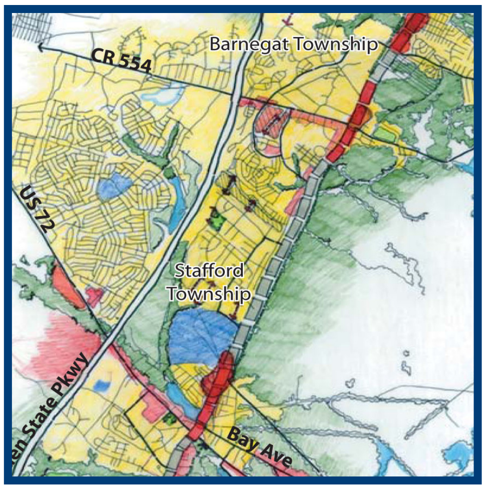
# New Jersey Long Range Transportation Plan 2030

## *Technical Memorandum*

## *Task 11: Local Street Connectivity Redefined*

**July 2007**





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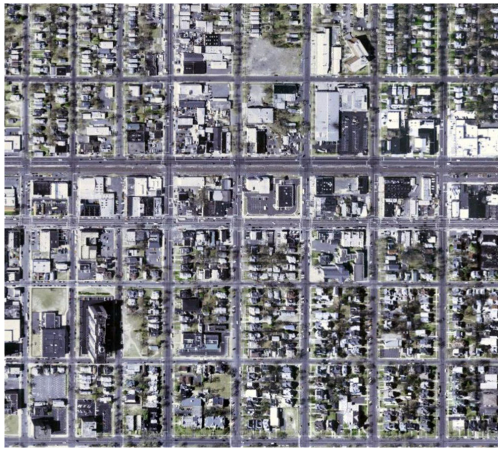
## Table of Contents

# I. Introduction

Prior to World War II most communities in the United States were developed to be relatively compact with many finely grained grid streets supporting housing side-by-side with neighborhood retail shops and a continuous sidewalk system. Many of these towns were also served by an extensive public transportation network. Postwar neighborhoods, in contrast, were built to accommodate the automobile and were characterized by sprawling development, wider and curvilinear streets, fewer sidewalks and a clear separation of land uses. This new pattern of suburban development negatively affected the local transportation system by consciously making routes less direct and concentrating traffic on only a few roads. The results of recent development patterns, including increased traffic congestion and a lack of communities with a sense of place or character, have led municipalities to reconsider development practices. Many are deciding to return to a more grid-like system of organizing streets and buildings in an effort to more evenly distribute traffic, support increased walking, biking and transit, and to create authentic, mixed-use town centers.



*Asbury Park, NJ*

*West Windsor, NJ*

The New Jersey Department of Transportation (NJDOT) is developing a statewide Long Range Transportation Plan called *Transportation Choices 2030* that will establish a framework for directing investments in transportation over the next 25 years. New Jersey is one of a growing number of states that has adopted principles of smart growth, well-planned and well-managed growth that preserves natural resources, to guide the placement of public infrastructure. Smart growth supports development and redevelopment in recognized centers and areas with existing infrastructure as outlined in New Jersey's State Development and Redevelopment Plan (SDRP). *Transportation Choices 2030* is being developed in accordance with the smart growth principles found in the SDRP. One of the principles of smart growth is to provide a variety of transportation options so that residents have realistic opportunities to drive, walk, bike or take transit to their destinations. This approach to providing a multimodal transportation system relies on an interconnected local street system that can provide many alternative routes, shortened distances between destinations and a supportive environment by design.

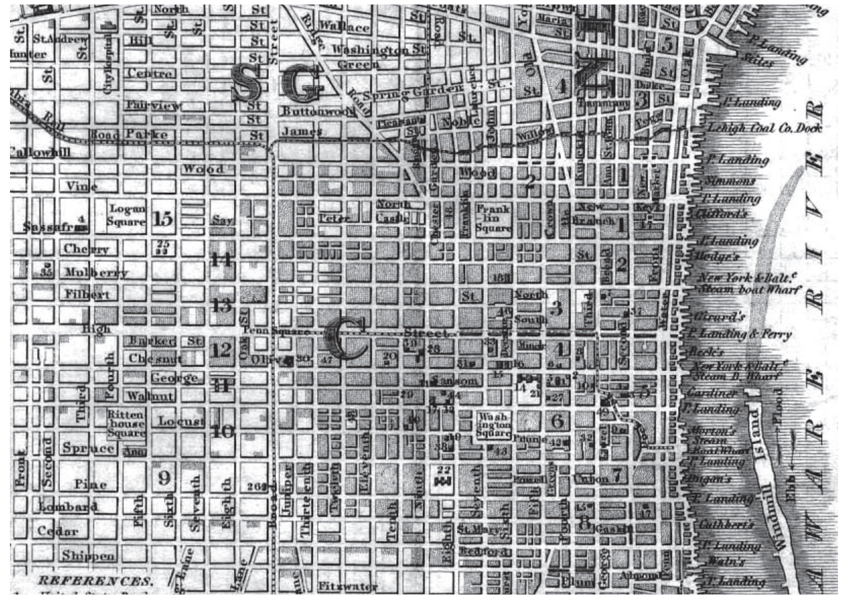
The purpose of this technical memorandum is to discuss and analyze the topic of local street connectivity and its relationship to the New Jersey Long Range Transportation Plan. Section II presents a historical perspective on interconnected streets and how planners now view the traditional grid system of roadways. Section III discusses street connectivity techniques and applications that are based on the activities of other municipalities in the

United States. Section IV presents the advantages and issues of providing interconnected streets from the perspective of transportation professionals and neighborhood residents based on recent research and case studies. The section also contains a discussion of the advantages and issues that are raised specifically for transit operations by creating interconnected streets.

Section V summarizes three of NJDOT's Integrated Land Use and Transportation Studies (ILUTS) that are being used to explore transportation solutions that are grounded in the state's principles of smart growth. The case studies are located along the Route 9 corridor in Ocean County, the Route 29 waterfront in Mercer County, and the Route 31 corridor in Hunterdon County. Each of the case studies contains examples of how increasing the connectivity of the local street network can support development and redevelopment efforts. Section VI discusses other New Jersey initiatives that support interconnectivity including NJDOT's Future in Transportation (NJFIT) initiative for the public, NJDOT's Transit Village Initiative and NJ TRANSIT's Transit-Friendly Planning Initiatives to support Transit Oriented Development (TOD). Finally, Section VII recommends a strategic direction for the New Jersey Long Range Transportation Plan with regard to local street interconnectivity.

## II. Historical Perspective

For centuries various systems of roads and walkways have been developed to provide for public circulation in human settlements. A system of straight and parallel streets, a design known as the gridiron, was originated by the Greeks and Romans and established related design criteria for the width and construction of roads. The grid as an organizing concept for circulation




*Philadelphia, PA c. 1842*

persisted and it first appeared in the United States in Philadelphia, modeling its network after London's. Over time, the grid remained popular because it was a simple and efficient method of subdividing land and it allowed for the standardization of lot sizes. By the late nineteenth century, however, the grid began to be criticized by architects and planners because it tended to be monotonous and it did not adapt well to natural topographic features.[1]

[1] *Planning for Street Connectivity: Getting From Here to There, Susan Handy, Robert G. Paterson, Kent Butler, American Planning Association, 2003*

In response to this criticism, two neighborhoods in London, Bedford Park and Hampstead Garden, were planned as the world's first garden suburbs introducing curved streets, reduced street widths and planting strips for trees. Further, these neighborhoods were designed to discourage traffic in neighborhoods and keep it on the major thoroughfares by using cul-de-sacs and open courts to separate pedestrians as much as possible from motor vehicles. American planners soon followed suit and by the 1920s curvilinear streets began to appear on the suburban landscape.

Clarence Perry of the Regional Planning Association of America (RPAA) established a set of principles for suburban design that created distinct boundaries in the form of major streets and promoted the use of a hierarchy of roads. Clarence Stein, also of the RPAA, advanced and implemented these principles in the famous Radburn development in New Jersey. Radburn's development was based upon a road hierarchy that separated commercial from residential streets and was characterized by curvilinear and narrow streets that discouraged automobile traffic. At the same time, Radburn also created a network of pedestrian trails and bridges that separated the automobile from the pedestrian. Minimizing through traffic in neighborhoods was accomplished by purposefully creating discontinuities in the street network which was intended to improve the quality of life in residential areas.

Radburn represented a major shift in the design of residential communities, and it popularized a non-grid system of street design. Unfortunately, in the following decades, Radburn's focus on the separation of modes, pedestrian connectivity, and common open space were not emulated by the development community to the same degree as were its cul-de-sacs. Thus, the hierarchy of roadways with a disjointed network of low-traffic residential streets surrounded by high-traffic arterials and the rejection of the traditional grid became a fundamental practice for transportation planning and engineering in the United States. As a result, today residential areas are typically separated from other types of surrounding development and different neighborhoods are often unconnected. This reduced connectivity creates indirect and circuitous routes that tend to increase travel distances. Reduced connectivity also reduces the practicality of walking. These negative


*Radburn, NJ*

effects of a street hierarchy have recently created a renewed interest in the traditional gridiron. Many communities in states across the country are looking at ways to increase street connectivity.

## III. Street Connectivity Techniques & Applications

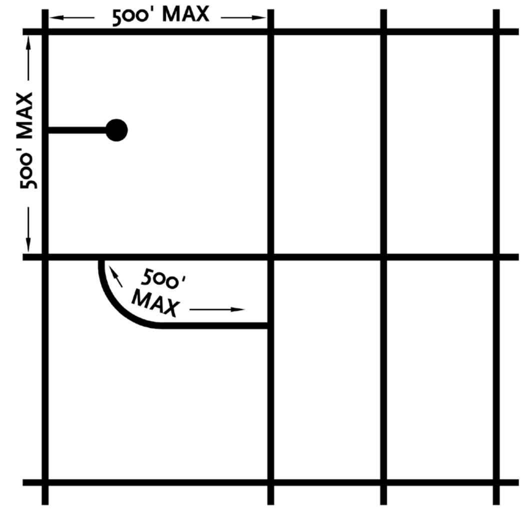
Recently, the American Planning Association (APA) published a report entitled *Planning for Street Connectivity: Getting from Here to There* that reports on the efforts of communities in the United States to increase street connectivity.[2] To prepare this report, the APA conducted a survey of groups of municipalities where connectivity standards and ordinances are in place to determine the techniques that are used to increase connectivity. The APA report identified cities in Oregon, Colorado, North Carolina, Delaware and Florida. Municipalities in these states and increasing numbers of cities and towns across the country have been adopting standards and ordinances that include the two most common interconnectivity techniques: block length requirements and connectivity indices. Each technique has advantages and disadvantages. In most cases, communities did not follow the techniques strictly because factors such as environmental features or topography prevented absolute adherence. Overall, the goals of connectivity requirements are to increase the number of connections and the directness of travel routes. The national case studies for street interconnectivity are summarized in Table 1 located at the rear of this report.

Block lengths can be determined by block size as measured by block area, the number of acres per block or by the perimeter of the block. A recent report by Duany Plater-Zyberk suggests a set of standards for block size based on block perimeters for various intensities of land development from rural to urban areas.[3] They can be also determined by the spacing of intersections so that there is a maximum spacing between local streets ensuring that the street network is predictably and evenly distributed. Block lengths that support connectivity are between 330 and 550 feet. Imposing standard block lengths is an easy way to develop interconnected streets that create a grid system, but it can be a somewhat inflexible approach to connectivity.

[2] *Planning for Street Connectivity: Getting From Here to There, Susan Handy, Robert G. Paterson, Kent Butler, American Planning Association, 2003*

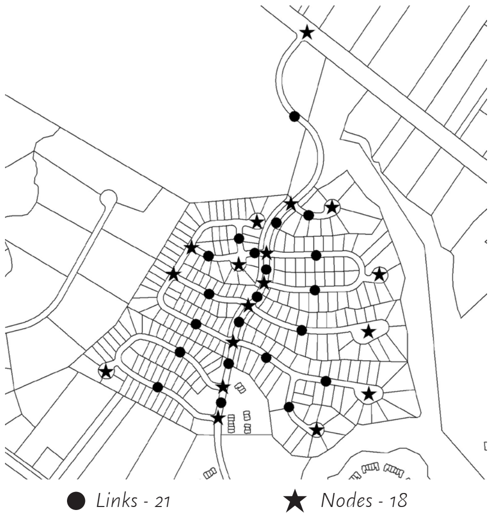
[3] *SmartCode: A Form-based Planning Ordinance, Duany Plater-Zyberk, 2005.*

Cul-de-sacs, which intentionally isolate land uses from the local roadway system, are often restricted in towns that have block length requirements. In these instances, cul-de-sacs are allowed only in locations where connections would be impractical due to topographical or other environmental features and they are usually restricted to 200 to 300 feet in length. The restriction of cul-de-sacs has also been found to reduce infrastructure costs, in particular utilities such as sewer and water, and to reduce the cost of providing municipal services.



*Block Length Requirements*

A second common connectivity technique is the connectivity index which is defined as the number of street links (street segments) divided by the number of nodes (intersections and cul-de-sac heads). The higher the ratio of links to nodes, the greater the connectivity index of the street system. Traditional street grid networks typically have a connectivity index of 1.7 compared to more recent suburban networks of 1.2. Communities and developers have found that using a connectivity index allows for greater flexibility than does block length requirements in designing a development to accommodate unique site features. It also serves as a performance standard in the development approval process. Utilizing the index leads to the creation of more four-way intersections and to the reduction of cul-de-sacs. There are several other less common ways of measuring connectivity. A direct way to measure connectivity is to calculate the number of intersections per mile of the road. Another way to measure connectivity is to calculate the ratio of travel distance to straight line distance between two points using the street network.



*Calculation of Connectivity Index in Readington, NJ*

Over the course of defining and measuring street connectivity, communities are faced with a number of related issues as connectivity standards and ordinances are actually applied. One such issue is that connecting residential areas to arterials creates more route choice and can lead to increased traffic volumes on residential streets. To reduce cut-through traffic volume and travel speeds with increased connectivity, many communities also allow narrower street widths and other traffic calming devices. They reduce the minimum required street widths and rights-of-way. In addition to traffic calming effects, narrower streets reduce developer costs and the amount of impervious surface.

Another issue is planning for future development; this becomes increasingly important when applying connectivity standards and ordinances in practice. To ensure that connectivity is extended to new streets, localities often require that stub streets be built to serve as future connections between developments. Some even place stub streets on comprehensive plans or create a separate map of these facilities so that the public may anticipate that connections will be made in the future. Additionally, for new residential areas, communities often restrict the use of private streets and gated communities unless more than one access to the community can be created.

Finally, topography, built features or lot lines can offer reasons to permit exceptions to interconnectivity standards. Thus, some communities permit variances to interconnectivity requirements or offer incentives to encourage connectivity. To gain relief from requirements, developers are asked to present alternative means of accomplishing the community interconnectivity goals. One example of an incentive is discounts on development fees that are offered in some locations to encourage developers to increase connections.

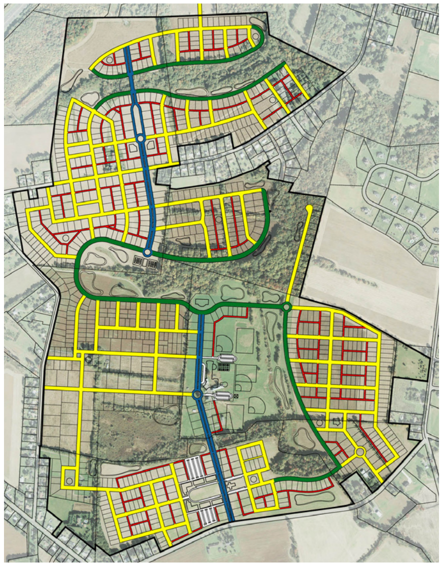
## IV. Street Connectivity in Practice

There appear to be many benefits to increasing street connectivity for communities that wish to enhance the transportation system while building vibrant town centers. Planners argue that street connectivity has many benefits for all modes of transportation, including automotive traffic, and that it can contribute to improved quality of life. While many of these benefits tend to be supported by national research and the experiences of municipalities that have adopted connectivity standards and ordinances, these benefits are not unconditional and without tradeoffs. Although increased connectivity can improve how communities function, there are many issues that must be addressed during implementation. This section presents the benefits and issues that characterize street interconnectivity. It is based on research and case studies found in the APA report, *Planning for Street Connectivity*, and on interviews with various public agencies and organizations in New Jersey.

### Benefits and Issues

**Building a system of interconnected streets supports smart growth practices**. Smart growth supports planned and managed growth which preserves open space, farmland and environmental resources. Smart growth relies on land planning techniques that strengthen and direct development toward existing communities already served by infrastructure. Creating connections between streets enhances transportation systems and communities that are already in place thus increasing the efficiency and vibrancy of both. Communities in several states point out that they encourage interconnected streets as a way of meeting growth management objectives. In New Jersey, an interview with staff at the Municipal Land Use Center at The College of New Jersey indicated that several municipalities in the state are using connectivity policies and regulations to accommodate new growth.[4]

**Traditional Neighborhood Development (TND) is supported by increased connectivity.** Traditional Neighborhood Development relies on a pattern of walkable, mixed-use neighborhoods that exist in many pre-World War II communities throughout the country. Unfortunately, current zoning and subdivision ordinances which encourage the free flow of traffic and separate land uses often prohibit the establishment of these types of neighborhoods in new locations. Development ordinances that allow for TND state that streets should be laid out in a network so that alternate routes and alternate means of travel are more possible. A grid-like network also serves to create streets and squares that are human-scaled so that community interaction is more likely. Several communities stated that increased connectivity is one way that they are enhancing walkability in their towns.



*Planned Village - Chesterfield, NJ*

**Interconnected streets decrease traffic on arterials because vehicle trips are distributed and dispersed throughout a grid network.** Many of the case study communities have adopted connectivity standards and ordinances in an attempt to improve the carrying capacity of arterial streets. The redistribution

[4] *Interview, Caroline Armstrong, Special Projects Planner, Municipal Land Use Center, The College of New Jersey, February 8, 2006.*

of traffic away from arterials to the local street system appears to be the result of providing additional route choices. However, research shows that a moderate level of connectivity tends to yield greater improvements than a high level of connectivity. A moderate level translates into one connection every 330 to 530 feet for local and arterial streets. Communities in the U.S. that specify distances between street connections tend to have connections that fall within this range. Additional connections beyond this range diminish traffic improvements because the capacity of streets declines with an increased number of intersections. Higher levels of connectivity also increase the opportunity for cut-through traffic in neighborhoods as people tend to use route alternatives provided, in part, because of a decline in the serviceability of the arterial. Communities that desire increased connectivity in their street networks must find a balance between reducing traffic on arterials and increasing traffic in residential areas.

**Compared to low-connectivity suburban street networks, traditional grid networks decrease vehicle miles traveled (VMT), trip lengths and travel time.** This benefit has been proven by research in locations where connectivity has increased.[5] At the same time, increased connectivity may result in a greater number of trips being taken by all modes because a denser system of roadways increases accessibility and reduces travel distances to destinations. At this point, the research is inconclusive. Again, if additional vehicular trips are generated and increased travel appears on local residential streets, traffic calming and other strategies must be employed to ensure that drivers do not speed through neighborhoods.

Increased connectivity facilitates walking and bicycling. Street connectivity offers the potential to increase trips by walking and bicycling because shorter travel distances are created to various destinations and to passenger rail and bus services. In fact, several case study communities stated that they hoped to provide more mode choice to residents by making increased street connections. Empirical evidence to prove that an interconnected street network *per se* increases walking and bicycling is ambiguous as it appears that land use patterns and design characteristics are important when people make the choice to walk or bike. In other words, simply connecting streets is not likely to increase pedestrian and bicycle activity if there are no destinations to attract pedestrian or bicycle trips or transit services are not available. Thus, it is important to conduct land use planning activities in conjunction with connectivity requirements.

**Greater connectivity helps emergency medical services, trash collectors, police and other municipal service workers provide more efficient and higher quality services by increasing access.** For obvious reasons, emergency and municipal service providers tend to support interconnectivity and the elimination or reduction of cul-de-sacs and dead end streets. However, interconnected street requirements often call for standards such as narrower streets which could make it more difficult to maneuver fire trucks and other types of equipment. Case study communities recommend working directly with emergency and municipal service providers when planning new street standards and ordinances. In some instances, certain streets may designated as emergency routes and the standards relaxed.

**Disadvantages**

While there are many known benefits to increased connectivity, there can be opposition from residents who may face additional traffic on their roadways,

[5] *Planning for Street Connectivity.*

and developers who may need to follow new requirements.

**Greater numbers of connections on local streets can increase through traffic on residential streets.** One study conducted for Portland Metro, the regional government in the Portland,Oregon area, concluded that as traffic increases on arterials some drivers divert to local streets to bypass congested intersections. High levels of connectivity appear to increase the opportunity for cut-through traffic in neighborhoods. On the other hand, as more traffic uses local streets, drivers who remain on the arterial benefit from reduced travel times.

**There are several perceived disadvantages to increased connectivity; however, there is not been adequate study of the actual impacts of interconnectivity to confirm these disadvantages.** For example, residents are often concerned that crime will increase as more connections are made to and in residential areas because of increased access to properties. Others in the community are concerned that infrastructure costs and impervious cover will increase and that the affordability of housing will decrease. Developers fear that if more connections are required through local ordinance that it will require more land to develop the same number of units and that the profitability of developments will be threatened. Again, more empirical study is needed, and it is important to recognize that residents, officials and property owners do not universally accept increased connectivity as beneficial.

### Transit & Street Interconnectivity

Interconnected streets appear to have many benefits including the ability to preserve capacity on arterials, support bicycle and pedestrian activity and assist in building communities with a sense of place. Municipalities that require additional connections between streets also seek increased access to public transit bus and rail services. Intuitively, increased connectivity should benefit transit, but there is no known research about the topic. Interviews were conducted with several NJ TRANSIT managers to determine the views of the agency about street connectivity and creating grid systems and its potential impact on accessibility to transit and transit operations.[6] The discussion below summarizes the results of these interviews which identify the advantages of greater street connectivity and also some of the issues that should be considered by planners as they design service in areas where there is greater street connectivity.

### Advantages

The implementation of greater street connectivity in areas throughout New Jersey provides the opportunity for implementing transit service in a way that can be significantly different than the way in which service is typically structured today, with a much higher degree of flexibility afforded by greater street connectivity.

**Interconnected streets create shorter and more direct transit trips and bring the service closer to riders.** The curved streets and multiple cul-de-sacs prevalent in the majority of suburban developments throughout the state are typically inhospitable to the provision of transit service. These streets are often difficult to access with a transit vehicle because of the limited number of access points into the neighborhood. Furthermore, because the curved nature of suburban streets results in an indirect travel path through a

*[6] Interviews, Alan Maiman, Director, Bus Service Planning, January 25, 2006 and Jack Kanarek, Senior Director, Project Development, February 2, 2006.*

neighborhood, buses on these streets must typically travel greater distances to get from one point to another compared to a trip on a linear street. This indirect trip adds travel time to each transit trip which, in turn, means increased inconvenience for riders, who must spend a longer time on the bus before getting to their final destination. This increased trip time also means greater vehicle requirements to provide a level of service comparable to service being provided on linear streets. Because of these barriers to providing transit service on the typical suburban street network, transit service often does not penetrate the heart of suburban neighborhoods. Instead, service is usually kept on arterials adjacent to a neighborhood, with the responsibility for accessing the bus left to the patron.

One of the key characteristics of greater street connectivity is the implementation of a partial or full grid street system. The advantage to transit of this grid system is twofold. First, the grid system provides the opportunity for straighter and much more direct trips, and thus the trips also take less time to complete. Secondly, the grid system allows more effective penetration of residential neighborhoods, thus allowing buses to get closer to where people live. Ultimately, providing more convenient and less time consuming transit service should attract new riders and lessen dependence on automobiles.

**A grid system supports transit transfers.** Improved transfer opportunities resulting from a strengthened grid system of both east-west and north-south streets is another key advantage to transit of interconnectivity. In a grid network, east-west and north-south bus lines naturally cross each other as part of their routing and become logical transfer points between routes. These natural crossing points are often not present in a suburban roadway network that consists of individual neighborhood "pods" each of which is not connected to the other and which also has a limited number of access points to the arterial system. Since the street network in these isolated neighborhoods is not connected to the street networks in other neighborhoods, the natural transfer points associated with a grid system are not present.

Because transfer points are still required for changing from one route to another, however, in an area with curved, disconnected street networks, transfer points must be located at large activity centers such as suburban malls. NJ TRANSIT managers interviewed reported that, unfortunately, many malls do not necessarily perceive a benefit from having the facility on their property and therefore do not maintain the area around the facility if one is established on-site. Further, they often push the facility to the furthest reaches of the parking lot, making the site inconvenient for transit users. Being located on someone else's property also means that the transit system can be asked to leave at relatively short notice, thus resulting in a scramble to find a new facility. Finally, complicated liability issues are associated with being on private property. According to the NJ TRANSIT managers, often transit vehicles are not even permitted within a mall's access roadway system and parking areas which results in transit passengers needing to make transfers to different routes along an arterial highway. A more defined grid system leading to a greater number of natural transfer points where routes intersect is generally a more effective and efficient transfer configuration than what is currently in place in many suburban areas of the state.

**Pedestrian access to transit is enhanced with a system of interconnected streets.** A previous discussion shows how a partial or full grid system associated with greater street connectivity provides the opportunity for transit service to move closer to the places people live. Conversely, this greater connectivity also makes it much easier for people to access the bus, even if it is not passing directly in front of a person's house. As noted, suburban street networks often rely on one or two access points to the arterial system, which essentially isolates the neighborhood. Because buses typically run on the arterial system in these suburban areas, people walking to the bus are forced to get to a stop via the one or two access points out of the neighborhood. This can result in a long, non-direct walk to get to a bus stop. Just as with the positive impacts of the grid system for the travel path of the bus, the pedestrian travel path is also made more convenient with the full or partial grid system associated with greater street connectivity.

**A street network that provides for a high degree of connectivity offers more flexibility for deviated service.** In less densely populated parts of the state many of the bus services provided by NJ TRANSIT are a variant of a purely fixed route service known as a deviated fixed route. A deviated fixed route will leave the route mainline to pick up or drop off riders on streets a few blocks off of the mainline. This is often geared to the elderly or disabled who find it difficult to get to a regular bus stop. Providing a full or partial grid through greater street connectivity provides for much greater flexibility in deviating from the fixed route because there are more travel paths to follow and there are also more alternative paths to get back to the mainline.

**The distribution of traffic throughout a grid system improves traffic conditions on arterials.** Much of the discussion above is focused on the benefits of buses utilizing new street capacity built as part of an increased street connectivity effort. Another benefit may accrue to transit service that is remaining on an arterial after new streets are constructed. In this instance, there may be the potential for improved traffic operations on the arterial because fewer cars are making local trips on the arterial and, instead, choosing to remain on neighborhood streets. If traffic operations improve on the arterial, then this would benefit transit service utilizing the arterial by reducing travel times and delay associated with congestion.

**Issues and Other Considerations**

The sections above outline the clear advantages of greater street connectivity for transit. Other potential issues associated with this connectivity, however, must be considered when designing transit service to take advantage of the greater connectivity. These issues are outlined below.

*Circulation Study - Bordentown, NJ*

**Spacing of bus stops.** The standards for implementing greater street connectivity call for streets to be spaced every 330 to 550 feet. Creating a bus stop at every one of these streets would result in a stop every 1/10th of a mile, which may be excessive since people are typically willing to walk up to ¼ mile to board transit. Furthermore, too many stops can result in longer trip times, thus creating an inconvenience for riders. Generally speaking, for the same number of boardings it is better to have fewer stops with a greater number of passengers boarding at each stop, than it is to have a greater number of stops with fewer passengers boarding at each stop. It takes more time for the bus to make multiple stops than it does to load a larger number of passengers. As service is designed or re-designed for areas with greater street connectivity, the spacing of bus stops should be a primary consideration as the service design moves forward.

**Impacts of traffic calming and narrow streets.** One of the primary purposes of greater street connectivity is to provide alternative travel paths along local streets so that a person making a local trip is not required to use an arterial to complete the trip. A potential drawback is that these local streets can become an alternative for making other non-local trips, thus potentially increasing volumes and speeds on local residential streets. To combat these potential ill effects, a narrow street section and other traffic calming techniques are often installed as an integral component of the new street network. From a transit point of view, however, narrow streets and calming techniques such as speed humps could be detrimental to transit operations. Both narrow streets and speed humps slow down buses, resulting in slightly longer trip times, which could be a problem when runs are tightly scheduled. In addition, speed humps also have the potential to damage the undercarriage of a bus if they are not mounted correctly. On the other hand, curb extensions, another traffic calming strategy that narrows the street at strategic locations, can enhance transit stops by providing visible, logical locations to board passengers and bringing riders closer to the door of the bus. As designs for increased street connectivity move forward, planning for transit should be carefully integrated. This may include an alternative design for streets that have extensive transit service as well as including or modifying traffic calming techniques so that they are transit friendly.

**Adequacy of resources as access to transit increases.** One of the key advantages of a grid system is increased flexibility that transit planners have in designing service. This includes the ability to provide a greater density of transit service as well the opportunity to provide different types of transit service, each of which could be customized to the market it will serve. For instance, in addition to full size buses, neighborhood circulators utilizing smaller vehicles feeding into a mainline local or express service could be provided. Providing service to take full advantage of the increased flexibility made possible by greater street connectivity would likely require increased resources to provide the service. A greater density of transit would mean more routes, which in turn means more buses and drivers. Providing different services customized to specific markets will also require additional funding. Ultimately, this means that as greater street connectivity is implemented, a careful assessment of how best to take advantage of the greater flexibility provided by a more connected street network, while also considering funding constraints, will be required. In short, greater connectivity has the potential to support a higher level of transit service but this also can create raised expectations that must be managed.

*Frontage Road*

**Community opposition to service.** One of the elements of a connected street network is more roadway capacity closer to residential neighborhoods. For transit, the ability to provide service closer to residences is a benefit in that it requires a shorter walk for potential transit users, but actually using newly connected roads in residential areas for transit routes can result in community opposition. Residents often express concern regarding buses in their community, and a more connected street network has the potential to bring buses even deeper into their neighborhoods. Transit strategies to take advantage of greater street connectivity will have to be sensitive to community concerns.

**Increased use of frontage roads.** One of the key foundations of the increased street connectivity concept is the use of frontage roads to minimize the number of driveways that feed directly onto arterials. Where this concept is implemented it will be very important for frontage roads to be designed in a manner such that they are accessible and convenient for transit. This design should ensure that deviating to a frontage road would not result in an excessive time penalty for transit. Conversely, service design would have to plan for the use of frontage roads, including the location of passenger facilities, access to surrounding generators, and ensuring all potential patrons for a stop are adequately served on frontage roads.

## V. NJDOT Integrated Land Use & Transportation Studies (ILUTS)

Post World War II development patterns have led to growth in suburban and rural areas as highways were built to accommodate traffic. Continued growth soon created traffic congestion which led residents to call for wider highways. In a familiar cycle, once highways were widened, travel was made easier again which facilitated new growth and congestion. In the past, NJDOT simply responded to traffic congestion from unmanaged growth by building more roads and widening existing ones to carry more and longer trips by automobile. Unfortunately, this conventional approach only solved traffic problems temporarily and encouraged further sprawl. In addition, this approach rarely supported alternatives to driving alone which could ease congested traffic conditions. NJDOT has determined that it can no longer afford to fund all the major transportation investments that are needed to maintain this type of land use or transportation planning which leads to unsustainable growth.

The state of New Jersey has adopted smart growth principles to support development and redevelopment in designated Centers, which are locations of compact, mixed-use development, as outlined in the State Development and Redevelopment Plan. Smart growth is an approach to land use planning that targets the State's resources and funding to support planned and managed growth which preserves open space, farmland and environmental resources. New Jersey's smart growth principles aim to create livable neighborhoods with a variety of housing types, price ranges and forms of transportation.

As part of the state's efforts, the NJDOT initiated a Smart Transportation philosophy that integrates smart growth land use planning and transportation planning to support the state's smart growth agenda. This philosophy represents a major shift in NJDOT's approach to relieving congestion in New Jersey which heretofore relied on adding capacity by building more and wider roads.
The NJDOT smart growth transportation principles include:

1. Downsize state highway projects to affordable levels
2. Create transportation network connectivity
3, Help communities with land use design
4. Develop context sensitive street design

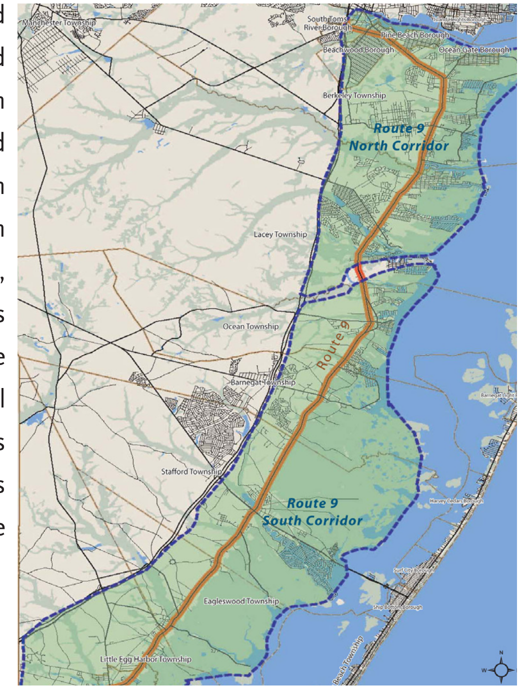
Through its Integrated Land Use and Transportation Studies NJDOT is exploring alternatives to conventional solutions using Smart Transportation principles in nearly two dozen locations throughout the state. Three case studies are described below which contain examples of increasing the connectivity of the local street network to support development and redevelopment efforts. These case studies are the Route 9 Integrated Land Use and Transportation Plan in Ocean County, the Route 29 Waterfront Boulevard Study in Mercer County, and the Route 31 Transportation and Land Use Plan in Hunterdon County.

## Route 9 Integrated Land Use and Transportation Plan, Ocean County

### Description of Study Area

As described in the Route 9 Corridor Master Plan prepared by Parsons Brinkerhoff, Glatting Jackson, and Martine A. Culbertson, the Route 9 corridor constitutes 30 miles of roadway located between South Toms River and Tuckerton Borough in Ocean County. Route 9 runs parallel to the Garden State Parkway and serves as the only north/south alternate route to the Garden State Parkway through the County.

The area surrounding Route 9 south of Oyster Creek consists of permanently protected lands within the Pinelands as well as residential neighborhoods. Residential uses comprise the largest land use category while most of the land area consists of wetlands and preserved land. In the Tuckerton downtown area, the corridor has a more densely settled, urban character, while north of the Borough the corridor is bordered on one side by the Edwin Forsythe Wildlife Refuge and on the other by undeveloped lands. The northern section of Route 9 is more developed than the southern section and has older suburban communities. In this area, residential land use is predominant, although there are clusters of commercial development at intersections with larger roads, such as County Route 614 and Route 166.




*Route 9 Study Corridor (Courtesy of Glatting Jackson)*

### Study Progress and Status

The work for the Corridor Master Plan study began in January 2004 and a final report was completed in November 2005. The consultants involved in the study incorporated interviews with more than 30 stakeholders, formed a Strategic Advisory Group (SAG), and participated in interactive workshops all of which took place in the first half of 2004. In early 2005 an agreement was drafted forming the Route 9 Corridor Coalition comprised of state and regional agencies, and the municipalities. The purpose of the Coalition is to implement the Route 9 Master Plan using the plan's guiding principles as outlined in the section below. The draft agreement requests that a Route 9 Corridor Coalition Steering Committee be established to guide the Coalition partners and the implementation process.

**Community Objectives**

The objectives expressed by local residents and other stakeholders for the future of Route 9 show that the highway needs to serve both local and regional trips, as well as to provide an identity to the communities along Route 9. There is a desire that future development be consistent with the character of the existing communities. Alternatives to driving were explored such as enhanced public transit. Land use policy, an interconnected road design and access to transit, walkways, and bikeways will need to be improved in order to meet these objectives.

The study indicates six guiding principles in regard to the land uses and the transportation within the study area. For each principle, the study gives specific strategies that could be implemented so that each principle is brought to fruition. The principles from this study are listed below.

1. Balance regional mobility and local access needs
2. Focus on improving capacity where it counts
3. Reconnect and enhance the street network
4. Strengthen community character
5. Provide alternatives to the car
6. Match growth to infrastructure locations

**Transportation and Land Use Issues & Recommendations**

The design and development of the Route 9 corridor has been such that it perpetuates car use and exacerbates traffic congestion along the highway. Route 9's southern section is transitioning from a rural arterial to a corridor of regional significance as it undergoes suburban development. The type of development that is being built is supported by a sparse network of new dead-end streets, some in gated communities, which force all local trips onto Route 9. The northern section of the Route 9 corridor contains a denser local urban road network but areas that have developed within the last several years are characterized by a lack of interconnected streets. Again, almost all local traffic ends up on Route 9.

According to the master plan for Route 9 the highway should balance the regional need for mobility with the local need for accessibility that reflects the community needs and the form of adjacent development. The master plan calls for enhanced connections to the Garden State Parkway and providing regional traffic a variety of choices in accessing the corridor through the Parkway. It also recommends that facilities which parallel the Parkway and Route 9 be improved to enhance the quality of connectivity.

Reconnecting and enhancing the street network overall within the corridor is an objective of the plan. The network would be built by making connections when new streets are created and by making connections between existing streets. Creating interconnected streets will allow many different facilities to share the traffic load with Route 9 so congestion can be reduced on the arterial. New local streets are to be neighborhood in scale so that motor vehicles travel at slow enough speeds to be compatible with increased bicycle and pedestrian activity. Where actual street connections are not possible, the plan urges that pedestrian and bicycle connections be built.

The existing land uses need an alternate local access and interconnected street network, so that local traffic is not dependent upon traveling on

Route 9 for every household trip. This will create a better balance between regional mobility and local traffic, in accordance with the first principle, while supporting the third principle of reconnecting and enhancing the street network. Interconnectivity and a redesign of key portions of Route 9 that serve as community centers will provide for better pedestrian options and alternatives to automobile uses, while strengthening the community character, the fourth principle, through mixed-use development and opportunities for community development.

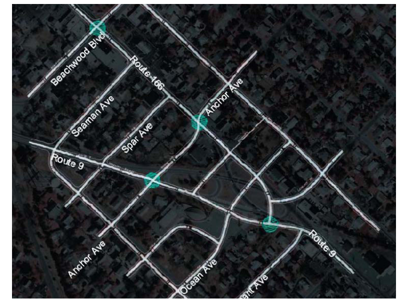
Some intersections in both the northern and southern sections of the Route 9 corridor are experiencing unacceptable levels of service (LOS). Recommendations suggest a number of conventional options, such as widening, to improve intersections and newer options such as replacing traffic signals with modern roundabouts that would increase capacity and safety for motorists and pedestrians. Some of the options being considered look to rationalize the block structure to create a more complete system of interconnected local roadways. Improving the grid system would create land for development and redevelopment in a town center format and result in walkable urban blocks.

**Transportation Strategies & Measures of Effectiveness**

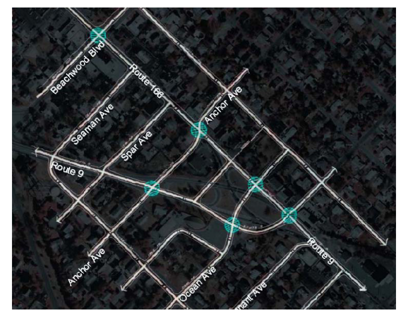
One of the major objectives of the plan is to focus on improving capacity where it counts. Consistent with smart growth principles the NJDOT and the Route 9 corridor partners determined that rather than adding capacity to the entire roadway which could encourage speeding and result in excess capacity, capacity should only be increased at critical intersections or nodes. A range of low-impact solutions are offered that are proven to be more effective over time than more extensive widening solutions as demonstrated by preliminary analysis of current and future traffic conditions. Solutions that result in increasing the connectivity of the roadway network in the northern and southern portions of the study area are presented below.

**North Corridor Intersections**

**Route 9/Route 166 in Beachwood.** This interchange is currently a large intersection with jughandles. Option A would create a network solution to the Route 9 movement as a priority move. This option would restore much of the original network of streets around Route 9/Route 166 as practically possible. It would provide more route options and more intersections to travel through as well as additional turning movements along and between Route 9 and Route 166. The network solution would reclaim some of capacity of Route 9 and developable land along the highway and create a series of new streets and walkable blocks. Option B is similar to Option A, but it would prioritize the Route 166 traffic flow. Option C is a split roundabout that would allow Route 9 to remain while Route 166 connects to a roundabout. This option has similar advantages to Options A



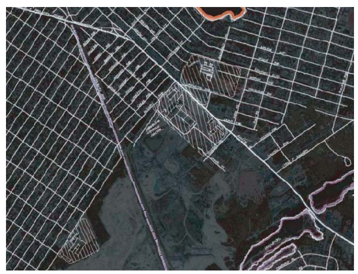
*Option A (Courtesy of Glatting Jackson)*



*Option B (Courtesy of Glatting Jackson)* and B. Option C would accommodate more than 1300 vehicles per hour in the afternoon peak period.

*Option C (Courtesy of Glatting Jackson)*

**Mizzen Avenue/Route 9 and Washington Avenue/Route 9 in Beachwood and Pine Beach.** These two intersections are currently entangled. The improvement concept is to create a complete system of roadways that would connect to existing streets and reflect the current block structure to the north and south of the intersection. The new network would relieve traffic on Route 9 and create additional access to local properties and neighborhoods. It would also provide the framework for the development of a new town center.


*Mizzen Avenue Before (Courtesy of Glatting Jackson)*


*Mizzen Avenue After (Courtesy of Glatting Jackson)*

**Ocean Gate Drive/Korman Road/Route 9 in Berkeley Township.** The plan proposes to replace the signalized intersection. Option A calls for splitting Route 9 into a one-way pair so it creates a block and street pattern. Option B would replace the traffic signal with a modern roundabout that would accommodate high volume streets with slower moving traffic. Option C would replace the signal with a split roundabout and Route 9 would traverse the middle. It may be more efficient than Option B.

*Option A (Courtesy of Glatting Jackson)*

*Option B (Courtesy of Glatting Jackson)*

*Option C (Courtesy of Glatting Jackson)*

**South Corridor Intersections**

**Route 9/Green Street in Tuckerton.** There are three options to relieve congestion at the intersection of Route 9 and Green Street. Option A would re-stripe Green Street to accommodate turn lanes for traffic approaches where there is heavy volume. Delay would decrease from 55 seconds (Level of Service E) to 33 seconds (LOS C). However, this option would not serve long term traffic needs projected to 2025. Option B would widen Route

9 at the intersection and re-stripe Green Street or widen Route 9 at the intersection by adding right-turn lanes on the north and southbound direction of Route 9. This widening scheme would offer long-term congestion relief by reducing delay to 33 seconds (LOS C), but there would be significant impacts to adjacent properties. Option C would replace the signal with a modern roundabout which serves high volume traffic at lower speeds. It would also complement the downtown area of Tuckerton and provide a safer environment for pedestrians and cyclists. The roundabout would function at LOS D with a delay of 42 seconds. Using a roundabout would redistribute local traffic and allow Green Street to remain a serviceable connection to the Garden State Parkway and to nearby residential areas.

*Option A (Courtesy of Glatting Jackson)*

*Option B (Courtesy of Glatting Jackson)*

*Option C (Courtesy of Glatting Jackson)*

**Route 9/Bay Avenue and US 72 in Stafford Township.** There are three options to relieve congestion at this intersection. Option A would widen Bay Avenue and Route 9. Delay would be reduced dramatically from 200 seconds to 35 seconds based on current year traffic. However, delay would rise again, according to 2025 traffic projections, to approximately 125 seconds (LOS F). Option B would separate interchange traffic from each intersection and a new roundabout would replace the traffic signal at Route 9 and Bay Avenue. Short term and long term delay is significantly reduced to 14 seconds and 40 seconds, respectively. The roundabout would accommodate traffic yet slow it down in the area. Option C also provides increased connectivity within the local street system and it provides access to support adjacent land uses.

*Option A (Courtesy of Glatting Jackson)*

A second objective of the plan calls for strengthening community character and one way to accomplish this is to introduce urban design guidelines that shape how centers can grow in urban and suburban areas. The conceptual plan suggests that future development support pedestrian-friendly environments. In the plan a desirable pedestrian environment that

*Option B (Courtesy of Glatting Jackson)* also allows for the movement of traffic is defined as a block perimeter of no more than 2,400 feet. Based on typical requirements of commercial buildings and block standards throughout the U.S., this perimeter guideline yields block sizes of between 250 feet to 350 feet by 500 feet to 700 feet. The concept plan suggests that these design guidelines serve local jurisdictions along Route 9 as they refine their land development regulations and comprehensive plans.

A third objective is that the street network be reconnected and enhanced. The plan explains that a connected street network will allow many different facilities to share the traffic load thus taking pressure off of Route 9 and providing for a more walkable environment. Connecting roadways within neighborhoods and planning for existing streets to connect to new developments is considered to be an important action.

**Lessons Learned**

The lessons of this study highlight the importance of designing and constructing residential neighborhoods that are connected via roadways, pedestrian walkways and bikeways to provide for multi-modal transportation between various locations. When residential area are cut off from other residential neighborhoods and commercial uses, the overall community suffers. When the highway becomes the dominant feature of the region upon which residents are dependent for most of their travel, all activities and community interaction suffer. Greater interconnection of communities and roadways would allow for economic growth within the Route 9 corridor and the development of pedestrian oriented community centers.

## Route 29 Waterfront Boulevard Study, Mercer County

**Description of Study Area**

The study area for this project encompasses an area of Route 29 within Trenton from Route 1 to Sullivan Way, a total of three miles. The study area encompasses the residential neighborhoods of The Island, Parkside West, Berkeley Square and West End and the downtown area surrounding the State House office complex.

North of the study area, Route 29 is a four-lane road to Interstate 95 where

*Route 29*

it becomes a two-lane road along the Delaware River and Delaware Raritan Canal, connecting historic river communities. South of the study area, Route 29 becomes Interstate 195 at its intersection with Interstate 295. Historically, the section of Route 29 within the study area was a pedestrian boulevard, or a parkway, surrounded by a passive park. The Delaware Raritan Canal was parallel to Route 29, even with the park between them. In 1959 and 1960 the park and the canal were built over when Route 29 was transformed into a highway and the State government expanded its offices.

### Study Progress and Status

In recent years, there has been a number of studies conducted reviewing the ability to return Route 29 to a boulevard and provide interconnected street networks along the waterfront in Trenton. The study performed by the consultant team of Vollmer, Glatting Jackson, and ACT Engineers looked at ways the state could improve pedestrian access to the waterfront, provide traffic calming methods along Route 29 and a street network design for downtown Trenton. The leaders of this study worked to coordinate with the many organizations involved in the other studies, particularly the City of Trenton and the Capital City Redevelopment Corporation.

The project kickoff meeting took place in September 2004. Stakeholder interviews, meetings with key staff, and public workshops occurred during the month of October and a draft presentation was made in December 2004. Two final community input sessions were held in January and February 2005. The consultants provided land use and transportation analyses as part of the final report.

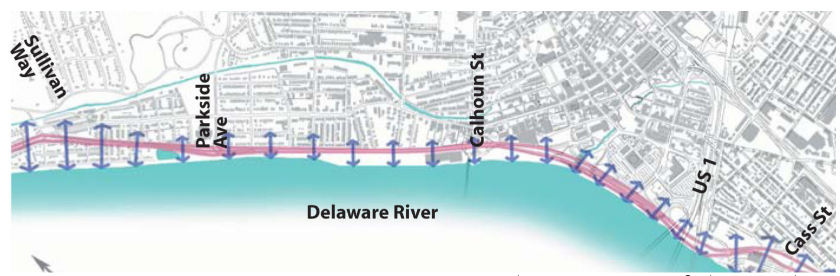
### Community Objectives

The plan introduces a conceptual design that creates an interconnected system of local streets using Route 29 as the spine of a new roadway network. Following are the themes from the plan that address interconnectivity:

**Create a network.** With the new boulevard as a centerpiece in the redesigned roadway network, a new system of interconnected streets will provide route and travel options for drivers, pedestrians and bicyclists.


*Create Network (Courtesy of Glatting Jackson)*

**Reconnect to the river.** Route 29 should reconnect Trenton's neighborhoods and downtown with the river through a transportation network that accommodates motor vehicles, pedestrians and bicyclists.




*Reconnect to the River (Courtesy of Glatting Jackson)*

**Strengthen established areas.** A network of local streets will share the traffic load with Route 29 as an urban boulevard.

**Facilitate change in redevelopment areas.** A connected network of streets and a reconfigured Route 29 will provide opportunity for redevelopment activities.

**Design the streets to fulfill desired roles.** The boulevard and the new street system should be designed to serve the desired orientation of buildings and to support pedestrians.

**Transportation & Land Use Issues and Recommendations**

Transportation issues in the study area include the need to maintain the function of Route 29 and the local street network while enhancing safety by reducing motor vehicle speeds. In addition, there is a need to increase connectivity in the city particularly linkages to the waterfront. The concept plan would convert Route 29 to an urban boulevard by installing traffic signals and/or roundabouts, connecting the side streets to Route 29, installing at-grade pedestrian crosswalks, adding street trees and narrowing the pavement. These improvements in conjunction with lowering the speed limit should reduce the speed of traffic along Route 29 making it safer and more pleasant for both drivers and pedestrians. Current motor vehicle traffic would be rerouted on the street network to accommodate proposed redevelopment activity in downtown Trenton.

The community seeks to redevelop the waterfront area of downtown Trenton, redevelop the existing residential neighborhoods along Route 29 to the north, and design a street network that will allow for the same flow of traffic, while allowing for increased pedestrian access to Route 29. To achieve these objectives, the concept plan calls for improvements in the roadway connection to the City street network and the existing block pattern which was compromised when Route 29 was converted into a freeway. Reinstating this street network would strengthen the existing residential neighborhoods and the downtown core, which in turn would positively affect Trenton's revitalization efforts. The findings from the study show that there are many intersections that would benefit from greater pedestrian access.

Further south in downtown Trenton, the study has two options proposed for Route 29. Both continue Route 29 as an urban boulevard with a center planting strip and parking on both sides of the street. The existing road network would be modified into a grid pattern so the existing parking lots could be utilized as developable land.

The first version recommends that Route 29 be modified into a waterfront boulevard, in which case Route 29 would remain adjacent to the Delaware River. The waterfront boulevard cross section would have a total of four travel lanes at 11 feet each, with a center planting strip. There would be an 8 foot parking lane on both sides of Route 29. On the building side of Route 29, there would be an 18-foot walkway with shade trees and on the river side there would be a strip of shade trees, a 10-foot walkway, a variable width planted area and a variable width river walk.

The second version, the urban boulevard alternative, would bring Route 29 in from the Delaware River, with crosswalks and enhanced pedestrian connections to get to the proposed river walk. The cross section for this alternative proposes a 111 foot right-of-way that would include the four travel lanes at 11 feet each, two parking lanes on each side at 8 feet each, and sidewalks with shade trees on both sides at a width of 18 feet. Parking garages are proposed as part of the development to occur on the existing parking lots.

**Transportation Strategies & Measures of Effectiveness**

A preliminary analysis of the traffic impacts of the boulevard concept was completed for the concept plan. It was assumed that the redevelopment of Trenton would not significantly increase existing traffic volumes; thus, existing traffic volumes were used to base future traffic conditions. This was assumed because traffic conditions are constrained today during peak hours. Also, it was assumed that additional trips generated by new more intensified land uses would be captured by alternative modes, shorter trips and internal downtown trips. A travel time was projected the Route 29 corridor using SimTraffic Simulation software. In the morning peak hour it was projected that the total corridor travel time would increase by about two minutes and during the afternoon peak hour that it would increase by approximately one minute. These increases are negligible by all standards, but they are also welcome because slowing down the high speed of traffic in downtown Trenton is an objective of the plan.

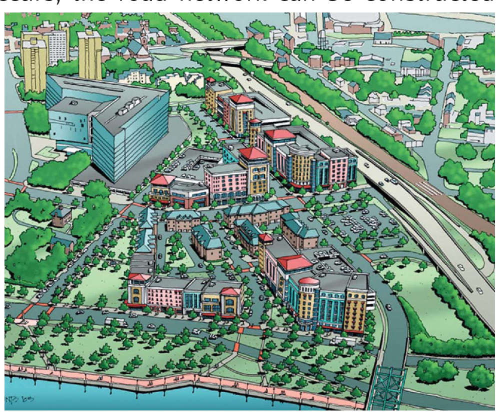
Clearly, connectivity is a goal of the plan and the enhanced connectivity of the street system in this plan increases route options and supports multimodal travel. The Calhoun Street interchange is currently the only full access interchange that provides motorists with opportunities to access West State Street, an important roadway that parallels Route 29. The concept plan recommends the addition of intersections at Hermitage Avenue and

*Waterfront Boulevard Concept (Courtesy of Glatting Jackson)*

Delawareview Avenue to provide additional travel options in the roadway network. Regarding pedestrian travel, the concept plan explains that the Route 29 boulevard will remove fences and bridges that currently keep residents from reaching the waterfront easily. Sidewalks and pathways will be provided to encourage walking. Eight new signalized pedestrian crossings would be provided to improve access to a new waterfront park connecting to Stacy Park to the north and Mercer County's Riverfront Park to the south. The new waterfront park would then create a continuous park along the Delaware River in Trenton. Bicycle use would be encouraged within the continuous park. Transit would be easier to provide and reach because of the boulevard and its series of interconnected streets. In addition to realizing transportation benefits, the concept plan uses increased connectivity and an enhanced grid network to free land currently being used by the freeway for land development and redevelopment opportunities.

**Conclusion**

The study concludes with a review of the benefits of multi-modal transportation and lessons learned. One of the lessons of this study is to coordinate the land use development decisions and the road network design, so that when development occurs, the road network can be constructed at the same time. This is an important lesson since land use decisions often occur faster than decisions regarding transportation infrastructure.



*Proposed Buildout (Courtesy of Glatting Jackson)*

It is important to include all stakeholders and development representatives during the development process, so residents and stakeholders do not become disenfranchised. The design of the street network reinforces the importance of an interconnected street network that is built at the pedestrian scale. When Route 29 was built as a limited access freeway, the residents of four neighborhoods were cut off from each other and a large natural resource. These communities lost the intrinsic value that multi-modal transportation and the connection to the Delaware River gives to a community. With the street network as it is envisioned in the concept plan these communities will regain these assets.

## Route 31 Land Use and Transportation Plan, Hunterdon County

**Description of Study Area**

The study area focuses on the Flemington Circle and the surrounding areas in Raritan Township and Flemington Borough. The northeast border of the study area follows the South Branch River, which is the border between Raritan and Readington Townships. Flemington Circle is the historic junction for Routes 31, 202 and 12 within Hunterdon County. It is an early 20th century traffic invention that now results in significant congestion along these highways. The intersection of highways at the circle continues to make the area an attractive location for commercial development. Existing development on Route 31 includes a mix of homes, older strip commercial development, and recent commercial and office development.

**Study Progress and Status**

The South Branch Parkway study conducted by the consulting firms McCormick Taylor and Glatting Jackson began in May 2004 and has employed an integrated approach to review the land use and transportation challenges facing this section of Hunterdon County. Stakeholder interviews, design workshops, and establishment of an advisory group composed of representatives from the political entities within the study area have been the three main methods used to understand local planning issues.

The Advisory Group met twice during the initial planning process. It is anticipated that the group will participate more as the final plan is prepared. There have been a total of four design workshops. The first two workshops were prior to the completion of the Draft Framework Plan in July 2004 and the two most recent design workshops were in preparation for the next steps of the South Branch Parkway Land Use and Transportation Plan. Since the Draft Plan was developed, Robert Charles Lesser Company, a real estate consulting firm, completed a market analysis to determine the future development pressures faced by Raritan Township and Flemington Borough. The analysis showed that the highest demand for land is for residential development and that the area will face increasing demand for higher-density residential development.

*Design Workshops (Courtesy of Glatting Jackson)*

**Community Objectives**

The stakeholder interviews, design workshops and meetings of the Advisory Group have led to a set of community objectives that include defining an edge between the urban and rural development patterns in this area and connecting the existing street network with proposed development. This expanded street network is intended to include sidewalks and bikeways in order to support alternate forms of transportation. Community objectives include preserving open space along the South Branch River, preserving farm land within the region, and the creation of a greenway corridor that promotes passive and active open space with adjacent schools, cultural and historic resources.

**Transportation and Land Use Issues and Recommendations**

The Flemington Circle has developed from a simple confluence of roadways into a major suburban commercial hub. The existing land use patterns within the corridor range from the historic mixed-use grid pattern of Flemington, to the commercial strip development in Raritan Township along Routes 31 and 202, to the farmland and suburban residential development between the highways. The existing development at the circle was designed primarily for access by automobile and not by pedestrians, while the land use and traffic pattern within downtown Flemington supports a mix of commercial and residential uses. This latter pattern is of a scale both people and motor vehicles can use.

The existing traffic pattern, along with the increased commercial development, contributes to the area's traffic congestion. A redesign of the street network in the area may be appropriate to enhance pedestrian accessibility of the commercial uses and provide alternatives to automobile traffic. Local officials and residents are particularly interested in increasing access to developing activity centers such as major medical facilities and retail areas by creating a grid-like street system that supports walking and taking transit.[7] The development of the Hunterdon Medical Center at Bartles Corner, north of Flemington at the intersection of Route 612, increases the need for greater street connectivity; otherwise, Routes 31 and 202 will see an even greater increase in traffic congestion as this area is built out with large-scale commercial uses.

In the past, NJDOT proposed a Flemington Bypass and a grade-separated interchange for the region in order to relieve the congestion at the circle and along Route 31. Over the past several years, as a product of this study, NJDOT has proposed an alternative to the bypass, the South Branch Parkway, a scaled-down version of the roadway, located to the east of Route 31 that would provide access to the undeveloped land between Routes 31 and 202 and the South Branch River. A series of interconnected streets would be created in tandem with the Parkway. As conceived, the Parkway and the new network of streets would distribute the area's traffic to a large number of streets and intersections avoiding an accumulation of traffic on any one street.

The stakeholders have expressed that maintaining connections to the natural environment along the South Branch River is an important objective of the land use and transportation plan. Open space, either as an active recreation facility or as a passive trail system, can add value to properties and communities. The river has played an important role in the region's transportation history and it should continue to play a part by connecting the region with pedestrian trails and canoe launches.

*Transportation Network (Courtesy of Glatting Jackson)*

[7] *Interview, Tara Braddish, Executive Director, HART Commuter Information Services, January 25, 2006.*

**Transportation Strategies**

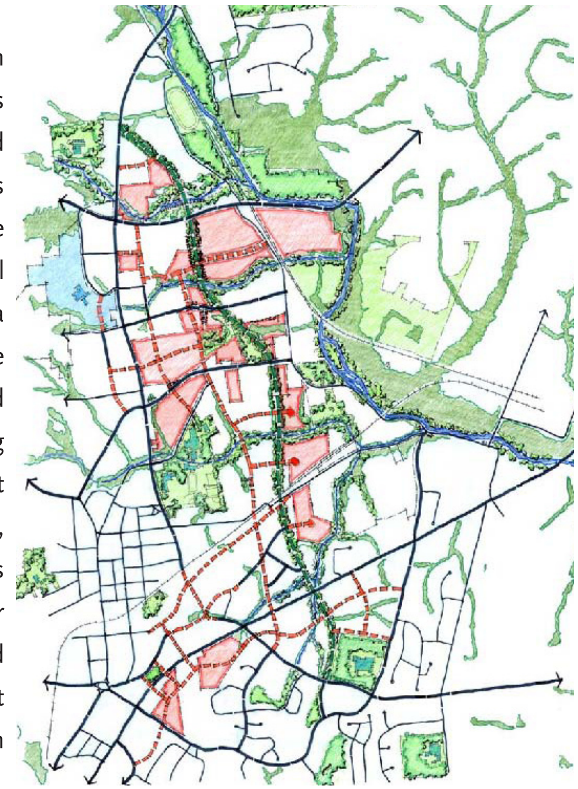
As with the plan for the Route 29 Boulevard, connectivity is a key goal of the Route 31 plan. By promoting enhanced connectivity of the street system, the plan seeks to increase route options and support multimodal travel. The conceptual design relies on a new South Branch Parkway, a series of parallel roads and a new interconnected system of local streets. The South Branch Parkway along with a new network of local streets would distribute traffic more evenly because there would be a larger number of streets and intersections to travel on. It would also provide the opportunity for a range of new transportation alternatives. Both benefits would help to organize future development patterns and support sustainable growth. The plan's framework addresses interconnectivity by promoting an expanded street network. The network would provide for increased interconnectivity for local traffic and provide amenities for pedestrians and bicyclists. The South Branch Parkway would be linked to the proposed street network with intersections at key locations.

**Lessons Learned**

The lessons learned from the experience of the Route 31 region are similar to those seen in other rapidly growing suburban areas. When guiding the land uses and development of a region, it is important to recognize the existing, historic land uses, as well as the competing needs of new development. The properties available for development, as well as those under pressure to develop, should be incorporated into the land use and transportation plan, so an extensive street network can be designed prior to development. Once a plan is designed, it is possible to build this interconnected street network and other infrastructure, as the projects are approved and built, rather than after the fact when the negative effects of such development are felt on area roadways.

For the Flemington area specifically, connecting and expanding the local street network as proposed in the South Branch Parkway is more cost effective, promotes the use of multiple modes of transportation, and allows for alternate routes. It will also aid in alleviating the traffic pressure on Route 31 and the Flemington Circle.

The Flemington/South Branch River area has a unique history and environment. It is important to preserve the historic and natural resources within a community at the same time enhanced connectivity is being pursued. As street networks are created, pedestrian connections to stream corridors or other resources should be included as part of the transportation planning process.



*Framework (Courtesy of Glatting Jackson)*

# VI. New Jersey Initiatives to Support Connectivity

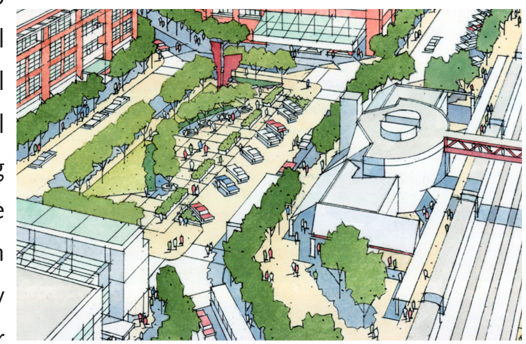
## New Jersey FIT: Future in Transportation (NJFIT)

New Jersey's Integrated Land Use and Transportation Studies (ILUTS) being conducted across the state are part of a comprehensive public communications initiative called New Jersey FIT: Future in Transportation (NJFIT) to help communities understand the relationship between building more and wider roads and increased development. NJDOT wishes to break the cycle of building wider roads that simply generate more sprawling development that creates the need to build even large roads. To accomplish this, NJDOT wants to work with municipalities and residents to build a transportation system that works with local land use decisions so that communities can continue to grow in ways that support the goals of the New Jersey State Development and Redevelopment Plan. NJDOT wishes to design roads to reflect the context of the community and to support community growth and development that is more compact and efficient.

The NJFIT initiative features a set of guidelines to support this new vision, and one of the underlying principles is to enrich the local roadway structure so that it connects various types of land uses and supports alternative modes of transportation. The NJFIT initiative supports the strategy of employing a grid-like system of connected streets that will increase accessibility by all modes and reduce the distance between destinations. The NJFIT initiative advocates for more connections by limiting the size of blocks and increasing the number of intersections that would create shorter trip distances, reduce the number of vehicle miles traveled, and encourage people to walk and cycle instead of drive. In addition, the NJFIT initiative proposes to reduce the width of streets to make them safer for all users. Narrower streets cause traffic to slow down and thus create an environment in which there are fewer crashes. Finally, the NJFIT initiative discourages dead-end streets and cul-de-sacs that funnel all local traffic to a limited number of arterials.

### Transit Village Initiative

One variant of greater street connectivity and its ability to enhance mobility comes in the form of transit friendly development around commuter rail stations and other large transit hubs. This form of development, also known as Transit Oriented Development (TOD) or Transit Villages, can be comprised of redevelopment of existing town centers, or the development of new town centers that incorporate transit into their design from the earliest stages of project development. A Transit Village is a densely developed community centered on a transit hub such as a commuter rail station, a Metro or light rail station, or a bus intermodal center. Though each existing or planned Transit Village is unique, the common foundation is a community that is designed in a manner that allows for a wide range of trips to be made without an automobile. There are many benefits of this form of connectivity for all modes of transit.



*Hamilton Vision Plan - Hamilton Township, NJ*

One key element of this community design is a strongly connected grid based street network, with sidewalks, that provides greater connectivity for pedestrian and bicycle trips. This allows for pedestrian or bicycle access to the center of the community, the train station or transit hub, for both work and recreational trips. Paired with the grid based street network is a focus on dense mixed use development that allows for the completion of multiple tasks on a single trip. As an example, accessible ground level retail at street level would allow a person who has gotten off a train at the commuter rail train station to stop off and purchase food for their dinner, pick up their dry cleaning, and perhaps even take a book out of the library, all on their walk home from the train station. In a typical suburban development, these tasks would very likely require an automobile, with each task often requiring a separate trip. Some transit oriented development also include a day care center, which often allows working parents to complete the second leg of their work trip, dropping off and picking up their children from day care, without the use of an automobile. Other TOD have mixed-use development placing residential, office and retail bringing both transit origins and destinations in proximity to transit services.

The NJDOT, in cooperation with a number of other state agencies, including NJ TRANSIT, has an active Transit Village Initiative. The focus of the program is to provide implementation support, in the form of financial and technical assistance, to municipalities throughout New Jersey who are interested in using their transit hub as a catalyst for development or redevelopment. Upon review of an interested municipality's application by an inter-agency Transit Village Task Force, the municipality may be designated as a Transit Village based on a range of criteria that reflect the municipality's commitment to the principles of transit-friendly or transit-oriented development. Generally, designated municipalities have demonstrated a commitment to revitalizing and redeveloping the area around its transit facility into a compact, mixed use neighborhood with a strong residential component.

*Broad Street Vision Plan - Newark, NJ*

Specific criteria considered by the inter-agency task force when determining whether to designate a municipality a Transit Village include:

- A commitment to growth in jobs, housing, and population
- The existence of a transit facility
- Vacant land and underutilized buildings within walking distance of the transit hub
- An adopted land use strategy for achieving compact, transit supportive, mixed use development within walking distance of transit
- "Ready-to-go" projects with at least one transit-oriented project that can be completed within three years
- Demonstrable pedestrian and bicycle friendliness, including clear and direct pathways from the transit station to shops, offices, surrounding neighborhoods, and other destinations
- A view of the transit station as the focal point of the community, including utilizing the station plaza as a gathering place for community activities such as festivals

There are over a dozen designated transit villages throughout the state, and many are centered on a NJ TRANSIT commuter rail station, although not exclusively. To supplement these existing Transit Villages, NJ TRANSIT has an extensive outreach program that focuses on municipalities that have expressed interest in moving toward a Transit Village designation. This outreach includes communicating the advantages of a Transit Village designation, assistance in completing station area plans, assistance in developing land use codes, and assistance in developing urban design guidelines. With a very dense commuter rail network throughout the state and an extensive bus system and light rail operations, NJ TRANSIT sees great opportunity for the expansion of Transit Villages. Additionally, NJ TRANSIT provides planning assistance to municipalities under their Transit-Friendly planning program. As of mid 2005 there were transit-oriented developments underway in Rutherford, Princeton Junction, Camden, and Morristown, New Jersey. All plans recommend a mix of land uses proximate to transit services.[8]

[8] *Transit-Friendly Planning Activities, Transit-Oriented Development in New Jersey, NJ TRANSIT, May 2005.*

## VII. Strategic Direction

The NJDOT and NJ TRANSIT are already undertaking many activities to support the planning principles of the State Development and Redevelopment Plan which direct investments to develop and redevelop centers. This technical memorandum demonstrates how encouraging interconnected streets supports these principles.

NJDOT should continue its support of connecting local street systems to provide transportation choices and to build communities. Indeed, one strategy that is recommended by *Transportation Choices 2030* is to improve connectivity on local roadway networks. Similar principles may be found in the SDRP and in the principles of smart growth. Providing a system of interconnected streets eases the strain on main arterials, and reduces vehicle miles traveled, trip length and travel times. Together with supportive urban design, a system of interconnected streets facilitates biking, walking and taking transit. It can also create greater efficiencies for emergency and municipal service providers. In addition to these benefits, a system of interconnected streets can help communities grow in ways that are center rather than sprawl-oriented.

NJDOT and NJ TRANSIT have developed a series of goals, policies, strategies and actions as framework for *Transportation Choices 2030*. The discussion below presents the basis for supporting statewide policies and strategies regarding interconnected streets.

## Goal: Integrate Transportation & Land Use Planning

### Policies: Champion Smart Growth & Create Better "Tools"

One of the major goals of the new long range plan is to integrate transportation and land use planning. Over the past several years, the NJDOT and NJ TRANSIT have engaged in activities and programs that mutually support both community building and the development of a more effective and efficient multimodal transportation system. These activities and programs are beginning to have beneficial results in New Jersey as they encourage the state to grow in smart, sustainable ways as advocated by the State Development and Redevelopment Plan. *Transportation Choices 2030* recommends that the momentum for integrating land use and transportation be accelerated through specific strategies and actions to champion smart growth and to create better tools to implement it.

A strategy of the long range plan is to adopt a multi-modal corridor management approach with state, regional, county and local partners. One of the actions related to this strategy is to work with the metropolitan planning organizations (MPOs) to identify and prioritize corridors. In order to support the development of interconnected street networks the MPOs could use whether or not a proposed project develops a more robust local roadway system as one of the criteria that it uses to prioritize projects for advancement and funding. Likewise, NJDOT could use similar criteria as part of the capital programming process. In both instances, projects that aim to increase connectivity for all types of travelers, in particular making it safer for pedestrians, cyclists and transit users, should receive a credit when making choices about which projects to fund and develop.

The long range plan recommends changes to statutes for consistency with the growth management principles of the SDRP. In this regard, a specific action calls for advocating that circulation elements be required in municipal master plans and that smart growth criteria be established for these elements in the Municipal Land Use Law (MLUL). One of the smart criteria that could be developed would be standard block lengths, perimeter requirements or a connectivity index. Each of these criteria could be stratified or could vary according to the intensity of land uses from rural to suburban to urban areas or according to SDRP Planning Areas and/or types of centers. In addition to criteria that would assist towns in measuring and implementing connectivity, there are related actions or criteria that should be considered as a necessary adjunct to increased connectivity in circulation plans. Plans should address maximum local street widths, and cul-de-sac and dead-end street restrictions. A recommendation is for NJDOT to initiate a project that would develop appropriate criteria for different levels of development keyed to the SDRP Planning Areas and the various sized centers. In addition to these criteria, the MLUL could require that the official map of a municipality illustrate how stub streets would eventually connect in municipalities.

Another strategy of the long range plan is to continue to promote development that is predicated on the existence of public transportation. NJDOT could supplement the criteria used to designate Transit Villages by requiring that a connectivity index be added to local zoning and/or redevelopment plans. NJDOT requires municipalities to prepare a Statement of Qualification application for a municipality to be considered for designation as a Transit Village. Among the essential criteria in the application for Transit Village designation is an adopted zoning and/or redevelopment plan based on transit-oriented development principles. Towns that have such zoning or redevelopment plans have accompanying site design guidelines and details that support compact form and walkable environments. Guidelines and details that make walking desirable provide appropriate pathways, and offer development that is human-scaled, accessible and attractive. In terms of connectivity, plan details that support walkability and connectivity also include a grid or modified grid network or maximum block lengths. To supplement these details, NJDOT could require that a local plan contain a connectivity index so that future development must meet a relatively high ratio of street links to nodes in order to be considered worthy of Transit Village designation.

NJDOT defines a successful Transit Village as one that has a complementary and compatible mix of transit-supportive land uses developed in a compact and walkable manner. NJDOT, in partnership with NJ TRANSIT, could establish a connectivity index that would be the minimum threshold that would support transit oriented development. The development of this index could be based on research about the presence and use of connectivity indices in New Jersey municipal land development ordinances and the level of connectivity typical in varied types of New Jersey communities. This threshold could then become the minimum required index that would be incorporated into local land regulations in order for a municipality to obtain Transit Village designation.

In addition to creating Transit Villages in well-developed centers, there is an opportunity for NJDOT and NJ TRANSIT to help establish new centers. This would occur by ensuring that planning for transit services happens early in the development planning process. An attractive complement to current planning assistance would be to work with municipalities that have large-scale new developments planned or underway, in order to improve the transit friendliness of these developments. It is understood that there are limited staff resources available at NJDOT and NJ TRANSIT to be involved in all of the new developments occurring in the state, but there can be a benefit from involvement in some of the larger developments throughout the state. This can be implemented through a modified State Highway Access Management Code that requires transit access where needed and incorporates a NJ TRANSIT review of access applications and site plans. In some instances these developments are already being designed with many of the elements of transit villages already in place, including a grid street network, mixed use development, and other pedestrian friendly components.

Often, however, these developments do not move forward with transit in mind. For instance, they are often designed without consideration of space requirements for transit stops, or street width requirements for transit vehicles. Preliminary design of these new developments is the ideal time to ensure that space for future transit stations or stops is incorporated up front. It is also the ideal time to ensure that streets are developed with sufficient width for transit vehicles, and that pavement sections are sufficient to handle heavier transit vehicles. Finally, early NJ TRANSIT involvement can ensure a transit service design that meets the needs of new residents and businesses. Involvement in new developments would come in the form of review of current plans and direction to developers on the type of transit supportive designs elements that should be incorporated into new developments.

## Goal: Improve Mobility, Accessibility, Reliability

**Policies: Counter Congestion with Multimodal Solutions & Improve Connections**

Another goal of the long range plan is to improve mobility, accessibility and reliability of the transportation system in New Jersey. *Transportation Choices 2030* recommends that the state continue to find ways to address congestion by increasing the attractiveness of transportation options and local routes for travel. Several strategies that support this goal relate to increased connectivity on streets.

The long range plan contains a strategy to support walking and bicycling as alternative ways to travel. This strategy calls for action to reform land use planning policies, ordinances and procedures to maximize opportunities for walking and bicycling. Research shows that a grid-oriented street system can increase walking and cycling trips by adding needed infrastructure that increases access to local destinations. However, the design of a community is important to increasing the share of travel by these modes. Pedestrians and bicyclists need attractive and serviceable environments and there has to be a reason to make the trip; a variety of destinations within reasonable distances creates the desire to travel in the first place.

Form-based zoning codes which are based on smart growth principles can offer a planning tool that provides plans and standards that determine where and how sustainable growth can be implemented. Such codes are important because most of the current municipal zoning ordinances segregate land uses and support street hierarchies that work against connectivity and the creation of mixed use centers and thus do not support walking and bicycling. Form-based codes, which illustrate and set standards for all elements of building towns, including streets, help towns to create interconnected street networks to disperse traffic and to reduce automobile trips. At the same time, such a network supports appropriate mixed-use densities and alternate means of travel. NJDOT should fund the development of model form-based codes that would complement the SDRP Planning Areas and centers and provide them as guidelines to municipalities that wish to grow in a manner more consistent with the SDRP.

The long range plan includes a strategy to improve connectivity on local roadway networks. NJDOT proposes to encourage municipalities to increase connectivity by working with municipalities and developers. Presumably, if municipalities can create more grid-like street patterns then local traffic can be redistributed to local streets and capacity for through trips can be preserved on arterials. Congestion should ease on major roads as traffic destined for local destinations would have many different travel routes from which to choose. Additionally, improving the local street network should provide more opportunities for shorter and more direct pathways for pedestrians and cyclists, also helping to ease congestion. NJDOT is already working with individual municipalities that are located within the corridors that are being studied under the Integrated Land Use and Transportation Studies (ILUTS) to plan comprehensively for growth and increased street connectivity. NJDOT should expand this approach beyond the current ILUTS studies and offer technical assistance and information to all municipalities that wish to codify it. Besides technical assistance NJDOT should help municipalities educate the public about connectivity and work with stakeholders to build consensus.

## Table 1: National Case Studies for Connectivity

| COMMUNITY (Adoption Date) | IMPETUS | ISSUES | REQUIREMEMNTS/ SPECIFICATIONS | IMPLEMENTATION/ PROGRESS | RESULTS/ EFFECTIVENESS | LESSONS/ COMMENTS |
|---|---|---|---|---|---|---|
| **METRO, Portland, OR Area (1997)** | • Perceived need to reduce reliance on arterial streets and to promote bicycle and pedestrian movements and transit. | • Adopting ordinance not as controversial as implementing it.<br>• Exceptions for environmental constraints.<br>• Emergency services strong supporters.<br>• Preparation of map for future connections controversial. | • Street connections no more than 530' apart.<br>• No more than 28' local streets.<br>• Cul-de-sacs only 200'. | • Communities have been implementing standards.<br>• Prepared map of future connections. | • Higher number of connections did not affect LOS.<br>• Regional model data showed connection benefits. | |
| **Portland, OR (1998)** | • Adopted METRO Plan.<br>• The Portland Transportation System Plan (2002) includes policy on connectivity to improve arterial street capacity, enhance mode choice, improve emergency response time, and reduce traffic volumes by spreading out traffic. | • Most of City built out and development is infill.<br>• Did not face opposition from residents or developers. | • Street connections no more than 530' apart.<br>• No minimum street widths.<br>• Dead end streets are allowed, but not more than 200'.<br>• Allows private and gated streets. | • Standards have only recently been adopted.<br>• Master street plan shows conceptual and detailed level of streets. | | |

| COMMUNITY (Adoption Date) | IMPETUS | ISSUES | REQUIREMEMNTS/ SPECIFICATIONS | IMPLEMENTATION/ PROGRESS | RESULTS/ EFFECTIVENESS | LESSONS/ COMMENTS |
|---|---|---|---|---|---|---|
| **Beaverton, OR (1998/2002)** | • Adopted METRO Plan.<br>• Give residents more mode choices to avoid local arterials.<br>• Traditional neighborhood design movement.<br>• Construction of light rail line.<br>• Future of regional growth boundary. | • Developers not upset with requirements because were allowed to review and comment.<br>• Cut-through traffic, but responded with traffic calming and narrower streets. | • Local street connections no more than 530' apart.<br>• Connections to collector streets at 220' - 440' and arterials 660' - 1,000'.<br>• Street widths not indicated.<br>• Cul-de-sacs are allowed, but no more than 200'. | • Updated inventory of stub streets.<br>• Map of recommended street connections. | • Reasonably effective. | • Considerable education of residents. |
| **Eugene, OR (1996)** | • Improved emergency access and response time.<br>• Lower utility distribution costs.<br>• Effective mass transit service.<br>• Planning staff main impetus. | • Developers comply with little enforcement.<br>• Narrow streets help save developer costs.<br>• Residents were main problem.<br>• City won two court cases upholding connectivity. | • Connection in residential developments over one-half acre.<br>• Block length requirements apply to local streets only.<br>• Local street widths 20' - 34'.<br>• Cul-de-sacs no longer than 400'.<br>• Street stubs required.<br>• Address cut-through traffic with "T" intersections and traffic calming methods. | • Fire Department strong supporter.<br>• Developers can present alternate connections, however, few exceptions are allowed. | • Planning staff believes this will reduce traffic on arterial streets. | • Education lasted two years. |

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|---|---|---|---|---|---|---|
| **Fort Collins, CO (1999)** | • Rewrote land-use code.<br>• Reverse trends of winding street system with cul-de-sacs.<br>• Code implements vision of walkable community. | • Developers did not vehemently oppose standards.<br>• Fire Department supported requirements.<br>• Street stub requirements encountered difficulties from adjacent residents. | • Limiting block sizes to seven to ten acres.<br>• Establishing minimum connection intervals of 1,320' on arterials and 660' on local streets.<br>• Reduced street widths to 24' - 36'.<br>• All streets over 660' must have two outlets.<br>• Prohibits gated streets, but allows cul-de-sacs. | • Requiring specific traffic shed patterns to three arterials in three directions.<br>• Developer may submit alternative plan. | | • More success in new developments than infill neighborhoods. |
| **Boulder, CO (1996)** | • Adopted transportation master plan.<br>• To reduce arterial street pressure, achieve better sense of community, and encourage alternate transportation modes. | • Encountered no developer objectives.<br>• Residents in existing neighborhoods objected.<br>• Future connections identified. | • Space streets 300' - 350' apart.<br>• Allows narrow streets (20').<br>• Allows cul-de-sacs, but would like loops.<br>• Cul-de-sacs no longer than 600'.<br>• Private streets and gated streets not permitted. | | | • Educate public and leaders to connectivity benefits.<br>• Need for strong local leaders. |

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|---|---|---|---|---|---|---|
| **Cary, NC (1999)** | • Meets town's growth management plan.<br>• Wanted to control cul-de-sacs and require street stubs. | • Fire and Public Works support idea.<br>• Benefits for trash collection, utilities, emergency response, transportation compelling.<br>• No opposition to proposal. | • 1.2 Connectivity index with incentives for higher index.<br>• Connections of 1,250' - 1,500' apart.<br>• Cul-de-sacs of no longer than 900'.<br>• Private streets allowed, gated streets are not. | • Want to increase index to 1.4. | • Has helped city realize 20% savings in solid waste collection. | • Connectivity index has had impact on local streets, but not arterials. |
| **Huntersville, NC (1996)** | • Rapid town growth and potential loss of character. | • Not highly controversial.<br>• Developers felt it would not help them to meet market demands.<br>• Fire Dept. supported requirements. | • Called for short block lengths (250' - 500').<br>• Allows narrower streets (18') and 40' right-of-way.<br>• Prohibited cul-de-sacs and private streets.<br>• Allows, but does not require traffic calming. | • Community has accepted the standards.<br>• Educated the public and forged a common vision for future growth. | • Success in infill and new developments. | |
| **Cornelius, NC (1996)** | • Rewrite of land development code.<br>• Visioning process. | • Connectivity fairly well accepted.<br>• Large number of peninsulas and a nuclear power plant.<br>• Some builders fought ordinance, but community likes ordinance. | • Block lengths of 200' - 500'.<br>• Should provide at least two access routes to a location.<br>• Streets 20' w/ 15' curb radii.<br>• Alternatives to cul-de-sacs are encouraged and limited to 250'.<br>• Encourages on-street parking and traffic calming. | • Exceptions fairly frequent. | | • Emphasizes community and pedestrian aspects. |

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|---|---|---|---|---|---|---|
| **Conover, NC (1994)** | • Traffic congestion and poorly designed subdivisions.<br>• Staff showed good and bad designs to community. | • Developers and some residents opposed.<br>• Emphasized education and knowledge for two years. | • Max. block length of 400' x 1,200'.<br>• Cul-de-sacs allowed, but restricted.<br>• Private and gated streets prohibited.<br>• Requires street stubs.<br>• Traffic calming to address cut-through traffic.<br>• Streets should be curved with T intersections. | | • Been successful and has good examples of new subdivisions and infill developments.<br>• Have not yet studied the impacts. | |
| **Middletown, DE (1998)** | • Designated Delaware "Growth Center".<br>• Rewrite of development code.<br>• Worked with State and U. of Delaware | • Developers resisted code.<br>• Concern about whether developers could maintain same number of units. | • 1.4 connectivity index.<br>• Permits narrower streets (24' - 32').<br>• Cul-de-sacs up to 1,000' allowed, but prefer loops.<br>• Prohibits private and gated streets.<br>• Street stub must extend. | • Lack of awareness and understanding.<br>• Some residents near connections did resist. | • No reaction by residents. | |
| **Orlando, FL (1999)** | • Created incentive-based standards.<br>• Discount on impact fees if developer meets or exceed 1.4 connectivity index. | • Planning Board supports and public seems favorable.<br>• Local examples were important to promote interconnectivity. | • Street stubs and connections to existing streets required.<br>• Minimum street width of 24'.<br>• Cul-de-sacs no longer than 700' or 30 single-family homes.<br>• Gated streets only if connections can be made later.<br>• Traffic calming is used. | • Currently working to incorporate standards into land development code. | | • Public opinion is forthcoming. |