Toward a Vision for the Nation’s Surface Transportation System: Policies to Transcend Boundaries and Transition to a New Era

Michael D. Meyer, P.E.
Georgia Institute of Technology

Introduction

Throughout history, the ability to move people and goods effectively and efficiently has been a prerequisite for a nation’s success and economic health. The history of the United States is particularly symbolic of this symbiotic relationship between transportation system capacity and national prosperity. Investments in turnpikes, ports, canals and railroads provided the initial ability for the nation to expand beyond the original colonized coasts, and promote the agricultural and industrial development of the nation’s heartland. Similarly, investments in urban transit and streets allowed growing American cities to handle the increasing number of people that were needed to support the massive expansion of the nation’s industrial capacity. In more recent times, the construction of the interstate highway system has arguably done more to influence urban America than any other single initiative or program.

In each of the above examples, the purpose of the transportation investment, whether from public or private sources, was clear. The intent was to connect, expand, provide for national defense, promote economic development, or earn a financial return on the initial investment. Public policies were often enacted to foster private investment in adding capacity to the nation’s transportation system, such as the land grant program for railroad expansion or federal dollars to improve the nation’s ports. Investments were targeted and, at least in the case of the interstate highway network, the national vision was understood. However, since the completion of the interstate highway program, one could argue that there is no longer an agreed-upon vision of what the nation’s transportation system should be accomplishing, and perhaps even more importantly in
recent years, what the respective roles should be for different levels of government and between the public and private sectors. The purpose of this paper is to provide some thoughts on what such a national vision should include and how the characteristics of this vision relate to the rapidly changing context within which a national transportation system operates. In particular, this paper provides a perspective on what policies and investments should be pursued to shape America’s transportation policy in the 21st century.

**Looking Back…**

A national vision for surface transportation involves all levels of government and private stakeholders in promoting the steps and actions necessary to achieve that vision. Presumably, this vision is formed through consultative processes and serves as the basis for investment strategies and new directions in policy formulation. Federal transportation legislation, originating as it does from elected national representatives, could be considered consultative in nature. Thus, as an example, the statement of policy found in the preamble to the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 is illustrative of a vision for the nation’s surface transportation system (see sidebar on next page). This legislation, in many ways, promoted different ways of looking at the transportation system. For example, although the concept of intermodal connectivity and its impact on overall system effectiveness had been known for some time, it was the inclusion of the word “intermodal” in ISTEA that spurred governmental action at all levels in understanding and improving the interconnectivity of the transportation system. Similarly, ISTEA promoted additional flexibility in the use of federal funds so that states and metropolitan areas could use the funds in the ways most appropriate for their needs.
National Surface Transportation Vision As Articulated in the Intermodal Surface Transportation Efficiency Act of 1991

It is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient and environmentally sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy efficient manner.

The National Intermodal Transportation System shall consist of all forms of transportation in a unified, interconnected manner, including the transportation systems of the future, to reduce energy consumption and air pollution while promoting economic development and supporting the Nation's preeminent position in international commerce.

The National Intermodal Transportation System shall include a National Highway System which consists of the National System of Interstate and Defense Highways and those principal arterial roads which are essential for interstate and regional commerce and travel, national defense, intermodal transfer facilities, and international commerce and border crossings.

The National Intermodal Transportation System shall include significant improvements in public transportation necessary to achieve national goals for improved air quality, energy conservation, international competitiveness, and mobility for elderly persons, persons with disabilities, and economically disadvantaged persons in urban and rural areas of the country.

The National Intermodal Transportation System shall provide improved access to ports and airports, the Nation's link to world commerce.

The National Intermodal Transportation System shall give special emphasis to the contributions of the transportation sectors to increased productivity growth. Social benefits must be considered with particular attention to the external benefits of reduced air pollution, reduced traffic congestion and other aspects of the quality of life in the United States.

The National Intermodal Transportation System must be operated and maintained with insistent attention to the concepts of innovation, competition, energy efficiency, productivity, growth, and accountability. Practices that resulted in the lengthy and overly costly construction of the Interstate and Defense Highway System must be confronted and ceased.

The National Intermodal Transportation System shall be adapted to "intelligent vehicles", "magnetic levitation systems", and other new technologies wherever feasible and economical, with benefit cost estimates given special emphasis concerning safety considerations and techniques for cost allocation.
Visions for the nation’s surface transportation system have also been offered by federal agencies or commissions, but, in many cases, these visions often represented a particular administration’s perspective on transportation’s role in the bigger picture of its political agenda. Some examples and the visionary aspects of past efforts include:

**Statement of National Transportation Policy, Secretary Volpe, 1971**
1. Increase the benefits derived from the preservation and enhancement of the environmental, aesthetic, and social attributes of transportation and its surroundings
2. Minimize the loss of human life and property and the human suffering due to transportation-related accidents
3. Provide that mix of transportation alternatives, including modal systems, related facilities, manpower, research and development, etc., which results in maximum benefits such as service, convenience, comfort, capacity and speed for a given cost
4. Further other objectives of the Federal government whenever they are affected by transportation or whenever the Department can perform a particular task more effectively and efficiently
5. Facilitate the process of local determination by decentralizing decision making and fostering citizen participation

**Statement of National Transportation Policy, Secretary Coleman, 1975**

The transportation sector should contribute substantially to an improved quality of life by:
1. Attaining high standards of safety
2. Protecting the air and water from pollution, reducing excessive noise, and supporting sound land use patterns and community development
3. Bringing people together and closer to the variety of benefits that our culture and economy offer
4. Minimizing the waste of human resources that results from congestion, inadequate transportation service, and inefficient transport operations
5. Providing the lowest cost services to the consumer consistent with safety, a reasonable rate of return on capital a sound government fiscal policy, and other public interests
6. Promoting the most efficient use of scarce, finite and costly energy supplies
7. Creating and maintaining employment and capital opportunities

**National Transportation Policy Study Commission, June 1979**
1. National transportation policy should be uniform
2. There should be an overall reduction in Federal involvement

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1 The following list is only a short excerpt from the Secretary’s Policy Statement. Other elements of the vision are found in the original statement.
3. Economic analysis of intended Federal actions should be used
4. When the transportation system is used to pursue social goals, do so in a cost effective manner
5. Federal involvement in (including financial assistance for) transportation safety and research is required, and
6. Users and those who benefit from Federal actions should pay.

*Transportation Agenda for the 1980s: Issues and Policy Directions, Secretary Goldschmidt, 1980*

1. To get us through the immediate transition from an energy-rich society to one of increased price and unpredictable supply, we must turn to the lowest cost, most readily available solution we can find—conservation
2. The Federal government must develop long-range conservation and capital investment strategies aimed at protecting our massive investments in the nation’s transportation system and making more effective use of it
3. Improving our nation’s performance in world trade is the surest path to achieving the goals of stabilizing the dollar and increasing job opportunities for Americans… the transportation sector will have a key role in accomplishing this goal
4. Federal transportation programs should be used to stimulate private investment in transport-related and transport-dependent industries. A decade-long transportation investment program should be developed which will assure a nationwide pattern of public and private sector investments
5. A principal issue of the 1980s will be how to maintain mobility for all segments of the population in the face of severely increasing transportation costs and uncertainty of fuel supplies
6. In the 1980s, a challenge will be to use transportation to improve the quality of life and to build better environments, particularly in our neighborhoods
7. Providing greater transportation safety, particularly automobile safety, will require the combined efforts of government and the private sector

*Moving America, New Directions, New Opportunities, Secretary Skinner, 1990*

1. Maintain and expand the Nation’s transportation system
2. Foster a sound financial base for transportation
3. Keep the transportation industry strong and competitive
4. Ensure that the transportation system supports public safety and national security
5. Protect the environment and the quality of life
6. Advance U.S. transportation technology and expertise

These policy statements and embedded visions emphasize several common themes as well as illustrate how a national policy formulated by a government agency will often focus on the problems it is facing at that time (such as Goldschmidt’s emphasis on
energy costs and availability coming as it did soon after the oil embargoes of the 1970s). Interestingly, all of the policies include transportation safety as a major national goal and relate national transportation policy to such issues as environmental quality and economic competitiveness. In some ways, however, these policy statements represent a disconnect between the high-level policy pronouncements of national transportation leadership, and the actual accomplishment of the announced goals. That is, the policy statements describe important directions and goals that in almost all cases have yet to be accomplished.

Clearly, the federal government has a critical role in promoting and supporting a cohesive and connected national transportation system, in some cases, a role relating to constitutional responsibilities, for example, interstate commerce and national defense. It is often through federal legislation and federal transportation policy statements that a national focus and consensus can be developed on investment priorities and on issues/concerns that warrant federal activity. This might be even more important in the future as domestic economic markets span multi-state regions, thus needing some group to convene key stakeholders or promote multi-state compacts for solving transportation problems, or itself providing policies and/or financial incentives to encourage multi-state solutions. Thus, the influence and role of the federal government in national transportation is critically important for the continued success of a nationally coherent system.

However, one of the defining characteristics of the U.S. institutional structure for transportation planning and decision making over the past 40 years has been the steady decline in the role of the federal government with increasing responsibilities being given to states and metropolitan areas. This increased responsibility, found in legislation and supporting regulations relating to the planning and decision making process, has been
augmented with a declining relative share of federal funding for transportation investment. Many metropolitan areas, for example, have created their own dedicated transportation funding source, such as San Diego where in 1987 voters approved a half cent sales tax dedicated for transportation purposes (the program was re-approved in 2004 with 67 percent voter approval). Many states have found new and different funding sources both from the use of traditional governmental taxing powers and more recently in partnership with private investors. Outside of the National Highway System, the successor to the Interstate highway system as the defining concept of a road network of national significance, investment priorities are established primarily in relation to state and local goals and policy directions. And this is most likely the best place for such decisions to be made. The federal government does, however, provide important contexts for such decisions that often have influence on local decisions, such as the transportation/air quality conformity determination for metropolitan areas that are not in compliance with national ambient air quality standards. The challenge for defining any statement of a national vision for surface transportation is recognizing the changing institutional structure within which investments will be carried out, while identifying the factors that will strongly affect the context within which such decisions will be made.

Looking Ahead…

Part of the title of this paper “Transcend Boundaries” has been carefully chosen to represent a major theme of the paper’s argument. The evolving economic, geographic, financial and, to some extent, political context within which the nation’s transportation system operates, and will continue to operate in the future, largely ignores jurisdictional boundaries. Global economic markets and world-spanning supply chains pay little attention to passing across a political boundary (except when regulatory or infrastructure barriers cause unacceptable delays, and then the markets adjust). In the United States, economic regions have been evolving for some time that span multiple states and have
given rise to mega-regions and transportation corridors of national significance. Although lagging many other countries, the United States is rapidly exploring the potential of private financing of infrastructure that has for decades been the responsibility of government agencies, thus transcending another boundary of sorts. The transportation challenges of a rapidly growing urban America have often resulted in allies across the political spectrum joining forces to provide solutions. And the continued connection between transportation system performance and environmental conditions and community quality of life requires a broad vision for surface transportation that transcends a focus simply on the transportation system itself.

Another part of the paper’s title “Transition to a New Era” suggests that the United States is entering an era of substantial challenges and opportunities that have not been addressed in prior federal transportation legislation in any significant way. These challenges and opportunities relate not only to evolving global markets and concomitant movement of freight and goods, but also to a growing movement (once again) on the need to protect the natural environment and enhance our quality of life. Ten factors below are offered as important contextual influences on the future of the nation’s transportation system, each having important influences on the “what” and “how” of providing a connected and effective national transportation system. These factors include: 1) population growth and related increase in transportation capacity, 2) demographics and corresponding mobility needs, 3) evolving economic markets, 4) transportation system preservation, 5) technology, 6) financing capacities, 7) changing institutional structures, 8) environmental imperatives, 9) security concerns, and 10) energy supply and price. Figure 1 shows how these factors link to the performance of the nation’s transportation system. It is important to note whereas “congested
transportation facilities" is often identified as one of the most important issues facing states and metropolitan areas, congestion is viewed in Figure 1 as simply a characteristic of system performance, not a determining factor. However, Figure 1 does show an important relationship between the performance of the transportation system and the outcomes enabled by this performance. Thus, for example, national, inter-regional and community connectivity; national competitiveness; community development; environmental quality; national and personal security; and quality of life are enabled by the existence and operation of the transportation system. I would suggest that these desired outcomes become the basis for a vision of a national transportation system, and of the corresponding national transportation policy.
Space limitations allow only a brief discussion of the factors shown in Figure 1. For some, such as financing capacity and changing institutional structures, additional material is found in the papers by Mort Downey and Gary Maring.

*Population Growth* - The United States reached a milestone in 2006 -- the population increased to over 300 million. This population is expected to grow to between 380 and 390 million by 2035. With this growth in population will come new demands on the transportation system, both in providing mobility for person trips as well as for delivering the food and goods this population will depend on. For freight, the increase in economic activity that corresponds to this population growth means greater movement of goods. For example, a recent estimate is that between today and 2035 there will be an 89 percent increase in the tonnage moved, a 92 percent in ton-miles, and corresponding significant increases in truck miles traveled.² By far trucking will be the major means of moving freight in the future, even more so than today. These trucks will not only be using the interstate highways that connect markets and production centers, but will also result in even more trips being made on local streets and roads in delivering goods and services.

Where population and employment growth occurs will also have dramatic impact on transportation system performance.³ Most of this growth will occur in metropolitan areas, in some cases, in reinvigorated center cities and, in other cases, new development will continue historical trends by locating in suburban and exurban locations. In the absence of public policies that link housing and employer location decisions to the costs to society of these decisions, the location of new housing and employment sites in the future will largely respond to factors that influence the

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³ A 2003 United Nations study estimated that by 2030, 87 percent of the population in North America would live in urban areas, the largest percentage in the world, greater even than Asia. Europe or Latin America.
desirability of the development market. These include such things as the price of land, local tax burdens, school quality, proximity to community services, commonality with shared ethnic values, transportation system congestion and special factors relating to the potential buyer market (for example, access to urban amenities for the empty nesters).

In summary, the growth in population and where this population locates will place increasing pressures on governments at all levels to provide transportation infrastructure and services, even though the mechanisms for providing this service might be very different from historical practice. In the absence of development market-influencing policies, this growth will likely continue past trends, with noticeable exceptions in the population growth in many center cities.

Demographics -- The changing profile of the U.S. population will perhaps have more of an impact on transportation than the actual increase in population. Put simply, the U.S. population is aging and changing in demographics. According to a recent report from AASHTO, “children and working age adults will continue to make up the majority of the U.S. population, but the number of children below age 21 will grow at a compound annual growth rate of only 0.6 percent, and the number of working age adults age 16 to 54 at a rate of only 0.4 percent. In contrast, the number of adults age 65 to 84 will grow at 2.4 percent and the number of adults age 85 and above will grow at 3.0 percent.”

The nation’s population profile is also changing with respect to ethnic background. The fastest growing non-White ethnic group is Hispanics, with an estimated increase in the nation’s Hispanic population between 2000 and 2050 of 67 million (compared to 74 million for Whites). In the period 2030 to 2040, absolute increases in the Hispanic population will for the first time outpace that for the White population. By 2050, the

4 See Note 2 above.
population will be approximately 50 percent White alone, 24 percent Hispanic of any race, 14 percent Black, 8 percent Asian, and 4 percent all other races.\textsuperscript{5} This shifting make-up of the population is particularly pronounced in major metropolitan areas, historically the magnet for new immigrants to the United States.

It is not clear whether either the aging or the shifting ethnic background of the population will create a movement toward more compact development or whether it will continue historical metropolitan expansion trends. Very clearly, there has been a pronounced increase in population in central cities over the past several years, as empty nesters look to move to a more appealing urban environment and young (child-less) professionals enjoy the lifestyle and (initial) affordability of newly renovated city neighborhoods. With public policies and market inducements put in place to encourage the continuing increase in central city population, the next 20 years could be a major benchmark in positioning many cities for the remainder of the century.

The implications to the transportation system of the changing national demographics will be challenging, not only to government agencies, but also to individual families. Although many older Americans will continue to drive, many will be unable or unwilling to do so. This will place an increasing burden on other family members, and will also likely lead to desires for new and targeted transit services. Large concentrations of ethnic groups in metropolitan areas will most likely lead to very specific types of transit or ridesharing services aimed at these markets (we have been seeing this for some time at a smaller scale in many U.S. cities).

In addition, the aging driver creates other challenges in terms of vehicle design, operational strategies and road signing, and emergency response. With reaction times and reflexes much reduced from younger years and with a more fragile body, it is not

\textsuperscript{5} U.S. Census Bureau, “U.S. Interim Projections by Age, Sex, Race and Hispanic Origin,” March 18, 2004.
surprising that the older driver has a much higher fatality rate than mid-age drivers. The combination of aging and an increased propensity to drive as compared to historical levels will likely be a significant challenge in the coming decades.

**In summary, the aging and changing demographic characteristics of the U.S. population will likely have profound and lasting effects on the manner of personal transport for many in the future, and will increase demands for services that are targeted at market populations very different than what we have today. New demands from these market populations for housing choices and community services, improved access to cultural and recreational sites and easy access to interstate travel, all lead to a transportation system that is not focused so much on aggregate flows, as it is on individual and group travel patterns.**

**Evolving economic (and thus geographic) markets --** There is no need to examine in great detail one of the defining phrases of the 1990s and 2000s, “we live in a global market,” because most everyone now agrees. However, the level of understanding of what this phrase means especially to future transportation needs is perhaps not as evident. Figure 2 shows the change in international trade with the United States, one aspect of the changing national economic market. Ever since 1980, international trade with the United States has grown significantly, with substantial demands being placed on the nation’s ports of entry and on the transportation arteries that serve them. One only has to go back to 2002 and the west coast dock strike to see what happens when
international trade is obstructed—disruptions in manufacturing, loss of retail sales due to no delivery of stock, and economic losses to shippers and carriers. International trade via bulk, container and air cargo movements is expected to grow dramatically over the next 30 years. The globalization of many manufacturing processes and the dependence of the United States’ economy on globe-spanning supply chains suggests that the movement of freight will become a much greater concern in future years than it has been in the past (at least for the public sector; clearly trucking and rail companies have always been concerned). This concern will not only focus on ports of entry, but on major arteries and local roads where much of the freight is ultimately destined.

Figure 3 shows another aspect of the evolving markets phenomenon that will have a significant impact on transportation system performance and investment. World-wide, major economic markets are emerging that transcend country and city boundaries.
Figure 3: Evolving Mega-Regions in the United States

These markets often include major consumption as well as production centers, and in their own right represent major economic engines of their respective nations. Figure 3 suggests that there are nine mega-regions emerging in the United States, with several other regional centers acting as important market centers for their region. Each of these mega-regions (except possibly the one in Florida) has influence areas that include many states and numerous urban centers. It seems highly likely that the future economic success of the United States will be found in these mega-regions, thus drawing attention to the transportation needs internal to each region, access between, and connections to the global market. The transportation connections within mega-regions will need particular attention in that these connections not only support the economic activities of
the mega-regions themselves, but also serve as gateways to the rest of the nation. Longer distance, inter-mega-region transportation challenges will become even more apparent in future years as the nation’s economy becomes more intertwined with the economic and financial activities occurring in all of the mega-regions in the country.

In summary, the future economic success of the United States will be tied closely to the ability of the nation’s economic centers or mega-regions to connect to the global economy. This suggests that not only should transportation investment focus be given to the nation’s major ports of entry and the related transportation facilities serving them, but also to the effectiveness of the internal transportation system in these economic centers.

Transportation system preservation -- The United States has invested an estimated $1.75 trillion in its transportation system, including all levels of government and all modes of transportation. Much of this infrastructure was built in the 1950s and 1960s and is now entering into the final stages of its useful life. What this means to infrastructure owners is that substantial investment must be made to rehabilitate or reconstruct this infrastructure, and to provide preventive maintenance efforts to prolong the life of facilities that have yet reached the reconstruction stage. In many states and metropolitan areas, well over 50 percent of the total investment budget is dedicated to system preservation.

The confluence of system preservation needs with pressures to provide more system capacity or improved performance is, and will continue to be, a major challenge to transportation decision makers. Just as we face rising concerns about congestion and acknowledge the importance of efficient transportation for economic competitiveness, many states and metropolitan areas are faced with a “bill due” on their previous investments. And although most transportation system users understand the need to
keep the bridges from falling down and transit vehicles from malfunctioning, such investment does not often capture the imagination or votes of those responsible for providing transportation dollars. It seems likely that the increasing system preservation needs of the nation’s transportation system will motivate the more successful transportation organizations to combine strong asset management principles and programs with capacity expansion initiatives, with the latter perhaps funded via special purpose programs or in partnership with private groups.

**In summary, although certainly not one of the most stimulating issues in political forums, preserving and maintaining the existing transportation system infrastructure will increase in importance over the next several decades. In fact, in most states and metropolitan areas, such needs will dominate investment priorities in the foreseeable future.**

**Technology** – The technology of transportation, that is, the system control and monitoring systems, information technologies, propulsion and the vehicles themselves, will significantly influence the use and resulting impacts of future transportation systems. For example, the reduction in most transportation-related air pollutant emissions over the past 30 years has been predominantly caused by new lower emission engine technologies. The development of hybrid and hydrogen vehicles, when and if they penetrate the consumer market in significant ways, could go a long way toward further reducing motor vehicle-based air pollutant emissions and reducing petroleum-based fuel consumption (although they will not do much to reduce congestion). The application of sensors and navigational systems to the operations of the transportation system will build upon the legacy of ISTEA when the then called intelligent vehicle highway system, now called intelligent transportation system-ITS, program was created. The technology of today, and certainly of tomorrow, will enable the universal identification and tracking of
vehicles and cargo that should improve the efficiency and security of the transportation system. And the increasing use of new combinations of information systems technologies for recreational, educational, and purchasing purposes will have influences on individual behaviors including travel patterns that are yet unknown.

Predicting the exact nature of the potential influence of new technologies is uncertain at best. However, it does seem that, in general, new technologies will make traveling easier and safer, and that although telecommunications technologies have been used to substitute for travel movement, there does not appear to be any technology that will reduce in significant numbers the expected trips that will be made on the nation’s transportation system.

*In summary, modern society is largely defined by the technologies that are used to support an individual’s everyday activities and the foundational technologies that keep communities functional (such as water, transportation, waste removal, and power technologies). Absent any major disruption in the nation’s economic structure, new technologies will likely play a significant role in how the nation and individual citizens conduct their business in future years. This is likely to be especially true for the management and use of the transportation system.*

*Financing capacities –* Much of the national, state and metropolitan debate that surrounds the future of transportation usually focuses on where the funding will come from to support needed investments. The capacity of all levels of government to provide the level of funding that is considered necessary for maintaining and expanding the nation’s transportation system is, in most cases, strained beyond the political will and ability found within government. However, as noted earlier, with increasing population and economic-related needs, the demand on the nation’s transportation system will only
get greater. This creates a significant challenge to the current financing structures for transportation investment, especially in light of declining financial resources coming from the federal government.

In response, many states, metropolitan areas and local governments have created their own funding source or sources dedicated to transportation purposes. In recent years, several metropolitan areas have approved transportation funding sources for regional investment programs (usually a dedicated sales tax). Many states have begun the process of developing public/private partnerships in promoting private investment in their road network. And in still others increased funding for transportation has followed the traditional channel, which is to increase motor vehicle-related taxes. It seems likely that future financial solvency for transportation programs will depend on having a menu of financing options that provides funding from a variety of sources, with the mainstay in the short term still being the gas tax.

However, there are several characteristics of the financing dilemma that merit concern.

1. Much of the debate over future financing has focused on road investment, with little attention given to other modes such as transit and pedestrian/bicycle facilities. Public/private partnerships at the magnitude of those discussed in recent years have largely targeted road projects. Where will the funding come from for a truly multi-modal transportation investment strategy?

2. Public/private partnerships will likely be a major component of future transportation finance in the United States. However, by definition, the private investors in such partnerships are interested only in those components of the road network where toll receipts will provide a desirable return on investment. How can we structure such partnership arrangements so that the benefits to society encompass more than just the most profitable routes?

3. Although the mainstay of road financing in the United States is the petroleum-based gas tax, a change to a new vehicle fleet mix and increased reliance on more fuel efficient and alternative fueled vehicles will likely result in declining gas tax revenues, even more than being experienced today. The United Kingdom has decided to pursue a distance-based funding scheme, one that collects receipts on the basis of the usage of the road network rather than the
consumption of fuel. **What should be the future basis for funding the U.S. transportation system?**

4. Although for years, economists have argued that correctly pricing the use of a transportation system will result in economically optimal utilization, there has been little implementation of such pricing strategies in the United States. In recent years, some jurisdictions (such as in southern California) have adopted dynamic pricing strategies for transportation facilities and have generally found them to be successful. Other states and metropolitan areas are now studying the feasibility of adopting pricing strategies especially for new additions to the road network. **How do pricing strategies fit into state or regional investment financing approaches? And what are the equity implications of using such strategies on the different population groups in a typical metropolitan area?**

5. Many states and local governments have adopted financing strategies that rely on borrowing funds with requirements for paying back the principle and interest at future dates. Although the benefits of investment today in pure economic terms likely offset the future payments, in financial terms these governments are incurring debt that must be repaid with future receipts. **To what extent are governments constraining future financial investments in transportation with their borrowing today?**

   **In summary, the future will likely see a much wider variety of financing strategies used to support the transportation system, although in the short term the gasoline tax will likely continue to be the major source of road finance. New financial strategies will include a combination of public and private initiatives, and the application of pricing schemes that will result in some additional financial resources.**

   **Security** – Ever since 9/11, those responsible for transportation have become more aware of the serious vulnerability of the nation’s transportation system to disruptions. It is not a coincidence that, historically, the target that terrorists around the world over the past 50 years have hit the most has been transportation infrastructure and services. Transportation is a highly visible and strategic component of the economic life of states and metropolitan areas. It seems likely that concern over physical, biological, chemical and nuclear attacks against the nation’s transportation system will be a component of transportation planning and engineering over the next several decades. The
implications of this concern relate not only to the types of designs and materials that engineers incorporate into transportation facilities, but also the types of surveillance and monitoring technologies that will be incorporated into facility operations.

In summary, the future will likely see a much greater concern for security in the planning and design of transportation facilities and services. There will likely be new materials that are used in such design and a wider use of sensor and information technologies that provide more real time management of facility operations. In addition, from the planning perspective, security concerns will be the basis for more attention to evacuation and contingency planning.

Changing institutional structures – To a large extent, today’s road and transit systems are the result of decisions made by public agencies that are responding to policies and mandates established by federal, state or local governments. Although institutional structures can be created for a variety of reasons, the history of transportation in the United States suggests that the source of funding and the means of distributing funding receipts has a significant influence on institutional arrangements. In the period of rapid road network expansion during the 1960s and 1970s, much of the investment was supported by funding sources that provided stable and long-term commitments to network expansion. This is not the case today. As a result, many states and metropolitan areas are seeking alternative institutional means of providing the transportation investment necessary. This has included new government agencies (such as toll road agencies), new special authorities having part governmental and part private sector capabilities, partnership arrangements between public and private agencies where each has an important role in delivering the service, and completely privatizing the provision of infrastructure. In the absence of any major new federal financial support for transportation investment that would utilize existing institutional
channels for delivering projects, one can expect even more institutional experiments being tried in future years.

In addition to the financial influence on institutional structure, one also sees the jurisdictional and governmental accountability aspect of how institutional arrangements evolve. Perhaps the best example of this and of the challenge associated with jurisdictional prerogatives is found in multi-state metropolitan planning organizations (MPOs). In such instances, the urban boundary of a metropolitan area extends beyond one state and thus requires the involvement of many different state and local agencies in developing a metropolitan-wide strategy for the transportation system. This often does not occur without conflict and disagreement….and, in some cases, stalemate. But as noted in the first section of this paper, transportation flows do not recognize jurisdictional boundaries, and this will become even more striking in the future. There are already several examples of new institutional structures and approaches that, in my opinion, will become even more prevalent in future years, including the I-95 Corridor Coalition, the NAFTA international trade corridors, the Heartland corridor project, etc. Each of these is an effort to transcend jurisdictional boundaries and to develop strategies that focus on the effectiveness and efficiency of the transportation system, regardless of who is in charge.

In summary, due to the changing financing strategies that will likely characterize future investment programs, and to the changing geographic definition of markets, future institutional arrangements will likely include many different structures and strategies over what we see today. In many ways, this will allow states and local governments to deal with the increasing transportation challenges they will be facing.
Environmental imperatives – The environmental quality context for transportation decision making could be one of the most important long term factors influencing the type of transportation systems we will have in the future. At the same time, it is also one of the most uncertain given the likely need for governmental action (and thus corresponding compromises and delays) to set the institutional framework within which investment decisions are to be made (assuming, of course, that public and private organizations do not themselves voluntarily take steps to reduce environmental impacts of their decisions). It is interesting to note that if one takes a long perspective of the evolution of national transportation policy, one of the defining characteristics in the U.S. and in other developed countries has been the increasing incorporation of environmental factors into the investment decision making process. Indeed, bell weather states such as California, Minnesota, Oregon, Washington and Wisconsin have state laws for considering environmental factors in transportation decision making that go much beyond national requirements.

There is very little evidence that public support for actions to improve environmental quality is waning, and if anything, seems to be getting stronger. And, in my opinion, this is true also about global warming and carbon emissions. Slowly, but surely, scientific evidence is chipping away at the reluctance of some in government and business to acknowledge the human influence on the global environment. Whether in the foreseeable future we will see in the United States the adoption of a “carbon budget” or of a carbon emissions trading program on a widespread basis is unclear. However, it does seem inevitable that when serious policy attention is paid to this issue, the transportation system will be affected significantly given the relative contribution it makes
to carbon emissions nationally. The programmatic responses can range from the development of new vehicle fuel sources to strategies that reduce the need to travel.

In summary, one of the most significant factors affecting the future of transportation decision making is likely to be the continuing public and policy concern for preserving and enhancing environmental quality. This will be especially true for the inevitable (in my opinion) movement to control the emission of greenhouse carbon gases.

Energy -- One cannot talk about the future context of transportation without discussing energy supply and pricing. The current dependence of the U.S. transportation system on petroleum-based fuel supplies not only leaves the nation dependent on uncertain sources of supply, but also subjects the economy to wide variability in fuel costs. The current national initiative on the hydrogen economy and corresponding interest in a hydrogen-fueled vehicle relate directly to the desire for alternative sources of energy. The transformation of the transportation system from its currently based energy source to another would be both dramatic and time-consuming. The timeline for fleet turnover is measured in decades not years, and although financial incentives could be used to hasten this transformation, there would likely be a need for dual energy distribution systems for some time. Although the timeframe for conversion to a new energy source will be long, there is every reason to encourage the development of alternative fueled vehicles and the infrastructure needed to support them even more than has been done to date.

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6 In 2003, the Environmental Protection Agency estimated the 27 percent of the nation’s greenhouse gas emissions came from the transportation sector. See, Environmental Protection Agency, Greenhouse Gas Emissions from the U.S. Transportation Sector, 1990-2003, Office of Transportation and Air Quality, Washington D.C., March 2006.
One of the challenging aspects of developing a national energy policy that makes sense is that different strategies could be used depending on what it was you were trying to accomplish. For example, Professor Ken Small recently made a presentation at the Transportation Research Board meeting in which he laid out the following tradeoffs:  

- If the policy objective is energy security, then the strategies should include use of tar sands, coal liquefication and oil shale. These strategies, however, contribute to global warming.

- If the major policy objective is to reduce global warming, then the nation should substitute oil or gas for coal (which is bad for energy security), use of adaptation and sequestration (which would be ineffective in enhancing the nation’s energy security), or use biofuels (which at the current time is very expensive).

- If both of these objectives are desirable, the most effective strategies would include nuclear energy, use of ethanol and energy conservation.

In the short term, the federal corporate average fuel economy standards (CAFÉ) should be rigorously examined from the perspective of their effectiveness, and loopholes that currently exist (for example, for light duty trucks) should be closed. Incentives should also be provided to the motor vehicle industries to produce energy efficient technologies and designs.

*In summary, energy supplies and pricing in the long-term could be one of the most defining characteristics of how the U.S. transportation system is managed and used. Moving toward energy independence will require a concerted effort over many decades in both the development and implementation of new*

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7 Ken Small, „Is Energy Policy the Tail Wagging the Dog?“ Presentation before the Executive Committee of the Transportation Research Board, January 24, 2007, Washington D.C.
technologies to transform the U.S. transportation system. In the short term, CAFÉ standards should be made more stringent, and energy conservation should once again take its place among the many factors that are considered important when investment decisions are made for the transportation system.

Toward a National Vision...

The United States stands at a crossroads with respect to its transportation system. Arguably, the nation is facing decisions on the financial future of transportation that could lay the groundwork for transportation solvency over the next 50 years. The demand that the nation is likely to see for personal and freight travel will be comparable to the fastest historical growth in travel experienced by the country. Important "defining contexts" for transportation are edging toward conditions that could well force the transportation community to respond, such as controls on greenhouse gas emissions and petroleum-based fuels or the changing nature of the travel markets themselves. The condition of much of the transportation system is such that preventive maintenance, rehabilitation, and/or reconstruction projects will be a much greater need in future years, thus competing with new capacity projects for limited resources. And the very nature of global and national economic development will place additional pressure on the nation’s, states’ and metropolitan areas’ transportation systems to provide effective and efficient transportation connections.

The phrase “Transition to a New Era” in the title of this paper reflects the potentially different transportation environment the nation could be facing 30 years from now. A national vision, supported with federal legislation, should provide the platform from which the nation can prepare itself and perhaps even influence this future. Historically, very seldom does federal legislation adopt a seminal perspective on the programs and initiatives that it creates (see Mort Downey’s accompanying paper). The 1956 Interstate
Highway and Defense Act along with the accompanying act that established the Highway Trust Fund represents such seminal legislation. The 1962 Federal Aid Highway Act, which established the “3C” transportation planning process, is another landmark piece of legislation that has had lasting impact on the transportation development process. One could argue that ISTEA in 1991, representing as it did the first major federal transportation legislation after the “completion” of the interstate highway system, is another seminal event in federal transportation legislative history. The important question now facing the nation is whether the next federal legislation will simply be an incremental adjustment to the current law, or whether it will outline a new vision for the future of the nation’s transportation system. The following thoughts are offered from the perspective that what is needed is a vision that lays the groundwork for defining the place of transportation in a broader societal context and to prepare the transportation system for the challenges and opportunities of the future.

What should be a national vision for transportation? As noted in Figure 1, such a vision should include primarily the outcomes desired by the nation as they are enabled by the transportation system. However, the specific wording of a national vision for surface transportation is not as important as the underlying principles and policies that guide it. Therefore, the following paragraphs provide some suggested policies that could define the characteristics of a national transportation system, and relate therefore to possible federal action (although the federal government is only one actor in the much bigger picture).

**Surface Transportation System**

- The growth in population, employment, international trade and domestic economic activity suggests that the nation’s transportation system will be facing even greater demands than today’s system. It is in the national interest to provide a national
transportation system that connects its citizens, promotes economic vitality, protects national security and enhances public health. There is thus a strong role for the federal government in providing the vision and (some of) the financing for this system.

- The nation’s transportation system exists to support the economic and personal aspirations of the nation’s citizens and businesses. Accordingly, investment in this system should be linked to, and measured by, how investment enhances and allows such aspirations. This suggests continued flexibility in the funding programs that support transportation investment that allows state and local decision makers to target investments on the most effective and appropriate projects. In addition, this suggests that future investment will have to consider the changing demographic characteristics of the population.

- The current investment in the nation’s transportation system should be preserved and protected through the adoption of effective asset management approaches. For those portions of the transportation infrastructure that have received federal funding, the adoption of a formal asset management system should be required. This policy would be implemented for both state DOTs and MPOs.

- The transportation system should be managed and operated to utilize fully the infrastructure that currently is in place. This suggests the application of system management technologies, reduction of demand in highly congested corridors through shifting of travel times and other means, use of pricing to encourage best utilization of limited infrastructure, and implementation of operational strategies to reduce bottlenecks and conflicts in travel flow.

- Facility or system pricing is a strategy that is being considered in many parts of the world, including in some parts of the United States. Equitable pricing of the
transportation system should be a strategy that is encouraged in those areas where limited infrastructure results in congested conditions.

- Priority areas should be identified for national investment and resources allocated to provide measurable progress. For example, some investment programs should be targeted on the nine mega-regions noted in this paper to enhance the global competitiveness of the United States. This investment would be linked closely to the emerging growth patterns that are occurring in these regions, and on inter-regional transportation needs. Thus, national investment might very well target inter-city transportation needs (such as, high speed rail) that not only provides intra-regional travel options, but also enables connections to other mega-regions. National investment strategies should also examine those areas “being left out” of the evolving economic market structure of the mega-regions.

- It is in the national interest to reduce impediments to the international flow of goods given the importance of transportation to global supply chains. Some national investment should be targeted at bottlenecks in the national freight transportation system. States and metropolitan areas should be encouraged to examine the feasibility of freight-only road facilities for their road network. Other mechanisms (such as an investment tax credit) should be provided to providers of transportation to encourage their own investment in transportation capacity.

- The United States is falling behind other western nations in its road safety record. Reducing the number of fatalities and other crashes requires a combination of both infrastructure and behavioral strategies. Although safety is listed many times as a transportation agency’s first priority, the safety record often continues to worsen. Infrastructure investment, new vehicle and network technologies, enforcement
strategies, driver education, and many other similar types of efforts should be part of a national effort to reduce the societal costs associated with crashes.

- Studies of terrorist attacks world-wide show that the service or infrastructure most often targeted is transportation. Our society and economy are vulnerable to attacks against the nation’s transportation system, and thus steps must continue to prevent such attacks through surveillance and hardening of the existing network against the damage that might occur when such an attack is successful. More broadly, the vulnerability of the transportation system to natural disasters also suggests that the transportation community has an important role to play in preventing, identifying, responding to, and recovering from major disruptions in normal transportation operations. The state DOTs and MPOs should be “at the table” when emergency management and disaster recovery plans are being formulated.

**Context Factors**

- New decision making structures should be encouraged (where needed) that reflect the changing multi-state and multi-jurisdictional nature of the evolving economic market and corresponding provision of transportation services. Incentives should be provided that encourage multi-state solutions to multi-state transportation problems.

- The relationship between urban structure, urban design and transportation investment will become even more influential in defining community quality of life in the future. Transportation planning should be encouraged more strongly to connect the three when making investment decisions (similar in concept to the station area planning efforts that occur when new light rail lines are designed). This might also imply the formal adoption of a context sensitive solutions (CSS) approach to project development.
Transportation is a major contributor to many of the environmental concerns facing society. As such, environmental impacts should be viewed not so much as something that need to be mitigated as part of a project development process, but rather as part of the environmental stewardship of the state. Thus, similar to policies adopted in some European countries and New Zealand, a sustainability framework becomes the most important “point of departure” for considering investment in the transportation system. This might also be implemented by requiring every state DOT to have an environmental management system.

The reduction of carbon-based pollutants should rise in importance when making investment decisions. Until vehicle propulsion technologies are used generally throughout the fleet based on non-petroleum-based fuels, it is in the national and global interest to find ways to reduce the emissions of carbon-based pollutants. The transportation-related release of carbon-based emissions should be a national indicator monitored annually, with appropriate measures used at the state and metropolitan levels as well.

Although motor vehicle taxes will remain the most important funding source in the near term, financial solvency of the transportation system in the future will depend on a wide variety of funding mechanisms and innovative financial strategies. It is in the national interest to promote, foster and encourage the development of such approaches to financing the transportation system.

Transportation projects that benefit the freight community should be eligible for public funding, under guidelines that stipulate the public benefits of such investment.

New transportation financing mechanisms should be developed in anticipation of changes in fuels, motor vehicle fuel economy, and allowable air pollutant emissions. Given the time it takes to develop new policy initiatives, especially those that disrupt well-established structures, steps should be taken now to develop a phased
implementation strategy for establishing a sufficient and stable funding source in the future. This is a national issue, and certainly one that affects states and metropolitan regions. It is likely that the small, but noticeable trend in metropolitan-based transportation funding sources will continue to grow.

- Public/private financing partnerships will be an important part of the future financing of the nation’s transportation system. However, by their very nature, they will tend to focus on a limited number of miles of the nation’s road network. Some attention should be given to how such partnerships can be structured to encompass more than just those roads that have the highest volumes.

This paper has examined a very broad topic—what should be the vision for a national transportation system?, and what policies would provide a path for achieving this vision? In the limited amount of space available, it is likely that important dimensions of such a vision and of the policies that enable it have been missed or not been treated in sufficient detail. However, in the United States, the creation of such a vision and policies necessarily occurs within a public forum where good ideas are vetted resulting in the eventual formulation of a national transportation strategy. Hopefully, this paper has provided enough fodder for such a discussion. The most fundamental concept that this paper puts forth is that the nation (and the world) is arguably in the path of a wave that will overwhelm us unless we think about how to use that wave to our advantage. Environmental challenges, energy concerns, community quality of life, and increasing deterioration of transportation system performance all suggest a fundamental transition in the way we look at transportation. Not only does this transition imply transcending boundaries as broadly defined earlier in the paper, but it also implies new funding concepts, institutional arrangements and ultimately new ways of investing in the nation’s
transportation system that truly connects transportation to the desires and needs of a
growing population.