"If we are not careful we shall leave our children a legacy of billion dollar roads leading nowhere except other congested places like those they left behind."

General Omar Bradley

BACKGROUND

The Route 29 corridor Planning Forums conducted in various sections of the corridor in March and April of 2009 resulted in a number of common themes that were voiced by residents, business people and officials in localities along the corridor. The themes elicited in the forums reinforced the need to establish more sustainable patterns of transportation investments and land use policies so that the 29 corridor could continue to fulfill its vital role in the future. The recommendations of this study are based in part on those common themes and concerns of corridor communities. This section describes a series of broad Corridor-Wide Planning Concepts as study recommendations that apply throughout the corridor. These will also be called Level Two Recommendations in this study, to distinguish them from the Level Three Recommendations described in a later section that are intended to be area-specific, rather than corridor-wide.

THE TRANSPORTATION AND LAND USE CYCLE

The current state of funding and transportation needs in the Commonwealth make it clear that we need to look beyond traditional solutions in order to solve the transportation issues in the Route 29 corridor over the long term. Historically, there has been a close relationship between transportation improvements, land development and economic growth in the corridor. Current fiscal realities, however, dictate a smarter and more proactive approach in order for the corridor to continue fulfilling its multiple functions of local and regional mobility and supporting economic growth. A complex regional corridor like Route 29 has multiple functions that include both the direct need to go "through" and the need to go "to" destinations, as well as its traditional role of supporting local economic development.

The diagram below illustrates what can be called the "Transportation and Land Use Cycle." This is a typical cycle of interrelated transportation and land use responses that tend to create a repetitive cycle. Briefly, starting at the top of the diagram, a typical transportation improvement, such as a corridor widening or a bypass gives people the ability to travel faster and further – granting increased mobility, which in turn raises land values for areas that are now more reachable – an increase in accessibility. With an increase in land values, pressure for development causes more land further out to be rezoned for new dispersed commercial and residential development. Finally, with the success of this new development, congestion on the corridor increases, thereby creating the need for yet more traffic improvements, thus continuing the cycle.

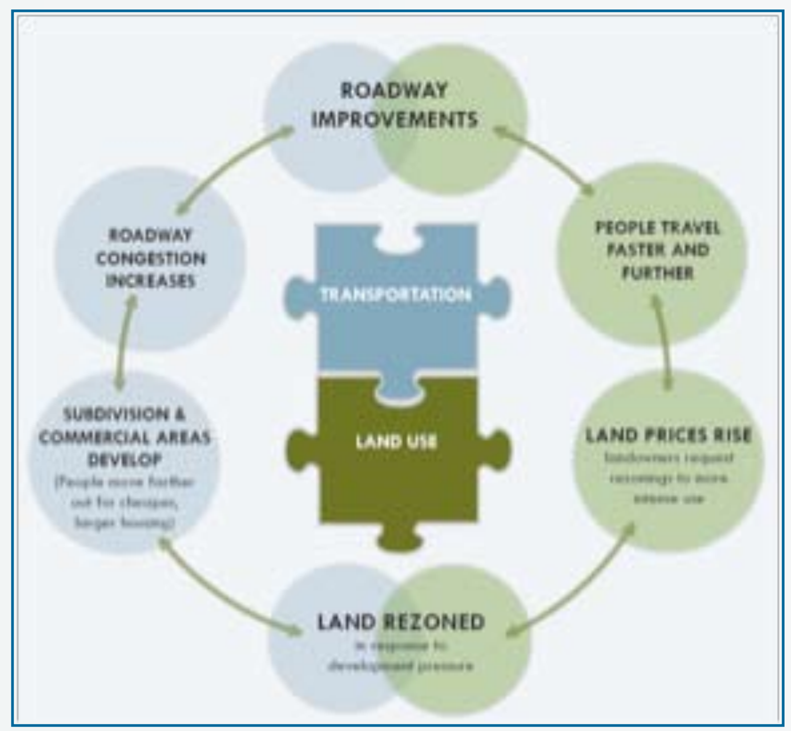
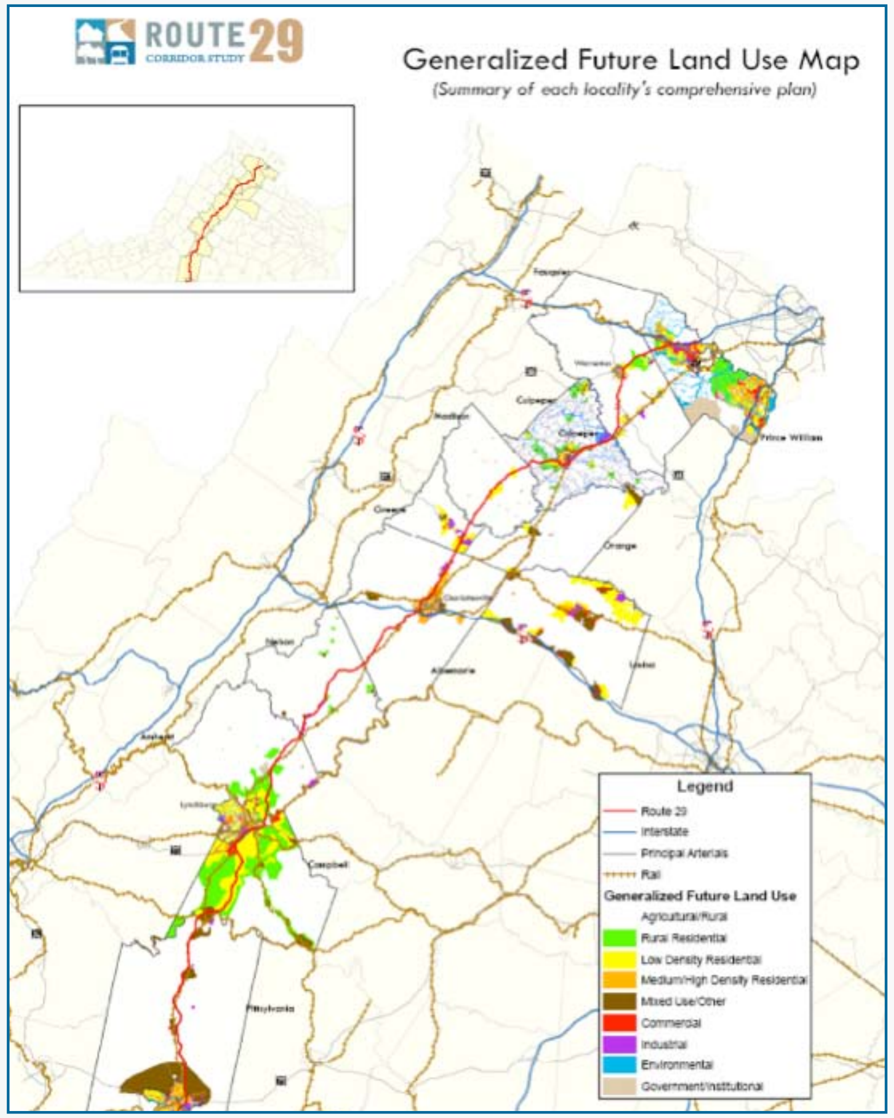


Diagram of typical connected Land Use and Transportation Cycle (Renaissance Planning Group)

The basic problem with this cycle is that it cannot sustain itself indefinitely. Roadway capacity cannot be increased indefinitely and – as some stretches of the Route 29 corridor have shown – relatively small increases in roadway capacity can come at a very high cost once congestion is at an advanced state. The best way out of this dilemma is to ensure a balance between the transportation system and the land use pattern. In order to do this, we need to develop land use plans and transportation plans in concert with each other and ensure that transportation and land use are properly balanced at all points in the cycle.

FUTURE LAND USE IN THE CORRIDOR

A key issue in planning for the future of the Route 29 corridor is to understand the local government future land use plans for the areas adjacent to the corridor. The map below shows a general-



Generalized summary of Future Land Use Plans from corridor localities (Renaissance Planning Group) ized summary of the future land use plans from each corridor locality assembled on a single map. As the maps shows, many corridor localities are projecting future growth areas along the corridor. In fact, for some of the localities, the Riute 29 corridor is the primary locus of higher density and intensity land uses. Furthermore, many of the policies in these comprehensive plans reinforce the importance of the corridor for local economic development. Given the continuing importance of the corridor in future land use planning for growth and economic development, it is especially critical that the capacity of the corridor to accommodate this growth be preserved long term. To a significant extent, the future pattern of development and transportation improvements will determine the ability of Route 29 to maintain its role as a viablelocal and statewide transportation resource in the future.

CORRIDOR-WIDE PLANNING CONCEPTS

Deriving from common themes from the public input process for this study, a series of Corridor-Wide Concepts are described below that have broad application in a variety of rural to urban contexts throughout the corridor. These concepts function as a sort of "best practices" for the 29 corridor and help establish a common set of objectives for how we should be developing new transportation enhancements and associated land uses along the corridor for the long term.

ACCESS MANAGEMENT

Principles of Access Management

Access management is a comprehensive approach for controlling the location, spacing, design and operation of entrances, street intersections, median openings, and traffic signals. Managing access, therefore, seeks to limit and separate entrances, intersections, median openings, and traffic signals in order to maintain and improve the flow of traffic and enhance public safety. Access management was one of the strongest themes to arise from the public input process for the Route 29 corridor. Among benefits of access management for Route 29, the following are particularly important:

- Less traffic congestion.
- Fewer and less severe traffic crashes.
- More efficient movement of people and goods to promote economic development by expanding the market area and labor market for businesses.
- Preserving highway traffic carrying capacity to avoid having to widen existing or build new roadways.
- Lower fuel consumption and air pollution.

Functional Classification of Highways

Travel involves movement through a network of roads. To achieve safe and efficient traffic circulation within the network, highways are classified according to the importance of their function to move traffic versus provide access to adjoining property. Access to roads should be managed so they perform the function they were built to serve.

Interstates - offer the highest level of mobility and are intended to carry the greatest amount of traffic at the highest speeds. Accordingly, they provide no direct access to property, allowing access only at interchanges.

Principal Arterials - provide the next highest level of mobility and convey large amounts of traffic over relatively long distances. Direct property access may be provided but require careful management to preserve arterial mobility and avoid creating unsafe and congested traffic operations.

Minor Arterials – interconnect with and augment the principal arterial system, distributing traffic to smaller geographical areas.

Collectors - provide traffic circulation within residential and business areas. They distribute trips from the arterials through these areas to the motorist's destination and conversely collect traffic to channel it to the arterial system. Trips are shorter distance local trips at lower speeds, so they can safely provide a higher amount of property access.

Local streets - provide the lowest level of mobility and are intended to offer direct access to abutting land.

The reason so many principal arterials are congested and have high traffic crash counts is because multiple entrances, intersections, and traffic signals have been allowed to serve development, affecting the arterial's primary function to move traffic. In order to prevent this from happening, it is necessary to limit the number of such connections and to safely space them from each other. Maintaining the functional integrity of the highway network over time preserves its overall travel capacity and safety. This in turn maximizes the expenditure of highway related taxes.

Development of Virginia's Access Management Program

During 2007, access management regulations and standards were drafted by a VDOT committee representing a broad range of disciplines. The documents were reviewed and refined by an advisory committee composed of representatives from local government, development, environmental, and transportation engineering organizations.

Several hundred comments received during the public comment period were evaluated and used to revise the regulations and standards, which were approved by VDOT's Commissioner in December 2007.

Legislation approved by the 2008 General Assembly established that the access management program would be implemented in phases. Due to the critical importance of principal arterials for travel within the state, transporting of goods, commuting to work, tourism, and emergency evacuation, the first phase implementation of the access management regulations and standards were for principal arterials, to take effect July 1, 2008. Minor arterials, collectors, and local streets were included in the second phase implementation with an effective date of October 1, 2009.

Principal Arterials

In Virginia there are approximately 3,660 miles of principal arterials including those designated by the commissioner because of their operational characteristics. They represent about 5% of the total miles in the state highway system.

Access Management Regulations and Standards for Principal Arterials

The regulations and standards were designed to balance the right of property owners to reasonable access to the highway with the right of users of the roads to mobility, safety, and efficient expenditure of public funds. Key elements include:

- Spacing standards for intersections, median openings, and driveways.
- Shared entrances.
- Vehicular/pedestrian connections to adjacent properties.
- Locating entrances a safe distance from interchange ramps.
- Traffic signal spacing standards.
- Right-in/right-out entrances.
- Entrance throat depths.
- Encouraging the preparation of highway corridor access management plans.

The principal arterial spacing standards in Appendix F of VDOT's Road Design Manual are based on urban vs. rural highways, the speed limit, and type of entrance.

Highway Functional Classification	Legal Speed Limit (mph)	Centerline to Centerline Spacing in Feet		
		Signalized Intersections	Unsignalized Intersections & Full Access Entrances	Partial Access One or Two Way Entrance
Urban Principal Arterial	≤ 30 mph 35 to 45 mph ≥ 50 mph	1,760 2,640 2,640	1,050 1,320 1,320	270 325 510
Rural Principal Arterial	≤ 30 mph 35 to 45 mph ≥ 50 mph	2,640 2,640 2,640	1,320 1,320 1,760	270 440 585

Two Issues That Are Not Addressed by the Access Management Regulations

Virginia now has regulations and standards to better control access to principal arterials. However, their effectiveness is limited by a site-by-site approach to the approval of connections to the highway. As vacant parcels are developed, the owner has to try to fit proposed entrances and traffic signals within the pattern of existing ones.

If the access management spacing standards can not be met, the regulations require restrictions on the type of entrance that can be approved, such as right-in/right-out entrances, or the denial of a traffic signal. Depending on the situation, the developer may seek an exception from the spacing standards.

In addition, as parcels are subdivided, new property owners expect access to the highway. In high growth areas, the subdivision of land leads to the potential for more and more new entrances. The cumulative impact of strip development along principal arterials results in a deterioration of their function, creating unsafe and congested traffic operations.

Potential Recommendation: Require Local Government Transportation Plans to Address Principal Arterial Access Management

§ 15.2223 of the Code of Virginia states that local government comprehensive plans must include transportation plan component. During the preparation of the comprehensive plan the locality can coordinate the location of future land uses and public facilities with planning the transportation network. Subsequent land development decisions can then be based on guidance provided by the comprehensive plan.
However, entrance locations on principal arterials also need to be planned in advance of development. § 15.2223 of the Code should be amended to specify that localities work with VDOT during the transportation planning process to designate along principal arterials appropriate locations for entrances to parcels that do not have an existing connection to the highway. Existing entrances also would be designated in the plan.

Aerial photographs, parcel sheets, and topography maps would be evaluated in relation to the future land use, public facility, and transportation plans to identify the location of an entrance for each parcel to assure the best possible compliance with the principal arterial spacing standards (presented in the above table).

In addition, based on this analysis the transportation plan could recommend opportunities to:

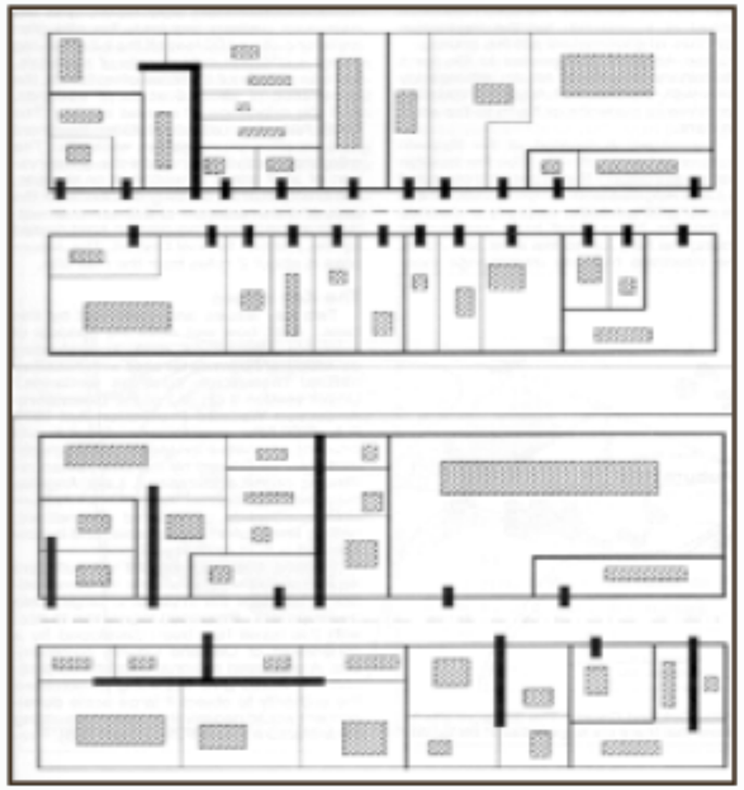
- Place traffic signals to achieve the 1/2 mile signal spacing necessary for signal timing to produce maximum traffic flow rates.
- Separate potential entrances from interchange on and off ramps.
- Use minor side streets for property access.
- Close and/or relocate median openings (crossovers).
- Identify suitable locations for future vehicular connections to adjacent properties (where there are no physical constraints to such connections).
- Share entrances.
- Add left turn lanes to existing crossovers.
- Evaluate the potential for frontage roads.

By identifying these opportunities to better manage access in the locality's transportation plan, property owners can be assured of an entrance location that conforms as close as possible to the state access management spacing standards for principal arterials.

Furthermore, the plan recommendations can be used during the local government's review of development proposals to suggest ways to help mitigate the impacts of traffic generated by the development on the efficient and safe operation of the highway.
Potential Recommendation: Reduce the Number of New Entrances Created Through the Subdivision of Land

The challenges of managing access tend to be greatest on principal arterials where demand for individual property access conflicts with the public's demand for through traffic movement with minimal travel delay. Preventing the proliferation of new entrances is a key strategy to meet this challenge. This can be accomplished by requiring lots created from the subdivision of a parcel to access the highway using an internalized street circulation system.

§ 15.2223 of the Code should be amended to specify that for principal arterials any lots created by the subdivision of a parcel can only use the parcel's entrance as designated in the local transportation plan. Prior to subdividing the parcel, the developer has the ability to configure the new lots and create a vehicular circulation system so as to access the highway via the designated entrance.



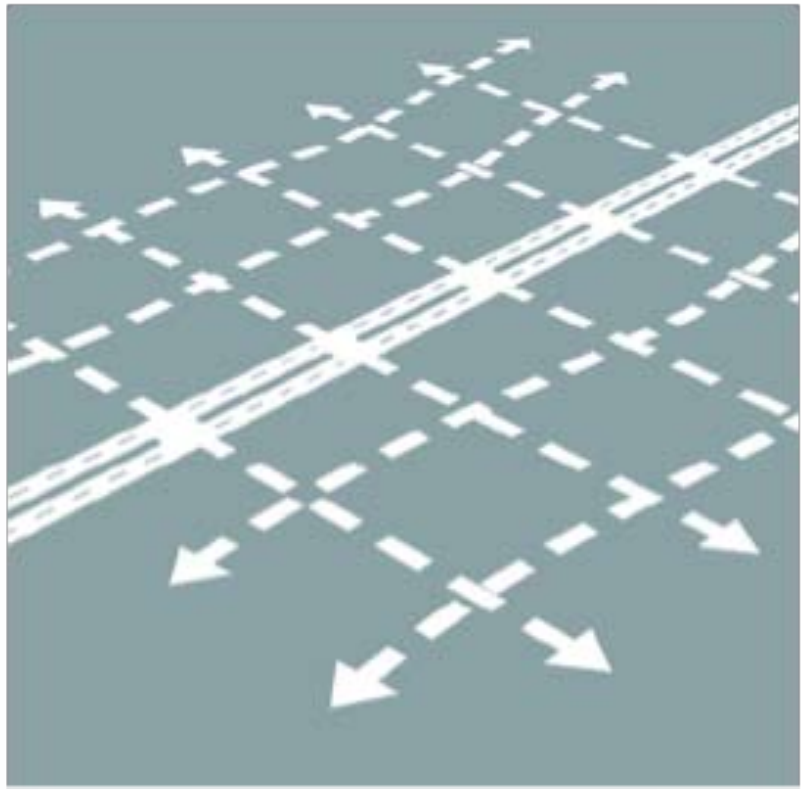
Potential Recommendation: VDOT Approval of Commercial Entrances in Accordance with the Local Transportation Plan

§ 33.1-198 of the Code establishes the VDOT Commissioner's authority to approve commercial entrances to state highways. This Code section should be amended to enforce the location of entrances designated along principal arterial highways in the local government's transportation plan.

DISTRIBUTED NETWORKS AND CONNECTIVITY

Background

One of the most fundamental principles for efficient transportation for all modes is the establishment of a well connected and distributed network of streets. Advantages of an interconnected street network include, enhanced access, reduced congestion, and more responsive emergency services. Well-connected residential areas promote pedestrian activity and encourage walking in place of driving for local trips. Additionally, this framework promotes mixed-use development patterns with smaller block sizes and a greater diversity of building types within close proximity. A grid of blocks is also an important element in creating a walkable area. Neighborhood blocks help to create a comfortable scale for pedestrians by creating an increased sense of location and direction, breaking down the space between intersections and destinations, and providing increased visibility for businesses and offices.



Contemporary development patterns often reduce or eliminate connections to surrounding centers and roadways, limiting all traffic to single outlets. Creating a more interconnected network allows for more transportation choices, in turn making it possible to reduce lane widths and reduce vehicle speeds. Doing so also fosters the connected, pedestrian friendly environment needed to create walkable communities. In commercial areas, an interconnected street network allows all buildings to have a street presence while reducing the scale of required parking areas in favor of actual roadway connections.

Diagram of typical connected (left) and disconnected (right) roadway patterns

VDOT Secondary Street Acceptance Standards (SSAS)

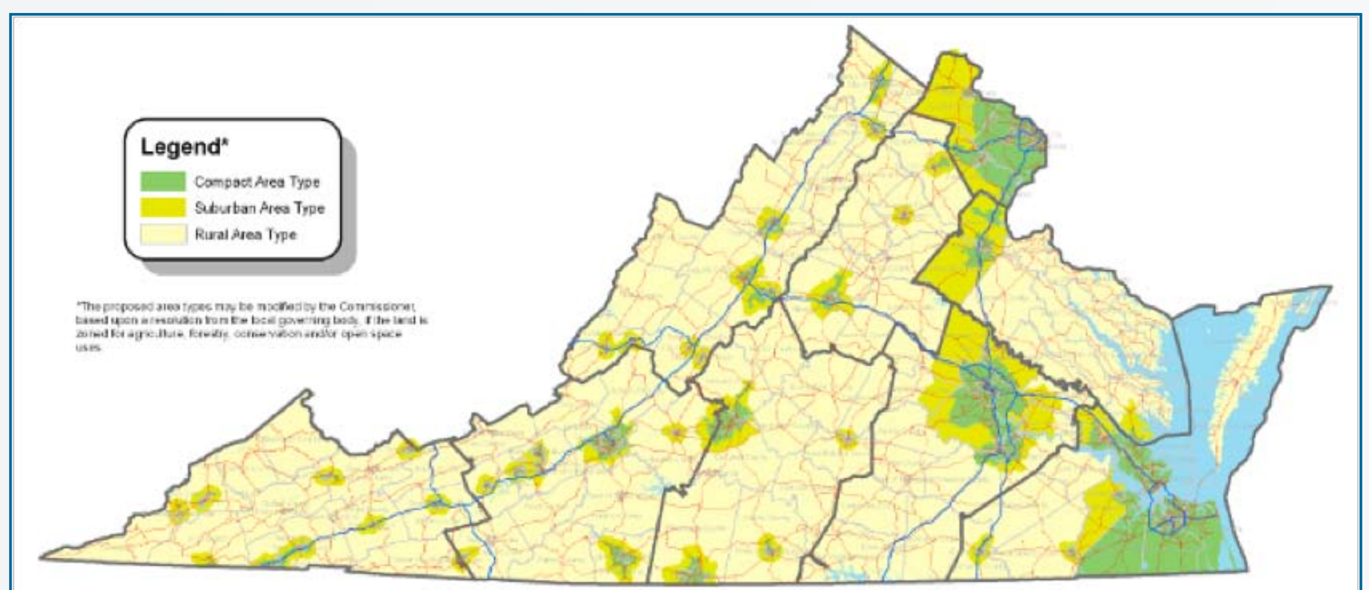
The importance of connectivity in improving transportation performance in the state system was reinforced by the establishment, in 2009, of the Secondary Street Acceptance Standards (SSAR). Section § 33.1-70.3 of the Virginia Code, enacted in 2007, directed the Commonwealth Transportation Board to establish development requirements that include the following:

- Improve connectivity of road and pedestrian networks
- Minimize stormwater runoff and impervious surfaces (reduce local street widths)
- Update performance bonding and cost recovery fees

In the past streets have been accepted into the state system without consideration to the overall public benefit they provided. This new legislation ensured that streets must satisfy a public benefit requirement to be accepted into the state system.

The Commonwealth Transportation Board (CTB) approved the Secondary Street Acceptance Requirements at its meeting on Feb. 19, 2009. The regulation became effective upon its submittal to the Registrar of Virginia, which took place on March 9, 2009. The SSAR supersedes the 2005 edition of the Subdivision Street Requirements (SSR). The regulation establishes requirements that newly constructed streets will need to meet to be accepted into the secondary system of state highways for perpetual public maintenance.

The SSAR have a number of provisions to ensure connectivity road and pedestrian networks with the existing and future transportation network. Based on this legislation, secondary street networks will need to both provide multiple connections to adjacent properties and meet applicable connectivity index value for the area type being served. There is also flexibility built into the provisions to reduce requirements for physical constraints and unique conditions. The map below shows the general area types for application of the SSAR:



Map of generalized statewide areas for application of SSAR

How the SSAR fit into the Recommendations for Route 29

The SSAR as a whole will ensure two key objectives statewide - That new streets added to state system are part of a network; and that the new street network is well connected. Over time, the application of these standards will support the objectives of the Route 29 corridor plan by:

- Providing an alternative to using Route 29 for short local trips in communities and land uses directly fronting the corridor
- Ensuring that new development along the corridor is interconnected and that local trips can be distributed throughout new communities.
- Allowing more flexibility for accessing properties fronting on the corridor through secondary streets located behind and parallel to the corridor.

Improving Understanding of the SSAR Legislation

In order to facilitate the application of the SSAR standards, it would be advantageous to improve the understanding of the standards and their application in practice among local governments, transportation/planning consultants, and the development community. Better understanding and communication about the expectations of the legislation among these stakeholder groups would help with compliance and overall implementation of the standards in a consistent way.

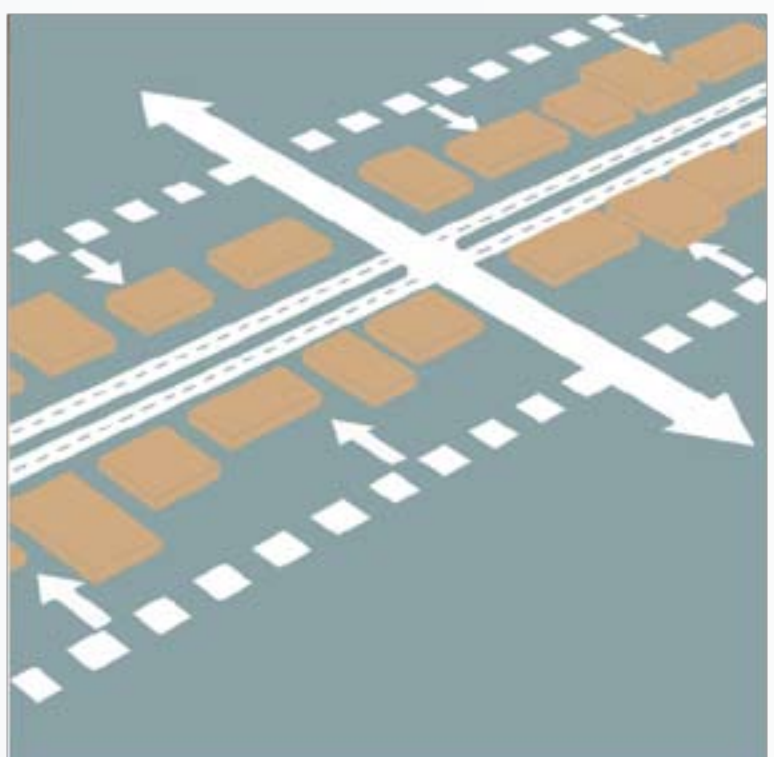
The SSAR can be a powerful tool for improving traffic performance and safety within a network, but they need to be understood and applied consistently particularly for new development in the Route 29 corridor.

Potential Recommendation: Improve understanding of the expectations and typical application approaches of the SSAR among local governments and developers and consulting professionals

While the details will need to be carefully considered and integrated with both VDOT's and localities' current review processes, it is recommended that a basic understanding of the SSAR standards be included in future subdivision plat application review processes. For example, corridor communities could amend their site plan and subdivision approval checklists to include requirements for the applicant to document compliance with the SSAR standards. This change in approval processes could be supported by training sessions for local government staff and the development and consultant communities in each jurisdiction.

PARALLEL COLLECTORS

A Parallel collector is a collector type roadway that parallels a major transportation facility, such as a primary arterial highway. It serves to collect and distribute traffic along the general corridor without impeding flow along the arterial. Parallel collectors can be part of a grid of local streets and may also be referred to as frontage roads or "access," "feeder," and "service" roads.



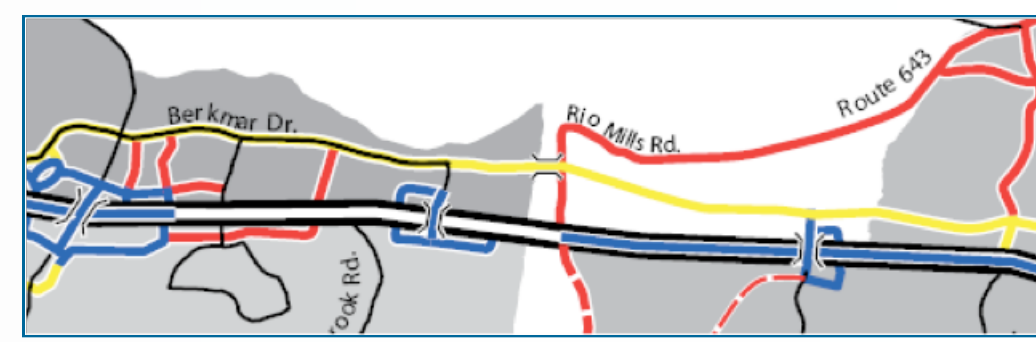
Parallel collectors are an important concept for the Route 29 corridor as a whole. In addition to a distributed network of local streets, a continuous parallel collector corridor adjacent to Route 29 is beneficial for several reasons:

- In an urban or suburban area, parallel collectors can help distribute short and medium-distance local trips off the main 29 corridor and allow an alternative way of accessing major centers along the corridor.
- In a rural context, parallel connectors can provide a way for new subdivisions and rural centers to be accessed off the main corridor, providing a "backage" or service road that all parcels fronting on the corridor could be accessed from.
- In general, parallel collectors can reduce VMT on the Route 29 corridor by taking a certain percentage of vehicle trips off the corridor.
- Parallel collectors can also provide a more appropriate location for new concentrations of growth rather than directly fronting on the 29 corridor. In order for Route 29 to preserve its capacity over the long term, it will be important to allow for these adjacent centers of growth off the corridor but still accessible to it. A network of new centers located along parallel collectors can provide this framework.
- Parallel collectors can also be more appropriate locations for transit. Rather than on the main Route 29 corridor. Limited access and high speed portions of the corridor are difficult to retrofit with transit and station areas do not fit easily into a corridor of this width. By locating transit on the parallel collectors, and by integrating transit into new nodal centers of growth along the parallel collectors, can improve the multi-modal capacity of the whole corridor.
- The lower design speed and more flexible design of collector roadways also make them a much better option for locating a bicycle and pedestrian network than along the main highway corridor.

Parallel Collectors in Places 29

The Places 29 study looked at a number of different alternatives to expanding capacity in a heavily developed section of the Route corridor north of Charlottesville. One of the conclusions from an alternatives analysis was that a parallel collector system – specifically an extension of existing Berkmar Drive provided better capacity enhancement than widening of the main corridor. Places 29 also included the goal of using the parallel collector system as the focus of much new growth in the corridor in the future as well as an essential part of the transit and bicycle/pedestrian network.

Photo simulation from the Places 29 report showing the development of a new mixed use center along Berkmar Drive.



The use of existing Berkmar Drive and a proposed future extension to relieve traffic on Route 29 (excerpt from the Places 29 report).

As demonstrated in the traffic analysis conducted as part of the Places 29 study, the use of parallel collectors can be an effective strategy for alleviating corridor congestion that can have applications throughout the corridor.

INTERPARCEL ACCESS

Another important concept that has potential application throughout the corridor is that of interparcel access. This can be defined as a system of drives that connect parcels to each other. A system of connected parcels along a major highway, for example allows trips between parcels to be made without the need to access the highway for these purely local trips. These interparcel access roads should also connect to parallel collectors and the grid of local streets to facilitate funneling traffic to major crossover locations and preserving capacity on the highway.

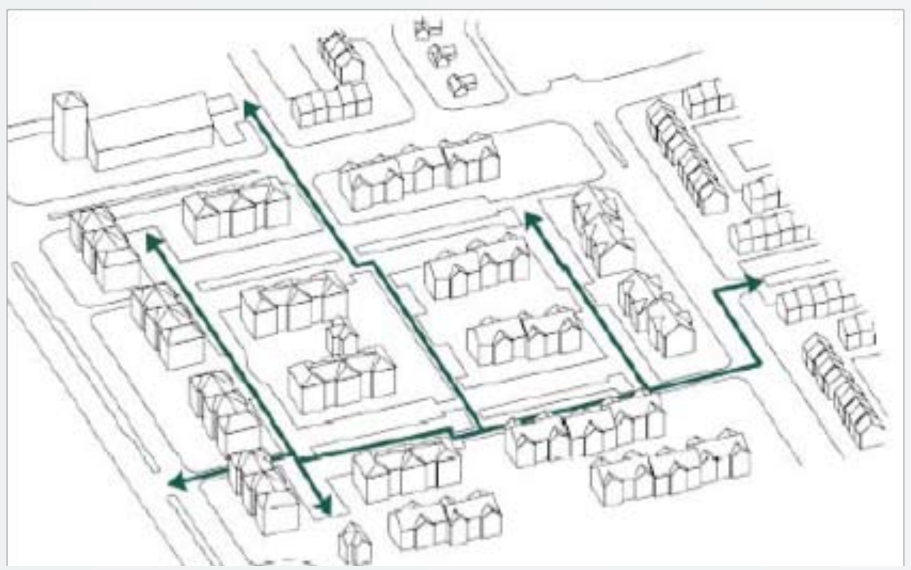


Illustration of how a coordinated system of connected parcels can provide alternate routes for local trips and emergency access along a corridor.

This is different from the practice of connecting public rights of way or providing "stub" connections on subdivision plats because it deals primarily with private driveways and non-residential land uses. Typically, interparcel access works best with compatible uses, such as shopping centers, pharmacies, restaurants, etc. along a typical strip commercial corridor. A coordinated approach to requiring interparcel access as redevelopment occurs in a typical suburban strip corridor can – over time – improve corridor performance by reducing access points and curb cuts. This strategy can work both for new development and for retrofitting older development. In the case of retrofits, implementation would occur over time as properties are redeveloped and may be gradual, depending on the market conditions.

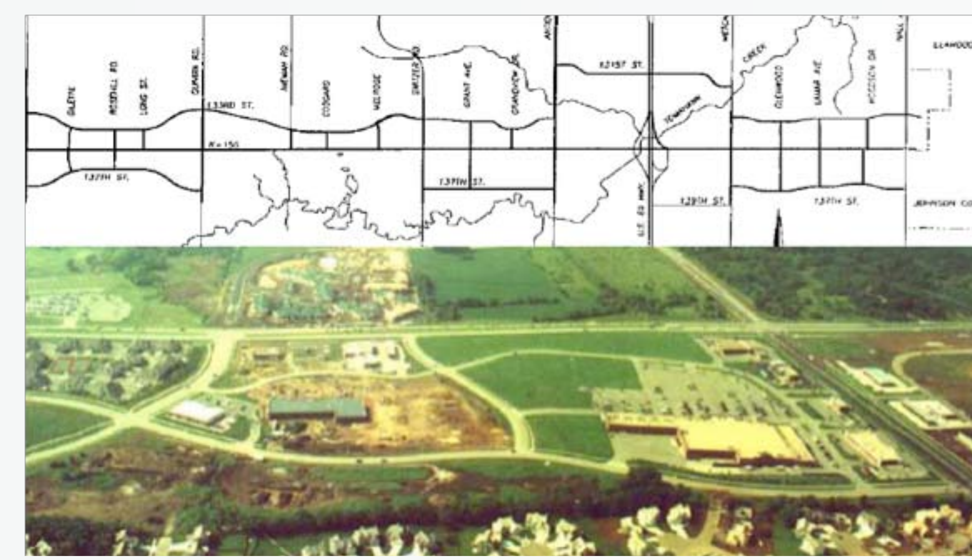
Illustration from the Pennsylvania/New Jersey Smart Transportation Guide showing how interparcel connections, when gradually phased into a suburban strip type of context, can permit safer traffic conditions on the corridor.

Over time, a coordinated program of interparcel connections can be developed into a parallel accessway along a corridor, thus eliminating most curb cuts.

Implementation

Requirements for interparcel connections are often included in local ordinances. They can be addressed at the site plan approval level and made a required condition of site plan approval, subject to defined standards. They can also be addressed at the subdivision plat stage and requirements included in the local subdivision ordinance for the platting of easements to allow cross-parcel access. Finally, standards can be put into an overlay zoning district to address only certain properties, such as those fronting on a primary corridor. If the interparcel access involves the use of shared driveways, it is advisable that a maintenance agreement be recorded at the time of the platting to avoid problems with maintenance and upkeep over time.

Photograph showing how parcels developing along a major arterial all are accessed from a "backage" road to preserve capacity of the arterial at an interchange.



The 135th Street access management Plan in Overland Park, Kansas illustrates how new development fits into a newly developed parallel collector and incorporates connections between parcels.

Potential Recommendation: Require the development of local ordinances for interparcel connections as part of the Route 29 Master Plan adopted in each locality.

Many localities in Virginia already have ordinances with interparcel access provisions. It is recommended that the Corridor Master Plan that is to be adopted for the Route 29 corridor include a provision that requires the adoption of interparcel access requirements in local ordinances as a condition of approval of the plan in each locality. To facilitate this, model ordinance provisions should be included in the master plan that localities can use or modify to meet their needs.

CROSSOVERS

Background

Crossovers are generally major access points onto a highway such as road intersections, median breaks and interchanges. Crossovers can have either full or partial access. The spacing of crossover locations and the management of access at the crossovers is a major concern of providing effective traffic flow on a highway. An important principle for the Route 29 Corridor is to plan for and manage the development and evolution of crossover types along the corridor. Current conditions along the corridor vary widely, from limited access sections with grade-separated crossovers, to sections with frequent median breaks and at-grade full-access crossovers. Although the specific recommendations for crossovers will vary according to individual conditions along the corridor, it is useful to establish a general typology and principles of application for crossover types that could apply corridor-wide.

Recommendations for Grade Separated Crossovers

Within the site specific (Level Two) recommendations of this study, there are a number of locations along the corridor that are recommended to have existing at-grade intersections converted to grade separated interchanges in the future. While each intersection will be designed according to individual site conditions, there are some general principles for grade separated interchanges that may have application at various locations throughout the corridor. In areas where there is sufficient land and little or no development, there exists a lot of flexibility in interchange design. However, many of the locations that are most critical for adding grade separations on the 29 corridor are in already heavily developed stretches. In these cases, two interchange designs, described below are potentially appropriate (depending on site conditions) to be retrofitted from at-grade crossovers in an already built out context.

The Quadrant-Road or 'Box" Interchange

A quadrant roadway intersection introduces an extra roadway connection between two legs of an intersection (see illustration below). This allows for left turns to be taken off the main highway, or even for the intersection to be converted to a a grade-separated interchange. This type of interchange also integrates well with parallel collectors and a grid of local streets.

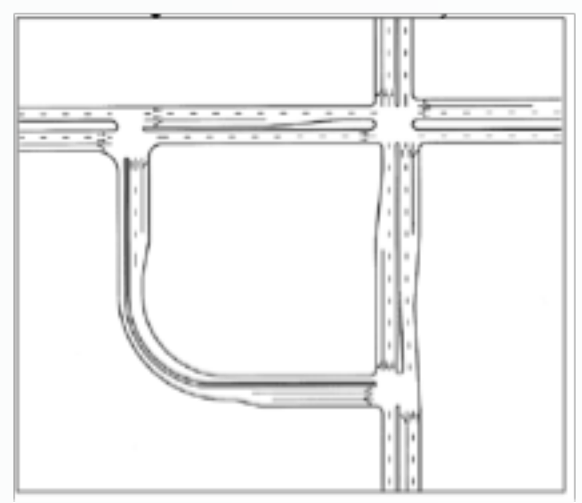
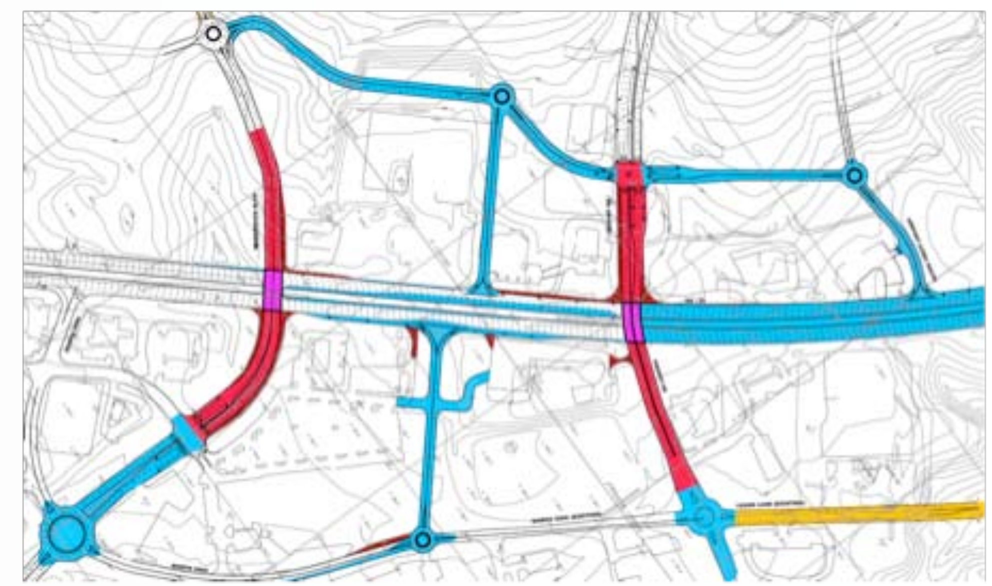


Illustration of one segment of a typical Quadrant Road

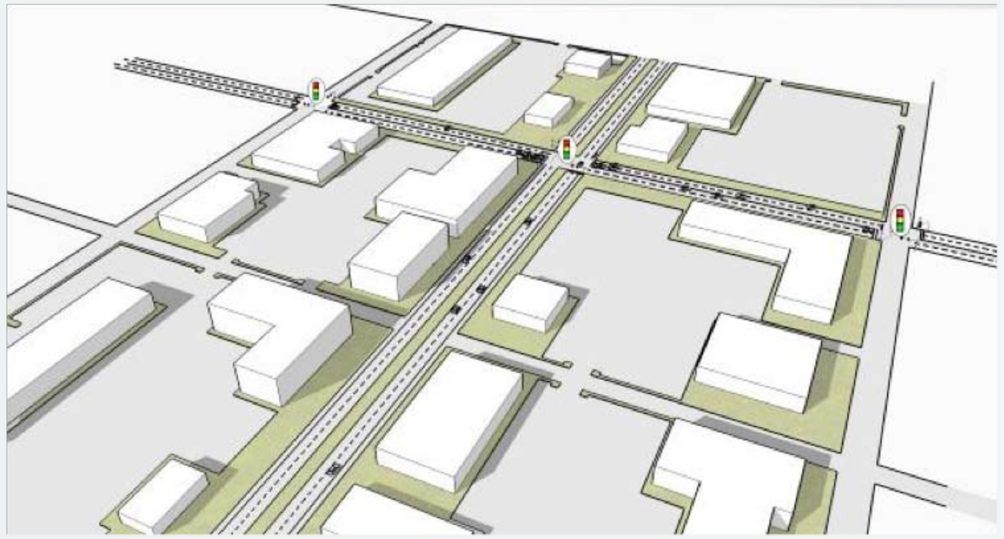
In order to address the issues prevalent along many parts of Route 29, the quadrant road concept can be expanded so that it becomes a way of gradually converting existing at-grade crossovers into grade-separated crossovers. The introduction of quadrant road connections on either side of an existing intersection will allow alternate access to the cross street in the near term with right-only turns from Route 29. This alternate access will also allow construction phasing to be accomplished in order to develop a bridge over Route 29 to create a grade-separated crossover in the future.

The most important feature of this type of interchange is that it has minimal land acquisition needs and will preserve the opportunities for high visibility private development sites all the way up to the interchange. Both of these features are of critical importance in an already developed urban context. In addition, this type of crossover integrates very well into a distributed network and parallel collector system, since the quadrant roads are not ramps and can become part of the system of blocks in a developed urban setting.

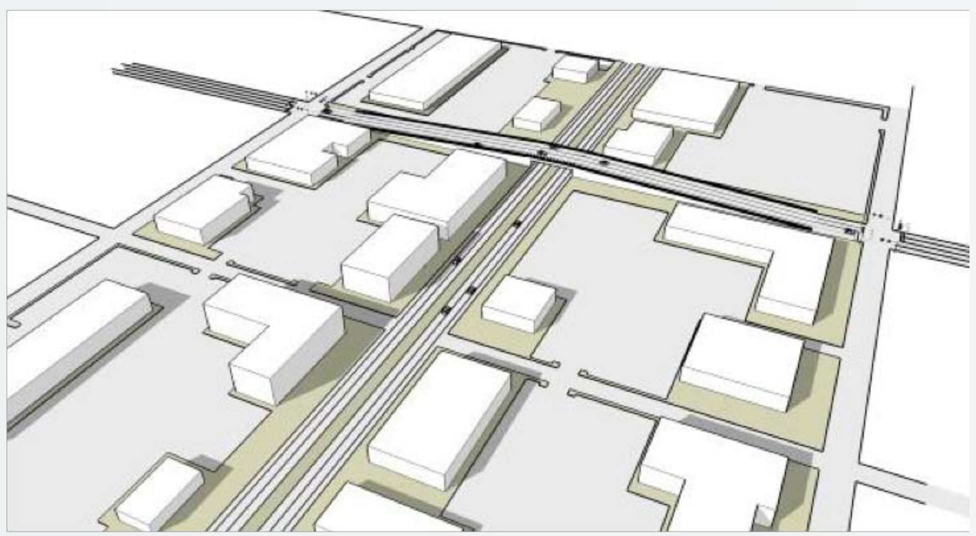


Portion of the Places 29 recommendations showing the addition of quadrant roads (in blue) to the existing crossovers at Airport Road and Timberlake Boulevard to allow for the eventual bridging of these two intersections Lavender color shows the bridge and red shows the ramped portions of the roadway.

The folliwing illustrations show the conversion of a hypothetical at-grade intersection along Route 29 into a 'box' interchange that is grade separated and has only right-turn movements on the main highway.



Existing at-grade crossover on a hypothetical portion of Route 29



Conversion or the intersection to a "box" interchange over time by grade separating the crossover. Retaining walls on the crossover allow existing or future development to remain relatively undisturbed by the grade separation.

The Urban Diamond Interchange

Another type of interchange that should be considered for the existing developed portions of the corridor is the urban diamond interchange, which is a more compact version of the normal grade-separated diamond interchange, and more suitable for intensely developed areas on a corridor. There are several variants, depending on site conditions, and ramps can either be separated minimally from the highway, or – if space is severely limited – can be attached to the highway with retaining walls.

The photograph above shows an urban diamond on a major arterial in Henrietta, NY. Here, a major arterial (left to right) crosses over a secondary arterial in a busy retail area. The ramps entering the major arterial, two lanes wide, are controlled by traffic signals, with both lanes feeding directly into the divided highway. Note that the ramps also serve adjoining properties, and to provide left turn movements from these areas, the interchange features "Texas U-turns" on either side of the major arterial.

The urban diamond does not integrate as well as the Box interchange into local roads as part of a distributed network, but it has the advantage of exclusive interchange ramps which can be better in very high traffic conditions and – as shown in the example above – can still accommodate adjacent development with minimal intrusion and acquisition needs.

U-Turn Crossovers

Median U-turn crossovers eliminate left turns at intersections and move them to median crossovers beyond the intersection. For median U-turn crossovers located on the major road, drivers turn left off the major road by passing through the intersection, making a U-turn at the crossover, and turning right at the crossroad. Drivers wishing to turn left onto the major road from the cross street turn right onto the major road and make a U-turn at the crossover. This design can also be modified to accommodate a narrow median. The illustrations below show a variety of U-turn crossover design options

U-turn crossovers may be appropriate along the Route 29 corridor in situations where a grade separated interchange is not warranted, but there is a need to close existing median breaks and provide an option for u-turn access to properties where the median break has been eliminated. Some sections of the northern portion of the corridor have a significant number of median breaks which create safety problems. By closing these median breaks and providing safe u-turn options, these portions can be made safer and overall corridor performance can be improved. In addition, some conditions would warrant consideration of a U-turn crossover replacing an existing or proposed traffic signal. Where traffic signals are warranted for crossings, their replacement by an appropriately designed U-Turn crossover or even a roundabout could yield improvements in travel time and overall safety in some conditions.

Potential Recommendation: Incorporate the Quadrant, Urban Diamond and U-turn Crossover concepts into future crossover planning for the Route 29 corridor and show on the Corridor Master Plan the most appropriate locations for each type of crossover.

The following table shows the types of crossovers and connections, their potential benefits and features and the most appropriate locations for implemntingthem on the Route 29 corridor.

CONNECTION TYPE	CHARACTERISTICS	POTENTIAL BENEFITS & APPROPRIATE LOCATIONS
GRADE SEPARATED		
Urban Diamond Interchange	Compact diamond interchange – cross street may be over- or under-pass	Appropriate for intensely developed areas – accommodates high traffic with minimal intrusion into adjacent areas
Quadrant intersection	A right angle roadway connection providing at-grade connections between two legs of a grade-separated overpass connection (see illustration below)	Appropriate for retrofitting into existing suburban strip-style development or to serve new urbanizing nodes. Allows for all direct access onto the main highway to be right turns. Integrates well into a distributed local street network while allowing for development to be placed directly adjacent to interchanges.
AT-GRADE		
Signalized Intersection	A traffic signal at an at-grade intersection	Congestion and safety concerns make this connection generally not appropriate for a regional transportation facility like Route 29, except as an interim solution
U-Turn Crossovers	Widened medians and controlled U-turns with dedicated turn lanes away from major crossovers	Appropriate approach to eliminating left turns at existing at-grade intersections and moving them to median crossovers beyond the intersection (see illustrations below)
Roundabout Crossover	A channelized at-grade intersection around a circular island in the median	Appropriate as a replacement for a traffic signal at existing intersections in rural sections of the corridor with sensitive scenic or environmental resources