ABSTRACT

When developing transportation infrastructure plans or projects, state and local transportation planners typically employ a time horizon that extends 20 to 30 years into the future. This interval works well for planners because Federal law requires that state and local transportation agencies prepare plans that have at least a 20-year horizon and because most large-scale transportation projects are achievable within a 30-year period. Rarely, if ever, do transportation agencies commit significant resources to planning transportation infrastructure projects that are not expected to begin operating until 40, 50, or even 60 years into the future. This difficult task, however, is presently being undertaken by staff of the Texas Department of Transportation, researchers, and consultants. They are in the initial stages of planning the Trans-Texas Corridor, a system of more than 4,000 centerline miles (6,000 km) of tolled, multi-modal corridors that will traverse the state of Texas. This paper discusses some of the difficulties of planning for such a large-scale, multi-modal infrastructure project, which requires planners to look beyond what is normally considered the “long-term” into a period of even greater uncertainty and speculation.
INTRODUCTION

When developing transportation infrastructure plans or projects, state and local transportation planners typically employ a time horizon that extends 20 to 30 years into the future. This interval works well for planners because Federal law requires that state and local transportation agencies prepare plans that have at least a 20-year horizon and most large-scale transportation projects are achievable in a 30-year period. Federal laws that regulate the transportation planning process in the United States mandate a minimum 20-year planning horizon (1), although Departments of Transportation (DOTs) and metropolitan planning organizations (MPOs) typically plan at least 25 years into the future. Those who plan must consider future changes to the region’s transportation patterns and demand, which are products of population and employment growth as well as land use trends. Although the state DOTs and MPOs plan far into the future, they are constantly reassessing the situation by developing new long-range plans every three to five years, as required by Federal regulations. This permits transportation projects to be more effective since the plan can be modified to adapt to political, social, environmental, technological, and other changes.

Rarely, if ever, do transportation agencies commit significant resources to planning transportation infrastructure projects that are not expected to begin operating until 40, 50, or up to 60 years into the future. The magnitude of changes that can occur during this timeframe is much larger than normally encountered for shorter-term projects. However, staff of the Texas Department of Transportation, researchers, and consultants are presently undertaking this difficult task in the initial stage of planning the proposed Trans-Texas Corridor (TTC), a system of tolled, multi-modal corridors that will traverse the state of Texas. When looking this far into the future, planners must consider how a variety of conditions may change. Neglecting to do so may result in a project that is ineffective or too extensive or expensive to meet future needs.

This paper attempts to consider the potential changes to demographics, economics, environmental conditions, technology, and funding that may occur during the implementation of the TTC, since there are indications that various demographic, economic, and environmental trends could have significant ramifications on the viability of the system, if they continue unchanged. With respect to demographics, planners need to consider the potential users of the project and where they will live and work, where and why they will want to travel, and whether they will be able to afford the system’s user fees four or more decades from now. Important economic considerations include the future economic strength of the state, domestic and global trade patterns, and the attractiveness of the state’s labor force. Environmental aspects that may change in the long-run include the availability of a cheap and ready supply of energy for transportation, and future regulations regarding vehicle emissions, especially the emissions of greenhouse gases. From the perspective of technological change, transportation modes may shift or new modes may develop because of changes to the sources of energy we use or the cost of travel. Finally, as Texas’s population and economy changes, will there be sufficient funds to support the TTC project? It is important for planners and policy makers to be aware of and understand these trends so that they can account for them and make contingency plans. Futuristic planners should think broadly about how global conditions may change and then narrow the focus to the national, state, and local perspectives.
DESCRIPTION OF THE TRANS TEXAS CORRIDOR

The TTC is a proposed network of 4,000 centerline miles (6,500 km) of multi-modal corridors connecting the metropolitan and rural areas of Texas (Figure 1). The plan includes separate rail lines for freight, commuter, and high-speed trains; two lanes for truck traffic and three lanes for passenger vehicles in each direction; and a zone for utilities, including electrical transmission lines and pipelines carrying gas and oil (Figure 2). A project of this scope, with a 1,200-foot (366-m) proposed right-of-way (ROW) width, is unprecedented (2). A study of the geometric constraints of all the elements indicates the corridor must have extremely gradual horizontal and vertical curves as well as minimal grades. The minimum horizontal curve radius for High Speed Rail (HSR) at 220 mph (354 km/h) with 7 in. (18 cm) superelevation is 15,600 feet (4,755 m) (3). If HSR is not included in the corridor, passenger cars traveling at 75 mph (129 km/h) and 8% superelevation require a minimum horizontal curve radius of 2,675 feet (815 km). While 2,675 feet (815 km) is the minimum allowable radius, the TxDOT Roadway Design Manual recommends 4,025 feet (1,227 m) for such designs (4). Conventional rail will constrain the TTC’s maximum vertical grade to just 1% (5). Assuming operation of double-stack trains, the minimum vertical clearance needed is 23 feet (7 m) from the top of rail (6), not including electric transmission lines in the corridor’s utility component. The clearances of all elements limit the corridor to a minimum width of 765 feet (233 m), which is significantly less than the TxDOT proposed 1,200-foot (366-m) proposed width but will still have a large impact on surrounding areas.

The TTC’s ROW width and geometric constraints will dramatically limit the ability of transportation planners and ROW administrators to minimize project’s impacts on humans and the natural environment. Inclusion of HSR constrains this ability even further, leaving little, if any, room for alignment choices. Planners are likely to be confronted by repeated situations where they cannot avoid environmentally sensitive areas, valuable agricultural land, or residential areas. Such inflexibility suggests substantial expense and environmental impact, as well as extended time to complete the planning stages and ROW acquisition.

As with most major projects, the TTC will be built in stages. TxDOT has identified four priority corridors (Figure 1) to be constructed first and is currently accepting proposals for the design and construction of the first corridor, from Oklahoma to Mexico, parallel to IH-35 (7). Once the priority corridors are in operation, the toll and other revenues from these segments are hoped to be sufficient to fund construction of the remaining corridors. Assuming that each corridor’s components will be constructed based upon existing and future demand, anticipated revenues, and ease of construction, while also allowing adequate time for preliminary planning, environmental studies, design, toll road investment grade studies, land acquisition, and construction, it is doubtful the first corridor could be fully operational any sooner than 25 or 30 years. Development of the other corridors would likely be a staggered, parallel effort but, given the scale of the project, it is unlikely that they could all occur simultaneously. The non-priority TTC corridors and nonessential components, such as HSR between certain cities, would obviously be expected to take much longer.

TRANS-TEXAS CORRIDOR ANALYSIS

To demonstrate the complexity for planning this far into the future, the following sections discuss the possible changes Texas will see over the next 40 to 60 years and the implications
theses changes could have for the TTC. This narrative will consider demographic and economic changes, the availability of natural resources, technological innovation, and future funding for the project.

**Demographics**

If current trends continue, analysts at the Texas State Data Center (SDC) (8) predict that Texas’s population will become more urbanized, less-educated, poorer, and older over the next 40 years. The dominant trend in Texas since 1900 has been the growth of the state’s population at a rate of 0.6% per year faster than the U.S. population (Table 1). This trend is expected to continue, due to high migration and birth rates among certain segments of the State’s population. This larger population in Texas may increase the demand for the TTC. However, SDC projections also suggest that Texas will become more urbanized, a trend that is found in the rest of the country and world (9, 10). This would mean a smaller share of the population than as at present will live and work the near the TTC corridors.

Another worrisome projection for Texas is that its population will become less educated (8). Table 2 shows the distribution of educational attainment for Texas residents 25 years of age and older in 2000 and the SDC’s projections to the year 2040. Their projections assume that migration rates between 1990 and 2000 will continue, and that current population characteristics, by segment, will not change. The SDC found that all segments, with the exception of those with less than a high school education, are expected to grow more slowly than the State’s overall population. If current trends do not change, college-educated individuals are expected to represent a smaller portion of Texas’s future population. Similarly, the SDC projects that Texas’ changing demographics will result in a lower mean income for the state in constant dollars (Table 1). Finally, the age distribution of Texas is expected to shift, resulting in a higher median age or an older population (Table 1 and 3) (8). The upshot to this discussion is that if current demographic trends continue, Texas will have more people, who are older, less educated, and less wealthy.

**Economics**

Unlike demographic trends, the economic conditions of a state or region can change quickly; consider the impacts of the September 11, 2001 terrorist attacks on an already weak U.S. economy. Thinking about the future economic conditions of the state is vitally important, when proposing a project with such an enormous cost as the TTC. Although Texas had the United States’ third largest gross state product in 2001 (11), global, national, and statewide trends will strongly influence its future vitality. At the state level, if left unchanged, current demographic trends will saddle Texas with an aging, poorer, less-educated population. On the other hand, Texas presently has one of the most vibrant economies in the United States and was this country’s largest exporter to the world in 2003 (defined by the origin of movement) (12). Mexico’s role as Texas’ largest trading partner (13), which is also the United States’ second largest overall trading partner (Table 4) (14), is one of Texas’ important strengths. A key objective of the TTC will be to facilitate this freight movement through and within the state by reducing the existing friction to the movement of goods. The TTC would not only provide a faster route for trucks, but it would also add new rail lines, with the possibility of connecting them to existing and new intermodal ports.
Although the continued growth of global trade is almost certain over the near and medium-term, planners should also consider the long-term prospects for globalization and understand how conditions can change, since they will directly and indirectly affect the Texas economy. During the early part of the 20th Century, global trade was expanding at a rapid rate, similar to what we are experiencing now, but two World Wars brought an abrupt end to this expansion and even led to a contraction (15). In our current context, given our nation’s concerns about security and nuclear proliferation in some of the most unstable locations in the world, we cannot automatically assume there will be a continued and boundless expansion of trade. It is completely possible that another shock to the global economic or political system, including terrorism, could reverse the trend of globalization.

Texas’s long-term challenge in the national and global economy is to remain an attractive location for investment and to train and attract a highly skilled workforce. At present, it is not so much that workers are attracted to the employers of a region as it is that employers are attracted to a region’s skilled workers. Thus, in recent years, an educated and diverse workforce increasingly characterize competitive places. These skilled workers foster innovation, which is necessary to be competitive (16). Texas must reverse its current demographic trends that could eventually lead to a less educated workforce and make strong investments into improving its human capital.

From a logistical perspective, the TTC has the potential to improve Texas’ competitiveness for trade, manufacturing, and warehousing, by increasing accessibility to and around cities in the state. For many businesses, reduced transportation costs will give them access to a broader market (17). Manufacturers using just-in-time (JIT) delivery systems will also benefit from the TTC, since it requires quick and reliable delivery (18). The TTC, especially its trucking component, has the potential to make Texas a more attractive location to firms using JIT.

The future role of Texas in the global economy will depend upon the global and national economy, as well as the quality of its workforce, business environment, and transportation network. Although the TTC has the potential to improve the transportation infrastructure in Texas, transportation is just one of many factors that drive the competitiveness and economic development of a region.

Natural Resources and the Environment

The availability of natural resources and the impacts of human activity on the environment have the ability to drastically alter future choices and modes of transportation. Today's transportation infrastructure is highly dependent upon fossil fuels. According to the U.S. Department of Energy (DOE) (19), fossil fuels supply 85% of the nation’s energy needs, about two thirds of electrical energy, and almost all of its transportation fuels. The DOE also predicts the United States will require increasing amounts of fossil fuels over the next 20 years. The U.S. Energy Information Association (EIA) (20) expects world consumption of energy to increase around two percent every year through 2025. Developing nations, such as China and India, will account for the majority of this increase as their energy needs will likely double within this time frame. Oil is expected to remain the primary source for energy, especially in transportation, since there is no other competitive choice.
Our continued reliance upon petroleum creates two problems for the assumption that Texas will need the same type of roadway infrastructure that we use now. First, petroleum reserves are being rapidly depleted and we do not have an adequate or ready replacement of energy. Second, the continued use of fossil fuels for transportation will add even more greenhouse gases into our atmosphere that will result in even greater climatic change, which may not be tolerated by future generations. Multiple and varying estimates exist for the amount of oil eventually available for consumption. Most sources agree petroleum will be available through the next half century, but before the complete depletion of oil occurs, prices will begin to rise steadily, diminishing its accessibility and potentially reducing our mobility (21). Even if petroleum supplies are nowhere near exhaustion, however, the continued use of petroleum products will add more greenhouse gases to the environment. In the U.S., about 82% of the greenhouse gases are emitted from the burning of fossil fuels for energy and fuel. According to the U.S. Environmental Protection Agency (EPA) (22), these greenhouse gases, mainly carbon dioxide, methane, and nitrous oxide, have heat-trapping properties. As the affects of global warming become more obvious and destructive, it is likely that the laws and regulations will be enacted that will curtail, perhaps drastically, the volume of greenhouse gases we produce. The result of this effort will likely be less travel or at least more expensive travel in automobiles, which could reduce demand for the TTC’s roadway components. On the other hand, these changes could have very positive impacts on the TTC’s proposed rail corridors, which should also be considered.

**Technology**

Innovative technological advances have the potential to minimize the impact of the depletion of fossil fuels and their negative impact on the environment. Various alternative energy sources are being researched for transportation uses, though at this time, none of them is likely to be as ideal as oil is for use in vehicles (23). Resources that would behave similarly to oil are considered too difficult to retrieve. While electricity is perceived as an adequate alternative to fuel for vehicles, there are multiple problems with the technology. Today's batteries do not have the capability to store energy as dense as gasoline. A battery with the storage capacity of a tank of gasoline would be impractically heavy for mobile machines, including farm equipment and airplanes (23).

The best hope at present to replace petroleum, at least temporarily, is hydrogen fuel cell technology. Vehicles powered by hydrogen fuel cells are still many years away from practical use, but there is widespread support for research into this technology. The benefits of fuel cells are that they produce nearly zero emissions and have the potential to be twice as efficient as an internal combustion engine (24). However, one of the problems with hydrogen fuel cells is that the hydrogen must be produced from natural gas through a steam reforming process (25, 26). Other barriers to this technology include the cost to develop fuel cells for light-duty vehicles and the need for infrastructure and on-vehicle storage, as compressed hydrogen is highly dangerous (25, 27).

Another technology with the potential to impact the need for more roadway capacity is automatic cruise control (ACC). With ACC, cars are equipped with sensors to detect objects in front of them and the speed of those objects. When the sensors recognize a slower-moving vehicle ahead, they communicate with a computer in that car and the driver’s speed is automatically adjusted to maintain a safe distance. ACC works to maintain a constant headway between vehicles by controlling braking and acceleration. These systems are also able to react
quicker than humans to apply the brakes if the vehicle were to be at risk of hitting another car. It is possible these systems will be developed to recognize lane markings and be given the ability to shift lanes, taking away more control from the driver (28). ACC has the potential to positively impact the driving environment through increased safety, decreased congestion, and lower emissions. Although the initial purpose for ACC was to increase safety on the road by reducing the number of rear-end collisions, a potential benefit of ACC is to reduce congestion and increase capacity on existing roadways. One cause of congestion is drivers over-reacting or not anticipating and braking too hard. Drivers may slow for many reasons, including merging traffic or accidents. The effect is generally felt far upstream of the original incident. A study by Davis (29) indicated that with even 20% of cars on a highway using ACC, it may be possible to eliminate congestion previously due to the slow reaction time of humans. Also, if people become comfortable with closer headways, such as one second, the capacity of the roadway may increase, potentially postponing the need, at least temporarily, for new roads or alternative modes of transportation.

Funding

Due to possible demographic, economic, and technological change, current assumptions about the revenue that the TTC will generate may need to be reconsidered. The TTC is expected to be financially supported by multiple sources, including the Texas Mobility Fund, toll equity, regional mobility authorities, and the federal government (2). However, as the state’s population becomes older and potentially poorer, state government will likely be pressured to divert scarce funding to social programs, such as social security, health care, and welfare. Similar conditions will exist at the federal level. The social security trust fund will be depleted in 2042 unless the program changes (30). In 2002 health care was 14.9% of gross domestic product, and is expected to be 18.4% in 2013 (31). Texas may also have lower per capita funds available to allocate for transportation if less tax revenue is produced from a poorer population. The federal government will also be pressured to divert money away from transportation to care for the country’s elderly population. Finally, the future agendas of state and national political parties and elected leaders may affect the priorities given to funding transportation projects.

IMPLICATIONS OF FUTURE TRENDS FOR THE TTC

There is a multitude of ways by which the future could affect the operation of the proposed TTC. Once constructed, the TTC has the potential to alter the Texas economy and means by which Texans travel throughout the state. However, when planning for the TTC, it is important to consider existing or future trends that could diminish the viability of the project. Understanding these challenges and creating detailed plans for dealing with them will avoid the possibility of problems in the future. Based upon the narrative above, these are some of the issues that the TTC’s planners should consider:

- If the state’s trend towards urbanization continues, the TTC will be less likely to stimulate economic development in rural areas.
- If Texas residents have lower real incomes in the future, they may travel less and be less willing to choose toll roads for their travel. This could diminish the total amount of revenue generated from the corridors.
- The cost of travel may increase due to rising energy costs or environmental regulations. If these changes do occur, commuters may be driving less and may be less likely to use the
roadway component of the TTC. On the other hand, these changes could create a strong stimulus for passenger rail service.

- Future technological changes in transportation, such as ACC could diminish congestion on existing roadways, reducing or postponing the need for new roadways.
- If, many decades from now, other forms of transportation replace private vehicles, the TTC may be too wide or too extensive for the new mode of transport or for demand. TTC planners and engineers should consider flexible design practices to accommodate technological change to transportation.

CONCLUSIONS

Rather than purporting to be a prophesy of the future, the purpose of this exercise has been to introduce and illustrate the many difficulties that transportation planners must confront when attempting to plan for a large-scale transportation project like the TTC. Peering into the future is a difficult task because there are so many unknowns, including changes in demographics and economics, regulations, transportation technology, and funding priorities. While some trends continue, others do not and there is always the risk of some unforeseen endogenous or exogenous shock. Because there are so many unknowns, this paper is not proposing that state DOTs and MPOs begin to develop actionable items beyond their existing long-range planning horizons. Instead the authors suggest that they begin to consider the implications of potential changes to demographics, the economy, the environment, the availability of natural resources, and future funding sources on the success of their existing plans.

Frequently, state DOTs and MPOs avoid consideration of long-term issues because the solutions are difficult, expensive, politically unfeasible, or the problems appear so remote that they are considered unimportant. For many organizations, it is far easier to wait until problems become tangible or even reach a crisis, than it is to be proactive. Additionally, because long-range transportation plans are updated on a regular basis, there is often a convenient excuse to put off action, assuming it will be dealt with during the next planning cycle. However, the responses to some of these issues require such a significant change in thinking, as well as commitment of resources, that planning organizations cannot continue to avoid thinking about them. The authors suggest a pragmatic approach, in which an agency demonstrates an awareness of a trend and a need for future action. The need for future action does not necessarily need to translate into immediate action, especially if it is premature or would be ineffective. However, it puts the problem on the “radar screen” so that decision makers know that the problem will have to eventually be dealt with, rather than being that surprised when they learn that it exists at all.

Many of the trends identified in this paper will likely begin to affect transportation planning in Texas by the tail end of the current set of long-range plans. In the case of very-long-range planning, like for the TTC, there could be significant implications from not considering these existing trends now. Organizations should begin to consider a more holistic view of transportation planning that includes an awareness and understanding of domestic and global trends that, though they may not appear to have a direct relationship to transportation planning, could still affect transportation investments during their normal 20- to 30-year planning horizon, as well as beyond.
ACKNOWLEDGEMENTS

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FIGURE 2  Trans-Texas Corridor Conceptual Layout.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total Population</th>
<th>CAGR&lt;sub&gt;a&lt;/sub&gt;</th>
<th>Median Age</th>
<th>Median Household Income ($1999)</th>
<th>% Urban</th>
<th>Total Population</th>
<th>CAGR&lt;sub&gt;a&lt;/sub&gt;</th>
<th>Median Age</th>
<th>Median Household Income ($1999)</th>
<th>% Urban</th>
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<tr>
<td>1900</td>
<td>76,212,168</td>
<td>1.9%</td>
<td>22.9</td>
<td>39.6%</td>
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<td>3,048,710</td>
<td>18.7</td>
<td>17.1%</td>
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<td>1910</td>
<td>92,228,496</td>
<td>0.7%</td>
<td>24.1</td>
<td>45.6%</td>
<td></td>
<td>3,896,542</td>
<td>20.2</td>
<td>24.1%</td>
<td></td>
<td></td>
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<tr>
<td>1920</td>
<td>106,021,537</td>
<td>1.5%</td>
<td>25.3</td>
<td>51.2%</td>
<td></td>
<td>4,663,228</td>
<td>22.0</td>
<td>32.4%</td>
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<tr>
<td>1930</td>
<td>123,202,624</td>
<td>1.4%</td>
<td>26.5</td>
<td>56.1%</td>
<td></td>
<td>5,824,715</td>
<td>23.7</td>
<td>41.0%</td>
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<tr>
<td>1940</td>
<td>132,164,569</td>
<td>1.5%</td>
<td>29.0</td>
<td>56.5%</td>
<td></td>
<td>6,414,824</td>
<td>26.8</td>
<td>45.4%</td>
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<tr>
<td>1950</td>
<td>151,325,798</td>
<td>1.4%</td>
<td>30.1</td>
<td>64.0%</td>
<td></td>
<td>7,711,194</td>
<td>27.9</td>
<td>62.7%</td>
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<tr>
<td>1960</td>
<td>179,323,175</td>
<td>1.7%</td>
<td>29.5</td>
<td>69.9%</td>
<td></td>
<td>9,579,677</td>
<td>27.0</td>
<td>75.0%</td>
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<tr>
<td>1970</td>
<td>203,302,031</td>
<td>1.3%</td>
<td>28.1</td>
<td>73.6%</td>
<td></td>
<td>11,198,655</td>
<td>26.4</td>
<td>79.7%</td>
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<tr>
<td>1980</td>
<td>226,542,199</td>
<td>1.1%</td>
<td>30.0</td>
<td>73.7%</td>
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<td>14,225,513</td>
<td>28.0</td>
<td>79.6%</td>
<td>35,539</td>
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<tr>
<td>1990</td>
<td>248,709,873</td>
<td>0.9%</td>
<td>32.9</td>
<td>75.2%</td>
<td></td>
<td>16,986,510</td>
<td>30.8</td>
<td>80.3%</td>
<td>35,063</td>
<td></td>
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<tr>
<td>2000</td>
<td>281,421,906</td>
<td>1.2%</td>
<td>35.3</td>
<td>79.0%</td>
<td></td>
<td>20,851,820</td>
<td>32.3</td>
<td>82.5%</td>
<td>39,927</td>
<td>54,441</td>
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<tr>
<td>2010</td>
<td>308,936,000</td>
<td>0.9%</td>
<td>35.3</td>
<td>82.5%</td>
<td></td>
<td>25,897,018</td>
<td>33.6</td>
<td>52,639</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>335,805,000</td>
<td>0.8%</td>
<td>35.3</td>
<td>82.5%</td>
<td></td>
<td>32,427,282</td>
<td>32.3</td>
<td>50,903</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>363,584,000</td>
<td>0.8%</td>
<td>35.3</td>
<td>82.5%</td>
<td></td>
<td>40,538,290</td>
<td>32.3</td>
<td>49,326</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>391,946,000</td>
<td>0.8%</td>
<td>35.3</td>
<td>82.5%</td>
<td></td>
<td>50,582,961</td>
<td>38.3</td>
<td>47,883</td>
<td></td>
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</table>

<sup>a</sup> Compound Annual Growth Rate (CAGR)

<sup>b</sup> Projections assume net migration rate between 1990 and 2000 will continue


Sources: U.S. Census Bureau; Murdock, et al. 2003
### TABLE 2  Texas’ Civilian Labor Force’s Educational Attainment: 2000 and 2040

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Number 2000</th>
<th>Number 2040a</th>
<th>% of Population 25+ 2000</th>
<th>% of Population 25+ 2040b</th>
<th>CAGR&lt;sub&gt;a&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>1,848,040</td>
<td>6,983,366</td>
<td>18.8%</td>
<td>30.0%</td>
<td>3.4%</td>
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<tr>
<td>High School or equivalent</td>
<td>2,855,502</td>
<td>6,674,661</td>
<td>29.0%</td>
<td>28.7%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Some College</td>
<td>2,144,625</td>
<td>4,261,479</td>
<td>21.8%</td>
<td>18.3%</td>
<td>1.7%</td>
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<tr>
<td>Associate Degree</td>
<td>681,363</td>
<td>1,310,401</td>
<td>6.9%</td>
<td>5.6%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Bachelor/Graduate/Professional Degree</td>
<td>2,301,029</td>
<td>4,040,215</td>
<td>23.4%</td>
<td>17.4%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Total Labor Force</td>
<td>9,830,559</td>
<td>23,270,122</td>
<td></td>
<td></td>
<td>2.2%</td>
</tr>
</tbody>
</table>

<sup>a</sup> Compound Annual Growth Rate (CAGR)<br>
<sup>b</sup> Projections assume net migration rate between 1990 and 2000 will continue.

Source: Murdock et al. 2003

### TABLE 3  Texas Age Distribution: 2000, 2010, 2040

<table>
<thead>
<tr>
<th>Age</th>
<th>2000</th>
<th>2010</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18</td>
<td>28.2</td>
<td>25.9</td>
<td>21.4</td>
</tr>
<tr>
<td>18-24</td>
<td>10.6</td>
<td>10.8</td>
<td>9.1</td>
</tr>
<tr>
<td>25-44</td>
<td>31.1</td>
<td>29.6</td>
<td>29</td>
</tr>
<tr>
<td>45-64</td>
<td>20.2</td>
<td>23.7</td>
<td>24.7</td>
</tr>
<tr>
<td>65+</td>
<td>9.9</td>
<td>10</td>
<td>15.8</td>
</tr>
<tr>
<td>Median Age</td>
<td>32.3</td>
<td>33.6</td>
<td>38.3</td>
</tr>
</tbody>
</table>

Projections assume net migration rate between 1990 and 2000 will continue.

Source: Murdock et al. 2003
## TABLE 4   Top Ten Export Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Value ($ Billion)</th>
<th>% of Total Exports</th>
<th>Country</th>
<th>Value ($ Billion)</th>
<th>% of Total Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>41.6</td>
<td>42%</td>
<td>Canada</td>
<td>77.4</td>
<td>23%</td>
</tr>
<tr>
<td>Canada</td>
<td>10.8</td>
<td>11%</td>
<td>Mexico</td>
<td>44.5</td>
<td>13%</td>
</tr>
<tr>
<td>China</td>
<td>3.1</td>
<td>3%</td>
<td>Japan</td>
<td>22.3</td>
<td>7%</td>
</tr>
<tr>
<td>South Korea</td>
<td>2.8</td>
<td>3%</td>
<td>United Kingdom</td>
<td>15.3</td>
<td>5%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>2.8</td>
<td>3%</td>
<td>China</td>
<td>14.6</td>
<td>4%</td>
</tr>
<tr>
<td>Japan</td>
<td>2.7</td>
<td>3%</td>
<td>Germany</td>
<td>12.9</td>
<td>4%</td>
</tr>
<tr>
<td>Singapore</td>
<td>2.3</td>
<td>2%</td>
<td>South Korea</td>
<td>10.9</td>
<td>3%</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.3</td>
<td>2%</td>
<td>Netherlands</td>
<td>10.0</td>
<td>3%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2.1</td>
<td>2%</td>
<td>Taiwan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>2.1</td>
<td>2%</td>
<td>France</td>
<td>8.8</td>
<td>3%</td>
</tr>
</tbody>
</table>

Total Value of Exports: 98.8 | 334.5

Source: Texas Business and Industry Data Center; U.S. Census Bureau