Anticipating Global Transportation Concerns in an Ever-Changing Environment

The success of meeting the world's transportation needs in the next century resides in how well engineers meet the challenge of continual change.

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Beware of technological solutions looking for problems. Experience has shown that technology is rarely a controlling factor in bringing about transportation innovation. Other issues — institutional, political, economic, financial and social — weigh heavily in today's intricate transportation decision-making processes. When a new transportation concept is introduced — be it monorail, levitated vehicles or anything else — always ask the simple questions:

- Who are the passengers?
- Where is the right-of-way?
- From where will the funding to pay for the project come?

A Growing World

The traditional theories and concepts about the position of the United States in the world are changing drastically, and at an ever-accelerating rate. The world population is currently 5.7 billion people (and growing) and becoming more urbanized. Tokyo, with 30 million people, is larger than 162 countries. Since 1960, Bangkok's population has tripled in size to 7.1 million. Asia's urban population will increase by 600 million during the next twenty-five years.

In his book, *Megatrends Asia*, John Naisbitt states that "at six minutes past midnight on December 6, 2006, the human being will become primarily an urban animal."[1] In other words, more than half of the projected 8 billion people in the world will be living in cities, many in megacities with populations approaching 30 million, and with names and places not normally in the evening news — Karachi, Pakistan; Dhaka, Bangladesh; Hyderabad, India; Sao Paolo, Brazil; and Lagos, Nigeria — to name a few.

Although the new market prospects are enormous, the resulting urban congestion will place profound strains on the world's environmental, social, political and economic systems. The need for basic transportation infrastructure and transportation financing will be acute.

Today, nearly 1 billion of the world's population lack access to safe drinking water; 1.7 billion lack modern sanitary services and nearly 2 billion lack electricity. One of the major responsibilities of national governments around the world is to assure that vital infrastructure elements necessary to sustain a modern society and economy — such as transportation, communications, utilities, water and sanitary systems, housing and education — are effectively constructed, maintained and operated.

The Impact of Tourism

Not only will the world's population be increasing, but there will be more affluent people. This increased affluence, combined with the influence of the mass media and telecommunications, has contributed to a booming travel and tourism market that places its own unique demands on the transportation systems of individual countries, regions and the world. Travel and tourism is currently the world's largest and fastest growing industry.

Tourism employs more than 200 million people — or one in every nine workers globally — and currently has a gross output approaching $3.4 trillion. People will be traveling who have never traveled before. In the United States, tourism is the number one source of foreign currency and produces more than $50 billion annually. However, at the same time, there is going to be increased global competition for the tourist dollar — from the Caribbean nations, Europe and Asia.

Transportation is the foundation of travel and tourism. Within the next 25 years it is predicted that the U.S. air traffic control system, airlines and airports will have to accommodate more than 1 billion passengers a year — twice as many as today.

More Reliance on Transportation

World trade is currently on the upswing and imports and exports are 20 percent of the U.S. gross national product. An increasing fraction of these goods is handled in containers. Currently, 10 million containers a year are handled in ports in this country, but by the year 2020 this number will have tripled or even quadrupled.

Notwithstanding the growing recognition that the ever increasing use of the personal passenger car and just-in-time delivery system is leading to gridlock and, in the minds of some, environmental misery, there is no end in sight. There will be increased competition for urban corridors between city dwellers and goods carriers.

Since congestion is here to stay, ways to avoid severe gridlock must be figured out. The era of demand-and-build and addressing urban congestion through new construction is over. Even though the speed of intercity travel can be doubled, intracity travel will only get slower. For example, the introduction of the long-awaited high-speed train service between central Boston and New York will still result in the problem of getting to and from the terminal at each end. While moving faster between cities is more exciting, the real problem is how to move people around once they get there.

The world motor vehicle fleet now exceeds 500 million. Over the next 25 years, it is projected to even double or triple in size. Notwithstanding congestion problems, this increase will lead to more global demand for petroleum and more concern about global warming as well as concern about air pollution. It has been jokingly suggested that Armageddon will occur when one billion new car owners in the developing world all get up one morning and turn on their engines at the same time. There is an urgent need for more efficient and less polluting motor vehicles that are petroleum independent.

Safety Crisis

Worldwide, half a million people die from road accidents each year and over 15 million people suffer injuries. Developing and emerging countries account for about 70 percent of these accidents. As the number of motor vehicles in the developing world increases, by the year 2020 fatalities may reach two million per year, with 40 to 50 million injuries. This safety crisis will provide an outstanding opportunity for the United States to share what it has learned about transportation safety.

At the same time, the United States still has much to do about carnage on its own highways. Particularly difficult and sensitive problems are those associated with the aging driver. The developed world has an aging population — 1 out of 5 licensed drivers in the United States will be 65 and over by the year 2020. As people age their reflexes and ability to negotiate traffic tend to decline, posing difficult questions that society must answer:

- When is one too old to drive?
- How does one get to the store and the doctor when he or she does not have a license and lives in a rural area or an affluent suburb?
- And, when does a truck driver who does not have a pension turn in his or her license?

Adjusting to New Defense Concerns

With the end of the Cold War, the defense strategy in the United States has shifted from global to regional conflict. Current Secretary of Defense William Cohen is working to redefine the military's mission and reassess service roles as the focus is being shifted from the former Soviet threat to regional ones such as those posed by Iraq and North Korea.

The world will remain filled with regional aggressors with non-traditional challenges to U.S. power such as terrorist attacks, use of biological or chemical agents, and sabotage of American computer networks. Emphasis has shifted from delivering weapons of mass destruction to transporting men and materials from U.S. bases to anywhere in the world at a moment's notice — as was the case in Somalia, Haiti and South Korea.

Information Technology

Integrating computer and information technology with transportation — knowing where things are at any moment of time, and bringing about a seamless flow of goods — is critical in an age of intense international competition. In the face of this competition, producers will implement just-in-time distribution methods to avoid the expense of tying up large inventories in warehouses in order to offset disruptions in their parts supply chains.

Much of the technology needed to attack information systems is low-cost and widely available to fanatics, local and foreign terrorists, as well as disgruntled employees. Although transportation and logistic systems are being made more effective and efficient through the use of computer and communication technology, they are becoming at the same time more vulnerable to disruption. Safeguards must be built in at the start.

The findings of a recent U.S. Senate investigation on security in cyberspace were chilling. There were more than 250,000 attacks on Department of Defense computers in 1996, and 65 percent were successful. Little is known about who launched them, why or what they found. In one of the few known attacks, a 16-year-old from Britain used a cheap computer in 1994 to hack into the computer at Griffis Air Force Base in Rome, New York. He also gained access to other Air Force systems, and it took them months to recover. In a recent test, Defense Department "red teams" intentionally hacked into 18,200 systems. Only 5 percent of the attacks were detected, and only 27 percent of those were reported.

Early in 1997 a mock cyberwar exercise was conducted at which attendees were asked to pretend they were responsible for briefing the President in response to the following scenario:

- The traffic lights in Manhattan have all turned green;
- The Holland and Lincoln tunnels are shut down;
- Two commercial airplanes have been put on a collision course; and,
- The pressure in the gas lines in the Bronx had been surged, causing all the pilot lights to go out, with numerous fires and explosions occurring as people try to figure out what is going on.

Attendees were asked to determine what the President should tell the nation. One response was simple: "Remain calm and God bless the United States of America." To be honest, no one knew what the President should do. Although much is known how to respond to physical threats to the transportation infrastructure through experience with earthquakes, floods and other natural disasters, the cyberwar threat

is very real, very scary and no preparations have been made to respond to the threat.

No Silver Bullets

Looking ahead to the year 2020, the major advances in transportation are not going to be made in mechanical and electrical engineering technologies, but rather as a result of the ongoing revolution in computer and communications technology. Electronic technology — in the form of sensors, computers and communication links — is and will be used to make the most of existing capacity.

There have been periods in the past when the introduction of a "silver bullet" — for example, new electro-mechanical systems such as steam, internal combustion and jet engines — was followed by revolutionary advances in transportation technology. These times — and the conceivable future — do not fall into one of those periods. While there will always be a recurring interest in monorails and levitated vehicles, the major advances in the future will be made through the utilization of information technology to more effectively manage the flow of passengers and goods.

In the developed world, the problems in 2020 will not be solved by building more systems. Instead, they will be solved only by determining how best to use existing transportation capacity more effectively. That is not to say that there will be no new transportation infrastructure construction. The major megaprojects, however, will be in the developing world. For example, the Chinese and other Asian governments are contemplating at least a trillion dollar investment in new infrastructure, including 22 new state-of-the-art airports.

Increased public involvement in transportation issues has lengthened long-term planning horizons. Gone are the days when the New Jersey Turnpike could be built in just two years through the most industrialized stretch of land in the country. Today, the necessary land is no longer available, and people are increasingly reluctant to give up their neighborhoods and homes.

Always look out for unintended consequences. The rapid introduction of the car phone has led to higher accident rates. Deregulation has led to transportation carrier consolidation rather than proliferation. Thirty years ago there were nearly 70 first-class railroads; soon there may be only four.

Some lessons have been learned regarding the waves of change and their possible impact on the global transportation network. Today's engineers and tomorrow's transportation professionals must be prepared to solve the problems of a much more complex world than what existed 25 years ago. Younger engineers, and even those who have been around since ushering in the "modern" age, must be able to integrate social, economic and institutional as well as technical factors into their responses to future transportation challenges since the only thing that is certain is that change will be continuing and unexpected. It is up to the transportation engineer to make that journey of change a pleasant one.

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REFERENCE

1. Naisbitt, J., *Megatrends Asia: Eight Asian Megatrends That Are Reshaping Our World*, Touchstone Books, 1997.