Performance Indicators for the Road Sector

SUMMARY OF THE FIELD TESTS

TRANSPORT

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Road Transport and Intermodal Research

Performance Indicators for the Road Sector

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Publié en français sous le titre :
INDICATEURS DE PERFORMANCE POUR LE SECTEUR ROUTIER
Résumé des essais sur le terrain

FOREWORD

The Road Transport and Intermodal Linkages Research Programme (RTR) is a co-operative approach to transport issues among Member countries of the OECD.

The Mission of the RTR Programme is to promote economic development in OECD Member countries by enhancing transport safety, efficiency and sustainability through a research programme that recommends options for the development and implementation of effective transport policies for Members, and that encourages outreach for non-member countries.

The research on Performance Indicators for the Roads Sector was initiated in 1995 by a scientific expert group under the leadership of the RTR Secretariat.

A major recommendation of this Group was to create a Taskforce to conduct a co-ordinated set of field tests for selected performance indicators. The Taskforce was established in 1997 with the objective of refining the indicators selected by the Scientific Expert Group and testing them over a period of two years. The field tests would allow the applicability of the performance indicators to be evaluated in order to determine their value in improving the management of road administrations. The following countries participated in the field test: Australia, Belgium, Denmark, Finland, Hungary, Japan, the Netherlands, New Zealand, Portugal, Sweden, Switzerland, the United Kingdom and the United States.

ABSTRACT

ITRD N°E 108267

Following the recommendations of the OECD 1997 report, *Performance Indicators for the Road Sector*, a task force was established to field test a selection of 15 performance indicators used by road administrations throughout the world. The objective of the project was to assess the applicability of the performance indicators to improving the management of road administration. The field test was conducted over the period 1997-99 in 15 Member countries. This report outlines the approach adopted and summarises the results of the field tests.

The 15 indicators that were field tested included: average road user costs; level of satisfaction regarding travel time and its reliability and quality of road user information; protected road user risk; unprotected road user risk; environmental policy/programmes; processes in place for market research and customer feedback; long-term programmes; allocation of resources to road infrastructure; quality management/audit programmes; forecast values of road costs vs. actual costs; overhead percentage; value of assets; roughness; state of road bridges; satisfaction with road condition.

A key aspect of the project was the comparison of the *processes* in which the indicators are applied by different road administrations. Qualitative assessment on the role of and function served by road administrations, and whether the execution of their mandates reflects the views of the public and government, suggested a need cultural change in most cases toward a client focused approach. The task force concluded that quantitative comparison between administrations is of limited usefulness unless it is accompanied by a thorough examination of the underlying reasons for any differences.

Field classification:
Highway and transport planning; economics and administration.

Field codes:
21, 10.

Key words:
Administration, audit, cost, economic efficiency, efficiency, evaluation, highway, measurement, OECD, planning, policy, quality, road construction, road network, road user, surveillance.

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SUMMARY AND CONCLUSIONS

The challenge faced by road administrations

An emerging challenge for road administrations is to define goals and objectives pertinent to current community views, and to devise creative ways to respond to contemporary problems. Key issues facing road transport system and road administrations today include:

- Decreasing road budgets.
- Demand for greater transparency in road administration performance.
- Separation of the *production* and *administration* roles of road administrations.
- Adoption of a customer focus rather than an "expert knows best" attitude.
- Demand for greater efficiency in all operations, leading to better results and quality.
- Demand for more co-ordination and co-operation across the transport sector.
- Demand for performance improvements to be implemented more rapidly than in the past.
- New management aspects and the demand for an open and broad understanding of the mobility problems facing society.
- Demand for more data and more efficient data management.

In 1995, the OECD Road Transport Research Programme established a Scientific Expert Group to investigate *Performance Indicators for the Road Sector* (OECD, 1997). The report included: a survey of current methods used by Member countries' road administrations to assess road performance; a set of performance indicators; procedures for refining the performance indicators to meet the needs of different countries (taking note of available data resources and analytical procedures); and a basis for tracking important trends, identifying efficient interventions and making country comparisons.

The most important observation from the 1997 report, was that much less emphasis must be put on quantitative analysis, compared to qualitative assessment of the purposes served by the road programme and whether these reflect the views of the public. The objective is to widen the views of road managers and planners to reflect the vision of an integrated transport system and the role that road administrations play in achieving that vision. In the long term, generic road administration processes could be developed from existing processes, allowing practices to be compared and recommendations for key rules put forward. This may entail developing common indicators/criteria as well as a data information network and management system for the OECD countries.

The 1997 report showed that there is a high level of confidence in the ability of the road administrations to deliver, once the deliverables have been identified. The most important outcome of the performance indicator review is improved performance through the exchange of experiences, and the most important finding is the degree of change in response to an intervention. To understand differences in performance, the specific context in which the test was performed needs to be described. Comparisons must be made between countries, states and regions, and any recognisable trends identified.

A Taskforce was to set up a co-ordinated set of field tests for selected performance indicators. The following countries participated in the field tests: Australia, Belgium (Walloon region), Denmark, Finland, Hungary, Japan, the Netherlands, New Zealand, Portugal, Sweden, Switzerland, the United Kingdom and the United States (both the Federal Highway Administration and the Minnesota Department of Transportation).

Fifteen performance indicators (PI) were tested:

PI 1. Average road user costs.
PI 2. Level of satisfaction regarding travel time and its reliability and quality of road-user information.
PI 3. Protected road-user risk.
PI 4. Unprotected road-user risk.
PI 5. Environmental policy/programmes.
PI 6. Processes in place for market research and customer feedback.
PI 7. Long-term programmes.
PI 8. Allocation of resources to road infrastructure.
PI 9. Quality management/audit programmes.
PI 10. Forecast values of road costs vs. actual costs.
PI 11. Overhead percentage.
PI 12. Value of assets.
PI 13. Roughness.
PI 14. State of road bridges.
PI 15. Satisfaction with road system.

This report describes the approach adopted and summarises the results of the field tests. In addition, the detailed results for each performance indicator and examples of field tests that can be considered as “best practice” can be found on the OECD Web site at http://www.oecd.org/.

Approach

The main objectives of the Taskforce were to:

- Test and learn from the application of the 15 road administration performance indicators.
- Establish the main processes undertaken in a road administration, and to evaluate those processes against the performance indicators.
- Help build a learning organisation.
- Make recommendations for the dissemination of results.

In order to achieve these objectives, the Taskforce compared the values of performance indicators for different countries, and investigated the reasons for any differences in these values.

Experience from the general reorganisation of road administrations around the world indicates that a primary benefit is the clear identification of the two principal roles of a road administration: responsibility for road policy and responsibility for the condition and quality of the road network. In particular:

- The separation between the two roles of road management planning and road production will become clear.
- Road management planning will be enhanced.
- Road policy will not be dependent on production factors.
- The neutrality of competition will be guaranteed and production will be transparent.
- Both the road administration and the producer will be responsible for quality as follows:
  - The road administration will be responsible to road users for quality.
  - The road producer, together with the road administration, will be responsible for producing the required level of quality.
- Road production will become more efficient when run like a business. Efficiency will be influenced by:
  - Independent responsibility for activities.
  - Increased flexibility.
  - Better motivation within the organisation.

Selection of the performance indicators

A key component of the most successful road projects and programmes is a well-defined set of goals and objectives. However, the use of performance indicators goes well beyond simply evaluating the degree to which goals and objectives have been achieved. The use of performance indicators by a road administration depends on the particular needs for development or improvement in performance. The main aspects that influence decisions on the use of performance indicators are:

- The main characteristics of the road transport vision in the country concerned.
- The position of the road administration in the process of organisational reform.
- The management style of the organisation.
- The specific functions that require development or learning.

The 15 performance indicators selected for this project are not the “ideal”, or even the most important, indicators. They were selected by the Expert Group to cover the previously developed taxonomy.

Using the performance indicators

Performance indicators can be applied to road programme evaluation, planning and organisation management in the following ways:

- In process management, to measure the success of individual processes or groups of processes.

- In management-by-results, to set targets and evaluate the achievement of goals and objectives.

- In benchmarking, to establish "best practice" or "superior performance" processes in order to improve performance of the road administration.

- To aid the development or improvement of the functions or specific engineering tasks of the road administration.

PI 1 Average road-user cost (car and truck)

- Road agencies should continue to monitor road-user cost within their jurisdictions over the long term, so that a basis exists for monitoring changes and trends in road-user cost levels.

- Further analysis should be carried out to measure and monitor road-user costs over a long period of time (for example, to assess the benefits of policy changes such as increased mass limits and introduction of new vehicle classes).

- Further work should be undertaken by road agencies to identify the reasons for differences in the cost components of road-user cost between jurisdictions (as measured by the World Bank's HDM-III methodology).

PI 2 Level of satisfaction regarding travel time, reliability and quality of road user information

- The elements that contribute to this indicator are, in the majority of cases, in the relatively early stages of development. Even countries with more experience in this field are still in the learning process. At present, the "Satisfaction with the quality of information provided" element fails to provide enough detailed information to set benchmarks and implement an improvement strategy.

- In order for this indicator to work effectively and provide reliable data for the targeting of policy and strategy, the road authority must be able to measure and compare the level of road-user satisfaction with a known travel time. It is therefore recommended that future work should follow the development of this type of measure and monitor its impact on future strategy and performance.

- This performance indicator could become a useful tool in measuring the performance of a road authority from the road users' perspective. Where a road authority is able to "optimise" the journey time on its network and where road-user satisfaction is high, one can assume that the road authority is performing to a high standard. However, with its current limited

application, it would be premature to whole-heartedly recommend this performance indicator. Further investigation of the current methods in use and a longer-term study to examine whether these can lead to improvements for the road system and the road user are needed before any genuine recommendations can be made.

PI 3 and PI 4 Protected and unprotected road-user risk

- Performance indicators should be closely related to the products and services being measured in order to provide efficient evaluation tools for management. Fatality risk is not a suitable indicator for measuring the road safety performance of a road administration. More specific data are required for the development and implementation of effective road safety programmes and their evaluation.

- More specific indicators include average speed for different road types, number of drunk drivers, crash risks for new/young drivers, seat-belt use.

PI 5 Environmental policy/programme (yes/no)

- Road administrations' policies and programmes should aim to achieve wider environmental objectives. The policies/programmes should fulfil the characteristics described in the ISO 14001 standard.

- This indicator mainly shows whether environmental activities have been initiated and, to a lesser extent, how far the process has gone compared to the characteristics outlined in the indicator definition. As defined, the indicator does not give any information on the administration's concrete environmental targets.

- More exact – and preferably measurable – indicators need to be developed for a more results-oriented and systematic approach. Preferably, these indicators should be verified at regular intervals.

PI 6 Processes in place for market research and customer feedback (yes/no)

- Road administrations should continue to use market research as a planning and feedback mechanism.

- More work should be done on this indicator to track the results of market research data and in particular to evaluate whether the results make a difference.

- When using market research, road administrations should be careful to balance expressed customer needs with other development factors such as cost and overall system improvements. Surveys should be phrased in such a way as to encourage customers to prioritise their needs, keeping cost as a factor. This is called a "level of service" decision.

PI 7 Long-term programmes for construction, maintenance and operations (yes/no)

- The existence of a long-term programme should be considered an indicator of a well-managed organisation. The involvement of the public in its development and the identification of specific, measurable performance objectives in the programme should be considered "best practices" for a long-term programme.

- A key goal for any road administration would be to obtain approval for the multi-year programme from the highest political level, *e.g.* the government.

- Implementation of the long-term programme should include objectives and performance indicators that reflect public opinion and customer needs; achievements should be monitored on an annual basis.

- More transparency is called for in developing long-term programmes in terms of the setting of objectives, estimation of costs, estimation of impacts, and evaluation and reporting of programme implementation.

PI 8 Allocation of resources to road infrastructure (yes/no)

- Significant opportunities exist for improving resource allocation systems and procedures in road administrations. Examples of systems and procedures to stimulate this process are available.

- Road administrations need to exchange and share information, knowledge and experience in order to better understand and identify issues and areas where the improvement of systems and procedures is opportune for their particular circumstances.

- Road administrations should consider assessing the compliance??? and robustness of their systems, procedures and processes against the "best practice" concepts developed in this project.

PI 9 Quality management audit programme (yes/no)

- Quality management systems should be adopted as a means to improve the performance of road administrations. The establishment of such a system requires a major commitment by the organisation, but the effort is worthwhile. The complexity of the quality management system should be carefully examined.

- It is recommended that road administrations adopt a quality management system that is ISO 9004:2000 compliant.

- The PI 9 Quality Management/Audit Programme, as defined in the field test, is a good originator/initiator of the road administration's quality management programme and provides an outline of the overall situation in different countries. However, it does not detail the actual situation, specifically the real performance of the road administration. In order to provide more information on this issue, the indicator needs further development.

PI 10 Forecast values of road costs vs. actual costs

- Although the establishment of benchmarks and international comparisons was not possible, it is recommended that each road administration emphasise the reduction of project cost overruns. Administrations should strive to make the implementation of road projects more efficient. This indicator provides the key to monitoring overruns and can be used as the basis for improving the planning process to better anticipate variations in project implementation.

- Road administrations should use this indicator although it does require further analysis. It is necessary to collect more chronological and accurate data; to check the results annually in the context of a review process for next year's management; and to monitor and evaluate project objectives on a regular basis.

- It is not possible to recommend a "best practice" for this indicator from among the participating countries.

PI 11 Overhead percentage

- This indicator is useful in evaluating the cost-effectiveness of the road administration. In addition, international comparisons can be made if the same basis of comparison is used to establish the appropriate relative performance. The definition of the components comprising this indicator requires further consideration. Hence, it is difficult to select a "best practice" among the participating countries.

- It is recommended that each road administration evaluate trends in overhead percentage, with the objective of continuously lowering the overhead percentage in order to improve the effectiveness and overall performance of the road administration.

PI 12 Value of assets

- Significant opportunities exist to use asset valuation to improve the systems and methods of road administrations. Asset values are an important source of information for government, road agencies, road users and taxpayers.

- This indicator is still being developed in most road administrations; further exchange of information regarding the use of this indicator in road management would therefore be beneficial.

- An OECD Working Group is currently carrying out further work on this topic and more specifically on A*sset Management Systems* (OECD, forthcoming in 2001).

PI 13 Roughness

- The responses clearly show that the measure of roughness used in the field test does not permit useful cross-country comparisons.

- The study is based on the threshold matrix derived from the World Bank's HDM-III model which incorporates limits that are too broad to allow effective application in developed

countries, since they lead to measures that are allocated nearly exclusively to the "very good" and "good" categories.

- The roughness measure is useful as a performance indicator to the extent that the reference tool is adapted to the development level of the country being evaluated. A stricter threshold matrix should be used in developed countries to generate more precise data, with greater user comfort being the objective. In developing countries, the larger matrix is sufficient. In this case, the final goal is to evaluate the level of mobility and user safety.

- Apart from this technical constraint, roughness measures are especially relevant in a budget allocation process.

PI 14 State of road bridges

- This indicator is recommended for all road administrations. However, given the wide range of tools in use, it is difficult to make technical recommendations.

- No "best practice" is recommended for this indicator. However, the detailed report provides useful information for various participating countries.

PI 15 Satisfaction with the road system

- Satisfaction with road system condition has been found to be a useful indicator with many applications. It is perhaps the best summary descriptor of the long-term performance of the road programme. It is most useful as a trend or series of annual summaries. The indicator is country-specific, but inter-regional (state) comparisons are possible.

- "Best practice" can be defined as a standard and applicable process for market surveys and customer feedback to monitor and measure road-user satisfaction with road system condition (see also PI 6). In addition to having such processes in place, best practice could include some of the following issues:

  – Definition of the road system (reflecting the organisation's role in managing the road sector).

  – Monitored results for each component of the defined road system.

  – Categorisation of road users and their level of satisfaction.

  – Existence of a standard process to measure trends and changes in user satisfaction.

  – Utilisation of the indicator for strategic planning and resource allocation.

- None of the responses indicated any direct correlation between road-user satisfaction survey results and the programming process (objective setting). No "best practice" can be recommended.

Conclusions and recommendations

The analysis of performance using key indicators provides road administrations with a basis for redefining their activities. However, having established the existence of variations in performance across road administrations and the reasons for those differences, the real challenge is to effectuate improvements. Implementation was left for participating road administrations to carry out.

A key aspect of the project was the comparison of the *processes* in which the indicators are used. Qualitative reflection on the role and function served by the road programme and whether the execution of its mandates reflects the views of the public, represents an important framework for cultural change. A quantitative comparison between administrations is of limited usefulness unless it is accompanied by a thorough examination of the underlying reasons for any differences. If numbers are compared, the most relevant comparison is the trend within a single administration over time.

It is inappropriate to propose a common vision or common performance indicator target for all countries. Each administration should define its own vision and determine best practices in other countries to realise that vision in the most effective way. Hence, it is essential to place each performance indicator in perspective with the role of the road administration in the overall road transport system and in society as a whole. In other words, this report does not define a vision for adoption in all countries. Rather, the results should serve as a framework for evaluating the role and performance of the road administration.

Customer focus has become increasingly important for assessing a road administration's performance. The purpose is to widen road administrators' views in order to reflect society's vision for the road transport system and the role of the road administration in that vision.

There are different types of performance indicators and different ways to use them. This understanding is crucial in selecting indicators for an administration. Different indicators should be selected based on whether the intention is to improve:

- The internal efficiency of the road administration.
- The quality of the administration's products and services.
- The overall performance of the road transport system.
- Or a particular process of a specific engineering task.

The concept of a "learning organisation" was one of the driving forces in this work. The novel focus was that the renewal and innovation abilities of every road administration should be increased with a view to actively improving the organisation's ability to adapt.

Benefits to participating administrations

There was consensus among field test participants that their administrations had benefited from the use of performance indicators. Although there were wide variations in experience among participating administrations at the outset of the project, all participants benefited from the exercise and learned from the experiences of other administrations.

As a result of the field test, several countries intend to further develop the indicators and apply their experience to areas beyond the 15 indicators field-tested.

The more quantitative indicators (such as road roughness or fatalities) were easier to define and most administrations have collected data for many years. For others, in particular the qualitative ("yes/no") indicators, definition was more difficult. However, the exercise resulted in some innovative suggestions and points the way for improvements and continued use of these indicators.

At the outset, some doubts were expressed as to the applicability and usefulness of the qualitative indicators. However, the field tests demonstrated the applicability of the qualitative indicators and their value in effecting change in an organisation.

A great deal of work is involved in defining indicators, collecting and analysing the results and using the results to effect change. The participants in this field test are convinced that the outcomes are well worth the effort.

Recommendations for administrations wishing to embark on similar work

Before starting the exercise, the processes and management style of the administration should be defined. Areas for improvement or development should be identified and performance indicators selected. The precondition for starting the benchmarking process is to recognise and define the correct performance indicators and to describe and understand the administration's core processes.

The indicators studied in this field test are not necessarily the most relevant, nor those which best respond to the specific needs of a road administration. It is a mistake to start collecting data on a number of indicators without understanding the underlying process, or knowing what the information is going to be used for.

Each road administration should visit neighbouring road administrations (or those from other parts of the world) to see how they define their processes and carry out their business, and should learn from them.

Chapter 1

INTRODUCTION

Background

In 1995, the OECD Road Transport Research Programme established a Scientific Expert Group to investigate *Performance Indicators for the Road Sector* (OECD, 1997). The report included:

- A survey of current methods used by Member countries' road administrations to assess road performance.
- A set of performance indicators.
- Procedures for refining the performance indicators to meet the needs of different countries (taking note of available data resources and analytical procedures).
- A basis for tracking important trends, identifying efficient interventions and making country comparisons.

A major recommendation of this Group was to create a Taskforce to conduct a co-ordinated set of field tests for selected performance indicators. The Taskforce was established in 1997 with the objective of refining the indicators selected by the Scientific Expert Group and testing them over a period of two years. The field tests would allow the applicability of the performance indicators to be evaluated, in order to determine their value in improving the management of road administration. The following countries participated in the Field Test: Australia, Belgium (Walloon region), Denmark, Finland, Hungary, Japan, Netherlands, New Zealand, Portugal, Sweden, Switzerland, United Kingdom and United States (both Federal Highway Administration and Minnesota Department of Transportation).

Selection of the performance indicators

A key component of the most successful road projects and programmes is a well-defined set of goals and objectives. However, the use of performance indicators goes well beyond simply evaluating the degree to which goals and objectives have been achieved. The use of performance indicators by a road administration depends on the particular needs for development or improvement in performance. The main aspects that influence decisions on the use of performance indicators are:

- The main characteristics of the road transport vision in the country concerned.
- The position of the road administration in the process of organisational reform.

- The management style of the organisation.

- The specific functions that require development or learning.

Fifteen performance indicators (PI) were tested:

PI 1. Average road user costs.
PI 2. Level of satisfaction regarding travel time and its reliability and quality of road-user information.
PI 3. Protected road-user risk.
PI 4. Unprotected road-user risk.
PI 5. Environmental policy/programmes.
PI 6. Processes in place for market research and customer feedback.
PI 7. Long-term programmes.
PI 8. Allocation of resources to road infrastructure.
PI 9. Quality management/audit programmes.
PI 10. Forecast values of road costs vs. actual costs.
PI 11. Overhead percentage.
PI 12. Value of assets.
PI 13. Roughness.
PI 14. State of road bridges.
PI 15. Satisfaction with road system.

The 15 performance indicators selected for this project are not the "ideal", or even the most important, indicators. They were selected by the Expert Group to cover the previously developed taxonomy. Of the 15 indicators selected for the field test, ten could be defined as exact measures with an associated absolute value. The other five were "yes/no" indicators, giving a qualitative measure of performance rather than exact values. Additional data were required for further analysis, particularly to give detailed explanations for the "yes" or "no" answers. The use to which performance indicators are put in different countries and road administrations was of primary importance to this field test. A comparison of actual indicator results revealed little information on the performance of a road administration.

In order to understand why a particular indicator is used, the role of the road administration in the entire road transport system, and in society as a whole, has to be considered. Road administrations can benefit from comparing the processes by which indicators are used, and determining how the indicators are used to improve performance. Without this background, desk-top comparisons using performance indicator measures are of little value in promoting "best practice".

An emerging challenge for road administrations is to define goals and objectives pertinent to current community views, and to devise creative ways to respond to contemporary problems. The most important observation from the report *Performance Indicators for the Road Sector* (OECD, 1997), was that much less emphasis must be put on quantitative analysis, compared to qualitative assessment of the purposes the road programme is serving, and whether these reflect the views of the public. The objective is to widen the views of road managers and planners to reflect the vision of an integrated transport system in society and the role road administration plays in achieving it. In the long-term, generic road administration processes, with recommended key rules, could be developed from the various existing processes, allowing practices to be compared. This may entail developing common indicators/criteria as well as a data information network and management system for OECD countries. The 1997 report shows that there is a high level of confidence in the ability of the road administrations to deliver, once the deliverables have been identified.

The most important outcome of the performance indicator review is improved performance through the exchange of experiences, and the most important finding is the degree of change in response to an intervention. To understand differences in performance, the specific context in which the test was performed needs to be described. Comparisons must be made between countries, states and regions, and any recognisable trends identified. Due to the extent of the project undertaken by the Taskforce, the results were published in two separate reports:

- Performance Indicators for the Road Sector: Summary of the International Field Tests (this report).

- Performance Indicators in the Road Sector: Results of the International Field Tests.

The first report describes the approach adopted by the Expert Group and summarises the results from the field tests. In addition, detailed results for each performance indicator with examples from countries that can be considered as "best practice" can be found on the OECD Web site.

Approach

The main objectives of the Taskforce were:

- To test and learn from the application of the 15 road administration performance indicators.

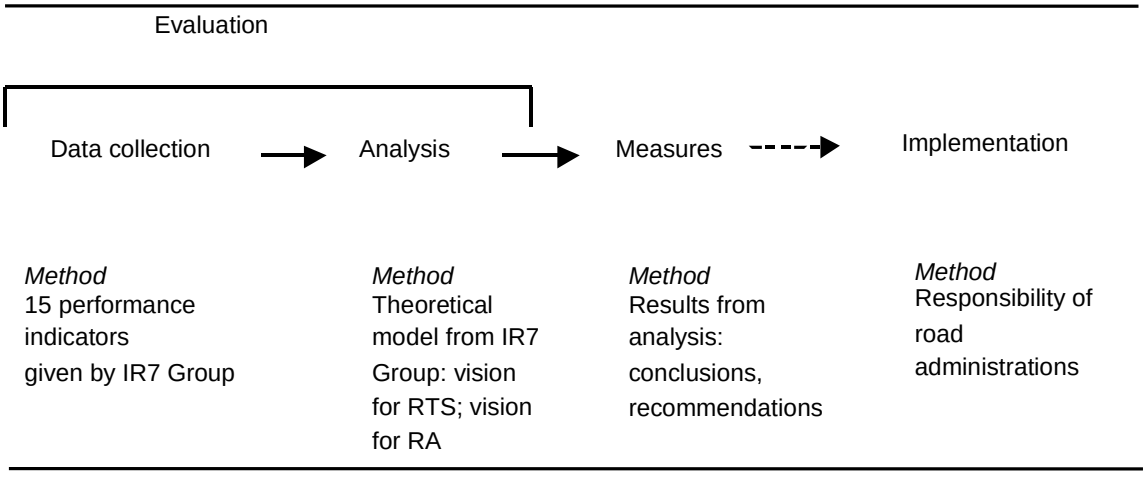
- To find out the main processes in a road administration, and to evaluate those processes against the performance indicators.

- To help build a learning organisation.

- To make recommendations for the dissemination of results.

In order to achieve their objectives, the Taskforce compared the values of performance indicators for different countries, and investigated the reasons for any differences in these values. The following practical evaluation approach was used, as shown in Figure 1.1.

Figure 1.1. **Evaluation model**



The above approach was not established at the beginning of the project, but evolved over the course of the work. The results of the Taskforce can be best illustrated against this evaluation model.

The report *Performance Indicators for the Road Sector* (OECD, 1997) developed a descriptive conceptual model for the road transport system and for the road administration's overall performance. The model was revised and a methodology was developed to put the model into practice through field-testing and to allow comparison of the 15 performance indicators used in the different countries. The final results are expressed as conclusions, recommendations and "best practice" examples. The implementation phase was outside the scope of this Group and was left for each individual road administration to carry out.

Chapter 2 discusses the descriptive conceptual models (vision for the road transport system and vision for the road administration) and the evaluation model (Figure 1.1). The chapter examines each performance indicator in the context of the vision for the road transport system. It also considers how the use of different performance indicators should be judged against the vision for the road administration and the vision for the use of performance indicators in a road administration. The objective of the chapter is to answer the question:

- How should the performance indicators be used?

In Chapter 3 the performance indicators are defined and their possible uses are discussed. The chapter aims to answer the following questions:

- What are the performance indicators?

- In which circumstances are they used in a road administration and why?

The results from the comparisons or "benchmarking" of the 15 indicators in participating countries are summarised in Chapter 4 (detailed results of this work will be made available on the OECD Web site).

Chapter 2

MEASUREMENT AND EVALUATION OF ROAD ADMINISTRATION PERFORMANCE

Traditionally, the success of a road administration has been measured by efficiency and fulfilment of the objectives set by the higher authorities, and by the quality of the products and services offered. Nowadays, the satisfaction of customers has been given more emphasis. A satisfied customer whose expectations have been fulfilled indicates efficient and high-quality performance. The views of the "technical" road administrator have broadened to take into account the values of customers instead of emphasising the best quality product or adopting an "expert knows better" attitude.

In order to compare and understand why particular indicators are used and the reasons for their values, the indicators have to be viewed in the perspective of the role of the road administration in the road transport system and in society as a whole. The driving force behind performance indicators is the vision for the road transport system and the mission of the road administration in fulfilling that vision.

To fully understand the differences in values brought to light through performance indicators, the specific contexts that exist in each country need to be described. For the purposes of this study, a "generic" road transport system vision for the road administration and its role was adopted. This conceptual vision formed the basis for "best practices" or "superior" performances for each indicator. In practice, it should be recognised that different circumstances, visions and procedures exist in each country and in each road administration, and there are no general or agreed "best practices".

Generic vision for the road transport system

The key issues facing the road transport system and road administrations include:

- Decreasing road budgets.
- Demand for greater transparency in road administration performance.
- Separation of the traditional roles of road administrations: production and administration.
- Change to customer focus instead of expert knows best attitude.
- Demand for greater efficiency in all operations.
- Demand for better results and quality.
- Demand for more co-ordination and co-operation across the transport sector.

- Demand for performance improvements to be implemented more rapidly than in the past.

- New management aspects, demand for an open and broad understanding of the mobility problems facing society.

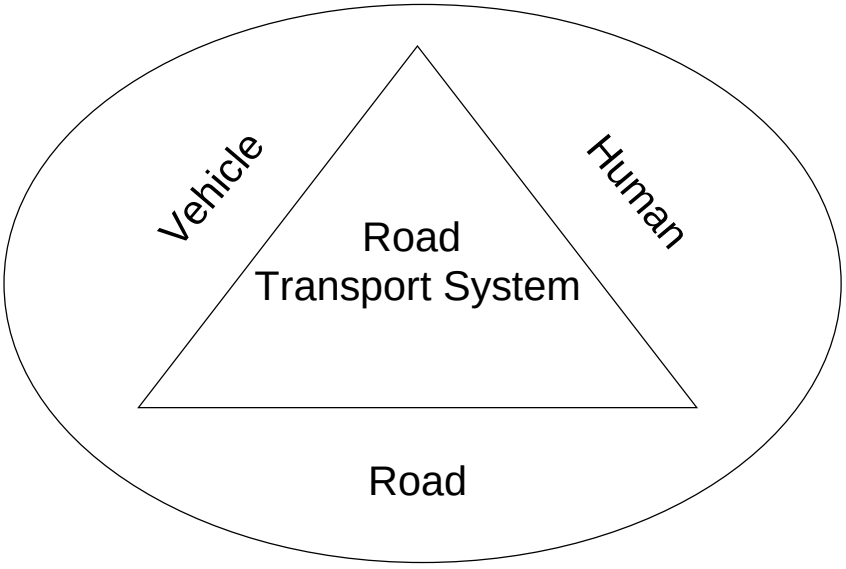
- Demand for more data and more efficient data management.

In order to view these problems in a broader context and to develop a strategy to minimise the gap between existing problems and future goals (vision) the conceptual model developed in the OECD report *Performance Indicators for the Road Sector* (1997) was redefined.

For example, one of the difficulties of meeting the rapid changes in transport demands is the long life cycles of roads. Road construction decisions taken today can hardly reflect demand for transport in 60 years time.

The three components of the road system (Figure 2.1) respond to change at different paces. Transport demands (driven by human behaviour) change rapidly in response to customer needs, while improvements in vehicle design evolve comparatively slowly (over ten years), and road design and construction even more slowly (over some 30 to 60 years) (Figure 2.2).

Figure 2.1. **The three components of the road transport system**

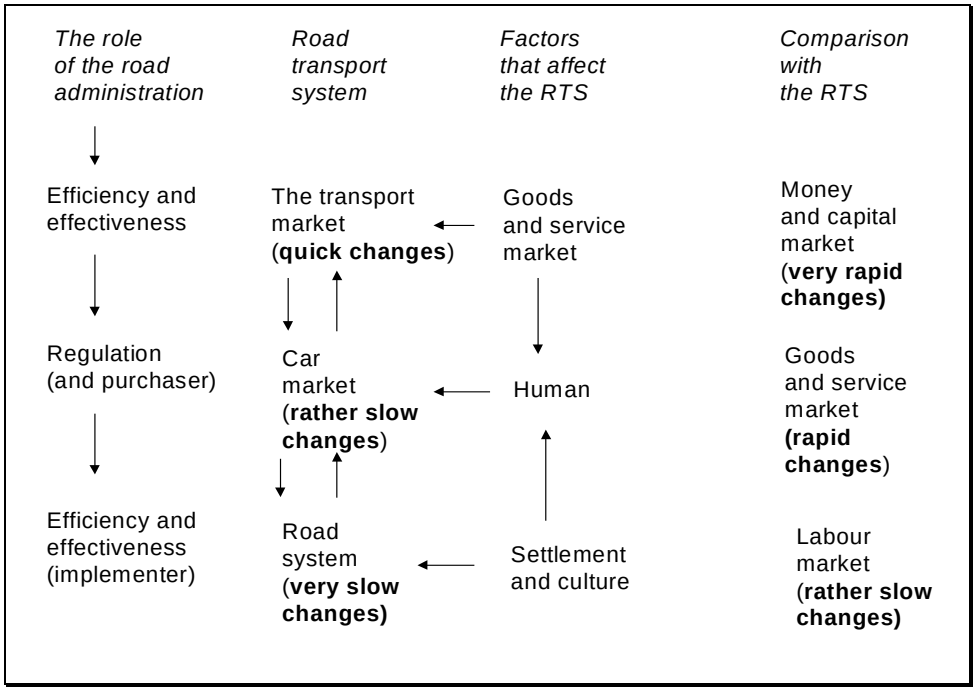


The principal purpose of the road transport system is accessibility and mobility. The ultimate vision for the road transport system is to bridge the gap between need and satisfaction. In that context the vision can be defined as:

> *In a rapid and continuously changing world, the road transport system is so flexible that it has the capacity to rapidly react to all new change and immediately redesign itself. There is a total absence of sacrificed user time and other resources or bad-quality products because of the road transport system.*

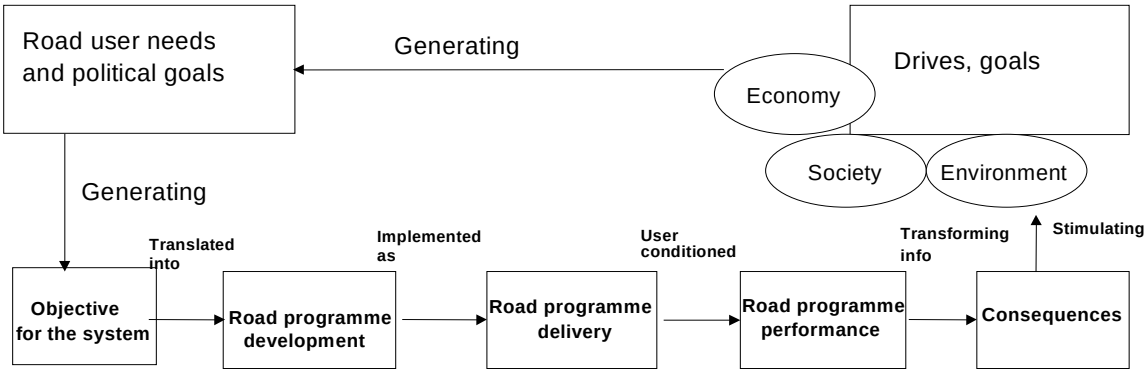
The key components in the above vision are: the ability to change/adapt; quality; customer focus; and rapid changes in demand for mobility.

Figure 2.2. **Speed of change in the road transport system**



In Figure 2.3, “drives” (basic human motivations) and “goals” (desired direction of change, or an ideal function of a transport system) generate the needs of users and those of policy makers. These needs generate the objectives (a concrete, measurable course or milestone on the way to a goal) which are translated into road programmes. Programme implementation seeks to translate the objectives into actions and, through road administration performance, to consequences which are beneficial for the whole of society.

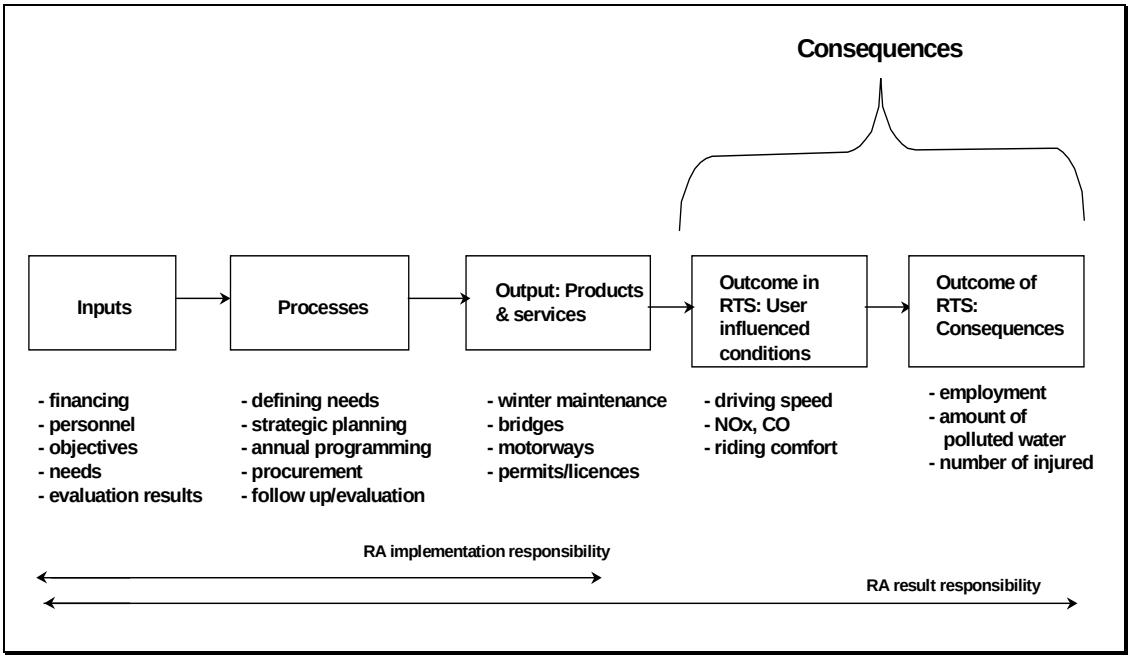
Figure 2.3. **Conceptual model of a road transport system**



Generic vision for the road administration

The conceptual model of the road administration shown in Figure 2.4 illustrates the input-process/output-outcome flow. The quality of products and services (outputs) is judged in relation to predetermined objectives using performance indicators. Outcomes are judged relative to the requirements for the objectives put forward by road users and the community at large. All predetermined target values for the performance indicators are objectives, which cannot be traded off by the road administration against other objectives or between each other.

Figure 2.4. **Conceptual model of a road administration's performance**



The traditional role of the road administration derives from a nation's government structure. The road administration fulfils its mission and objectives in accordance with the standards and goals set by policy makers and/or the ministry to which it is answerable. At the same time, road administrations are responsible for determining road-user needs when preparing programmes and policies for approval by the ministry and policy makers. Most road administrations still have in-house units which carry out road maintenance and elements of construction works; however, outsourcing is on the increase in all countries.

Road administrations have dual responsibilities. One role involves responsibility for the consequences of the road transport system for society as a whole. The other relates to responsibility for road production (roads, bridges, tunnels, etc.) in an open and competitive market. These different roles may cause problems or at least inefficiencies in operation if carried out by the same organisation or if not clearly understood to be separate processes. These two roles should be recognised and described.

There is evidence that benefits can be gained by commercialising the highway sector. Maintenance and construction works can be packaged into convenient lots, suitable for lease to the private sector through conventional contractual arrangements. The cost savings achieved by doing so are quoted as being in the range of 10-15% (Harral *et al*., 1986; Madelin, 1994b; Robinson, 1999).

The Audit Commission in the United Kingdom reported a study of routine maintenance by contract (1988). They concluded that GBP 90 million (approximately USD 140 million) per year could be saved on routine maintenance by improving the efficiency of in-house works and by making greater use of competitive tendering. Failure to expose in-house units to competition resulted in routine maintenance work being less efficient than it might be.

Although most authors agree that maintenance by contract is generally cheaper than when it is undertaken by in-house organisations, the evidence is not universal. Several studies have noted that in-house units are capable of competing successfully for work against the private sector, except in certain specialised tasks such as road markings. Efficient in-house units will force contractors to cut their margins and, for some jobs, they will even be able to under-cut the contractors.

The following section describes the general reorganisation of road administrations around the world and provides an example from New Zealand. After separation of its roles, the road administration will be responsible for road policy and the condition and quality level of the road network. In particular:

- The roles of road management planning and road production will become clear.
- Road management planning will be enhanced.
- Road policy will not be dependent on production factors.
- The neutrality of competition will be guaranteed and production will be invisible transparent.
- The road administration and the producer will be responsible for quality:
  - The road administration will be answerable to road users for quality.
  - The road producer, together with the road administration, will be responsible for producing the required level of quality.
- Road production will be more efficient when run like a business. Efficiency will be influenced by:
  - Independent responsibility for activities.
  - Increased flexibility.
  - Better motivation within the organisation.

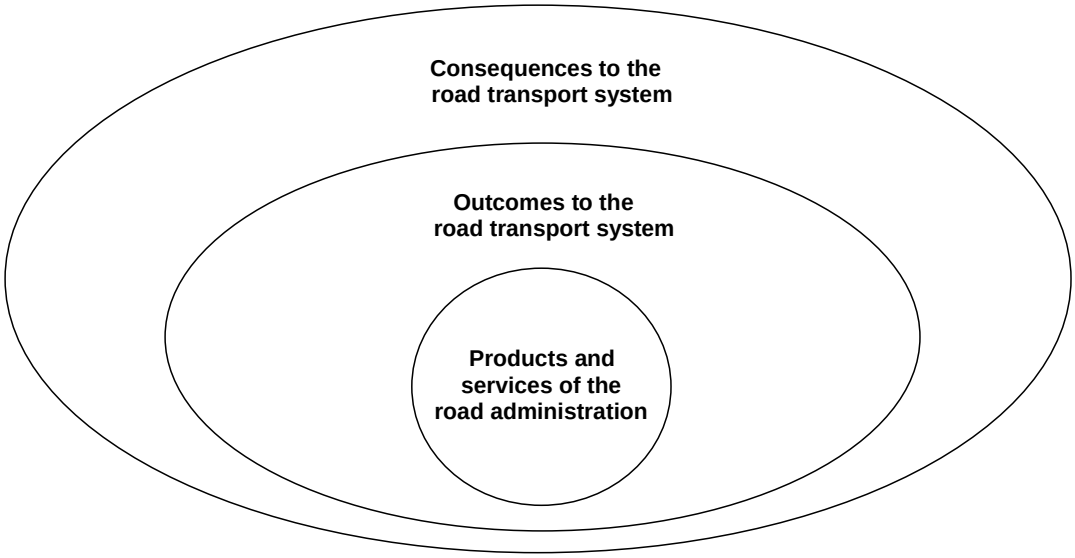
It is important to recognise the scope of responsibility of the road administration within the road transport system. Some of the indicators used in this field test exceeded the area of responsibility of road administrations since much of the performance is dictated by policies set by government. For example, in the case of road accidents, the performance of road administrations depends on and reflects the views and needs of governments and road users. In practice, the opportunities for road administrations to improve these performances are limited unless the authority and responsibility of the road administration encompass the whole transport sector decision-making process (the Swedish case example gives a good analysis of this, see Chapter 4). Another example concerns road-user costs. Although the road administration can influence the value of road-user costs by constructing and

designing better transport infrastructure, it has little or no jurisdiction over the majority of road-user costs (which, for example, include fuel and vehicle taxes).

Finally, the overall organisational structure of a country's transport sector has a significant influence on efficiency and the results of performance indicators. Strong modal administrations within centralised ministries perform differently to administrations that deal with issues that are wider than simply road network management. In some countries, the road administration is responsible for the entire national road network, while in others much of the responsibility may lie with local authorities with the road administration being responsible for the motorway network.

Figure 2.5 illustrates the areas where the responsibilities of the road administration can be widened. The traditional role of the road administration is to produce road-related products and services. The performance of the road administration and the consequences to society can be improved if the road administration can decide and act on wider issues than the construction and maintenance of roads. Improvements can be made to the co-ordination and the co-operation among all the actors in the road transport system. This could be extended to include other modes of transport. Ideally, the road administration should be able to fully contest decisions on wider issues on a level playing field with other stakeholders in the transport sector. The New Zealand example below illustrates this situation.

Figure 2.5. **Sector responsibility of the road administration**



Case examples

The following three examples describe the performance evaluation of the road administration. The first case describes general road administration organisational reform around the world and includes a specific example from New Zealand. The second describes the development project undertaken by the Finnish Road Administration (Finnra) to improve the customer orientation in Finnra's activities. The third example from VicRoads illustrates the use of the Road User Charter in Australia.

Case 1. General road administration organisation reform and an example from New Zealand

Experiences around the world suggest that the introduction of a competitive element into the road administration's operations has resulted in:

- Improvements in the cost-effectiveness of bonus incentive schemes.
- Improved attitudes of employees.
- Gains in operational efficiency.
- Considerable cost savings.
- No reduction in quality.

Talvitie (1996) of the World Bank notes that on efficiency grounds, the case for restructuring is supported by the following general conclusions:

- Decentralisation in programming outputs can increase efficiency by 10-15%.
- "Optimal" timing and scheduling of works reduces total road transportation costs (user and administration) by 5-30%.
- Efficient, decentralised data collection represents 2-3% of the maintenance budget.
- Contracting can reduce costs by 5-15%.
- Reworking the planning processes can shorten the planning and design cycle.

Many countries around the world have recognised the benefits of road administration reform and have embarked on this course of action. Their reform objectives have been mainly efficiency-driven, although in more recent times the pressure on governments to adequately fund road maintenance and new development projects has brought increased private sector participation and funding.

Talvitie (1996) describes the reform process that has been occurring around the world as a five-stage process:

Phase I Traditional construction and maintenance organisation. A traditional public works ministry of either state or federal government employing large numbers of employees.

Phase II Identification of client and provider functions. Greater emphasis on efficiency in service delivery and a move to outsource works. Public works organisations tend to be replaced by a Ministry of Transport for policy direction.

Phase III Separation of client and delivery organisations. The increased emphasis on policy, especially on environmental issues and the drive for greater efficiency, pushes the separation of client and provider. The traditional public service providers or deliverers are normally corporatised during this phase.

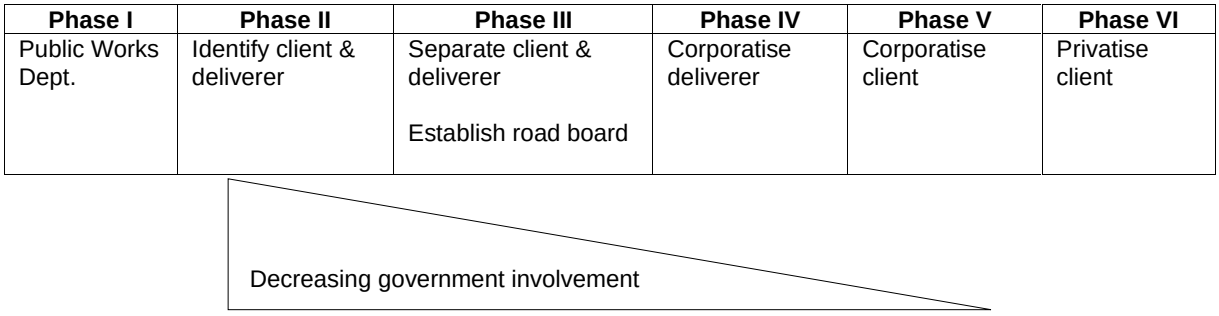
Phase IV Corporatisation/privatisation of the deliverer. In this phase, government-owned delivery organisations are at least corporatised, but more likely privatised by either sale or

devolution of these activities to the private sector. A more dedicated road fund normally appears in this phase.

Phase V Corporatisation of the client organisation. In this phase, the client road manager becomes the formal owner of the roads on behalf of government and manages them as a government corporation.

Phase VI was introduced by Dunlop (1998). It would involve some form of privatisation of some or all of the road network. This has occurred to a limited degree throughout the world although no country has yet privatised or corporatised its entire network and hence dealt with all the ramifications of a natural monopoly. Also, nearly all privatisation agreements to date have incorporated an end-date after which the road is handed back to the government.

Figure 2.6. **Phases in road administration reform**



Source: Dunlop, 1998.

Highway agencies throughout the world are currently between Phases I and IV of the six stages, depending on the particular government's role in directing reform (Figure 2.6). However, the trend has been to progress towards Phase IV over time. Countries have adopted different methods of reform and progressed at different rates although nearly all have moved through the phases in sequence without omitting any stage. The debate is now centred around the benefits and disadvantages of continuing to Phases IV, V and possibly even to VI. The complex policy implications involved in further changes, which would require the introduction of a dedicated road fund and a clear establishment of road ownership with the client (road agency), have slowed the pace of reform. Also, the debate as to whether or not the privatisation process should include routine maintenance, as well as the strong opposition of the labour unions, has slowed down the process in some countries.

Reform in New Zealand

Restructuring and commercialisation within the land transport industry in New Zealand has followed similar changes to other state and local government reforms. Wilcox (1997) notes that it has forced accountability onto organisations and moved much of the work from the public to the private sector. The application of the "user pays" principle and of dedicated road funding provides a more stable environment for policy development and strategic investment decisions. Cost savings have been achieved through the institutional changes that have been implemented. These have been of the order of NZD 70 million (approximately USD 40 million) on an annual expenditure of NZD 420 million (USD 230 million).

Indicative savings by sector are:

Passenger transport	12% lower
Professional services on state highways	20-30% lower
Physical maintenance on state highways	17% lower

These institutional changes have led to a better definition and understanding of what is required, what standards to apply, and what are the appropriate costs. They have resulted in a more focused and effective road transport system.

Until 1987, road funding and co-ordination on behalf of government was managed by the National Roads Board with the Minister of Works and Development as the Chairman. The Ministry of Works and Development, employing 9 600 people, undertook most of the work.

In September 1989, after a period of transition during which the professional services and contracting production units of the Ministry of Works and Development were corporatised, the New Zealand Government passed a number of laws which began a process of reforming the management of the New Zealand Land Transport System.

After further law changes in 1996, the current arrangement was implemented whereby the New Zealand Government introduced a new body called Transfund New Zealand, an independent Crown Agency with responsibility for allocation of the Land Transport Fund to state highways, local roads and alternatives to roads, including public passenger transport. Transit New Zealand is responsible for the management of the state highway system in New Zealand.

Transfund New Zealand's responsibilities are to:

- Approve maintenance and capital projects for payment from the National Roading Programme to the full extent of the revenue accruing to this dedicated fund from fuel tax, heavy vehicle road-user charges and registration and licence fees.

- Review and revise the National Roading Programme in accordance with its most recent performance agreement and forward revenue and expenditure projections.

- Approve competitive pricing procedures.

- Audit the performance of Transit New Zealand and local authorities.

Transit New Zealand's objective is to "operate a safe and efficient state highway system". This single focus and clarity of role has provided a clear objective for the organisation and confirmed its role as a purchaser of consultancy and contracting services in the marketplace.

As a road management agency, Transit New Zealand does not directly undertake its maintenance or construction programme. All physical works and professional services are contracted out on a competitive basis to private sector contractors and consultants.

An increasing level of professionalism and the desire to be seen as an intelligent purchaser of consultancy and physical works services for state highways, means that strong incentives exist for Transit New Zealand staff to achieve good results.

The large-scale tendering out of all consultancy services and physical works required for the maintenance and improvement of the state highway network in New Zealand has yielded considerable gains, both in quality and price. The discipline of clearly defining roles and documenting policy and procedures, has meant that each organisation in a relationship has the ability to innovate and improve the value of the entire system, while being able to publicly demonstrate cost-effectiveness through the tendering procedure.

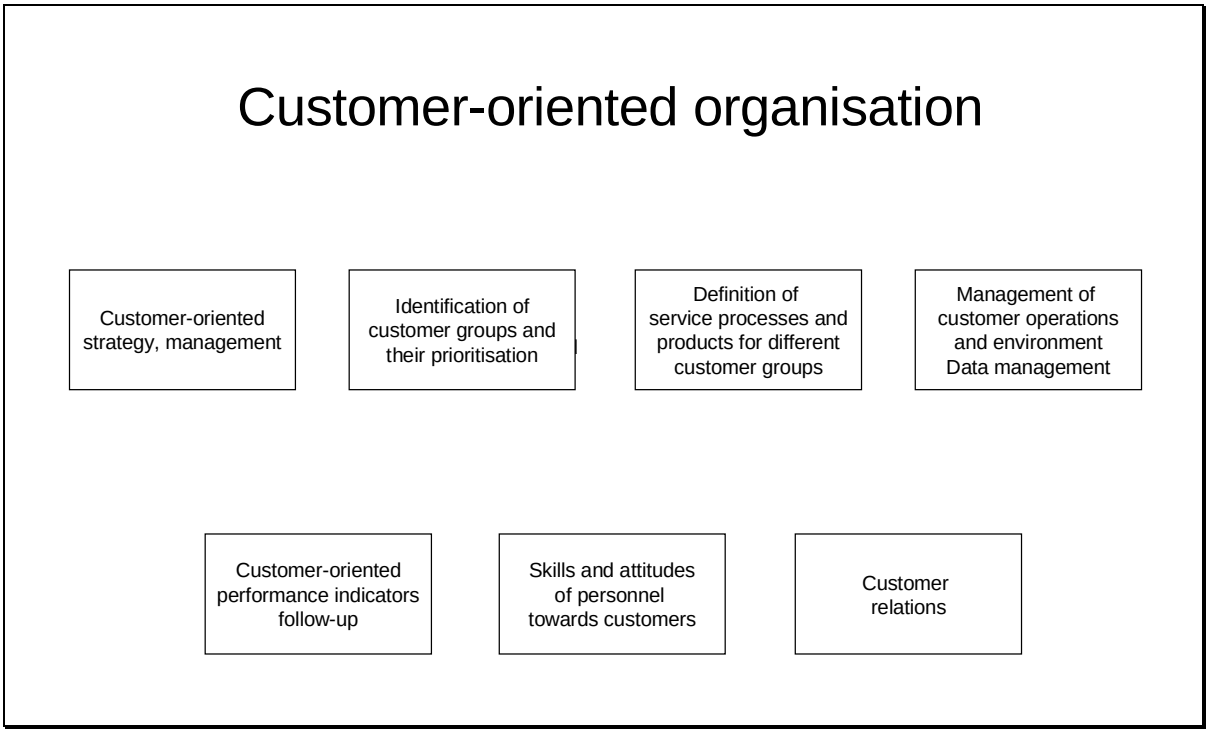
Case 2. Development of the Finnish Road Administration towards a customer-oriented organisation

The Finnish Road Administration (Finnra) started a development project to improve its customer orientation (Laamanen and Tinnila, 1998). The objectives of the project are to:

- Clarify the terms related to and used with customers.
- Define the needs and values of different customer groups and prioritise those needs.
- Develop and utilise the management of customer data, surveys, research and indicators.
- Describe the products and services for the customer as part of the supply chain.
- Develop an external relations process with customers.

The problem areas identified by Finnra in terms of customer orientation are described in Figure 2.7.

Figure 2.7. **Typical customer-related areas that require development in a road administration**



Source: Finnish Road Administration.

The problems encountered when moving towards a customer-oriented organisation are:

- Customer-oriented strategies and management:
  - The information used is not systematic but based on “experience”.
  - It is not clear how customer information is used in the management process; its use tends to be optional and random.
  - The customer is not clearly included in the company objectives; the management system does not support or reward customer orientation.
- Identification of customer groups and their prioritisation:
  - There are usually several views on how to prioritise customer needs; decision making is muddled.
  - There are no clear policies on how to deal with often contradictory customer needs; uncertainty prevails.
  - Customer classification or categorisation is scattered; the different roles that can be held by customers (sometimes owner, sometimes partner, sometimes supplier, etc.) cause problems.
- Definition of service processes and products for different customer groups:
  - The definition is based on the views and experiences of experts rather than on customers’ needs.
  - The use of Road User Charters (or equivalent) provides a good base for development.
- Management of customer operations and environment:
  - There is inadequate customer data management.
  - The knowledge of customers and their needs requires improvement.
  - Customer data is not used systematically in operations or processes; traditional “bureaucracy” acts as a barrier.
  - Utilisation of customer data is difficult because of the attitudes and skill levels of organisation staff.
- Customer-oriented performance indicators and their monitoring:
  - The system is inexistent.
  - There is uncertainty among experts about alternative indicators and how they function.
  - Fear of placing too much emphasis on customer-oriented indicators in decision making (the traditional expert’s fear of losing power).

- Skills and attitudes of personnel towards customers:
  - Contradictions between the expert's (administrator's) role and the customer's point of view.
  - Adoption of a "customer doesn't understand" attitude.
  - The conception of "customer" might be new or badly understood.
- Customer relations:
  - No clear processes have been developed.
  - Improvements are needed in overall information and relation policies.

Finnra has tested the use of the Road User Charter in one of its road districts. As part of the project, the Road User Charter will be implemented in all districts.

The Road User Charter is a powerful tool allowing a road administration to treat its customers in a transparent way. The Charter outlines what it will provide and describes the consequences to the customer. The Road User Charter is a detailed description of a road administration's products and services, although it also serves to "prioritise" road administration activities. It indicates what will be accomplished with the given budget and in what order. This provides customers with an understanding of how their needs are being prioritised. At the same time, it acts as an agreement with the political hierarchy as it indicates what will be accomplished with the allocated appropriations. If policy makers require more, they need to provide more funds or indicate how the priorities should be changed.

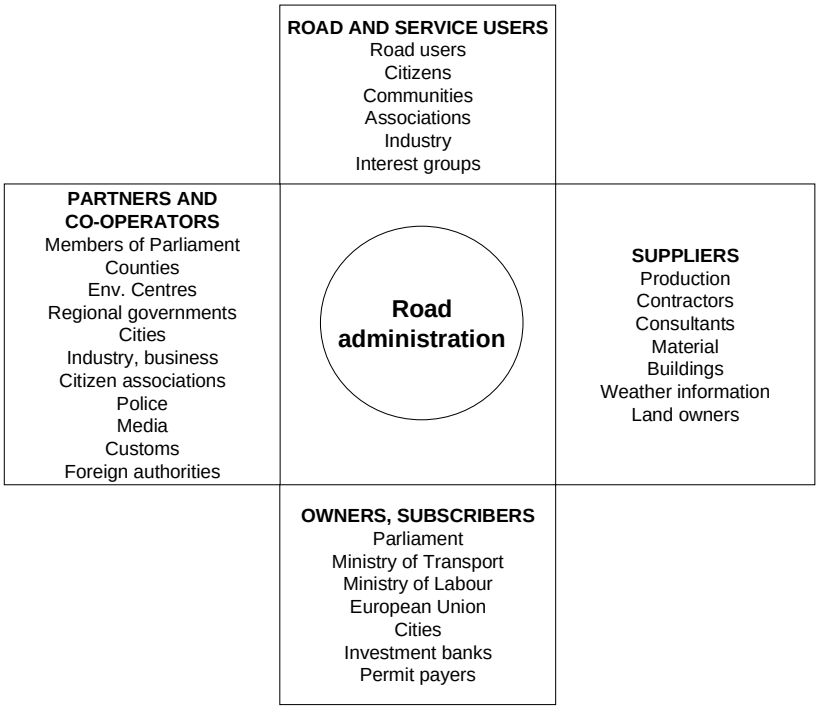
Road User Charters remove much of the burden from the shoulders of the road administrator to policy makers, who should take more personal responsibility by telling voters (road administration's customers) what they want the road administration to achieve through the national road policy. On the other hand, the Charter can serve to lighten the road administration's cumbersome load of being placed between policy makers (who provide funds) and road users (who have the needs which create demand). If the road administration simply provides its expert opinion to policy makers on ways to solve the country's transportation needs based on existing problems and customers' needs, the real responsibility for choosing priorities belongs to the Government.

The above discussion is simplified if the road fund is used or if considerable private funding is available to the road administration. In such cases, the paying customer is directly in relation with the road administration and the services can be agreed mutually.

The Road User Charter is used in Australia and in the United Kingdom. A case example describing the use and the status of the Road User Charter in Victoria, Australia is presented below.

Customer orientation must derive its argumentation through the vision, values and strategies of a road administration. There are many ways and methods (in addition to the Road User Charter) to meet customers' requirements, but the main objective is that the approach chosen is systematic and consistent throughout the activities of the organisation. Viewing the customer in the correct context can be difficult, because at different times the same customer can be a partner, an owner or an associate of the road administration. It is therefore important to define and understand customer areas and relations. Whatever the role of the customer, the same principles should apply: objectivity, transparency, equality, openness and a willingness to find a solution to the customer's needs. Figure 2.8 illustrates the general customer areas defined by Finnra.

Figure 2.8. **General customer areas of the Finnish Road Administration**



Source: Finnish Road Administration.

Case 3. VicRoads and the Road User Charter

VicRoads is the Victorian State Government agency responsible for managing the state's road system as an integral part of the overall transport system. VicRoads is responsible for the needs of all road users on the state's freeways, highways, main roads, tourists' roads and forest roads. It also develops road safety programmes, registers vehicles and licences drivers.

The Road User Charter sets out VicRoads' service commitments to Victoria's road users in areas such as: road safety, traffic flow, the road network, registration and licensing services, the environment and communications. Significant benefits have been derived from the process of developing the Charter.

In order to ensure that the Charter made commitments on issues of relevance and importance to road users, VicRoads undertook extensive market research through questionnaires and focus groups. The process involved citizens in urban and rural areas, and of varying age and socio-economic groups. The views of key stakeholders such as trucking companies, the police, motoring associations, and so on, were also sought.

Staff were consulted on key issues of concern to road users, and this process produced some novel ideas on how to improve customer services. The staff who manage VicRoads' construction, maintenance, road safety registration and licensing activities, are aware of the service targets outlined in the Charter and monitor their performance against these targets. Results are reported in VicRoad's Annual Report.

The Charter has been published in booklet form and on the Internet at: http://www.vicroads.vic.gov.au/.

Chapter 3

PERFORMANCE INDICATORS IN A ROAD ADMINISTRATION

Performance indicators and performance measures

A literature review on performance measurement showed that the terms *performance indicator* and *performance measure* are synonymous, their usage depending on the country. Where a distinction is made, *performance measure* generally has a broader meaning than *performance indicator*. *Performance measure* indicates the direction for the performance (*e.g.* reduction, increase) while *performance indicators* are conceived more narrowly as data elements.

For the purpose of this study, the following definition was adopted for both performance indicator and performance measure:

> *A tool enabling:* i) *the effectiveness of an operation or of an organisation to be measured; or* ii) *an achieved result to be gauged or evaluated in relation to a set objective.*

Of the 15 performance indicators selected for the field test, ten could be defined as exact measures with an associated absolute value. The other five were "yes/no" indicators, giving a qualitative measure of performance rather than exact values. Additional data were required for further analysis, particularly to give detailed explanations for the "yes" or "no" answers. The use to which performance indicators are put in different countries and road administrations was of primary importance to this field test. A comparison of actual indicator results revealed little information on the performance of a road administration.

Selection of performance indicators

The first step in the evaluation process was to define and select the performance indicators (Figure 1.1). Understanding the role of performance indicators in improving the overall performance of a road administration is central to this process.

The 1997 OECD report classified performance indicators for various aspects (dimension) of the road transport system according to the following three perspectives (Table 3.1):

- Government (including stakeholders).
- Road administration.
- Road user.

Table 3.1. **Taxonomy of performance indicators**

Perspective / **Dimension**	**Government (ministry)**	**Road administration**	**Road user**
Accessibility/Mobility	Average road-user costs		Level of satisfaction regarding travel time
Safety	Protected road-user risk		Unprotected road-user risk
Environment		Environmental policy/programme (yes/no)	
Equity			
Community		Processes in place for market research and customer feedback (yes/no)	
Programme development	Long-term programmes (yes/no)	Allocation of resources to road infrastructure (yes/no) Quality management/audit programme (yes/no)	
Programme delivery		Forecast values of road costs *vs.* actual costs Overhead percentage	
Programme performance	Value of assets	Roughness State of road bridges	Satisfaction with road system

Source: OECD, 1997.

The three views (government, road administration and road user) are important and should be kept in mind when choosing the indicators. However, the field test was carried out by road administrations and therefore their view became dominant. Hence, the focus of the field test was on the road management process, as shown in Table 3.2.

Tables 3.1 and 3.2 are helpful in selecting the appropriate performance indicators and determining which of the following require development or improvement:

- The internal efficiency of the road administration.
- The quality of the administration's products and services.
- The outcome for the road transport system.
- The consequences for society.
- Any particular process or learning exercise for a specific engineering task.

A key component of the most successful road projects and programmes is a well-defined set of goals and objectives. However, the use of performance indicators goes beyond evaluating the degree to which goals and objectives have been achieved.

Table 3.2. **Taxonomy of performance indicators adopted for the field test**

Processes and activities within the road administration	Product and services	Outcome operational conditions	Consequences
Environmental policy programme	Roughness	Average road-user cost	
	Defective deck		
Processes in place for market research	Surface condition	Level of satisfaction regarding travel time	
Long-term programmes for construction		Accident risk: – Fatalities – Unprotected	
Management system for distribution		Satisfaction with road system	
Quality management audit programme			
Forecast value			
Overhead percentage			
Value of assets			

The use of performance indicators by a road administration depends on the particular needs for development or improvement in performance. The main aspects that influence decisions on the use of performance indicators are:

- The main characteristics of the road transport vision in the country.
- The position of the road administration in the process of organisational reform.
- The management style of the organisation.
- The specific functions that require development or learning.

The 15 performance indicators selected for this project are not representative of the "ideal" or even the most important. They were selected by the Expert Group to cover the previously developed taxonomy.

How to use the performance indicators

Performance indicators can be applied to road programme evaluation, planning and organisation management in the following ways:

- In process management, to measure the success of individual processes or groups of processes (Hannus, 1994).

- In management-by-results, to set targets and evaluate the achievement of goals and objectives.

- In benchmarking, to establish the “best practice” or “superior performance” process methods in order to improve part or overall performance of the road administration.

- To aid the development or improvement of the functions or specific engineering tasks of the road administration.

This section gives an overview of these four situations. Case studies follow

Performance indicators in process management

In a society in perpetual flux, road administrations must constantly analyse their operations and re-evaluate their processes in order to improve main strategic capabilities and guarantee optimal performance.

Process management calls for a re-thinking of traditional organisational structures and staff roles. The traditional distinctions between managerial and operational work are eliminated, creating a lean, horizontal organisation with shared responsibility between managers, working teams and operative personnel. The goals of process management include:

- High productivity and efficiency.

- Good economic results.

- Customer and owner satisfaction.

- Improved understanding of the organisation’s strategic goals.

- Staff satisfaction.

Performance indicators are used in process management to evaluate the efficiency of each process and provide insights on which processes could be refined and/or streamlined. One or more indicators may be assigned to each process, measuring the quality of the end product and its value to the customer. The results may be used for comparison, benchmarking, improving, learning or development purposes.

A case study of the use of performance indicators on processes in the Finnish Road Administration is presented below.

Performance indicators in management-by-results

Management-by-results is based on defining objectives or targets for a project without defining the core and support processes in the organisation. Targets are set for certain processes, outputs or outcomes that need to be improved (for example, lower the number of traffic accidents; improve the condition of pavements). These targets are usually set by the owner (ministry, government) or by the customers (road users).

A case study of management-by-results used by the Finnish and the Swedish Road Administrations is given below.

Performance indicators in benchmarking

Benchmarking is the search for best practices to achieve superior performance. It compares the critical dimensions of a process with those of leading competitors or fellow road administrations, in order to develop a standard for these processes. This standard (or benchmark) may then be used as a base for further comparison or evaluation.

There are several types of benchmarking:

- *Internal benchmarking*: comparing processes used in the different organisational units of an organisation.

- *Competitor benchmarking*: comparing processes used in one organisation with equivalent processes used by competitors.

- *Activity-based benchmarking*: comparing the processes of one organisation with equivalent processes of a similar organisation which has been achieving superior results.

- *Generic benchmarking*: comparing equivalent processes across different types of organisations.

Before beginning the benchmarking process, one or two organisations should be selected as a base for comparison. These organisations should be chosen according to the level at which they perform the process (or processes) in question. The basic steps for carrying out the benchmarking process are:

1. Identify and describe the purpose and role of core processes and their performance indicators.

2. Determine and understand the best practices used for these processes around the world.

3. Analyse the differences between the performance of own organisation processes and best practices, and the reasons for these differences.

4. Plan and implement the necessary changes in order to achieve the best practice scenario.

5. Continually monitor and assess the performance of the organisation, and develop new and existing processes.

The most important step is to decide which performance should be the benchmark. A clear understanding of the underlying process and what the information is going to be used for is needed before any indicator data is collected.

Performance indicators as an aid to learning organisations (Sarala and Sarala, 1996)

The main benefit for participants in this field test was to better understand the operation of other administrations and to draw lessons from their experiences. The *use* of performance indicators was of

primary importance – a direct comparison of actual indicator results revealed little of a road administration's performance even where the numbers were significantly different.

Organisations can be reticent about introducing performance indicators for certain processes, as this is often seen as the first step in proposing cuts in an administration. However, performance indicators are a key component in managing the changes that are necessary to meet the evolving needs of road users.

It is impossible to define a common vision, or common performance indicator targets, for all countries. Every road administration needs to define its own vision and choose suitable best practices among those in place in other countries.

Case studies

The following five case studies describe the use of performance indicators in Australia (VicRoads), Belgium (Walloon region), Finland, Sweden and New Zealand.

1. The VicRoads case presents an example of how performance indicators are used as an integral element of a performance-based approach to management.

2. The Walloon case illustrates the use of performance indicators in the Walloon region, demonstrating a success story in the use of a specific indicator for engineering structures.

3. The Finnish case presents a development project to define key processes and move to process management.

4. Case studies of the management-by-results approach are given for Finland and Sweden.

5. The case study from New Zealand describes performance indicators for the road funder, road administration and supplier.

Case 1. VicRoads' use of performance indicators

Background

VicRoads uses performance indicators, at both strategic and tactical levels, as an integral element of its performance–based approach to management. A number of advances in the use of performance indicators have been made over the past few years.

Strategic and budget level

VicRoads uses both outcome-based and efficiency indicators to monitor its strategies. These indicators were based on the set of national performance indicators developed by Austroads, which measure both road system and road agency performance.

An example from the VicRoads approach is the use of the "Smooth travel exposure" indicator to monitor road conditions. This indicator has been cascaded down from the state level to the regional level to assist in the determination of road maintenance priorities. Similarly, the Austroads "Travel time" indicators have been cascaded within VicRoads to report trends at a finer level of detail (for example, the travel time trends for different classes of roads). Furthermore, the Austroads "User

transaction efficiency" indicator provides a basis for target setting within VicRoads about the future costs of transactions for vehicle registration and driver licensing.

These outcome-based indicators are also used by the Victorian State Government central agencies; both in the assessment of government expenditure priorities, and in assessing VicRoads' performance as a road system manager. As part of the budgetary planning cycle, VicRoads uses the indicators (travel times, road maintenance, etc.) in support of its budgetary submissions.

This approach is being introduced throughout the Victorian State Government Administration. The government has adopted the attitude whereby agencies' funding is based on the delivery of agreed outputs. The delivery of these outputs is conditional on various quality, efficiency and timeline targets being met. The use of performance benchmarks for comparison with other jurisdictions is now being introduced into the process.

The advantage of this approach is that it focuses the debate and the establishment of priorities on the real objectives for the road system sought by stakeholders. It is also part of a shift towards a greater commercial focus on the part of the government. The debate now centres on the outputs that the government is seeking to purchase on behalf of the community, and the efficiency with which those outputs are being delivered.

One drawback of the output-based approach is that the road system and its use are influenced by many other factors outside the control of an agency such as VicRoads. These influences include general economic conditions, movements in wage rates, interest rates and currencies, as well as changes in the competitive environment in segments of the road transport industry. Furthermore, these fundamental indicators of road system performance change slowly and are not necessarily appropriate to the three-monthly reporting cycle in place.

Tactical level

These system indicators are complemented by organisational performance measures. VicRoads Management Committee, comprising the Chief Executive and Directors, monitor organisational performance on a monthly basis. Key indicators of performance monitored at this level include business outcomes (profitability of off-budget businesses vs. key targets), measures of outputs (progress of projects against plan), measures of inputs, (revenues and expenditures vs. target) and human resources (staff numbers, sick leave, etc.). Customer-related indicators are also monitored (for example, delays). Regular monitoring enables the timely implementation of appropriate corrective actions, ensuring that targets are met.

Conclusion

The focus of VicRoads has shifted over the past few years from managing inputs to managing outputs. The use of output-based performance indicators has been a key contributor to this shift (Table 3.3).

Table 3.3. **Use of performance indicators within VicRoads**

Type of indicator	Activity requiring indicator of type specified	Frequency of activity requiring use of performance indicator	Focus of indicator
Outcome-based indicators	Review strategic directions	Every few years	External
	Establish targets for coming year in strategic business plan	Annually	External
	Report to State Parliament in Annual Report	Annually	External
	Report to Corporate Management Group	Annually	External
Major outputs	Establish strategic business plan targets	Annually	External
	Report to State Government on progress against plan	Quarterly	External
Outputs (projects *vs.* plan)	Report within VicRoads to Management Committee	Monthly	Internal
Inputs (financial, human resources)	Report within VicRoads to Management Committee	Monthly	Internal

Source: VicRoads.

Case 2. Use of indicators in Belgium (Walloon region)

Road authorities have gradually had to face an increasingly competitive environment. Following the example of the private sector, the government has demanded higher quality in the supply of services. Controls have become more thorough and management has become client-oriented. Seizing the opportunities provided by this new approach, service users have started to formulate increasingly specific – and sometimes conflicting – demands (mobility *vs.* compliance with environmental requirements). On the other hand, the tasks devolved to the administration have increased and become more complex (*e.g.* road information). Unfortunately, this evolution is taking place in a context of budgetary restraint. The only way for road administrations to cope with these changes is to adopt the performance and quality based management techniques of the private sector. As might be expected, such changes take time.

In the past, the Walloon region administration had developed a few indicators to evaluate pavement and bridge conditions. Data such as longitudinal evenness, roughness, etc., were measured in an effort to gain better knowledge of pavement conditions. With these indicators, the administration began fulfilling its fundamental purpose. Although performance improvement vocabulary was not yet

used, the aim pursued was performance improvement. An objective knowledge of the present state of play was sought in order to improve the situation. However, the indicators used and the data collected were only for internal use, and the possibility of releasing this information to the public was never considered. Today, the Walloon region road authorities are still evolving in their development of a long-term vision, setting up the process of management-by-objectives and the accurate and continuous measurement of performance which seem to be the tools required to address the challenges of the 21st century. These developments imply a profound change in organisational culture – which perhaps constitutes the main difficulty.

The Walloon region road authorities thus knuckled down to the task of becoming a client-oriented service provider:

- First, they concentrated on the definition of a strategic plan over three years. Besides determining the levels of service to achieve the road authority's various fields of action (maintenance, safety, signalling, traffic management, engineering structures, etc.) and the means required to attain these levels, the strategic plan constitutes the first step towards management-by-objectives and hence a new enterprise culture. The plan is to be implemented over a number of years, which breaks with the principle of yearly budgeting and allows a medium-term projection. As the evolution of management methods is deemed inevitable, a positive attitude was adopted towards it in order to take full advantage of the situation.

- Second, the Walloon region road authorities set out to develop precise indicators, in correlation with the objectives selected in the strategic plan, in order to check the progress of their objectives. This phase of the project is still under way.

It goes without saying that the first aim of performance indicators is to improve the internal workings of a road administration by enabling better use of the available resources. This constitutes a considerable asset. However, in the present context of budgetary restraint, the indicators can also be used as a means to put pressure on the political authorities. Indeed, a well-defined indicator gives an objective measure, providing the road authorities with a clear and accurate view of the situation in case of problems. It is then the Minister's duty either to solve the problem or to leave things as they stand, with full knowledge of the trade-offs. Consequently, responsibilities are clearly delimited: the road administration identifies the problems, produces objective measures to assess them and suggests a certain number of solutions, whereas the Minister analyses the whole situation and takes a decision based on the examination of a complete dossier. Once again, this implies a profound change in culture. A relationship of trust must be established between the administration, the Minister responsible and his departmental staff, and an unequivocal collaboration needs to be set up between them. Reliable and objective expertise is expected from the administration while the will to tackle all the problems – even those which are less appealing politically – is expected from the Minister.

The approach taken to solving the problem of the condition of bridges in the Walloon region illustrates this new way of dealing with issues. Lack of maintenance led to a far from satisfactory situation and, in the case of certain bridges, resulted in an advanced state of deterioration with risks to users' safety. Because the political milieus were not aware of the question, the road administration carried out numerous surveys with the help of the specialised technical services, and classified all the engineering structures into four categories:

- Class A: highest priority – structures liable to present serious risks to users.

- Class B: structures presenting a danger in the short term.

- Class C: structures showing significant deterioration.

- Class D: structures showing minor deterioration (all other structures).

Next, the budget needed to repair the dangerous structures was calculated (BEF 3 294 million) and spread over three years (BEF 1 098 million/year). This represented an impossible amount in terms of public finance, and, therefore, the plan was submitted to the Minister who accepted it, and granted a special budget to the administration, enabling them to deal effectively with the situation.

In this case, in addition to playing a passive role in identifying a situation, the indicator took an active part in solving an serious problem. This example clearly illustrates the usefulness of indicators.

Case 3. Core processes in the Finnish Road Administration

The Finnish National Road Administration (Finnra) started a development project in 1997 to define its key processes and gradually move towards a process-management approach. The project was a natural continuation of a ten-year development process of quality management systems and organisational changes in Finnra.

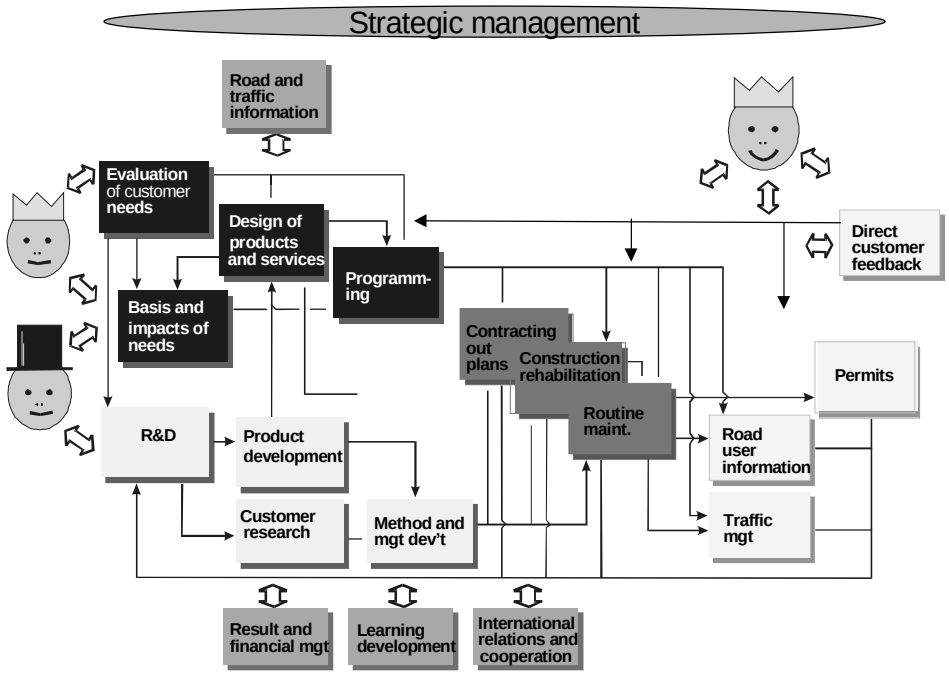
At the beginning of 1998, Finnra was internally separated into two sections: road administration (client functions), and road production (road construction and maintenance operations). It was important to clearly define the processes within these two functional activities, in order to fully carry out the separation process. Because process management forces the customer to be defined, the definition of key processes enabled Finnra to introduce a more customer-oriented philosophy into the organisation. Each process contains one, or several indicators with which the efficiency of the process itself, the quality of the end product and the value for the customer are measured. This facilitates the use of the performance indicators for comparison, benchmarking, improving, learning or development purposes.

Core processes are directly related to serving external customers, and are an essential part of every business. In Finnra, the core processes for the road administration functions were defined as strategic planning, outsourcing, and customer services. These can be seen as the generic "administrative" core processes in any road administration.

Within these three core processes, 16 key processes were identified (Figure 3.1). A "key process" may be a core process or may support a core process, and is critical to the success of the organisation. These are the processes that are most likely to be benchmarked using performance indicators (process indicators) whose values or targets can be compared with those of other administrations and analysed to explain differences in performance levels between organisations. When making process improvements, efforts should focus on these key processes. Often there are fewer than 20 key processes in an organisation. The core processes of the production functions of Finnra were defined as customer commitment, order fulfilment and customer satisfaction services. They are shown in Figure 3.2.

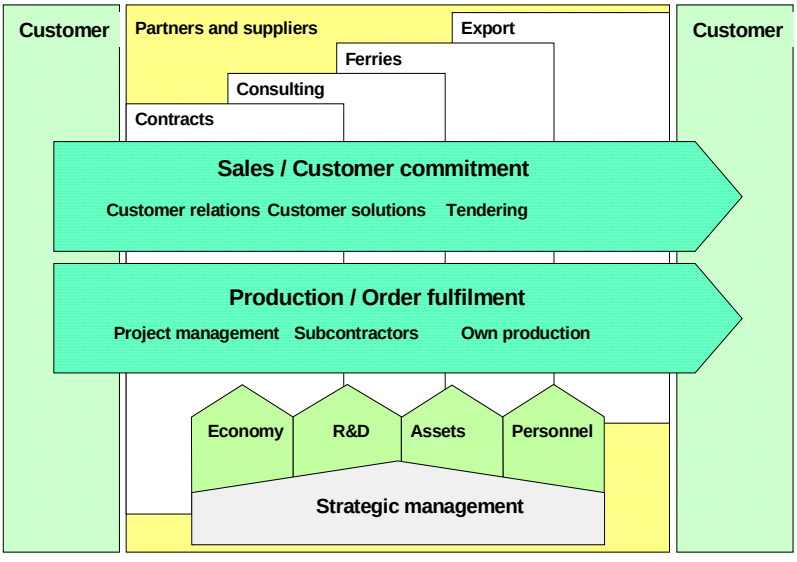
No matter whether the production activities have been separated or not within a road administration, the above core processes can usually be found. Of course, there are country specifics and, depending on the extent of the responsibilities of a road administration, there are differences in these processes.

Figure 3.1. **Key processes in the Finnish Road Administration**
Organisation of administration



Source: Finnish Road Administration.

Figure 3.2. **Key processes in the Finnish Road Administration**
Organisation of production



Source: Finnish Road Administration.

The Finnish example, illustrated in Figures 3.1 and 3.2, describes the processes currently used in the Finnish Road Administration. It should be noted that this description of these processes dates from 1999. The process management is at the development stage, and the number of processes and their descriptions are continually evolving.

Case 4. Management-by-results in the Finnish and Swedish road administrations

Finland and Sweden have used the management-by-results approach for more than 15 years. Previously called management-by-objectives, the emphasis on end-results became more important some ten years ago. Consequently, targets have been set for end-results and outcomes (such as the condition of pavements, reduction in the number of casualties, the number of noise barriers built), rather than setting the targets for the overall functions of the administration. The Finnish experience using management-by-results can be summarised as follows:

Advantages

- Performance has become more goal-oriented.
- The commitment of managers and personnel to achieve the objectives has increased.
- Visible changes have taken place in the road transport system.
- Political guidance has improved; politicians and the Ministry of Transport are satisfied with the system and the road administration's performance.
- Discussions with customers have become an integral part of the process.

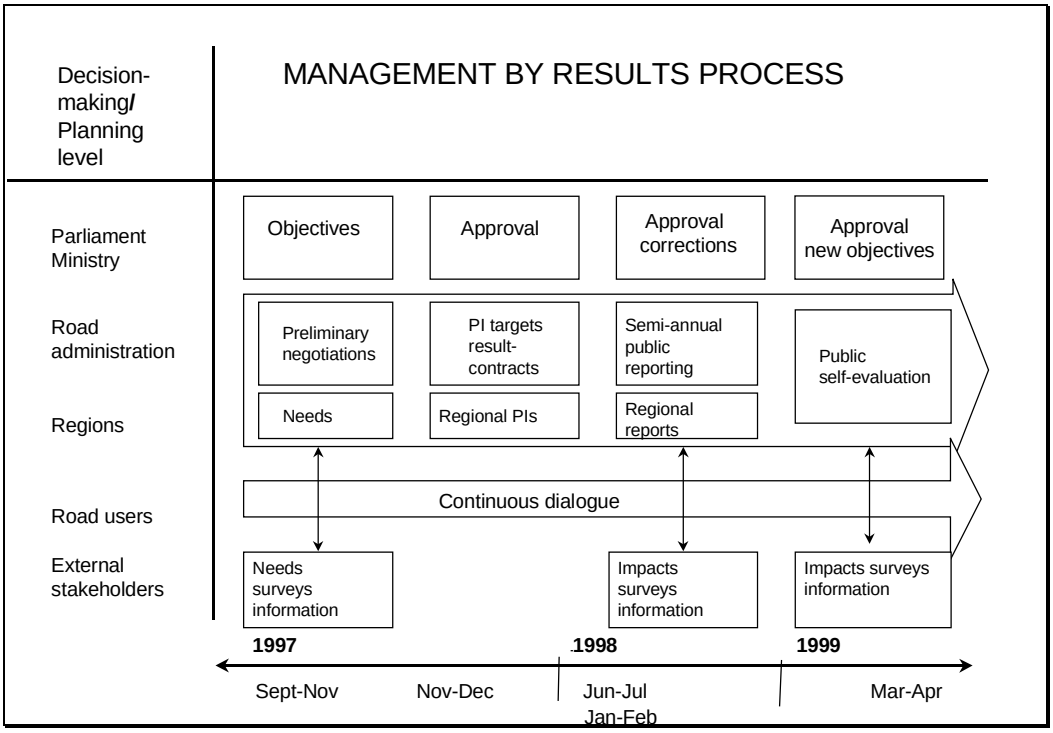
Disadvantages

- The set objectives do not cover all the functions of the administration.
- Requirements and performance levels are set by the Ministry and the administration.
- Customer needs and dialogue do not guide performance.

The process of setting and approving objectives in Finland is shown in Figure 3.3. Figure 3.4 describes a similar process in Sweden. The Swedish model is somewhat more advanced since it emphasises customer needs, long-term programmes and the objectives for the road administration. It also covers more sectoral responsibility, which helps the road administration to perform more efficiently towards achieving the set targets.

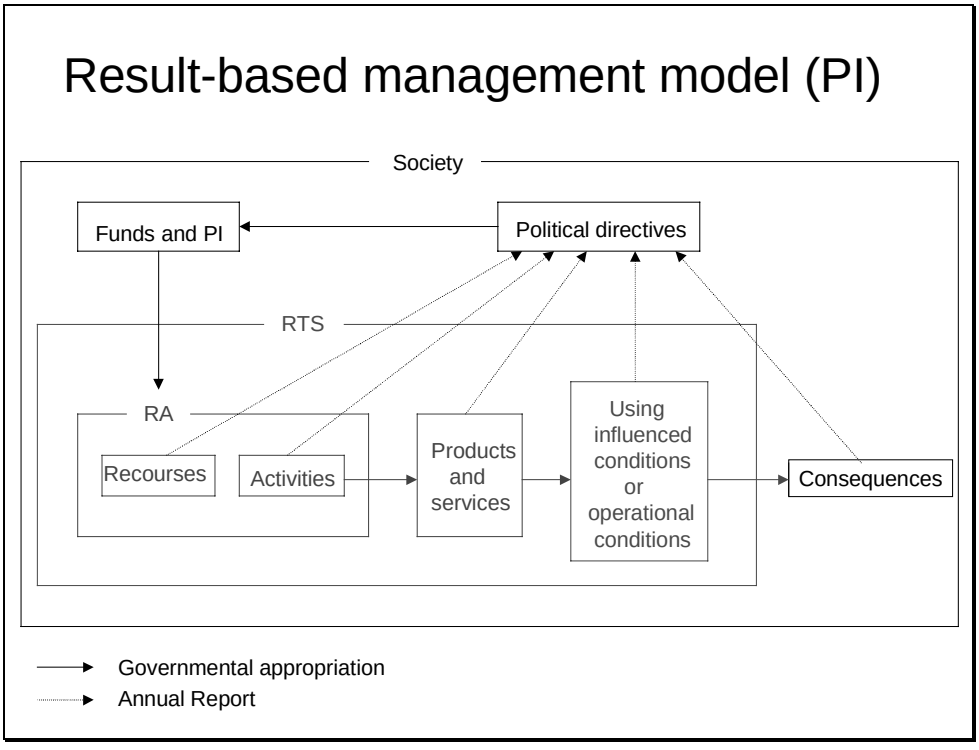
These models are useful benchmarks for road administrations interested in improving performance through the use of indicators. The Swedish long-term programmes indicator example (PI 7 in the field test report) provides an example of how the management-by-results model has been adopted at high levels of decision making.

Figure 3.3. **Management-by-results in Finland**



Source: Finnish Road Administration.

Figure 3.4. **Management-by-results in Sweden**



Source: Swedish National Road Administration.

Case 5. Performance indicators in New Zealand

The New Zealand Ministry of Transport has established a set of high-level desired outcomes for which all agencies in the transport sector are required to develop performance indicators. These target the social, economic, environmental and safety dimensions of the transport sector.

Performance indicators and the funding agencies

Transfund New Zealand, an independent agency, is responsible for allocating a dedicated road fund to the maintenance and construction of roads, and alternatives to road transport (including public passenger transport). A separate agency, the Land Transport Safety Authority is similarly responsible for the allocation of funds to road safety administration (including enforcement).

Both Transfund and the Land Transport Safety Authority are required to establish short- and long-term performance targets. Their performance is measured and audited using a set of performance indicators which track both sector outcomes. Through the indicator results, the independent boards of these agencies are held accountable for the performance of their respective agencies. Therefore, the performance indicators have a very high degree of importance in the contractual agreement between the agencies and the Government of New Zealand.

Performance indicators and Transit New Zealand

Transit New Zealand has an annual contractual agreement for the delivery of highway maintenance and capital improvement projects. While the contract includes a specific level of service and quality requirements, a framework of performance indicators has been developed to provide a tool for measuring and monitoring Transit New Zealand's overall performance. Measures have been developed to reflect products and services, but more importantly, to measure Transit New Zealand's compliance with agreed key process and system requirements, thus giving Transfund New Zealand an assurance of value for money spent.

The independent governance structures have encouraged a very high focus of attention on performance measurement, which includes:

- User exposure to smooth roads.
- User exposure to roads with good texture.
- Completion of improvements ahead of target.
- Completion of projects without exceeding contingency allowances.
- Control of overhead budgets.
- Compliance with outsourcing rules.

Over the last four years, Transit New Zealand has participated in the comparison of systems and procedures through indicator measurement with Australia in a collaborative Austroads framework.

Performance scorecards for Transit New Zealand suppliers

Through facilitated value management processes Transit New Zealand has established performance scorecards with its consultants and contractors. This new approach includes short-term

network performance measures, long-term asset life protection measures and user performance measures to report monthly on network health. Consultants and contractors responsible for maintenance are measured together so that there is a strong incentive for team behaviour to provide good service for Transit New Zealand. The performance of suppliers affects the retention of their contracts and their evaluation when they tender for future work.

Conclusion

New Zealand's experience is that performance indicators and measures are an essential feature of a governance structure of the type developed for analysis of the field work in this OECD project. The governance separation which has resulted from road reform, has encouraged clarity and simplicity in establishing helpful and effective measures for management.

Chapter 4

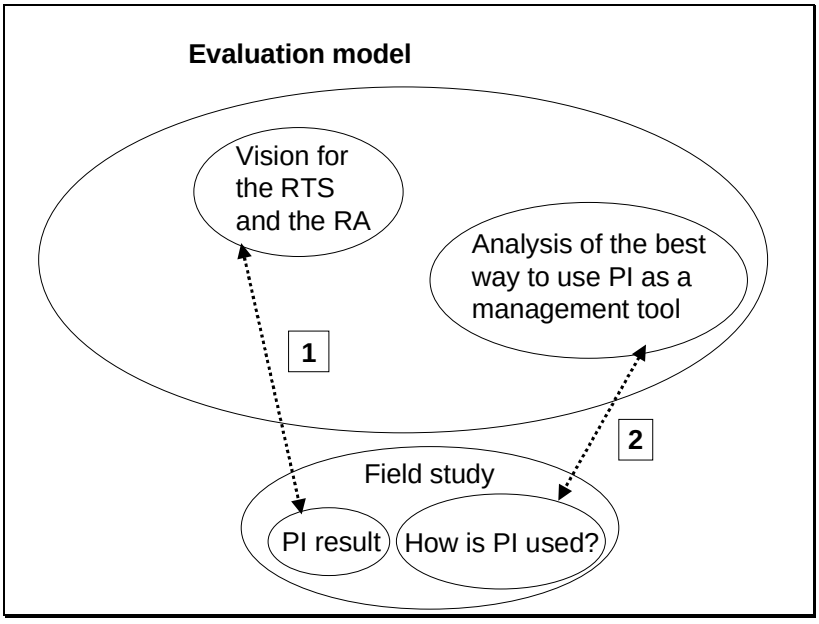
FIELD STUDY

This chapter summarises the main conclusions and recommendations for each performance indicator. The complete results of the field test can be found on the OECD Web site. Figure 4.1 shows schematically how each performance indicator was analysed:

1. The best *result* for each performance indicator is the *best value* in relation to the visions of the road transport system and the road administration described in Chapter 2.

2. Best *practice* for each performance indicator is the *best use* according to the analysis made (see Chapter 3).

Figure 4.1. **The analysis method for performance indicators**



For each indicator, the performance which was closest to the conceptual model was selected as a "superior" performance. In practice, it is not easy to recommend best practice due to the specificities of the participating countries and the complex nature of the areas being examined.

To undertake the analysis of each performance indicator, the Expert Group targeted the following objectives:

- Describe the use of performance indicators.

- Describe emerging problems and needs for change.

- Consider the use of this performance indicator in the management-by-results model.
- Consider the use of this performance indicator in benchmarking.
- Evaluate the use of process descriptions in benchmarking.
- Describe how road administrations can learn from others by using this performance indicator and possible benchmarking.
- Develop descriptions and recommendations for "best practice", if appropriate.

Table 4.1 presents the performance indicators field-tested and their respective authors.

Table 4.1. **Performance indicators used in the field test**

Number	Title	Name of person responsible	Country responsible
PI 1	Average road-user costs	Mrs. Miranda Douglas-Crane	Australia
PI 2	Level of satisfaction regarding travel time and its reliability and quality of road user information	Mr. Les Hawker	United Kingdom
PI 3	Protected road-user risk	Mr. Lars Stenborg	Sweden
PI 4	Unprotected road-user risk	Mr. Lars Stenborg	Sweden
PI 5	Environmental policy/programmes	Mr. Jens Holmboe	Denmark
PI 6	Processes in place for market research and customer feedback	Ms. Janet Blacik	AASHTO
PI 7	Long-term programmes	Mrs. Gerry Williams	United States
PI 8	Allocation of resources to road infrastructure	Mr. Rick van Barneveld	New Zealand
PI 9	Quality management/audit programme	Mr. Willi Immer	Switzerland
PI 10	Forecast values of road costs *vs.* actual costs	Mr. Masamichi Sano	Japan
PI 11	Overhead percentage	Mr. Masamichi Sano	Japan
PI 12	Value of assets	Mr. Jani Saarinen	Finland
PI 13	Roughness	Mr. Marc Lemlin	Belgium
PI 14	State of road bridges	Mr. Marc Lemlin	Belgium
PI 15	Satisfaction with road condition	Mr. Jani Saarinen	Finland

To analyse each indicator, the following questions were asked of the participating road administrations:

- *Definition of the performance indicator*: Is it essentially different from country to country?
- *Targets:* Are there targets set for the indicator?
- *Results:* Have the targets been achieved?
- *Trends:* Explain the trend and why the target was (not) achieved.

- *Best practice:* What is the recommendation as a best practice? It may also be the best trend, not only the last year's best value.

- *Use:* How is the indicator used?

PI 1 Average road user cost (car and truck)

Responding countries

Nine responses were received from Australia, Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Sweden and the United States.

Purpose

Lowering road-user costs is one of the major tasks of road administrations. Road-user costs are driven by a whole range of factors. Road agencies and governments have a major influence on road-user costs through both the road system and taxation measures such as fuel taxes, motor vehicle taxation and other related charges. Other country specific factors also affect road-user costs, such as general prices and wages and the level of transport demand.

Definition

The average cost of running a medium car, a light diesel truck and an articulated six-axle truck was estimated for both urban and rural operation. The World Bank's HDM-III model was used to calculate average vehicle operating costs. Costs were presented as fixed costs, variable costs and total costs.

- Unit: cost in USD per kilometre.

- Target value: the aim is to reduce vehicle operating costs over time.

Application in the participating countries

Road-user costs were broken down for urban and rural roads, based on six components: fuel, tyres, depreciation, interest, repairs and maintenance, and time.

The indicator values show that cost components across countries, vehicle types and road types are highly variable. As an example, the high vehicle depreciation and interest costs for six-axle articulated trucks in Sweden arise from their high purchase price and relatively low annual usage.

Table 4.2 shows how this indicator is used in different countries. The specific case of Australia is described in Box 4.1.

Table 4.2. **Use of the road-user cost indicator by country**

Country	Experience
Australia	See description in Box 4.1.
Belgium	Not used in the Walloon region.
Denmark	No response.
Finland	Used at network level to find out the optimal road condition.
Hungary	Used for comparative purposes and for strategic planning.
Japan	Used to predict the effects of five-year Road Improvement and Management Programmes.
New Zealand	Used in benefit-cost ratio analysis for prioritisation of projects.
Sweden	Used for roads with traffic volumes exceeding annual average daily traffic (AADT) 4 000.
United States	Not currently used as a performance indicator at the national level.

In many countries, road-user cost information is one of the inputs used in benefit-cost analysis to assess the economic benefits of a project and as a means of prioritising projects.

Box 4.1. **Austroads' use of the road user cost indicator**

Austroads, the association of Australasian road transport and traffic authorities, has found this indicator useful in several policy contexts. The road-user cost data provided by Austroads' user cost distance performance indicator is used for comparative purposes and for strategic planning; these data allow a comparison of transport cost competitiveness in different Australian cities and states. The indicator provides a benchmark for state road agencies to reduce road-user costs, although it is recognised that the results are affected by a wide variety of factors outside the control of the road agencies (such as costs of vehicles, wage rates, fuel prices and industry competition). Comparisons of road-user costs may be made either between jurisdictions or within jurisdictions over time.

In Australia, a large amount of effort has been devoted to reducing freight transport costs. User cost distance freight indicators (rural and urban) provide a broad indication of how the nation is performing in reducing costs in road freight transport.

Along the rural road network, VicRoads uses a model called *EVAL4* to evaluate the benefits-costs of new works. The *EVAL4* model uses road-user costs as one of its inputs. For maintenance projects, road-user cost serves as an input for assessing the economic benefit of improving road roughness.

Influence of roughness on road-user costs

The variations in road roughness that occur in most developed countries result in only small changes in estimated operating speed. To test the sensitivity of roughness as a variable, "dummy" values of the International Roughness Index (IRI) from two through to seven were inserted into the model for Australia, keeping all other factors constant. The results show that over this range, the average costs per kilometre vary by only about 5% between IRI two and IRI seven, which represents a very large change in roughness. Most of the increased costs occur once IRI exceeds five. For the range of roughness values which apply in most countries, it is reasonable to conclude that changing roughness has only a small effect on road-user costs in relation to the other factors that influence total costs.

Conclusions and recommendations

- Road agencies should continue to monitor road-user cost within their jurisdictions over the long term, so that a basis exists for monitoring changes and trends in road-user cost levels.

- Further work should be done to assess the benefits of policy changes such as increased mass limits and the introduction of new vehicle classes.

- Further work should be undertaken by road agencies to identify the reasons for differences in the cost components of road-user cost, between jurisdictions as measured by the HDM-III methodology.

- Readers are recommended to refer to the Austroads and VicRoads case studies as examples of "best practice".

PI 2 Level of satisfaction regarding travel time, reliability and quality of road-user information

Responding countries

Ten countries responded: Australia, Belgium (Walloon), Finland, Hungary, Japan, New Zealand, Portugal, Sweden, the United Kingdom and the United States (FHWA and MnDOT).

Purpose

The level of user satisfaction is a key element of accessibility, with travel time, its reliability, and the quality of road-user travel information being the appropriate measures from a road-user perspective. This information can be assembled by the road administration using travel time surveys and other "objective" methods. However, objective surveys on travel times lack information on road users' satisfaction. Information revealing the level of user satisfaction with these aspects can be collected by market surveys of road users. For maximum usefulness, the surveys must provide some means of relating the results on travel time and the reliability of travel time, with a comparison of the quality of road-user information.

Definition

The indicator which measures satisfaction with travel time and its reliability is constructed through two separate processes. First, a *system* is required that is capable of collecting sufficient actual journey time information on strategic routes or corridors for statistical analysis. This information is then compared with user expectations derived from *market surveys*. The existence of both of these processes and the number or percentage of "yes/no" answers to the market survey with supporting comments provide an indication of the level of performance. The indicator which measures satisfaction with the quality of the road-user information gathered relies on the existence of a *market survey* process to monitor customer feedback and road-user satisfaction.

Measurement process:

- Is there a system in place to collect annual journey times and a method in use to measure road-user satisfaction with these times and their reliability? (Yes/No)

- Is there a method in place to measure road-user satisfaction with the quality of road-user information? (Yes/No)

If *yes*, describe the key elements of the process.

- Unit: Number or percentage of yes/no answers.

Road-user satisfaction with regard to travel time, its reliability and the quality of road-user information will be measured on a scale from one (poor) to ten (excellent).

- Target value: Continuous annual improvement based on the "Business excellence model" principles.

Application in participating countries

Responses for this performance indicator questionnaire show that it is limited in its application. Of the 11 responses received:

- Two indicated that no processes were in place to monitor any of the elements of this performance indicator: Belgium (Walloon) and Portugal.

- Only six respondents indicated the existence of a system to measure travel times [Australia, Finland, Japan, Sweden, United States (both Minnesota State and the Federal Highway Administration)].

  - Of six responses, only two provided substantial evidence that these measures are collected regularly and utilised within the road administration (Australia and Minnesota).

  - Five indicated that the countries are only in the very early stages of developing systems to monitor road-user satisfaction [Finland, Hungary, Japan, New Zealand and the United States (FHWA)].

  - Only four of the responses indicated that a system of surveys is in place for measuring road-user satisfaction [Australia, Sweden, the United Kingdom and the United States (Minnesota State)].

In Australia, the indicators are used as benchmark indicators of satisfaction and of road system performance. Agencies continually develop strategies to improve their performance on the factors measured by these indicators.

In the Minnesota Department of Transportation, average travel time is used in association with trip distance to evaluate congestion. "Satisfaction with time it takes to travel" attempts to quantify the public's satisfaction with the portion of the transport system they use regularly for general purposes.

"Satisfaction with travel information" is used to measure the public's satisfaction with MnDOT's level of service.

The "Travel time" element

Judging by the questionnaire responses, it is clear that the measurement of travel time is not a particularly widespread practice and in few cases is this information collected regularly and utilised by the road authority.

The responses indicate that there are two methods for measuring travel time: either by direct measurement using a variety of technological "on-road" systems or by obtaining the information through road-user surveys on travel time.

Box 4.2. **Measuring travel time: the experience of Australia**

The use of technological "on-road" systems has been put into practice most effectively in Australia. Travel time is measured directly from the road system and used by the road authority to provide justification for roadwork improvements and investment levels, as well as providing the foundation for target setting. This system appears to work effectively, providing a direct link between physical road conditions and any subsequent measures taken to improve travel time.

However, there are a few limitations to this method. Although the method would seem to work effectively on representative routes in metropolitan areas, it is unclear whether it would be equally effective outside metropolitan areas where it would be more difficult to select representative routes. The current system costs USD 160 000, but this amount could increase significantly if the survey were to be extended to non-metropolitan routes. Comments received from the United States (FHWA) indicate that the cost of collecting travel time, on their network, for a representative sample of highways would be very expensive. Results would be unlikely to change significantly from year to year. The benefits of collecting data would therefore be outweighed by the cost.

The analysis revealed several reasons for the lack of systems for the measurement of travel time. It is difficult to provide a cost-effective method for measuring travel time through "on-road" systems, although the Australian case example provides a good starting point. The other problem stems from the road-user measurement method. Lack of reliable and accurate data, together with the non-specific nature of the data, create obstacles to effective application of this method to the road system.

The "Satisfaction with travel time" element

Despite the fact that user satisfaction measures are more widespread than the measurement of travel time, the measurement of road-user satisfaction with travel time appears to be missing from most road-user satisfaction surveys. Of the responses received to the questionnaire, only two (Australia and MnDOT) identified a system in place to measure road-user satisfaction with travel time. The methodology, processing and utilisation of user satisfaction surveys are discussed in the following section.

None of the responses indicate any direct relationship between the "Travel time" element and the "Satisfaction with travel time" element, and only the Minnesota Department of Transportation indicated that this might be done in the future.

Satisfaction with the quality of road-user information

In most cases, taken in isolation, the measurement of satisfaction with the quality of road-user information provides little useful information for targeting strategy. However, the Minnesota response provides useful additional information by identifying three types of road-user information (winter

driving, construction/maintenance and congestion/crashes), thus enabling the road authority to identify which types of information are best received.

Australia and the United Kingdom use road-user satisfaction factors. This would appear to be a useful tool for identifying priorities from the point of view of the road user and allowing targeted improvements. A combination of these two strategies would provide a better method for measuring this element of the indicator; it would identify the cause of any dissatisfaction and allow prioritisation in these areas.

Conclusions and recommendations

- The elements that contribute to this indicator are, in the majority of cases, in the relatively early stages of development. Even countries with greater experience in this field are still in the learning process. Nevertheless, elements of "good practice" include the Australian measurement of travel time, the United Kingdom methodology for road-user satisfaction surveys, the Minnesota "Satisfaction with travel information" measure, and the Australian and United Kingdom prioritisation of road-user satisfaction factors.

- The "Travel time" element is probably measured most effectively in Australia, where "on-road" technological systems are used to measure travel time on the metropolitan network and provide justification for strategy. However, it would be too costly to implement these systems on a network-wide basis and therefore they cannot be recommended as a "best practice" for all road authorities. Road-user surveys, as practised in Minnesota, are cheaper to implement for travel time measurement, although the data gathered do not have the same reliability as those collected using "on-road" systems.

- At present, the "Satisfaction with the quality of information provided" element fails to provide sufficient detailed information to set benchmarks and implement an improvement strategy. The Minnesota methodology goes someway towards this target by separating the types of information into three groups, but the use of the data within this authority appears to be limited.

- For this indicator to work effectively and provide reliable data for the targeting of policy and strategy, the authority must be able to measure and compare the level of road-user satisfaction with a known travel time. The Minnesota response indicated a plan to measure user satisfaction related to travel time. It is therefore recommended that future work should follow the development of this type of measure and monitor its impact on future strategy and performance.

- In summary, this performance indicator could become a useful tool in measuring the performance of a road authority from the road users' perspective. Where a road authority is able to "optimise" the journey time on its network and where road user satisfaction is high, one can assume that the road authority is performing to a high standard. However, with its current limited application, it would be premature to recommend this performance indicator whole-heartedly. Further investigation of the current methods in use and a longer-term study of whether these can lead to improvements for the road system and the road user are needed before any genuine recommendations can be made.

- Readers are recommended to refer to the Australia, United Kingdom and Minnesota cases as good examples (available on the OECD Web site).

PI 3 and PI 4 Protected and unprotected road-user risk

Responding countries

Basic data is available from all participating countries. Refer to the Web site for case examples from Australia, Denmark, Hungary, Japan, Sweden, the United Kingdom and the United States.

Purpose

Road safety is a high priority in all countries. Crash indicators form the basis of road safety programmes, permit benchmarking (both over time and across countries) and are used for evaluation. Crash data has been collected for many years in all OECD countries as a basis for improving road safety. The International Road Traffic and Accident Database (IRTAD) was set up to provide internationally comparable data as a research tool for institutes and countries active in the road safety field.

Definition

Protected road users are drivers and vehicle passengers. Unprotected road users (also called vulnerable road users) include pedestrians, motorcyclists and cyclists.

Road traffic fatality risks are calculated by dividing the annual number of fatalities by an exposure measure such as vehicle kilometres, number of registered motor vehicles or number of inhabitants. For the purposes of these field tests, two measures of road risk were examined:

- Fatal risk from a road traffic perspective is defined as the number of annual fatalities divided by the number of cars on the road:

$$\text{Fatality risk (road traffic perspective)} = \frac{\text{Annual fatalities}}{\text{Registered vehicles}}$$

- Fatal risk from a health perspective is defined as the number of annual fatalities divided by the number of inhabitants:

$$\text{Fatality risk (health perspective)} = \frac{\text{Annual fatalities}}{\text{Population}}$$

Application in responding countries

The choice of exposure data can lead to a distortion in the road safety picture. Population data are usually reliable and readily available; nevertheless, they are not necessarily the most appropriate data to use. In particular, population data are unsuitable for use in developing countries with low levels of motorisation. This is because using this exposure measure may lead to their safety records comparing well with the safest developed country whereas a very different picture emerges when vehicle-kilometres travelled, or number of vehicles registered are used as the exposure measure. However, population data can serve as a a good indictor of “health risk” for national use and do provide information on the safety of the road transport system compared to other sectors.

The indicators used in this field test provide an overview of the situation and trends. Comparisons can be made with other countries and serve as an incentive to develop a safety culture and implement

more rigorous safety programmes. Although the trend in most countries has been towards a reduction in fatalities over the last 30 years, there are clear differences in the performance across OECD countries. It is important to note that improvements have slowed in recent years, in recognition of the fact that it is more difficult to decrease risk in a low-risk situation than in a high-risk situation.

Nevertheless, the two indicators used in the field test are too general to be useful in developing specific safety measures or evaluating existing programmes. There are too many variables that affect the safety risk for general "catch all" indicators to be used in changing the safety management in a road administration. Specific measures are more useful in this regard.

Countries can learn a lot from the successes of other countries in tackling road crashes. Case examples on successful risk treatment from Sweden, Denmark and the United Kingdom can be found on the Web.

Conclusions and recommendations

- To provide efficient evaluation tools for management, performance indicators should be closely related to the products and services being measured. Fatality risk is not a suitable indicator for measuring the road safety performance of a road administration. More specific data are required for the development and implementation of effective road safety programmes and their evaluation.

- Specific indicators include average speed for different road types, number of drunk drivers, crash risks for new/young drivers, seat-belt use.

- The experiences of the United Kingdom, the Netherlands and Sweden can be considered as good examples.

PI 5 Environmental policy/programme (yes/no)

Responding countries

Eleven countries responded: Australia, Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Portugal, Sweden, the United Kingdom and the state of Minnesota in the United States.

Purpose of the field test

The objectives of this indicator were to establish whether participating road administrations have an environmental policy/programme covering all or some of the administration's activities. The indicator also aims to determine which of the following characteristics are contained in the policy/programme:

- Identification of aspects which can be controlled or influenced.

- Commitment to comply with applicable laws and continual improvements.

- Availability of the policy to the public.

- Existence of targets (preferably measurable) for improvements.

- Time frame(s) for the achievement of targets.
- Intervals for review of policy and programmes.
- Establishment of environmental management systems, such as ISO 14001.
- External audit of the management system.
- Adequate funds for the programmes.

Definition

The performance indicator *environmental policy/programmes*, has been defined as a "yes/no" indicator; that is, either the road administration has an environmental policy/programme or it does not. However, for practical use, more details are required. A questionnaire based on the ISO 14001 standard was therefore developed to examine the content of environmental policies/programmes.

Application in participating countries

All responding countries have embarked on measures to alleviate the undesired environmental impacts of road transport systems. Such environmental measures range from the establishment of the necessary legal framework for regulations and standards, to setting operational targets for planning, construction, operation and maintenance of roads. Several countries have now started the process of establishing environmental management systems. However, not all of the above characteristics are included in the environmental policies/programmes. This is especially the case for environmental management systems and external audits.

The responses showed that this indicator – as defined in the field test – is not commonly used. The indicator serves only to indicate whether road agencies have started to establish environmental management systems; it does not show the concrete targets a road administration may have set for the environment. However, overall, the responses indicate that there has been much improvement in recent years in the fields of environmental policy and regulation. In general, activities have focused: *i)* on the establishment of frameworks for environmental management (and especially on legislation and regulations); and *ii)* on target setting, standards and management procedures for road planning, construction, operation and maintenance.

Recommendations

- Road administrations should implement policies and programmes aimed at achieving wider environmental objectives. The policy/programmes should contain the characteristics described in the ISO 14001 standard.
- This indicator mainly shows whether environmental activities have been initiated and, to a lesser extent, how much progress has bee made compared to the characteristics outlined in the indicator definition. As defined, the indicator does not provide any information on the administration's concrete environmental targets.

- More accurate – and preferably measurable – indicators need to be developed for a results-oriented and systematic approach. Preferably, these indicators should be verified at regular intervals.

- Australia, Sweden and the United Kingdom can be used as the basis for good practices.

PI 6 Processes in place for market research and customer feedback (yes/no)

Responding countries

Australia, Belgium, Finland, Hungary, Japan, Minnesota, New Zealand, Portugal, the United Kingdom and the United States (Federal Highway Administration and the state of Minnesota).

Purpose

Historically, the planning and delivery of road infrastructure and related services was exclusively the domain of the road administration. However, customer focus and participation have become increasingly important to most road administrations.

Definition

The performance indicator *processes in place for market research and customer feedback*, was defined as a "yes/no" indicator; that is, either the road administration has these processes in place or it does not. The indicator covers two areas.

First, a questionnaire was developed to examine the processes in place for obtaining data from customers. This was a series of "yes/no" questions accompanied by a request for comments regarding the type, extent and success of the market research being conducted. Best practice was defined as the existence and success of an operational market research function, measured by the "yes/no" answers and supporting comments.

For the second part of this indicator, an index of customer satisfaction was developed. This could be applied in each country and a trend line of reported satisfaction over time could be traced. The index consists of a numerical value assigned to the responses to the ten-twelve questions customers were asked concerning their level of satisfaction with various components of the road system. Best practice is based on a high level of satisfaction (represented by a high index number) and a positive trend line.

Application in participating countries

Most countries are at the learning stage regarding market research, the data it provides and the usefulness of that data for better decision making. Australia and Minnesota have cited cases where customer data have been used for further analysis, resulting in either improved services or in some cases, reduced emphasis on certain services. All countries that have used market research data agree that the exercise made them more customer-focused and led to better communications with customers. This, in turn, has led to an improvement in the public perception of the road administration and its services.

Even in administrations with staff dedicated to market research, consulting firms are hired to design surveys and methods, gather data and perform the analysis. Internal staff are often dedicated to planning, priority setting, managing the process and reporting results to managers for action. The responses indicated that this process serves them well.

In Minnesota, much of the market research has focused on the concept of "level of service". Customers are not questioned about desired services from the department, but rather are asked how they would prioritise services. The results have led the maintenance operations to spend a larger portion of their budget on pavement markings, which the public considered very important, and to cut back on some aesthetic services such as roadside mowing and planting, which were of low priority for the public.

In general, market research appears to provide a valuable new tool for road authorities and the use of market research data is growing.

Road administrations are finding that they have to become competitive in order to be successful and achieve their objectives. This means focusing on cost, quality and timeliness of services, while reflecting customer needs and wishes. Typically, in the past, road administrations assumed that they knew what customers needed. Using the concept of quality management, administrations are beginning to survey their customers and are discovering that at times they have guessed their needs incorrectly. The value of market research is starting to show benefits.

Conclusions and recommendations

- Road administrations should continue to use market research as a planning and feedback mechanism.

- More work should be done on this indicator to track the results of market research data and in particular to verify whether the results make a difference.

- When using market research, road administrations should be careful to balance expressed customer needs with other development factors such as cost and overall system improvements. Surveys should be phrased in such a way as to make the customers prioritise needs, keeping cost as a factor. This is called a "level of service" decision.

- The use of market research data is in its early stages. Administrations seeking to pursue a market research activity should use the Minnesota case study as a template. Australia, Finland and the United Kingdom also provide some useful examples.

PI 7 Long-term programmes for construction, maintenance and operations (yes/no)

Responding countries

Australia (six states), Belgium (Walloon region), Finland, Japan (national and three local governments), New Zealand, Portugal, Sweden, the United Kingdom and the United States (Minnesota).

Purpose

A long-term programme for road development can assist governments to become more effective in achieving desirable social objectives and help road administrations to deliver services efficiently. This indicator examines how effective long-term programmes are in meeting these objectives and gives a fair and comprehensive portrayal of user perceptions regarding the road programme.

Definition

The indicator was defined as a "yes/no" indicator, *i.e.* "either a long-term road programme exists or it does not." In addition, the questionnaire was developed to examine the detailed characteristics of long-term plans.

This indicator measures whether the long-term programme is: *i)* based on trade-off analysis among new construction, maintenance and operations of the road system; and *ii)* allocates available resources at the system level among these alternative strategies for achieving the goals for the system. This type of programme may be referred to as a strategic plan for the road system.

Applications in the participating countries

All respondents indicated that they had a long-term programme for the road system. The frequency of programme revisions ranges from annually to up to 40 years. On average, programmes have a planning horizon of five to ten years; that is, although they may be updated annually, they cover the next five to ten years. Several respondents update their plans every four to five years.

A wide variety of methods are used to evaluate programme options including multivariate analysis, impact analysis, major investment studies, benefit cost analysis, strategic analysis and economic modelling. Most programmes are approved either by the government or by the funding entity.

Most countries involve the public in preparing the programme and have processes in place for monitoring implementation of the programme.

It was difficult to ascertain whether the wider objectives expected from the long-term programmes were achieved. Although performance is tracked in most cases using indicators, quantifiable goals are not set for long-term programmes.

A wide range of parameters (performance indicators) were monitored to track the implementation of the long-term programme. These include: level of service, pavement roughness, design speed, weight and width restrictions, number and cost of crashes, consistency of speed environment, fatality and injury accidents per vehicle kilometre, the number of fatalities and injuries, the length of roads open annually to the public, travel time, costs, rutting, bearing capacity, level of winter maintenance and the number of bridges.

Most responses regarding how the programme was used indicated that it had helped to achieve better outcomes or results. The use of long-term programmes to obtain additional funding or a multi-year commitment of funds varied.

Conclusions and recommendations

Road administrations consider long-term programmes as a useful management tool which can help the organisation to achieve its goal. There also appears to be a consensus that the public should be involved in programme development and the results of implementation should be monitored. However, there is less consensus on what should be included in the programme and on the frequency of updates.

- The existence of a long-term programme should be considered an indicator of a well-managed organisation. The involvement of the public in its development and the identification of specific, measurable performance objectives in the programme should be considered "best practices" for a long-term programme.

- The objectives for any road administration would be to obtain approval for the multi-year programme from the highest political level, *e.g.* the government.

- Implementation of the long-term programme should include objectives and performance indicators that reflect public opinion and customer needs; achievements should be annually monitored.

- There should be more transparency in developing the long-term programmes, including in terms of setting of objectives, estimation of costs, estimation of impacts, and evaluation and reporting of programme implementation.

- The Swedish case is recommended as good practice.

PI 8 Allocation of resources to road infrastructure (yes/no)

Responding countries

Australia (six states), Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Portugal, Sweden, the United Kingdom and the United States (Minnesota).

Purpose

Resource allocation has become an important task for road administrations. With ageing networks, maintenance and rehabilitation have become increasingly important and now compete for funds with new constructions. In addition, stringent regulations (such as for safety and the environment) have also to be taken into account. Coupled with pressures to reduce public spending, countries have been forced to develop systematic processes for resource allocation.

Definition

Resource allocation was defined as a "yes/no" indicator. It evaluates the existence of a standard and robust system, covering the following broad issues related to resource allocation:

- Existence of management systems.

- Big-picture planning framework (long-term strategy plans/programmes).

- Project-level allocation issues.
- Safety, social and environmental issues.
- Asset management plans and techniques.
- Processes for application of strategies and asset management plans (annual plan/programme).
- Accountability and transparency issues.

Participating countries were surveyed to examine the coverage of these issues in road administrations and in road management.

Application in the participating countries

The responses to the questionnaire and the case examples show that:

- There are some systems, procedures and processes, practised by all respondents.
- Many respondents consider that their systems, procedures and processes on specific issues relating to allocation of resources are not sufficiently robust.
- The responses are unclear as to how the long-term strategy plans are translated to resource allocations through the management processes.
- Allocation processes are often based on "traditional" rationale such as engineering experience, technical arguments, identified needs and historical expenditure information.
- Some road administrations rely on "user costs" based on road conditions for maintenance allocations; and return on investment or economic assessment (benefit-cost ratio, etc.) for capital project allocations.
- Some road administrations use other factors (such as use of multi-criteria evaluation for project approval and ranking) for deciding allocations to capital projects.
- In many cases, budget decisions are political. Sometimes analytical tools are used to support political decision making.
- Ideally, in a "best practice" situation, road administrations should have in place systems, procedures and processes that address all of the issues related to resource allocation for road infrastructure. These systems and procedures should cover the following issues:

Management systems

- Strategic planning.
- Asset management planning.
- Developing annual and forward plans/programmes.

- Monitoring of plan/programme implementation.
- Review of plans/programmes.
- Auditing.

Big-picture planning framework

- Strategic plans for medium- to long-term perspective.
- Asset management plans for short- to medium-term perspective.
- Pre-determined ratios or formulas for dividing available funds between road infrastructure maintenance and improvement and accessibility or mobility (passenger transport, etc.) projects/programmes, in order to compliment integrated transport plans and systems.
- Criteria for pre-determining the share of available funds for accessibility or mobility.
- Policies for balanced funding between maintenance and capital improvement of road infrastructure.
- Economic assessment of capital improvement and periodic maintenance of road infrastructure.
- Separate programmes for capital improvement and maintenance.

Project-level allocation

- Standard project evaluation manual or guideline for economic assessment and analysis.
- Economic assessment at multiple phases.
- Prioritisation and ranking systems.
- Independent or third-party auditor review of economic assessments, risk susceptibility and priority ranking.
- Forward programmes based on economic evaluation.

Safety, social and environmental issues

- Auditing to ensure that projects meet road safety requirements.
- Assessment of significant projects in terms of alternative transportation mode and integrated transport plans.
- Assessment of significant projects for environmental effects and impacts; ensuring that such impacts are either mitigated or addressed.

Asset management plans and techniques

- Forward maintenance programme on the basis of a strategic plans or long-term asset management plans.
- Asset management systems, which comprises:
  - Road condition data and information.
  - Recorded historical maintenance activities and cost data.
  - Analysis routines for maintenance option selection.
  - Techniques for economic prioritisation of maintenance intervention strategies and options.
  - Fund distribution optimisation techniques.

Process for application of asset management plans and techniques

- Separate annual expenditure plans for maintenance and capital improvements within long-term strategic plans and asset management plans, using the management systems.
- Separate annual maintenance expenditure plans for pavements, bridges, traffic facilities and services, drainage, land and property and other activities, to enable prioritisation within each asset type.

Accountability issues

- Systems for periodic review of annual expenditure plans and transparent reporting.
- Systems for measuring performance of road administration and road network, and reporting.
- Annual report reflecting resource allocations and achievements.

Conclusions and recommendations

- There are significant opportunities for improving resource allocation systems and procedures in road administrations. Examples of systems and procedures are available to stimulate this process.
- Road administrations need to exchange and share information, knowledge and experience to better understand and identify issues and areas, where the improvement of systems and procedures is opportune for their particular circumstances.
- Road administrations should consider assessing the standard and robustness of their systems, procedures and processes against the “best practice” concepts developed in this project.
- The reader is recommended to refer to the experiences of Finland, New Zealand and the United Kingdom as good practice.

PI 9 Quality management audit programme (yes/no)

Responding countries

Australia (seven answers), Belgium (Walloon), Finland, Hungary, New Zealand, Sweden, Switzerland (nine answers).

Purpose

The purpose of this indicator is to improve the internal processes of management of a road administration by focusing on outputs and outcomes through a client-based approach.

Definition

This indicator has been defined as a "yes/no" indicator. The fundamental questions are:

- Has your organisation already implemented a quality management system?
- If not, does your organisation plan to set up a quality management system?

In addition, country experiences on the implementation and use of the quality management systems were collected.

The objectives of the field test on quality management/audit programmes was to establish whether the participating road administrations have a quality management system covering all or some of the administrations' activities. In addition, case studies were requested to assist those road administrations that have made less progress in the field of quality management.

The detailed report on the Web site provides descriptions for the most commonly used quality management standards, such as International Standards in the ISO 9000 family, Malcolm Baldrige National Quality Award (MBA), and the European Foundation for Quality Management (EFQM) Excellence Model.

Application in the participating countries

Sixteen of the 21 respondents indicated that quality management systems had been implemented: all seven Australian state road administrations, seven Swiss canton road offices, and the Hungarian and Swedish road administrations. The remaining five respondents are also planning to set up quality management systems.

All of the respondents refer to ISO 9000, mostly to ISO 9001. The Finnish concept is similar to Committee Draft two of ISO 9004:2000. In addition, the Total Quality Management (TQM) model and the Australian Quality Council (AQC) business excellence awards' criteria are mentioned. VicRoads (Victoria) has a certification of all its operations and business functions to ISO 9001 or 9002. VicRoads also has an overall Corporate Certification of its Corporate Quality System to ISO 9001. Seven Swiss canton road offices are certified according to the ISO 9001 model and a further two road offices plan to obtain certification in 1999.

Only one of the respondents (VicRoads) did not experience any major problems in setting up its quality management system. One of VicRoads' strengths was strong senior management commitment

with regular reporting and monitoring of progress and its approach to giving middle management support. The other respondents (apart from Belgium, which did not provide this information) all experienced various problems. The main difficulty appears to arise from a lack of understanding and commitment by top and middle management. This has resulted in passive opposition and poor motivation in the organisation.

The most important experiences are as follows:

- Top management commitment is crucial to success: personal involvement and analysis creates understanding, understanding creates acceptance and interest, and interest creates commitment.

- Implementation of a quality management system means a profound change in the culture of the organisation.

- Implementation takes time.

- It is necessary to inform and involve personnel at every level.

- More robust business procedures are extremely valuable.

- Total Quality Management programmes help.

Experiences vary according to the approach applied in the organisations and are dependent on the time period used to set up the quality management system.

Accurate information on the costs of setting-up and maintaining quality management systems is difficult to establish. The Swiss respondents provide the most exact information. However, it is evident that the external costs are minimal (5-20%) compared with the internal costs (80-95%).

In addition, the following experiences are worthy of note:

- Improved awareness of the “essence” of the organisation, improved leadership and management, improved strategic and annual planning, improved performance.

- Improved customer orientation (increased effectiveness), continuous improvement of key processes (increased efficiency), improved personnel commitment and well-being and improved orientation of the whole organisation.

- Recognition by and alignment with key suppliers.

- Consistency and uniformity of service.

- Information regarding work is collected and presented in a transparent way.

- Efficient management tool.

- Consistent approach to construction processes, with the contractor taking responsibility for the product.

The conclusion from the responses might be that those with experience of quality management systems are convinced of its benefits. However, there are also a number of disadvantages:

- The system demands a great deal of documentation, resulting in extra work.

- The system leads to a continuous focus on third-party certification rather than on business improvement.

- Quality management systems can become self-fulfilling and hinder business.

Conclusions and recommendations

- Quality management systems should be adopted as a means to develop the performance of road administrations. The establishment of such systems requires a major commitment from the organisation, although the effort is worthwhile. The complexity of the quality management system should be carefully examined.

- Road administration structures and roles range from one end of the spectrum, where the funding agency is separated from road management and the supply of services is outsourced, to fully integrated road agencies at the other end. The results of the field test suggest that the certification of the quality management system is motivated in business functions, whether internal or external. In more traditional functions the benefits are largely perceived as internal, and less focused on external relationships. The road administration's most important customer – the road user – does not ask for the certificate. (On the other hand, the road administration does not need to assure the customer of its capability to manage the roads. The road user inspects it daily.) Therefore, the certification is less motivated. However, as a challenging objective for management and personnel, certification might be justified.

- In the past, use of the ISO 9001 standard as a basis for quality system certification schemes tended to focus attention on the external quality assurance aspects. The new ISO 9004:2000 and ISO 9001:2000 standards are more applicable than the existing versions (according to the Finnish experience). They encourage the adoption of the process approach for the management of the organisation and its processes, and as a means of readily identifying and managing opportunities for improvement. In addition, ISO 9004:2000 gives guidance on all aspects of a quality management system to improve an organisations' overall performance, while ISO 9001:2000 addresses the quality management system requirements for an organisation to demonstrate its capability to meet customer requirements. Therefore, for the quality management of a road administration, it is preferable to adopt ISO 9004:2000.

- In many cases, the setting up of a quality management system can be viewed as an organisation's first step towards enhancing its performance. The next step is often a self-evaluation based on criteria such as the Malcolm Baldrige National Quality Award, the European Foundation for Quality Management Excellence Model (or their national applications), and the start of more comprehensive development work according to the principals of the Total Quality Management model.

- The PI 9 Quality Management/Audit Programme, as defined in the field test, is a good originator/initiator of the road administration's management and outlines the overall situation in different countries. However, it does not detail the actual situation, *i.e.* the real

performance of the road administration. In order to -provide more information on this issue, the indicator needs further development.

- The reader is recommended to refer to the VicRoads and UK cases as examples of good practice.

PI 10 Forecast values of road costs vs. actual costs

Responding countries

Responses on exact values for this indicator were received from only six countries: Japan, Belgium, New Zealand, Australia, Sweden and the United Kingdom.

Purpose

In many instances, final costs have exceeded the initially projected costs. Since large cost overruns cast a shadow on the road administration, this performance indicator is important and can serve as a useful benchmark for improving cost estimation methods or modifying decision-making processes (for example, to allow for reconsideration of project objectives and content at a late stage). Changes in actual costs originate from both external and internal factors and can have a negative influence on the project. If changes are recognised in time, they can be avoided or used in a positive way.

Definition

A direct comparison of forecast and actual costs provides no information regarding the underlying reasons for the difference. It is more interesting to analyse how administrations monitor costs and how this information is used in project management. Administrations were therefore surveyed regarding their practices.

Application in OECD countries

This indicator can serve as:

- An indicator for road administrations' managing ability in operational schedule and cost management.

- An indicator for improving administrations' ability to adjust project objectives and contents at final stages.

Cost overruns may occur for several reasons: the initial engineering estimates may have been undertaken during a period of low prices; new laws affecting tighter environmental measures may have been introduced during the construction phase; political preferences may affect cost estimates in the implementation of the project; increases in types and quantity of work or possible additions to the original project may occur.

Difficulties identified during the field test include:

- Collection of appropriate data (many countries do not monitor and collect this type of data).

- Cost forecasts often give high and low values, making initial benchmarks difficult to establish, particularly where the extent of the project has evolved.

- The findings are only available after the project has finished and hence are only useful in improving processes for future projects; they cannot influence the outcome of the current project.

- This indicator is not easily defined for international comparison and therefore is of limited usefulness in this context.

Conclusions and recommendations

- Although the establishment of benchmarks and international comparisons was not possible, it is recommended that each road administration should emphasise the reduction of project cost overruns. Administrations should strive to render the implementation of road projects more efficient. This indicator provides the key to monitoring overruns and can be used as the basis for improving the planning process to better anticipate variations in project implementation.

- Road administrations should use this indicator, although it does require further analysis. It is necessary to collect more chronological and accurate data; to check the results annually together with a reviewing process for the next-year management; and to monitor and evaluate project objectives on a regular basis.

- It is not possible to recommend a "best practice" from the participating countries for this indicator. However, for successive calculation and to decrease uncertainty in relation to road costs, the reader is recommended to study the case examples from the United Kingdom, Denmark and Japan.

PI 11 Overhead percentage

Responding countries

Responses were received from eight countries and regions: Japan, Hungary, Finland, Portugal, Belgium (Walloon region), New Zealand, the United Kingdom and Sweden.

Purpose

This indicator provides a measure of the cost effectiveness of an administration in delivering and maintaining the road sector.

Definition

Overhead costs were defined as the administrative (fixed) costs of a road administration. In other words, overhead is the balance obtained after deducting actual road costs from total costs (annual expenditure) of a road administration, where actual road costs include:

- Civil works cost.
- Auxiliary work cost (relocations of services such as gas, electricity, water supply, etc.).
- Consulting service cost.
- Land acquisition cost.
- Compensation cost.
- Maintenance cost.

$$\text{Overhead percentage} = \frac{\text{administrative costs}}{\text{total costs}} \times 100$$

Application in participating countries

The responses should be divided into two groups. On the one hand, in road administrations that leave most or all of the project implementation to the private sector (such as the United Kingdom and New Zealand), the overhead cost is low, in the range of 3-4%. On the other hand, where road administrations are partly in charge of the implementation of road projects (such as Japan), it is higher, of the order of 7-8%. This is very much related to the discussion in Chapter 3, sections *Vision for the road administration* and *Case 1: General road administration organisation reform.*

It is important to recognise these differences when evaluating the results of this indicator. International comparisons using this indicator should take account of the level of involvement in the implementation of programmes. It is also advisable to evaluate the historical trend over time in a single country only. The objective should be a declining overhead percentage regardless of the phase at which the administration might be in the overall organisational reform.

Conclusions and recommendations

- This indicator is useful in evaluating the cost-effectiveness of the road administration. In addition, international comparisons can be made if the same basis of comparison is used to establish the appropriate relative performance. The definition of components comprising this indicator requires further consideration.

- Each road administration is recommended to evaluate their trends of overhead percentage within their country. The objective should be to continuously lower the overhead percentage in order to improve the effectiveness and overall performance of the road administration.

- It is difficult to select a "best practice" among participating countries. However, the reader is recommended to study more closely examples from New Zealand and Japan, one for each type of benchmark.

PI 12 Value of assets

Responding countries

Australia (New South Wales, South Australia, Queensland, Tasmania, Victoria and Western Australia), Belgium (Walloon region), Finland, Hungary, Japan (Hokkaido D.B., Kochi Prefecture and Yokohama City), New Zealand, Portugal, the United Kingdom and the United States (FHWA and MnDoT).

Purpose

The indicator provides a measure of the net economic value of road infrastructure, but may also include the economic value of other assets which include the road administration as an organisation.

Definition

Asset values may be determined in many ways. For example, it can be described as a single value for the whole sector, or each element can be determined separately. Typical assets include engineering structures (such as roads and bridges), buildings and machinery, financial assets (such as capital stock and liquid assets). Extensively determined, assets could include items such as human resources. The assets included will depend on the organisation (national, state, local, etc.).

Assets are determined by balancing depreciation against maintenance expenditure. However, there is no international evidence to suggest that the annual maintenance expenditure of the road administration should equal the annual depreciation of the value of assets of the road network.

A time series of asset values would help road administrations to track their performance. It is also important that individual indicators are seen within the context of a larger set of indicators and the background information or indicators, such as financing or annual cost of road management. They have a wide range of uses for analysts concerned with road agency performance and other policy issues, including the contributions of the road sector to the economic performance of the nation.

Applications in the participating countries

Responses to the questionnaire have highlighted the following:

- Value of assets is not yet in use in Japan, Portugal or Minnesota State (United States).
- All respondents determined asset values from a technical point of view as an infrastructure or group of different engineering structures. However, classification or distribution of the elements of the infrastructure is country specific and varies widely.
- Assets may be estimated according to written down values, replacement values, gross values and net values. They are not comparable values.
- Actual value of assets is closely connected to the performance of the road network, the type of roads and their classification.
- The procedures for including parameters (such as depreciation, residual life, etc.) and estimating their values are country specific.
- In some cases, the asset value is based on costs of the investments or expenditures, in others it is based on the present condition of the roads.
- Approximately half of the respondents are able to calculate the asset value for physical road sections.
- Most countries provide balance sheets where the value of assets is included, but only a few countries use the asset value for strategic planning or for planning.
- Historical data is available for only a few countries.
- There is no target value for assets.
- Data collection is based on reported costs or measured condition.

The asset value indicator is most commonly used in annual reporting and financial statements, monitoring performance (New Zealand), measuring the level of investments (Belgium, Finland), and also for strategic planning, resource allocation and road management (Australia, Denmark, Finland, Hungary). For these purposes, definitions of the asset, investments and the valuation parameters are essential. While many road administrations use asset values in their work, the valuation does not seem to have any real connection to road management.

Based on this field test, “best practice” is the existence and use of a method for asset valuation, including the following issues:

- Definition of an asset, including determined engineering structures or elements of the road network.
- Definition of the parameters for valuation and their data requirements.
- Definition of road investments.

- Existence of a standard procedure or a system for calculating the asset, depreciation and investments.

- Utilisation of the indicator for balance sheets and for financial statements or programme performance.

- Utilisation of the indicator for strategic planning, resource allocation, etc.

- Existence of an accounting system to provide yearly expenditures and balance sheets.

Conclusions and recommendations

The value of the road asset, as a trend, has been found to be a most useful indicator and is the best summary description of the long-term performance of the road programme. It is useful to calculate the asset value separately for its different elements and engineering structures. The indicator is country specific, but inter-regional (state) comparisons are possible.

- There are significant opportunities to use asset valuation to improve the systems and methods of road administrations. Asset values provide significant information for government, road agencies, road users and taxpayers.

- This indicator is still being developed in most road administrations and further exchanges of information regarding the use of this indicator in road management would be beneficial.

- An OECD Working Group is currently carrying out further work on this topic and more specifically on Asset Management Systems (OECD, forthcoming in 2001). The reader is recommended to review the results from this research when they become available.

- The detailed report on the Web site provides case examples.

PI 13 Roughness

Responding countries

Australia (six states), Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Portugal, Sweden, the United Kingdom and the United States

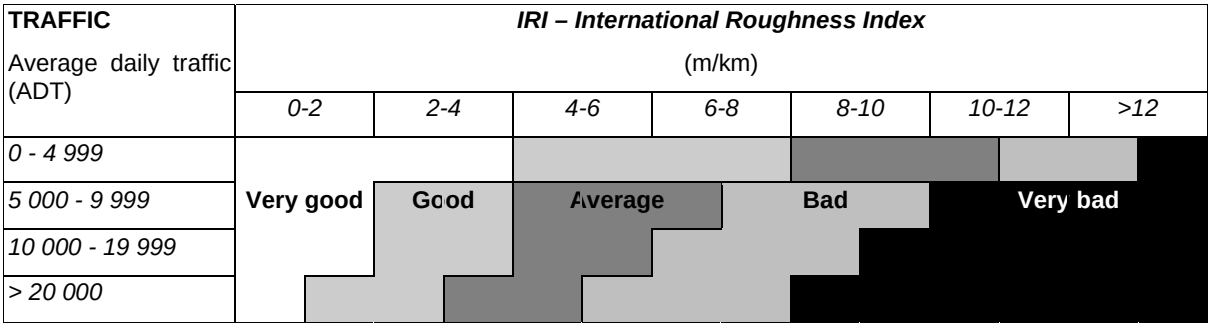
Purpose

Roughness is a key determinant of pavement quality, travel cost and user satisfaction; it also reflects the structural quality of the road.

Definition

Due to its wide use throughout the world, the International Roughness Index (IRI) was used as the reference unit of measurement (Figure 4.2). As some countries use other tools such as longitudinal profilometers (Belgium), pavement rating by wave bands (Portugal) or Maintenance Control Index (Japan), some results had to be converted to the IRI.

Figure 4.2. **IRI threshold matrix**



Source: World Bank.

Application in the participating countries

Eleven countries responded to this questionnaire. The high response rate shows that this indicator is widely used.

The main findings were:

- In terms of the aim of this indicator, the target value is similar in the majority of countries, *i.e.* the two lowest road classes (in terms of their condition) must disappear. This very high level of requirement reflects the experience of the developed countries. Besides safety, this goal also aims at ensuring a high level of comfort to the user.

- Measurement recurrence varies from one to four years. Finland adjusts measurement recurrence according to traffic level. This procedure is more exacting but has the merit of avoiding measurements which are of little use.

- The suggested calculation method, which is based on the threshold matrix derived from the HDM-III model of the World Bank, has been adopted by all the participating countries with the exception of Belgium, Japan and Portugal.

- Costs of measuring roughness vary by a factor of ten (from USD 2.40 to USD 26.85 per km of lane). These figures should be analysed in more detail to identify the reasons for such large disparities.

- Besides the purely technical uses of this indicator, it is often used as an element of resource allocation. It is therefore useful for both engineering and management issues.

- Road networks in participating countries are of a high standard. However, the results for certain countries (Belgium, Hungary, Japan and, to a lesser degree, the United States) are mostly in the “good” category.

Conclusions and recommendations

- The responses clearly show that the measure of roughness as done in the field test does not allow useful comparisons to be made across countries.

- The study is based on the threshold matrix derived from the HDM-III model of the World Bank which incorporates limits which are too broad to allow effective application in developed countries. This situation leads to measures which are located nearly exclusively in the "very good" and "good" categories.

- The measure of roughness is a very useful performance indicator to the extent that the reference tool is adapted to the development level of the country being evaluated. A stricter threshold matrix should therefore be used in developed countries to generate more precise data, with the user's comfort as the objective. In developing countries, the larger matrix is sufficient. In this case, the final goal is to evaluate the level of mobility and user safety.

- In addition to this technical use, roughness measures are especially relevant in a budget allocation process. The Finnish case study (together with PI 8) provides an example of the use of IRI to optimise pavement budgets in relation to the societal costs. The cases of Japan and the United Kingdom are recommended examples of "technical" uses of IRI.

PI 14 State of road bridges

Responding countries

Nine countries responded to the questionnaire: Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Sweden, the United Kingdom and the United States.

Purpose

Monitoring the state of road bridges is an essential component of Bridge Management Systems. This indicator provides information on the engineering soundness of road bridges.

Definition

This indicator is measured by the percentage of engineering structures having major defects. Bridges and engineering structures are categorised according to four classes:

- Class 1: Structures liable to be a great danger to users (absolute priority).

- Class 2: Structures presenting danger in the short term.

- Class 3: Structures with significant deterioration.

- Class 4: Structures with minor deterioration.

Application in the participating countries

The target value for this indicator is similar in the majority of the countries, *i.e.* the most dangerous bridge class (Class 1) should not occur. This high level of requirement reflects developed country responses. The underlying aim is to ensure maximum safety for users.

Most countries carry out different kinds of inspections with different recurrence periods. A distinction is usually made between routine inspections, which are frequent but superficial, and in-depth inspections, which are less frequent but more detailed. Japan has developed special measures to cope with earthquakes, which are worth highlighting.

The responses provide an impressive list of measuring tools. Many are used by several participating countries. Visual inspection and the expertise of the inspector are of great importance. Costs are very disparate and depend on the type of inspection, the measurements carried out, the type of bridge, its location, etc. An inspection can take from a couple of hours to several weeks.

This indicator is useful for both engineering and management purposes. Besides the purely technical uses, it is often used as an element of budget resource allocation. In this sense, it is a good example of the current trend: road administrations continue to deal with technical issues, but economic and financial management issues are assuming increasing importance.

The majority of engineering structures are from eleven to 30 years old. Maintenance of these structures constitutes an essential task in order to ensure maximum longevity at an optimum safety level.

The Walloon region provides a good case example of how this indicator has been used to secure specific budgets to repair the most damaged bridges.

Conclusions and recommendations

- This indicator is recommended for all road administrations. However, given the wide range of tools in use, it is difficult to provide any technical recommendations.

- No “best practice” is recommended for this indicator. However, the detailed report provides useful information from different countries.

PI 15 Satisfaction with the road system

Responding countries

The following countries responded: Australia, Belgium, Denmark, Finland, Hungary, Japan, New Zealand, Portugal, Sweden, the United Kingdom and the United States.

Purpose

This indicator provides insight to road users’ overall satisfaction with the road system. It provides road administrations with an indication of the degree to which road-user needs are being met, and highlights priority areas for action.

Definition

The indicator of satisfaction with road system condition is broader in scope than the road surface. It addresses road user-satisfaction with the road system as a whole and covers congestion, road environment, pavement type, alignment and design, signs and signals, markings, visibility and comfort in various weather conditions. This indicator can – and should – be correlated with road users' willingness to pay more (or less) for better (or worse) roads depending on traffic volume or type of traffic. The aim is to obtain information about the kinds of roads a user would like to have and would be willing to pay for. In order to make the best use of this measure, it must be categorised by road user and road type.

Satisfaction with road system condition might be determined in many ways. It can be described by a single value, or by the values of each element of the whole road system. The definition of a road system might also depend on a point of view or on a level of organisation.

Application in the participating countries

The questionnaire responses and case examples show that:

- Monitoring and measuring satisfaction with road system condition has to be based on standard and applicable processes for market surveys and customer feedback (see PI 6).

- Some administrations, such as the Department of Transportation of Minnesota, have a long history of market surveys and customer feedback processes, where satisfaction with road system condition has been one of the main parameters.

- In countries where neither this indicator nor market surveys and customer feedback processes are in use, there is a strong will to initiate these processes and to measure satisfaction.

- Utilisation of the results of this indicator and surveys has not been fully developed yet in all agencies. The use of the indicator for strategic planning and resource allocation is not clear.

- This indicator seems to be in the development process in all of the responding countries.

- This indicator (and in particular the units used) varies considerably and is highly country specific. Meaningful comparisons are therefore difficult to perform.

Road administrations have either measured or plan to measure and monitor their performance in many ways. User satisfaction is emerging as one of the most important indicators for evaluating programme performance.

Conclusions and recommendations

Satisfaction with road system condition has been found to be a useful indicator with many applications. It is perhaps the best summary descriptor of the long-term performance of the road programme. It is most useful as a trend or a series of annual summaries. The indicator is country specific, but inter-regional (state) comparisons are possible.

"Best practice" can be defined as a standard and applicable process for market surveys and customer feedback to monitor and measure road-user satisfaction with road system condition (see also PI 6). In addition to having such processes in place, best practice could include some of the following issues:

- Definition of the road system (reflecting the organisation's role in managing the road sector).
- Monitored results for each component of the defined road system.
- Categorisation of road users and their satisfaction.
- Existence of a standard process to measure trends and changes in user satisfaction.
- Utilisation of the indicator for strategic planning and resource allocation.

The main conclusions from the analysis include:

- There are significant opportunities for improving the systems and methods of road administrations (including road-user surveys and the use of these results). Road-user satisfaction provides significant information for governments, road agencies, road users and tax payers.
- Road administrations should exchange and share information and experiences with a view to improving the application of road-user surveys, methodologies and their results.
- Comparison of "user satisfaction" across different countries is not relevant because the definitions and "user satisfaction" are country specific. However, inter-regional (state) comparisons are useful. In addition, collecting this indicator data for the trend is recommended.
- None of the responses indicated any direct connection between road-user satisfaction survey results and the programming process (objective setting). No "best practice" can be recommended, although the United Kingdom case example comes closest, especially the use of specific action indicators to change the road administration's programming process to better respond to customer needs.

Annex

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BIBLIOGRAPHY

Dunlop, R. (1998), *Highway Management Reform in New Zealand Post 1984 Compared to World-wide Road Agency Reform*, Transit New Zealand.

Hannus, J. (1994), *Process Management*, HM&V Research Oy, Finland (in Finnish).

Laamanen, K. and M. Tinnila (1998), *Terms and Concepts in Business Process Management*, MET, Finland.

OECD (1997), *Performance Indicators for the Road Sector*, Road Transport and Intermodal Linkage Research Programme, OECD, Paris.

OECD (2001), *Asset Management Systems*, Road Transport and Intermodal Linkage Research Programme, OECD, Paris.

Robinson, R. (1999), *Benefits of Commercialisation in the Highway Sub-sector*.

Sarala, U. and A. Sarala (1996), *Learning Organisation*, University of Helsinki, Finland.

Talvitie, A. (1996), *International Experiences in Restructuring the Road Sector*, The World Bank, Washington, DC.

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(77 2001 02 1 P) ISBN 92-64-18680-8 – No. 51907 2001