Public Transport Planning
New Zealand Transport Agency
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Public Transport Performance Monitoring

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PTRG PUBLIC TRANSPORT RESEARCH GROUP

GROUP OF EIGHT AUSTRALIA

MONASH INSTITUTE OF TRANSPORT STUDIES

Introduction

Objectives

PT Performance Assessment

This presentation provides an introduction to PT route and service performance methods

- It aims to present an overview of the subject matter
- It will identify the key sources and issues
- It starts by looking at objectives – these are directly related to performance

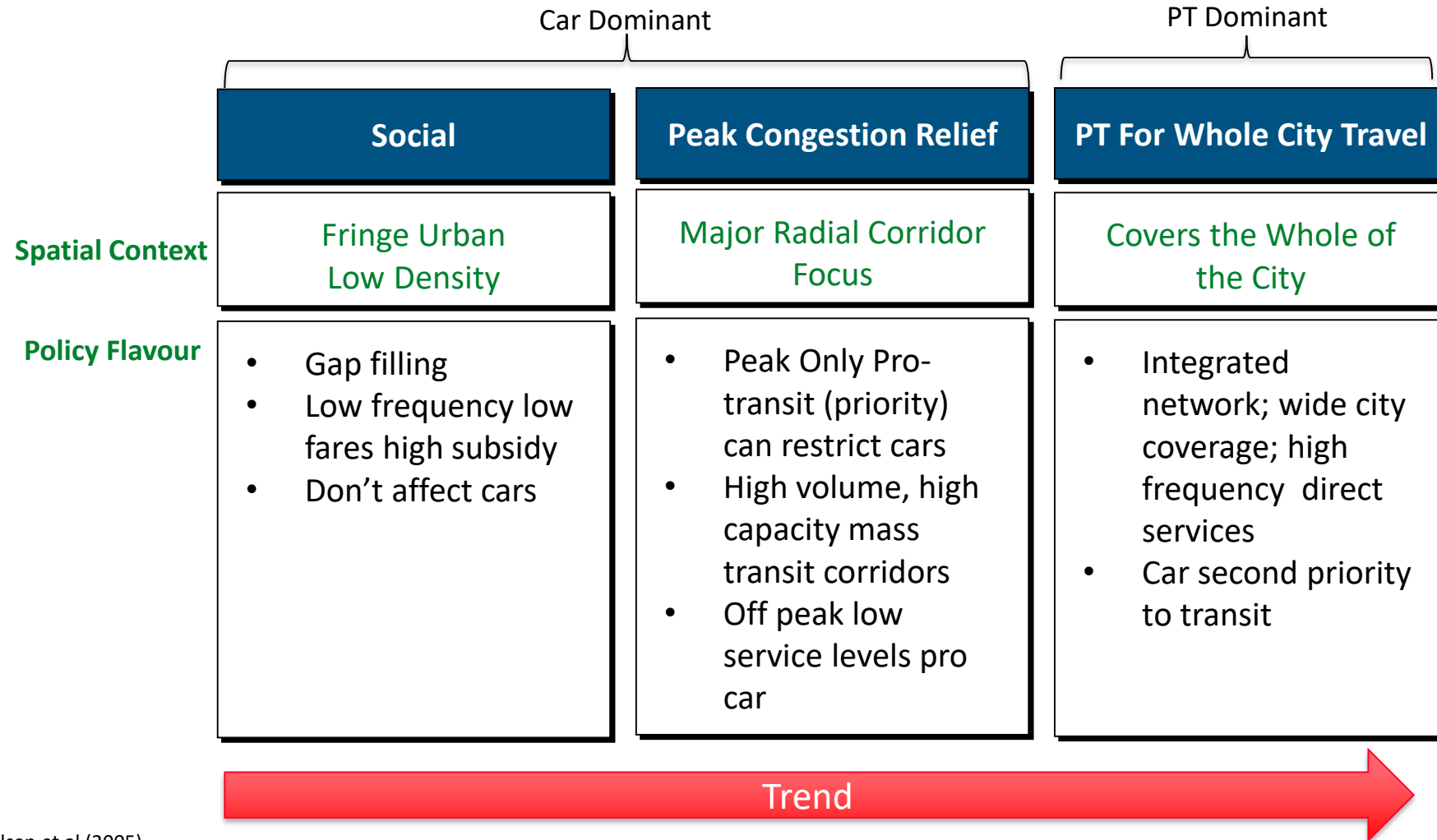**Introduction**

Objectives

PT Performance Assessment

"'high quality public transport', 'best practice' and 'success examples' can only be meaningful in relation to a defined purpose. Objectives vary between cities and often change over time."

Nielsen et al (2005)

WHAT ARE THE OBJECTIVES OF URBAN PUBLIC TRANSPORT?

There are THREE WORLDS in public transport – they explain how objectives link to public transport design and policy?

THREE WORLDS - Public Transport System Goal and Policy Outcomes

Car Dominant — PT Dominant

	Social	Peak Congestion Relief	PT For Whole City Travel
Spatial Context	Fringe Urban Low Density	Major Radial Corridor Focus	Covers the Whole of the City
Policy Flavour	• Gap filling • Low frequency low fares high subsidy • Don't affect cars	• Peak Only Pro-transit (priority) can restrict cars • High volume, high capacity mass transit corridors • Off peak low service levels pro car	• Integrated network; wide city coverage; high frequency direct services • Car second priority to transit

Trend →

Source: after Nielsen et al (2005)

How do objectives link to public transport design and policy?

Characteristics of Policy Outcomes Resulting From Differing Goals for Public Transport Provision

Transport Policy	Main Public Transport System Goal		
	Mobility for all members of society	**Relieve roads of congestion from car traffic**	**Replace car traffic in order to create a sustainable city**
	Social Emphasis	*Congestion Relief Emphasis*	*Liability Emphasis*
Role of public transport in relation to car use, road system and traffic	Public transport complements individual car-based transport	Public transport competes with the car system to reduce excessive car traffic	Public transport is the main system for the operation and structuring of the urban region, car transport is complementary
Car traffic strategy	Only minor regulations for functional purposes	Restrictions on car parking and driving in central areas at peak periods	Restrictions on car use and parking in all parts of the region
Public transport supply strategy	Dispersed in time and geography, at the expense of speed and frequency	Corridor concentration of resources to busy axes and periods	Network of high quality lines serving the whole region
Key quality factors	Local accessibility and reasonable fare levels	Quality of service and transport capacity with priority measures in peak traffic	Priority over cars in land use, infrastructure and traffic management
Other key quality aspect	Service friendly personnel, with little time stress	Fast and reliable, specially in main corridors at peak hours	Integration of network of high quality services, with reasonably high frequencies at low traffic periods
Public finance support for the system	For clearly specified social needs	For improved capacity and quality in peak periods, and reduced fares for regular users	For all aspects of the public transport system in order to keep fares at a competitive level in relation to car use even outside peak periods

Source: Based on Nielsen et al (2005, p21)
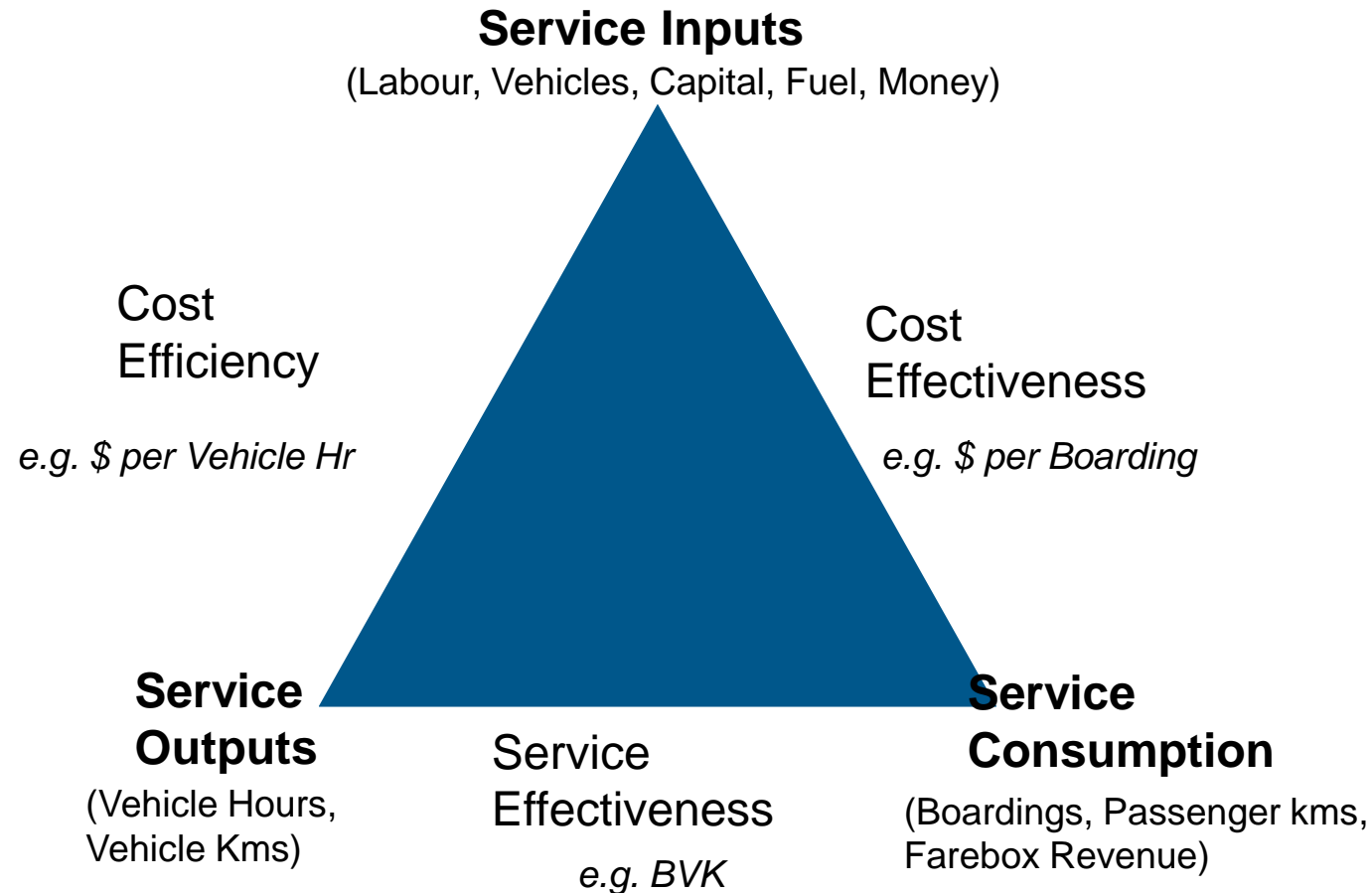
Introduction

Objectives

PT Performance Assessment

– You are required to do so

- Reporting and regulatory requirements

– Self Improvement

- Identify improvement priorities

– To Communicate Results
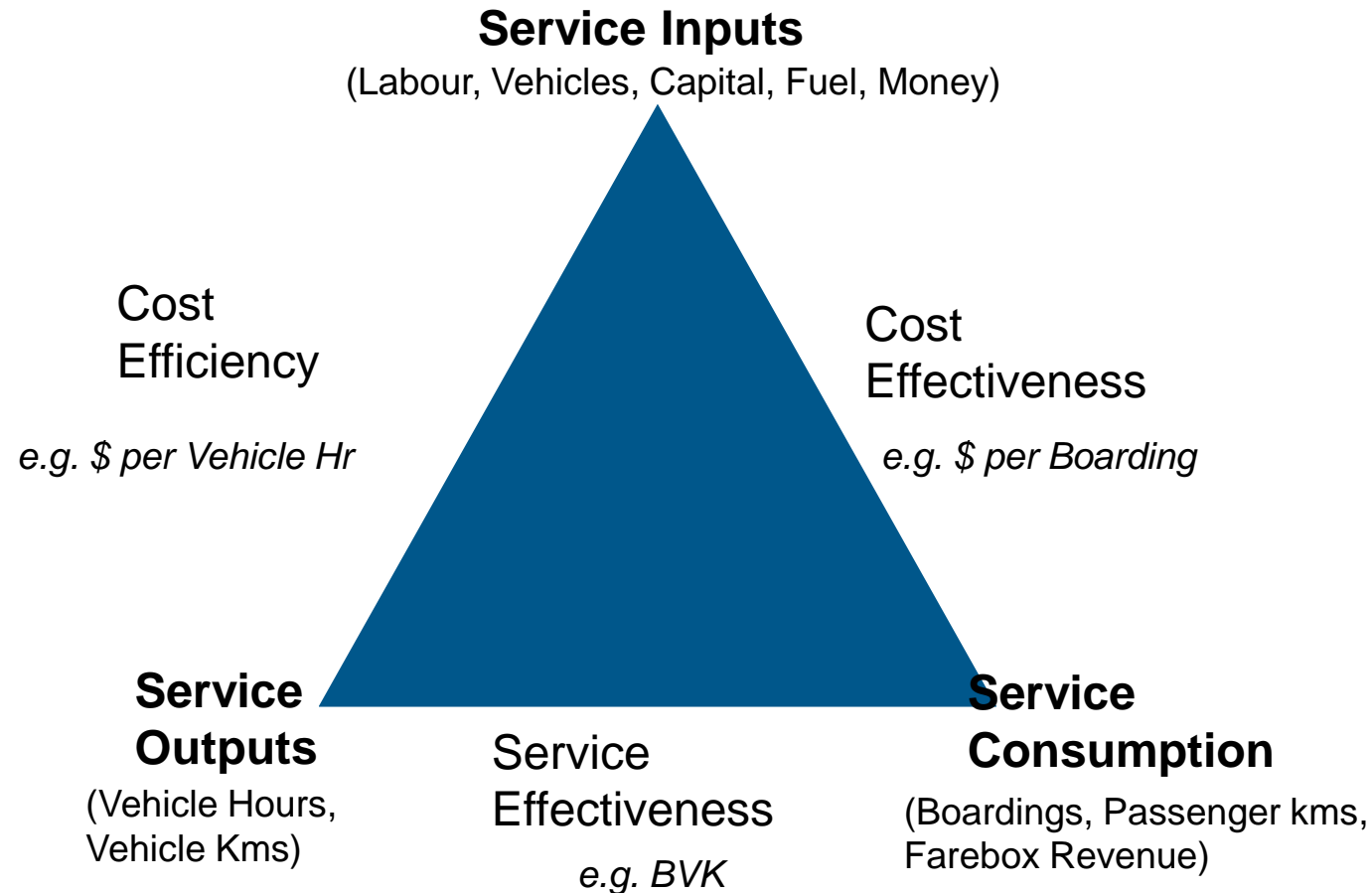
- Why are we subsidising these guys?

- The European model is more holistic. It sees PT performance within the context of improving service quality and considers it from all points of view including the passenger and society

- The US model enshrined in TCRP Report 88 is easier to apply, is transit agency fcussed but not quite as comprehensive.

- But first I shall mention the "Fielding Triangle"

Service Inputs
(Labour, Vehicles, Capital, Fuel, Money)

Cost
Efficiency

e.g. $ per Vehicle Hr

Cost
Effectiveness

e.g. $ per Boarding

**Service
Outputs**
(Vehicle Hours,
Vehicle Kms)

Service
Effectiveness

e.g. BVK

**Service
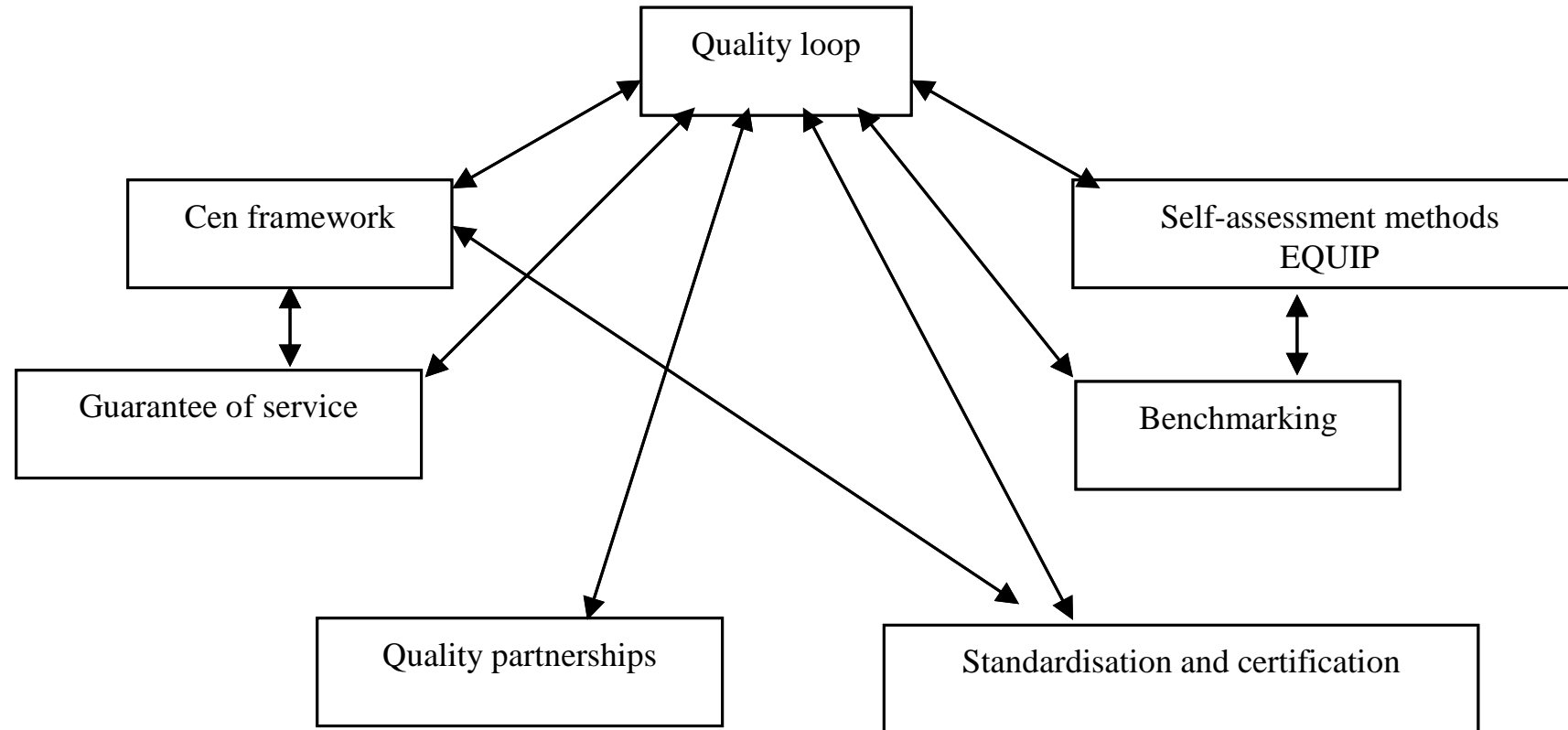Consumption**
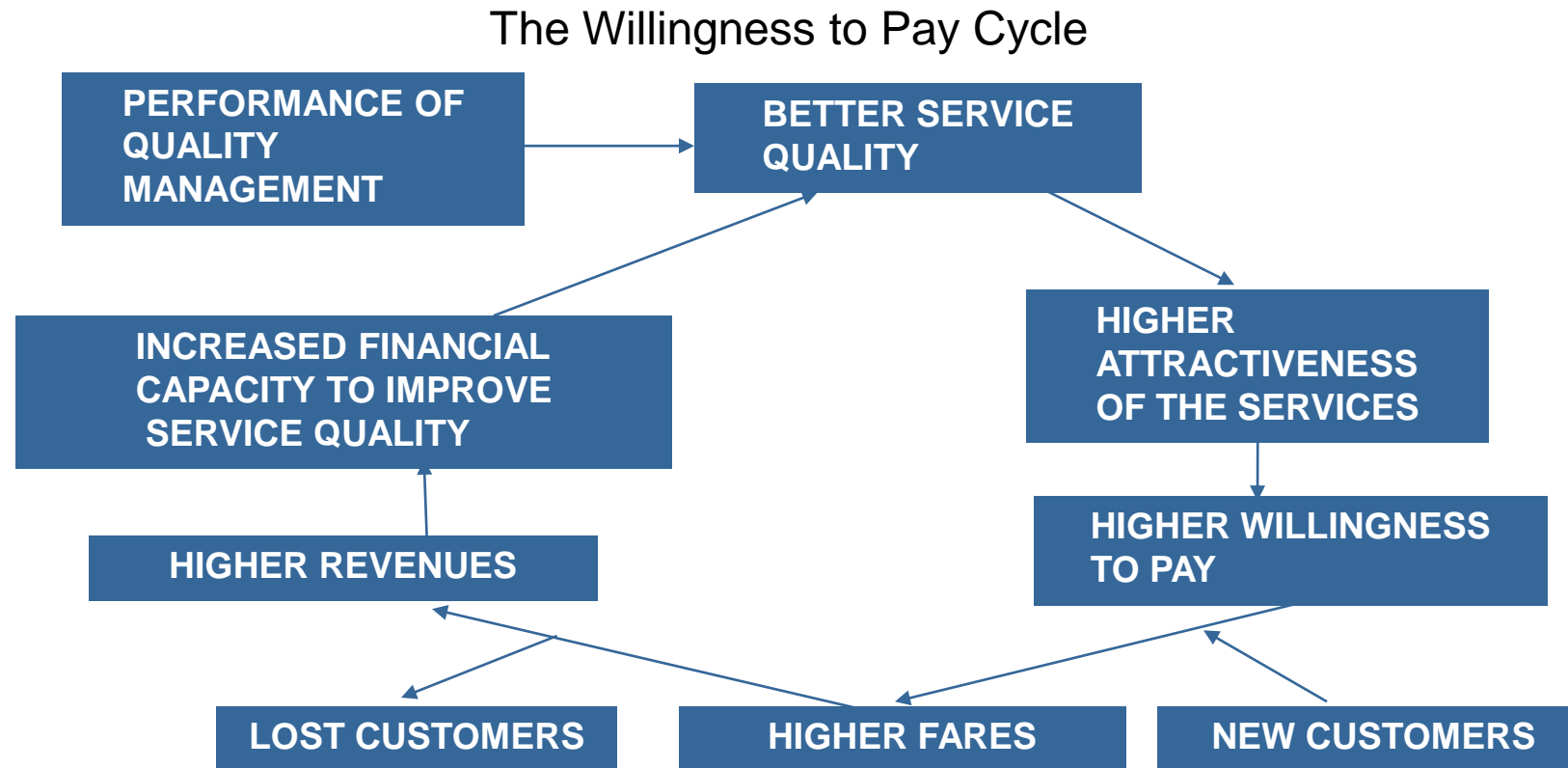(Boardings, Passenger kms,
Farebox Revenue)

Source: Gordon (Pete) Fielding 'Managing Public Transit Strategically : A Comprehensive Approach to Strengthening Service and Monitoring Performance'
San Franscisco: Jossey Bass Publishers 1987

It has been criticised for its cost emphasis and lack of customer service orientation

Service Inputs
(Labour, Vehicles, Capital, Fuel, Money)

Cost
Efficiency

e.g. $ per Vehicle Hr

Cost
Effectiveness

e.g. $ per Boarding

**Service
Outputs**
(Vehicle Hours,
Vehicle Kms)

Service
Effectiveness

e.g. BVK

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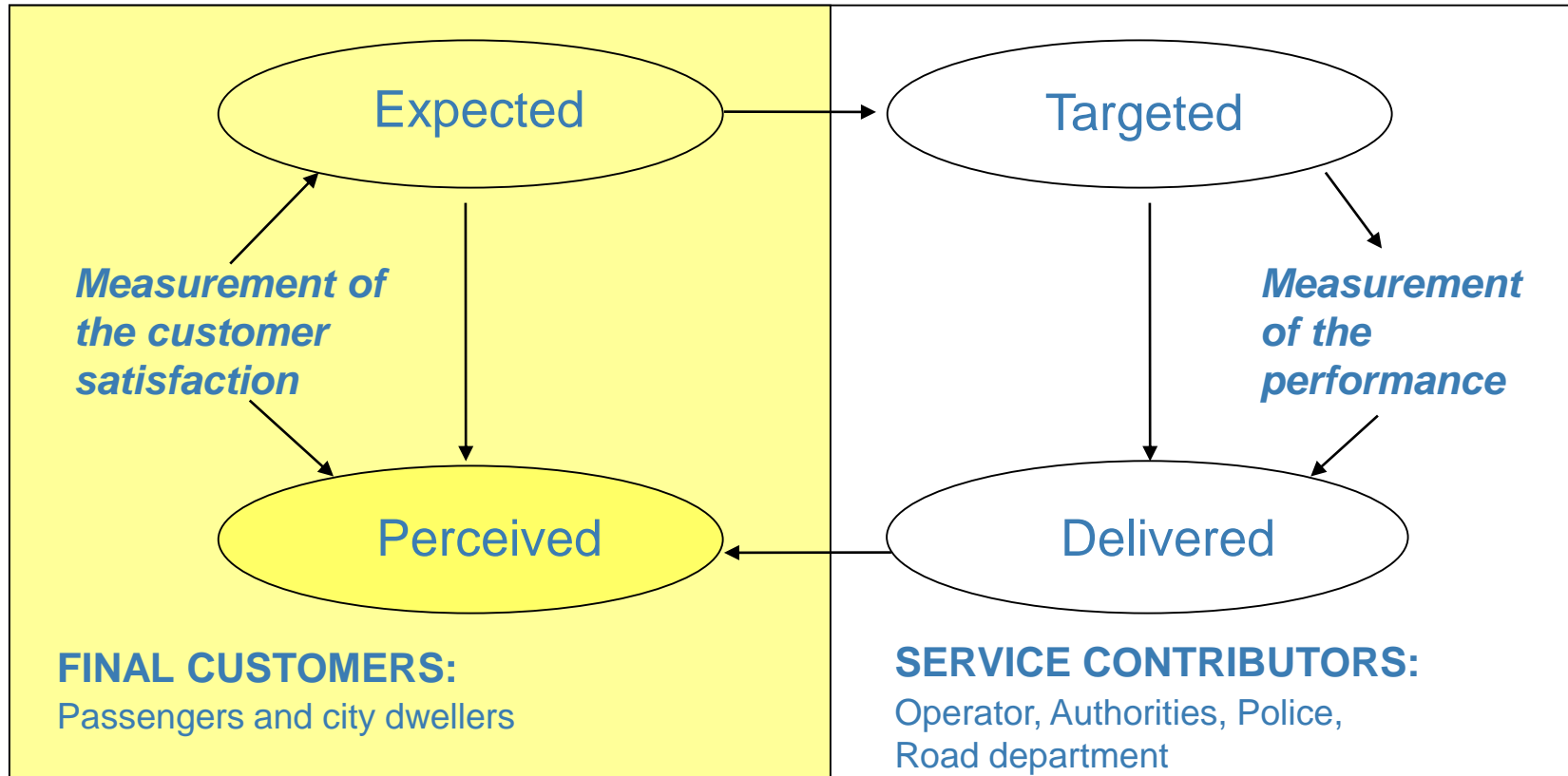# EU performance work emphasies quality management through a range of tools

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

It hopes to generate a "Virtuous Process" an interesting reversal of typical PT processes

The Willingness to Pay Cycle

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

The EU Quality Loop Model starts and finishes with customer orientation

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

It recognises differences between what PT agencies do and how it is perceived

Expected

Targeted

Perceived

Delivered

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

Traditional performance approaches just look at this
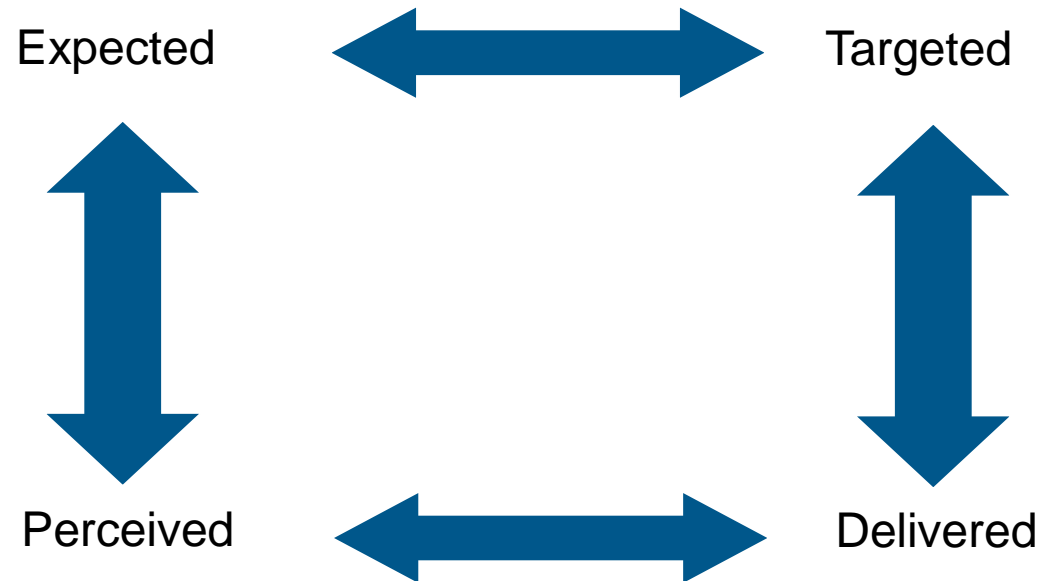
Expected   Targeted

Perceived   Delivered

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

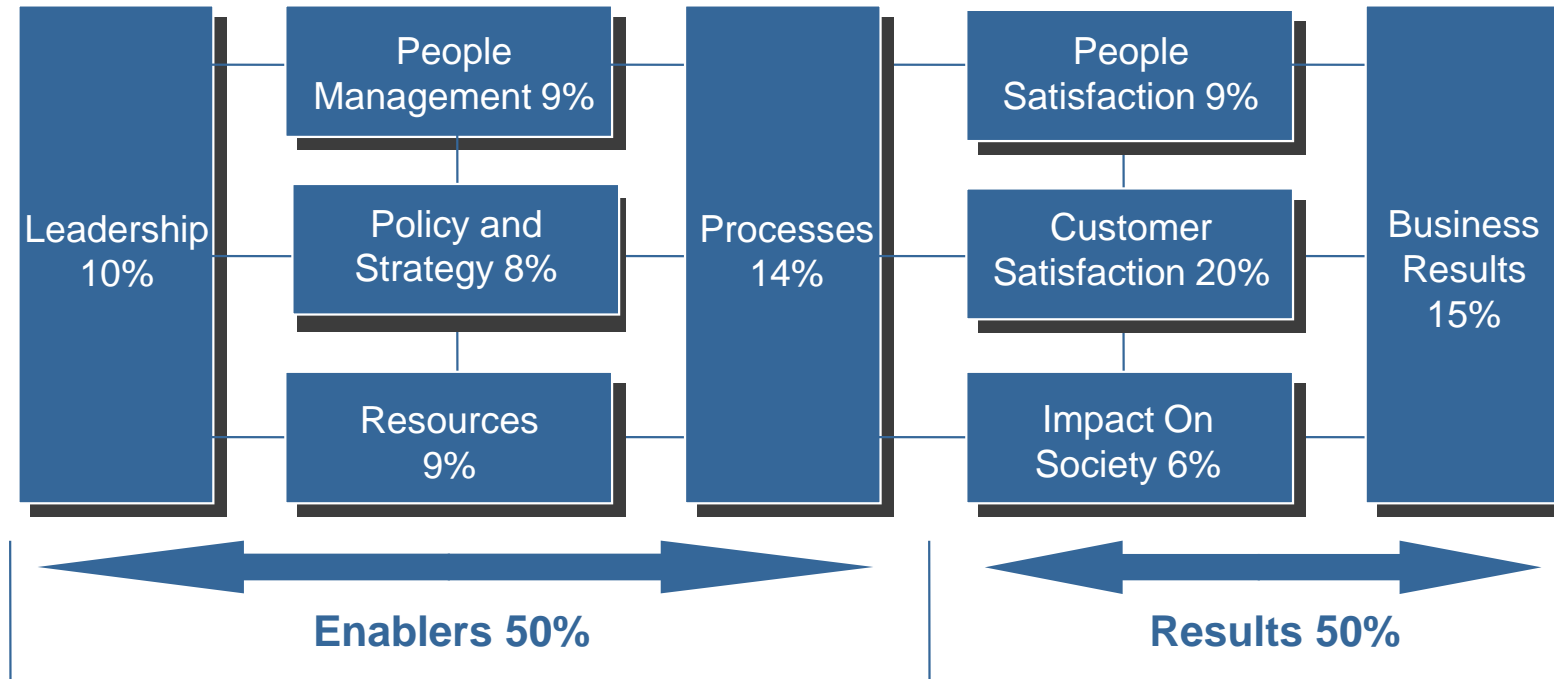# But good performance management is aware of all of these trade offs

Expected ⟷ Targeted

Perceived ⟷ Delivered

Source: Quality and Benchmarking in Public Transport EU PORTAL Project

- EFQM self-assessment model (nine management data sources and proposes a weighted assessment method).

- EQUIP (Extending the Quality of Urban Public Transport) model (UPT indicators).

The EFQM Self Assessment model aims to fully assess PT businesses/ organisations

The EFQM defines self assessment as "*taking a hard look at your organisation and scoring it against an ideal or model (the EFQM model in this case). The results indicate the organisation's strengths and areas for improvement and provide the basis for future strategy and improvement plans…*".

EQUIP clustering of indicators:

1	Company profile	(21)
2	External influences on operator	(13)
3	Revenue and fare structure	(9)
4	Asset/Capacity utilisation	(8)
5	Reliability	(5)
6	Production costs	(3)
7	Company performance	(4)
8	Technical performance	(6)
9	Employee satisfaction	(12)
10	Customer satisfaction	(7)
11	Safety and security	(3)
Total:		**91**

With 21 major indicators

Cluster and Indicator Number	Name	Cluster and Indicator Number	Name
1.1	Subcontracting of services	7.1	Operating profit or loss
1.3	Type of service area	8.2	Emissions
1.4	Vehicle kilometres	8.3	Fleet reliability
1.6	Fleet composition	9.1	Staff turnover
1.7	Passenger trips	9.2	Sickness
1.15	Operating speed	10.1	Passenger feedback ratio
2.9	External contributions to variable costs	10.3	Vehicle accessibility
3.3	Type of tickets	10.4	On board the vehicle
4.1	Load factor	10.5	At the stations/stops
4.2	Peak fleet utilisation	10.6	Information etc.
5.3	Abandoned service journeys	10.7	Transfers between vehicles
5.4	Delayed service journeys	11.1	Incidents
6.2	Costs per employee	11.3	Passenger health and safety
6.3	Costs per vehicle and passenger		

Table 1: The EQUIP Super Indicators. Source : Equip project

Level	Category	Elements
1	Self-assessment	Measure your own performance.
2	Comparison	Compare your performance with a database of values.
		Identify improvement areas and best "standards".
3	Partnering	Work with relevant partners, perhaps with some outside your direct business sector.
		Exchange confidential information.
		Learn best practice and the means of implementing the change.
		Ideally, this should be a two-way process.

EQUIP is a database as well as a process

1.3 Type of service area	Percentage of total number of services that operate in each type of service area.				
	See System Definitions sheet for definition of service areas (urban access, etc), and demand responsive transport				
	Place "Yes" in appropriate boxes.				
	Period: Most up to date information available				
	Method: Operator's personal knowledge				
	Percentage of Services				
	0-20	21-40	41-60	61-80	81-100
Urban access					
Connecting					
Rural access					
Demand Responsive Transport					

The type of service area is an important description of the operation. Some operators will be hybrids (these are likely to be large companies). See also vehicle kilometres [1.4], fleet composition [1.6], passenger trips [1.7] and passenger kilometres [1.8]). In a number of cases a service will change its character during its route (e.g. it may start as a rural access service but end as a connecting service) - this variation is accommodated by the broad bands used to complete the indicator.
[The EQUIP Handbook does not specify indicators that relate to the actual size of the operational area, as it is difficult to calculate, and may have limited meaning for operators where services are mainly connecting and/or rural access].

It can get down to quite fine detail for benchmarking comparisons

Mode	Full Indicator List		Super Indicators	
	Electronic	Paper	Electronic	Paper
Bus except trolley bus	Bus_elec	Bus_papr	SuBus_el	SuBus_pr
Trolley bus	Tly_elec	Tly_papr	SuTly_el	SuTly_pr
Tram/light rail	Trm_elec	Trm_papr	SuTrm_el	SuTrm_pr
Metro	Met_elec	Met_papr	SuMet_el	SuMet_pr
Local heavy rail	Hvy_elec	Hvy_papr	SuHvy_el	SuHvy_pr

Table 0.3 Versions of the EQUIP Handbook

Bus except trolley bus	Trolley bus	Tram/light rail	Metro	Local heavy rail
Small (<5m)	Standard (<15m)	Single axle	Single car	Single car
Midi (5-10m inclusive)	Articulated	Double axle	Multiple car	Multiple car
Standard (>10 and <15m)	Double deck	Treble axle		
Double deck				
Articulated (single deck)				
Articulated (double deck)				

Table 0.4 Breakdown of Modes in the EQUIP Handbook

Indicators are provided for the full version of the bus mode and the shortened (super) version of the tram mode.
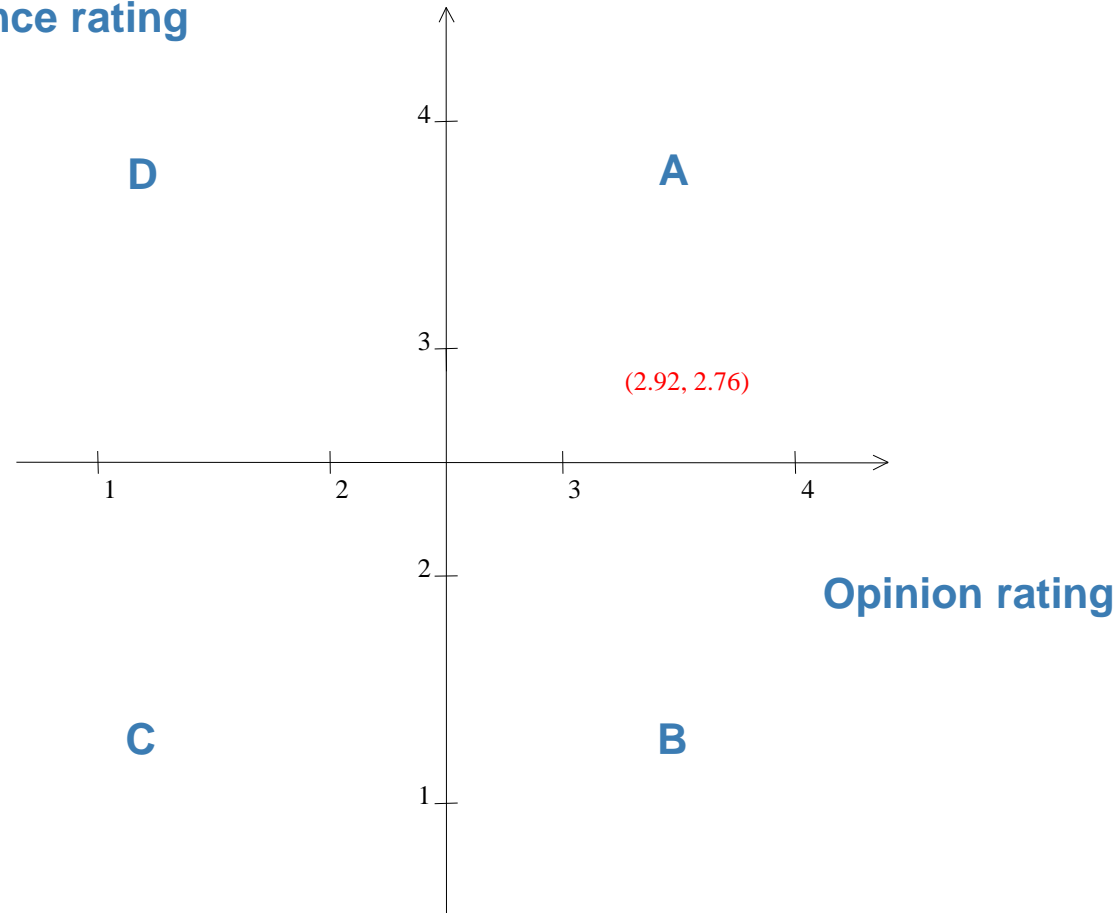
These, and indicators for all other modes, including the electronic versions which have automatic calculation built into the spreadsheet are available from Corinne Mulley, the Project Co-ordinator, by e-mail (Corinne.Mulley@ncl.ac.uk).

Key success factors have been identified for successful benchmarking

KSF	Notes
Have the right conditions	• **Know yourself, know your enemy incorporate the best, gain superiority** • **"Benchmarking is the <u>continuous process</u> of <u>measuring our products, services and practices</u> against our toughest competitors or those <u>companies renowned as industry leaders</u>."**
Support/Commitment from Management	• **Each benchmarking exercise needs the real, active support from a 'Sponsor'**
Chose the Right Benchmarking Subject Area	• **The subject of the exercise has to be, and seen by the organisation to be, in an area that is important to the achievement of key business goals.** • **Current business opportunities, threats, strengths, weaknesses, performance shortfall, etc., have to be clearly understood.**
The Right Benchmarkers	• **Understand the purposes, good training in benchmarking**
The Right Approach	• **Ensure a rigorous, step-by-step approach to helping ensure that the exercise stands a good chance of success. It must have credibility.**

Importance rating

D

A

(2.92, 2.76)

1   2   3   4

Opinion rating

C

B

27

A series of 8 groups of measures are included in the CEN Quality Framework

1. Availability	1.1 Network
	1.2 Timetable
2. Accessibility	2.1 External interface
	2.2 Internal interface
	2.3 Ticketing
3. Information	3.1 General information
	3.2 Travel information normal conditions
	3.3 Travel information abnormal conditions
4. Time	4.1 Length of travel time
	4.2 Punctuality and reliability
5. Customer care	5.1 Commitment
	5.2 Customer interface
	5.3 Staff
	5.4 Physical assistance
	5.5 Ticketing options
6. Comfort	6.1 Ambient conditions
	6.2 Facilities
	6.3 Ergonomics
	6.4 Ride comfort
7. Security	7.1 Safety from crime
	7.2 Safety from accident
	7.3 Perception of security
8. Environment	8.1 Pollution
	8.2 Natural resources
	8.3 Infrastructure

A series of 8 groups of measures are included in the CEN Quality Framework

Availability

Accessability

Information

Customer Care

Time

Comfort

– Available if you are a UITP member

– Many operators filled the data in including several Australian cities

Millennium Cities Database – Factors Examined

- – • Population, Land Use and Wealth
- – • Vehicle Ownership and Private Mobility
- – • Overall Daily Mobility
- – • Public Transport Usage
- – • Public Transport Infrastructure
- – • Public Transport Supply and Speed of Service
- – • Private Transport Infrastructure
- – • Traffic System Performance
- – • Economic Aspects of Urban Transport
- – • Transport Energy Use and Externalities

Millennium cities database – example Data

City	Population	Number of jobs in the CBD	Proportion of jobs in CBD	Urban density	Job density	Metropolitan gross domestic product per capita
			%	persons/ha	jobs/ha	USD $1995
Atlanta	2,897,178	102,695	6.3%	6.4	3.6	31,037
Chicago	7,523,328	403,319	10.0%	16.8	9.0	32,110
Denver	1,984,578	102,182	8.6%	15.1	9.0	32,391
Houston	3,918,061	135,133	7.2%	8.8	4.2	30,680
Los Angeles	9,077,853	171,364	4.1%	24.1	11.2	28,243
New York	19,227,361	2,094,400	20.7%	18.0	9.5	34,395
Phoenix	2,526,113	28,088	2.7%	10.4	4.3	26,920
San Diego	2,626,714	68,411	5.8%	14.5	6.6	26,508
San Francisco	3,837,896	230,255	13.9%	20.5	8.9	37,154
Washington	3,739,330	297,189	12.4%	14.3	9.2	34,420
US AV.			9.2%	14.9	7.5	31,386
Brisbane	1,488,883	73,953	11.9%	9.6	4.0	15,036
Melbourne	3,138,147	123,056	9.4%	13.7	5.7	21,476
Perth	1,244,320	99,938	19.2%	10.9	4.6	21,995
Sydney	3,741,290	203,240	12.8%	18.9	8.0	22,397
AUST. AV.			13.3%	13.3	5.6	20,226
Calgary	767,059	93,500	23.0%	20.8	11.0	23,983
Montreal	3,224,130	220,425	16.3%	31.7	13.3	16,066
Ottawa	972,456	98,223	20.1%	31.3	15.7	18,827
Toronto	4,628,883	149,782	6.5%	25.5	12.8	19,456
Vancouver	1,898,687	115,255	12.6%	21.6	10.4	25,793
CAN. AV.			15.7%	26.2	12.7	20,825
Copenhagen	1,739,458	129,133	14.1%	28.5	15.0	37,058
Paris	11,004,254	890,000	18.1%	47.6	21.3	41,305
Frankfurt	653,241	108,583	20.5%	47.6	38.7	54,571
Hamburg	1,707,901	161,923	16.4%	38.4	22.3	37,306
Munich	1,324,208	278,959	36.3%	55.7	32.3	54,692
Stockholm	1,725,756	111,800	13.3%	29.0	14.1	33,438
Zurich	785,655	66,116	12.2%	44.3	30.6	50,168
London	7,007,100	1,047,700	28.0%	59.1	31.5	22,363
Vienna	1,592,596	100,336	11.8%	69.4	37.1	39,316
Amsterdam	831,499	74,730	17.7%	57.0	29.0	28,322
Brussels	948,122	166,250	26.7%	72.4	47.6	28,009
W. EUR. AV.			19.5%	49.9	29.0	38,777
Tokyo	32,342,698	2,500,551	14.3%	87.7	47.5	45,425
Hong Kong	6,311,000	189,263	6.4%	320.4	151.3	22,969
Singapore	2,986,500	278,659	16.4%	93.5	53.3	28,578
ASIAN AV.			12.3%	167.2	84.0	32,324

Table 1. Population, Land Use and Wealth in World Cities, 1995/6
Source: Kenworthy and Laube (2001) UITP Millennium Cities Database for Sustainable Transport

City	Passenger cars per 1000 persons	Motor cycles per 1000 persons	Passenger car passenger kilometres per capita	Motor cycle passenger kilometres per capita
	units/1000 persons	units/1000 persons	p.km/person	p.km/person
Atlanta	746.0	10.0	24,641	16
Chicago	573.0	12.7	15,697	102
Denver	629.7	21.6	17,771	64
Houston	693.3	6.5	25,323	26
Los Angeles	527.4	11.7	17,343	35
New York	444.0	10.2	12,485	19
Phoenix	530.6	14.8	15,082	46
San Diego	555.1	15.9	18,675	61
San Francisco	599.6	20.1	17,242	53
Washington	572.8	7.3	17,288	26
US AV.	587.1	13.1	18,155	45
Brisbane	596.4	17.0	12,487	153
Melbourne	593.7	11.6	11,918	67
Perth	658.1	19.0	13,546	84
Sydney	515.6	9.9	10,506	46
AUST. AV.	590.9	14.4	12,114	88
Calgary	703.0	11.5	11,203	6
Montreal	429.1	9.1	7,597	7
Ottawa	531.6	10.3	8,298	46
Toronto	464.4	6.4	6,818	3
Vancouver	519.7	10.4	9,310	43
CAN. AV.	529.6	9.5	8,645	21
Copenhagen	275.3	8.8	7,943	46
Paris	418.0	60.6	5,156	229
Frankfurt	451.3	19.6	6,845	36
Hamburg	418.2	17.5	8,150	79
Munich	469.4	25.8	5,913	117
Stockholm	386.0	16.4	8,460	64
Zurich	462.4	45.0	7,958	94
London	331.9	8.8	5,463	91
Vienna	372.9	29.4	4,873	83
Amsterdam	322.6	11.5	5,394	60
Brussels	454.0	14.6	5,700	41
W. EUR. AV.	396.5	23.5	6,532	85
Tokyo	306.8	99.0	4,080	71
Hong Kong	46.5	3.6	930	46
Singapore	116.3	43.4	3,570	260
ASIAN AV.	156.5	48.7	2,860	126

Table 3. Vehicle Ownership and Private Mobility in World Cities, 1995/6.
Source: Kenworthy and Laube (2001) UITP Millennium Cities Database for Sustainable Transport

MONASH University

PTRG PUBLIC TRANSPORT RESEARCH GROUP

— A little 'broad' BUT has many more international operators

— Has been going longer than most databases

- Published in 2003
- Includes case studies (with Australian examples)
- Available at

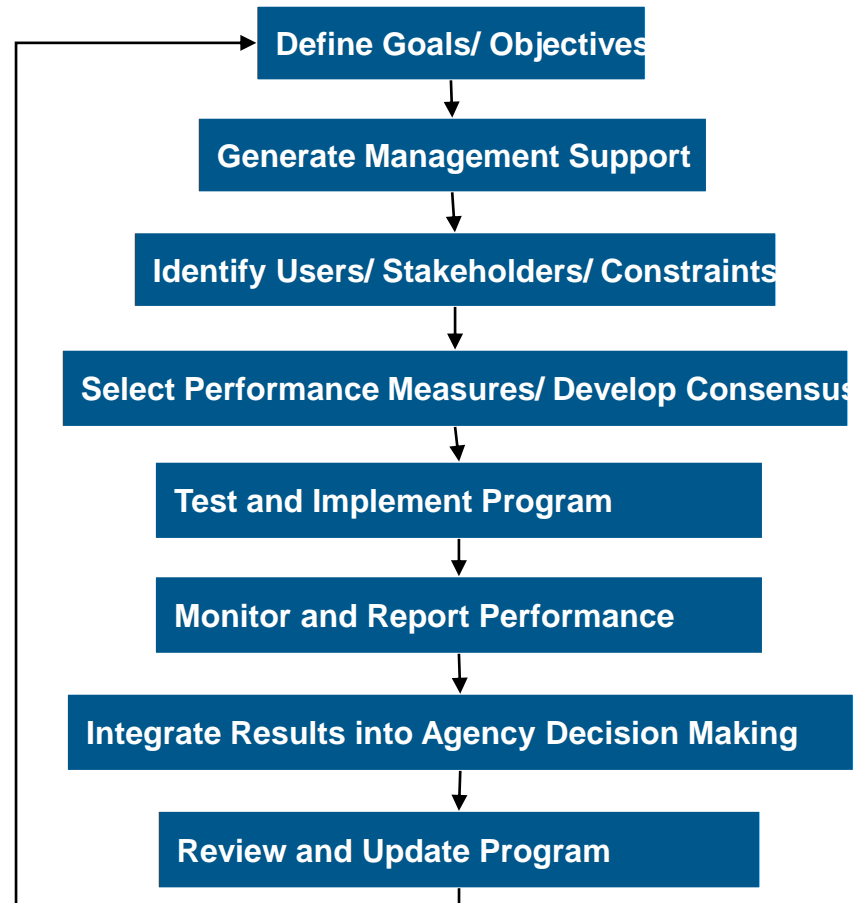http://trb.org/news/blurb_detail.asp?id=1120

(Or search for TCRP Report 88)

- CUSTOMER – Quality of Service

- COMMUNITY – Impact on Broad Community Objectives

- AGENCY – Management of Effectiveness and Efficiency
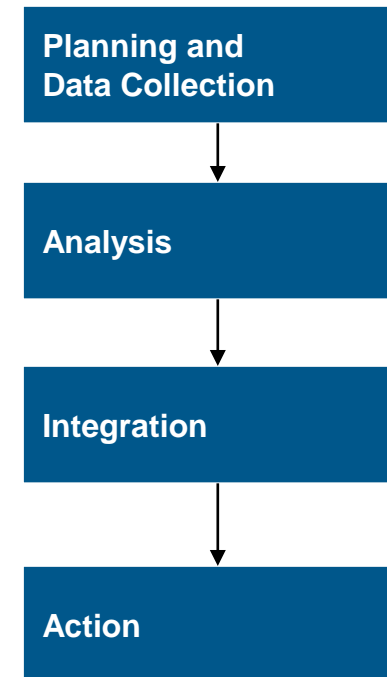
- DRIVER/VEHICLE – Traffic Engineering

"Measures selected merely to make an agency look good are of little help in identifying areas for improvement"

TCRP 88 / EU approaches to performance measurement system development

TCRP 88

- Define Goals/ Objectives
- Generate Management Support
- Identify Users/ Stakeholders/ Constraints
- Select Performance Measures/ Develop Consensus
- Test and Implement Program
- Monitor and Report Performance
- Integrate Results into Agency Decision Making
- Review and Update Program

EU (EQUIP) – Benchmarking Process

- Planning and Data Collection
- Analysis
- Integration
- Action

TCRP 88 - Performance Measure Categories

Category	Customer	Agency	Community	Driver/ Vehicle
Availability of Service	✓			
Service Delivery	✓			
Safety and Security	✓			
Community			✓	
Maintenance & Construction	✓	✓		
Economic		✓	✓	
Administrative		✓		
Capacity			✓	✓
Travel Time	✓			✓

Table 1. Core Fixed-Route Availability Measures

Large	Medium	Small	Under 50,000
Service coverage		Route coverage	
Frequency			
Hours of Service			
Stop Accessibility			

Table 2. Core Fixed-Route Service Delivery Measures

Large	Medium	Small	Under 50,000
Missed trips			
Complaint rate			
Route directness			
On-time performance			
Customer response time			
Passenger load			
Reliability factor			
Transit-auto travel time			
Number of fare media sales outlets			
Customer satisfaction			
Headway regularity			
Passenger environmt.			
Customer loyalty			

200K to 1M

50K To 200K

Population Over 1M

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Number of fare media sales outlets			
Customer satisfaction			
Headway regularity			
Passenger environmt.			
Customer loyalty			

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Table 3. Core Fixed-Route Safety and Security Measures

Large	Medium	Small	Under 50,000
Accident rate			
Number of incidents of vandalism			
Crime rate			
Number of vehicles with specified safety devices			
Passenger safety			
Ratio of police officers to transit vehicles			

Table 4. Core Fixed-Route Community Measures

Large	Medium	Small	Under 50,000
Personal economic impact			
Demographics			
Communications			
Mobility			
Service equity			
Community economic impact			
Environmental impact			
Visual impact			

Table 5. Core Fixed-Route Maintenance Measures

Large	Medium	Small	Under 50,000
Road calls			
Average spare ratio vs. scheduled spare ratio			
Fleet cleaning			
Maintenance work orders: model vs. fleet			
Average life of vehicle components			
Average age of vehicle components			
Mean vehicle age			
Maintenance program effectiveness			
Fleet maintenance performance			

Table 6. Core Fixed-Route Economic Measures

Large	Medium	Small	Under 50,000
Ridership			
Productivity			
Cost effectiveness			
Cost efficiency			
Energy consumption			
Risk management			

Table 7. Core Fixed-Route Administrative Measures

Large	Medium	Small	Under 50,000
Percent positive drug/alcohol tests			
Employee productivity			
Employee relations			
Employee work days lost due to injury			
Administrative performance			

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TCRP 88 makes some good points about reporting performance results

General Public

Board

Senior Managers

Operating Staff

Breadth of Responsibility — High / Low

Level of Detail — High / Low

- The US Integrated National Transit Database Analysis System (INTDAS) is available for free download as part of the Florida Transit Information System at

  http://www.ftis.org/

– A simple software system designed to interrogate the National Transit Database (NTD) and also to identify peer groups within the US

– Avoid GIGOSIS

– Be aware of the Benchmarking Problem – finding the appropriate peer

– Make valid comparisons

All performance relate to objectives

Objectives for Providing Public Transport

i. Improved or efficient capacity/volume of travel,

ii. fosters sustainable development patterns

iii. reduces traffic congestion/ car dependence

iv. less environmental emissions/ pollution/ greenhouse

v. reduces oil dependence

vi. builds positive social interaction including 'social capital'

vii. creates sustainable economically viable and efficient communities

viii. creates liveable cities

ix. addresses inequities in access and social disadvantage

x. reduces divisions in society through provision of universal access

Objectives for Providing Public Transport

i. Improved or efficient capacity/volume of travel,	**vi. builds positive social interaction including 'social capital'**
ii. fosters sustainable development patterns	**vii. creates sustainable economically viable and efficient communities**
iii. reduces traffic congestion/ car dependence	**viii. creates liveable cities**
iv. less environmental emissions/ pollution/ greenhouse	**ix. addresses inequities in access and social disadvantage**
v. reduces oil dependence	**x. reduces divisions in society through provision of universal access**

TCRP 88

http://trb.org/news/blurb_detail.asp?id=1120

EQUIP

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