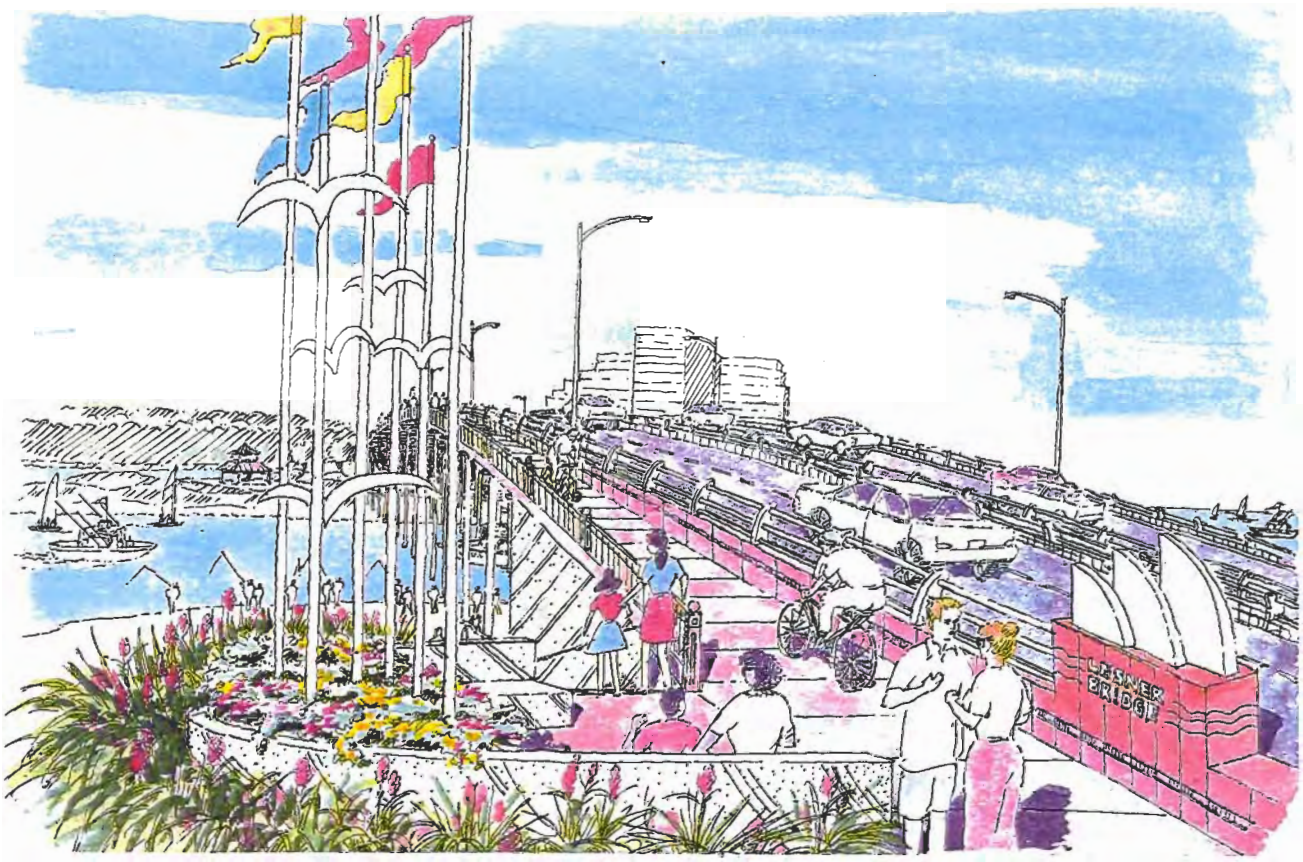
SHORE DRIVE CORRIDOR PLAN



CITY OF VIRGINIA BEACH
DEPARTMENT OF PLANNING

CITYSCAPES

ADOPTED BY THE CITY COUNCIL OF VIRGINIA BEACH ON MARCH 28, 2000

the figures on pages 35 and 36 are provided for discussion purposes and are non-binding cost estimates and suggestions

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Introduction

ULI Study:

The City of Virginia Beach is a unique community, blessed with an abundance of natural resources and amenities unmatched in the Hampton Roads region. These resources and amenities, coupled with its cultural, recreational, and economic opportunities, make Virginia Beach a major destination for residents and visitors alike.

Each area of Virginia Beach has unique resources, development patterns and physical conditions which help define the character of that area. One of the most unique of these areas is the Shore Drive corridor. This area, located along the Chesapeake Bay between First Landing State Park on the east and Little Creek Naval Amphibious Base on the west, is known for its mix of residential areas, beaches, waterways, vegetation, and businesses which share a connection to the Bay and help define what makes this area special.

Because of this special mix of resources and opportunities, the Shore Drive corridor has undergone rapid transformation over the last decade through a combination of new development and redevelopment activities. This activity has combined to begin changing the character of this area and undermining the very resources and amenities which fueled the development activity in the area.

In response to this pressure, the City Council commissioned the Urban Land Institute (ULI), a non-profit research and education organization promoting responsible leadership in the use of land to enhance the total environment, to undertake a study of the Shore Drive corridor and offer recommendations to protect and enhance its unique character and sense of place in Virginia Beach. A panel of recognized experts in real estate, land use, redevelopment, urban design, and economics focused their efforts on developing a study of the corridor in May, 1997. The report generated by the panel made the following observations concerning the Shore Drive corridor:

- the Bayfront / Shore Drive corridor is a "resort community" as opposed to a "resort destination"
- the corridor lacks a clear image or unifying identity
- the community and the City currently lack a definitive vision of what the area should be like in ten years

Shore Drive

- the absence of a vision results in unclear plans for the future and a tendency toward hodgepodge development patterns

- the City has many tools necessary to implement a plan and create a stronger image for the area, but in the absence of a clear vision it is hard to find the basis for consistent administrative action and strong political will

- much of the area is already built out

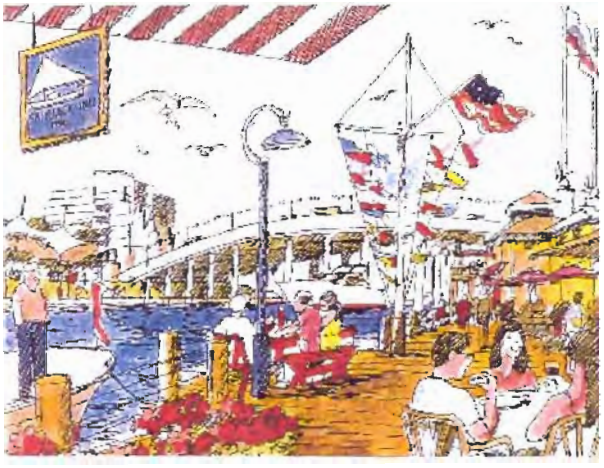
- much development activity is limited to residential development on infill parcels

The ULI panel recognized three areas exhibiting opportunities of high priority in the area:

- the area between Lesner Bridge and the City Marina, dubbed "Waterman's Walk"

- the sand disposal area located to the west of Lesner Bridge, dubbed "Fisherman's Park"

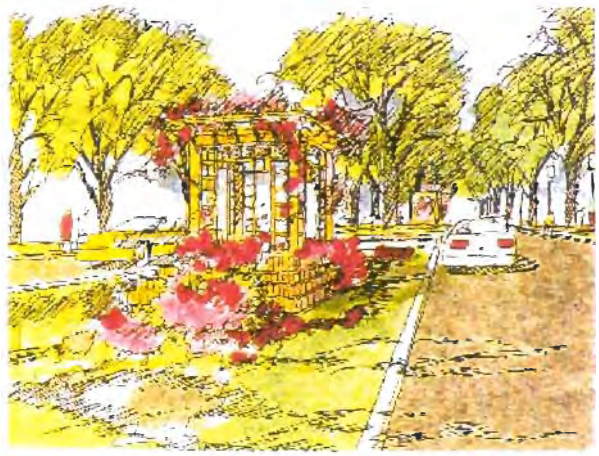
- the area between Ocean Park and Pleasure House Creek, dubbed "Marina Village"



The panel strongly believed that existing residential areas and the amenities that they enjoy must be preserved and/or further enhanced, but that the area needs to be improved both as a scenic corridor and as an amenity area for all City residents, and as an ancillary amenity for visitors. Development strategies for the area should involve several major initiatives, including creating a sense of arrival at key gateways to the area, beautifying Shore Drive, targeting the three opportunity sites for development, focusing on better site plan review and design quality, and promoting the area more effectively to the City and the region.

Shore Drive

The ULI panel made the following conclusions and recommendations :



- a strong image and identity should be created for the area by making Shore Drive a scenic highway from Route 13 (Northampton Boulevard) to Fort Story
- Lesner Bridge can serve as a focal point on Shore Drive, and road treatment and landscape design should distinguish residential from commercial uses while still developing a overall unifying theme
- Shore Drive should not be widened beyond four lanes, and its role as a scenic corridor should take precedence over its role as a transportation corridor to the Oceanfront and resort areas
- the bikepath through First Landing State Park should be extended through the area

Specific design concepts were additionally recommended for various zones along the Shore Drive corridor.

Finally, the panel proposed a series of actions which should be undertaken by the City to begin implementation of these recommendations:

- create an advisory commission comprised of civic and business leaders in the area to create a unified voice to promote the area and ensure timely implementation of the ULI recommendations
- initiate demonstration projects and tighten enforcement of existing regulations to effect some immediate changes and send the message plans are underway for the area
- develop a landscape design plan for Shore Drive
- develop a public beach plan
- initiate the development of Waterman's Walk, Fisherman's Park and Marina Village

- better design in new development projects, and develop criteria for an incentive zoning overlay district

The panel firmly believed that future success in the area will depend more on the quality of development that takes place rather than the type of development. The panel felt the City needs to take a more rigorous approach to approving and controlling development on the area, and that the City Council needs to advance the interests of the larger community rather than simply respond to the needs of individual property owners or interests in the area.

Shore Drive Advisory Committee:

Based on these recommendations, the City Council appointed the Shore Drive Advisory Committee in February, 1998 to follow up on the recommendations generated by the ULI panel, and specifically assigned the Committee the following charge:

- familiarize itself with the ULI Bayfront Study and issues associated with development of the Corridor
- develop an aesthetics and urban design plan for the Corridor using the ULI Study as a foundation
- identify and prioritize a series of recommended projects and actions to implement the aesthetics and urban design plan

- facilitate establishment of public-private partnerships to achieve its goals and recommendations and those of the ULI Study
- investigate alternative funding sources for projects in the Corridor
- engage in public information efforts regarding Committee work
- monitor the progress of implemented projects and plans

This plan is intended to accomplish a significant part of the City Council's charge to the Committee: to utilize the ULI Bayfront Study to develop an aesthetics and urban design plan for the Corridor, and to identify and prioritize a series of recommended projects and actions to implement the plan.

Corridor Planning Process:

The Shore Drive Advisory Committee has utilized an open planning process for the development of the Shore Drive Corridor Plan. Since its inception in February, 1998, the Committee has held regular monthly meetings open to the public. Public comments have been encouraged and time allotted for public comment at all meetings. In addition, the Committee has sponsored a series of public workshops to provide residents and business owners in the corridor the opportunity to express their views and comments concerning the corridor planning process. The Committee and staff have shared information being considered for the plan at these workshops as it has been developed. The plan adoption process employed a similar public comment opportunity, beginning with the Shore Drive Advisory Committee, and continuing on to the Planning Commission and the City Council.

The Shore Drive Advisory Committee also hosted a Design Charrette sponsored by the Hampton Roads Chapter of the American Institute of Architects concerning development opportunities for the area identified in the ULI Study as "Waterman's Walk". The Committee hosted Charrette participants with an orientation meeting to the area, followed later by a boat tour, and design charrette session. Charrette participants split into three teams and developed varius concepts for the area. Shared observations and recommendations were presented at a public meeting of the Committee where property owners and adjoining residents were provided the opportunity to comment on the charrette work effort. Final recommendations from the Design Charrette are presented in the Appendix to the plan.

Before developing a corridor plan for Shore Drive, the Committee recognized the need to build a foundation for the plan based on defining a vision for the Shore Drive area. The work to define a vision for the area has involved extensive time at Committee meetings, and has been strongly supplemented by feedback received from residents and business owners in the area. Committee members have spent many hours touring the area both individually and as a group. Staff have worked with the Committee to help provide additional information to better define the existing character of the area and to keep the Committee apprized of new issues which may help clarify the vision for the area. In broad terms, the vision for the Shore Drive area has been defined as follows.

A Residential Community:

As noted in the ULI Bayfront Study, and reinforced by Committee members, the Shore Drive area is first and foremost a residential community, comprised primarily of residential neighborhoods which are oriented to the area's beaches and waterways. These residential neighborhoods primarily have well-defined character, and provide a wide array of housing styles and types. It is envisioned that this predominance as a residential community should continue to form the backbone of land use for the area. Businesses in the area should be focused on providing support services to area neighborhoods primarily, with a secondary emphasis on businesses which can perform a unique role in the area and help give it its special character, such as restaurants and marine-oriented businesses. Overall, the area should be focused primarily toward local neighborhoods and local resident rather than visitor needs. New development and redevelopment in the area should be oriented towards protection and enhancement of the character of existing residential neighborhoods, while commercial development should be oriented toward servicing neighborhood needs or building on the restaurant and marine-oriented business theme in the area.

A Community with a Rich Physical Character:

The Shore Drive area is an eclectic mix of architectural styles, as well as densities and building bulk. Shore Drive itself provides the central spine linking the area together, with various stretches of the corridor having fairly distinct character. Significant vistas of area waterways and natural areas help define the area's special character and should be protected and enhanced where possible. The distinctive character of sections of the corridor should likewise be protected and enhanced to the greatest extent possible, such that these areas maintain their special character and aesthetic quality without giving way to the sameness and blandness of design evidenced in other corridors in the City.

Pedestrian Access and Recreational Amenities:

To ensure that the area maintains its rich neighborhood character, it is envisioned that major expansion of safe and convenient pedestrian and recreational amenities are a necessity for the area. Accordingly, adequate sidewalks along the majority of the corridor length are strongly recommended. All signalized intersections should have clearly delineated pedestrian crossing areas with signal control devices to ensure safe pedestrian crossing of Shore Drive and intersecting roadways. Extension of the multi-purpose trail from West Great Neck Road to the Bayside Recreation Center is a further priority.

Likewise, future planning efforts following the adoption of this plan should focus on providing safe and convenient access to the area's waterways and beaches; its unique recreational assets. In particular, the views of Lynnhaven Inlet from the proposed Waterman's Walk area from Lesner Bridge along Vista Circle, and the Pleasure House Creek Shoreline along Marlin Bay Drive to the site of the proposed Lynnhaven Inlet Boat Ramp facility should be preserved.

A Community with Diverse Opportunities and Activities:

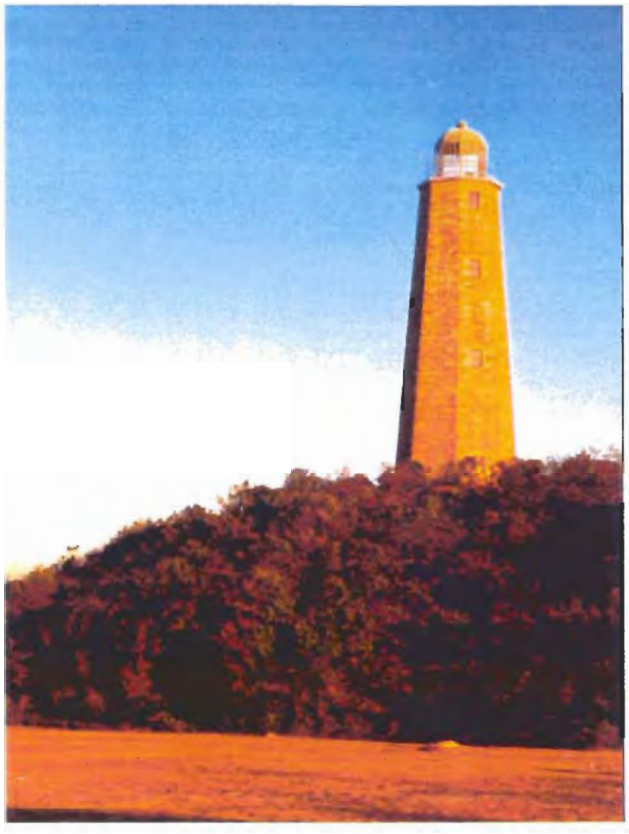
Limited opportunities for development remain on vacant parcels in the area. Accordingly, it is envisioned that these areas should be sensitively scrutinized to ensure that new development is in keeping with the overall character of the area. Additionally, these development opportunity areas should be targeted for development which can provide additional diversity and high quality amenities to the Shore Drive area. New developments should, at a minimum provide pedestrian amenities, protect vistas and natural resources to the greatest extent possible, help restore lost amenities such as native trees, and adequately address parking and alternative transportation modes, including bikeways and bus services. Development should concurrently include the development of active and passive recreational areas in the Pleasure House Creek / Ocean Park area.

A Gateway with Unique Natural Resources:

The Shore Drive area is a special enclave containing plants and animal species not found elsewhere in combination within the City. These natural resources help define the setting of a special area characterized by sand dunes, wooded hills, Spanish moss, live oak trees, sandy beaches, tidal marshes, and wide expanses of salt water estuaries. The First Landing State Park and Natural Area has been recognized as a national treasure due to its exceptional natural resources. Development and redevelopment activity in the corridor should take special care to protect where possible and restore where necessary this rich natural tapestry which helps define the Shore Drive corridor.

A Community with a Rich History and Cultural Heritage:

The Shore Drive area has had a prominent role in national, state, and local history, beginning with the first landing of English colonists along the Chesapeake Bay shoreline in 1607 on their way to Jamestown, to DeGrasse's blockade of the mouth of the Chesapeake during the American Revolution, to its strategic importance during the twentieth century in two World Wars, to its role in international peace efforts today. This heritage should be highlighted for residents and visitors to the area alike, through well-designed interpretive signage oriented to pedestrians. New place names and projects should take advantage of relating to this heritage to the greatest extent possible.



Purpose of the Plan

It is the purpose of the Shore Drive Corridor Plan to accomplish the following:

Guidance for Shore Drive Corridor:

The Shore Drive Corridor Plan is intended to serve as the City's overall guidance document to define and recommend a means of implementing a vision for the Shore Drive corridor. This plan is further intended to assist the City in continuing its efforts to accomplish the recommendations set forth by the ULI Study Panel in its report for the Shore Drive Corridor and Bayfront area.

Amendment to Comprehensive Plan:

Through its adoption by the City Council, the Shore Drive Corridor Plan is to be recognized as part of the City's Comprehensive Plan. Where such differences may occur, planning policies embodied in and relating to the Shore Drive Corridor Plan supersede those presented in the 1997 Comprehensive Plan.

A Strategy and Conceptual Plan:

It is recognized that the Shore Drive Corridor Plan is primarily a strategy and conceptual plan. Following its adoption, implementation of the Shore Drive Corridor Plan will require that more detailed plans be developed for various elements to address specific design issues. Recognizing that this will be required, it is critical that the detailed design and implementation phases be fully coordinated with the Shore Drive Advisory Committee to maintain consistency with the spirit and intent of the adopted Shore Drive Corridor Plan.

Policies, Goals and Objectives

The Shore Drive Corridor Plan sets forth the following policies, goals and objectives:

Policies:

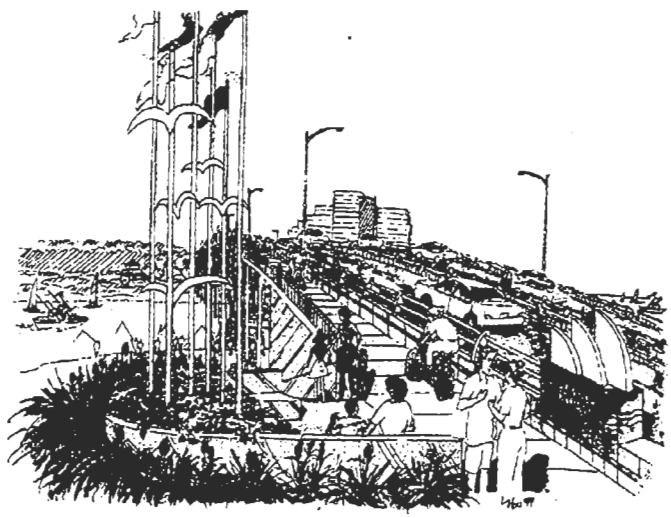
- The City recognizes that the Shore Drive corridor serves primarily as a unique residential community and secondarily as a resort destination access corridor.

- The City is committed to the development and implementation of architectural design guidelines, landscaping guidelines, and sign guidelines which promote the development and redevelopment of quality public and private projects in the corridor.

- The City realizes that the defining of a vision for the corridor is the first step in a long series of activities which are intended to ultimately lead to full implementation of the defined vision. Accordingly, it is understood that the vision must be linked to practicalities and limitations of funding, evolving ideas, and projects, and that phasing and prioritization of the ideas embodied in the vision for the corridor constitute a critical component of the ultimate plan for the area.

Goals:

- To protect, restore and enhance the Shore Drive corridor to reflect the area's unique character as a residential community, and to make the corridor a functional and attractive scenic gateway and accessway to the resort destination of the Oceanfront.



- To encourage development and redevelopment of the corridor as an attractive residential community.

- To make improvements to current conditions in the corridor by strategically targeting limited financial resources.

Objectives:

- To undertake significant improvements to the streetscape of visually undesirable properties along the Shore Drive corridor. To undertake significant improvements at key locations along the corridor.
- To enhance existing recreational opportunities and facilities in the corridor.
- To undertake improvements to the existing motorized and nonmotorized transportation network in the corridor.
- To protect, restore and enhance the aesthetics of the corridor.
- To improve traffic safety in the corridor.
- To better define community identity in the corridor and create a sense of place.
- To preserve and enhance scenic views and vistas in the corridor.
- To develop public boating access to the Chesapeake Bay and Lynnhaven River.
- To protect and enhance the quality of residential communities in the corridor.
- To encourage public-private partnerships for revitalization and development of appropriate business opportunities in the corridor.
- To reduce the clutter of excessive traffic signs along the corridor.

General Recommendations

- The Shore Drive Corridor should be enhanced and maintained in its role as the only east-west evacuation corridor in the northen end of the City. Accordingly, existing drainage problems along Shore Drive during periods of heavy rainfall or storm tides evidenced at the west gate of Fort Story and the Pleasure House Creek area should be redesigned to prevent decreased traffic capacity during emergencies.

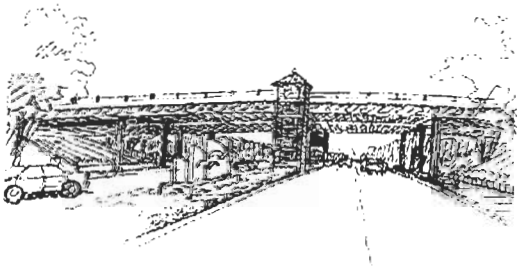
- All billboards along the Shore Drive Corridor should be removed through an aggressive and proactive strategy strongly supported by the City in conjunction with the development review process.

Aesthetics:

Bridge Treatment:

- Enhance the appearance of Lesner Bridge through the incorporation of design and structural elements, including extension of a multi-purpose trail along the south side of the eastbound bridge, addition of abutments at the ends of each bridge, and incorporation of gateway elements at the bridge abutments. Lesner Bridge should be enhanced so that it serves not merely as a transportation link in the corridor, but enhanced in its function to support improved navigation, safe pedestrian access and safety.

- Add signage in coordination with the Sign Guidelines appended to this plan which identifies the crossing of Lynnhaven Inlet, Pleasure House Creek and Lake Joyce from each direction on Shore Drive.



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- The Northampton Boulevard interchange should be enhanced so that it is both functionally efficient and aesthetically pleasing through structural and landscaping treatments.

Landscaping:

- Phase in landscaping which satisfies the criteria defined in the Landscaping Guidelines appended to this plan, in coordination with the phasing and construction of other plan elements.

- Coordinate plan review and approval process with criteria defined in the Landscaping Guidelines appended to this plan to enhance overall corridor aesthetic appeal and continuity of design.

- Develop incentive programs to encourage existing businesses and residences in the corridor to retrofit existing landscapes as replacement is warranted to further enhance overall corridor aesthetic appeal and continuity of design. Private use of the public right-of-way should be encouraged where appropriate to promote this objective.

- Encourage use of informal public and private landscape designs that reflect the natural setting of the Shore Drive corridor.

Sign Treatments:

- Complete a comprehensive inventory of all signs in the Shore Drive corridor and establish a program which accomplishes the following:

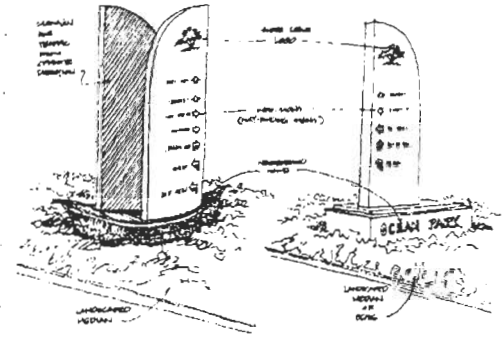
    - removal of obsolete, outdated, deteriorated, or redundant and unnecessary public signs

    - replacement of all remaining public signs to conform with uniform public sign standards as outlined in the Sign Guidelines appended to this plan

    - removal of private signs located within the City right-of-way which are not under a specific license agreement with the City

    - removal of nonconforming private signs in the corridor with replacement which conforms to the private sign standards as outlined in the Sign Guidelines appended to this plan if the cost to repair existing signs exceeds fifty percent of value

- Encourage the construction of neighborhood identification signs which promote the Shore Drive corridor logo in the public right-of-way which adhere to the Sign Guidelines appended to this plan, in order to enhance the overall aesthetic appearance of the Shore Drive corridor and reinforce the residential community theme.



Right-Of-Way:

- Where appropriate and in accordance with the overall plan typical roadway section, utilize right-of-way along the Shore Drive corridor to help implement the gateway, sidewalk, multi-purpose trail, bridge treatment, and landscape improvements described in other sections of the Shore Drive Corridor Plan.

- Develop a detailed plan for appropriate use of all identified excess right-of-way and other City-owned real estate in the Shore Drive corridor for potential disposal and development. Earmark all funds generated through the sale of excess right-of-way in the Shore Drive corridor to assist in funding desired improvements identified as part of the Shore Drive Corridor Plan.

- Review all existing license agreements authorizing encroachments into the right-of-way for consistency with the policies, goals and objectives set forth in the Shore Drive Corridor Plan. Develop method for renewal of existing license agreements to conform with the policies, goals and objectives set forth in the Shore Drive Corridor Plan. Ensure all future license agreements conform with the policies, goals and objectives set forth in the Shore Drive Corridor Plan.

- Develop a landscaping encroachment easement procedure to promote private activity in accordance with the Landscaping Guidelines appended to this plan.

Gateways:

- Develop a gateway design and theme for the Shore Drive corridor for use at the identified Gateway locations.

- Design elements should incorporate the following general criteria and specifications:
  - simplicity of structural design, texture and color treatment to reflect dynamic nature of natural environment and setting in the corridor
  - scale of design to complement and not overpower existing physical setting
  - selection of materials to reflect sustainability at the site, including salt and wind resistance, minimal maintenance, ease of periodic cleaning and use of recycled/recyclable materials

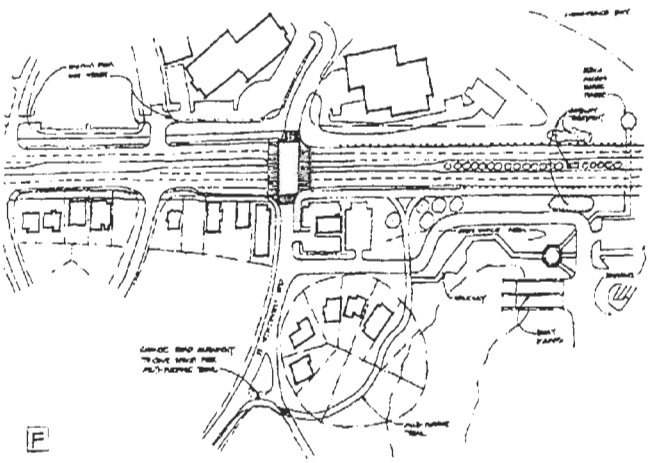
Recreation:

Multi-Purpose Trail:

- Ten foot width asphalt pavement section.
- Pavement treatments denoting trail crossings at all road and street intersections.
- Renovation and reconstruction of existing trail from West Great Neck Road through First Landing State Park to the west gate of Fort Story.

- Extension of trail west from West Great Neck Road to Jade Street with connection to Lynnhaven Colony Neighborhood Park, and extension alongside west side of Jade Street to Shore Drive.

- Extension of trail west along south shoulder of Shore Drive from Jade Street to East Stratford Road as ten foot wide concrete path, in conjunction with south shoulder sidewalk and as pedestrian crossing of Lesner Bridge, including connection to boat ramp and Ocean Park public beach access area at Crab Creek.



- Extension of trail west from boat ramp site to Marlin Bay Drive through Lochaven Neighborhood Park and existing City-owned rights-of-way.

- Extension of trail west along south shoulder of Marlin Bay Drive to Shore Drive.

- Extension of trail west alongside Shore Drive to and across First Court Road, including connection to proposed wayside area at Pleasure House Creek.

- Extension of trail alongside west side of First Court Road through Bayville District Park to Greenwell Road and Bayside Community Recreation Center.

- Optimize potential of obtaining funds for trail construction through appropriate federal, state and private grant sources to best leverage City funding.

- The City should acquire the McLeskey property in the Ocean Park area adjoining Pleasure House Creek as a major passive natural area park, in order to expand the functionality of the proposed Lynnhaven Boat Ramp facility and to ensure better integration of the proposed multi-purpose trail in this area.

- The City should acquire the Sunstates property in the vicinity of North Great Neck Road as a means of improving access to the multi-purpose trail in this area.

Boat Ramp and Beach Access Area:

- Complete construction documents for the boat ramp facility at Crab Creek, ensuring that plans integrate the multi-purpose trail, gateway, and landscape elements set forth in the Shore Drive Corridor Plan.

- Thoroughly research and exhaust potential funding sources for construction of the boat ramp facility to help offset City funding requirements and best leverage City funding for other Shore Drive corridor improvements.

- Develop final plans for access to the boat ramp from Shore Drive via Stratford Road East which ensure integration of the proposed pedestrian and traffic signal crossing of the intersection with other elements set forth in the Shore Drive Corridor Plan. These plans should incorporate acceleration and deceleration lanes, as appropriate, and include parking for multi-purpose trail users as well as boat ramp and beach users. These plans should be designed to also preclude boat ramp and beach facility vehicular traffic from using other entrance or exit points through the Ocean Park neighborhood to the greatest extent possible.

Opportunity Areas:

- Develop specific plans in partnership with private landowners, in accordance with the criteria set forth in the Shore Drive Corridor Plan, to address development and redevelopment opportunities in the following types of areas:

  - business areas which predate the City's landscaping requirements

  - business properties adjoining the right-of-way of the proposed multi-purpose trail

- properties adjoining City right-of-way
- properties adjoining underutilized City right-of-way

- Pursue and refine the general recommendations for the "Waterman's Walk", "Fisherman's Park" and "Marina Village" identified in the ULI Bayfront Study, in coordination with affected property owners.

Transportation:

Pedestrian Amenities:

- Construct an five foot wide concrete sidewalk along the north and south shoulders of Shore Drive from South Oliver Drive to Croix Street, with the exception of those areas where the multi-purpose trail will adjoin the south shoulder of Shore Drive. In those areas, a ten foot wide concrete sidewalk will function as both a sidewalk and as a multi-purpose trail.

- Mark all roadway crossings of the multi-purpose trail with appropriate pavement markings to differentiate the trail from the roadway.

- Mark all pedestrian button signalized intersection crossings with appropriate pavement markings to differentiate the crossings form the roadway.

- Install pedestrian crossing buttons at all signalized intersections along Shore Drive between Diamond Springs Road and North Atlantic Avenue. Adjust timing frequency of pedestrian crossing buttons to accommodate either complete crossing of Shore Drive to the opposite shoulder, or to adequate safe areas in median, as appropriate.

Traffic Issues:

- Perform pedestrian data collection to determine the need for exclusive pedestrian phasing in intersection signal timings.

- Encourage bicycle storage facilities at businesses and public areas where appropriate.

- Address the traffic study recommendations as set forth in the Shore Drive Corridor Transportation Study prepared by the Hampton Roads Planning District Commission and adopted as part of the Shore Drive Corridor Plan.

- Enforce controlled access management policies in the Shore Drive corridor.

- Encourage owners of the Duck-In property to work with the City to develop solutions to seasonal parking and traffic issues.

- Encourage private schools in the Baylake area of the corridor to work with the City to develop solutions to stacking problems in the morning and evening school traffic periods.

- Investigate the potential of reducing the travel speed on Shore Drive east of North Great Neck Road to 35 miles per hour as the area closely resembles the densely developed residential character of North Atlantic Avenue which has similar lower speed limits.

Roadway Edge and Access Management:

- Phase in construction of roadway edge improvements, including median and shoulder treatments, to better define the roadway edge between Diamond Springs Road and Kendall Street.

- Identify specific site locations through detailed site analysis where roadway improvements should be undertaken in conjunction with relocated and/or consolidated accessways to properties abutting Shore Drive, including the use of cross access agreements between individual property owners, in order to reduce congestion and improve overall corridor appearance.

Intersection Management:

- Increase traffic capacity on the existing roadway through effective intersection management and reconstruction methods, including:
  - dual left turn lanes, as appropriate, at key intersections
  - right turn lanes, as appropriate, at key intersections
  - acceleration lanes beyond intersections, as appropriate

Utilities:

Underground Utilities:

- Strive to replace overhead power and other utility lines alongside Shore Drive between Diamond Springs Road and Kendall Street with underground utilities in accordance with a phased implementation of other improvements scheduled for the corridor.
- Encourage the placement of underground utility service boxes in areas which will not detract from the overall aesthetic character and goals defined in the Shore Drive Corridor Plan.
- Promote the coordination of utility improvements along the Shore Drive corridor through the development of a Memorandum of Agreement between the City and all private utilities in order to further the aesthetic objectives set forth in the plan.
- Adhere to the Landscaping Guidelines appended to this plan which set forth criteria for landscaping of utility service boxes and high tension power lines to help de-emphasize the prominence of these structures in the corridor.
- Eliminate overhead utility lines which cross Shore Drive to help reinforce the unity and visual character of the corridor.

Lighting:

- Develop uniform spacing and style of roadside lighting from Diamond Springs Road to Kendall Street. Lighting styles to be of a type which facilitates routine maintenance by Virginia Power without City involvement, under guidelines outlined in the current City contract.

- Lighting should be located within the public right-of-way along the shoulders of Shore Drive and not in the median to allow for lighting of both roadway and pedestrian areas along shoulders.

- Ensure lighting fixture poles as well as other utility poles are not physically located on or constrict pedestrian sidewalks or the proposed multi-purpose trail.

Implementation Strategy

Projects Currently Underway:

The Shore Drive Advisory Committee has recommended that the City begin implementation of the Shore Drive Corridor Plan through a series of specific demonstration projects. These projects are as follows:

- Community Colors Project at Great Neck Road
  This project is to be undertaken during Fiscal Year 1999-2000 with full City funding and technical assistance from the Department of General Services, Landscape Services Division, and the Virginia Beach Beautification Commission. Plans for the intersection improvements will incorporate the planting concepts outlined in the Landscaping Guidelines.

- Lynnhaven Inlet Boat Ramp and Ocean Park Beach Access Facility
  This project is being undertaken beginning in Fiscal Year 1999-2000 with completion scheduled in Fiscal Year 2000-2001. Funding for the project is contained within the City Fiscal Year 1999-2000 Capital Improvement Program, augmented with grant funding from the Virginia Salt Water Fishing License Fund. Plans for the project are being designed to integrate with the proposed multi-purpose trail and incorporate the planting concepts outlined in the Landscaping Guidelines.

- Cape Henry Trail Revitalization Project
  This project is being undertaken in Fiscal Year 1999-2000. Funding for the project is contained within the City Fiscal Year 1999-2000 Capital Improvement Program, augmented with grant funding from the Virginia Department of Conservation and Recreation Trail Grant Program funded under the federal Intermodal Surface Transportation Efficiency Act. Plans call for reconstructing the existing Cape Henry Trail from First Landing State Park to West Great Neck Road.

- Cape Henry Trail from Bayside Community Recreation Center to Bayville Park Entrance
  This project is being undertaken in Fiscal Year 1999-2000. Funding for the project is contained within the City Fiscal Year 1999-2000 Capital Improvement Program.

The City Council requested that the Commonwealth provide funding for extending the Cape Henry Trail from the State Park Entrance Road to the West Gate of Fort Story as part of the City's 2000 Session Legislative Package, as an amendment to the Governor's Proposed Budget. As this was not approved, it is recommended that the funding for this project again be included in the City's 2001 Session Legislative Package for inclusion with amendments to the Commonwealth's Biennial Budget for 2000-2002.

Proposed Phasing of Future Projects:

The Shore Drive Advisory Committee has recommended that the City begin implementation of the Shore Drive Corridor Plan through a series of phased projects linked to the City's Capital Improvement Program. The Committee recommends that the City include funding within the Fiscal Year 2000-2001 Capital Improvement Program Budget for the following three projects:

I. Gateway Project

Shady Oaks Drive / Marlin Bay Drive to East Stratford Road (3,100 feet)

East Stratford Road to Lesner Bridge (650 feet)

Lesner Bridge (1,525 feet)

Lesner Bridge to Jade Street (2,100 feet)

II. Multi-Purpose Trail Improvement Project

Multi-purpose Trail from Bayville Park Entrance to First Court Road and Shore Drive (2,250 feet)

Multi-purpose Trail from Marlin Bay Drive to East Stratford Road (4,275 feet)

Multi-purpose Trail from Jade Street and Shore Drive to West Great Neck Road (3,825 feet)

Multi-purpose Trail from State Park Entrance Road to West Atlantic Avenue (2,700 feet)

III. Open Space Acquisition Project

Sunstates Property

Ocean Park Property

Pleasure House Creek Wayside Property

The Shore Drive Advisory Committee additionally recommends that funding be provided in the Fiscal Year 2000-2001 Capital Improvement Program Budget to complete the Architectural Design Guidelines, Landscaping Guidelines, and Sign Guidelines appended to this plan.

The Shore Drive Advisory Committee further recommends that the City include funding in subsequent Capital Improvement Program budget cycles for the following phased projects:

I. Phase Two Corridor Project

South Oliver Drive to Baylake Road / First Court Road (6,400 feet)

Baylake Road / First Court Road to Shady Oaks Drive / Marlin Bay Drive (2,750 feet)

Jade Street to Croix Drive (4,925 feet)

Croix Drive to Kendall Street (3,075 feet)

II. Phase Three Corridor Project

Diamond Springs Road to Kimball Circle West (2,700 feet)

Kimball Circle West to Gate 4 / Staplesmill Lane (4,650 feet)

Gate 4 / Staplesmill Lane to Independence Boulevard (2,070 feet)

Independence Boulevard to South Oliver Drive (2,540 feet)

Cost Estimates:

Cost estimates for the Fiscal Year 2000-2001 Capital Improvement Program and Operating Budget are as follows:

I. Gateway Project

$6,585,000

II. Multi-Purpose Trail Improvement Project

$1,076,000

III. Open Space Acquisition Project

$5,178,000

IV. Preparation of Design Guidelines

$150,000

Total Costs $12,989,000

Detailed cost estimates are provided in the Appendix.

Cost estimates for the subsequent fiscal year Capital Improvement Program budgets are as follows:

I. Phase Two Corridor Project

$8,362,000

II. Phase Three Corridor Project

$4,525,000

Total Costs $12,887,000

Detailed cost estimates are provided in the Appendix.

Funding:

Implementation of the Shore Drive Corridor Plan is proposed to be funded primarily through the City's Capital Improvement Program as adopted by the City Council. In addition, it is recommended that this funding strategy be augmented through an aggressive effort which solicits private donations as memorials, neighborhood and business contributions, grants, and partnerships as appropriate in conjunction with new development projects.

Agenda for Future Action:

The Shore Drive Advisory Committee has identified the following items for future action which should be undertaken in the Shore Drive area subsequent to the adoption of this plan. They are as follows:

- Support completion of the Architectural Design Guidelines, Landscaping Guidelines, and Sign Guidelines appended to this plan to augment the development review process for the area.

- Encourage the City Council to appoint a Beaches and Waterways Commission to address issues specific to the Shore Drive Area as well as City-wide which relate to dredging, beach access, beach ownership, shoreline erosion and replenishment, parking, and public facilities.

- Develop neighborhood plans which address issues including land use, landscaping, traffic patterns, aesthetics, recreation, pedestrian amenities, and open space, to complement the Shore Drive Corridor Plan for areas within the limits of the Shore Drive Overlay District.

- Develop a plan for the remainder of the dredged material disposal area adjoining the Lynnhaven Inlet Boat Ramp and Ocean Park Beach Access Facility and its potential for use as recreational open space for the Corridor.

- Follow through on developing a concept plan for the Waterman's Walk Area, building on recommendations generated during the Waterman's Walk Design Charrette for the area adjoining Lynnhaven Inlet and Vista Circle located at the eastern end of Lesner Bridge.

Acknowledgments:

Shore Drive Advisory Committee
- Bob Stanton, Chair
- Dan Creedon, Vice Chair
- Betsy Atkinson, Planning Commission
- Scott Ayers
- Ron Bray
- Dan Brockwell, Parks and Recreation Commisison
- Judy Connors
- Bill Harrison, City Council
- Fred Hazelwood, First Landing State Park
- Louis Jones, City Council
- Kal Kassir
- Erle Marie Latimer
- Ron Ripley, Planning Commission
- Tom Betz, Planning Commission (former member)
- John Langlois (former member)

Norm Carrick, Newsletter Coordinator

Alaura Guion, Secretary

Cityscapes
- Lu Hou

Shore Drive Task Force
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- Travis Campbell
- Tara Drake
- Frank Fentress
- Barry Frankenfield
- John Fowler
- Bob Gey
- Ty Lee

Waterman's Walk Design Charrette Team
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Virginia Beach Department of Management Services
Stacy Hershberger

Virginia Beach Department of Communications and Information Technology,

Center for Geospatial and Information Services
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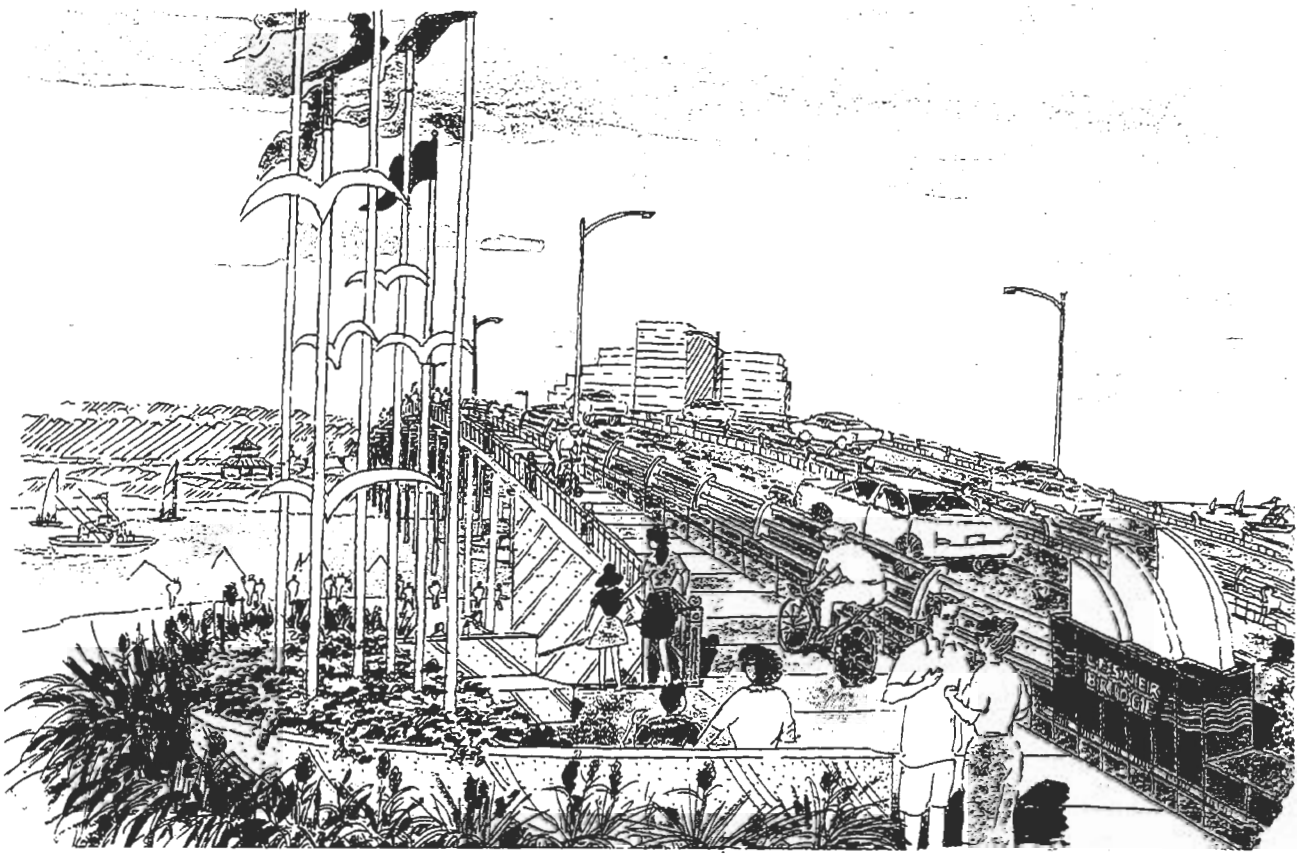
Ed Calhoun
David Little
Hampton Roads Planning District Commission
Jody Lewis
Keith Nichols
Camelia Ravanbakht
Porterfield Design Center
Gerry Porterfield
Henry's Planet Seafood Restaurant
Warner Athey
Westminster Canterbury

References:

Virginia Beach Comprehensive Plan
Virginia Beach Outdoors Plan
First Landing State Park Master Plan
Fort Story Master Plan
Little Creek Naval Amphibious Base Master Plan
Code of the City of Virginia Beach
Design With Nature, Ian McHarg
The Image of the City, Kevin Lynch
ULI Bayfront Study
Seacoast Plants of the Carolinas For Conservation and Beautification, Karl Graetz
The Sanibel Report, John Clark

SHORE DRIVE CORRIDOR PLAN



APPENDICES

CITY OF VIRGINIA BEACH
DEPARTMENT OF PLANNING

CITYSCAPES

ADOPTED BY THE CITY COUNCIL OF VIRGINIA BEACH ON MARCH 28, 2000

pages 132 through 144 are provided for discussion purposes and are non-binding cost estimates and suggestions

TABLE OF CONTENTS

Appendices

Existing Conditions Description by Road Segment:

Diamond Springs Road to East Kimball Circle:

- Curb and gutter on south shoulder.
- Overhead power lines along south shoulder.
- 3 foot sidewalk along south shoulder.
- No landscaping in median or along shoulders in right-of-way.
- Limited streetlights located along shoulder.
- North outside lane at limit of existing right-of-way adjoining U.S. Navy property.

East Kimball Circle to Gate 4 / Staplesmill Lane:

- No curb and gutter.
- Overhead power lines along south shoulder.
- No sidewalks.
- No landscaping in median or along shoulders in right-of-way.
- Limited streetlights located along shoulder.
- North outside lane at limit of existing right-of-way adjoining U.S. Navy property.

Gate 4 / Staplesmill Lane to Independence Boulevard:

- Curb and gutter on south shoulder.
- Overhead power lines along south shoulder.
- 3 foot sidewalk along south shoulder.
- No landscaping in median.
- Limited landscaping located along shoulders.
- Limited streetlights located along shoulder.
- North outside lane at limit of existing right-of-way adjoining U.S. Navy property.

Independence Boulevard to South Oliver Drive:

- No curb and gutter.
- Overhead power lines along south shoulder.
- 3 foot sidewalk along south shoulder.
- No landscaping in median.
- Limited landscaping located along shoulders.
- Limited streetlights located along shoulder.
- Pedestrian lighting along south shoulder.
- Wall treatments along majority of north and south shoulders.
- North outside lane at limit of existing right-of-way adjoining U.S. Navy property.

South Oliver Drive to Baylake Road / First Court Road:

- Approximately half of link has curb and gutter on shoulders, with almost entirely no curb and gutter on median.
- Overhead power lines along south shoulder.
- Approximately one fourth of link has 3 foot sidewalks on either north or south shoulder.
- Limited landscaping in median.
- Limited landscaping located along shoulders.
- Limited streetlights located along north and south shoulders.
- Paved shoulders used as drop-off / pick-up turn lanes to private schools adjoining Shore Drive

Baylake Road / First Court Road to Shady Oaks Drive / Marlin Bay Drive:

- No curb and gutter.
- Overhead power lines along south shoulder.
- Overhead high transmission lines parallel to south road shoulder from former location of First Court Road to Marlin Bay Drive.
- No sidewalks.
- Limited landscaping in median except for intersection with Baylake Road / First Court Road.
- Limited landscaping located along shoulders except for former intersection of Shore Drive and First Court Road.
- Limited streetlights located along north and south shoulders.

Shady Oaks Drive / Marlin Bay Drive to East Stratford Road:

- No curb and gutter on median.
- Limited curb and gutter on shoulders.
- Overhead power lines along south shoulder.
- Overhead high transmission lines parallel to south road shoulder.
- Limited 3 foot sidewalks.
- Limited landscaping in median; paved median in areas closest to East Stratford Road.
- Moderate landscaping on private properties abutting north shoulder.
- Limited streetlights located along north and south shoulders.

East Stratford Road to Lesner Bridge:

- Curb and gutter on median.
- Limited curb and gutter on shoulders.
- Overhead power lines along south shoulder.
- Overhead high transmission lines parallel to south road shoulder.
- Limited 3 foot sidewalks.
- Limited landscaping in median; paved median predominates.
- Limited streetlights located along north and south shoulders.
- Metal guardrails along shoulders and median predominates.

Lesner Bridge:

- Curb and gutter on north and south bridge shoulders.
- Overhead high transmission lines parallel to and south of south bridge.
- Limited 2 foot sidewalk on outside bridge shoulders.

Lesner Bridge to Jade Street:

- Limited curb and gutter on median.
- Limited curb and gutter on shoulders.
- Overhead power lines along south shoulder.
- Overhead power lines along north shoulder from Lesner Bridge to Roosters Restaurant.
- Overhead high transmission lines parallel to south road shoulder from Lesner Bridge to Vista Circle.
- Limited 3 foot sidewalks.
- Limited landscaping in median; paved median predominates from Lesner Bridge to Page Avenue / Vista Circle.
- Limited streetlights located along north and south shoulders.
- Metal guardrails along shoulders and median predominates from Lesner Bridge to Page Avenue / Vista Circle.

Jade Street to Croix Street:

- Majority of link has curb and gutter on shoulders and on median.
- Overhead power lines along south shoulder.
- Approximately half of link has 3 foot sidewalks on either north or south shoulder.
- Limited landscaping in median.
- Limited landscaping located along shoulders.
- Limited streetlights located along north and south shoulders.

Croix Street to Kendall Street:

- Majority of link has curb and gutter on median.
- No curb and gutter on shoulders.
- Overhead power lines along south shoulder.
- No sidewalks.
- Extensive landscaping in median.
- Limited streetlights located along north and south shoulders.

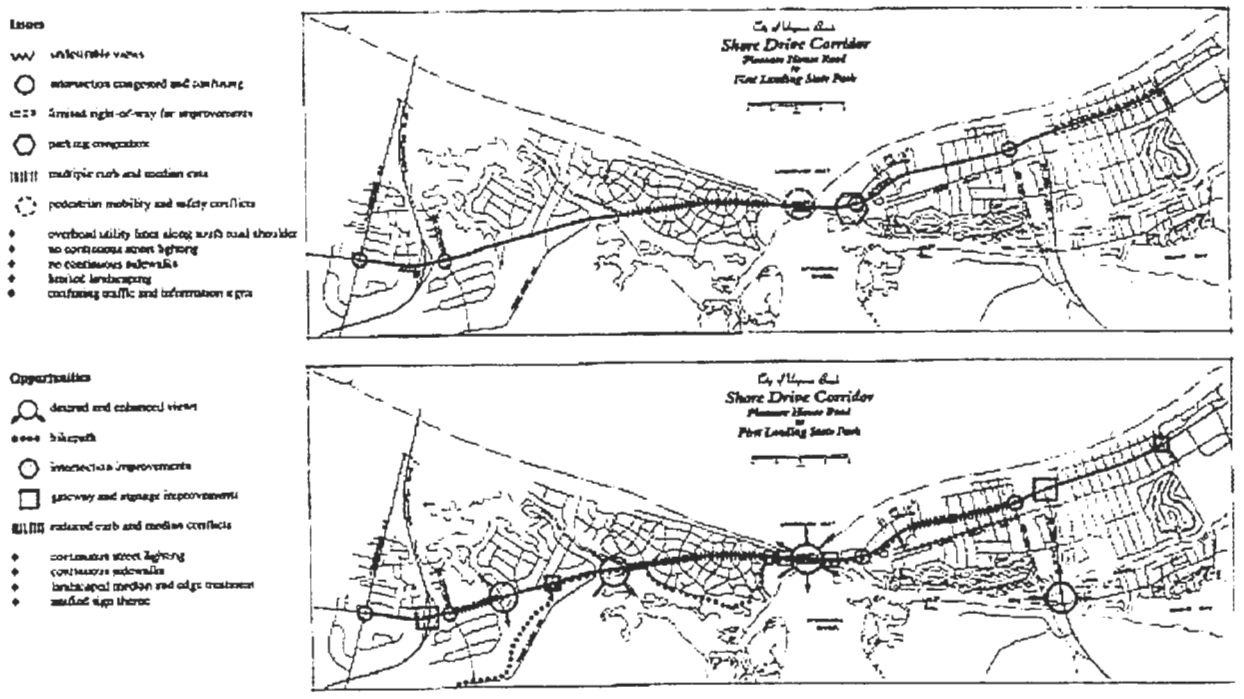
Kendall Street to North Atlantic Avenue:

- No curb and gutter on median or on shoulders.
- Limited landscaping in median from Kendall Street to West Fort Story entrance.
- Limited streetlights located along north and south shoulders.
- No sidewalks.
- Paved shoulder with rumble strip.

Issues and Opportunities:

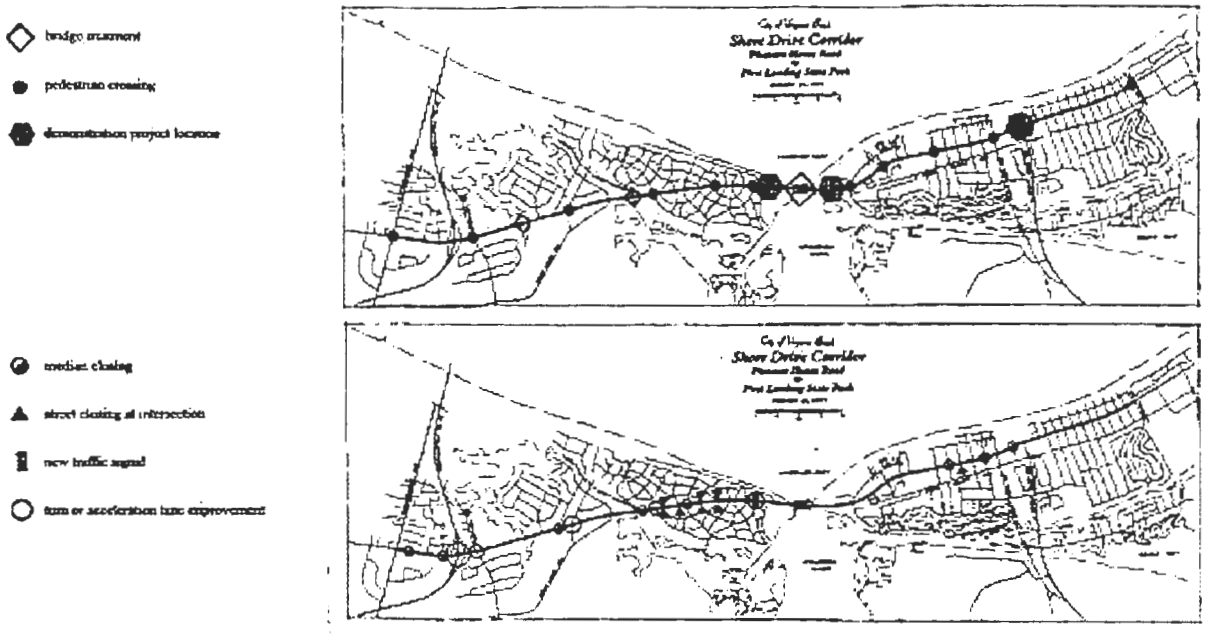
The Shore Drive Advisory Committee has identified a number of issues and concerns in conjunction with the public during the Corridor Planning Process. These issues include undesirable views, congested and confusing intersections, right-of-way limitations, parking congestion, multiple curb and median cuts, pedestrian mobility and safety conflicts, overhead utility lines, street lighting deficiencies, sidewalk deficiencies, inconsistent landscaping, and confusing traffic and information signs. These items have been identified in more detail in the preceding description of existing conditions by road segment.

The Corridor Planning Process also provided the Committee and the public an opportunity to identify options presented after an evaluation of existing conditions. These include desired and enhanced views, multi-purpose trails, intersection improvements, gateway and signage improvements, reduced curb and median conflicts, continuous street lighting, continuous sidewalks, landscaped median and edge treatments, and a unified sign theme. These items have been identified in more detail in the following description of general recommendations and description of specific recommendations by road segment.



Issues and Opportunities Diagrams

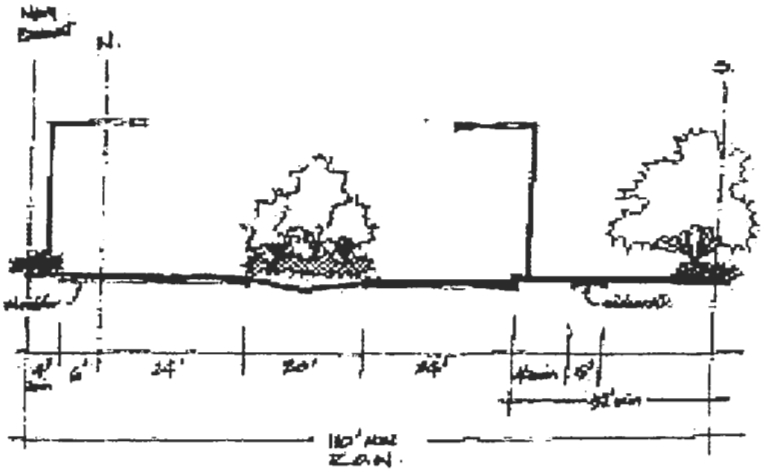
Specific Recommendations Description by Road Segment:

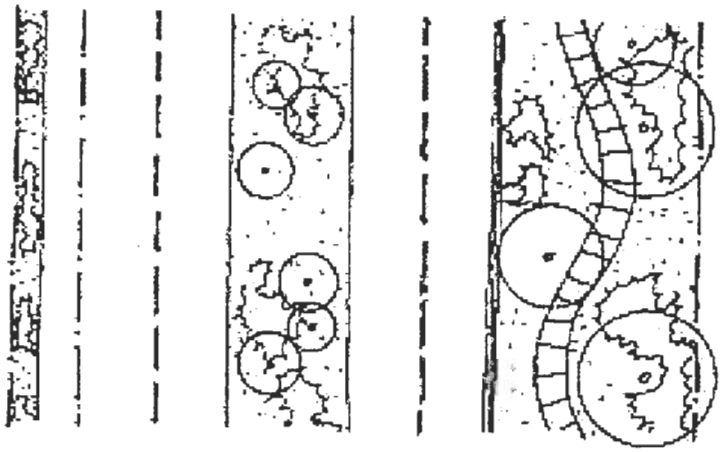


Proposed Improvements Diagrams

Diamond Springs Road to Kimball Circle:

- Replace existing paved deceleration lane along south shoulder with landscaped shoulder by relocating curb to edge of roadway. Maintain right turn deceleration lanes at street intersections only.
- Construct four foot wide asphalt paved shoulder with rumble strip along north shoulder.
- Install continuous five foot wide concrete walk in landscaped right-of-way along south shoulder.
- 20 foot landscaped median
- 2-lane traffic capacity in each direction
- 6 foot road shoulder on both sides; shoulder on north side will encroach into Navy easement
- 5 foot sidewalk along south side
- underground utility lines
- minimum right-of-way available and needed is 110 feet

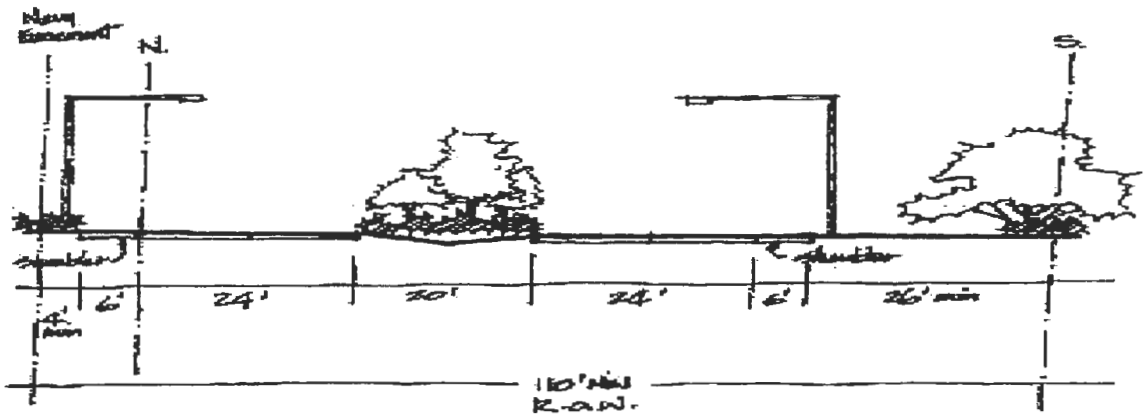


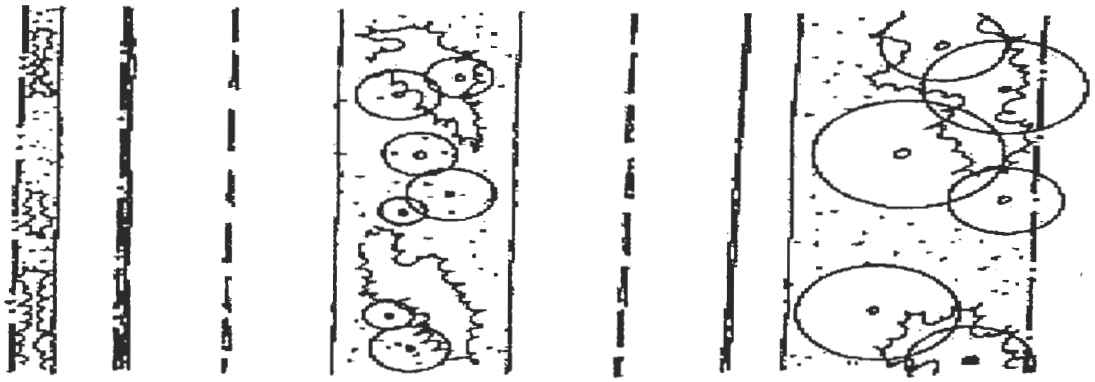


DIAMOND SPRINGS TO KIMBALL

Little Creek Reservoir:

- Enhance water views through selective pruning and elimination of plant material along south shoulder adjoining reservoir.
- Redesign road shoulder to facilitate safe pedestrian and bicycle travel along south shoulder adjoining reservoir.
- Replace existing guardrails along roadway with uniform guard rail system, preferably out of treated timber, to improve aesthetics of the roadway and shoulder.

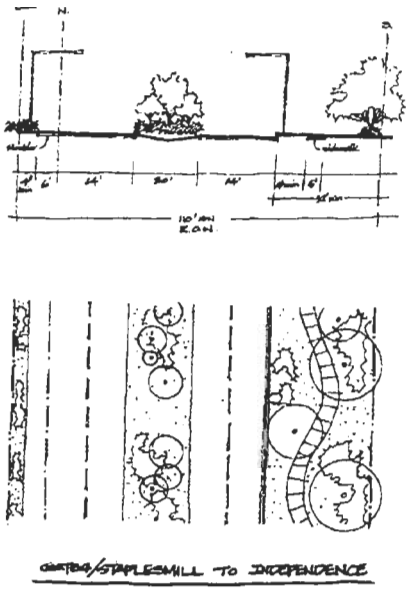




KIMBALL TO GATE 4/STAPLESMILL

Kimball Circle to Gate 4 / Staplesmill Lane:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction
- 6 foot road shoulder on both sides; shoulder on north side will encroach into Navy easement
- underground utility lines
- minimum right-of-way available and needed is 110 feet

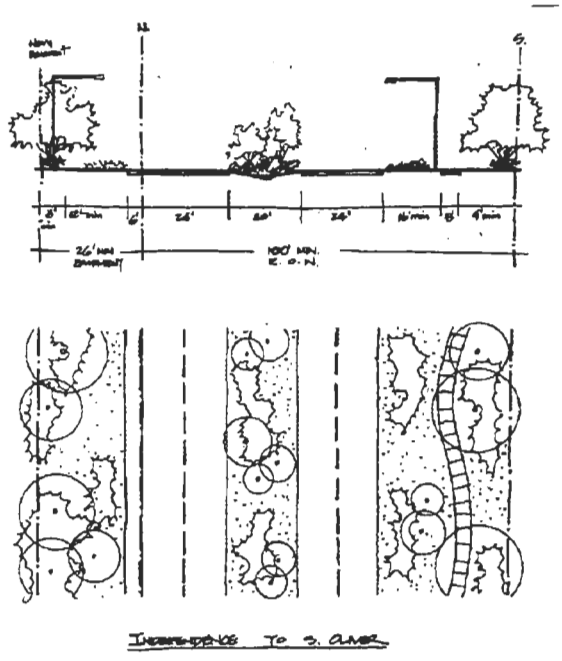


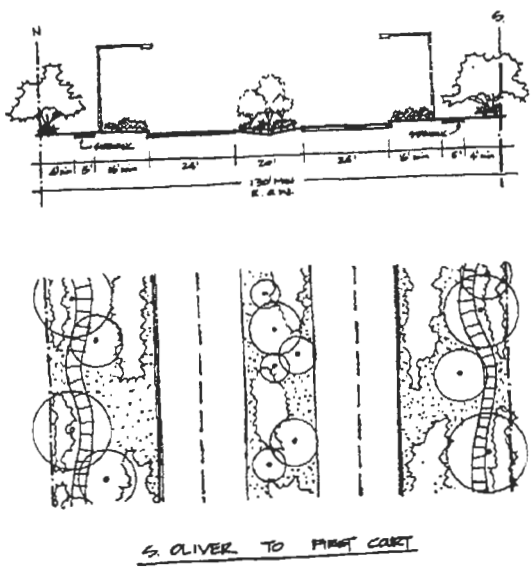
Gate 4 / Staplesmill Lane to Independence Boulevard:

- 20 foot landscaped median
- 2-lane traffic capacity on each direction
- 6 foot road shoulder on both sides; shoulder on north side will encroach into Navy easement
- 5 foot sidewalk on south side
- underground utility lines
- minimum right-of-way available and needed is 110 feet

Independence Boulevard to South Oliver Drive:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 6 foot road shoulder on both sides; shoulder on north side will encroach into Navy easement
- 5 foot sidewalk on south side
- underground utility lines
- minimum right-of-way available is 100 feet; 26 feet of Navy easement will be needed



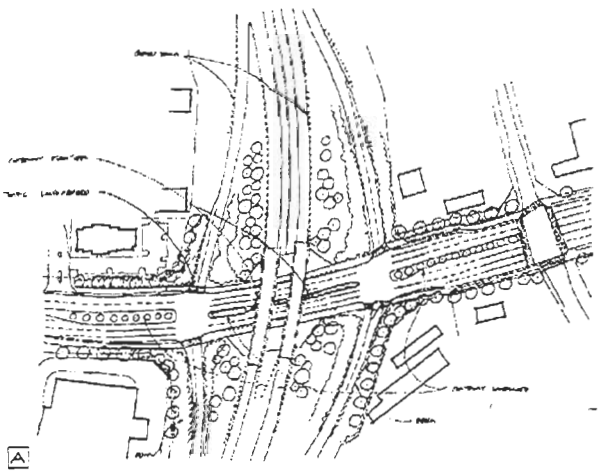


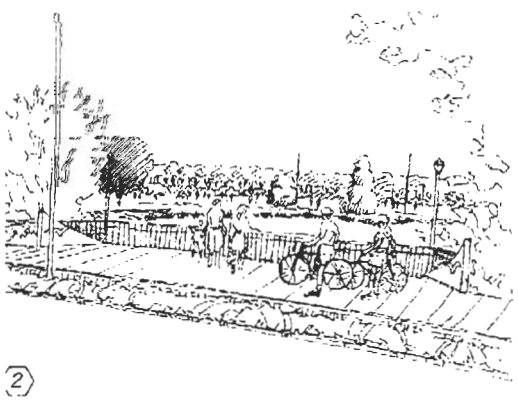
South Oliver Drive to Baylake Road / First Court Road:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 5 foot sidewalk on north and south sides
- underground utility lines
- minimum right-of-way available and needed is 130 feet

Northampton Interchange:

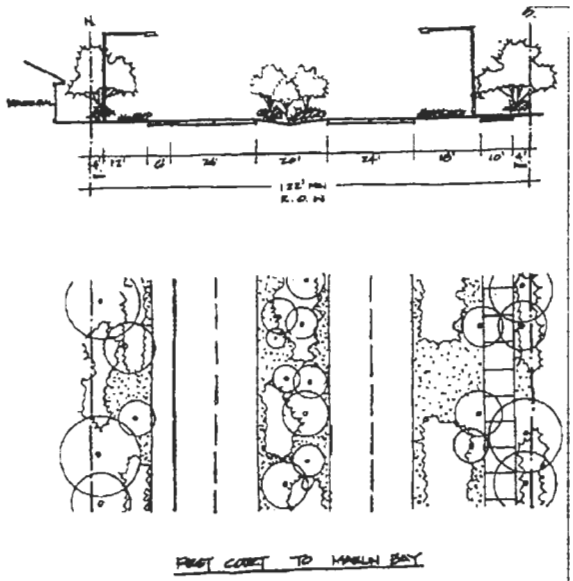
- Design concept determined by ultimate interchange reconstruction (maintain current ramps, add westbound cloverleaf ramp, or single-point urban intersection).
- Add themed gateway structures and landscaping.
- Reduce number of curb cuts.
- Add curb, gutter and sidewalks.
- Redesign drainage at interchange to increase usable site area.





Lake Joyce:

- Add sidewalks, curb, gutter and landscaping.
- Widen sidewalk at bridge treatment as overlook of lake and Bayville Park to enhance water views.
- Add multi-purpose trail connection from south shoulder sidewalk to Bayville Park.

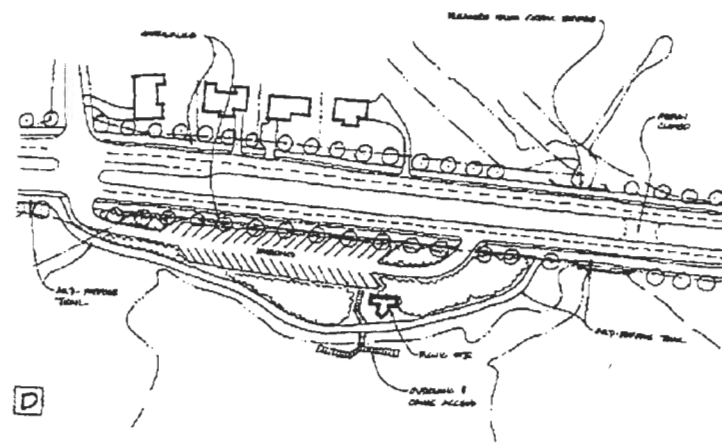


Baylake Road / First Court Road to Shady Oaks Drive / Marlin Bay Drive:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 6 foot shoulder on north side
- 10 foot multi-purpose trail on south side
- underground utilities
- minimum right-of-way available and needed is 122 feet

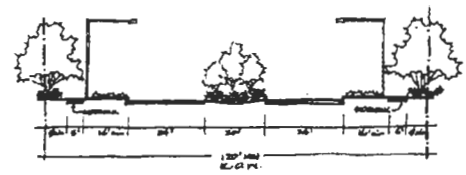
Pleasure House Creek:

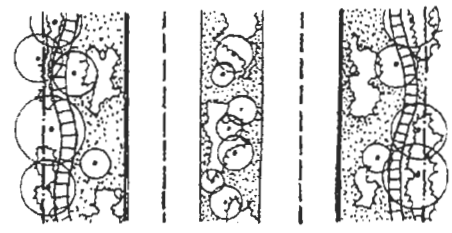
- Add sidewalks, curb, gutter and landscaping.
- Widen sidewalk and multi-purpose trail at bridge treatment as overlook of Pleasure House Creek to enhance water views.
- Develop property on south shoulder as wayside with parking, picnic area, scenic overlook, canoe access area and fishing/crabbing access area.



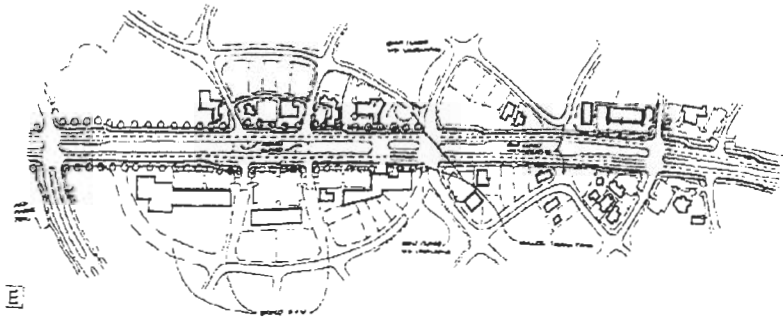
Shady Oaks Drive / Marlin Bay Drive to East Stratford Road:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 5 foot sidewalk on both sides.
- underground utilities
- minimum right-of-way available and needed is 120 feet





MARLIN BAY TO E. STRATFORD

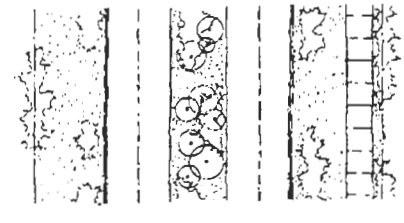


Ocean Park:

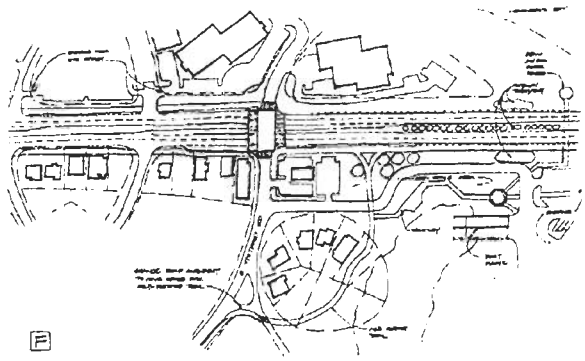
- Add sidewalks, curb, gutter and landscaping.
- Transfer excess public right-of-way to private ownership for future development.
- Close side street access and median crossings as identified on sketches.
- Reduce curb cuts.
- Redesign continuous right turn lane on south shoulder to enhance aesthetics and direct turning movements.

East Stratford Road to Lesner Bridge:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 10 foot multi-purpose trail on south side
- underground utilities
- minimum right-of-way available and needed is 126 feet

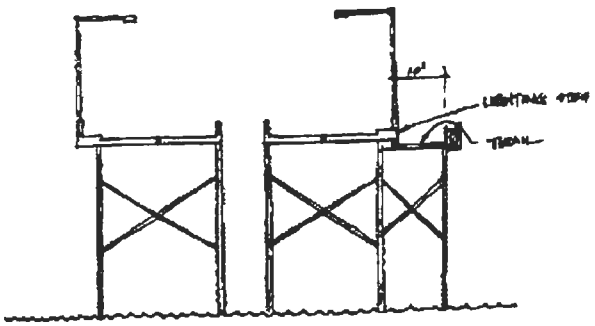


E. STRATFORD TO BRIDGE



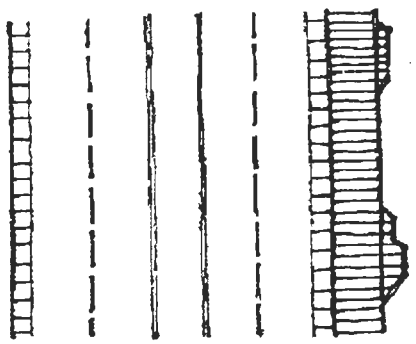
Lesner Bridge West and Boat Ramp:

- Construct boat ramp and public beach access area with landscaping.
- Preserve existing live oak trees on site.
- Construct themed gateway structure.
- Replace sidewalks, and add curb, gutter and landscaping.
- Construct multi-purpose trail and bridge connection and crossing.
- Improve intersection of East Stratford Road.

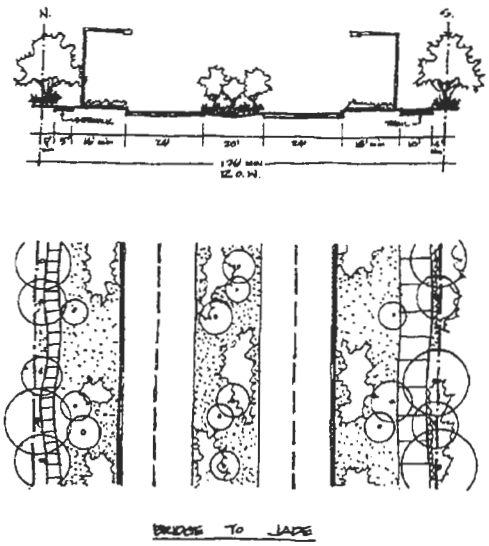


Lesner Bridge:

- 2-lane traffic capacity in each direction
- 10 foot multi-purpose trail on south side attached to the bridge
- future replacement of the bridge to 3 lanes in each direction and higher waterway clearance is recommended



LESNER BRIDGE

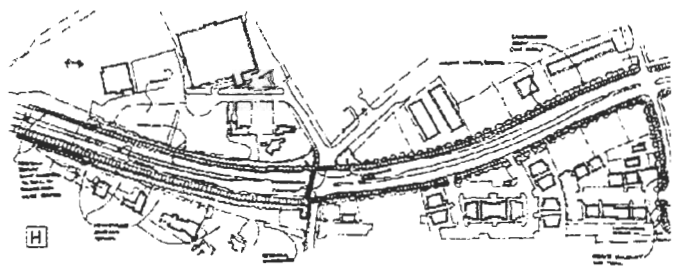


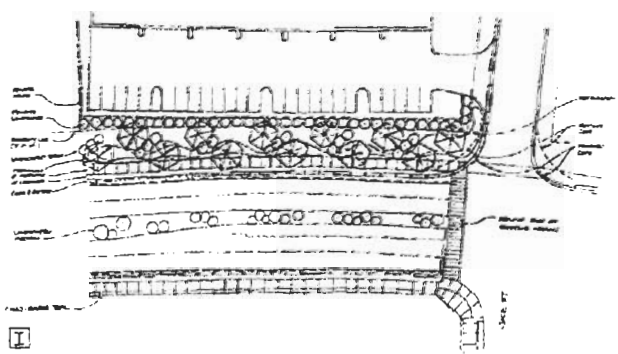
Lesner Bridge to Jade Street:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction
- 10 foot multi-purpose trail on south side, and 5 foot sidewalk on north side
- underground utilities
- minimum right-of-way available and needed is 126 feet

Lesner Bridge East:

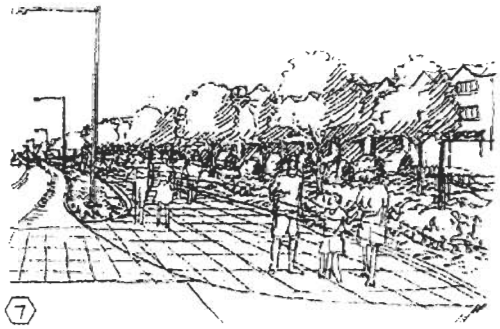
- Construct themed gateway structure.
- Replace sidewalks, and add curb, gutter and landscaping.
- Construct multi-purpose trail and bridge connection and crossing.
- Construct ramps down from bridge abutments and sidewalks to pedestrian connection and fishing access under the bridge.
- Improve intersection of Page Avenue / Vista Circle.





Jade Street:

- Construct landscaped berm with dense landscaping on north shoulder at intersection.
- Construct multi-purpose trail and transition from Shore Drive south shoulder to Jade Street west shoulder to Cape Henry Drive paper street.
- Replace sidewalks, and add curb, gutter and landscaping
- Redesign Jade Street cul-de-sac to better accommodate multi-purpose trail.



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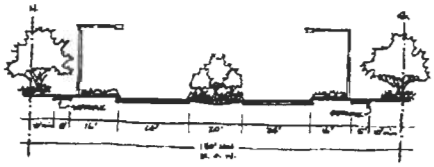
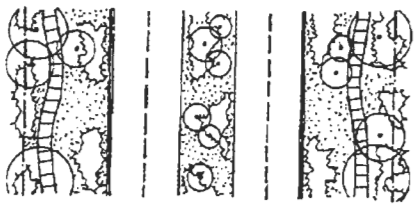
Shore Drive at Jade Street Looking West

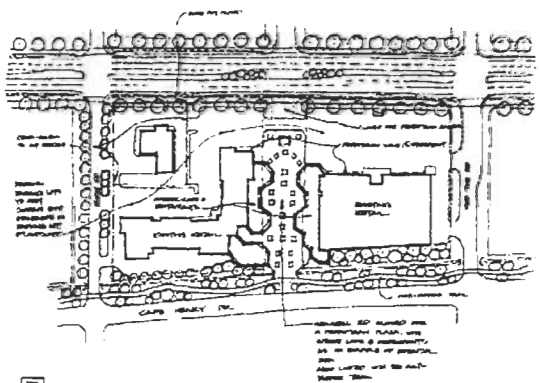




JADE TO CROIX

Jade Street to Croix Drive:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction, with the potential to be expanded to 3 lanes in each direction from Jade Street to North Great Neck Road
- 5 foot sidewalks on north and south sides
- underground utilities
- minimum right-of-way available and needed is 130 feet



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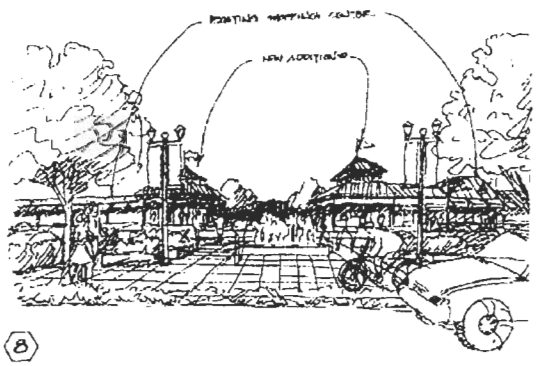
Seashell Road:

- Investigate potential of closing Seashell Drive between Shore Drive and Cape Henry Drive for public and/or private development.
- Improve pedestrian access with multi-purpose trail and amenities.
- Develop direct multi-purpose trail access to businesses.
- Redirect shopping centers access from Shore Drive to Urchin Road and Red Tide Road.
- Replace sidewalks, and add curb, gutter and landscaping.



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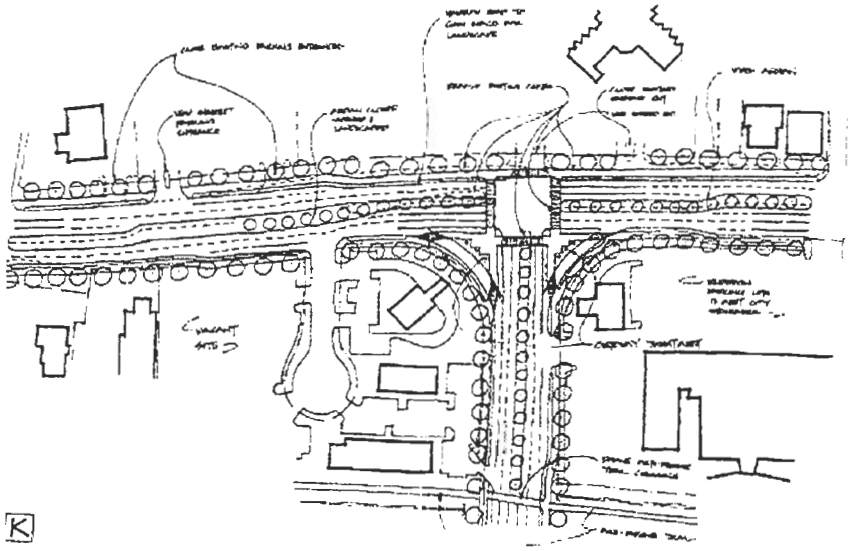
North Great Neck Road:

- Widen median with landscaping to provide pedestrian safety island.
- Replace sidewalks, and add curb, gutter and landscaping.



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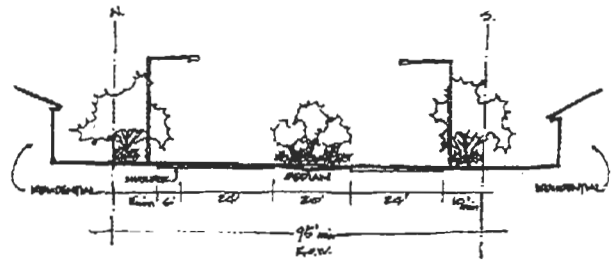
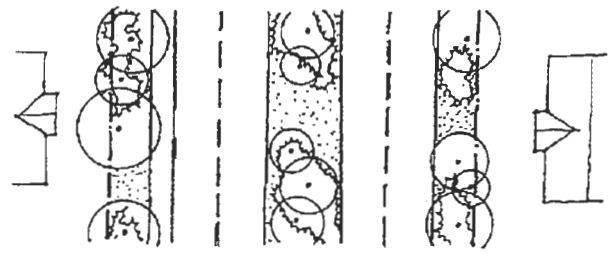
- Improve pedestrian crossing pavement markings at intersection.
- Add themed gateway treatments in triangle traffic islands.
- Decrease width of roadway by standardizing lane widths and eliminating merge lanes in order to widen median

Croix Drive to Kendall Street:

- 20 foot landscaped median
- 2-lane traffic capacity in each direction
- 6 foot shoulder on north and south sides
- no sidewalks on north or south sides
- minimum right-of-way available and needed is 95 feet

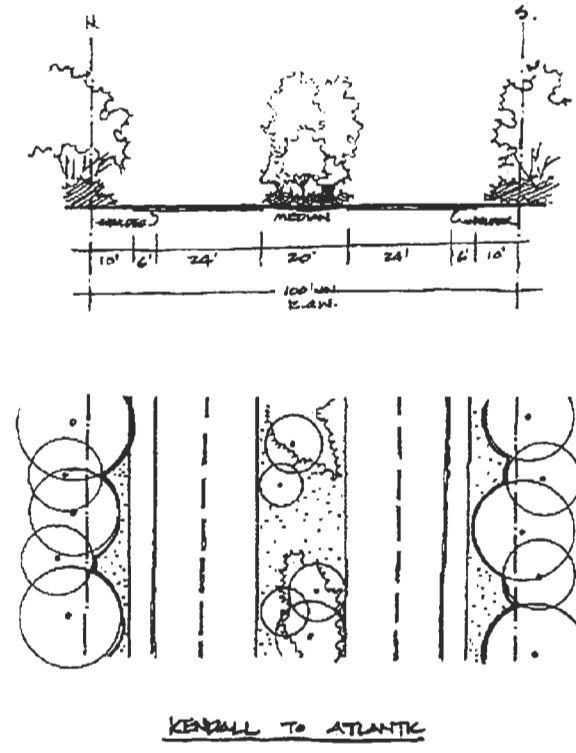




CROIX TO KENDALL

Kendall Street to North Atlantic Avenue:

- minimum 20 foot landscaped median
- 2-lane traffic capacity in each direction
- 6 foot shoulder on north and south sides
- minimum right-of-way available and needed is 100 feet



KENDALL TO ATLANTIC

Shore Drive Corridor Transportation Study:

The Shore Drive Corridor Transportation Study contained herein was prepared by the Hampton Roads Planning District Commission and is inserted here as part of the Appendix to the Shore Drive Corridor Plan. The original study has only been revised for this report to the extent of renumbering the study pages and adding the footer design to better incorporate the study in the body of this report. The original page numbers as shown on the table of contents, list of figures and list of tables pages in the study have been corrected accordingly for this report.

The remainder of the Appendix begins on page 110, following the Shore Drive Corridor Transportation Study.

Shore Drive Corridor Study

HAMPTON ROADS
PLANNING DISTRICT COMMISSION

JUNE 1999

T99-06

Shore Drive

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Shore Drive Corridor Study

This report was included in the Work Program for Fiscal Year 1998-1999, which was approved by the Commission and the Metropolitan Planning Organization at their meetings of March 18, 1998.

Prepared by

Hampton Roads Planning District Commission

June 1999

REPORT DOCUMENTATION

TITLE:

Shore Drive Corridor Study

REPORT DATE

June 1999

AUTHORS:

Joseph L. Lewis
Keith M. Nichols

Grant/Sponsoring Agency

FHWA/VDOT/LOCAL FUNDS

ORGANIZATION NAME, ADDRESS AND TELEPHONE

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ABSTRACT

The City of Virginia Beach requested the staff of the Hampton Roads Planning District Commission to perform a corridor analysis of Shore Drive between Independence Boulevard and North Great Neck Road. The study includes analyses of accident data, daily traffic, peak hour traffic, pedestrian accommodations, bicycle accommodations, and a summary of transit operations along the study corridor. The analysis of projected conditions included the land developments that are expected to be in place by year 2020 and the transportation network that is expected to be in place by year 2018. Alternative improvements to address the deficiencies in the highway network were analyzed for existing and projected conditions. Improvements were also identified to address safety and connectivity deficiencies in the non-highway transportation system through the corridor. The findings of this report will assist the City in its efforts to address land development and transportation issues in the Shore Drive Corridor.

ACKNOWLEDGMENTS

This report was prepared in cooperation with the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), the Virginia Department of Transportation (VDOT), and the City of Virginia Beach. The contents of this report reflect the views of the staff of the Hampton Roads Area Metropolitan Planning Organization (MPO). The MPO staff is responsible for the facts and the accuracy of data presented herein. The contents of this report do not necessarily reflect the official views or policies of FHWA, VDOT, or the Hampton Roads Planning District Commission. This report does not constitute a standard, specification or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any of the recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

EXECUTIVE SUMMARY

At the request of the City of Virginia Beach, the staff of the Hampton Roads Planning District Commission performed traffic analyses for the Shore Drive corridor. Shore Drive, a four-lane urban principal arterial with a posted speed limit of 45 miles per hour, is the main east-west thoroughfare for the northern portion of the City of Virginia Beach. The study area included a 4.5 mile segment of Shore Drive bounded to the west by Independence Boulevard and to the east by North Great Neck Road. Eleven signalized intersections are located in the study area as well as a diamond interchange at Northampton Boulevard. Analyses were performed to assess traffic operations for both existing conditions and projected conditions during the AM and PM peak hours. The analysis of existing conditions also included a review of accident data from the previous three years to identify prevalent accident types and accident-prone locations as well as a review of access management concerns. Deficiencies were identified and alternative improvement strategies were analyzed to address those deficiencies. In addition to performing analyses of traffic operations, the staff of the Hampton Roads Planning District Commission also assessed the non-highway components of the transportation system in the corridor such as sidewalks, bikeways, and transit service.

The following deficiencies in the non-highway transportation system were identified:

- The existing sidewalk system does not connect to form a continuous walkway through the study area.
- Other than a multi-use path extending from First Landing State Park (located to the east of the study area) no other bikeways are provided.
- Bicycle storage facilities are not provided at many of the restaurant and retail locations in the study area.
- Tourist shuttle and trolley services have not been implemented in the Bayfront Resort Area to offer alternative transportation modes to tourists, although Tidewater Regional Transit (TRT) and TRAFFIX are currently performing a study to determine the need and feasibility of implementing services in the study area.

The following improvements are recommended to address the existing deficiencies in the non-highway transportation system:

- Implement plans to construct sidewalks along both sides of Shore Drive in the study area.
- Perform pedestrian data collection to determine the need for exclusive pedestrian phasing in intersection signal timings.
- Implement plans to extend the existing multi-use path from First Landing State Park to the Bayside Recreation Center (located in the western section of the study area).
- Implement the recommendations of the study currently underway by TRAFFIX to provide alternative transportation services in the study area.
- Perform a ridership survey to determine the needs of transit users.

The following deficiencies were identified for the highway transportation system:

- Most accidents in the study area occurred in the vicinity of Northampton Boulevard.
- The most common causes of accidents are drivers following too closely and failing to yield right of way.
- Shore Drive in the vicinity of Northampton Boulevard is the most congested section in the study area during both the morning and afternoon peak hours.
- The northbound right-turn movement at the intersection of First Court Road and Shore Drive experiences delays during the PM peak hour.
- Some traffic signals in the study area are not coordinated.
- During the school year, westbound traffic on Shore Drive between First Court Road and Greenwell Road is being stopped to allow vehicles to access two private schools in the study area.
- Extreme delays are expected to continue to occur at the interchange of Shore Drive and Northampton Boulevard unless capacity improvements are implemented.
- Excessive delays are expected to occur in the eastbound direction on Shore Drive during the afternoon peak hour unless capacity improvements are implemented by year 2020.

The following improvements are recommended to address the deficiencies of the highway transportation system:

- Enforce access management policies in the Shore Drive Corridor.
- Coordinate and optimize traffic signal timings to increase through-flow on Shore Drive and diminish the stop-and-go conditions that contribute to the number of rear-end accidents.
- Use protected-only left-turn phasing at the following intersections in an effort to reduce the number of right-angle accidents: Northampton Boulevard, Greenwell Road, and Shady Oaks Drive.
- Provide a northbound free-flow right-turn lane at First Court Road with an acceleration lane onto eastbound Shore Drive.
- Consider interchange improvements at Northampton Boulevard to address capacity deficiencies during the morning and afternoon peak hours.
- Consider improving capacity by widening Shore Drive from 4 lanes to 6 lanes between Northampton Boulevard and North Great Neck Road, as indicated in the 2018 Long Range Plan.

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INTRODUCTION

The Shore Drive corridor, shown on **Maps 1 and 2**, has become a high priority to the City of Virginia Beach in recent years. As identified in the 1997 Comprehensive Plan[1], the corridor "is viewed as an area that has evolved in a rather uncoordinated and uninspired fashion". The corridor is a mix of residential, recreational, retail and commercial land uses. In the spring of 1997, the Urban Land Institute (ULI) evaluated the potential of the area and developed a strategy for enhancement and development.[2] The findings of the ULI report focused on strategies to accomplish three major tasks:

- Utilize the Shore Drive Corridor as a resort community rather than a resort destination, placing priority on serving the needs of the local community.
- Utilize the Shore Drive Corridor as a tourist gateway to access oceanfront resort destinations.
- Develop land areas adjacent to the Lynnhaven Inlet into "exciting and high quality waterfront activity centers"[3].

The ULI report also emphasizes the importance of forming an advisory committee to coordinate strategy development. Therefore, the Virginia Beach city council appointed the Shore Drive Advisory Committee (SDAC). The SDAC meets monthly to discuss issues relating to development on the Shore Drive corridor.

The ULI report references the importance of traffic flow through the Shore Drive corridor but does not identify strategies to accomplish the task of providing acceptable levels of traffic operations along the corridor. This report addresses those concerns.

At the request of the City of Virginia Beach, the staff of the Hampton Roads Planning District Commission performed traffic analyses for the Shore Drive corridor. Analyses were performed to assess traffic operations for both existing conditions and projected conditions during the AM and PM peak hours. The analysis of existing conditions also included a review of accident data from the previous three years to identify prevalent accident types and accident-prone locations. Deficiencies were identified and alternative improvement strategies were analyzed to address those deficiencies. In addition to performing analyses of traffic operations, the staff of the Hampton Roads Planning District Commission also assessed the non-highway components of the transportation system in the corridor such as sidewalks, bikeways, and transit service.

In recognition of the desire to utilize the Shore Drive corridor as a resort community, the City is developing strategies to enhance the pedestrian and bicyclist accommodations in the corridor. The SDAC has commissioned a bikeway plan with the

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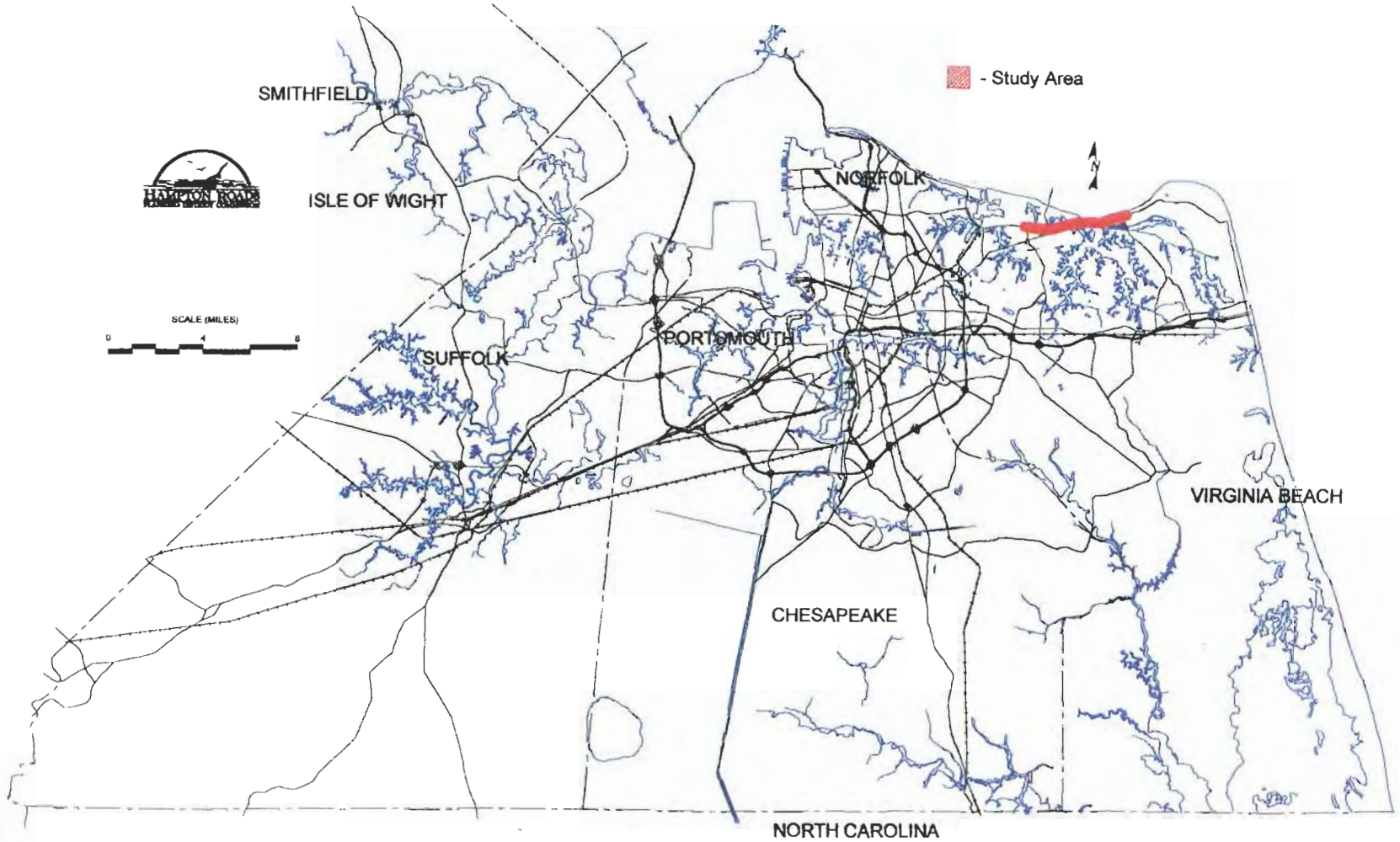
[1] *Comprehensive Plan*, City of Virginia Beach, Virginia. November 4, 1997.
[2] *Bayfront, Virginia Beach, Virginia. An Evaluation of the Area's Potential and a Strategy for its Enhancement and Development*. The Urban Land Institute. May 18-23, 1997.
[3] Ibid.

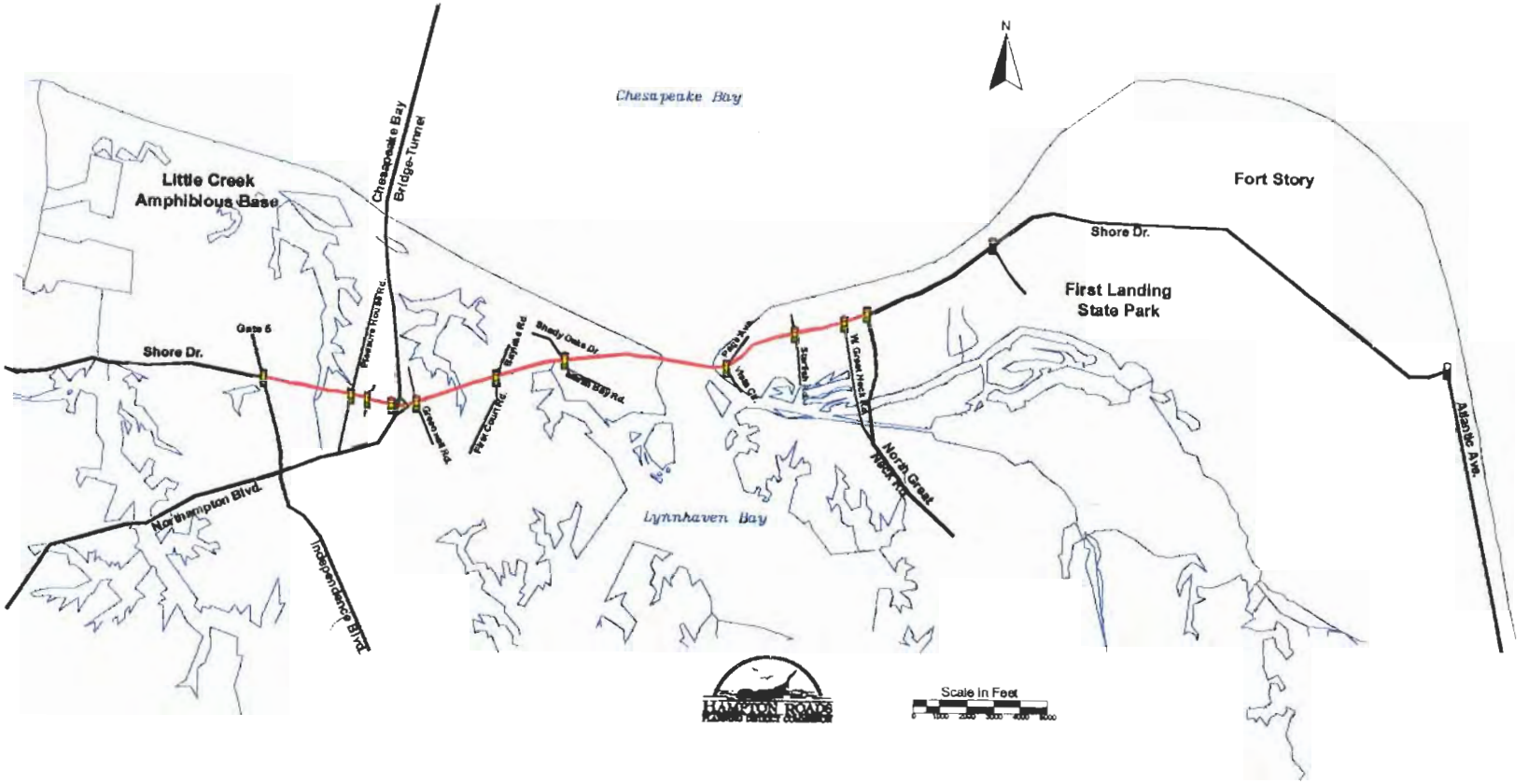
objective of providing a continuous bikeway connecting First Landing State Park and the Bayville Recreation Center. In addition to identifying proposed bikeway locations, the plan also identifies traffic median openings proposed for closure. The HRPDC staff has reviewed the bikeway plan and the findings are included in this report.

This report will assist the City staff in their efforts to address the deficiencies of the transportation network and to propose strategies for development in the Shore Drive Corridor.

MAP 1
Vicinity Map



MAP 2
Study Area Map



NON-HIGHWAY SYSTEM

EXISTING CONDITIONS

Pedestrian/Bicycle Destinations

Pedestrians and bicyclists typically access several destinations within the study area.

- The Bayside Recreation Center is located in the western section of the study area and is accessible from Shore Drive via First Court Road.
- Public access is provided to many of the beaches along the Chesapeake Bay, but parking is limited, so Shore Drive residents as well as non-Shore Drive residents often access the beaches by walking or by bicycle.
- First Landing State Park is located to the east of the study area. Many residents along Shore Drive use an existing multi-use pedestrian/bicycle path for recreation and to access the park.
- In addition to the recreational destinations, the mix of residential and retail land uses in certain sections of the study area encourages pedestrian and bicycle activities.

Pedestrian and bicycle access is an important consideration in the development of the transportation system in the Shore Drive Corridor. Although some accommodations for pedestrians and bicyclists have been provided, the existing facilities are insufficient in most sections of the study area.

Pedestrian Accommodations

Pedestrian accommodations are provided along the Shore Drive Corridor between Great Neck Road and Independence Boulevard, as shown in **Figure 1**. Sidewalks are provided in some sections of the corridor but are not linked to form a continuous walkway through the study area. All of the signalized intersections are stripped with pedestrian crosswalks and are equipped with pedestrian signals and accompanying push-buttons. Also, an existing multi-use path located to the south of Shore Drive provides access to First Landing State Park although it terminates at West Great Neck Road.

Figure 1: Sidewalk on the northbound approach of N. Great Neck Road to Shore Drive.

Bicycle Accommodations

In addition to the pedestrian accommodations that are in place in the study area, some accommodations have also been provided for bicyclists. As already stated, a multi-use path (**Figure 2**) provides access to First Landing State Park and terminates at West Great Neck Road. Although no other bike lanes are marked in the study area, bicycle use is evident. Wide paved shoulders along Shore Drive to the east of the study area are currently being used by bicyclists as are the sidewalks, adjacent residential streets, and the travel lanes along Shore Drive.

Proper signage and pavement markings are important components of a safe bicycle plan. Proper signage and markings will clearly direct bicyclists and pedestrians along the designated travel paths and will warn motorists of upcoming conflicts. A bicycle crossing sign is posted on the northbound approach of North Great Neck Road to identify the crossing of the multi-use path shown in **Figure 2**, however a warning sign is not posted on the southbound approach of Shore Drive. In addition to the crosswalk markings on Shore Drive, pavement markings are also provided on the multi-use path directing the users to stop and yield to traffic on the sidewalk and on the roadway.

Figure 2: This multi-use path provides pedestrian and bicycle access to Seashore/First Landing State Park and terminates at West Great Neck Road.

The provision of storage facilities is another important component of bicycle accommodations. Bike racks are provided at various locations in the study area: the Bayside Recreation Center (**Figure 3**), Bayville Park and Disc Golf Course, and Cape Henry Plaza. However, bike racks are not provided at the most of the shopping centers located in the study area or at the public beach access points. At these locations, bicyclists are securing their bicycles to building posts and signs or not securing them at all. The lack of adequate storage facilities may discourage the use of bicycles in the study area.

Figure 3: Bicycle racks are provided at the Bayside Recreation Center.

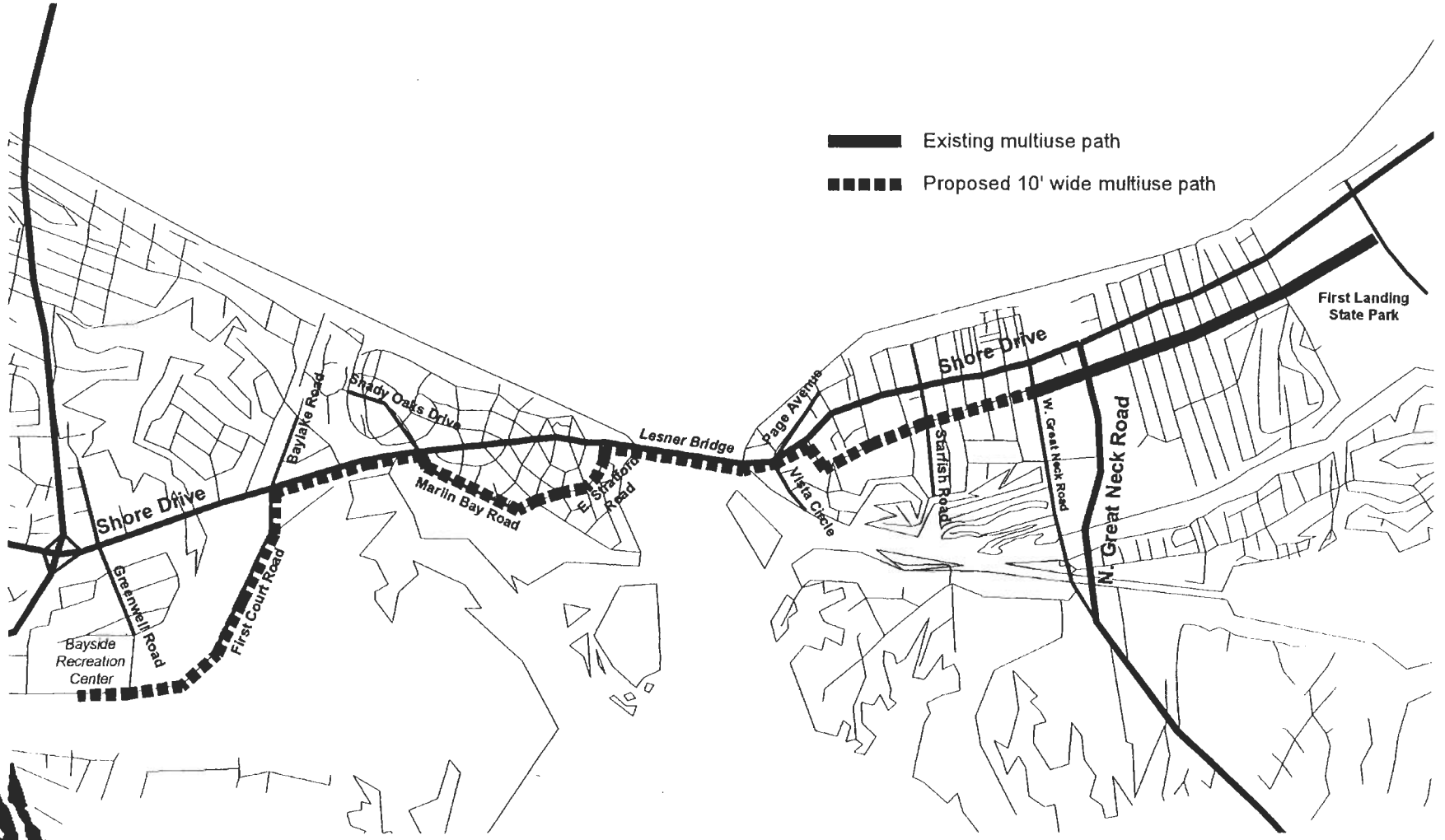
PROJECTED CONDITIONS

The City of Virginia Beach has placed a high priority on enhancing the pedestrian and bicycle accommodations along the Shore Drive Corridor in the study area. To that end, the City Council has appointed the Shore Drive Advisory Committee (SDAC). Improving the pedestrian and bicycle transportation system in the corridor is one of the many tasks being addressed by the SDAC. The SDAC has commissioned a bikeway plan for the corridor that is currently under development.

The draft bikeway plan addresses some of the deficiencies of the current bikeway and sidewalk system. The draft bikeway plan includes upgrades and additions to the existing bikeway and sidewalk system that will connect the two major recreation sites in the study area: First Landing State Park and Bayside Recreation Center. The improvements indicated for the sidewalk system include the construction of an eight-foot wide walkway along both sides of Shore Drive, except for the Lesner Bridge. The proposed bikeway plan includes the construction of a ten-foot wide multi-use pedestrian/bikeway path that connects to the existing multi-use path that terminates at West Great Neck Road. **Map 3** illustrates the alignment of the proposed multi-use path. The draft plan proposes that the path be extended west to Jade Street along right-of-away adjacent to Cape Henry Drive. At Jade Street, the new multi-use path will then connect to Shore Drive and be constructed along the south side of Shore Drive across the Lesner Bridge to the west. After crossing the bridge, the new path will then be constructed along East Stratford Road and connect to Marlin Bay Drive. At Marlin Bay Drive the new path will again be constructed along the south side Shore Drive to First Court Road. At First Court Road the path will then be extended to connect to the Bayside Recreation Center. **Figure 4** shows the bridge over the Rudee Inlet in the oceanfront resort area. The bridge was constructed with a multi-use path separated from the adjacent vehicle travel lanes by guardrail. A facility of this type would require reconstruction or retrofitting of the existing Lesner Bridge.

Figure 4: Rudee Inlet Bridge. A multi-use path over the Rudee Inlet is provided at the oceanfront resort area.

MAP 3
Bikeway Network
Existing and Proposed Facilities



Safety Issues

Although the draft bikeway plan does not directly address safety issues relating to the proposed bikeways or sidewalks, pedestrian and bicyclist safety is a priority. The existing signalized intersections are equipped with crosswalk markings and pedestrian push-buttons. However, some intersections experience increased pedestrian activity during the peak summer season. In particular, the intersection of Shore Drive and Vista Circle (**Figure 5**) experiences a significant increase in pedestrian crossings during the summer months. A restaurant located near this intersection hosts beach parties various nights of the week. Parking on the property is limited, so patrons are parking on adjacent properties and are crossing Shore Drive at Vista Circle. At locations that experience increased seasonal pedestrian or bicycle activity, increased signage may be a minimum appropriate step to warn motorists of upcoming pedestrian conflicts.

Figure 5: Intersection of Shore Drive and Vista Circle/Page Avenue. Pedestrian activity at this intersection increases during the summer months.

Bicycle Storage Facilities

The provision of bicycle facilities is an important component of a bikeway system, although they are not identified as part of the proposed bikeway plan. As already stated in this report, bicycle racks are provided at the major recreational facilities in the study area. Bicycle racks, however, are not provided at many of the retail centers in the study area. Although some land uses in the study area do not typically attract bicyclists (golf course, auto repair shops, etc.), many of the businesses located in the study area could possibly benefit by providing bike racks. Convenience stores, video stores, and even grocery stores generate bicycle trips in the study area; however, bike racks are not provided at most of those businesses. Bicycle racks could be mutually beneficial to both property owners and bicyclists. Properly placed bike racks can encourage bicycle use while clearly identifying where bicycles should be stored on the property, rather than the bicycles being secured their bikes to posts or signs. Also, owners can have a sense of security that their bicycle will not be stolen or damaged while they are away.

EXISTING CONDITIONS

Transit usage is an important tool to address existing and projected capacity deficiencies. TRT bus stops (**Figure 6**) are signed along eastbound and westbound Shore Drive. However, the Shore Drive corridor is serviced by only one transit route with 60-minute headways. In addition to the Shore Drive corridor, the transit route serves Independence Boulevard, Virginia Beach Boulevard, and Great Neck Road. Ridership data for years 1996 through 1998 are summarized in **Table 1**.

Figure 6: TRT bus stop. This bus stop is typical of all the TRT bus stops along Shore Drive.

TABLE 1
Transit Average Daily Ridership

Year	Average Daily Ridership
1996	468
1997	461
1998	570

Source: Tidewater Regional Transit
Prepared by: HRPDC, June 1999.

PROJECTED CONDITIONS

The portion of Shore Drive in the study area is included in the Oceanfront Transportation Needs Assessment study that is currently being performed by TRAFFIX. The purpose of the study is to determine the feasibility of the implementation of traffic demand management (TDM) strategies to address the transportation needs in the bayfront and beachfront resort areas. The first phase of that study has been completed. During the first phase of the study Traffix staff members interviewed employers in the oceanfront and bayfront resort areas. The next phase of the transportation needs assessment study is to interview the employees working in the oceanfront and bayfront resort areas. The key findings of the first phase of the study are summarized below.

- Traffic congestion is identified as a problem in the oceanfront and bayfront areas.
- Business owners are willing to participate in the Traffix programs to help reduce congestion.
- Employers are willing to sponsor employee transportation as an incentive to retain employees.
- Several options were offered by the employers including improvement and expansion of the bus service, off-site parking sites, resort area trolley services, and better information concerning alternate routes to the oceanfront.

One of the possible outcomes of this study could be a tourist shuttle service that would provide transportation connecting the hotel and resort areas to other tourist destinations in the region. The implementation of a tourist shuttle service in the

Williamsburg resort area has been very successful. In an effort to provide transportation to seasonal tourists and to reduce the number of vehicles on the roads in the Williamsburg resort area, the regional transit agencies worked cooperatively to provide a visitors shuttle service during the peak tourist season. The service was first implemented during the 1997 tourist season and provided transportation for over 120,000 riders during the 1998 tourist season. The shuttle service provides transportation between hotels and major tourist destinations in the Williamsburg area (Colonial Williamsburg, Busch Gardens, Williamsburg Pottery, and numerous retail outlet centers). The provision of a visitors shuttle service could have similar success if properly marketed and implemented in the Shore Drive corridor.

A trolley service is currently in operation in the oceanfront resort area. The implementation of the service has been considered a success; however, the trolley service does not provide a connection to the bayfront resort area.

HIGHWAY SYSTEM

EXISTING CONDITIONS

Roadway Characteristics

Shore Drive, an urban principal arterial, is the main east-west thoroughfare for the northern portion of the City of Virginia Beach. Three other major arterials intersect Shore Drive within the study area. Independence Boulevard and Gate 5 of Little Creek Amphibious Base intersect Shore Drive in the western portion of the study area. Approximately one mile to the east, Northampton Boulevard intersects Shore Drive and leads to the Chesapeake Bay Bridge-Tunnel. North Great Neck Road intersects Shore Drive in the eastern portion of the study area.

Shore Drive has a divided four-lane cross-section throughout the entire 4.5-mile long study corridor. The eastern and western portions of the corridor are mostly curbed, while the center portion has unpaved shoulders and uncontrolled access points.

Eleven intersections are currently signalized along this portion of the Shore Drive corridor. The current lane configurations of these intersections are shown on **Map 4**.

Accident Analysis

Analyses were performed to determine the types, locations, and probable causes of accidents along the Shore Drive corridor. In addition, analyses were performed to determine which signalized intersections have had high accident rates. The data for these analyses were provided by the City of Virginia Beach for the three-year period between January 1995 and December 1997.

Corridor Summary

The City of Virginia Beach rates arterial road segments by a standard called the Equivalent Property Damage Only (EPDO) rate. **Table 2** shows the EPDO values for the Shore Drive corridor, along with the method used for calculating the EPDO accident rate. The four segments that make up the study area were all below the citywide average rate of 324.39. The most hazardous segment was between Northampton Boulevard and First Court Road, and it ranked 77th out of the 185 arterial road segments analyzed by the City with an EPDO rate of 290.63.

MAP 4
Existing Intersection Configurations

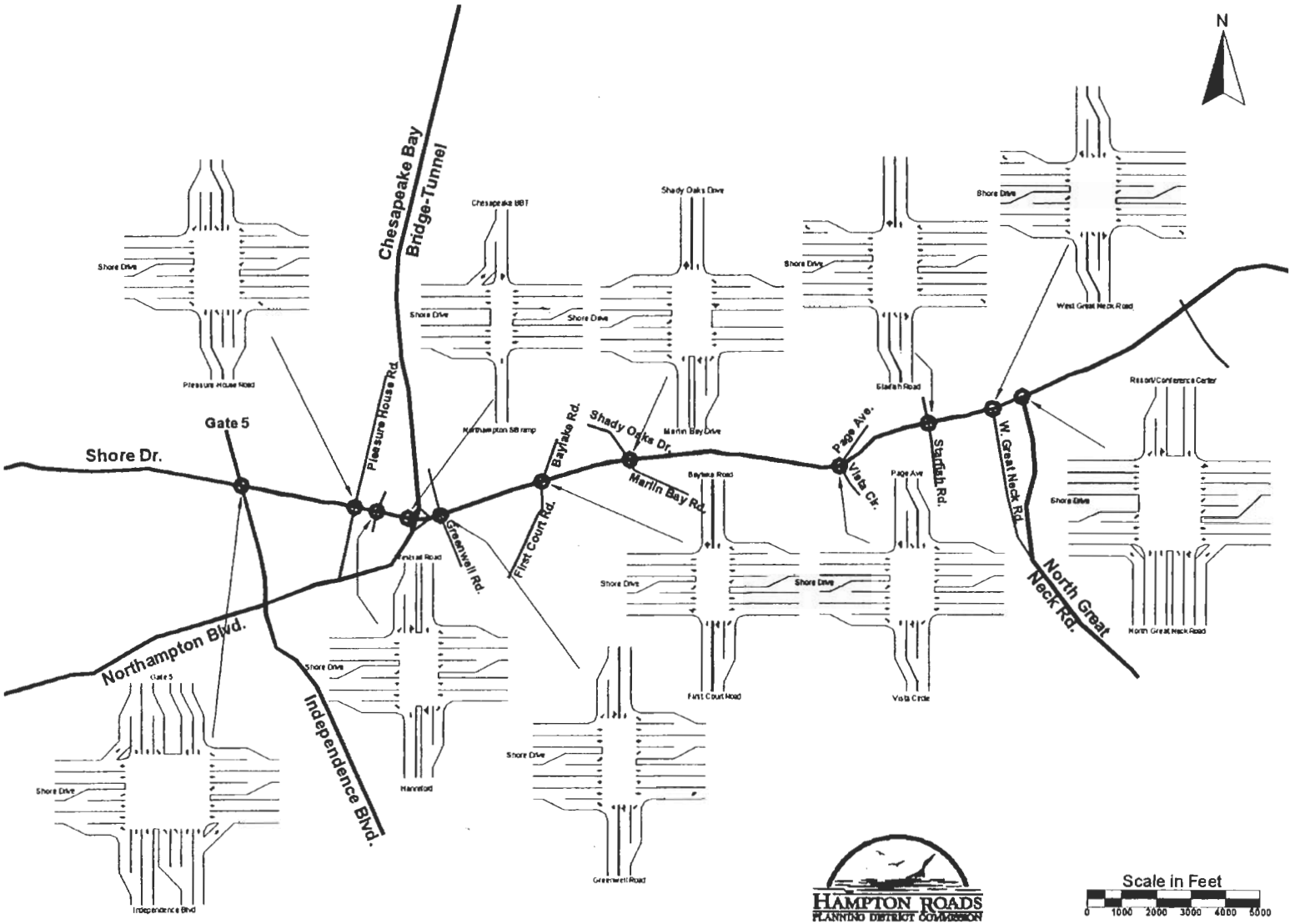


TABLE 2
Shore Drive Equivalent Property Damage Only (EPDO) Rates

Shore Drive segment between...	Average EPDO per year (1)	EPDO accident Rate (2)	Citywide Ranking (3)
Independence Boulevard - Northampton Boulevard	12.00	146.30	155/185
Northampton Boulevard - First Court Road	43.33	290.63	77/185
First Court Road - Page Avenue/Vista Circle	49.33	261.02	88/185
Page Avenue/Vista Circle - North Great Neck Road	54.67	266.99	84/185

(1) EPDO = (Property Damage accidents x 1) + (Injuries x 3) + (Fatalities x 12)
(2) EPDO accident rate = (Average EPDO x 100 million) / (ADT x 365 x segment length)
(3) 185 arterial segments are included in the analysis.

Prepared by: Hampton Roads Planning District Commission, June 1999.
Source: City of Virginia Beach

A total of 570 accidents occurred on Shore Drive in the study area between January 1, 1995, and December 31, 1997. These accidents produced 309 injuries and one fatality. There were a similar number of accidents in both 1995 and 1996, but there was a large decline in 1997, as shown in **Figure 7**.

Figure 8 shows the distribution of accidents by the month of year. Most accidents occurred during the summer months, however **Figure 8** shows an increase in accidents during the winter months from 1995 to 1996.

Figure 9 summarizes the percentage of accidents by the day of the week. Friday was the most hazardous day of the week, accounting for more than seventeen percent of all accidents in the corridor. Saturday was also hazardous, accounting for over sixteen percent of all accidents. Sunday had the lowest percentage of accidents with approximately ten percent of all accidents.

Figure 10 shows the percentage of accidents by the time of day. The most hazardous hour of the day was the afternoon peak hour, between 5:00 PM and 6:00 PM. As expected, the number of accidents increased during the morning peak, midday peak, and the afternoon peak hours.

Figure 11 summarizes the number of accidents at the top ten unsignalized intersections ranked by the number of reported accidents. East Stratford Road, at the western base of the Lesner Bridge, was the site of the most reported accidents at unsignalized intersections in the study area. The number of accidents at the Northampton Boulevard northbound exit ramp was also significant as well as at the unsignalized intersections located in the largely residential area between Page Avenue/Vista Circle and Starfish Road.

Signalized Intersection Summary

A total of 354 accidents occurred at the eleven signalized intersections within the study area. **Figure 12** shows this data analyzed by intersection and year. The most

hazardous signalized intersection was Greenwell Road, although this is misleading. Most of these accidents were of the rear-end variety, due to the queue formed from the signalized intersection at the Northampton southbound ramp.

Figure 13 shows that over 90 percent of the accidents at signalized intersections were of the rear-end and right-angle varieties. The number of conflicts involving either a bicyclist or a pedestrian was just over one percent of the total number of accidents within the study area.

Recommended Improvements

Although this corridor is not as hazardous as some of the other roadway segments within the City of Virginia Beach, improvements can be made to reduce the large number of rear-end and right-angle collisions. These improvements include optimizing and coordinating traffic signals, using protected-only phasing for some left-turn movements, and closing some of the driveways and median openings along the corridor.

Currently, the majority of the traffic signals on Shore Drive are not coordinated. In fact, many of the signals operate with different cycle lengths within this corridor. This setup does not allow for a smooth progression of vehicles, requiring drivers to stop at numerous signals as they proceed through the corridor. Optimizing and coordinating traffic signals will reduce this number of stops, and in turn will reduce the number of rear-end collisions.

Changing some eastbound and westbound left-turns from protected-permitted phasing to protected-only phasing will eliminate some of the right-angle accidents. Because of the large traffic volumes on Shore Drive, there are few adequate gaps for left-turning vehicles during a permitted phase. Independence Boulevard, Pleasure House Road, Page Avenue/Vista Circle, and North Great Neck Road currently have protected-only phasing. Protected-only phasing is recommended for the Northampton southbound ramp, Greenwell Road, and Shady Oaks Drive/Marlin Bay Road.

Closure of some driveways and median openings will also produce fewer conflict points. Street, median, and driveway closures are components of access management policies. Certain streets and medians have been identified for closure as part of the development of the draft driveway plan. Those plans are still under development, therefore this report does not address the closure of specific streets and median openings.

FIGURE 7
Shore Drive Corridor Study
Summary of Total Accidents
1995 - 1997

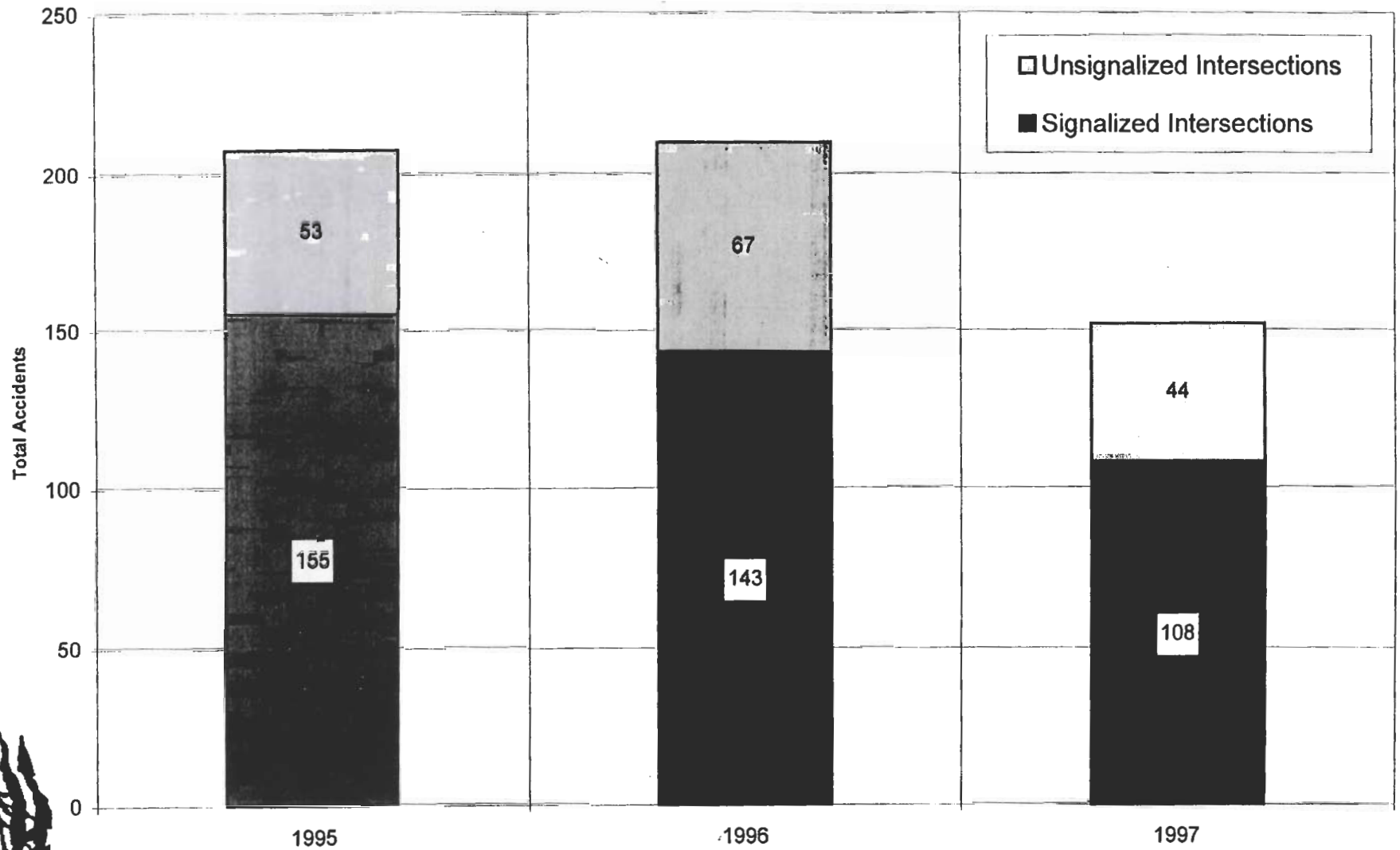


FIGURE 8
Shore Drive Corridor Study
Summary of Accidents by Month of Year
1995-1997

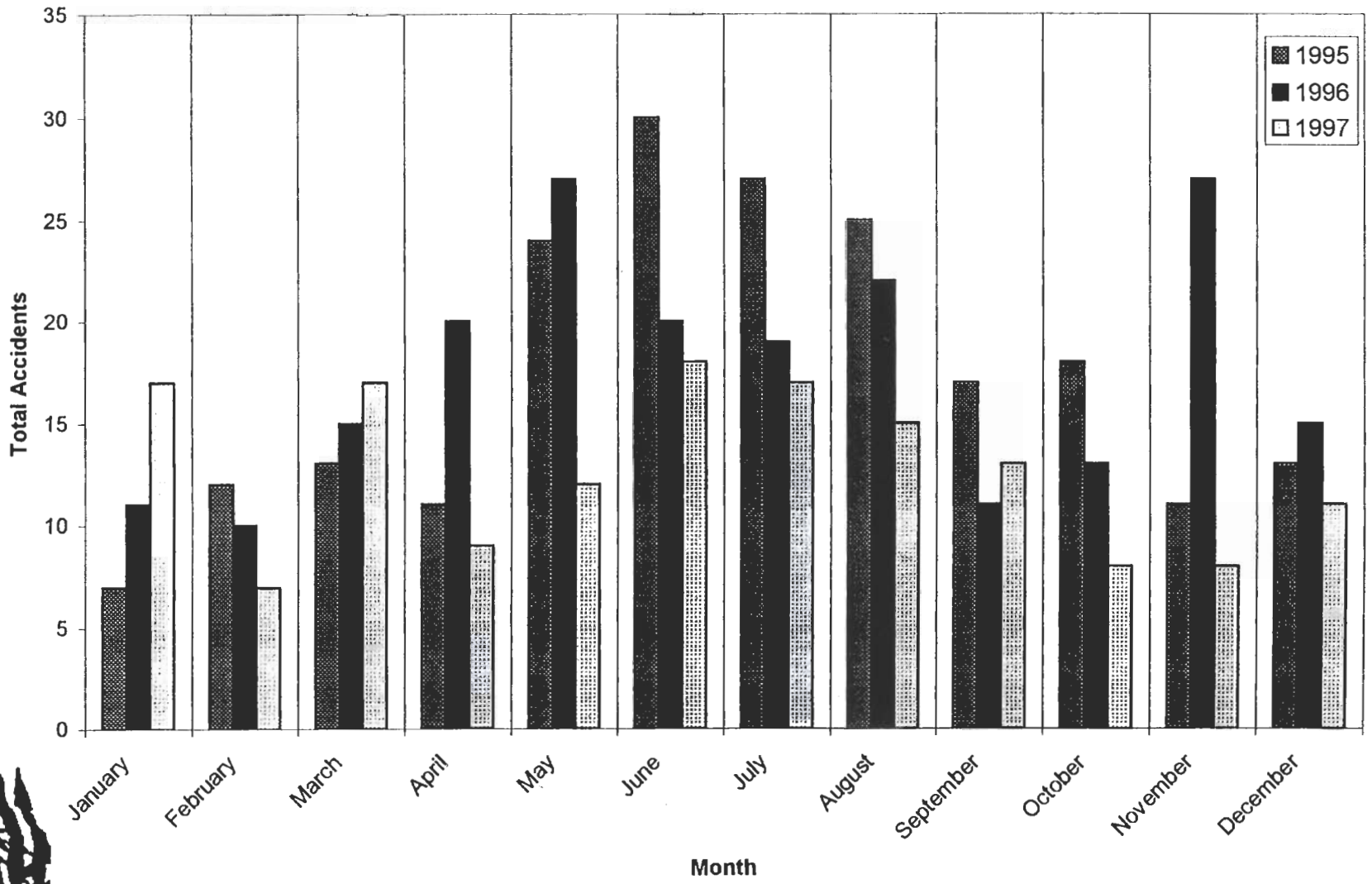


FIGURE 9
Shore Drive Corridor Study
Summary of Accidents by Day of Week
1995-1997

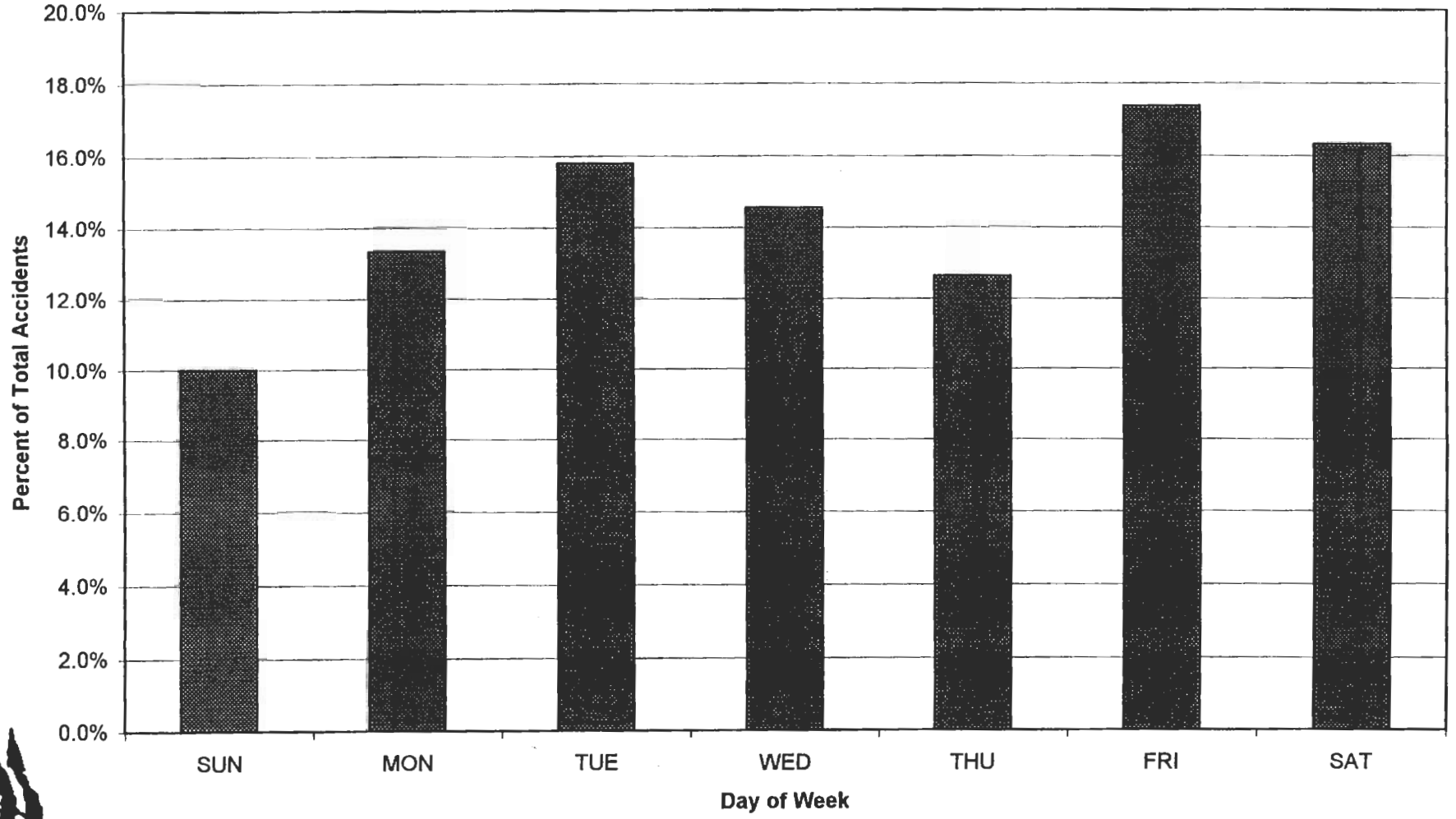


FIGURE 10
Shore Drive Corridor Study
Summary of Accidents by Time of Day
1995-1997

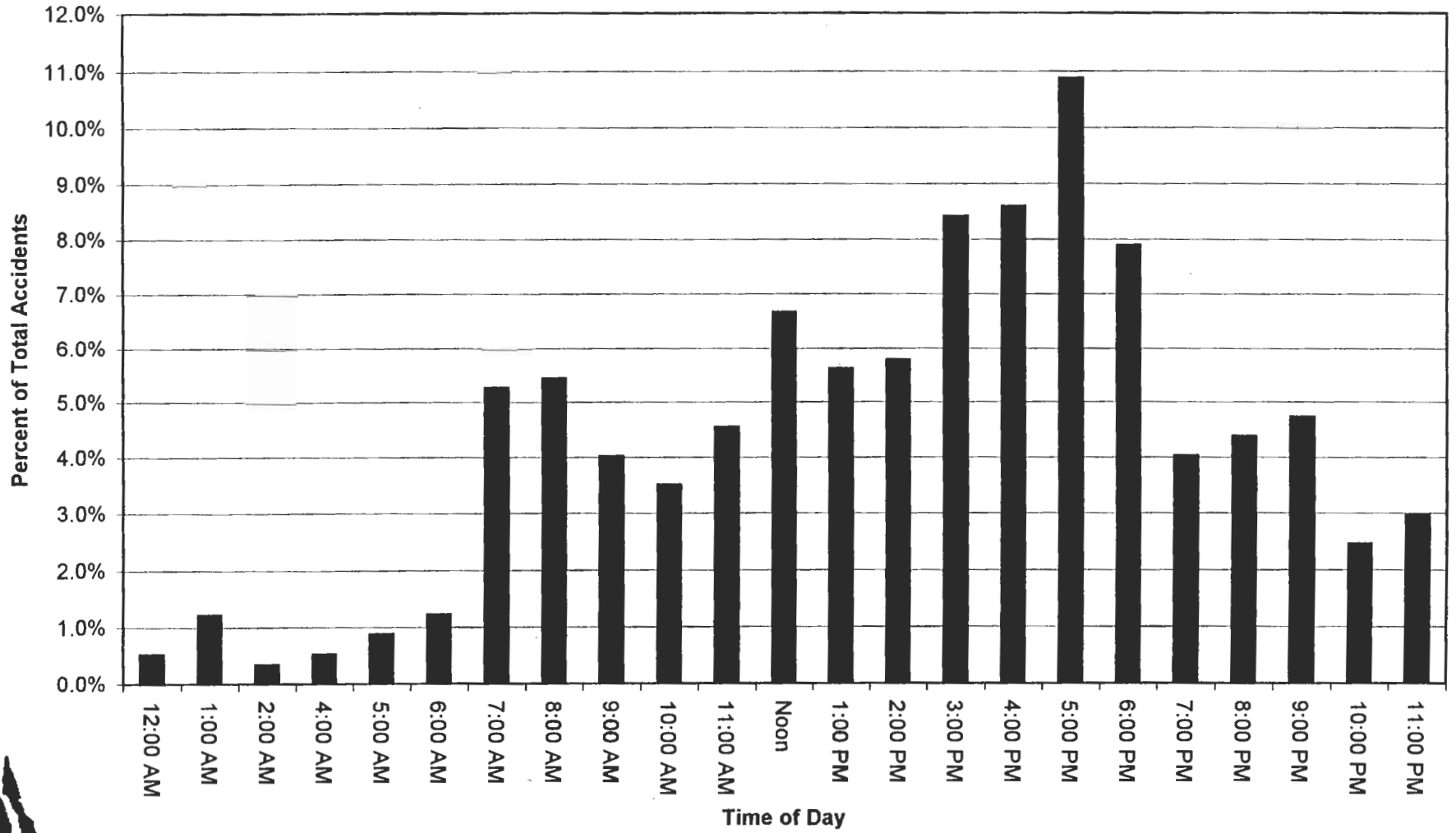
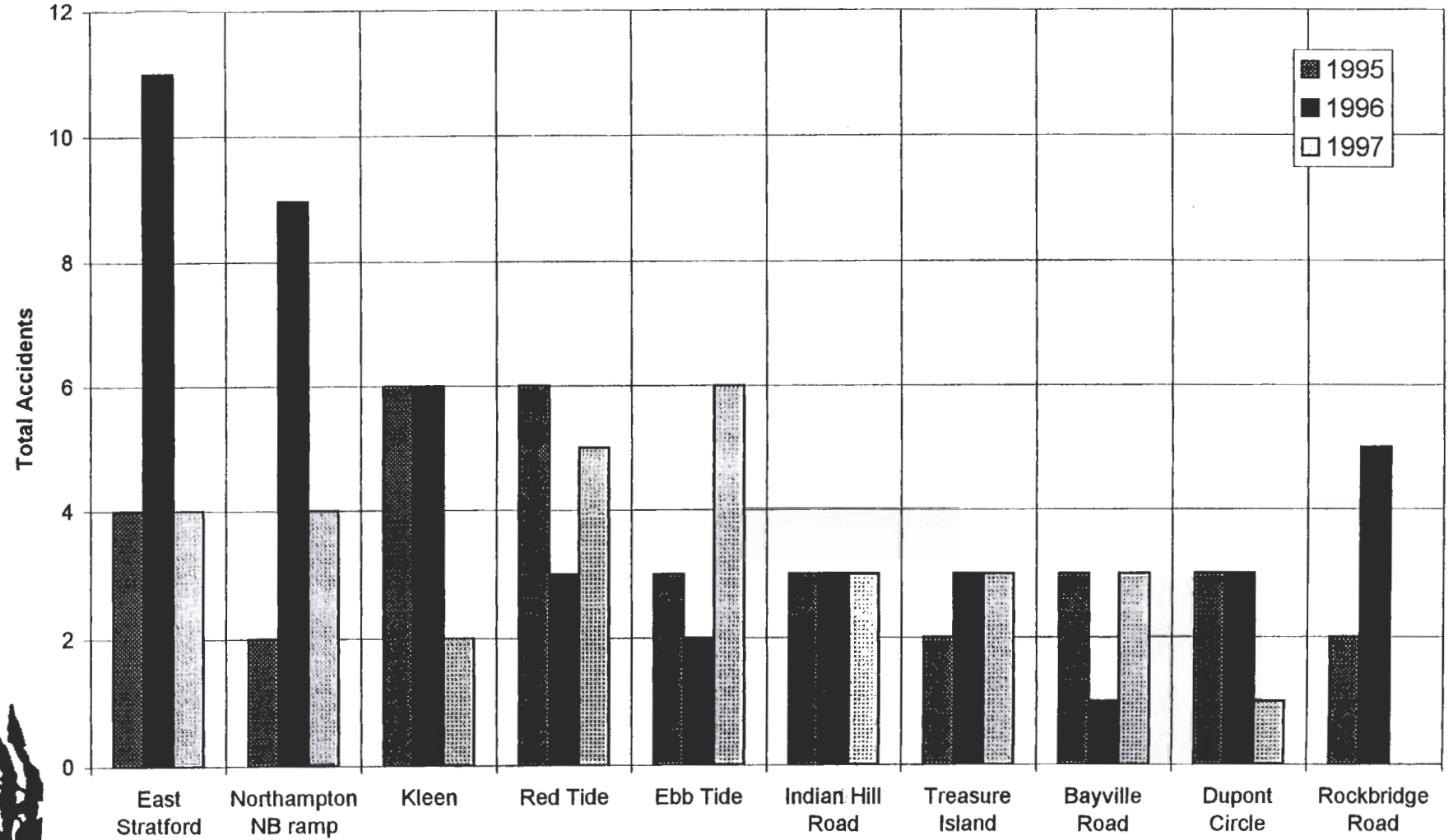
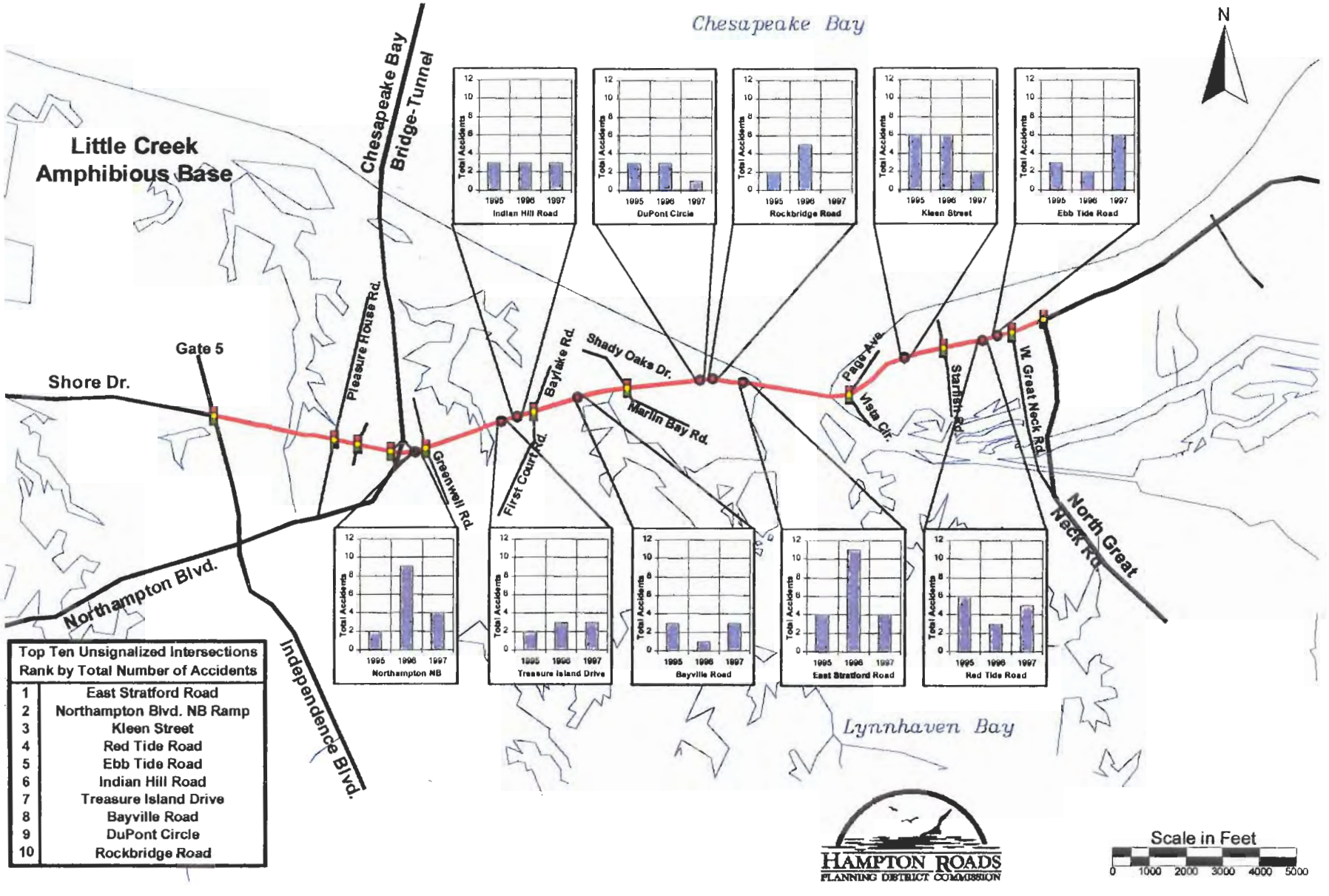


FIGURE 11
Shore Drive Corridor Study
Summary of Accidents at Unsignalized Intersections
Top 10 Intersections by Total Number of Accidents
1995 - 1997



MAP 5
Summary of Accidents at Unsignalized Intersections
1995-1997



Top Ten Unsignalized Intersections Rank by Total Number of Accidents	
1	East Stratford Road
2	Northampton Blvd. NB Ramp
3	Kleen Street
4	Red Tide Road
5	Ebb Tide Road
6	Indian Hill Road
7	Treasure Island Drive
8	Bayville Road
9	DuPont Circle
10	Rockbridge Road

FIGURE 12
Shore Drive Corridor Study
Summary of Accidents at Signalized Intersections
1995 - 1997

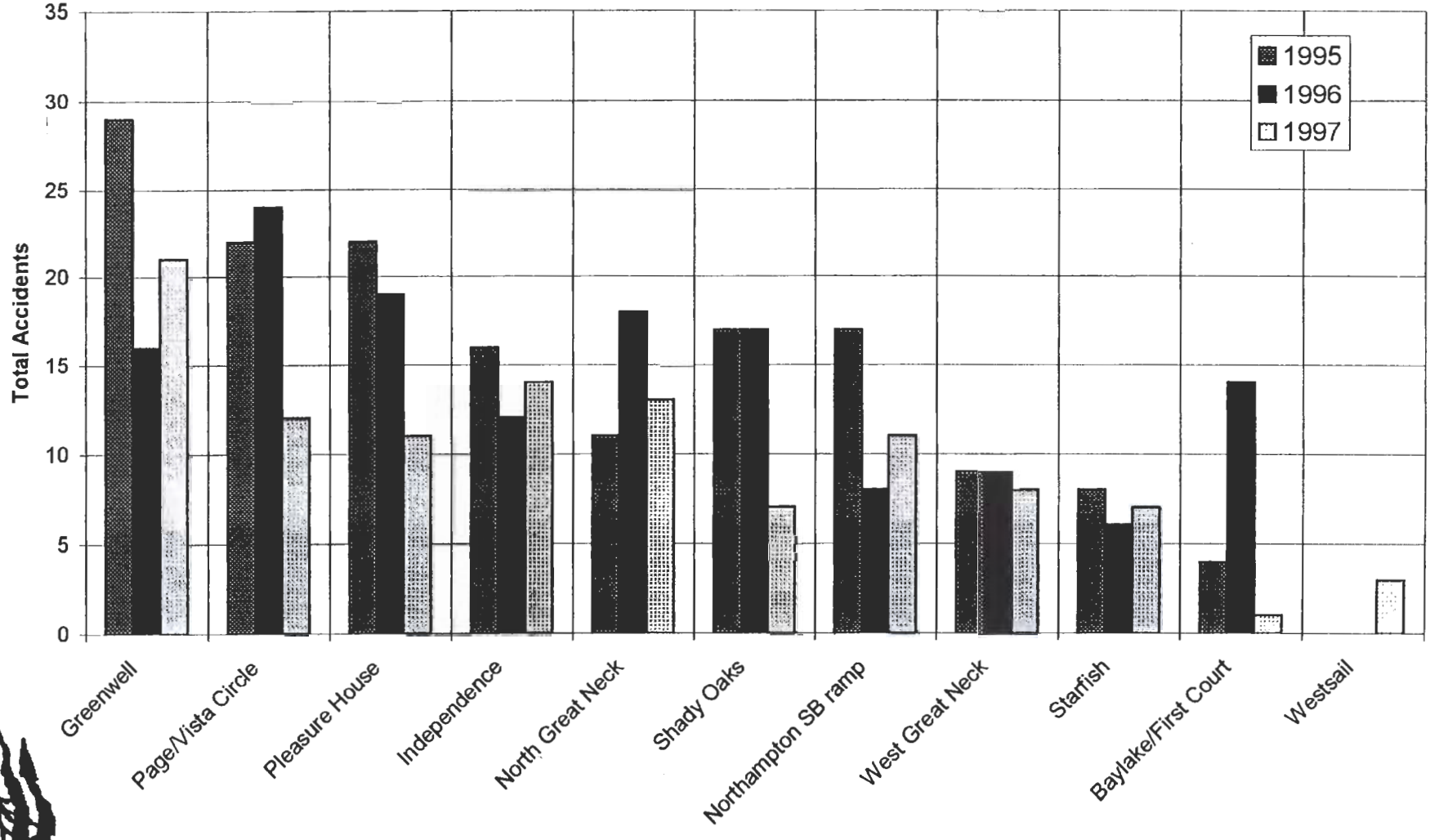
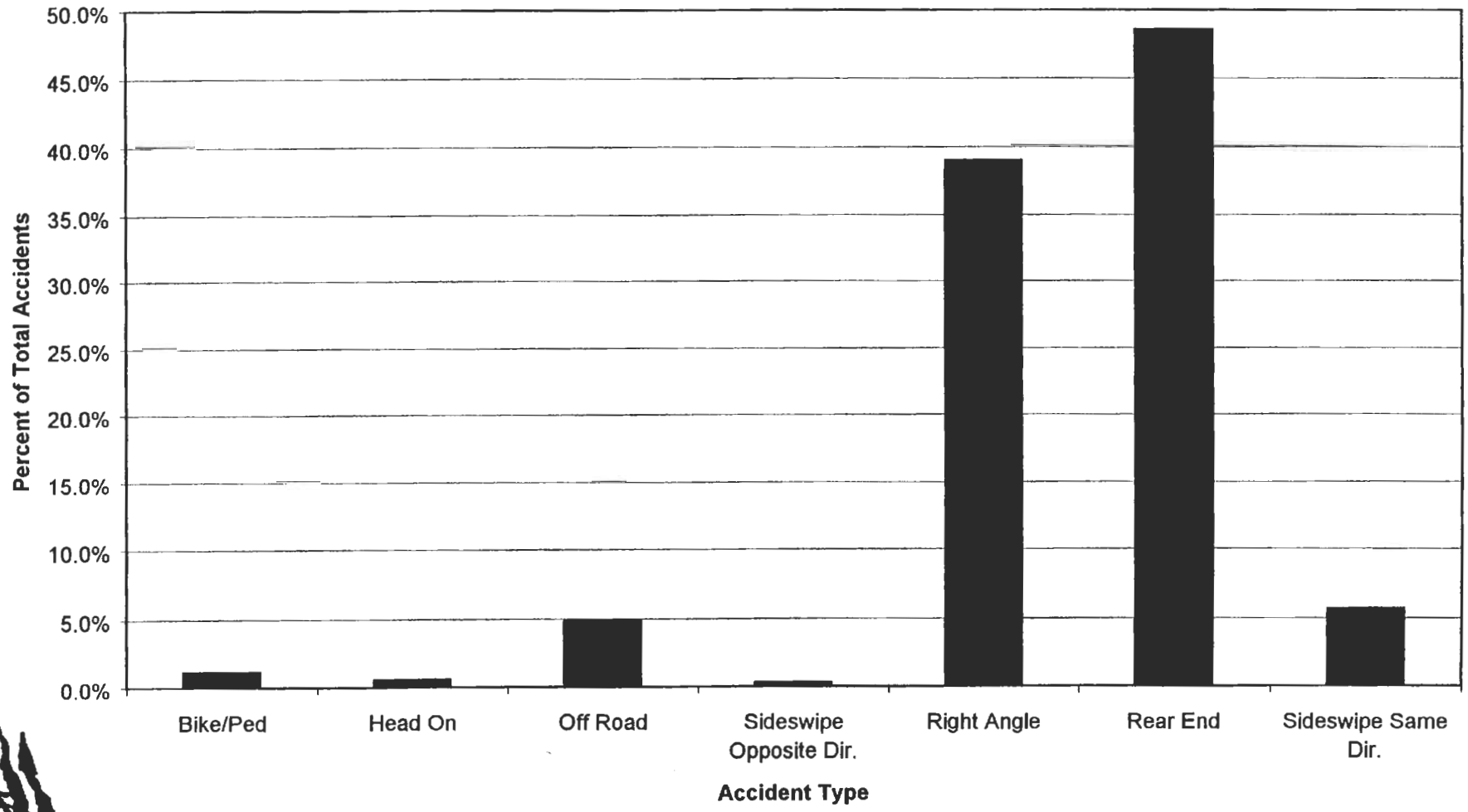


FIGURE 13
Shore Drive Corridor Study
Summary of Accident Types at Signalized Intersections
1995-1997



Access Control

Access control is an important issue along major thoroughfares such as Shore Drive. Inefficient access management can lead to undesirable results such as inappropriate driveway location, unnecessary median openings, increased modal conflicts, and degradation of traffic flow. As cited in the Comprehensive Plan, the Shore Drive corridor has evolved in an "uncoordinated and uninspired fashion"[4]. This statement is clearly supported by the number of poorly placed driveways and median openings in the study area.

Many of the intersections along Shore Drive are cluttered with poorly located driveways. Many of the businesses were constructed allowing two driveways on the frontage of Shore Drive in addition to at least one driveway on the minor intersecting street. In many instances, driveways on Shore Drive are located directly adjacent to an intersection (**Figure 14**). Access control at other locations is even worse.

Figure 14: Poor driveway location on Shore Drive adjacent to existing intersection.

Some businesses along Shore Drive, both at intersections and mid-block locations, do not provide any controlled access to their properties. Instead, vehicles are allowed direct access between Shore Drive and parking areas (**Figure 15**). Some types of businesses require larger driveways than others, i.e. boat marinas, auto repair shops, etc., but some access control strategies are appropriate.

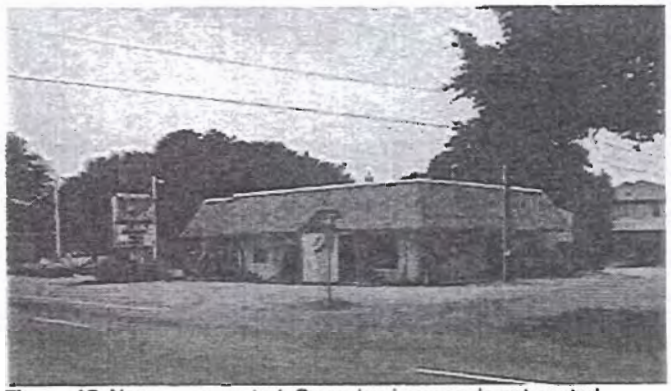


Figure 15: No access control. Some businesses do not control access along Shore Drive.

The draft bikeway plan for the Shore Drive corridor identified median openings and minor street intersections that are proposed for closure. The following streets are proposed for closure: Seashell Road, Ebb Tide Road, Clipper Bay Drive, Ocean Tides Drive, and Mystic Cove Drive. The median openings adjacent to those intersections are also identified for closure as is a median opening located near Pleasure House Creek to the west of Shady Oaks Drive. At the time of this study, traffic movement counts at those locations were not available; therefore only general statements can be made concerning the impact of those proposed closures. As with any change to an existing transportation system, median and street closures can have both positive and negative impacts. Some of the possible impacts are summarized below.

[4] Comprehensive Plan of Virginia Beach, City of Virginia Beach. Virginia, November 4, 1997. p. 55

Positive Impacts

- Reduction of traffic conflict points.
- Reduced interruption to traffic flow on thoroughfares.
- Reduction of cut-through traffic on side streets.

Negative Impacts

- Increase in U-turn movements.
- Reduced accessibility to adjacent properties.
- Increased need for signalized intersections.

In addition to the impacts on traffic movement, the City has indicated a desire to close some of streets and to consolidate properties. Property consolidation could possibly lead to more desirable land development or even the provision of public parking facilities in the study area.

Public Parking Facilities

The City has identified public parking facilities as a deficiency in the Shore Drive corridor. The lack of public parking has long been an identified deficiency at the oceanfront resort area and during the peak recreation months of the summer the same is true in the bayfront resort area. The City has received complaints from residents in the study area concerning vehicles being parked along the residential streets adjacent to the public beach access points in the study area. Street closures and property consolidations could give the City the opportunity to provide parking for area visitors in the form of on-street parking or higher density parking facilities such as parking lots or garages. Properly located public parking facilities could be a successful strategy to address the deficiency of public parking in the study area. The construction of public parking lots and garages is a strategy that the City of Virginia Beach has successfully utilized in the oceanfront resort area. The location and feasibility of new public parking facilities in the study area requires further analyses that are beyond the scope of this study.

Figure 16: Existing parking garage at the beach front resort area.

Traffic Volumes and Trends

Daily Traffic

Average daily traffic (ADT) volumes were obtained from the Virginia Department of Transportation and the City of Virginia Beach. The 24-hour counts used for this study were performed by VDOT during the summer of 1994, since this data was the most representative of the corridor. Two count stations are located on Shore Drive within this study area, and showed a volume of 22,472 vehicles per day between Independence Boulevard and Northampton Boulevard, and a volume of 43,151 vehicles per day between Northampton Boulevard and North Great Neck Road. Six count stations were also studied on adjacent thoroughfares. These counts, along with roadway cross-sections and annual growth rates for 1988 through 1994, are shown for each location on **Map 5**.

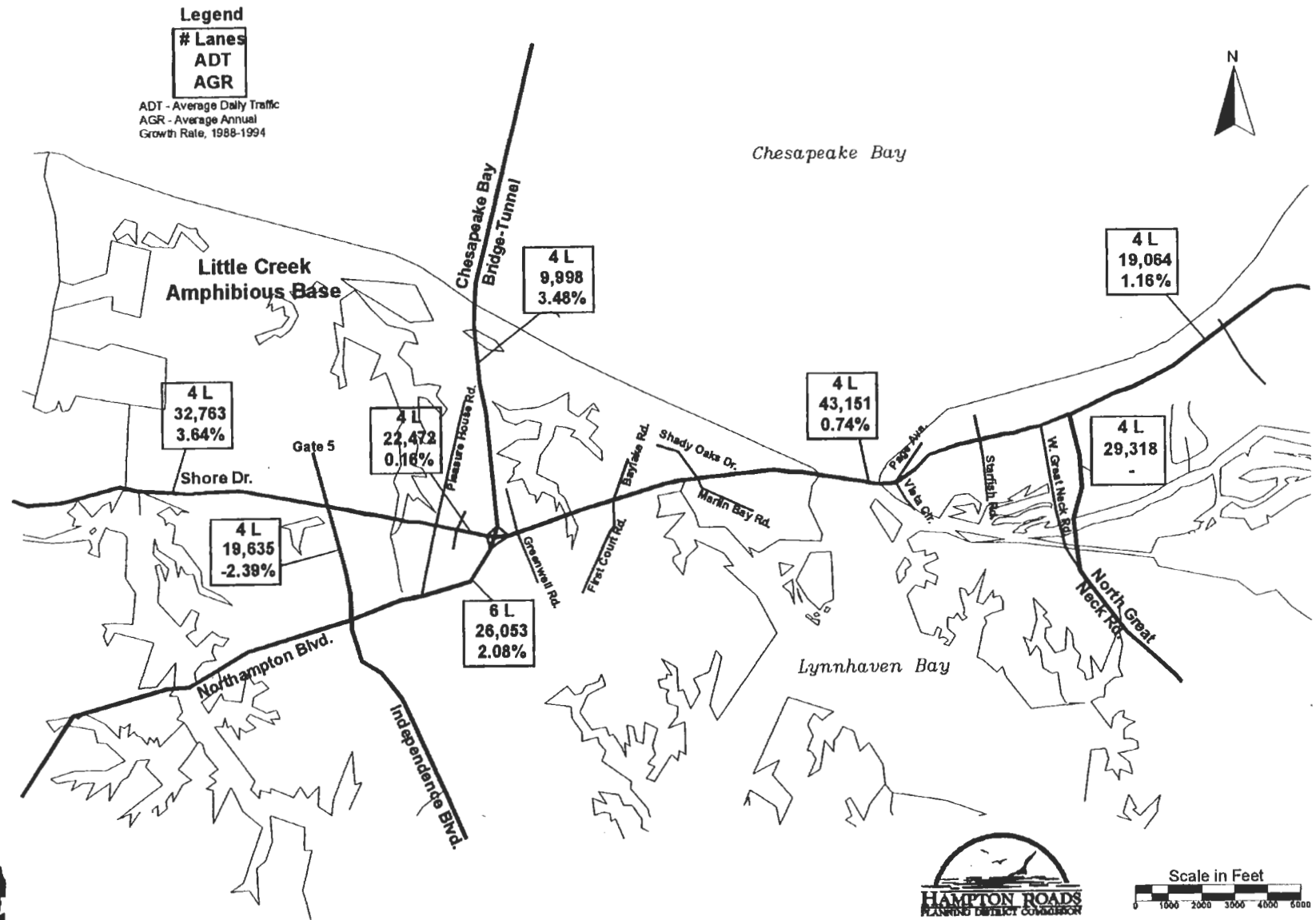
An analysis of traffic trends between 1988 and 1994 indicates that there has been very little growth along Shore Drive. The section of Shore Drive between Independence Boulevard and Northampton Boulevard has experienced a 0.16% yearly growth rate during this period, while the section between Northampton Boulevard and North Great Neck Road has experienced a 0.74% yearly growth rate. These trends, along with 2020 projections, are shown in **Appendix A**.

Peak Hour Traffic

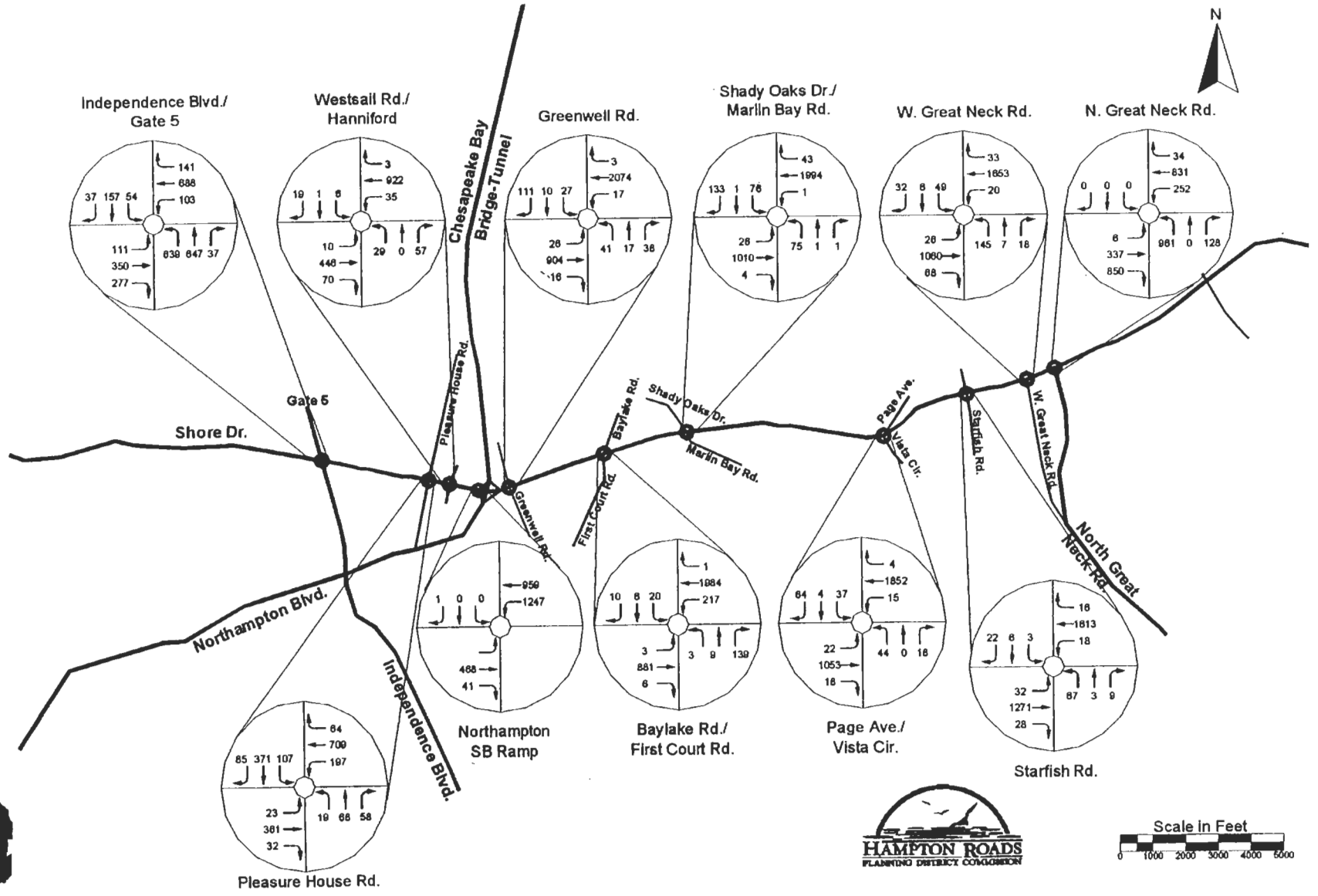
The City of Virginia Beach collected morning and afternoon peak hour turning movement counts during March 1999. The morning peak hour turning movement counts are shown on **Map 6** and the afternoon peak hour turning movement counts are shown on **Map 7**.

The typical weekday morning peak hour is between 7:00 AM and 8:00 AM and the typical weekday afternoon peak hour is between 5:00 PM and 6:00 PM. Approximately 64% of the morning peak hour traffic travels in the westbound direction, and 64% of the afternoon peak hour traffic travels in the eastbound direction. The morning peak hour volumes constitute approximately 6.2% of the Average Daily Traffic (ADT), while the afternoon peak hour volumes are 7.5% of the ADT.

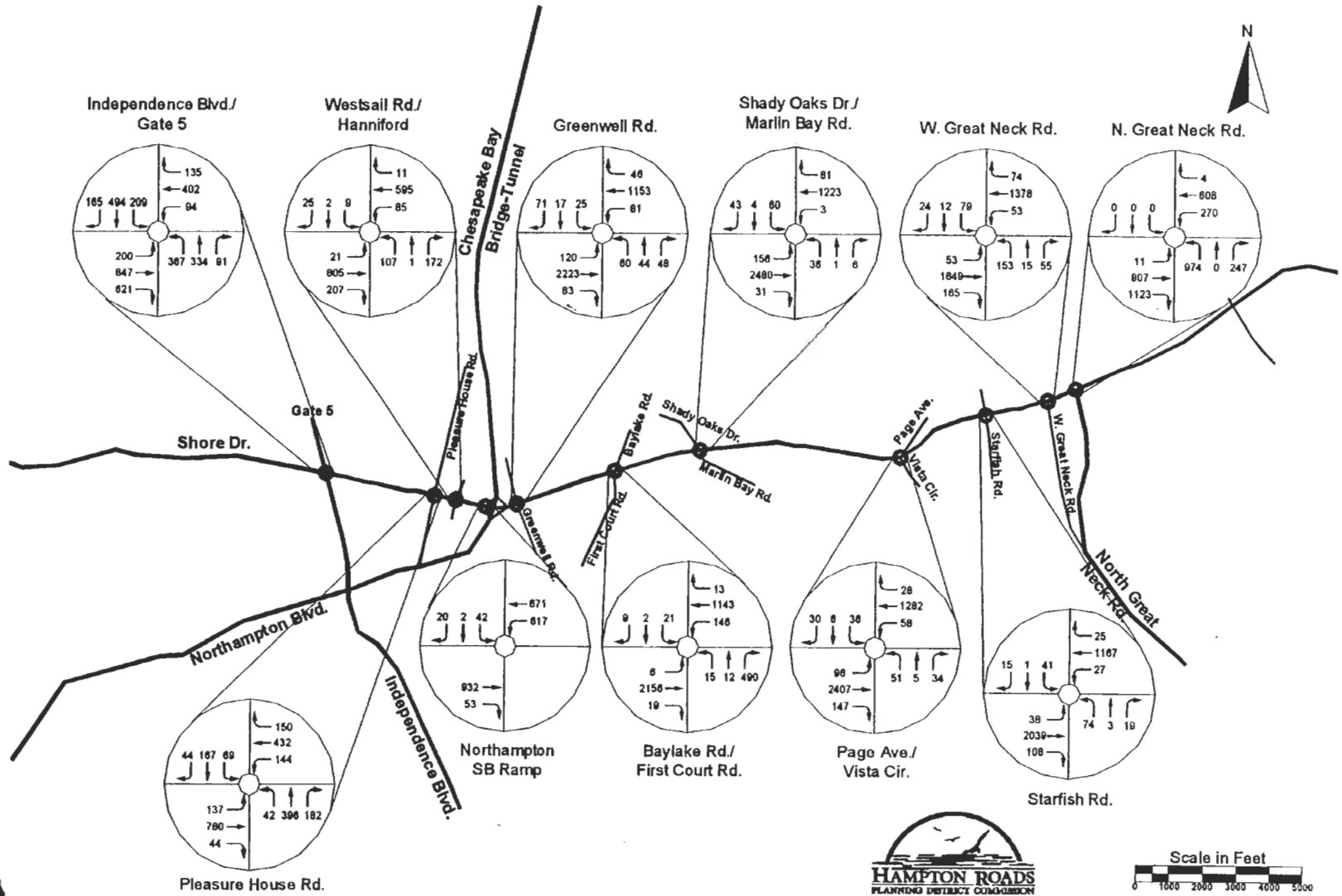
MAP 6
Existing Traffic and Roadway Conditions



MAP 7
Intersection Turning Movement Counts
1999 AM Peak Hour



MAP 8
Intersection Turning Movement Counts
1999 PM Peak Hour



Arterial Level of Service Analysis

Methodology

The arterial level of service analysis was performed using the worksheets that calculate level of service for different facility types based upon methodology contained in the 1994 *Highway Capacity Manual* (HCM).[5] The Shore Drive corridor was divided into two segments, Independence Boulevard to Northampton Boulevard and Northampton Boulevard to North Great Neck Road, to match the segments that were used for analysis in the *Congestion Management System for Hampton Roads* (CMS)[6].

Results

The resulting arterial levels of service are shown below in **Table 3**. Assuming a level of acceptance of level of service D or better, each segment operates at acceptable levels in both the morning and afternoon peak hours.

TABLE 3
Existing Peak Hour Arterial Level of Service for Shore Drive

Shore Drive Section	AM LOS	PM LOS
Independence Blvd. - Northampton Blvd.	D	D
Northampton Blvd. - North Great Neck Rd.	B	C

Prepared by: Hampton Roads Planning District Commission, June 1999.

Even though the section from Northampton Boulevard to North Great Neck Road has a higher volume, many of its traffic signals allow more green time for the through traffic on Shore Drive, and therefore produces a better level-of-service than does the segment between Independence Boulevard and Northampton Boulevard.

Intersection Level of Service Analysis

Methodology

Intersection level of service analyses were performed for the weekday morning and afternoon peak hours at the eleven signalized intersections along the Shore Drive corridor. The analyses were performed using the existing signal timings and turning movement counts provided by the City of Virginia Beach. The existing intersection lane geometries, as shown on **Map 3**, were also used. *Synchro*[7], a traffic signal analysis/optimization program, was used for this study. This program uses the methods

[5] **Highway Capacity Manual**, Special Report #209, Transportation Research Board, 1994.
[6] **Congestion Management System for Hampton Roads, Virginia**, Hampton Roads Planning District Commission, October 1995.
[7] **Synchro Professional**, Version 3.2, Trafficware.

contained in the 1994 *Highway Capacity Manual* to analyze the performance of signalized intersections.

Results

The results of the analysis of existing conditions are shown in **Table 4,** and in more detail on **Maps 8 and 9**. For this and all other tables showing levels of service, intersections operating at level of service A or B are highlighted in green, levels of service C and D in yellow, and unacceptable levels of service E and F in red.

Many deficiencies exist in both the morning and afternoon peak hours. Of utmost concern in the morning peak hour is the traffic queue that forms for the westbound left-turn at the Northampton Boulevard southbound ramp. The number of left-turning vehicles greatly exceeds its current capacity, causing vehicles to block the adjacent through lane. This queue often extends beyond the Greenwell Road intersection, as shown in **Figure 17**.

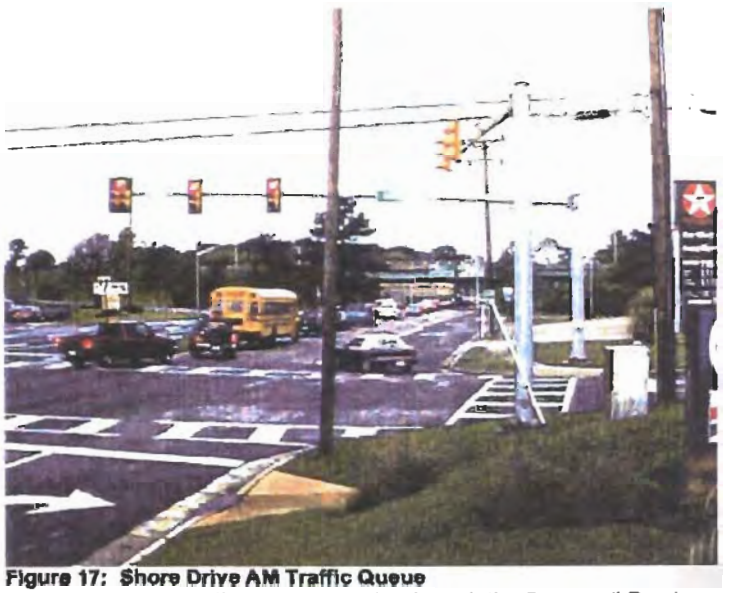


Figure 17: Shore Drive AM Traffic Queue
Traffic queues on westbound Shore Drive through the Greenwell Road intersection waiting to make a left-turn onto the southbound entrance ramp for Northampton Boulevard.

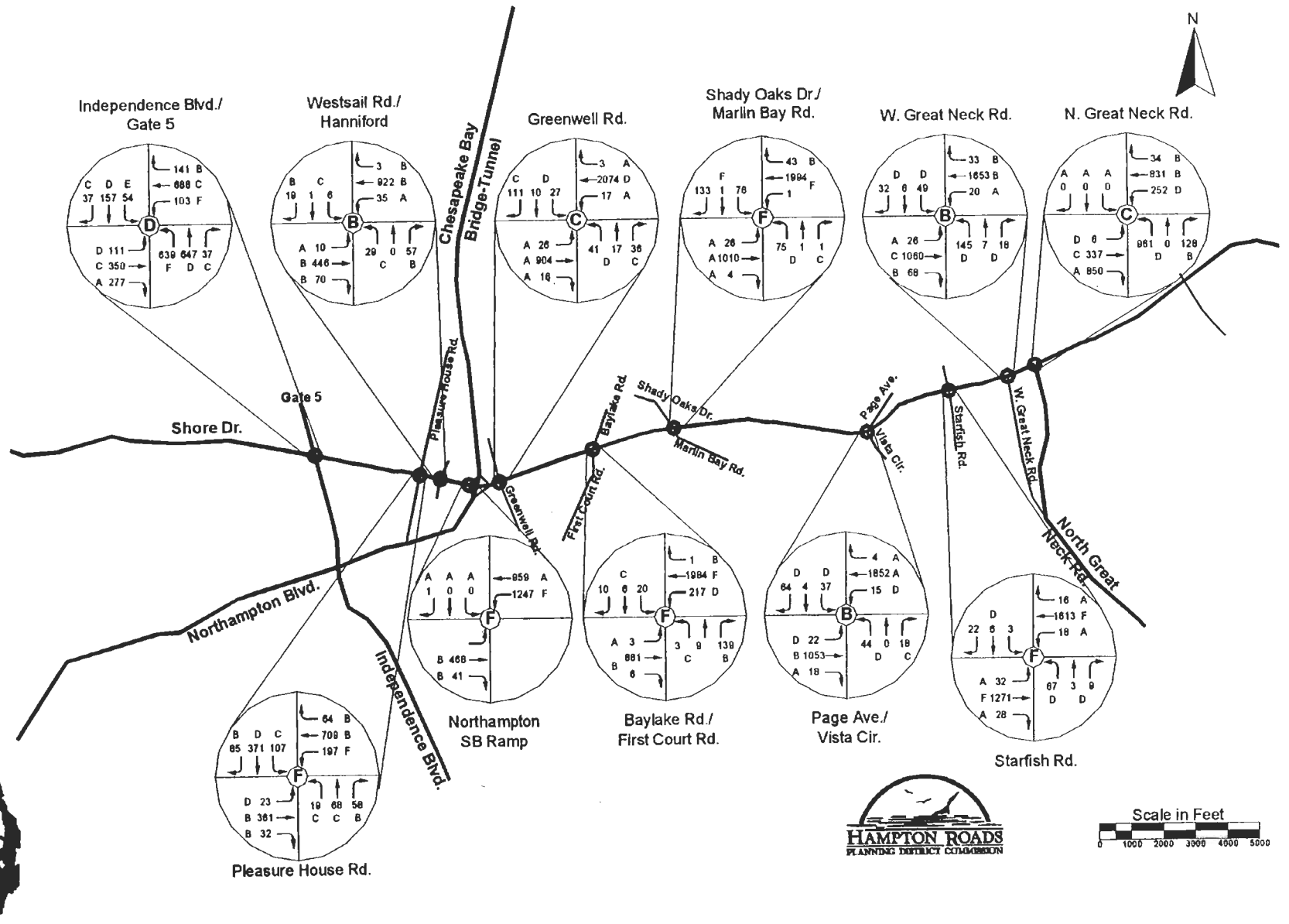
Four other intersections are operating at unacceptable levels of service during the morning peak hour: Pleasure House Road, Baylake Road/First Court Road, Shady Oaks/Marlin Bay Road, and Starfish Road. At the latter three intersections, the westbound through movement experiences delays of over 90 seconds per vehicle.

TABLE 4
Existing Peak Hour Intersection Level of Service

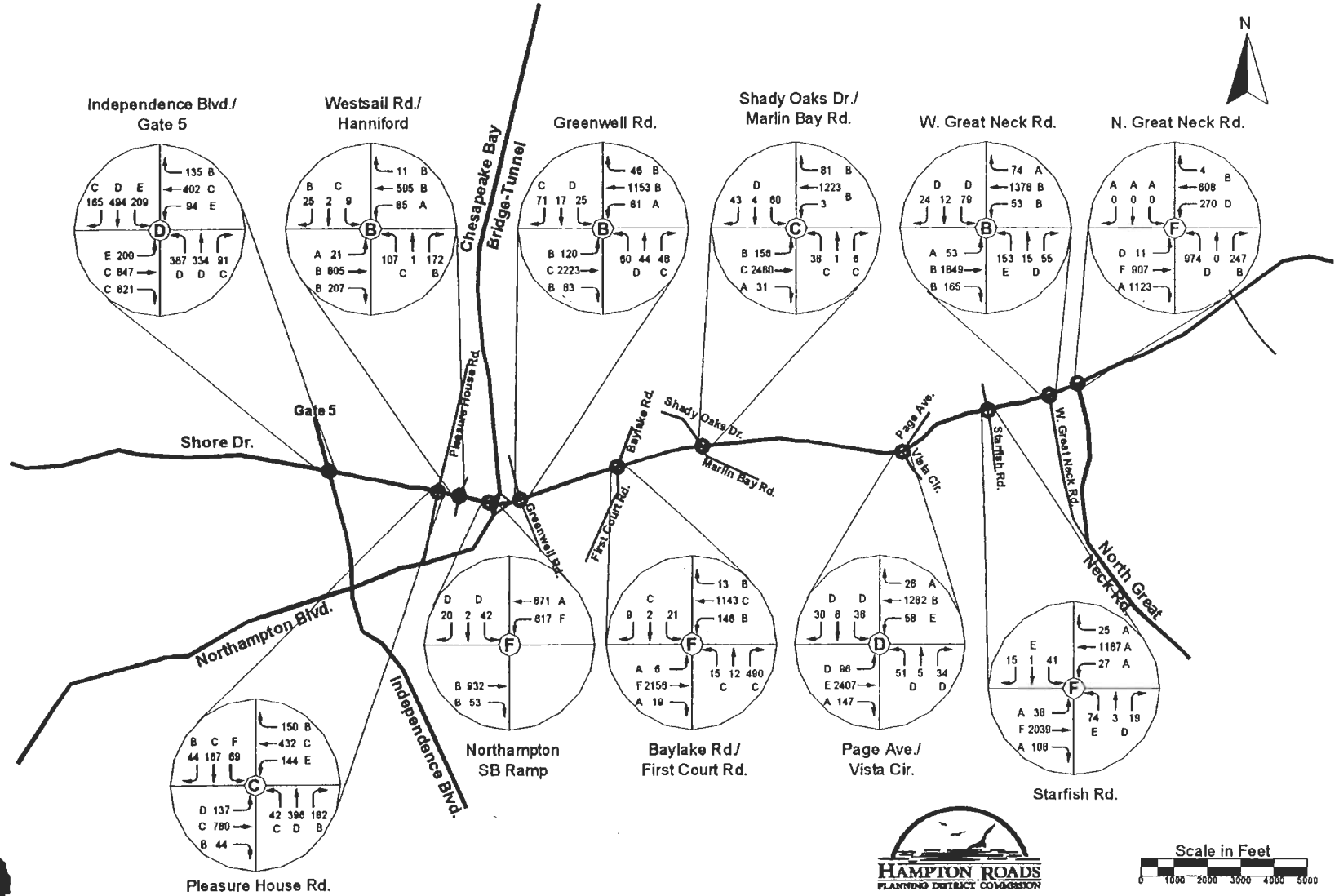
	Independence Boulevard	Pleasure House Road	Westsail Road	Northampton Blvd SB ramp	Greenwell Road	First Court Road	Marlin Bay Drive	Vista Circle	Starfish Road	W Great Neck Road	N Great Neck Road
AM	D	F	B	F	C	F	F	B	F	B	C
PM	D	C	B	F	B	F	C	D	F	B	F

Prepared by: Hampton Roads Planning District Commission, June 1999.

MAP 9
Intersection Turning Movement Counts and Level of Service
1999 AM Peak Hour



MAP 10
Intersection Turning Movement Counts and Level of Service
1999 PM Peak Hour



The commuter traffic that forms the queue at Northampton in the morning peak hour uses the Northampton northbound exit ramp to eastbound Shore Drive during the afternoon peak hour (**Figure 18**). Although an acceleration lane exists beyond the Greenwell Road intersection, some drivers need to merge to make the left turn at Greenwell Road and wait for acceptable gaps on Shore Drive, causing delays. Also, some drivers that wish to travel east on Shore Drive do not realize that the acceleration lane extends beyond Greenwell Road and they often wait for an acceptable gap on Shore Drive.

The intersections of Baylake Road/First Court Road, Starfish Road, and North Great Neck Road also operate at level of service F during the afternoon peak hour. This is primarily due to the long delays incurred by the eastbound through movement. Also, although traffic volumes are not excessive at Starfish, the signal phasing includes an actuated exclusive pedestrian phase crossing Shore Drive. Although this phase is rarely called, the analyses were performed assuming the pedestrian phase is called every cycle. Therefore, the level of service reported in this study could be worse than the actual level of service being experienced if the pedestrian phase is not actuated.

Figure 18: Shore Drive PM Traffic Queue at Northampton Boulevard
Traffic queues on northbound Northampton exit ramp. A large volume of traffic enters eastbound Shore Drive at Northampton and at First Court Road during the afternoon peak hour.

Existing Alternative Analysis

Due to the poor levels of service of many intersections in this corridor, different alternatives to improve the performance of the corridor in the short-term were tested. Most of these improvements used Transportation Systems Management (TSM) strategies. Six alternatives were tested for both the morning and afternoon peak hours, and are listed in **Table 5**.

TABLE 5
Description of Short-Term Alternative Improvements

Alternative	Improvement
1	Existing signal timing and phasing.
2	Optimized and coordinated signal timing and phasing.
3	Optimized signal timing and phasing, including minimum pedestrian timings.
4	Optimized signal timing and phasing, including protected-only phasing for all eastbound and westbound left-turn movements.
5	Optimized signal timing and phasing, including protected-only phasing for accident-prone intersections, including the Northampton southbound ramp, Greenwell Road, and Shady Oaks Drive/Marlin Bay Road.
6	Same as Alternative 5 plus the addition of a free-flow northbound right turn lane at First Court Road with an acceleration lane onto eastbound Shore Drive.

Note: The City of Virginia Beach is currently developing a city-wide ITS Masterplan that will identify the resources required to implement the improvements described in Table 5.

Results

The results of the analysis of the above short-term alternatives are summarized in **Table 6**. Detailed analysis results for each alternative are included in **Appendix B**. Optimizing and coordinating the traffic signals greatly improves the performance of the corridor. All eleven signalized intersections improve to acceptable

FIGURE 19: PM traffic queue on First Court Road.

levels of service D or better, except for the intersection of Shore Drive and Baylake Road/First Court Road (**Figure 19**) in the afternoon peak hour. Alternative 6, which includes constructing a free-flow northbound right-turn lane from First Court Road to Shore Drive, improves all intersections to acceptable levels.

TABLE 6
Short-term Improvements
Existing Alternative Level of Service Analysis Results

AM PEAK

Alternative	Independence Boulevard	Pleasure House Road	Westsail Road	Northampton Blvd SB ramp	Greenwell Road	First Court Road	Marlin Bay Drive	Vista Circle	Starfish Road	W Great Neck Road	N Great Neck Road
1	D	F	B	F	C	F	F	B	F	B	C
2	C	B	A	C	B	B	C	B	D	B	B
3	C	B	A	C	B	B	C	B	A	B	B
4	C	B	A	D	B	B	D	B	A	B	B
5	C	B	A	D	B	B	D	B	A	B	B
6	C	B	A	D	B	B	D	B	A	B	B

PM PEAK

1	D	C	B	F	B	F	C	D	F	B	F
2	C	C	B	B	B	E	B	B	B	B	C
3	C	C	B	B	B	E	B	B	B	B	C
4	C	C	B	C	B	E	B	B	B	B	C
5	C	C	A	C	B	E	B	B	B	B	C
6	C	C	B	C	B	B	B	B	B	B	C

Prepared by: Hampton Roads Planning District Commission, June 1999.

PROJECTED CONDITIONS

Traffic Characteristics

Staff members of the HRPDC worked in coordination with the City staff to project traffic volumes for the year 2020 utilizing the 2018 transportation network and 2020 land use data. The projected 2020 daily traffic volumes for the roadways in the study area are shown on **Map 10** and in **Appendix A**. The projected 2020 morning and afternoon peak hour turning movements are shown on **Maps 11 and 12** respectively.

Year 2020 Alternative Analysis

Corridor and intersection capacity analyses were performed for future traffic conditions. Spreadsheet templates were used for the corridor analysis, while *Synchro* was used for the signalized intersection analyses. Alternative 6 as described in Table 6 was used as the "Base Case" of the analysis of projected conditions. The assumptions for that alternative are listed below and were included in the analysis of projected conditions.

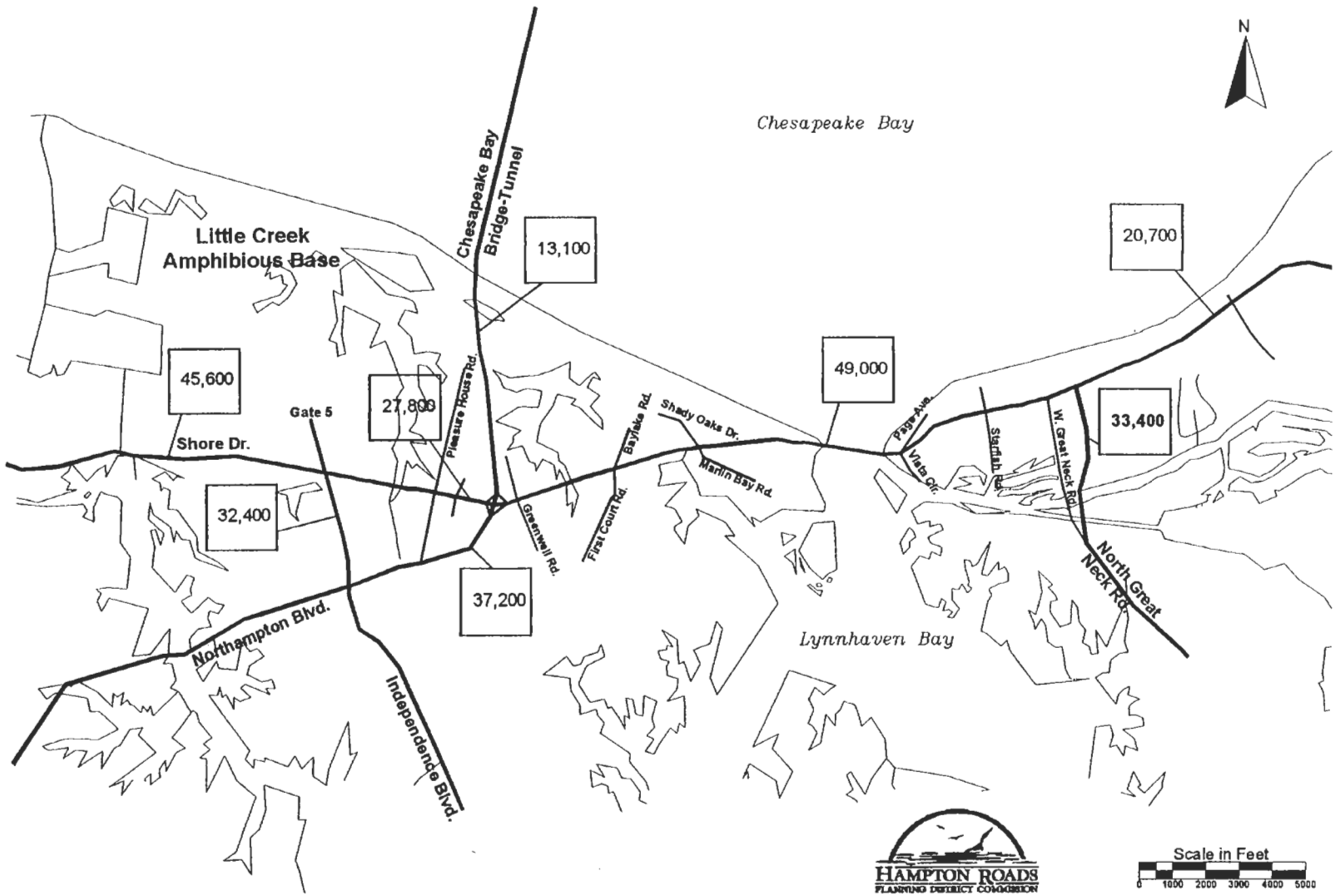
Analysis Assumptions

Level of service analyses were performed for the year 2020 with the following assumptions concerning land development and corridor performance:

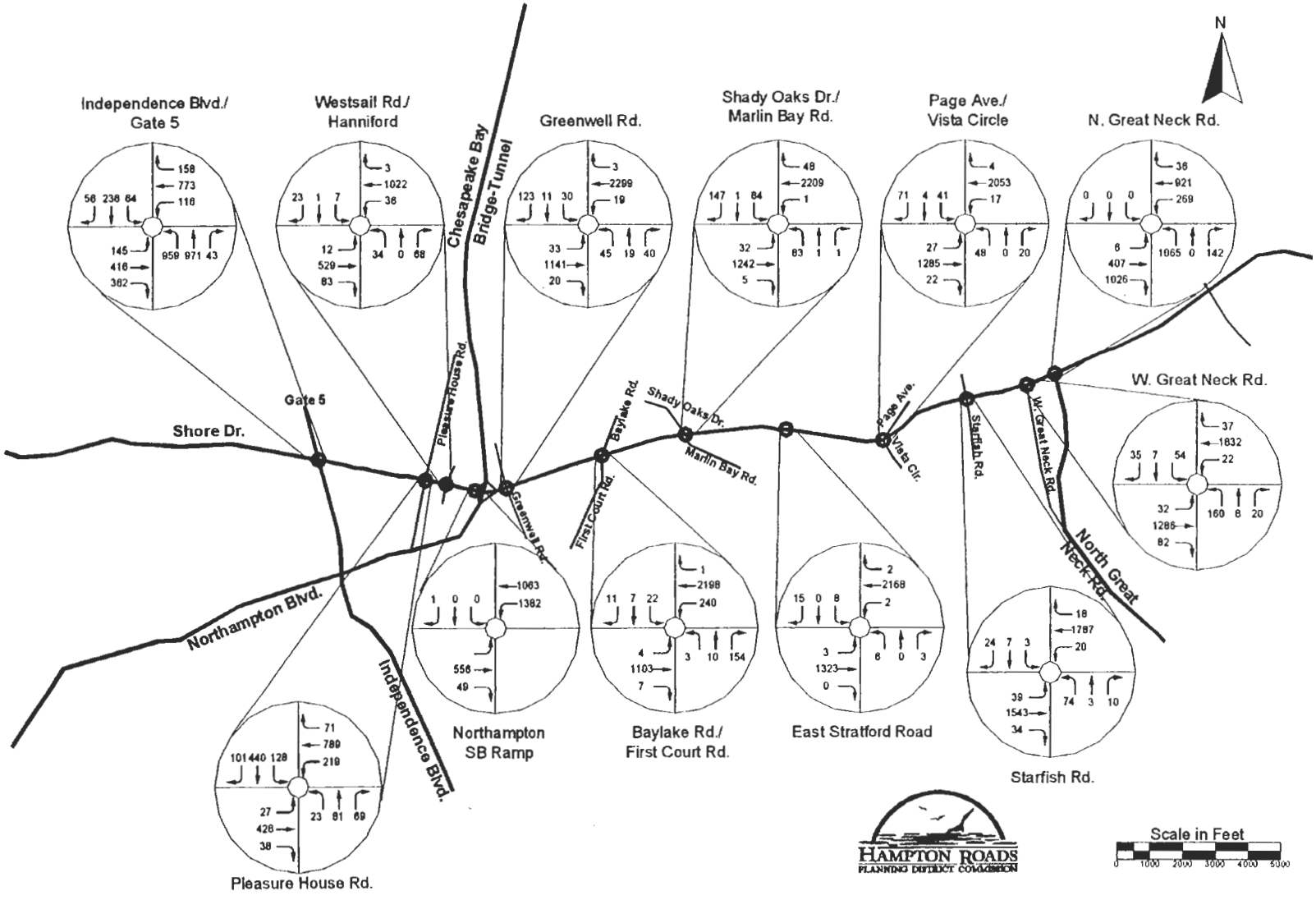
- The 2020 land use will be fully built, and the 2018 long range transportation improvements will be complete.
- Although it does not meet any warrants based on existing vehicular volumes and accidents, a traffic signal will be installed at the intersection of Shore Drive and East Stratford Road for the planned city boat ramp.
- All twelve traffic signals (the eleven existing signals plus the addional signal at East Stratford Road) throughout the corridor will be optimized and coordinated.
- Protected left-turn phasing for eastbound and westbound left-turns will be used at accident-prone intersections, including the Northampton southbound ramp, Greenwell Road, and Shady Oaks Drive/Marlin Bay Road.

Minimum pedestrian timings will be incorporated into the signal timings at all twelve signalized intersections, and none of these intersections will operate with exclusive pedestrian phasing.

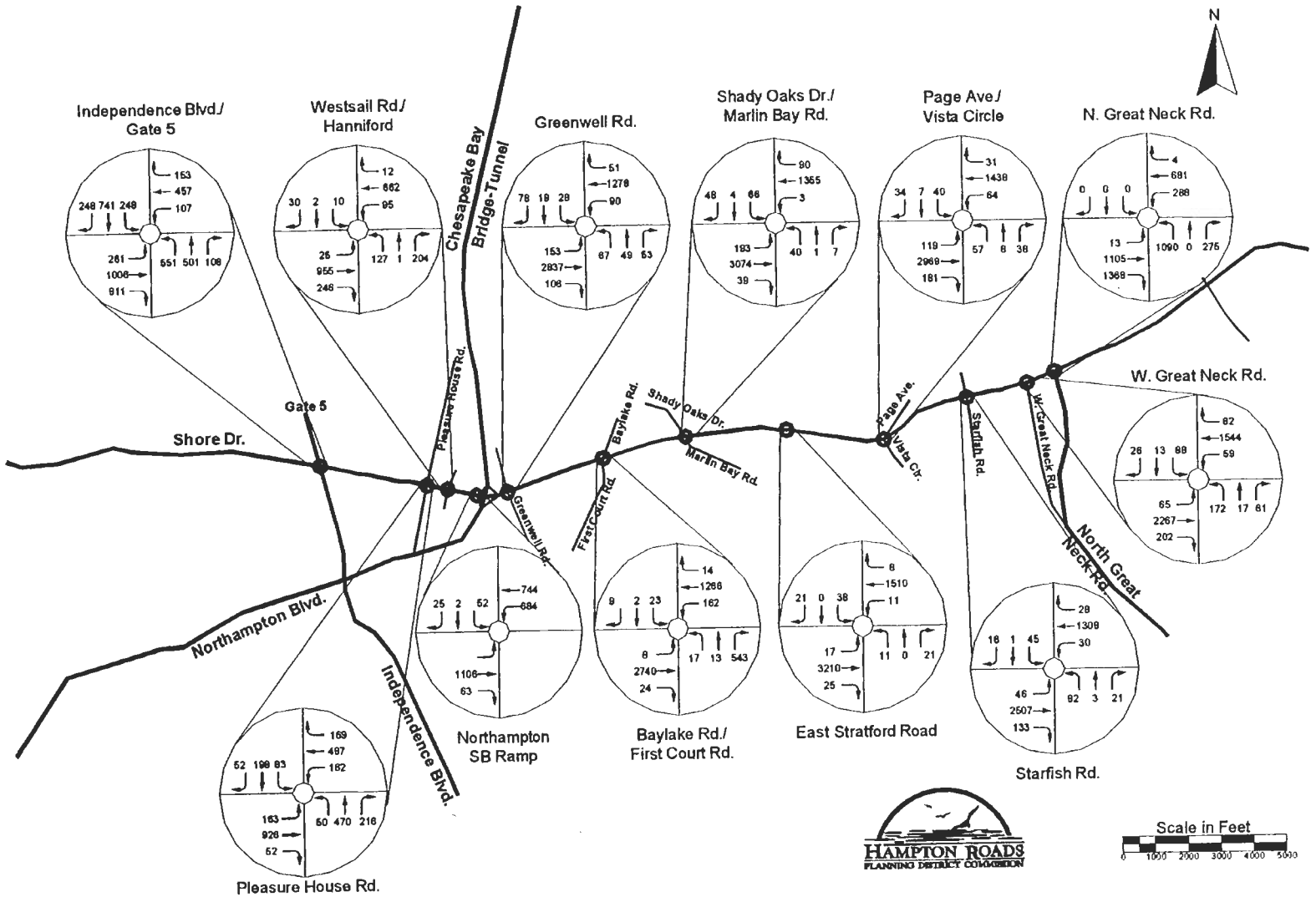
MAP 11
Projected 2020 Daily Traffic Volumes



MAP 12
Projected 2020 AM Peak Hour Turning Movements



MAP 13
Projected 2020 PM Peak Hour Turning Movements



Base Case Analysis Results

Arterial Analyses

The projected 2020 arterial level of service is shown below in **Table 7**. Assuming level of service D as the minimum level of acceptability, the segment between Independence Boulevard and Northampton Boulevard fails in the morning peak hour, while the entire corridor operates at unacceptable levels during the afternoon peak hour.

TABLE 7
Projected 2020 Peak Hour Arterial Level of Service

Shore Drive Section	AM LOS	PM LOS
Independence Blvd. to Northampton Blvd. - 4 lanes	E	E
Northampton Blvd. to North Great Neck Rd. - 4 lanes	C	E

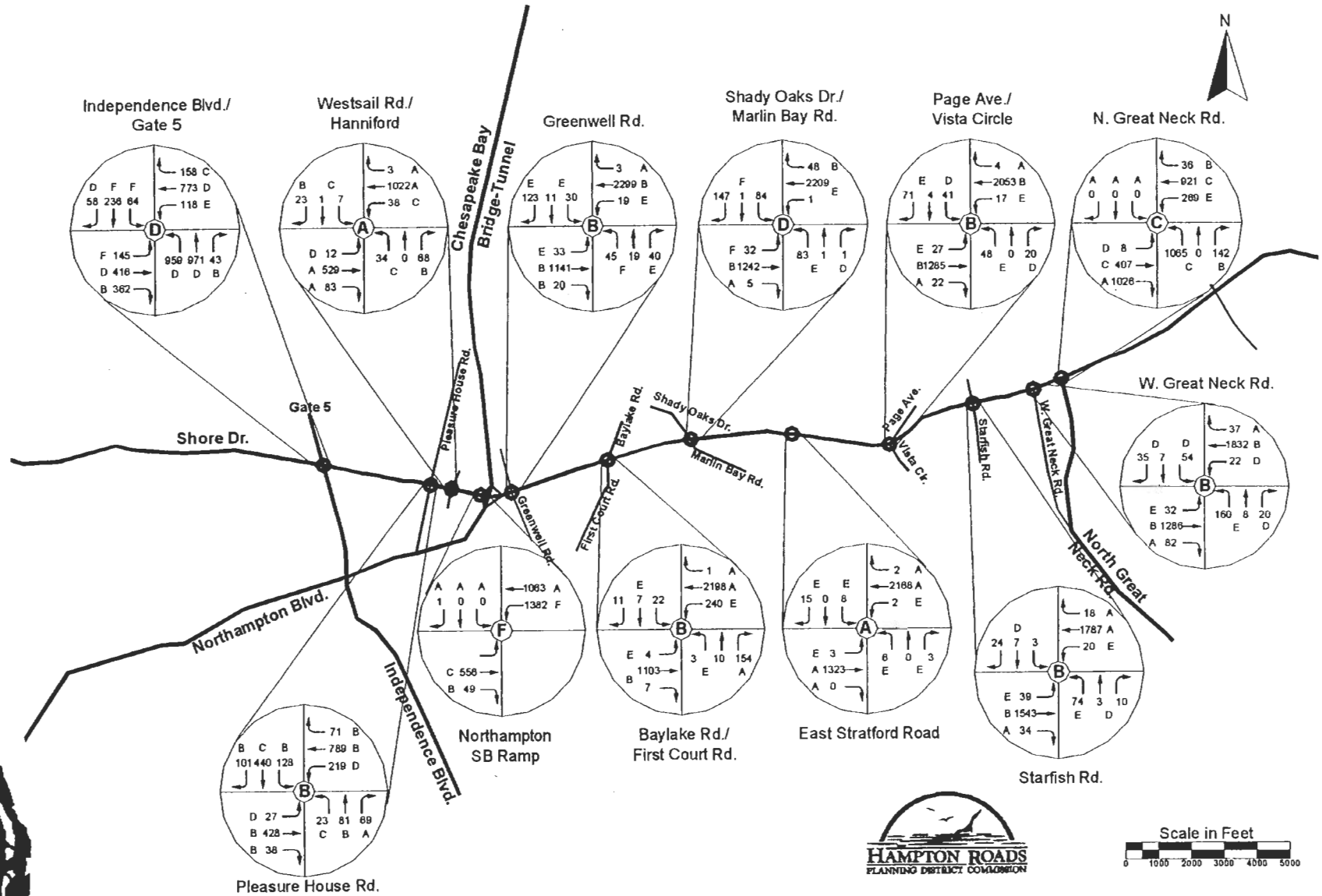
Prepared by: Hampton Roads Planning District Commission, June 1999.

Signalized Intersection Analyses

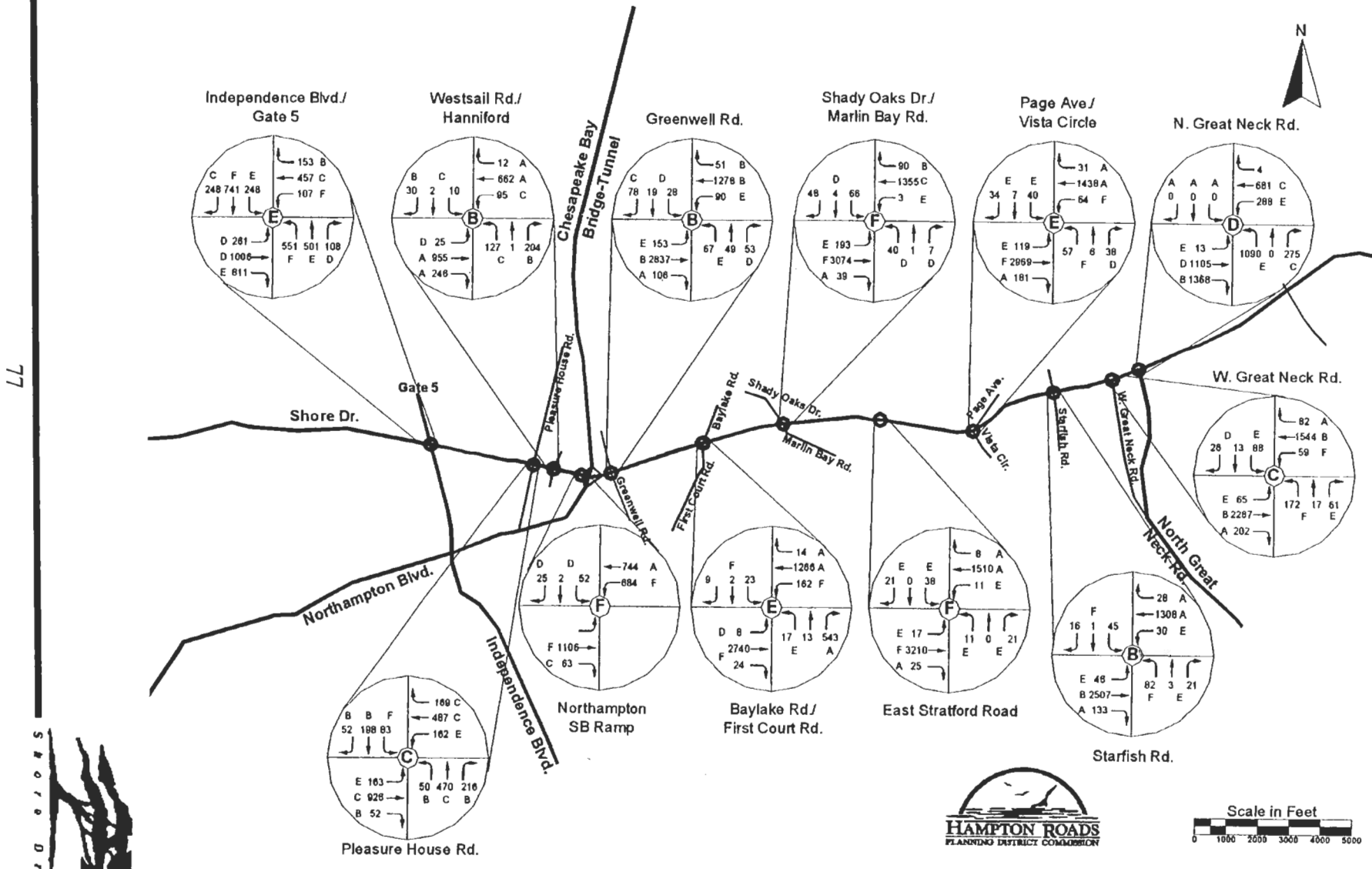
The 2020 level of service results by movement and intersection for the Base Case are shown in **Appendix C** and **Maps 13 and 14**. During the morning peak hour, the only intersection operating at an unacceptable level of service is the Northampton Boulevard southbound ramp. The estimated delay is approximately 300 seconds per vehicle, indicating severe congestion will occur at this intersection unless capacity improvements are implemented.

The afternoon peak hour contains a much higher level of congestion than the morning peak hour. Six of the twelve signalized intersections will operate at level of service E or worse, including all four intersections located between Baylake Road/First Court Road and Page Avenue/Vista Circle.

MAP 14
Projected 2020 AM Peak Hour Turning Movements and Level of Service
Base Case



MAP 15
Projected 2020 PM Peak Hour Turning Movements and Level of Service
Base Case



Year 2020 Alternative Improvements

Based on the traffic volume projections, results of the analysis of Alternative 1, and discussions with the City staff, several alternative improvements were considered for the Shore Drive corridor. Thirteen varying alternatives were tested, using combinations of cross-sections, speed limits, and geometrics of the Northampton Boulevard interchange. The alternatives tested for the Northampton Boulevard interchange include dual left-turn lanes in the westbound direction, a partial cloverleaf taking drivers from westbound Shore Drive to southwestbound Northampton Boulevard, and a single-point urban interchange (SPUI). The different alternatives are listed below in **Table 8**.

TABLE 8
Alternative Improvements Tested for the Shore Drive Corridor

Alternative	Cross-section	Speed Limit	Northampton Boulevard Interchange
1 (Base Case)	4 lanes	45 mph	Existing diamond
2	4 lanes	45 mph	SPUI
3	4 lanes	35 mph	SPUI
4	6 lanes	45 mph	SPUI
5	6 lanes	35 mph	SPUI
6	4 lanes	45 mph	Dual Left-turn Lanes
7	4 lanes	35 mph	Dual Left-turn Lanes
8	6 lanes	45 mph	Dual Left-turn Lanes
9	6 lanes	35 mph	Dual Left-turn Lanes
10	4 lanes	45 mph	Partial Cloverleaf
11	4 lanes	35 mph	Partial Cloverleaf
12	6 lanes	45 mph	Partial Cloverleaf
13	6 lanes	35 mph	Partial Cloverleaf

Prepared by: Hampton Roads Planning District Commission, June 1999.

Results

Arterial Analysis

For the peak hour analysis, the only alternative tested was widening Shore Drive from four lanes to six lanes between Northampton Boulevard to North Great Neck Road, as included in the 2018 Long Range Plan. As shown in **Table 9**, the level of service improves to B for both the morning and afternoon peak hours.

TABLE 9
Projected 2020 Peak Hour Arterial Level of Service

Shore Drive Section	AM LOS	PM LOS
Independence Blvd. to Northampton Blvd. - 4 lanes	E	E
Northampton Blvd. to North Great Neck Rd. - 4 lanes	C	E
Northampton Blvd. to North Great Neck Rd. - 6 lanes	B	B

Prepared by: Hampton Roads Planning District Commission, June 1999.

Signalized Intersection Analyses

The results of the signalized intersection analyses for each alternative are shown in **Tables 10 and 11** and **Appendix C**.

The signalized intersections between Baylake Road/First Court Road and Page Avenue/Vista Circle will operate at unacceptable level of service E or worse with a 4-lane cross-section. With a six lane cross-section, these four intersections would operate at level of service C or better.

Reducing the speed limit from 45 miles per hour to 35 miles per hour had very little effect on the delay and level of service at each intersection. Although traffic flowed at a slower rate, platoons were more defined, which allowed for shorter cycle lengths.

The design of the Northampton Boulevard interchange that produced the least delay was the partial cloverleaf. With this design, the signal at the Northampton Boulevard southbound ramp can be removed. However, this design requires the demolition of some homes and businesses in the northwest corner of this intersection.

There was very little difference in the performance of the dual left-turn lanes and the single-point urban interchange. The primary turning movements at this intersection are the westbound left-turn from Shore Drive, and the northbound right-turn from the Northampton Boulevard ramp. The other turning movements are all minor, therefore reducing the benefits of a single-point urban interchange.

For all alternatives tested, the intersection at Independence Boulevard operated at level of service E. An additional alternative was considered to extend the widening of Shore Drive to Independence Boulevard. Even with the additional capacity for through movements, the intersection level of service did not improve. Without capacity improvements to Independence Boulevard, the performance of this intersection can not be significantly improved.

A sensitivity analysis was also performed for two alternatives to test the effect the cycle length had on corridor performance. Alternatives 2 and 6 were tested for the afternoon peak hour volumes with the optimized cycle length and a cycle length that was 20 seconds shorter than the optimum. As shown in **Table 10,** there was a large disparity in delay at some of the signalized intersections. For the entire corridor, the optimum timing plan produced 30% less delay than the shorter cycle length produced for Alternative 2, and 32% less delay for Alternative 6. Due to this difference, it is recommended that the optimum cycle length be used for coordinating the traffic signals in the Shore Drive corridor.

TABLE 10
Cycle Length Sensitivity by Intersection Delay

Alternative	Cycle Length	Independence	Pleasure House	Westsail	Northampton ramp	Greenwell	Baylake/First Court	Shady Oaks/Martin Bay	East Stratford	PageVista	Starfish	West Great Neck	North Great Neck
2	C_{opt} = 140 s.	49.8	20.6	6.0	24.7	12.7	41.7	218.3	83.4	58.4	11.1	16.0	25.2
2A	C = 120 s.	51.2	41.5	9.4	20.0	12.8	55.9	314.8	108.1	71.0	14.6	15.8	23.7
6	C_{opt} = 140 s.	49.5	21.6	6.9	17.5	15.7	45.3	204.7	83.4	58.4	11.2	15.9	25.1
6A	C = 120 s.	51.2	40.7	8.6	18.3	13.0	56.7	314.8	108.0	70.9	14.5	15.6	23.7

Prepared by: Hampton Roads Planning District Commission, June 1999.

TABLE 11
Projected 2020 Peak Hour Level of Service by Intersection and Alternative

	Alternative[1]	Independence	Pleasure House	Westtail	Northampton ramp[2]	Greenwell	Baylake/First Court	Shady Oaks/Marlin Bay	East Stratford	Page/Msta	Starfish	West Great Neck	North Great Neck
AM	1 Base Case	D	B	A	F	B	B	D	A	B	B	B	C
	2 4 lane/45 mph/SPUI at Northampton	D	B	B	B	B	B	D	A	B	B	B	C
	3 4 lane/35 mph/SPUI at Northampton	D	C	B	B	B	B	D	A	B	B	B	B
	4 6 lane/45 mph/SPUI at Northampton	D	B	B	B	B	B	C	A	B	A	B	B
	5 6 lane/35 mph/SPUI at Northampton	D	C	B	B	B	B	C	A	B	A	B	B
	6 4 lane/45 mph/Dual left at Northampton	D	B	B	B	B	B	D	A	B	B	B	C
	7 4 lane/35 mph/Dual left at Northampton	D	B	B	B	B	B	D	A	B	B	B	B
	8 6 lane/45 mph/Dual left at Northampton	D	B	B	B	B	B	C	A	B	A	B	B
	9 6 lane/35 mph/Dual left at Northampton	D	B	A	B	B	B	C	A	B	A	B	B
	10 4 lane/45 mph/Partial cloverleaf at Northampton	D	B	B		B	B	D	A	B	B	B	C
	11 4 lane/35 mph/Partial cloverleaf at Northampton	D	C	B		B	B	D	A	B	B	B	B
	12 6 lane/45 mph/Partial cloverleaf at Northampton	D	B	B		A	B	C	A	B	A	B	B
	13 6 lane/35 mph/Partial cloverleaf at Northampton	D	C	B		B	B	C	A	B	B	B	B
PM	1 Base Case	E	C	B	F	B	E	F	F	E	B	C	D
	2 4 lane/45 mph/SPUI at Northampton	E	C	B	C	B	E	F	F	E	B	C	D
	3 4 lane/35 mph/SPUI at Northampton	E	C	B	D	C	E	F	F	E	B	C	C
	4 6 lane/45 mph/SPUI at Northampton	E	C	B	C	B	A	B	A	B	A	B	C
	5 6 lane/35 mph/SPUI at Northampton	E	C	B	C	C	A	C	A	B	A	B	C
	6 4 lane/45 mph/Dual left at Northampton	E	C	B	C	C	E	F	F	E	B	C	D
	7 4 lane/35 mph/Dual left at Northampton	E	C	B	C	C	E	F	F	E	B	C	C
	8 6 lane/45 mph/Dual left at Northampton	E	C	B	C	B	A	C	A	B	B	B	C
	9 6 lane/35 mph/Dual left at Northampton	E	C	B	C	B	B	C	A	B	A	B	C
	10 4 lane/45 mph/Partial cloverleaf at Northampton	E	C	B		C	E	F	F	E	B	C	D
	11 4 lane/35 mph/Partial cloverleaf at Northampton	E	C	B		C	E	F	F	E	B	C	C
	12 6 lane/45 mph/Partial cloverleaf at Northampton	E	C	B		C	A	B	A	B	B	B	C
	13 6 lane/35 mph/Partial cloverleaf at Northampton	E	C	B		C	A	C	A	B	A	B	C

1 - No build option and all alternatives include free-flow NBRT at First Court, East Stratford signalized, and protected EB + WB left turn phasing

2 - Alternatives 10-13 involve the removal of the traffic signal at the Northampton Boulevard southbound ramp

Prepared by: Hampton Roads Planning District Commission, June 1999.

TABLE 12
Projected 2020 Peak Hour Delay by Intersection and Alternative

	Alternative[1]	Independence	Pleasure House	Westsail	Northampton ramp[2]	Greenwell	Baylake/First Court	Shady Oaks/Marlin Bay	East Stratford	Page/Vista	Starfish	West Great Neck	North Great Neck
AM	1 Base Case	36.1	13.6	4.6	296.4	10.9	8.3	35.9	2.5	8.9	7.8	12.2	16.5
	2 4 lane/45 mph/SPUI at Northampton	35.9	14.2	5.5	13.1	9.6	8.2	35.7	2.5	8.9	7.8	12.2	16.5
	3 4 lane/35 mph/SPUI at Northampton	34.7	15.2	5.7	12.3	12.8	8.7	33.4	2.7	8.9	8.3	11.5	14.2
	4 6 lane/45 mph/SPUI at Northampton	33.3	14.5	5.5	10.0	6.0	5.3	16.0	0.5	5.4	4.0	8.9	14.0
	5 6 lane/35 mph/SPUI at Northampton	31.1	16.0	5.9	11.7	6.2	6.9	15.5	0.6	5.4	5.0	6.0	13.7
	6 4 lane/45 mph/Dual left at Northampton	36.3	13.8	6.3	12.0	9.7	8.6	35.7	2.5	9.0	7.7	12.1	16.4
	7 4 lane/35 mph/Dual left at Northampton	36.8	13.5	5.3	11.6	8.8	12.3	34.3	2.7	8.9	8.3	11.5	14.2
	8 6 lane/45 mph/Dual left at Northampton	36.4	13.3	5.7	12.0	6.2	5.8	18.2	0.5	5.4	4.0	8.9	14.0
	9 6 lane/35 mph/Dual left at Northampton	37.9	13.4	4.5	11.0	6.1	6.0	16.8	0.6	5.4	5.0	6.0	13.7
	10 4 lane/45 mph/Partial cloverleaf at Northampton	36.0	13.7	6.7		9.2	9.4	36.3	2.5	8.9	7.8	12.2	16.5
	11 4 lane/35 mph/Partial cloverleaf at Northampton	35.1	16.4	6.7		8.9	9.0	33.4	2.7	8.9	8.3	11.5	14.2
	12 6 lane/45 mph/Partial cloverleaf at Northampton	30.2	13.6	7.3		5.9	6.0	15.9	0.5	5.4	4.0	8.9	14.0
	13 6 lane/35 mph/Partial cloverleaf at Northampton	29.9	18.1	6.5		6.6	5.8	16.3	0.6	5.4	5.2	5.8	13.8
PM	1 Base Case	49.5	21.7	6.2	85.0	13.5	46.4	204.7	83.4	58.4	11.2	15.9	25.1
	2 4 lane/45 mph/SPUI at Northampton	49.8	20.6	6.0	24.7	12.7	41.7	218.3	83.4	58.4	11.1	16.0	25.2
	3 4 lane/35 mph/SPUI at Northampton	50.6	20.3	6.9	26.3	16.9	42.9	204.7	84.3	58.8	14.2	16.9	24.5
	4 6 lane/45 mph/SPUI at Northampton	49.7	20.4	6.3	20.1	14.5	4.1	14.8	3.9	11.5	4.1	10.0	24.5
	5 6 lane/35 mph/SPUI at Northampton	50.5	18.6	6.8	22.9	15.7	4.6	21.2	4.5	12.5	4.3	10.9	24.7
	6 4 lane/45 mph/Dual left at Northampton	49.5	21.6	6.9	17.5	15.7	45.3	204.7	83.4	58.4	11.2	15.9	25.1
	7 4 lane/35 mph/Dual left at Northampton	51.5	20.3	6.9	19.9	18.4	43.6	204.7	84.2	58.8	14.4	16.4	24.3
	8 6 lane/45 mph/Dual left at Northampton	49.4	21.9	6.7	18.3	14.9	4.3	15.0	3.9	11.7	5.3	10.3	24.3
	9 6 lane/35 mph/Dual left at Northampton	51.1	20.3	7.9	16.0	14.7	5.4	16.7	4.5	12.2	4.8	11.1	24.7
	10 4 lane/45 mph/Partial cloverleaf at Northampton	50.0	21.0	6.3		15.5	42.0	222.9	83.4	58.4	11.2	15.9	25.1
	11 4 lane/35 mph/Partial cloverleaf at Northampton	50.4	20.8	7.1		19.7	42.8	204.7	84.2	58.8	14.4	16.4	24.3
	12 6 lane/45 mph/Partial cloverleaf at Northampton	49.7	22.2	6.3		16.4	3.9	14.9	3.9	11.7	5.3	10.3	24.3
	13 6 lane/35 mph/Partial cloverleaf at Northampton	50.2	18.5	7.5		16.9	4.5	21.2	3.9	12.1	4.8	11.0	24.7

1 - No build option and all alternatives include free-flow NBRT at First Court, East Stratford signalized, and protected EB + WB left turn phasing

2 - Alternatives 10-13 involve the removal of the traffic signal at the Northampton Boulevard southbound ramp

Prepared by: Hampton Roads Planning District Commission, June 1999.

CONCLUSIONS

Non-highway

The analyses of the non-highway transportation network in the study area revealed that some accommodations for pedestrians, bicyclists, and transit users are in place in the study area. However, some elements of the non-highway system are deficient. Listed below are the conclusions of the analyses of the non-highway transportation system in the Shore Drive corridor.

- Pedestrian accommodations
  - The existing sidewalk system does not connect to form a continuous walkway through the study area, but the City is planning to construct eight-foot wide sidewalks along both sides of Shore Drive.
  - Crosswalks and pedestrian push-buttons are provided at signalized intersections in the study area.
  - An exclusive pedestrian phase is included in the signal timing at Starfish Drive.
- Bicycle accommodations
  - A multi-use bicycle/pedestrian path extends from First Landing State Park into the eastern section of the study area, but terminates at West Great Neck Road.
  - Bikeway crossing signs are posted on the intersecting streets in the study area with the exception of southbound North Great Neck Road.
  - Other than the multi-use trail extending from First Landing State Park, no other bike lanes are marked in the study area.
  - The City has developed a draft bikeway plan for the study area that includes an extension of the existing multi-use trail from First Landing State Park to Bayside Recreation Center.
  - Bicycle storage facilities are provided only at the major recreational facilities and at a few businesses in the study area.
- Transit system
  - TRT bus stops are posted along eastbound and westbound Shore Drive in the study area.
  - The Shore Drive corridor is currently serviced by only one bus route.
  - Neither TRT or the City have implemented special shuttle or trolley services along the bayfront resort area, but a plan is underway by TRAFFIX to determine the feasibility of implementing resort area transit services in the study area.

Highway

Certain segments of the Shore Drive corridor are operating under both hazardous and congested conditions. A summary of these conditions is listed below:

- Accident concerns
  - This corridor does not experience a high number of accidents.
  - Certain sections have experienced a higher number of accidents than others, especially between the Northampton Boulevard southbound ramp and Greenwell Road.
  - Over 90 percent of the accidents in the study area are of the rear-end or right-angle varieties.
  - The most common causes are drivers following too closely or failing to yield the right of way.
- Current peak hour traffic conditions
  - Certain sections of the corridor are experiencing congestion.
  - The worst congestion occurs at the intersection of Shore Drive and Northampton Boulevard during both the morning and afternoon peak hours.
  - Traffic also queues making the northbound right turn from First Court Road to eastbound Shore Drive during the afternoon peak hour.
  - Traffic signals to the west of the Lesner Bridge are not coordinated, and many different cycle lengths are used.
  - Traffic is being stopped on westbound Shore Drive during the morning peak hour between Baylake Road/First Court Road and Greenwell Road to allow vehicles to enter the two private schools in the area.
- Projected 2020 peak hour traffic conditions
  - Extreme delays will occur at Shore Drive and the Northampton Boulevard southbound ramp without capacity improvements.
  - Excessive delays will also occur in the eastbound direction between Baylake Road/First Court Road and Page Avenue/Vista Circle during the afternoon peak hour.

RECOMMENDATIONS

The analyses performed for this study were not intended to provide a single recommended alternative for implementation, but rather provide guidance to the City of Virginia Beach to improve the Shore Drive corridor and adjacent Bayfront area.

Non-highway

In order to enhance the existing non-highway system and to address existing deficiencies, the following improvements are recommended:

- Pedestrian accommodations
  - Implement plans to construct eight-foot wide sidewalk along both sides of Shore Drive in the study area.
  - Perform pedestrian data collection to determine the need for exclusive pedestrian phasing in intersection signal timings.
- Bicycle accommodations
  - Implement bike plans to extend the existing multi-use path from First Landing State Park through the study area to Bayside Recreation Center.
  - Provide bicycle storage facilities at businesses where appropriate.
- Transit system
  - Complete the study currently underway to determine the feasibility and need of resort area transit and TDM services in the Shore Drive corridor.
  - Perform a ridership survey on the existing bus route to determine needs of the transit users in the Shore Drive corridor.

Highway

The following list includes recommendations to consider for reducing congestion along the Shore Drive corridor both now and in the future:

- Enforce access management policies in the Shore Drive corridor.

- Coordinate and optimize traffic signal timings to increase through-flow on Shore Drive and diminish the stop-and-go conditions that cause the excessive number of rear-end accidents.

- Use protected-only left-turn phasing at the following intersections to reduce the excessive number of right-angle accidents: Northampton Boulevard, Greenwell Road, and Shady Oaks Drive/Marlin Bay Road.

- Construct a northbound free-flow right-turn lane at First Court Road with an acceleration lane onto eastbound Shore Drive to relieve congestion at this intersection.

- Consider interchange improvements at Northampton Boulevard to address capacity deficiencies during the morning and afternoon peak hours.

- Consider improving capacity by widening Shore Drive from 4 lanes to 6 lanes between Northampton Boulevard and North Great Neck Road, as indicated in the 2018 Long Range Plan.

Appendix A

Historical Traffic and Traffic Projection

TABLE A-1
Historical 24-hour Traffic Volumes and 2020 Projections

				EXISTING COUNTS						CMS						MINUTP Average Growth Rate				2020 CMS & MINUTP AVERAGE	
Stat. No.	Street Name	Segment From	Segment To	1988 ADT	1989 ADT	1990 ADT	1992 ADT	1994 ADT	2020 Hist. ADT w/ 1994	1995 CMS ADT	1995 CMS LOS	2015 CMS ADT	2015 CMS LOS	CMS AGR	2020 CMS ADT	1990 MINUTP	2020 MINUTP	MINUTP AGR	2020 ADT w/ 1994	VOLUME	AGR w/ 1994
U797	Shore Drive	Independence Blvd	Northampton Blvd	22261	22685	18643	23578	22472	23410	22472	C	28500	C	1.20%	30244	23962	27511	0.46%	25330	27787	0.82%
U798	Shore Drive	Northampton Blvd	Great Neck Road	41293	42452	41912	43451	43151	52218	43151	F	46050	C*	0.33%	46805	35008	42667	0.66%	51222	49013	0.49%
U735	Independence	Northampton Blvd	Shore Drive	22700	23720	21783	24847	19635	10473	19635	C	27200	C*	1.64%	29509	18859	37117	2.28%	35308	32409	1.95%
U769	Northampton	Pleasure House Rd	Shore Drive	23029	21949	x	25463	26053	44468	26053	A	34700	A	1.44%	37278	25147	37853	1.37%	37136	37207	1.38%
U796	Shore Drive	Diamond Springs Rd	Independence Blvd	26439	30493	28277	31526	32763	82982	32763	D	42500	F	1.31%	45357	32431	47720	1.30%	45789	45573	1.28%
U799	Shore Drive	Great Neck Road	W. Gate Fort Story	17786	18130	18485	16211	19064	25751	19064	A	19371	A	0.08%	19449	19485	22896	0.54%	21925	20687	0.31%
U832	Northampton	Shore Drive	Bay Bridge-Tunnel	8144	9480	7573	12581	9998	24317	9998	A	12000	A	0.92%	12560	8322	12000	1.23%	13730	13145	1.06%
U860	Great Neck Rd.	Shore Drive	Poinciana Drive	x	x	x	28555	29318								21575	25117	0.51%	33446	33446	0.51%

* - after widening from 4L to 6L

1 - These counts were taken in the fall and winter, and therefore are not seasonal volumes.

CMS – *Congestion Management System for Hampton Roads*, Virginia, Hampton Roads Planning District Commission, October 1995.

APPENDIX B

Intersection Peak Hour Level of Service by Movement

Existing Conditions and Short-Term Alternative Analysis

TABLE B-1
Existing Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 1

Existing AM Delay and LOS by Intersection

	Independence			Pleasure House									Northampton NB			Greenwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	37.8	D	149	26.8	D	35	2.7	A	5							0.8	A	12
EBTH	16.4	C	128	10.6	B	128	10.6	B	85	12.3	B	170				0.9	A	94
EBRT	4.4	A	101	9.7	B	101	8.6	B	33	10.5	B	43				0.8	A	5
WBLT	110.1	F	174	*	F	174	2.8	A	11	*	F	1322				1.4	A	5
WBTH	22.1	C	291	11.5	B	291	11.0	B	193	0.1	A	61				29.8	D	833
WBRT	13.7	B	101	9.5	B	101	7.9	B	4							3.8	A	3
NBLT	62.3	F	304	21.5	C	304												
NBTH	39.7	D	287	17.5	C	287	20.8	C	49							28.0	D	51
NBRT	15.5	C	36	10.6	B	36	11.8	B	33							17.9	C	40
SBLT	40.4	E	85	18.6	C	85												
SBTH	36.0	D	97	25.7	D	97	20.2	C	8							27.4	D	50
SBRT	23.9	C	43	11.0	B	43	11.2	B	16	26.2	D	5				19.1	C	102
Intersection	36.7	D	115 s.	*	F	90 s.	10.7	B	Free	*	F	90 s.				20.2	C	90 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	3.1	A	3	2.1	A	10	30.6	D	38	2.8	A	10	5.0	A	19	36.7	D	14
EBTH	13.9	B	302	3.2	A	144	6.5	B	236	*	F	490	15.9	C	459	24.9	C	163
EBRT				2.1	A	3	4.2	A	11	2.9	A	22	11.0	B	71	0.5	A	372
WBLT	26.6	D	176				31.3	D	26	0.1	A	0	3.9	A	5	29.6	D	121
WBTH	96.7	F	804	94.2	F	870	4.4	A	221	*	F	296	12.3	B	364	9.7	B	166
WBRT	9.0	B	2	6.4	B	25	0.8	A	3	0.6	A	3	7.5	B	22	7.0	B	20
NBLT										32.6	D	83	33.6	D	164	34.4	D	526
NBTH	22.0	C	20	25.6	D	47	28.2	D	66	29.2	D	21	27.0	D	33	34.2	D	546
NBRT	12.9	B	109	20.0	C	4	19.7	C	22							8.5	B	71
SBLT							27.7	D	51				27.5	D	62			
SBTH	22.7	C	62	102.0	F	128	28.8	D	53	29.9	D	36	27.0	D	49			
SBRT																		
Intersection	60.8	F	Free	63.1	F	Free	6.9	B	100 s.	*	F	100 s.	14.9	B	100 s.	17.2	C	100 s.

Existing PM Delay and LOS by Intersection

	Independence			Pleasure House									Northampton NB					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	48.7	E	279	31.6	D	141	2.7	A	10							5.7	B	67
EBTH	25.0	C	374	16.9	C	253	10.1	B	210	12.5	B	273				16.0	C	514
EBRT	21.1	C	515	11.9	B	38	8.9	B	120	9.2	B	35				8.6	B	58
WBLT	44.1	E	144	43.6	E	158	3.1	A	29	*	F	708				3.0	A	97
WBTH	23.5	C	181	15.6	C	143	9.3	B	130	0.2	A	5				8.6	B	268
WBRT	10.2	B	91	14.8	B	113	7.7	B	9							5.7	B	24
NBLT	33.3	D	180	18.6	C	48												
NBTH	25.9	D	153	25.8	D	356	21.8	C	55							31.1	D	118
NBRT	18.8	C	80	11.4	B	119	13.6	B	98							18.3	C	50
SBLT	40.8	E	227	180.9	F	140												
SBTH	28.9	D	228	19.4	C	137	20.0	C	13	31.0	D	46				27.6	D	50
SBRT	16.6	C	128	8.8	B	30	11.3	B	23	30.0	D	34				18.9	C	66
Intersection	27.0	D	110 s.	24.2	C	100 s.	10.4	B	Free	*	F	100 s.				13.8	B	100 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	3.1	A	4	13.5	B	100	35.7	D	134	0.2	A	1	3.0	A	1	34.6	D	25
EBTH	*	F	1325	20.2	C	1000	58.0	E	1333	*	F	9	11.5	B	9	*	F	487
EBRT				2.2	A	10	4.9	A	63	0.1	A	1	6.8	B	1	1.5	A	
WBLT	11.4	B	113				47.5	E	100	0.7	A	5	5.7	B	5	38.6	D	156
WBTH	15.7	C	324	13.2	B	405	7.6	B	362	4.7	A	106	7.0	B	106	9.7	B	140
WBRT	9.2	B	11	6.7	B	46	4.5	A	14	1.8	A	8	4.2	A	8			
NBLT										45.2	E	129	47.7	E	129	31.9	D	569
NBTH	22.4	C	33	21.5	C	39	36.1	D	58	37.7	D	46	34.7	D	46	31.8	D	568
NBRT	22.7	C	512	20.0	C	14	26.2	D	45							11.2	B	160
SBLT							34.4	D	56				37.2	D				
SBTH	22.5	C	31	26.5	D	85	34.7	D	52	44.0	E	62	33.3	D	62			
SBRT																		
Intersection	*	F	Free	17.6	C	Free	38.7	D	120 s.	*	F	120 s.	11.9	B	120 s.	*	F	120 s.

* - v/c ratio for this movement is greater than 1.20
Queue = Length of 95th percentile queue
1 - includes an exclusive pedestrian phase

TABLE B-2
Existing Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 2

Optimized AM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SB			Northampton NB					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.1	D	116	26.7	D	35	0.6	A	1							2.9	A	31
EBTH	19.2	C	118	7.4	B	40	1.8	A	18	53.2	E	361				2.3	A	49
EBRT	5.3	B	95	7.1	B	11	1.5	A	8	30.9	D	68				1.7	A	5
WBLT	30.7	D	103	21.2	C	121	0.2	A	7	33.4	D	1717				0.4	A	6
WBTH	19.9	C	131	7.7	B	190	0.3	A	131	0.1	A	46				4.3	A	845
WBRT	9.1	B	44	6.1	B	41	0.0	A	2							0.9	A	2
NBLT	19.6	C	180	15.9	C	21												
NBTH	21.2	C	181	13.8	B	53	21.5	C	57							50.7	E	79
NBRT	6.5	B	19	5.1	B	26	14.3	B	41							38.9	D	66
SBLT	24.0	C	60	14.6	B	80												
SBTH	24.7	C	69	19.7	C	261	20.9	C	9							49.3	E	77
SBRT	16.1	C	31	8.3	B	46	13.5	B	19	50.5	E	7				41.6	E	172
Intersection	19.0	C	75 s.	11.8	B	75 s.	2.4	A	75 s.	24.6	C	150 s.				7.0	B	150 s.

	Bayleaf/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	0.8	A	3	4.7	A	14	32.7	D	40	0.1	A	8	2.2	A	19	37.3	D	12
EBTH	5.0	B	302	2.2	A	84	5.3	B	189	2.9	A	344	6.3	B	216	10.5	B	112
EBRT				1.7	A	2	3.5	A	9	0.0	A	9	5.0	B	39	0.5	A	316
WBLT	10.4	B	176				37.5	D	29	0.9	A	9	1.1	A	4	34.3	D	127
WBTH	5.2	B	804	30.4	D	1243	3.4	A	75	47.8	E	261	10.1	B	478	12.3	B	192
WBRT	0.8	A	2	7.1	B	31	1.4	A	1	1.7	A	11	3.3	A	14	9.6	B	25
NBLT										16.1	C	78	30.3	D	160	19.2	C	406
NBTH	23.1	C	20	40.4	E	68	30.6	D	69	15.3	C	20	25.7	D	32	19.2	C	421
NBRT	11.6	B	109	34.2	D	5	22.4	C	25							7.3	B	62
SBLT							29.8	D	53				26.2	D	60			
SBTH	24.9	C	62	74.2	F	192	31.4	D	56	15.6	C	34	25.7	D	48			
SBRT																		
Intersection	6.3	B	75 s.	24.5	C	150 s.	6.1	B	100 s.	26.8	D	100 s.	10.1	B	100 s.	12.6	B	100 s.

Optimized PM Delay and LOS by Intersection

	Independence			Pleasure House									Northampton NB					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	25.8	D	184	37.7	D	146	0.8	A	1							11.9	B	76
EBTH	17.2	C	278	16.9	C	135	2.2	A	120	15.5	C	167				5.9	B	192
EBRT	14.0	B	377	10.9	B	27	1.7	A	51	8.7	B	27				3.6	A	26
WBLT	51.0	E	135	35.0	D	135	6.8	B	42	23.6	C	489				9.3	B	51
WBTH	6.3	B	34	11.1	B	118	8.3	B	165	2.3	A	98				3.2	A	41
WBRT	1.0	A	8	10.5	B	96	7.0	B	13							2.2	A	6
NBLT	31.6	D	155	12.5	B	37												
NBTH	31.6	D	149	16.1	C	276	23.6	C	62							25.0	C	105
NBRT	19.6	C	81	6.7	B	84	14.1	B	112							15.2	C	43
SBLT	29.2	D	185	28.9	D	103												
SBTH	36.0	D	207	13.1	B	106	21.6	C	15	29.7	D	44				23.0	C	44
SBRT	12.3	B	106	4.5	A	20	14.6	B	27	28.2	D	32				14.7	B	55
Intersection	22.0	C	90 s.	17.0	C	90 s.	7.0	B	90 s.	14.4	B	90 s.				6.5	B	90 s.

	Bayleaf/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	0.3	A	1	18.6	C	101	46.6	E	158	1.0	A	6	2.3	A	48	48.6	E	28
EBTH	65.3	F	1017	7.1	B	170	15.4	C	1085	5.9	B	332	6.8	B	380	25.2	D	473
EBRT				0.9	A	5	2.8	A	46	1.1	A	15	3.3	A	42	1.5	A	562
WBLT	30.3	D	158				67.6	F	131	1.5	A	15	8.0	B	45	47.7	E	181
WBTH	0.6	A	43	11.2	B	340	2.4	A	277	3.9	A	187	3.8	A	144	11.3	B	152
WBRT	0.6	A	2	6.5	B	42	1.4	A	9	2.8	A	12	2.1	A	16			
NBLT										34.5	D	124	41.7	E	216	34.0	D	601
NBTH	22.6	C	30	27.2	D	39	70.3	F	71	32.9	D	48	36.3	D	87	33.9	D	599
NBRT	123.0	F	559	24.5	C	14	38.0	D	58							13.4	B	187
SBLT							46.4	E	67				37.6	D	125			
SBTH	22.6	C	28	42.3	E	84	47.6	E	63	34.3	D	65	35.1	D	62			
SBRT																		
Intersection	50.4	E	90 s.	10.3	B	90 s.	14.4	B	140 s.	6.3	B	140 s.	8.3	B	140 s.	20.1	C	140 s.

* - v/c ratio for this movement is greater than 1.20
Queue = Length of the 95th percentile queue
1 - exclusive pedestrian phase removed

Shore Drive

TABLE B-3
Existing Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 3

Optimized AM Delay and LOS by Intersection - Pedestrian timings adjusted

	Independence			Pleasure House						Northampton SB			Northampton NB					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.2	D	116	26.0	D	35	1.7	A	5							2.1	A	18
EBTH	19.2	C	118	7.6	B	41	4.2	A	55	50.7	E	376				1.8	A	48
EBRT	5.3	B	95	7.4	B	11	4.1	A	22	29.1	D	84				1.8	A	5
WBLT	30.5	D	95	22.2	C	154	1.1	A	4	32.7	D	1715				0.3	A	3
WBTH	18.9	C	115	2.9	A	88	1.7	A	134	0.1	A	81				4.3	A	1270
WBRT	7.1	B	30	2.5	A	22	1.0	A	2							0.9	A	1
NBLT	19.6	C	180	15.9	C	21												
NBTH	21.2	C	181	13.8	B	53	21.5	C	57							50.7	E	79
NBRT	6.5	B	19	5.1	B	26	14.3	B	41							38.9	D	66
SBLT	24.0	C	60	14.6	B	80												
SBTH	24.7	C	69	19.7	C	261	20.9	C	9							49.3	E	77
SBRT	16.1	C	31	8.3	B	46	13.5	B	19	50.5	E	7				41.6	E	172
Intersection	18.7	C	75 s.	10.3	B	75 s.	4.1	A	75 s.	23.9	C	150 s.				6.8	B	150 s.

	Sayleka/First Court			Shady Oaks/Marlin Bay			Pope/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	1.0	A	1	4.2	A	14	28.8	D	36	0.6	A	21	2.0	A	17	37.4	D	11
EBTH	5.2	B	264	2.3	A	120	5.2	B	176	1.1	A	42	7.0	B	262	15.6	C	161
EBRT				2.0	A	2	3.4	A	8	0.5	A	4	5.1	B	42	0.5	A	144
WBLT	12.8	B	131				38.1	D	28	0.6	A	7	3.5	A	0	33.1	D	124
WBTH	5.8	B	599	30.4	D	1243	2.4	A	89	3.7	A	210	8.0	B	641	10.4	B	206
WBRT	1.1	A	1	7.1	B	31	0.7	A	1	1.8	A	9	3.6	A	9	8.2	B	21
NBLT										28.8	D	76	29.2	D	149	21.6	C	400
NBTH	23.1	C	17	40.4	E	68	28.2	D	64	26.1	D	20	23.8	C	30	21.5	C	428
NBRT	11.6	B	89	34.2	D	5	20.0	C	23							7.4	B	43
SBLT							27.3	D	50				24.3	C	57			
SBTH	24.9	C	53	74.2	F	192	29.2	D	51	26.7	D	33	23.8	C	95			
SBRT																		
Intersection	6.8	B	75 s.	24.6	C	150 s.	5.3	B	90 s.	3.7	A	90 s.	9.2	B	90 s.	13.2	B	90 s.

Optimized PM Delay and LOS by Intersection - Pedestrian timings adjusted

	Independence			Pleasure House									Northampton NB					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	25.8	D	184	37.7	D	146	0.7	A	1							12.2	B	76
EBTH	17.2	C	278	16.9	C	135	2.2	A	120	15.5	C	167				5.7	B	187
EBRT	14.0	B	377	10.9	B	27	1.7	A	51	8.7	B	27				3.4	A	25
WBLT	51.0	E	135	35.0	D	135	6.9	B	37	23.7	C	475				8.8	B	86
WBTH	6.3	B	34	11.1	B	118	8.4	B	163	2.3	A	95				2.5	A	16
WBRT	1.0	A	8	10.5	B	96	7.0	B	13							1.3	A	2
NBLT	31.6	D	155	12.5	B	37												
NBTH	31.6	D	149	16.1	C	276	23.6	C	62							25.0	C	105
NBRT	19.6	C	81	6.7	B	84	14.1	B	112							15.2	C	43
SBLT	29.2	D	185	28.9	D	103												
SBTH	36.0	D	207	13.1	B	106	21.6	C	15	29.7	D	44				23.0	C	44
SBRT	12.3	B	106	4.5	A	20	14.6	B	27	28.2	D	32				14.7	B	55
Intersection	22.0	C	90 s.	17.0	C	90 s.	7.0	B	90 s.	14.4	B	90 s.				6.1	B	90 s.

	Sayleka/First Court			Shady Oaks/Marlin Bay			Pope/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	0.6	A	1	17.3	C	91	46.6	E	158	0.8	A	5	2.3	A	49	49.6	E	28
EBTH	62.7	F	1009	7.8	B	136	15.4	C	1085	3.4	A	295	5.7	B	418	24.6	C	516
EBRT				0.9	A	5	2.8	A	46	1.2	A	15	3.1	A	42	1.5	A	586
WBLT	32.3	D	129				68.0	F	131	1.6	A	13	8.0	B	52	47.7	E	181
WBTH	1.9	A	57	10.9	B	340	3.0	A	76	4.4	A	187	3.5	A	366	11.3	B	178
WBRT	1.5	A	3	6.3	B	42	1.5	A	5	3.3	A	8	1.9	A	16			
NBLT										44.7	E	128	41.7	E	216	34.0	D	601
NBTH	22.6	C	30	27.2	D	39	70.3	F	71	41.2	E	49	36.3	D	87	33.9	D	599
NBRT	123.0	F	559	24.5	C	14	38.0	D	58							13.4	B	151
SBLT							46.4	E	67				37.6	D	125			
SBTH	22.6	C	28	42.3	E	84	47.6	E	63	44.2	E	67	35.1	D	62			
SBRT																		
Intersection	49.4	E	90 s.	10.6	B	90 s.	14.5	B	140 s.	5.6	B	140 s.	7.7	B	140 s.	20.0	C	140 s.

* - v/c ratio for this movement is greater than 1.20
Queue = Length of the 95th percentile queue
1 - exclusive pedestrian phase removed

TABLE B-4
Existing Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 4

Optimized AM Delay and LOS by Intersection - Protected EB and WB left-turn phasing

	Independence			Pleasure House			Pleasant			Northampton SB			Northampton NB			Greatwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.1	D	116	27.4	D	35	24.5	C	18							71.4	F	62
EBTH	19.2	C	118	7.2	B	38	1.4	A	21	58.3	E	362				1.8	A	48
EBRT	5.3	B	95	6.9	B	10	1.3	A	8	29.0	D	68				1.6	A	5
WBLT	30.8	D	98	30.8	D	156	25.8	D	39	43.1	E	1724				55.9	E	47
WBTH	20.4	C	132	5.3	B	122	1.3	A	154	0.1	A	63				4.4	A	744
WBRT	8.7	B	56	4.6	A	30	0.8	A	3							1.2	A	1
NBLT	19.6	C	180	15.9	C	21												
NBTH	21.2	C	181	13.8	B	53	21.5	C	57							50.7	E	79
NBRT	6.5	B	19	5.1	B	26	14.3	B	41							38.9	D	66
SBLT	24.0	C	60	14.6	B	80												
SBTH	24.7	C	69	19.7	C	261	20.9	C	9							49.3	E	77
SBRT	16.1	C	31	8.3	B	46	13.5	B	18	50.5	E	7				41.6	E	170
Intersection	19.1	C	75 s.	11.9	B	75 s.	3.9	A	75 s.	29.7	D	150 s.				7.8	B	150 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Pegs/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.1	D	11	68.1	F	62	28.8	D	36	42.0	E	54	24.2	C	42	37.5	D	11
EBTH	6.7	B	233	2.3	A	109	5.2	B	176	1.1	A	42	7.0	B	271	16.2	C	163
EBRT				2.1	A	2	3.4	A	8	0.5	A	4	5.1	B	43	0.5	A	150
WBLT	22.8	C	183				37.1	D	27	31.6	D	31	26.4	D	29	33.1	D	124
WBTH	6.0	B	665	30.4	D	1243	2.4	A	69	4.1	A	199	7.7	B	632	10.4	B	206
WBRT	1.1	A	1	7.1	B	31	0.7	A	1	1.8	A	9	3.4	A	7	8.2	B	21
NBLT										28.8	D	76	29.2	D	149	21.6	C	400
NBTH	23.1	C	17	40.4	E	68	28.2	D	64	26.1	D	20	23.8	C	30	21.5	C	428
NBRT	10.1	B	78	34.2	D	5	20.0	C	23							7.4	B	43
SBLT							27.3	D	50				24.3	C	57			
SBTH	24.9	C	53	74.2	F	192	29.2	D	51	26.7	D	33	23.8	C	45			
SBRT																		
Intersection	8.2	B	75 s.	25.2	D	150 s.	5.3	B	90 s.	4.5	A	90 s.	9.4	B	90 s.	13.2	B	90 s.

Optimized PM Delay and LOS by Intersection - Protected EB and WB left-turn phasing

	Independence			Pleasure House			Pleasant			Northampton SB			Northampton NB			Greatwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	21.9	C	163	35.4	D	134	36.6	D	35							26.1	D	118
EBTH	16.2	C	254	14.4	B	124	1.9	A	71	19.6	C	347				6.3	B	198
EBRT	16.0	C	366	9.5	B	25	1.7	A	31	8.9	B	28				3.9	A	27
WBLT	37.2	D	115	43.0	E	134	11.5	B	51	36.0	D	497				29.4	D	92
WBTH	7.6	B	84	7.3	B	113	1.0	A	160	3.2	A	66				4.8	A	112
WBRT	1.1	A	10	6.8	B	93	0.8	A	12							3.6	A	16
NBLT	33.9	D	142	11.5	B	35												
NBTH	29.9	D	135	15.1	C	254	21.7	C	57							24.6	C	98
NBRT	17.0	C	72	6.4	B	79	11.9	B	96							13.9	B	40
SBLT	28.5	D	170	31.0	D	98												
SBTH	33.0	D	186	12.1	B	98	19.7	C	14	25.4	D	39				21.8	C	41
SBRT	10.2	B	92	4.8	A	20	12.7	B	23	24.4	C	29				12.8	B	50
Intersection	21.2	C	80 s.	15.5	C	80 s.	5.1	B	80 s.	19.5	C	80 s.				8.0	B	80 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Pegs/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	36.8	D	14	30.4	D	137	43.2	E	148	54.2	E	74	49.6	E	98	52.8	E	27
EBTH	73.0	F	917	7.5	B	845	16.5	C	1093	3.4	A	219	7.8	B	412	16.1	C	471
EBRT				1.0	A	5	2.8	A	45	1.3	A	16	4.5	A	52	1.5	A	615
WBLT	147.9	F	211				59.6	E	118	40.0	E	54	57.3	E	90	46.1	E	171
WBTH	1.9	A	60	12.5	B	329	2.0	A	215	2.8	A	207	9.7	B	537	10.6	B	171
WBRT	1.4	A	4	7.0	B	41	1.6	A	12	2.4	A	14	3.0	A	28			
NBLT										42.5	E	121	38.9	D	203	32.1	D	565
NBTH	20.0	C	27	25.0	C	36	65.2	F	67	38.7	D	48	33.7	D	82	32.0	D	563
NBRT	123.7	F	509	22.0	C	13	34.8	D	54							12.7	B	141
SBLT							43.2	E	63				34.9	D	118			
SBTH	20.1	C	25	43.1	E	77	44.4	E	59	42.0	E	64	32.5	D	58			
SBRT																		
Intersection	59.3	E	80 s.	11.4	B	80 s.	14.5	B	130 s.	6.0	B	130 s.	12.1	B	130 s.	17.9	C	130 s.

* - v/c ratio for this movement is greater than 1.20
Queue = Length of the 95th percentile queue
1 - exclusive pedestrian phase removed

Shore Drive

TABLE B-5
Existing Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 5

Optimized AM Delay and LOS by Intersection - Protected EB/WBLT except at Westsail, Baylake, Starfish, and West Great Neck

	Independence			Pleasure House			Westsail			Northampton SB			Northampton NB			Greenwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.1	D	116	25.3	D	35	1.1	A	2							70.3	F	62
EBTH	19.2	C	118	7.8	B	43	2.4	A	28	57.7	E	363				1.8	A	48
EBRT	5.3	B	95	7.5	B	11	2.3	A	11	27.9	D	71				1.6	A	5
WBLT	24.5	C	99	26.9	D	159	0.2	A	7	44.8	E	1724				61.3	F	47
WBTH	20.7	C	120	5.8	B	116	0.4	A	138	0.1	A	81				4.5	A	813
WBRT	8.7	B	43	4.9	A	29	0.2	A	2							1.1	A	2
NBLT	19.6	C	180	15.9	C	21												
NBTH	21.2	C	181	13.8	B	53	21.5	C	57							50.7	E	79
NBRT	6.5	B	19	5.1	B	26	14.3	B	41							38.9	D	66
SBLT	24.0	C	60	14.6	B	80												
SBTH	24.7	C	69	19.7	C	261	20.9	C	9							49.3	E	77
SBRT	16.1	C	31	8.3	B	46	13.5	B	19	50.5	E	7				41.6	E	170
Intersection	18.9	C	75 s.	11.8	B	75 s.	2.8	A	75 s.	30.3	D	150 s.				7.9	B	150 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish[1]			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	1.3	A	1	62.4	F	60	28.8	D	36	0.6	A	21	2.0	A	18	37.5	D	11
EBTH	4.3	A	64	2.2	A	133	5.2	B	176	1.1	A	42	7.0	B	271	16.2	C	163
EBRT				1.7	A	2	3.4	A	8	0.5	A	4	5.1	B	43	0.5	A	150
WBLT	11.7	B	130				37.1	D	27	0.7	A	6	3.3	A	0	33.1	D	124
WBTH	5.5	B	552	30.4	D	1243	2.4	A	69	4.1	A	199	7.7	B	632	10.4	B	206
WBRT	0.8	A	1	7.1	B	31	0.7	A	1	1.8	A	9	3.4	A	7	8.2	B	21
NBLT										28.8	D	76	29.2	D	149	21.6	C	400
NBTH	23.1	C	17	40.4	E	68	28.2	D	64	26.1	D	20	23.8	C	30	21.5	C	428
NBRT	11.6	B	88	34.2	D	5	20.0	C	23							7.4	B	43
SBLT							27.3	D	50				24.3	C	57			
SBTH	24.9	C	53	74.2	F	192	29.2	D	51	26.7	D	33	23.8	C	45			
SBRT																		
Intersection	6.3	B	75 s.	25.1	D	150 s.	5.3	B	90 s.	3.9	A	90 s.	9.0	B	90 s.	13.2	B	90 s.

Optimized PM Delay and LOS by Intersection - Protected EB/WBLT except at Westsail, Baylake, Starfish, and West Great Neck

	Independence			Pleasure House			Westsail			Northampton SB			Northampton NB			Greenwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	21.9	C	163	36.1	D	134	0.7	A	0							26.9	D	118
EBTH	16.2	C	254	14.5	B	118	1.8	A	48	20.3	C	346				6.1	B	187
EBRT	16.0	C	366	9.4	B	24	1.5	A	21	10.0	B	32				3.8	A	26
WBLT	36.4	D	114	41.9	E	131	2.7	A	22	33.3	D	497				29.0	D	91
WBTH	8.8	B	90	7.5	B	106	1.7	A	144	1.8	A	50				4.8	A	123
WBRT	1.2	A	10	7.0	B	87	0.7	A	10							3.6	A	18
NBLT	33.9	D	142	11.5	B	35												
NBTH	29.9	D	135	15.1	C	254	21.7	C	57							24.6	C	98
NBRT	17.0	C	72	6.4	B	79	11.9	B	100							13.9	B	40
SBLT	28.5	D	170	31.0	D	98												
SBTH	33.0	D	186	12.1	B	98	19.7	C	14	25.4	D	39				21.8	C	41
SBRT	10.2	B	92	4.8	A	20	12.7	B	24	24.4	C	29				12.8	B	50
Intersection	21.3	C	80 s.	15.5	C	80 s.	4.3	A	80 s.	18.7	C	80 s.				8.0	B	80 s.

	Baylake/First Court			Shady Oaks/Marlin Bay			Page/Vista			Starfish[1]			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	0.6	A	1	29.9	D	134	43.2	E	148	0.9	A	7	2.0	A	98	46.3	E	27
EBTH	71.6	F	926	7.5	B	180	16.5	C	1093	3.5	A	210	5.7	B	478	20.2	C	493
EBRT				1.0	A	5	2.8	A	45	1.5	A	17	2.6	A	33	1.5	A	615
WBLT	23.6	C	119				53.1	E	116	1.3	A	17	4.9	A	54	46.1	E	171
WBTH	2.1	A	70	12.5	B	329	2.4	A	182	4.2	A	242	5.1	B	422	10.6	B	171
WBRT	1.6	A	4	7.0	B	41	2.1	A	14	3.1	A	11	1.9	A	14			
NBLT										42.5	E	121	38.9	D	203	32.1	D	565
NBTH	20.0	C	27	25.0	C	36	65.2	F	67	38.7	D	48	33.7	D	82	32.0	D	563
NBRT	123.7	F	509	22.0	C	13	34.8	D	54							12.7	B	141
SBLT							43.2	E	63				34.9	D	118			
SBTH	20.1	C	25	43.1	E	77	44.4	E	59	42.0	E	64	32.5	D	58			
SBRT																		
Intersection	53.9	E	80 s.	11.4	B	80 s.	14.5	B	130 s.	5.5	B	130 s.	8.0	B	130 s.	18.3	C	130 s.

* - v/c ratio for this movement is greater than 1.20
Queue = Length of the 95th percentile queue
1 - exclusive pedestrian phase removed

TABLE B-6
Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 6

Optimized AM Delay and LOS by Intersection - Free-flow NBRT at First Court

	Independence			Pleasure House			Westcott			Northampton SB			Northampton NB			Greenwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	27.1	D	116	25.3	D	35	1.1	A	2							70.3	F	62
EBTH	19.2	C	118	7.8	B	43	2.4	A	28	57.7	E	363				1.8	A	48
EBRT	5.3	B	95	7.5	B	11	2.3	A	11	27.9	D	71				1.6	A	5
WBLT	24.6	C	99	27.2	D	159	0.2	A	7	44.0	E	1724				58.1	E	47
WBTH	20.7	C	120	6.0	B	116	0.3	A	138	0.1	A	81				4.2	A	838
WBRT	8.7	B	43	5.1	B	29	0.2	A	2							1.4	A	2
NBLT	19.6	C	180	15.9	C	21												
NBTH	21.2	C	181	13.8	B	53	21.5	C	57							50.7	E	79
NBRT	6.5	B	19	5.1	B	26	14.3	B	41							38.9	D	66
SBLT	24.0	C	60	14.6	B	80												
SBTH	24.7	C	69	19.7	C	261	20.9	C	9							49.3	E	77
SBRT	16.1	C	31	8.3	B	46	13.5	B	19	50.5	E	7				41.6	E	170
Intersection	18.9	C	75 s.	11.9	B	75 s.	2.7	A	75 s.	30.0	D	150 s.				7.7	B	150 s.

	Bayview/First Court			Shady Oaks/Marlin Bay			Page Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	1.0	A	1	66.8	F	62	28.8	D	36	0.6	A	21	2.0	A	17	37.4	D	11
EBTH	3.9	A	65	2.6	A	105	5.2	B	176	1.1	A	42	7.0	B	262	15.6	C	161
EBRT				2.3	A	2	3.4	A	8	0.5	A	4	5.1	B	42	0.5	A	144
WBLT	12.1	B	130				38.2	D	27	0.6	A	7	3.5	A	0	33.1	D	124
WBTH	5.6	B	571	30.4	D	1243	2.4	A	69	3.7	A	210	8.0	B	641	10.4	B	206
WBRT	1.1	A	1	7.1	B	31	0.7	A	1	1.8	A	9	3.6	A	9	8.2	B	21
NBLT										28.8	D	76	29.2	D	149	21.6	C	400
NBTH	23.1	C	17	40.4	E	68	28.2	D	64	26.1	D	20	23.8	C	30	21.5	C	428
NBRT	0.0	A	0	34.2	D	5	20.0	C	23							7.4	B	43
SBLT							27.3	D	50				24.3	C	57			
SBTH	24.9	C	53	74.2	F	192	29.2	D	51	26.7	D	33	23.8	C	45			
SBRT																		
Intersection	5.8	B	75 s.	25.2	D	150 s.	5.3	B	90 s.	3.7	A	90 s.	9.2	B	90 s.	13.2	B	90 s.

Optimized PM Delay and LOS by Intersection - Free-flow NBRT at First Court

	Independence			Pleasure House			Westcott			Northampton SB			Northampton NB			Greenwell		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	25.8	D	184	37.0	D	146	0.7	A	0							32.0	D	129
EBTH	17.2	C	278	16.7	C	141	1.8	A	44	18.0	C	386				6.4	B	187
EBRT	14.0	B	377	11.0	B	28	1.6	A	22	9.4	B	31				3.9	A	25
WBLT	51.7	E	135	38.9	D	146	4.0	A	36	27.9	D	519				26.9	D	100
WBTH	6.7	B	34	8.8	B	95	8.3	B	168	1.7	A	57				6.4	B	180
WBRT	1.0	A	8	8.4	B	77	5.7	B	12							5.1	B	18
NBLT	31.6	D	155	12.5	B	37												
NBTH	31.6	D	149	16.1	C	276	23.6	C	62							26.0	D	106
NBRT	19.6	C	81	6.7	B	84	14.1	B	113							14.8	B	43
SBLT	29.2	D	185	28.9	D	103												
SBTH	36.0	D	207	13.1	B	106	21.6	C	15	29.7	D	44				23.6	C	45
SBRT	12.3	B	106	4.5	A	20	14.6	B	27	28.2	D	32				13.8	B	54
Intersection	22.1	C	90 s.	16.6	C	90 s.	6.6	B	90 s.	16.4	C	90 s.				8.8	B	90 s.

	Bayview/First Court			Shady Oaks/Marlin Bay			Page Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	0.0	A	0	30.7	D	133	43.2	E	148	1.0	A	9	1.9	A	98	46.3	E	27
EBTH	11.8	B	883	8.2	B	81	16.5	C	1093	3.7	A	210	5.8	B	486	20.2	C	494
EBRT				0.4	A	2	2.8	A	45	1.7	A	20	2.5	A	31	1.5	A	604
WBLT	29.0	D	146				53.8	E	117	1.1	A	18	4.9	A	55	46.1	E	171
WBTH	0.7	A	57	13.8	B	370	2.4	A	165	4.1	A	242	4.8	A	435	10.6	B	171
WBRT	0.5	A	3	7.8	B	46	2.1	A	13	2.9	A	12	1.9	A	14			
NBLT										42.5	E	121	38.9	D	203	32.1	D	565
NBTH	29.8	D	34	27.2	D	39	65.2	F	67	38.8	D	48	33.7	D	82	32.0	D	563
NBRT	0.1	A	0	24.5	C	14	34.8	D	54							12.7	B	141
SBLT							43.2	E	63				34.9	D	118			
SBTH	30.2	D	32	42.3	E	84	44.4	E	59	42.0	E	64	32.5	D	58			
SBRT																		
Intersection	8.2	B	90 s.	11.1	B	90 s.	14.5	B	130 s.	5.6	B	130 s.	7.8	B	130 s.	18.3	C	130 s.

* - v/c ratio for this movement is greater than 1.20

Queue = Length of the 95th percentile queue

1 - exclusive pedestrian phase removed

Shore Drive

APPENDIX C

2020 Peak Hour Level of Service Results

Projected Conditions and Alternatives Analysis

TABLE C-1
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 1

Alternative 1 (No Build) - 2020 AM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SE			Greenwell			Baylake/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	30.3	D	62	33.2	D	21				41.3	E	72	48.3	E	17
EBTH	38.5	D	264	7.2	B	89	1.1	A	14	20.1	C	207	9.0	B	203	9.2	B	376
EBRT	7.0	B	202	6.6	B	22	1.1	A	5	10.5	B	46	5.5	B	16			
WBLT	50.7	E	192	33.1	D	178	20.9	C	35	688.3	F	1566	53.9	E	50	41.2	E	268
WBTH	31.9	D	354	9.8	B	214	3.1	A	190	0.1	A	31	5.6	B	261	2.1	A	931
WBRT	20.4	C	140	8.1	B	52	2.5	A	3				1.4	A	2	0.4	A	1
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				61.8	F	88	45.5	E	31
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				41.1	E	73	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				58.3	E	86	48.1	E	99
SBRT	37.0	D	81	7.6	B	50	13.5	B	21	35.3	D	7	47.6	E	194			
Intersection	36.1	D	150 s.	13.8	B	75 s.	4.6	A	75 s.	298.4	F	150 s.	10.9	B	150 s.	8.3	B	150 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	85.4	F	63	43.6	E	13	44.1	E	57	46.8	E	78	44.9	E	60	36.4	D	22
EBTH	6.1	B	757	1.1	A	206	5.7	B	268	7.5	B	198	5.1	B	348	23.0	C	199
EBRT	3.4	A	5				3.2	A	10	3.0	A	16	2.3	A	39	1.4	A	216
WBLT	50.5	E	7	44.5	E	11	42.1	E	36	49.8	E	48	32.9	D	48	42.8	E	167
WBTH	47.4	E	1434	2.6	A	172	6.9	B	271	4.2	A	140	12.6	B	629	16.3	C	322
WBRT	7.7	B	35	0.4	A	1	3.5	A	3	2.3	A	6	4.9	A	11	12.6	B	34
NBLT				43.7	E	22				40.2	E	108	40.5	E	218	22.9	C	554
NBTH	40.7	E	73	43.6	E	13	42.0	E	92	35.9	D	26	33.4	D	44	22.8	C	575
NBRT	26.2	D	5				31.7	D	34							8.7	B	56
SBLT				43.8	E	26	39.5	D	71				34.1	D	80			
SBTH	85.6	F	209	44.1	E	40	42.2	E	75	36.8	D	46	33.3	D	63	43.3	E	7
SBRT																		
Intersection	35.9	D	150 s.	2.5	A	130 s.	8.9	B	130 s.	7.8	B	130 s.	12.2	B	130 s.	16.5	C	130 s.

Queue = Length of 95th percentile queue

Alternative 1 (No Build) - 2020 PM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SE			Greenwell			Baylake/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	42.6	E	178	30.9	D	36				50.7	E	225	39.3	D	23
EBTH	31.0	D	538	20.3	C	267	4.3	A	142	77.7	F	537	10.2	B	345	70.0	F	817
EBRT	58.7	E	1067	7.6	B	37	2.9	A	54	16.5	C	66	4.1	A	37			
WBLT	102.8	F	236	40.9	E	137	23.0	C	86	179.7	F	1014	43.3	E	145	148.8	F	316
WBTH	21.2	C	193	17.6	C	154	1.6	A	98	5.0	A	169	8.1	B	340	1.2	A	3
WBRT	13.0	B	102	16.2	C	120	1.4	A	6				6.6	B	43	0.1	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13	33.3	D	69	39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22	32.4	D	49	23.3	C	87			
Intersection	49.5	E	140 s.	21.7	C	70 s.	6.2	B	70 s.	85.0	F	140 s.	13.5	B	140 s.	46.4	E	140 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.6	E	237	47.9	E	45	49.4	E	201	50.3	E	88	57.6	E	115	54.9	E	33
EBTH	315.1	F	2177	122.3	F	2173	86.7	F	722	9.7	B	221	15.0	B	981	26.4	D	638
EBRT	1.5	A	14	0.5	A	9	2.4	A	49	2.1	A	30	2.9	A	40	6.6	B	670
WBLT	46.7	E	14	44.0	E	34	68.5	F	147	41.8	E	70	64.0	F	113	57.3	E	197
WBTH	22.2	C	680	3.2	A	160	2.7	A	169	4.6	A	291	7.4	B	448	15.2	C	198
WBRT	12.6	B	82	2.3	A	4	1.5	A	5	2.9	A	11	2.3	A	17			
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	7
SBRT																		
Intersection	204.7	F	140 s.	83.4	F	140 s.	58.4	E	140 s.	11.2	B	140 s.	15.9	C	140 s.	25.1	D	140 s.

TABLE C-2
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 2

Alternative 2 - 4 lane/45 mph/SPUI - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SPUI			Greenwell			Bayleaf/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	28.9	D	61	19.3	C	18	52.8	E	24	60.3	F	65	48.0	E	17
EBTH	38.5	D	264	7.2	B	108	4.7	A	82	19.6	C	315	4.9	A	280	9.2	B	226
EBRT	7.0	B	202	6.7	B	26	4.4	A	30				2.2	A	13			
WBLT	51.4	E	193	24.6	C	186	18.7	C	51	18.0	C	686	55.4	E	50	40.6	E	266
WBTH	30.1	D	334	13.8	B	184	2.5	A	179	2.9	A	301	5.3	B	261	2.0	A	1121
WBRT	20.6	C	134	10.7	B	31	2.0	A	3				1.2	A	2	0.4	A	1
NBLT	39.7	D	488	16.2	C	24				45.2	E	33						
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				61.8	F	88	45.5	E	31
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				41.1	E	73	0.0	A	0
SBLT	66.7	F	142	13.9	B	91				44.8	E	8						
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				58.3	E	86	48.1	E	99
SBRT	37.0	D	81	7.6	B	50	13.5	B	21				47.6	E	194			
Intersection	35.9	D	150 s.	14.2	B	75 s.	5.5	B	75 s.	13.1	B	150 s.	9.6	B	150 s.	8.2	B	150 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Viola			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	62.6	F	62	43.6	E	13	44.1	E	57	46.8	E	78	44.9	E	60	36.4	D	22
EBTH	5.5	B	702	1.1	A	206	5.7	B	268	7.5	B	198	5.1	B	348	23.0	C	199
EBRT	3.4	A	5				3.2	A	10	3.0	A	16	2.3	A	39	1.4	A	216
WBLT	50.5	E	7	44.5	E	11	42.1	E	36	49.8	E	48	32.9	D	48	42.8	E	167
WBTH	47.4	E	1434	2.6	A	172	6.9	B	271	4.2	A	140	12.6	B	629	16.3	C	322
WBRT	7.7	B	35	0.4	A	1	3.5	A	3	2.3	A	6	4.9	A	11	12.6	B	34
NBLT				43.7	E	22				40.2	E	108	40.5	E	218	22.9	C	554
NBTH	40.7	E	73	43.6	E	13	42.0	E	92	35.9	D	26	33.4	D	44	22.8	C	575
NBRT	26.2	D	5				31.7	D	34							8.7	B	56
SBLT				43.8	E	26	39.5	D	71				34.1	D	80			
SBTH	85.6	F	209	44.1	E	40	42.2	E	75	36.8	D	46	33.3	D	63	43.3	E	7
SBRT																		
Intersection	35.7	D	150 s.	2.5	A	130 s.	8.9	B	130 s.	7.8	B	130 s.	12.2	B	130 s.	16.5	C	130 s.

Queue = Length of the 95th percentile queue

Alternative 2 - 4 lane/45 mph/SPUI - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SPUI			Greenwell			Bayleaf/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	42.6	E	178	31.6	D	36	61.8	F	21	45.4	E	224	51.4	E	24
EBTH	31.0	D	538	21.0	C	267	4.2	A	168	22.3	C	448	10.1	B	491	62.1	F	832
EBRT	58.7	E	1067	7.6	B	37	2.8	A	63				4.9	A	52			
WBLT	100.8	F	237	39.4	D	158	16.4	C	83	45.0	E	377	53.0	E	152	123.4	F	290
WBTH	25.6	D	177	11.4	B	185	2.1	A	148	3.8	A	133	4.8	A	342	3.6	A	488
WBRT	13.7	B	85	10.7	B	144	1.8	A	9				4.1	A	44	1.3	A	10
NBLT	84.8	F	366	11.8	B	40				42.0	E	65						
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115				43.9	E	88						
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	49.8	E	140 s.	20.6	C	70 s.	8.0	B	70 s.	24.7	C	140 s.	12.7	B	140 s.	41.7	E	140 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Viola			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	49.6	E	268	47.9	E	45	49.4	E	201	50.3	E	88	57.6	E	115	53.4	E	32
EBTH	336.2	F	1268	122.3	F	2173	86.7	F	722	9.7	B	221	15.0	B	981	26.8	D	643
EBRT	4.2	A	25	0.5	A	9	2.4	A	49	2.1	A	30	2.9	A	40	6.6	B	659
WBLT	46.7	E	14	44.0	E	34	68.5	F	147	43.1	E	70	64.2	F	113	57.3	E	197
WBTH	23.1	C	680	3.2	A	160	2.7	A	169	4.4	A	291	7.8	B	496	15.6	C	200
WBRT	13.2	B	82	2.3	A	4	1.5	A	5	2.7	A	11	2.3	A	16	9.5	B	7
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	6
SBRT																		
Intersection	218.3	F	140 s.	83.4	F	140 s.	58.4	E	140 s.	11.1	B	140 s.	16.0	C	140 s.	25.2	D	140 s.

TABLE C-3
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 3

Alternative 3 - 4 lane/35 mph/SPUI - AM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SPUI			Greenwell					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	70.7	F	272	67.0	F	62	26.2	D	23	38.4	D	24	64.0	F	62	41.5	E	17
EBTH	37.4	D	253	5.0	B	253	4.4	A	109	18.9	C	315	2.9	A	288	11.5	B	209
EBRT	6.8	B	194	2.5	A	45	3.6	A	40				1.6	A	10			
WBLT	40.1	E	130	38.2	D	314	18.5	C	48	18.6	C	686	36.2	D	43	38.3	D	250
WBTH	34.0	D	425	11.2	B	317	3.5	A	205	0.5	A	301	12.7	B	662	1.9	A	902
WBRT	19.4	C	109	8.4	B	72	2.8	A	3				4.1	A	3	0.4	A	1
NBLT	36.7	D	455	19.5	C	33				41.4	E	33						
NBTH	33.9	D	433	14.8	B	77	19.8	C	60				54.4	E	83	43.0	E	30
NBRT	6.9	B	27	8.5	B	30	12.7	B	42				37.2	D	69	0.0	A	0
SBLT	58.5	E	129	15.9	C	121				41.0	E	8						
SBTH	59.3	E	186	19.8	C	420	19.0	C	9				51.8	E	80	45.8	E	94
SBRT	35.0	D	76	15.4	C	75	11.8	B	19				42.3	E	180			
Intersection	34.7	D	140 s.	15.2	C	140 s.	5.7	B	70 s.	12.3	B	140 s.	12.8	B	140 s.	8.7	B	140 s.

	Shady Oaks/Martin Bay			East Shadford			Page/Vista			Starrish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	68.4	F	68	32.2	D	11	33.0	D	51	44.9	E	65	35.9	D	47	31.7	D	15
EBTH	0.8	A	40	0.2	A	215	5.5	B	61	2.2	A	82	8.7	B	414	13.2	B	200
EBRT	0.4	A	1				3.1	A	4	1.0	A	7	3.6	A	23	1.4	A	460
WBLT	46.7	E	6	35.0	D	9	36.2	D	30	42.0	E	37	38.1	D	32	35.5	D	135
WBTH	44.3	E	1344	3.7	A	116	4.4	A	144	6.5	B	414	9.7	B	794	14.6	B	263
WBRT	7.0	B	33	0.0	A	1	1.5	A	2	0.8	A	3	2.3	A	30	10.4	B	26
NBLT				32.2	D	18				32.6	D	89	37.0	D	199	22.0	C	474
NBTH	39.8	D	70	32.2	D	11	34.4	D	78	28.5	D	22	27.1	D	36	21.9	C	492
NBRT	25.1	D	4				23.7	C	27							6.8	B	46
SBLT				32.3	D	21	31.4	D	59				27.8	D	67			
SBTH	99.6	F	200	32.5	D	32	35.2	D	62	29.3	D	38	27.1	D	53	31.9	D	5
SBRT																		
Intersection	33.4	D	140 s.	2.7	A	100 s.	6.9	B	100 s.	6.3	B	100 s.	11.5	B	100 s.	14.2	B	100 s.

Queue = Length of the 95th percentile queue

Alternative 3 - 4 lane/35 mph/SPUI - PM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SPUI			Greenwell					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	38.7	D	169	29.5	D	36	56.3	E	22	47.7	E	224	59.9	E	24
EBTH	31.0	D	538	22.0	C	116	4.0	A	108	21.7	C	459	10.0	B	397	63.6	F	1837
EBRT	58.7	E	1067	6.1	B	33	2.9	A	41				4.7	A	42			
WBLT	129.5	F	240	41.9	E	102	16.9	C	81	55.2	E	433	53.7	E	133	161.2	F	329
WBTH	29.8	D	311	8.8	B	146	6.0	B	198	0.3	A	99	21.4	C	689	0.1	A	0
WBRT	10.5	B	148	8.3	B	114	4.2	A	12				9.4	B	37	0.0	A	0
NBLT	84.8	F	366	11.8	B	40				42.0	E	65						
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115				43.9	E	88						
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	50.6	E	140 s.	20.3	C	70 s.	6.9	B	70 s.	26.3	D	140 s.	16.9	C	140 s.	42.9	E	140 s.

	Shady Oaks/Martin Bay			East Shadford			Page/Vista			Starrish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.6	E	237	47.9	E	45	49.4	E	201	39.3	D	81	57.6	E	115	58.6	E	32
EBTH	315.1	F	2177	122.3	F	2173	86.7	F	722	12.9	B	449	15.0	B	981	23.5	C	612
EBRT	1.5	A	14	0.5	A	9	2.4	A	49	3.2	A	50	2.9	A	40	6.6	B	714
WBLT	46.7	E	14	50.7	E	30	53.7	E	142	43.7	E	64	64.3	F	110	57.3	E	197
WBTH	22.2	C	680	5.9	A	477	4.6	A	225	8.8	B	329	10.1	B	622	15.6	C	200
WBRT	12.6	B	82	2.6	A	8	3.3	A	17	4.8	A	19	2.7	A	22	9.5	B	7
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	6
SBRT																		
Intersection	204.7	F	140 s.	84.3	F	140 s.	58.8	E	140 s.	14.2	B	140 s.	16.9	C	140 s.	24.5	C	140 s.

TABLE C-4
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 4

Alternative 4 - 6 lane/45 mph/SPUI - AM Delay and LOS by Intersection

Movement	Independence			Pleasure House			Westbury			Northampton SPUI			Greenwell			Skyview/First Court		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.5	F	259	65.3	F	59	26.1	D	21	34.2	D	21	36.3	D	65	40.1	E	15
EBTH	34.1	D	236	5.0	A	236	4.6	A	114	18.2	C	316	5.8	B	153	6.8	B	257
EBRT	6.2	B	182	2.2	A	49	3.3	A	42				3.7	A	14	5.8	B	6
WBLT	24.7	C	145	36.5	D	296	20.8	C	41	13.9	B	462	58.8	E	45	28.1	D	200
WBTH	34.4	D	461	10.3	B	242	3.3	A	302	0.2	A	57	1.6	A	10	0.3	A	95
WBRT	21.2	C	134	7.3	B	56	2.3	A	4				1.2	A	1	0.0	A	1
NBLT	36.2	D	428	19.3	C	31				37.6	D	29						
NBTH	32.7	D	405	14.2	B	71	17.8	C	56				40.2	E	74	38.6	D	27
NBRT	6.5	B	26	8.0	B	29	10.9	B	37				29.1	D	59	0.0	A	0
SBLT	57.8	E	127	15.3	C	113				37.2	D	7						
SBTH	56.5	E	177	19.1	C	391	17.2	C	8				39.4	D	72	40.7	E	88
SBRT	32.4	D	72	14.8	B	69	10.1	B	17				30.1	D	151			
Intersection	33.3	D	130 s.	14.5	B	130 s.	5.5	B	65 s.	10.0	B	130 s.	6.0	B	130 s.	5.3	B	130 s.

Movement	Shady Oaks/Marlin Bay			East Shoreline			Page/Vista			Stanton			West Great Neck			Great Neck		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	43.0	E	52	30.9	D	11	31.5	D	44	46.5	E	65	25.7	D	54	29.6	D	14
EBTH	2.5	A	314	0.1	A	135	6.1	B	182	1.8	A	33	6.3	B	137	12.0	B	133
EBRT	0.8	A	3				4.3	A	4	1.3	A	4	5.3	B	37	1.4	A	449
WBLT	42.9	E	6	84.4	F	10	35.4	D	28	30.2	D	38	32.1	D	33	35.5	D	135
WBTH	21.1	C	689	0.3	A	14	2.0	A	191	2.7	A	175	7.8	B	427	14.6	B	263
WBRT	10.3	B	42	0.0	A	1	1.2	A	1	2.0	A	10	3.9	A	34	10.4	B	26
NBLT				30.8	D	18				29.1	D	85	26.2	D	165	22.0	C	474
NBTH	26.0	D	57	30.9	D	11	29.3	D	72	26.6	D	21	22.7	C	33	21.9	C	492
NBRT	17.5	C	3				20.2	C	25							6.8	B	46
SBLT				30.9	D	21	28.5	D	56				23.2	C	61			
SBTH	34.2	D	162	31.1	D	31	29.9	D	59	27.3	D	36	22.7	C	49	31.9	D	5
SBRT																		
Intersection	16.0	C	130 s.	0.5	A	100 s.	5.4	B	100 s.	4.0	A	100 s.	8.9	B	100 s.	14.0	B	100 s.

Queue = Length of the 95th percentile queue

Alternative 4 - 6 lane/45 mph/SPUI - PM Delay and LOS by Intersection

Movement	Independence			Pleasure House			Westbury			Northampton SPUI			Greenwell			Skyview/First Court		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	42.6	E	178	24.6	C	35	54.6	E	19	42.9	E	224	48.0	E	24
EBTH	31.0	D	538	21.0	C	267	4.6	A	70	22.6	C	588	12.1	B	573	2.8	A	57
EBRT	58.7	E	1067	7.6	B	37	3.9	A	44				6.0	B	61	1.0	A	3
WBLT	98.6	F	236	54.0	E	142	14.4	B	60	30.3	D	281	42.1	E	147	31.1	D	175
WBTH	24.5	C	215	6.4	B	71	3.0	A	54	1.9	A	89	8.8	B	290	1.6	A	0
WBRT	15.5	C	127	5.7	B	55	2.3	A	6				7.4	B	48	0.2	A	0
NBLT	84.8	F	366	11.8	B	40				42.0	E	65						
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	48.3	E	52
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115				43.9	E	88						
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	49.9	E	47
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	49.7	E	140 s.	20.4	C	70 s.	6.3	B	70 s.	20.1	C	140 s.	14.5	B	140 s.	4.1	A	140 s.

Movement	Shady Oaks/Marlin Bay			East Shoreline			Page/Vista			Stanton			West Great Neck			Great Neck		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	42.4	E	225	47.9	E	45	46.7	E	193	24.8	C	52	25.6	D	62	41.3	E	33
EBTH	10.8	B	1192	3.8	A	687	11.6	B	401	4.3	A	494	10.4	B	108	24.0	C	659
EBRT	0.6	A	10	0.7	A	10	4.7	A	84	1.1	A	50	3.7	A	18	6.6	B	1218
WBLT	46.7	E	14	51.4	E	35	58.6	E	120	26.0	D	30	23.3	C	61	57.3	E	197
WBTH	16.0	C	388	0.9	A	47	2.7	A	206	0.1	A	106	6.8	B	59	15.6	C	200
WBRT	12.2	B	83	0.8	A	2	2.4	A	20	0.0	A	6	3.8	A	12	9.5	B	7
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	34.4	D	54	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	27.0	D	17				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	39.7	D	121	46.7	E	51	41.5	E	86	23.7	C	42	17.6	C	38	47.1	E	6
SBRT																		
Intersection	14.8	B	140 s.	3.9	A	140 s.	11.5	B	140 s.	4.1	A	70 s.	10.0	B	70 s.	24.5	C	140 s.

TABLE C-5
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 5

Alternative 5 - 6 lane/35 mph/SPUI - AM Delay and LOS by Intersection

	Independence			Pleasure House														
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	74.5	F	239	40.7	E	52	20.4	C	18	43.3	E	21	35.4	D	42	45.9	E	14
EBTH	30.8	D	204	11.9	B	64	6.8	B	115	19.2	C	214	7.2	B	277	7.6	B	324
EBRT	6.0	B	156	10.4	B	16	4.9	A	24				3.5	A	18	3.7	A	6
WBLT	40.0	D	149	19.4	C	156	13.4	B	37	17.2	C	655	37.3	D	39	43.0	E	270
WBTH	26.0	D	389	18.2	C	380	3.7	A	276	0.4	A	178	2.3	A	114	0.9	A	81
WBRT	13.1	B	35	12.5	B	45	2.3	A	5				1.5	A	0	0.4	A	1
NBLT	32.8	D	366	19.3	C	30				30.1	D	26						
NBTH	33.8	D	355	13.1	B	65	14.6	B	48				33.4	D	64	32.3	D	24
NBRT	6.1	B	24	5.8	B	26	8.4	B	30				22.9	C	50	0.0	A	0
SBLT	42.8	E	101	14.1	B	103				29.6	D	6						
SBTH	51.2	E	159	17.8	C	353	14.1	B	7				32.7	D	82	34.1	D	77
SBRT	27.9	D	63	12.7	B	61	7.8	B	14				24.1	C	128			
Intersection	31.1	D	110 s.	16.0	C	110 s.	5.9	B	55 s.	11.7	B	110 s.	6.2	B	110 s.	6.9	B	110 s.

	Shady Oaks/Marlin Bay																	
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	47.0	E	56	27.1	D	10	27.5	D	46	28.7	D	57	29.4	D	45	40.4	E	12
EBTH	0.9	A	59	0.1	A	136	6.5	B	90	2.5	A	114	3.6	A	101	7.8	B	124
EBRT	0.6	A	1				4.7	A	9	1.6	A	14	3.0	A	16	1.4	A	744
WBLT	35.3	D	5	69.2	F	9	40.4	E	30	32.4	D	35	33.1	D	30	34.8	D	137
WBTH	21.4	C	604	0.5	A	51	2.0	A	59	4.6	A	139	4.5	A	500	12.6	B	239
WBRT	10.1	B	38	0.0	A	1	1.2	A	1	1.4	A	2	2.7	A	31	8.6	B	22
NBLT				27.1	D	17				25.5	D	78	22.4	C	147	24.3	C	498
NBTH	22.8	C	50	27.1	D	10	25.1	D	65	23.5	C	19	19.6	C	30	24.2	C	518
NBRT	13.7	B	3				16.8	C	22							7.1	B	46
SBLT				27.2	D	19	24.6	C	51				20.0	C	55			
SBTH	32.0	D	142	27.3	D	29	25.7	D	52	24.1	C	33	19.6	C	44	28.1	D	5
SBRT																		
Intersection	15.5	C	110 s.	0.6	A	90 s.	5.4	B	90 s.	5.0	A	90 s.	6.0	B	90 s.	13.7	B	90 s.

Queue = Length of the 95th percentile queue

Alternative 5 - 6 lane/35 mph/SPUI - PM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SPUI			Greenwell					
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	36.8	D	316	50.1	E	160	21.4	C	33	53.7	E	19	49.3	E	212	51.7	E	24
EBTH	28.2	D	497	14.6	B	102	5.7	B	91	20.9	C	432	12.0	B	626	2.6	A	43
EBRT	52.8	E	993	4.5	A	28	4.9	A	57				3.8	A	35	0.8	A	2
WBLT	125.9	F	167	61.1	F	161	9.9	B	40	43.4	E	394	47.3	E	127	60.9	F	237
WBTH	25.5	D	274	3.8	A	107	3.7	A	249	1.6	A	70	13.2	B	367	0.0	A	3
WBRT	7.1	B	95	3.5	A	84	2.1	A	9				7.7	B	28	0.0	A	0
NBLT	81.8	F	345	12.2	B	39				38.2	D	61						
NBTH	43.9	E	292	23.3	C	346	17.6	C	55				45.1	E	166	45.3	E	49
NBRT	27.0	D	123	7.2	B	92	8.9	B	86				25.9	D	69	0.1	A	0
SBLT	43.0	E	297	55.7	E	107				39.7	D	83						
SBTH	88.9	F	466	12.8	B	110	15.4	C	12				37.0	D	67	47.0	E	45
SBRT	15.2	C	194	5.9	B	24	9.7	B	21				21.8	C	82			
Intersection	50.5	E	130 s.	18.6	C	65 s.	6.6	B	65 s.	22.9	C	130 s.	15.7	C	130 s.	4.5	A	130 s.

	Shady Oaks/Marlin Bay															Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	42.6	E	209	47.9	E	45	45.4	E	182	24.5	C	52	24.0	C	69	38.0	D	34
EBTH	21.7	C	1138	3.8	A	687	12.1	B	565	4.2	A	479	11.4	B	122	25.0	D	657
EBRT	0.6	A	7	0.7	A	10	3.1	A	29	1.1	A	50	4.1	A	11	6.6	B	1161
WBLT	42.9	E	13	65.4	F	33	56.7	E	111	24.7	C	36	25.1	D	66	57.3	E	197
WBTH	15.8	C	380	2.9	A	173	5.6	B	234	0.9	A	44	8.0	B	151	15.6	C	200
WBRT	12.0	B	83	0.6	A	1	3.5	A	16	0.7	A	6	5.2	B	32	9.5	B	7
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	30.4	D	50	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	24.4	C	15				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	34.7	D	111	46.7	E	51	41.5	E	66	23.7	C	42	17.6	C	38	47.1	E	6
SBRT																		
Intersection	21.2	C	130 s.	4.5	A	140 s.	12.5	B	140 s.	4.3	A	70 s.	10.9	B	70 s.	24.7	C	140 s.

TABLE C-6
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 6

Alternative 6 - 4 lane/45 mph/Dual left - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SB			Greenwell			Baytide/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	31.0	D	62	15.2	C	18				60.0	F	74	46.2	E	17
EBTH	38.5	D	264	7.4	B	80	7.1	B	151	17.6	C	234	4.9	A	291	10.3	B	235
EBRT	7.0	B	202	6.6	B	19	6.4	B	55	11.7	B	42	2.2	A	19			
WBLT	49.4	E	192	24.0	C	96	22.2	C	35	19.4	C	730	58.2	E	50	40.3	E	266
WBTH	33.2	D	365	12.5	B	202	2.2	A	192	0.1	A	52	5.3	B	209	2.0	A	1179
WBRT	21.2	C	148	9.4	B	20	1.8	A	3				1.2	A	2	0.4	A	1
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				61.8	F	88	45.5	E	31
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				41.1	E	73	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				58.3	E	86	48.1	E	99
SBRT	37.0	D	81	7.6	B	50	13.5	B	21	35.3	D	7	47.6	E	194			
Intersection	36.3	D	150 s.	13.8	B	75 s.	6.3	B	75 s.	12.0	B	150 s.	9.7	B	150 s.	8.6	B	150 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	58.2	E	62	43.6	E	13	44.1	E	57	47.6	E	79	44.5	E	60	36.4	D	22
EBTH	5.8	B	558	1.1	A	206	5.7	B	268	7.1	B	185	4.8	A	348	22.9	C	199
EBRT	3.1	A	5				3.2	A	10	3.0	A	15	2.0	A	39	1.4	A	216
WBLT	50.5	E	7	44.5	E	11	41.8	E	36	49.8	E	48	32.9	D	48	42.7	E	167
WBTH	47.4	E	1434	2.6	A	172	7.1	B	282	4.2	A	140	12.6	B	629	16.3	C	322
WBRT	7.7	B	35	0.4	A	1	3.6	A	3	2.3	A	6	4.9	A	11	12.6	B	34
NBLT				43.7	E	22				40.2	E	108	40.5	E	218	22.9	C	554
NBTH	40.7	E	73	43.6	E	13	42.0	E	92	35.9	D	26	33.4	D	44	22.8	C	575
NBRT	26.2	D	5				31.7	D	34							8.7	B	56
SBLT				43.8	E	26	39.5	D	71				34.1	D	80			
SBTH	85.6	F	209	44.1	E	40	42.2	E	75	36.8	D	46	33.3	D	63	43.3	E	7
SBRT																		
Intersection	35.7	D	150 s.	2.5	A	130 s.	9.0	B	130 s.	7.7	B	130 s.	12.1	B	130 s.	16.4	C	130 s.

Queue = Length of the 95th percentile queue

Alternative 6 - 4 lane/45 mph/Dual left - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SB			Greenwell			Baytide/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	42.6	E	178	33.1	D	36				52.6	E	224	45.1	E	23
EBTH	31.0	D	538	20.3	C	267	5.6	B	228	18.2	C	427	12.4	B	735	68.1	F	1830
EBRT	58.7	E	1067	7.6	B	37	3.5	A	86	10.2	B	57	4.1	A	37			
WBLT	102.8	F	236	36.1	D	158	26.5	D	76	29.0	D	410	40.0	E	147	148.8	F	316
WBTH	21.5	C	178	18.4	C	185	1.4	A	124	3.0	A	65	11.6	B	438	1.2	A	3
WBRT	13.3	B	100	17.1	C	144	1.2	A	9				9.0	B	54	0.1	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13	33.3	D	69	39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22	32.4	D	49	23.3	C	87			
Intersection	49.5	E	140 s.	21.6	C	70 s.	6.9	B	70 s.	17.5	C	140 s.	15.7	C	140 s.	45.3	E	140 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.6	E	268	47.9	E	45	49.4	E	201	50.3	E	88	57.6	E	115	54.9	E	33
EBTH	315.1	F	1268	122.3	F	2173	86.7	F	722	9.7	B	221	15.0	B	981	26.4	D	638
EBRT	1.5	A	25	0.5	A	9	2.4	A	49	2.1	A	30	2.9	A	40	6.6	B	670
WBLT	46.7	E	14	44.0	E	34	68.5	F	147	41.8	E	70	64.0	F	113	57.3	E	197
WBTH	22.2	C	680	3.2	A	160	2.7	A	169	4.6	A	291	7.4	B	448	15.2	C	198
WBRT	12.6	B	82	2.3	A	4	1.5	A	5	2.9	A	11	2.3	A	17			
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	7
SBRT																		
Intersection	204.7	F	140 s.	83.4	F	140 s.	58.4	E	140 s.	11.2	B	140 s.	15.9	C	140 s.	25.1	D	140 s.

TABLE C-7
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 7

Alternative 7 - 4 lane/35 mph/Dual left - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SB			Greenwell			Bayswater Int Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	14.7	B	41	19.4	C	25				61.6	F	74	40.9	E	16
EBTH	36.6	D	264	16.5	C	252	4.9	A	70	9.6	B	166	1.6	A	58	21.6	C	363
EBRT	6.1	B	202	12.7	B	46	4.7	A	26	5.4	B	43	1.4	A	5			
WBLT	41.6	E	184	26.5	D	172	22.5	C	36	22.2	C	730	51.5	E	49	40.6	E	266
WBTH	38.6	D	505	6.1	B	155	1.7	A	192	0.1	A	98	5.4	B	339	2.0	A	1121
WBRT	26.8	D	127	5.1	B	38	1.3	A	3				1.1	A	3	0.4	A	1
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				61.8	F	88	45.5	E	31
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				41.1	E	73	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				58.3	E	86	48.1	E	99
SBRT	37.0	D	81	7.6	B	50	13.5	B	21	35.3	D	7	47.6	E	194			
Intersection	36.8	D	150 s.	13.5	B	75 s.	5.3	B	75 s.	11.6	B	150 s.	8.6	B	150 s.	12.3	B	150 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	69.5	F	71	32.2	D	11	33.0	D	51	44.9	E	65	35.9	D	47	31.7	D	15
EBTH	1.1	A	37	0.2	A	215	5.5	B	81	2.2	A	82	8.7	B	414	13.2	B	200
EBRT	0.5	A	1				3.1	A	4	1.0	A	7	3.6	A	23	1.4	A	460
WBLT	50.5	E	7	35.0	D	9	36.2	D	30	42.0	E	37	38.1	D	32	35.5	D	135
WBTH	47.4	E	1434	3.7	A	116	4.4	A	144	6.5	B	414	9.7	B	794	14.6	B	263
WBRT	7.7	B	35	0.0	A	1	1.5	A	2	0.8	A	3	2.3	A	30	10.4	B	26
NBLT				32.2	D	18				32.6	D	89	37.0	D	199	22.0	C	474
NBTH	40.7	E	73	32.2	D	11	34.4	D	78	28.5	D	22	27.1	D	36	21.9	C	492
NBRT	26.2	D	5				23.7	C	27							6.8	B	46
SBLT				32.3	D	21	31.4	D	59				27.8	D	67			
SBTH	85.6	F	209	32.5	D	32	35.2	D	62	29.3	D	38	27.1	D	53	31.9	D	5
SBRT																		
Intersection	34.3	D	150 s.	2.7	A	100 s.	6.9	B	100 s.	6.3	B	100 s.	11.5	B	100 s.	14.2	B	100 s.

*Queue = Length of the 95th percentile queue

Alternative 7 - 4 lane/35 mph/Dual left - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westcott			Northampton SB			Greenwell			Bayswater Int Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	37.7	D	167	24.7	C	35				52.7	E	224	61.2	F	24
EBTH	31.1	D	538	22.7	C	226	4.7	A	70	18.2	C	383	12.5	B	858	64.9	F	1837
EBRT	58.7	E	1067	5.9	B	33	4.0	A	44	10.7	B	57	4.1	A	37			
WBLT	116.7	F	240	50.6	E	126	14.9	B	86	36.9	D	387	54.6	E	133	161.2	F	329
WBTH	42.7	E	310	5.8	B	81	5.1	B	203	4.0	A	192	21.1	C	688	0.1	A	0
WBRT	10.5	B	151	5.1	B	63	4.0	A	13				9.1	B	36	0.0	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13	33.3	D	69	39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22	32.4	D	49	23.3	C	87			
Intersection	51.5	E	140 s.	20.3	C	70 s.	6.9	B	70 s.	19.9	C	140 s.	18.4	C	140 s.	43.6	E	140 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.6	E	237	47.9	E	45	49.4	E	201	39.5	D	81	57.6	E	115	58.5	E	33
EBTH	315.1	F	2177	122.3	F	2173	86.7	F	722	13.1	B	461	15.0	B	981	23.2	C	660
EBRT	1.5	A	14	0.5	A	9	2.4	A	49	3.2	A	49	2.9	A	40	6.6	B	714
WBLT	46.7	E	14	50.9	E	30	53.8	E	141	41.0	E	64	66.7	F	114	57.3	E	197
WBTH	22.2	C	680	5.7	B	465	4.8	A	233	9.0	B	326	8.7	B	482	15.2	C	198
WBRT	12.6	B	82	2.5	A	8	3.4	A	17	4.9	A	21	2.4	A	18			
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	7
SBRT																		
Intersection	204.7	F	140 s.	84.2	F	140 s.	58.8	E	140 s.	14.4	B	140 s.	16.4	C	140 s.	24.3	C	140 s.

TABLE C-8
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 8

Alternative 8 - 6 lane/45 mph/Dual left - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayshore/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	56.2	F	275	31.7	D	62	14.8	B	18				20.8	C	40	33.0	D	9
EBTH	38.5	D	264	7.7	B	72	7.4	B	157	17.2	C	221	2.6	A	180	9.8	B	36
EBRT	7.0	B	202	6.7	B	17	6.7	B	57	11.7	B	38	1.3	A	11	4.9	A	5
WBLT	45.2	E	192	22.5	C	109	24.0	C	29	19.5	C	839	30.4	D	29	19.3	C	280
WBTH	34.1	D	375	11.5	B	165	0.6	A	171	0.2	A	3	6.0	B	118	1.2	A	308
WBRT	24.2	C	148	8.0	B	16	0.3	A	2				2.7	A	2	0.8	A	2
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				24.0	C	48	22.4	C	18
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				14.8	B	36	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				23.4	C	47	24.1	C	57
SBRT	37.0	D	81	7.6	B	50	13.5	B	21	35.3	D	7	16.0	C	92			
Intersection	36.4	D	150 s.	13.3	B	75 s.	5.7	B	75 s.	12.0	B	150 s.	6.2	B	75 s.	5.8	B	75 s.

	Shady Oaks/Marlin Bay			East Shoreline			Pagoda Vista			Starlish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	59.8	E	71	30.9	D	11	31.5	D	44	46.5	E	65	25.7	D	54	29.6	D	14
EBTH	8.4	B	212	0.1	A	135	6.1	B	182	1.8	A	33	6.3	B	137	12.0	B	133
EBRT	6.7	B	7				4.3	A	4	1.3	A	4	5.3	B	37	1.4	A	449
WBLT	50.5	E	7	84.4	F	10	35.4	D	28	30.2	D	38	32.1	D	33	35.5	D	135
WBTH	20.7	C	774	0.3	A	14	2.0	A	191	2.7	A	175	7.8	B	427	14.6	B	263
WBRT	10.3	B	46	0.0	A	1	1.2	A	1	2.0	A	10	3.9	A	34	10.4	B	26
NBLT				30.8	D	18				29.1	D	85	26.2	D	165	22.0	C	474
NBTH	29.3	D	63	30.9	D	11	29.3	D	72	26.6	D	21	22.7	C	33	21.9	C	492
NBRT	22.0	C	4				20.2	C	25							6.8	B	46
SBLT				30.9	D	21	28.5	D	56				23.2	C	61			
SBTH	37.1	D	180	31.1	D	31	29.9	D	59	27.3	D	36	22.7	C	49	31.9	D	5
SBRT																		
Intersection	18.2	C	150 s.	0.5	A	100 s.	5.4	B	100 s.	4.0	A	100s.	8.9	B	100 s.	14.0	B	100 s.

Queue = Length of the 95th percentile queue

Alternative 8 - 6 lane/45 mph/Dual left - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayshore/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	42.6	E	178	32.4	D	36				52.7	E	224	45.8	E	24
EBTH	31.0	D	538	20.3	C	267	5.1	B	198	18.5	C	426	12.4	B	734	3.5	A	117
EBRT	58.7	E	1067	7.6	B	37	3.3	A	74	10.5	B	57	4.1	A	37	1.6	A	6
WBLT	103.3	F	236	37.5	D	103	26.7	D	89	29.9	D	412	43.0	E	148	31.2	D	175
WBTH	20.8	C	195	19.2	C	152	1.4	A	52	4.9	A	121	8.4	B	224	1.1	A	0
WBRT	12.6	B	108	17.9	C	119	1.3	A	4				7.2	B	38	0.1	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	48.3	E	52
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13	33.3	D	89	39.5	D	72	49.9	E	47
SBRT	15.4	C	201	5.2	B	22	9.9	B	22	32.4	D	49	23.3	C	87			
Intersection	49.4	E	140 s.	21.9	C	70 s.	6.7	B	70 s.	18.3	C	140 s.	14.9	B	140 s.	4.3	A	140 s.

	Shady Oaks/Marlin Bay			East Shoreline			Pagoda Vista			Starlish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	49.2	E	226	47.9	E	45	52.5	E	197	23.9	C	45	26.3	D	59	43.4	E	34
EBTH	10.6	B	895	3.8	A	687	11.7	B	315	5.0	A	578	10.6	B	138	23.2	C	659
EBRT	0.7	A	5	0.7	A	10	4.4	A	71	1.1	A	50	3.3	A	14	6.6	B	1170
WBLT	46.7	E	14	50.5	E	34	55.7	E	119	30.1	D	30	26.4	D	67	57.3	E	197
WBTH	18.1	C	388	1.0	A	57	2.7	A	94	2.5	A	52	7.3	B	101	15.2	C	198
WBRT	12.3	B	83	0.8	A	2	2.3	A	10	1.0	A	3	4.4	A	21			
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	34.4	D	54	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	27.0	D	17				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	39.7	D	121	46.7	E	51	41.5	E	66	23.7	C	42	17.6	C	38	47.1	E	7
SBRT																		
Intersection	15.0	C	140 s.	3.9	A	140 s.	11.7	B	140 s.	5.3	B	70 s.	10.3	B	70 s.	24.3	C	140 s.

TABLE C-9
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 9

Alternative 9 - 6 lane/35 mph/Dual left - AM Delay and LOS by Intersection

Movement	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayswater Ext Court		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	13.3	B	35	19.6	C	24				21.7	C	52	23.3	C	9
EBTH	37.8	D	265	17.5	C	252	4.2	A	80	9.8	B	175	2.4	A	108	10.4	B	200
EBRT	6.6	B	202	13.6	B	55	4.0	A	29	5.6	B	45	1.8	A	9	7.3	B	8
WBLT	51.7	E	195	30.1	D	171	25.1	D	30	20.7	C	602	29.9	D	29	19.6	C	276
WBTH	42.0	E	509	4.2	A	140	0.3	A	135	0.1	A	181	5.9	B	107	1.2	A	317
WBRT	30.2	D	123	3.5	A	34	0.0	A	2				2.7	A	1	0.8	A	2
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				24.0	C	48	22.4	C	18
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				14.8	B	36	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				23.4	C	47	24.1	C	57
SBRT	37.0	D	81	7.6	B	50	13.5	B	21	35.3	D	7	16.0	C	92			
Intersection	37.9	D	150 s.	13.4	B	75 s.	4.5	A	75 s.	11.0	B	150 s.	6.1	B	75 s.	6.0	B	75 s.

Movement	Shady Oaks/Marlin Bay			East Seabrook			Ridgeview			Sherman			West Great Neck			Great Neck		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	50.2	E	64	27.1	D	10	27.5	D	46	28.7	D	57	29.4	D	45	40.4	E	12
EBTH	4.5	A	242	0.1	A	136	6.5	B	90	2.5	A	114	3.6	A	101	7.8	B	124
EBRT	2.9	A	5				4.7	A	9	1.6	A	14	3.0	A	16	1.4	A	744
WBLT	50.5	E	7	69.2	F	9	40.4	E	30	32.4	D	35	33.1	D	30	34.8	D	137
WBTH	20.7	C	774	0.5	A	51	2.0	A	59	4.6	A	139	4.5	A	500	12.6	B	239
WBRT	10.3	B	46	0.0	A	1	1.2	A	1	1.4	A	2	2.7	A	31	8.6	B	22
NBLT				27.1	D	17				25.5	D	78	22.4	C	147	24.3	C	498
NBTH	29.3	D	83	27.1	D	10	25.1	D	65	23.5	C	19	19.6	C	30	24.2	C	518
NBRT	22.0	C	4				16.8	C	22							7.1	B	46
SBLT				27.2	D	19	24.6	C	51				20.0	C	55			
SBTH	37.1	D	180	27.3	D	29	25.7	D	52	24.1	C	33	19.6	C	44	28.1	D	5
SBRT																		
Intersection	16.8	C	150 s.	0.6	A	90 s.	5.4	B	90 s.	5.0	A	90 s.	6.0	B	90 s.	13.7	B	90 s.

Queue = Length of the 95th percentile queue

Alternative 9 - 6 lane/35 mph/Dual left - PM Delay and LOS by Intersection

Movement	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayswater Ext Court		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	37.7	D	167	25.0	D	35				51.9	E	224	40.6	E	22
EBTH	31.1	D	538	22.7	C	130	4.9	A	71	18.7	C	392	11.8	B	782	5.8	B	279
EBRT	58.7	E	1067	5.9	B	33	4.3	A	44	11.1	B	57	4.1	A	38	3.2	A	14
WBLT	124.1	F	240	50.7	E	138	11.5	B	46	25.5	D	389	40.7	E	144	31.3	D	175
WBTH	36.5	D	310	5.8	B	105	8.9	B	228	0.2	A	14	9.2	B	350	0.3	A	0
WBRT	9.2	B	168	5.1	B	82	5.7	B	0				7.5	B	56	0.0	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	46.3	E	52
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13	33.3	D	69	39.5	D	72	49.9	E	47
SBRT	15.4	C	201	5.2	B	22	9.9	B	22	32.4	D	49	23.3	C	87			
Intersection	51.1	E	140 s.	20.3	C	70 s.	7.9	B	70 s.	16.0	C	140 s.	14.7	B	140 s.	5.4	B	140 s.

Movement	Shady Oaks/Marlin Bay			East Seabrook			Ridgeview			Sherman			West Great Neck			Great Neck		
	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	45.0	E	238	47.9	E	45	45.7	E	182	24.5	C	52	24.0	C	69	39.6	D	34
EBTH	13.6	B	891	3.8	A	687	12.1	B	550	4.2	A	479	11.4	B	122	25.0	C	667
EBRT	3.0	A	12	0.7	A	10	3.1	A	28	1.1	A	50	4.1	A	11	6.6	B	1161
WBLT	46.7	E	14	61.5	F	33	55.3	E	113	23.6	C	36	24.2	C	64	57.3	E	197
WBTH	16.1	C	388	3.0	A	240	4.4	A	210	2.4	A	54	8.6	B	165	15.2	C	198
WBRT	12.2	B	83	0.8	A	1	2.8	A	15	2.2	A	7	5.8	B	35			
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	34.4	D	54	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	27.0	D	17				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	39.7	D	121	46.7	E	51	41.5	E	66	23.7	C	42	17.6	C	38	47.1	E	7
SBRT																		
Intersection	16.7	C	140 s.	4.5	A	140 s.	12.2	B	140 s.	4.8	A	70 s.	11.1	B	70 s.	24.7	C	140 s.

TABLE C-10
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 10

Alternative 10 - 4 lane/45 mph/Partial Cloverleaf - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westlan			Northampton SB			Greenwell			Bayleaf/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	66.2	F	275	28.2	D	60	15.2	C	16				46.9	E	67	49.2	E	16
EBTH	38.5	D	264	7.2	B	118	8.1	B	136				3.6	A	147	12.9	B	368
EBRT	7.0	B	202	6.7	B	29	7.3	B	49				2.5	A	10			
WBLT	54.8	E	193	26.6	D	131	25.2	D	36				62.3	F	51	40.0	E	266
WBTH	30.3	D	323	11.7	B	170	2.2	A	194				5.5	B	145	2.0	A	1174
WBRT	20.4	C	132	8.6	B	17	1.8	A	3				0.9	A	1	0.4	A	1
NBLT	39.7	D	488	16.2	C	24												
NBTH	35.3	D	461	12.8	B	58	21.7	C	64				61.8	F	88	45.5	E	31
NBRT	7.5	B	29	4.9	A	29	14.0	B	45				41.1	E	73	0.0	A	0
SBLT	66.7	F	142	13.9	B	91												
SBTH	62.2	F	195	20.7	C	322	20.9	C	9				58.3	E	86	48.1	E	99
SBRT	37.0	D	81	7.6	B	50	13.5	B	21				47.6	E	194			
Intersection	36.0	D	150 s.	13.7	B	75 s.	8.7	B	75 s.				9.2	B	150 s.	9.4	B	150 s.

	Shady Oaks/Martin Bay			East Stratford			Pagevista			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	49.0	E	62	43.6	E	13	44.1	E	57	46.8	E	78	44.9	E	60	36.4	D	22
EBTH	8.0	B	718	1.1	A	206	5.7	B	268	7.5	B	198	5.1	B	348	23.0	C	199
EBRT	3.0	A	4				3.2	A	10	3.0	A	16	2.3	A	39	1.4	A	216
WBLT	50.5	E	7	44.5	E	11	42.1	E	36	49.8	E	48	32.9	D	48	42.6	E	167
WBTH	47.4	E	1434	2.6	A	172	6.9	B	271	4.2	A	140	12.6	B	629	16.3	C	322
WBRT	7.7	B	35	0.4	A	1	3.5	A	3	2.3	A	6	4.9	A	11	12.6	B	34
NBLT				43.7	E	22				40.2	E	108	40.5	E	218	22.9	C	554
NBTH	40.7	E	73	43.6	E	13	42.0	E	92	35.9	D	26	33.4	D	44	22.8	C	575
NBRT	26.2	D	5				31.7	D	34							8.7	B	56
SBLT				43.8	E	26	39.5	D	71				34.1	D	80			
SBTH	85.6	F	209	44.1	E	40	42.2	E	75	36.8	D	46	33.3	D	63	43.3	E	7
SBRT																		
Intersection	36.3	D	150 s.	2.5	A	130 s.	8.9	B	130 s.	7.8	B	130 s.	12.2	B	130 s.	16.5	C	130 s.

Queue = Length of the 95th percentile queue

Alternative 10 - 4 lane/45 mph/Partial Cloverleaf - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westlan			Northampton SB			Greenwell			Bayleaf/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	39.7	D	171	29.5	D	36				43.4	E	216	55.4	E	24
EBTH	31.0	D	538	21.4	C	243	3.9	A	108				15.3	C	764	63.0	F	786
EBRT	58.7	E	1067	6.4	B	34	2.9	A	41				5.6	B	49			
WBLT	103.4	F	236	44.1	E	109	22.3	C	99				56.5	E	153	123.7	F	308
WBTH	28.0	D	211	12.5	B	131	2.7	A	95				3.9	A	323	3.0	A	452
WBRT	11.3	B	104	11.6	B	103	2.2	A	7				3.3	A	39	1.3	A	10
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	50.0	E	140 s.	21.0	C	70 s.	6.3	B	70 s.				15.5	C	140 s.	42.0	E	140 s.

	Shady Oaks/Martin Bay			East Stratford			Pagevista			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	41.6	E	274	47.9	E	45	49.4	E	201	50.3	E	88	57.6	E	115	54.9	E	33
EBTH	344.5	F	1436	122.3	F	2173	86.7	F	722	9.7	B	221	15.0	B	981	26.4	D	638
EBRT	4.2	A	31	0.5	A	9	2.4	A	49	2.1	A	30	2.9	A	40	6.6	B	670
WBLT	46.7	E	14	44.0	E	34	68.5	F	147	41.8	E	70	64.0	F	113	57.3	E	197
WBTH	23.1	C	680	3.2	A	160	2.7	A	169	4.6	A	291	7.4	B	448	15.2	C	198
WBRT	13.2	B	82	2.3	A	4	1.5	A	5	2.9	A	11	2.3	A	17			
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	7
SBRT																		
Intersection	222.9	F	140 s.	83.4	F	140 s.	58.4	E	140 s.	11.2	B	140 s.	15.9	C	140 s.	25.1	D	140 s.

TABLE C-11
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 11

Alternative 11 - 4 lane/35 mph/Partial Cloverleaf - AM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SB								
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	70.7	F	272	63.0	F	62	19.9	C	28				47.4	E	71	50.2	E	17
EBTH	37.1	D	253	6.8	B	255	8.5	B	45				2.9	A	92	12.3	B	450
EBRT	6.7	B	194	4.4	A	30	6.6	B	16				2.3	A	7			
WBLT	26.4	D	114	31.3	D	274	21.6	C	31				49.2	E	47	38.3	D	250
WBTH	39.2	D	450	16.0	C	424	2.4	A	201				6.2	B	300	1.9	A	902
WBRT	20.2	C	140	11.6	B	86	1.8	A	3				1.2	A	2	0.4	A	1
NBLT	36.7	D	455	19.5	C	33												
NBTH	33.9	D	433	14.8	B	77	19.8	C	60				54.4	E	83	43.0	E	30
NBRT	6.9	B	27	8.5	B	30	12.7	B	42				37.2	D	69	0.0	A	0
SBLT	58.5	E	129	15.9	C	121												
SBTH	59.3	E	186	19.8	C	420	19.0	C	9				51.8	E	80	45.8	E	94
SBRT	35.0	D	76	15.4	C	75	11.8	B	19				42.3	E	180			
Intersection	35.1	D	140 s.	16.4	C	140 s.	6.7	B	70 s.				8.9	B	140 s.	9.0	B	140 s.

	Shady Oaks/Marlin Bay			East Seaford			Page/Vista			Starrett			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	70.7	F	68	32.2	D	11	33.0	D	51	44.9	E	65	35.9	D	47	31.7	D	15
EBTH	0.8	A	40	0.2	A	215	5.5	B	61	2.2	A	82	8.7	B	414	13.2	B	200
EBRT	0.4	A	1				3.1	A	4	1.0	A	7	3.6	A	23	1.4	A	460
WBLT	46.7	E	6	35.0	D	9	36.2	D	30	42.0	E	37	38.1	D	32	35.5	D	135
WBTH	44.3	E	1344	3.7	A	116	4.4	A	144	6.5	B	414	9.7	B	794	14.6	B	263
WBRT	7.0	B	33	0.0	A	1	1.5	A	2	0.8	A	3	2.3	A	30	10.4	B	26
NBLT				32.2	D	18				32.6	D	89	37.0	D	199	22.0	C	474
NBTH	39.8	D	70	32.2	D	11	34.4	D	78	28.5	D	22	27.1	D	36	21.9	C	492
NBRT	25.1	D	4				23.7	C	27							6.8	B	46
SBLT				32.3	D	21	31.4	D	59				27.8	D	67			
SBTH	99.6	F	200	32.5	D	32	35.2	D	62	29.3	D	38	27.1	D	53	31.9	D	5
SBRT																		
Intersection	33.4	D	140 s.	2.7	A	100 s.	6.9	B	100 s.	6.3	B	100 s.	11.5	B	100 s.	14.2	B	100 s.

Queue = Length of the 95th percentile queue

Alternative 11 - 4 lane/35 mph/Partial Cloverleaf - PM Delay and LOS by Intersection

	Independence			Pleasure House						Northampton SB			Greenwell			Bayside/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	36.8	D	165	28.9	D	36				43.2	E	215	63.5	F	24
EBTH	31.0	D	538	23.4	C	152	4.3	A	91				15.3	C	759	63.4	F	1837
EBRT	58.7	E	1067	5.7	B	32	3.3	A	34				5.5	B	49			
WBLT	129.2	F	175	42.3	E	126	17.3	C	90				53.7	E	133	161.2	F	329
WBTH	27.7	D	310	9.4	B	152	6.1	B	231				21.0	C	689	0.1	A	0
WBRT	9.9	B	126	8.7	B	119	4.1	A	13				9.1	B	37	0.0	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	57.1	E	54
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	66.9	F	49
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	50.4	E	140 s.	20.8	C	70 s.	7.1	B	70 s.				19.7	C	140 s.	42.8	E	140 s.

	Shady Oaks/Marlin Bay			East Seaford			Page/Vista			Starrett			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.6	E	237	47.9	E	45	49.4	E	201	39.5	D	81	57.6	E	115	58.5	E	33
EBTH	315.1	F	2177	121.9	F	2173	86.7	F	722	13.1	B	461	15.0	B	981	23.2	C	660
EBRT	1.5	A	14	0.5	A	9	2.4	A	49	3.2	A	49	2.9	A	40	6.6	B	714
WBLT	46.7	E	14	50.9	E	30	53.8	E	141	41.0	E	64	66.7	F	114	57.3	E	197
WBTH	22.2	C	680	5.7	B	465	4.8	A	233	9.0	B	326	8.7	B	482	15.2	C	198
WBRT	12.6	B	82	2.5	A	8	3.4	A	17	4.9	A	21	2.4	A	18			
NBLT				47.7	E	33				72.2	F	183	63.7	F	283	44.4	E	767
NBTH	34.4	D	54	48.4	E	52	178.4	F	86	45.7	E	56	40.2	E	100	44.2	E	765
NBRT	27.0	D	17				38.8	D	63							15.1	C	181
SBLT				50.8	E	80	48.3	E	73				45.2	E	146			
SBTH	39.7	D	121	48.3	E	52	51.2	E	70	64.7	F	77	38.4	D	68	47.1	E	7
SBRT																		
Intersection	204.7	F	140 s.	84.2	F	140 s.	58.8	E	140 s.	14.4	B	140 s.	16.4	C	140 s.	24.3	C	140 s.

TABLE C-12
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 12

Alternative 12 - 6 lane/45 mph/Partial Cloverleaf - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayberry/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	71.1	F	225	46.2	E	49	11.9	B	4				33.6	D	54	57.6	E	14
EBTH	28.4	D	187	4.5	A	84	12.1	B	202				4.2	A	96	8.1	B	245
EBRT	5.4	B	138	3.6	A	8	10.0	B	65				3.4	A	8	5.1	B	7
WBLT	39.0	D	127	33.7	D	199	14.6	B	34				41.6	E	37	30.6	D	197
WBTH	29.9	D	413	11.1	B	181	2.7	A	162				2.1	A	75	0.7	A	54
WBRT	10.8	B	42	8.7	B	37	2.0	A	3				1.2	A	0	0.8	A	0
NBLT	29.5	D	332	19.9	C	28												
NBTH	33.8	D	326	12.6	B	62	13.3	B	44				29.1	D	59	29.2	D	22
NBRT	6.1	B	23	5.4	B	27	7.6	B	28				19.3	C	44	0.0	A	0
SBLT	36.8	D	88	13.5	B	97												
SBTH	48.9	E	149	17.2	C	334	12.8	B	7				28.6	D	57	30.8	D	71
SBRT	25.3	D	58	10.7	B	56	7.1	B	13				20.2	C	113			
Intersection	30.2	D	100 s.	13.5	B	100 s.	7.3	B	50 s.				5.0	A	100 s.	8.0	B	100 s.

	Shady Oaks/Marlin Bay			East Shoreford			Pagaview			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	44.1	E	52	30.9	D	11	31.5	D	44	46.5	E	65	25.7	D	54	29.6	D	14
EBTH	0.8	A	54	0.1	A	135	6.1	B	182	1.8	A	33	6.3	B	137	12.0	B	133
EBRT	0.6	A	1				4.3	A	4	1.3	A	4	5.3	B	37	1.4	A	449
WBLT	31.5	D	5	84.4	F	10	35.4	D	28	30.2	D	38	32.1	D	33	35.5	D	135
WBTH	22.8	C	579	0.3	A	14	2.0	A	191	2.7	A	175	7.8	B	427	14.6	B	263
WBRT	9.9	B	36	0.0	A	1	1.2	A	1	2.0	A	10	3.9	A	34	10.4	B	26
NBLT				30.8	D	18				29.1	D	85	26.2	D	165	22.0	C	474
NBTH	20.6	C	46	30.9	D	11	29.3	D	72	26.6	D	21	22.7	C	33	21.9	C	492
NBRT	11.8	B	3				20.2	C	25							6.8	B	46
SBLT				30.9	D	21	28.5	D	56				23.2	C	61			
SBTH	29.3	D	131	31.1	D	31	29.9	D	59	27.3	D	36	22.7	C	49	31.9	D	5
SBRT																		
Intersection	15.9	C	100 s.	0.5	A	100 s.	5.4	B	100 s.	4.0	A	100 s.	8.9	B	100 s.	14.0	B	100 s.

Queue = Length of the 95th percentile queue

Alternative 12 - 6 lane/45 mph/Partial Cloverleaf - PM Delay and LOS by Intersection

	Independence			Pleasure House			Westbay			Northampton SB			Greenwell			Bayberry/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	38.7	D	335	39.7	D	171	32.3	D	36				41.1	E	208	52.0	E	24
EBTH	31.0	D	538	21.4	C	103	4.6	A	198				15.5	C	753	2.9	A	60
EBRT	58.7	E	1067	6.4	B	34	3.0	A	74				5.6	B	50	1.0	A	3
WBLT	95.3	F	228	42.7	E	102	25.5	D	79				42.3	E	146	31.2	D	175
WBTH	24.8	C	204	18.3	C	149	0.7	A	32				8.6	B	277	0.7	A	0
WBRT	16.2	C	120	17.4	C	117	0.7	A	3				7.2	B	46	0.0	A	0
NBLT	84.8	F	366	11.8	B	40												
NBTH	44.4	E	309	18.9	C	337	18.1	C	57				47.5	E	175	48.3	E	52
NBRT	28.1	D	129	6.7	B	90	9.2	B	90				27.9	D	73	0.1	A	0
SBLT	44.4	E	315	76.5	F	115												
SBTH	73.4	F	477	12.4	B	111	16.0	C	13				39.5	D	72	49.9	E	47
SBRT	15.4	C	201	5.2	B	22	9.9	B	22				23.3	C	87			
Intersection	49.7	E	140 s.	22.2	C	70 s.	6.3	B	70 s.				16.4	C	140 s.	3.9	A	140 s.

	Shady Oaks/Marlin Bay			East Shoreford			Pagaview			Stanton			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	47.1	E	226	47.9	E	45	52.5	E	197	23.9	C	45	26.3	D	59	43.4	E	34
EBTH	10.6	B	1168	3.8	A	687	11.7	B	315	5.0	A	578	10.6	B	138	23.2	C	659
EBRT	0.7	A	6	0.7	A	10	4.4	A	71	1.1	A	50	3.3	A	14	6.6	B	1170
WBLT	46.7	E	14	50.5	E	34	55.7	E	119	30.1	D	30	26.4	D	67	57.3	E	197
WBTH	16.0	C	388	1.0	A	57	2.7	A	94	2.5	A	52	7.3	B	101	15.2	C	198
WBRT	12.2	B	83	0.8	A	2	2.3	A	10	1.0	A	3	4.4	A	21			
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	34.4	D	54	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	27.0	D	17				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	39.7	D	121	46.7	E	51	41.5	E	66	23.7	C	42	17.6	C	38	47.1	E	7
SBRT																		
Intersection	14.9	B	140 s.	3.9	A	140 s.	11.7	B	140 s.	5.3	B	70 s.	10.3	B	70 s.	24.3	C	140 s.

TABLE C-13
Projected Peak Hour Delay and Level of Service by Intersection and Movement
Alternative 13

Alternative 13 - 6 lane/35 mph/Partial Cloverleaf - AM Delay and LOS by Intersection

	Independence			Pleasure House			Westbell			Northampton SB			Greenwell			Bayside/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	71.1	F	225	37.3	D	49	15.4	C	19				33.5	D	49	37.4	D	12
EBTH	28.4	D	187	10.8	B	64	6.0	B	100				5.5	B	162	5.7	B	79
EBRT	5.4	B	138	9.8	B	17	5.3	B	38				3.8	A	11	5.2	B	4
WBLT	56.4	E	141	27.3	D	222	12.4	B	30				33.3	D	36	38.0	D	249
WBTH	25.9	D	376	23.3	C	315	3.7	A	222				2.6	A	109	0.9	A	80
WBRT	7.2	B	51	18.2	C	75	2.0	A	4				1.5	A	0	0.4	A	1
NBLT	29.5	D	332	19.9	C	28												
NBTH	33.8	D	326	12.6	B	62	13.3	B	44				29.1	D	59	29.2	D	22
NBRT	6.1	B	23	5.4	B	27	7.6	B	28				19.3	C	44	0.0	A	0
SBLT	36.8	D	88	13.5	B	97												
SBTH	48.9	E	149	17.2	C	334	12.8	B	7				28.6	D	57	30.8	D	71
SBRT	25.3	D	58	10.7	B	56	7.1	B	13				20.2	C	113			
Intersection	29.9	D	100 s.	18.1	C	100 s.	5.5	B	50 s.				5.6	B	100 s.	5.8	B	100 s.

	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	52.2	E	53	27.1	D	10	27.5	D	45	29.4	D	57	30.0	D	46	40.8	E	12
EBTH	1.5	A	41	0.1	A	136	6.5	B	98	2.5	A	109	3.3	A	97	8.2	B	114
EBRT	1.4	A	2				4.7	A	10	1.6	A	14	2.7	A	12	1.4	A	746
WBLT	31.5	D	5	73.7	F	9	39.9	D	30	31.3	D	34	33.1	D	30	34.8	D	137
WBTH	22.8	C	579	0.4	A	48	1.9	A	62	5.1	B	171	4.5	A	500	12.6	B	239
WBRT	9.9	B	36	0.0	A	1	1.2	A	1	1.7	A	2	2.7	A	31	8.6	B	22
NBLT				27.1	D	17				25.5	D	78	22.4	C	147	24.3	C	498
NBTH	20.6	C	46	27.1	D	10	25.1	D	65	23.5	C	19	19.6	C	30	24.2	C	518
NBRT	11.8	B	3				16.8	C	22							7.1	B	46
SBLT				27.2	D	19	24.6	C	51				20.0	C	55			
SBTH	29.3	D	131	27.3	D	29	25.7	D	52	24.1	C	33	19.6	C	44	28.1	D	5
SBRT																		
Intersection	16.3	C	100 s.	0.6	A	90 s.	5.4	B	90 s.	5.2	B	90 s.	5.8	B	90 s.	13.8	B	90 s.

Queue = Length of the 95th percentile queue

Alternative 13 - 6 lane/35 mph/Partial Cloverleaf - PM Delay and LOS by Intersection

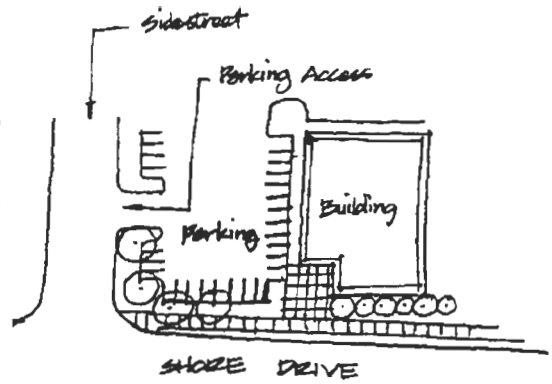
	Independence			Pleasure House			Westbell			Northampton SB			Greenwell			Bayside/First Court		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	36.8	D	316	50.1	E	160	24.5	C	33				40.7	E	198	50.3	E	24
EBTH	28.2	D	497	14.6	B	199	5.2	B	64				14.8	B	711	2.6	A	43
EBRT	52.8	E	993	4.5	A	28	4.4	A	41				5.1	B	46	0.8	A	2
WBLT	128.3	F	164	47.9	E	141	15.8	C	96				47.6	E	127	62.5	F	237
WBTH	22.7	C	274	7.0	B	126	6.6	B	222				12.7	B	368	0.0	A	5
WBRT	5.5	B	98	6.5	B	98	4.5	A	16				7.3	B	28	0.0	A	0
NBLT	81.8	F	345	12.2	B	39												
NBTH	43.9	E	292	23.3	C	346	17.6	C	55				45.1	E	166	45.3	E	49
NBRT	27.0	D	123	7.2	B	92	8.9	B	86				25.9	D	69	0.1	A	0
SBLT	43.0	E	297	55.7	E	107												
SBTH	88.9	F	466	12.8	B	110	15.4	C	12				37.0	D	67	47.0	E	45
SBRT	15.2	C	194	5.9	B	24	9.7	B	21				21.8	C	82			
Intersection	50.2	E	130 s.	18.5	C	65 s.	7.5	B	65 s.				16.9	C	130 s.	4.5	A	130 s.

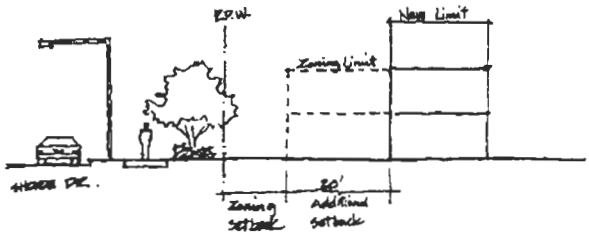
	Shady Oaks/Marlin Bay			East Stratford			Page/Vista			Starfish			West Great Neck			Great Neck		
Movement	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)	Total Delay (sec/veh)	LOS	Queue (ft.)
EBLT	42.2	E	210	47.9	E	45	46.0	E	192	24.5	C	52	24.0	C	69	38.1	D	34
EBTH	21.7	C	1138	3.8	A	687	11.6	B	422	4.2	A	479	11.4	B	122	25.0	D	657
EBRT	0.6	A	8	0.7	A	10	4.7	A	89	1.1	A	50	4.1	A	11	6.6	B	1161
WBLT	42.9	E	13	52.3	E	33	55.4	E	113	23.2	C	35	25.4	D	66	57.3	E	197
WBTH	15.9	C	380	0.7	A	69	4.8	A	221	2.4	A	54	8.3	B	151	15.2	C	198
WBRT	12.0	B	83	0.6	A	1	2.9	A	15	2.2	A	7	5.3	B	32			
NBLT				46.2	E	33				23.7	C	82	24.9	C	148	44.4	E	767
NBTH	30.4	D	50	46.7	E	51	46.2	E	74	20.7	C	32	18.4	C	54	44.2	E	765
NBRT	24.4	C	15				32.4	D	58							15.1	C	181
SBLT				47.9	E	78	41.1	E	69				19.2	C	78			
SBTH	34.6	D	111	46.7	E	51	41.5	E	66	23.7	C	42	17.6	C	38	47.1	E	7
SBRT																		
Intersection	21.2	C	130 s.	3.8	A	140 s.	12.1	B	140 s.	4.8	A	70 s.	11.0	B	70 s.	24.7	C	140 s.

Architectural Design Guidelines:

Setbacks and Massing

- Commercial buildings are encouraged to approach right-of-way lines.
  Rationale: Buildings close to the street can generate more architectural interest.





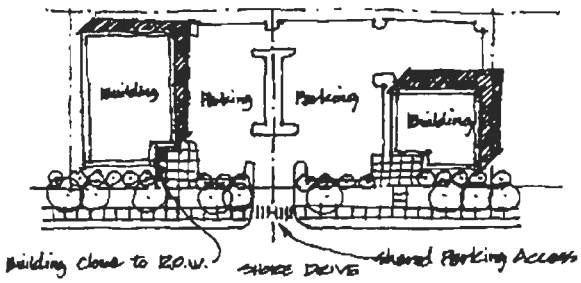
- A building can add one floor on top of existing Zoning height limit for every 20 feet of additional setback from required setback line adjoining right-of-way.
  Rationale: Raising building heights with setbacks can achieve the same architectural effect along the street.

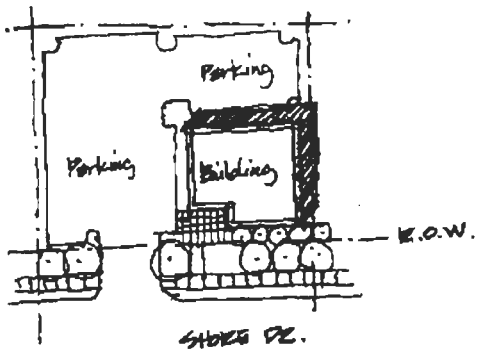
- Upper 1/3 of building facade along Shore Drive should be integrated roof treatment, while the lower 2/3 as wall facade should generate architectural interest by using doors, windows, material/color patterns, etc.
  Rationale: Properly designed wall facades with integrated roof treatment may be more desirable than blank walls or flat roofs.

- Low and moderate buildings in height should be encouraged throughout the corridor.
  Rationale: Building in moderate height may better reflect the residential character and neighborhood scale of the corridor.

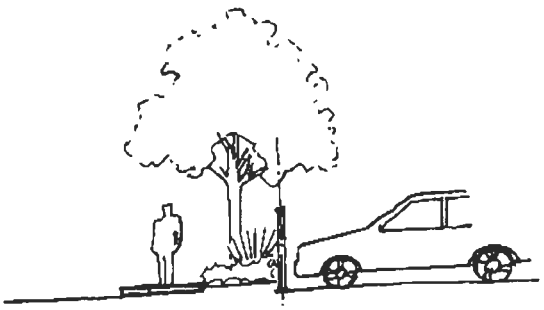
Parking Entrances, Location, Landscaping and Screening

- Adjacent lots should share parking access if physical conditions permit.
  Rationale: Shared access can reduce the number of curb cuts and promote traffic flow.





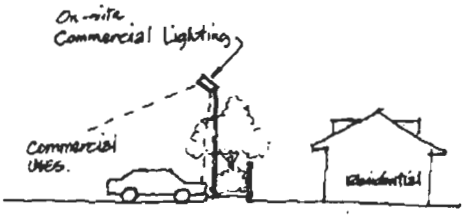
- Parking lots should be located to the side and/or behind the main building where the main building approaches the right-of-way.
  Rationale: Parking to the side and/or behind can have less negative visual impact on the street.



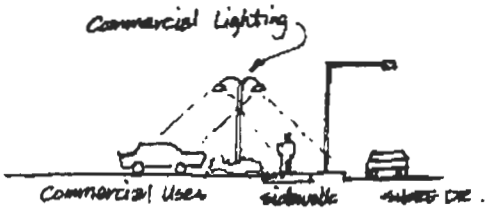
- Landscaping fronting the street should at least consist of shrubs no lower than 4 feet and middle to large size trees. Landscaping should be arranged in masses to avoid a "canyon effect" and should be irregular in design, with clustering and open spaces between clusters. Simple, repetitive patterns in straight lines should be discouraged.
  Rationale: Combination of shrubs and trees can create sufficient screening effect.

- Where screening walls are used to screen parking lots, the wall should be designed a minimum of 4 feet high and a maximum of 8 feet high with landscape elements and visual interest.
  Rationale: Bare walls may have negative visual impact along the street.

On-Site Lighting



- On-site lighting should be carefully designed in order to prevent glaring to adjacent properties.
  Rationale: Unintended lighting to adjacent properties may be undesirable.



- Lighting of commercial properties should cover sidewalks along the street.
  Rationale: Well lit sidewalks may increase a sense of safety on the property and encourage pedestrian activity.

Existing Trees and Surroundings

- All development and renovations are encouraged to preserve and protect existing mature trees where possible.
  Rationale: Mature trees are assets to the appearance and value of a property.

Special Features: Stormwater Ponds, Public Art, Billboards, etc.

- Stormwater ponds should be integrated into projects as a landscape / open space feature.
  Rationale: Stormwater ponds can enhance water feature character of the corridor.

- Works of public art should be encouraged throughout the corridor.
  Rationale: Public art may help create a sense of community and improve aesthetics.

- All commercial billboards should be removed.
  Rationale: Billboards may have negative visual effects for the corridor.

Materials and Colors

- While all materials and colors are allowed for buildings throughout the corridor, selected materials and colors are encouraged in the design review process.
  Rationale: Selected materials and colors may help develop aesthetic themes for the corridor.

- Roof materials and colors should reflect details such as earth tone colors, architectural shingles, metal roofs with architectural relief, shake shingles, etc.
  Rationale: Selective colors and materials with texture can help reinforce and create a unique character for the corridor and help reinforce traditional historic architectural elements of the area.

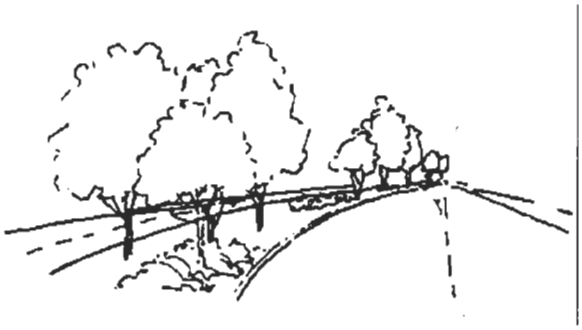
- Wall materials and colors with horizontal detailing, articulation, earth tone colors, etc. should be encouraged.
  Rationale: Selective colors and materials with details can help create interest and reinforce the unique character of the area; examples include the Seascapes Interiors building and the Medical Building at Jade Street.

Street Trees

- Street trees should be greatly encouraged throughout the corridor. Refer to the Landscape Guidelines for recommended list of plants.
  Rationale: Street trees may help create special character, reinforce a corridor theme, and enhance aesthetics for the corridor as a special place.

- The primary trees along the corridor should be live oaks, sycamores, loblolly pines, supplemented with smaller trees such as yaupon hollies, black pines, and tree form wax myrtles.
  Rationale: These trees have thrived locally for generations and can help to recreate the unique character of the corridor.

- Trees in the median should be planted in clustered fashion.
  Rationale: Clustered planting can help create visual interest, reduces maintenance costs, and allows for wider mix of plant sizes at installation, thereby reducing initial costs



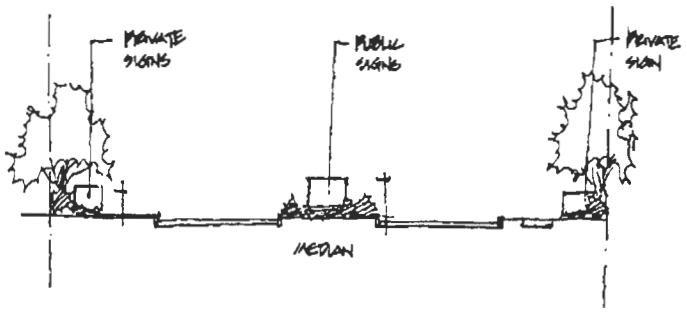
Pavement

- Pedestrian crossings at major intersections and all commercial driveways should be paved with brick pavers.
  Rationale: Brick pavers may enhance aesthetics and provide visual alert to drivers for pedestrian safety. However, brick pavers are expensive treatments and should be integrated into any other roadway improvements. In the short term, special pavement markings for pedestrian crossings can accomplish the same intent at lower cost.

Signage Guidelines

- All public signs should be placed within the median, including directional sign, information sign, neighborhood sign, street sign, etc. No part of such signs should be exceed 4 feet in height.
  Rationale: Uniform appearance, heights, and color scheme conforming to international standards can make a dramatic impact on roadway aesthetics. Current City standards do not meet this recommendation, and a compromise should be pursued which accomplishes the intent to improve aesthetics in the corridor.

- All private signs should be placed within or adjacent to the shoulder right-of-way, including commercial signs, informational signs, temporary signs, etc. Private signs which encroach in the right-of-way should adhere to strict design standards as to size, height, materials, colors, etc. Designs should be compatible with one another and with the overall themes of the corridor.
  Rationale: A coordinated approach to size, height, materials, colors and appearance which conforms to uniform standards can make a dramatic impact on roadway aesthetics and may help reinforce the unique character of the area.



Lighting

- Roadway lighting fixtures should be located on the shoulders of the roadway to provide both roadway and pedestrian lighting and safety along the corridor. Style of lamp post and wattage / color of light should be uniform throughout the corridor.
  Rationale: Shoulder lighting is more economical to install and maintain. Uniformity of installation can reinforce design themes for a unified corridor.

- Pedestrian lighting fixtures may be desirable in certain areas along the corridor which exhibit high volumes of pedestrian activity. Style of lamp post and wattage / color of light should be uniform throughout these areas.
  Rationale: Pedestrian lighting can help identify special areas of activity along the corridor and create aesthetic interest, as well as promote pedestrian safety.

- Site and signage lighting should be of a scale and intensity which does not detract from roadway or pedestrian lighting fixtures, and should be directed to the interior of a site.
  Rationale: Site and signage lighting can be complementary of roadway lighting treatments in the corridor.

Landscaping Guidelines:

The naturally occurring environment of the Shore Drive Corridor offers some unique development and roadway design opportunities. By blending the design of new projects with the existing landscape of protected dunes and coastal forest, the image of Shore Drive can be both more fully defined and preserved. The Shore Drive Corridor also presents some design challenges. Some of these challenges include; the close proximity to Chesapeake Bay, with areas directly exposed to salt spray from northeast winds, the predominantly sandy soil conditions, the views of the water from condos, businesses and homes (which should not be obstructed), and the broad range of existing architectural elements in the corridor.

The following landscape guidelines address many of the issues described above:

1. Plants, as well as other landscape and architectural elements should be chosen based on their ability to perform in an environment where it is seasonally windy, salty, and dry. Drought-tolerant plants should be the only plants used unless a sprinkler system is in place. Plants with large, fragile leaves should be avoided except in the most wind-sheltered locations. In areas where there is direct exposure to northeasters, such as the Lesner Bridge, only proven salt tolerant plants should be used.

2. Native plant materials should be used when possible, especially near First Landing State Park and other areas that have not been impacted by development.

3. Plantings along roadways and for commercial development should utilize a more random placement of plants. Masses of differing plant species as opposed to evenly spaced rows of the same plants will lend a more natural feel to the corridor. One possible example would be to use a Bald Cypress, two or three Live Oaks and an understory planting of flowering shrubs or junipers. This type of plant grouping could be placed at various spacings along the roadway.

4. In areas where residents and businesses have views that they would like preserved, designers should use plant materials that will not obstruct these views as they mature. Smaller trees such as Vitex, Wax Myrtle, and Yaupon Holly should be used to keep views open.

5. Accent plants with flowers will have more impact if they are massed in large quantities of the same color. Accent colors can be used to define different areas of the corridor. For example, white perennial flowering plants could be used to designate the gateway areas into the corridor. Red or pink could be used along the commercial segments of the corridor. Large masses of brightly colored flowers will very effectively draw a motorist's attention.

6. No new planting is necessary in the natural corridor through First Landing State Park. Any existing introduced species should be removed, and the areas allowed to return to their natural state.

7. Native Species should be utilized as species of preference due to increased drought, salt spray, pest, disease and stress tolerance. Minimize use of Exotic Species as accent plants or for additional color or texture.

8. The types of plants used in built environments are usually more ornamental than the naturally occurring flora in First Landing State Park. An area which includes a blend of native and exotic species will smooth the transition from the Natural Corridor to the Single Family Residential area.

The Shore Drive Advisory Committee has developed the following plant list to assist developers, residents, and business owners in their efforts to preserve and enhance existing natural vegetation in the corridor.

Shore Drive Recommended Plant Materials List

Trees

Native Species

Loblolly Pine	Pinus taeda
Southern Magnolia	Magnolia grandiflora
Live Oak	Quercus virginiana
Darlington Oak or Laurel Oak	Quercus hemisphaerica
Red Maple	Acre rubrum
Hackberry	Celtis occidentalis
Northern Red Oak	Quercus rubra
Southern Red Oak	Quercus falcata
Willow Oak	Quercus phellos
Bald Cypress	Taxodium distichum
Sweetbay	Magnolia virginiana
Hawthorn	Crataegus sp.
River Birch	Betula nigra
Loblolly Bay, Pond Pine	
Serviceberry	Amelanchier sp.
Virginia Pine	Pinus virginiana
Wild Cherry	

Exotic Species

Black Pine	Pinus thumbergill
Leyland Cypress	Cupressocyparis leylandii
Norway Maple	Acer platanoides

London Plane Tree	Platanus acerifolia
Torulosa Juniper	
Crape Myrtle	
Loropetalum	

Shrubs

Native Species

Yucca	Yucca filamentosa
Juniper	Juniperus virginiana
Rugosa Rose	
Osmanthus	
Viburnum	
Swamp Azalea	Rhododendron viscosum
Yaupon Holly	Ilex vomitorium

Exotic Species

Abelia	
Euonymus	
Russian Olive	
Dwarf Holly	
Nellie Stevens Holly	
Burford Holly	Ilex burfordi
Festia	
Wintergreen Barberry	
Nandina	
Oleander	
Crimson Pygmy Barberry	
Buddleia	
Spirea	
Raphiolepis Cotoneaster	

Ornamental Grasses

Native Species

Switch Grass	Panicum virgatum
Salt Meadow Hay	Spartina patens

Exotic Species

Japanese Silver Grass	
Pampass Grass	Cortaderia selloana
Fountain Grass	Pennisetum setaceum
Dwarf Fountain Grass	
Blue Fescue	
Maiden Grass	Miscanthus sinensis gracillimus
Variegated Maiden Grass	Miscanthus sinensis variegatus

Perennials

Native Species

Wild Orange Daylilly	Hemerocallis fulva
Rose Verbena	Verbenaceae canadensis
Rose Coreopsis	
Pink Tickseed	
Slender Blue Flag Iris	Iris prismatica

Exotic Species

Cannas
Sedum
Veronica

Groundcovers

No Native Species

Exotic Species

Liriope
Mondo Grass
Non-Climbing Ivy
Aspidistra

Native Species should be utilized as species of preference due to increased drought, salt spray, pest, disease and stress tolerance.

Minimize use of Exotic Species as accent plants or for additional color or texture.

Sign Guidelines:

Sign Types

- Public signs:
  - Directional signs
  - Traffic signs
  - Identification signs
- Community signs:
  - Gateway signs
  - Neighborhood signs
  - Banners
- Private signs:
  - Retail and commercial signs
  - Billboards
  - Temporary signs

Objectives

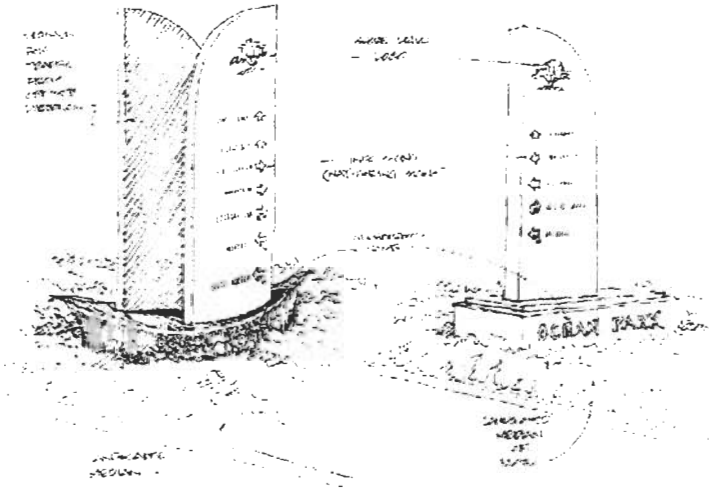
- Promote aesthetics of corridor
- Assure visibility and friendly to both drivers and pedestrians
- Help define community identity and character
- Conform with international design standards of signs when applicable

Guidelines

- All signs should be organized and located in designated zones: Public and community signs should be located in the median, while all private signs should be located on the sides of the street.
  Rationale: Properly organized sign systems can provide clear visibility and enhance community image.

- Directional street name signs at major intersections should be of consistent design, mounted on traffic signal arms, and be clearly seen from both directions. Directional street name signs at minor intersections should be of consistent design, mounted on sign posts, and be clearly visible from adjacent lane of traffic. Other directional signs should be of consistent design, mounted on sign posts, and be clearly seen from road shoulder.
  Rationale: Clearly visible and consistent signs reflect a positive image of the community as well as provide easy orientation to residents and visitors.

- Design and locations of traffic signs should be of a consistent and uniform appearance. Outdated or redundant traffic signs should be removed from the corridor.
  Rationale: Uniformity of traffic signs can help enhance safety, accuracy of information and community appearance.



- Community signs should be designed and maintained according to defined City specifications and standards, and be recognizable to all users.
  Rationale: City specifications and standards can reflect aesthetic quality and consistency with international standards.

- Gateway signs should be established at the Diamond Springs Road intersection, the Independence Boulevard intersection, the Northampton Boulevard interchange, both ends of the Lesner Bridge, the North Great Neck Road intersection, the Kendall Street intersection, and the North Atlantic Avenue transition.
  Rationale: These locations are critical locations along the corridor that provide entrance and exit to the community.

- Neighborhood signs should be established to reflect a positive spirit and image of residential areas. Temporary signs for neighborhood activities may be attached to the neighborhood signs as integrated in the design.
  Rationale: Neighborhood signs can define the identity of and create a positive image for neighborhoods.

- Commercial signs located within the public right-of-way shall fully conform to the City's Sign Standards as part of the agreement allowing their encroachment within the right-of-way. Similarly, all new or replacement commercial signs located on private property shall fully conform to the City's Sign Standards. Nonconforming signs or other grandfathered commercial signs located on private property shall be maintained in safe condition, or shall be subject to a demolition notice from the City, requiring replacement with signs which conform to the City's Sign Standards.
  Rationale: An organized commercial signage system can help to improve the community's image and character.

- Design of all signs, public or private, are encouraged to include landscape elements or to be part of the main building structure it serves, as specified in the City Sign Standards. Nonconforming signs should strive to meet this criteria as a means of integration with other corridor improvements.
  Rationale: An integrated design approach can help create better signage and enhance community appearance.

- All billboards should be removed from the corridor.
  Rationale: Billboards are distractive and create a negative image for the community.

- Temporary signs for commercial activities should not be independently installed. They should be attached either to permanent signs or buildings. Term limits for temporary signs should be strictly enforced.
  Rationale: Independent temporary signs can create or enhance distraction and confusion for the public, as well as detract from the aesthetic character of the area.

- All signs should be sensitive to local preferences in color, materials and appearance.
  Rationale: Local preference is the basis for establishment of community identity.

Waterman's Walk Design Charrette:

The purpose of a charrette is to brainstorm and generate ideas. Final solutions are not usually developed in this manner. A charrette is a meeting, usually held for one or two days, where all interested parties can discuss multiple solutions and ideas and get feedback from a group of people. The ideas generated from a charrette can then be used as a basis for the design effort. The design charrette for Waterman's Walk was organized by the Shore Drive Advisory Committee and conducted on August 7, 1999.

Charrette Day Schedule and Activities

- Walking tour and boat tour of the site by charrette participants
- Orientation – discussion of relocation of main channel to south side of marsh island and overall boat traffic patterns
- Charrette participants broke into three teams
- Each team developed a scheme
- Teams reconvened to discuss and compare each scheme.

There were many similarities between the team concepts for the area. As a group the teams developed an overall scheme and discussed potential phasing.

Issues Discussed

- The parking problem will not be solved with surface parking on the available land area. A parking garage or satellite parking will be necessary to create adequate parking if more people are to be drawn to this area.
- Future development of the property on the other side of the Lesner Bridge (the Duck-In site) is important. There is a possibility for a public/private venture for a parking structure in this area.
- It is important to develop access to the waterfront and to emphasize waterfront activities.
- Existing vegetation should remain and landscaping should be enhanced to make the area more inviting. Relocation of the main channel and expansion of the marsh island would help enhance the view and create a buffer between boat thru-traffic and boats coming to the area as a destination.

- Water taxi service is an interesting option to bring people to the area without creating a worse parking problem.

- In the future, a higher clearance at the Lesner Bridge location would help draw more transient traffic to the area. Currently there are no transient facilities in this area. This is one of the functions proposed for the existing City Marina.

Master Plan

A conceptual master plan for the Waterman's Walk area was developed through the combined ideas generated by the charrette teams and presented to the Shore Drive Advisory Committee on November 4, 1999. Key points raised by the charrette team members concerning the future of the Waterman's Walk area are as follows:

- The key for this area is to look at tying the whole area together rather than developing each parcel individually. Linkages between individual parcels and activities are critical to achievement of the optimum development potential of the area.

- Phasing of improvements to the area is important. Some things are easier to implement than others. Do the easy things first.

- Beautification and landscaping could begin tie the area together without a large construction effort.

- Work with City properties at the eastern and western ends of the area. The City Marina anchors the area at its eastern end and the property from the Pilot's Association Building around and under the Lesner Bridge anchors the area at its western end.

- Individual landowners and tenants will have to work together to knit the parcels and functions together.

The conceptual master plan developed at the Waterman's Walk Design Charrette is shown on the following page. This plan should be viewed as a tool to generate ideas; not as a final solution for the area but as a starting point for exploring and developing more specific ideas as to how the development potential of the area can be achieved. The key elements identified by the charrette team members are listed below and broken down into three general phases of implementation.


Shore Drive Area
East of Lynnhaven Inlet
GIS
CONCEPTUAL MASTER PLAN
NOVEMBER 4, 1999
PARKING GARAGE
DEVELOPMENT OPPORTUNITY
PEDESTRIAN CONNECTION
BIKE PATH CONNECTION
ENTRY PARK
PEDESTRIAN CONNECTION
ENTRY PLAZA
PARK AREA
PILOT'S ASSOCIATION
BOAT SLIPS
"HENRY'S"
"BUBBAS"
SALT MARSH AREA
OBSERVATION DECK
BOAT TRAFFIC
BOAT DOCK
"DOCKSIDE" BOARDWALK
COMMUNITY PARK
"CHICKS" RETAIL
HISTORY CENTER
TRANSIENT MARINA
COMMERCIAL FISHING/MARKET
RETAIL

Shore Drive

Phase 1 – First Steps

- The city owns property at the east and west ends of the area studied.

- To the west of the Pilot's Association Building, the City owns the land at the base of the abutment of the Lesner Bridge. This is a good place to develop a public park with an observation area on the inlet as the west anchor to the "Waterman's Walk."

- To the east of the project area is the City Marina. This area could be converted to use as a transient marina. Adjacent property could be developed to provide services to transient boaters. No transient facilities are currently available in this area.

- General clean-up of the existing properties and improvement of the landscaping (in keeping with the Shore Drive Corridor Plan's recommendations for landscaping along Shore Drive) should be a high priority in this area.

- It was agreed that realignment of the main channel to the south of the marsh island would improve waterway circulation in this area. This area to the south is the marked channel but depth problems encourage boat traffic to travel on the north side of the island, closer to the existing businesses. If the channel can be improved and boat traffic can occur to the south of the island, the area to the north can become a destination and temporary mooring area, rather than a path of travel. Work should begin as early as possible as this will involve dredging of the channel and stabilization of the marsh island.

- Parking will always be a problem in this area because of the lack of available land. If pedestrian, bicycle and boat travel can be encouraged, this may help to reduce congestion in the area.

- Encourage development of a continuous walk along the water to begin to unify the area as "Waterman's Walk." Many existing walkways already exist.

- With major boat traffic redirected, additional boat slips should be provided to encourage water travel to this destination.

Phase 2 – Development

- Many of the businesses in this area are restaurants. There may be some opportunity for some small retail sprinkled in along the "Waterman's Walk."

- Enhance the commercial fishing industry that is active in this area by providing a fish market or other activities to enhance their visibility. Encourage people to stop, watch and learn about the process. The existing area that the commercial fishermen use is in a good location at the east end of the area where it can be somewhat isolated from other businesses but still be accessible to the public.

- The marsh island is privately owned. The same family owns the large wooded lot with a house on the hill overlooking the marsh island. The existing terrain and large live oak trees on this lot should be preserved to the greatest extent possible. This house could be converted to a History/Nature Center. A nature walk could be developed on the marsh island with a pedestrian ferry from the History/Nature Center. Informational signage could be placed along the nature path and along the "Waterman's Walk" to tell visitors about the history and nature interests in the area.

Phase 3 – Long-Term Development

- Two major issues were discussed by all three teams, the need for a focal point in the area and the need for parking.

- A green open space area should be developed at the east end of the Lesner Bridge. This area would act as a gateway with landscaping and signage to enhance entrance into the area.

- The land where the Duck-In is currently located is a prime area for future development. There could be an opportunity for a public/private partnership to develop a site-sensitive parking structure to help alleviate the parking problems in the area. With care, a parking structure could be designed that is stepped back and offers opportunities for landscaping to enhance it's appearance in this highly visible area. Additionally, ground floor areas could be developed with shops and restaurants to avoid creating a dead zone for pedestrians in the area.

- In the center of the Waterman's Walk area a park is proposed. This would become the focal point for the area and offer a place for gatherings, possibly providing an amphitheater for special events and also opening up a view of the Lynnhaven Inlet. Obviously, the parking problems in the area will have to be addressed before a park like this could be developed.

In conclusion, the charrette team members believed that there are many opportunities in this already popular area. Enhancement of the existing properties and cooperation between the existing land owners and tenants will be the key to future development of the "Waterman's Walk" area.

Cost Estimates:

The following cost estimates were developed based on these criteria which are based on other projects undertaken in the City:

Item	Cost
new curb and gutter or relocate curb to edge of roadway	$135 per linear foot
maintain deceleration lanes at street intersections only (eliminate continuous deceleration lane)	$59 per linear foot
install 5 - foot sidewalk	$13 per linear foot
streetlights on shoulder	$42.50 per linear foot
underground utilities (duct bank system)	$1,280 per linear foot
4 foot asphalt shoulder with rumble strips	$20 per linear foot
acceleration and deceleration lanes at street intersections only (add new turn lanes with 150 foot storage / 150 foot taper)	$85,000 per turn lane
replace guardrail	$75 per linear foot
10 foot multi-purpose trail	$26 per linear foot
10 foot multi-purpose trail addition to Lesner Bridge	$2,280,000
close medians	$155 per linear foot
reconstruction of existing culvert crossings at Pleasure House Creek and Lake Joyce	$240 per square foot
landscaping	$45 per linear foot
street closure	$82,750 per street

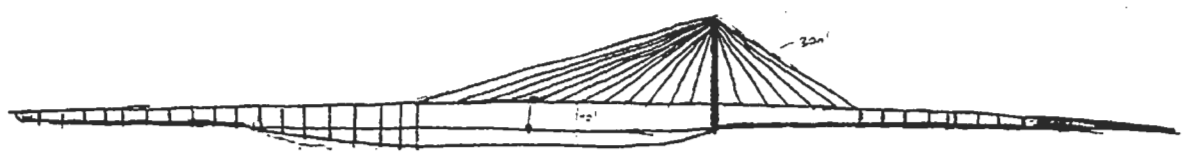
Cost estimates are **not** included for the following items:

design
right-of-way or easement acquisition
contingencies
signs
demolition

Cost estimates will additionally be affected by site specifics which can only be determined during design, such as:

public utility adjustments
stormwater management facilities
relocation of signs
geotechnical conditions

Cost estimates are provided for each of the following segments and elements with projected costs broken down to assimilate into phased increments.



Concept for Future Replacement of Lesner Bridge Developed at Waterman's Walk Design Charrette

Gateway Project

Shady Oaks Drive / Marlin Bay Drive to East Stratford Road (3,100 feet)

eastbound

$ 170,000	add deceleration lanes at street intersections (East Stratford Road, East Stratford Road)
$ 418,500	add curb and gutter
$ 40,300	five foot sidewalk
$ 131,750	streetlights on shoulder
$ 85,000	add acceleration lane at street intersection (Marlin Bay Drive)

westbound

$ 170,000	add deceleration lanes at street intersection (Shady Oaks Drive)
$ 418,500	add curb and gutter
$ 40,300	five foot sidewalk
$ 131,750	streetlights on shoulder
$ 85,000	add left turn lane at street intersection (Marlin Bay Drive)

other

$ 15,500	close median at Powhatan Avenue
$ 15,500	close median at Albemarle Avenue
$ 82,750	close West Stratford Road at Roanoke Avenue
$ 82,750	close Clipper Bay Drive at East Stratford Road
$ 82,750	close Surry Road and Dupont Circle at Shore Drive
$ 82,750	close Pendleton Avenue and Dupont Circle at Shore Drive
$ 279,000	landscaping

$ 2,332,100 SUB-TOTAL

East Stratford Road to Lesner Bridge (650 feet)

eastbound

$ 85,000	add acceleration lane at street intersection (East Stratford Road)
$ 87,750	add curb and gutter
$ 16,900	ten foot multi-purpose trail
$ 27,625	streetlights on shoulder

westbound

$ 85,000	add deceleration lane at street intersection (East Stratford Road)
$ 87,750	add curb and gutter
$ 27,625	streetlights on shoulder

other

$ 29,250	landscaping
$ 30,750	gateway treatment

$ 477,650 SUB-TOTAL

Lesner Bridge (1,525 feet)

eastbound

$ 64,813	streetlights on shoulder

westbound

$ 64,813	streetlights on shoulder

other

$ 2,280,000	add ten foot multi-purpose trail to bridge crossing

$ 2,409,626 SUB-TOTAL

Lesner Bridge to Jade Street (2,100 feet)

eastbound

$ 170,000	add deceleration lanes at street intersections (Vista Circle, Jade Street)
$ 85,000	add acceleration lane at street intersection (Vista Circle)
$ 283,500	add curb and gutter
$ 54,600	ten foot multi-purpose trail
$ 89,250	streetlights on shoulder

westbound

$ 85,000	add deceleration lanes at street intersection (Page Avenue)
$ 85,000	add acceleration lane at street intersection (Page Avenue)
$ 283,500	add curb and gutter
$ 14,950	five foot sidewalk from Page Avenue to Jade Street
$ 89,250	streetlights on shoulder

other

$ 94,500	landscaping
$ 30,750	gateway treatment

$ 1,365,300 SUB-TOTAL

$ 6,584,676 PROJECT TOTAL

Multi-Purpose Trail Improvement Project

Multi-purpose Trail from Bayville Park Entrance to First Court Road and Shore Drive (2,250 feet)

multipurpose trail
$ 58,500 ten foot multi-purpose trail

other
$ 101,250 landscaping

$ 159,750 SUB-TOTAL

Multi-purpose Trail from Marlin Bay Drive to East Stratford Road (4,275 feet)

multipurpose trail
$ 111,150 ten foot multi-purpose trail

other
$ 192,375 landscaping

$ 303,525 SUB-TOTAL

Multi-purpose Trail from Jade Street and Shore Drive to West Great Neck Road (3,825 feet)

multipurpose trail
$ 99,450 ten foot multi-purpose trail

other
$ 172,125 landscaping

$ 271,575 SUB-TOTAL

Multi-purpose Trail from State Park Entrance Road to West Atlantic Avenue (2,700 feet)

multipurpose trail

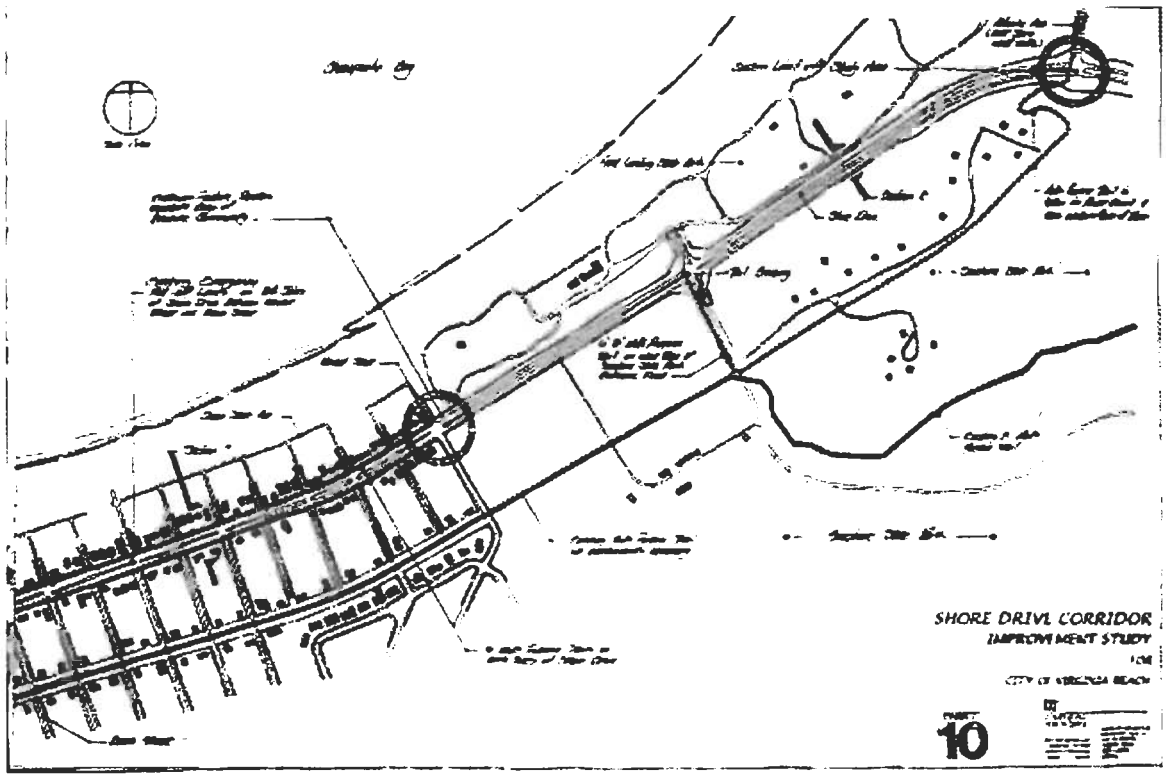
$	23,400	rebuild existing trail from Kendall Street to Park entrance road as ten foot multipurpose trail
$	46,800	build new trail from Park entrance road to west gate Fort Story as ten foot multi-purpose trail

other

$	121,500	landscaping
$	150,000	upgrade traffic signal at West Atlantic Avenue to full signal with pedestrian crossing button

$	341,700	SUB-TOTAL

$ 1,075,550 PROJECT TOTAL



Open Space Acquisition Project

Sunstates Property

city assessment value

$ 792,920

$ 792,920 SUB-TOTAL

Ocean Park Property

city assessment value

$ 4,344,900

$ 4,344,900 SUB-TOTAL

Pleasure House Creek Wayside Property

city assessment value

$ 40,147

$ 40,147 SUB-TOTAL

$ 5,177,967 PROJECT TOTAL

Phase Two Corridor Project

South Oliver Drive to Baylake Road / First Court Road (6,400 feet)

eastbound

$ 425,000	add deceleration lanes at street intersections (Pleasure House Road, Westsail Lane / Hannaford, South Bound Northampton, Greenwell Drive, Baylake Road)
$ 864,000	add curb and gutter
$ 83,200	five foot sidewalk
$ 272,000	streetlights on shoulder

westbound

$ 425,000	add deceleration lanes at street intersections (Pleasure House Road, Westsail Lane / Hannaford, North Bound Northampton, Greenwell Drive, Treasure Island Drive)
$ 864,000	add curb and gutter
$ 83,200	five foot sidewalk
$ 272,000	streetlights on shoulder

other

$ 15,500	close median between Pleasure House Road and Westsail Lane
$ 15,500	close median at Windward Lane
$ 15,500	close median at Burger King between Greenwell Road and Treasure Island Drive
$ 15,500	close median at Indian Hill Road
$ 576,000	landscaping

$ 3,926,400 SUB-TOTAL

Baylake Road / First Court Road to Shady Oaks Drive / Marlin Bay Drive (2,750 feet)

eastbound

$ 170,000	add deceleration lanes at street intersections (former Bayville Road, Marlin Bay Road)
$ 55,000	four foot wide asphalt shoulder with rumble strip
$ 71,500	ten foot multi-purpose trail
$ 116,875	streetlights on shoulder

westbound

$ 85,000	add deceleration lane at street intersection (Baylake Road)
$ 85,000	add acceleration lane at street intersection (Shady Oaks Drive)
$ 55,000	four foot wide asphalt shoulder with rumble strip
$ 116,875	streetlights on shoulder

other

$ 15,500	close median between Bayville Road and Shady Oaks Drive / Marlin Bay Drive
$ 247,500	landscaping

$ 1,018,250 SUB-TOTAL

Jade Street to Croix Drive (4,925 feet)

eastbound

$ 255,000	add deceleration lanes at street intersections (Starfish Road, Red Tide Road, West Great Neck Road)
$ 664,875	add curb and gutter
$ 64,025	five foot sidewalk
$ 209,313	streetlights on shoulder

westbound

$ 255,000	add deceleration lanes at street intersections (north Great Neck Road, Red Tide Road, Starfish Road)
$ 664,875	add curb and gutter
$ 64,025	five foot sidewalk
$ 209,313	streetlights on shoulder
$ 85,000	add left turn lane at street intersection (Jade Street)

other

$ 15,500	close median at Kleen Street
$ 15,500	close median at Urchin Road
$ 15,500	close median at Ebb Tide Road
$ 15,500	close median at Sunstates Court
$ 221,625	landscaping

$ 2,725,051 SUB-TOTAL

Croix Drive to Kendall Street (3,075 feet)

eastbound		
$	85,000	add deceleration lanes at street intersections only
$	61,500	four foot wide asphalt shoulder with rumble strip
$	130,688	streetlights on shoulder
westbound		
$	61,500	four foot wide asphalt shoulder with rumble strip
$	130,688	streetlights on shoulder
$	85,000	add left turn lane at street intersection (Croix Drive)
other		
$	138,375	landscaping
$	692,751	SUB-TOTAL
$	**8,362,452**	**PROJECT TOTAL**

Phase Three Corridor Project

Diamond Springs Road to Kimball Circle West (2,700 feet)

eastbound

$ 364,500	relocate curb to edge of roadway
$ 255,000	maintain deceleration lanes at street intersections and eliminate continuous deceleration lane (Lough Lane, Lake Smith Drive, Kimball Circle West)
$ 35,100	five foot sidewalk
$ 114,750	streetlights on shoulder

westbound

$ 55,000	four foot wide asphalt shoulder with rumble strip
$ 114,750	streetlights on shoulder

other

$ 243,000	landscaping

$ 1,182,100 SUB-TOTAL

Kimball Circle West to Gate 4 / Staplesmill Lane (4,650 feet)

eastbound

$ 93,000	four foot wide asphalt shoulder with rumble strip
$ 255,000	add deceleration lanes at street intersections (Lake Shores Road, Jack Frost Road, Staplesmill Lane)
$ 60,450	five foot sidewalk
$ 197,625	streetlights on shoulder
$ 105,000	replace guardrail at Little Creek reservoir with new guardrail

westbound

$ 93,000	four foot wide asphalt shoulder with rumble strip
$ 197,625	streetlights on shoulder
$ 85,000	add deceleration lane at street intersection (HRSD)

other

$ 418,000	landscaping
$ 15,500	close median opening at Little Creek Reservoir between Kimball Circle East and Lake Shores Road

$ 1,493,700 SUB-TOTAL

Gate 4 / Staplesmill Lane to Independence Boulevard (2,070 feet)

eastbound

$ 279,450	relocate curb to edge of roadway
$ 170,000	maintain deceleration lanes at street intersections and eliminate continuous deceleration lane (Shopping Center, Independence Boulevard)
$ 26,910	five foot sidewalk
$ 87,975	streetlights on shoulder

westbound

$ 41,400	four foot wide asphalt shoulder with rumble strip
$ 87,975	streetlights on shoulder
$ 85,000	add deceleration lane at street intersection (Gate 4 (Nider Boulevard))

other

$ 186,300	landscaping

$ 965,010 SUB-TOTAL

Independence Boulevard to South Oliver Drive (2,540 feet)

eastbound

$ 170,000	add deceleration lanes at street intersections (Joslin Street and South Oliver Drive)
$ 33,020	five foot sidewalk
$ 107,950	streetlights on shoulder

westbound

$ 50,800	four foot wide asphalt shoulder with rumble strip
$ 107,950	streetlights on shoulder
$ 170,000	add deceleration lanes at street intersections (Joslin Street and B Street)

other

$ 15,500	close one median located between Wellings Court West and Joslin Street
$ 228,600	landscaping

$ 883,820 SUB-TOTAL

$ 4,524,630 PROJECT TOTAL