Oxford Systematics Report OS/05/03 for Department of Infrastructure

Information Strategy Initiation for Policy Support

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SUMMARY
Pragmatic and usable data sources are a key resource for policy and planning. There are many gaps in transport data coverage, especially freight-related, and increasing demands for evidence-based policy to support. The Policy and Planning Directorate of the then-Victorian Department of Infrastructure commissioned a report to initiate an information strategy to support transport policy formation, evaluation, monitoring and management. An over reliance on large household interview surveys has become evident, and the accessibility and usage made of these and other sources needs review. As the range of possible data demands is so wide, the process will require the cooperation of a range of policy related groups to determine what data each needs to support their current, developing and future activities. The report considers the development of transport data collections in support of transport policy, and many areas are severely underserved. In some cases modelling methods can fill at least part of these gaps, and are often the only way that they can be filled. Transport model requirements are clearly key clients in their own right.

A ten-step process is proposed to identify the actual data resources used by specialist areas in DoI, the limitations of these, the needs that are already felt and those that are not being met. The simultaneous steps required to exploit technical advances in data specification, linkage, access and management to this end are also outlined. These developments now make it possible to link disparate types of data with common elements in a far more reliable and cost effective manner, and also permit unified access through a straightforward single web interface. Attention to delivery mechanisms such as this is as important as the identification of the data sets that are needed, their quality and frequency, and the identification of those that need to be collected anew to support policy. Such innovations can also materially speed up modelling development, ease consultation support, and improve the productivity of modelling applications.

This ten-step process will also have important links with other parts of the DoI. The need for data and meaningful information flows is complemented by the processes of archiving. The repeated experience in traffic, planning and transport is that key data sets have been simply lost - or documented in such a way that the data cannot be recovered in a useful manner. This has been a perennial issue in transport planning for several decades. The emergence of planning processes demanding closer and more numerate integration with planning and strategy development and management is placing pressure on all these fields not only to do better in forecasting and monitoring – but also to be able to track the changes over quite long periods of time. These demand archiving processes that can handle cumulative recording and, more important, clear retrieval processes. The requirements are essentially identical to those of the Victorian Records Office (VRO) for documents in government. The VERS approach developed by the VRO for documents has much in common with the functional requirements for transport and planning information – and the links to numerical data are a natural next step for this process to address. The VRO archival requirements are mandatory for all Victorian Departments, and have already been implemented in a clean and undemanding interface for Departmental staff. One possibility is to build on this, as there is already some convergence between the transport/planning data storage, recovery and archival and the already proven VRO documentary archival systems.

However these technical issues are considered secondary in importance (if not priority) to the identification of what is currently in use, what the major shortfalls and gaps are, the priorities to fill these needs and the rationale for an information and modelling strategy to support transport policy. A ten-stage program is specified, with some steps prior to a Departmental or Inter-Departmental workshop, and the subsequent steps to achieve a workable and welcome information strategy process and implementation, with the necessary technical and modelling underpinnings.

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Executive summary

Transport planning, evaluation, policy development, execution and monitoring all require measurement and management. Few of these tasks can be done successfully without relevant and timely data and analysis.

The complexity of transport is caused not only by its internal complications but also by its many interactions with how people live and move, and how industry and commerce operates. This makes the information demands substantial.

There are ways of limiting the amount of information needed: by careful sampling when collecting data, by developing and applying good understandings of these interactions, and also by developing forecasting and behavioural models to take advantage of this insight to bridge the inevitable gaps in data coverage.

None of these can be entirely dispensed with, not all can be used to substitute for others. Consequently any strategy for addressing these needs will inevitably be a mix of data gathering, data analysis and modelling.

Transport policy management demands both a sound quantitative knowledge of the present, and a steady flow of up to date intelligence on how different key aspects of the transport systems and its impacts are changing over time.

A balance is needed between the substantial effort required to gain a sound knowledge of what is going on, and how both people and freight systems are behaving right now. This is required to ensure that the right key factors (and performance indicators) are collected at appropriate intervals so that underlying changes can be detected and policy interventions monitored and responded to.

It is no longer enough to simply undertake a decennial household survey, rely upon Census data to fill the gaps, and to make occasional forays into surveying freight and goods movement demands.

A considerable and basic data gap has emerged in Victoria, which needs to be addressed to inform, guide and manage the travel, commercial and goods movement needs of the State over the next decade and more. Realising the 2030 Vision demands not only more up to date, but also regularly updated, intelligence on travel, transport and the economic factors underpinning the demand. The implementation strategies for 2030 requires various types of models, some very simple and some more complicated. These are needed to keep a clear view on how different trends, developments and proposals are likely to interact – and to assess how they are actually do as they come into play.

An **Information Strategy** is needed to ensure that these complex demands are met. Such an information strategy must also include a modelling strategy, as a means both limited data collection and maximising the effective uses that can be made of it. A successful integrated Information and Modelling Strategy was developed for the NSW Department of Transport in the early 1990s[1]. This basic strategy has worked reasonably well for a decade and adapted well to changes over time, and only now perhaps needs reconsideration and reassessment.

It is timely for DoI to address these issues as both data and models are now fundamental to supporting transport policy, and both need early review and attention for Victoria.

[1] Managed by what has now become the TPDC (Transport and Population Data Centre): see Hensher et al (1994), Wigan et al (1995)

An Action Plan for Victoria

- Establish information strategies for DoI and DSE
- Determine priorities for monitoring
- Define the gaps and tasks that models will have to fill
- Ensure that the available state of the art in data collection, management and modelling is available to DoI DSE and State development
- Determine appropriate budgets over a reasonable planning horizon
- Set up appropriate internal and external organisational link and structures to ensure continuing effectiveness, peer review, public reporting and good links to international expertise and experience[2]
- Develop appropriate models
- Undertake appropriate overall travel behaviour survey
- Assess available freight and commodity flow data sources against the needs
- Undertake appropriate surveys
- Ensure continuing reporting processes
- Set up data management and communication systems to ensure maximum usage is made of the resources created
- Review the overall process at 3-4 year intervals

The current national transport data initiatives are unlikely to be of great benefit until each State has at the elements of such as strategy and action plan. Once these are in train, then many of the somewhat diffused national proposal can gain practical traction and impact, and benefits may be gained in expertise and tools sharing as well as just data issues, are currently their sole focus.

The first step is to initiate an Information (and modelling) Strategy: the background and proposals for gaining perspective and the necessary initial momentum are discussed in this report.

[2] The peer review panels and consulting and internal team links adopted by the State of Oregon USA TLUMIP project an the Uk DfT offer some relevant experiences and models

1. Why consider an information strategy at all?

Policy processes increasingly require supporting information and analysis.

- Forecasting has always been important, but it is now critical to be able to detect trends at an early stage, that may indicate a need for anticipatory analysis or plans for policy and action. Such trends are not always readily forecast or forseen[3].
- Analysis and modelling play a major role in estimating and integrating many of the factors involved: these need appropriate data to be effective.
- The diversity of impacts and evaluation aspects now needed both to develop workable policy, and to ensure that it is implemented and operating effectively, cannot be secured unless planned for in advance.
- The private sector now plays a major role in implementation of transport services, and the contract and investment processes require monitoring mechanisms that need to be anticipated as part of the tendering processes.
- Freight systems have become more important to the overall economic health of the country. These require greater depth of appreciation, which demands better and appropriate information flows, in the planning areas in the public sector.

These are not the only factors that have raised the significance of having an information strategy to support transport policy; nor is transport any longer even the main player in many of these areas. Planning, environment, revenue raising and economic development are all major players. Each group has developed its own data support needs and information support requirements, as a numerate base for policy has become an accepted standard requirement[4]. This may be expressed as 'evidence based policy', or in other terms, but is now a widely expected underpinning for policy development, implementation and monitoring virtually across the board.

In all areas of public sector policy summary measures of performance are needed to monitor and manage an increasingly complex system. However, the demands on performance measures in their turn have developed beyond what simple measures of supply (km of road

[3] Such as sudden oil shocks, recessions and natural disasters. There are many others.

[4] This is not restricted to transport: the use of microsimulation models to assess housing, pension, taxation and many other polices is well established (Harding, 1996).

maintained, number of bus miles operated etc) can provide, and are now recognised as also having to relate resource utilisation to the outputs achieved. Multiple measures of efficiency and effectiveness need to be derived in order to permit informed management of the transport system and its outcomes in several different ways. These include efficiency, effectiveness, service efficiency, differential impact and distributional effects, environmental and health interactions, social inclusion and many more.

The time horizons have also changed. Not only are strategic goals aimed at 25 years ahead now part of current integrated assessments, but also implementation strategies are required to span the whole planning period in order to realise these specific goals. This also affects the types of range of information required. For the shorter term a 'predict the present' approach is needed.

For the intermediate future and for forward planning a longer term approach it is necessary to include a number of linked or causal factors that change more slowly. Choices must be made between projection (ie trend extrapolation) and forecasting (where causal relationships become essential). For the latter, modelling of some kind is not only unavoidable, but also an economic and timely approach.

At first sight it might look as if the necessary information flows arising from transport operations would have more than matched these rising demands. Automated data acquisition systems for traffic and transactions have produced a rising tide of raw information. Intelligent transport systems have also contributed to this flood, and will soon contribute far more. Ironically, as such data flows have become more plentiful, the amount of processed, meaningful and usable data has often diminished. For example, area traffic control systems can – and do – produce terabytes of detailed raw data, as a by product of daily operations, but these have yet to deliver much in terms of strategic information, however helpful in day to day immediate feedback. However rapid advances are being made by the ASTMS (American Standards) on standards to make this information more accessible, and this will expand options for many different forms of measures and monitoring: but not yet.

It is therefore timely to consider what is needed to ensure that there is appropriate and adequate information to support policy program development and review. This report draws

on what has been done to address similar needs in the past, and proposes the steps required to address current and emergent needs.

While this report looks forward to a future with an improved information and modelling strategy, the past also matters. Much transport data has been lost or become unusable over the years, and as land use and transport requires long horizons, much of the material needed to monitor, model and project this has been lost. Consequently archival issues are raised, consistent with the Victorian Public Service mandated VERS[5] documentary archival system, raising the issue of extending the coverage and scope of VERS to numerate data.

2. What have we been doing to date?

Numerate transport planning began half a century ago as a means of predicting future demands for road provision and matching with appropriate plans. The major infrastructure networks (such as the Interstate system in the United States) were still being built, and the balance of road maintenance and new construction was heavily weighted towards new road building. As a result the emphasis was on estimating flows of vehicles, so that the necessary road capacity could be determined, and the models and the data collected to build them focussed on this. Australia initially followed the US approach (promoted by Wilbur Smith), but steadily developed a more distinctive and wider ranging approach. The last 20 years has seen rapid growth in information and management systems in Australia, ranging from bridge information and detailed LGA asset inventories to travel and transport behaviour data collections and surveys.

Transport occurs only[6] when people or goods need to move to satisfy some demand at a different location. Methods of determining what these patterns might be, how they might develop and how they might change with new construction or road improvements was soon seen to be required. Household interview surveys of travel were the major information instrument that was chosen. Such surveys were often expensive to do and to process, and in many studies the data gathering and production of vehicle movement models took up so much of the available time and resources that only a very few construction/improvement

[5] http://www.prov.vic.gov.au/vers/vers/default.htm

[6] This is not true of certain types of leisure travel where the journey is part of the experience. Tourism has become a growing and major industry.

options or futures could be considered. The options were further constrained by the time and cost of the computing required. These constraints have only fairly recently become a comparatively a minor issue.

At the same time only a tiny fraction of the rich data in household travel surveys was actually examined or used. In many cases many of the data elements collected were not even taken from the forms and coded into machine-readable form, and so were never available for use. As vehicle movement matrices were so useful in their own right, once these had been estimated, entire data sets often fell into disuse. In many organizations these data sets were often simply lost, as their full potential value and importance had never been investigated or realised, and so no adequate archival processes had been established. The assumption was frequently made that once a transport model had been built that the data was no longer important, even though much of the data and the understanding it could provide had not been exploited at all (Wigan ,1997).

These large scale surveys and matrix estimation processes continued at intervals, usually timed to match Population Census dates, but became subject to review of their utility and value. Since 1980 there have been a number of reviews[7] of the information needs served by large scale Australian transport surveys. In each case these reviews highlighted emergent needs to know more about the population under study (and, although not strongly emphasised, on freight vehicle movements). However the demand for matrices of vehicle flows (passenger and freight) remains a critical resource for a large number of practical applications. More recently, these have made efficient use of Weigh in Motion (WIM) data and other more recent data sources to improve the estimation of multiple freight matrices (see for example, (Pekol et al., 2004)).

Data, analysis and forecasting models often move in tandem, one enabling or driving the other as issues and capacities change. However this can be a slow process. The first clear identification of the need for microsimulation emerged in the mid 1980s, and general agreement that GIS[8] methods were now essential was identified by the end of the 1980s. In

[7] Appendix 1 for the detailed discussion.

[8] Geographical Information Systems: generalised spatial maps with data attached which can be visually analysed and presented

both cases many years elapsed before these developments began to be adopted in operational areas.

The first known Australian integrated information and modelling strategy to be developed and adopted[9] was produced for the NSW Department of Transport by the Institute for Transport Studies at the University of Sydney, in response to a tender requesting solely a replacement for the ageing SATS modelling system.

The key novel feature of this work was the recognition that although modelling required data, there were also continuing demands for various forms of information, not all of the type demanded by any particular model. Consequently a continuing process of data collection, management and quality assessment was seen to be necessary. This complemented the practical approach of progressively updating each of the different elements of the modelling system, bit by bit. Continuing services to clients in and out of the public sector could then be handled.

This overcame unsatisfactory experiences of years of delay in getting usable result after mounting a single major program of data collection, modelling and publication roughly every ten years. This balanced and continuing collection, processing and updating strategy was adopted by the NSW Government, and has now been in place for a decade. The aspects of this NSW experience to emphasise here are that the data should be collected progressively and utilised continuously and cumulatively, and that the modelling processes be developed module by module at the same time as part of a continuous process. Similar advice was given to the UK Department of Transport (Wigan, 2000) as part of a systematic reassessment of data and modelling issues for Transport for London

This approach was advocated to ensure level budgeting from year to year, and to ensure a continuing flow of interpreted information from the data collected. This also allowed a critical mass of knowledge and skills to be developed and retained. This was expected to (and did) lead to a central holding of information (as well as data) and of models that could be used by all parties without the previous problems of access, intellectual property conflicts or credibility. This organisational model has considerable advantages to government as it

[9] Appendix 1

ensures that comparable data bases from a wide range of consulting and other tasks are used. This means that the results can be compared - and indeed also permits the models to be transparent and contestable without the difficulties that arise when different data collections underpin different expert contributions to planning and transport projects and proposals.

It is now also critical that the data and the modelling become subject to regular and continuing peer review, and this will best be achieved by wide and continuing usage of both the data and the models. This process will secure a critical mass of knowledge and experience, as well as maximising the returns to the community from the government investment in the underpinning program.

The UK Department of Transport recently used a similar organisational approach to NSW as part of the preparations for the return of regional government to London (the Greater London Authority (GLA)). While the GLA is an extremely large organisation, it is still far smaller and with many fewer responsibilities than the Greater London Council of earlier years, but transport was one of the powers returned to GLA. An international review of the current state of practice in transport surveys and modelling for passengers and freight was undertaken so that Transport for London (TfL) – the responsible part of the GLA - would have a solid and current start to their survey and modelling work.

A new issue emerged from this review: a recognition that access to heterogeneous data sources would be needed by a wide range of groups, both inside and outside government. Subsequently the GLA has made steady progress towards a formal metadata[10] approach to ensure that all their data is well described in a formal manner and will become accessible in an integrated manner across a distributed set of locations and holdings. The pre-release version already includes both transport survey data and bus boarding information, has connections to maps of the region, and offers simple statistical calculations to end users over the web.

This is a new approach to managing modern transport data access and quality requirements, and one of rising practical importance both to professionals within planning and transport and to the wider community at large. These developments also show the steady move towards

[10] Appendix 2 covers this area in more detail, and cites relevant recent resources

sharing planning and transport data with the community involved: an aspect of information strategy for policy that needs serious consideration in Victoria, as it shifts the nature and range of factors that are worth covering, and also alters the basis of a number of consultation processes.

In the research area, a recent project carried out by Napier University, Edinburgh and Imperial College, London for the UK Engineering and Physical Sciences Research Council (EPSRC) found that there was more widespread concern in a range of users than the lack of fresh data. Access to (and indeed even knowledge of) **existing** transport data sources was a concern shared by local and central government, academics and consultants. This was consistently rated higher priority than a major **new** data collection to enable research and policy practice to advance. Partly for these same reasons, the Scottish Executive had already begun to move in the same direction as TfL in terms of their handling of the Scottish Household Survey.

In the US the Bureau of Transport Statistics (BTS) has been charged with many (but not all) of these tasks. The US Bureau of the Census plays a very high profile role in transport and planing data, and packages the data for each state for delivery by the BTS. The US Bureau of the Census collaboration with the CTTP subcommittee of the US Transportation Research Boards Urban Data Committee is now producing extensive and well interpreted transport information outcomes as well as packaged data sets for each State. The limitations of confidentiality in the data collection presents perennial and familiar problems to transport policy analysis, which relies in many areas on quite different cross-analyses of individual data than are usually released.

This constraint is shared by most Census bodies, and a measure of direct transport data collection appears to be inevitable as these constraints cannot realistically be circumvented. At a broader level the European Union as a whole has undertaken a series of projects aimed at a European Integrated Transport Information System (ETIS – See Appendix 1) specifically to support transport policy[11], and in Australia a move between States and Commonwealth has taken the initial steps towards a similar program to bring the data available across the nation into a more usable and accessible framework (Meyrick, 2004). However the foundations of the Australian initiative have yet to be able to demonstrate a high level of commitment to

[11] http://www.etis-link.info/

formal metadata and data integration, at least in part due to the existing incompatibilities of the information elements collected in different administrative areas- and the barriers to public policy analysis presented by increasing commercialisation factors affecting the distribution and use of public data.

These selected developments underline the emergent importance of ensuring that transport related information is well managed and accessible. While some governments have continued to address their requirements by repeated household travel surveys as a primary instrument, some better – and probably more wide ranging - combinations of information strategy and data collection and access mechanisms are now clearly essential.

The need to develop and assess policies using methods which take into account considerably more than the fiscal and economic implications is giving a fresh impetus to this development. Even at this classical level, the distributional effects can no longer be ignored or aggregated over groups or locations. The need to assess the differential impacts on both a range of groups and a wide range of locations demands more extended and integrated data collection and management.

Just as the distributional impacts of transport polices now need to be considered, so too do the social and environmental impacts: both in the incidence and in scale. This balanced consideration of the full range of impacts and the incidence of benefits and disbenefits is sometimes referred to as a ‘triple bottom line’. Although the tradeoffs and joint variations of impacts are not always assessed very fully in analytical studies in transport, the need to do so is now widely recognised, and the data needed to do this well are still not fully integrated into transport data programs.

Many of the longer term environmental, ecological and economic impacts, especially involving the land use aspects of transport policies, demand data over a long period of time to be held and progressively updated. This modern approach to evaluation therefore makes ‘old’ data very valuable, as many such effects need to be assessed over several decades. Much of the necessary data is neither well conserved nor readily accessible.

The technical demands of making this expanded range of information coherent, discoverable and accessible need to be recognised and responded to in any information and modelling strategy. The rising importance of detailed spatial impacts demands that GIS tools be integrated into any such technical infrastructure. To ensure that the consultation benefits are fully realised, and an Open Source approach to data access and provision would be timely, and would help to realise the full benefits from a DoI strategy. This is an issue already addressed in the GIS data area, but needs revisiting for the broader transport policy area.

The effort required to do this for diverse data bases at one time is no longer unachievable or impractical. The current Transport for London ROMULUS program is now showing a simple and unified access to transport surveys, passenger counts on London transport and other data sources with mapping support. This resource will become publicly accessible by mid 2005. Greater detail on these and other current developments in this area are covered by Wigan (2005).

3. Where are we now?

Although the use of information systems in transport as a whole has expanded substantially in individual sectors of transport since the last Victorian review of transport data needs in the late 1980s and early 1990s, the methods and practice for transport data holding and utilisation for transport policy purposes have not made comparable advances. Thus a rich range of technical opportunities have emerged to help deliver any fresh strategic initiative. These draw upon Intelligent Transport Systems, spatial data and personal logging sources as three major 'new' areas.

During most of the 1990s and early 2000's Victoria outsourced household activity and travel data to University-based groups set up as commercial enterprises. This framework proved to limit the possible uses that could be made of these data sources. As this operation has now completed nearly a decade of data collection on a particular basis, it is now timely to rethink the needs and means of provision of policy, program and project support as part of a more comprehensive framework. The data collected has not yet been fully utilised, and has much

to offer in a number of areas – but by its design is not able to address many of the issues now important to DoI as the coverage and scale required was not achieved.

This outsourcing had some growing pains and the experiment has now run its course. But it is now quite clear from the experience built over this period that the scale of data collection, survey specifications, coverage, data management and data access and usage provisions need a coherent, integrated and well focussed strategy to be able to address more of the often-competing demands of the users of such data inside and outside government.

Within government, operational management of government information can be very responsive to policy groups, but only if their needs are clearly enunciated and supported. Policy analysis and support requirements are not the same as those for financial management, and specialist input from them is needed to enable the information systems groups to deliver appropriate systems and support. A lesson from the recent experiences of both Sydney and London are that is highly desirable to maintain a critical mass of technical skills in the IT and modelling areas within government to both manage the funding and transport information review processes, and to ensure efficient access and delivery to both community and government. The expertise built up in processing and interpreting the data also enables more rapid and informed responses when issues arise.
Due to the growth in complexity and number of specialist groups interested in different aspects of transport, there are now a large number of specialist data silos e.g.

- Planning and cadastral (GIS) data
- Population forecasts
- Housing demand information
- Land use and development monitoring and projection
- Public transport operations
- Traffic counts
- Accident data
- Area Traffic Control and incident monitoring and travel speed measurement
- Weigh-in-Motion (WIM) data
- Port operations
- Air pollution monitoring

Typically each of these specialist areas holds or makes use of data that is not necessarily well known outside each group. Reliance is placed on specialists to hold the data and to provide analytical capacity for these groups. These are often from outside the civil service. The variety of 'business models' used within many of these groups has also contributed to the limited degree of integration readily available. The result is that a wide range of government areas develop their own data resources, but not always in a manner easily accessed, or even known about by others. Combining many different such sources of information is still organisationally difficult and costly, and new technical means are needed to make this more realistic, responsive and economic – as well as to make current resources more readily discoverable.

In most Australian States, household travel survey data is collected at reasonably regular intervals, increasingly on a continuing basis, and held centrally and made more or less widely available. This is the case in Western Australia, South Australia, NSW and Queensland. The Victorian household travel data (the Victorian Activity and Travel Survey) was collected by a third party from 1994 and made available to contributors on a subscription basis. These arrangements ultimately proved not to be workable or successful on a continuing basis. As the ownership of the enterprise migrated though several incarnations this led to the termination of this initiative data at the end of 2002. However the expertise generated in this program is currently widely used for current and similar data collections in Western Australia and elsewhere. Although the combined data set comprising the full nine years of VATS still has significant unrealised value for a number of policy questions, the current range of policy needs are wider and have different requirements to be met.

This has provided an opportunity to undertake a reassessment of the types, range and frequencies and processes of collection of transport data collection for the State, and a new view of the data and information and holding arrangements and practices.

In each specialist area of transport policy there are at least some sources generally relied upon. The Australian Bureau of Statistics is one such source, but the ABS has progressively withdrawn from vehicle registration and crash information, leaving state and private sources

to fill any gaps. Broad information continues to be collected and used on vehicle usage, manufacturing production, population and journey to work.

The nature of ABS data means that unit record data cannot be made available. Small anonymised population census samples are a critical resource for certain types of microsimulation models in many areas of the world, but the confidentiality requirements of the ABS limit many of the analyses of travel and transport behaviour policy. This problem is shared with other countries, such as the US, and there are increasing grounds for ensuring that appropriate data is available within Australian States for such examination and analysis.

A perennial problem is presented by freight vehicle and commodity flow data. The only currently available continuing source is a private system (FreightInfo). Even so very low prices for access are sought by clients for what is an expensive data resource to create and maintain. The reasons are a lack of knowledge of the effort required to maintain FreightInfo, and most clients want 'only a bit of the data base'. As a result the economies of scale of Government involvement in providing an underpinning of such key transport data would appear to be well founded as part of any strategy for information provision.

The need to monitor a progressively wider range of economic, behavioural, social and environmental factors has been widely recognised, but the fact that existing data sources and access mechanisms may not be adequate is not too frequently accepted.

Operational data for the transport system has now expanded well beyond counting vehicles on road networks. Passenger flows on public transport, walking densities, and operational performance monitoring are examples. Performance monitoring is a data function of special and increasing interest to all organisations, as the need for it has become so widespread and the results of monitoring can in many cases now be put to use very quickly. A few examples from across transport-

- Speed monitoring
- Axle load monitoring
- Traffic volumes by vehicle characteristics
- Transit headways, arrival times and missed services

- Boarding and departure flows at transit exchanges and stations
- Road surface performance monitoring
- Noise monitoring
- Air quality monitoring

Less extensive are the ways in which the behaviour and choices made by people are monitored, as these are less readily handled by automated methods, and thus usually more expensive. Panel data is particular case where the maintenance of the panel over time is often extremely difficult. These factors are often considered to be the foundation of policy development for transport provision and programs, while the list above is more typical of those needed for regulatory or supply management instrument purposes.

4. What do we need?

Transport policy needs both broad and also very specific data. There are many issues where broad information is needed. For example: how many disabled people of what kind travel by public transport, by taxi or drive their own vehicles? What are the travel movements in tourism? Even at this level the need to address the transport requirements of small groups requires attention. Travel by children[12] is a good example, as it links education and other services, highlights major gaps in public transport provision and pinpoints severe limitations in weekend accessibility to many activity points.

The other dimensions are spatial and over time. Transport is about movement from one place to another, and the detailed characteristics of these locations and the people involved at each end are rarely available from 'broad' general surveys. Tracking what is changing over time demands monitoring or repeated data gathering. There is a substantial shortage of suitable instruments.

Transport models offer one of the ways of bridging these gaps, and so one of the key requirements for supporting transport policy is to the be able to estimate, fit and regularly validate transport models. There are several different kinds of models that are needed. Some are available already in some form, and some still need to be developed in a form suitable for Victorian transport policy support. E.g.

- Economic activity models
- Land use models
- Population models
- Traffic and vehicle flow models
- Transport network models
- Travel choice (and choice set estimation) models of several different types
- Freight movement and generation models
- Supply chain models (a difficult task)

[12] ie. people of an age to legally operate a car, moped, scooter or motorcycle of any kind. Victoria sets this at the highest age in Australia.

In essence, the sets of data required for policy purposes and the models required to make this data really effective are now considerably wider than simply determining household travel patterns, Any review of this well-timed opportunity to structure a systematic information strategy for transport for the State will inevitably involve a wider range of parties than have previously been considered, not only within the public service but outside it.

There will be a range of types of models required for policy development and continuing support. Stakeholders will need to address this in conjunction their own transport information needs, once these have been carefully considered. Models also provide a means of expanding the areas and conditions where understanding and estimates are needed beyond where data can be secured – or afforded. Models are therefore an intrinsic component of the information strategy formation and execution process. Models are often essential to build 'data' and information that has been identified as needed to support transport policy formation, monitoring, evaluation or implementation.

While many transport data needs statements have in the past frequently been expressed solely in terms of the requirements for a particular transport model, this is only one element in the current information strategy process. Models make it possible to deduce, project or estimate elements of both the present and the future and so may be used to secure data elements that cannot be obtained in any other way.

The first stage is clearly to assess the internal needs of DoI against what is available, and what is needed to form and manage transport policy measures in the short to medium term. This process should not be underestimated, it provides not only a basis for assessing what is now in use, but also **why** it is, and what is seen to be missing at this point.

There is no current and readily accessible index of the types and sources of data now in use (or needed for use) across the transport portfolio, and certainly no integrated method for accessing much of what is available. There are many reasons for this, but the fact remains that DoI is not yet in a position to do it. This is now changing, and the approaches being worked out in London are a key resource to determine how best to do it for Victoria[13].

[13] The process involved of describing datasets in a more effective manner (metadata), is covered in Appendix 3.

To do this there are at least ten separate stages to go through:

1. Shape an inclusive transport information strategy;
2. Consult on current transport data used and concerns over the range, timeliness, accuracy, relevance of what is now known to be available for policy support, modelling, consultation and communication purposes;
3. Develop a formal and agreed policy framework between the affected parties;
4. Determine what models are needed of what parts of the system for policy, planning and program development, and for policy performance monitoring;
5. Determine the priorities for various types, frequencies and levels of detail of data and measures;
6. Prioritise the models to be developed and maintained for policy support and policy monitoring;
7. Set up a technical data integration infrastructure to support this, taking into account the formal archiving requirements in Victoria (i.e as specified in the Public Records Office VERS system) as well as metadata integration and web access;
8. Initiate the major priority data collections and establish spatial and access linkages between what is already available, using the technical infrastructure established under Stage 6;
9. Monitor and ensure that analytical and modelling process are well integrated into this process, and
10. Monitor the outputs of this process to policy and implementation areas for operational relevance and utility to these different parties.

These steps are simply a first stage of a possible expansion of the Action Plan headings in the Executive Summary, and goes into greater detail on how to gain momentum once a commitment to build and execute and Information Strategy has been made.

5. What are the next steps?

The discussion in the previous sections has highlighted the evolution that has occurred in the range and types of policy support information required, listed some of the problems now observed, and indicated the steps that need to be followed to develop and operate an information strategy. The types of issues have shifted over time, and the organisational and

policy frameworks have also evolved substantially, but the data and analysis frameworks have not kept up. It is time for a systematic review of the current situation, the current and foreseeable future needs, and the mechanisms required to reach a broad consensus in principle as to what these are. One can confidently predict that there will be a wide divergence of views on both the content and nature of the information required, and an even wider divergence on how to address these needs.

At the same time, the technical capacity to deliver better information has also improved, but there is no specification of priorities and needs from the policy sector to permit these capacities to be harnessed.

It is desirable to consider and address each element of this review process separately, as the inevitable organisational complications of full or partial implementation will need a foundation of clear and well specified outcomes of the data needs and technical capacities reviews if they are to be addressed successfully.

It is also important to separate out some of the operational issues as a separate segment for very similar reasons. The educational levels (and indeed technical and analytical skills) of the community have risen substantially over the last few decades, and as information processing has become ubiquitous, so too have the demands of government for evidence-based cases for action or consideration. Currently there is a major asymmetry between the government access to data and the community's, and steps to address this raise a different group of questions covering access to whatever is collected.

These questions include the role of cooperative analysis of the basis for policy implementation, new models of consultation and eGovernment, and the need to have contestable and transparent common information bases for such developments to emerge. As these issues are still novel to many in the government sector it would be desirable to treat them as a last stage in any review process. However, they also affect policy formation and mediation processes, and thus need to form part of the agenda Care is needed to ensure that these issues do not distract attention from the foundations that are needed irrespective of the ways in which they are subsequently deployed, they.

Preferably, each segment of this review of policy support processes should be treated separately, and probably in the order in which they have been raised.

The sequence proposed to work towards an information strategy for transport policy support was expressed as a ten-stage process in Section 4. But in order to deliver on this some foundation work is necessary. In particular, preliminary work is needed to:

- Determine and secure at least some consensus on the data needs to support transport policy and, where monitoring is required, the frequency and accuracy required, and
- Assess the means by which existing data resources can be inventoried, characterised for quality, timeliness and coverage.

These are two very different work packages. The first will require a consultation process primarily with policy related staff, and the second a technical review involving specialists in GIS, metadata and databases on how to deliver the information requirements. Those involved in modelling and analytical support for policy development, evaluation and monitoring form an overlapping group between these two very different cultures, and will need to play a role in both workpackages, particularly to:

- Review the technical means for making these and future sources accessible with appropriate safeguards and security.
- Explore the means by which these more accessible resources can be shared between organisations, government and the community in an appropriate manner to improve consultation, assessment and transparency for decision making and review.

Developing and implementing an information strategy is not simply a technical task. Information and data are key areas of organisational, commercial and community concern and it is unlikely that a successful overall information strategy could be defined in advance of the steps defined above. It is also clear that it must be adaptive, and secure support progressively on a step-by-step basis

Both of the work packages summarised here are needed to form a sound basis for an initial strategy, and the evolution of broader agreement may be addressed in a progressive manner as each area reaches a suitable stage of agreement.

While a great deal of useful work can be done to discover and marshal data needs by direct consultation, the interactions and establishment of common ground at a workshop is a valuable method of consolidating such groundwork.

The technical infrastructure segment can be undertaken as a basic building block, as the possibilities, capabilities and controls that are now available need to be spelt out so that this package can be one of the elements informing the process of reaching the rather less easily determined outcomes of the work in the other segments.

The assessment of modern data and metadata management would involve some review of the requirements of models currently in use. New models should be considered only after the technical data management review has been completed in parallel with the first round of data needs identification. Models and their technical and data requirements can then be seen with an appropriate perspective on what they are for and what they can be used for and where enhancements or new developments are needed.

It is important to note that several of the currently available data sources will undoubtedly be reassessed for their capacity to meet some the agreed emergent requirements after the workshop stage. For example, VATS in particular has frequently been applied to tasks for which it was essentially not designed, and for which it has attracted informed criticism as a result, but has not yet been fully explored for the time series aspects where it is uniquely capable of contributing insights for transport policy formation.

All but the technical infrastructure issues should be addressed in sequence. The first step is clearly to sort out exactly what is needed to support current end emergent transport policy. This process is addressed in the next section, with consultations within DoI recommended as the next step to take. The technical infrastructure segment can be run in parallel, although some of the intermediate results could be useful at various stages of the proposed ten stage process.

6. Data and information needs workshop

To ensure that the workshop stage is both useful and effective it is necessary to focus on exactly what is to be addressed, and how. In the case of identifying information needs this will also need a clear framework for consistent and coherent assembly of the different perspectives. It is also important to ensure that the diversity of needs and types of information is brought to the attention of those either likely to attend or who simply wish to contribute summary views in writing.

Assembling and reviewing such written views in advance will ensure a sound and well structured basis for an effective workshop. The common ground and themes will provide a core basis for agreement, while the range of needs will sharpen the perception of differing specialist areas to the needs of others.

Most specialist areas will have developed some information resources peculiar to their needs, but many of these will not be known to other parties, sometimes even to those from other areas working in regular contact with them.

The workshop will require two different forms of formal preparatory involvement.

- A structured survey of the data resources found to be of most value to each specialist group;
- Areas where new sources are needed and why.
- A summary view of the data needs of the specialist unit, which will include how frequently each data group is needed and with what level of accuracy or detail, spatial or otherwise. This should be addressed in either a survey or interview format

Interviews provide a useful process of determining in discussion with different parties how such issues might be more effectively addressed. The present document is a resource that would be useful to prime such discussions with different parties. A proposed survey framework is summarised in Appendix 4.

These less formal discussions are critical to securing meaningful response to the formal enquiries. Policy staff often have heavy workloads and frequent new requirements and short term deadlines that make it difficult to address and focus on medium or longer term issues such as these. Once the issues are recognised as being able to assist them in their work within a reasonable time horizon, then the survey instruments will command more attention. Once the ability to deliver information in a timely and integrated form can be demonstrated, the credibility and usefulness of the strategy will be recognised.

It is important to note that while a comprehensive response to the two groups of items above would be very useful, even a small number of items well considered, would be an ideal preparation for the workshop.

The objective of the workshop is to make a concrete start on implementing a practical information strategy, and well worked out real cases will of course generate wider understanding and support for the needs of groups that develop them.

7. Recommendations

The process of working towards an information strategy is one of matching relevant and usable support for transport policy formation, programme and project development, evaluation and monitoring of transport policies and their implementation outcomes.

This spectrum ranges from securing insight and understanding of transport related factors, through data analysis and modelling, to assessing and evaluating the likely impacts of options for addressing them, and then to monitoring the effectiveness of the implementation of these policies in practice.

An information strategy is required to ensure that the limited resources available are brought together in some form to improve their usage, and the data and information needs are identified. This is seen to be an iterative and progressive process, with a technical segment of work[14] that can be run in parallel.

[14] Evaluating models, determining metadata standards, assessing federated databases

The most important first step is to bring together the data needs seen by the many different specialist interests in government. This will require some preparatory discussions within DoI, prior to a workshop[15]. This workshop would benefit from independent facilitation, review and reporting[16].

A review of the technical aspects of data management and integrated access should be undertaken, either in parallel or immediately afterwards. But, as this would provide useful insights to the workshop participants as to how progress towards a more effective data and information support process for their needs, it would seem sensible to consider at least a first stage technical review and explanatory report prior to the workshop.

It is recommended that prospective participants of the workshop be informally approached beforehand assess the the coverage of the data that they currently have, or have ready access to, and what gaps and shortfalls that they already see need to be addressed.

The workshop should open with a summary of the rationale for working towards an information strategy for transport policy. A concise summary of major points identified in the surveys outlined in Appendix 4 should also be provided at the start of or prior to the workshop.

The outcomes of the workshop should include[17]:

- A summary report on the views and examples considered in a form suitable for attendees to comment on and extend;
- Broad emergent priorities for different types of data resources; and
- Preferred mechanisms for moving forward, with input from, and feedback to the different parties concerned.

[15] Appendix 4
[16] This model has been used successfully by the State of Oregon, DfT and TfL in the Uk.
[17] Appendix 4

8. Summary

Information is a key input to transport policy formation, assessment and evaluation of outcomes.

- Modelling is one of the tools needed to extend the reach of the data and to enable alternative scenarios to be assessed in advance.

- Equally, monitoring of the performance of policies once implemented has become a major policy area, especially in public transport.

A range of indicators, performance measures and assessments provide an overview of how the system is performing – and these too need continuing or regular new information input.

Information strategy recognises that these factors must be handled, and addresses both the priorities for information acquisition and for its timely provision.

Transport policy staff are the key parties to determine what information is likely to be most valuable to them, while technical information staff can frame how it can be delivered most effectively.

The present report addresses these two areas, and recommends the steps to take to progress the development of an information and modelling strategy for transport[18] policy support.

[18] Transport is neither the only area affected by systematic data and analysis needs, nor the only one that could benefit from such a strategy process.

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Appendix 1. European Transport Information System (ETIS) project

A1.1 Managing data requirements for transport policy

Transport policy has for the last few decades become increasingly evidence based, and has drawn upon numerate modelling methods and data collection as well as broader public policy and political objectives. The progressive widening of the transport and planning debates from purely engineering, economic and infrastructure bases has reduced the perceived value of investments in numerate foundations as those that were classically available proved to be a poor match to the needs of one policy after one off policy requirements. It has been clear for some time that reliance solely on household travel surveys at widely spaced intervals could not meet all of these one off requirements – yet their presence encouraged a perception that 'there was enough data'. As this mismatch has deepened – due as much to changes in policy contexts as the deficiencies real or imagined of the household interview surveys themselves – deficiencies in data, gaps in data, difficulties in locating data that did exist all steadily rose in importance.

These issues are world wide, and not the province of just one country - or indeed just one continent.

However determining exactly what information was likely to be useful in advance of (what are often one off) policy needs has not been straightforward. Addressing this gap requires movement on both the policy and the information speciality areas. It cannot be addressed solely by one side or the other.

The problems would initially appear to be intractable, and establishing a starting point a demanding and expensive exercise with limited hope of early success. It is therefore important to make full use of similar experiences and efforts elsewhere, and not to depend solely on local resources, skills and experience.

One difficulty is that the few recent approaches have generally been curtailed by initial specification to simple expressions of a need for connection of existing data sources, and long lists of data items of interest (Meyrick, 2004). This is clearly inadequate for an integrated information strategy for a policy group - or indeed even just for a 21st century modelling

strategy - unless greater care is taken in delving deeper into the apparent information that the data might at first sight be thought to represent.

Few organisations have addressed the whole issue, from performance indicators to operations federated database systems, and it is critical for success in any new system in a further country without this previous basic investigations and work to ignore the experiences of those that have. It is important to note that the aggregations of data brought to public access by the Bureau of Transportation Statistics in the USA[19] has not faced most of these issues, while being singularly successful in making extant data genuinely accessible. BTS has recently moved to operating a small Omnibus survey (1000 households) to address what have been reported in a previous inquiry to be 'data gaps' in coverage.

Probably the sole really comprehensive example that can be picked out at present is a series of European Union projects that moved from policy variable requirements and indicators to the selection and specification or suitable information systems and currently in the process of moving on to a trial implementation in the ETIS set of linked projects. This set of projects is very much still under way, and will certainly provide an excellent template against which to test any Victorian Transport Information Strategy.

ETIS has encountered enough and more of the problems that were hinted at or specified in the 2004 Oxford Systematics inception report. The materials that have now emerged since provide a useful reference base to illustrating what can realistically be worked towards, a framework that may be possible to draw upon, and a pool of experience to inform what may be practicable and useful in a Victorian setting. It also provides some further signposts for the national follow on work which is expanding on the Meyrick report and addressing areas not focussed on in that report.

The EU ETIS project- still in progress 2002-2005 - is framed with a full recognition of the strategic sense in linking transport data to policy requirements and the indicators that allow broad monitoring of aspects of interest to the policy process. This provides an example of several further links in the chain that connect evidence based transport policy and monitoring, very much in the spirit of the approach of the present report.

[19] http://www.bts.gov/

The Meyrick report is also a small but specific element in this spectrum of linked needs and process. Meyrick focuses on the requirement to bring together in some unified framework the data resources needed to monitor, manage and develop and evaluate policy for transport across Australia. Data quality and verification and specification are not a major part of the Meyrick report, and are also glossed over in the ETIS work in favour of the assembly of achieving at least a first pilot of this proposed policy support Information System.

This is not the place to go into the finer details of this set of projects, only the overall framework and direction, which helps to make the concepts concrete, and thus make discussions within Victoria more effective.

A1.2 Concrete example linking transport indicators policy and data

ETIS itself ranges over several stages, the last being ETIS AGENT whose main technical objectives include:

1. Compilation of a conceptual transport meta-model providing the cross-reference between policies, problems, models and data requirements on the one hand and available data sources and actual data on the other;

2. Analysis, design and development of an intelligent Agent based service to support retrieval and translation of transport policy-specific data from heterogeneous and dispersed data sources, including (apart from the Agents) a metadata repository, a user interface and transient data storage allowing basic operations on the retrieved data and export to GISCO [an EU-wide GIS system] and other transport model supporting tools;

3. Validation of the system through a pilot including retrieving actual data from heterogeneous sources to support a real transport case study. (ETSI Report D5)

This goes far beyond where a DoI Information strategy would need go for some considerable time, but shows how the links between the basic policy needs, the information required to address them, and the acceptance of the problems of heterogeneous data sources, quality and reliability that are already recognised here.

EITS was preceded by a series of other European Commission (EC) projects, some aimed at refining the policy areas to be monitored at a broad level (TEN-T), some delineating a series of indicators for transport policy assessment (TEN-STAC and INDICATORS) and yet others at an earlier stage in the ETIS program. The ETIS system then provides linkage between the database of transport information and a set of relevant indicators. An example of a typical such indicator is given in Fig.1.

The linkages between policy, performance and indicators being implemented in ETIS are illustrated here from ETIS Report D5, and are a nice example of the linkages between the three major strands of policy, indicator and data resources.

These ETIS examples illustrate how other bodies are facing the same set of connected needs.

Embarking on this road not only has benefits for Victoria, but also is seen to be increasingly necessary on the wider canvas of other States and nations. The first step in every case is assessing what information is needed to support specific policy areas and specific policies.

Fig. 1 TEN-T policy query and the corresponding ETIS domains

Policy query	ETIS domains

Are the frequencies and delays along the corridors sustainable?	• Mobility
Are the TEN-T corridors effectively utilised?	• Optimal use of capacities
Are the TEN-T infrastructure facilities sufficient?	• Intermodality/interoperability
Is accessibility at the TEN-T network viable?	• Accessibility
Can the transport social costs be evaluated?	• Economic viability
Can the environmental and safety impacts along the TEN-T corridors be estimated?	• Environment and safety
Is road freight traffic growing more rapidly than rail? And is this true for the whole of TEN?	• Modal balance

Source ETIS Report D5(2004)

Fig. 2 Policy and indicator connections in ETIS

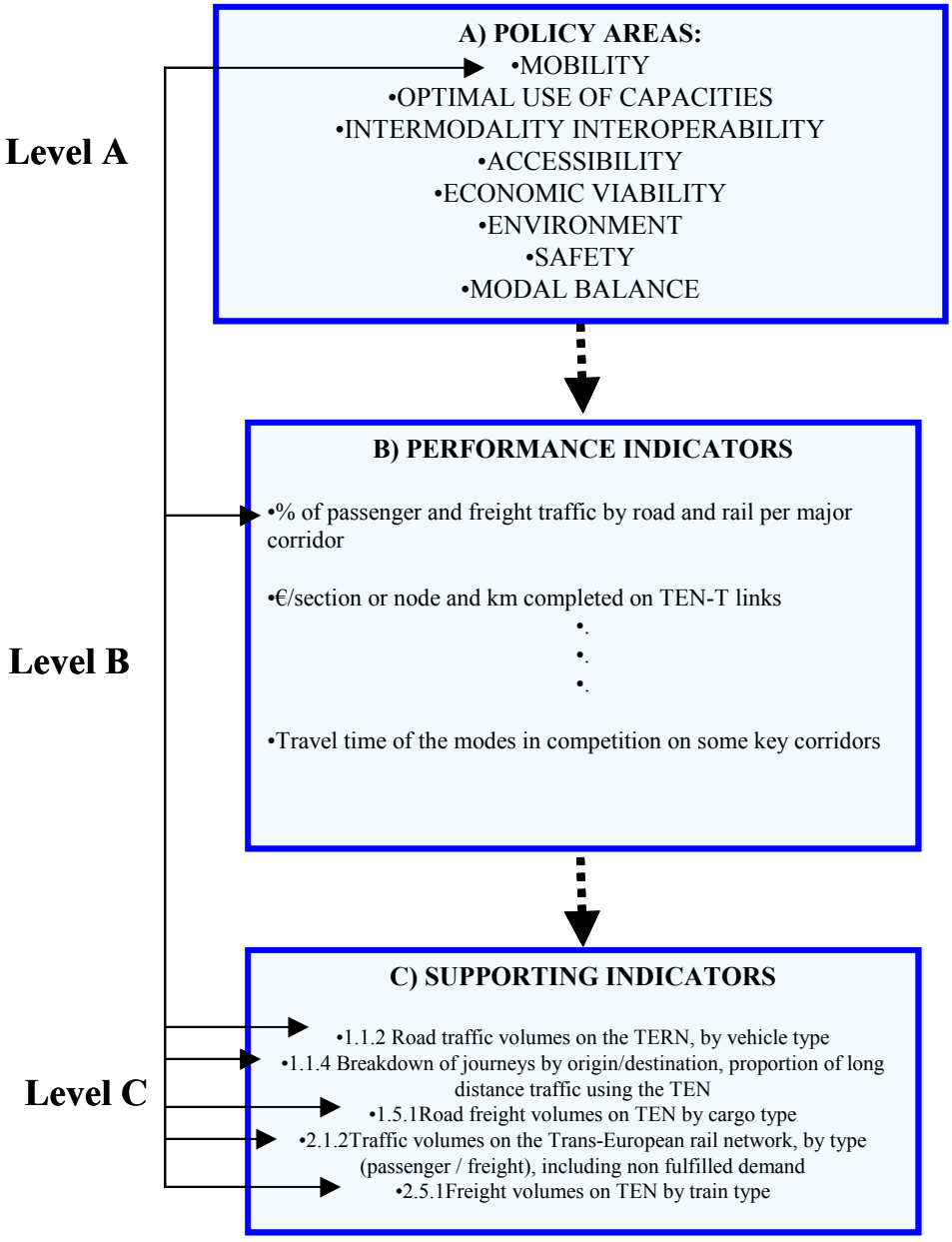

Fig. 3 A TEN-T policy query and corresponding Indicator

Policy ref. no	ACCESSIBILITY – 19-1
Policy Definition	Accessibility of EU/Eastern European/Peripheral Regions through the different networks
PI ref. no	30 (WP6)
PI Definition	Best travelling time, frequency of services, destinations taken into account and weighting of the parameters by O/D relation
ETIS Glossary	
Computation Method (Formula)	The ideal method would involve calculating the optimum *multi-modal* path, according to a generalised cost formula for any given NUTS 2 O/D pair, i.e. Min(Generalised $Cost_{ij}$), where Generalised $Cost_{ij}$ = Sum(Travel Time * Value of Time) + Sum(Delays* VOT) + Sum(Intervals between services/2 * VOT) + Sum(Direct Cost), for all feasible network paths.

	Variable definition	**Variable computation method**	
		Directly from a database or agreed classifications/nomenclatures	**Output of the model**
Method variable V1	Travel Time	1.6.1F to 5.6.1F Freight travel times	
Method variable V2	Intervals	2.6.2F Freight services frequency (including intermodal)	
Method variable V3	Delays	2.6.3F Rail transport delays.	
Method variable V4	Direct Cost	1.6.2F Direct freight travel costs road	
Method variable V5	Direct Cost	2.6.4F Direct freight travel costs rail	

Source ETIS Report D5(2004)

Appendix 2. Development of transport data reviews and surveys

The progressive evolution of Australian reviews and reassessments of transport surveys has considerable relevance to understanding why it is that Information Strategies for the transport policy area are only now being addressed. This Appendix provides an overview of the way in which this has developed and includes appropriate document references.

Information and data provide the basic foundation for the formation, assessment and management of policy. This is true for most areas of interest, but is central to transport and the closely related fields of planning and environment: both social and physical.

In the last half of the 20th Century the revolution in government cost benefit analysis, largely initiated by MacNamara in the USA, gave both an analytical and a conceptual depth to the processes of policy assessment and evaluation. What has remained is a body of experience that has established that both information and analysis have major supporting roles in good government, and can take strength from the transparency so often lacking in this arena. Given that MacNamara was in the US, the equally important aspects of guaranteed access to government information was not considered a key factor worthy of attention. This is not the case in Australia.

There are two separate issues that need to be addressed as the basis for an information strategy in government for transport and related fields:

1. Processes need to be in place for the collection and analysis of appropriate data on which to found and substantiate policy measures.
2. For best effect for good government, both the processes of analysis and securing the data on which it is founded need to transparent and also – ideally – should be contestable.

These two goals are far from easy to fulfil. Collecting data is rarely a priority in an operationally-oriented organization. The perennial dismissive crises of *'its too urgent to collect any fresh data'* are heard, even when there are two, three or even more than four years

available (as the Olympic Road Transport Authority (ORTA) stated[20] at a pre-tender meeting in Sydney attended by the principal author and many others over four years before the Sydney Olympics).

It is all too common when a policy assessment or major proposal is in train for there to be an assumption that the relevant data 'must be available'. In transport this is usually a most unwise assumption to make. The breadth and coverage of detailed data needed to assess, model, forecast and appraise transport proposals and polices are amongst the most complex in government. They include perceptual issues, quite apart from the behavioural and objective information required. Even with excellent models, which are indeed available for some aspects of the tasks involved, unless the right data is available in the right location, this lack can have a major impact on the ability to do the task at all.

Typically, an in several countries, not only Australia, the necessary effort to undertake a large scale data collection for core aspects of transport planning has usually been mounted at intervals of a decade or so, on dates coincident with population Census dates. However, the data collection and processing tasks frequently overran the overall process for which they were required, and as a result only a very limited range of alternatives were examined. The data itself was frequently lost, as there was no continuing concern (or perceived role) for it once the one-off study had been completed.

With Government being the major, if not sole, client for such information, the near total absence of links with the operations, monitoring and management phases of projects was surprisingly widespread. In many cases the data from a previous decade was simply not available at all when the trends over the years were needed at the next cross sectional planning cycle.

One of the regular cycles in the USA was the National Personal Travel Survey, which took place at three to five (and sometimes ten) year intervals from the early 1980s. Data from the earlier cycles are not all available (although efforts are being made to recover it as the importance of being able to address longer term time trends becomes better and better

[20] As the statement was made a very senior engineer representing a globally-prominent compony, who had flown from Hong Kong specially for this meeting simply got up and left to return there stating in passing that "we have heard nothing to allow us to assess the risk in this proposition"…)

appreciated by more and more groups). But the process is now considerably more important as the major transport expenditure Acts of the last decade or so (ISTEA, TEA21 and the new Act in process) have progressively raised the profile of the management of transport and planning – and tied funds to numerate and well prepared transport plans with models and data support.

The UK has run a National Travel Survey on an annual basis for more than a decade, and in recent years it has emerged as the most trusted and most useful data survey available for use for broad planning purposes in that country. The budget and the sample rate was recently doubled as a result.

In Australia the outcome of the reassessment made of transport planning and travel surveys in the early 1990s led to two very different models. The Melbourne Transport Survey Review Program (MTSRP) process in Melbourne was instigated by the Victorian MoT as a direct result of the recognised pertinence[21] of the analyses of personal travel data published by the ARRB (Wigan 1987). While this led to a wider recognition of the need for and value of travel survey data on a continuing basis (Taylor, Young et al. 1989), and led to several widely cited professional publications (Taylor, Young et al. 1992; Taylor, Young et al. 1992). The final outcome was the decision of one of the participants to initiate a university enterprise to collect travel and activity data on a continuing basis (VATS).

This courageous decision led to many survey advances. But, as a result of the problematic financial foundations, it, like the FreightInfo (Rockliffe, Wigan et al. 1998) private database for commodity flows, found that Government simply does not pay for the real cost of such information unless it is an internal operation buttressed by the immediate and continuous connections with working policy and modelling professionals. This has led to a situation where freight data in particular is in a poor state for policy and planning

NSW had had an internal unit (the Transport Study Group (TSG)) for many years, and this too had been subject to a review of the actual uses made of the data and an evaluation of the rate of return achieved by the community for the investment in this process (Wigan and Groenhout 1990). The then non-traditional areas (for the 1980's) of workplace-based

[21] By Mr Don Pritchard MoT (Vic), who then initiated the MTSRP process

childcare services was just one of the findings on how this data service had led to returns to the community – but not solely in transport in a strict sense. This sort of application, 20 years later, is unexceptional and expected, and it is a tribute to the NSW MoT that not only did they collect the data, but made it widely available so that areas which would certainly not have considered purchasing it were able to secure large returns for the State from its deployment.

As a result the next major review was in 1994, when a team led by ITS at the University of Sydney was asked to review the modelling development requirements, as the original Sydney Area Travel Survey (SATS) model was by then over 15 years old and in clear need of rebuilding, redesign and recalibration.

ITS determined that both a modelling and **a complementary information strategy** was essential to realise the goals of the Urban Transport Study Group(UTSG) (the name that TSG then worked under within the NSW DoT) and its tender was accepted. The final outcome of the work was a combination of forward analysis of needs (Wigan, Hensher et al. 1995) and a specific modelling strategy and the promised complementary information strategy. The fundamental principles of both were placed in an operational context where lumpy budgets were clearly very difficult funding targets to sustain in a Government environment. Consequently a principle of progressive replacement of segments of the SATS models was recommended, while at the same time a continuing data collection process was established to build up the data required to update and redesign and recalibrate the SATS models into a new model over a 6-10 year period (Hensher, Wigan et al. 1995).

A design principle of the strategy was that interpreted data outcomes were to be programmed in as a steady and regular output to ensure that the knowledge and results being produced would enhance the quality for the data and provide a regular output of information to the NSW MoT and the professional community. This was to serve three separate goals:

1. To ensure that the essential knowledge capital was steadily built up within the Unit (and the quality of the data improved by such exercises).

2. The utility of the whole Unit: the information dissemination process would secure a regular flow of informative and straightforward interpretations demonstrating that the

Unit and the NSW MoT was well informed and skilled to handle the role of reference base for the State for transport data.

3. The combined effects of 1 and 2 would ensure that the NSW MoT could effectively require the Units' data base to be the authoritative reference base for all transport evaluations and planning. Since (Wigan and Groenhout 1990) had found that if consultants had no relevant data they had in the past (if need be) simply invented it. This was a further quality and cost effectiveness underpinning for the Unit and the process as a whole.

Some of these points were restricted to the client presentations rather than detailed in the technical reports and appendices.

As the program of model element replacement continued, freight information and modelling became apparent as a difficult and increasingly important issue. Freight analysis has been under-invested in for a very long time, and is now seeing a widespread concern and action to address this shortfall.

Victoria is at present the key freight entrepot in Australia, due to the Port of Melbourne and has much to gain from a better understanding of freight generation, movement and projection. Road freight movements were one of the segments of the Greater Sydney models that were addressed in the late 1990s, with a review of the survey and matrix building approaches (Rockliffe, Wigan et al. 1996) and then an implementation phase with a peer review audit involvement as the first cut matrices were built. This progressive approach was still in train with further matrix work in 2004. One must note that freight is a key factor in airport, rail and sea related movements, not just on road.

As a participant and protagonist throughout the 25 years that this has gone on in NSW, the principal author is able to give the more strategic picture of the reports and processes as they were framed and emerged. This NSW experience remains the best current Australian example of a long range information strategy for transport information.

In the decade since the ITS Information and Modelling Strategy Report (Hensher, Wigan et al 1994) was presented to and adopted by TSG, the TSG data base has been built up, maintained and utilised by the NSW TSG. It is a basic common reference for work done in transport in the Greater Sydney Region, and provides a resource with substantial knowledge capital and network connections that have ensured that the data has been understood for what it is and can be used for, and its has been set up for ready and tailored provision for variations in client needs.

Although the Unit collects data and builds models (usually through consultants in the first instance), the Unit uses and extends the models and data internally, ensuring the quality is well understood and the models are workable and their limitations well appreciated. This also allows TSG to remain a highly informed client. The privacy and intellectual property aspects are also managed in a unified manner, and the Unit provides a contestable resource for government policy studies by supply to community groups able to use it, with provision for it not to be charged for. These are a selection of the additional gains that NSW has secured by adopting this centralised strategy for this aspect of transport data collection and provision.

Some of the features of this model have been a high level of staff stability and a clear frame of reference. This unit develops data and works towards a steadily refreshed set of models of the Greater Sydney Region, and as a result has a limited set of modelling and database tools in which substantial expertise and understanding has been invested. While the model components have been steadily replaced in accord with the DTSG 1994 strategy advice, a steady flow of directly usable data outcomes have flowed from the complementary continuous data collection process.

TSG used a range of expert consultants from UK, Australia and elsewhere, to create a set of updated choice and other model components. The data infrastructure now shows signs of needing a strategic review. The data is held in a relational database which has been designed and maintained for a very long time. While the internal experience and expertise is more than capable of making this work well, there are newer developments that would be difficult to implement (if indeed any need is seen to do so) in the current database design.

It is a tribute to the NSW TSG (now[22] continuing as the Transport and Population Data Centre in the NSW Department of Infrastructure Planning and Natural Resources) and that it has proved to be workable for such a long period, it is simply that changes have occurred in many areas and data access and management has seen substantial improvements and now has the potential to allow a more effective approach to be considered. This is, of course, part of Victoria's purpose in commissioning this paper.

Other States have in the main continued with a Big Bang travel survey data collection process at widely spaced intervals. This section has set the scene for a different approach by reviewing some of the relevant experience in Australia with a formal information strategy.

A2.1 Recent Work on a Broader Front

The need to secure appropriate transport and travel behaviour data (as a core of the policy relevant data requirements for transport, not as an exclusive requirement for these client areas) has been building for a considerable time. These concerns have several strands, each of which is all too relevant to the current situation in Victoria.

A2.1.1 Secondary uses of transport data

These have been changing the demands made from road planning to broader spheres. In freight for example, the matrix of movements of freight vehicles by tonne-axle km or numbers of vehicles by broad classifications is still enough for many major road and planning authorities – and is far from easy to create even now. Consultants to the Brisbane City Council have recently produced multiple light and heavy vehicle matrices without any requirement (or need) to produce a causal or forecasting base, but recognising that Light Goods and indeed commercial vehicles below 3.5 GVM have become important in traffic flow, if not in tonnage carried. The requirements for, and laid upon, transport data have evolved quite quickly since the 1980s – but even at that date the lack of reliable and documented archives of data then available had become problematic (Wigan 1985).

[22] 2004

Nevertheless the collection of travel survey data was generally considered, and often undertaken, to take advantage of the Population census collections by timing them for the same intervals. For many decades the transport surveys, especially of household activities and movements, were mined for other purposes than transport, as data of this kind gave a rich picture of household and family needs from many different angles. Family expenditure, time use, shopping behaviour and, more recently leisure and sporting activities, have all become numerate bases for transport assessment at the person level.

A2.1.2 Passenger and goods movement patterns

The vehicle level has been a primary requirement for road design, and vehicle counts have long been collected, but with an emphasis on either undifferentiated axle counts or on a fine grained categorisation based on axle loads of freight vehicles as a key feature in road design. Commodity flows, route choice and freight trip generation have attracted less attention. However, it is still the case that matrices of heavy vehicle movements are required for many freight planning purposes from a roads management viewpoint, just as matrices of passenger vehicle movements are appropriate for broad scale traffic and transport planning.

A2.1.3 Monitoring changes

The use of wide ranging transport data for monitoring purposes has a long history, but little uptake. This issue, critical for policy and resource monitoring and management, has received attention only in a few areas of transport and until recently not even the broadest monitoring indicators were brought together by the Australian national Association of State Road Authorities (AustRoads, essentially a rebranded and expanded NAASRA). Again, academic and research interests led the way in the less considered areas such as freight (Wigan 1985) and cycling (Wigan and Smith 1997), while public transport performance gained increasing attention and resources.

The total factor productivity analyses of Australian railway systems by the Institute of Transport Studies (ITS) at the University of Sydney, and the Federal Bureau of Transport Economics (BTE) studies of Australian ports are two important signposts along this pathway – distinguished in our current context by the need for very different types of data than had previously been considered necessary for the understanding and monitoring of transport.

In more and more cases monitoring and detection of significant changes in different aspects of transport are becoming central to the overall transport policy implementation management.

This trend is enhanced by the outsourcing of much of public transport, and the progressive growth in road construction and management to non-government sector with the direct result that performance monitoring and management are essential and continuing performance measures required as a central feature of contracts for transport services provision.

A2.1.4 Divergent demands

Transport information is not restricted to surveys of travel behaviour, although these provide one of the richest sources for policy formation and framing, even in a cross sectional form, and it is appropriate to pose the question:

• What do we want the transport information for?

This depends not only on the tasks being undertaken, the bodies asking the questions, the purposes for which the information is sought but also on the roles that information plays in the policy formation, project and program development and the information management process. There have been many cases where large scale cross sectional transport data have been collected, but not used – until reappraised by researchers seeking understanding of some aspects of the travel behaviour, generations or change processes.

Large scale household travel surveys often collected data on household, building and land use types which were not analysed or used for many years. This might be interpreted as wasteful in terms of the initial focus of the work, or far sighted once the historical record built up over time, but in both cases the primary role of the survey had been to generate present and future matrices of origin-destination passenger and car movements.

Once these had been created, the rest of the data often lay fallow or was even put aside or lost. However many of these data sources later proved to be central to many policy and understanding investigations.

This highlights the conflicting perceptions of such surveys:

- Are they for creating trip matrices?
- Are they simply to calibrate very detailed spatial models?
- Are they to form a basis for inspecting and understanding many of the complex relationships that pervade transport, and thus give insight and support to policies designed to affect transport through land use, infrastructure or behavioural interventions?

Clearly a single survey instrument or process cannot address all of these requirements. Cross sectional surveys alone are certainly not suitable for monitoring changes to any of these factors, other than at a broad scale at intervals of 5 or 10 years. They are also usually not ideal for very detailed geographical coverage, and for special studies of individual locations will always invariably be too thin to be satisfactory for such appraisal.

However, if broader scale analytical models, calibrated using these data and ancillary information, have been developed in a form suitable to be applied with appropriate sensitivity to local conditions and characteristics, then the 'thin' geospatial coverage is no longer a serious constraint.

These different perspectives have not been well defined and disentangled in many cases in the past, and so confusions over the purpose, value and appropriate applications of large scale data collections have arisen. Many special one off studies have been done, largely ignoring the large scale data sources, on the assumption that they were not worth having because they were not suitable for the purposes for which they were subsequently needed.

However a quality review of the various national transport data collections in the UK. Showed that the UK National Travel Survey was consistently rated the most reliable continuing source, and that various regions were prepared to pay to expand the samples taken. As a direct result the sampling level was doubled with the appropriate increase in budget. Large scale surveys at reasonably frequent intervals can therefore play a major and

trusted role- but the key questions are how frequent? How extensive? And what else competes for priority?

A widespread feeling that 'we have not got the data we need' and 'we can't find out if it already exists', has been a common recent perspective (Wigan and Polak et al. 2003).

There are two very different types of data related to transport policy.

The first is data collected to try to understand what is happening and why given demands or situations arise. Achieving insights and perspective is a major function of such data collection. This type of work focuses on individual decision making and the results of such choices. Household Travel surveys are in this group. Applications include the building and calibration of travel models and examining the levels of transport accessibility and demand for different groups and locations.

The second is aimed at finding out what is happening now as the major objective. This has been termed 'Predicting the present". Commodity and public transport passenger flows and freight movements are typical.

Large scale household or commodity flow studies have been relied upon for both purposes, not always very successfully.

An alternative requirement is to be able to assess a specific project in a well defined location in a small part of the larger survey area. Household interview sources quickly come to be regarded as having had too little location-specific to be 'useful'. A third is where the central issue neither one of scale nor of identifying interrelationships, but where changes need to be detected so that appropriate responses can be made or planned for. Unsurprisingly 5 or 10 year large scale cross-sectional data collections cannot do this very well.

It might appear that collection of household interview data on a continuing basis would be a good way of monitoring changes over time. Experience has shown that this is not necessarily the case. This overall approach certainly avoids a large budget peak at intervals, rather than a steady budget base, but simply cannot do the same job as large scale cross-sectional or even

panel data collections. If monitoring of change is regarded as the primary issue, then a clear specification of what is needed is essential. This will lead to a better outcomes, and a better instrument, than simply assuming that a large scale continuing survey will necessarily be able to deliver useful results in this area.

Fresh options continue to emerge: mixes of continuous household surveys and embedded collections of choice data suitable for modelling choice sets or choices themselves, offer some possibilities. Methods of updating existing surveys by sample simulation or Bayesian methods can also address some of these mixed types of needs.

The rapid improvements in microsimulation methods for travel activity and other aspects of travel behaviour also offer different opportunities, but also demand data of a different kind. This is one more example of where modelling requirements and data needs for policy support can interact very strongly.

A2.2 What do we collect data for?

This section pinpoints a major distinction between three fundamentally different data types and requirements;

1. Cross sectional rich data designed to explore and understand inter-relationships;
2. Closely focussed studies of specific subareas;
3. Identifying and tracking changes in factors affecting traffic, travel or demand for transport, or changes in travel behaviour in panel surveys over time

No one form of data collection can reasonably be expected to meet these three goals, but appropriate mixes can create the necessary framework.

The requirements for policy formation and review are quite different to those needed for monitoring individual projects or initiatives. It is simply not possible to collect all the information that one might guess would be useful, or to process it if it were possible.

Transport models are valuable in that they minimise the data required to assess a wide variety of changes, and can therefore be used to predict the present in an effective manner. There has been a steady shift from predicting patterns of vehicle movement to a broader appreciation and assessment of human behaviour that gives rise to these patterns. As freight systems have been comparatively neglected, freight vehicle movements are still one of the most important area for road network planning applications. However. this is rapidly changing as the rapid economic integration of freight systems is placing a far greater emphasis on supply chains and total logistics as the key areas to understand.

It is important to recognise that the range of information now required extends well beyond what can be secured from home interviews or household surveys. Operational monitoring is now a key area of transport policy, and such surveys are not at present well suited to this. The most distinctive difference is the expansion of the managerial role of the public sector, not only in public transport, but also in personal road vehicle and individual movement. This shift from full access to information available from operations to the need to monitor actual performance from a number of supply and demand dimensions has become an increasingly pervasive requirement for the public sector. This adds another dimension to the fundamental data roles already reviewed

However in many transport areas, contracts need to be set up to provide the performance monitoring goals – and for the overall objectives of the public sector these criteria are still incomplete, and demand factors and forecasting are still needed. The division of ownership and access to the necessary information has slowly made it an emergent issue to be able to verify the performance of the various operations contracted to the public sector or undertaking public sector roles, and this has increased the relative importance of operational information and performance measures. Similarly there has been a progressive evolution in the relevance of land use and other factors related to transport demand and location. It is therefore important to note that over the last decade or so the data required for transport has expanded, from both government and community perspectives. The interests in transport policy and planning have also expanded, but systematic data collection processes have not necessarily matched this expansion. Some bodies have developed a series of approaches to these questions (UK: Department for Transport 2004) especially for indicator and assessment purposes, but on a scale difficult to consider unmodified within a single State.

Appendix 3. Why metadata[23]? What does it do for us?

The functional value of formal metadata and the tools that can then use it is that it enables a substantial improvement in the way in which data from diverse sources and holdings can be made usable and accessible. It has become a key tool in making data and information discoverable and retrievable. It is one of the foundations (if not always visible) of the VERS government archival system mandated for all Victorian Government Departments.

Examples are now readily available on the web, the best known being the access to the combined Social Science Data Archives of Europe via a tool called NESSTAR, developed to do exactly this (Wigan, Grieco et al. 2002). The first transport data archive to use these methods is held at the ETH transport centre in Zurich and (Axhausen and Wigan 2003) is a paper describing the essential tools and rationale behind them. The same methods and tools are now being used by the transport group of the German Aerospace Organisation (DLR). DLR aims to bring all the German transport survey data sets of many different types into a clearing house[24] for more active and accessible use.

The client base for such assemblies of data are becoming wider, but the ability to handle the considerable effort required to work though each individual data set has proved to be a substantial resource and time barrier for many who could make effective use of it (Hine, Wigan et al. 2003).

Metadata and metadata bases are unfamiliar to most professionals, but the concepts are straightforward. Any data set contains items that need to be precisely understood. A 'trip' for example may mean many things, and unless the exact meaning used is know then the ability to use the data is severely impaired. It might mean '*a round trip from home to home with many stops on the way*', or '*a movement between two stops*' or many other different variations. Unless the analyst knows exactly what definition is being used he cannot make use of the data – and certainly cannot combine or compare it with other data sources!

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[23] Wigan (2005) is an extended briefing on the current state of play in transport

[24] http://www.clearingstelle-verhehr.de

At its most basic level, metadata is simply a description of a dataset. The most useful single piece of information about any dataset is the name and contact details of the person who knows most about the dataset and how it was put together and made into a computer readable database. This is a typical piece of metadata. Perhaps the first Australian transport metadatabase (ie collection of full descriptions of different sources of data) was created by the University of Sydney Institute for Transport Studies for the Federal Department of Transport (Wigan and Smith 1996). It contains details of the privacy and commercial constraints, the actual items of data included, and many other details not usually included in datasets at all - and which, if they become separated from the machine readable data records, severely diminish their value. The same project also considered what data might be available that could be used to create useful performance indicators as all the necessary descriptions about the data available were then to hand (Wigan and Smith 1997).

Metadata is now more than just descriptions and details about datasets: it is now possible to assemble straightforward item definitions of each data item in a way that can allow common items to be extracted from a range of different data sources. These data sources may be local or spread all over the web, and can be accessed as if it was all one database.

Transport has such diverse data needs and sources that only this sort of approach can hope to make data more accessible and usable. This is now beginning to occur, and the experience of the first movers is becoming available to be used with little risk by governments elsewhere (Wigan, 2005).

It is one of the key technical foundations for any information strategy, and best dealt with in the parallel technical development process.

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Appendix 4. Survey instruments prior to the workshop

These survey instrument in this section is designed both to introduce the ideas underpinning an information strategy and also to secure relevant information and views from prospective participants. Both aspects are equally important. If there is no understanding of how participation could help, then the response levels and engagement will be low.

While the VATS series of surveys fulfilled a range of useful roles for nearly a decade, applications and demands on data sources and types have expanded beyond the range it could address. This section is aimed at this wider span, and is not framed simply to update a VATS approach. However the gap of 3 years since VATS was completed simply emphasises the expanding gap in policy support that now needs to be addressed.

Prior consideration of the types, quality and frequency of information required by different policy segments by means of informal discussions within DoI would make a real difference to the process as a whole.

Tools to assist this process of familiarisation and relevance establishment include:

- The present document;
- Survey of current data resources used, recurrent gaps of concern;
- Select at least one well-known example of a continuing data resource, with the issues of applicability, timing, reliability and frequency of availability, as a starting point[25]

Such surveys provide invaluable examples of the instruments currently adopted, and as such are a valuable component of a developing strategy. Also, the process of identifying and considering the quality and scale of the data resources currently relied upon will sharpen both the appreciation of their own needs and put them in a form that can be addressed.

[25] what new, modified or different approaches should follow VATS would be a pragmatic example

It is unlikely that a full coverage of these areas would prove to be possible before holding the workshop, and so it is recommend that a limited approach be taken to identify a few specific items of each type from each specialist group.

This will ensure that the necessary range of examples will be available by the time of the workshop, and that the issues have been at least initially considered by each specialist group.

The appropriate action at this stage is to limit the enquiries to a small number of questions to each specialist group or subunit. The essential objective to work towards is:

> "What kind of data, is needed at what level of accuracy over what period of time to be able to manage the implementation and monitoring of projects and critical factors in your special areas of interest?"

These prompt questions may be used either as a simple survey or as the basis for a brief discussion on information needs – or both.

1. What are your current prime sources of information for
    a Policy formation
    b Evaluation
    c Monitoring purposes?
2. How satisfactory are they for your present and future purposes?
3. What are your top two needs for information that are not yet being met?
4. What are the barriers to you filling these gaps?
5. Please pick one example of a need for monitoring or for assessments of changes (summarise this)
    a What frequency do you really need to be able to secure such information?
    b What levels of accuracy or precision are needed?
    c Is frequency generally more important than accuracy and detail?

Clearly a fuller survey with more issues addressed would be necessary after the workshop, to move an integrated information policy forward, but the results from these questions would provide an excellent basis for the workshop itself.

Appendix 5. Proposed workshop structure

Workshop Objective: To establish a key list of transport information for DoI policy and programme development.

The program proposed will need to bring all parties up to a common point for the discussions, include concrete examples of issues before the DOI right now, and enable focussed discussion of the processes and priorities that are necessary to move forward.

The introduction would therefore need a presentation on **why** an information strategy would help DoI undertake its tasks, and what would be involved in developing such a strategy. This introduction would need to make a clear distinction between the technical aspects of current and future data handling, and concentrate on what the information was for and how readily it would need to be made accessible. This segment should cover both the perceived needs of direct policy staff and the perspectives of those responsible for delivering analytical and modelling support for transport policy, programme and project development.

An outline of what is now technically possible to deliver in terms of data integration and access should only follow later in the day, after the priorities and needs have discussed in some concrete detail. At this point the issues involved in providing for wider access to data resources than simply within DoI should be considered.

A summary of the small scale survey would then follow, as a means of structuring the varied types of real requirements, and currently encountered barriers to their being met.

Workshop sessions discussing the requirements of different groups would then follow, seeded by specific examples of the quality/timing/frequency tradeoffs secured prior to the workshop. Summary plenary presentations from each group would then run up to lunch.

Lunch would then provide an opportunity for discussion about the points raised, the degree of commonality and diversity.

After lunch the gaps would be considered and a summary list of items actually used and still missing would be created in each group. Brief summary presentations would then follow.

A short presentation would then describe the technical capacities to improve how such varied data can now be handled and made discoverable and accessible, in end user terms.

Discussion would then follow on how each specialist group would wish to see practical improvements to their own current and emergent data problems, and what priority they would place on this for specific items or types of data. The requirements for any information strategy developed to address these shortfalls would be the prime focus of this session. Short plenary presentations would follow.

The closure would be a summary of the steps required to move forward by a facilitator, followed by the formal thanks by the DoI Chair of the workshop.