

Use of Future Scenarios in Long-Range Public Transportation Planning

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The Municipality of Metropolitan Seattle (METRO) needed to update its current long-range plan. Based on experience with the current plan, a new approach was adopted to enhance the agency's ability to respond to alternative futures. Alternative future scenarios for 1987 through 2000 were developed with the help of an expert panel representing diverse but appropriate disciplines. The panel focused on three reasonable scenarios and two others that represented the upper and lower bounds for contingency planning. Implementation of public transportation planning is discussed and key regional factors that require monitoring are identified.

The Municipality of Metropolitan Seattle (METRO), the agency responsible for public transportation in King County, Washington, developed its present long-range plan in the late 1970s, a period which saw two severe gasoline crises and a rapid annual increase in the demand for public transportation services. These crises had a noticeable but short-lived impact on auto travel, and a more lasting impact on political support for alternatives to the automobile, such as public transit.

Expanding federal capital and operating assistance, combined with a strong local funding base and severe equipment shortages during the second gasoline shortage, encouraged METRO to increase service rapidly and embark on an ambitious capital program. METRO's long-range plan, called the 1990 Plan, reflected the optimism about the prospects for public transportation in presenting a detailed list of transit capital and operating improvements in the Seattle metropolitan area. Based on a target ridership forecast of 120 million in 1990, the 1990 Plan was essentially a blueprint for a single scenario of conditions expected to occur during the 1980s, as follows:

- presence of auto disincentives,
 - rising gasoline prices,
 - increased concentration of population and employment,
- and
- transit incentives in the form of expanded transit service with lower fares.

In retrospect, METRO exerted direct control over only the last condition, transit incentives. During the 1980s, METRO has embarked on the construction of a downtown bus tunnel to address the problem of transit congestion in downtown Seattle. Transit centers and a large number of park-and-ride

lots have been built, and a modern fleet of buses, including the largest number of articulated buses in North America, have provided expanded service, particularly during peak periods.

Despite these accomplishments, transit ridership stopped growing in the 1980s and stood at 63.2 million in 1986. The other conditions on which the 1990 Plan depended have not occurred as anticipated. Disincentives to automobile use have been imposed in a limited number of areas by only a few jurisdictions. The 1990 Plan had assumed that real gasoline prices would increase 85 percent between 1978 and 1990, whereas real prices actually declined in the 1980s. Population and employment growth have occurred largely in low density suburban areas of King County that cannot be served cost effectively with traditional fixed-route transit service.

The shortcomings of the blueprint approach to long-range planning have been pointed out previously in articles by Westerman (1) and by Schofer and Stopher (2) who emphasize that the central concern of long-range planning is uncertainty. Traditional long-range transportation plans have attempted to deal with uncertainty by eliminating it through a single set of assumptions about the future. Such a blueprint plan is particularly vulnerable to changing conditions that can undermine the assumptions of the plan. A long-range plan may then be no plan at all, as ad hoc decision-making takes over.

METRO'S YEAR 2000 LONG-RANGE PLAN

In July 1986, METRO staff began work on a new approach to guide the long-range plan for public transportation in King County through the 1990s to 2000. In contrast to the 1990 Plan, the new approach calls for the formulation of a number of alternative future scenarios. Each scenario is a hypothetical sequence of events constructed to assess the boundaries of possible future conditions as well as their impacts.

The usefulness of scenarios in exploring the future has been pointed out by futures researchers such as Amara and Wilson (3). Scenarios can help policy makers identify choices, understand the factors influencing future conditions, and assess risks and tradeoffs. Scenarios cannot eliminate uncertainty about the future, but they can help planners and decision makers manage uncertainty by increasing initiative while reducing surprise to a minimum.

Although using scenarios in long-range planning is a new approach for METRO, the scenarios approach has been used frequently in the recent past in both public and private sector long-range planning efforts. In the Pacific Northwest, the Northwest Power Planning Council has developed four regional

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economic and demographic scenarios to guide its most recent 20-year electric power and conservation plan (4). Sullivan (5) has pointed out the relevance of the approach for transportation planning. Recent examples include the Southeastern Wisconsin Regional Planning Commission's alternatives analysis of bus and rail options in the Milwaukee area (6) and a study of long-term transportation needs in conjunction with alternative energy scenarios in the Baltimore region (7, 8).

Building on this past experience, METRO's new long-range plan will use future scenarios to provide a context for assessing future markets for public transportation in King County, developing assumptions for ridership forecasts, and identifying appropriate mixes of services and facilities best suited to a range of future conditions. The approach will provide a framework for strategic thinking about both threats and opportunities for public transportation in King County through 2000, as well as establish an ongoing process to monitor conditions and offer timely input to the annual budget process.

In contrast to the 1990 Plan, which specified services and facilities needed to meet the demand of a target ridership, the new long-range plan will take into account three scenarios that could affect public transportation in METRO's service area. Potential public transportation markets will be identified for each of these futures. Types of services and facilities, termed public transportation "products," will then be matched to the markets in each scenario.

Sets of products will be organized into four components of the new long-range plan. These components will include the following:

- *Core Program.* This program represents the minimum commitment necessary to maintain the 1990 services and facilities until 2000 and assumes no new or added public transportation programs.
- *Scenario Plans.* Sets of products best suited to the market conditions described in each scenario will be developed into alternative public transportation plans.
- *Basic Program.* This program will include those public transportation products appropriate to all three future scenarios, as well as elements of the Core Program.
- *Implementation Program.* Program priorities for initial implementation will be developed from the Basic Program and the assessment of the direction of current trends.

Figure 1 describes conceptually the development of the long-range plan.

The scenario outlines developed by the expert panel and described below will be expanded into more detailed quantitative and qualitative descriptions. These descriptions will be used in subsequent tasks to guide the assessment of future public transportation markets and products, forecasts of transit ridership under each scenario, financial analyses of alternative plans, and development of an ongoing monitoring program.

The scenario descriptions will be particularly important in transit ridership forecasting and analyzing future markets for public transportation. Quantifiable detail about the concentration and distribution of households and employment will be desirable to analyze changes in land use under each scenario. The analysis of changes in future travel costs and congestion will require assumptions to be made about trends in real household income, private auto ownership and operating costs, and auto parking costs under each scenario. This

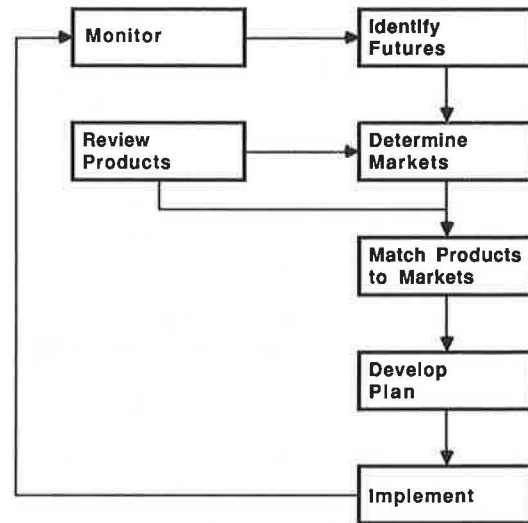


FIGURE 1 Development of the long-range plan.

effort will consider available national and regional studies and data in developing the descriptions.

SCENARIO DEVELOPMENT PROCESS

METRO Futures Team

To further develop the scenario approach and also develop background information, a METRO staff team was formed in September 1986. This interdivisional group, called the Futures Team, began its work by researching other long-range planning efforts around the country and identifying trends and events, external to METRO, that could affect supply of and demand for public transportation. The team identified five general categories of trends and events with the following ranges of variability:

1. Economy and trade
 - rapid economic growth
 - moderate economic growth
 - economic decline
2. Petroleum availability and price
 - plentiful supply and no real price increase
 - plentiful supply and low price in the early 1990s, shortages and large price increases later in the 1990s
 - volatile supply and price
 - stable supply and gradual price increases
3. Major directions in public policy
 - expanded government intervention and spending
 - government deregulation and reduced spending
4. Technological innovation
 - rapid rate of innovation
 - slow rate of innovation

5. Demographic trends

- increased elderly population, smaller teenage cohort, smaller households, greater number of middle-aged households (common to all scenarios).

Each variable was arrayed against every other variable in the form of a matrix for undertaking a cross-impact analysis. The purpose of analyzing cross-impacts was to assess which variable might do the following:

1. enhance or provoke another variable;
2. inhibit, block or render infeasible or implausible certain other variables; or
3. show little or no relationship with other variables.

An explicit identification of cross-impacts assisted in screening out combinations of variables that are implausible or are not likely to occur at the international, national or regional levels.

The Futures Team then developed 18 combinations of variables using a cross-impact table to represent an entire range of possible conditions. An outline of this table is shown as

Figure 2. To simplify the process of developing scenarios, only economy, energy, and public policy variables were subsequently used to form possible combinations. Since the same demographic trends would be present in all combinations, demographics were not used as a variable to define different scenarios. Technological innovation was considered to be secondary in importance to the three variables and was also dropped from consideration.

The cross-impact table was used to narrow the number of preliminary scenarios. Nine scenarios were dropped because they appeared less plausible, highly unlikely or less meaningful in terms of implications for public transportation. The nine remaining scenarios, shown by circled combinations in Figure 3, were submitted to a panel of outside experts for further development.

Expert Panel

A distinguished panel of experts with knowledge of economics, demographics, social sciences, development, law, trade

		IMPACTED VARIABLES									
		ECONOMY			ENERGY			PUBLIC POLICY		TECHN. INNOVATION	
		(1) Rapid Economic Growth	(2) Moderate Economic Growth	(3) Economic Decline	(1) Plentiful Supply Constant (low) Price	(2) Volatile Supply and Price	(3) Stable Supply Gradual Price Increase	(1) Expanded Govt. Intervention & Spending	(2) Govt. Dereg. & Reduced Spending	(1) Rapid Rate of Innovation	(2) Slow Rate of Innovation
ECONOMY	(1) Rapid Economic Growth										
	(2) Moderate Economic Growth										
	(3) Economic Decline										
ENERGY	(1) Plentiful Supply Constant (low) Price										
	(2) Volatile Supply and Price										
	(3) Stable Supply Gradual Price Increase										
PUBLIC POLICY	(1) Expanded Govt. Intervention & Spending										
	(2) Govt. Dereg. and Reduced Spending										
TECHN. INNOVATION	(1) Rapid Rate of Innovation										
	(2) Slow Rate of Innovation										
DEMOGRAPHICS	Demographic profile characterized by: • Increased elderly population • Smaller teenage cohort except for minorities • Smaller households • Increase in middle-aged households										

FIGURE 2 Cross-impact analysis of independent scenario variables.

POLICY TREND: Expansion in government expenditures; emphasis on regulation and government intervention		ECONOMY		
		(1) Rapid economic growth	(2) Moderate economic growth	(3) Economic decline
ENERGY	(1) No real price increase	A	B	C
	(2) Plentiful supply and low price until early 1990's shortages and large price increases in the late 1990's	D	E	F
	(3) Stable supply and gradual real price increase	G	H	I

POLICY TREND: Contraction in government expenditures; emphasis on deregulation		ECONOMY		
		(1) Rapid economic growth	(2) Moderate economic growth	(3) Economic decline
ENERGY	(1) No real price increase	J	K	L
	(2) Plentiful supply and low price until early 1990's shortages and large price increases in the late 1990's	M	N	O
	(3) Stable supply and gradual real price increase	P	Q	R

FIGURE 3 Preliminary scenario matrix.

and business was assembled. The purpose of the panel was threefold: to provide technical expertise on national and regional trends and issues, to independently review and validate the scenarios developed by staff, and to reach a consensus on three scenarios to be used in developing METRO's Long-Range Plan. Panelists were not asked to develop policy responses to future conditions, assign probabilities or values to particular regional scenarios, reach a consensus on one scenario, or attempt to estimate impacts of various scenarios on specific jurisdictions.

The composition of the METRO scenarios panel differed from panels of other scenario development efforts in that METRO's panelists were neither asked nor expected to render policy judgments. This objective differs from other scenario development efforts such as the Baltimore study (7), where a group of regional officials was assembled to consider public policy responses to alternative energy scenarios.

The panel members included the following disciplines and expertise:

- a bank economist,
- a professor of geography,

- a vice president of a development company,
- a law partner and trade expert,
- a professor of public affairs,
- a professor of economics, and
- a director of market research for a large manufacturing company.

The panel members met in three sessions over a two-month period to develop a set of scenarios that reflected what could reasonably happen before the year 2000. Considerable time was spent discussing alternative directions for the local economy in conjunction with linkages to the national economy and international trade. The panel recognized that regional economic cycles have swung higher or lower than national economic cycles. This variability was attributed to the region's dependence on a single employer, the Boeing Company.

In the late 1960s, a boom in aerospace employment was followed by a bust, thrusting the four-county central Puget Sound region into an economic depression as Boeing employment fell from 120,000 in 1968 to 40,000 jobs by 1971. Although the region's economy has diversified since then, particularly in King County, Boeing remains the single most important

employer, with 86,000 jobs in the region as of early 1987 and 70,000 jobs in King County alone. Boeing employment comprises a smaller percentage of total county employment than in the late 1960s, but the value of output has remained close to 20 percent of regional output (9). The history of economic expansion and contraction led the panel to pay specific attention to alternative directions of the aerospace sector in King County.

Because METRO staff supplied the panel with nine preliminary scenarios well in advance of the first panel session and offered strong support throughout the panel process, the panelists were already familiar by the first session with the format of the scenarios and the objectives of the process. One major change made by the panel to the work done by METRO staff was to redefine the public policy variable. The panel saw the federal budget deficit as an issue of paramount importance, and therefore did not see a significant expansion in real terms of federal spending as a realistic option. Consequently, the panel redefined the national policy variable around the distribution of spending between military and non-military programs and around deregulation versus policy intervention.

The aforementioned considerations and other discussion led to respecification of the scenarios in the form of an inter-

mediate matrix, as shown in Figure 4. Dimensions of change in economic and energy variables were quantified into rates of economic growth or decline and real percentage change in energy prices.

Other key points made during the sessions that influenced the description of the scenarios eventually chosen by the panel are summarized below:

- Puget Sound has an economic cycle different from that of the U.S. and the rest of the state due to the impact of Boeing's aerospace employment and the ports of Seattle and Tacoma.
- Federal expenditures may shift in emphasis from military programs to social and infrastructure programs but will not decline in absolute level.
- The Boeing employment trend looks strong due to the favorable prospects for the aircraft replacement market in the 1990s.
- Per capita income should increase as the baby boom generation ages.
- Downtown Seattle has developed rapidly as a regional finance and trade center.
- Energy prices should rise gradually during the 1990s.

POLICY TREND:

Federal government expenditures increase at rates slightly higher than inflation; more domestic policy intervention and expenditures shifted from military to domestic issues		KING CO. ECONOMY			
		(1) Rapid growth, 3+%	(2) Moderate growth, 1 - 3%	(3) Steady growth, 0 - 1%	(4) Decline 0 to -2%
ENERGY	(1) No real price increase	A	B	C	D
	(2) Price increase 50% higher than rate of inflation	E	F	G	H
	(3) Price increase twice rate of inflation	I	J	K	L

POLICY TREND:

Reduction in increase of federal government expenditures; continued emphasis on deregulation and military expenditures		KING CO. ECONOMY			
		(1) Rapid growth, 3+%	(2) Moderate growth, 1 - 3%	(3) Steady growth, 0 - 1%	(4) Decline 0 to -2%
ENERGY	(1) No real price increase	M	N	O	P
	(2) Price increase 50% higher than rate of inflation	Q	R	S	T
	(3) Price increase twice rate of inflation	U	V	W	X

FIGURE 4 Intermediate scenario matrix.

- The female labor force participation rate is flattening due to lack of affordable child care and slower growth in service sector jobs.
- Reduced military expenditures will not have a dramatic effect on King County, since major military installations are located in other counties.
- Local jurisdictions outside Seattle will continue to attract high technology firms and business service development.
- Puget Sound is in an excellent geographic position to benefit from the growth of trade with Asian countries.
- Increased efficiency in railroad operations will benefit distribution activities related to international trade.
- Alaska's recent economic downturn will not have a big effect on King County since it affects only 2 to 3 percent of Puget Sound's economy.
- No new transportation technology is likely to be commercially available before the year 2000 because of the long lead times necessary to introduce innovations.
- Federal taxes will likely be increased to cover the budget deficit.
- Household income is rising due to female labor participation and non-wage income.
- Trade protectionism will have short-term impacts only since the U.S. depends on trade.
- Boeing is diversifying; 40 percent of its business is now the manufacture of commercial airplanes.
- Development will push to outlying areas because of cheaper land farther out and attempts to regulate growth.
- Lack of uniform government policies on growth in King and adjacent counties is a deterrent to more concentrated development patterns.

Scenario Selection

Panel members considered all possible matrix combinations shown in Figure 4, and narrowed their attention to the eight circled intermediate scenarios by the end of the second panel session. Through discussion and debate, the panel at its third session recommended three primary scenarios for use in developing METRO's long-range plan for the 1990s. Two additional scenarios were identified to reflect extreme con-

ditions with a low probability of occurrence; these extreme scenarios can be used in contingency planning.

Figure 5 shows the five scenarios selected by the panel. The King County environment under each scenario was described in terms of the following characteristics:

- *National Policy Trend:* The balance between military and social programs at the federal level, and the degree of emphasis on government deregulation versus government intervention.
- *Demographic:* Regional demographic trends.
- *Economic:* Production, distribution, and consumption of goods and services at the international, national, and regional levels.
- *Employment:* Job composition and unemployment rates.
- *Housing and Land Use:* Residential and employment composition, spatial distribution, and housing demand.
- *Energy:* Price and availability of gasoline and other energy resources.
- *Institutions:* Land use regulation and policy, relations between state and local governments, and state and local taxation.

Planning Scenarios

In Figure 5 Scenarios B, R/N, and G/K represent the panel's consensus on a range of scenarios to cover the period from now to 2000. Detailed descriptions of these scenarios follow:

Scenario B—Prosperity Continues An overview of Scenario B is shown in Figure 6. At the national level, this scenario assumes a slightly more liberal administration and Congress, which would shift some military spending to non-military programs. New tax revenues would be raised to reduce the federal budget deficit. More domestic policy intervention is also assumed; this might mean an increase in federal assistance for public transportation. "Free trade" policies nationally would be conducive to a rapid expansion of trade through the Port of Seattle.

The Puget Sound economy would remain strong, as it is

Metro Year 2000 Scenarios Long Range Plan Update		KING CO. ECONOMY			
		(1) Rapid growth, 3+%	(2) Moderate growth, 1-3%	(3) Steady growth, 0-1%	(4) Decline 0 to -2%
ENERGY	(1) Price increase 0-25% greater than inflation	M	B		
	(2) Price increase 25-75% greater than inflation		R/N	G/K	
	(3) Price increase 75% greater than inflation				X

FIGURE 5 Final scenario matrix.

KING COUNTY ENVIRONMENT

<u>National Policy Trend</u>	<ul style="list-style-type: none"> Federal government expenditures increase at rates slightly higher than inflation; more domestic policy intervention and expenditures shifted from military to domestic issues
<u>Demographic</u>	<ul style="list-style-type: none"> In-migration 1-2% Real wages stable
<u>Economic</u>	<ul style="list-style-type: none"> Redistribution of jobs from military to domestic issues Rapid port growth 4% Boeing employment 90,000 in 2000 Reduced military contracts Overseas aviation competition reduced R&D investment increases Manufacturing grows slightly Retail/commercial expansion
<u>Employment</u>	<ul style="list-style-type: none"> Aerospace grows High tech shows rapid rise (small base) Unemployment at or slightly lower than U.S.
<u>Housing & Land Use</u>	<ul style="list-style-type: none"> Continued suburban growth Dispersion of employment
<u>Energy</u>	<ul style="list-style-type: none"> Little interest in conservation No increase in real gas price
<u>Institutions</u>	<ul style="list-style-type: none"> Local role and taxes increase Gas tax increases Growth controls spread sprawl further out Little cooperation between local government and developers

FIGURE 6 Scenario B—prosperity continues.

currently. This economic growth, led by Boeing and the ports, would cause expansion in nearly all economic sectors. Employment in downtown Seattle would continue to increase, while dispersed housing and commercial expansion would continue in the suburbs. Due to continued low fuel prices, little interest would be shown in conservation efforts.

Low interest rates and growth in per capita income would result in a strong housing market, particularly in the early 1990s. Low gasoline prices and the continuing demand for road improvements would result in passage of an increased state gas tax. Local jurisdictions would compete with one another for both new development and state funds for infrastructure improvements.

In summary, this scenario is basically an improvement on the economic and social conditions experienced by the central Puget Sound region during the mid-1980s.

Scenario R/N—Business As Usual This scenario outline is shown in Figure 7. At the national level, the emphasis on deregulation and control over the federal budget deficit would continue. Military expenditures for research and development would remain constant, thereby helping high tech firms in the region. A reduction in the growth of federal expenditures would occur, and this would sustain current trends in federal financing of public transportation.

By the late 1990s, higher energy costs would dampen the economy, and overall economic activity would grow at a rate lower than that in Scenario B. Boeing employment would remain steady.

Downtown Seattle and suburban areas would continue to grow. The dispersed nature of suburban development would

make traditional transit service difficult to provide cost-effectively.

Owing to a rise in energy prices and the slow growth of the state's economy, gas taxes would not be increased. Local jurisdictions would be forced to seek agreements with the private sector to share in the cost of road improvements.

In summary, this scenario represents a continuation of present trends in King County.

Scenario G/K—Slowdown Figure 8 provides a summary of Scenario G/K, which takes place in the context of national policies similar to those of Scenario B, except for increased protectionism. Scenario G/K is characterized by slower growth in the regional labor force and productivity. Higher interest rates and higher inflation would adversely affect economic sectors associated with durable goods and capital investment. This scenario assumes that the balance of trade deficit and federal budget deficit would remain serious problems into the 1990s. The political results would be protectionism and new federal taxes by the late 1990s.

Higher energy prices, a downturn in Boeing employment, and lower port activity would cause the entire local economy to slow. In-migration would be reduced, unemployment would be up, and business activity would be flat.

Energy conservation efforts would make a comeback due to high energy prices and a major supply interruption in the early 1990s. Lower household incomes and higher fuel prices would push people to alternative modes of transportation.

Office development in downtown Seattle would slow as vacancy rates rose. Suburban growth would also slow. Tax increases would be modest due to economic conditions.

KING COUNTY ENVIRONMENT

<u>National Policy Trend</u>	<ul style="list-style-type: none"> Reduction in increase of federal government expenditures; continued emphasis on deregulation; military expenditures constant in real terms
<u>Demographic</u>	<ul style="list-style-type: none"> In-migration 1-2% Real wages stable
<u>Economic</u>	<ul style="list-style-type: none"> Moderate port growth (2% average annual growth) Boeing employment 80,000 in 2000 Steady military contracts Increased overseas aviation competition R&D investments increase Manufacturing moderate Retail/commercial expansion
<u>Employment</u>	<ul style="list-style-type: none"> Aerospace stable High tech shows rapid rise (small base) Unemployment matches U.S.
<u>Housing & Land Use</u>	<ul style="list-style-type: none"> Continued suburban growth Dispersion of employment
<u>Energy</u>	<ul style="list-style-type: none"> Some interest in conservation Gas prices increase 50% higher than inflation
<u>Institutions</u>	<ul style="list-style-type: none"> Local role and taxes increase No gas tax increase Growth controls spread sprawl farther out Little cooperation between local government and developers

FIGURE 7 Scenario R/N—business as usual.

In summary, protectionism and higher energy costs would affect King County through higher unemployment and slower economic growth.

Contingency Scenarios

Scenarios B, R/N, and G/K described above will be used as the primary alternatives for the development of METRO's

new long-range plan. The panel also selected two contingency scenarios, which will provide the outside boundaries on the conditions which could result if a rather remote combination of events occurred simultaneously. These scenarios are useful to answer "what if" questions but are not probable enough to justify the development of major plans to respond to them. However, the testing of final planning alternatives against these scenarios could provide the necessary information to develop contingency plans.

KING COUNTY ENVIRONMENT

<u>National Policy Trend</u>	<ul style="list-style-type: none"> Federal government expenditures increase at rates slightly higher than inflation; more domestic policy intervention and expenditures shifted from military to domestic issues
<u>Demographic</u>	<ul style="list-style-type: none"> No in-migration Real wages decline slightly
<u>Economic</u>	<ul style="list-style-type: none"> Moderate port growth at current annual rate Boeing employment 70,000 in 2000 Reduced military contracts Slow increase in overseas aviation competition R&D investment flat Small manufacturing flat Retail/commercial flat
<u>Employment</u>	<ul style="list-style-type: none"> Aerospace shows decline High tech steady Unemployment at or slightly higher than U.S. Other sectors stable
<u>Housing & Land Use</u>	<ul style="list-style-type: none"> Slowed suburban growth New employment dispersed
<u>Energy</u>	<ul style="list-style-type: none"> Some conservation efforts Gas prices increase 75% higher than inflation One major supply interruption
<u>Institutions</u>	<ul style="list-style-type: none"> Local tax increases moderate No gas tax increases

FIGURE 8 Scenario G/K—slowdown.

The two contingency scenarios below were selected by the panel. One describes conditions for extremely rapid regional economic growth and the other a prolonged regional recession.

Scenario M—Regional Boom This scenario, shown in Figure 9, takes place in the context of conservative national policies, few restrictions on trade, and a booming economy in the central Puget Sound region. Rapid economic growth in all sectors would be fueled by high Boeing employment and an expansion of trade through the ports of Seattle and Tacoma.

Owing to rapid economic growth, the region would experience high levels of in-migration and increases in real per capita income. Unemployment would be less than the U.S. average and labor shortages would appear in the service industries. Although downtown Seattle would expand rapidly in employment, the predominant trend would be explosive growth of low-density commercial and residential development outside the city of Seattle, particularly in unincorporated King County. Rapid suburban employment growth, combined with low interest rates and growth in per capita income, would result in a strong housing market.

Since gas prices would remain low, there would be little interest in conservation. Low gasoline prices and the demand for road improvements would result in passage of an increased

state gas tax in the early 1990s to fund both road and public transportation improvements. Local jurisdictions would compete against one another for both new development and funds for infrastructure improvements.

In summary, this scenario assumes an extraordinary period of economic growth, resulting in rapid urban and suburban development. Severe congestion problems in the region's transportation system are a consequence of such rapid growth.

Scenario X—Prolonged Recession Scenario X, shown in Figure 10, would occur in the context of a prolonged decline in the national economy and protectionist trade policies. This decline would affect the central Puget Sound region more severely than the U.S. due to substantial reductions in port activity and a massive Boeing employment reduction, causing out-migration, particularly in aerospace and other high tech industries.

Past over-expansion of retail, commercial and residential development would cause business failures and banking problems. Unemployment would be much higher than the U.S. average. Higher interest rates and higher inflation would depress the economic sectors associated with durable goods and capital investment.

Several major interruptions in petroleum supplies are assumed to occur in the late 1990s, followed by significant

KING COUNTY ENVIRONMENT

<u>National Policy Trend</u>	<ul style="list-style-type: none"> Reduction in increase of federal government expenditures; continued emphasis on deregulation; military expenditures constant in real terms
<u>Demographic</u>	<ul style="list-style-type: none"> High in-migration in all employment sectors Real wages increase
<u>Economic</u>	<ul style="list-style-type: none"> Port expands rapidly due to reduced controls (free trade) Boeing employment 100,000 in 2000 Massive military contracts Overseas aerospace market share increases for Boeing to 60% Other sectors expand rapidly State's economy expands with timber, agricultural and minerals
<u>Employment</u>	<ul style="list-style-type: none"> Aerospace booms High tech shows very rapid rise Unemployment 1% less than U.S. Manufacturing increases Retail/commercial rapid rise Service employment labor shortage Other sectors expand rapidly
<u>Housing & Land Use</u>	<ul style="list-style-type: none"> Explosive suburban growth Cross-lake traffic expands eastside development (housing and commercial) Infill in Seattle increases Apartment complexes multiply in suburbs Housing costs and rents rise rapidly
<u>Energy</u>	<ul style="list-style-type: none"> No interest in conservation No real price increase
<u>Institutions</u>	<ul style="list-style-type: none"> Local tax increases Gas tax increases steadily to build roads and fund transit improvements Many conflicts between developers and suburban governments Near-in suburban growth controls create sprawl in fringe

FIGURE 9 Scenario M—regional boom.

KING COUNTY ENVIRONMENT

<u>National Policy Trend</u>	<ul style="list-style-type: none"> Reduction in increase of federal government expenditures; continued emphasis on deregulation; military expenditures constant in real terms
<u>Demographic</u>	<ul style="list-style-type: none"> Out-migration, particularly in aerospace Real wages decline
<u>Economic</u>	<ul style="list-style-type: none"> Port declines rapidly Boeing employment 45,000 in 2000 Military contracts cushion Boeing from further decline High tech bust with no investment All other sectors in rapid decline after 1995 Local mortgage banks fail Retail bust due to overexpansion
<u>Employment</u>	<ul style="list-style-type: none"> Aerospace shows rapid decline High tech in rapid decline Unemployment 6% over U.S. Military manpower constant
<u>Housing & Land Use</u>	<ul style="list-style-type: none"> No growth, development stops Many vacancies and houses for sale
<u>Energy</u>	<ul style="list-style-type: none"> Price increase at twice inflation rate One or more supply interruptions OPEC price rise throughout decade Much conservation due to poor economy and reduced travel for employment and other trips
<u>Institutions</u>	<ul style="list-style-type: none"> Public works programs begin mid-decade State tax base shrinks, causing institutional conflicts

FIGURE 10 Scenario X—prolonged recession.

increases in petroleum and natural gas prices. Energy prices, which would increase at twice the inflation rate, would reduce travel and put pressure on public transportation systems. Institutional conflicts would result from a shrinking tax base and demands for social services. Development would essentially stop due to previous over-expansion.

Summarizing, the scenario includes the impact of downturns in the region's two most important industries, aerospace and trade. Their employment base has a very large impact on the local economy. Some eastern U.S. cities have experienced similar conditions when their basic industries have declined.

Scenarios Versus Snapshots

Our national and regional economies experience many cycles during a period longer than a decade. The scenarios discussed here are meant to reflect a long-term trend rather than snapshots of conditions in any given year. Public transit decisions are made both in the short and long run and the planning processes must respond to various time periods. The next section will outline some of the implications of using these scenarios in the planning process.

PLANNING IMPLICATIONS OF SCENARIOS

Planning Scenarios (Scenarios B, R/N and G/K)

The planning scenarios can help provide basic information for developing necessary forecasts, public transportation alternatives, and policies. The parameters of the scenarios are generally out of METRO's control or influence (employment, gas price, etc.) but define the information for input to the

planning process. The following paragraphs will outline the major differences in the three planning scenarios and discuss their implications for the planning process. The national policy trend impacts are assumed to be translated into local effects and will not be discussed individually.

Scenario B—Prosperity Continues

This scenario assumes continued strong growth of the local economy and sustained development activity. Downtown Seattle would continue to develop as a financial center and congestion in corridors would increase dramatically. Suburban growth would be dispersed for residential and commercial development. Because of the growth, regional travel forecasts would be increased substantially. While the density increase in downtown Seattle would benefit transit, many of the new jobs would be in higher income groups and might need special services to attract them to public transportation. Subscription buses, well-equipped vans, rail service, or additional high-quality express bus services might be necessary. Given the projected congestion levels this scenario could be an excellent opportunity for such services.

Serving the suburban growth would be more problematic. This scenario is a strong argument for land use planning at the county level to provide more concentrated employment centers served by nearby residential areas and to coordinate commercial development with highways and public transportation. METRO's current services would have to be expanded greatly in the non-bus modes (carpools and vanpools). This scenario would include tax increases that could support additional capital and operating expenditures for highways and public transportation. Pressure for high-capacity transit facilities in major corridors would increase.

Scenario R/N—Business As Usual

This scenario assumes less economic growth than Scenario B and higher fuel costs. This lower growth would still result in an increase in travel and congestion. However, higher fuel prices would make public transportation more competitive. The opportunities for the Seattle downtown and suburbs discussed in Scenario B would still apply here, but the higher fuel prices would increase the use of the services described. While the panel did not make a formal selection, it favored this scenario as the most probable.

Scenario G/K—Slowdown

Scenario G/K assumes a much lower rate of economic development and sharply higher fuel prices with a major fuel supply interruption. While employment growth would be reduced, the high fuel prices and continued congestion would make public transportation attractive. However, pressure for increased public transportation services would be difficult to respond to owing to limited tax resources. Under this scenario there would be much less likelihood that sufficient tax resources would be made available to construct high-capacity transit facilities.

Contingency Scenarios (Scenarios M and X)

Scenario M—Regional Boom

The congestion caused by low fuel prices and unprecedented growth would probably lead to capital investments for high capacity public transportation and new arterials and highways in the suburbs. Given the lead time for capital projects, it is unlikely that many of these facilities would be in place before 2000. Expansion of existing modes would provide additional capacity. However, construction projects in present freeways and roads would degrade the service quality of bus routes operating in these corridors. Suburban congestion would get much worse; however, as in other high growth counties in the U.S., the expansion would continue.

Scenario X—Prolonged Recession

In this scenario, fuel prices rising at twice the rate of inflation would make public transportation attractive to the people who still had jobs or money to spend. There would be no major capital transportation projects unless they were linked to public works programs. Current public transportation modes would likely be operated near capacity.

NEXT STEPS

Development of Detailed Scenario Descriptions

More detailed scenario descriptions are being developed from the outline of the five scenarios recommended by the panel. These descriptions will be divided into two periods, early 1990s and late 1990s. Details will focus on King County con-

ditions and be summarized into four categories directly relevant to public transportation. These categories are Economy, Energy, Housing and Land Use, and Policy Trends and Institutions.

Quantitative dimensions will be included in the detailed descriptions as key inputs to the transit and ridesharing forecasting processes. These inputs include the following:

- population and employment distribution,
- household income,
- parking charges, and
- auto operating and ownership costs.

As part of plan development, different combinations of inputs under each scenario will be tested using the EMME2 software package and an elasticity-based forecasting methodology. Qualitative elements of the descriptions will be used to recommend major program directions and priorities within the long-range plan.

Monitoring Process

METRO has already instituted a process to assess market strategy in advance of the annual budget review. A market strategy report is produced that reflects decisions on priorities for programs and projects. One task in the development of this report is an environmental scan with a five-year time horizon.

The monitoring process proposed for METRO's new long-range plan fits very well with the annual market strategy assessment. Monitoring is an essential element of the future scenarios approach, in that it will allow the organization to respond better to changing conditions, many of which are beyond its control. Information about regional conditions will help METRO gauge how well its long-range plan is matching the assumptions under which the plan was developed.

Every two to three years, a special effort would be made to reevaluate the set of future scenarios upon which the long-range plan is based. New medium- (five years) and long-range (ten years) transit ridership forecasts could be prepared. For the purpose of setting priorities, a five-year time horizon would be more useful than ten years in most cases.

A preliminary list of key external indicators to monitor has been identified. This list will be revised as METRO develops its long-range plan and gains experience with the annual process. This list includes the following:

1. Demographics

- household size and income
- population distribution

2. Economy

- general distribution of employment
- Boeing employment level and distribution
- trade volume through the Port of Seattle
- automobile ownership and operating cost

3. Housing and Land Use

- office vacancy rates
- employer size
- interest rates
- building permits
- parking cost in downtown Seattle and other activity centers

4. Energy

- gas price
- auto fuel consumption

In addition to the preceding external factors, internal performance measures will also be incorporated in the monitoring process.

CONCLUSION

The future scenarios approach represents a departure from previous long-range planning at METRO. By incorporating an annual monitoring process, the scenarios approach holds promise of overcoming the static nature of previous long-range plans.

One criticism that can be raised about the scenarios approach is that it may encourage a "wait and see" posture on the part of both planners and decision makers, especially when they are faced with a decision about a major capital investment project with a long lead time. However, the establishment of the justification for a proposed major project under multiple scenarios might actually increase the decision makers' confidence level and persuade them to move ahead with the project.

The benefits of the scenarios approach—the identification of choices, increased understanding of factors influencing those choices, and the assessment of risks and tradeoffs—present strong reasons for proceeding in a new direction for long-range planning. The results of this approach will be evaluated and compared with previous long-range planning efforts.

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REFERENCES

1. H. L. Westerman. Planning for Options and Commitments: An Approach to Transport Planning in Uncertainty. Unpublished paper, School of Town Planning, the University of South Wales, Sydney, Australia, no date.
2. J. L. Schofer and P. R. Stopher. Specifications for a New Long-Range Urban Transportation Planning Process. *Transportation* 8 (1979), pp. 199–218.
3. R. Amara. "Probing the Future," and I. H. Wilson, "Scenarios" in *Handbook of Futures Research*, ed. by J. Fowles (Westport, CT: Greenwood Press, 1978).
4. *Northwest Conservation and Electric Power Plan*, two volumes (Portland, OR: Northwest Power Planning Council, 1986).
5. Brian E. Sullivan, "Some Observations on the Present and Future Performance of Surface Public Transportation in the United States and Canada," *Transportation Research—A*, Vol. 18-A, No. 2 (1984), 111–123.
6. Southeastern Wisconsin Regional Planning Commission, *A Primary Transit System Plan for the Milwaukee Area* (June 1982).
7. Baltimore Regional Planning Council, *Scenario Planning: Energy Considerations in the Long-Range Urban Transportation Planning Process*, DOT-I-83-20, prepared for the Federal Highway Administration and the Urban Mass Transportation Administration, May 1983.
8. J. M. Mordecai, "The Scenario Analysis Process and Long-Range Transportation Planning," *Transportation Research Record* 988, 29–33.
9. Dick Conway and Associates, "Eight Facts About the King County Economy with Some Implications for the Next Five Years," presentation to the Municipality of Metropolitan Seattle, October 14, 1986 (unpublished paper).

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