



Understanding Network Performance Information Provided to Road Users

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The study aimed to identify and provide an approach for road managers to convey network performance information to users and road managers

Purpose of Performance Indicators

Road User

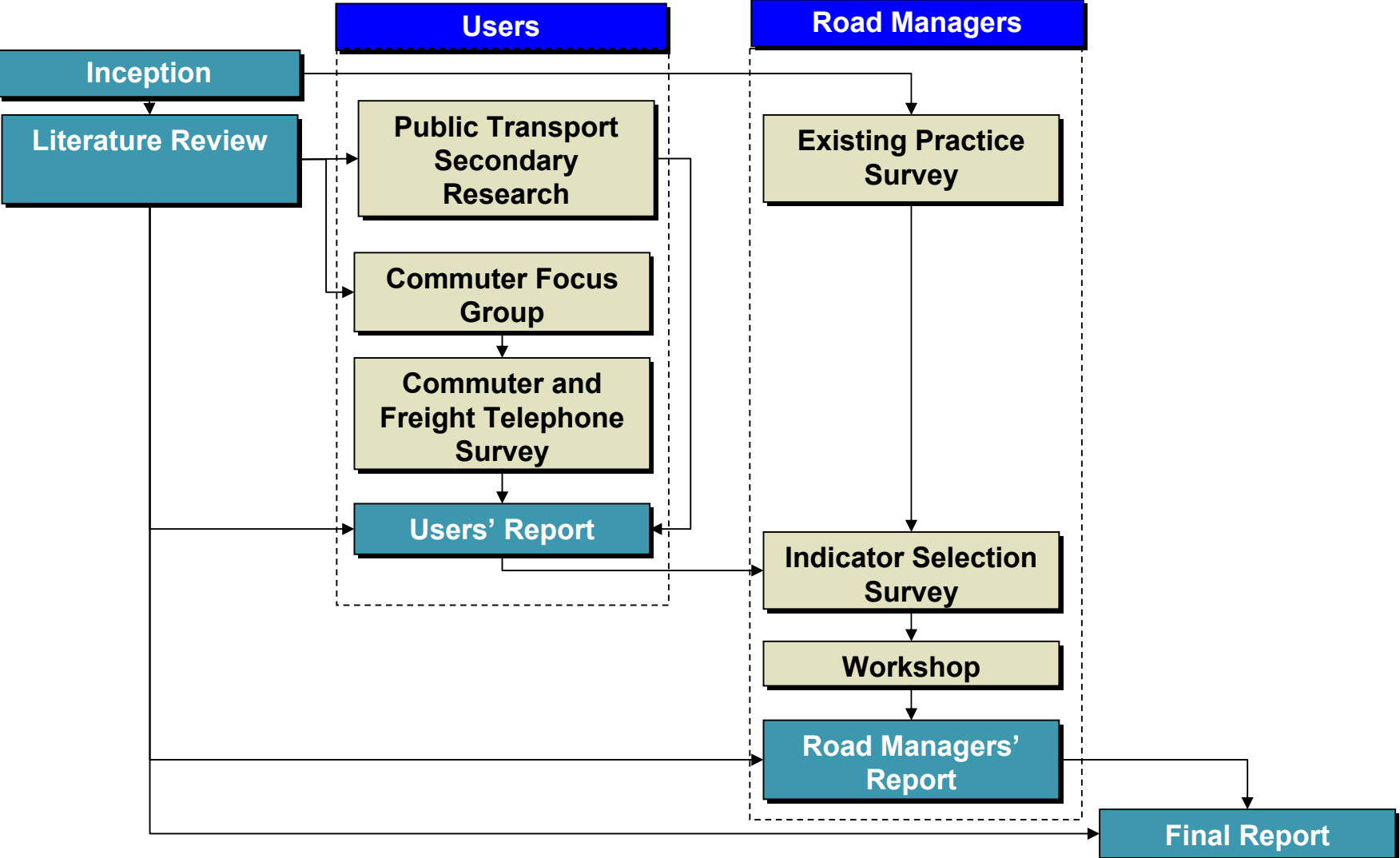
- ▶ Assist with road user travel decisions, including:
 - Mode choice
 - Route choice
 - Time of travel
- ▶ Planned and en-route information

Road Manager

- ▶ Enable managers to provide relevant performance information to users
- ▶ Understand level of service, degree of utilisation and deficiencies across all modes (incl. freight)
- ▶ Assist road managers' in decision making in relation to the management and operation of the network
- ▶ Evaluate and measure impact of improvements made to the network

- ▶ Emphasis on road users' understanding and perspective of performance
 - Focus on operational performance only (ie not safety, environment etc)
- ▶ Includes a review of relevant existing Austroads National Performance Indicators

This study included a literature review, user survey and road manager surveys and workshop



Survey Design

Key Questions

- ▶ **What are the most important attributes to road users' when assessing the performance of the road network?**
- ▶ **How would road users like performance information expressed?**
- ▶ **What and how should timely information about changes in road conditions be conveyed?**

Survey Design

Commuter Focus Groups

- ▶ **Identify key issues, understanding and potential approaches to information delivery**
- ▶ **Clarify terminology for survey**
- ▶ **Two hour discussions with participants held in Melbourne and Sydney**

Survey Design

PT: Existing Surveys

- ▶ **Existing surveys sourced from various public transport agencies - NSW, Vic, Qld, SA, WA, ACT**
- ▶ **Previous work undertaken by Booz Allen were also sourced**

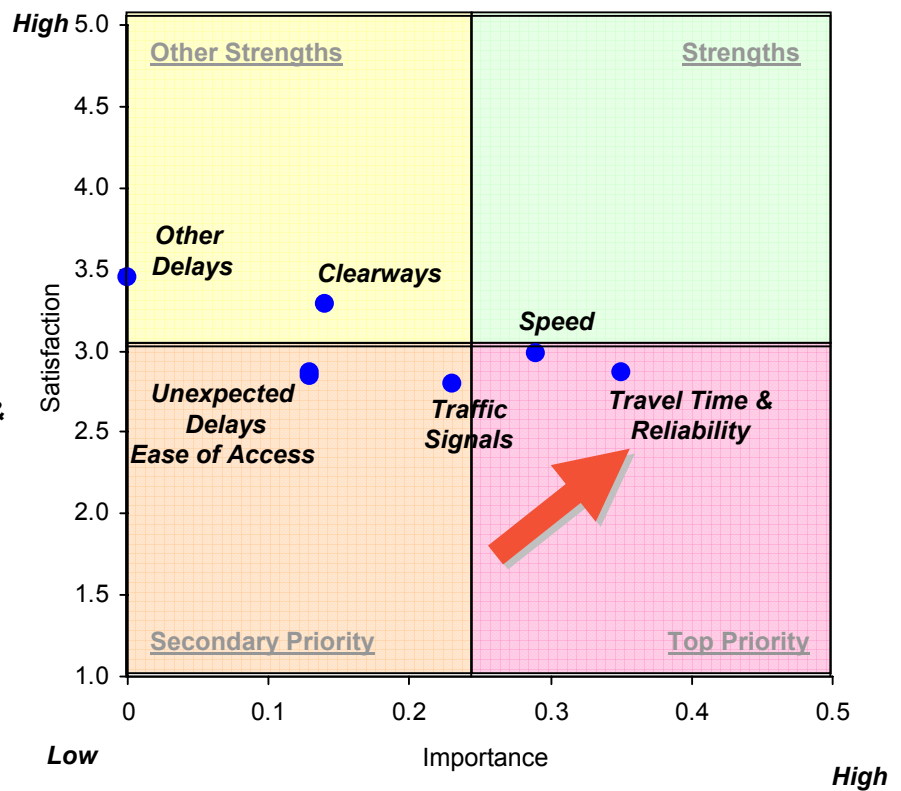
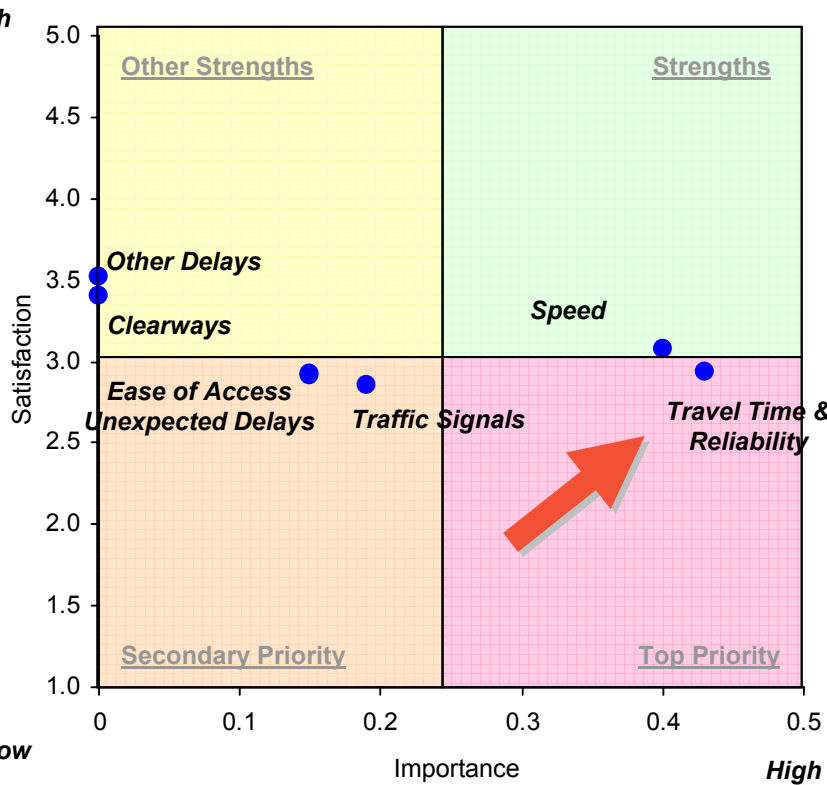
Commuter and Freight Telephone Survey

- ▶ **Commuter (road users): 400 respondents each from Brisbane, Melbourne and Sydney**
- ▶ **Freight: Total of 300 respondents from Brisbane, Melbourne and Sydney**

Commuter survey found that travel time and reliability were the most important attributes affecting their perception of performance

Importance and Satisfaction of Attributes - General

Importance and Satisfaction of Attributes - Peak



Commuters best relate to information about the entire trip and accept that performance will be lower at certain times

Greater importance was placed on information that relates to overall trip performance rather than specific operational elements.

Users don't fully understand how specific elements affect performance. On some occasions they may not be aware of what is affecting their travel time.

"During Olympics (the road network) worked a dream. Couldn't believe it. Can't understand it. You couldn't do it today ⁽¹⁾"

Users accept that performance will be lower at certain times⁽¹⁾

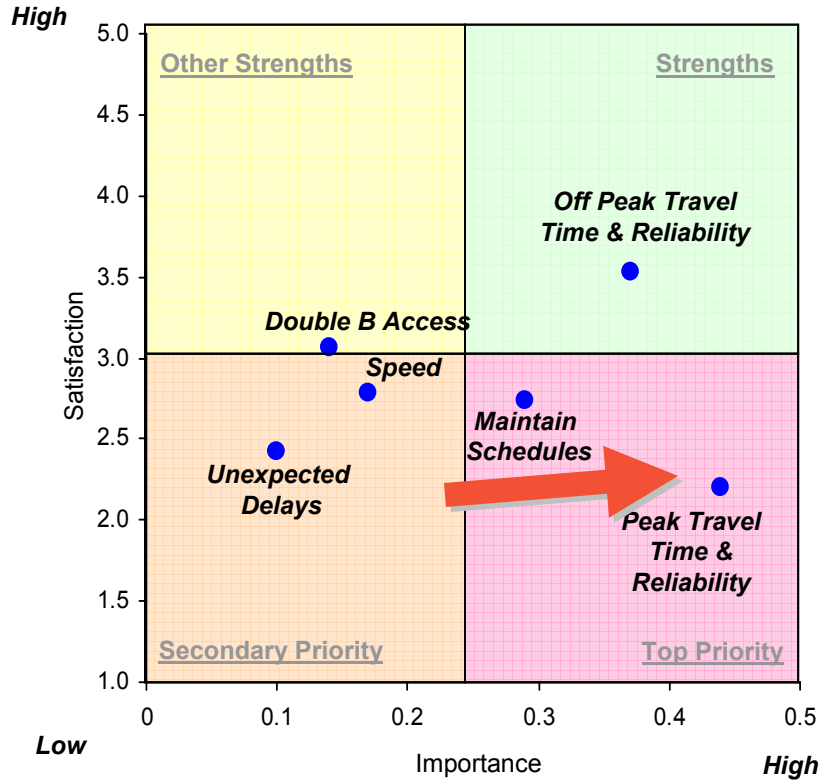
".... can't expect everything to be perfect. If there are more cars on the road, the things can't be perfect"

".... don't want a gold plated road to get me to my appointment"

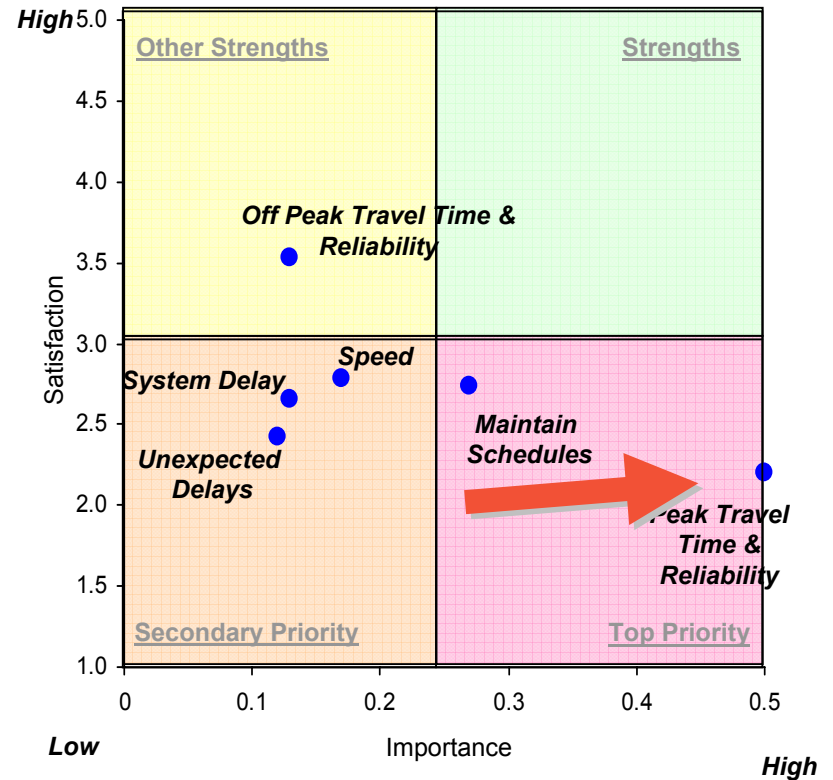
Source: (1) Focus group quotes

Travel time and reliability were the most important attributes for freight users by a significant margin

Importance and Satisfaction of Attributes - General




Importance and Satisfaction of Attributes - Peak



Travel time and reliability was rated as the most important attributes across all user groups

Ranking of Attributes by User Group

Attribute	Commuter	Freight	Public Transport
Travel time	1	1	2
Reliability	1	1	1
Ability to Maintain Schedules	-	2	-
Speed	2	3	-
Accessibility	3	-	3
B Double Network Coverage	-	4	-
Traffic Signal Delays	4	5	-
Unexpected or Temporary Delays	5	6	-



Source: Public transport user rankings were determined from:

(1) Existing surveys sourced from various public transport agencies across Australia

(2) Previous work undertaken by Booz Allen

Users prefer performance expressed as travel time supplemented by information about traffic conditions and course of action

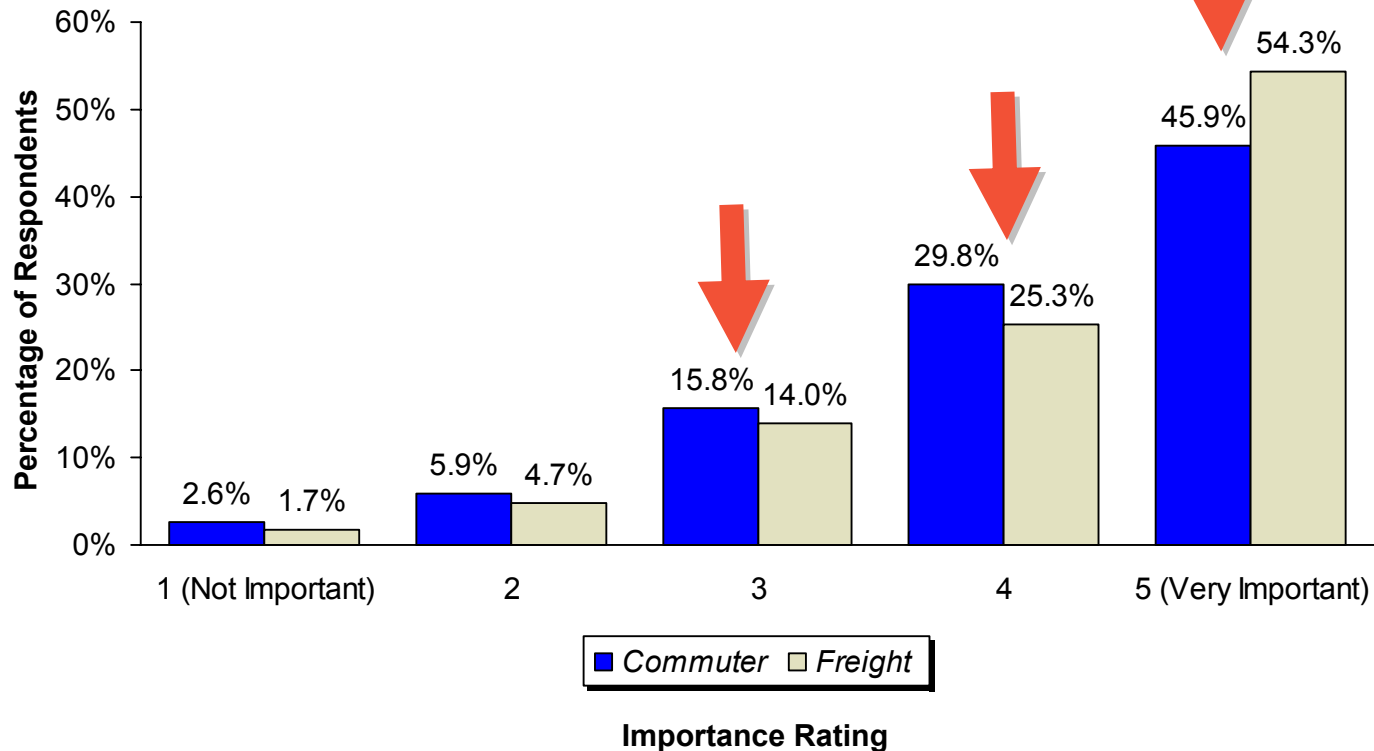
- ▶ Time was identified as the most useful and practical indicators
 - Users can transfer it to other daily activities
 - A range of attributes can be expressed in terms of time (travel time, delay etc)
 - Unfamiliar users readily understand it
- ▶ Time to key intersections or landmarks (whichever is more prominent) were preferred
 - Landmarks need to be a specific point (eg airport) and not an area (eg CBD)
- ▶ Ideally supplemented with some general information about traffic conditions such as incidents or non recurrent delays
- ▶ Advice of an alternative course of action/ routes was also highly desirable in the event of a major incident
- ▶ *“ If you give people estimates (time) on freeways, people will expect it... it doesn't matter what I do, I know that (if) I go with the traffic, it's ok” , “ ... puts your mind at rest”*

Users found speed, statistical measures, ratios and indices difficult to understand and apply

- ▶ Users tended to convert any performance information into time
- ▶ Users found it difficult to estimate/ convert speed to travel time
 - Many users were not confident of their ability to estimate distance
 - Applying the mathematics, which could be a distraction
- ▶ Speed information (eg average speed) is difficult to interpret unless users can actually drive at that speed consistently
 - On arterial roads there are traffic lights and changes in the posted speed limit
- ▶ Users also found esoteric or statistical measures difficult to apply, especially for users undertaking an unfamiliar journey
 - Statistical variations
 - Ratios
 - Indices of accessibility or congestion

Most users consider receiving timely information about changes in road conditions as important

- ▶ Ques: “On a scale of 1 to 5, where 1 is *not important* and 5 is *very important*, how would you rate the need for timely information on changes in road conditions?”



Users prefer to receive timely information on either a continuous basis or as problems occur

Slightly more freight users wanted information on a continuous basis as there are on the road for longer time periods

Many commuters wanted information only when there are problems and during peak hours

There very few respondents who did not want any information at all

Preferred Frequency of Receiving Timely Info
(One Response)

Frequency	Commuter	Freight
Continuous	32.2%	39.3%
Only when there is a problem	34.3%	28.9%
Peak hours only	15.8%	16.9%
Regular time intervals	7.3%	3.6%
Traffic related (eg on demand)	0.4%	0.3%
Don't Know	9.2%	6.2%
Other	0.6%	4.2%
None	0.2%	0.6%

Users prefer to receive timely information en-route by roadside signs or radio

► Users preferred to receive timely information through media that is accessible whilst en-route, such as electronic roadside signs and audio breaks in the radio

- Timely information specific to the location of the user was regarded as the most useful (eg electronic road signs and tunnel audio radio breaks)

► Media amenable to providing information to plan trips were viewed as being useful by one in four commuters and one in three freight users

- Such media includes internet sites, TV channels and email

Useful Media
(Multiple Stated Intention Responses)

Frequency	Commuter	Freight
Electronic roadside signs	71.1%	72.6%
Audio break in radio	66.1%	70.8%
Traffic internet site	26.0%	34.5%
Permanent TV channel	25.8%	23.5%
SMS to mobile phone	19.6%	24.9%
Email to work or home	12.5%	28.1%
Two way radio	0%	25.3%

Users would like more timely reliability and travel time information to be provided

- ▶ Users have indicated that travel time and reliability are the most important attributes driving their satisfaction of road network performance
- ▶ Users would like this information to be expressed in minutes
 - Should there be delays, users would like supplementary information about traffic conditions and advice as to how to minimise these delays (such as specific details of alternative routes)
- ▶ Users prefer that this information be provided using en-route media, such as electronic roadside signs and radio.
 - Notwithstanding this, more than one in four would like information to be provided using media that is accessible prior to commencing the trip (eg email, TV, internet)
 - Ideally the information should be tailored to the users' specific locational temporal context
- ▶ Whilst some road agencies have undertaken selected initiatives to provide users with information, the existing level of information provision is somewhat less than what users desire

Only travel time was found to be useful in real time, with road managers preferring that other data be generated less frequently

Preferred Performance Data Reporting Frequency (Multiple Responses)

These results suggest that travel time is the most important data input for real time operations management

The wide cross section of indicators for less frequent reporting periods suggests that these would be used by road managers for forward planning

Rank	Performance Indicator Category	Possible Dimensions			
		Frequency of Reporting			
		Real Time	Daily	Weekly	Annually
1	Travel Time	100%	33%	17%	100%
2	Travel Time Reliability	0%	33%	0%	67%
3	Congestion	17%	33%	33%	83%
4	Delay	33%	33%	17%	67%
5	Speed	50%	17%	33%	83%
5	Volumes	0%	50%	50%	83%
7	People/ Load/ Occupancy	0%	0%	17%	67%
7	Queuing	33%	17%	33%	67%
7	Stops	0%	17%	17%	67%
10	Modal	33%	0%	0%	67%
11	Availability	17%	67%	50%	50%
12	Accessibility	0%	17%	0%	0%
13	Distance	0%	17%	33%	83%

Source: Road Managers Performance Indicator Survey

Very few road users are currently receiving timely information in their preferred format

User Preferences	Extent of Provision	Existing Practice
Travel time, reliability and delays to be timely conveyed in minutes	Limited	<ul style="list-style-type: none"> ▶ No provision of travel times for planning trips ▶ No provision of real time information on arterial roads ▶ Only Victoria and Western Australia real time travel information on selected freeways, with Victoria providing it in minutes
General information about traffic conditions, especially delays to complement travel time	Few examples	<ul style="list-style-type: none"> ▶ Roadside variable message signs and Victoria's "Drive Time" provides information on limited parts of the road network in most states ▶ Some agencies report congestion levels and incidents on the internet site
Advice of an alternative course of action when there are major delays	Limited	<ul style="list-style-type: none"> ▶ Generally not provided
Information to be delivered according to user preference (most want continuous, problem activated or peak hours)	Limited	<ul style="list-style-type: none"> ▶ Incident information provided on electronic roadside signs that cover limited parts of the network and radio
Information to be delivered according to preferred media	Limited to a few media	<ul style="list-style-type: none"> ▶ Electronic roadside signs provided on some roads ▶ Provided on most radio stations, but at predetermined intervals and information may not be specific to the users' location ▶ Limited information provided on internet ▶ No information conveyed by email, SMS, TV channel or two way radio

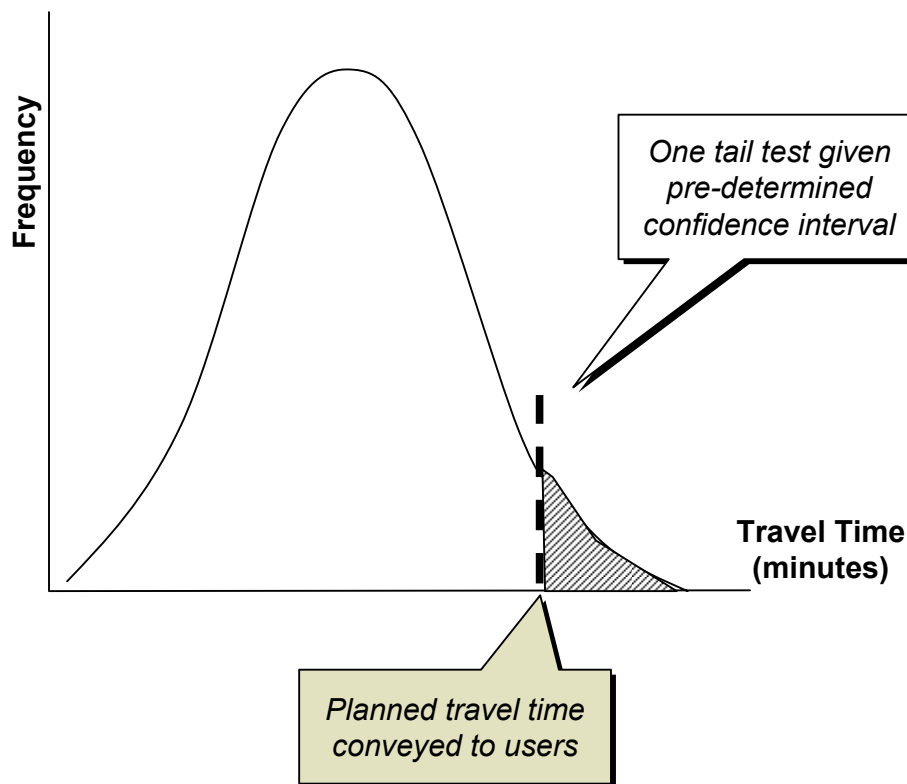
Continuous travel time information is needed to provide quality information for all users and road managers

Objectives	Existing Approach	Desired Outcome	Gap
Quality of travel (travel time, reliability, delay, speed)	<ul style="list-style-type: none"> ▶ Floating car surveys undertaken periodically with a low sample on a representative sample of the road network 	<ul style="list-style-type: none"> ▶ Continuous data for road managers to better manage network operations in real time 	<ul style="list-style-type: none"> ▶ Significant - Poor confidence due to low sample size
	<ul style="list-style-type: none"> ▶ Real time travel time and speed information (Vic and WA) generated from SCATS on selected freeway sections 	<ul style="list-style-type: none"> ▶ Accepted and utilised by road users, although time is preferred rather than speed ▶ Managers utilise data for freeway management 	<ul style="list-style-type: none"> ▶ Marginal – but only on a small section of the entire network
Throughput	<ul style="list-style-type: none"> ▶ SCATS captures volumes of vehicles ▶ Occupancy surveyed once – twice per year for cars only 	<ul style="list-style-type: none"> ▶ Number of vehicles are captured accurately ▶ Public transport occupancy should be captured 	<ul style="list-style-type: none"> ▶ Some
Modal	<ul style="list-style-type: none"> ▶ Quality of travel and throughput is focussed on cars ▶ Limited information about freight throughput 	<ul style="list-style-type: none"> ▶ Quality of travel information is desired by all road users ▶ Required for measuring the achievement of throughput objectives 	<ul style="list-style-type: none"> ▶ Significant – most measures are car focussed
Accessibility	<ul style="list-style-type: none"> ▶ Maps 	<ul style="list-style-type: none"> ▶ Maps 	<ul style="list-style-type: none"> ▶ None

Providing actual and planned travel times for users will provide them with ample information about travel time and reliability

- ▶ Implicit in actual travel times is a provision for delays
 - Supplementary information about traffic conditions and advice to reduce delays would be valuable to users
- ▶ “Planned” travel times would assist users estimate their trip time for trips in the near future
 - These times should be provided at appropriate intervals throughout the day. The length of these intervals is dependent on how quickly traffic patterns change.
 - Users will be able to “trade off” their journey start and travel time options with other activities

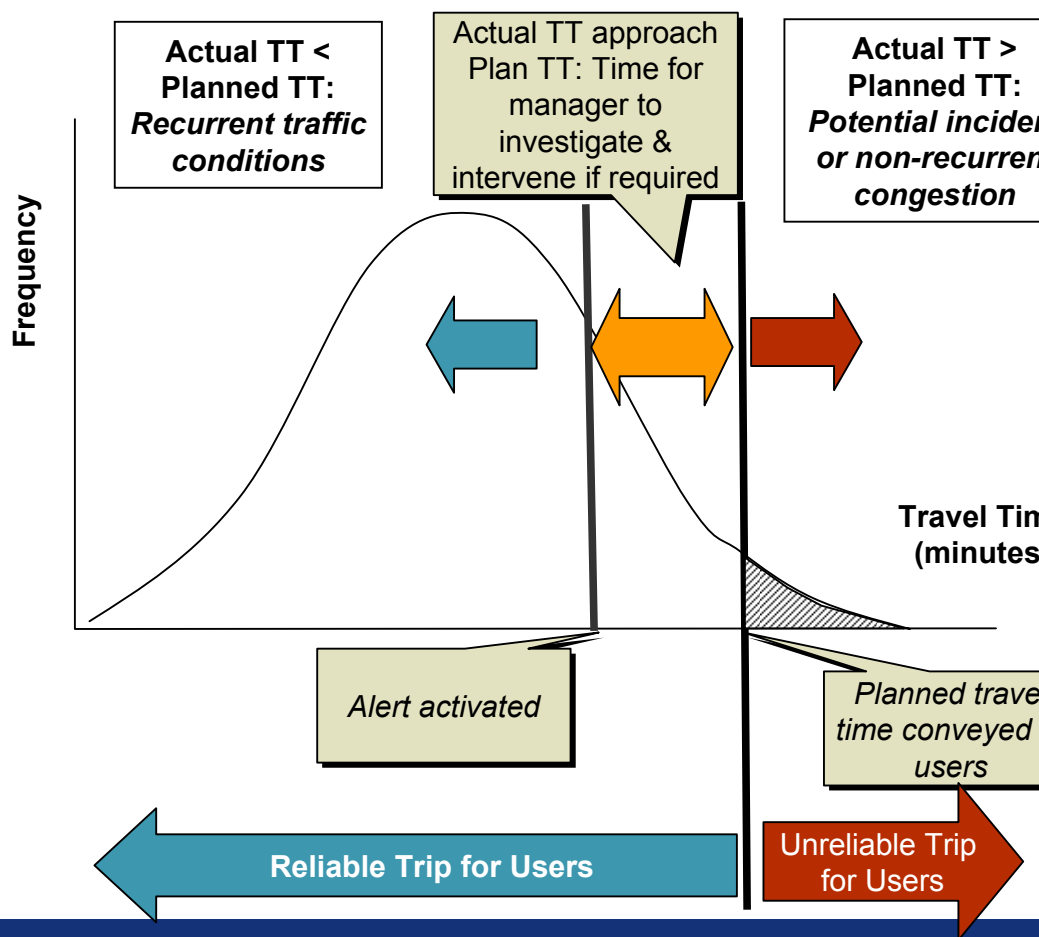
Historical Distribution of Travel Times



Operational managers could be alerted when actual travel time is near planned travel time to proactively investigate and intervene

- ▶ Comparing actual travel time to planned travel time would assist operational managers with deciding how to manage the network
- ▶ When actual travel time approaching planned travel time, the operations manager could be alerted to investigate whether an incident or non - recurrent congestion has occurred
- ▶ Alongside other indicators, this would assist the road manager to decide whether to take action to minimise the delay or activate an incident management plan

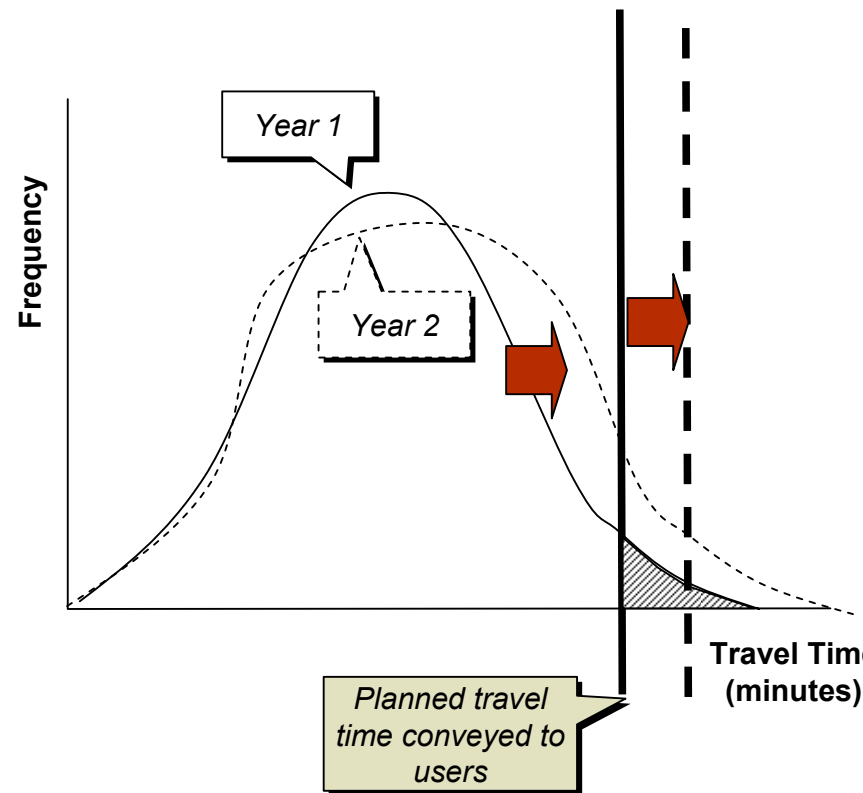
Travel Time Frequency Distribution Curve



Travel time data could be used to determine network performance trends

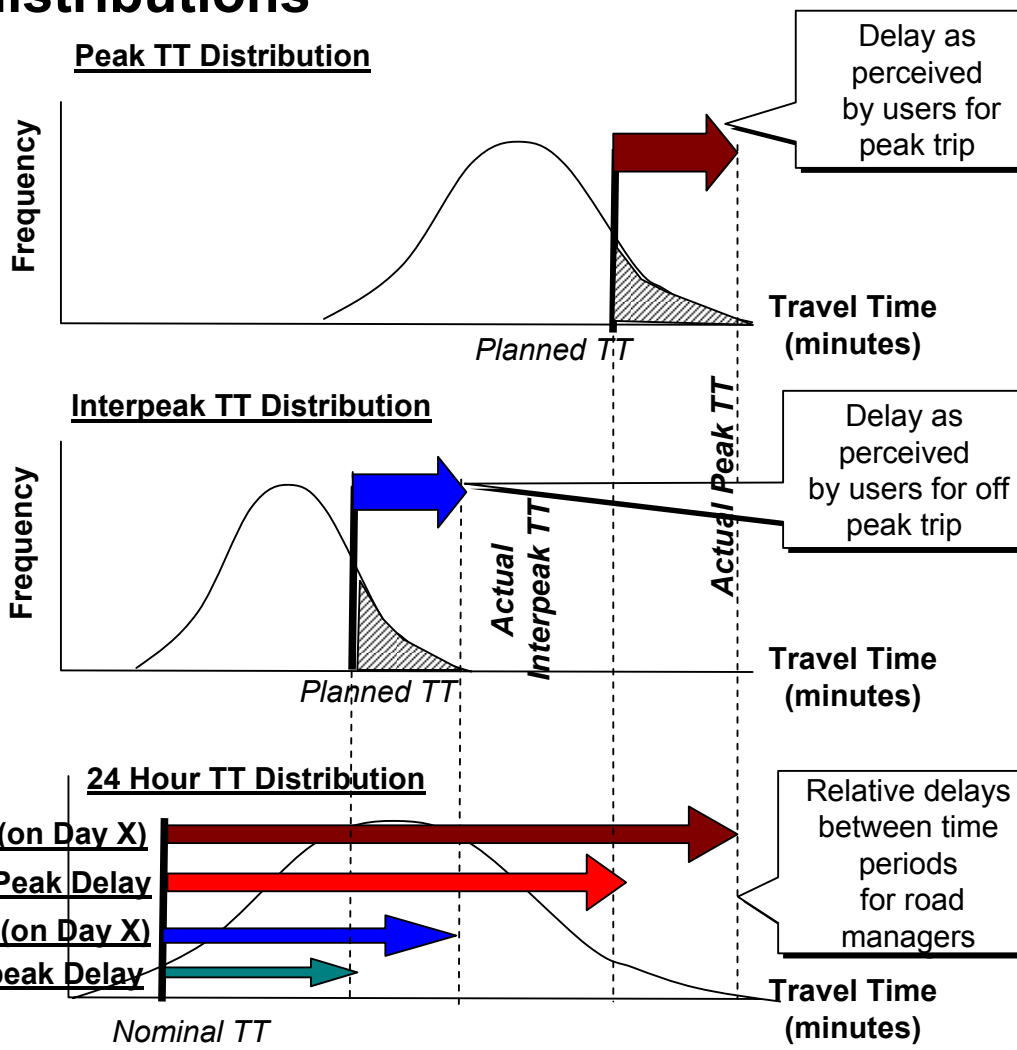
- ▶ When actual travel time is frequently greater than planned travel time, it indicates that performance is deteriorating
 - This suggests that the distribution curve is shifting towards the right
 - This could alert managers that more intensive network planning may be required (eg new permanent traffic management measures etc)
- ▶ Conversely, a road improvement would shift the curve to the left
- ▶ The change in the shape of the curve (ie standard deviation) also indicates reliability changes

Travel Time Frequency Distribution Curve



Delays from a road manager and users' perspective could be determined from travel time distributions

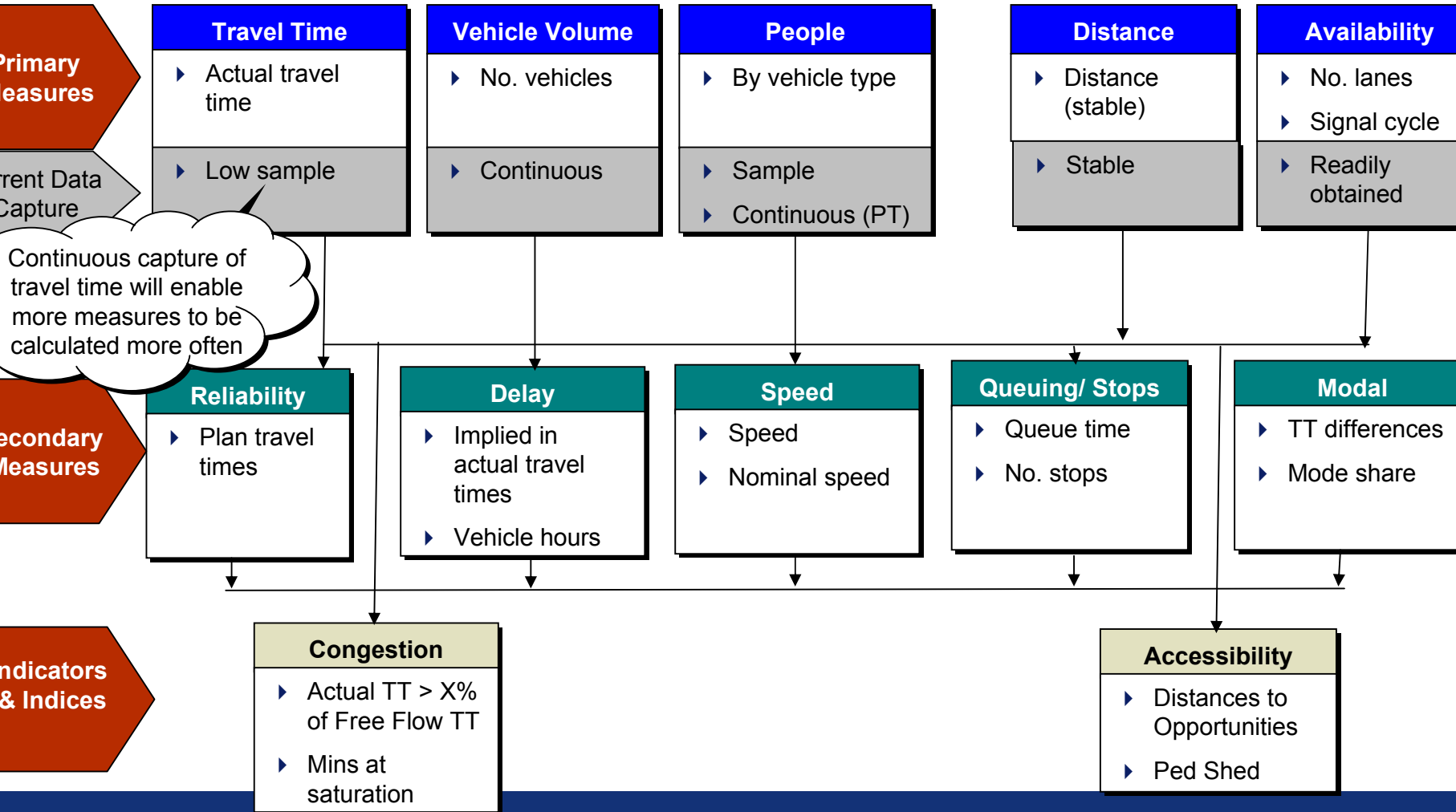
- ▶ Road users are likely to perceive delays to occur when travel time exceeds the planned travel time that is relevant to their trip (if they are informed of it)
- ▶ To understand the relative delay across all links and time periods, road managers could measure delays from a predetermined nominal travel time taken from a 24 hour travel time frequency distribution



Actual and planned travel time indicators have the basic requirements preferred by users and road managers

Requirement	Actual Travel Time	Planned Travel Time	Comments
User Requirements			
▸ Relevant to travel decisions relating to different modes, timing and routes	✓	✓	
▸ Expressed in minutes	✓	✓	
▸ Able to be timely conveyed	?	✓	Emerging technology
Road Manager – Analysis			
▸ Appropriate across all modes (including freight and public transport)	✓	✓	
▸ Used to determine service levels and identify deficiencies	✓	✓	Used to derive other indicators
▸ Scalable	✓	✓	
▸ Robust and cost effective	?	?	Emerging technology
Road Manager – Reporting			
▸ Used to determine the achievement of network objectives	✓	✓	Used to derive other indicators
▸ Measures mobility	✓	✓	
Road Manager - Action			
▸ Readily applied in project evaluation	✓	✓	
▸ Applicable for range of projects (HOV, freight lanes, toll roads, bus lanes)	✓	✓	
▸ Determine impacts from improvements	✓	✓	

From primary indicators, of which travel time is one, a range of secondary indicators can be determined for network planning



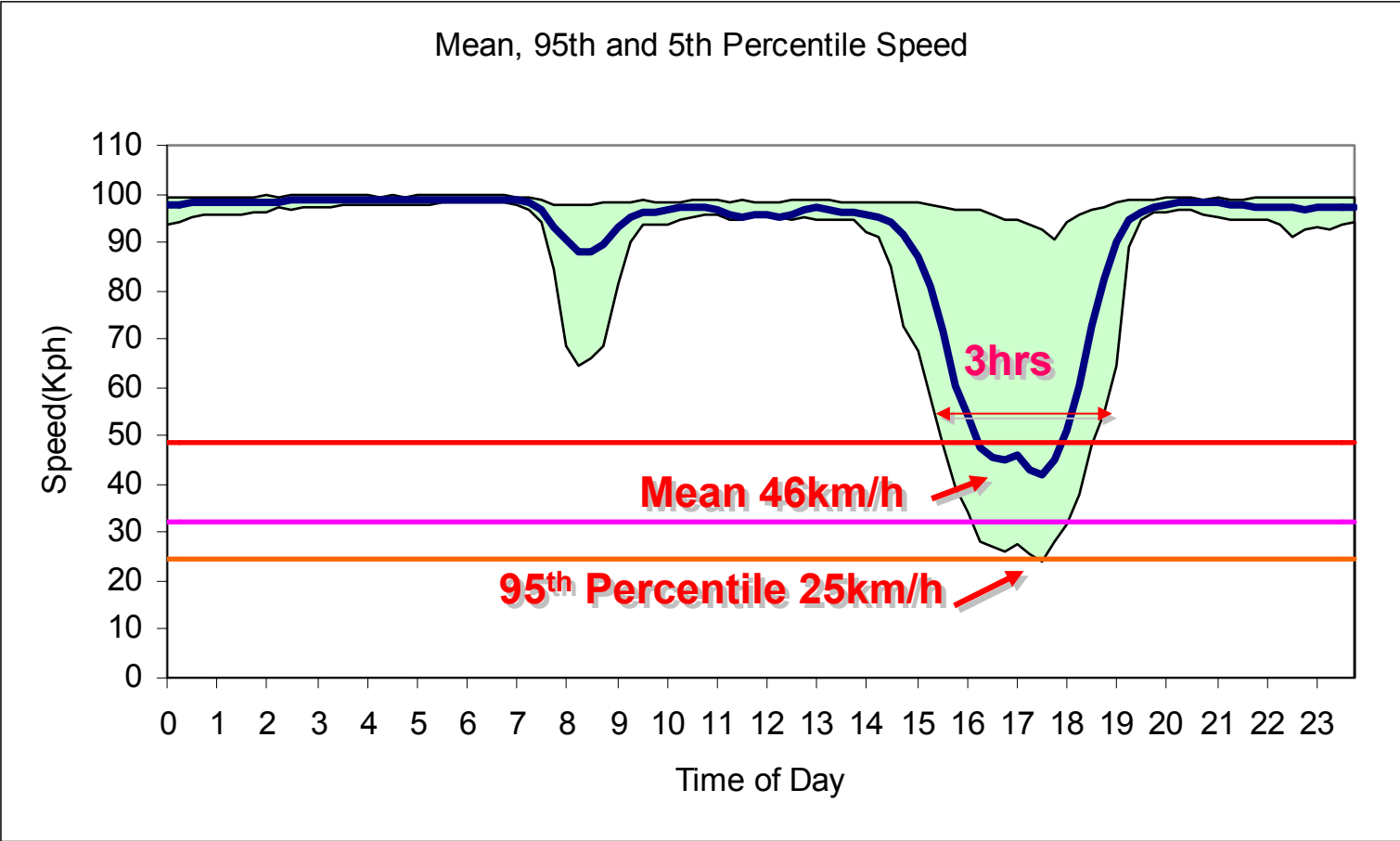
**Finally
some examples of VicRoads
directions in
Network Performance
Measurement**

“If you can’t measure it you can’t manage it”

- ▶ Whilst VicRoads has had the benefit of continuous reporting of freeway data for over 10 years it has only used this data effectively for performance measurement over the past 2-3 years
- ▶ What is the data revealing about network performance?

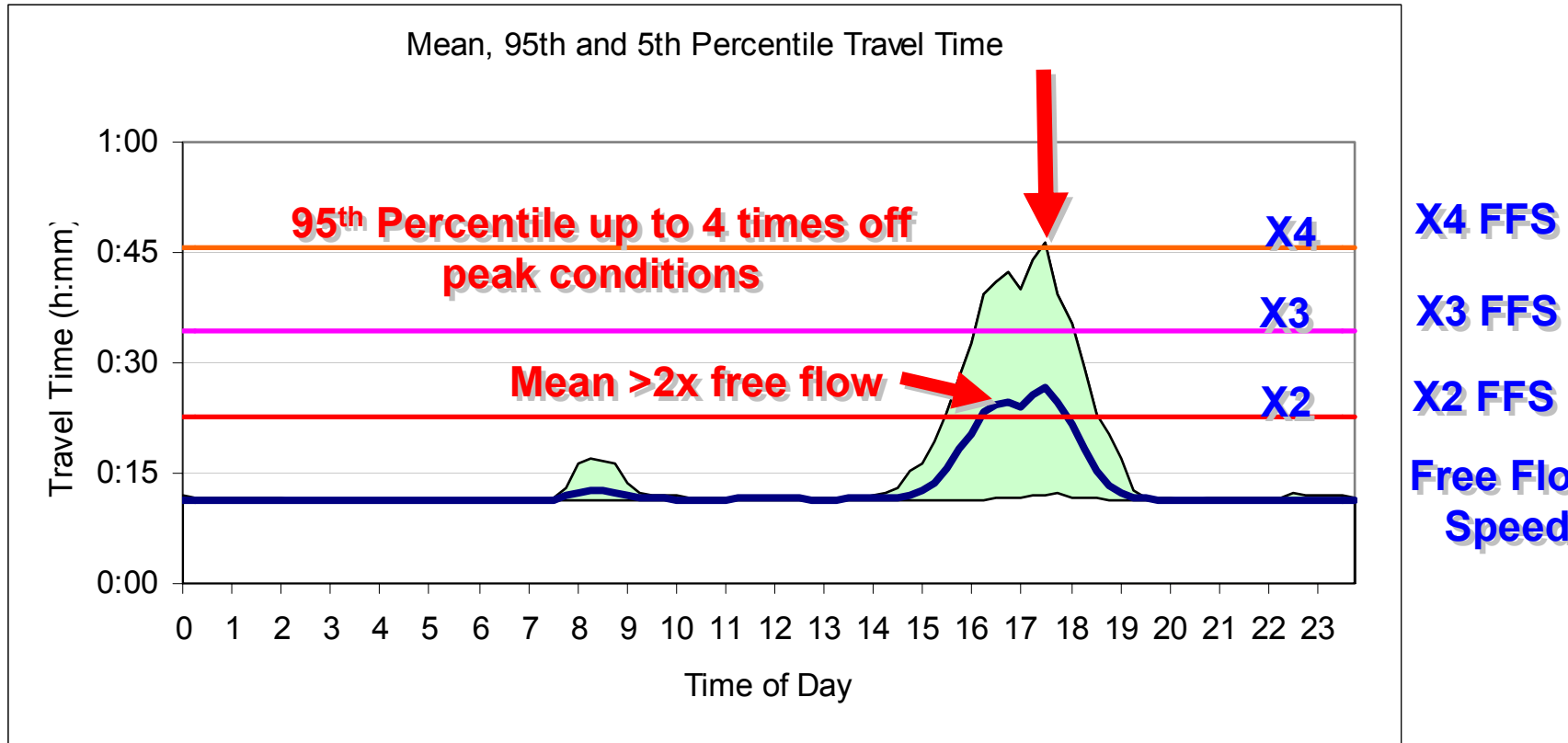
Variability of Speed

Monash Freeway outbound



Planning Travel Time (95th%)

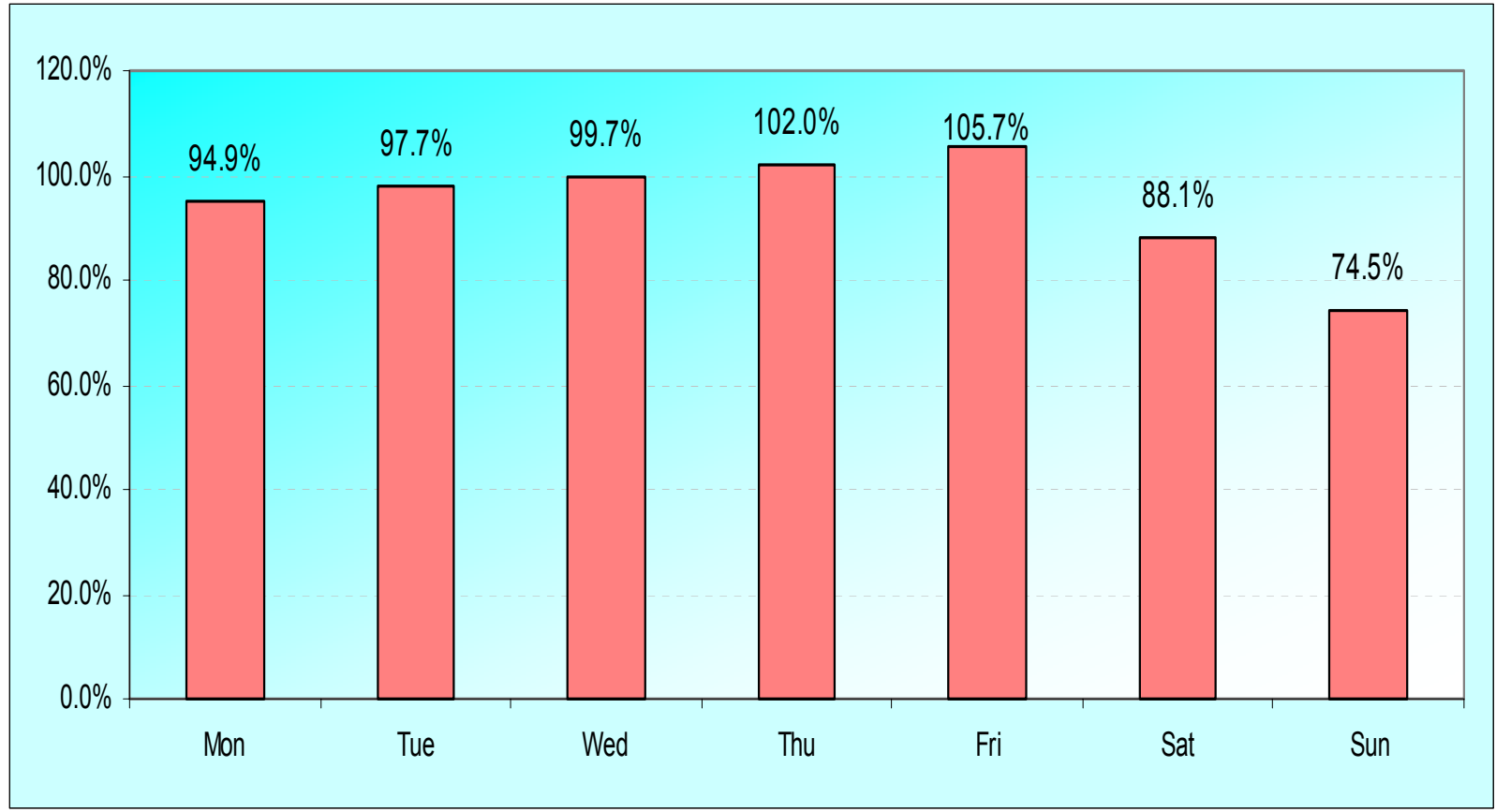
Reliability on Monash Freeway outbound



Congestion rapidly becoming a 7 days a week problem

– Saturday 88% of average weekday

_ Sunday has some of our heaviest congestion – No clearway operating

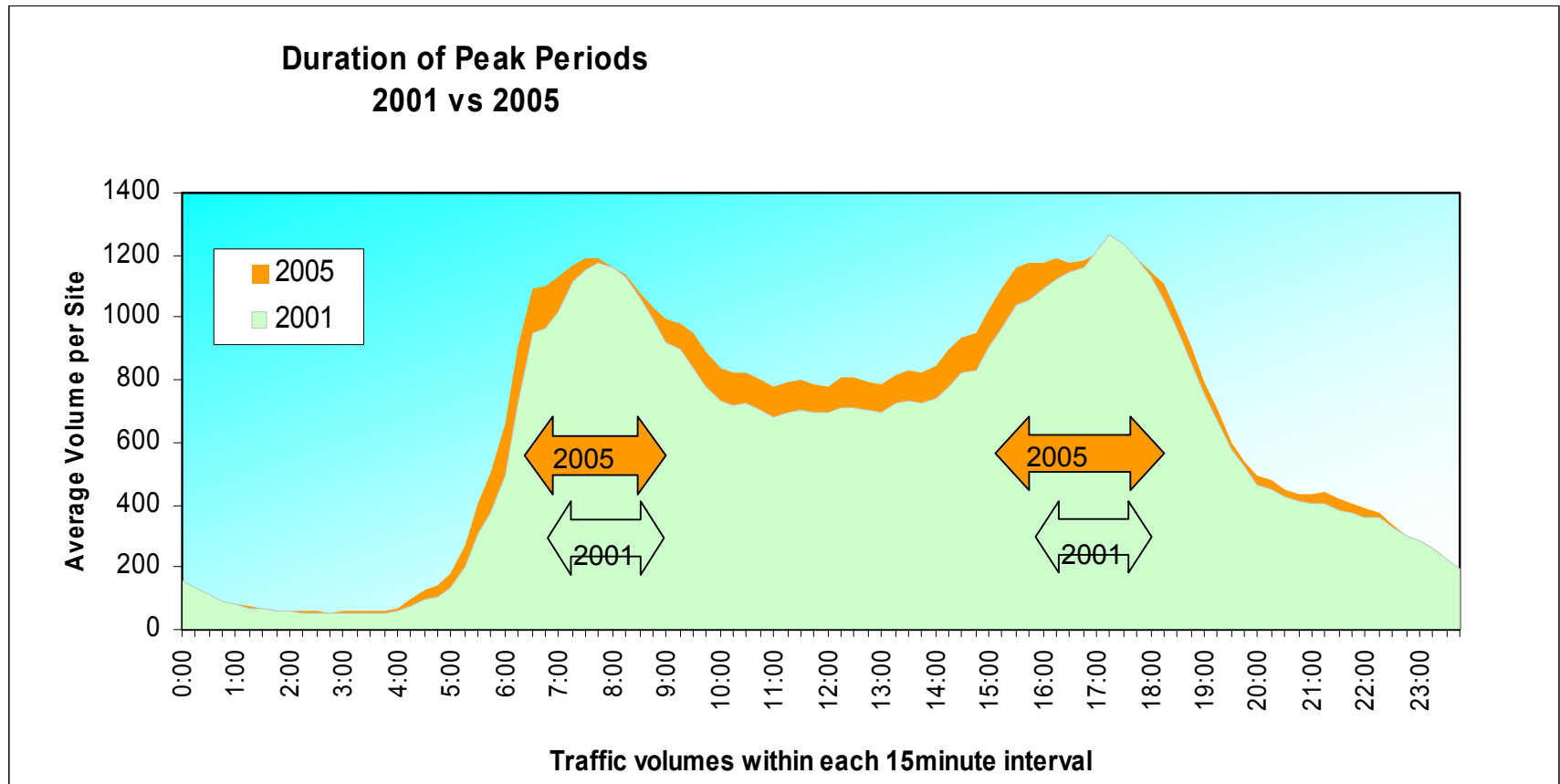


Daily Percentage Variation from Weekday Average

Rapid Growth in Durations of Peak Periods

-West Gate Freeway Inbound Sections <60km/h for >7hours duration

-Other freeways peak > 4hours in each direction

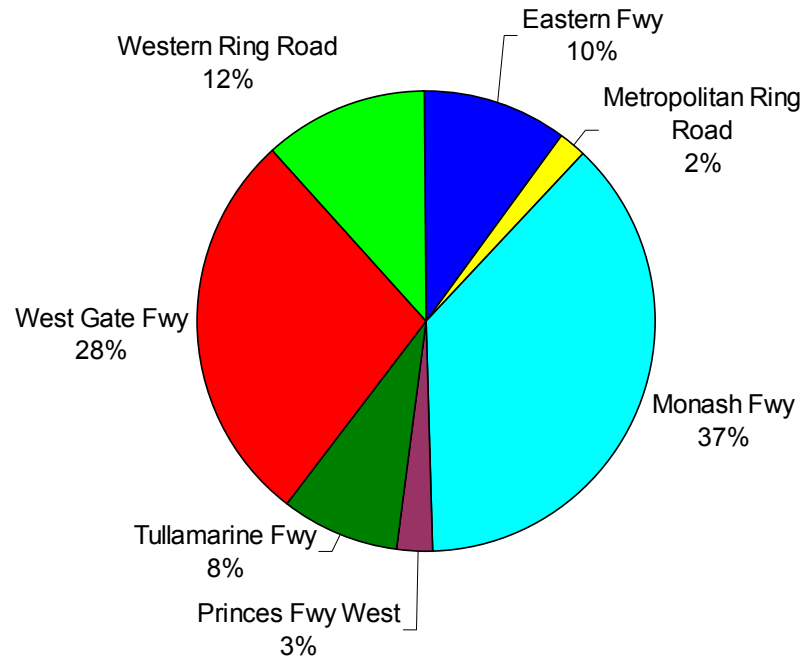


All freeways - Vehicle Hours of Delay

– Sept Qtr 2005 Census or Survey?

**Continuous Speed
and Volume Data
enables routes to
be analysed,
compared
enabling
investment
decisions**

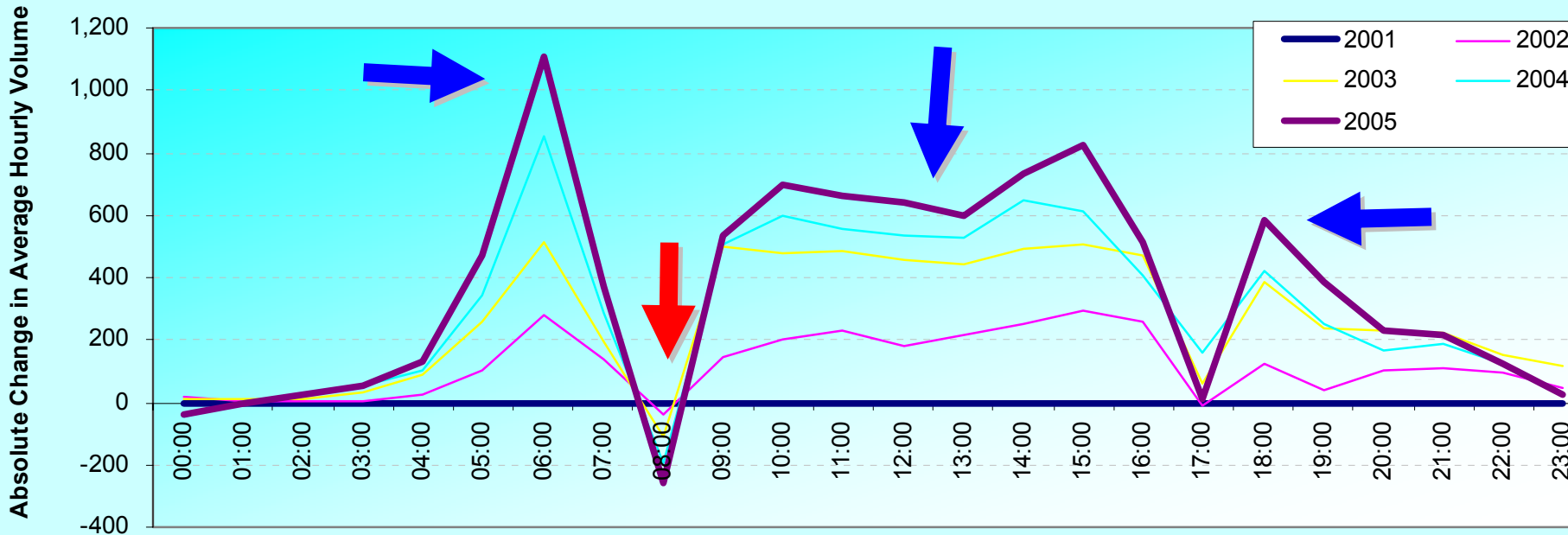
Vehicle Hours Delay by Freeway,
ALL Day, September Quarter, 2005



Absolute Growth in Hourly Volumes since 2000

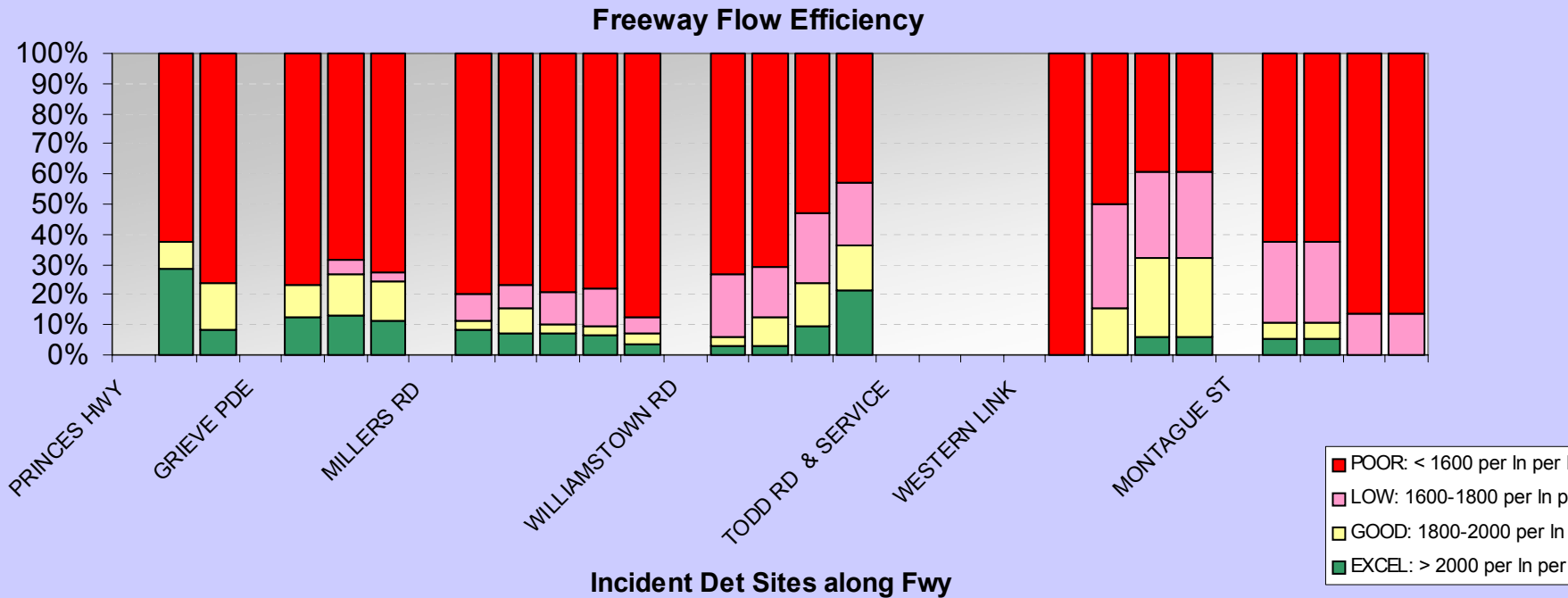
West Gate Freeway

West Gate Freeway Absolute Change In Hourly Average Volume
Per Site Relative To Base Year 2001

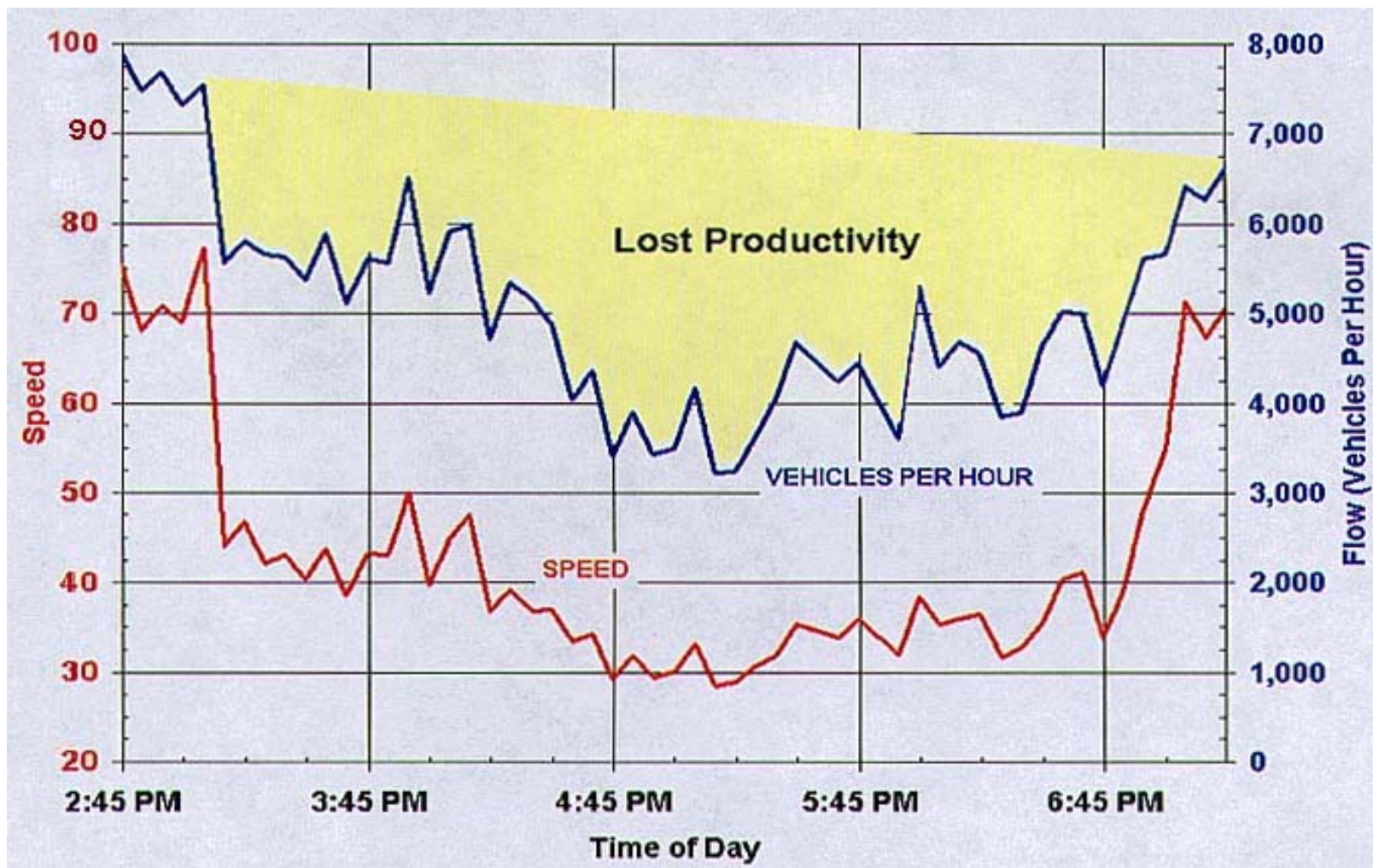


Freeway Flow Efficiency

80% Low or Poor operation

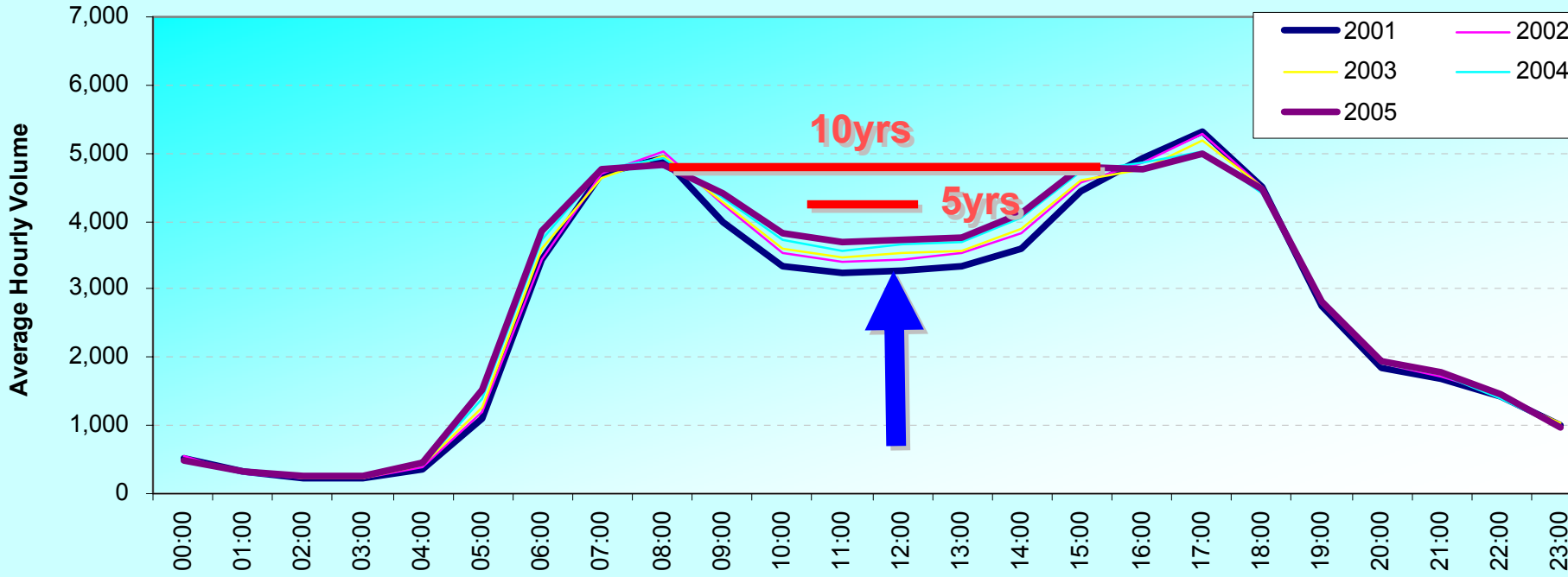


Lost Productivity - a traffic operations issue

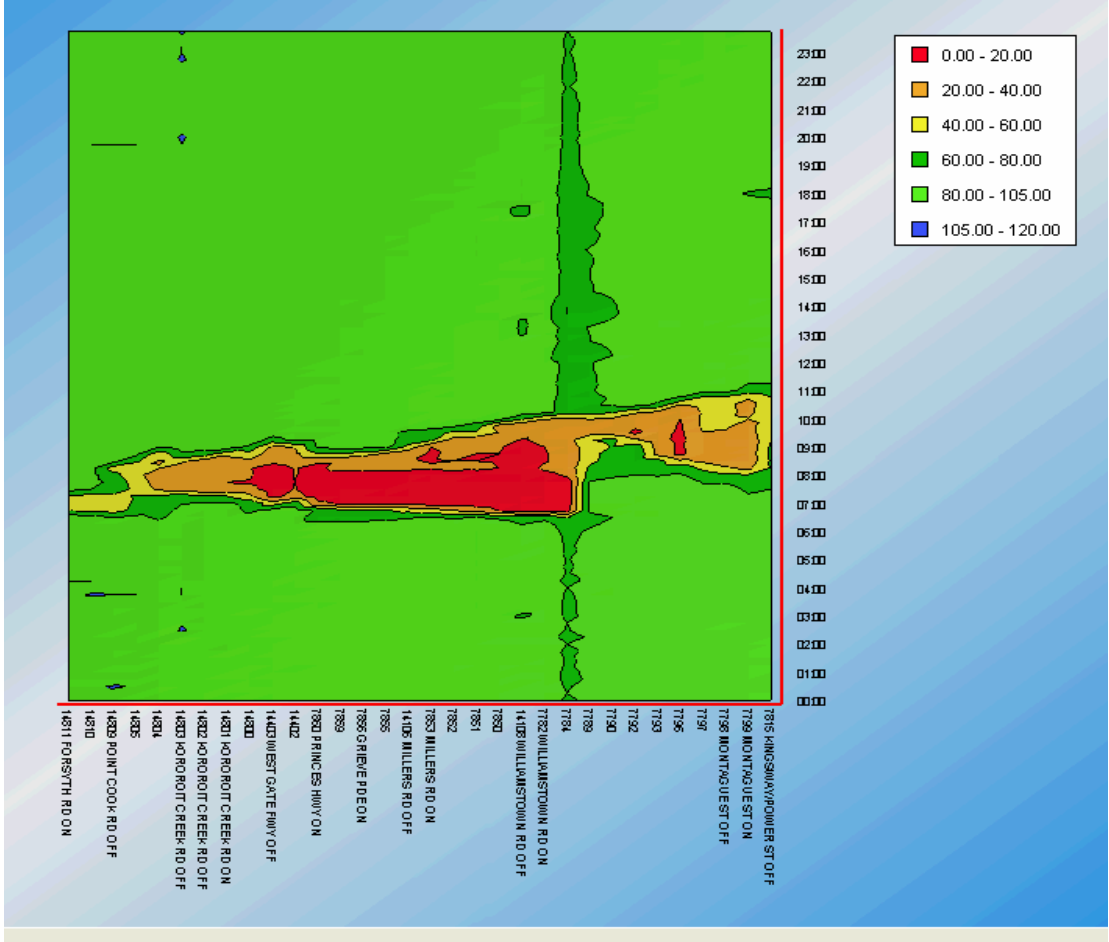


If past growth rates are maintained we will be at capacity or experience flow breakdown for up to 13 hrs a day on many critical freeways within 10 years

Monash Freeway Annual Average Hourly Volume Per Site



Speed Contour Maps can reveal Location of bottlenecks and can measure the impacts of incidents



Final Thought

Should we think of the performance of the road network in terms of Productivity, Efficiency and Spare Capacity?

Doing this will enable us to optimise the use of the Infrastructure

Thank You