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Road Functional Classification

Technical Memorandum

An Element of Connecting Landscapes—the Transportation Plan for Chester County

PREPARED BY THE CHESTER COUNTY PLANNING COMMISSION

CPC

BOARD OF COUNTY COMMISSIONERS

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Summary

The road network in any community functions in a similar fashion to the circulatory system of the human body. It is this analogy that led to the term "arterial" road as derived from the term artery. The human circulatory system has different elements that serve different capacities and functions. The same is true with the road network.

Road functional classification is an important land use and transportation planning tool that establishes a hierarchy of roads based on use relating to mobility and access. As a tool, functional classification provides a basis for the integration of land use and transportation through road design, access design and all relevant land use ordinances.

The classification that was established by the Chester County Planning Commission followed an eight-step process that led to adoption by the Planning Commission in 2003. The adoption focused on a map of the classification and a table of specific variables and criteria that was used to define and delineate the classification.

The adopted classification is comparable in scale to the classifications set at the regional, state and national levels. About 3 percent of the network mileage in the County consists of expressways. The arterials represent almost 10 percent of the mileage. Collectors represent about 20 percent of the mileage. The bulk of the mileage (over 2/3) consists of local roads, which in this context refers to their function and not necessarily ownership.

Approximately 12 percent of the road mileage carries 70 percent of the traffic. This relates to the circulatory analogy where the expressway and arterials are the lifeblood of the network.

In terms of the relationship of the functional classification to ***LANDSCAPES***, the County's comprehensive policy plan, there is a strong nexus between the function of the major roads and their impact on the growth areas in the plan and on the preservation areas.

As a planning tool, the functional classification has several direct applications that integrate land use and transportation. Planning principles, design concepts, design guidelines, and access guidelines can be applied to assist in ordinance language, right-of-way preservation, actual road design, and the establishment of capital and maintenance priorities.

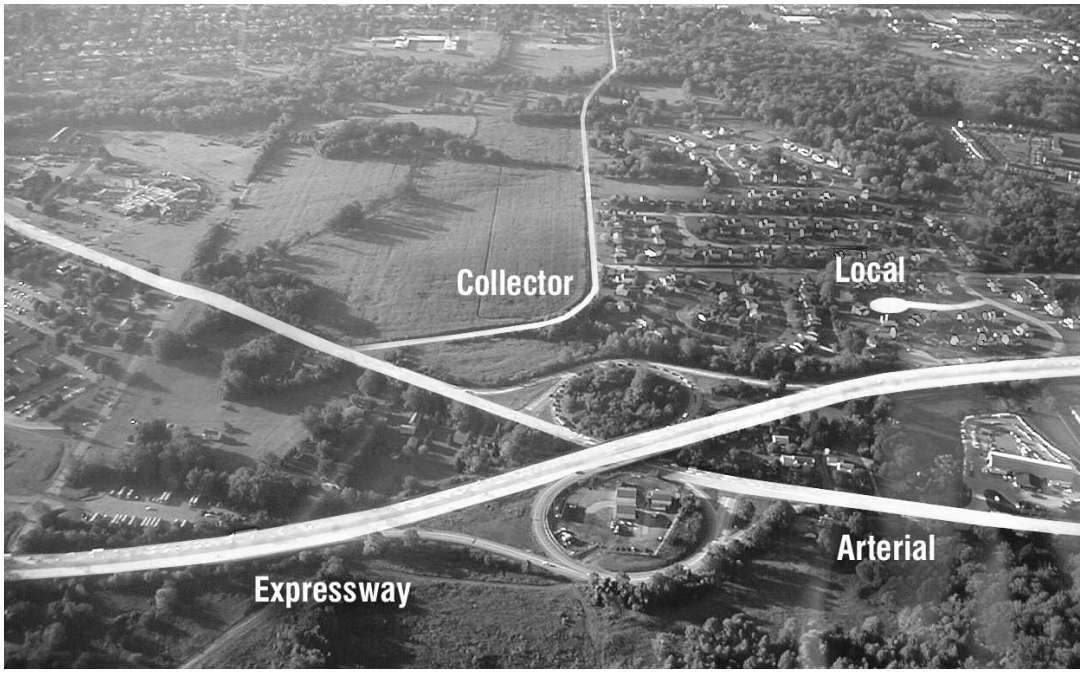
Background

There is a direct analogy between the network of roads and the circulatory system of the human body. The road network and circulatory system each contain elements that serve different functions. The hierarchy of roads within a road network is very similar to the hierarchy of blood vessels within the circulatory system. Expressways are representative of the main arteries. They are the largest roads, carrying the most traffic, having the highest mobility rate and the lowest accessibility rate. Arterial roads can be viewed as secondary arteries and veins. Arterials are very similar to expressways but they provide more access to smaller roads like collector roads and have less mobility. Collector and local roads can be viewed as capillaries. Collectors are small roads with higher accessibility and lower mobility than expressways and arterials. If an artery is clogged it creates higher pressures and higher use of the secondary system of veins and capillaries. If expressways and arterials are congested they become dysfunctional which then places more pressure on the collector and local networks.

While this analogy helps to describe how road capacity problems develop, there is an issue with road capacity where this analogy does not apply. Excessive capacity in the expressway and arterial networks under certain circumstances can lead to unintended consequences. For example, excessive capacity is one of several factors that can precipitate or induce a higher level of development than desired or anticipated.

Road functional classification is an important land use and transportation planning tool that establishes a hierarchy of roads based on use relating to mobility and access. As illustrated in Figure 1, the hierarchy that the Planning Commission has developed is composed of four basic classes: expressways; arterials; collectors; and local roads.

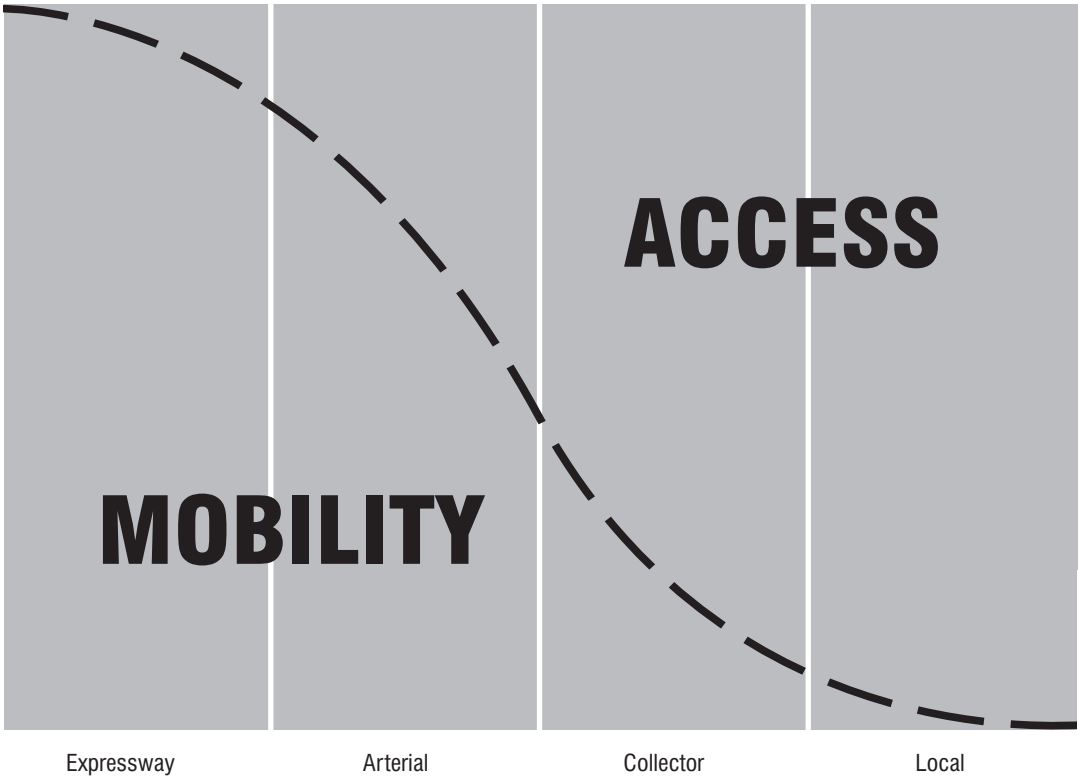
Figure 1 | Road Functional Classification



Source: Chester County Planning Commission, 2004

Mobility describes the ability of the road to move traffic and is measured in traffic volumes, vehicle speeds, and trip lengths. Access is the linkage between the road and adjacent land uses. The separate functions of mobility and access can be incompatible and conflict with each other particularly where through traffic inappropriately mixes with local traffic. Roads fail from a congestion or safety standpoint because of the conflict and inverse relationship between mobility and access. The overall relationship between road classification and mobility and access is characterized in Figure 2. On one end of the scale, expressways provide maximum mobility but only limited access, thus, the term limited access expressway.

Figure 2 | Relationship of Mobility Access



Source: CCPC Highway Needs Study, 1986

Conversely, local roads are intended to provide maximum access to adjacent properties but minimum mobility. Expressways work well when mobility is the priority and access is minimized. Expressways fail when access overwhelms the mobility function through too many ramps or too much volume on the ramps. Conversely, local roads work well when access is the priority but fail when the volume of through trips increases. The real conflict occurs with arterials and collectors where the distinction between mobility and access is less obvious and the mix of through and local traffic is greater.

To mitigate or minimize road problems, the intended function of each road should be established through the functional classification. The classification then becomes a guide for road design, access design, and all relevant land use ordinances relating to zoning and land development. As roads are improved or as ordinances are changed, the classification becomes the basis for decision makers. Functional classification can be used to establish capital and maintenance needs and priorities. It can also be used to establish a right-of-way preservation program where appropriate. Information on municipal uses of road functional classification can be found on Figure 3.

Figure 3 | Municipal Uses of Road Functional Classification

Document	Application
Comprehensive Plan	**Define and Designate Functional Classifications**—The comprehensive plan is where a municipality will identify (in the transportation section) the functional classifications of the roads in the municipality. There is usually a discussion of the criteria used in these designations, a map that shows the classifications, and sometimes a discussion of the classification of each arterial and collector road. A few communities that have very old comprehensive plans designated their functional classifications in the subdivision and land development ordinance instead, but these are increasingly rare in Chester County. As such, this designation of functional classifications can be found in the comprehensive plans of nearly any Chester County municipality.
Zoning Ordinance	**Setback Regulations/Right-of-Way Preservation**—Many zoning ordinances will establish setback regulations beyond those associated with the zoning district based on the functional classification of the road. This additional setback requirement prevents buildings from being placed so close to the road as to preclude future widening of the road in question. This setback effectively preserves right-of-way. Examples of right-of-way preservation regulations can be found in Upper Uwchlan, Westtown, and East Whiteland (in draft form) Townships. These regulations are sometimes implemented in the subdivision and land development ordinance, rather than the zoning ordinance. **Access Management Regulations**—These are zoning requirements that limit the number of access points onto a given classification of road in order to minimize "friction" between through and turning traffic at driveways. This is most commonly done on arterial and collector roads with adjacent commercially zoned land and frequently gives options for how such access management will be achieved. While generally based on the classification of the road, sometimes particular roads are specified in the ordinance. Examples of municipalities employing these regulations in their zoning ordinances include West Fallowfield, Franklin, and North Coventry.
Subdivision and Land Development Ordinance (SLDO)	**Road Design Standards**—These standards establish the required width of right- of-way, cartways, lane widths, etc. for new roads constructed in the municipality and are based on the functional classification. Arterials would have different design standards than collectors, for example. Such standards are found in almost every SLDO in Chester County. **Intersection Separation Distance**—The SLDO generally specifies how closely/far apart intersections can be located on higher functioning roads. On an arterial, for example, speed limits are generally higher than on a local road and intersections must be spaced farther apart to ensure safety. These regulations are found in most SLDOs of Chester County municipalities.
Official Map	**Right-of-Way Preservation**—As noted above, this is usually done in the zoning ordinance through the requirement of additional setbacks for particular classifications of roads. The official map could be used to identify a right-of-way needed on roads as was done by East Caln Township.
Open Space Plan	**Scenic Road Designations**—The open space plan does not deal directly with functional classification, but it does identify and designate scenic roads throughout a municipality. The functional classifications should be taken into account when designating scenic roads to avoid conflicts between a scenic road designation and a high-order functional classification.
Regional Plans	**Inter-Municipal Coordination/Consistency**—Regional studies and plans can be used to achieve classification consistency between bordering municipalities. For example, two municipalities might classify the same road very differently due to definitions and criteria. A regional plan could identify such inconsistencies and rectify them by creating a common set of definitions and criteria and applying them. Examples of this approach are the West Chester Region Functional Classification Study and the Kennett Area Comprehensive Plan.

Source: CCPC, 2004

How was the County Functional Classification Established?

The development of the recommended road functional classification for Chester County was framed around an eight-step process.

1| A general hierarchy of roads was established.

A review of all municipal comprehensive plans determined that there was a wide variation in existing classifications relative to terms, definitions and designations. To develop continuity and consistency at a county level, a basic road hierarchy was established. The hierarchy that the Planning Commission developed is comprised of four classes: expressways; arterials; collectors; and local roads. Within the arterial and collector classes there are two sub-classes described as major and minor. Local roads also have two sub-classes described as local distributors and locals.

2| Variables and criteria were developed.

Based on the review of municipal comprehensive plans, it was determined that qualitative and quantitative information was needed to classify roads in a uniform fashion. Figure 4 was created to identify the variables that needed to be considered and the specific criteria for each variable and each class.

3| A network of roads was identified.

The comprehensive plans from all 73 municipalities were reviewed to identify the roads for consideration in the new classification. While there was considerable diversity in terms and definitions, there was consistency in the basic selection of roads.

4| State, regional and county existing classifications were reviewed.

Two primary sources were used in this step. First, the most current classification was identified from the Federal Highway Administration. This classification was established by PennDOT and the Delaware Valley Regional Planning Commission (DVRPC). Second, the classification from the *Chester County Highway Needs Study* from 1986 was reviewed.

5| A draft classification map was created.

Based on the existing municipal, regional, county, state, and federal classifications and the draft variables and criteria, a draft classification for the entire County was developed.

6| Municipal officials reviewed a draft map.

Regional maps with groupings of 10–15 individual municipalities were created with the draft classification. These maps were then distributed to all 73 municipalities along with the table of variables and criteria. Municipalities were asked to comment on the classification, variables, and criteria.

7| Revisions were made based on municipal responses.

Of the 73 municipalities, 18 municipalities responded. Of these, seven municipalities agreed with the County recommendations while eight municipalities had suggestions that warranted changes. Three municipalities had suggestions that did not match up with the County criteria and no changes were made.

8| The road functional classification was adopted.

In June 2003, the Chester County Planning Commission considered and adopted the recommended road functional classification.

Figure 4 | Chester County Planning Commission Road Functional Classification—Variables and Criteria

Variables	Expressway	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local Distributor	Local
Daily Traffic Volume Range (1)	15,000 to over 100,000 vehicles	10,000–60,000 vehicles	8,000–20,000 vehicles	4,000–10,000 vehicles	1,000–5,000 vehicles	Less than 1,500 vehicles	Less than 1,000 vehicles
Mobility	Strict priority to moving vehicles	Mobility more critical than property access	Mobility more critical than property access	Even priority to mobility and access	Even priority to mobility and access	Access more important than mobility	No priority to mobility
Access	Only at interchanges	Strict median access control	Some control of property access	All roads and properties have access	All roads and properties have access	Priority is given to property access	Priority is given to property access
Corridor Length	Over 15 miles	Over 15 miles	Over 10 miles	4–15 miles	2–10 miles	Less than 4 miles	Less than 2 miles
Connections (Relationship to ***LANDSCAPES***)	Connects states, regions, counties, cities and landscapes urban centers	Connects regions, counties and multiple landscapes centers	Connects multiple landscapes centers some inter-county trips	Connects landscapes centers and villages, primarily intra-county trips	Connects villages and multiple neighborhoods primarily intra-county trips	Connects neighborhoods some inter-municipal trips	Links individual properties to distributors and collectors
Truck Traffic	Highest truck mobility	High truck mobility	High truck mobility	Moderate truck mobility	Moderate truck mobility	Local delivery only	Local delivery only
Basic Geometry and Design	Wide lanes and shoulders; medians; more than 2 through lanes	Wide lanes and shoulders; occasional median; turning lanes	Wide lanes and shoulders; no medians; turning lanes	Two lanes; no medians; limited turning lanes	Two lanes; no medians; limited turning lanes	Narrow Lanes	Narrow lanes
On-Street Parking	Prohibited	Only in urban areas	Only in urban areas	Discouraged outside "centers"	Discouraged outside "centers"	Limited use outside "centers"	Appropriate on selected streets
Through Traffic (2)	Over 50%	Over 50%	Over 50%	25–50%	25–50%	Less than 25%	Less than 10%
Vehicle Speed (Posted)	55–65 mph 40 mph minimum	35–55 mph	35–55 mph	35–55 mph	35–55 mph	Less than 45 mph	Less than 35 mph
Bicycle Pedestrian Access	Only through separate facilities	Specially designed facilities	Adjacent facilities and crossings	Adjacent facilities and crossings	Adjacent facilities and crossings	High priority to bike and pedestrian access	High priority to bike and pedestrian access

(1) Wide range of traffic volumes accounts for differences between urban, suburban, and rural areas.
(2) Through traffic has no origin or destination in the immediate neighborhood, community, village or center.
Source: Adopted by Chester County Planning Commission, 2003

Interpretation of the Functional Classification

Figure 7 illustrates the Chester County road functional classification. The entire road network consists of 3,373 miles of roads. The classification includes 93 miles of expressways, 321 miles of arterials, 676 miles of collectors, and the remaining 2,283 miles are local roads. Figure 5 provides a percent comparison of the classification in Chester County, the DVRPC region, Pennsylvania and the nation.

Figure 5 | Road Mileage—Percent Comparison by Class

Class	Chester County Percent	DVRPC Region Percent	Pennsylvania Percent	National Percent
Expressways	2.8%	2.0%	2.0%	1.0%
Arterials	9.5%	16.0%	11.0%	10.0%
Collectors	20.0%	12.0%	16.0%	20.0%
Locals	67.7%	70.0%	71.0%	69.0%

Source: CCPC, DVRPC, US DOT

The percent of expressway mileage in the County is slightly higher than the other geographic areas in this comparison. The percent of arterials is lower than all other geographic areas, particularly the regional level. This difference is offset by a higher percent of collector mileage in the County than in the region. However, the percent of collectors in the County is comparable to the national percent. The percent of local roads in the County is also comparable to all other geographic areas in this comparison. This wide range in the arterial percentage may be a reflection of the more rural nature of Chester County. As the County urbanizes more collectors may begin to function as arterials.

While the mileage of expressways and arterials in the County only represents 3 and 9 percent of the network respectively, these classes carry a much higher percentage of the daily traffic. DVRPC estimates that 70 percent of daily vehicles of travel on all Chester County roads is accommodated by the expressways and arterials. The percent identified on Figure 6 demonstrates the mobility function of these two classes.

Figure 6 | Road Use—Percent Comparison by Class

Class	Chester County Percent	DVRPC Region Percent	Pennsylvania Percent	National Percent
Expressways	28.0%	30.0%	29.0%	31.0%
Arterials	42.0%	48.0%	43.0%	41.0%
Collectors	18.0%	11.0%	15.0%	15.0%
Locals	12.0%	12.0%	13.0%	13.0%

Use is defined in vehicle miles of travel
Source: DVRPC, US DOT

Summary of the Functional Classification Map

An overall perspective of the functional classification map suggests that the density of expressways, arterials and collectors correlates closely to the densities of population and employment in the County. A more intense road network exists in the area bounded by Phoenixville Borough, the Valley Forge area, West Chester Borough and the City of Coatesville. This area has the heaviest concentration of people and jobs. Conversely, a less dense road network exists in the northern, western and southern areas of the County.

The orientation of expressways in Chester County is primarily on an east west basis with the exception of the portion of US 202 near West Chester. The heaviest concentration of expressways is in the central part of the County, and includes the Pennsylvania Turnpike, US 202 from the Frazer area to Montgomery County, US 30 from the Coatesville area to the Frazer area and a small segment of PA 100 south of the village of Exton. US 1 is the only expressway serving the southern part of the County. US 422 serves the northern most part of the County and a small segment of the eastern part of the County.

The network of arterials is more evenly distributed throughout the County than the expressways. While there are several arterials that serve a north-south orientation such as Routes 10, 82, 100, 29, and 252, most of the arterials are less oriented to a particular direction than the expressways. A heavier concentration of arterials exists in the Exton, Paoli, and West Chester areas. In terms of the major and minor arterials, several patterns are evident:

- The southwest area of the County has a limited density and coverage of major arterials.
- Downingtown and West Chester Boroughs are the convergence point for several major arterials.
- PA 100 is the only major arterial with a distinct north-south orientation.
- There are distinct convergence points of minor arterials in areas near East Goshen Township, the Longwood area, the Paoli area and Phoenixville Borough.

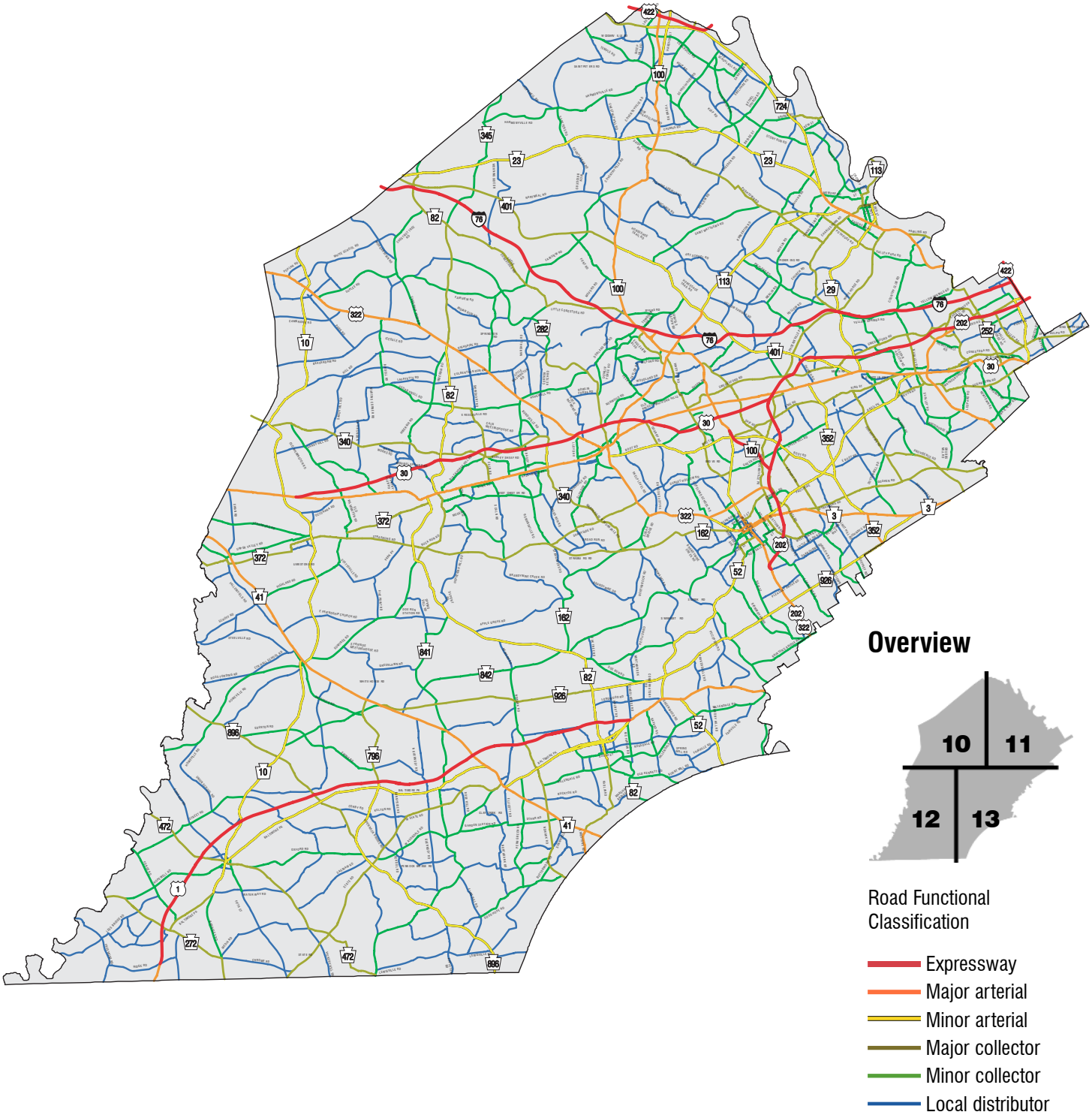
These convergence points of major and minor arterials are critical because they represent areas where different flows of traffic are conflicting, resulting in congestion.

Only 5 of the 73 municipalities are not directly served by an expressway or arterial. These include Elk, Newlin, and Wallace Townships and Modena and South Coatesville Boroughs. The Pennsylvania Turnpike borders Wallace Township but there is no direct access or interchange.

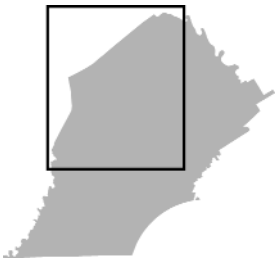
The collector network is widely distributed in terms of areas and directions. Every municipality has at least one collector. The density of collectors is light near the agricultural areas in Highland, Honeybrook, West Fallowfield, and West Marlborough Townships.

Because the local road network makes up over 2/3 of the entire road network it is the most evenly distributed network throughout the County.

Figure 7 | Chester County Road Functional Classification Map



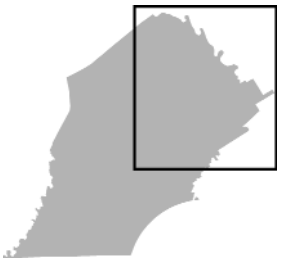
Northwest Section



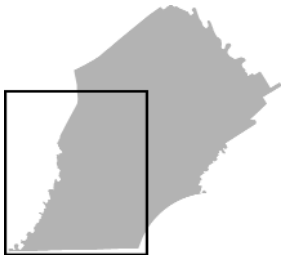
Road Functional Classification

- Expressway
- Major arterial
- Minor arterial
- Major collector
- Minor collector
- Local distributor
- Local

Northeast Section

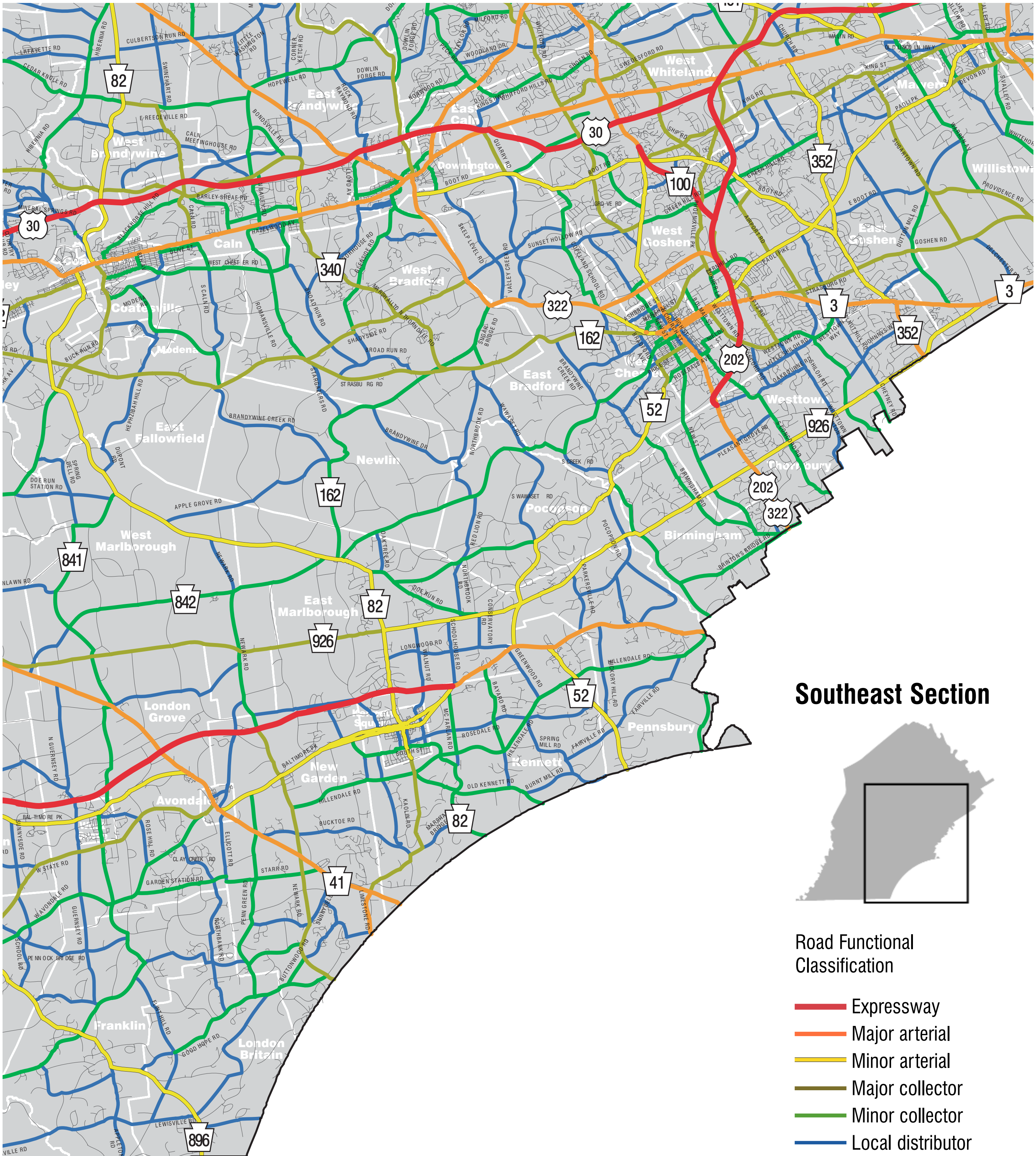


Southwest Section



Road Functional Classification

- Expressway
- Major arterial
- Minor arterial
- Major collector
- Minor collector
- Local distributor
- Local



Southeast Section

Road Functional Classification

- Expressway
- Major arterial
- Minor arterial
- Major collector
- Minor collector
- Local distributor
- Local

Relationship to *LANDSCAPES*

LANDSCAPES establishes a vision for the future. That vision is to "Preserve and enhance the unique character of Chester County landscapes by concentrating growth in the most appropriate areas." This vision promotes the conservation and preservation of agricultural, open, and natural areas of the County but also promotes economic sustainability and growth of other areas particularly the "Centers" and "Suburban" landscapes.

The road network identified in the functional classification relates to this vision in several critical ways.

1| The growth areas and centers throughout the County are highly dependent on mobility for movement of goods, services, and people. Sustaining, enhancing, and connecting these centers will in part rely on adequate mobility. The highest level of mobility is provided by expressways and arterials. All "Urban Centers" and "Suburban Centers" identified on the *Livable Landscapes Map* are served directly by an expressway or an arterial. Of the 24 "Rural Centers" only five are not directly served by an expressway or an arterial. These include Glenmoore, London Grove, Marshallton, Romansville, and Wagontown.

2| The expressway portion of US 1 in southern Chester County functions as a general barrier or growth boundary. Areas north of US 1 are predominantly in "Rural" landscapes while the areas south are a mix of "Urban Centers," "Suburban" landscapes and "Rural Centers."

3| There are several arterials that connect a large concentration of *LANDSCAPES* "centers."

- Baltimore Pike connects six "Urban Centers" and "Rural Centers" in the southern portion of the County.
- US Business 30 connects eight "Urban," "Suburban," and "Rural Centers" in the central core of the County. This may account for its intense commercial orientation.
- PA 41 connects six "Urban Centers" and "Rural Centers" in the southwestern part of the County.
- PA 724, when coupled with a short segment of PA 23, connects three "Urban Centers" in the northeast corner of the county.
- PA 896 and PA 796 south of US 1 connect five "Rural Centers" in the southern most area of the County.

This connecting function makes these roads critical from a traffic flow perspective but it introduces issues concerning the mix of through and local traffic. Baltimore Pike and US Business 30 have expressways that carry the bulk of the through traffic.

4| Expressways and arterials can impact the rural and natural areas of the County. The greater mobility afforded by the expressways and arterials can precipitate or induce development pressures in these areas that are not intended for moderate or higher levels of development. There are three particular corridors of concern.

- PA 41 is a major arterial in the southwestern part of the County. The segment of PA 41 between Atglen and US 1 traverses a significant core of agricultural lands.
- PA 100 is a major arterial that extends from central part of the County to and beyond the northern tier. A segment that extends between PA 401 and PA 23 traverses significant open and natural areas.
- US 322 is a major arterial that extends through the entire County from the northwest to the southeast. The segment that extends between Honeybrook and Guthriesville has a significant agricultural core.

These three arterials currently carry moderate volumes of traffic at fairly high operating speeds with high percents of through traffic in these sensitive areas. The problem stems from the need to accommodate the future travel demand without inducing additional land development. These corridors serve an important function of connecting centers and connecting areas external to the County; yet, the areas around these corridors are not intended as focal points for development. This is a dilemma that will require special consideration of roadway design and land use management.

5| Similarly, there are several minor arterials that traverse sensitive rural, agricultural, and natural areas that are not appropriate for moderate or higher density development. These include:

- PA 10 between Oxford and Parkesburg Boroughs.
- PA 10 between US 30 and Honeybrook Borough.
- PA 23 between Elverson and PA 100.
- PA 82 between Unionville and Coatesville.
- PA 113 between PA 401 and Phoenixville.

These corridors will also require special consideration of roadway design and land use management to accommodate the natural growth in traffic without inducing unanticipated development.

Applications of Functional Classification

Functional classification is the primary tool that integrates land use and the road network. There is a two-directional relationship between transportation and land use. Land use can have a profound impact on the operation of the transportation system. Conversely, the transportation system can often be a factor in inducing major changes in land use.

The appropriate integration of land use and transportation can be guided through certain planning principles and implemented through proper design of the road and the access points.

Planning Principles and Design Concepts

- Road functional classification must be based on land use policies.
- Land use changes must be accompanied by appropriate capacity and safety improvements to the road network.
- The "Urban Centers" as identified in ***LANDSCAPES*** should be interconnected with a network of expressways or arterials.
- Road improvement plans, access management plans, and right-of-way preservation efforts should be coordinated with all municipalities and jurisdictions along a corridor.
- For new or existing expressways, the number of access points (ramps) should be minimized to preserve the mobility function of the expressway.
- Land use around interchanges must be carefully controlled to preclude induced development that would lead to ramp and interchange failures.
- Appropriate building setbacks or buffer mitigation (walls or berms) should be provided along expressways and arterials to mitigate noise and visual impacts.
- Major improvement projects along expressways and arterials should be accompanied by implementation plans that properly manage traffic incidents and encourage travel demand management.
- Medians on arterials should be used as a safety and congestion mitigation measure.
- Access along arterials and collectors must be carefully managed to minimize the number of access points and to properly design existing and future access points.
- Proper access management could preclude the need for widening the roads. (See separate list of access management techniques in Appendix A.)
- Turning movements on arterials and collectors should be channelized (turning lanes) to properly separate through traffic and turning traffic.
- Driveways should be located as far from intersections as practical particularly along arterials and collectors.
- Traffic signals along arterials and collectors should be integrated into systems to improve safety and traffic flow and to reduce overall delay without encouraging excessive speeds.
- Complex intersections of arterials and collectors should be avoided to minimize driver confusion that can lead to safety and congestion problems.
- Urban and suburban arterials and collectors should be designed to accommodate existing and future public transit routes.

- All arterials and collectors in urban and suburban areas, rural centers, and villages should be designed to accommodate bicycle and pedestrian traffic.
- Neighborhoods and land developments should be interconnected with adequate bicycle and pedestrian access to reduce automobile use of arterials and collectors.
- Where additional road capacity and widening is anticipated rights-of-way should be preserved or protected on arterials and collectors through the use of official maps, ultimate right-of-way, setbacks, or land development negotiations.
- Where new or expanded expressways and arterials are needed but cannot be provided for cost or environmental reasons, a wider network of collectors and local roads should be established to properly accommodate local traffic. The wider network would include parallel access roads and local ring roads around critical intersections.
- Traffic calming should be considered on collectors and local roads and possibly some urban arterials with the recognition that traffic calming techniques can shift traffic problems to other collectors and local roads.
- Local roads should be interconnected in a fashion that allows local traffic to circulate without encouraging through traffic in neighborhoods and developments. Drivers should not have to use arterials or collectors to travel between adjacent neighborhoods.
- A grid pattern of local roads around ***LANDSCAPES*** centers and villages should be developed or expanded to accommodate local traffic without encouraging through traffic.

Design Standards

With the conflicting goals of mobility and access in mind, roads should be designed to accommodate the anticipated land use of an area and the expected levels of through traffic and local traffic.

Many of the roads in the road network of Chester County are the product of an evolution, originating as indian trails, progressing to cartways for horses and wagons and eventually becoming roads for trucks and automobiles. In this evolution many major roads were never reconstructed. Some were periodically widened and partially improved but never reconstructed. Funds were not available at a state or municipal level to modernize many of the older roads into contemporary design standards.

The expressways are the more recently constructed roads in the County. These were built or rebuilt from 1960 to as late as 2003. Many major arterials were reconstructed in the 1960s. However, many of the minor arterials and collectors have not been modernized. This has led to the design oddity where some recently constructed housing development streets are better designed than the collectors that the developments feed into.

Recognizing that some roads cannot be modernized due to environmental constraints, right-of-way limitations or cost factors, Figure 8 provides recommended design guidelines that should be considered in the reconstruction of older roads and the construction of new roads. This figure represents a synthesis of information from four sources:

- *Chester County Highway Needs Study*, 1986
- Chester County *Circulation Handbook*, 1994
- PennDOT's *Design Manual Part II*, 2004
- American Association of State Highway and Transportation Official's *A Policy on Geometric Design of Highways and Streets*, 2001

Figure 8 | Recommended Design Guidelines by Functional Classification

	Expressway	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local Access
Number of lanes	min. 2 per direction	2–8 lanes	2–4 lanes	2–3 lanes	2–3 lanes	1–2 lanes
Median width	10–100 ft	4–60 ft	4–60 ft	2–40 ft	none	none
Travel lane width	12 ft	12 ft	12 ft	10–12 ft	10–12 ft	9–12 ft
Left turn lane width	NA	10–12 ft	10–12 ft	10–12 ft	10–12 ft	10 ft
Right turn lane width	12–14+ ft	12–14 ft	12–14 ft	10–12 ft	10–12 ft	9–12 ft
Shoulder width	10–12 ft	8–10 ft	8–10 ft	2–8 ft	4–8 ft	4–8 ft
Parking lane width	NA	8–12 ft	8–12 ft	8–11 ft	7–11 ft	7–10 ft
Buffer width	25–50 ft	15–20 ft	15–20 ft	10–15 ft	10–15 ft	10–15 ft
Sidewalk width	NA	4–8 ft	4–8 ft	4–8 ft	4–8 ft	4–8 ft
Right-of-way width	150–300 ft	100–150 ft	80–120 ft	60–80 ft	60–80 ft	33–50 ft
Design speed	50–70 mph	30–70 mph	30–70 mph	20–60 mph	20–60 mph	20–30 mph
Percent grade (max)	3–5%	3–9%	3–9%	5–12%	5–12%	5–12%

Design guidelines recommended by the Chester County Planning Commission, 2004
NA: Not Applicable

Local Roads

The County's recommended road functional classification (Figure 7) includes all classes of roads with expressways, arterials, collectors, and local roads. From recent work with municipalities throughout the County on their comprehensive plans, several municipalities requested information that is more descriptive of the different functions of the local road network. For purposes of the County classification, local roads were split between local distributors and local access roads. Because of the wide recognition that the local road network has a subsystem with different functions, the Chester County *Circulation Handbook* provided more definitive guidance on this matter. The basic design concepts for the different local roads are illustrated in Figure 9. More details are available in the handbook.

Access Management and Functional Classification

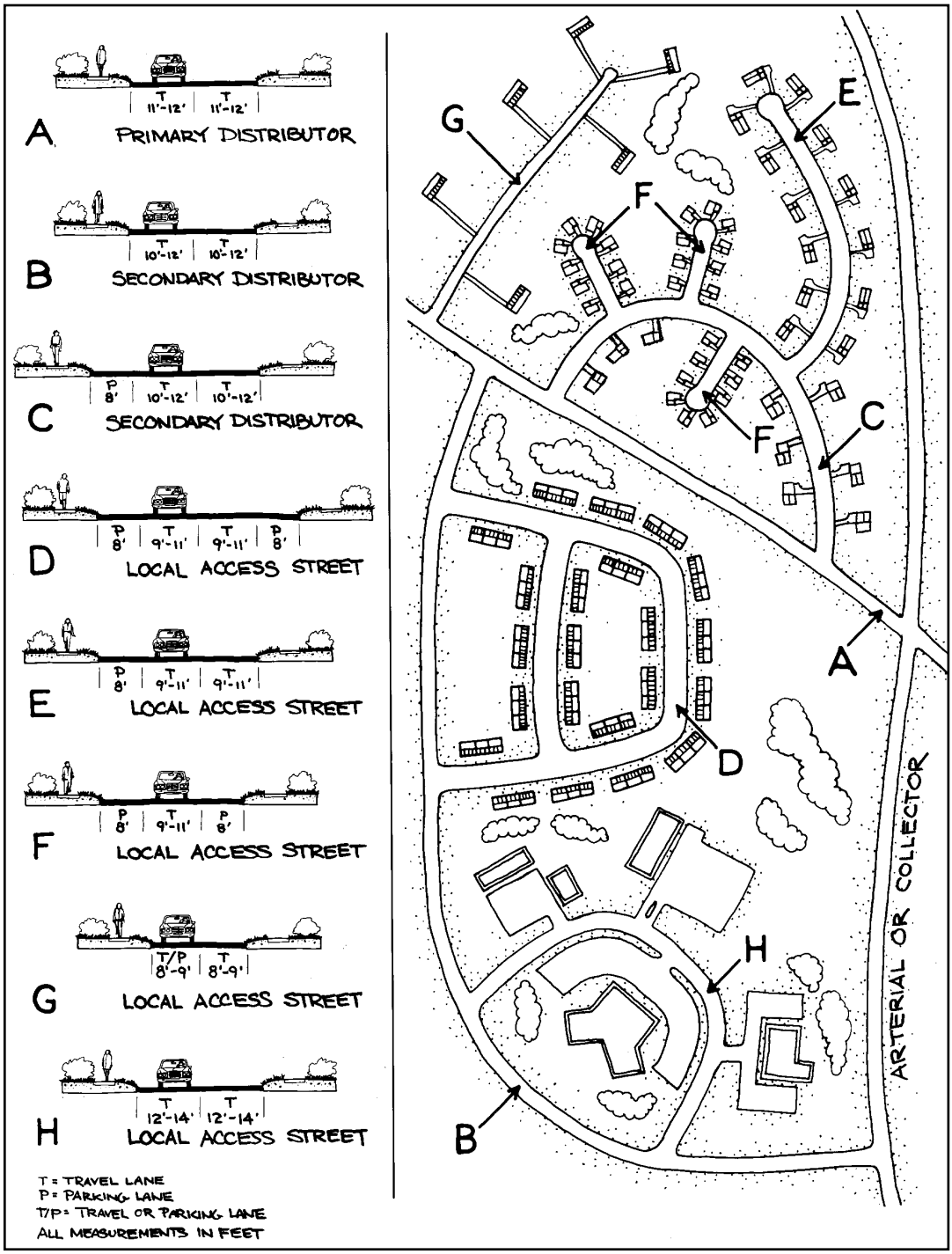
Because some roads cannot easily be brought up to current design standards it becomes more critical to find ways to improve safety and mitigate congestion. One of the most effective means, without total reconstruction, is through the application of appropriate access management techniques.

Access is the interface between land use and the road network. How well the access points function, has a direct impact on the operation of the road and helps to determine the best use of the land. Access management includes strategies to reduce the number of traffic conflicts associated with driveways and to enhance the safe and efficient movement of traffic.

Figure 10 provides a list of access management techniques that can be considered for each class of road. These techniques need to be reviewed for every access point on a corridor-wide basis. The techniques can be included in municipal ordinances and can be implemented during the land development process or as a roadway is reconstructed.

Appendix A provides illustrations that depict improper and preferred treatments for different types of access management.

Figure 9 | Functional Classification of Local Roads for Office Park and Residential Development with Recommended Cross-Sections



Source: Chester County Planning Commission, 1993

Figure 10 | Recommended Access Management Techniques by Road Classification

Road Class	Access Management Technique
Expressway	No property access
	Access only at designated interchanges
	Collector-distributor road for high volume weaving or merging traffic movements
	Continuous median to prevent left turns
Major Arterial	Parallel access road (where possible) with reverse frontage lots
	"High volume" type driveway design for major land developments with additional secondary access on other roads
	Acceleration and deceleration lanes (acceleration tapers not lanes in some cases)
	Driveway turning speed of 25 mph
	Right angle intersection to avoid acute turning movement.
	No parking on arterial near access point or on access road near arterial
	No traffic obstructions within parcels that would backup traffic onto arterial
	Shared driveways (where possible)
	Separated lanes on the access road for egress and ingress movements (possible use of one-way operations or boulevard design)
	Minimum driveway spacing of 250 feet
	Maximum separation of driveway from adjacent intersection on corner lots
	Median to prevent left turns
	Left turns restricted to dedicated left turn lanes or jughandles
	Coordinated traffic signal systems
	Driveway design to accommodate all relevant vehicle types and to accommodate peak hour traffic demand
	Clearly delineated street name signs to avoid driver confusion
	Shared property advertising signs to avoid sign clutter and driver confusion
Minor Arterial	Parallel access road (where possible) with reverse frontage lots
	"High volume" type driveway design for major land developments with additional secondary access on other roads
	Deceleration lanes and acceleration tapers
	Driveway turning speed of 25 mph
	Right angle intersection to avoid acute turning movement
	No parking on arterial near access point or on access road near arterial
	No traffic obstructions within parcels that would backup traffic onto arterial
	Shared driveways (where possible)
	Separated lanes on the access road for egress and ingress movements (possible use of one-way operations or boulevard design)
	Minimum driveway spacing of 200 feet

Road Class	Access Management Technique
Minor Arterial (continued)	Maximum separation of driveway from adjacent intersection on corner lots
	Median to prevent left turns
	Left turns restricted to dedicated left turn lanes or jughandles
	Coordinated traffic signal systems
	Driveway design to accommodate all relevant vehicle types and to accommodate peak hour traffic demand
	Clearly delineated street name signs to avoid driver confusion
	Shared property advertising signs to avoid sign clutter and driver confusion
Major Collector	"High volume" type driveway design for major land developments with additional secondary access on other roads
	Deceleration lanes in cases of problem grades, high traffic volumes, high speeds or poor sight distances
	Driveway turning speed of 20 mph
	Right angle intersections to avoid acute turning movement
	No parking on collector near access point or on access road near collector
	No traffic obstructions within parcels that would backup traffic onto collector
	Shared driveways (where possible)
	Clearly delineated egress and ingress lanes
	Minimum driveway spacing of 150 feet
	Maximum separation of driveway from adjacent intersection on corner lots
	Left turn lanes on the collector in cases of problem grades, high traffic volumes, high speeds or poor sight distances
	Coordinated traffic signal systems
	Driveway design to accommodate all relevant vehicle types and to accommodate peak hour traffic demand
	Clearly delineated street name signs to avoid driver confusion
	Shared property advertising signs to avoid sign clutter and driver confusion
Minor Collector	"High volume" type driveway design for major land developments with additional secondary access on other roads
	Deceleration lanes in cases of problem grades, high traffic volumes, high speeds or poor sight distances
	Driveway turning speed of 20 mph
	Right angle intersections to avoid acute turning movement
	No parking on collector near access point or on access road near collector
	No traffic obstructions within parcels that would backup traffic onto collector
	Shared driveways (where possible)
	Clearly delineated egress and ingress lanes
	Minimum driveway spacing of 150 feet
	Maximum separation of driveway from adjacent intersection on corner lots

Road Class	Access Management Technique
Minor Collector	"High volume" type driveway design for major land developments with additional secondary access on other roads
	Deceleration lanes In cases of problem grades, high traffic volumes, high speeds or poor sight distances
	Driveway turning speed of 20 mph
	Right angle intersections to avoid acute turning movement
	No parking on collector near access point or on access road near collector
	No traffic obstructions within parcels that would backup traffic onto collector
	Shared driveways (where possible)
	Clearly delineated egress and ingress lanes
	Minimum driveway spacing of 150 feet
	Maximum separation of driveway from adjacent intersection on corner lots
	Left turn lanes on the collector in cases of problem grades, high traffic volumes, high speeds or poor sight distances
	Coordinated traffic signal systems
	Driveway design to accommodate all relevant vehicle types and to accommodate peak hour traffic demand
	Clearly delineated street name signs to avoid driver confusion
	Shared property advertising signs to avoid sign clutter and driver confusion
Local Roads (Distributor)	Driveway turning speed of 15 mph
	Right angle intersections to avoid acute turning movement
	Shared driveways (where possible)
	Minimum driveway spacing of 100 feet
	Maximum separation of driveway from adjacent intersection on corner lots
	Driveway design to accommodate all relevant vehicle types and to accommodate peak hour traffic demand
	Clearly delineated street name signs to avoid driver confusion
	Shared property advertising signs to avoid sign clutter and driver confusion

Conclusions and Recommendations

A properly functioning road network is dependent on the appropriate accommodation of mobility, access and the interconnection of all the roads in the network. Road functional classification is a tool that can be used to reach the proper mix of mobility and access through the diversity of classes. While there is no prescribed or required formula for the correct mix, sustaining growth, and economic development in the ***LANDSCAPES*** "centers" is highly dependent on adequate mobility and capacity of the roads. However, excessive mobility and capacity can have unintended consequences of induced development in areas where development is not appropriate.

The road functional classification that was adopted by the Chester County Planning Commission will be used throughout the development of the transportation plan for the County.

There are other applications and follow-up efforts associated with this functional classification.

- This classification should be forwarded to the Delaware Valley Regional Planning Commission and PennDOT for their use as they update or modify their classifications.
- Within Chester County there are several regional planning commissions that are actively involved in transportation and land use planning. This classification can be used by them as a basis for coordinating the municipalities in their respective regions.
- The classification should be made available to the general public. The map of the road functional classification is available on the Planning Commission's Web site (*http://www.chesco.org/planning/index.html*). This technical memorandum will be distributed to the public.
- As municipal ordinances are updated, this information can be used to supplement or modify ordinance language. This is particularly relevant with access management regulations. Very few municipalities have access management provisions in their ordinances.
- This report will be used by the County Planning Commission as policy and technical input in the review of land development proposals, zoning ordinance changes and comprehensive plans.
- The policy and technical aspects of this memorandum are dynamic. Changes are occurring that will need to be monitored with updates to this material.
- As municipalities review their functional classification, this material can be used for reference. Some municipalities may wish to refine their local road classification.

Appendix A | Access Management Techniques

Access Management techniques involve strategies which serve to reduce the number of traffic conflicts associated with driveways and to enhance the safe and efficient movement of traffic.

The US Department of Transportation identifies four major objectives essential to access management strategies:

1| Limit the number of conflict points. These techniques directly reduce the frequency of encroachment conflicts, or reduce the area of conflict at some or all driveways on the highway by limiting or preventing certain kinds of maneuvers.

2| Separate basic conflict areas. These techniques either reduce the number of driveways or directly increase the spacing between driveways or between driveways and intersections.

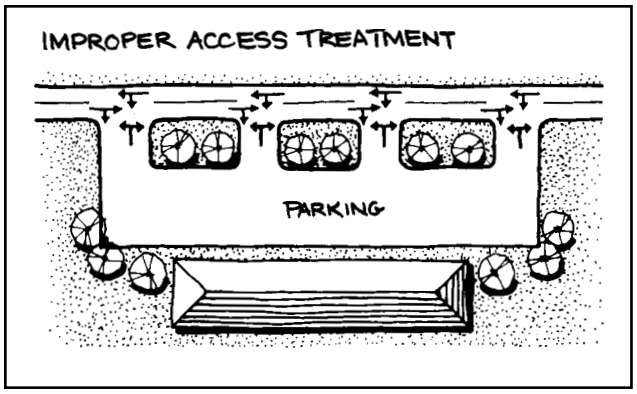
3| Improve deceleration design. These techniques reduce the severity of conflicts by increasing driveway turning speeds, by decreasing delay to through trips, or by increasing driver perception time.

4| Remove turning vehicles from through lanes. These techniques directly reduce both the frequency and severity of conflicts by providing separate paths and storage areas for turning vehicles.

The techniques which can be used on arterial and collector roads to address these objectives are illustrated in Figures 11 through 21.

Additional techniques include these traffic signal timing procedures:

- Regularly monitor and adjust timing to optimize traffic flow.
- Install volume-density controller to better utilize green time for side streets.
- Establish variable phasing for different times of the day.
- Interconnect signals to improve traffic flow.
- Install time-base coordination to optimize traffic flow.



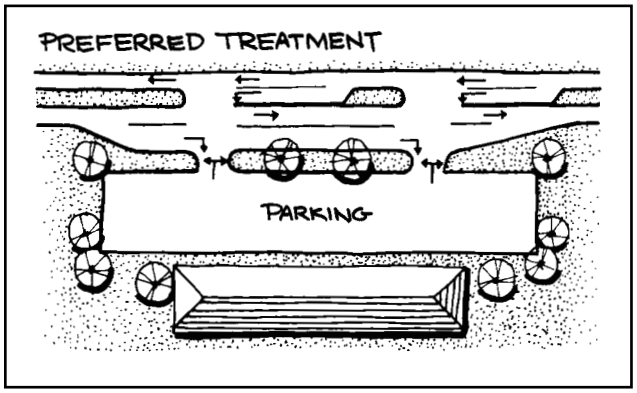
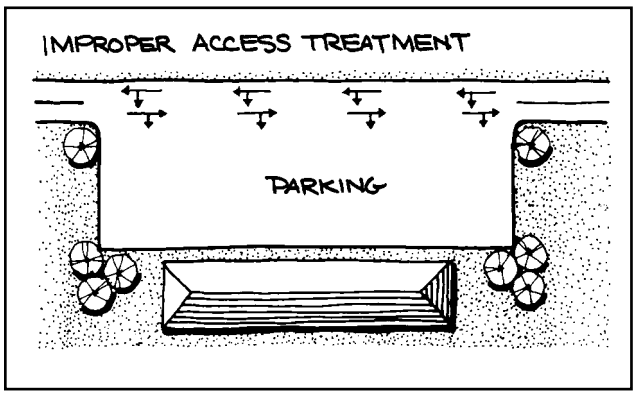


Figure 11
Reducing the Number of Access Points

Reducing the number of access points decreases the accident rate by minimizing the number of traffic conflicts. Having fewer access points can improve the ability to provide channelization.



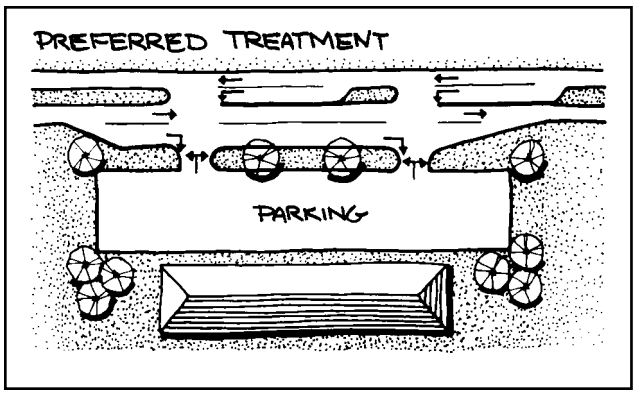


Figure 12
Channelize Access Points

Turning movements to and form large parcels with no access control lead to rear-end accidents, side-swipe accidents and vehicle queuing on the adjacent road. Providing access controls and separate turning lanes reduce driver confusion and improve the capacity of the adjacent road.

Figure 13
Relocate Access point Away from Intersection

Moving access point away from the adjacent intersection allows for a separation of conflicting movements thereby decreasing the accident rate. It also provides a better opportunity to channelize the adjacent intersection and the access point.

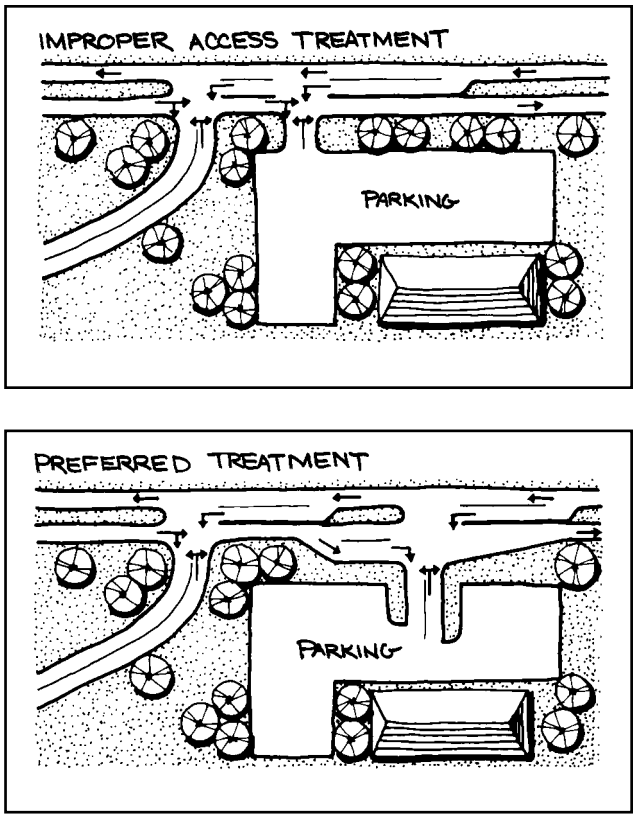
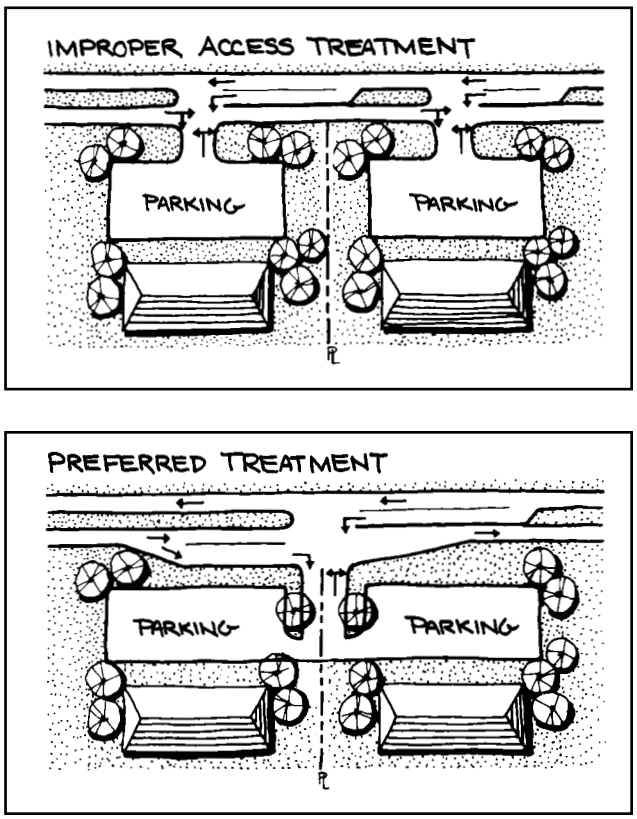
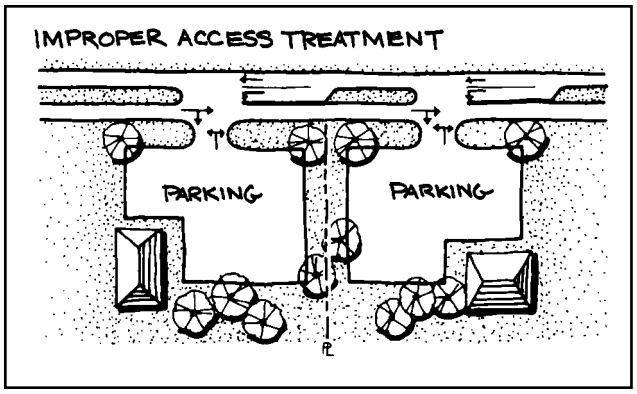


Figure 14
Combine Access Points

Combining access points of adjacent parcels reduces the number of access points thereby decreasing the accident rate. This treatment requires an easement which delineates maintenance responsibilities.





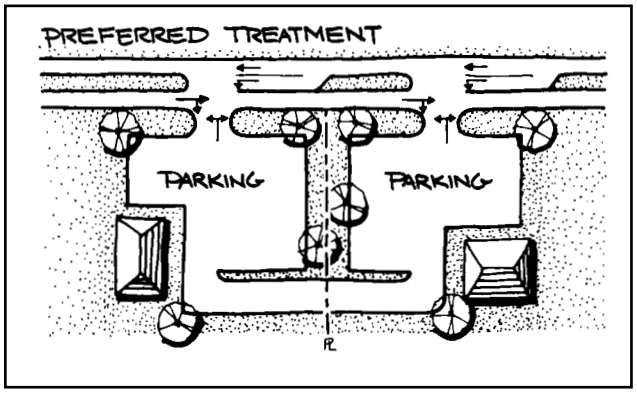
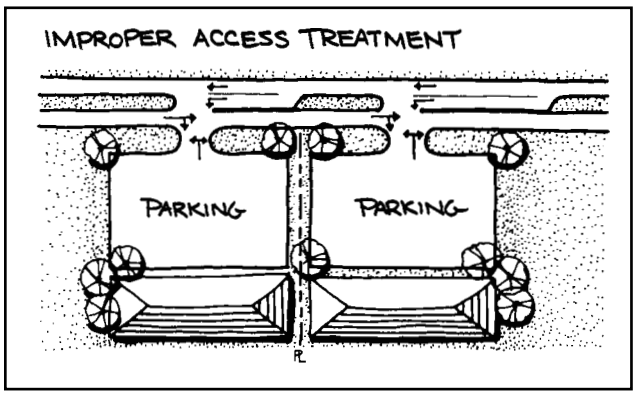


Figure 15
Provide Access between Adjacent Parcels

Providing access between adjacent parcels allows vehicles to move from one parcel to another without using the adjacent road.



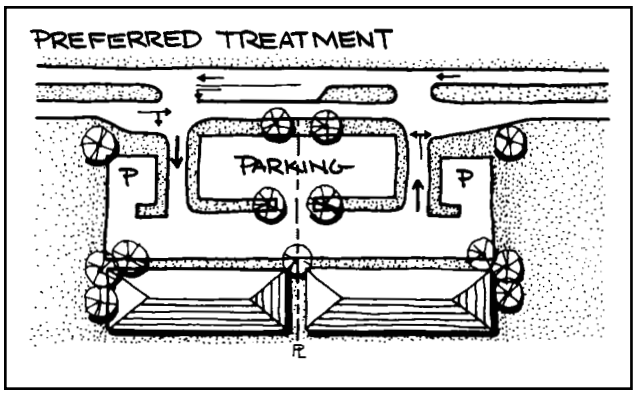


Figure 16
Create One-Way Traffic Pattern

Creating a different access for ingress and egress separates conflicting movements, decreases the accident rate and improves driveway capacity.

Figure 17
Provide Deceleration Lane and Acceleration Taper

Providing a deceleration land for right turn movements reduces the number of rear-end accidents and improves the capacity on the adjacent road. An acceleration taper increases sight distance and provides a safety zone.

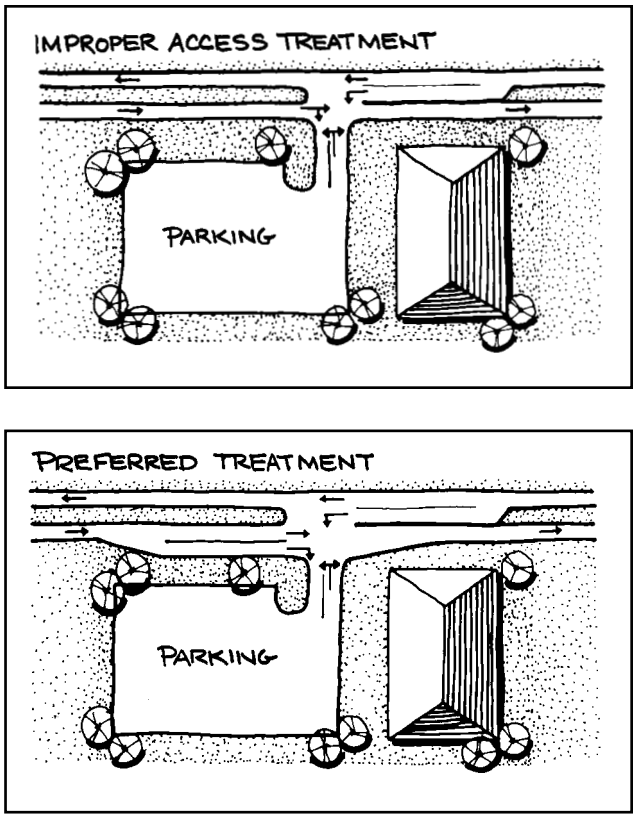
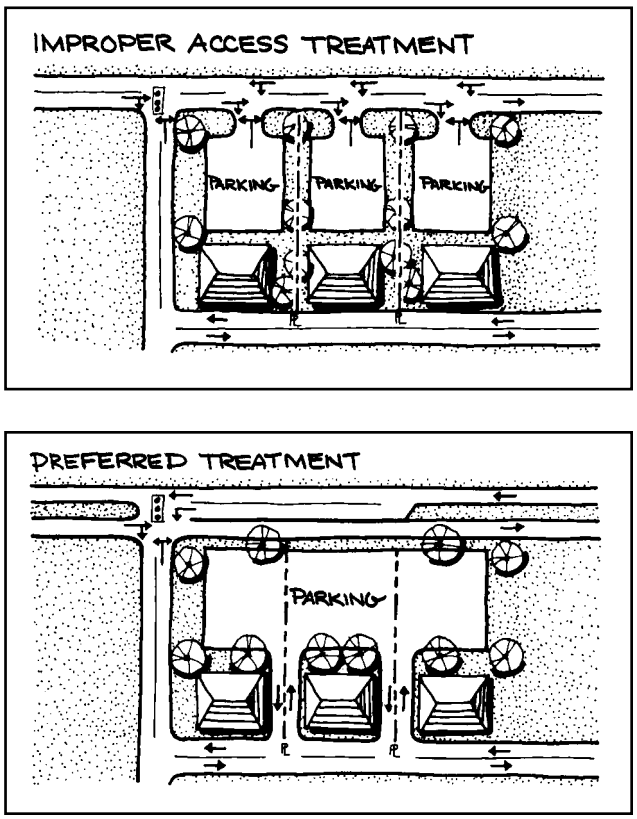
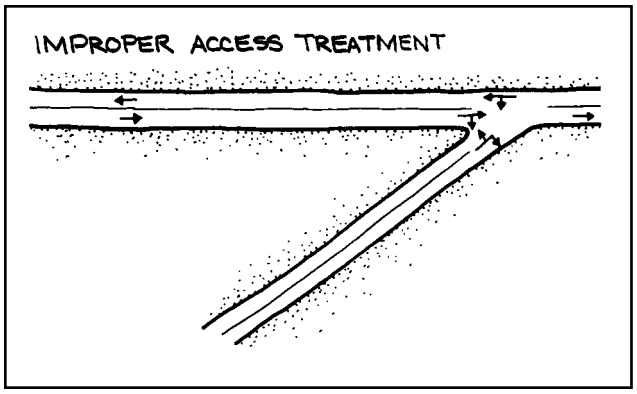


Figure 18
Reverse Frontage Road

Access on the reverse frontage road decreases the accident rate on the primary road by eliminating access points and by focusing turning movements to channelized, signalized intersections.





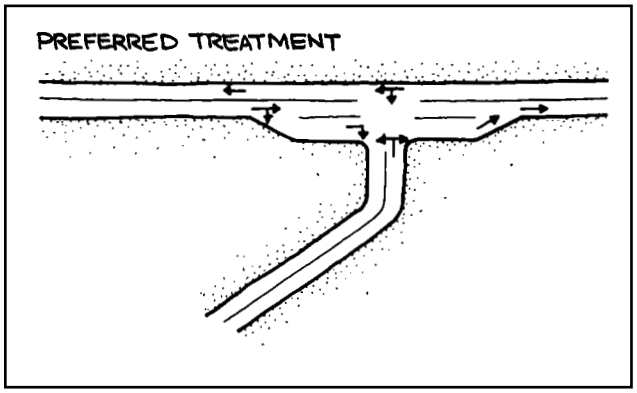
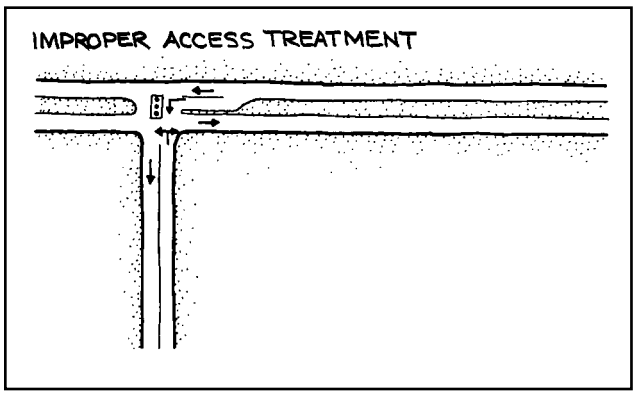


Figure 19
Realign Access Point

A right-angle intersection decreases the accident rate by improving the approach angle for sight distance and providing better turning radii for vehicles.



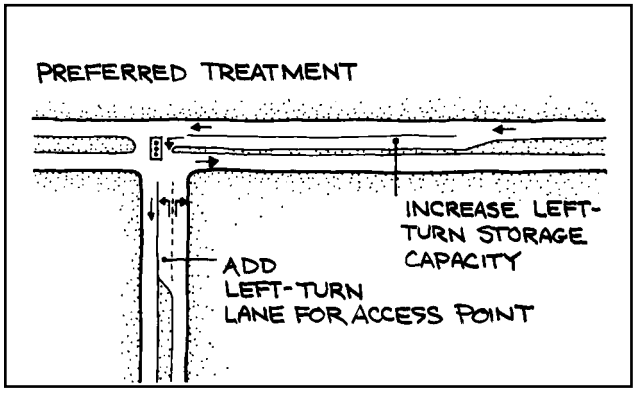
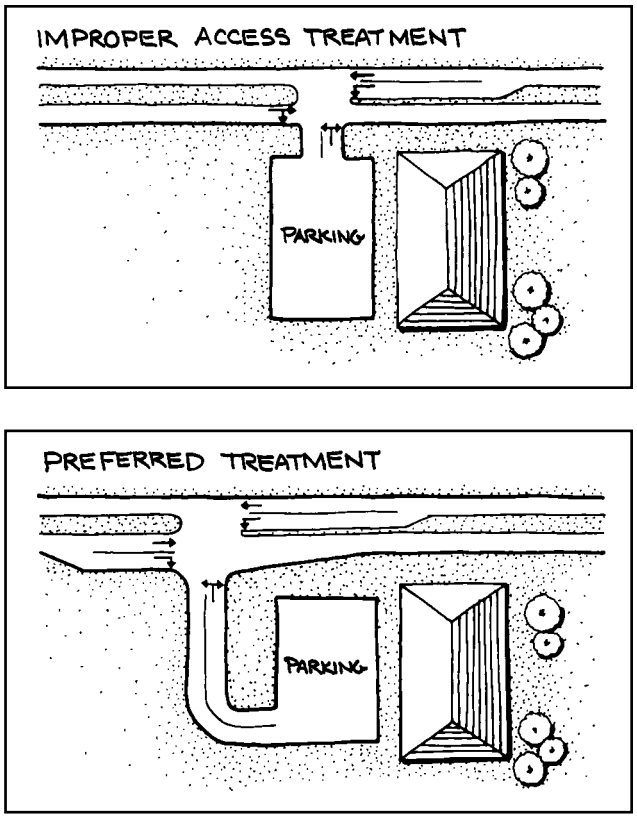


Figure 20
Modify Left Turn Movements

Providing additional left-turn storage areas into and out of an access point decrease the accident rate and improves the capacity of the adjacent road and the access point.

Figure 21
Improve Access to Parking Lot

A deceleration lane and a stacking area leading to the parking lot decrease the accident rate by minimizing the conflicts between: through vehicles on the adjacent road, vehicles turning into the parking lot and vehicle moving in our out of parking spaces.



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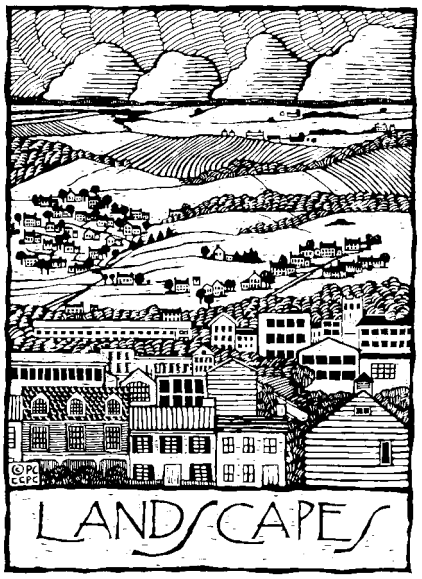
June 2004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