

ning a town center redevelopment project that is characterized by high density. In July 2007, the city selected a developer who has proposed one 15-story and three 22-story residential towers along with a public park on a four-acre (1.6-ha) site. Because the city is almost completely built out, high-density housing is a practical means for the city to meet statewide growth management population targets. To enable this potential, in December 2006 the city center raised the residential building height limit from 85 to 200 feet (26 to 61 m) in the core downtown zone.

Just north of Seattle, the city of Lake Forest Park (population 13,000) has been planning a town center redevelopment that offers an example of a relatively modest-scale project. The 16.5-acre (6.7-ha) site is the entire commercial center of the city, so in this case the project is not intended to be a catalyst for surrounding redevelopment. In anticipation of the sale of the privately owned property, the city produced a set of guidelines for redevelopment, which not only formalized the town center vision, but also served to educate prospective buyers on the site's development potential. The property was purchased in 2006, and the project is currently in the conceptual design phase.

Town center redevelopment is born of the desire to restore the economic and social well-being of communities, and as such, directly addresses two key components of sustainability. Furthermore, a properly designed town center has the potential to shrink the environmental footprint by reducing car dependence and relieving development pressure on ecologically sensitive land. Consideration of town centers through the lens of sustainable development only emphasizes the need to understand and improve the strategies that help bring about successful projects. The public/private partnership continues to be the most promising and essential approach. **U**

DAN BERTOLET is a LEED-accredited planner and urban designer with GGLO, a design firm located in Seattle, Washington. (GGLO is involved in the Burien town square project.)

Mixing It Up

JERRY WALTERS AND REID EWING

Successful mixed-use development can reduce transportation impacts on roadways, vehicle emissions, and energy use—provided the development scale, mix, and design are fashioned in a manner that satisfies travel needs internally and reduces off-site automobile travel.

THOUGH THEY HAVE BEEN SLOW to give mixed-use proposals the credit they deserve, transportation planners and engineers are beginning to recognize that—with the right combination of ingredients—such development can offer tangible and verifiable traffic reductions relative to the rates in the Institute of Transportation Engineers' *Trip Generation* manual, the source commonly used for assessing impacts and sizing infrastructure for proposed development projects in the United States.

Since the late 1980s, transportation researchers have been uncovering evidence that a mix of land uses generates less vehicular travel than equivalent stand-alone land uses. The discoveries come in the context of broader travel behavior studies, in which travel choices are explained by eight sets of variables all conveniently starting with the letter *D*:

- ▷ *Diversity*—mix of jobs, housing, and/or job types to create internal trip—reducing synergies;
- ▷ *Density*—compact development supports interaction, walking, and transit availability;
- ▷ *Design*—walkability and connectivity encourage walking and biking and reduce travel distances;
- ▷ *Destination accessibility*—development at infill locations generates lower vehicle miles traveled (VMTs) per capita due to convenient accessibility to destinations compared with the same development at suburban locations;
- ▷ *Distance from transit*—people who live or work near high-level transit such as rail or express bus are more likely to use it;
- ▷ *Demographics*—household travel choices are influenced by family size, life stage, and income;
- ▷ *Development scale*—larger mixed-use developments reach critical mass of internal opportunities, amplifying internal trip—capture levels; and
- ▷ *Demand management*—many travel option programs and incentives reduce driving, but the most effective are parking charges and other direct costs to the automobile traveler.

Travel research published over the last few years shows that changes by several percentage points in any or several of these “D variables” slightly reduce the number of vehicle trips and VMTs.

Diversity of development can take several forms:

- ▷ *Jobs/housing balance*—the ideal ratio is equivalent to the regionwide balance of jobs to housing, generally between 1.2 and 1.4 jobs

per dwelling unit. Site-specific ratios within this range minimize the number of commuter vehicles traveling to and from the site.

▷ Retail/population balance—the ideal balance of retail employment per household is about 0.15 to 0.25, a level that best satisfies the need to travel long distances from home when seeking personal services, shopping, and entertainment opportunities.



The traffic impact of RiverPlace, a 32-acre (13-ha) mixed-use development south of downtown Portland, Oregon, is a fraction of that generated by single-use suburban developments of comparable composition and size.

▷ Jobs/services mix—the objective is a ratio of total employment to service and retail employment that is consistent with typical region-wide balances of about 5.0 to 7.0, a ratio that reduces lunchtime and errand driving for office employees.

▷ Land use diversity—the objective is to have many distinct land uses represented within the site, or to have compatible amounts of land or floor area devoted to different uses.

The U.S. Environmental Protection Agency is sponsoring a national study of the travel generated by mixed-use development using household travel survey data from Boston, Atlanta, Houston, Sacramento, Portland, and Seattle. The study compares choices by individuals traveling to and from 240 mixed-use developments within the six regions, assessing the percentage of trips remaining internal to the developments and the choices of driving, walking, or transit for those entering or

leaving the site. The sites vary in terms of their size, mix of uses, proximity to transit, and locations within their regions. Of the 35,877 trip ends generated by these sites, 6,378 (17.8 percent) involved trips within the mixed-use site, another 2,099 (5.8 percent) entailed trips entering or leaving the site via walking, and another 1,995 (5.6 percent) involved trips entering or leaving via transit. A total of 29 percent

of the total trip ends generated by the site put no strain on the external street network and generated very few VMTs. Statistical equations derived from the data reveal that the primary factors affecting this reduction in automobile travel are:

- ▷ the total and the relative amounts of population and employment on the site;
- ▷ the site density (floor/area ratio);
- ▷ the size of households and their auto ownership;

- ▷ the amount of employment within walking distance of the site;
- ▷ the pedestrian-friendliness (small blocks and sidewalks) of the site; and
- ▷ the number of bus stops per square mile, presence or absence of a rail station, and the access to employment within a 30-minute transit ride of the site.

The study also found that compared with commute trips between home and work, those traveling home to activities such as restaurants, services, or shopping were almost three times as likely to remain internal to the mixed-use site, and those traveling among activities outside the home (from work to someplace to eat, for example) were almost five times more likely to remain within the site.

For traffic impact, greenhouse gas, and energy analyses, the number of VMTs generated by a mixed-use site depends, in addition to the factors above, upon the site's placement within the region—specifically, the number of jobs located within a 20-minute drive of the site. Greater destination accessibility translates into shorter auto trips external to the site. This effect is as significant as the effects associated with internal capture of trips with mixed-

use developments, and conversion of some external trips from auto to alternate modes.

RiverPlace, a 32-acre (13-ha) mixed-use development south of downtown Portland, illustrates the pattern. Its internal capture rate is a surprisingly high 36 percent. Of the external trips, 14 percent are made by walking and 9 percent by transit. Its external auto trips average 7.7 miles (12.3 km), somewhat longer than most mixed-use developments in the sample. However, on balance, the traffic impact of RiverPlace is a fraction of that generated by single-use suburban developments of comparable composition and size.

This fall, the preliminary results on mixed-use trip generation will be refined and validated through field surveys at representative sites in locations such as southern California, Salt Lake City, Denver, Dallas, Florida, Atlanta, and Washington, D.C. When the study is completed later this year, it will help guide planners and developers of mixed-use projects on design features likely to minimize traffic generation and greenhouse gas and energy impacts, and will produce new analysis techniques for traffic engineers to more realistically quantify impacts and size infrastructure for mixed-use development proposals.

The Transportation Research Board, Caltrans, the San Diego Association of Governments, and other agencies are also sponsoring studies of trip generation by mixed-use developments, infill developments, and transit-oriented developments. One of the studies has conducted trip counts and interviews at Atlantic Station in Atlanta, Mockingbird Station in Dallas, and Legacy Town Center in Plano, Texas.

Preliminary findings indicate that sites with a full array of integrated uses—the study sites each contain residential, office, retail, restaurant, cinema, and hotel uses—can internalize as much as 20 to 40 percent of their peak period travel. According to Brian Bochner, senior research engineer at the Texas Transportation Institute in College Station, Texas, who is leading the effort, the ability of a mixed-use development to internalize travel depends on factors such as scale, balance, proximity, and synergy. Undersupplying any use relative to the magnitude of the others, such as too few restaurants for the amount of office space, reduces the ability to internalize office trip generation. A site's internal capture rate also

drops off proportionally the further apart potentially synergistic uses are placed from one another.

Sites that are large enough to provide a full range of opportunities to residents and workers, an optimal balance in the relative magnitudes of the respective use types—each tailored to suite the development’s market profile—and blending compatible uses throughout the mixed-use site are essential ingredients for minimizing traffic generation. **U**

JERRY WALTERS is a principal with Fehr & Peers, a transportation consultancy based in Walnut Creek, California, and leader of the firm’s smart growth discipline.

REID EWING is a research professor at the National Center for Smart Growth at the University of Maryland in College Park, Maryland, and he is an academic fellow of the Urban Land Institute.

Greenbelts as Planning Tools

VISHAL PANDEY

Greenbelts can be strengthened as a policy tool and used for strategic planning. Five Scottish cities show evidence of successes—and challenges—in the use of greenbelts.

CHANGING SOCIOECONOMIC lifestyle patterns, an increasing number of households, and more service-oriented industries are increasing the demand for land for expansion in and around cities and towns in Scotland. The Scottish Greenbelt Alliance is fighting the notion that growth-related problems should affect greenbelts, but from a planning perspective that cannot always be accommodated.

Though in theory, greenbelts can never be developed, debates have continued over whether they should be made available for housing or should continue to be preserved. Greenbelt land often has been redesignated and developed. Some of this change in status has been planned, some has been in response to planning permissions, and some has been market led. All of this has resulted in the belief that greenbelt policy is an urban and countryside planning tool that helps contain urban growth.

A greenbelt is designated open land around, beside, or within an urban area protected from development. The idea of a greenbelt—open land encircling a major city and embracing both small- and medium-sized settlements located in the hinterland of a “core” city—is one of the main philosophical and practical underpinnings



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