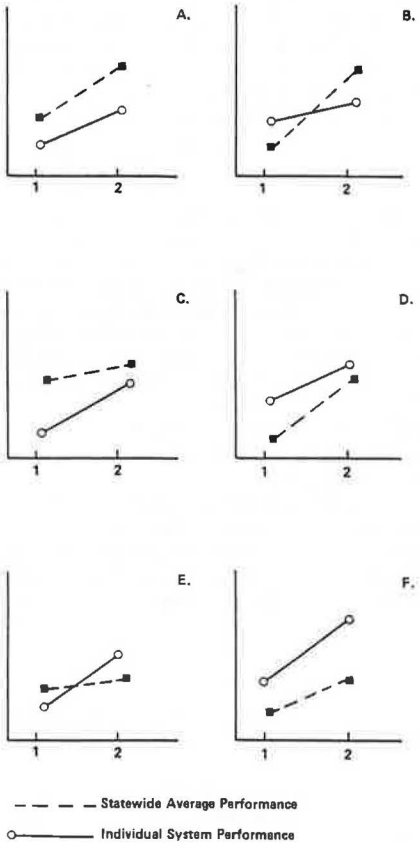
Figure 7. Comparisons of transit system performance indicators to statewide average values over time.



ently reduced by focusing on those indicators that fit scenarios A and F. Classifying indicators by using these scenarios does not imply either exemplary or poor performance. Rather, it focuses attention on the indicator for more detailed investigation.

In selecting indicators to review the use of this decision rule, it is particularly important to consider the relationships among indicators. An increase in expense for one indicator may be accompanied by an increase in productivity or a decrease in expense in another indicator. Alternatively, a change in productivity or the rate of wage increases may be accompanied by a negotiated change in fringe benefits. These interrelated factors must be carefully assessed.

In addition to comparing the performance of a transit system with that of other systems, a system can be compared with itself over time. In this type of analysis, the focus is on the magnitude and direction of change for each indicator value to identify indicators that appear to merit detailed evaluation by, for example, (a) comparing the change in expense-related indicators with the consumer price index, (b) comparing the change in fuel price indicators with a nationwide fuel price index, or (c) comparing selected indicators performance with an acceptable limit such as changes in value of more than 20 percent.

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Planning for Options and Commitments: An Approach to Transport Planning in Uncertainty

HANS L. WESTERMAN

Much transport planning is concerned with proposals of wide-ranging implications that are to be implemented over an extended period. During this time the context and the decisionmakers may change, and the original objectives may no longer be valid. The paper outlines an approach to planning and decisionmaking in such a situation of uncertainty. The approach requires inventing alternative futures for the system as a whole, developing scenarios for proposed intervention and, after evaluation, formulating time-limited commitments and credible options that are worth retaining. The process is incremental and open ended and involves collective learning and selective decisionmaking in which the only firm plans are those that are actually committed. The approach, in a greatly simplified form, is illustrated by a proposal to construct a major road in an inner area of Sydney, Australia. Four alternative futures are invented and examined to determine what strategic options seem worth retaining for the system as a whole. The results may not only show which aspects of the new road require consideration, but also what options are available for its introduction and the kind of commitment that can be made.

Transport planning has become like a game of chess in which it is difficult to plan more than one or two moves ahead. The opponents are many and the game requires great skill because some of the rules are no longer observed. To make matters worse, the board itself is changing.

Uncertainty has always been a critical variable in planning, but it has become more obvious in recent years. Greater public awareness and concern for the environment and the impact of development proposals, energy constraints, technology and its impact on employment and leisure, curtailment of public capital expenditure, changes in population growth and structure, and many other influences have undermined the confidence in longer-term planning.

It has been customary to define objectives and develop proposals that meet these objectives, but uncertainty about the future creates problems in such a closed-system approach. The context giving rise to the objectives may change during the implementation of the proposals. A similar problem exists with forecasting and evaluation models, calibrated on the basis of existing data. Transport planning is particularly vulnerable because it is often concerned with the formulation and implementa-

tion of systems within a long time frame, during which both ends and means can change in unpredictable ways.

There is a natural inclination to abandon long-term planning and deal with each case on its merits. This may seem like practical politics but will sell the environment short in the long term. Without longer-term perspectives, options may be foreclosed that should have been kept open and commitments made that need not have been made.

This paper outlines one approach to the problem and illustrates it by applying it to a particular problem: the planning of a major new road in inner Sydey, Australia. In view of the very broad nature of the subject and the difficulty of dealing with it in a short paper, the description of the process and its application in particular can only be sketchy.

PROBLEM DEFINITION

Planning and decisionmaking are part of the same process and the value of planning can be measured by its relevance and usefulness for decisionmakers in a given institutional and political context. In most situations this means a rather short-term planning horizon with greater emphasis on meeting the needs of today than on possible needs at some future time. The value of planning is not limited to today's decisionmaking, but it is also determined by the opportunities it creates for future decisionmakers acting in a different context. This longer-term horizon is particularly important when there are strong and divergent community or political views on matters with a long-term impact such as the introduction of new technology or energy constraints.

Urban planning and transport planning have always operated in both the short- and long-term range. They involve making policy and program decisions, not all at the one time but sequentially and with cumulative effects. The conventional process is to prepare an optimal strategic or structure plan, expose it to the public and decisionmakers, and proceed with the preparation of short-term operational plans and programs after its adoption. The operational plan is subject to cost/benefit analysis, environmental impact assessment, sensitivity tests, and other routines; implementation follows after these hurdles have been successfully overcome.

In the 1950s the transportation planning process was seen as a simple linear sequence. Proposals were developed on the basis of a study of the physical context and future needs, submitted to the decisionmakers who rarely questioned the professional advice, and, once approved, a commitment to both long- and short-term implementation could be assumed.

In the 1960s it was realized that land use and transport interacted and required iterative procedures, but the approach and implementation processes were essentially unchanged.

In the 1970s community concern and the emergence of action groups led to a much closer interest by decisionmakers and others in the formulation of proposals, but there was still the notion that, once the hurdles had been cleared, there was a straight road ahead.

The weakness in this notion lies in the commitment to a single strategic plan. Although the plan has been simplified progressively to that of a diagram or a statement of policies or principles, it nevertheless has tended to become codified in many countries including Australia (1) by legislative or administrative requirements after formal public exhibition procedures. There has been much discussion on the degrees of commitment to such plans (2,3) but the issue is far from resolved. There is usually the qualification that they are to be reviewed regularly, but this rarely happens in practice.

The uncertain nature of the long-term future has two consequences. A commitment to a single strategy and a whole bundle of policies and programs derived from such a commitment will almost certainly create problems. There will be a resistance to change it because of legal and administrative as well as professional commitments to the plan, yet the rapidly changing context will undermine its basic assumptions. When the tension becomes too great, the plan is discarded and ad hoc decisionmaking takes over.

Second, the implementation of a particular proposal over an extended period (as so many transport proposals require) is exposed to high risk as the context, the people, and organizations that make decisions and those that influence them will probably change during this period. Thus uncertainty about the future of the system as a whole and the manner in which it may be controlled create uncertainty about the progressive introduction of a new component of that system, such as a new road, technology, or energy policy.

The problem can then be stated as that of how to formulate and implement a proposal to introduce a new system component over an extended period during which the system as a whole may undergo change not only in its nature but also in the manner in which it is controlled.

REQUIREMENTS

There are a number of requirements for a planning process designed to deal with such a problem (4).

1. There is a need to make forecasts not only of the possible evolution of the new component, but also of the system as a whole.
2. There must be a systematic study of the component and the way it interacts with other parts of the system.
3. The frame of reference must be wide enough to encompass the broad spectrum and long-term implications of the component's introduction.
4. The impact on individuals and groups must be understood and public participation should be built into the process.
5. Values differ among groups and there will be conflict over choice; the process must present options, with their implications, for political decision.
6. Values change over time and the introduction of a new component changes values and behavior; hence, there can be no unalterable choices during its introduction and the process should be ongoing and adaptive.
7. The process must provide the basis for commitments of a strategic and operational kind and must, therefore, be integrated with the decisionmaking process.
8. The demand on resources in using the process should not be excessive.

The process must therefore be anticipatory, systematic, long term, broadly based, participatory, ongoing; present options; allow decisions to be made; and be manageable. The key lies in the relationship between learning and decisionmaking: what needs to be known for what decision, who needs to know and to what extent, how much can be committed with confidence, what options must be kept open.

This is not a once-for-all activity but an ongoing process of exploration, enquiry, reflection, synthesis, consultation, and decision. There is a substantial body of literature on parts of this process: forecasting (5), sensitivity and impact

analysis (6), operational research and decisionmaking (7), and many other aspects, but few encompass the entire range of criteria enumerated below. Jantsch (8) attempts to link thinking about the future with action in the present and presents a general framework for long-range exploration and its translation into terms of corporate planning. Etzioni (9) proposes long-term mixed scanning as a means of reducing uncertainty in short-term decisionmaking. Friend and Jessop (10) put forward the concept of strategic choice as a means of making decisions in uncertainty. These contributions are valuable, but the problem remains of how to develop an operational process meeting all the criteria.

OPTIONS-COMMITMENTS APPROACH

The options-commitments approach originated from a study that examined the progressive introduction of a line-haul transit system in Canberra, Australia (11). It was part of an international project on the social assessment of new transport technology. The approach has been under further study since (12) and, although much more requires to be done, the basic structure is simple.

There are four phases in the process: long-term, short-term, and intermediate-term assessments and a repetition of these assessments.

The long-term assessment is essentially a learning phase in which options are generated, awareness of possible implications is created, and a broad indication of preferred direction and bundles of options emerges.

The short-term assessment looks at the preferred options in more detail and in a shorter time frame, analyzes the implications more precisely, indicates what decisions can be made now, establishes the degree of support for them, and identifies how long the decision is likely to remain valid before the next decision has to be made. The short-term assessment is conventional and generally follows well-established procedures and is not elaborated here.

The intermediate assessment is concerned with preparing the ground for the next decision. It assumes that there is a desirable course to pursue but that it does not occur by chance. At the time when the next decision has to be made, the decisionmaker will be influenced not only by the performance of the previous action but also by the attitude of the community toward it. It involves the monitoring of performance and attitudes, the acquisition of new data, recalibration of models, seeking legislative changes, improving institutional arrangements, creating more effective interaction with certain groups (i.e., clients and unions). Although the intermediate assessment is often overlooked, it is no innovation and does not require further comment. The three phases are repeated when the next decision must be made.

The principal difference with currently used processes lies in the long-term assessment and the integration of long-term, short-term, and intermediate-term assessments. A guidance process is established that searches out directions without firm destinations but with an identification of the first likely port of call (Figure 1). Repetition of the process at future points of decision produces a course adjusted to the perceptions at the time (Figure 2).

The long-term framework consists of systemwide forecasting, preparing scenarios for the progressive introduction of a new component of the system, evaluating the scenarios and forecasts together, and delineating possible strategic options and commitments that form the basis for formulating operational decisions during the short-term assessment phase (Figure 3).

LONG-TERM ASSESSMENT

Systemwide Forecasting

The first activity is that of systemwide forecasting. A horizon year must be assumed that is far enough into the future to encompass likely impacts of the new component. In urban planning, a period of 25 years may be appropriate. This is followed by an important step in the process: the inventing of alternative futures. It does not start with alternative proposals (which has often been the practice to date), but with alternative contexts and controls at the horizon year. Assumptions are made about the socioeconomic system, the values, and institutional influences acting on the physical environment (Figure 4).

The conceptualization of quite different futures is an exercise in lateral thinking and a creative act of "imagineering". It requires developing a holistic view of a number of quite different futures, each with a characteristic dominant theme. For instance, one could postulate, as Robertson does (13), two contrasting views of post-industrial society: the hyperexpansive (HE) view with high technology, computing and telecommunications setting the pace, or the sane, humane, and ecological (SHE) view where personal and humane development is the dominant consideration. The Gamma Report (14) considers five futures: doing more with more, doing more with less, doing the same with less, doing less with less, or doing less with more. There are many ways in which alternative futures can be conceived, but the principal criteria are that there is diversity, the assumptions are made explicit, and the futures are comprehensive.

The futures are transformed into physical forms or structures and policies to enable some degree of quantification to be carried out. This conversion requires a good knowledge of the strengths and weaknesses, and the opportunities and constraints of the system, and an understanding of the processes of urban change. For instance, the scope for major changes in a city's form and structure, even in the longer term, may not be as great as is often assumed, but significant changes within an existing morphology can occur, especially in population and employment structure. It is possible to evaluate alternative structures in terms of equity, accessibility, economy, funding, pliability, and probability.

It is also possible, and indeed desirable, to involve groups with a particular view about the future at this stage in order to understand the willingness to trade-off conflicting objectives and outcomes. None of this activity is intended to lead to decisions; it is an attempt at discovering boundary conditions of the future and understanding the impact of possible fundamental rather than incremental changes of the system as a whole.

Developing Scenarios

The second activity of the long-term assessment concerns the preparation of scenarios for the progressive introduction of the new component into the system. There may be a wide choice, ranging from introducing it in one operation to doing nothing, with many forms of incremental development in between.

The development of alternative scenarios should, at this stage of the process, not be a matter of developing a single decision tree and selecting a few paths to it for closer analysis. While it is

Figure 1. Options and commitments.

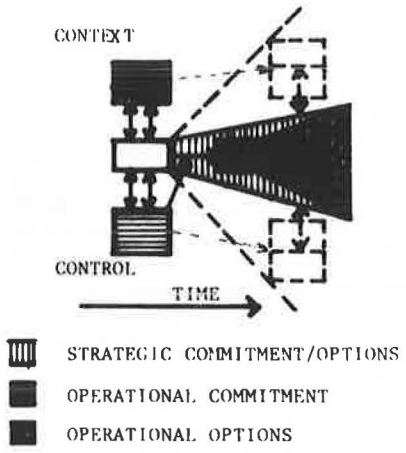
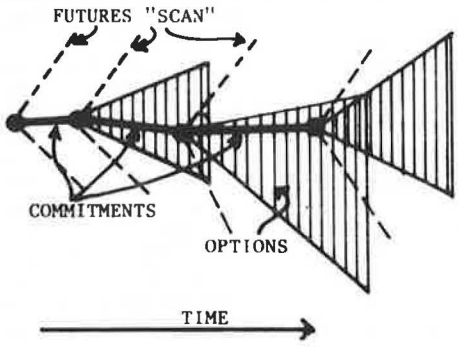


Figure 2. Ongoing nature of the process.



fortunately not a forest, there may be a number of trees because there are quite different criteria and understanding is increased by looking at them individually, at least initially. For instance, the introduction of a new line-haul transport system may involve choices of routes and their progressive development, changing levels of service and rates of technological change in addition to matters such as programming and budgeting (Figure 5). Another significant consideration is the likely policy and community response as means and ends in planning are often difficult to separate.

It is possible to develop scenarios for each of these criteria and, in turn, holding the others constant. For instance, one can develop a systems concept specifying the principal elements of the operation requirements without specifying the precise technology or policy (15). Another approach is to specify policy levels of service and to develop a floating corridor concept (16). A third way is to vary the levels of service and make assumptions about degree of exclusivity of right-of-way, technology class, and operational strategy (17). However, if there is limited time or resources for such a procedure, it is possible to develop the scenarios as different combinations of such variables.

There is scope for systematic approaches as well as for creative short cuts but in all approaches a thorough knowledge of the component is required, a range of alternatives should be explored, and a preliminary appreciation of possible impacts should be obtained. Again, there is no need for any decisions; the purpose is to test incremental changes under different conditions. Selective public participation in some cases is feasible (18).

Figure 3. Long-term assessment.

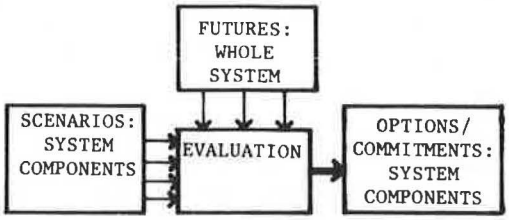
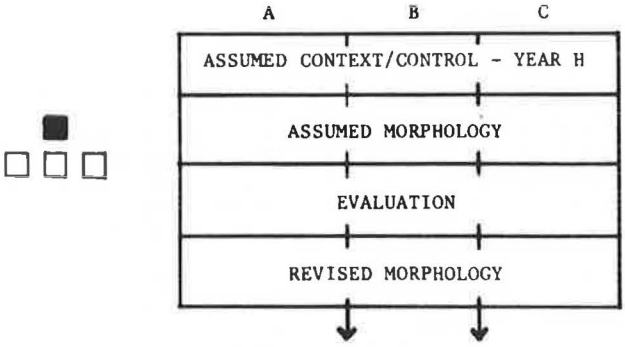


Figure 4. Alternative futures.



Evaluation

It is now necessary to relate the alternative scenarios for a new component of the system to the alternative futures of the system as a whole. This is the core of the long-term assessment. The aim is to reduce uncertainty and complexity and to obtain a picture of what strategic direction may be worth pursuing and which options should be kept open.

Before considering evaluation procedures, it is necessary to comment on the methodological problem of relating time series (scenarios) to fixed states (alternative futures at horizon year). It is possible to take the end of the scenarios and thus have a common horizon year for comparison. It is also possible and preferable to regard the fixed states as the outcome of dynamic action and relate the scenarios to this dynamic context. In essence, one is relating a number of different things to each other: the incremental introduction of a new component against the possible fundamental change of the system as a whole and a view from the present "up" to the future (i.e., the scenario) against a view from possible futures "down" to the present.

The systematic evaluation of possible outcomes and impacts can be exceedingly complex in both conceptual and computational terms. Computer interactive approaches may hold promise in the longer term, but as the evaluation is carried out for the purpose of learning, intuitive procedures based on an assessment of probability and credibility may be sufficient. Obvious inconsistencies will appear, undesirable or improbable associations can be detected, conflicting values can be revealed, and information needs for future decisions can be identified (Figure 6).

The result can be summarized in a simple status report and exposed to the community and decision-makers. It identifies the assumptions made; the issues, possible impacts, options that would appear to be worthwhile to keep open; and the general direction to pursue. It is beyond the scope of this paper to expand on the normative or functional as-

Figure 5. Alternative scenarios.

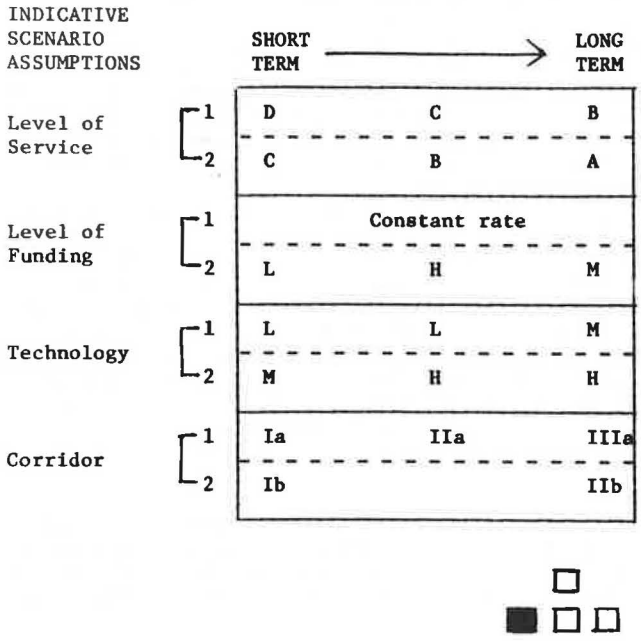
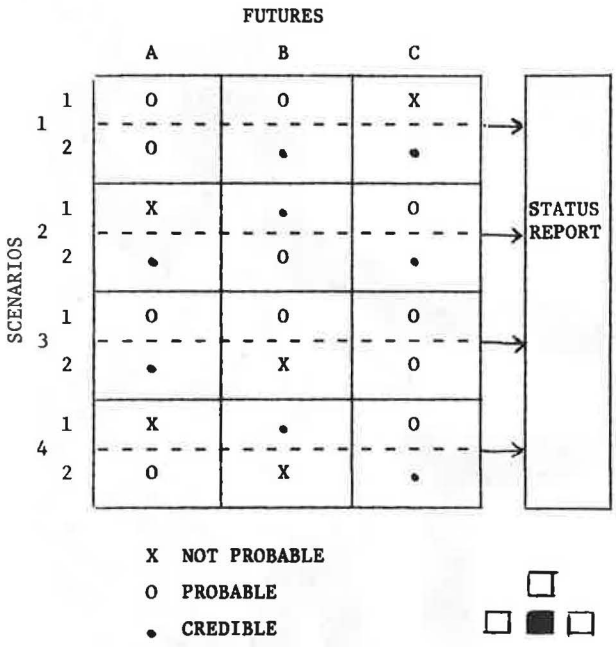


Figure 6. Evaluation.

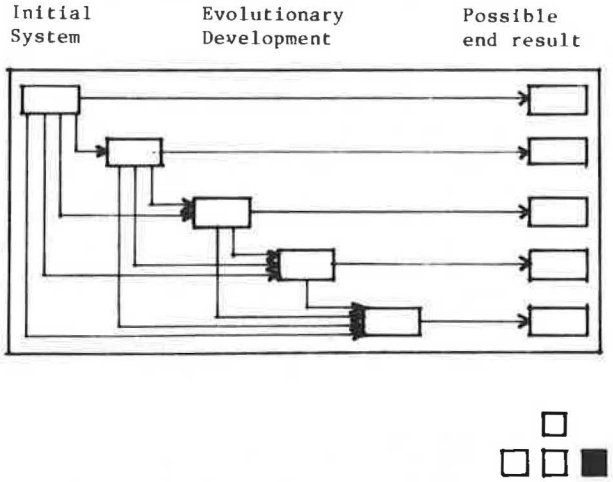


pects of this procedure (19). However, it may suffice to point out that the credible direction should be determined by the likely policy response of decisionmakers and influential groups, and responses to this status report should therefore be sought.

Options and Commitments

The final activity of the long-term assessment is the structuring of those options that are worth retaining in some form of evolutionary framework (Figure 7). It involves making a strategic commitment on the direction to pursue or, as Jantsch puts it, "determining the future boundary conditions" (20), as it is unlikely that all worthwhile options can be retained.

Figure 7. Framework of options.



For instance, in the case of a new line-haul transit service there may have to be a commitment to a corridor, but there can be options in implementation starting from an express bus in mixed traffic to an automated light rail vehicle on its own right-of-way.

The structuring of the options can be based on single or composite criteria and following analytical (21) or intuitive procedures. However, as the time-limited, operational decision is made during the short-term assessment, great accuracy is not called for and a simple procedure may well suffice.

To conclude, the long-term assessment provides an understanding of the implications of making a strategic commitment to the component to be introduced and particularly of its robustness in an uncertain situation. However, there is no operational commitment. Such a commitment involving a decision on the first stage of implemenation depends on the outcome of the short-term assessment.

SCOPE AND LIMITATIONS

The options-commitments approach can be described as a process that allows long-term possibilities to be taken into account in short-term decisionmaking despite uncertainty about the future. It meets the requirements set out earlier in that

1. There is an open-ended and integrated approach to planning and decisionmaking;
2. There is an emphasis on thinking holistically about the city, not within a single view, but within a range of possible futures;
3. Collective learning in which professionals, politicians, and the community can participate is an integral part of the process;
4. There are no unrealistic and unnecessary commitments but a careful combination of commitments that are achievable and options that are worth retaining; and
5. There is a differentiation between strategic and operational commitments and options.

One of the central questions is the relationship between information collection and analysis and decisionmaking. In view of the very broad nature of the approach, there is a risk of losing the trees for the forest of possible options. The process requires a careful assessment of how much is needed to know for what level of decisionmaking, and it may be more productive to make quick assumptions (so

long as they are made explicit) than to undertake time-consuming studies that do not remove the basic uncertainty underlying the future development of the system or its component. A quick assessment may be more relevant for a decisionmaker than a thorough assessment that comes too late to be useful.

There are several procedures to simplify the process without diminishing its essential character (Figure 8). Diagram 1 sets out the process as described. In diagram 2, the alternative futures are evaluated in terms of commonalities so that a bundle of options and commitments for the system as a whole is selected against which alternative scenarios for a specific proposal or new component can be tested. This simplification is used in the illustration that follows and can also be useful where the management of change is centralized (e.g., development corporations). In diagram 3, the alternative scenarios are contracted to one or two basic variants. It was used in the Canberra study of a proposed line-haul system where the route was predetermined but technology and funding levels were the uncertain elements (11). Diagram 4 represents a simplification in both alternative futures and scenarios.

APPLICATION: SYDNEY'S TRANSPORT SYSTEM--A CASE STUDY

My interest in applying the options-commitments approach to Sydney's transport system was aroused by the decision of the state government in 1979 to conduct an inquiry into the location and construction of a major arterial road through the inner suburbs of Sydney. The road was seen to fill a need following the development of a new port and container terminal. The options presented were not all compatible, the case made in support of the road was based on traffic growth, using models not calibrated for changes in energy costs, and the evaluation relied on cost-benefit analysis with its attendant problems of quantifying benefits.

A wide range of differing objectives was put to the inquiry in public submissions. The inquiry typified the complexities of decisionmaking in today's climate: uncertainty about the future, absence of long-term policy guidelines, conflict between long-term and short-term interests, and between metropolitan and local interests, distrust of professional attitudes, rationality clouded by emotion, electoral prospects, union attitudes, differences between public authorities, limitations in public funds, and unequal impact in different groups.

Sydney's growth since 1945 has been rapid but has slowed down in recent years. The city has a population of about 3 million (1980), spread out over an area as large as greater London. It has a reasonably good radial railway system, an extensive system of buses and ferries, but an arterial road system that has not been upgraded sufficiently to keep up with the city's expansion. There has been some freeway construction, confined mostly to the fringes, and there have been longstanding proposals to improve traffic conditions in the intermediate and inner suburbs by the construction of new arterial roads and freeways. These plans were thrown into disarray in 1977 when the government decided to abandon large sections of the proposed inner suburban freeways (Figure 9).

The decision was not unexpected as the freeways would seriously affect the environment and funds were simply not available nor likely to become available in the near future. The context had changed to a point where the concept could no longer be supported. However, the removal of a significant part of a proposed system may invalidate that which remains and makes it all the more difficult to judge whether an ad hoc proposal such as the new road to the port made sense in the long run.

Methodology

The process outlined in the first part of the paper was adapted and simplified because of the need to make a quick assessment, use readily available information, and relate it to the inquiry in

Figure 8. Alternative procedures.

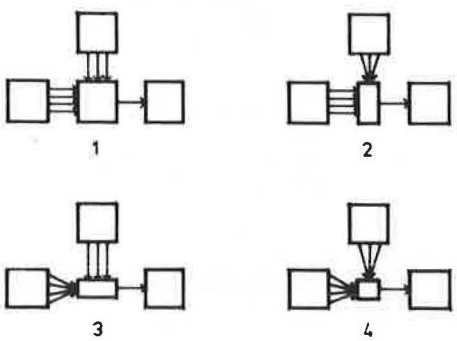
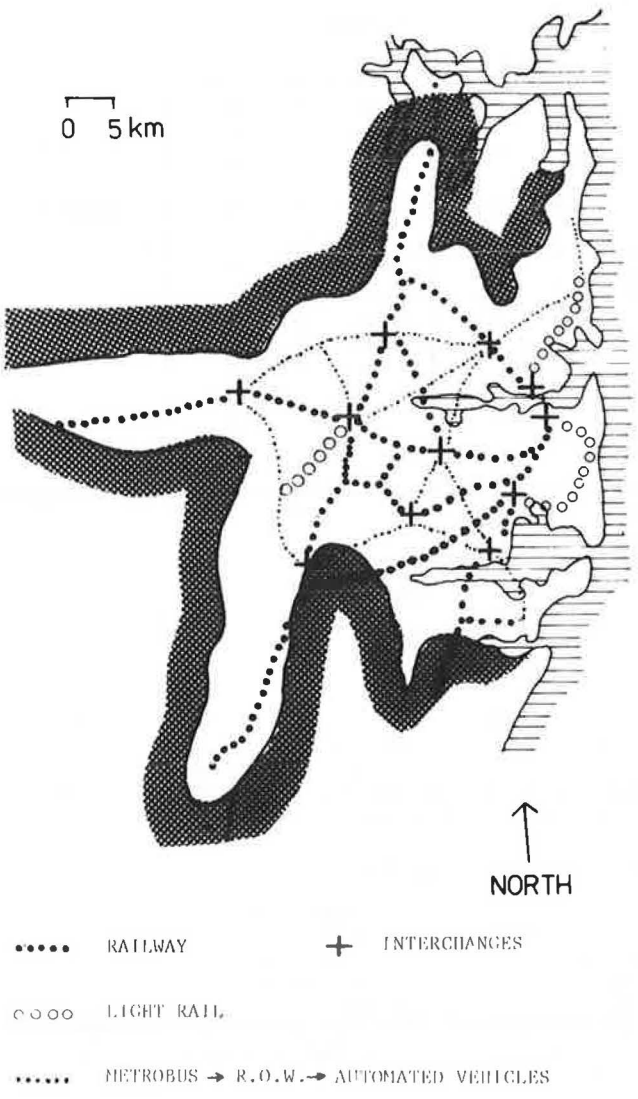


Figure 9. Strategic public transit options in Sydney, 1980.



progress. Procedure 2 (Figure 8) was followed for the long-term assessment; the short- and intermediate-term assessments were not carried out because they required a policy decision first.

A study was made of the historical relationship between context and strategic planning concepts, and this was followed by an examination of current problems (e.g., imbalances in employment and work force, accessibility, equity, and incidence of congestion), existing commitments, opportunities, and constraints.

The long-term assessment commenced with the formulation of alternative futures and a search for commonality that produced a framework of strategic options and possible commitments for the city as a whole. The options for the location and performance of the road as presented to the inquiry were accepted as alternative scenarios. These were then related to the strategic options and commitments for the system as a whole. Some conclusions were drawn from this evaluation used for constructing an options-commitments diagram for the introduction of the new road.

Application

The four different futures were a public-investment-sensitive future, an energy-sensitive future, a pollution-sensitive future, and a future based on accessibility at a price.

In the public-investment-sensitive future, the overriding assumptions are those of doing more with what exists, making small rather than large-scale commitments, and maximizing the utility of any future transport extensions or improvements by supporting land use or other policies. In such a future there would be less emphasis on freeways and expressways and more on selective elimination of congested areas, further extension of clearways, priority lanes for buses, area traffic management, and downgrading of traffic-generating land uses fronting arterial roads.

In the energy-sensitive future the overriding concern can be much higher cost of fuel and/or lack of supply. Lack of supply will mean rationing that would affect every motorist; higher costs will mean that those able to afford it will continue to use their car and those who cannot must have an alternative. Accessibility to public transport and trip length become critical variables. Relocation of jobs and homes, with employers seeking employees closer to where they live and employees moving closer to work, would be some of the consequences.

In the pollution-sensitive future the overriding concern is that of improving the environment by reducing air pollution by cars and industry, eliminating noise and waste, increasing safety, enhancing the environment through higher standards of building, landscaping and urban design, and preserving historic buildings and environments. Stringent controls on vehicle emissions, reducing stop-start driving and traffic densities in critical areas, affecting a shift to public transport, duo-mode or electric buses, electric commercial vehicles, and applying clean air standards to industry would be some of the implications.

In the accessibility-at-a-price future it is assumed that the user pays directly for the price of improved accessibility by private vehicle. It would involve a simple network of freeways, accessibility only by payment with the charge dependent on the distance traveled and the weight of the vehicle. Credit cards could be used, with the level of charges set to recover capital and operating costs. The public transport system would be expected to meet its operating costs, but historic costs would be written off and there would be grants for capital improvements. Special funds would also be available for the development of an intrasuburban metrobus system, suburban paratransport services, and public transport interchanges (with cost recovery through the sale of development rights).

The alternative futures are expressed in diagrams showing their morphology and related policies and are described in more detail elsewhere (12). A comparison of the alternatives shows that there are commonalities. Land use policies directed toward subcentralization and transport policies to improve conditions in congested areas are common to all alternative futures. They are robust, current policies, and continuing commitment can be justified with little risk.

There are others that emerge as recurring themes: the relocation of industrial and related storage functions from inner areas and their replacement by higher-density housing, the concentration of employment into nodes that can be served by public transport, the development of an express intermodal public transport system with proper interchanges, the rationalization of goods movement with greater use of the railway network, and the improvement of public transport with further land use intensification in the areas served to maximize the benefits of such improvements.

All futures provide for high-standard regional connections, at least one major intermediate link from north to south and one intermediate-ring route. These options would appear important to retain. In the accessibility-at-a-price future, additional corridors are envisaged and these may be desirable to retain as longer-term options, which can be reviewed at the next round. There are also a number of arterial roads that may be considered as candidates for progressive upgrading to expressways. Long-term land use policies designed to reduce the impact of frontage access would make their upgrading a more realistic option in the long term (Figure 10).

All futures also envisage, inter alia, significant improvements in the intrasuburban public transport system including the development of interchanges. The evolution of such a system can take different forms and at this stage it would seem that the longer-term option of moving toward a separate right-of-way with a capability of automated vehicles should be kept open (Figure 11).

In terms of commitments, there are some links that seem to be robust, irrespective of the kind of future that may occur. These include the new road as part of a circumferential route, roughly in the position proposed to the inquiry. Its long-term status is that of a high-capacity expressway serving a significant metropolitan function.

THE NEW ROAD--SCENARIOS AND EVALUATION

Four options of the new road were put to the inquiry. The first and second option envisaged a new arterial road with small differences between them in location. The first minimized the disruption of existing residences while the second minimized the effect on open space. The third option involved a partial upgrading of existing roads. The fourth option proposed the construction of a freeway running in a different direction.

The options were not strictly comparable and internally consistent. None considered incremental implementation in the form of scenarios. There was an assessment of environmental impact and costs and benefits of the alternative routes, but there was no consideration of costs and benefits of alternative levels of service.

Evaluation of the options for the road against

Figure 10. Strategic road options.

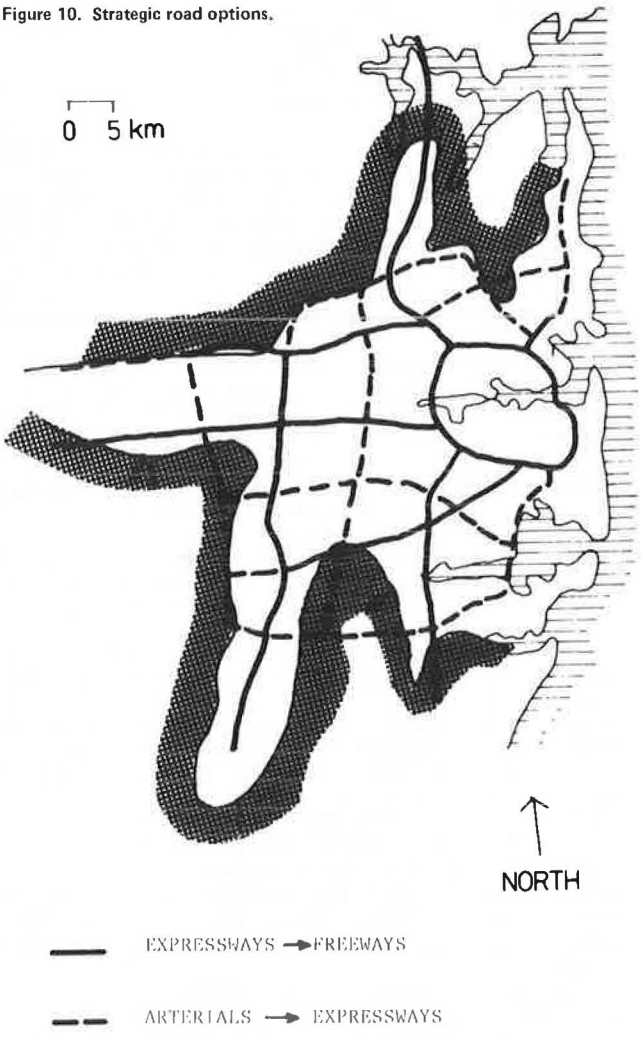
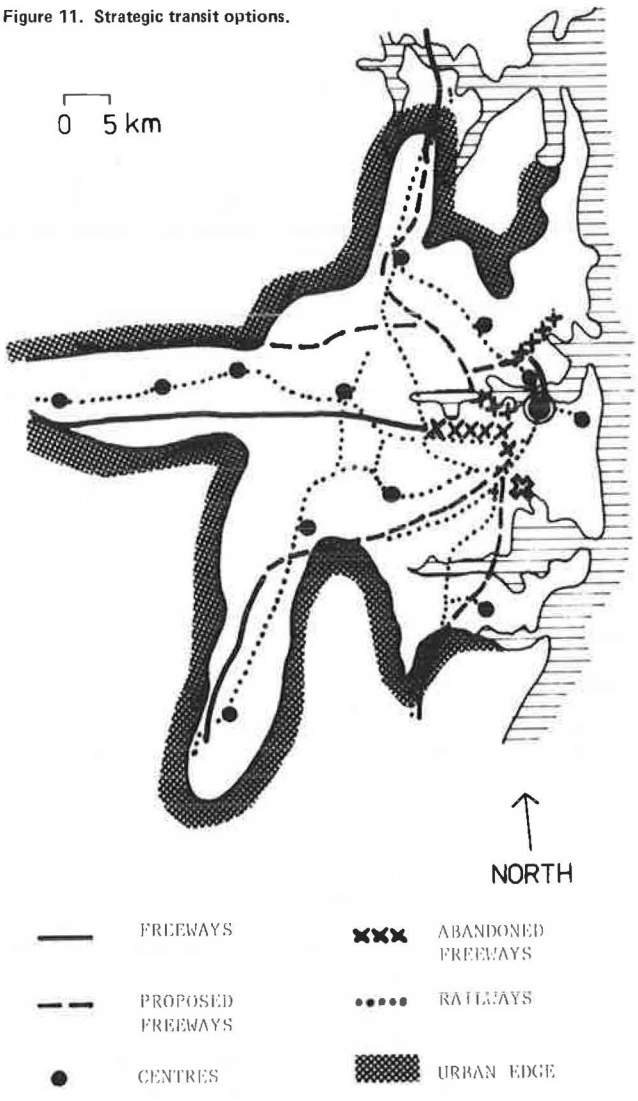


Figure 11. Strategic transit options.



the strategic options and possible commitments for the system as a whole showed that the assumed level of service of the road--an arterial road with many intersections at grade--was ill-considered and that the long-term option should have been that of an expressway with potential grade separation.

At this point, the proper course would have been to prepare new scenarios for the road, assume different levels of service, and reassess its performance. When the credibility and robustness of the road and its general performance characteristics in a metropolitan long-term context had been established and political support had been received in principle, studies of operational options and commitments could have commenced. They would have taken account of the level of resources likely to be available, direct and indirect costs, and the need for parallel programs. Such programs could ensure that loss of open space is compensated for, people affected are rehoused in the locality, traffic management schemes are introduced to reduce the incidence of through traffic, and the new road acts as a catalyst to a general upgrading of the area affected by it. An options-commitments diagram can then be prepared that shows different ways in which the road (and associated programs) can be phased in (Figure 12).

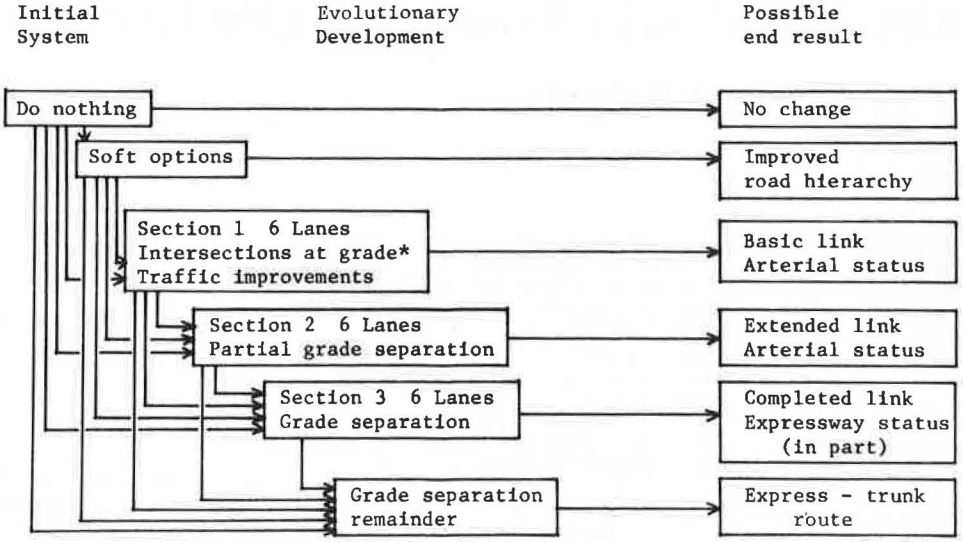
The terms of reference of the inquiry, however, did not foresee the need to distinguish strategic from operational decisions. Had this been the case, abortive work could have been avoided and metropolitan issues could have been resolved before local issues were dealt with. A two-stage approach to the inquiry would have provided the feedback necessary for making strategic commitments.

Since this paper was written, the report by the Commission of Inquiry has been tabled in the New South Wales Parliament. It recommends that the road not be built, that any land already acquired for the road be declared as open space, and that the containers from the new port be moved substantially by rail. The recommendations are understandable in the current context of limited public funds and/or improving the local environment and will be welcomed by local residents and politicians. However, they appear to ignore the longer-term metropolitan needs. The declaration of land acquired as open space removes, for all time, the option of progressively introducing the new road. There is obviously a need for more emphasis on collective learning so that the need to keep options open for future generations is understood and widely accepted.

CONCLUSION

There has been a rapid expansion of specialized knowledge and techniques in recent years. This is valuable as planning and decisionmaking must proceed on a solid base, but there is a danger of fragmenta-

Figure 12. Options for development.



tion if such expansion is not matched by growth in understanding of the totality of the environment and by the development of holistic approaches to the management of physical change.

This will be all the more important and also the more difficult in the 1980s, which will be characterized by uncertainty. The natural reaction in situations of uncertainty is to deal with problems and issues on an ad hoc basis, but this does not constitute a holistic response to the management of change. There is a need, therefore, to develop processes that allow decisions to be made in a broad context and within both a short-term and long-term perspective.

The approach outlined in this paper is one such process. It does not produce immutable plans (with the inevitable psychological commitment by those who prepared them with care and conviction), but options and limited, time-based commitments. The process may be more accurately described as a general approach than a rigorous procedure as it need not be elaborate and can be adapted to suit individual situations. It is an incremental process of collective learning and selective decisionmaking in which plans, policies, and programs can respond to changes in context and control.

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