Benchmarking Bus Operations

Presentation to the National Capital Region Transportation Planning Board

27th January 2011

Definition of Benchmarking

- **A systematic process of continuously measuring, comparing and understanding organisations' performance and change in performance**
  - of a diversity of key business processes
  - against comparable peers anywhere else in the world
  - to gain information which will help the participating organisations to improve their performance

- *Adapted from the definition by Lema and Price*

Imperial College London are World Leaders in the Field of Public Transport Benchmarking

Sixteen year history of benchmarking projects facilitated by Imperial College London

1994 Group of Five heavy metros formed (incl. NYCT)

1996 *Community of Metros (CoMET)* founded (9 of the world's largest 12 metros)

1998 Success of *CoMET* leads to formation of *Nova* group for medium-sized metros

2004 *International Bus Benchmarking Group* established

2010 *Suburban Rail Benchmarking Group* established

Significant benefits have driven continued participation: for example NYCT New York is a member for CoMET for 16 years and the IBBG for 6 years

Imperial College currently ranks 9th in the world

- Rankings released in September 2010 shows Imperial College ranked 9th between Berkeley and Yale

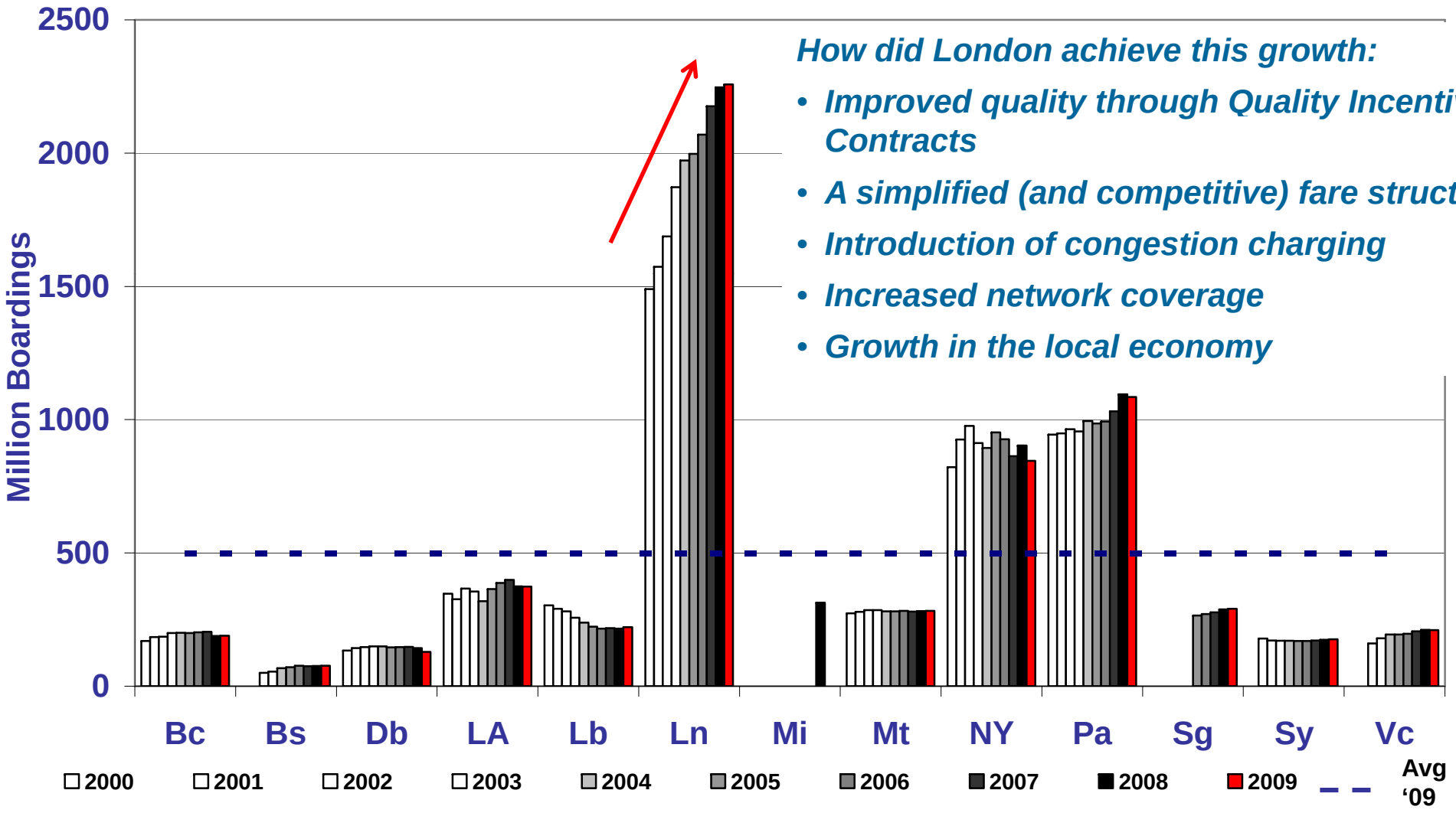
THE WORLD UNIVERSITY RANKINGS 2010

WORLD RANK ▼	INSTITUTION	COUNTRY	OVERALL SCORE change
1	Harvard University	United States	96.1
2	California Institute of Technology	United States	96.0
3	Massachusetts Institute of Technology	United States	95.6
4	Stanford University	United States	94.3
5	Princeton University	United States	94.2
6	University of Cambridge	United Kingdom	91.2
6	University of Oxford	United Kingdom	91.2
8	University of California Berkeley	United States	91.1
9	Imperial College London	United Kingdom	90.6
10	Yale University	United States	89.5
11	University of California Los Angeles	United States	87.7
12	University of Chicago	United States	86.9
13	Johns Hopkins University	United States	86.4
14	Cornell University	United States	83.9

Thirteen Bus Benchmarking Group members

IBBG Member Size: Passenger Boardings – Trends
Possible to Compare Organisations of Different Sizes

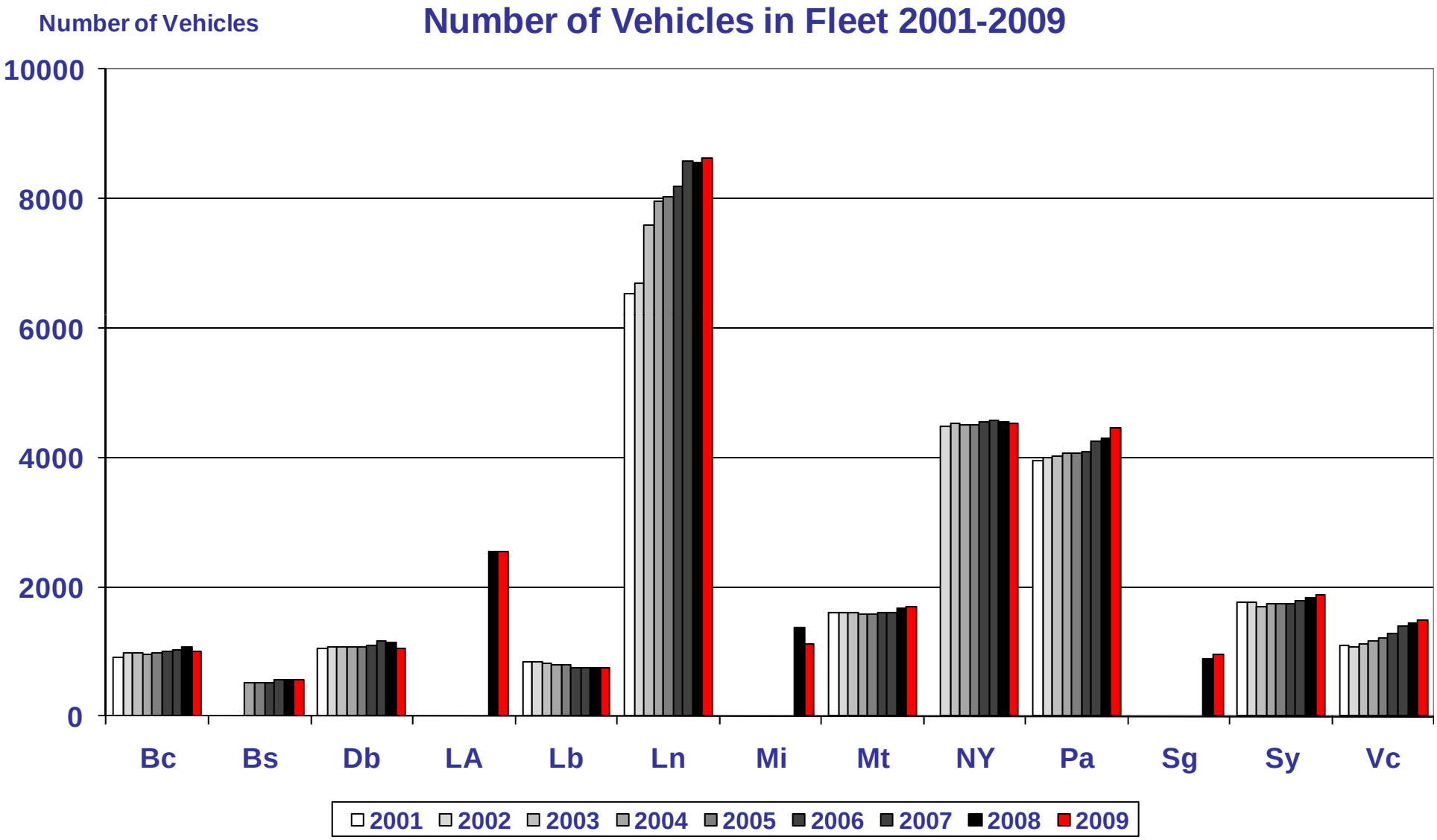
GA: Annual Passenger Boardings - Trends



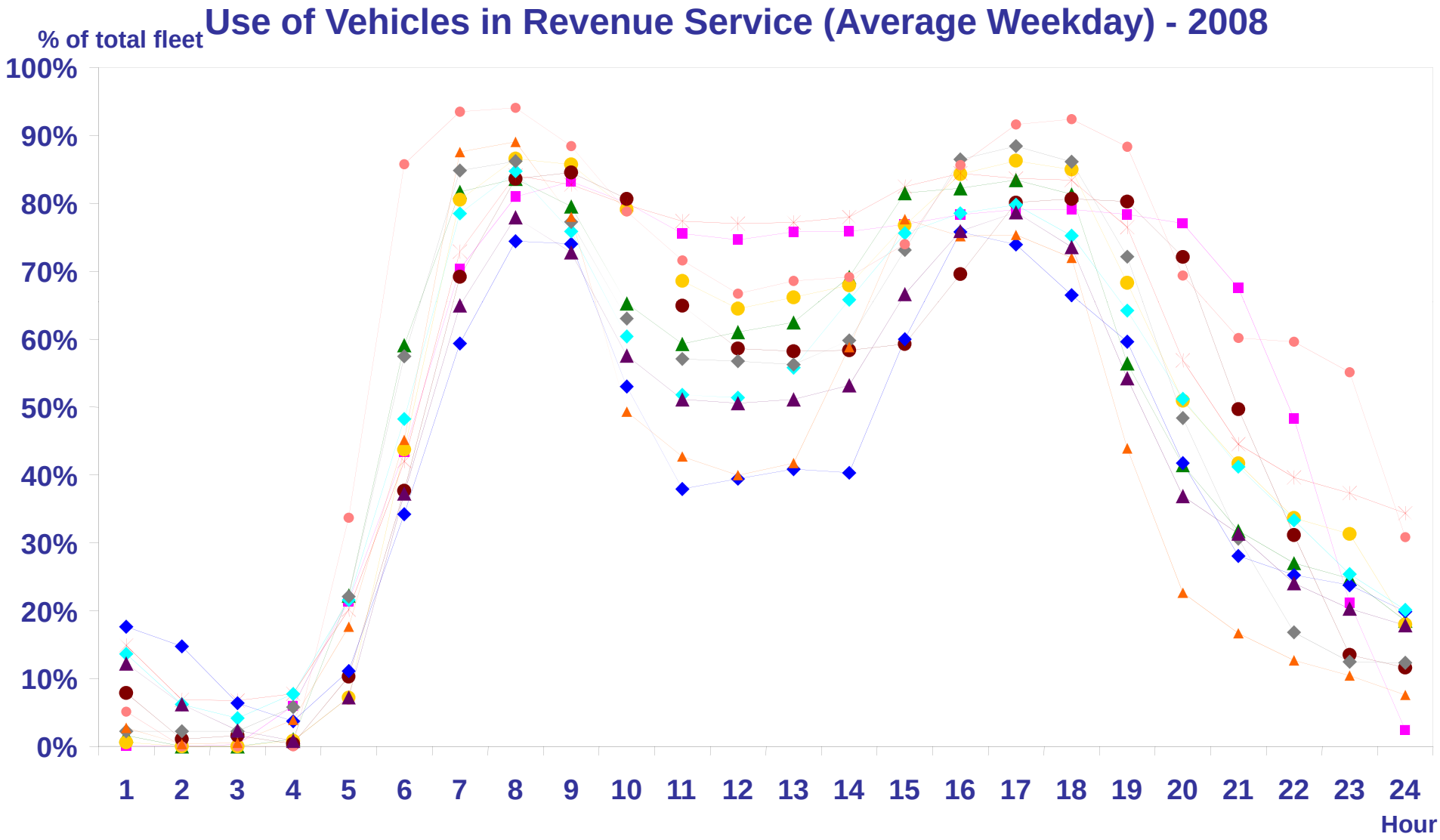
How did London achieve this growth:

- ***Improved quality through Quality Incentive Contracts***
- ***A simplified (and competitive) fare structure***
- ***Introduction of congestion charging***
- ***Increased network coverage***
- ***Growth in the local economy***

Member size - Fleet



Background Information example: Supply profile differences help to understand differences in performance



High Level Benefits of Membership

Benefits mentioned by current International Bus benchmarking Members
▪ Save resources by learning where and how to be more productive ▪ Save resources by taking into account other members' experiences - no need to 'reinvent the wheel' ▪ Improved allocation and prioritisation of resources by understanding where most improvements can be achieved ▪ Save resources on research / consultants ▪ Defending & promoting your position to government, authority, media, etc ▪ Expert network with quick information exchange ▪ Better informed and more creative staff

International Bus Benchmarking Group

Work programme & Process Overview

Objectives of Bus Benchmarking Group

There is rarely a challenge that another member has not also faced

- The group acts as an independent, confidential and effective forum for information exchange
  - *Expert level*
  - *Fast access to information / exchange of information*
- It builds a system of objective measures to identify best practice
  - *Who are best?*
  - *Can we learn from them?*
  - *Who has improved and how?*
  - *Where are our strengths and weaknesses?*
  - *How much can we improve?*
- Building networks of contacts - multidisciplinary

Benchmarking – Project Ownership and Management

- Groups owned, run by the participating agencies; group presidencies rotate annually
- Key attributes are:
  - Independence
  - Speed
  - Confidentiality
  - Contacts/networking
- Project management and analysis carried out by Imperial College London
- *Ideal group size between 10 - 15 organisations*

Confidentiality Agreement

- **A ‘closed group’ leads to honest and open information sharing - It is KEY to successful benchmarking**
- *Complete openness within the benchmarking groups, complete confidentiality to the outside*
- Information may be disseminated as widely as participants wish within their own organisations
- Use only anonymised and randomised data in information issued to outside organisations or individuals, including shareholders, government or the media, or published in academic papers
- A significant leak by any participant may lead to the exclusion of that participant from the benchmarking group

Elements of the Benchmarking Process
Annual cycle – Members decide

- Standardised Key Performance Indicator (KPI) System to compare performance and identify best practices + Graphing & Dashboard Tools
- Member Profile (context) report for improved understanding of performance
- Case Studies, in-depth research on areas of common interest
- Expert workshops
- A mechanism for quick collection of other specific data and information
  - Clearinghouse Studies (member initiated)
  - Online Forum
- Secure website: www.busbenchmarking.org
- Two meetings per annum:
  - Steering Group (mid-year) and Annual

Studies: KPIs can identify major differences between organisations, justifying more detailed examination

- About Detailed **Case Studies** (15 already completed studies)
  - Proposed by members and voted for at the Steering Group Meeting
  - Detailed analysis by RTSC to determine best practices
  - 2-3 Studies per year per group. Lead time – 6 to 9 months
  - Wide-ranging, practical, emphasis on improving service quality & efficiency

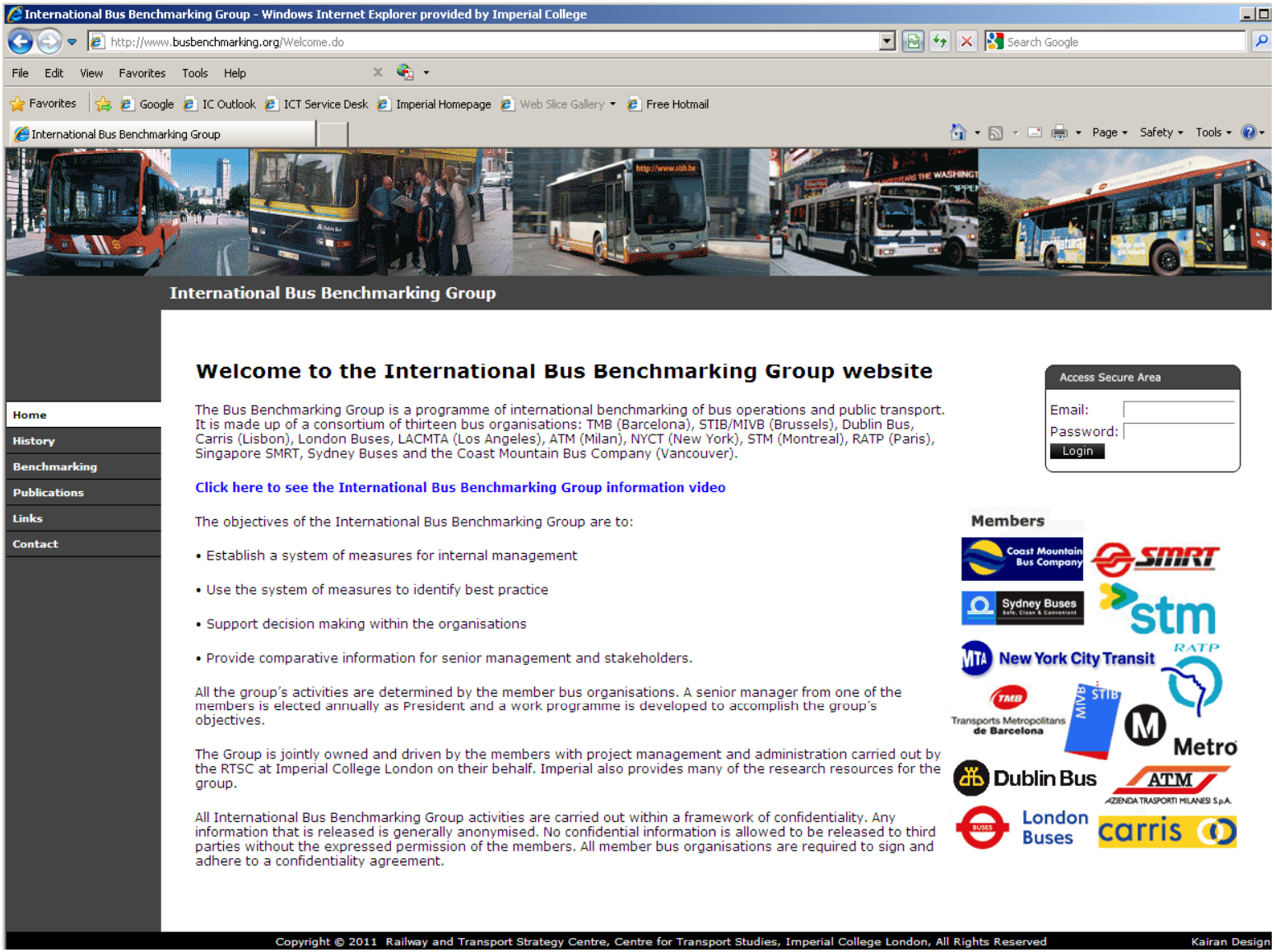
- **Clearinghouse study**: Member initiated exchange of information on a specific topic (28 already completed)
  - Lead-time 1-2 months
  - Member performs the analysis, RTSC facilitates
  - Used to inform strategy, business case and option development….To identify best practices

- **Forum question**: Member post a short specific question on the website
  - Lead-time 2 weeks, More than 125 questions posted in 6 years

Bus member experts have initiated studies on a large variety of topics. Six years of reports and deliverables available. Examples are:

- Case Studies
  - Driver Productivity
  - Service Control
  - Vehicle Maintenance
  - Bus Priority
  - Service Quality Measurement
  - Safety Programmes
  - Real-time information
- Forum
  - Tyre Pressure Monitoring
  - Cleanliness of Buses
  - Driver Reward
  - Employee Time Lost due to Accidents
  - All Door Boarding
  - Contactless Fare Cards
- Clearinghouse studies
  - Eco Driving
  - Passenger Counting
  - Accident Management
  - Control Room Organisation
  - Hybrid Buses
  - Driver Complaints
- Workshops
  - Service control and route management
  - Impacts of new EU bus regulation
  - AVL data for service control
  - Bus Priority
  - Vehicle Maintenance

International Bus Benchmarking Group Website www.busbenchmarking.org



Online Forum of the International Bus Benchmarking Group

Forum List / Short Questions /

Short Questions

95 items found, displaying 1 to 50.[First/Prev] **1**, 2 [Next/Last]

Topics	Replies	Author	Last Post
Overtime as a Percent of Standard Pay	2	Robert Newhouser 2010-02-09 16:31:20	Mark Langmead 2010-02-18 21:43:27
Bicycles on "Bus-Only lanes"	3	José Maia 2010-02-07 00:36:38	Ted Orosz 2010-02-17 17:27:55
Cleanliness of the buses	5	Koen Op de Beeck 2010-02-03 07:10:22	Mr. Élio Serra 2010-02-15 15:07:27
Use of Vinyl or Other Signs Near or Over Bus Lanes to Encourage Private Cars and Trucks to Stay Clear of Bus Lanes	4	Robert Newhouser 2010-01-29 17:47:13	Mark Langmead 2010-02-18 22:24:16
Using Color to Identify Bus Lanes	8	Ross Kapilian 2010-01-28 19:00:11	Colin Brady 2010-02-04 15:42:07
Employee Lost Time Accidents	4	Ross Kapilian 2010-01-28 18:38:46	Koen Op de Beeck 2010-02-16 07:49:05
Operator work selection	5	Mark Langmead 2010-01-28 16:56:42	Colin Brady 2010-02-12 12:17:02
Main Stock KPI	2	Paolo Marchetti 2010-01-15 09:05:46	Koen Op de Beeck 2010-02-16 07:50:38
Tyre Pressure Monitoring Systems	8	Karen James 2009-12-23 21:41:23	Koen Op de Beeck 2010-02-16 07:51:19
Transport and information for blind people	9	Mr. Luis Vale 2009-12-22 10:44:46	Ted Orosz 2010-02-17 17:29:31
Campaign Member Get Member/Employee Get Member	9	Mr. Luis Vale 2009-12-22 10:38:14	Judith Reviejo 2010-02-03 14:36:32
Exclusive vehicles for Bus routes model	8	Mr. Élio Serra 2009-12-20 23:29:51	Ross Kapilian 2010-01-28 16:05:32
Passenger Pass-up metrics	8	Mark Langmead 2009-12-17 17:33:17	Ross Kapilian 2010-01-29 13:28:08
Recording fuel issued and distance travelled by buses	9	Karen James 2009-12-14	Daniel Guigonnet 2010-01-28

Benefits: understanding productivity improvements

Using benchmarking results to understand where productivity improvements can / must be made, some examples:

- Understanding service control productivity differences
  - 33 Buses per controller versus 170 buses
  - Case study showed that some members could improve productivity
  - Member now investigating how to improve with visits to other members
- A member recognised that their administration cost is too high
  - Cost reduction efforts can be focussed on areas where most improvement can be made
- A member discovered that their % of fleet used in peak was too low and that they run too many deadhead km.
  - Benchmarking results lead to prioritisation of resources

Benefits: Using benchmarking results in communication with stakeholders (Government, Authority, Media, Passengers)

Using benchmarking results in communication with stakeholders:

- A member used the benchmarking to proof that public funding was spend effectively and efficiently
  - Resulted in $130 million additional funding
- An operator was asked by the Mayor to show 'value for money': benchmarking data was readily available
  - Operator called the IBBG dataset 'invaluable', savings est. $150k
- A member showed unions that driver absenteeism is 200% higher than the Group average
  - Provided the member with a much better position in their negotiations
- Members use data to 'back-up' requests for additional funding
  - Imperial presented to a Minister of Transport the business case for additional funding for new buses

Benefits: Informed and more effective decision making

- Much return on (benchmarking) investment is created by NOT making unnecessary costs and investments

  Example of focus on fuel efficiency:
  - Smaller cooling fans could be installed that run on the battery, rather than on the engine.
    - Small investments led to significant (10-15%) fuel savings
  - Lessons shared in reducing idling, Operator saved $150,000
  - ECO driving experiences shared, 6% fuel efficiency

- Members use the data from the Benchmarking Group to set realistic targets

- Knife attack on driver led to study of driver cabins and in-vehicle CCTV
  - Information from other members gave different options for drivers cabin designs and CCTV configurations.

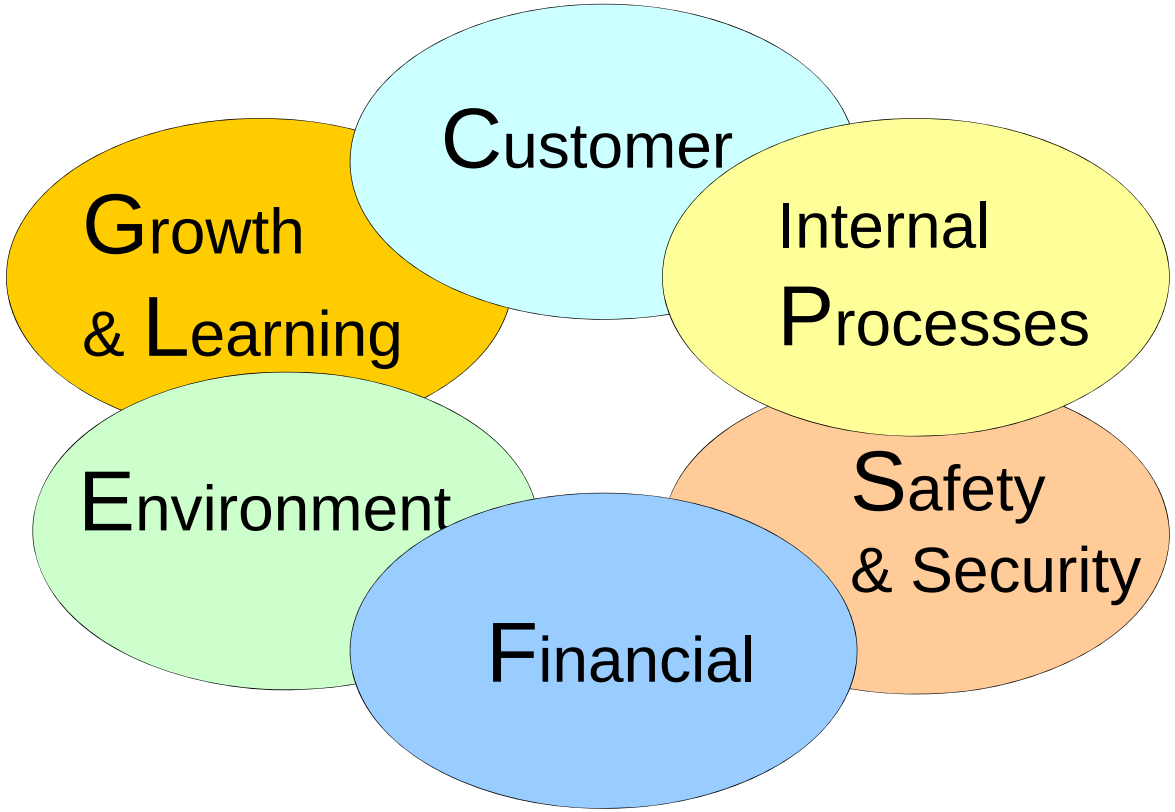
International Bus Benchmarking Group

Key Performance Indicators

(KPIs)

Balanced Scorecard approach

Six Success Dimensions:



Bus Benchmarking Group KPIs

Growth & Learning

G1 Passenger Boardings
G2 Vehicle Kilometres
G3 Staff Training (categories)

Customer

C1 Passenger km / Revenue capacity km
C2 Actual / Scheduled revenue km & hour
c3 dynamic customer information
c4 low floor buses
C5 % buses on-time (Punctuality)
C6 Regularity (Excess Wait Time)
C7 Customer satisfaction

Internal Processes

P1 % of fleet used in peak (not used split by cause)
p2 revenue / total vehicle km & hour
P3 Total vehicle hours per labour hour
p4 staff absenteeism rate (categories)
P5 Mean distance between failures
p6 lost vehicle km (internal/external causes)

Safety & Security

S1 Number of vehicle accidents per vehicle km & hour
S2 Number of staff accidents per million staff hours
S3 Number of passenger accidents per boarding
S4 Number of 3rd party accidents
S5 Incidences of on-board crime

Financial

F1 Total cost per total vehicle km & hour
F2 Total operating cost per total vehicle km & hour
(F3 service operation, F4 maintenance, F5 administration)
F6 Service operation cost per revenue vehicle km & hour
F7 Total fare revenue / Total operating cost
F8 Total operating cost per passenger boarding/kilometre
F9 Fare revenue per passenger boarding/kilometre

Environmental

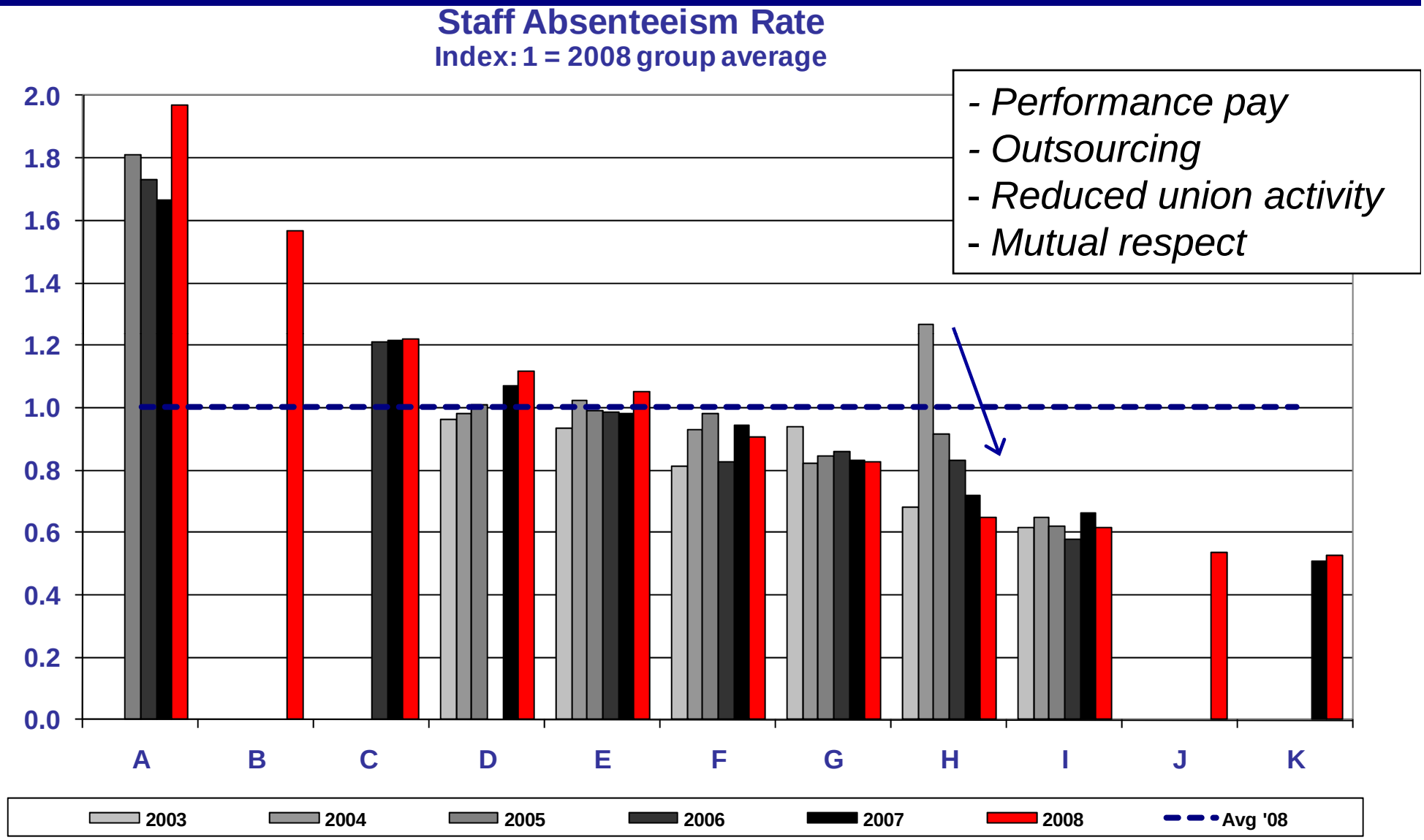
E1 Diesel/CNG fuel consumption per 100 total vehicle km
E2 Diesel/CNG fuel consumption per passenger kilometre
E3 Diesel/CNG fuel consumption per total vehicle tonne km
e4 % of fleet meeting EURO emissions categories
E5 CO2 emissions per passenger km & vehicle km

Purpose and use of KPIs

- **Benchmarking is NOT merely a comparison of data or a creation of league tables.**

- The structured KPI comparisons can be used for:
  - Stimulating productive “why” questions / identifying lines of inquiry.
  - Identifying high priority problems, strengths and weaknesses.
  - Identifying trends: performance can be monitored over time, allowing the identification of organisations which have truly improved performance over time.
  - Internal motivation – setting targets for improved performance.
  - Supporting dialogue with government, authorities, media and other stakeholders (confidentiality permitting).

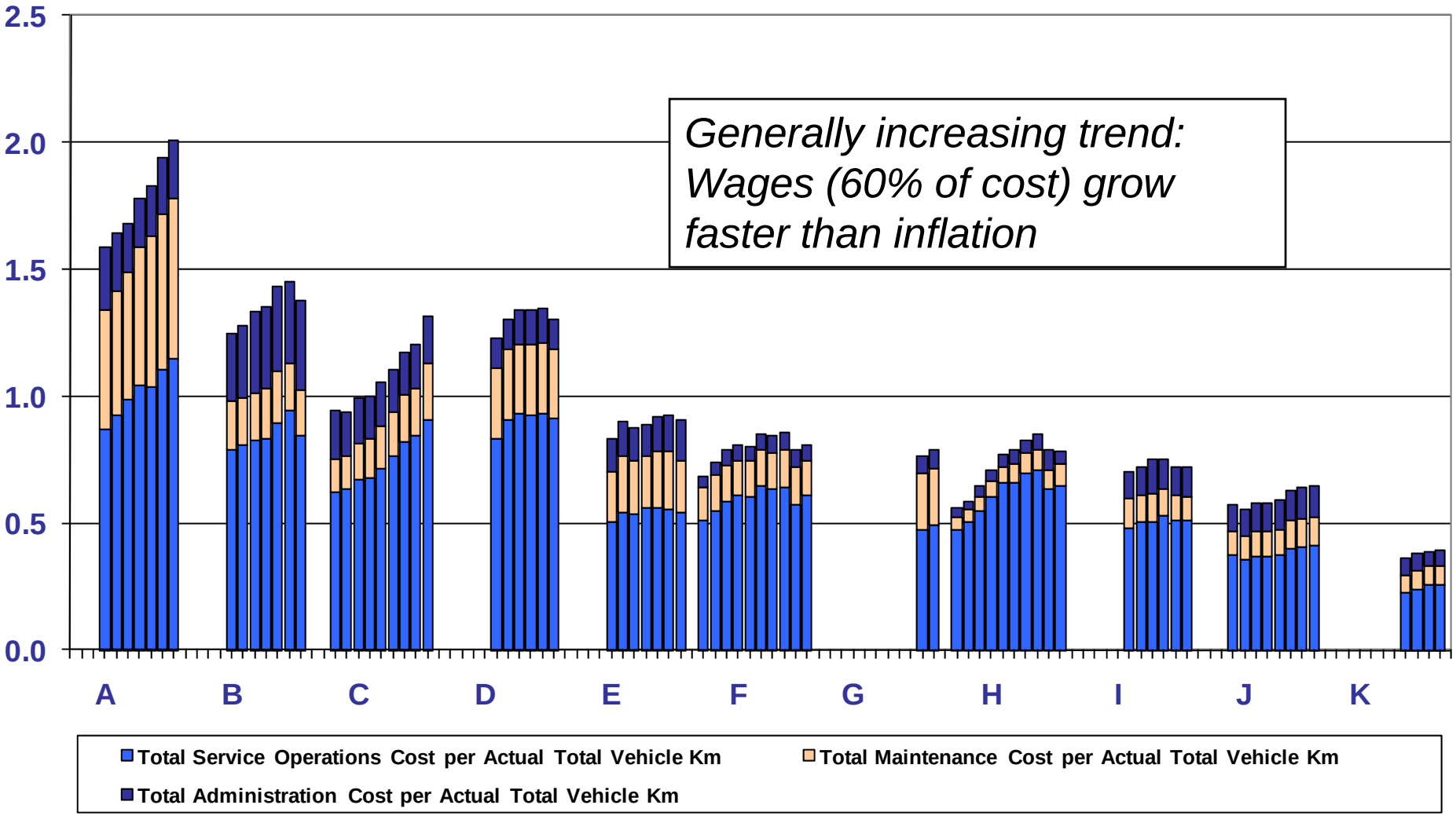
KPI example: Staff absenteeism - Bus organisation ‘A’ now realised absenteeism is too high relatively to peers, info used with talks to unions



Financial Comparison and Trends – Costs normalised using World Bank Purchasing Power Parity (PPP) system

Total operating cost per total vehicle km 1999 - 2008

Index: 1= Total cost group average in 2008



KPI Graphing Tool – Excel based software that allows members to make any indicator with the available data

Bus Benchmarking Group - KPI Graph Generating Tool

Version February 2010 Developed by Xiang Liu (RTSC, Imperial College London)

Important: If you use the graphs generated by this tool, Always 'Copy - Paste Special as picture', the graphs into your document.
This is necessary to keep the incorporated KPI data in the graph confidential

	Name	Code	Financial Conversion
Input Numerator	Maintenance costs (m)	MC	No Financial Conversion
Input Denominator (Leave blank if raw data required)	Passenger boardings (m)	1	

Graph Name: Maintenance costs (m) per Passenger boardings (m)

Bus Organisations to be Included	Bc	Bs	Db	LA	Lb	Ln	Mi	Mt	NY	Pa	Sg	Sy	Yo
	Named	Named	Named	Anonymous	Named	Named	Omit	Named	Named	Named	Named	Named	Named

Quick options

Anonymise All Buses

Name All Buses

Select All Years

Graph Output Options

(•) Absolute Value
( ) Indexed Value - Anonymised

Ranked graph options

( ) Ascending Order
(•) Descending Order

Draw graph

Graph Data

	Bo	Bs	Db	LA	Lb	Ln	Mi	Mt	NY	Pa	Sg	Sy	Yo
1999	N/A	N/A	0.1933	N/A	N/A	0.0373	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2000	0.0984	N/A	0.2350	N/A	N/A	0.0389	N/A	0.3152	N/A	N/A	N/A	N/A	N/A
2001	0.1013	N/A	0.2386	N/A	0.0611	0.0432	N/A	0.3116	N/A	N/A	N/A	0.2735	N/A
2002	0.1204	N/A	0.2444	N/A	0.0623	0.0478	N/A	0.3106	0.4473	0.1437	N/A	0.3029	N/A
2003	0.1261	0.5202	0.2519	N/A	0.0657	0.0529	N/A	0.3450	0.5195	0.1414	N/A	0.3220	N/A
2004	0.1384	0.4084	0.2648	N/A	0.0657	0.0603	N/A	0.3433	0.5621	0.1442	N/A	0.3443	N/A
2005	0.1487	0.4089	0.2869	N/A	0.0673	0.0651	N/A	0.3484	0.5746	0.1531	0.1042	0.3722	N/A
2006	0.1658	0.4040	0.3083	N/A	0.0672	0.0665	N/A	0.3781	0.6715	0.1632	0.1222	0.4072	N/A
2007	0.1746	0.4293	0.3287	N/A	0.0682	0.0637	N/A	0.3993	0.7641	0.1448	0.1207	0.4104	0.5993
2008	0.2213	0.4366	0.3540	N/A	0.0638	0.0772	N/A	0.3789	0.7917	0.1473	0.1213	0.4253	0.6438
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Input your graph details | Time Series Chart | Bus Group Rank

Closing statements

Key Success Factors of the International Bus Benchmarking Methodology

- **Confidentiality**
- **Speed:** Quick information exchange
- **Independence:** Members own the groups and steer research
- Academic Institution: Members have confidence and trust in the management of the group and objectivity of the analysis
- Manageable group size: 10-15 members
- Long-term approach, annual cycles
- Continuous development: comparability takes time
- Board level commitment
- High level performance (KPIs) understood by drill-down in detailed studies
- Quick wins: Clearinghouse studies and Web forum
- There is significant variability in comparable areas of performance

- **<u>There is rarely a challenge that another member has not also faced</u>**

United States (International) Public Transport Benchmarking Activity

- **CoMET** (large metros):
  - New York City Transit
- **Nova** (medium sized metros):
  - Chicago CTA
- **International Bus Benchmarking Group:**
  - MTA New York City Transit
  - MTA Bus
  - Los Angeles County Metropolitan Transportation Authority
- **International Suburban Rail Benchmarking Group:**
  - MTA Metro North
  - MTA Long Island Railroad
  - BART – San Francisco

- Development: **Mid-sized North American Bus Benchmarking Group**
  - 150-600 buses
  - Rochester, Forth Worth, Eugene, Syracuse, Milwaukee, Dayton

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International Bus Benchmarking Group

- Thirteen members as of December 2009:

Transport Metropolitans de Barcelona (TMB, Barcelona)	Bc
Société des Transports Intercommunaux de Bruxelles (STIB, Brussels)	Bs
Dublin Bus (Dublin)	Db
Los Angeles County Metropolitan Transport Authority (LACMTA)	LA
Companhia Carris de Ferro de Lisboa (Lisbon)	Lb
London Buses (LBSL, London)	Ln
Azienda Trasporti Milanesi (ATM, Milan)	Mi
Societe de Transport de Montréal (STM, Montréal)	Mt
MTA – New York City Transit (NYCT, New York)	NY
Régie Autonome des Transports Parisiens (RATP, Paris)	Pa
SMRT Buses (Singapore)	Sg
State Transit Authority of New South Wales (STA, Sydney)	Sy
Coast Mountain Bus Company, (CMBC, Vancouver)	Vc

- Presidency rotates annually – currently held by STIB Brussels