How much travel will there be in 2055?

As a result of CUTR’s previous work exploring vehicle miles of travel trends and seeking an “outside the Beltway” perspective, U.S. Department of Transportation (USDOT) staff recently called upon CUTR to develop an estimate of 2035 and 2055 vehicle miles of travel (VMT), with the forecast sensitive to demographic assumptions like immigration and aging, different land development assumptions, and income growth. The estimates were used as input to the report of for the National Surface Transportation Policy and Revenue Study Commission created in SAFETEA-LU.

Economic, demographic and travel behavior data from various sources were scoured to identify foundational behavioral relationships that could serve as the basis for a 50-year forecast of travel demand. Travel demand scenarios developed with the spreadsheet tool were then input into the Highway Economic Requirements System (HERS) model by USDOT and used to produce long-range estimates of transportation needs. These needs served to define the financial and governance challenges that the Commission was charged with addressing.


continued on p.2
Travel is fundamental to the human desire to interact for social and economic benefit, and it is anticipated that the desire to travel to socialize will continue as it has through the history of mankind. Similarly, the role of travel in enabling economic interaction and the transportation of products will continue. The fundamental trend toward specialization of labor continues to underlie the historic trend toward trade and urbanization of the population. The geographic specialization of labor and production has created a strong interdependency across geography, resulting in demand for travel. Be it importing fresh seasonal produce from the Southern hemisphere, taking a trip across the country to visit a relative, or sending a child to a magnet school across town, the dispersion and specialization of people and economic activity create demands for travel and commerce.

Forecast framework
The basic equation embodied in the long-range forecasting model is the product of four terms: resident population, daily person trips per capita, length in miles per person trip, and vehicle miles of travel per person mile of travel.

\[
\text{Population} \times \frac{\text{Person Trips}}{\text{Persons}} \times \frac{\text{Person Miles}}{\text{Person Trips}} \times \frac{\text{Vehicle Miles}}{\text{Person Miles}} = \text{Vehicle Miles of Travel}
\]

This can be applied for any given time reference period, geography, or population subsegment for which data are available. Without the fourth term, this equation can be used to forecast person miles of travel.

This basic equation was built into a spreadsheet model that uses the 2001 National Household Travel Survey (NHTS) to provide measures of trip rates, trip length, and mode share. The model calculates person travel for the District of Columbia and individual states. Truck travel is forecast separately and added to person travel to create a forecast for total VMT. The model is calibrated using 2001 as a base year to match estimated passenger VMT from the Highway Performance and Monitoring System (HPMS) after which state level adjustment factors are developed. It is validated with 2005 data and applied for forecast years 2035 and 2055.

Critical factors influencing future travel demand
The past few generations of U.S. history have been characterized by significant changes in travel behavior coincident with dramatic changes in the economy, culture, development pattern, and technology. We have witnessed the evolution of dominance of auto and air travel and the culmination of a century of population redistribution, resulting in much greater urbanization of population and the preeminence of suburban areas as residential and employment locations. The specialization of labor, the growth in influence of national and regional retail chains, the dramatic growth in labor force participation by women, and the growth and maturation of the baby boom generation have all impacted travel behavior. The shift towards a service and information economy, dramatic advances in communications and computerization, and globalization of the economy are other significant factors.

The collective consequence of these trends has produced historic growth in travel demand, well outpacing population growth. The sources of travel demand growth over the past quarter-century can be attributed to population growth and changes in travel behavior, including increases in trip making (trip rate), increases in trip length, and changes in mode choice. Figure 1 attributes national VMT increases to these factors for the period from 1977 to 2001. Perhaps most surprising is the fact that trip frequency is the single
largest factor responsible for VMT growth in the past few decades. Each of us is making more trips.

Looking ahead, several conditions that have been factors contributing to VMT growth in the past do not appear to be as potentially significant going forward. For instance, the growth in vehicle availability may not be as significant going forward, as there is near saturation of vehicle availability for the able-bodied adult population. While income growth may result in some increases in vehicle availability, the magnitude of the potential for new vehicle ownership is modest. In addition, the aging of the baby boom generation will no longer be putting upward pressure on travel growth.

To a certain extent, real income growth derives from specialization of labor. The logical premise is that workers become more expert in a specialized skill and are able to be more productive, thus producing more income. This specialization by its very nature alters the distribution of opportunities for these workers and, to the extent they are similarly more specialized in their consuming patterns (e.g., going to a French restaurant versus the neighborhood diner), it alters the distribution of travel activities.

One might envision that future real income growth will lead to an extension of the specialization of activities. This might include ongoing changes in daily travel as trip mode, frequency, and distance change in response to resource availability and the subsequent changes in household activity patterns. It is possible that leisure time activities will both increase in number and become more specialized (with longer trips) as real income increases. For example, a higher income household may add additional vacation travel. Similarly, more households may have vacation homes or may participate in other more specialized personal and professional activities, which create increased levels of VMT.

While the history and economic forecasts presume continued growth, the extent of real income growth is uncertain, and there will be competing demand for increases in real income. Healthcare, energy, infrastructure needs, environmental protection and other resource demands may impact the discretionary resources available for expenditure on transportation, even with greater real incomes. In addition, increases in the real cost of transportation may dampen the impact of real income growth as it may take a larger share of household spending just to purchase the amount of transportation that is consumed today.

A tremendous level of attention is currently being paid to the relationship between transportation and land use. Large commitments to transit infrastructure, increasing land development regulatory activities, and significant professional and public energies are being expended to influence land development with the expectation that it can be a substantial contributor to meeting or moderating travel needs. How this plays out over the next 50 years will impact transportation demand.

The differences in travel behavior as a function of development density embedded in the VMT forecasting model were derived from travel behavior as revealed in the 2001

<table>
<thead>
<tr>
<th>Tract density in persons/square mile</th>
<th>under 500</th>
<th>500 to 1,999</th>
<th>2,000 to 3,999</th>
<th>4,000 to 9,999</th>
<th>10,000+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in per capita VMT from density under 500 persons/square mile</td>
<td>-</td>
<td>-11.6%</td>
<td>-17.7%</td>
<td>-28.6%</td>
<td>-56.8%</td>
</tr>
</tbody>
</table>

Source: CUTR analysis of NHTS/NPTS data
National Household Travel Survey. These empirically-derived differences in per capita behavior confirm other research in documenting a lower level of VMT for denser development patterns.

The population growth scenarios for 2055 have been processed with the VMT forecast model to produce forecast shares of population in the various density categories as shown in the accompanying table. Future density distributions are based on a regression analysis of density changes between 1990 and 2000; however, other scenarios can be evaluated by exercising model features that let the user test preferences for denser development.

The nature of the population, specifically, the age and gender distribution and the share of foreign-born population, are characteristics that are known to influence travel behavior. Young population is dependent on adults to provide vehicle mobility. At the age of driver license attainment, travel levels increase, peaking in the middle-age working years when persons have the economic resources to travel and the responsibilities for work and family that often involve extensive travel. As children move away and adults enter their senior years, travel generally declines. The need for work travel diminishes, material item consumption generally slows, and health or stamina issues may begin to moderate travel levels.

Travel typically declines significantly for those beyond 80 to 85 years of age. Figure 2 overlays the population age profile on a graphic of travel levels as a function of age.

Research carried out to support the development of the VMT forecasting model as well as other national research has shown a marked difference in travel behavior between the domestic population and immigrants. Characteristics of immigrants—in particular family size, the role of women in the culture, economic status, and employment skills—are among the

Forecast Density of Future U.S. Population

<table>
<thead>
<tr>
<th>Tract density in persons/square mile</th>
<th>under 500</th>
<th>500 to 1,999</th>
<th>2,000 to 3,999</th>
<th>4,000 to 9,999</th>
<th>10,000+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population distribution in 2000</td>
<td>30.12%</td>
<td>19.28%</td>
<td>17.26%</td>
<td>21.82%</td>
<td>11.52%</td>
</tr>
<tr>
<td>Population distribution in 2055</td>
<td>25.85%</td>
<td>19.33%</td>
<td>15.25%</td>
<td>24.54%</td>
<td>15.03%</td>
</tr>
</tbody>
</table>

Figure 2. U.S. Population Age Distribution with Annual VMT and PMT per Capita by Age

Source: CUTR analysis of NHTS/NPTS and Census data.

continued on p.14
Planning strategies to improve SIS mobility

Over the last several years, the State of Florida has established the Strategic Intermodal System (SIS), a multimodal transportation network to support the intrastate movement of both people and goods. As the State’s top transportation priority, the majority of federal and state transportation funding is spent on maintaining mobility on the SIS. The 2005 growth management legislation further supported this priority with specific development review requirements regarding development impacts to the state highway system, specifically roads designated as part of the Strategic Intermodal System (SIS), the Florida Intrastate Highway System (FIHS), and facilities funded through the Transportation Regional Incentive Program (TRIP).

The Florida Department of Transportation (FDOT) commissioned CUTR to research development review processes and provide specific guidance in meeting these requirements. Specifically, the research objectives were to:

- clarify the process(es) used in the evaluation of level of service (LOS), particularly on SIS, FIHS, and TRIP facilities, regarding transportation site impact analysis for comprehensive plan amendments and developments of regional impact;
- identify methodology issues and clarify acceptable applications; and
- define “concurrence” and provide standard guidance regarding review and acceptance of mitigation strategies for transportation impacts, particularly on SIS, FIHS, and TRIP facilities for use by FDOT staff and the development community.

This research resulted in a report entitled “Documenting Improved Mobility on SIS and TRIP Facilities.” The first section reviews applicable legislation, literature, research projects, and practices regarding FDOT procedures for level of service analysis within the site impact review process. The report also identifies issues gathered during a series of interviews held with FDOT and other reviewing agency staff. The information provided the basis for recommendations to develop a clear process for site impact review, application of level of service tools, and procedures for concurrence with proposed mitigation strategies.

The review revealed extensive information on site impact and level-of-service analysis, as well as guidance on analyzing and addressing transportation concurrency alternatives (such as transportation concurrency exception areas, multimodal transportation districts), and the incorporation of multimodal solutions in development review and approval. This information was supplemented through interviews with District personnel as to current FDOT practices for site impact analysis, level-of-service analysis, and concurrence on SIS and TRIP mitigation. Those interviewed expressed a variety of concerns on these topics; however, the primary concern was what constitutes acceptable mitigation of adverse transportation impacts on SIS and TRIP facilities. Clear direction on FDOT policy and preferences relating to SIS/TRIP mitigation is needed.

When transportation impacts affect the SIS, the 2005 growth management legislation directs local governments to develop a plan to mitigate impacts to the SIS in cooperation with FDOT, including, if appropriate, the development of a long-term concurrency management system. It further requires the Department’s concurrence on proportionate fair-share mitigation. As with the DRI process, a key benefit of the concurrence requirement is that it affords FDOT the opportunity to participate in the review of local government land use decisions.
This initial stage of research resulted in the development of guiding principles aimed at further clarifying how the Department might accomplish its new role. These principles included ideas on how to champion effective mitigation strategies, to recognize valid mitigation proposals, to provide better certainty of outcomes, and to streamline administration using the working concepts outlined as follows:

- Focus on building and maintaining relationships/partnerships.
- Provide data, tools, and other technical assistance to local governments and transit agencies.
- Develop a “menu” of mitigation options.
- Work with local governments to develop and implement corridor plans that can form the basis for mitigation.
- Apply alternative approaches to measuring impacts to the SIS.
- Include a definition of and specific requirements for transit-oriented development (TOD).
- Consider access and mobility issues on SIS Connectors in relation to the functions of related hubs.

The second section of the report includes tools, resources, and guidance to enable transportation partners to respond effectively to growth management issues, to become more proactive, and to maximize use of limited transportation funds. These transportation partners may include, among others, local governments, MPOs, RPCs, FDOT, and the Florida Department of Community Affairs (DCA). The report also offers examples of acceptable mitigation of transportation impacts to transportation facilities that are part of the SIS or FIHS, or are funded through the TRIP.

Growth management and site impact review processes also are addressed in the report. FDOT staff reviews a variety of transportation impact analyses addressing the impact of the proposed development, primarily on the State Highway System. Transportation impact analyses may address concurrency, comprehensive plan amendments, developments of regional impact (DRIs), or sub-DRI developments. In most cases, the transportation impact review process and methodology is driven by local governments, with little uniformity across the state or even at the District level. This section includes recommended practices to augment existing review processes.

Information from the study assists FDOT staff in carrying out their role in the review of the transportation impacts of proposed developments on the SIS, the FIHS, and TRIP-funded roadways. Florida statutes require FDOT to concur with mitigation plans for those impacts as proposed by local governments. The report defines “concurrence,” discusses opportunities to develop mitigation plans, and provides options regarding mitigation strategies for transportation impacts. Such strategies will require the collaboration of transportation partners during development and application.

Another aspect of the report focuses on building and maintaining relationships among government agencies and other transportation partners which is essential to achieving mobility goals. The following approaches are mechanisms for coordination and collaboration:

- initiate and maintain contact with transportation partners;
- collaborate on multimodal strategies; and
- host (or co-host) an annual Multimodal Transportation Peer Exchange for the region. This regional event is a forum where peer-level representatives from FDOT, regional planning councils, MPOs, local governments, transit agencies, and developers can work toward creating a viable mobility plan for the region.

Every development review scenario is unique based on its own features, the surrounding community, and existing transportation system concurrency issues. As a result, each mitigation plan should offer solutions appropriate for the situation. Rather than providing a specific formula, the report provides options that developers, local governments, and FDOT may combine create a suitable mitigation solution.

FDOT is distributing the report to its District offices and other interested parties. An electronic copy can be downloaded at http://www.dot.state.fl.us/planning/systems/sm/los/los_sw2.htm#papers. For further information on this report or CUTR’s ongoing growth management research program, contact Karen Seggerman, seggerman@cutr.usf.edu, or Kristine Williams, kwilliams@cutr.usf.edu, (813) 974-3120.
Printed transit information materials are the mainstay of every transit agency’s service information strategy. System maps, route maps, and schedules are the traditional means for providing service information to transit users. Such materials are a valuable resource because they are:

- **portable**—for use in pre-trip planning and to check trip progress
- **accurate**—providing details for planning complex trips
- **independent**—so trips can be planned without interaction with another entity

Research has shown that many people find printed information aids like maps and schedules extremely difficult to use for a variety of reasons, including the complexity of their travel needs and differing cognitive abilities, transit experience, and information needs.

The Transit Information Materials Guidebook was recently completed as the culmination of a series of studies conducted through CUTR’s National Center for Transit Research. Previous market research identified the designs that maximize user comprehension and surveyed actual design practices among transit agencies across the country. The research showed that the majority of transit agencies tended to develop their own approaches to designing schedules and transit service maps, resulting in a lack of recognized design standards and high levels of variability in the quality and readability of materials. It was concluded that there was a pressing need to provide design recommendations and example materials that illustrate best practices in the field.

These five stages require three different types of information aids. A **system map** shows the alignment of all the agency’s transit routes and is designed to give customers an overview of the complete system and its relationship to the geography of the area. A **route map** illustrates the alignment of an individual bus route and is typically designed to be used with a schedule to allow customers to determine where to board and alight from each bus. A **schedule** (sometimes called a **timetable**) provides timing information for the buses serving a specific route and is typically used in conjunction with a route map to enable a customer to determine when to board and alight from each bus and how long their journey will take. The guidebook features a section on each of these topics, in addition to sections on general publication design and the design of instructions on how to use the materials correctly.

### The Transit Trip Planning Process

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Information Aids Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Locating trip origin and destination on system map</td>
<td>System map</td>
</tr>
<tr>
<td>2</td>
<td>Selecting bus routes and transfer point(s)</td>
<td>System map</td>
</tr>
<tr>
<td>3</td>
<td>Locating closest time points/transfer time points</td>
<td>Route map</td>
</tr>
<tr>
<td>4</td>
<td>Identifying correct section of schedule</td>
<td>Route map, Schedule</td>
</tr>
<tr>
<td>5</td>
<td>Using schedule to get bus times</td>
<td>Schedule</td>
</tr>
</tbody>
</table>
General publication guidelines

The following general recommendations regarding basic design are based on best practices in publication design:

- **Typeface:** Use sans serif font for titles, sans serif or serif fonts for text
- **Type case:** Use initial or all caps for titles/headers, lower case for text
- **Type size:** Use 10 to 16 point where possible for sans serif fonts (never below 8 point) Use 12 to 16 point where possible for serif fonts (never below 10 point)
- **Color:** Dark lettering on a light background is generally recommended
- **Paper:** Flat, matte, or eggshell is generally recommended

System map design

In general, a system map should include:

- all major transit system elements, including the basic alignment of each route, major transfer points, and transfer centers
- all major topographical elements, including major street names and points of interest/landmarks.
- a white or light colored background with color coding used to identify different service routes
- symbols that are consistent with local conventions; a legend should be provided that identifies each symbol, and also states the scale of the map (if to scale)
- different scales and insets to allow service information to be presented in a manageable way

Route map design

A route map should include:

- a title based on the area it serves, using either the name of the general area served by the route, or using the route’s start and end points.
- an illustration of the route alignment, preferably in the same color as shown on the system map and, if possible, in the same orientation as on the system map
- route variations, denoted by a broken line
- the route number
- major points of interest (landmarks) in the vicinity of route, and corresponding intersecting street names
- major streets and intersecting streets in the route’s vicinity
- major topographical features (rivers, lakes, parks, etc.), shown in their natural color if possible
- transfer points with intersecting routes and with other transit modes
- time points spaced preferably at 5 to 10 minute intervals, based on major destinations and transfer points; intersecting street names at each time point should be displayed if possible
- bus stop locations may also be included if sufficiently limited in number
- route direction should be clearly indicated using an arrow where service is in one direction only
- a legend and compass rose

Schedule design

Prior CUTR research showed that using a schedule was the most problematic aspect of the trip planning task, with only around 50 percent of the public able to use one correctly. Thus, a two-tier approach to the provision of service timing information was recommended in the guidebook:

- **Tier 1:** provide accurate service timing information using the tabular schedule format
Tier 2: provide a simple headway-based summary of the service timing information for customers who do not need, or are unable to use, the tabular format.

Other recommendations related to schedule design include the following:

- **Provide the route map and schedule on the same spread.**

  - Group all service information pertaining to a particular direction of travel on the same spread. If necessary, show reverse direction on a separate spread, along with a separate route map.
  - If different time points are employed in the reverse direction, a separate route map for this direction should be provided.
  - Align time points horizontally. Avoid vertical time point alignments.
  - Identify each time point by a unique number or letter that corresponds with that used on the route map. Time point should also be labeled using an adjacent point of interest and/or adjacent intersecting street names.
  - Orient time point labels horizontally or at 45° angle. Avoid perpendicular time point labeling.
  - Shade alternate rows or provide horizontal line separators.
  - Use the 12-hour clock and differentiate the AM and PM times by bolding the PM times and/or by providing AM/PM labels. Use of the 24-hour clock is not recommended.

- Use “To/From” direction labeling. Avoid cardinal directions (“eastbound”, “northbound”).

- Use named days (“Monday to Friday”) rather than groups (“Weekday” / “Weekend”).

**Instruction Design**

Good instructions provide both explanatory text and a graphic illustration of correct schedule use and should be placed in close proximity to the information aids they are describing. Depending on space availability, three different instruction levels are possible:

- **Schedule Use Instruction**—since schedule use is the most difficult part of the trip planning task for most customers, a clear depiction of correct schedule usage is strongly recommended in close proximity to each published schedule.

- **Schedule and Map Use Instruction**—include a section on correct map usage; recommended if materials are packaged in a Ride Guide, or if a separate “How To” pamphlet is provided.

- **Full Trip Instruction**—include other aspects of transit usage besides trip planning, such as how to pay the fare and how to board and disembark for the bus; recommended if materials are packaged in a Ride Guide, or if a separate “How To” pamphlet is provided.

**Conclusion**

This project and the guidebook, published in January 2008, are part of an ongoing interest in the development of industry standards in information materials design. The further development of such standards would undoubtedly benefit individual transit customers and the transit industry as a whole. As part of this ongoing process, feedback is welcomed on the guidebook’s contents or the impact of any of its recommendations.

Copies of the guidebook and supplementary Technical Memorandum can be downloaded from [www.nctr.usf.edu/abstracts/abs77710.htm](http://www.nctr.usf.edu/abstracts/abs77710.htm).

For more information on the guidebook and its development or for a hard copy of the guidebook, contact CUTR Senior Research Associate Alasdair Cain, (813) 974-5036, cain@cutr.usf.edu.
Flagler County prepares for new transit services

In April 2006, a U.S. Census Bureau report indicated that Florida’s Flagler County ranked Number 1 of the top 10 fastest growing housing markets in the U.S., with a housing stock that expanded by 14.8 percent over a 12-month period that ended July 1, 2005. By the 2010 Census, it is expected that Flagler County’s population profile will be radically different than 10 years earlier. Although the Census Bureau is not expected to release the list of urbanized areas until around 2012, Flagler County is taking the proactive step of planning for mobility services in the event that new sources of transit funding become available after the 2010 Decennial Census. Designation as an urbanized area confers eligibility to become a recipient of FTA 5307 funds and FDOT Block Grant funds.

In anticipating such growth, Flagler County contracted with CUTR to assist with determining the first steps to be undertaken in the Transit Development Planning process required by FDOT when federal and state funding sources for transit are available to a community. The Assessment of Transit Needs is conducted in three phases that will result in a Transit Development Plan that will immediately qualify Flagler County for federal and state funds if urbanized area status is realized.

The rapid growth Flagler County has experienced over the past seven years could not be captured utilizing the data collected during the 2000 Census period. Therefore, it was important to seek alternative sources of data that may be more current and accurate in portraying the demographic conditions of Flagler County that currently exist. There are now publicly-generated and private-sector products on the market that provide interim projections of population. For Flagler County, CUTR utilized the American Community Survey (ACS), ESRI (ArcGIS) 2006 and 2011 population projections, and the Bureau of Economic and Business Research’s (BEBR) Florida Statistical Abstract to project population for the county. The results showed that overall growth has been significant since 2000 and population could more than double by the 2010 census.

Flagler County population projections 2010-11:

- 2011 population estimate, ESRI 129,197
- 2010 population estimate, BEBR 113,800

In developing service concepts for Flagler County, it was necessary to envision a fixed-route service that will be supported with paratransit services to feed fixed-route stops. In Flagler County, residential development has occurred in suburban form wherein residential streets feed into major arterials and collectors. Because of the development pattern, most people would not be within the standard walking distance of two blocks to a bus stop. Supplementary paratransit service would operate on residential streets and then deliver passengers to designated stops within the fixed-route service area. Fixed-routes were developed in the conceptual network to connect major activity centers via the available arterial and collector road network. In the next phase, CUTR and Flagler County will pursue an aggressive public engagement program to gain resident input on future transit services in the county.

For more information on transit service in Flagler County, contact CUTR Senior Research Associate Bill Morris at (813) 974-6604, wpmorris@cutr.usf.edu.
Extraboard management tool aids agencies

While transit agencies attempt to employ sufficient regular bus operators to provide scheduled service, they also employ operators to cover work assignments that are temporarily unfilled. Work assignments can become open for extraboard (backup) operators because of vacations, illness, unscheduled absences, insufficient manpower, or attrition (retirement, etc.), or for work that is open due to the course of normal labor practices. Extraboard operations are generally defined as the process of utilizing available manpower to perform work assignments in accordance with labor agreement provisions and work rules to ensure the provision of scheduled transit service. The challenge is to assign manpower to execute scheduled service delivery with minimum cost. Proper extraboard management is critical to the overall workforce management of the transit agency.

Four general parameters define extraboard management: available manpower, open work, labor agreement provisions, and work rules. For any given open work and given available manpower situation, there are normally several alternative decision paths. Such decisions are affected by two conditions: those established by prior actions of the transit system such as scheduling and work force planning, and those that change daily. Both have service delivery and/or financial implications. Opportunities exist to improve the efficiency and effectiveness of extraboard management.

Researchers at CUTR’s National Center for Transit Research (NCTR) conducted a study to find an application tool to aid small to mid-size transit agencies in managing their extraboard. The application tool had to be characterized by easy data entry and model inputs.

A survey on the extraboard practices of transit agencies across the United States was conducted, and 35 systems responded, including large transit agencies (greater than 250 buses), medium-sized transit agencies (greater than 50 and less than 250 buses), small systems (less than 50 buses), and two airport shuttle systems. The survey instrument was divided into five sections:

- basic system information
- labor agreement
- absenteeism and attrition
- scheduling
- operations

From the basic system information, a series of statistical calculations was developed for each of the systems that supplied data:

- percentage of full-time extraboard operators to total operators
- ratio of total extraboard operators to weekday revenue hours

Overall, the survey showed that the percentage of full-time operators to total operators varied significantly between large (20 percent), medium (12 percent) and small (7 percent) transit agencies. However, the one statistic that
remained consistent among the three system types was the ratio of total extraboard operators to weekday revenue hours, which was between .03 and .04 for all system types.

As a result of the survey, it was learned that DART, the Dallas transit system, uses an Optimal Operator instrument to manage its extraboard activities. Optimal Operator was developed by the agency to project the optimal bus operator forecast for the agency and assist with extraboard management. To learn more, NCTR researchers conducted a site visit to DART, where the staff provided assistance in understanding the instrument and its development.

The impetus for the development of Optimal Operator was that the agency needed to address issues that were faced by all related management departments (Finance, Operations, Service Planning, Human Resources). A task force was formed to develop an instrument that all departments and senior management of the agency could understand and use for management purposes. Considerable time, effort and resources were expended over a period of years to develop and refine the instrument and meet organizational objectives. The final result is an instrument that is formatted such that multiple audiences can read and understand it.

Optimal Operator uses a worksheet that determines extraboard needs using actual tallies of absenteeism and attrition by month and then, based on current staffing, calculates the rate of recruiting that is necessary to maintain optimum operator staffing levels. The categories of absenteeism in the worksheet include:

- unscheduled absences
- FMLA leave
- alternative duty
- scheduled absences
- non-operating functions
- operator training
- union business

The worksheet calculates the number of absences for each one of these categories by month and then establishes a rolling trend and average over time. Categories of attrition (turnover) include:

- terminations
- promotions
- transfers

Optimal bus forecasts include the optimal number of full-time and part-time operators. Current staffing then provides a value in relation to the optimal staffing level. Finally, the recruitment section provides the total number of students in training scheduled for graduation, and the required recruiting levels for full-time and part-time operators. This worksheet is especially valuable because it can be universally applied to all transit systems.

On a day-to-day basis, DART continues to employ methods used by all transit agencies to ensure that scheduled service is provided at 100 percent, such as offering voluntary overtime to operators on days off and picking up extra shifts if within the mandatory Hours of Service guidelines. For overall management, however, the Optimal Operator forecast enables finance operators to appropriately budget for bus operator staffing levels and provides Human Resources departments with the necessary recruiting levels for new operators, resulting in overall savings and service improvements for the agency.

For more information on extraboard management, contact CUTR Senior Research Associate Bill Morris at (813) 974-6804, wpmorris@cutr.usf.edu.
Travel in 2055—continued from p.4

Factors that influence the propensity to travel and the nature of that travel for immigrants. Thus, the pace of immigration will impact travel demand through its impact on the total population and the fact that immigrants may have more modest travel demands.

Transportation policy discussions today focus a great deal of attention on the role that alternative modes might play in addressing travel demand. Costs, right-of-way availability, and environmental or community impacts are cited as reasons for favoring policies and investment programs to enhance the competitive position of alternative modes. The magnitude and nature of future person travel demand will be influenced by policies and constraints that affect the supply of infrastructure and services that are provided by each of the various transportation modes.

Over the past several decades travel demand has shifted markedly toward single occupant vehicles. Speed, cost, convenience, personal security, flexibility, and image and status are among the factors that contributed to this trend. The dispersion of population to the suburbs, areas difficult to serve with transit, has contributed to the overall trend.

More recently, a growing interest in downtown condominium living, high energy costs, roadway congestion, and global warming and other environmental impacts are among the factors causing a reexamination of the role public transportation may have in the future. Opinions range from belief that transit is the inevitable sustainable mode that must play a larger role, to those who are convinced that the fundamental appeal of individualized travel will perpetuate the trend toward personal vehicle-based travel—but perhaps with a vehicle that has energy and environmental impacts far more modest than is the case for current automobiles.

By extrapolating known behaviors, this VMT forecast model implicitly assumes a continuing dominant role for vehicle-based travel. Several factors collectively favor caution regarding expectations of meaningfully different assumptions regarding modal availability and use. These factors include:

- the massive existing infrastructure
- the fundamental appeal of individualized travel
- the lack of economic resources and political will that would be required to meaningfully change the relative supply of travel by alternative modes
- the prospect that technologies have and will continue to significantly mitigate or even reverse the competitive advantage of transit in terms of energy and air quality impacts

However, the days of declining transit mode share and declines in the walk, bike and shared ride travel may be at or near an end.

**And the answer is?**

More—a lot more. With population growth nationally expected to be approximately 0.75 percent per year, VMT is expected to increase approximately 1.6 percent per year, resulting in per capita driving times of over 100 minutes in 2055. In Florida, the numbers are expected to be higher, with the population growing approximately 1.5 percent per year and VMT growing over 2 percent per year. Slower economic growth, higher travel costs, or a decline in the importance of wealth in spurring additional travel could moderate this demand growth.

As time passes, it is likely that there will continue to be tension between our tolerance of declining performance of the transportation system and our willingness to incur the costs and other impacts that will be required to expand the transportation systems capacity. Exactly where the equilibrium point will be—balancing between our desires for mobility versus our willingness to pay—remains to be seen.

For more information on this study, contact CUTR Mobility Program Manager Steve Polzin at (813) 974-9849, polzin@cutr.usf.edu.
CUTR partners with Veolia Transportation to provide transit leadership training

In September 2007, 25 general managers of transit systems managed by Veolia Transportation across the United States took part in a Leadership Training course jointly developed by Veolia and CUTR. Held at the Embassy Suites on the campus of the University of South Florida, the program was developed by Veolia Director of Organizational Development Cheryl de Hoog, CUTR Transit Training and Technical Assistance Program Director Lisa Staes, and CUTR Senior Research Associate Amber Reep.

Initially conceived by Bill McCloud, Senior Vice-President of Veolia Transportation and a member of CUTR’s National Center for Transit Research (NCTR) Advisory Board, the training included a variety of subjects to increase the effectiveness of Veolia managers. CUTR Mobility Program Manager Steve Polzin opened the formal days of training with a two-hour workshop on “The State of the Transit Industry,” in which he shared the results of his research on trends and conditions of the changing market for transit services and the performance of transit agencies over time. NCTR Director Joel Volinski provided findings from his research on “Conditions that Promote Creativity at Transit Agencies.”

Dr. Polzin (a member of the HARTline Board of Directors) addressed the group on “Working with Transit Agencies Governing Bodies and Board Members.” CUTR’s Transit Management and Innovation Program Director Rob Gregg closed the training program with “Thinking Styles and Organizational Fundamentals for Public Transportation Management,” a session that addressed the different behaviors and strengths of people within an agency.

This blend of training that incorporated Veolia-specific instructors and CUTR research faculty was enthusiastically endorsed by those in attendance. In addition to the skills and information learned, the program allowed Veolia Transportation’s managers to establish closer and more helpful relationships with their peers around the country and expanded their network of colleagues and friends. CUTR faculty also were appreciative of getting to know more transit general managers from all over the United States and the issues with which they were dealing.

Veolia Transportation and CUTR look forward to more professional training sessions in the future.

For more information on CUTR’s training programs, contact Lisa Staes at (813) 974-9787, staes@cutr.usf.edu.
CUTR celebrates its 20-year anniversary in January 2008 with a luncheon for employees, Advisory Board members, and College of Engineering and USF colleagues. The event was highlighted by comments from Founding Director Gary Brosch and special greetings from Florida Transportation Commission Chair Marcos Marchena and Florida Representative Rich Glorioso.

Established in the USF College of Engineering in 1988 by the Florida legislature and the Florida Board of Regents, CUTR has a long record of developing innovative, implementable solutions to transportation problems through high quality, objective transportation expertise in the form of technical support, policy analysis, and research that translates directly into benefits for its project sponsors. The center now employs more than nearly 50 full-time faculty researchers, 25 graduate students, and numerous technical and support staff.

CUTR currently conducts nearly $8 million in research annually. Since establishment, more than 1,200 research projects valued than $80+ million have been conducted to the benefit of project sponsors throughout Florida and the U.S.