Low-speed vehicles (in particular, neighborhood electric vehicles) and golf carts have become increasingly popular, especially among older adults, as motorized alternatives to passenger cars. Numerous states and communities are grappling with legislative proposals that aim to address the increasing use of such vehicles for everyday travel on local streets and paths. Safety considerations need to play a more central role in the design of the transportation networks that will accommodate these vehicles and in the regulation of their use.

Policy and Design Considerations for Accommodating Low-Speed Vehicles and Golf Carts in Community Transportation Networks

Amanda Taylor Poncy and Hannah Twaddell, Renaissance Planning Group
Jana Lynott, AARP Public Policy Institute

Study Purpose

The purpose of this study is to assess current trends and identify key issues and best practices for safely accommodating golf carts and low-speed vehicles (LSVs), particularly neighborhood electric vehicles (NEVs), within community transportation networks. The study was commissioned by the AARP Public Policy Institute (PPI) in response to increasing requests for information on the topic from state AARP offices and city planners. Numerous states and communities are grappling with legislative proposals to address the increasing use of LSVs and golf carts for everyday travel on local streets and paths. These policies are relevant to all age groups but have a particular significance to older adults.

Unfortunately, little information exists on national trends and issues regarding the use of LSVs and golf carts as modes of local transportation. More urgently, there are few practical resources for planners and engineers who are trying to address the issue in their communities. To help address this lack of information, the AARP PPI prepared this Insight on the Issues to provide a basic overview of the topic, including the following elements:

- A description of existing federal and state regulations governing LSV and golf cart use;
- Relevant local experiences and insights from selected case study communities; and
- Recommendations for consideration by local, state, and national agencies.

What Are LSVs, NEVs, and Golf Carts?

LSVs are small electric or gas-powered cars designed for low-speed, local trips in areas such as planned communities, resorts, college campuses, and even large industrial parks. LSVs are typically one- or two-passenger vehicles, though some models are equipped to carry up to six passengers.

An NEV is a commonly used type of LSV. NEVs are powered by rechargeable batteries and typically provide a driving range of up to 40 miles on a single charge.
Golf carts are not legally defined as LSVs. While some models of LSVs are similar to golf carts in size and carrying capacity, and only a little faster, they offer superior performance, safety, and comfort. A lower center of gravity, front-wheel drive, and carlike suspension give LSVs better stability and maneuverability than golf carts, especially when making turns. Compared to golf carts, LSVs also have higher and more visible profiles. In accordance with federal safety standards, LSVs are required to have more safety features than golf carts, such as windshields, side view mirrors, seat belts, and lights.

### Vehicle Definitions and Safety Standards

On June 17, 1998, the National Highway Traffic Safety Administration (NHTSA) created a new class of motor vehicle, the Low-Speed/Neighborhood Electric Vehicle, defined in 49 CFR 571.3.¹ The NHTSA ruling identifies several types of vehicles:

A **fleet golf cart** is a vehicle with a maximum speed of less than 20 mph that is used solely to carry people and golf equipment. Fleet golf carts are intended for use on golf courses and are not considered LSVs in the NHTSA ruling.

A **personal golf cart** is a vehicle with a maximum speed of less than 20 mph that is for personal use. Personal golf carts may be gas powered or electric. In addition to golf course use, personal carts may be driven on public roads (subject to provisions in state and local law) for purposes unrelated to golf. However, they are still not classified as motor vehicles under federal law and are not considered LSVs. As such, they are not regulated by NHTSA.

A **speed-modified golf cart** is a cart adapted by an individual, after its purchase, to increase its speed. “Street-legal” carts that can go at least 20 mph are considered LSVs, and are thus subject to state or local regulations that adhere to federal LSV standards.

An **LSV** or **NEV** is any four-wheeled motor vehicle with a gross vehicle weight rating of less than 3,000 lbs. whose top speed is greater than 20 miles per hour, but not greater than 25 miles per hour on a paved level surface.

### How Are LSVs and Golf Carts Used in Community Transportation Networks?

LSVs and golf carts have been used for many years in gated communities, resorts, college campuses, and large industrial campuses. In recent years, however, their use on public roadways has become more popular. They provide a motorized alternative to larger, fossil-fueled passenger cars and trucks for short trips.

### LSVs Compared to Automobiles

Several trends and forces are converging to enhance the environmental, economic, and social attractiveness of LSVs. The current economic slowdown, coupled with rising fuel costs, is motivating many people to cut their transportation budgets. Electric-powered LSVs and golf carts require no gasoline at all—just a standard 110 volt electrical outlet.
for power. And without all of the parts and labor associated with gas-powered vehicles, they cost little to maintain.

Operating costs for LSVs range from one to three cents per mile, depending on the rate charged by the electrical company and the time of day the vehicle is recharged. By comparison, the fuel costs associated with operating a gas-powered personal automobile (as of 2010) range from nine to thirteen cents per mile, depending on factors such as vehicle size and fuel efficiency.\(^3\)

---

**Figure 2**  
Evolution of Golf Carts and LSVs in the United States

<table>
<thead>
<tr>
<th>Type of LSV</th>
<th>First Generation LSV</th>
<th>Second Generation LSV</th>
<th>Third Generation LSV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golf Cart</td>
<td>Golf cart &quot;FMVSS 500&quot; Minimal equipment</td>
<td>LSV with a &quot;golf&quot; look but with design geared to use on the road – Equipment exceeding the requirements of FMVSS500</td>
<td>LSV with the look of an urban car. Equipment exceeding the requirements of FMVSS500</td>
</tr>
<tr>
<td>Golf function only</td>
<td>Columbia ParCar (NEV)</td>
<td>GEMcar, Big Man EV, Think Neighbor, Bombardier NV</td>
<td>Dynasty, ENN</td>
</tr>
<tr>
<td>Examples of manufacturers</td>
<td>EZ-Go Yamaha, Club Car Columbia ParCar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photos types</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>20 mph (32km/h)</td>
<td>25 mph (40 km/h)</td>
<td>25 mph (40 km/h)</td>
</tr>
<tr>
<td>Propulsion</td>
<td>Gas or electrical</td>
<td>Electrical 4 HP</td>
<td>Electrical 4 HP</td>
</tr>
<tr>
<td></td>
<td>Electric 5 HP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>No seat belt, often no headlights/signals/rearview mirror, just rear brake – with cables, often no windshield, low seat without head support.</td>
<td>A golf cart “base” with added headlights, rear view mirrors, turn signals, often AS5 windshield, no windshield wipers, rear brakes, regular parking brake, 2-point seatbelt, roof and minimalist safety cage, fabric doors, low seat.</td>
<td>Laminated windshield (AS1), windshield wipers, 3-point seatbelt, often rigid safety cage, often high seats, independent parking brake, hydraulic brake on the 4 wheels, master cylinder with two compartments, 3rd stoplight, better acceleration than the first Gen LSV, optional or vinyl doors.</td>
</tr>
</tbody>
</table>

Photos courtesy of Institut du transport avancé du Québec.
The Growing Demand for LSVs

The National Household Travel Survey reported nearly 70,000 light electric vehicles and golf carts in operation on the nation’s roadways in 2009, the first year the Federal Highway Administration began tracking this vehicle type. Americans took more than 180 million trips and drove nearly 65 million miles on these vehicles that year. Forty-five percent of these trips were taken by persons age 65 and older, a surprisingly high number given that older adults comprise just 13 percent of the U.S. population and account for 12 percent of all trips in the United States.

The nation’s growing population of older adults is likely to generate an increasing demand for mobility options beyond the automobile. LSVs and street-legal golf carts could provide a convenient, cost-effective, and clean local transportation alternative for older adults, students, commuters, and government fleet operators.

A number of recently enacted state laws aim to reduce greenhouse gas emissions and vehicle miles traveled. This fact has created an immediate market for zero-emission vehicles, especially in California.

More than three-quarters (76%) of all American vehicle trips are 10 miles or less. The use of LSVs for a larger share of these short trips could play an important part in reducing America’s greenhouse gas emissions.

The benefits of LSVs are significant enough that the Energy Improvement and Extension Act of 2008 allowed select qualifying vehicles purchased on or before December 31, 2009, to be eligible for the Qualified Plug-In Electric Drive Motor Vehicle Credit (Internal Revenue Code 30D). While this particular credit does not apply to vehicles purchased after December 31, 2009, another tax credit equal to 10 percent of the cost of a qualified plug-in electric vehicle (up to $2,500) was made available through January 2012. Numerous states are offering similar incentives beyond the federal credit.

Safety Concerns

As a class of motor vehicles, LSVs differ from conventional passenger cars in significant ways. Although federal motor vehicle safety standards require that they be equipped with many standard safety features, they do not need to conform to the safety standards of a conventional car, and they do not require crash testing. For example, NHTSA does not require LSVs to have airbags. Seat belts are required for ejection protection, but since LSVs are intended for “low-risk” driving, NHTSA does not require frontal crash protection.

That said, the Insurance Institute for Highway Safety (IIHS) is quite vocal about the hazards of LSVs, advocating for improved safety standards and/

<table>
<thead>
<tr>
<th>LSVs and Golf Carts vs. Automobiles – A Brief Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>Relatively inexpensive to own and operate</td>
</tr>
<tr>
<td>Particularly well suited for trip lengths of 10 miles or less</td>
</tr>
<tr>
<td>Non-polluting</td>
</tr>
<tr>
<td>Silent</td>
</tr>
<tr>
<td>Maneuverable and easy to drive</td>
</tr>
<tr>
<td>Takes little room in traffic and parking areas</td>
</tr>
<tr>
<td>Easy to recharge from a standard electrical outlet</td>
</tr>
</tbody>
</table>
Policy and Design Considerations for Accommodating Low Speed Vehicles and Golf Carts in Community Transportation Networks

or greater restrictions on their use. As David Zuby, the IIHS’s chief research officer, stated in a 2010 IIHS report, “There’s a world of difference between vehicles that meet crashworthiness standards and those that don’t. It may be time for Congress to step in to extend federal passenger vehicle safety standards to LSVs or else restrict them to the low-risk traffic environments they were designed to navigate.”

In 2010, the IIHS ran crash tests to study the effects of LSV operation on public roadways. Institute researchers conducted side crash tests of two GEM e2 electric vehicles. In one test, IIHS crashed a moving deformable barrier into the side of a GEM e2; in the other test, a Smart Fortwo (the smallest passenger vehicle on U.S. roads that meets crashworthiness standards) struck the LSV at 31 mph. Since LSVs are not designed to meet the crash and energy attenuation requirements of passenger cars, it is not surprising that they did not perform well in the tests. In every instance, the dummies recorded indications of seriously debilitating or fatal injuries to drivers in real-world crashes.

In addition to the IIHS tests, Transport Canada conducted frontal crashes at 40 km/h (25 mph) that clearly show the potential for serious head and chest injury even with lap-shoulder belts. Without crumple zones, energy-absorbing steering columns, or airbags, there is no protection for the driver from injurious contact with the steering column. Furthermore, lap-only belts are permitted in LSVs, so there is a possibility of the driver hitting his/her head or chest against the steering wheel even in slower-speed crashes. Added to this risk is the potential for seat belts to degrade after being exposed to the elements (sun, rain, etc.), as they might be in an LSV.

Ejection is a common problem when golf-cart-like vehicles crash, because most do not have doors. Serious ejection injuries have been recorded even in low-speed crashes (10–25 mph).

LSVs are vulnerable because they are smaller and lighter than conventional cars, which makes their passengers more likely to be injured in collisions with cars. A University of California study notes that LSVs are typically shorter in length, width, and wheelbase than the American Association of State Highway and Transportation Officials (AASHTO) design for passenger cars, and they have slower acceleration.

Smaller-mass vehicles absorb the brunt of the force in collisions with heavier vehicles, resulting in greater damage to the smaller vehicle and, potentially, its passengers.

Slower acceleration rates in LSVs can make it more difficult for drivers to react quickly enough to avoid a crash. The combination of slower acceleration rates and smaller vehicle mass make LSVs particularly vulnerable on public roads that intersect with high-speed highways.

The safety issues with golf carts are even greater. NHTSA does not consider them motor vehicles and thus does not regulate them. Thus they usually lack even the minimum safety features of LSVs.

Mixing LSVs or golf carts on roads with higher-speed vehicles can be dangerous for all users of the roadway, including automobile drivers. A recent study conducted for the Oregon Transportation Research and Education Consortium points out that the presence of vehicles moving as little as 10 to 20 mph faster or slower than the general traffic stream tends to impede traffic flow and increase collision rates. If most of the vehicles on a corridor are traveling 35 mph or faster, introducing vehicles that cannot exceed 25 mph could cause congestion and safety problems.
Assessing LSV and Golf Cart Safety Issues and Trends

In general, data on crashes involving LSVs and golf carts in America are sparse. National, state, and local vehicle crash databases do not have reliable, consistent statistics. This lack of information may be due in part to a lack of clarity and consistency among state and local law enforcement agencies in addressing or reporting issues with LSV and golf cart safety. For example, database coding limitations can make it difficult to classify LSV and golf-cart-related crashes correctly and consistently.

As part of the 1998 ruling, NHTSA evaluated 1993–1998 crash statistics from the Fatal Analysis Reporting System (FARS) and the Consumer Product Safety Commission (CPSC). The NHTSA study concluded that deaths and serious injuries resulting from the on-road use of golf carts were not numerous, but were occurring. The agency anticipated that the number of serious injuries and deaths would grow with the numbers of vehicles on the roads. In 1998, only 12 states permitted LSVs to operate on public roads. Today, 46 states do.

In 2009, Congress charged NHTSA with studying the safety and fuel-economy ramifications raised by the expanded use of low-speed vehicles on 40 mph or slower roads. Information from the NHTSA report was not available at the time this Insight on the Issues was developed.

A variety of media reports, professional journals, and anecdotal reports indicate that crashes involving golf carts are occurring, and that they often result in serious injury or fatalities. The June 2008 issue of the American Journal of Preventive Medicine reports that golf-cart-related injuries skyrocketed more than 132 percent between 1990 and 2006. More than 147,000 people, ranging in age from 2 months to 96 years, were injured in golf cart crashes over that 17-year span. Seven people died, according to the journal. The 15 percent of injuries that occurred on streets resulted in more concussions and hospitalizations than injuries that occurred in other locations.

Falls from golf carts and overturns were the leading cause of injury (47.2 percent). Another study found that golf carts moving at speeds as low as 11 miles per hour can readily eject a passenger during a turn. Both sets of researchers strongly advise that golf carts be equipped with seat belts and four-wheel brakes.

A study by the Center of Injury Sciences at the University of Alabama, Birmingham, examined nationwide emergency room data from 2002 through 2005. The report determined that there are approximately 1,000 golf cart injuries in the United States each month. The highest injury rates were observed in males age 10–19 and those over 80. Head trauma and fractures were the most common injuries.

Current LSV and Golf Cart Standards and Regulations

Federal Standards

As described earlier, LSVs are required to comply with the NHTSA “Federal Motor Vehicle Safety Standards No. 500.” LSV manufacturing standards, defined in 49 CFR 571.500, were implemented in 1998 under pressure from various communities, certain states, and manufacturers that wanted to market LSVs in the southern United States.

NHTSA identifies LSVs as appropriate for “short trips for shopping, social, and recreational purposes primarily within retirement or other planned communities with golf courses.” LSVs must be able
to go at least 20 mph. The maximum speed attainable at any given point in a distance of one mile cannot exceed 25 mph.

The NHTSA ruling further states that an LSV must be equipped with an automotive safety glass windshield, turn signals, mirrors, wiper blades, head- and taillights, brake lights, parking brakes, seat belts, and a vehicle identification number. The standards do not apply to golf carts unless they have been modified to travel 20 mph or faster.

NHTSA defines appropriate performance and safety standards for LSVs, but it has no say in the types of roadways on which LSVs may be driven. Those decisions are left to state and local governments.

State and Local Regulations
State and local regulations regarding LSVs and golf carts have evolved gradually over the past 30 years. NHTSA recognizes that while some states and local governments have taken steps to permit on-road use of golf carts and LSVs, others have not. In the agency’s view, the final rule does not alter the authority of state and local governments to make regulatory decisions regarding on-road use of golf carts and LSVs. Similarly, the rulemaking has no effect on any other aspect of state or local regulation of golf carts and LSVs, including classification for taxation, vehicle and operator registration, and conditions of use on state and local roads.

Use of LSVs on Roadways
Recent legislative activity has expanded the use of LSVs on public roads. Almost every state has adopted legislation accepting the NHTSA ruling on LSVs. Today, 46 states and the District of Columbia allow them. Connecticut, Mississippi, Montana, and Pennsylvania are the exceptions.

![Figure 3](image-url)
Use of Golf Carts on Roadways

For years, a common practice among the relatively few states that permitted on-road use of golf carts was to allow such use only within a limited range outside of a golf course (generally one to two miles). In the 1990s, however, a growing number of states, from California to Florida, passed legislation eliminating or establishing exceptions to this rule. The new regulations usually authorize local jurisdictions to permit general on-road use of golf carts, subject to speed and/or operational limitations. Some states authorize general on-road use, provided the golf cart meets equipment safety requirements.

Use of Golf Carts on Pathways

Because of their larger size and weight and higher speeds, the operation of golf carts and LSVs on multiuse pathways can present hazards to bicyclists, pedestrians, and other users. Even when golf carts and LSVs are driven with care, their size and speed can be intimidating to other users, especially older pedestrians who may have a legitimate fear of falling.

Appropriately, federal law prohibits the use of motorized vehicles (including golf carts and LSVs) on federally funded trails and pedestrian walkways, except in limited circumstances (U.S.C. §217(h)(5)). Exceptions can be granted where trails are funded under the Recreational Trails Program and designed for motorized use and on limited segments of a trail funded under the federal-aid highway program, such as for 90 degree crossings, short doglegs, crossing structures such as bridges, and other exceptional circumstances.

The use of golf carts on multiuse pathways may be acceptable in some additional circumstances. Their use appears to work in planned retirement communities such as The Villages, Florida, where pathways were originally designed for these vehicles and where golf carts are predominantly driven by mature, experienced drivers (see discussion below). As the trail network was built with private funding, the developer had latitude in setting the rules governing trail use.

A mix of low-speed motorized and nonmotorized users may also work in rural areas where the volume of pedestrians, bicyclists, and golf carts is low.

Vehicle Definitions

Many states have recently updated their definitions of golf carts and LSVs. Traditionally, golf carts were defined as having a top speed of 15 mph or less. Several states have recently changed their laws to reflect the existence of sub-25 mph vehicles that are faster than most golf carts. Some have replaced old statutory provisions that limit the defined top speed of a golf cart from 15 to 25 mph. Others have added a new class of vehicles capable of achieving 25 mph.

Required Safety Features

There is no generally accepted safety-rating system for golf carts. For golf carts with a maximum speed of less than 20 mph, state and local governments may adopt their own equipment safety standards. But any vehicles that travel 20 mph or more, including modified golf carts, must usually be equipped with the federally defined LSV safety features.

Licensing and Registration

Golf cart and LSV licensing and registration rules vary by state. Most states require a valid driver’s license and insurance for all vehicles—golf carts or LSVs—that travel on public roads. Some states, such as Florida, do not require a golf cart operator to hold a driver’s license, but they may establish a minimum age (typically 16) for legal operation of a golf cart on public roads.
States may impose registration requirements and additional regulations governing LSV operation. These additional requirements generally address one or two topics: the maximum speed limit of public roadways upon which an LSV can legally operate, and the types of intersections that LSVs can legally cross.

**Speed Limits**

Most states allow LSVs to operate on roadways with a maximum speed limit of 35 mph. Alaska and Texas allow LSVs to operate in certain localities on highways with a maximum speed limit of 45 mph. Other states restrict LSV use to lower-speed roads. Illinois, Kansas, Maryland, Massachusetts, and District of Columbia regulations specify a maximum of 30 mph, while New Jersey, West Virginia, and Rhode Island restrict LSVs to roadways with a maximum speed limit of 25 mph.

**Intersection Crossings**

With some exceptions, such as Washington and Idaho, most states allow LSVs to cross roadways with higher speed limits than the maximum allowable for LSV use. Few regulations, however, specify whether the intersection must be controlled. Those that do, such as Maryland, usually restrict LSV crossings to intersections that have a traffic signal or stop sign.

**Case Studies**

**The Villages, Florida, Golf Course Network**

**Overview**

The Villages is a master-planned, age-restricted (55+) retirement community located within three counties in central Florida, about 45 miles northwest of Orlando. Development began in the 1970s as a mobile home park in the northwestern corner of Lake County. The development was renamed The Villages in 1992. It is still largely controlled by families of the original landholders.

The development of the community’s now-extensive network of golf cart paths began in the early 1980s, as a strategy to boost flagging sales. The developers noted that successful retirement communities offered residents well-maintained amenities and easy access to a variety of nearby commercial activities. Thus, they began to significantly upgrade the development with recreational centers, town squares, and numerous golf courses, allowing them to market the offer of “free golf for the rest of your life.” As retirees flocked to The Villages for lifelong free golf, the developers and the community began to operate on the principle that everything should be accessible by golf cart.

**Usage Patterns**

Today, golf carts are an integral part of the transportation system within The Villages and an important element of the community’s lifestyle and social network. It is quite common for people to take their golf carts to the grocery store, the recreation center, and to concerts, shops, and restaurants in the various town centers throughout the community.

As of December 2008, 38,000 golf carts accommodated more than 75,000 residents in approximately 40,000 homes. More recently, The Villages estimates from surveys that 50,000 golf carts zip along its trails and streets. In addition, LSVs are a small but growing proportion of the small electric vehicle “fleet.”

While there is no specific study of the number of golf cart and LSV trips, local planners estimate that the community’s internal trip capture rate is between 75 and 80 percent. In other words, residents make more than three-fourths of their
daily trips within the community, largely because of its extensive accessibility for golf carts and LSVs.

**Facilities**

The Villages features an 87-mile network of concrete golf cart trails that connect all of its golf courses and communities. In addition, golf carts and NEVs can use designated on-road facilities and shared traffic lanes.

Tunnels have been built into most of the locations where a path intersects with a highway, except across US 27/US 441, where an overpass was built. The tunnels and bridges were designed specifically to fit golf carts, but the size of golf carts is steadily increasing—a recent model available from Sam’s Club is six inches wider than previous models. Not all of the tunnels and bridges can now properly accommodate two of the larger vehicles at the same time.

The wide variety of routes reflects the evolution of the network over time. When the community was built in the 1970s, carts and cars shared the same lanes. As development progressed, golf carts were separated from traffic within the roadway, and now there are separate pathways for LSVs.

LSVs are allowed on the golf cart paths, as are pedestrians and cyclists. The community has not reported significant conflicts among different path users. Perhaps because the paths were designed from the beginning for golf carts, residents are accustomed to accommodating a variety of travelers throughout the network. They expect to encounter one another, so they may operate with a bit more awareness than they would on a path designed primarily for pedestrians and bicyclists.

**Safety Issues and Programs**

Many, if not most, of the people who live in The Villages had been driving...
carts on golf courses for years before they moved there. Some have difficulty realizing that driving golf carts on paths and roads requires greater alertness and caution. Believing, mistakenly, that golf carts are nothing like cars makes it easier for people to operate them in ways they would never consider when behind the wheel of an automobile, including driving while intoxicated, maneuvering one-handed or with a leg dangling over the door, not using seat belts, and parking on sidewalks.

Perhaps the most challenging safety problem with cart drivers is the propensity to try to make their vehicles go faster than their design permits. Owners will “soup up” their carts to go faster than 20 mph, but the brake, suspension, and restraint systems on golf carts are not designed to handle those speeds—especially when it comes to turns, stops, and collisions. This practice has led to some significant injuries. Public safety officials report the number is not statistically large, but it is still a troubling issue.

Florida law does not require that golf carts be equipped with seat belts, and vehicle owners receive no insurance benefit from installing them.

People of all ages drive or ride in golf carts, including a fair number of young people and children from the many family visitors in the community on any given day. Children under the age of 14 are not permitted to drive carts on public roads or streets, and it is the responsibility of the residents to ensure that younger drivers understand the “rules of the road.” But the propensity of teen drivers to drive any vehicle too fast is an ongoing safety issue, especially given the relative instability of golf carts operating at high speeds.

Drivers of golf carts are not required to be licensed. On the one hand, this affords those who have given up driving cars continued independence and mobility; on the other hand, it raises safety concerns. The same physical and cognitive declines that affect driving skill (e.g., reduced vision and reaction time) are likely applicable to the on-road and on-trail golf cart environments. While their speed is lower, the vehicles are less protective in a crash.

Another challenge faced by The Villages is the issue of golf cart parking. Within each village there are central areas with shopping, restaurants, gazebos, and a center square with nightly entertainment. Thousands of people come in by golf cart, parking on the sidewalk so they can get closer to the venue rather than having to walk from the parking lot. Florida regulations state that motorized vehicles are not allowed to run or park on sidewalks, but the rules are enforced and interpreted somewhat differently from county to county.

**Safety Enforcement and Education**

A number of separate entities work to ensure that golf cart use is safe and enjoyable. The roads and golf cart paths within The Villages are developed and maintained by 12 Community Development Districts (CDDs), a form of special-purpose local government available under Florida law. Because of the CDD’s limited powers, and because the roadways are public, the CDD has no law enforcement jurisdiction. All roadway laws are enforced by the three county sheriff’s departments and one municipal police department. However, the sheriffs may not go onto the paths to enforce safe driving and prevent problems unless they observe reckless or intoxicated driving.

The CDD and The Villages Homeowners Association (VHA) are working hard with public safety officials to increase awareness of the safety issues of golf cart use and to educate people about making
wise choices. An educational blitz in late 2010 served as a wake-up call to golf cart users that speeding will not be tolerated. Over a two-month period, the Sumter County sheriff’s department issued about 70 golf cart speeding violations, technically categorized as operating a vehicle without a license, because they exceeded 19 mph. In some cases, that resulted in a $1,500 fine and court costs. The project heightened awareness of the seriousness of the issue.

In addition, the VHA works to inform and educate residents about safe golf cart use. Since 1998, the VHA has sponsored a Golf Cart Safety Clinic taught by local law enforcement officers. It is a vital tool for promoting traffic safety in The Villages. In January 2011, the VHA and CDDs launched a joint communication and education campaign related to golf cart safety.

**Peachtree City, Georgia, Golf Cart Network**

**Overview**

Peachtree City, Georgia, is a master-planned community located 29 miles southwest of Atlanta. Founded in 1959, the development was envisioned as a community that would offer residents a better way of life through careful planning and design. The city consists of a series of linked villages, each containing its own shopping areas, recreational areas, and schools, with approximately 20 percent of the land dedicated as open space.

While paths were not part of the plan when the city was incorporated in 1959, the developers built a golf course in the 1960s, and paths were added for residents who wanted a way to take their own carts to the course. More paths were added as more neighborhoods were built, and the city adopted an ordinance requiring that new development include a connection to the system. In 1974, Georgia adopted legislation allowing local communities to permit golf carts on public streets specifically to accommodate Peachtree City.

**Usage Patterns**

Today, many of Peachtree City’s roughly 34,000 residents (about 13,600 households) use golf carts. More than 10,000 golf carts are registered within the city, and residents use them as an extra vehicle for local transportation. Many students at McIntosh High School drive their golf...
carts to school because of limited car-parking facilities. Families use them to visit the 250-acre lakes, and golfers can ride from home to any of the three golf courses in town. Several businesses have created designated golf cart parking spaces in front of their stores.

Like The Villages, Peachtree City does not require a driver’s license for golf cart operators over 16. People whose license has been suspended or revoked may not drive a golf cart in the city.

Facilities

Peachtree City’s five villages are connected not only by standard roads, but also by more than 90 miles of wooded paths for a variety of users. The extensive network provides a secondary means of access to almost any destination within city limits.

The design of the path system has evolved over time. Some of the older paths, originally designed for walking, are only five or six feet wide. Today, a 10-foot minimum width is specified in the city’s ordinance, based on national bicycle facility design guidelines developed by AASHTO.\textsuperscript{25}

Most paths are designed for nearly all modes of travel that do not exceed 20 mph (i.e., pedestrians, bicyclists, and golf carts). LSVs are allowed on the paths “provided that the vehicle is operated only in a mode or other restriction which does not allow the vehicle to exceed 20 miles per hour.” Local officials do not report significant conflict among different path users.

All LSVs and golf carts are prohibited from major arterials and collectors with speed limits greater than 35 mph. On residential streets, golf carts and LSVs mix with vehicular traffic. Travel lanes are typically 12 feet wide (24 feet curb to curb). There are very few special markings for bicycles, and none for golf carts and LSVs. Local officials report few problems with this arrangement because all drivers are accustomed to it.

There are no on-road accommodations to separate golf carts from LSVs, but a local ordinance requires golf carts to use a path instead of a road if one is available. By state law, LSVs are entitled to full use of a travel lane.

A growing challenge for golf cart and LSV users is travel within commercial parking lots. Several retail centers have designated golf cart spaces, but they have not modified the design of the entire lot to ensure safe passage of golf carts and LSVs from the entrance to the designated parking areas.

Design standards for developing alternative vehicle pathways in shopping centers.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{golf_cart_facilities.png}
\caption{Examples of Golf Cart facilities in Peachtree City, Georgia}
\end{figure}

Photos courtesy of City of Peachtree City.
center lots were recently proposed by a group of graduate students at Georgia Institute of Technology. One retail center recently enhanced its entrance area and added up-front parking for golf carts as part of a major renovation, which was well received by customers. Another developer is working with the city on this approach to attract more golf cart drivers to its stores.

**Planning and Building the Network**

The city is in the process of updating the multiuse path master plan to include a ranking system, connectivity requirements, and much more detail on planning and prioritizing projects. The plan will help guide the development of more paths as funds become available.

To date, most of the network infrastructure has been installed by developers. The city assumes ownership and maintenance of paths once they are constructed. Most of the paths are on city-owned property, but some are on private property. In these situations, the city gains easements that relieve the property owner of the burden of liability. This strategy has made it easier for the city to convince property owners to grant the easements. The standard easement is 20 feet wide, which makes it possible to widen the path if needed.

City officials have learned that it is much easier to install the infrastructure before development takes place. Even in places like Peachtree City, where alternative modes of transportation are highly valued, adding new path connections in established neighborhoods or partially developed areas is challenging. People do not want paths behind their homes or across their property, but they do want access to them. The foresight of the city to require developers to connect into the system as part of the original projects was extremely valuable in getting large portions of the network built up front.

Another lesson Peachtree City officials learned is the importance of working with the state department of transportation (DOT) early and continuously before major roadways near the paths are improved. This proactive approach has gained the city two multiuse bridges over state highways, 27 tunnels under major roads, and a bridge over a major rail line. City leaders started working with the state DOT years ago to incorporate these improvements into the roadway widening plans. City officials advise other communities to be vigilant for possibilities to incorporate tunnels and crossings into widening projects early in the planning process.

**Safety Issues and Programs**

To supplement local ordinances governing the use and design of golf cart paths, the city provides residents with an informational brochure describing the rules associated with golf cart and LSV use.

All golf carts and LSVs in Peachtree City must be registered. State law requires liability insurance for LSVs; the city highly encourages it for golf carts. Children age 12 or over may operate a cart on local paths with a
parent, grandparent, or guardian in the front seat. Unaccompanied 15-year-olds with valid Georgia learner’s permits are allowed to operate golf carts alone.

LSVs are permitted to operate on roadways with speed limits under 35 mph and to cross higher-speed streets. Treated as licensed vehicles, LSVs have a toggle switch for a flashing light, which is required when driving on public streets. Golf carts are not required to have flashing lights.

The Peachtree City Police Department has several golf carts that patrol the paths. A 2007 Traffic Safety Report published by the department reported 106 golf cart citations (6 percent of all vehicle citations). Of the nearly 1,200 vehicle accidents reported in 2007, only 56 were golf-cart-related. Of these, 25 resulted in injury.

In general, police say there are 60 to 70 golf-cart-related accidents each year, about a third of which result in injuries, including a fatality several years ago. The fatality, as well as many of the injuries, occurred because a passenger was thrown from the golf cart when the driver tried to maneuver a curve too fast and lost control.

As with automobiles, one of the biggest safety challenges for golf carts is reckless driving by young people. In 2009, Peachtree City officers responded to 64 reported golf cart crashes, 31 of which involved injuries and 33 of which involved a driver 16 years of age or younger. In July 2010, the city began enforcing “no texting” laws on golf carts. Since the city began allowing 15-year-olds to drive alone with a learner’s permit, it has received more complaints about teen drivers.

Few golf cart drivers (of any age) have gone through any formal training in operating the vehicles. The Peachtree City Police Department has designed a Golf Cart Safety Course to help educate young drivers on the proper use of the vehicles on Peachtree City’s paths. Students must take an online course and pass a quiz before they are eligible to take the practical road course. The program is designed for drivers age 12 to 16, but anyone may participate in the program.

Western Riverside Council of Governments, California, Regional NEV Plan

Overview

The Western Riverside Council of Governments (WRCOG) represents 16 cities, the Riverside County Board of Supervisors, and the Eastern and Western Municipal Water Districts (together more than 1.6 million people) in Southern California.

In response to a number of statewide planning initiatives related to greenhouse gas reductions, the WRCOG undertook a multijurisdictional approach to evaluate near-term and long-range transportation network plans. Scalable implementation strategies to deploy LSVs were chosen rather than golf carts as the subject for the WRCOG Four-City LSV Transportation Plan because of their

Figure 9
A Peachtree City Golf Cart Bridge over a State Highway

Photo courtesy of City of Peachtree City.
superior safety features, and registration and licensing requirements.

The study area included four cities in the northern portion of the county, each with unique characteristics:

- Norco – a small rural community (pop. 27,370), often dubbed “Horse City, USA”
- Corona – a large, fairly dense city (pop. 150,416), with two MetroLink stations
- Moreno Valley – a larger but less dense community (pop. 188,537), with no MetroLink station
- Riverside – the region’s largest city (pop. 304,051), with two MetroLink stations

The June 2010 plan was funded by the Southern California Association of Governments’ (SCAG) Compass Blueprint Demonstration Project Program, which assists Southern California cities and other organizations in evaluating planning options and stimulating development consistent with regional goals. The LSV plan is seen as a model for future intercity planning efforts.

**Usage Patterns**

LSVs are currently in use within the study area. While it does not have specific demographic data, WRCOG estimates that existing and potential LSV users are people looking to replace one of their vehicles or add a third vehicle for short trips. They tend to be affluent and middle-aged or older. LSVs are also used on larger lots and farms to carry hay, dogs, and so on.

**Planned Facilities**

Because the cities are already connected via traditional transportation networks, this plan identifies low-speed connectors and potential LSV/bike lane backbone facilities to leverage existing and future public street networks for maximum transportation benefit.

California law allows LSVs to operate on streets posted at 35 mph or below, but the WRCOG recognized that people are using LSVs to cross or access streets with a higher speed limit. Also, some of the 35 mph streets are not ideal for LSV use, either for safety or connectivity reasons. The plan provides routes that would allow people to travel legally and safely on these routes.

Short-term recommendations focus on promoting LSV usage on priority routes that can be used without any changes, and discouraging travel on streets inappropriate for LSVs. Longer-term recommendations emphasize improvements that could be made if state legislation were passed to allow LSV use on higher-speed routes. The plan also includes a long-term recommendation to establish a fine for LSV use on streets not in the plan.

The plan includes design standards for three classes of LSV facilities: separate off-road paths, designated on-road facilities, and shared on-road facilities. Standards were largely based on design standards adopted by Rocklin and Lincoln, California, as part of local LSV plans completed in 2006.

The preferred on-street design includes a separate seven-foot-wide lane for LSVs and bicycles, especially on streets with buses and heavy vehicle use. Previous planning efforts looked at having LSVs operate on bike trails, but this plan was based on a general principle of keeping LSVs on roadways instead of putting them on separate paths.

**Plan Development and Implementation**

Preparation of the WRCOG Four-City LSV Transportation Plan was a cooperative effort that involved the study
cities, a variety of stakeholder agencies including the California Department of Transportation (CALTRANS), Riverside Transit Agency, Riverside County Transportation Commission, March Joint Powers Authority, and the County of Riverside Transportation Department. With guidance from WRCOG, an Oversight Committee and stakeholders’ Working Group were formed to review and provide input regarding data collection, design considerations, and route selection. The Oversight Committee comprised representatives from WRCOG, SCAG, and each of the four cities.

In addition to working with the Oversight Committee and stakeholder groups, the WRCOG employed a public input process, largely devoted to education and outreach. Local print, television, and radio coverage provided broad exposure. Planners also offered an online survey and a series of public outreach meetings in each city. Turnout at meetings was not very high, but the process yielded useful ideas.
The city councils and city managers were engaged throughout the process, which, planners say, was valuable in helping them apply the plan concepts to their own situations, needs, and unique contexts. For example, traffic calming was a big issue for one of the cities, so the city manager emphasized the speed reduction benefits of LSV use. Each jurisdiction has formally supported the plan and has requested the necessary state legislation to enact it.

WRCOG is currently advocating for state enabling legislation that would allow the other jurisdictions within Riverside County to develop an LSV plan. With hindsight, WRCOG planners say they would have engaged state legislators earlier and more frequently in the process, since this legislation is a critical component of plan implementation.

Another challenge to implementation is that people, including public safety officials, are not clear about the difference between LSVs and golf carts. Education is needed to make sure the LSV plan is implemented safely. The plan encourages working closely with public safety officials, who may not have a clear strategy for addressing LSV use. As part of the planning process, WRCOG produced an educational PowerPoint presentation and a fact sheet, but for the most part the cities will be developing their own educational programs.

Once state legislation is adopted, each city’s planners and traffic engineers will move forward with incorporating the recommendations into their local plans and policies, in coordination with local stakeholder groups. For example, each city can promote wider (minimum seven-foot) on-street bike lanes that comfortably accommodate both LSVs and bicycles. Each city will need to engage the cycling community to be comfortable with this approach.

Cities may also have to work with business owners to evaluate the pros and cons of removing on-street parking to accommodate wider travel lanes for LSVs. In addition, the cities will have to work with Caltrans to address crossings of bridges and freeways.

**Linton, Indiana, Golf Cart Ordinance**

**Overview**

Linton is a rural community located near the Illinois state line in southeastern Indiana. It is surrounded by three major cities: Terre Haute, Vincennes, and Bloomington. With a population of roughly 5,800, Linton is the largest community in Greene County. Mining and agriculture have traditionally been the main sources of income in the community, and the city is known for its recreational amenities and its relaxed, small-town atmosphere.

In 2009, Indiana passed enabling legislation to allow local municipalities to establish “golf cart” ordinances. Several communities, including as Linton, moved forward quickly to adopt an ordinance.

The Linton ordinance helped the city build upon themes established in its recently adopted comprehensive plan: “a good place to grow up and a good place to grow old.” It also complemented other age-friendly community work.

**Usage Patterns**

In 2010, 86 licensed golf carts were operating within the city. They are used year-round, primarily by adults and families for recreational purposes such as taking kids to the park and visiting friends.

Before adopting the ordinance, the city had problems with children driving golf carts. The new requirement for a driver’s license to operate a cart has quelled the issue and helped the city to regulate on-street golf cart use more effectively.
Ordinance Development Process

As part of a pilot study designed to demonstrate the potential of online surveys to gauge older adults’ opinions on key issues, the Center on Aging and Community of the Indiana Institute on Disability and Community marketed to the Linton area an eight-minute online survey on mobility issues called “Getting Around.” Between March 1 and March 15, 2010, the survey was completed by 239 respondents.

The survey was well timed to attract respondents who held strong opinions, both positive and negative, around the pending ordinance for the use and regulation of golf carts on city streets. It played an important role in the mayor’s positive position on the issue, and in the decision to approve a city council ordinance in the spring of 2010.

In January 2011, the city began designing a “Complete Street” along E Street, NE. It is anticipated that the design will include space for bicycles and golf carts within the existing right of way by converting an eight-foot parking lane to a shared bike/cart lane.

Safety Regulations and Programs

Provisions in the current state legislation require an on-road driver of a golf cart to have a valid driver’s license and for the vehicle to have insurance, as well as a revolving red or amber light or slow-moving vehicle sign. On-street golf carts must travel on the far right-hand side of the road, not directly in travel lanes.

In addition to the state requirements, the Linton ordinance requires lighted headlights and taillights at all times, specifies the locations where golf cart operation is prohibited, and requires the city to put appropriate signage in place before issuing golf cart permits. Golf carts may not be driven on public roads after dark.

To date, no accidents have been reported. The mayor has been impressed by how well people are following the rules and believes the increased golf cart use has been a pleasurable experience for all, though the city has received some complaints about the $50 annual licensing fee.

The mayor feels strongly that the enthusiasm with which the community has embraced safe golf cart use is a product of the vibrant, ongoing civic engagement process that began a few years ago with a series of “EngAge” meetings. The ongoing dialogue is a grassroots effort, developed and conducted by volunteers within the community.

Summary of Case Studies

Each of the four communities discussed above approaches the accommodation of golf carts and LSVs in a different manner, based on state law, community history, and context.

The Villages and Peachtree City are planned communities that designed cart pathways into the community fabric in the 1970s. Both allow carts and LSVs, along with pedestrians and bicyclists, on their pathway system. Peachtree City requires that LSVs be operated in slow-speed golf cart mode (less than 20 mph).

Golf carts and LSVs may also use designated low-speed roads. Access across major roads is accommodated through a system of grade-separated underpasses and bridges.

More recently, WRCOG and Linton have aimed to integrate accommodations into existing communities. WRCOG’s planning efforts emphasize safety along with the environmental benefits of electric vehicles. The plan primarily accommodates LSVs on roads, but does provide an option for their
use on appropriate pathways along with bicyclists and pedestrians. The WRCOG plan does not address golf carts; however, Riverside County’s Municipal Code allows carts to travel on LSV-designated roads provided that they are equipped with additional safety features.

Linton allows golf carts to travel on roads provided they are registered, insured, and meet minimum safety requirements. The ordinance does not specify whether golf carts can be used on multiuse trails, nor does it speak to LSV accommodations. However, Indiana state law allows LSVs to travel on highways with posted limits no greater than 35 miles per hour.

Additional items of comparison may be found in table 1.

Recommendations

This section outlines a few basic findings and recommendations drawn from this analysis of issues related to the use of LSVs and golf carts as a meaningful form of transportation in the United States. AARP does not have policy in this emerging area of study. These recommendations reflect the authors’ professional perspective with the hope that they might serve as a starting point for more in-depth analyses by, and dialogue among, organizations, agencies, and institutions that can play a part in making America’s transportation networks safe, convenient, and efficient for people of all ages and abilities.

Safety Education and Enforcement

Ensure that policy makers, law enforcement officials, city planners, and the public are fully aware of the vulnerability of golf carts compared to LSVs and LSVs compared to passenger cars.

Many people are unaware of the significant safety differences between golf carts and LSVs, even in communities where they are widely used. Golf carts are not designed to operate on roads, nor are they designed to operate above 19 mph. They tip easily and offer no protection to occupants in crashes with other vehicles. LSVs, with their stable wheel base, are undoubtedly safer, even at slightly higher speeds. Their required safety features, while certainly not those of passenger cars, provide more protection to occupants.

Many golf cart drivers are used to driving on golf courses and do not realize that driving on streets requires a higher level of attention and a firmer hand on the wheel. Injuries and fatalities from golf cart accidents are often caused by people driving too fast to maneuver safely, especially around corners. Some crashes involve drunk drivers who would never operate a car when intoxicated, but who mistakenly assume they can steer a golf cart safely in that condition.

Policy makers, law enforcement officials, city planners, and the public should also be aware that the safety features that NHTSA requires for LSVs are based on the use of such vehicles in low-speed “retirement or other planned communities with golf courses.” The only required occupant protection features are seat belts and shatterproof windshields. Seat belts alone offer protection only against ejection. NHTSA requires no protection from frontal crashes. Consequently, even LSVs provide inadequate occupant projection at speeds many people would consider slow to moderate (less than 31 mph).

Programs should educate the public on the safety limitations of both golf carts and LSVs. State and local laws governing the roads LSVs are permitted on should reflect these limitations, and transportation networks should be designed for their safe accommodation.
Provide law enforcement agencies with the resources necessary to enforce laws governing LSV and golf cart use.

Modifying golf carts to operate faster than 20 mph puts them into a different vehicle class. At that point, they are defined as LSVs and must be equipped as such. Speed-modified golf carts that do not meet LSV safety standards are illegal and pose a true hazard to their drivers, passengers, and other travelers. Enforcing laws against these types of violations is essential for maintaining a safe transportation system.

Private trails essentially function as a public network. The public sector should be granted access easements onto privately built and maintained multiuse trails so that law enforcement officers can enforce speed limits and other safety laws.

Engage law enforcement officials actively in the development and implementation of golf cart and LSV policies, regulations, and educational programs.

It is important to educate law enforcement agencies, as well as the general public, about the differences between LSVs and golf carts.

Law enforcement agencies are accustomed to conducting educational and enforcement programs about safe driving and bicycling, but few conduct similar programs about LSV or golf cart use. Communities that want to promote the use of these vehicles would be wise to include safety officials early and continuously in the planning and implementation process.

Licensing

A valid driver’s license should be required to operate both LSVs and golf carts on a public or private road or trail.

Legally, LSVs are generally treated like small automobiles: They must be insured and operated by licensed drivers, and they must have seat belts, lights, and other safety features. In contrast, some communities allow golf carts to be operated by unlicensed drivers, despite the fact that they generally lack basic safety features and pose greater risk to drivers and passengers.

Licensing requirements for golf cart drivers will help to educate the community about the risks of driving golf carts and underscore drivers’ responsibility to maintain a safe travel environment. Lax licensing requirements may encourage public tolerance for reckless driving and continued driving of golf carts by older drivers whose licenses have been revoked owing to ailments such as macular degeneration or dementia. There is no research evidence that people can safely drive a golf cart when they can no longer safely drive an automobile.

It may be appropriate in some communities to allow drivers younger than 16 to operate a golf cart on a multiuse trail with a learner’s permit under the supervision of an adult.

Registration and Insurance

All golf carts and LSVs should be registered with the appropriate local or state government agency.

This is important not only to ensure that basic safety requirements of the vehicles are met but also to help law enforcement officials and planning staff track vehicle use.

Require that both golf carts and LSVs be appropriately insured before their use on public and private roads and trails.

Most homeowner’s insurance policies do not cover golf carts. This can pose a significant liability to golf cart owners involved in a crash. It is appropriate for state and local governments to require that both golf carts and LSVs be appropriately insured before their use on public and private roads and trails.
The American Association of Motor Vehicle Administrators’ model legislation for low-speed vehicles includes requirements for registration, titling, and insurance.\textsuperscript{30}

**Vehicle Safety Features**

- *State and local governments should require minimum golf cart safety features for on-road driving.*

LSVs are regulated as motor vehicles by NHTSA, and thus are required to have basic safety features.

NHTSA does not view golf carts as motor vehicles but rather as small passenger vehicles intended exclusively for recreational off-road use. Thus, the agency does not regulate them. Nonetheless, golf carts are now routinely used for transportation purposes on public and private rights of way. If they are to be driven on roads, they should, at a minimum, be required to have seat belts, front-wheel brakes, brake lights, turn signals, and a windshield. If operated before sunrise or after sunset, their safety features should also include headlights and reflective devices on the sides of the cart.

**Planning and Designing Safe Facilities**

**On-street Facilities**

- *Allow LSVs and golf carts to mix with traffic only on low-speed streets.*

Communities should limit LSV use in mixed-vehicle traffic to roads with posted speeds no greater than 25 mph and golf carts to roads with posted speeds no greater than 20 mph.

Customary engineering practice is to design a road for speeds 10 to 15 mph above the posted speed limit. This practice often induces drivers to speed. Keeping slower vehicles on slower roads helps to ensure that other vehicles will not be traveling faster than the golf cart or LSV. Research has shown that vehicles traveling more than 10 mph slower than the general traffic flow can present a safety hazard to all drivers and can contribute to congestion problems. On lower-speed streets, all roadway users have more time to react to, and avoid, potential collisions. The widespread state policy of allowing LSVs on roads with posted speed limits of up to 35 mph needs serious reexamination.

Safe accommodation of LSVs and golf carts is not only a matter of speed limit but of the general character of the road. Roads with lower design speeds are the types of local roads underlying the intent of NHTSA’s LSV rulemaking. LSVs and golf carts offer their passengers very little protection. Passengers are essentially as vulnerable as pedestrians and bicyclists in the road environment. Pedestrian safety research reveals that the human body is at greatly elevated risk of death if hit by a motor vehicle traveling at speeds above 20 mph.\textsuperscript{31} Older road users, because of their increased fragility and frailty, are most vulnerable. Given that IIHS’s side crash tests have revealed fatal outcomes for the LSV driver even in collisions at only 31 mph, their use should be restricted to the lowest-speed, lowest-risk traffic environments they have been designed to navigate.

- *Provide marked travel lanes for LSVs and golf carts on 30- to 35-mph roads.*

Communities should make a point of establishing seven- to eight-foot marked travel lanes for use by lower-speed vehicles (LSVs, golf carts, and bicycles), especially on roads with speed limits of 30 to 35 mph. Wider lanes are not desirable, as autos may be tempted to use them. Separate lanes
Policy and Design Considerations for Accommodating Low Speed Vehicles and Golf Carts in Community Transportation Networks

are usually not needed on slower local streets.

- **Use traffic-calming strategies and other design treatments to enforce speed limits and improve safety for all travelers.**

Drivers have a tendency to go as fast as the roadway design permits, regardless of posted speeds. Design elements such as narrower travel lanes, medians, sidewalks, landscaping, and access controls provide visual and physical cues that encourage (or, in some cases, force) drivers to travel at the appropriate speed. Many communities are adopting “complete streets” policies and applying “context-sensitive solutions” design strategies to improve safety for all travelers on multimodal streets. These strategies are appropriate for roads traveled by LSVs, golf carts, and other low-speed users.

- **Ensure adequate room and appropriate signage for LSVs and golf carts.**

Post signs and conduct educational programs to make sure drivers know to watch out for LSVs and golf carts, whether they mix with traffic on local roads or share marked lanes with bicyclists on higher-speed roads.

- **Make parking lots safer for all users.**

Communities can work with local businesses to encourage safe and attractive parking areas for LSVs and golf carts. A number of retail centers are establishing special preferred parking spaces for electric vehicles in order to attract shoppers. Communities can encourage them to go further by incorporating safe travelways for golf carts, LSVs, cyclists, and pedestrians into the design of the entire parking lot. Making lots safer for these users tends to make them safer for drivers as well.

**Off-road Facilities**

- **Provide separate pathways for LSVs and golf carts as an alternative to routing them onto higher-speed (above 25–35 mph) roads, and to improve their overall viability.**

To make LSVs or golf carts a viable means of travel, communities should plan complete low-speed networks that connect residential areas with the places people typically go, such as shopping centers, recreation areas, workplaces, and schools, without requiring that these users access major roads. Ideally, a community’s road network should be designed to make it possible to complete an entire trip on existing low-speed streets. But, given the dispersed development patterns in most American communities, access to at least some destinations is likely to require traveling on high-speed roadways.

Comparable accessibility for lower-speed vehicles could be achieved through a combination of strategies such as building separate pathways and creating alternative access points (essentially a “back entrance”) to activity centers that front major highways.

- **Tailor trail design specifications appropriate for the physical environment and expected mix of users.**

There is little research or guidance on methods and strategies to integrate golf carts safely onto existing bicycle and pedestrian paths. Federal law prohibits doing so on most federally funded trails. Building separate paths for golf carts, rather than routing them onto existing bicycle/pedestrian trails, may be the safest strategy for many communities. However, this could be quite an expensive proposition. More research and guidance is needed on strategies to design and implement safe multiuse pathways for pedestrians, cyclists, and motor vehicles traveling under 20 mph.
Policy and Design Considerations for Accommodating Low Speed Vehicles and Golf Carts in Community Transportation Networks

The minimum 10-foot width recommended by AASHTO for multiuse trails is insufficient to accommodate golf carts and LSVs. WRCOG recommends a 20- to 26-foot cross section of pavement surface, with 4 feet of this space marked for pedestrians. LSVs and bicyclists may share the remaining 16 feet of space. A wider alternative provides LSVs with 14 feet of width separate from an 8-foot bike lane and a 4-foot pedestrian lane.

In determining the appropriate width, particular attention must be given to time-of-day and seasonal user volumes, sight distances, vegetation clearance, sign placement, gradients, ramps, surfacing, grade crossings, and other trail design considerations. The mix of users is another important design consideration. For example, children’s bike trailers and unpredictable child pedestrians and bicyclists themselves dictate wider lanes. Furthermore, planners and engineers must design for recently introduced golf carts that are six inches wider than standard carts.

- Consider carefully the safety implications of introducing golf carts and LSVs onto existing bicycle/pedestrian paths.

In places such as The Villages and Peachtree City, golf carts have shared on-road and off-road networks with walkers and cyclists for many years. Relatively few conflicts are reported among users, perhaps because they are all accustomed to accommodating each other. But introducing golf carts onto paths that have traditionally been used only by walkers and cyclists has the potential for serious negative consequences, especially for older pedestrians and cyclists who tend to move less quickly and who may have slower reaction times than younger people.

Existing trails have not been designed for larger, higher-speed passenger vehicles. Turn radii, sight distances, and pavement durability may not be safe and appropriate for these vehicles.

Furthermore, the vehicles themselves may present safety risks to nonmotorized users. Electric vehicles generate little engine noise and may overtake other users by surprise. Should a pedestrian or bicyclist suddenly turn in front of a near-silent golf cart or LSV traveling 20 mph, a serious crash may result.

- Enforce 20 mph speed limits on multiuse trails.

Most of the research and experience available to date indicates that LSVs and other vehicles that travel faster than 20 mph should not share paths with slower-moving travelers. They should operate on their own pathways, or on low-speed public streets with appropriate design and signage. LSVs may be allowed to operate on properly designed shared-use pathways in slow speed mode, as is the case in Peachtree City. The community should ensure adequate resources for enforcement.

Intersections

- Allow LSVs and golf carts to cross higher-speed roads only at controlled intersections identified by state and local governments as safe.

Both LSVs and golf carts are limited in their power to accelerate, thereby increasing the risk when crossing major highways. Many states appropriately regulate where LSVs and golf carts can cross major roads. Ideally these crossings should be at signalized intersections, where engineers have timed traffic lights to allow sufficient crossing time for lower-speed vehicles.
Policy and Design Considerations for Accommodating Low Speed Vehicles and Golf Carts in Community Transportation Networks

- **LSVs and golf carts should be accommodated across high-speed roads via bridges and tunnels or by reducing the traffic speed in the intersection.**

Hardly any communities or states permit the use of LSVs or golf carts on roads with travel speeds of more than 35 mph. However, provisions can and should be made to allow these vehicles to cross high-speed roadways at controlled intersections or via bridges or tunnels. Communities should work proactively with state DOTs and other relevant agencies to include these facilities in planning and programming highway improvements.

Design techniques that make intersections safer for pedestrians and bicyclists should work well for LSVs and golf carts. Some of the most commonly used treatments include clearly marked, lighted crosswalks, countdown pedestrian crossing signals, and median refuges in the middle of large highways. Roundabouts, which have successfully accommodated multimodal traffic in many other countries for years, are increasingly being employed in American communities. Essential to ensuring roundabout safety is designing tight circles that force drivers to travel smoothly but slowly (15 to 20 mph).

**Planning Complete Networks**

- **Integrate land development and transportation plans in order to develop complete networks for all travel modes.**

The market is growing for planned communities that feature a mix of homes, shops, and restaurants linked by multiuse trails and public green spaces such as golf courses and parks. Many such communities are designed specifically for active adults and retirees. Cities that adopt policies and plans for community-wide networks of golf cart paths and LSV routes can use these development projects as opportunities to get significant portions of their networks built. They can complete their networks by investing relatively small amounts of public funds in pathway links and selected road improvements that connect new developments with other important activity centers such as schools and downtown shopping districts.

Communities can also enhance existing developed areas by integrating routes for LSVs and golf carts into their urban fabric. These kinds of investments can boost economic development efforts to attract demographic groups such as “creative class” young professionals and active older adults.

The creation of a network of slower-speed roads, designed to safely accommodate LSVs and golf carts, will also increase the general livability of a community. Pedestrians, bicyclists, and transit users all feel more comfortable sharing the road network with motor vehicles when vehicle speeds are under 30 mph. Retail establishments also benefit from the increased foot traffic of a walkable environment and slower streets where drivers can notice shopping and service opportunities, parallel park, and exit their vehicles safely.

**Research and Data Collection**

- **Invest in data collection, analyses, and research that will help American communities safely integrate golf carts and LSVs into their transportation networks.**

There is woefully little data and information available for planners and engineers to use in designing and managing multiuser systems that include golf carts and LSVs.

Coordinated by NHTSA, states and localities should establish workable methods for tracking crashes involving golf carts and LSVs, in both on-road and
off-road settings. These methods could include strategies such as modifying police reporting and coding systems to differentiate LSV- and golf-cart-related incidents more clearly. Data collection methods should be integrated with existing FARS, CPSC, and the National Electronic Injury Surveillance System. Data are needed that distinguish LSV crash-induced injuries from those involving golf carts. This sort of initiative would provide a valuable opportunity for states and localities to ensure that law enforcement agencies understand and can consistently enforce the existing safety standards for golf carts and for LSVs. It would also give planners and policy makers better data with which to evaluate existing laws and regulation.

In addition, the research team was able to find little specific information on how to design roadways and off-road trails for golf carts and LSVs, particularly when the facilities are shared with other users. The communities studied for this report largely drew upon AASHTO standards for bicycle facility design when establishing standards for key elements such as lane or path widths and on-street pavement markings.

Although bicycles are (technically) capable of moving as fast as golf carts and even LSVs, they are utterly different from these vehicles. They are much smaller, much more maneuverable, and are usually operated at speeds around 5 to 15 miles per hour. While some aspects of bicycle facility design may work for golf carts and LSVs, they are all unique types of vehicles and should be subject to their own design standards.

**Conclusion**

Well-designed networks for LSVs and golf carts could help fill a gap in the existing array of transportation options. They could serve as useful alternatives to gas-powered automobiles, particularly for the many short trips most Americans make every day. They provide a convenient way for people to travel farther and faster than they would on foot or by bicycle, without having to use a car.

Nonetheless, community planners, law enforcement officials, local decision-makers, and users of these vehicles should not lose sight of the fact that these vehicles are much less safe to ride in than passenger cars.

With proper planning, education, regulation, and enforcement, communities can safely accommodate LSVs and golf carts and improve the quality of life for residents of all ages.
## Table 1
### Case Study Summary

<table>
<thead>
<tr>
<th></th>
<th>The Villages, FL</th>
<th>Peachtree City, GA</th>
<th>Linton, IN</th>
<th>Western Riverside Council of Governments (WRCOG), CA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>81,000</td>
<td>34,300</td>
<td>5,700</td>
<td>650,000 (four communities covered by NEV Plan)</td>
</tr>
<tr>
<td>Age 55 and above</td>
<td>predominantly</td>
<td>10,800 (32%)</td>
<td>2,400 (42%)</td>
<td>136,000 (21%)</td>
</tr>
<tr>
<td><strong>State policies or regulations regarding state and local authority to regulate LSVs or golf carts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golf Carts</td>
<td>Limited to roads where the posted speed limit does not exceed 35 mph. A county or municipality may prohibit the operation of low-speed vehicles or mini trucks on any road under its jurisdiction if the [local] governing body determines that such prohibition is necessary in the interest of safety.</td>
<td>§40-6-331 (Georgia Code) Local governing bodies have the authority, by ordinance, to designate certain public streets for the combined use of motorized carts and regular vehicular traffic. Crossing of state and local highways only at designated intersections.</td>
<td>§40-6-362 Low-speed vehicles shall be operated only on any highway where the posted speed limit does not exceed 35 mph.</td>
<td>§9-21-8-57 (Indiana Code) Only on local roads where local ordinance in place.</td>
</tr>
<tr>
<td>Low-Speed Vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated number of golf carts and LSVs in circulation</td>
<td>50,000 (estimated from surveys)</td>
<td>10,000+ registered</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Road Type Limitations</td>
<td>The Villages, FL</td>
<td>Peachtree City, GA</td>
<td>Linton, IN</td>
<td>Western Riverside Council of Governments (WRCOG), CA</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>State</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 miles per hour or less</td>
<td>Not addressed</td>
<td>35 mph or below LSVs entitled to full use of a lane</td>
<td>Speed not specified in state law</td>
<td>25 mph or less, except by resolution or ordinance by local authority</td>
</tr>
<tr>
<td>35 miles per hour or less</td>
<td>Not addressed</td>
<td>35 mph or below</td>
<td>35 mph or less</td>
<td>35 mph or less</td>
</tr>
<tr>
<td><strong>Local</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not addressed</td>
<td>35 mph or less</td>
<td>Not addressed</td>
<td>35 mph or below</td>
<td>WRCOG Plan limited to LSVs</td>
</tr>
<tr>
<td>Not applicable</td>
<td>25 mph or less</td>
<td>Cannot exceed posted speed limit</td>
<td>LSVs not addressed in ordinance</td>
<td>Streets identified in NEV Plan. Generally restricted to streets with posted speed limits of 35 mph or less. Streets with posted limits of 40 mph or greater require separate lanes for NEV operation.</td>
</tr>
</tbody>
</table>

**Operator Licensing Regulations/Policies**

<table>
<thead>
<tr>
<th>State</th>
<th>Required</th>
<th>Required</th>
<th>Required</th>
<th>Required</th>
<th>Required</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not required, but must be 14+ to operate on public road or street</td>
<td>§ 40-5-20 and § 40-5-21 Required on state highways §40-6-331 Grants authority to local government.</td>
<td>§ 40-5-20 Required</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
<td></td>
</tr>
</tbody>
</table>

| Local | Marion County only: Must be age 14+ | Not applicable | Persons age 16 or older with or without driver’s license (unless license has been suspended or revoked) Persons age 12 to 15 with limitations. | Not applicable | Not applicable | n/a | Not applicable |
Table 1 (continued)

<table>
<thead>
<tr>
<th></th>
<th>The Villages, FL</th>
<th>Peachtree City, GA</th>
<th>Linton, IN</th>
<th>Western Riverside Council of Governments (WRCOG), CA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Golf Carts</td>
<td>Low-Speed Vehicles</td>
<td>Golf Carts</td>
<td>Low-Speed Vehicles</td>
</tr>
<tr>
<td>Vehicle Registration Regulations/Policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>No</td>
<td>Required</td>
<td>§40-6-331</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>State law allows local governing authority to require local registration and licensing of carts by ordinance.</td>
<td>Not addressed</td>
</tr>
<tr>
<td>Local</td>
<td>No</td>
<td>Required</td>
<td>Not applicable</td>
<td>Required</td>
</tr>
<tr>
<td>Insurance Regulations/ Policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>No</td>
<td>Required</td>
<td>No</td>
<td>Not addressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>No</td>
<td>Required</td>
<td>Encouraged</td>
<td>Required</td>
</tr>
<tr>
<td>Other Local Policies, Regulations and Programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific vehicle types addressed</td>
<td>Golf Carts - ALL</td>
<td>LSVs - Lady Lake Only</td>
<td>Motorized carts</td>
<td>Low-speed motor vehicles</td>
</tr>
<tr>
<td>Use of LSVs or carts on multiuse trails</td>
<td>Yes 20 mph max. speed</td>
<td>Yes 20 mph max. speed</td>
<td>Allowed</td>
<td>Allowed provided it does not exceed 20 mph</td>
</tr>
<tr>
<td>Use of LSVs or carts on sidewalks</td>
<td>State law allows if sidewalk 8' wide and local government deems safe in consultation with state DOT.</td>
<td>Not addressed</td>
<td>Prohibited by municipal code</td>
<td>Prohibited by municipal code</td>
</tr>
<tr>
<td></td>
<td>The Villages, FL</td>
<td>Peachtree City, GA</td>
<td>Linton, IN</td>
<td>Western Riverside Council of Governments (WRCOG), CA</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td><strong>Golf Carts</strong></td>
<td>Low-Speed Vehicles</td>
<td>Golf Carts</td>
<td>Low-Speed Vehicles</td>
<td>Golf Carts</td>
</tr>
<tr>
<td><strong>Other Local Policies, Regulations and Programs</strong> (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LSV and/or cart facility design standards or guidelines</strong></td>
<td>Not known</td>
<td>Required with new development. Min. 10’ with 4’ aggregated base, 20’ easement</td>
<td>None</td>
<td>7’ min. shared use NEV/bike lanes on roads with posted speeds &gt; 35 mph Shared use on streets with a posted speed limit not greater than 35 mph 20-26’ shared use trails. Pedestrians given 4’ of marked lane space.</td>
</tr>
<tr>
<td><strong>Vehicle safety features</strong></td>
<td>Minimum equipment standards established by the Florida statutes: headlights, brake lights, turn signals, windshield, reliable steering apparatus, safe tires, rearview mirror, and red reflectorized warning devices in front and rear. Local requirements also include reflective devices on sides of cart if operated before sunrise and after sunset.</td>
<td>Regulated by NHTSA: Headlamps, stop lamps, turn signal lamps, tail lamps, reflex reflectors, parking brakes, rearview mirrors, windshields, seat belts and vehicle identification numbers required.</td>
<td>Headlights and taillights if driven after dark.</td>
<td>Regulated by NHTSA Slow Moving-Vehicle sign or flashing lamp, lights and headlights on day or night, rearview mirror.</td>
</tr>
<tr>
<td><strong>Education programs</strong></td>
<td>Homeowner’s Association volunteer-driven website. Orientation class in partnership with municipal sherrifs.</td>
<td>Online course, quiz, and practical road test oriented to teenagers.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Enforcement Programs</strong></td>
<td>Municipal sherrifs can patrol streets. Cannot patrol trails, but can enter if a problem is observed.</td>
<td>City police patrol pathways on carts and issue citations (100+ in 2007) Enforce no texting law.</td>
<td>Not addressed</td>
<td>Not addressed</td>
</tr>
</tbody>
</table>
Endnotes


2 http://www.thedenverdailynews.com/article.php?aID=3432


4 AARP Public Policy Institute analysis of the 2009 National Household Travel Survey, V 2.1.

5 http://www.irs.gov/businesses/article/0,,id=214841,00.html


7 http://www.iihs.org/news/rss/pr052010.html


9 Insurance Institute for Highway Safety, “Definitely not crashworthy.”


12 http://www.nhtsa.gov/cars/rules/rulings/lsv/lsv.html#lsv27

13 Insurance Institute for Highway Safety, “Definitely not crashworthy.”


15 Ibid.


19 Ibid.


21 http://www.wired.com/cars/coolwheels/magazine/17-10/ff_ecars?currentPage=all#ixzz16t4akLj6


25 Peachtree City Zoning Ordinance, Sec. 804. Cart path design standards.

26 Ibid.


28 The online course is accessible with a new user account. http://www.peachtree-city.org/golfcartsafety
Policy and Design Considerations for Accommodating Low Speed Vehicles and Golf Carts in Community Transportation Networks

29 By private roads, the authors refer to roads in gated communities or subdivisions that are frequented by numerous community members but privately maintained, rather than a private lane that functions more like a driveway.


32 For more information, visit http://www completaestreets.org

33 For more information, visit http://www.contextsensitivesolutions.org