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Winter July 1, 1995

Results of a Delphi study on transport research needs

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RESULTS OF A DELPHI STUDY ON TRANSPORT RESEARCH NEEDS

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ABSTRACT

A Delphi survey was undertaken with a selection of professionals in academic, government and consulting across the world. The objective was to identify the application areas where priorities should be placed, and the current status of the research and information tools needed to address them. For this reason both modelling and application experts were included. The shifts in priorities over the last five years, and the differences in view between the three sectors

are presented. The attitudes towards a range of specific research and development directions were also assessed.

1. INTRODUCTION

The NSW Department of Transport recently requested a review of their modelling and information strategy as the basis for the next 3-5 years. This project (discussed elsewhere) required a state of the art review in modelling, survey methods and information management and uniquely placed information and modelling strategies on an equal and integrated footing.

Effective transport planning now requires a careful balance between information, analysis and communication to ensure that the different parties affected can work together. The project therefore included three successive levels of consultation.

  • Focused interviews with key users and decision makes in NSW

  • Workshops with groups of users and potential users of transport and planning data and models

  • A Delphi survey of world expert opinion on both the state of the art and the state of application

The Delphi provided a special contribution to assess how locally perceived needs for modelling, techniques and information handling matched the directions being pursued elsewhere. Advances in transport analysis and modelling can now be communicated very swiftly between research and application specialists across the world, and the findings then applied with little delay.

The rapid dissemination of research findings is inevitably faster than the rate of transfer into practice. Sounding out solely the global views held by research workers on modelling capabilities and needs would not give adequate guidance. The views of experts in the application of modelling and analysis techniques are equally necessary.

A similar survey of this kind was done as part of a smaller project for the city of Melbourne in Victoria, Australia

(Taylor, Young, Wigan & Ogden, 1992a; Taylor, Young, Wigan & Ogden, 1992b).

2. DELPHI SPECIFICATION

The survey instrument covered a range of factors, and the survey form is given as an Appendix. A total of 34 completed responses were received, so that in general only broad conclusions may be drawn. The stratification of the sample over government, academic and consultant sectors enables some useful comparisons to be made. A selected set of analytical and applications experts, were invited to give their views in line with the following broad objectives:

- To increase the policy relevance and sensitivity of existing travel and transport forecasting procedures and their ability to respond to both traditional and emerging transport issues;

- To redesign the travel forecasting process to reflect today's traveller and freight flows behaviour, to respond to greater information needs placed on the planning and forecasting process, and to take advantage of changes in data collection technology; and

- To make travel model results (explanatory and forecasting) more useful to decision makers.

3. VIEWS ON RECENT AND FUTURE ISSUES

The opinions of the different respondents were sought on what had been the most important issues in the last five years, what would be the most important issues in the next five years - and what they felt ought to be given priority by others in the next five years. The views of the three segments of the professional community had much in common - but there were significant differences. Academics felt strongly about a number of issues - such as institutional reform, light busways and

consultation processes - that were rated in the top five by neither Consultant nor Government respondents.

Government respondents showed an emphasis on land use-transport and transport pricing, probably reflecting concern over the increasing difficulties in financing new infrastructure, and the necessity to have a sound integrated planning framework to maintain control as more partnership and private finance is used.

Priority issues for the next 5 years, in decending order
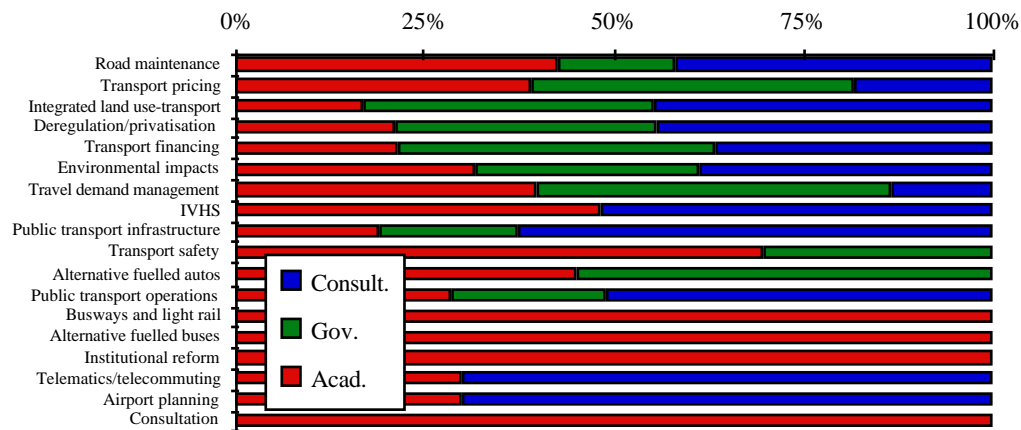
Views of different sectors to priority issues for the near future

The priority issues of the last five years had a rather different emphasis, with governments being concerned more with road maintenance, environmental and deregulation issues.

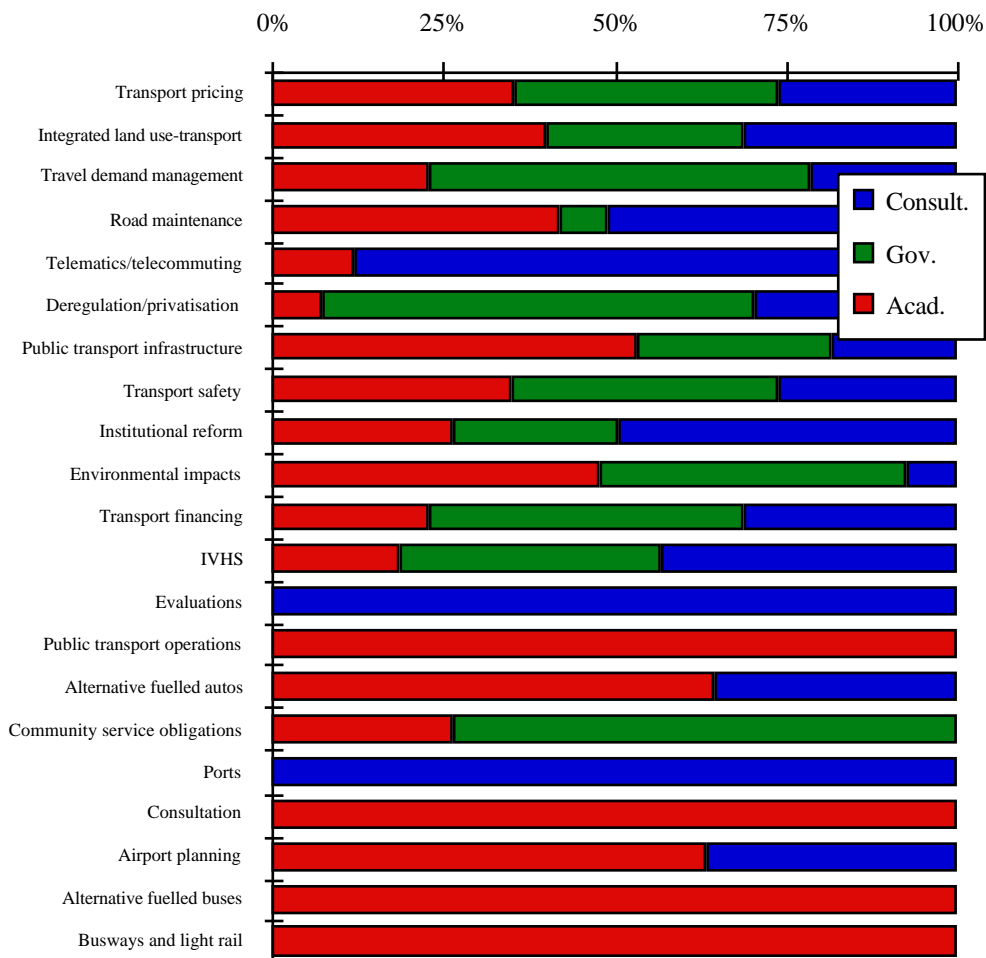**Priority issues for the last 5 years,in decending order**
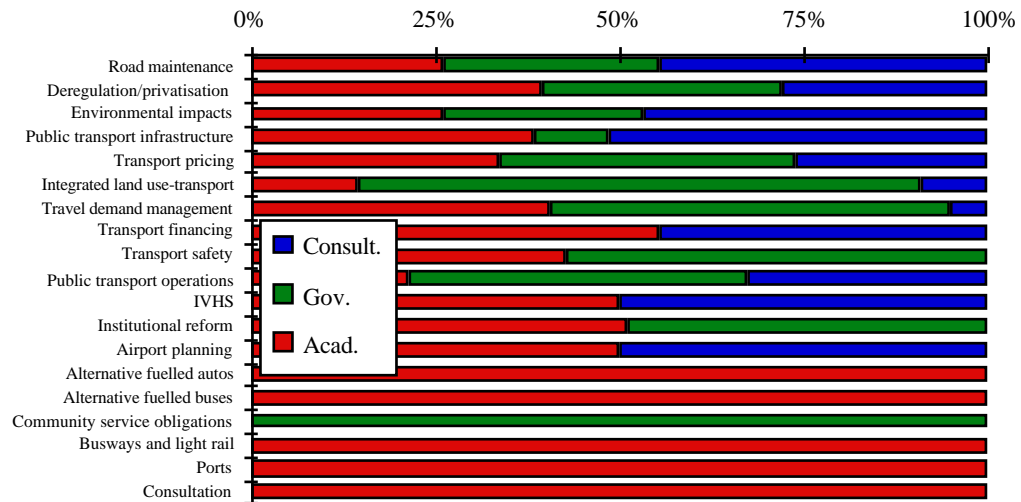
Views of respondents in different sectors as to what were the priority issues in the recent past

Views of respondents in different sectors as to what SHOULD the priority issues be for the next 5 years

The shifts in overall priorities tell a revealing story. Road maintenance was felt likely to be over-emphasised in the near future, at the expense of transport pricing, integrated land use and transport planning and travel demand management. Concern with financing transport is expected to reduce the attention need for travel demand management., but the major issue for analysts and planners is the rapid rise of integrated land use - transport planning towards the top of the list.
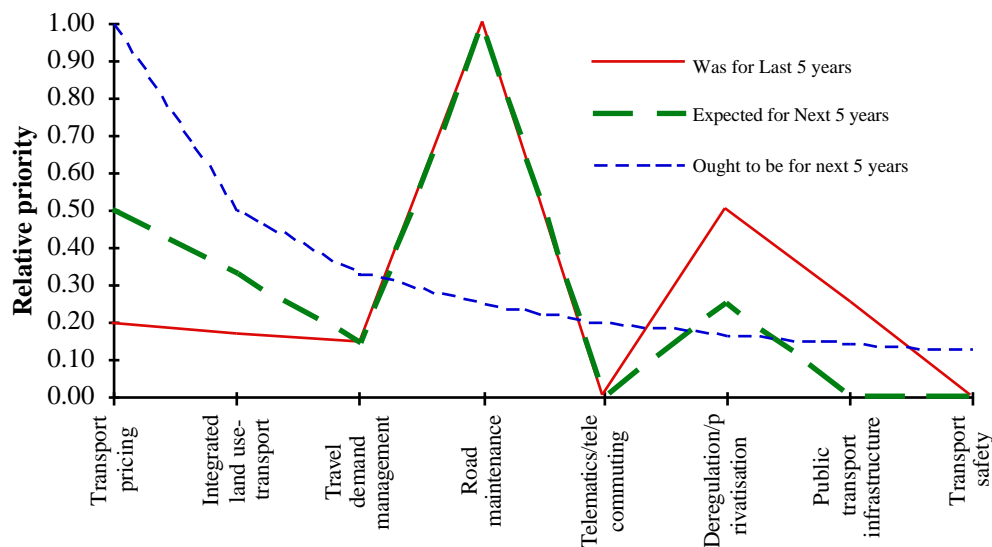
Priority shifts over time, and a leading indicator of views as to what should take priority in future

The following Table, showing priority shifts, complements the diagram showing the changes in views over time in order of rated priorities by the respondents in their own view. The points below the 'ought to be' line are the areas where the expected priorities are felt likely in practice to be set too low, and those above where they were (or are expected to be) set too high.

Priority	Observed in the Last 5 years	Expected to be for Next 5 years	Ought to be for the next 5 years
1	Road maintenance	Road maintenance	Transport pricing
2	Deregulation/ privatisation	Transport pricing	Integrated land use-transport
3	Environmental impacts	Integrated land use-transport	Travel demand management
4	**Public transport infrastructure**	Deregulation/ privatisation	Road maintenance
5	Transport pricing	***Transport financing***	Telematics/ telecommuting
6	Integrated land use-transport	Environmental impacts	Deregulation/ privatisation
7	Travel demand management	Travel demand management	**Public transport infrastructure**
8	***Transport financing***	IVHS	Transport safety

The nature of the issues that have become highly rated for attention show a strong swing back to systemwide policies, and reflect the growing need to plan and coordinate a range of different measures to addess transport problems successfully. The use of market forces in transport pricing, serious attempts to integrate of land use and transport planning and information and the coordinatd range of measures and organisation equired to implement travel demand management reflect the need for both competitive reform and a more effective and integrative public sector policy role.

4. ATTITUDES TO WARDS DIRECTIONS OF MODELLING DEVELOPMENT

The expressed views towards various research and model development areas provide one aspect of the expert opinion consensus, but does not clearly indicate the directions where choice are likely to be made. To probe this a series of weighted questions were included to elicit opinions of this kind. initially it was felt that the survey had only mixed success in doing this, but when the responses are arranged in decreasing order of agreement, the patterns become clearer.
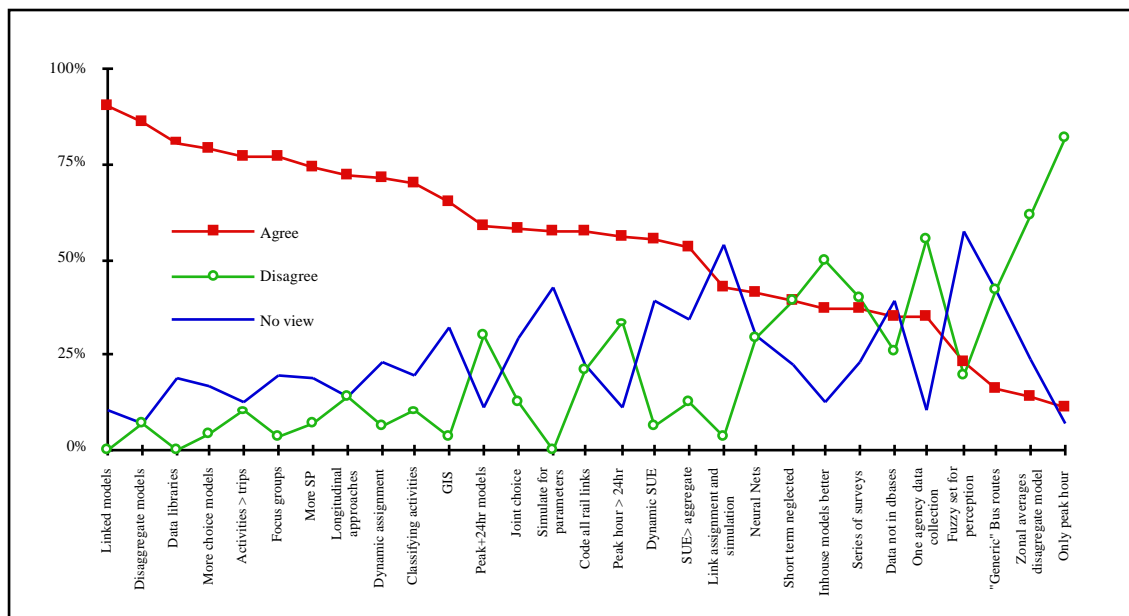

Attitudes towards different types of statements on modelling and data approaches

There is a high degree of agreement on several issues. Traffic and travel demand models need to more closely linked, greater use of desegregate choice models, and an emphasis on activities rather than

trips. Dynamic assignment, and classifying activities into mandatory, flexible and optional and using longitudinal surveys more were also supported.

The need for transport data libraries was strongly endorsed, with no recorded disagreements at all. The use of GIS (Geographical Information Systems) for modelling and data management was widely recognised as important.

Few respondents were in favour of using only peak hour models, coding only generic bus routes, and keeping data in a simplified format and outside data management systems.
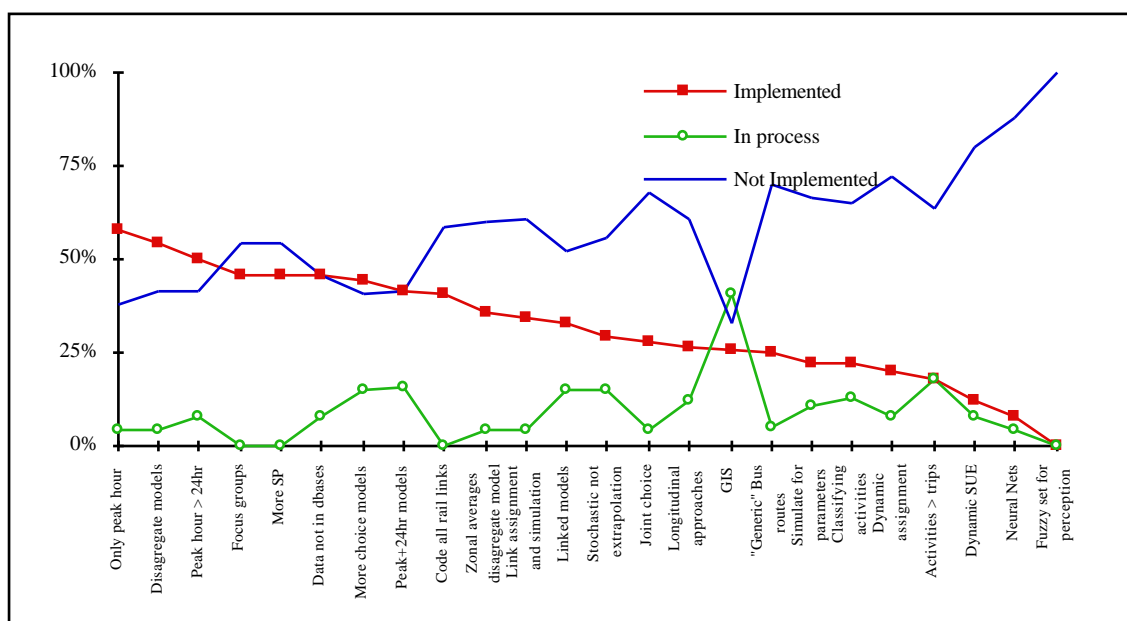
Where have we got to in applying a range of identified modelling and data areas

The contrast with the views on importance and the general levels of implementation in many of these areas showed some marked differences. The most significant initiative is the major emphasis on implementing GIS in a transport context. The level of implementation is still low, but approaching half the respondents report is as being in process of implementation.

The shift from treating trips to treating and classifying activities is the next most active area. Linking traffic and travel demand models, and using simulation methods for parameter estimation are also active. A shift to estimating both peak and 24 hour models is under way, although most still report solely peak hour models being the state of practice.

Effectiveness ratings for analysis and data functions
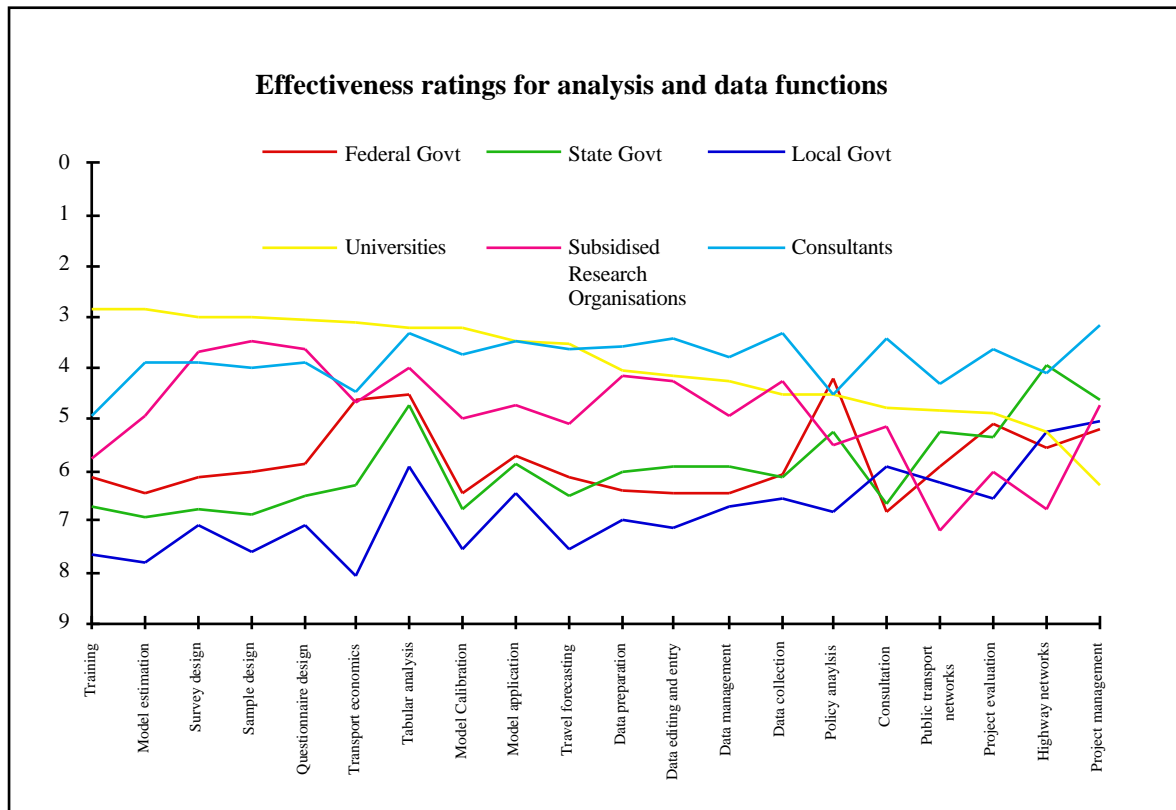
Overall organisational ratings for different data and analysis functions

The convergence of federal government, univrsites and consultants in policy issues is interesting,

ACKNOWLEDGMENTS

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University
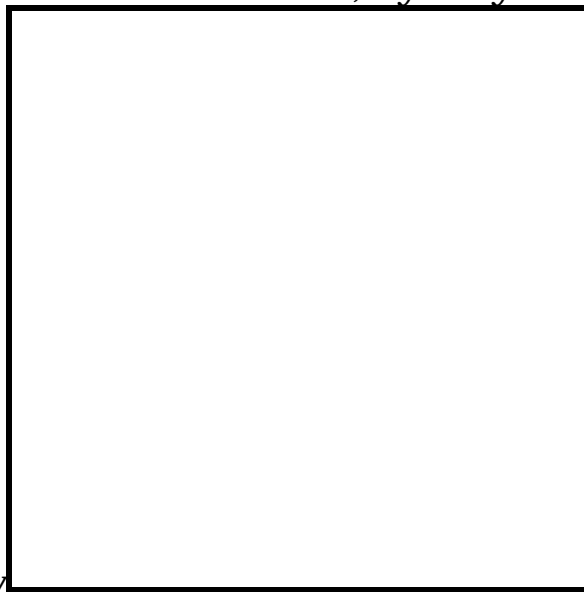
Taylor, M. A. P., Young, W. F., Wigan, M. R., & Ogden, K. W. (1992a). Designing a large-scale travel demand survey: new challenges and new opportunities. **Transportation Research A,** 26(3), 247-262.

Taylor, M. A. P., Young, W. F., Wigan, M. R., & Ogden, K. W. (1992b). Travel data: their collection and use. In E. S. Ampt, A. J. Richardson, & A. H. Meyberg (Eds.), **Selected readings in transport survey**

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Press.

Appendix: Abbreviated summary of the Delphi Instrument

Survey of Transport Professionals:
What do you think?

The Institute of Transport Studies (ITS) is undertaking a review of strategic travel information and model systems for **urban** transport, both passenger and freight.

An important activity of the inquiry is a Delphi exercise. The aim of the *Delphi Activity* is to identify the state of the art and the state of practice in areas of information associated with travel models and travel data; and to establish the important linkages between the state of play and its relevance to the transport planning and decision-making process.

A selected set of analytical and applications experts, including yourself, are invited to give your views in line with the following broad objectives:

- To increase the policy relevance and sensitivity of existing travel and transport forecasting procedures and their ability to respond to both traditional and emerging transport issues;

- To redesign the travel forecasting process to reflect today's traveller and freight flows behaviour, to respond to greater information needs placed on the planning and forecasting process, and to take advantage of changes in data collection technology; and

- To make travel model results (explanatory and forecasting) more useful to decision makers.

We would like to invite you to participate in the survey exercise. The exercise should take no more than 30 minutes of your time.

SURVEY OF TRANSPORT PROFESSIONALS

Section 1: PERSONAL DETAILS

4.   Highest educational qualification
   Type
   Year
   University:
Country

5.   Number of years in transport research (or related) field: years

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This question is optional but useful.

6.   Organisations worked for in last 5 years and duration with each organisation:
   (*No acronyms please*)

   Most recent..for............years

   Second most recent..for............years
   Third most recent ....for............years

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7.   How would you describe your expertise? *Tick one or more*
Basic research
Applied research
 Policy analysis

Section 2: POLICY AREAS

The table below lists a range of policy areas. In the columns we ask you to rank the five most important answers to each question from 1 to 5 (1 = most important)

8.   Which transport issues have been *most important* in the LAST FIVE years in terms of planning and policy in your country? *Please rank in column Q.8*
9.   Which areas do you believe will be high agenda items over the NEXT FIVE years in your country? *Please rank in column Q.9*
10.   Which OUGHT to receive greater attention in the next 5 years? *Please rank in column Q.10*
11.   Which areas do you think would be best studied via international funding and agencies? *Please rank in column Q.11*

	Q.8	Q.9	Q.10	Q.11
Transport Pricing				
Road maintenance				
Road infrastructure investment/toll roads				
Local Area Traffic Management				
Traffic control systems				
Travel demand management (urban-wide)				
Transport safety				
Busways and light rail				
Public transport infrastructure investment				
Public transport operations				
Community Service Obligations				
Transport financing				
Deregulation/privatisation/out-sourcing				
Alternative fuelled public transport (buses)				
Alternative fuelled automobiles				
IVHS				

Integrated land use – transport strategy				
Telematics/telecommuting				
Airport planning and strategy				
Ports transport strategy				
Environmental impact assessment				
Evaluation				
Institutional reform				
Consultation				
Other:				
Other:				
Other:				
Other:				
Other:				

Section 3: SKILLS

12. **What, in your view, are the range of transport-related skills required to plan and evaluate a transport system/network for a large city?** *Please list up to 5 that should be provided in-house by a government agency, and up to 5 that should be contracted out.*

      IN-HOUSE SKILLS   CONTRACTED OUT SKILLS

   1. ....   1. ....

13. **What software do you/your organisation use for:**   Don't knowNot
Applic.
Travel model data preparation/management:
Travel model estimation
Travel model calibration
Travel model application:
Network assignment:
GIS:
On-site data collection
Evaluation
Consultation support

14. **Where, in your view, does the expertise in your country lie in the following skill areas?** *Please rate each organisations' skills from 1 to 10 (1=very good, 10=very poor)*

            A = Federal Government   **D** = Universities
            B = State/Provincial Government   **E** = Subsidised Research
Organisations
            C = Local Government   **F** = Consultants

Skill Areas	A	B	C	D	E	F	Q.15	Q.16
Project management								
Survey design								
Sample design								
Questionnaire design								
Data collection								
Data editing and entry								
Data preparation								
Data management								

Highway networks								
Public transport networks								
Model estimation								
Model calibration								
Travel forecasting								
Training								
Model application								
Transport economics								
Consultation								
Project evaluation								
Policy analysis								
Tabular analysis								

15. **In the previous table, ideally, where should the expertise lie?** *Please write in column labelled Q.15 the letter A-F where you think the greatest level of expertise in each skill area should most usefully lie.*

16. **In the previous table, which areas of expertise do you think should be resident in a State/Provincial Government transport research organisation (even if they are not viewed as the major provider)?** *Please tick in column labelled Q.16*

17. **Do you have any comments on any issue that you wish to make at this stage?**

    No   Yes

Section 4:
DATA

18. **What are the most common frustrations you have faced in accessing information from:**

    a) government agencies? *List up to 5*
1. ....

    b) private data agencies? *List up to 5*
1. ....

    c) universities? *List up to 5*
1. ....

    d) other sources (*please specify***)**
Source:... Problems: ....

19. **Where do you usually get your travel data (for transport planning and evaluation)?** *List up to five sources used in the last two years*

    Source 1:..

20. **Who collect useful primary data on travel in your country?** *Please rank the 4 most useful, 1=most useful*
        government agencies
        private collection agencies
        universities
        other (*please specify*) ....

21. **What, in your view, are the most important core urban travel data items that should be collected to service the transport planning and research community?** *List up to 5 broad data categories*

    1. ....

22a. What, in your view, is a desirable mix of data collection strategies for this core data? *Please give percentages in boxes below*

22b. For each strategy, how often would you like to see reinterviewing?

	a.	**b.**
Single cross section	%	every years
Repeated cross section[1]	%	every years
Longitudinal panel[2]	%	every years

Section 5: RESEARCH

23.   RATE the following areas of basic research in terms of their potential impact in applications aimed at *improving* our understanding and forecasting of travel behaviour (you may add other important research areas) *Please rate on a scale of 1 to 10, where 1 = very unimportant, 10 = very important. Write DK if unsure or unfamiliar with technique.*

Dynamic traffic assignment methods
Stated preference and stated choice methods
Activity modelling (time budgets, trip chaining, household constraints, multi-purpose
    trips)
Valuation of travel time savings
Valuation of environmental impacts (noise, air quality, visual, aesthetic, etc.)
Integrating environmental variables in travel behaviour models
Advanced static discrete choice models (e.g simulated moments multinomial probit)
Dynamic discrete-choice modelling (allowing for state dependence, heterogeneity
    etc.)
Joint estimation of discrete-continuous choice models
Joint modelling of revealed and stated choices
Attitudinal and stated intention measurement and modelling
Traveller Information Systems/Intelligent Vehicle Highway Systems
Alternative travel survey sampling designs
Travel survey collection strategies (cross-section, panels etc.)
Geographic information systems as spatial data base managers
Vehicle operating cost models
Vehicle ownership/purchase models
Location based choice models (eg residential, workplace location choices)
Duration modelling to handle the timing of change
Equilibration procedures for the various markets (travel, vehicles, location)
Deriving origin-destination matrices from traffic counts
Decision-support systems to embed a model system into an operational framework
Methods for systematically segmenting travel markets
Model transferability in time and space
Algorithms for more efficient estimation of choice and demand models
Improved measures of accessibility, mobility and benefit
Descriptive studies of travel behaviour
Relationships between transport and quality of life
Qualify and efficiency of data collection methods
Scheduling algorithms
Pricing/ticketing systems for public transport
    Other:

Section 6: MODELS

24.   Rate on a scale of 1 - 10 the following travel models in terms of their relative importance in an integrated model system for *passenger transport*. *1=very unimportant, 10=very important*

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[1]   regular survey of a new sample drawn from the same population as previous samples

[2]   regular survey of the same sample with some refreshment to allow for attrition

a) Commuting:
    mode choice
    route choice (automobile)
    route choice (public transport)
    trip time switching/departure time choice
    workplace location choice
    frequency of travel
    telecommuting choice
    compressed work week choice
    parking location choice
    vehicle occupancy number choice (carpooling)
    vehicle availability choice
    trip chaining choice
    ticket type choice
    other (*write in*):..

b) Non-Commuting:
mode choice
departure time choice
route choice (automobile)
route choice (public transport)
frequency of travel by trip purpose
destination choice by trip purpose
parking location choice
vehicle availability choice
trip chaining choice
ticket type choice
air pollution
scheduling
accessibility
other (*write in*):..

c) Household activity:
residential location choice
dwelling type choice (detached, semi-detached house, flat/apartment, town house/villa)
tenure type choice (own, buying, renting)
automobile type choice
fleet size choice
access to company car 'choice'
annual vehicle use (kms)
Proportion of annual vehicle kms for commuting, urban non-commuting and non-urban use
accessibility
other (*write in*):..

d) Firm activity:
workplace location choice
i   ndustrial location
land use models
other (*write in*):..

25. Rank on a scale of 1 - 10 the following travel models in terms of their relative importance in an integrated model system for *freight transport and commodity demand*. *1=very unimportant, 10=very important*

    destination choice
    mode choice
    frequency choice/trip generation
    carrier type (private, public, independent owner etc.)
    route choice
    time of day of travel choice
    truck/light vehicle type choice

depot/warehouse location choice

other

26. What do you believe are the most important criteria to equilibrate the following model systems? *List up to 3*:

No Idea

Travel choice model system:..

Location/Land use model system:..

Automobile market model system: ....

27. Do you have any comments on any issue that you wish to make at this stage?

No   Yes:

Section 7: OPINION

The following statements provide divergent views on where the state of practice should reside. For each statement please indicate:

28. whether you agree or disagree or have no view
A = agree, D = disagree, N = no view

29. whether implementation is feasible today for the approach in (or solution to) the statement (assuming available resources)
F = feasible, NF = not feasible, DK = don't know

30. **whether you have implemented the approach (or solution) in recent years (or are in the process of doing so)**
I = implemented, PI = in process of implementing, NI = not implemented

Please note: where questions are not applicable, the cells are shaded

Statements	Q.28	Q.29	Q.30
1. I believe activity based rather than a trip-based approaches to travel data collection and modelling are more useful.			
2. I believe longitudinal data collection and modelling techniques should replace single cross-section static techniques			
3. Focus groups should be used to better understand household decision-making.			
4. Surveys should make greater use of stated preference questions as a means of gaining increasing understanding of potential responses to contexts not always observed at the time of the survey.			
5. I think GIS technology for database management and model integration is the preferred way to progress.			
6. Well-known, transportable and easy to use software for data management is the way to go for data holding in a readily reproducible form. For example SPSS headers and flat files and procedures (not save files). This is more flexible than data base management systems solutions.			
7. I think stochastic simulation should replace deterministic aggregate extrapolation.			
8. I would like to see traffic simulation models linked with travel demand models.			
9. The use of disaggregate choice models should be expanded.			

10. Statistical correlations of variables aggregated to some spatial unit are currently used to develop stable parameters for travel demand forecasting. Simulation techniques should be used instead on the specific trips made by individual and firms to develop stable parameters, and combine them with sample enumeration procedures to produce areawide traffic patterns			
11. Many of the travel choices that are currently modelled as sequential decisions can be more effectively modelled as joint choice decisions using traffic assignment models.			
12. A city needs only a peak hour(s) model.			
13. A city need both a 24 hour and peak(s) model.			
14. Models such as mode-choice should be estimated using a disaggregate (individual) model.			
15. Disaggregate models should be implemented using zonal averages.			
16. Stochastic user equilibrium should be extended to dynamic assignment.			
17. Current traffic assignment models should be replaced by a dynamic assignment process which allows differentiation of network level of service by discrete time periods, and computes flows of downstream links as functions on connecting links in prior time periods.			
18. Peak hour traffic models are a better option than 24 hour models.			
19. I prefer to use traffic assignment models with integrated traffic simulation rather than stand along assignment models			
20. Every rail line should be coded in the network.			
21. Bus routes are represented as "Generic" routes to reflect a corridor.			
22. Fuzzy set theory should be used to model user perceptions.			
23. The use of neural networks or similar rule based simulation approaches should be expanded.			
24. Classifying household and firm activities into mandatory, flexible and optional, based on their criticality in fulfilling the household's or firm's needs is a useful way of recognising the ability to vary such activities.			
25. Developing a model in-house rather than purchasing it from another source leads to better planning/forecasting results.			
26. There should be a transport research data library established in each country which can be accessed worldwide.			
27. All core travel data for an urban area should be collected by one agency.			
28. Too much emphasis in application is placed on long-term forecasting to the relative neglect of short to medium term forecasting.			
29. The preferred evolution of travel surveys is a survey methodology focussing on meeting immediate agency objectives with minimum hassle; this involves replacing the 'dinosaur' with a family of integrated 'insect' surveys oriented towards smaller, faster, low-budget surveys usually with a single goal.			

31. **If you have any comments on an issue we may have overlooked, we would welcome them:**