

METRAS - AN ARTERIAL ROAD
STRATEGY FOR MELBOURNE

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ABSTRACT:

In September 1983, the then Minister of Transport set up a strategic study of Melbourne's arterial road network, the Metropolitan Arterial Road Access Study (METRAS). The final report of the study will be released in 1986 for public comment. The recommendations will then be reviewed by the study team and, if accepted by the State Government, will be incorporated into the road programs of the Road Construction Authority and the Road Traffic Authority. The study is being carried out by the Victorian Ministry of Transport in close consultation with the two road authorities.

The paper sets out the objectives of the study, the context in which it is being undertaken and the study program and methodology.

It concentrates on the approach used to evaluate the effectiveness of major road proposals in meeting Government goals (particularly in the development of accessibility measures) and the consultation process.

METRAS - AN ARTERIAL ROAD STRATEGY FOR MELBOURNE

J.R. Webber, R.G. Evans and I.P. Wallis.

SCOPE OF THE STUDY

In September 1983, the then Minister of Transport set up a strategic study of Melbourne's arterial road network, the Metropolitan Arterial Road Access Study (METRAS). The final report of the study is being released in early 1986 and will be available for comment for 3 months. The recommendations will then be reviewed and submitted to the Government in mid-late 1986 and, if accepted, will be incorporated into the road programs of the Road Construction Authority (RCA) and the Road Traffic Authority (RTA).

*The Study is being carried out by a Study Team in the Ministry of Transport (MOT). The Ministry, under the reorganisation of the transport portfolio implemented in July 1983, has the principal role in strategic transport planning in Victoria (MOT 1983).

METRAS has two related objectives:

- (1) To prepare an arterial road strategy for Melbourne supportive of the Government's metropolitan development, economic and transport strategies (and responsive to environmental and resource constraints) in order to guide road network development in the metropolitan area, in particular over the next 10 years; and
- (2) To review the need for particular Melbourne Metropolitan Planning Scheme (MMPS) Proposed Road Reservations and Widening.

This paper is primarily concerned with the first of the METRAS objectives and particularly with the assessment criteria for the major proposals.

The final report of the Study includes recommendations on,

- * priorities of major road proposals,
- * programs of lower cost small scale road proposals directed at specific problems or goals,
- * existing MMPS land reservations, and
- * further corridor investigations where deficiencies are apparent, but the best means of overcoming the deficiencies are not clear.

The first part of the strategy involves the identification of those major road proposals which should be added to the program of projects which are currently under construction or which have a Government commitment to commence. In this context, major proposals have been defined as those costing over \$2 million. The cost to complete Melbourne's major road improvement projects currently under construction or committed for construction is about \$130 million (\$85/86).

The second part of the strategy is concerned with smaller scale measures or initiatives forming special purpose programs which would be somewhat akin to the existing accident black-spot program or the Fairway tram route management program.

The other aspect of the Study relates to road reservations. In this regard several road reservations have recently been removed from the MMPS following a Government decision in late 1983. The further review of MMPS road reservations must be seen in the context of both the emerging 10 year arterial road strategy and the need to maintain opportunities to adequately service activities in the metropolitan area beyond the 10 year period.

An essential element of the first Study objective is the resource constraint. METRAS therefore deals with road improvement priorities in the context of a feasible budget. It is not a study of road needs or road funding in the sense of setting various standards of traffic performance, adopting a range of design standards to address performance deficiencies, and costing the resultant improvement projects. This approach was used in the recent NAASRA Roads Study (RCA 1984). Instead, METRAS concentrates on identifying and setting priorities for projects and programs which meet a broader range of Government goals (i.e not just traffic performance) and on developing these into an affordable strategy given the likely availability of funds.

It is not a study of public transport as such, but it does examine ways in which arterial road system management can assist the operation of on-street public transport.

The Study is, of course, taking place in a dynamic situation. Since the change of Government in 1982, there has been a significant redirection in the Victorian road program as a result of changes in goals and emphasis. Over the past 2 years, the METRAS Study has been closely involved in this redirection process.

Both the road authorities are drawing on, and contributing to, the METRAS Study as they develop their corporate plans and forward programs.

The Study Team has consulted the general public, community groups, Local Government, and State planning and transport agencies. This is the first such consultation in a study aimed at producing an arterial road strategy for Melbourne, as distinct from a corridor study.

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The Government Administration Metropolitan Boundary was adopted as the limit of the Study area. To help the consultation process, the area was divided into five regions.

THE CONTEXT

Planning and Economic Strategies

METRAS must be seen in the context of the broader goals of urban planning and economic development.

The Metropolitan Development Strategy (MMBW 1981) emphasises consolidation of existing urban areas, rather than uncontrolled growth on the urban fringe. More attention is to be given to the structure of existing suburbs, with a vigorous central Melbourne and increased activity in 14 designated District Centres. Optimum use is to be made of Melbourne's existing services, including the extensive public transport network.

This accords with the current Government initiatives to develop an urban planning strategy and a system to co-ordinate Government expenditure on the whole range of urban services (both physical and social) to ensure equitable, effective and efficient use of funds to meet a range of common goals.

The Government's Economic Strategy (Victorian Government 1984 a & b) aims to maximise long term economic and employment growth in Victoria. It places considerable emphasis on improved efficiency of freight transport and distribution functions.

Road Access Guidelines

In early 1983, the then Minister of Transport issued policy directions and guidelines relating to metropolitan road access. The strategic goals are:

'to expand and promote equity in metropolitan accessibility for passengers, pedestrians and freight, and improve road safety and environmental amenity, within overall economy and efficiency in the use of resources.'

In September 1985 the Minister issued Strategic Guidelines which are to be used by the RCA, RTA and Councils in the development of the 1986/87 - 1988/89 road programs. The relevant section indicated that:

"The Metropolitan program is to have emphasis on:

- a) improvements to road safety, particularly pedestrian safety;
- b) public transport priority initiatives such as the Tram (Fairway) and Bus Route Management Program;
- c) the facilitation of freight movement, in particular port access;
- d) the urban development strategy, including improved circulation around the Central Activities District (CAD) and improved access to and around the 14 designated District Centres;
- e) specific development initiatives such as the Ministry for Planning and Environment's (MPE) Central Melbourne Program, including proposals to develop the Southbank area in South Melbourne;
- f) the need to improve route continuity, particularly in the western and north-western suburbs;
- g) route control measures, particularly traffic signal linking on arterial roads;
- h) protection and enhancement of the environment."

In addition,

"Arterial roads carrying high volumes of commercial vehicles are to be given priority for improvements. Alleviation of peak hour traffic congestion is not, in itself, seen to have a high priority."

Within this framework there are many road management problems which can be overcome by relatively small scale roadworks. In some cases, however, major construction projects will be necessary.

Other Studies

During the period of METRAS, detailed investigations of major road proposals and issues have been undertaken in several corridors and areas:

- * The Pascoe Vale Road Relief Study, which was conducted as an Environment Effects Statement (EES), was established as a result of concerns about the environmental effects of truck traffic. The study recommended the construction of an 8 km section of the R5 Outer Ring Route in the Broadmeadows area. (MoT 1984a)
- * The Western Bypass investigation, which is scheduled for completion in 1986/87, is also being carried out as an EES. It is examining a connection to the west of the Central Activities District between the Tullamarine Freeway and Footscray Road.

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- * The Eastern Corridor Road Study, which resulted from Council concerns about traffic problems in the corridor, investigated various proposals in the Doncaster-Ringwood area.
- * The Central Area Access Study is examining a wide range of transport issues in the central region.
- * A group convened by the Ministry of Transport is examining Surface Access to Melbourne (Tullamarine) Airport.

While these studies have (or will) reach conclusions specific to the particular corridors or problems investigated, their recommendations cannot be considered in isolation, but within the metropolitan-wide context.

THE STUDY PROGRAM AND CONSULTATIONS

The study is being carried out in three phases:

1. The identification and discussion of road related issues and concerns, and
2. The development and assessment of strategies to address these issues and concerns.
3. The review of the Study's recommendations.

Consultation has been an important and integral part of the study process. Local Government has been involved through Regional Liaison Committees in the four regions outside the central region. These involve representatives from each Council in the region, the Study Team and the relevant State agencies.

An Inter-Agency Advisory Committee was also established, consisting of representatives of the agencies concerned with the development and operation of the arterial road network.

Apart from these committees, inputs have been invited from the community, and the Study Team has had discussions and written communication with various interest organisations, local community groups and interested individuals, including road freight operators and tourist bus operators.

During 1984 the first METRAS Discussion Paper M1 (MoT 1984b) was circulated, its purpose being to outline the Study approach. At the same time eighteen regional Issue Papers were published covering strategic road issues in specific locations or corridors.

Following written comment and discussion from Councils, agencies, interest groups and individuals on the Issue Papers, four Regional Summary Papers, a Strategy Development Progress Report M2 (MoT 1985a) and a Report on Road Reservations M3 (MoT 1985b) were published in May 1985. These were followed by a set of Major Project Assessment Tables (to accompany M2) and individual reservation reviews (to accompany M3). Several Bulletins were also published during the Study.

The final report will consist of 3 publications:

- * a detailed technical report (M4);
- * a summary report with recommendations (M5)
- * Bulletin 4, which will summarise the findings of the study.

Council, agency and community views will be sought on the report, before forwarding the recommendations to the Minister for Transport for consideration by the Government. Three months will be allowed for these responses.

STRATEGY DEVELOPMENT FRAMEWORK

Goals and Objectives

The Government's policies and guidelines relating to metropolitan roads may be summarised by the following overall goal:

To improve the accessibility provided by, and the efficiency of movement on, the road system having particular regard for the need to:

- (1) support the metropolitan development strategy;
- (2) provide for efficient movement of freight;
- (3) secure more efficient use of the existing arterial road network in preference to construction of major new road links;
- (4) moderate the growth in private travel and encourage the use of public transport;
- (5) protect social and environment amenity;
- (6) improve road safety;
- (7) facilitate tourist and recreational travel;
- (8) promote equity in accessibility.

Financial Resources

Current expenditure levels (in \$85/86) on Melbourne's metropolitan arterial roads are as follows:

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	1984/5 Actual	1985/6 Proposed
Operations and Routine Maintenance	\$24M	\$21M
Pavement Rehabilitation	16	15
Network Improvements and Additions		
- estimated cost greater than \$10M	50	58
- estimated cost \$2M - \$10M	14	20
- estimated cost less than \$2M	28	30
Traffic Facilities Program	32	36
	<u>\$164M</u>	<u>\$180M</u>

The future availability of funds is inherently uncertain, and may indeed be influenced by the findings of METRAS and by the current inquiry into Commonwealth road funding. Some of the uncertainties relating to future funding are:

- * the possibility that the Australian Bicentennial Road Development (ABRD) Program would not continue or be replaced after the end of 1988
- * whether the Australian Land Transport Program (ALTP) will continue in its present or similar form after 1990
- * whether the State Government will continue its 1985/86 level of expenditure on metropolitan arterial roads in future years (this level is higher than in recent years).

Because of the uncertainty, the Study has concentrated on a range of funding rather than the most likely scenario. In any case, variations in funding are likely to have more impact on the timing of projects rather than on the overall strategy and the type of projects implemented.

The minimum level of funds likely to be available for new major projects or other initiatives over the 10 year period to 1995/96 is about \$370 million on the assumption that:

- * the 1985/86 level of funding (\$102M) on operation/maintenance, rehabilitation, traffic facilities and minor improvements will be at least maintained in the future
- * major projects which are in progress or are committed for construction will be completed
- * the ALTP Trust Fund will continue existing arrangements after 1989/90
- * 1986/87 State funds will be equal in real terms to the 1985/86 level, with annual amounts thereafter being 10% less than that level.

This could increase to \$500 million if an equivalent of the Federal ABRD Trust Fund continues after 1988 and a further \$100 million if State funding remains at the 1985/86 level in real terms. These variations are shown in Figure 1.

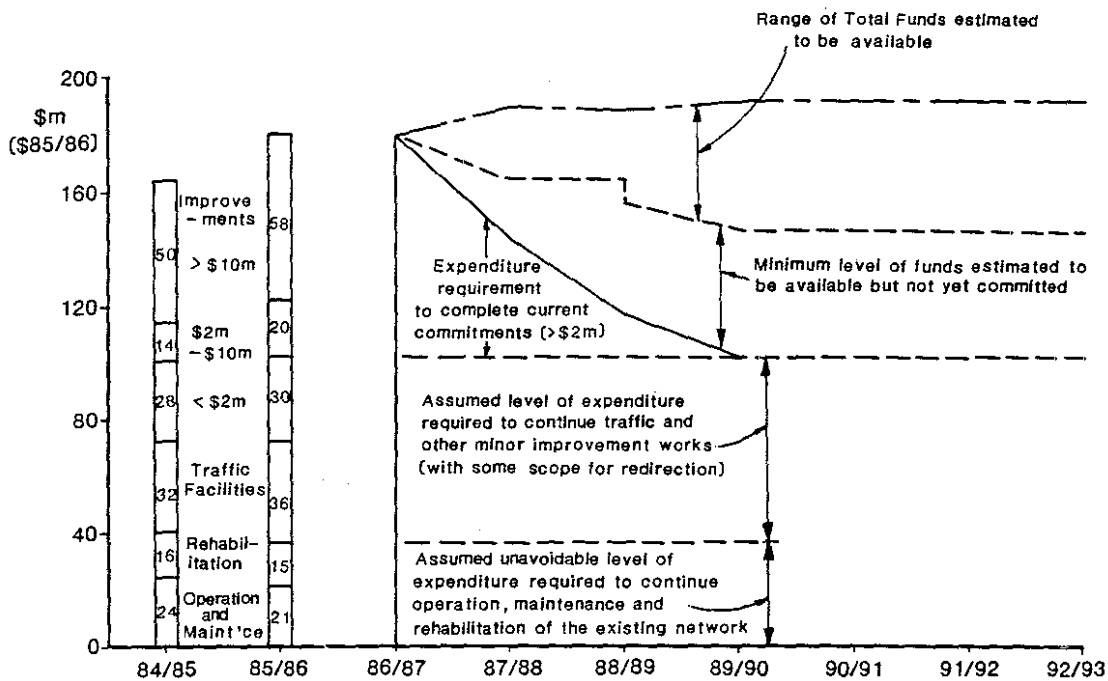


FIGURE 1 CURRENT PATTERN OF EXPENDITURE ON METROPOLITAN ARTERIAL ROADS AND PROJECTED FUTURE COMMITTED/UNCOMMITTED FUNDS (in constant \$85/86)

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Relationship Between Government Goals and Road Programs

METRAS is concerned with a comprehensive road development and management strategy, which includes:

- (1) Various major arterial road improvement proposals.
- (2) Smaller-scale lower-cost road proposals and improvement packages to address specific Government goals, such as support for District Centres.

In the initial phase of the study, many arterial road improvement proposals were generated during consultations with Councils, agencies and the community. These proposals generally consisted of medium scale and major arterial road improvements and additions.

Road projects of this scale normally attempt to address several goals. Construction of Route 7 in the Springvale area, for instance, would reduce traffic congestion at existing bottlenecks, facilitate freight operation, improve public transport operations and reduce the volume of through traffic using local roads in the corridor.

Large projects can achieve significant benefits, both in terms of improved accessibility and environmental amenity. However, they do absorb a large proportion of available funds and hence only a few could be implemented within the next 10 years. The benefits therefore would flow to a relatively small proportion of the community and many problems and opportunities in other locations would be neglected.

As mentioned, there are several current programs of smaller scale projects which principally address specific Government goals, notably the three RTA program Components:

- * Accident Black-Spot Treatment
- * Tram and Bus Route Management
- * Route Management and Operations (which mainly involves the implementation of the SCRAM signal system).

The other current example of an initiative which specifically addresses a Government goal is the RCA expenditure on retrofitting noise barriers to pre-1977 freeways. The RCA has "earmarked" \$1M p.a. for this purpose.

The smaller scale programs considered by the Study relate to,

- * district centres.
- * urban development initiatives
- * freight movement
- * upgrading of heavily trafficked 2 lane roads in developing areas
- * major intersection improvements
- * pavement improvements on public transport routes.

Figure 2 indicates the relationship between Government goals and the various project types considered in METRAS, grouped in accordance with the Program Budget format. The METRAS Matrix shows both the existing relationships and possible ways in which these might be extended to accommodate the range of project types being considered.

There is a need to examine current programs to clarify and strengthen the links between Government goals and particular projects and expenditures. There is also a need to consider whether and how new initiatives could be undertaken in this regard. This could either be through new program Components, similar to the Accident Blackspot Component, or through earmarking specific funds as for noise barriers.

THE ASSESSMENT APPROACH AND RESULTS

The Cost-Effectiveness Approach

Table 1 summarises goal areas, objectives within each area, corresponding program components and relevant effectiveness indicators. The first three columns are a modified version of the METRAS Matrix (Figure 2).

The METRAS evaluation approach is concerned with assessing the cost-effectiveness of proposals and programs against relevant objectives and hence selecting those proposals with higher cost-effectiveness ratings. These ratings measure the improvement in effectiveness of the road system from implementing a proposal, divided by the costs of the proposal. A variety of effectiveness measures are used, as shown in the last column of the table. In a number of cases, effectiveness measures have yet to be defined. This applies particularly for the lower-cost proposal types where METRAS work has been limited and further work will be required by the road authorities.

Even where effectiveness measures have been identified, they differ between programs. Thus it is not possible in an analytical sense, to compare the cost-effectiveness of one program with another which is directed at different objectives and therefore utilises different effectiveness measures.

Assessment of Major Improvements and Additions

The Metropolitan Development Strategy has two groups of objectives:

- * To strengthen the central area and District Centres by improved accessibility and reduction of through traffic,
- * To support inner and middle suburban areas and discourage urban sprawl by improving accessibility to inner and middle areas (particularly to employment opportunities) rather than to outer areas.

PROGRAM SUB-PROGRAM (1)	BUDGET COMPONENT	EQUITY	METROPOLITAN DEVELOPMENT (4)			ECONOMIC DEVELOPMENT		SAFETY	TRANSPORT / ACCESSIBILITY			ENVIRONMENTAL & SOCIAL CONSIDERATIONS
			D.C. ACCESS	D.C. CIRCULAT.	MID/INNER SUBURBS	FREIGHT OPN.	TOURISM AREAS		ON ROAD PUB.TRAN.	ROUTE CONTINUITY	BOTTLE- NECKS	
EXISTING COMPONENTS												
ARTERIAL ROADS	REHABILITATION									EF & PFG on RT	Pavement routes	
	IMPROVEMENTS & ADDITIONS											
	■ Major Proposals > \$10 million	Package of Major Proposals										
LOCAL ROADS	■ Med. Proposals \$ 2m-\$10 mill				PFG Urban D'ment Initiatives	PFG Freight	EF Tourism					EF \$1 mill/ annum noise
	■ Minor Proposals < \$2 million											
	REHABILITATION		PFG District Centres							EF & PFG on RT	Pavement routes	PFG Upgrading (2)
TRAFFIC MANAGEMENT (Known as Traffic Facilities Program)	IMPROVEMENTS & ADDITIONS											PFG Intersections
	ACCIDENT BLACK SPOT											
	TRAM/BUS ROUTE MANAGEMENT			PFG D'ment	Urban Initiatives							PFG Manage Kerb Space
POSSIBLE	ROUTE MANAGEMENT					PFG Freight						
	LOCAL TREATMENTS		PFG District Centres									
POSSIBLE SPECIAL PURPOSE COMPONENTS (3)												
	DISTRICT CENTRES											
	URBAN DEVELOPMENT INITIATIVES											
	FREIGHT											
	TOURISM											

(1) Sub-program objectives may be found in MOT-Program Budget Information 1985/86

(2) Upgrading includes duplication, paving shoulders generally upgrading from rural type to urban type road

(3) Possible components may in future be placed in one or more Sub-programs or incorporated into an existing component

(4) DC. refers to District Centres

KEY

EF= Existing Fund earmarked to address special goals shown

PFG= Possible Fund (earmarked) or guideline to address specific goal.

/// Existing Program showing principal goal areas

□ Possible Program

FIGURE 2 GOALS and PROGRAM OPTIONS

TABLE 1: SUMMARY OF GOALS, OBJECTIVES, PROGRAMS AND EFFECTIVENESS INDICATORS

GOAL AREA	OBJECTIVES	SUB PROGRAMS/COMPONENTS (1)	INDICATORS (3)
Support Metropolitan Development Strategy (Items 1,2,3)			
1. Strengthen CAD and District Centres	<p>Improve access to CAD and District Centres</p> <p>Improve traffic circulation within Centres</p> <p>Reduce through traffic</p> <p>Improve local amenity (including safety)</p>	<p>a) Improvements/Additions</p> <p>b) Traffic Facilities</p>	<p>Access Measure No. 1 to CAD/DC(2)</p> <p>Population within 15 mins/20 mins of CAD/DC(2)</p> <p>Delays to public transport, through traffic volumes, Accident savings, intersection delays</p> <p>Delays to public transport, intersection delays, Accident savings</p> <p>Access Measure No. 1 to jobs from inner/middle areas (2)</p> <p>Jobs within 20 mins/30 mins of inner/middle area population (2)</p> <p>Change in Access Measure No. 1 from inner/middle areas: change from other areas (2)</p> <p>Delays to public transport, intersection delays, Accident savings</p> <p>Delays to public transport, Travel times, Accident savings</p> <p>Delays to public transport, intersection delays, Accident savings</p> <p>ICV benefits (time & operating costs in \$ terms), intersection delays, Travel Times, Accident savings, ICV volumes on local roads</p>
2. Promote inner/middle Areas and Discourage Urban Sprawl	<p>Improve access from inner/middle areas particularly for employment purposes</p> <p>Limit access improvements from outer areas</p> <p>Improve amenity in inner/middle areas</p>	<p>a) Improvements/Additions</p> <p>b) Traffic Facilities</p>	<p>Access Measure No. 1 to jobs from inner/middle areas (2)</p> <p>Jobs within 20 mins/30 mins of inner/middle area population (2)</p> <p>Change in Access Measure No. 1 from inner/middle areas: change from other areas (2)</p> <p>Delays to public transport, intersection delays, Accident savings</p> <p>Delays to public transport, Travel times, Accident savings</p> <p>ICV benefits (time & operating costs in \$ terms), intersection delays, Travel Times, Accident savings, ICV volumes on local roads</p>
3. Support Urban Development Initiatives	<p>Improve local access and circulation</p> <p>Improve local amenity (including safety)</p>	<p>Improvements/Additions and Traffic Facilities</p>	<p>Delays to public transport, intersection delays, Accident savings</p> <p>ICV benefits (time & operating costs in \$ terms), intersection delays, Travel Times, Accident savings, ICV volumes on local roads</p>
4. Improve Road Freight Movement	<p>Intra-metropolitan & intra/inter-state road freight movements (by relief of bottlenecks and improved route continuity)</p> <p>Reduce truck volumes on local roads</p>	<p>Improvements/Additions and Traffic Facilities</p>	<p>ICV benefits (time & operating costs in \$ terms), intersection delays, Travel Times, Accident savings, ICV volumes on local roads</p>
5. Improve Movement Efficiency and General Accessibility	<p>Improve public transport accessibility and service efficiency</p> <p>Improve movement efficiency for all vehicles</p>	<p>a) Tram and Bus Route Man.</p> <p>b) Pavement Rehabilitation on public transport routes</p> <p>a) Improvements/Additions</p> <p>b) Traffic Facilities</p>	<p>Travel time (absolute and variation) Riding quality</p> <p>Traffic benefits (time and operating costs in \$ terms), Accident savings</p> <p>Traffic benefits, Accident savings, Travel times</p> <p>Changes in noise level, Traffic volumes, ICV volumes</p> <p>Change in noise level</p> <p>Changes in noise level, Traffic volumes, ICV volumes</p>
6. Protect Social and Environmental Amenity	<p>Minimise adverse environmental and social effects of road traffic</p>	<p>Improvements/Additions</p> <p>Improvements/Additions</p> <p>Improvements/Additions</p> <p>Improvements/Additions</p>	<p>Traffic benefits (time and operating costs in \$ terms), Accident savings</p> <p>Traffic benefits, Accident savings, Travel times</p> <p>Changes in noise level, Traffic volumes, ICV volumes</p> <p>Change in noise level</p> <p>Changes in noise level, Traffic volumes, ICV volumes</p>
7. Improve Safety	<p>Reduce road accident toll</p>	<p>Accident Black Spot Treatments and Improvements/Additions</p> <p>Additions on selected routes</p>	<p>Accident savings (by type), Economic benefits</p> <p>Travel time savings, Accident savings</p>
8. Encourage Tourism and Recreation	<p>Support tourist and recreational travel</p>	<p>Improvements/Additions</p> <p>Additions on selected routes</p>	<p>Travel time savings, Accident savings</p>
9. Promote Equity in Accessibility	<p>Improve access from areas with poor access</p>	<p>Improvements/Additions</p> <p>Traffic Facilities</p>	<p>Accessibility Deficiency Relief index (ADRI) to Jobs(2)</p> <p>To be developed</p>

Notes: (1) Existing Sub-programs and Components are shown. In some cases, a goal area could be addressed by a new Component.
 (2) Indicator can only be used for major proposals costing over \$10 million.
 (3) Further work on the development of indicators is needed.
 (4) Public transport refers to on-road services (buses, trams).

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Changes in accessibility resulting from adding to or deleting proposals from a base network⁽¹⁾ were based upon:

- * 1991 traffic generation and distribution forecasts using Melbourne and Metropolitan Board of Works (MMBW) population and employment forecasts;
- * accessibilities measured along the "minimum impedance path" (between zones), determined according to a weighted function of time and distance (at typical speeds, the weightings are about 80% time to 20% distance).

In each case, accessibility figures were derived as an output of the RCA traffic modelling procedures using the UTPS program suite.

In the early work in the study (MoT 1985a), the following effectiveness indicators were used in assessing major proposals:

Access of Population to District Centres and CAD:

- (1) Access Measure No. 1 (absolute and percentage change). This measure is a negative exponential (decay) function, which gives a very low weighting to population beyond about 20-30 minutes driving time.
- (2) Population within 15 minutes 'impedance value' by car (absolute and percentage change)
- (3) Population within 20 minutes 'impedance value' by car (absolute and percentage change).

Access of Inner/Middle Area Population to Jobs:

- (4) Access Measure No. 1 (absolute and percentage change)
- (5) Jobs within 20 minutes 'impedance value' by car (absolute and percentage change)
- (6) Jobs within 30 minutes 'impedance value' by car (absolute and percentage change).
- (7) Ratio of Access Measure 1 (absolute) for Inner/Middle Area Jobs to Access Measure 1 (absolute) for Outer Area Jobs.
- (8) Accessibility Deficiency Relief Index (ADRI) : a measure of the extent of accessibility improvements to jobs for those areas with current accessibility below the metropolitan average.

General Traffic Benefits:

- (9) Economic benefits (time, operating costs, accidents) to all traffic.

¹ The base network consists of the existing network plus committed projects.

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Freight Traffic Benefits:

- (10) Benefits to heavy trucks (time and operating costs).

In addition, the social and environmental effects of proposals were assessed.

The same quantifiable indicators were used in the subsequent work. However, to assist in selection of proposals, it was decided to focus principally on three of these indicators:

- (4) Access Measure No. 1 (absolute) to Inner/Middle Area Jobs.
(8) Accessibility Deficiency Relief Index (ADRI).
(10) Freight Traffic Benefits.

Details of the first two of these are given in the Appendix.

These accessibility measures were selected because:

- * The absolute changes in Measure 1 for accessibility to inner/middle area jobs has been selected in preference to the other accessibility indices as:
 - the results are more stable than those relating to an arbitrary time limit (e.g. 20 minutes) and incorporate a sensible weighting of accessibilities to opportunities at different distances;
 - the absolute change is more appropriate than the percentage change when comparing projects.
- * The ADRI has been included to indicate the effectiveness of proposals in improving accessibility to jobs from areas from which it is currently poor. However it should be noted that the ADRI measure may be heavily influenced by the particular base network used in the evaluation. With this caveat, the ADRI results give useful information relating to the effectiveness of projects in increasing the equity of access.
- * The Government places more emphasis on freight traffic benefits than on general traffic benefits.
- * Access to a District Centre is more effectively addressed by smaller scale improvements in close proximity to the Centre than by major road proposals remote from the Centre.

Social and environmental effects were again a major assessment factor, in terms of:

- * the adverse effects of proposals
- * the ability of a proposal to alleviate existing environmental problems.

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The desirable balance between expenditure on the Major Improvements and Additions program and the various other programs is, as noted, difficult to determine on technical grounds, given the differing objectives and the limited definition and evidence on the performance of some project types at this stage. Therefore a largely subjective view has to be taken.

Assessment of Other Programs

The assessment of the other programs (besides Major Improvements and Additions) and of projects within them also follows the cost-effectiveness approach. The main steps involved are:

- * define the objectives of the program
- * identify the criteria (performance indicators) which best reflect performance in terms of the objectives and which can be measured or estimated
- * generate and assemble typical projects to address the defined objectives
- * assess the performance of these typical projects against the defined performance indicators to determine the effectiveness outputs for typical projects
- * estimate the project cost and thus determine cost-effectiveness ratings for each project, and hence for each program.

This approach is applicable to components in the existing program structure (such as the RTA's Route Management and Operations Component) and to any further components developed in an expanded program structure.

Objectives and performance indicators for the various goal-related areas are shown in Table 1. The use of these objective-related performance indicators enables priorities within Components to be determined and assists in assessing trade-offs between Components. Consideration of funding levels can be related to performance measured, or assessed, in these terms.

Estimates of objective-related performance indicators are only possible if appropriate data are available for:

- * the performance of the existing system
- * the impacts of past projects of similar type
- * predictions of the impacts of new projects.

Hitherto there have been data deficiencies in these areas. Steps are now being taken to improve performance data collection and system monitoring procedures.

The specification of clear objectives and relevant, measurable performance indicators are critical to informed decision-making in the allocation of resources between the various competing programs.

Preliminary Findings for Major Proposals

The key traffic and accessibility indicators for a selection of major proposals are shown in Table 2. The table gives an indication of the range of values obtained for the various indicators. The locations of the proposals listed are shown in Figure 3.

The table indicates that, except for one indicator, the ranking of proposals remains relatively unchanged under the various indicators. The exception is the Accessibility Deficiency Relief Index (ADRI) which gives higher values for proposals in the western and northern suburbs, areas which have relatively poor accessibility at present.

The other important factors not included in the table are the social and environmental effects.

The Study Team is currently formulating the study recommendations, taking into account the broad range of assessment criteria. A 10-year program of Major Improvements and Additions proposals is being developed based on a version of Table 2 which includes all proposals.

CONCLUSIONS

METRAS has involved a substantial departure from previous studies in Victoria (and elsewhere) relating to the development of the road network. Its particular developments include:

- * The incorporation of a wide program of consultation throughout an extensive strategic study.
- * The broadening of the assessment of projects away from a narrow evaluation of traffic benefits to a wider cost-effectiveness approach based on the achievement of Government policy objectives relating to the metropolitan development strategy, economic priorities and accessibility to different activities. For major projects this has involved accessibility assessments within the traditional traffic modelling (UTPS) approach. For minor projects further work needs to be done to improve the cost-effectiveness approach, particularly with regard to data on existing system performance and prediction methods on the impacts of projects.

TABLE 2: KEY INDICATORS FOR TYPICAL MAJOR PROPOSALS

NO.	REGION/PROPOSAL (1)	Capital Cost \$ Million	Total B/C	Freight B/C	Inner/Middle Jobs Measure 1 (Absolute)	ADRI(2) Absolute Value
CENTRAL REGION						
1	Western Bypass of CAD	130	0.8	0.1	520	0.4
2	Punt Road, Bridge Road to Yarra River	20	2.8	0.7	1700	0.3
3	Punt Road, Yarra River to Rafeigh Street	35	1.3	0.2	360	0
WESTERN-NORTH WESTERN REGION						
11	ORR(3) Princes F/way to Tulla F/way	122	1.7	0.5	540	1.7
12	ORR Tulla F/way to Mahoneys Road	54	2.0	0.5	450	2.3
14	Maribyrnong River crossing, Western H/way to Military Road	20	2.3	0.2	340	1.6
15	Western H/way, widening Ashley Street to Princes H/way	35	0.8	0.2	130	0.5
16	E-14: ORR Somerton Road	30	1.4	0.3	0	1.3
NORTH-EASTERN REGION						
19	ORR - Mahoneys Road to Plenty Road	35	2.3	0.4	230	2.2
21	Bell Street - Banksia Street connection	15	4.6	1.2	1550	2.3
EASTERN REGION						
24	Route 6, Eastern F/way to High St. East Kew	15	1.2	0.2	190	0.3
26	Eastern Arterial, Doncaster Rd. Springvale Rd.	60	1.7	0.2	310	0.5
29	Ringwood Bypass	24	0.4	0.2	0	0.6
30	Route 7 - Wellington Rd. to Highbury Rd.	41	1.3	0.2	70	0.3
31	Scoresby Route, Mulgrave F/way-Maroonah H/way	80	0.7	0.2	0	0.3
33	Bayswater Bypass	15	0.3	0	0	0.6
SOUTH-EASTERN REGION						
36	Boundary Road - Dingley Route, Lower Dandenong Road to South Road	25	2.7	0.8	580	1.3
37	Route 7 - Dingley Route, Springvale Rd to Wellington Road	35	1.6	0.6	300	0.6
38	Dandenong Bypass	45	0.2	0.2	0	0.4

NOTES:

- (1) The locations of proposals are shown in Figure 3.
(2) Accessibility Deficiency Relief Index.
(3) Outer Ring Route

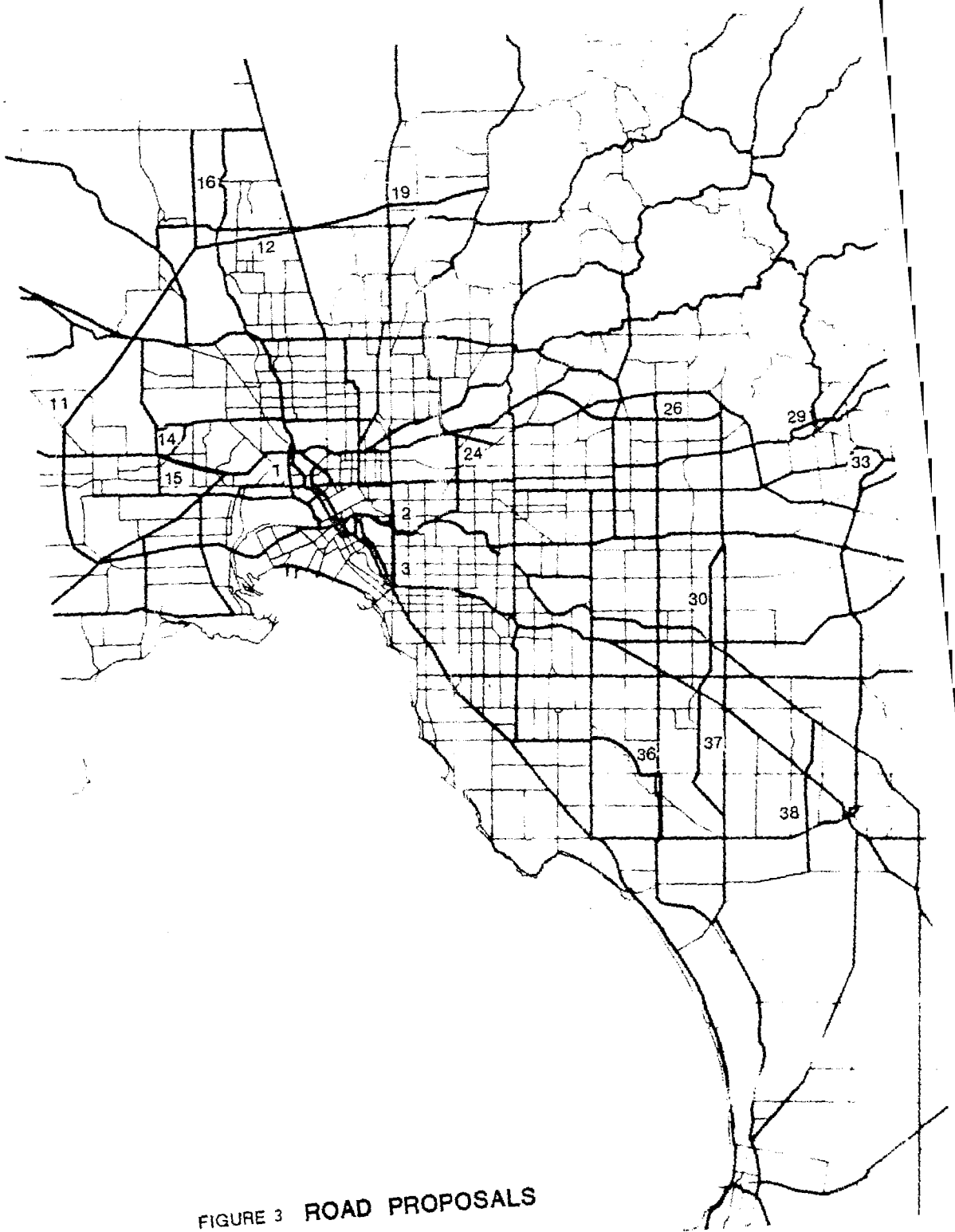


FIGURE 3 ROAD PROPOSALS

METRAS - AN ARTERIAL ROAD STRATEGY

Despite the difficulties faced in a number of areas, METRAS has been successful in reflecting Government requirements for the development of the road network.

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ACCESSIBILITY MEASURES

Accessibility measures have been used in transport planning to measure the "closeness" of certain facilities or activities to particular sites. Absolute values of accessibility measures are basically meaningless and it is the relative accessibility measure or the change in accessibility which is important. The METRAS Study examined the changes in various accessibility measures from the base network to the network with a road scheme added.

Most accessibility measures can be expressed as

$$A_i = \sum_{j=1}^n P_j f(t_{ij})$$

where A_i = accessibility measure of zone i
 P_j = the numerical value of some property of zone j
 t_{ij} = some measure of the separation of zones i and j
 (often called the impedance).

P_j can be almost any property capable of being quantified. One of the properties used in METRAS was total 1981 jobs. 1981 figures were chosen as census data was available. Use of estimated future figures would have introduced another source of uncertainty.

One aspect of residential areas which helps to make them attractive is closeness to jobs. Thus, the accessibility of residential areas (reported at LGA level) to total jobs was assumed to provide a measure of the attractiveness of those areas for residential development.

Three accessibility measures were calculated. The first function chosen was a negative exponential. Only one computer program was available which would calculate accessibility measures and this used Gamma distributions. These take the form

$$f(t) = \frac{B^{\&}}{\Gamma(\&)} t^{\&-1} e^{-Bt}$$

with $\& = 2$, $B = 0.3$ (referred to as Measure 1).

The other two measures of accessibility are of the opportunity type which can be expressed as "The number of jobs within thirty minutes travel time". In this case, the mathematical formula for $f(t)$ is

$$f(t) = 1 \text{ for } t \leq X \\ = 0 \text{ for } t > X$$

where X = the cut-off and varies.

METRAS - AN ARTERIAL ROAD STRATEGY

The values of X chosen were 20 and 30 minutes for the accessibilities to total jobs reported for each municipality.

The measures of impedance (or zonal separation) was chosen to be

$$1/4 (3t + d)$$

Where t = travel time in minutes
d = distance in kilometres.

This measure is the one used in the assignment model. The impedances were summed along the minimum impedance path.

For each of these three measures, the absolute change and the percentage change resulting from each proposal were calculated for each inner/middle municipality (these municipalities extend outwards as far as Altona, Sunshine, Coburg, Preston, Heidelberg, Box Hill, Oakleigh, Moorabbin and Mordialloc). The significant changes were weighted according to the population of each municipality as a measure of its potential for taking advantage of the improved accessibility and then summed. The result was divided by the proposal's estimated capital cost to provide a cost effectiveness measure for each proposal.

A further measure relating to equity considerations was used. With this measure improvements to accessibility where it is low were given greater weight or consideration than improvements where accessibility is already high.

It was decided that an index to measure equity should have the following properties:

- * It should only measure accessibility changes where the base accessibility is less than the metropolitan average; changes to areas where the base accessibility is greater than the average should be ignored.
- * The index should reflect the magnitude of the change in the accessibility. That is, a change of +100 units should be given twice the weight of a change of +50 units.
- * The index should give greater weight to improvements in zones with lower base accessibilities. That is, an improvement of 100 units on a base of 1000 should be given greater weight than an improvement of 100 units on a base of 2000.
- * Improvements should occur where people live - not to vacant land. Thus the index should be weighted by population.

The above considerations led to the following formula:

$$ADRI = \sum_{i=1}^n P_i * (\overline{BI} - BI_i) * (PI_i - BI_i) * C_i$$

where ADRI = Accessibility Deficiency Relief Index

P_i = population of zone i

\overline{BI} = area wide mean accessibility index for the base network

BI_i = accessibility index for zone i in the base network

PI_i = accessibility index for zone i in the project network

C_i = 1 if $BI_i < \overline{BI}$, and
0 if $BI_i \geq \overline{BI}$

The summation is carried out over all zones in the study area. The base accessibilities were analysed and the population - weighted mean accessibility was determined using Accessibility Measure 1 to Total Jobs.

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