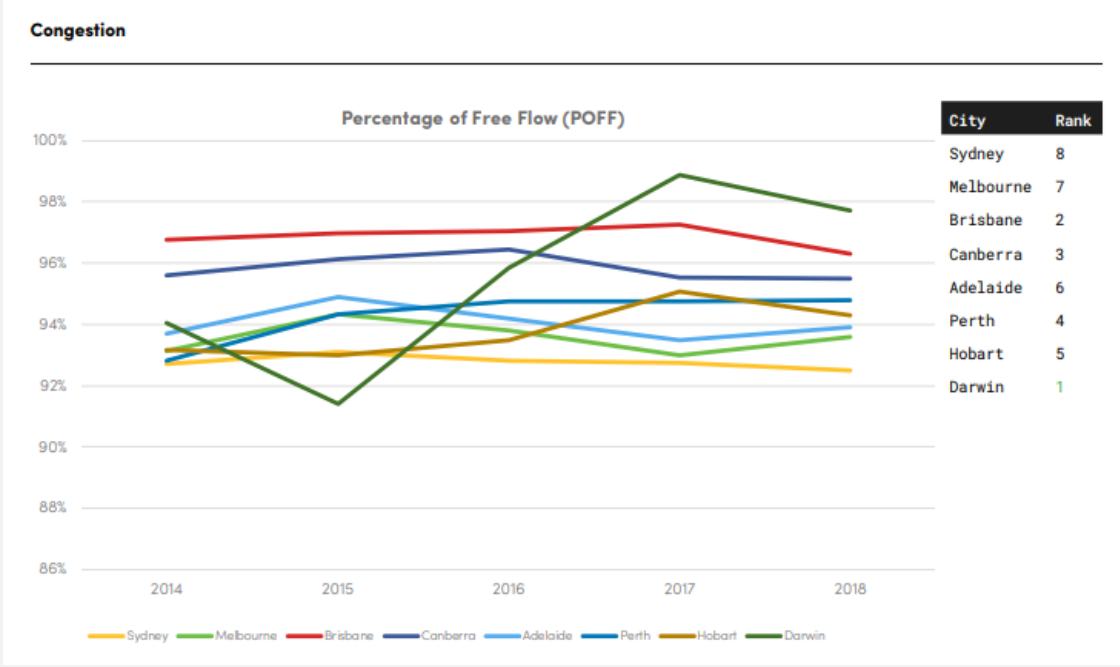
- Impacts **reliability** of a route and hence traveller's route choice decisions
- Affected by weather, roadway characteristics, etc.

Network Performance Indicators and Measures

Average Speed: Average prevailing speed across major arterials in a road network



Source: AAA (2018)



Source: AAA (2018)

Network Performance Indicators and Measures

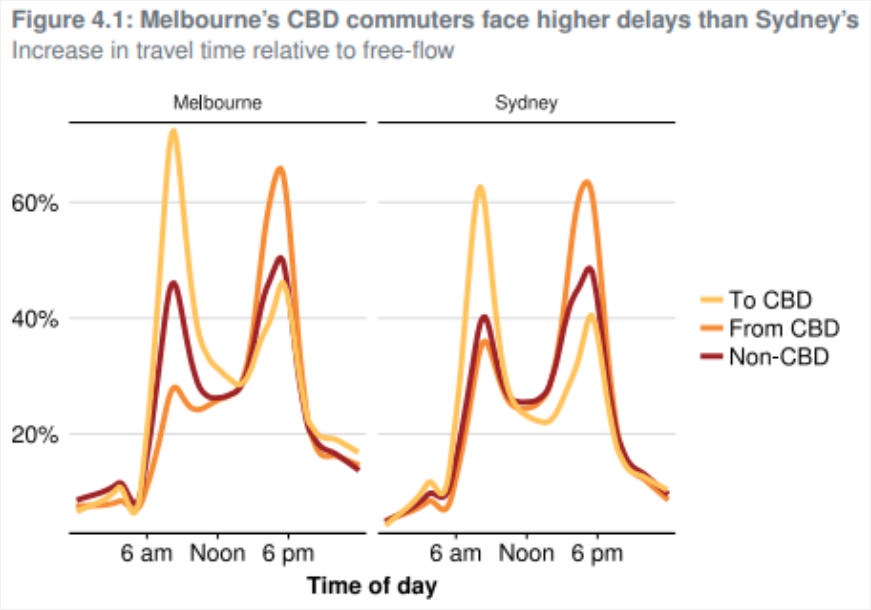
Average Delay: Average travel time delay across major arterials in a road network

$$Delay = t_l - t_l^{ff}$$

Where

t_l: prevailing travel time on link l

t_l^{ff}: free flow travel time on link l



Source: Grattan Inst. (2017)

Network Performance Indicators and Measures

VKT: Total distance travelled by motor vehicles in a network (measured in kilometres)

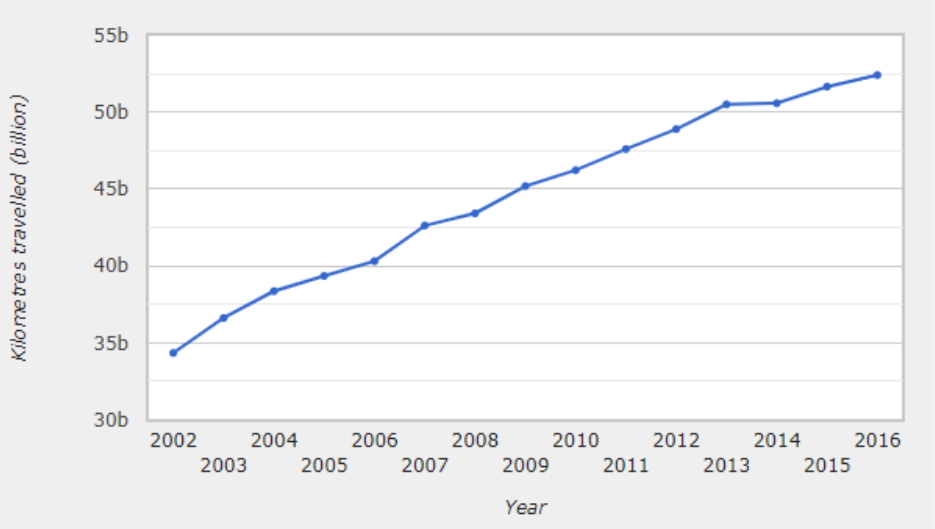
$$VKT = \sum_{\forall l} d_l \,.\, x_l$$

Where

l: every link (road) in a network

d_l: length of link l

x_l: traffic flow on link l



Source: QLD Govt. (2020)

Time to Reflect

1. Select the odd one out.

A. Average Speed

B. Weather

C. CO_2 Emissions

D. Number of Traffic Incidents/Crashes

Answer:

Option B is correct!

Weather is not a performance indicator, but rather has a causal relationship *(i.e. affects network performance indicators)*.

Traffic Impact Assessment

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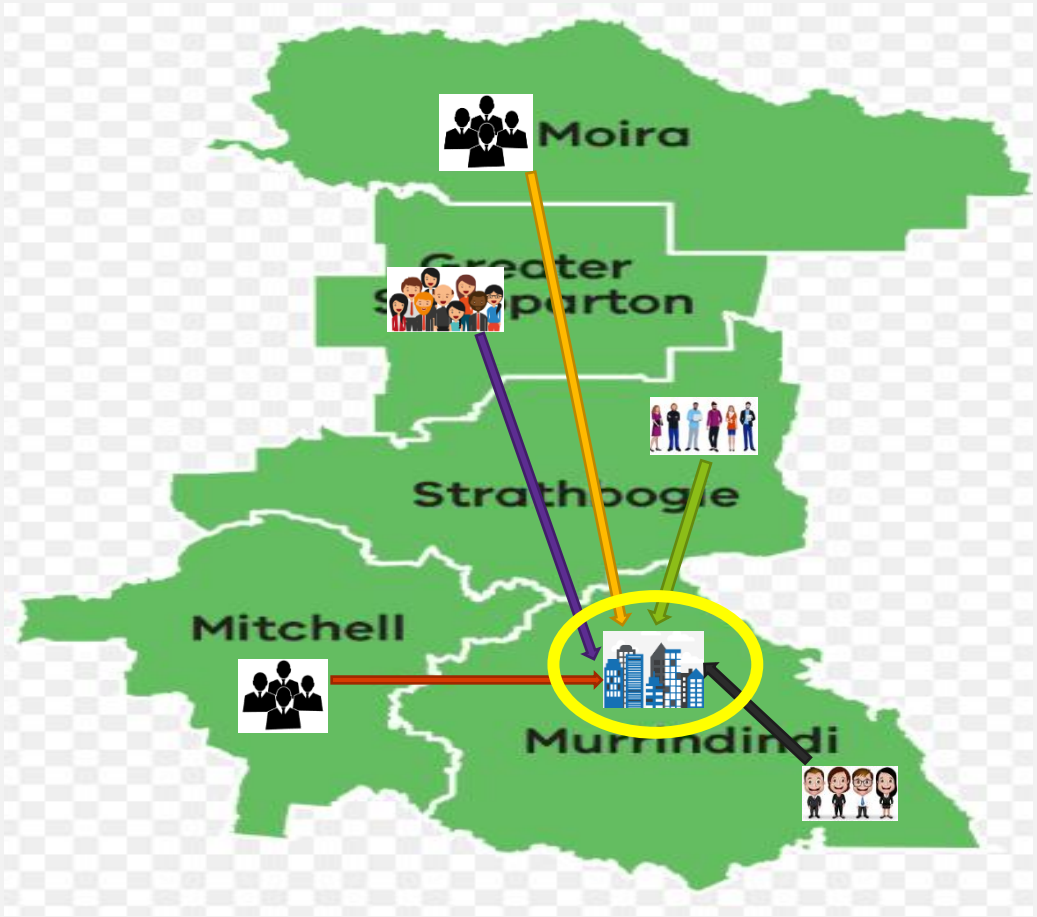
Context



Source: UNSW (2019)

Ways to Travel

Performance Indicators

Traffic Impact Assessment (TIA)

A TIA is the process of compiling, analysing information on, and documenting the effect that a development is likely to have on the operation of adjacent roads and transport networks. (Austroads, 2020b)

Scope:

- Consider motorised and non-motorised users
- Type and size of new development
- Safety and environmental considerations

See Sections 4 and 5, Austroads (2020b)

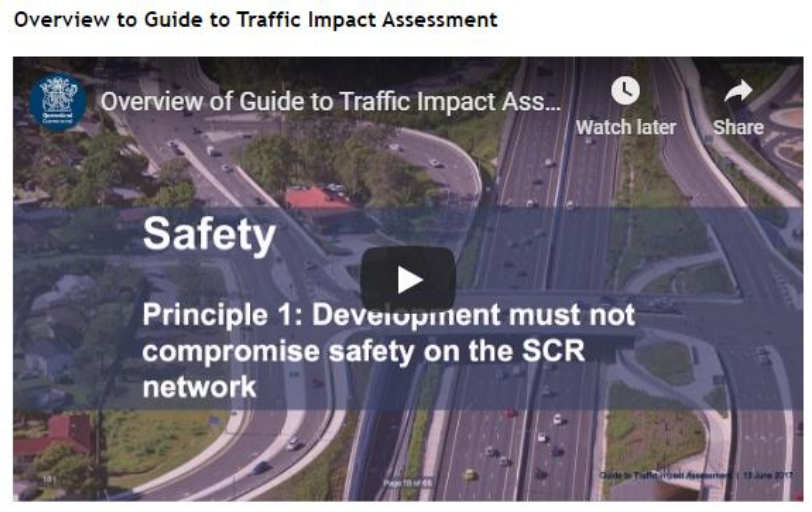
Need:

- Assess changes in network performance due to new development
- Legislative requirement

TIA

Example Case Study Videos available at TMR (2019):

- Overview to Guide to Traffic Impact Assessment
- Case Study 1 - Quarry in a rural area
- Case Study 2 - Small residential development
- Intersection Delay Assessment
- Pavement Impact Assessment
- Safety Assessment



Source: TMR (2019)

Generally conducted using *Microscopic Traffic Models*

Monitoring Traffic Conditions

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Monitoring Traffic Conditions

See Sections 3.4 and 4.2, Austroads (2020a)

Aim: To either detect or predict disturbances from normal traffic conditions, whether caused by incidents or otherwise arising from unusual congestion, as quickly as possible, in order to take prompt remedial action.

Also, to collect and centrally manage traffic data (e.g. flow, speed, etc.)

E.g. Traffic Management Centre

Source: Austroads (2020a)

Detection Technologies and Telecommunication

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Detection Technologies

See Section 3.4, Austroads (2020a)

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Purpose: For monitoring traffic, incident detection and traffic control.

Selection Criteria:

1. Purpose
2. Detection speed
3. Accuracy
4. Cost
5. Reliability

Detection technology
Inductive loop detectors
Magnetometers
Microwave radar, infrared, ultrasonic detection (non-intrusive detectors)
Video image detection
Probe vehicles
Automatic number plate recognition
Mobile device location
Bluetooth readers
GPS tracking

Source: Austroads (2020a)

Detection Technologies

See Section 3.4, Austroads (2020a)

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Relevant detection technologies used for a traffic purpose

Functions	Detection devices
Monitoring traffic • overall network • traffic nodes and routes.	• Detectors, probe vehicles, patrol reports, aerial surveillance. • Detectors, closed-circuit TV.
Incident management • incident detection/clearance.	• Detectors, probe vehicles, mobile/roadside phones, closed-circuit TV.
Driver information • on-trip/pre-trip information.	• Detectors, probe vehicles, patrol reports, closed-circuit TV.
Traffic control • speed/lane control • intersection/network control.	• Detectors, probe vehicles, patrol reports, closed-circuit TV. • Traffic signal information.
Demand control • ramp metering • vehicle control • toll collection.	• Mainline detectors, entry ramp detectors. • Vehicle weighing and height detectors. • Automatic vehicle identification, video image processing.

Source: Austroads (2020a)

Telecommunication

See Section 3.4, Austroads (2020a)

Purpose: Broadcasting information across the network in a real-time setting for a swift and effective action.

Also, to transfer traffic data to centralized facility.

Source: Aldridge (2018)

Information Transferred:

1. Monitored data from field
2. Operation commands from the centre
3. Mechanical status of field devices

Source: Vicroads (2013)

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Tutorial available for this learning module!

Thank you for participating

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