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Enhancing the Success of Light Rail Systems

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Talk given by Roger Mackett to the Transport Economists Group
University of Westminster
25 October 2000

The work was undertaken by Ela Babalik, as part of her PhD research, working under the supervision of Roger Mackett. The overall objective of the work is to help make new urban rail systems more successful, particularly in Britain and Turkey, where Dr Babalik now works.

The rationale for the work

Many new urban public transport systems are being developed, some of which are very successful, but some others are not so successful. There are many criticisms of recent schemes, especially in the United States, but they are still being developed. This raises the question: what can be done to increase the likelihood of them being successful?

The overall objectives of the work

- To establish the success of some new urban public transport systems
- To identify the factors that have influenced the degree of success
- To establish a framework to predict how successful new systems are likely to be
- To validate the framework
- To use the framework to predict the success of some new systems
- To make recommendations on how to increase the success of new systems

Table 1 lists the systems investigated in the United States, Canada and Britain, including the eight case studies used to develop the framework. The criterion for selection of systems is that they should be reasonably comparable with the systems being developed in Turkey.

| Table 1: The systems investigated | | | | |
|---|--------------|---------------------|-----------------------|------------------------------|
| Country | City | Opening Year | Type of system | Length of system (km) |
| United States | Baltimore | 1983 | metro | 25.0 |
| | Baltimore | 1992 | light rail | 48.9 |
| | Los Angeles | 1990 | metro | 17.9 |
| | Los Angeles | 1993 | light rail | 57.0 |
| | Miami* | 1984 | metro | 33.8 |
| | Portland | 1986 | light rail | 24.2 |
| | Sacramento* | 1987 | light rail | 29.2 |
| | San Diego* | 1981 | light rail | 80.4 |
| | St Louis* | 1993 | light rail | 27.2 |
| Canada | Calgary | 1981 | light rail | 29.3 |
| | Vancouver* | 1986 | automated light rail | 28.9 |
| Britain | Manchester* | 1992 | light rail | 31.0 |
| | Sheffield* | 1994 | light rail | 29.0 |
| | Tyne & Wear* | 1980 | light rail | 59.1 |
| * Indicates a system used to develop the framework; the others were used to validate it. | | | | |
| System length is based on their length in 1998. Since the performance analysis is based on 1998 data, extensions after 1998 are not included. | | | | |

Themes for assessing success

To assess success the following objectives have been used:

- To have high patronage
- To build and operate the system cost-effectively
- To increase public transport usage
- To reduce traffic congestion and environmental problems
- To improve the land-use and growth patterns

Table 2 lists the objectives with the criteria used for measuring whether the objectives have been attained.

The following tables (3 to 6) indicate how the schemes performed in meeting the objectives listed in table 2.

| Table 2: Criteria for measuring success in attaining their objectives | |
|--|---|
| Objectives | Criteria for the attainment of objectives |
| To have high patronage | Patronage per route kilometre is higher than the national or continental average Vehicle load is higher than the case study average Patronage is not lower than that forecast |
| To build and operate the system cost-effectively | Capital cost per passenger is less than the national or continental average Operating cost per passenger is less than the case study average Farebox recovery ratio is higher than the case study average |
| To increase public transport usage | Modal share for public transport increased Bus patronage did not decline due to the new system The patronage on the new system is increasing |
| To reduce traffic congestion and environmental problems | Reduction in growth in car usage Reduction in congestion Improvement in air quality |
| To improve the land-use and urban growth patterns | Improvement and development at the city centre Improvement and development in declining areas Improvement in the pattern of urban growth |

None of the schemes appear to have reduced congestion or to have improved environmental conditions. However, some of the systems have performed in terms of patronage levels (table 3), their cost-effectiveness (table 4), and ability to increase public transport use (table 5) and in attaining their land-use objectives (table 6), which suggests that these factors can be used to discriminate between the systems. The results are summarised in table 7.

The overall success in patronage terms is greatest for St Louis MetroLink, the Los Angeles Light Rail and the Vancouver SkyTrain.

The San Diego Trolley, St Louis MetroLink, Vancouver SkyTrain, Manchester Metrolink, and Tyne and Wear Metro proved to be the most cost-effectiveness systems.

All systems showed an increase in overall public transport use, with none causing a decline in bus use. The Portland and Calgary Light Rail systems are the most successful in terms of increasing the use of public transport.

None of the systems had significant success in reducing traffic congestion and environmental problems.

Attaining land-use objectives was not successful in general, with Vancouver Skytrain being the most successful.

| System | Passengers/ route km > relevant average | Passengers km/ vehicle km > the average of the systems below | Actual patronage > forecast patronage | Overall success |
|------------------------|---|--|---|--------------------|
| Baltimore Metro | | | | |
| Baltimore Light Rail | | | | |
| Los Angeles Metro | | | | |
| Los Angeles Light Rail | √ | √ | √ | √√√ |
| Miami Metrorail | | | | |
| Portland Light Rail | √ | √ | | √√ |
| Sacramento Light Rail | | | | |
| San Diego Trolley | | | √ | √ |
| St Louis MetroLink | √ | √ | √ | √√√ |
| Calgary Light Rail * | √ | | (no data) (√) | √(√) |
| Vancouver SkyTrain | √ | √ | √ | √√√ |
| Manchester Metrolink | | | √ | √ |
| Sheffield Supertram | | | | |
| Tyne & Wear Metro | | √ | | √ |

* There is no forecast data for Calgary, but alternative indicators of patronage, such as passengers per vehicle kilometres of vehicle hours, are higher than all the above systems, so it can be regarded as successful.

| System | Annual capital cost/passenger < the average of the systems below | Operating cost/passenger < the average of the systems below | Farebox recovery ratio > the average of the systems below | Overall success |
|------------------------|---|--|--|--------------------|
| Baltimore Metro | | | | |
| Baltimore Light Rail | | | | |
| Los Angeles Metro | | | | |
| Los Angeles Light Rail | √ | | | √ |
| Miami Metrorail | | | | |
| Portland Light Rail | √ | | | √ |
| Sacramento Light Rail | √ | | √ | √√ |
| San Diego Trolley | √ | √ | √ | √√√ |
| St Louis MetroLink | √ | √ | √ | √√√ |
| Calgary Light Rail* | √ | √ | (√) | √√(√) |
| Vancouver SkyTrain | √ | √ | √ | √√√ |
| Manchester Metrolink | √ | √ | √ | √√√ |
| Sheffield Supertram | | | √ | √ |
| Tyne & Wear Metro | √ | √ | √ | √√√ |

*The farebox recovery ratio cannot be calculated for Calgary because data on the revenue are not available, but the cost per passenger is very low so it is likely that the farebox ratio is below the average.

| System | Modal share of public transport increased | New system did not cause decline in bus usage | Patronage on the system is increasing | Overall success |
|------------------------|---|---|---------------------------------------|-----------------|
| Baltimore Metro | | √ | √ | √√ |
| Baltimore Light Rail | | √ | √ | √√ |
| Los Angeles Metro | | √ | √ | √√ |
| Los Angeles Light Rail | | √ | √ | √√ |
| Miami Metrorail | | √ | | √ |
| Portland Light Rail | √ | √ | √ | √√√ |
| Sacramento Light Rail | | √ | √ | √√ |
| San Diego Trolley | | √ | √ | √√ |
| St Louis MetroLink | | √ | √ | √√ |
| Calgary Light Rail | √ | √ | √ | √√√ |
| Vancouver SkyTrain | | √ | √ | √√ |
| Manchester Metrolink | | √ | √ | √√ |
| Sheffield Supertram | | √ | √ | √√ |
| Tyne & Wear Metro | | √ | | √ |

| System | To stimulate development in the city centre | To stimulate development in declining areas | To improve the pattern of urban development | Overall success |
|------------------------|---|---|---|-----------------|
| Baltimore Metro | | | √ | √ |
| Baltimore Light Rail | | | √ | √ |
| Los Angeles Metro | | | | |
| Los Angeles Light Rail | | | | |
| Miami Metrorail | | | | |
| Portland Light Rail | √ | N/A | √ | √√ |
| Sacramento Light Rail | | | | |
| San Diego Trolley | √ | | √ | √√ |
| St Louis MetroLink | √ | | | √ |
| Calgary Light Rail | √ | N/A | | √ |
| Vancouver SkyTrain | √ | √ | √ | √√√ |
| Manchester Metrolink | √ | | | √ |
| Sheffield Supertram | | | | |
| Tyne & Wear Metro | √ | | | √ |

N/A: not applicable because there are no declining slum areas along the urban rail system

Table 7: The overall success of the systems

| System | To have high patronage | | | To build and operate the system cost-effectively | | | To increase public transport usage | | | To reduce traffic congestion and environment problems | | | To improve the land-use and urban growth patterns | | | Total Number of ticks |
|-------------|------------------------|-------------------|---------------------|--|------------------|----------------|------------------------------------|-----------------------|----------------------------|---|-------------------|---------------------|---|------------|--------------|-----------------------|
| | Pass per km | Mean vehicle load | Forecast vs. actual | Capital cost /pass. | Oper cost /pass. | Fare box ratio | More PT use | No decline in bus use | Patron. increase on system | Reduct in car usage | Congestion relief | Improve air quality | City centre | Slum areas | Urban growth | |
| Baltimore M | | | | | | | | √ | √ | | | | | | √ | 3 |
| Baltim. LR | | | | | | | | √ | √ | | | | | | √ | 3 |
| LA Metro | | | | | | | | √ | √ | | | | | | | 2 |
| LA LR | √ | √ | √ | √ | | | | √ | √ | | | | | | | 6 |
| Miami | | | | | | | | √ | | | | | | | | 1 |
| Portland | √ | √ | | √ | | | √ | √ | √ | | | | √ | N/A | √ | 8 |
| Sacramento | | | | √ | | √ | | √ | √ | | | | | | | 4 |
| San Diego | | | √ | √ | √ | √ | | √ | √ | | | | √ | | √ | 8 |
| St Louis | √ | √ | √ | √ | √ | √ | | √ | √ | | | | √ | | | 9 |
| Calgary | √ | | (√) | √ | √ | (√) | √ | √ | √ | | | | √ | N/A | | 9(7) |
| Vancouver | √ | √ | √ | √ | √ | √ | | √ | √ | | | | √ | √ | √ | 11 |
| Manchester | | | √ | √ | √ | √ | | √ | √ | | | | √ | | | 7 |
| Sheffield | | | | | | √ | | √ | √ | | | | | | | 3 |
| Tyne/Wear | | √ | | √ | √ | √ | | √ | | | | | √ | | | 6 |

N/A: not applicable because there are no declining slum areas along the urban rail system

Table 8 shows the ranking of the schemes based on the overall success of the systems that were summarised in table 7. The ranking fits in well with intuition and is taken to be a reasonable assessment of the schemes.

| Table 8: Assessment of the relative success of the systems | | |
|---|----------------------------|----------------|
| System | Measures of success | |
| | Points | Ranking |
| Vancouver | 11 | 1 |
| St Louis | 9 | 2= |
| Calgary* | 9 (7) | 2= |
| Portland | 8 | 4 |
| San Diego | 8 | 4= |
| Manchester | 7 | 6 |
| Los Angeles Light Rail | 6 | 7= |
| Tyne & Wear | 6 | 7= |
| Sacramento | 4 | 9 |
| Baltimore Light Rail | 3 | 10= |
| Baltimore Metro | 3 | 10= |
| Sheffield | 3 | 10= |
| Los Angeles Metro | 2 | 13 |
| Miami | 1 | 14 |

* For Calgary lack of data meant that two criteria could not be assessed, but other evidence suggests strongly the criteria would have been met, which would raise the total from 7 to 9.

Factors that can influence the degree of success

Having considered how successful the fourteen systems have been, attention can now be turned to the factors and policies that contribute to that success. These are considered under six headings:

- Physical characteristics of the urban area
- Socio-economic characteristics of the area
- Route location and cost factors
- Operating policies
- Transport planning policies
- Urban planning policies

The physical characteristics of the urban areas that influence success are considered to be:

- An economically vital Central Business District (CBD)
- Location of employment and retail activity:
 - Mainly at the CBD
 - At other centres which the system serves
- Population density medium to high
- Pattern of urbanisation: radial corridors (and the system serving one or more)

The cities, which have these characteristics are shown in table 9.

| Table 9: Physical characteristics of the urban areas | | | | | |
|---|--------------------------------|-------------------------------------|---------------------------------------|--------------------------------|----------------------------------|
| Urban area | The CBD is economically viable | Location and employment and retail: | | Medium/high population density | Urban pattern: radial corridors* |
| | | Mainly at the CBD | At other centres served by the system | | |
| Baltimore | | | | | I |
| Los Angeles | | | | | |
| Miami | | | | | |
| Portland | | | I | | I |
| Sacramento | I | I | | | |
| San Diego | I | I | | | |
| St Louis | | | | | I |
| Calgary | I | I | | I | I |
| Vancouver | I | I | | I | I |
| Manchester | I | I | | I | I |
| Sheffield | | | I | I | I |
| Tyne/Wear | | | I | I | I |

* and the system located along one of these radial corridors

The socio-economic characteristics of the areas that are considered here are:

- Project has high level of local support
- Public transport is considered to provide personal security
- Public transport usage is high
- The system does not serve low-income areas *and* public transport usage in the corridor is high
or the system serves low-income areas *and* bus fares can be controlled.

The systems, which have these factors are shown in table 10.

| Table 10: Socio-economic factors | | | | | |
|---|--------------------------------|---|--------------------------------|--|--|
| System | Project has high local support | Public transport offers personal security | Public transport usage is high | Factors regarding income | |
| | | | | System does not serve low income areas <i>and</i> public transport usage in the corridor is high | System serves low income areas, <i>and</i> bus fares can be controlled |
| Baltimore Metro | | | | | |
| Baltimore LR | | | | | |
| LA Metro | | | | | |
| LA LR | | | | | |
| Miami | | | | | |
| Portland | | | | | |
| Sacramento | | | | | |
| San Diego | | | | | |
| St Louis | | | | | |
| Calgary | | | | | |
| Vancouver | | | | | |
| Manchester | | | | | |
| Sheffield | | | | | |
| Tyne/Wear | | | | | |

The route location and cost factors that are considered are:

- The system is located along a developed corridor
- The corridor does not serve declining areas
- The corridor is compatible with growth trends
- The corridor is compatible with urban plans
- The system is inexpensive
or the system is expensive but the area is very suitable for a rail system

The systems, which have these factors are shown in table 11.

| Table 11: Route location and cost factors | | | | | | |
|--|---|--|--|--|---------------------------------|--|
| System | System is located along a developed corridor | Corridor does not serve declining areas | Corridor is compatible with growth trends | Corridor is compatible with urban plans | System is inexpensive OR | System is expensive but the area is very suitable for a rail system |
| Baltimore Metro | | | | | | |
| Baltimore LR | | | | | | |
| LA Metro | | | | | | |
| LA LR | | | | | | |
| Miami | | | | | | |
| Portland | | | | | | |
| Sacramento | | | | | | |
| San Diego | | | | | | |
| St Louis | | | | | | |
| Calgary | | | | | | |
| Vancouver | | | | | | |
| Manchester | | | | | | |
| Sheffield | | | | | | |
| Tyne/Wear | | | | | | |

The operating policies that are considered to influence success are:

- Providing frequent service
- Introducing travelcards
- Offering free transfer to buses
- Offering free travel
- Marketing and advertising
- Providing security staff on board and at stations.

The systems that are operated with these policies are shown in table 12.

| Table 12: Experience of the systems with operating policies | | | | | | |
|--|-----------------------------------|--------------------------------|--|----------------------------------|----------------------------------|--|
| System | Providing frequent service | Introducing travelcards | Offering free transfer to buses | Offering some free travel | Marketing and advertising | Providing security staff on board and at stations |
| Baltimore Metro | | I | | | I | I |
| Baltimore LR | | I | | | I | I |
| LA Metro | | I | | | I | I |
| LA LR | | I | | | I | I |
| Miami | | Ä | | | | |
| Portland | | | I | I | I | |
| Sacramento | | I | I | | i | |
| San Diego | | I | I | | I | |
| St Louis | | I | | I | I | I |
| Calgary | | I | I | I | I | I |
| Vancouver | I | I | I | | I | I |
| Manchester | I | | | | | |
| Sheffield | | Ä | | | Ä | I |
| Tyne/Wear | | | | | | |
| Note: In Sheffield, introducing additional staff for ticket sale on board has enhanced the security image of the system. | | | | | | |
| Key: I The policy has been effective in enhancing the success of the system Ä The policy has been implemented but failed to have significant effects. O It is not certain whether the policy had any effect on the performance of the systems. | | | | | | |

The transport planning policies that are considered to influence success are:

- Integrating system into existing urban projects
- Locating stations at trip attractors or generators
- Integrating bus services with new system
- Integrating system into regional planning
- Providing car parking at stations
- Restricting car parking in the city or in the CBD

The systems, which are operated with these policies are shown in table 13.

| System | Integrating system into regional planning | Integrating system into existing urban projects | Locating stations at trip attractors or generators | Integrating bus services with new system | Providing car parking at stations | Restricting car parking in the city or in the CBD |
|--------------|---|---|--|--|-----------------------------------|---|
| Baltimore M | | | I | I | I | |
| Baltimore LR | | | I | I | I | |
| LA Metro | | | I | I | I | |
| LA LR | | | I | I | I | |
| Miami | | | | Ä | I | |
| Portland | I | | I | I | I | |
| Sacramento | | | | I | I | |
| San Diego | | I | i | I | I | |
| St Louis | | i | I | I | I | |
| Calgary | I | | I | I | I | I |
| Vancouver | I | I | | I | | |
| Manchester | | | | | i | |
| Sheffield | | Ä | | | i | |
| Tyne/Wear | i | I | | I* | i | |

*Policy was implemented and was effective during the first 5 years of the operation of the system.

Key: I The policy has been effective in enhancing the success of the system
 Ä The policy has been implemented but failed to have significant effects.
 O It is not certain whether the policy had any effect on the performance of the systems.

The urban planning policies that are considered to influence success are:

- Adapting plans to the new system, i.e. re-zoning
- Incentives of transit-oriented development
- Joint development projects
- Locating public development at stations
- Pedestrianising streets
- City centre redevelopment projects/actions
- Urban renewal projects

The systems that are operated with these policies are shown in table 14.

| Table 14: Experience of the systems with urban planning policies | | | | | | | |
|--|--|--|-----------------------------------|--|--------------------------------|---|-------------------------------|
| System | Adapting plans to the new system, i.e. rezoning | Incentive of transit-oriented development | Joint development projects | Locating public development at stations | Pedestrianising streets | City centre redevelopment projects/actions | Urban renewal projects |
| Baltimore M | | | i | | | | i |
| Baltimore LR | | | i | | | | i |
| Los Angeles M | I | | I | I | | | |
| Los Angeles LR | I | | I | I | | | |
| Miami | | Ä | I | Ä | | | Ä |
| Portland | I | I | I | I | I | I | |
| Sacramento | | Ä | | Ä | I | | |
| San Diego | I | I | i | | i | (1) | |
| St Louis | I | I | | I | | I | (1) |
| Calgary | | | | Ä | | | |
| Vancouver | I | I | I | I | | | (1) |
| Manchester | | | | | I | I | |
| Sheffield | | | | | | | Ä |
| Tyne/Wear | | | | | I | (1) | |
| (1) These are the projects that the systems were integrated into (the second transport planning policy); therefore, they are not shown under urban planning policies to avoid double counting. | | | | | | | |
| Key: | | | | | | | |
| I The policy has been effective in enhancing the success of the system | | | | | | | |
| Ä The policy has been implemented but failed to have significant effects. | | | | | | | |
| i It is not certain whether the policy had any effect on the performance of the systems. | | | | | | | |

Examples of other factors that can also influence the success of new systems

- Crime and concern about personal security if the system is segregated, particularly if it is automatic (can be overcome by employing extra staff, as in St Louis).
- Local population being antagonistic towards the system, as in Miami.
- Some areas may be so unsuitable for a new rail-based urban transport system that such a system can never be successful.

Table 15 shows the systems in terms of the relative success and the factors and policies that influence that success. There seems to be a high degree of correlation between the two lists. Given the causal relationship between them, it is deduced that it is possible to use the number of factors and policies which influence success to predict how successful a new system is likely to be.

Table 15: Assessment of the relative success, and factors and policies that influence success, ranked in order of success of the systems

| System | Measures of success | | Factors and policies influencing success | |
|-------------------|---------------------|---------|--|---------|
| | Points | Ranking | Points | Ranking |
| Vancouver | 11 | 1 | 22 | 1= |
| Calgary | 9(7) | 2= | 22 | 1= |
| St Louis | 9 | 2= | 16 | 4= |
| Portland | 8 | 4= | 21 | 3 |
| San Diego | 8 | 4= | 16 | 4= |
| Manchester | 7 | 6 | 14 | 6 |
| Los Angeles LR | 6 | 7= | 13 | 7 |
| Tyne & Wear | 6 | 7= | 12 | 8 |
| Sacramento | 4 | 9 | 10 | 11= |
| Baltimore LR | 3 | 10= | 11 | 9= |
| Baltimore Metro | 3 | 10= | 10 | 11= |
| Sheffield | 3 | 10= | 9 | 13 |
| Los Angeles Metro | 2 | 13 | 11 | 9= |
| Miami | 1 | 14 | 4 | 14 |

By way of example, the methodology can be applied to two new systems that have been opened recently in Britain: Croydon Tramlink, and Midland Metro in the West Midlands.

Examination of the factors and policies relevant to the two new systems, Croydon Tramlink would have 21 points and Midland Metro would have 15. This implies that Croydon Tramlink is likely to be a very successful system, doing better than all the US and British systems considered here, and nearly as well as the two Canadian systems. Midland Metro would not be quite so successful, but would still be slightly more successful than Manchester Metrolink.

It is possible to examine the policies, which have not been implemented on systems and use this as advice on how to make the systems even more successful. Therefore, to increase the success of these two systems, it is suggested that would be necessary to introduce the following:

Policies recommended to increase success of Midland Metro

Operational policies

- Increase frequency of service
- Increase through ticketing with other public transport services
- Provide more security staff

Urban planning policies

- Adapt local urban plans to the new system
- Encourage development that will generate trips on new system
- Locate public development near stops
- Stimulate urban renewal near system

Policies recommended to increase success of Croydon Tramlink

Urban planning policies

- Adapt local urban plans to the new system
- Encourage development that will generate trips on the new system

Conclusions

- The success of new light rail systems can be measured in relative terms
- Factors and policies that influence the degree of success can be identified
- There seems to be a correlation between the measures of success and these factors and policies
- It is possible to predict how successful a new system is likely to be on the basis of these factors and policies

- These policies can be used to enhance the success of the systems
- Croydon Tramlink and Midland Metro should be very successful, particularly the former

Discussion

Oliver Knipping (Bartlett School, UCL) opened the discussion by asking whether there is information on public subsidy versus private finance in determining the success of systems, such as West Midland's success. Secondly, is any light rail scheme operating on heavy rail tracks?

The speaker said that figures do exist but because the study was of new systems in North America and Britain no information was presented. However, there does not seem to be much of a relationship between public money and success.

The Nottingham system was originally going to use heavy rail tracks, but this was not allowed by HMRI (Her Majesty's Railway Inspectorate).

Idris Willis asked whether the success of light rail on street requires priority.

Roger Mackett tended to agree that there is a need to give priority at traffic signals. There is a problem in Leeds since car owners in Headingley opposed it. Schemes are most successful if they are automatic, therefore segregated. The consensus is for street running but with segregation and priority at signals.

Nigel Harris (The Railway Consultancy) likes simple measures but is worried that variables are too related to each other. One of the most different variables is the load factor, which shows that Sheffield is too bid with too few passengers.

Roger Mackett agreed that the correlation is probably there and similar thoughts had crossed his mind. They had not attempted a classic demand model but what they had done was totally transparent.

John Slaughter (Croydon Borough Council) said that the Croydon system had been planned as a segregated system as possible, since there had been a political problem of reallocation of road space. Park and Ride had also been an issue in Croydon because of the green Belt.

The speaker argued that segregation from traffic does work the best but there is a need for the system to be accessible. It also needs to be visible.

Don Box asked if separated provision and efficiency of infrastructure would influence the results. Do operating costs include infrastructure costs?

Roger Mackett's view was that the operating costs used might not be comparable. Also there can be a reluctance to give the figures, e.g. Manchester, which is private.

Peter Collins agreed that the virtue of the study is the sheer simplicity and transparency. However, he was worried that schemes to enhance development into the future (e.g. DLR) would not come out well.

Roger Mackett agreed that the time element is a true concern but it does not negate the work since some schemes are 20 years old, while others are much younger.

Robin Whittaker asked if methodology could be extended to other tramways, e.g. the Belgian 1m gauge single car system or the Hong Kong double-deck system.

Roger Mackett argued that the cities studied were all of a very similar scale and therefore would need to be careful in extrapolating. However, all systems in Turkey had been successful.

David Walmsley (Confederation of Public Transport) commented about competition between buses and light rail (e.g. in Croydon and West Midlands).

The speaker said there had been problems in Sheffield but there had been better co-ordination in the United States. Competition does not help plan new systems. While government is willing to pay for light rail, they are not willing to pay for buses. There should be systems appropriate for the city.

The Chairman thanked the Roger Mackett for a very stimulating description of the work and discussion.

The Value Of Time

Hugh Gunn (Hague Consulting) and Rob Sheldon (Accent Market Research)

Paper presented to the Transport Economists' Group
University of Westminster
22 November 2000

Background

If time savings are to be included in appraisals as an economic benefit, then we need to be able to determine what they are. A stream of work in the late 1970s and early 1980s led to the first authoritative study in 1982 (carried out by MVA and Institute of Transport Studies, Leeds). Although it became difficult thereafter to challenge any of that study's conclusions (given the quantity of infrastructure, which was built dependent upon it), there have been a range of developments which suggested that a new study was both possible and necessary.

The new possibilities came from the increasing use of disaggregate modelling techniques, which meant that there were more situations in which Value of Time (VOT) could be inferred, rather than assumed. The necessity of new values came partly from consideration of the data of the old experiments, and also doubt as to their independence. The earlier results (although generally in a 10% range) were subject to 100% error margins; this suggested that some 'orthodox' accepted values had arisen, probably affecting the willingness to publish values far away from that orthodox. The high measurement errors were partly due to problems of collinearity (for instance, longer journeys tend to be more expensive). However, the rise of Stated Preference (SP) techniques enabled better results to be obtained by questionnaire design removing the collinearity problem.

A new study was therefore carried out during the mid-1990s, and reported in 1997. The new figures challenge the use of some of the established figures and perhaps some of the theories as well.

This subsequent study was carried out by Hague Consulting, using Stated Preference research carried out by Accent.

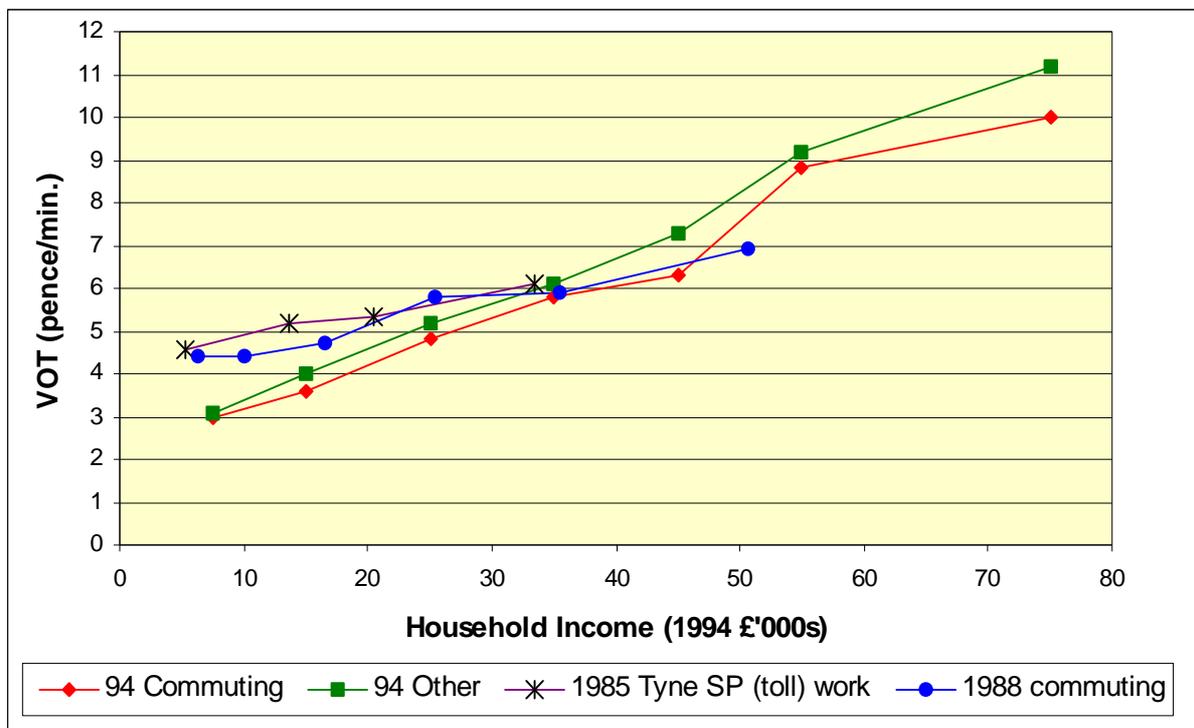
Results

Hugh Gunn started by emphasising that there is no such thing as “The” Value Of Time, since it varies by individual by journey purpose by time of day etc. However, he demonstrated a number of interesting relationships.

Income

Studies in both the UK and Holland have shown that the VOT is linearly related to income – but is certainly not proportional. Elasticities of VOT vary in relation to income range from 0.35 for leisure journey purposes to 0.7 for business. If VOT does not rise in line with income then we should stop assuming in appraisals that it does!

Figure 1: 1988 Dutch Commuting Driver VTTS Results versus 1985 and 1994 UK Results, by Income (1994 price levels)



Size of time savings

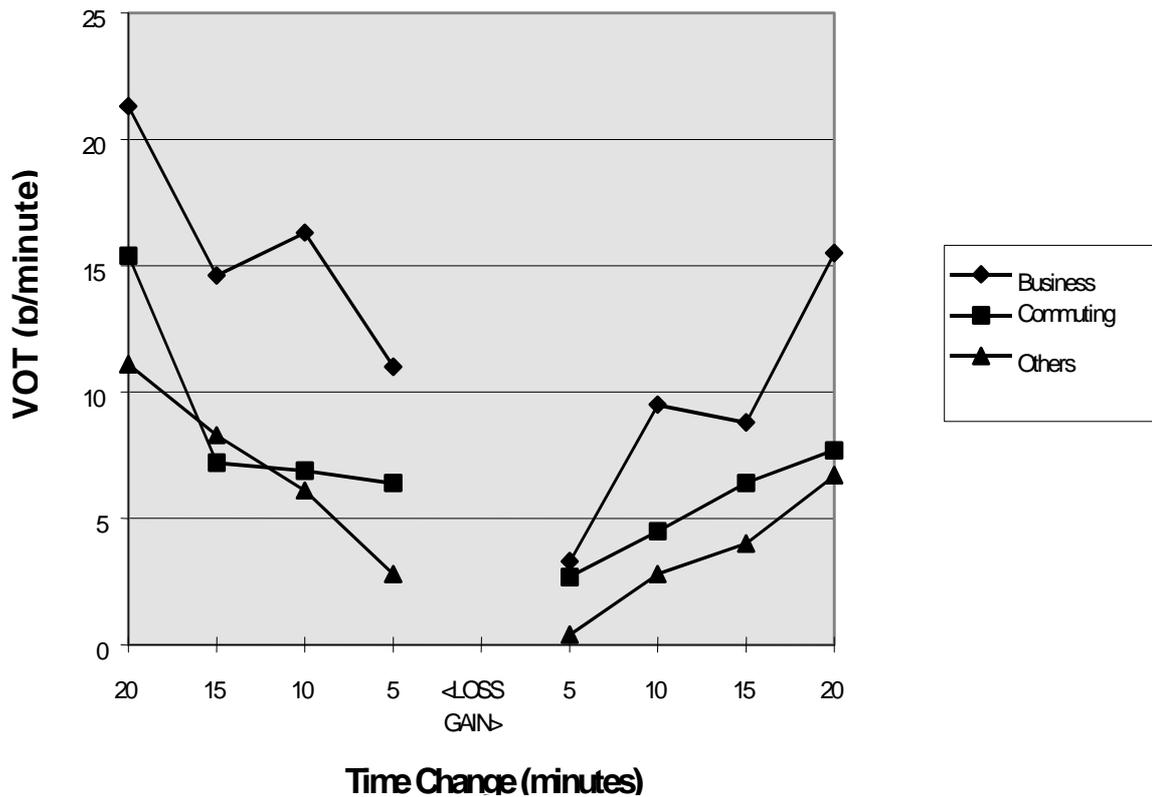
The results reported here certainly demonstrate that small time savings (say less than five minutes) really are not valued by the public in SP experiments.

On the other hand, this implies that larger time savings are worth more than average. Such time savings might be generated from a new estuarine crossing.

This implies that the design and context of the SP questionnaire being used to evaluate the VOT affects the average results.

Results (see figure 2) also show that the value of time lost is typically twice that of the time gained, as reported in SP experiments.

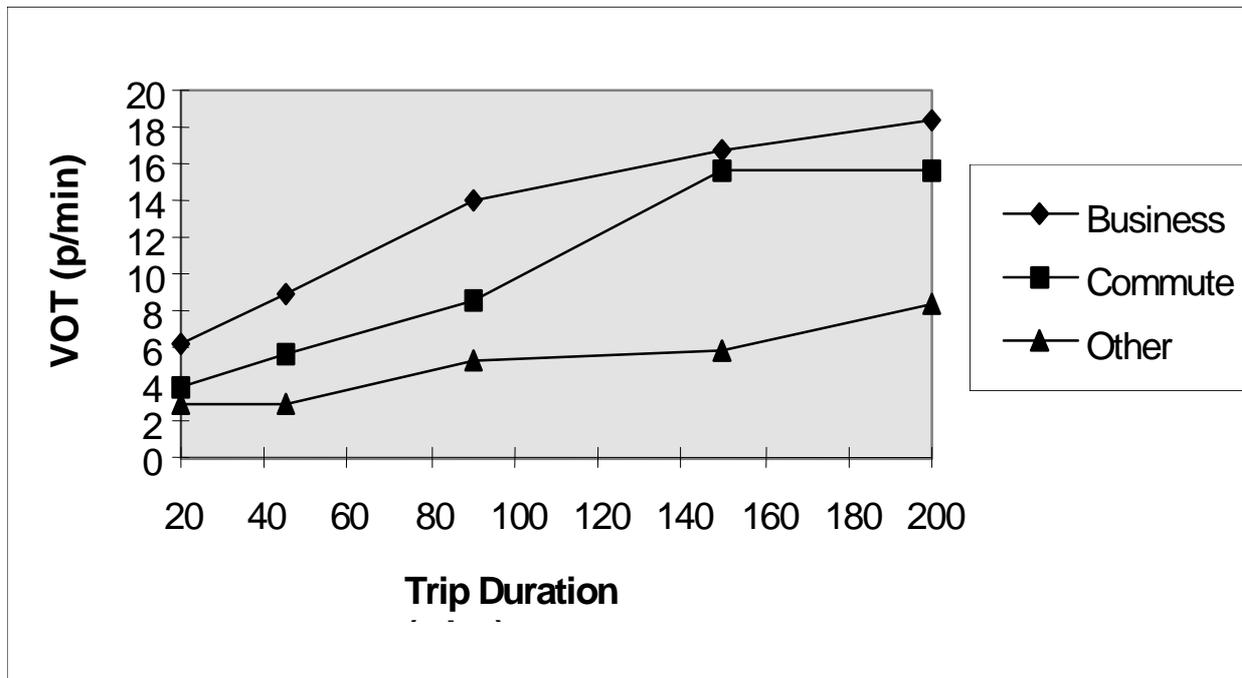
Figure 2: Values of Time Changes of Different Sizes: UK 1994



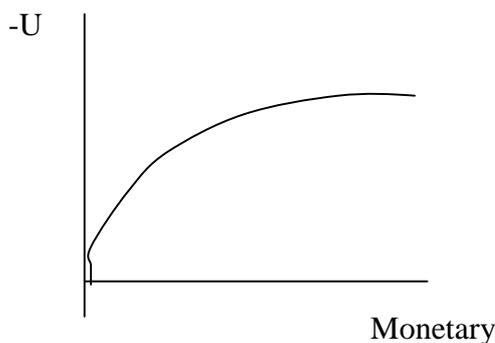
Journey Duration

Results (over a range of models and journey purposes) show that the Value Of Time increases with increasing trip duration.

Figure 3: Observed Values of Time by Trip Duration (minutes)



One explanation consistent with other evidence from RP studies is that the relationship between utility ($-U$) and monetary cost is logarithmic, and so monetary cost level has a key bearing on the VOT. Although the relationship is logarithmic, however, over observed values within a small range it may be reasonably linear.



It also follows that if this is generally true, it is absolute units of time, but proportionate units of money, that are important. On long journeys, people get less worried about monetary increases (because these can be transferred to another day's expenditure) but are still worried about time increases (because daily time budgets are fixed).

Summary

Fortunately, the overall average values from this latest study (averaging over size and sign) are generally similar to previous values, although they are higher for business trips and the freight sector (where companies appear to value the cost implications of time savings very highly). However, there remains considerable unexplained variation.

Previous work has, however, concentrated on journeys to/from work. More interesting results come, however, from the consideration of VOT for those without paid employment. For example, housewives can change the quality and quantity of goods purchased, and the quantity of services done themselves or bought in. One of the factors which affects this balance is the time and cost that trips take, and the ability to save money by 'shopping around'. In practice, VOT, then, can vary in a response to a domestic situation or, for instance, a locational situation e.g. house location against trip length to work.

Another factor is that people are able to adapt their behaviour. For instance, the VOT of delays to people with mobile phones is around half that without, presumably since alternative arrangements can be made, and apologies given. If businessmen are able to work on the train, speeding it up perhaps doesn't help productivity! These thoughts suggest that adaptive solutions be recommended.

Discussion

Peter Jones (University of Westminster): If travel time is used productively, this leads to lower VOT savings and counter-intuitive results! Are we trying to save productivity or time?

HG: This area does indeed need careful thought but it is not really counter-intuitive. Time is not saved by speeding up travel, just transferred from one activity to another. If productivity during travel, it is less worthwhile increased transferring the activity of (travel to) activity at the workplace. And for the ability to re-schedule activities that comes from mobile phones, it could arise that VOT varies by direction – for instance, some may have work-related pressures, others pressures from duties at the home.

Stephen Gibson (Railtrack): What is the relationship between the value of expected journey time and unreliability?

HG: The value of being late was found to be about twice as high as the value of a longer (known) journey time in our survey. This is because the value of reliability is a function of the value of undesirable time losses.

Peter Collins: One can hypothesise good reasons why VOT might go either up or down with income. But are small time savings really not valued?

HG: In repeated SP surveys, small time savings were not valued. However benefit can stem from the fact that a small time saving may enable a proportion of people to convert a block of spare time which was insufficiently large to be useful into a useful period. In other words, a few people could value a small time saving a great deal, whilst the majority not at all – the response is not homogeneous. It is to do with the use of time, which is needed in packets of useable size.

Don Box: Time savings aren't always a benefit – for instance, the police have complained that motorways enable criminals to escape more easily. More seriously, the results have implications for rail policies (e.g. between short- and long-distance trains, or car vs. rail).

HG: Indeed, and this also raises the issue of whether we should be responding to people's expressed preferences at all. Although many people think that it's a "good thing" to have public transport, they don't always vote for it in surveys. Currently expressed transport industry views may be out of step with public opinion.

Dick Dunmore (PriceWaterhouseCooper): The distribution of VOT also needs further attention, as a number of recent high-profile schemes (e.g. Sydney, Eurostar) where high fares are charged to recoup time savings have not attracted the demand forecasted.

HG: Forecasts are long-term, but the transition period to the new long-term state is often not considered much. Choices may be time- and information-constrained by current choices. Perhaps new forecasting models are needed for this. Important questions include: "What claims should we make about them?" and "What assumptions do we make?"

Peter Jones: SP assumes perfect information and current choice, but in real life, we make ongoing choices on the basis of imperfect information. When do SP results become valid?

HG: There are many reasons why people may not be able to change the habits of previous choices immediately, especially in terms of changing their trip destinations. Revealed Preference data may help us to determine "dispersion" factors much better than SP.

Tim Powell (independent consultant): Is SP good for estimating safety?

HG: Only if done indirectly.

Report by Nigel G Harris, The Railway Consultancy Ltd

Rail Strategies for Britain

Chris Austin, Executive Director, Strategic Rail Authority

Presentation to the Transport Economists' Group
University of Westminster
13 December 2000

Introduction

Chris Austin started his talk by explaining that now the Transport Bill had received Royal Assent the Strategic Rail Authority could shed its shadow form and assume its full responsibilities from 1 February 2001. The purpose of the talk was to stimulate discussion on some of the broader strategic issues rather than to catalogue the tasks to be undertaken by the SRA, with the emphasis upon long term strategy, rather than current operational problems.

Railway strengths

The railway has great strengths not shared by other modes of transport. These included:

- **High volume**, where high demand for inter-urban and radial commuter corridors could be served by a high frequency of services. For freight, trainloads of up to two thousand tons are often provided for customers for aggregates, coal and steel products.
- **Speed**, where there is great potential for the future; 140mph on the West Coast Main Line will compare very well with speeds of 70mph on the roads.
- **Predictability**, where rail has the potential to raise performance so that it can compare well with roads.
- **Safety**, where the actual record over a number of years is a main strength despite media reporting, which is not always as objective as it might be.
- **Environmental**, where modern fleets run over a well established and dedicated right of way make a small impact upon the environment.

Railway weaknesses

There are, however, weaknesses to be set against the above strengths. These include:

- **Inflexibility**, the rail industry has become less flexible since it was fragmented into a large number of disparate units and responses to minor incidents such as point failures or bridge strikes have taken time to co-ordinate.

- **Capacity constraints** have become evident as demand has risen, currently a third higher than at privatisation. Additional 1,700 trains a day (9%) have revealed a number of bottlenecks at key points in the network.
- **Asset condition** is a concern where replacement and modernisation took place in waves, making difficult to find adequate skilled resources when it is time to organise the next large investment programme.
- **Organisational** issues about the fragmented industry and the legal framework binding it together have recently come to the fore and Sir Alastair Morton had set up a number of working groups to identify stress-points.

The Railway Today

The strengths and weaknesses are reflected in the nature of the railway seen today:

- **Sustained growth** has been seen in passenger, up over 30%, and freight, up some 40%, since privatisation.
- **Substantial private sector investment** in rolling stock and infrastructure has taken place, even though it has taken a while for benefits to be felt on the ground.
- **Local focus and accountability** has moved the centre of gravity, to an extent, away from London: ScotRail is very much based in Scotland with Scottish priorities.
- **Focus and strategic direction** has not been evident and Railtrack, the only large company at the centre of the industry, appeared reluctant to take on the job.
- **Service quality** not improved significantly in the last few years and when things do go wrong service quality collapses and takes quite a while to recover.
- **Public expectations** were raised by privatisation and the quality of service provided by other railways and in other service industries.

The Role of the Strategic Rail Authority (SRA)

- The Transport Act 2000 requires the SRA:
 - ◆ *“To promote the use of the railway network by both passengers and freight;*
 - ◆ *“To secure the development of the railway network;*
 - ◆ *“To contribute to the development of an integrated system of transport of passengers and goods.”*

- The SRA Mission is:
 - ♦ *“To ensure within ten years that Britain’s rail system will be fit for its purpose in the twenty-first century and favourably comparable with any in Europe.”*

Such a task was never asked of the British Railways Board (BRB) or the Office of Passenger Rail Franchising (OPRAF). The remit is to ensure that the industry plays its part in delivering solutions to transport and development problems, such as relieving congested roads and boosting run-down communities, rather than simply solving railway problems.

The existing franchise agreements are a barrier to improving and growing the passenger railway. The agreements, which give some incentives to invest or perform well, do not set challenging quality targets and do not put the customer first. This is why the SRA sets out to replace all the short-term franchises.

The “PFI” Approach

The key functions of the SRA can be summed up in the acronym PFI, where "P" stands for Passenger, "F" for Freight and "I" for Infrastructure. PFI also underlines the partnership between public and private capital, which is the basis of the 10-Year Plan and the SRA approach to investment.

Delivery will be through contracts, not by command or control. It will be a partnership approach, with regulatory powers behind it. There is a balance to be achieved between micro management and strategy. Both the “S” of Strategy and the “A” of Authority are likely to apply.

Strategic Objectives

A bigger, better and safer railway will be delivered through investment. A step change in service quality is sought through the re-franchising process. But it is for operators to deliver the 50% growth in passenger and 80% growth in freight sought. There have been suggestions that the SRA might have been more prescriptive, but the objective has been to see what those closest to the market propose and to buy in to practical solutions. Accountability will be to passengers, passengers’ committees, regulators, Government and the media and widespread consultation was in hand with devolved regional and local authorities.

Passenger

There will be a challenge to match supply to increasing demand. This will particularly be the case for infrastructure where BR was quite efficient at removing surplus capacity. Instead we now have bottlenecks on the network to

address. There will also have to be sufficient capacity so that there is resilience: a capacity to react swiftly to unforeseen events.

Consultation with interested parties, including bodies such as Sustrans, has shown that there is a wide range of issues about access to be addressed. The co-operation of local authorities, bus operators and others will be helpful in delivering good interchanges and quality travel information. Fares are currently at the upper end of European comparisons, but regulated fares have been coming down in real terms since privatisation. It is notable that the public reacted against the use of prices and compulsory reservations to manage demand, a recent example has been GNER bookings for the Christmas period.

There has been significant investment in new trains. A recent example was £238m for trains on the Midland Main Line, which was agreed along with a new parkway station and reduced journey times in exchange for an extension of franchise. There has also been innovation through partnership funding for smaller schemes; cycle storage in East Anglia and a park and ride scheme in Edinburgh have been examples.

Freight

The strategy for freight will be spelt out in detail in the Strategic Agenda to be published in the New Year. One of the issues that are likely to be addressed will be access to and from ports. This is particularly critical for container traffic at Felixstowe and Southampton. If freight is to increase its market share inter-modal might be one of the means of achieving it. That Scotland should now have chilled and frozen food conveyed by train is encouraging news.

There will be track access grants for freight in order to level the playing field and these will be linked to the consignment and not the operator. In addition facility grants will continue to be available, particularly if heavy goods can be diverted from congested roads to rail.

Infrastructure

It is the responsibility of the Rail Regulator to determine prices for access charges, although absolute levels would impact upon the funding available for the whole industry. The SRA is purchasing a number of incremental outputs from Railtrack as part of an improving baseline. These are designed to raise standards and add flexibility to the network with minor works at a series of locations and stations.

The Rail Modernisation Fund, some £7bn in total, will enable improvements to be made to the network that support the re-franchising process and critical routes for freight, such as Southampton to the West Midlands. The Fund will be

used to lever in private capital and schemes will be progressed in an inclusive manner with the key industry stakeholders through project development groups.

Railtrack

It is becoming clear that Railtrack has two businesses: the operation and maintenance of the network as a regulated utility funded through access charges, and major projects. Many major projects will require a public/private partnership to fund. These will demand innovative structures (special purpose vehicles) to obtain the best value. Much work will be required in the near future to make them a reality.

Integration

The railway is just one part of the overall transport provision for the country, which if viewed in conjunction with other modes has much to offer. It is often at the local level that this is best seen. There is a great opportunity for Local Authorities to reach beyond the narrow confines of highway engineering and grasp opportunity to look at transport and the environment in total.

Conclusions

The rail industry has to demonstrate its worth: there are no free lunches. Growth in demand has now to be matched by an improved quality of service. Investment will play a part in providing it, but there are other actions to be taken as well.

Discussion

Dr Idris Williams asked about trains being removed from the timetable in the West Country. Chris Austin explained that the Passenger Service Requirement (PSR) was a minimum requirement including first and last services and frequencies. There is a balance to be drawn so that there is freedom to innovate with new services, a recent example being Rugby to Gatwick. It is possible that future franchises might have some additional services included within the PSR.

Peter Collins asked about the effect of the Hatfield crash and whether the obsession with safety was likely to make the system inoperable. Chris Austin felt that many of the basic factors, which had delivered growth in the past, such as road congestion, were still there so it should be possible to recover some of the lost business after Christmas. Safety management of the railway and a proper assessment of risk could mean that it would be difficult to match public expectations. Asked if the SRA could manage public expectation Chris Austin suggested that this might be possible over a period of time. Politicians were fond of quick fixes but the SRA was aware that the railway required long-term solutions.

Simon Smith asked if cost benefit analysis was used to allocate scarce network capacity between passenger and freight. Chris Austin said that as far as possible the national timetable conference aimed to accommodate both and seeks to optimise capacity on a case by case basis in an iterative process. The time had not yet come when the network could only accommodate one or the other.

Martin Brazil warned against the dangers of producing white elephants. He cited services from Scotland to the Channel Tunnel as an example. Chris Austin replied that the extensive consultation carried out by SRA was a guard against such dangers. In the past there had been an emphasis upon minimising cost, but the emphasis was now upon better value. In some instances this might lead to replacing capacity previously stripped-out, as has happened with the Chiltern franchise.

Jim Coates asked why major projects could not be funded from Railtrack's access charges. Chris Austin said that this could indeed be the case. But there could be other circumstances where there were many operators, or freight was competing with road, where there are no access charges, or where there was a limit to the capital Railtrack could raise upon the open market, where the SRA might look for alternative approaches.

Don Box asked about rolling stock privatisation, contending that prices had doubled under the private sector and the lease contracts provided insufficient incentive for investment to take place. Chris Austin noted that there had been an investment hiatus in the first year or so as managers grappled with the uncertainties surrounding the expiry of the initial leases. But in the following years two and a half thousand new passenger vehicles have been ordered. The current problem was getting the new vehicles into active service fast enough.

Dick Donnell asked about the planned award of long-term franchises for up to twenty years and asked if this was not too great a risk. Chris Austin responded by pointing out that there will be review points at five-yearly intervals, so that important issues could be addressed.

Report by Stephen Bennett

TEG NEWS

DR MARK BUNTING

We regret to record the death, in August 2000 through cancer, of Dr Mark Bunting. He spoke at the November 1997 TEG meeting on the subject of "*Developments in Canadian Transport*" and worked as an independent consultant based in Kingston, Ontario. His talk was reported in Volume 25, Number 1 (Spring 1998) issue of the Journal.

REPORT OF ANNUAL GENERAL MEETING, MARCH 2001

The Annual General Meeting of the Group took place on the 28th March 2001 with eight people in attendance.

CHAIRMAN'S REPORT

The past year has seen a slightly less regular programme of meetings than usual, but highly successful joint meetings with other organisations.

As usual, we managed to ensure that highly topical subjects were covered. Meetings organised solely by the Group and held here at Westminster comprised:

| | |
|-----------------|---|
| February | Bus issues in the Transport Bill (myself) |
| March | Potential for reducing short car journeys (Roger Mackett, UCL) |
| April | Analysis of Congested Networks (Peter Hills, University of Newcastle) |
| May | Green Travel Plans (David Pontefract, Oscar Faber) |
| June | London Mayor's Transport Strategy (Keith Gardner, GLA) |
| October | Enhancing light rail systems (Roger Mackett, UCL) |
| November | Research in the Value of Time (Hugh Gunn, Hague Consulting) |
| December | Rail Re-franchising (Chris Austin, Strategic Rail Authority) |

The series of joint meetings with the London Association of ICE continued. They comprised talks on "*Road User Charging Options in London (ROCOL)*" by Reg Evans of Halcrows at the University of Westminster in January 2000, and on the "*London Bus Initiative*" by Zyg Kowalczyk of TfL at One Great George Street in January of this year.

The two most heavily attended sessions were the joint half-day meetings arranged jointly with the Transport Planning Society, attracting around 70 participants in each case:

- New Approaches to Transport Appraisal (Mike Walsh of DETR and others) on 16th June 2000 (published in the previous issue of the *Journal*).
- Forecasting issues in the light of the Ten Year Plan (Tom Worsley of DETR and others) on 8th February 2001.

Our regular series of monthly meetings resumes with tonight's talk by Jon Willis of TfL on "*Intermediate Modes in London*", with further meetings to June inclusive.

I appreciate that notice of meetings has not been as adequate as we would normally wish (although attendance sometimes seems inversely correlated!), and in future we will also make more use of e-mail to inform members of events.

Having been in the chair for over fifteen years I would like to step down either from this meeting or in the fairly near future.

Thanks go to other committee members for all their work over the past year, especially Don Box as Treasurer and Membership Secretary, and Laurie Baker as Publications Editor.

Peter White,
28th March 2001

TREASURER'S REPORT AND ACCOUNTS

The Treasurer, Don Box, introduced his report and the accounts for 2000:

1. The result for 2000 is a loss of £203, which is a considerable improvement (£306) compared to 1999. The membership drive and increase in the subscription rate to £18 were largely responsible for this improvement. Expenses, although showing increases in all departments, were not as large as could have been if we had not taken action to curtail them. This action is continuing.
2. The breakdown of expenditure between the main items of administration, publications and meetings, compared with the two previous years is:

| | <u>2000</u> | <u>1999</u> | <u>1998</u> |
|----------------|-------------|-------------|-------------|
| Administration | £882 | £873 | £744 |
| Publications | £933 | £874 | £967 |
| Meetings | £1,210 | £1,142 | £936 |

3. The continued rise in the cost of meetings (albeit a substantially lesser increase this year) should be reversed this coming year due to the practice of running joint meetings with other organisations. Publication costs are expected to be about the same. Administration will show a small increase in secretarial costs but increased use of e-mail for correspondence should result in an offsetting of those. On the income side, there will be no change in rates this year, until we get the website established. But we must continue our efforts to increase membership so as to eliminate the current loss and the initiatives outlined in paragraph 4 of last year's report will be pursued and elaborated upon this year.

4. At 31 December 2000 there were 152 members paid-up for the year, which is an increase of seventeen over the corresponding figure for 1999. Twenty-seven new members enrolled for 2000, which gives ten lapsed during the year. A repetition of the improvement in membership recorded for the year 2000 during the current year would see our finances restored to a healthy position.

Income and Expenditure Account for 1999

| | | £ | £ |
|---|--------------------------|-------|---------------------|
| Income | | | |
| Subscriptions | 1999 | - | |
| | 2000 | 2,229 | |
| Interest | | 86 | |
| Other | | 21 | <u>2,836</u> |
| Expenditure | | | |
| Administration | Secretary | 794 | |
| | Other | 88 | 882 |
| Publications | | | 933 |
| Meetings | Room hire | 844 | |
| | Entertainment & expenses | 227 | |
| | Insurance | 139 | 1,210 |
| Corporation tax | | | 14 |
| | | | <u>3,039</u> |
| <u>Excess expenditure over income for the year</u> | | | <u>203</u> |

Balance Sheet

| | | |
|--------------------------------------|-------|---------------------|
| Accumulated funds at 31.12.99 | 3,042 | |
| Less: loss for 1999 | 203 | 2,839 |
| Creditors | | 1,138 |
| | | <u>3,977</u> |
| Represented by: | | |
| Deposit Account | 2,470 | |
| Current Account | 2,065 | 4,535 |
| Less: uncleared cheques | | 558 |
| | | <u>3,977</u> |

REPORT OF THE AUDITOR

To members of the Transport Economists' Group: I have examined the records of the Transport Economists' Group and have received explanations from your Treasurer as necessary. In my opinion the Balance Sheet gives a true and fair view of affairs as at 31 December 2000, and the Income and Expenditure Account properly reflects the excess of expenditure over income for the year then ended.

Signed: G Carson
5th March 2001

ELECTION OF COMMITTEE FOR 2001

The committee for 2001 remains unchanged. Individual tasks will be agreed at the first committee meeting after the AGM. The committee is:

Peter White
Peter Collins
Don Box
Laurie Baker
Stephen Bennett
Martin Lawrence
Roland Niblett
Roger Mackett
Peter Gordon