Chapter 7
Infrastructure

Introduction

A community's infrastructure is the framework of essential services relating to utilities and transportation networks. This chapter focuses on the following four topics: Water Service, Sewer Service, Stormwater Management, and Transportation. Most often, capital improvement plans are an outgrowth of planning for creation and expansion of existing utility and transportation facilities.

Warren County has had a history of privatization which is documented in the County Code, adopted in 1981. The code made it clear that the County wished to avoid an unreasonable burden for providing water and sewer, fire and rescue, police protection, and solid waste disposal services, or the expenditure of public funds for such services. This left many of these services in the hands of developers, untrained individuals, or owner associations which resulted in an inconsistent system of services.

When subdivisions were plotted in the 1950s through the 1970s, no one could have foreseen the problems inherent in a lack of unity of the infrastructure provision and planning. A 1992 demographic survey conducted by Property Owners' Associations of Virginia, Inc., determined that in rural area subdivisions platted 30 to 40 years ago, dwellings occupied less than 40% of their lots.

The Comprehensive Plan's survey of Warren County residents, revealed that citizens are feeling the negative effects from the lack of infrastructure. In fact, 61% are concerned about development trends in their neighborhoods and 63% are concerned about development trends elsewhere in the County. The largest concern was traffic congestion, followed by substandard roads and lack of groundwater. In response to this dissatisfaction, the County must re-evaluate its development ordinances in relation to guiding and facilitating orderly and beneficial growth and development that will promote public health, safety, and the population's welfare.

Section 1: Water Service

Background

There are several problems in establishing a public water system in Warren County. First, the County's topography is mountainous, making water lines and facilities construction more difficult. Secondly, the population areas and areas slated for commercial/industrial development are physically separated by several miles. As a result of these problems, implementing a public water service program would present difficulties in having a unified system which would provide adequate water pressure and flows for fire protection. Finally, any planned service must be consistent with the growth management an land use issues described in Chapter Four.

According to the Comprehensive Plan survey, 64% of the County's residents depend on wells for their drinking water. The survey also revealed that 3% of the County's residents were serviced by a private water system serving multiple households. Such systems when they serve more than 50 households are defined by the Code of Virginia (Section 56-265.1) as a Public

Utility. Private utility systems, must be registered and are regulated by the State Corporation Commission of Virginia. Often, private utility systems that serve single subdivisions do not provide the level of service or maintain the system properly. This leads to poor water service and quality. Other issues that are forcing the County to provide water service are:

- Limited ground water supplies.
- Increased well contamination and limited ground water resources.
- Increased septic system failures.
- Soil and geological factors which either foul the smell or the taste.
- The County Health Department's authority is limited to approval and permits the installation of water wells and septic sites.

Goals & Objectives

Goal: To develop and implement a method for water service which is cost-efficient to County residents and consistent with the County's Comprehensive Plan in terms of growth management and land use issues as described in Chapter Four.

Objectives:

A. Meet existing community needs as a first priority.

B. Encourage cooperation and shared facility use in conjunction with other entities or agencies.

C. Coordinate development with facility expansion.

D. Develop needed facilities in a cost-effective manner.

Implementation

Adequate Public Facilities Standards - Establish public facility and design standards for new development proposals within service districts.

Cooperation – Investigate and cooperate with the Town of Front Royal or other entities.

Citizen Participation - Include County residents on committees and advisory boards that provide additional input and comment to the Planning Commission and/or the Board of Supervisors.

Development Service Districts - Establish Development Service Districts based on the premise that new development can be serviced most efficiently if it is limited to certain County areas. A Development Service District's key to success is the availability of services and capital improvements.

Establish A Water Authority – Develop the County Water Authority to provide service extensions where appropriate into the County, or develop County owned facilities. (The County currently has a Water Authority, with includes the members of the County Board of Supervisors.)

Special Taxing Districts - Consider using special taxing districts to aid in financing public facilities.

Voluntary Proffers - Maintain a proffer system for capital improvements associated with development proposals and service expansion.

Summary

This section of the Comprehensive Plan has tried to identify the problems as well as possible solutions for potable water supplies for Warren County's citizens. Currently, the County relies on groundwater for its potable water supply. Additional water resources are available from the Town of Front Royal, but these resources are limited to industrial/commercial users only. The Town currently does not have the capacity to supply residential water needs in the County.

Section 2: Sanitary Sewer Service

Background

In 1988, a D.R.A.S.T.I.C. (Depth to water table, Recharge, Aquifer, Soils, Topography, Impact, and Conductivity) Report was prepared for Warren County, by Virginia Water Project, Inc. This report found that large areas of the County are highly susceptible to ground water contamination. This region stretches across the County's northern end (**Map 3.7**).

Nearly all Warren County residential development is serviced by individual septic systems. In the past few years there has been an increase of failing systems. According to County Health Department Records, there have been failures and subsequent repairs of Warren County septic systems since 1987. Prior to that date detailed records are not available. The location of these failures is shown on **Map 3.3**. Currently there are between 100 and 200 platted County subdivisions. Originally, many of these subdivisions were designed as weekend retreats and vacation homes. However, over the past 30 years, these subdivisions have become year-round residences. As more people move into these subdivisions, the septic load will be greatly increased.

Approximately one-third of Virginia septic permits are resting within the high water table. A separation distance of two to four feet is necessary for proper treatment. Virginia's requirements are the most lenient in the United States. The County adopted stringent regulations County-wide for new septic systems in August 2001 in an effort to protect ground water resources. Additionally, a public awareness campaign must be developed to educate residents about the proper care and maintenance of septic systems.

There are several problems in establishing a Warren County sanitary sewer system. First, the County's topography is mountainous. The construction of sewer lines and facilities is more difficult in such terrain. Second, the population areas and areas slated for commercial/industrial development are physically separated by several miles. Finally, as a result of these problems,

implementing a sanitary sewer service program would present difficulties in establishing a unified system. Other problems are as follows:

- Limited ground water supplies.
- Increased well contamination and limited ground water resources.
- Increased septic system failures.
- Soil and geological factors which either foul the smell or taste of ground water.
- The County Health Department's authority is limited to approval and permits the installation of water wells and septic sites.
- The County should require regular testing of alternative septic systems.

Goals & Objectives

Goal: To develop a County Sanitary Sewer System which is cost-efficient and meets residents' needs while providing an equitable service level in the County. The Sanitary Sewer System also would protect our environment and provide for economic growth and development.

Objectives:

A. Meet existing community needs as a first priority.

B. Encourage cooperation and shared use of facilities in conjunction with other government entities or agencies.

C. Coordinate development with facility expansion.

D. Develop needed facilities in a cost-effective manner.

Implementation

Adequate Public Facilities Standards - Establish public facility and design standards for new development proposals.

Consultant - Consider using a private consultant or providing additional staff to the County Health Department to conduct a County testing program that would gather evidence for State and Federal funds' application for a sewer service system and organization within the County.

Development Service Districts - Establish Development Service Districts based on the premise that new development can be serviced most efficiently if it is limited to certain County areas. A Development Service District's key to success is the availability of services and capital improvements: therefore, provide water and other types of infrastructure to accommodate anticipated growth.

Establish A Sewer Authority - Develop a Sewer Authority to provide service extensions where appropriate into the County, or develop County owned facilities.

Revise Ordinance - Revise the existing ordinances pertaining to County septic systems. Increase the development and/or design standards for County septic systems. Establish a buffer between septic systems and perennial streams and the Shenandoah River.

Special Taxing Districts - Consider using special taxing districts to aid in public facilities financing.

Voluntary Proffers - Maintain a proffer system for capital improvements associated with development proposals and service expansion.

Summary

The provision of sewage disposal facilities is one of the County's most powerful growth management tools available. The County's ability to grow depends upon its ability to provide economical sewer service. Currently, only the Town of Front Royal has sewer facilities. The County's use of these facilities is restricted to industrial users. The Town currently does not have the capacity to supply County residential sewer needs. Many of the existing residential lots that were created in the 1950s and 1960s are located in the regions with the poorest soils for septic systems. All residential growth in the County is served by septic systems. The majority of that growth is occurring in regions which have soils unsuitable for septic systems.

Map 7.1 Public Water and Sewer Facilities

Section 3: Stormwater Management

Background

Surface runoff from excess rainfall is a natural process. This runoff is nature's chisel which has formed the landscape as we know. This is a slow process; without man's interference nature creates a state of equilibrium.

Either through ignorance of ecosystem functions, poor planning, unwise land use decisions, or just plain indifference to natural stormwater runoff processes, humans, through construction and development activities, have created a number of problems for themselves and nature.

First, is the development of floodplains, putting possessions in jeopardy. Second, the development and urbanization of uplands has increased erosion and accelerated runoff processes altering natural runoff patterns and increasing flood hazards. Finally, many of civilization's contaminants are transported in stormwater runoff which ultimately can enter and degrade the quality of streams, rivers, lakes, wetlands, and estuaries.

Through their planning and regulatory functions, local governments have the principle responsibility for controlling developmental activities in the State of Virginia. This role carries with it the responsibility for ensuring that developmental activities are undertaken with the safety of future inhabitants in mind, and in a manner that is compatible with the protection and enhancement of natural resources - including water resources.

Problems of water quality, erosion, and increased flooding in developing areas, can be explained in a relatively straight forward manner. As more land becomes covered with buildings, roads, parking lots, sidewalks, and other impervious surfaces, stormwater is prevented from percolating into the soil. Instead, it runs off these impermeable surfaces and drains directly and rapidly to the nearest water body. This increases the peak flow, both in terms of volume and rate. The floodplain size also is affected, resulting in more frequent flooding and accelerated stream channel erosion. This large amount of runoff reduces the amount of water left for soil moisture replenishment and groundwater recharge. The reduction in groundwater translates to a reduction in the base flow of water to streams during dry weather. This adversely affects fish populations and other aquatic organisms. Additionally, as land is prepared for development by clearing and grading, soil becomes exposed and subject to erosion. Soil particles transported in stormwater runoff can be deposited as sediment in a stream or other water body. This elevates the stream bed's level resulting in more frequent flooding.

While the erosion and flooding problems long have been acknowledged, the pollution potential associated with stormwater runoff is not as widely understood or recognized. Pollutants collect on impervious surfaces and during storms are rapidly washed into drains and surface waters. There is no chance for these pollutants to be trapped by vegetative cover and soils. The Environmental Protection Agency has calculated that runoff from the first hour of a moderate-to-heavy storm, will contribute more pollution load than would a municipality's untreated sanitary sewage during the same period of time. The National Urban Runoff Program (NURP) has conducted studies confirming that contaminants contained in urban and suburban runoff, such as sediments, phosphorus, nitrates, coliform bacteria, as well as lead, and other heavy metals, can impair water quality in streams, lakes, wetlands, and estuaries.

Issues

- Frequent flash flooding of parking areas and roads during moderate storms.
- Substantial erosion associated with construction sites.
- Erosion associated with mountain side development and subdivisions.
- The lack of complete or unified drainage systems in existing developments and insufficient requirements for drainage system control in new developments.

Aspects of Stormwater Management

Stormwater management has two approaches, quantitative control and qualitative control. The quantitative control is a system of vegetative and structural measures which can be used to control the increased volume and rate of surface runoff caused by man-made changes to the land. Qualitative control is a system of vegetative, structural, and other measures which can be used to control or treat pollutants carried by surface water runoff.

Goals & Objectives

Goal: To prevent Stormwater Runoff from site development through maintaining pre-development conditions.

Objectives:

A. Evaluate potential of adopting local stormwater management ordinances.

B. Reduce impact of increased runoff from new land development, thereby reducing potential flooding and flood damage.

C. Minimize erosion potential from development or construction sites.

D. Assure that existing and proposed culverts and bridges are adequate.

E. Increase water recharge into the ground through using retention and detention ponds.

F. Enhance Stormwater Runoff quality to prevent water quality degradation in receiving water bodies.

G. Reduce stream bank erosion to maintain stream channels for their biological functions as well as for drainage.

H. Prevent stream base flow reductions caused by new land development.

I. Use on site and regional stormwater management techniques and methodologies.

Implementation

Capital Improvements Plan - Maintain a Capital Improvements Plan to identify and fund needed improvements in existing County developments.

Inspection & Maintenance - Conduct annual inspections of any stormwater control devices by County inspectors to ensure proper maintenance. Maintenance can be by a property owner's association or by the County through a special taxing district.

Lower Threshold for Land Disturbing Permit - Lower the threshold from 10,000 to 5,000 square feet for the issuance of a Land Disturbing Permit in lieu of an erosion and sediment control plan.

Special Districts - Explore the use of service and taxing districts to address the existing problems associated with stormwater management.

Stormwater Management Plan/Ordinance - Evaluate developing and implementing a stormwater management plan and ordinances associated with the plan, to address stormwater management issues.

Summary

This section of the Comprehensive Plan has identified and recommended solutions for stormwater management. As Warren County continues to develop and grow from a rural county to a more suburban one, county stormwater management will become an increasing issue for new development. Without planning, the County will face increased costs to address problems that were created in the past.

Section 4: Transportation

Background

This section will examine both private and public roads, railroads, mass transit, the County Airport, and the Inland Port. There are more than 331 miles of public roads in Warren County, according to *1990 Virginia Facts: A Comprehensive Look at Virginia Today, County by County*, by John Clements. The 331 miles of public roads, are classified as follows: Interstate, 15 miles; Primary, 35 miles; Secondary, 195 miles; Urban, 60 miles; and frontage, 2 miles. There are also private County subdivision roads that exist; the mileage of these roads has not been determined.

Public Roads

Existing Road Network

There are eight major points of entry and exit along Warren County's borders (**Map 7.2**). On its way from Gainsville, Virginia, to Moorefield, West Virginia, State Route 55 enters the County at Manassas Gap (Linden) on the east and exits at the North Fork of the Shenandoah River bridge near Strasburg. U.S. Highway 340, from Greenville, Virginia, to Frederick, Maryland, goes through the County parallel to the South Fork of the Shenandoah River and Crooked Run. U.S. Route 522, from Powhatan, Virginia, to Sellingsgrove, Pennsylvania, enters the County at Chester Gap on the east, goes through the Town of Front Royal and joins U.S. 340 North, to the Frederick County line. A 14.66 mile segment of Interstate 66 goes through Warren County from Interstate 81, to the Fauquier County line, and terminates in Washington, D.C. The eighth major access point is the Skyline Drive. The northern end of the drive begins just south of Front Royal (**Table 7.1**). It follows the Blue Ridge Mountain's summit until it connects with the Blue Ridge Parkway near Waynesboro. The Parkway continues south into western North Carolina.

Table 7.1 Major Points of Entry/Exit - Warren County

Highway	Entry/Exit	County Border	Entry/Exit	County Border
U.S. Route 55	Manassas Gap	East	Strasburg	West
U.S. Route 340	Nineveh	North	Overall	South
U.S. Route 522	Chester Gap	East	Nineveh	North
Interstate 66	Manassas Gap	East	Cedar Creek	West

Functional Classification

One way to study the County's existing roads is to classify the highways and streets by the major function each serves. The grouping system used by the Virginia Department of Transportation (VDOT) divides all public thoroughfares into arterial, collector, or local routes.

Principle Arterials are roads that serve as high speed connecting links for interstate travel between the country's major population centers and for state wide travel between the Commonwealth's larger cities and towns. Principle Arterials are divided into 2 categories:

A. Interstate, Freeways, and Expressways - These routes receive the highest design standards possible, including access control. Full access control is required on interstate routes and freeways, but expressways may be constructed with partial control.

B. Other Principle Arterials - These routes have lower design standards than interstates or freeways. Except for unusual circumstances, access control is limited to bypasses and major relocations.

Minor Arterials are roads that link urban areas with towns not situated on principle arterial routes. Minor arterials form a network providing interstate and inter County service.

Map 7.2 Traffic Volumes and Major Entry/Exit Points

This system is designed to provide relatively high speed travel, even though in many cases multi-lane facilities will be required.

Collectors are those roads which, regardless of traffic volume, are primarily of intra-County rather than of statewide importance. Because trip lengths are much shorter than on arterial routes, design standards provide for moderate travel speeds. Although some collector corridors might run through several counties, trip lengths within the corridor are usually relatively short. Collectors are also classified into 2 subcategories:

A. Major Collectors - These routes have 3 main functions:

1. To connect locally important traffic generators.
2. To link local traffic generators to nearby towns on higher class roads.
3. To serve the more important intra-County travel corridors.

B. Minor Collectors - These routes form a network bringing all remaining developed areas within reasonable distance from a major collecting route.

Local roads primarily serve as access to adjacent land. Because trip lengths are very short and land access is of prime consideration, design criteria provides only for low travel speeds.

Map 7.3 shows the major County road types. The 14.66-mile segment of Interstate 66 is the only part of the road system built to the high interstate, freeway, or expressway design standards. U. S. Route 340/522 north of the Town of Front Royal is the only other principle arterial and dual lane divided highway in the County. South of Front Royal, U.S. Routes 340 and 522 are the County's minor arterials. Major collector roads include Virginia Route 55, and Secondary Routes 619, 649, 627, 658, and 647.

Road Maintenance

The Town of Front Royal's streets are maintained by the Town. Interstate, primary, and secondary roads in the County are maintained by VDOT. Of the 331 miles of publicly maintained roads in the County, 85.5 miles are maintained by the Town of Front Royal. The remaining 257.7 miles of public roads are maintained by VDOT. The federal government maintains the 21 miles of the Skyline Drive located in the County.

Use

In Warren County there are five principle arterial roadways within the County. These arterial roadways include: U.S. Route 340, U.S. Route 522, U.S. Route 340/522, State Route 55, and Interstate 66 (**Map 7.2**).

Map 7.3: Functional Road Classification

During 2003, the total Annual Average Daily Traffic (AADT) on Warren County's five major arterials for Warren County was approximately 99,000 vehicles. In comparison, during 1993, there were approximately 71,900 vehicles traveling daily along the five major arterials.

Interstate 66, as it passes through Warren County from I-81 to Linden's Route 79 exit, has a segment length of 14.66 miles. 24.2% of the total AADT vehicles traveling in Warren County travel on I-66. U.S. Route 340/522, North to Double Toll-Gate; Route 340, south towards Bentonville; and Route 522, south towards Flint Hill; carry 58.9% of the total vehicles.

Traffic on Route 55 East, from Front Royal to the Linden exit, has increased significantly during the last few decades. As of 2003, this section of Route 55 carried 11,000 (11.1%) vehicles of the total County's AADT. In comparison, during 1983, the AADT along this section amounted to approximately 2,300 (8.3%) vehicles of the total County's AADT. This 378% increase, occurring between 1983 and 2003 primarily was due to the commuting traffic from Front Royal and Warren County to the Washington D.C. Metropolitan area. The remaining 5.6% travel was between Front Royal and Strasburg on Route 55 West.

Traffic volumes are the greatest from Front Royal where major highways converge; at Route 55 and Route 340/522. The highest 22,000 vehicles traveling daily on Route 340/522 between the North Fork of the Shenandoah River and I-66. In comparison, during 1983, there were 7,900 vehicles traveling daily on this section. This increase in traffic volume also is due largely to commuting traffic.

During an October 1994, peak 24-hour period, an additional 1,635 vehicles entered the northern entrance of the Shenandoah National Park's Skyline Drive. The entrance station is located immediately south of Front Royal off of Route 340. From January 1994 through December 1994, 464,647 people visited the Shenandoah National Park (SNP) in 190,248 vehicles entering the drive through SNP's northern entrance station. Statistics show that 25% of the total vehicular traffic entering SNP's entrance stations do so through the northern entrance station.

Primary - Interstate Roads

The 60.91 miles of primary and interstate highways; I-66, U.S. Routes 340 and 522, and Virginia Highway 55 form the major travel thoroughfares through the County.

Corridor H is being completed in West Virginia west to east to Wardensville. The segments from Wardensville to the Virginia line and from the Virginia line connecting to Interstate 66 and Interstate 81 are still being debated.

Warren County's highways offer good access between Front Royal and the larger population centers. Interstate 66 has lessened traffic on Route 55 east, but traffic in and through the Town of Front Royal has increased. Congestion has increased by funneling through the Town, a large portion of the intra and inter-regional traffic. Congestion is highest on summer and fall weekends when the Park's visitation is at its peak.

To lessen congestion on existing primary roads through and near the Town of Front Royal, a by-pass should be built. There have been several proposals for by-passes. A 1967 Department of Transportation proposal recommends a western by-pass from Route 340 south to the intersection of 14th Street and Shenandoah Avenue. An alternative was to relocate Route 340 to

the west of Front Royal, which would join the existing Route 340 north at Riverton and south at Route 619.

The final alternative is for an easterly by-pass originating from a new I-66 interchange east of Riverton, connecting with Route 340 via Criser Road. This by-pass would include the Town's proposed Leaches Run Parkway and extend the Parkway to the south and west, connecting with 340 South.

Primary Road Improvements

In order to accommodate future traffic volume and to better serve area residents the County has identified several primary road improvements. The County's top priority is the widening of the North Fork Bridge over the Shenandoah River. Construction is set to begin in mid 2005.

The next highest priority is the improvement of a three mile stretch of Route 55 East from Front Royal to the Linden Interchange with I-66 to a divided four lane roadway. Another priority is the construction of an interchange at the intersection of Interstate 66 and State Route 606 (Shenandoah Shores Road). Warren County and Front Royal are currently served by two interstate interchanges. A third interchange would serve as an eastern entrance to Front Royal. It would also serve two existing industrial parks and open up hundreds of additional acres of land that would be well suited for industrial and commercial development if interstate access were available. Front Royal is planning its transportation program to provide major roads to connect to Route 606 so that this interchange could well serve the rapidly growing eastern section of Front Royal and Warren County.

Another primary road improvement includes making safety improvements to and bringing Route 340 South from Route 619 to the Page County line up to present geometric design standards (Map 7.4). If traffic counts warrant expanding Route 340 to four lanes, the road should be constructed using context sensitive design to create a parkway-like road, without compromising safety.

Another priority that has been discussed is the improvement of the intersection, U.S. Route 340/522 north and Route 658 (leading to the Kelley Industrial Park), to include: left/right turning lanes, traffic control devices, and widening of Route 658 to the entrance to the Kelley Industrial Park. These improvements are needed to spur economic development as well as to accommodate the increased traffic from development.

Secondary Road Improvements

The greatest portion of the public road network consists of secondary roads, which comprise 197 miles (76%) of the County's total road system. Almost 104 miles of these secondary roads are paved. All-weather surface roads make-up the system's additional 43 miles. There are 48 miles of light surface and two miles of unsurfaced roads.

VDOT's current six-year plan scheduled improvements are listed in **Table 7.2**. The following goals for state maintained secondary roads were adopted by VDOT:

- A hard surface of width and strength adequate for the traffic to be served should be on all roads carrying more than 50 vehicles per day.
- An all weather stone or gravel surface should be on all roads carrying 10 to 50 vehicles per day.
- A light stone or gravel surface should be on all roads carrying less than 10 vehicles per day.
- All bridges of less than 10-ton capacity should be brought up to standard. To attain these goals is an ongoing task for VDOT. There are many miles of County roads that do not meet all of the goals.

Much of the County's Secondary road system has a substandard surface for the traffic volume. An additional 58 miles of road must be hard surfaced, with more than 48 more miles brought up to all-weather standards, including: grading, base treatment, and drainage improvements. The elimination of blind spots due to curves and hills also must be addressed.

Route 340/522 Corridor

The Route 340/522 corridor has been identified as the commercial and industrial growth area of the County. Major infrastructure improvements including water, sewer, and road construction have been made during the past three years to facilitate this growth. During review of the existing highway infrastructure in the corridor by the County and VDOT, several deficiencies were noted including: inadequate pavement width, unsafe crossovers and the need for turn lanes and signalization at various intersections. In addition, there was a need to look at transportation alternatives such as frontage and/or collector roads as a way to take local traffic off of Route 340/522 and maintain the flow of traffic on the highway.

The County hired an engineering consultant to develop an access and signalization plan to address projected traffic demands of the corridor from Interstate 66 to Route 661. After analyzing the projected traffic impact of future commercial and industrial development in the corridor, a plan was developed to handle the anticipated traffic volumes and maintain the carrying capacity of Route 340/522. The plan identified the following six traffic issues:

- Route 340/522 has an "old" lane which was paralleled by a new lane more recently. This old lane is substandard in terms of alignment, lane width, sight distance, and drainage as well as general construction dimensions. It requires reconstruction and/or other improvements too extensive to be described in this report.
- Collector roads need to be "free flowing" in the vicinity of intersections with Route 340/522.
- Traffic generated by commercial and industrial development should be delivered to Route 340/522 at efficient and controlled intersections.
- Future traffic flows and movements on Route 340/522 will exceed the capacity of a 4 lane divided highway.
- Misalignment of Route 658 (Rockland Road) and Route 627 (Reliance Road) will create traffic conflicts.

- Frontage roads at the intersection of Route 340/522 and Route 655 (Country Club Road) create traffic conflict points.
- Several of the existing crossovers on Route 340/522 do not meet VDOT's minimum requirements.

The corridor access plan and its recommendations were adopted by the County and have been incorporated into the comprehensive plan. Although developed as a conceptual plan, the access plan should be used as a guide in reviewing development proposals in the corridor. When practical and possible, all proposed roadway improvements should be in conformance with the adopted plan.

Table 7.2 VDOT Secondary Six-Year Plan for Warren County (2003 - 2009)

Route	Name	Improvement	Length	FY Year
603	Oregon Hollow Road	Reconstruct & S.T.	1.35 miles	2006-2009
628	Rocky Hollow Road	Reconstruct & S.T.	1.01 miles	2003-2007
603	Oregon Hollow Road	Reconstruct & S.T.	1.55 miles	2007-2009
607	Rocky Lane	Reconstruct & S.T.	1.6 miles	----------
613	Bentonville-Browntown Road	Reconstruct Bridge - Greasy	----------	----------
613	Panhandle Road	Reconstruct & S.T.	.90 mile	2003-2005
624	Happy Creek Road	Rebuild existing road	2.18 miles	2006-2009
626	Steed Lane	Reconstruct & S.T.	1.6 miles	2007-2008
638	Freezeland Road	Reconstruct & S.T.	1.1 miles	2003-2004
658	Rockland Road	Relocation of Intersection	.30 mile	2004-2007
631	Gooney Manor Loop	Reconstruct & S.T.	1.6 miles	2003-2005
643	Howellsville Road	Rebuild existing road	1.22 miles	2007-2009
670	Point Road	Reconstruct & S.T.	.60 mile	2008-2009
638	Blue Mountain Road	Reconstruct & S.T.	1.5 miles	----------
638	Blue Mountain Road	Reconstruct & S.T.	1.5 miles	----------

Map 7.4: Proposed Highway Improvements

Private Roads

Existing Conditions

There are many miles of privately owned County subdivision roads. Until 1981, most subdivision roads were not subject to County controls or construction standards. As a result, poorly designed and constructed roads have become a burden and a source of conflict to property owners, particularly in the older recreational/retirement subdivisions. Originally designed for weekend and occasional use, these subdivisions have become populated with full time residents. The substandard roads have become more heavily used and the deterioration rate has increased. Road design development standards for private roads must be addressed in the subdivision ordinance, the reduction of curb cuts along major state roads also must be addressed.

Road Maintenance

There are many miles of County subdivision roads that are privately owned and maintained. In some subdivisions, road maintenance has become a problem because of a lack of funding. To aid in the collection of road maintenance funds, some subdivisions have established Sanitary Districts.

Sanitary Districts serve as a mechanism for collecting road maintenance fees from property owners. Such a district can only be established by property owners petitioning the County Court. Such districts allow maintenance fees collection through the County and allow the placement of liens upon property for unpaid fees. An education program and/or printed literature must be provided for the residents and property owners associations that want to establish Sanitary Districts.

The current County subdivision regulations require that road maintenance agreements, or associations be developed and approved by the County prior to subdivision development. Additionally, County regulations require the submittal of subdivision covenants when subdivisions are submitted for approval. However, the County does not enforce the associations' covenants.

Improvements

The County must develop additional design standards for all future private subdivision roads. Currently, there are design standards for roads to be accepted into the state system. Design standards for Class III Roads (private subdivision) are included in the subdivision ordinance. However, these standards do not address sub-base, base, or surfacing. These design elements must be incorporated into the County Ordinance.

A study must be conducted to determine the number, distance, total miles, and conditions of existing private County subdivision roads. This study also should include information about the number of housing units served currently and the potential number of units that could be served. The number of entry points to public roads should also be noted; the study should be updated annually.

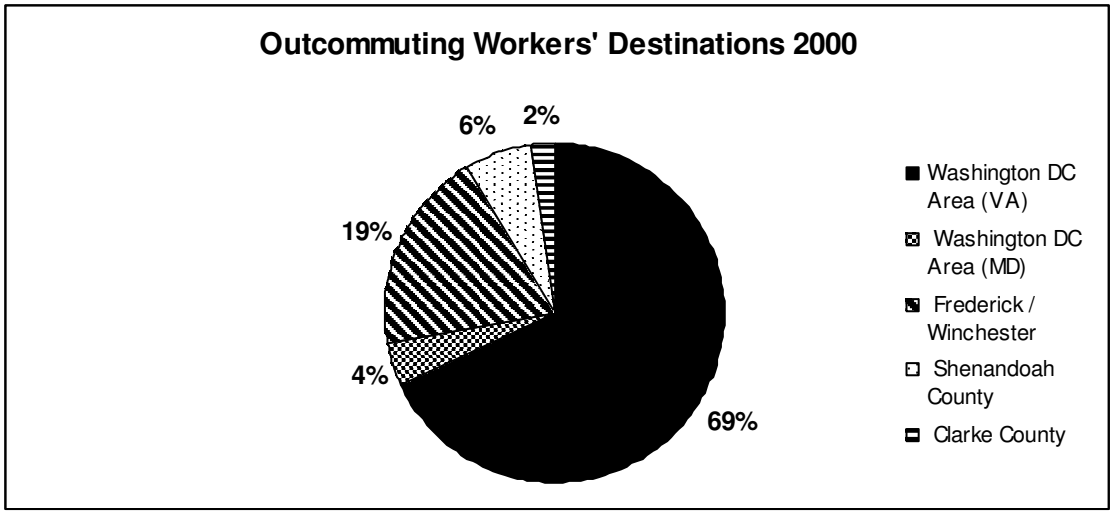
Commuting Patterns

Warren County is a net exporter of commuters. Of the County's 15,372 workers, only 6,844 work within Warren County. The Washington D. C. area is the major receiver of these commuters. Sixty percent of the commuters to the Washington area work within Virginia, while an additional 4% work in the Washington area's Maryland suburbs. The total commuters to the Washington area amount to 5,757, (68%) of the County's workers (**Chart 7.1**).

The second largest attraction for Warren County commuters is the Frederick County - City of Winchester region. These represent 1,572, (18%) of the County's commuting population. Finally, 550 commuters (6%), travel daily to Shenandoah County.

Many new Warren County residents are oriented to long-distance commuting and subsequently generate the greatest impact on the arterial routes serving the area: I-66, Route 55, and Route 340/522 north. Commuting will continue to be a cause of major congestion. A rural mass transit program was considered as a possible solution in the early 1980's.

Chart 7.1 Out-commuting Workers' Destinations (2000)



A Rural Mass Transit Feasibility Study was conducted by the Northern Shenandoah Valley Regional Commission in 1982. The practicality of establishing fixed-route, fixed-schedule, public transportation systems within the district was considered. A route serving Front Royal, Middletown, Winchester, and Berryville, was studied; but, based on projected ridership, it was too costly to initiate. A Front Royal to the City of Winchester and Frederick County route held the greatest promise. Being the district's two largest urban areas, they had the highest ridership projections.

Warren County residents' transit needs are expected to include trips to downtown Front Royal and to Winchester. Based upon the 1990 Census, 8.6% of the County's households do not have motor vehicles; 27.5% have only one vehicle. Front Royal's Downtown Redevelopment Plan notes that many potential shoppers do not have transportation to Main Street; therefore, the purchase and operation of a van could generate additional retail sales on a regular basis.

In order to meet commuters' demands, the Transit Study recommended the following:

- The establishment of a ride sharing program that would provide commuters with information to form carpool potential and would help employers establish carpools for their employees.
- The expansion of VDOT park and ride lots.
- The coordination of human service agencies' transportation services.

Ride Sharing

Warren County residents' major transportation need is for work. In 1980, 32% of the work force was employed outside of the County, as compared with 25% in 1970. By 2000, this figure had grown to 53.8%. The 2000 Census indicates that 68% of those workers commuted to the Washington, D.C. metropolitan area.

In 1982, the Northern Shenandoah Valley Regional Commission established The Ride Sharing Project (TRIP). In conjunction with the Metropolitan Council of Governments Commuters Club, the project matches long distance commuters. It also works with local employers and is in the process of establishing a general purpose matching system for workers commuting within the Planning District. The Highway Department funds the major cost of this program out of special funds set aside by the General Assembly. The Department is promoting ride-sharing as a way to meet public transit demands, as well as to promote efficient use of the roadways and to reduce pollution, operating costs, and capital outlays for new road projects.

Park & Ride Lots

Within the five-County region, there are four VDOT maintained park and ride lots. There are two lots in Warren County. The first is located on County-owned land on Route 340/522 south of the I-66 interchange and is the district's most heavily used lot. This lot has undergone expansion, which more than doubled its capacity from 104 spaces to 254 spaces. This facility is now a paved, modern, parking facility with lighting. The second lot, is on Route 647 near the Linden I-66 interchange, four miles east of Front Royal. It contains 75 spaces. There are plans for six additional lots in the Planning District.

Other Transportation Facilities & Services

Taxi Service

There are five taxicab companies in Front Royal. There is also a private limousine service company to provide transportation.

Transit Service

Although there is no public transit in Warren County, organizations serving the County have vehicles to transport their clients. These include Tri-County OIC, Northwestern Community Services, Shenandoah Area Agency on Aging, and Warren County Association for Retarded Citizens. The Rural Transit Study recommended a coordination of the agencies vehicles, as well as coordination of their volunteers, and the implementation of a regular vehicle replacement schedule.

Rail Service & Inland Port

The Norfolk-Southern railroad offers freight service to Warren County. There are north-south lines and east-west lines. All the lines intersect in the Town of Front Royal. The rail service also connects the Inland Port Facility directly to the Port of Hampton Roads, Virginia. The inland port is an intermodal facility where trailers and containerized cargo is loaded and unloaded from trains. This facility serves as both a domestic and an international shipping and distribution facility. The Inland Port has recently been expanded to over 40 acres. The facility owns approximately 160 acres, which is reserved for expansion.

Airport

Over the past several years, the Warren County Airport has grown from a grass strip with a few hangars to a modern, general aviation facility. Currently the Warren County Airport has hangars for more than 40 aircraft, most of which are modern metal buildings, competitive with any in the country. With the help of Federal and State grant programs, the airport also has a modern, 3000 x 75' runway, a taxiway that will soon run the whole distance of the runway, and plans, with Federal and State support, for a number of additional improvements.

As the airport continues to build revenue-generating hangar facilities, it is aimed toward achieving the Warren County Board of Supervisors' goal of financial self-sufficiency. It also generates, according to recent (2001) studies by the Virginia Department of Aviation, a substantial amount of direct and indirect economic activity: 77 jobs, $2 million per year in wages, and more than $5 million per year in total economic activity.

Goals & Objectives

Goal I: To provide for the safe and efficient movement of people and goods throughout the County.

Objectives:

A. Plan roadway development to support and enhance the Comprehensive Plan and the Land Use Plan.

B. Maintain and improve existing transportation facilities to meet increased demand.

C. Examine the potential for protecting scenic beauty and improving safety without compromising safety on the following roads: Rt. 340 South and Rt. 55 West.

D. Encourage and support State efforts to improve and expand the Inland Port's facilities.

E. Require development to pay its fair share of the costs resulting from increased transportation facility demands.

F. Develop a circulation system that encourages the separation of through traffic from local traffic.

G. Require that new subdivisions having more than four lots be serviced by reverse frontage roads meeting State Department of Transportation standards.

H. Encourage limited access management along County roads; discourage strip development; encourage reverse frontage lots for residential development.

I. Preserve and enhance opportunities for greater industrial use of the County's rail facilities.

J. Decrease the need for automobile trips by providing mixed use developments, pedestrian access, and bike paths.

K. Apply for Intermodal Surface Transportation Efficiency Act (ISTEA) funds to improve the existing transportation system and to provide alternative transportation modes such as biking and hiking trails.

L. Provide technical assistance to property owners' associations wishing to establish sanitary districts to handle private road maintenance.

Goal II: To provide for the safe, efficient and orderly development of the Route 340/522 corridor from Interstate 66 to Route 661; while maintaining the carrying capacity of the highway.

Objectives:

A. Develop a transportation model of the 340/522 corridor.

B. Request that the Virginia Department of Transportation conduct a preliminary engineering study identifying specific improvements needed on this section of Route 340/522.

C. Major commercial entrances and street intersections should be set back about 300 feet from the Route 340/522 travel lane to facilitate 200 foot turn lanes with transitions. Frontage Roads should be discouraged.

D. Collector roads should be used to carry commercial and industrial traffic to safe stoplighted intersections, identified in the corridor plan, complete with left and right turn lanes in all directions. Direct entrance onto Route 340/522 should be discouraged but, when needed, the entrance should provide ingress and egress for multiple uses such as at property lines. Additional collector roads should be built to provide safe and convenient access to internal industrial parcels such as in the Kelley, Toray, Inland, Success and Stephens industrial parks.

E. Provide a six lane roadway to handle the ultimate traffic build out of the corridor.

F. Realign Route 658 to intersect Route 340/522 to match centerline of the intersection with Route 627. This will allow the use of the existing Crooked Run Bridge and allow direct access to high volume commercial uses east of Route 340/522.

G. Relocate frontage roads at the Route 340/522 and Route 655 (Country Club Road) intersection.

H. Close existing crossovers that do not meet the Virginia Department of Transportation's minimum safety and turn lane requirements.

Implementation

Access Management - Create, initiate, and support an access management program. Ordinances would ensure that access opportunity is not unnecessarily pre-emptied along key road links, or near major intersections, particularly those along the designated Highway Corridor Districts. Consider the following techniques in managing access to principal corridor roadways.

- Limit the number of conflict points by installing physical barriers, modifying driveways, and installing signals at entrances.

- Separate basic conflict areas by regulating the minimum spacing of driveways, spacing driveways optimally in the permit authorization stage, consolidating access for adjacent properties, buying abutting properties, denying access to small frontage parcels, and requiring access via collector streets, i.e. service roads, etc.

- Minimize the need for deceleration in traffic by geometrically designing access points.

- Remove turning volumes or queues from through lanes sections by pavement marking alterations, geometric design modifications, right-of-way acquisition, or by requiring adequate internal site circulation.

- Adopt guidelines for access type and minimum spacing of intersections.

- Revise zoning and subdivision provisions to require reverse frontage lots on all County roads and to minimize left turn movements or conflicts, both on the site and in the street.

Design driveways in order to achieve clear sight lines based on design speeds as adopted by VDOT. Require that site access and circulation conform to the following standards:

- Arrange vehicular site access to avoid traffic use of local residential streets.

- Require that site access roads have sufficient traffic carrying capacity to accommodate the amount and type of traffic generated by proposed development.

- Require that provisions are made for turning lanes, directional islands, frontage/service roads, driveways, and traffic controls within the road.

Capital Programming - Capital programming has been recognized as a pro-active way of avoiding some of the past transportation capacity problems. To assure that opportunities for pre-planned expansion are not missed, implement and require an annual review of the County Capital Improvements Program (CIP). Coordinate the CIP with the County's Comprehensive Plan. Annually evaluate the relationship between the State's available resources and the demands upon the County's road systems created by the proposed land uses and by land use trends. The County should perform preliminary studies in conjunction with VDOT to ensure that adequate rights-of-way for proposed improvements and future roads can be preserved.

Commercial and Industrial Parks - Discourage linear development and encourage interior uses in planned parks where access control is efficient and where interior roads, rather than arterial or collector roads, provide access. This land use technique will discourage shallow strip development. This technique also provides deeper commercial and industrial zoning and permits effective site design to maximize access point usage. When between two and five commercial establishments can use a single access point, substantial traffic flow improvement results.

Coordination of Land Use/Transportation Planning Process - Emphasize coordination between the County, Town, and VDOT, on matters related to planning and programming, improvements, and transportation systems' management. Several steps can be taken to improve the current transportation planning process. The County and State should work together to evaluate the

County Comprehensive Plan's transportation system implications and a coordinated State and County transportation management policy should address expansion of car-pooling. This is particularly important at the major collector highway intersections serving commutersheds.

Development of Local Circulation Plans - Develop traffic circulation plans for each community center and/or village center to provide adequate traffic facilities and to access control on a smaller scale.

Highway Corridor Overlay Zoning - Overlay zoning should include access controls, transportation impact analysis for high volume-uses, as well as design and landscaping requirements. Overlay zoning brings additional design requirements and standards beyond those required by underlying zoning.

Intermodal Surface Transportation Efficiency Act (ISTEA) & Other Transportation Grants - Explore and apply for transportation grants for funding of major infrastructure projects.

Proffers - Utilize the Comprehensive Plan and the CIP to encourage dedication to new road rights-of-way, for road extensions, and widening existing highways.

Rights-of-Way Reservation and New Road Construction - Preserve rights-of-way for road improvements consistent with the Comprehensive Plan, the State Transportation Plan, and the CIP.

Special Service Districts - Use special service districts as a financing mechanism for service roads needed to control access along highway corridors.

Traffic Impact Analysis -Require a traffic impact analysis of all major new projects as part of the zoning process. This analysis would be used to determine if post development traffic levels. At a minimum, the traffic analysis should include a description of past and present roadway conditions, existing roadway capacity, traffic accident data, existing and projected traffic volumes (ADT and peak traffic), existing and projected levels of service, and existing and proposed sight lines. Where the County has short-term improvements scheduled, the development could include such improvements in the traffic impact analysis. Precise standards for the preparation of these analyses should be adopted.

Summary

This section of the Comprehensive Plan has focused on identifying existing and projected capacity of County transportation facilities. The implementation strategies identified in this segment of the Comprehensive Plan were designed to ensure that the transportation facilities and service provisions are phased with demand, or need, in accordance with the growth patterns as set out by the County's Land Use Plan. Some provisions, such as access management, address the efficient and effective facility use. Others, such as proffers and capital programming, address the financing of facilities and services.

Chapter Summary

This chapter has focused on identifying existing and projected infrastructure capacity, as well as recommendations for infrastructure improvements needed for the County's continued growth. The implementation measures identified in this chapter were designed to ensure that infrastructure is phased with demand or need. The County's resources are limited and only by phasing infrastructure improvements can the services needed be provided in a cost effective manner. Some of the implementation methods address the efficient delivery of services geographically, while others address the financing of such facilities and services.