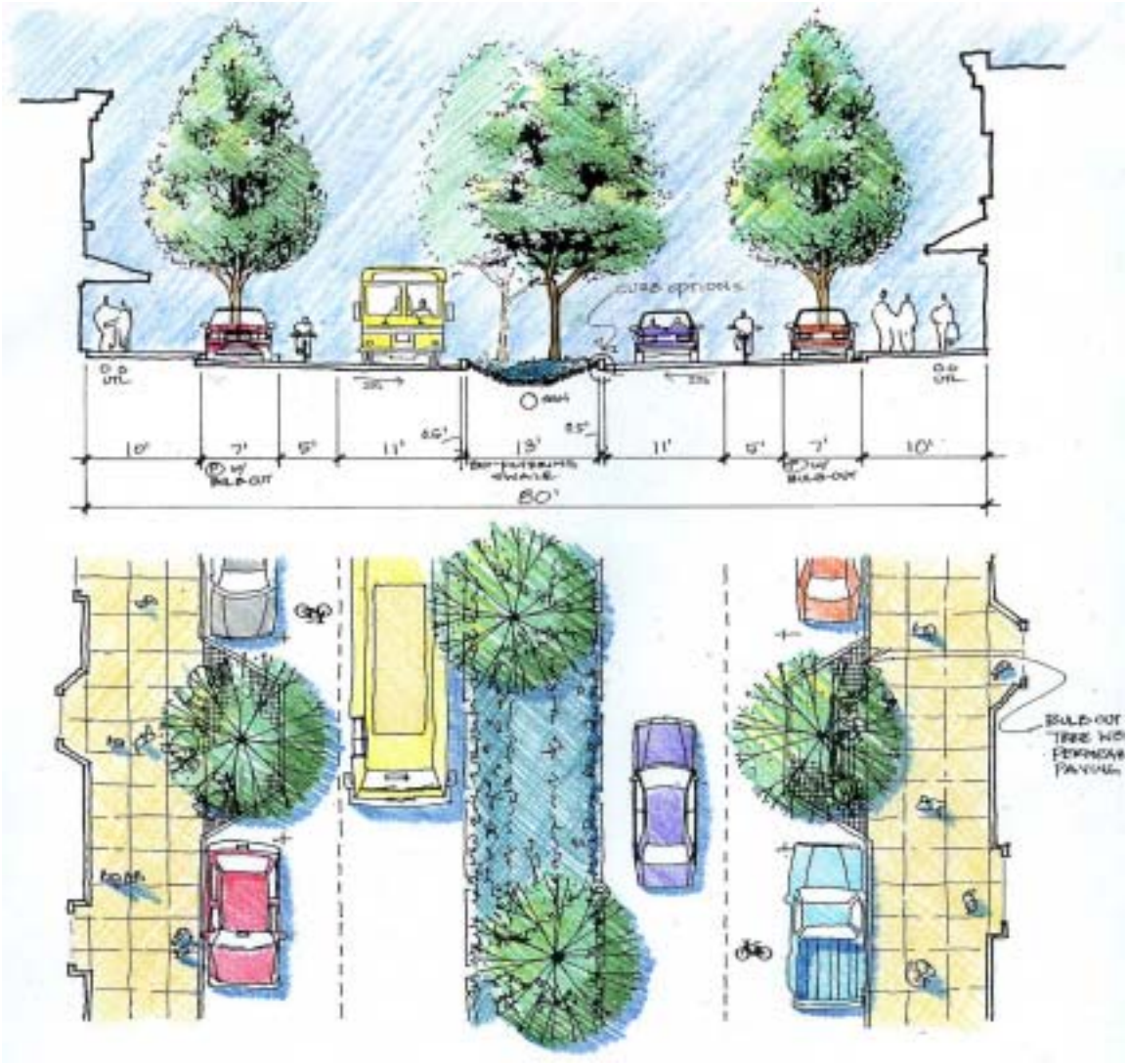

29H250 Phase 2 Report

Draft at 9.15.04

Thomas Jefferson Planning District



tjpdc.org

This 29H250 Phase 2 DRAFT Report details the findings of the recently completed study. It may be reviewed or downloaded from our website, and copies are available for review in local libraries and at the TJPDC office. Comments and questions can be e-mailed, mailed, faxed, or called in to the numbers below.

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September 15, 2004

Executive Summary

Introduction

This project is a continuation of the *29H250 Intersections Study*, completed in May 2003. The study area is expanded northward to include the Greenbrier and US-29 intersection and westward to the Barracks Road and US-250 Bypass interchange. An efficient, highly inclusive process was used to develop and evaluate several solutions that met the following goals:

- Improved function for all transportation types (regional and local auto, truck, transit, pedestrian, bicycle, and ADA)
- Access and safety maintained during construction
- Financially feasible in terms of construction cost and minimizing lost tax revenue.
- Near-term economic impacts are balanced with long-term gains.
- A road network that supports redevelopment opportunities and a mix of uses.
- Improved landscape quality and stormwater systems, and the visual character of private development and streetscape are enhanced.

Initial Design Concepts

US-29-Hydraulic-US-250 'Triangle' Concepts

The collaborative process resulted in three multi-modal design options each emphasizing a different path for regional traffic through the area. The Phase 1 designs were the starting point for developing the concepts. Influences from inside and outside the area identified the overlapping of regional and local traffic in the corridor and illustrated movement patterns on Hydraulic Road and US-29. From these patterns, three distinct transportation concepts were developed. Appropriate access management, intelligent transportation systems, and travel demand management techniques were used in all options.

Concept A: Continue the existing pattern of movement where both US-29 and Hydraulic Road carry regional and local traffic. Concept A draws directly from the Phase 1 findings.

Concept B: Focus regional traffic movements on US-29 by improving the interchange at the US-250 Bypass. De-emphasize Hydraulic Road as a regional route and restrict the intersection of Hydraulic/US-250 Bypass to right-in/right-out movements. The emphasis on US-29 allows Hydraulic Road to become more local-serving east of US-29, which would encourage pedestrian-supportive development.

Concept C: Reroute regional traffic onto Hydraulic and reconfigure the Hydraulic/US-250 Bypass interchange. Redesign US-29 south of Hydraulic to be more local serving. This concept would allow for pedestrian-oriented development on US-29, creating a character similar to that of Emmet Street south of the US-250 Bypass.

Network Concepts

All the concepts include additional local-serving roadways parallel to US-29 for connectivity among land uses in the county and city. The Hillsdale Drive extension, currently under study, and Cedar Hill Drive proposed for Albemarle Place are included in the circulation framework of smaller blocks. Converting US-29 north of Hydraulic Road to a multi-way boulevard would

complement the smaller block pattern formed by the local-serving parallel roadways and provide for pedestrian-scale development along US-29, while maintaining through traffic capacity.

Concept Evaluation & Refinement

The concepts were refined through a series of workshops and public meetings into five design alternatives. The evaluation took into account various technical, economic, and quality of life/environmental criteria. Detailed simulation modeling tested the effectiveness of traffic operations under future traffic volumes. Urban design options were developed to test the ability of the alternatives to accept development and to evaluate their pedestrian-supportive character. Stormwater and natural systems were evaluated for continuity and the connectivity of bicycle, transit, and pedestrian circulation. Costs for design and construction were also evaluated. Future travel times for regional trips on US-29 and the US-250 Bypass and for more local-serving routes were assessed. The analyses showed that without road improvements, future travel times would be considerably longer than current conditions. With the proposed improvements the future travel times, particularly for US-29 to and from the US-250 Bypass to the west, would be equivalent to or less than today's.

Recommended Design

The evaluation supports recommendation of Option B, which emphasizes improving US-29 to serve regional trips and changing the character of Hydraulic Road between US-29 and the US-250 Bypass. The Option B designs deliver a similar level of regional travel improvement as the other two options, while providing more cost effective construction, and resulting in a higher overall fiscal return from ensuing development opportunities.

The basic Option B design includes:

- Improving the US-29/US-250 Bypass interchange by adding a lane to the southbound to westbound on-ramp;
- Adding an auxiliary lane on the US-250 Bypass westerly to the Barracks Road interchange;
- Configuration of US-29 north of Hydraulic Road, eight-through-lanes-plus-turn-lanes, would be extended south to the US-250 Bypass interchange were additional lanes on US-29 are added and dropped in conjunction with the interchange redesign;
- South of the interchange area, Emmet Street would retain its current cross section;
- Increasing parallel local roadway capacity by constructing the Hillsdale extension from Greenbrier Road to Hydraulic Road and extending it further south of Hydraulic to Holiday;
- The westbound US-250 Bypass ramp to US-29 is redesigned connecting to a realigned Holiday/Angus intersection;
- The Hydraulic and US-250 Bypass intersection remains a signalized intersection with access revisions to provide right-in/right-out access on Rugby Road and Hydraulic Road. Left-out access from Hydraulic is permitted, but left turns onto Hydraulic from eastbound US-250 Bypass are not allowed
- Hydraulic Road would be reconstructed as a two-lane cross section with a landscaped median from US-250 Bypass to US-29 with modern roundabouts at intersections in place of traffic signals and stop signs.

The recommended design (see Figure RI 1) revises Option B in four locations making it more effective in meeting future demands throughout the 20-year design horizon:

- US-29/US-250 Bypass Interchange - a more cost-effective design is achieved with a diamond off-ramp configuration with one loop ramp rather than the existing modified cloverleaf design. The recommended design replaces the heavily-used eastbound-to-southbound loop ramp with a direct ramp to US-29/Emmet Street.
- Barracks Road and US-250 Bypass - the existing design's traffic signals at the ramp terminals are more cost effective in the near-term than Option B's double roundabouts. Roundabouts may be needed in the long-term as traffic on Barracks Road increases. The recommended design includes a merge (escape) lane in the westbound direction to accommodate traffic that wants to continue west on US-250 Bypass from the new auxiliary lane.
- US-29/Hydraulic Road - a grade separation of the intersection is necessary to meet the long-term traffic projections. A single point urban interchange configuration with US-29 under Hydraulic is recommended.
- North of Hydraulic on US-29 - a non-boulevard cross section would be more economical as it would minimize the reconstruction of US-29. However, the recommended design at US-29/Hydraulic is compatible with either a boulevard or non-boulevard cross section to the north. The decision about the cross section on US-29 north of Hydraulic should be linked with the findings of the upcoming expanded US-29 corridor study.

Hydraulic Road's change in character and access and the extension of Hillsdale Drive provide for more highly valued development in the City, similar to that proposed by Albemarle Place in the County. These opportunities allow public and private investment to implement development and transportation patterns that achieve the quality of life, transportation choice, and economic vitality desired by the community (see Figure AE 2). Following are specific reasons that the recommended design is preferred:

Deemphasizing Hydraulic as a major connector between US-29 and the US-250 Bypass allows it to:

- Function for more local level transportation trips;
- Support a vital commercial and mixed-use area between Greenbrier and US-250; and,
- Provides good access to businesses and services for pedestrians, bicyclists, and transit.

Transportation and urban design improvements for Hydraulic Road with sidewalks, bicycle lanes, park-like medians and roundabouts transforms its character from a street dominated by freeway traffic to one that:

- Provide an improved streetscape and multi-modal access that encourages new commercial and mixed-use development to front onto the street;
- Safely accommodates the important east/west bicycle connection;
- Provides safe and pleasant pedestrian environment, access, and circulation, and safe pedestrian crossings with median refuges;
- Creates an attractive streetscape with wide sidewalks, street trees, medians, and pedestrian-scale lighting;

- Connects development within the parcels in the triangle area and that north of Hydraulic Road; and,
- Provides a higher potential for 'Green Streets' landscaped water-quality treatments in proposed medians.

Construction of a single point urban interchange (SPUI) at US-29/Hydraulic Road supports multi-modal, economic, and urban design goals. If designed correctly, it:

- Protects pedestrians and bicyclists from exposure to heavy traffic on US-29 and provides a safe connection between areas east and west of US-29;
- Works most efficiently with existing topography in the area;
- The SPUI can work well with the concept of a multi-way boulevard to the north, if that proves to be a desired choice in the future corridor planning effort;
- Can be phased to follow the other planned improvements to satisfy building impact and project financing issues;
- Supports the deemphasizing of Hydraulic; and,
- Fits with the redirection of more local trips to the Hillsdale extension and connector roads to the west of US-29.

The reconfiguration of the US-29/US-250 interchange supports transportation, fiscal, and urban design goals as it:

- Reduces the amount of land occupied by off/on ramps, and creates new developable land in the triangle area;
- Provides high-quality access to Bodo's and nearby businesses, and creates the potential to expand the site to the north;
- Requires pedestrian and bicycle access improvements through the interchange similar to the other options, but with particularly high-quality access potential on the east side of US-29; and,
- Allows a sequence of construction that leaves the existing interchange in operation until the new interchange ramps are built, which minimizes regional delay

Construction of the Hillsdale Drive extension on the east of US-29 and Cedar Hill Drive on the west support:

- Near- to long-term private reinvestment on both sides of US-29 which will improve Charlottesville's and Albemarle County's sales and property tax base;
- High quality pedestrian and bicycle areas to the east and west of US-29 that can be connected to transit service and multi-use paths along US-29;
- Opportunities for public/private cost sharing;
- The Hillsdale extension integrates with the redesign of the US-250 Bypass west-bound off-ramp, the redesign of Hydraulic, and the catalyst development opportunities in the Triangle and the Brandywine properties to significantly improve the economic and urban design character of this part of Charlottesville; and,
- Potential for mixed-use development in the area that will be more economically and environmentally sustainable.

Construction Cost:

- When design, right of way, and construction cost is considered, Option B is lowest cost of the alternatives;
- When recommended design improvements are added to Options A and B, the overall costs are roughly equal, at about $130 million for all the alternatives;
- The recommended design is slightly more costly than Option A and slightly less costly than Option C; and,
- Overall costs could be significantly less with right of way proffered, and potential private construction of some portions in conjunction with redevelopment.

Revenue Implications

Under Option B, less than five percent of the land and building square footage are taken off the tax rolls as a result of the transportation improvements. Much of this is along existing property lines, providing increased road frontage at the same time. Property value alone is projected to increase by one- third to two-thirds (depending on the Option) within seven years of investment. The long term implications will be even more significant as redevelopment becomes a viable economic option.

Tax revenues are projected to increase under all Options. Property, meal and sales tax revenues (largely in the City) are projected to increase by $1.4 to $2.2 million per year depending upon the transportation Option selected. At an interest rate of 5 percent over 20 years this stream of new tax revenue could generate $17 to $28 million in capital. (Note: these figures do not include increases in value and revenue in County due to Albemarle Place development, which could equal these numbers).

From a real estate investment perspective Option B offers the greatest opportunity. It has minimal negative impact on existing land use, and maximum positive impact. It benefits the property owners by enhancing access, creating near term development opportunities and potential for higher density, mixed-use development in the long term.

Comparing seven year net new City revenues from impacted properties to the cost of the options demonstrates the following:

- Tax revenue associated with near term development does not fully justify the transportation improvements;
- Option B-2's fiscal impacts almost offset the annual costs of construction in year seven;
- Option C is the most problematic from a cost/land use impact standpoint.

Phasing

The recommended design provides flexibility for 1) construction timing of future improvements and 2) the sequence of construction for each improvement. This allows the package of improvements to be implemented as a series of independent roadway projects. Many individual design elements can be implemented concurrent with redevelopment activities. The recommended design also provides for existing interchange movements to operate relatively unimpeded during construction of new ramps. The following sequencing of design elements is suggested, although planning, design, and right of way acquisition for these elements may need

to start in the short term. The recommended sequencing should also be adjusted to meet specific development plans of major property owners in the study area.

Short-term: (1-5 years)

- Construct Hillsdale north of Hydraulic (the current City/VDOT project), and
- Expand southbound-to-westbound ramp at US-29/US-250 Bypass (near Best Buy) with auxiliary lane to Barracks Road off-ramp

Mid-term (5-15 years)

- Construct Hillsdale extension south Hydraulic as property redevelops
- Construct eastbound to northbound/southbound off-ramp at US-29/US-250 Bypass
- Close eastbound to northbound/southbound off-loop at US-29/US-250 Bypass and reconstruct northbound to eastbound on-ramp
- Construct new off-ramp at Holiday
- Reconstruct Hydraulic Road from US-29 to the US-250 Bypass
- Reconstruct southbound to eastbound on-loop at US-29/US-250 Bypass
- Construct westbound merge lane on the US-250 Bypass at Barracks Road interchange

Long-term (15-20 years)

- Replace US-29/Hydraulic intersection with single point urban interchange

Implementation

The strategy for implementation of the recommended design involves several additional steps in the planning and funding process before design and construction can proceed. These steps include review of these recommendations by decision makers and the public, integration of the findings from this study with the future corridor study on US-29 north, and coordination with on-going City/County/VDOT transportation projects in the study area. Following are suggested actions related to each of these areas:

Review of Recommendations

- The Technical Report will be available for comments through September, which will be either answered in the final report, addressed in project design and engineering, or in the Phase 3 29N Project.
- More detailed review by developers and locality staff reviewing specific project proposals is encouraged, and their concerns will be incorporated into the final report.

Phase 3 29N Project

- Planning and fund raising is under way to conduct the long-awaited multimodal study of the full 29 North Corridor from the 29H250 area to the University Research Park, north of Airport Road.
- This next phase would be conducted in concert with Albemarle County's Northern Development Area Neighborhood Master Plan, with an added goal of fully linking County land use and development plans and regulations with VDOT and local transportation project planning.

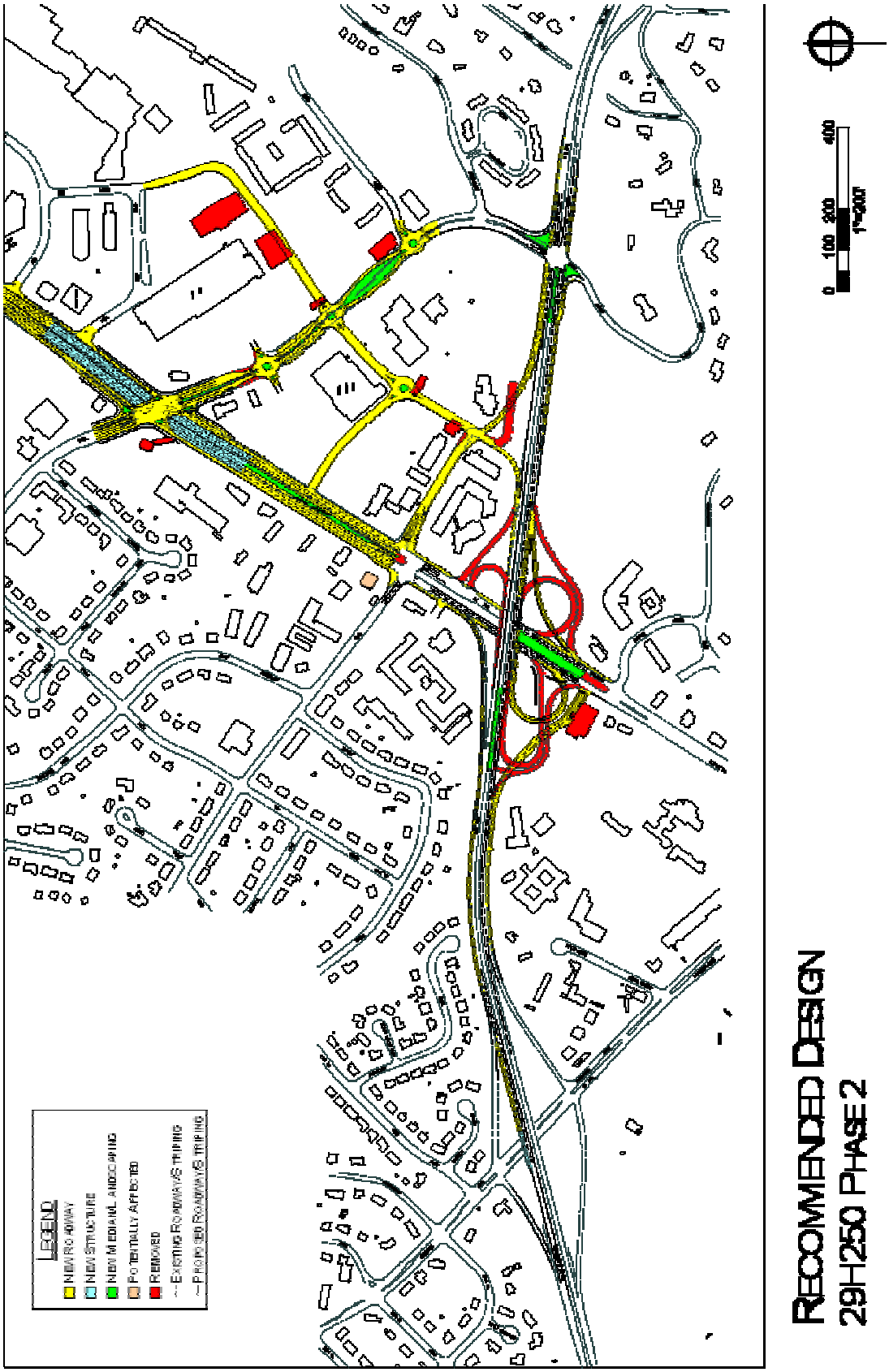
Coordination

- The Hillsdale Extension project is completing the Location phase, and should proceed into the Design phase shortly. Care should be taken to incorporate the multimodal and redevelopment goals of this study. Negotiations should be conducted between the City, VDOT, and landowners to determine the feasibility of accelerating construction via a combination of proffered right of way, construction contributions, concurrent re-development, and financing instruments.
- Funding should be allocated for the second recommended short-term project, expansion of the southbound to westbound on-ramp at US-29/US-250 Bypass with auxiliary lane to Barracks Road off-ramp.
- Explore establishment of a Regional Transportation Authority (City, County, MPO) to demonstrate localities' willingness to 1) work together on transportation and development projects, and 2) raise public-private funding contributions to accelerate project completion.

Credits

This study was conducted by an interagency technical team from the County of Albemarle, City of Charlottesville, Virginia Department of Transportation (VDOT), Thomas Jefferson Planning District Commission (TJPDC) and Charlottesville-Albemarle Metropolitan Organization (MPO). Added to the staff team were three consultant firms with expertise in alternative street design (Meyer Mohaddes Associates), urban design (Community Design + Architecture), and economic impacts analysis (ZHA). Funding for this study was provided by VDOT, with a local match added by the TJPDC and significant staff time provided by each locality and agency.

In addition to extensive public workshops and focus groups, community members served in advisory capacities. Representatives from the business community were appointed to a Study Steering Committee with a focus on the economic impacts analysis. The MPO's CHART Citizens Committee helped design and facilitate the public process.



RECOMMENDED DESIGN
29H250 PHASE 2

Visualization of recommended Option (B) at Hydraulic Road, between K-Mart and Kroger, facing wewith US-29 in the distance

Visualization of US-29 facing south towards Hydraulic Road intersection, India Road at left, Albemarle Place development at right. Recommended Option of grade-separated intersection (SPUI) with US-29 through lanes passing under Hydraulic

Introduction

Study Purpose

This 29H250 Phase 2 study was built on the 29H250 Intersections Study that was completed in May 2003. It set out to expand on the analysis on previously identified conceptual design solutions, consider new designs, and produce new design solutions for areas not studied in the first phase that meet all goals. The purpose of the 29H250 Phase 2 Study was to develop and complete an analysis of solutions and prepare final recommendations for near-term and long-term projects that would improve portions of the US- 29 North corridor. The proposed design solutions consider economic, environmental, and affordability impacts, as well as overall transportation system improvements. Initially, final recommendations and a scope for Preliminary Engineering (P.E.) for recommended projects was envisioned. As the study developed and Albemarle County made more detailed plans for its Northern Development Area Master Plan (which will include a continuation of this study as the transportation element), it was decided to hold off on improvements until the recommendations for the entire 29N urban corridor are presented.

The specific study area was defined as the 'triangle' of US-29/250 Bypass, 29/Hydraulic, and Hydraulic/250 Bypass, which was studied in Phase 1, and added the Barracks Road exit from the 250 Bypass. This expansion was necessary to include significant components of the immediate area that have an impact on it.

The goals for Phase 2 were developed from the Phase 1 study and focus on the transportation network and economics. Those goals are to:

- Improve function for all types of transportation (auto, truck, transit, pedestrian, bicycle, and ADA)
  - Improve safety for all
  - Improve access for customers, workers, and residents
  - Minimize congestion along streets
  - Minimize impacts to travel time on main through routes
  - Create a more connected street system
- Improve economics of the corridor
  - Protect existing businesses and provide new business opportunities
  - Protect and improve the value of adjacent neighborhoods
  - Protect and increase sales and property tax base
  - Maintain and improve employment
  - Provide new housing opportunities

Objectives were also defined and focused on transportation, economic, and quality of life/sustainability issues. Those include:

- Transportation Issues
  - Transit access and safety
    - Transit customer access to businesses and neighborhoods
    - Provide for planned transit improvements

        - Create safe and comfortable transit stops

    - Vehicular access and safety
        - Provide for both local and through trips
        - Separate local and through trips when possible
        - Improve "way finding" – local and directional signs

    - Maintain access and safety during construction

- Economic Issues
    - Revenues are concern for City and County
        - Sales tax
        - Property tax
    - Desired development needs to provide value to property owners
    - Planned improvements must be financially feasible
    - Balance near-term economic impacts and long-term gains

- Quality of Life/Sustainability Issues
    - Maximize transportation choice
    - Provide a mix of land uses
        - Support transit and internal trips
        - Mix housing for household types and income levels
        - Mix retail for both regional and local needs
        - Mix employment opportunities – office, industrial, service, & retail
    - Improve stormwater systems
        - Enhance water quality
        - Reduce peak flows to Meadow Creek
        - Make water quality system an amenity
    - Improve landscape quality
        - Street trees
        - Enhance and protect on-site landscape
    - Improve visual character of private development and streetscape

Phase 1 Background

The Phase 1 study was a staff exercise designed to show that practical solutions could be developed for the triangle area. The study area was chosen due to its increasing traffic problems and significant potential for improvements. The US-29 and Hydraulic Road intersection was also noted by City and County policymakers as requiring immediate attention during the recent long-range transportation plan update process. Policymakers were also concerned about impacts from potential major redevelopment proposals under consideration in both City and County.

Several objectives for this study were identified and met. One key objective was to develop a new working method that employed innovative approaches, beginning with the composition of the Technical Team. It was important to get local and VDOT staff working together on a project from the start, rather than complete designs and request support after the fact. Another objective was to design an efficient, engaging public process. Acknowledging that the region does not exist in a vacuum, but functions as a network of residents, businesses, and visitors, an active public involvement program solicited direct input to identify concerns and potential

solutions. A series of focus groups included various special interests. A further objective was to complete the study in a short time frame to make the most of available staff resources, it was important to set this objective in order to gain needed support as well as meet budget constraints. The final objective was to identify feasible solutions that could be built without shutting down the region's key transportation and business corridor.

The Phase 1 study acknowledged that numerous studies have taken a look at the US-29 corridor. These prior studies were reviewed and relevant merits of each were identified. Historically, these studies looked at trying to find the best solution to improve the roadways while paying minor attention to other issues. This study has taken a different approach and has sought to provide an analysis of many issues that are pertinent to feasible design alternatives. To be successful, this US-29-Hydraulic-US-250 Bypass Intersection study not only had to look at the multi-modal needs of the area, but also consider how transportation improvements could support economic development and desired land use.

The goal of the Phase 1 study was not to develop detailed design solutions, but rather show that feasible design concepts could be developed for the study area. The major traffic improvements recommendations resulting from Phase 1 included a grade-separated intersection at 29 and Hydraulic Road, constructed with roundabouts at the end of the off-ramps for optimum traffic control. Signalized intersections could also work, although with less capacity, pedestrian access and safety. A new Hydraulic Road alignment was proposed just north of existing Hydraulic to allow full traffic movements during construction.

Proposed improvements on 29 included the widening of 29 to four lanes just south of Hydraulic, and a potential underpass beneath 29 connecting Sperry and Seminole Square. Recommendations for the Angus Road intersection of 29, which was found to be a direct cause of traffic backup on 29 through Hydraulic, included the removal of the traffic light, the closure of the median, the addition of a U-turn opening just south of Angus, and an underpass (or overpass) crossing 29 at Angus connecting to Hillsdale Drive Extended via Holiday Drive.

Potential 250 Bypass improvements included the removal of the signal at the north-bound off-ramp at 29, adding a lane to the southbound on-ramp, moving the Barracks Road exit westward using a cloverleaf off-ramp, and closing the existing Barracks Road on-ramp. In the short term, the Rugby Road through movement to Hydraulic could be eliminated allowing more green signal time to through movements on the 250 Bypass. Longer-term improvements would include a grade-separated intersection at the 250 Bypass and Hydraulic. A modification to the existing 29/250 Bypass cloverleaf design was also proposed, to include a collector-distributor road to accommodate the exiting and entering traffic. Further analysis of these options is recommended in the next phase of this project.

These Phase 1 proposals took into consideration mobility needs, land use, and economic development. It considered the integration of redevelopment and proposed traffic improvements in this area as essential. The Phase 1 study also suggested that mixed-use development could be implemented by creating blocks within existing development and linking neighboring parcels with streets to complete the gaps in the grid, allowing for either big box or neighborhood-scaled development.

Study Approach

The approach used in the 29H250 Phase 2 study included a range of comprehensive elements. Since this study was a continuation of previous efforts, it was important to consider all elements of the previous study including its approach. Two factors were pertinent to maintain in this study—the public involvement process and the inter-agency staff team structure. There were three distinct stages in the study, each with a technical and public involvement component.

In Stage 1, the Phase 1 staff technical team reconvened to refresh and discuss Phase 1 outcomes as well as began preliminary discussion on important considerations for Phase 2. The staff team introduced the consultants to the Phase 1 work and design solutions. All previous alternatives were equally considered as well as any new alternatives proposed by team members. During this stage, three major concepts were developed using a systems approach differentiating local and regional routes. In addition to having input from special interest groups, the public was invited to comment on results from the Phase 1 study and considerations for the Phase 2 study.

Stage 2 focused on developing the three concepts into detailed design solutions including technical engineering and land use and economic analysis. During this stage, the Project Team convened for a week-long workshop performing very intense and detailed engineering and design analysis. To begin the process, evaluation criteria were developed for each of the design alternatives and were based on the stated goals of the study and included the general criteria of constructability with a focus on accessibility and safety, right of way requirements, and funding.

The public involvement component was heaviest during this stage with multiple meetings held with special interest groups including business and property owners and developers. A public meeting was held at the end of this stage to present the detailed design concepts. In addition to viewing the presentation, participants were given worksheets detailing design concepts to review and comment on.

Stage 3 wrapped up the study and began with the review of comments received at the final public workshop and from other various entities. The Project Team continued technical, land use, and economic analysis. In this stage all outstanding issues were researched and resolved and a final package of design alternatives were produced along with a package of recommended improvements.

Participants

This study continued to use the highly effective technical work team comprised of staff from various agencies including the County of Albemarle, City of Charlottesville, Virginia Department of Transportation (VDOT), Thomas Jefferson Planning District Commission (TJPDC), and Charlottesville-Albemarle Metropolitan Organization (MPO). The technical team was joined by an expert consultant team including Meyer, Mohaddes Associates serving as lead transportation and engineering consultants, Community Design +Architecture as land use and redevelopment consultants, and ZHA, Inc. contributing economic analysis.

A Study Steering Committee, consisting of members of the business community, and the MPO's CHART Citizens Committee served in advisory capacities. Active participants also included representatives of various groups including property and business owners, developers, and environmental advocates. Other members of the public, including neighborhood residents, played a large role in the development and outcome of the solutions recommended within.

Alternatives Development

The process of developing alternative design concepts for the Phase 2 study started with revisiting the Phase 1 design concepts in their entirety and testing them for applicability with the larger study area. This review also allowed for comments received on the Phase 1 report to be included in the evaluation and resulted in adjustments to several of the Phase 1 concepts. Most notably, flyover ramps were eliminated from consideration as inappropriate for the scale and urban form of the area.

Influences both inside the study area and external to it were used to identify the overlapping of regional and local traffic in the corridor and to illustrate general movement patterns on Hydraulic Road and US-29 in relation to US-250 Bypass. This understanding of how regional traffic (Lynchburg to Culpepper) overlaps with local trips that either originate in the residential areas adjacent to US-29 or are destined for the retail/commercial land uses in the corridor provided the basis for a systems-level approach that identified three systems concepts for the Phase 2 study.

The three concepts, labeled A, B, and C, approach improving roadways in the study area by focusing investment in different locations within the 29H250 triangle of the study area as follows:

A. Generally continue the existing pattern of movement where both US-29 and Hydraulic Road carry regional and local traffic. This approach would require intersection expansion at the three points of the 29H250 triangle and would draw directly from the Phase 1 findings. Figure AD-1 illustrates this concept.

B. Focus the regional traffic movement on US-29 by modifying the interchange at the US-250 Bypass to address capacity deficiencies in the current design. Hydraulic Road would be deemphasized as a regional route and the intersection of Hydraulic/US-250 Bypass would be restricted to right-in/right-out. The emphasis on US-29 would allow Hydraulic Road to be more of a local-serving street east of US-29, which would allow for a zone of pedestrian-supportive development. Figure AD-2 illustrates this concept.

C. Refocus the section of US-29 south of Hydraulic to be more of a local-serving street (consistent with the current land use pattern of smaller parcels and frequent access points). This would be accomplished by rerouting regional traffic onto Hydraulic and reconfiguring the interchange at Hydraulic/US-250 Bypass. A local parallel access road would be provided to the north of Hydraulic Road to maintain connections to Michie and Brandywine in order to minimize the number of intersections on Hydraulic. This emphasis on Hydraulic Road would allow for a zone of opportunity for pedestrian-oriented development on US-29 (allowing a character more similar to that of Emmet Street south of the US-250 Bypass). Figure AD-3 illustrates this concept.

All of these alternatives would include the use of appropriate access management, ITS, and demand management techniques to improve the multi-modal operations of the system. Additionally, the travel pattern analysis also highlighted the importance of additional local-serving roadways parallel to US-29 for connectivity among local and regional serving land uses in Albemarle Place and at Seminole Square, particularly north of the 29H250 triangle of intersections. This understanding led to incorporating the Hillsdale Drive extension, currently

under study by others, and Cedar Hill Road (proposed for Albemarle Place) into a circulation framework for the study area. The framework was used to define alternate block patterns and potential local-serving roadway connections that were the basis for the analysis of urban form and land use alternatives for the study area.

Phase 1 Options Revisited

A matrix of intersection treatments was developed to identify the possible combinations of Phase 1 designs for the three primary study area intersections (US-29/Hydraulic, US-29/US-250 Bypass and Hydraulic/US-250 Bypass) and their effectiveness with respect to the three Phase 2 concepts. Table AD-1 shows the matrix developed. The Phase 1 designs were analyzed in three rounds:

- Round 1: Review of the feasibility and constructability of each design alternative. Those alternatives that did not meet the initial criteria were either fully or partially eliminated from further consideration. For example, portions of the Design Alternative 2 that were found to be infeasible were eliminated from further consideration. This included the elimination of the flyover option of US-29. However, the improvements proposed as part of this alternative at the intersection of US-250 Bypass and Hydraulic were kept for further consideration.

- Round 2: Each design alternative from Phase 1 was mapped to a Phase 2 design concept (A, B or C).

- Round 3: Each design alternative was prioritized in respect to meeting the evaluation criteria (discussed in the following chapter). Priority 1 design alternatives better fit the evaluation criteria than Priority 2 alternatives. Less desirable design solutions are represented in Table AD-1 as strikeout.

Table AD-1 was created without the evaluation of each Phase 1 design alternative with all of the evaluation criteria. However, the discussion of each individual Phase 1 alternative included an array of considerations touching on the most critical criteria. Table AD-1 not only identifies which components of a Phase 1 design may be of relevance for the Phase 2 study, it also indicates the degree to which a design may be effective within a specific concept. The fact that only few of the Phase 1 designs were shown to be particularly effective for Concepts B and C indicated that additional work was necessary to either further modify the existing designs or to develop new designs that were tailored to the goals of these concepts.

Phase 2 Concepts

The findings from the review of Phase 1 concepts, as summarized in Table AD-1, were used as the basis for development of the three design concepts. Each of these concepts was developed through an iterative process, in which the concept designs were tested against future traffic volumes (discussed in the Alternatives Evaluation) and the evaluation criteria on a preliminary basis and then modified to address deficiencies that were identified. An underlying set of assumptions were made that all of the design concepts would include the use of appropriate access management, intelligent transportation systems (ITS) technology, and demand management techniques to improve the multi-modal operations of the system. The follow sections describe the final versions of the three concept designs. The primary designs for the 29H250 triangle area, extended to Barracks Road, are discussed first. The corridor network

components and options for US-29 north of Hydraulic Road are discussed separately at the end of this chapter.

Option A

For Option A, the investment strategy focuses on improvements to US-29 at Hydraulic Road and at the US-250 Bypass interchange and on the US-250 Bypass at Hydraulic and Barracks Roads. The underlying concept for Option A is to continue mixing regional and local traffic on both US-29 and Hydraulic Road much as is currently occurring, but with improvements to the road system to enhance traffic operations. Figure AD-4 illustrates the roadway changes included with Option A.

As defined during the Phase 1 study, the patterns of using Hydraulic Road for regional movements to and from the east on the US-250 Bypass and US-29 for regional movements to and from the west would cause turning movements at the US-29/Hydraulic Road intersection to continue to increase to the extent that grade separation of the intersection into an interchange would be necessary to accommodate future traffic volumes. Two designs for this interchange were incorporated into Option A. One design (Option A1, Figure AD-4) uses a modified single point urban interchange (SPUI) design to minimize the physical dimensions of the grade separation and ramping and brings six lanes of US-29 under Hydraulic Road. The other design (Option A2, Figure AD-5) uses the double roundabout design developed in Phase 1 that takes eight lanes of US-29 over Hydraulic Road. Ramping would be required in either condition to move traffic between US-29 and Hydraulic Road. With the SPUI configuration, a traffic signal would control turning movements in the interchange. With the double roundabout design, no traffic signals would be used, but the roundabouts would need to be two-lanes wide to accommodate future traffic volumes.

The Phase 1 work also identified deficiencies in the existing design of the US-29/US-250 Bypass interchange that were addressed in the Option A design. Primary changes include expanding the eastbound to northbound off-loop from one lane to two lanes and relocating the northbound to eastbound on-ramp. The southbound to westbound on-ramp would similarly be expanded to two lanes, which would require closing the westbound to southbound left-turn movement on the US-250 Bypass. The added future traffic south of Hydraulic Road on US-29 would require adding one through lane to each direction on US-29 from the US-250 Bypass to Hydraulic Road. The basic eight through lane cross section north of Hydraulic Road on US-29 to Greenbrier Road would be adequate to accommodate future traffic volumes.

Adding a lane to the westbound on-ramp to the US-250 Bypass at US-29 would also require creating an auxiliary lane westbound on the Bypass to connect to the off-ramp at Barracks Road. Preliminary analyses of the weaving conditions on the US-250 Bypass indicated that additional distance between ramp terminals would be required for the roadway to operate safely. The Option A design incorporates this added weaving distance by replacing the diamond configuration at Barracks Road with a partial cloverleaf configuration on the westbound side of the US-250 Bypass. The eastbound side of the Barracks Road interchange would not be affected by Option A.

The continued emphasis on Hydraulic Road between US-29 and the US-250 Bypass would increase traffic volumes in the future, but not beyond the point that the existing four-lane plus turn lanes cross section would not adequately address. However, the increased volumes would

require additional lanes at the intersection with the US-250 Bypass, which is presumed to remain as a signalized intersection and to accommodate the same turning movements as exist today. The intersections of Michie and Brandywine Drives with Hydraulic Road would be retained.

The westbound to northbound movements at both Hydraulic and at US-29 were determined to be problematic with the future traffic volumes and a redesign of both connections was developed. As shown in Figure AD-4, the westbound to northbound movement from US-250 Bypass to Hydraulic would be redirected to a new off-ramp that would connect to Holiday Drive. The ramps in the northeast quadrant of the US-29/US-250 Bypass interchange would be removed and the intersection of Holiday Drive and Angus Road would be realigned to form a single intersection. This series of changes was designed to resolve the existing queuing conditions adjacent to the Best Buy driveway and to eliminate the need for signalization at the Best Buy driveway since the signal at Holiday/Angus would serve Best Buy traffic from the Bypass.

Additional local-serving roadways parallel to US-29 for connectivity among local and regional serving land uses in Albemarle Place and at Seminole Square were incorporated into Option A. As illustrated in Figure AD-4, the Hillsdale Drive extension, currently under study would be extended south of Hydraulic Road and incorporated into a circulation framework that defines an alternate block pattern for the 29H250 triangle area. Potential local-serving connections to the Kroger site and to Holiday Drive are also included in the design. The potential future extension of Hillsdale to an on-ramp to westbound US-250 Bypass was also included in the design for Option A. These local-serving streets were assumed to be two-lanes with parking and turn lanes at major intersections. In Option A, the existing driveways to Kroger and K-Mart from Hydraulic Road (currently a signalized intersection) would be closed and relocated to the Hillsdale Drive extension. The intersection of Hillsdale Drive extension and Hydraulic Road would be signalized.

Option B

For Option B, the investment strategy focuses on improvements to US-29 at the US-250 Bypass interchange and on the US-250 Bypass at Barracks Road. The underlying concept for Option B is to separate regional and local traffic such that regional traffic stays on US-29 between Hydraulic Road and the US-250 Bypass, which would allow Hydraulic Road to revert to serving primarily local traffic. Figure AD-6 illustrates the roadway changes included with Option B.

The change in regional traffic emphasis that is the basis for Option B allows several substantial design differences from the Phase 1 work. De-emphasizing Hydraulic Road as a regional route to the US-250 Bypass reduces the volume of turning traffic at the US-29/Hydraulic Road intersection, which allows the intersection to operate into the future with its current configuration. Reducing the amount of regional traffic on Hydraulic Road between US-29 and the US-250 Bypass allows for fewer travel lanes on Hydraulic Road and reduces the demands at intersections on this segment of the roadway. With less regional traffic using Hydraulic Road and more using US-29 between the US-250 Bypass and Hydraulic Road, there would be more traffic using the interchange at US-29/US-250 Bypass, which would require additional improvements over those discussed in Option A.

The US-29/US-250 Bypass interchange requirements have been addressed in Option B through two designs. One of the designs (Figure AD-6) uses a design developed in the Phase 1 work that incorporates a collector-distributor (CD) road that would serve the eastbound-to-southbound and

the northbound and southbound-to-eastbound ramp movements. A higher capacity exiting movement for eastbound to northbound traffic would be provided by a widened off-loop and an auxiliary lane on the US-250 Bypass. The CD road, which would cross over the eastbound-to-northbound off-loop, provides for a higher capacity interchange by separating the entering and exiting volumes upstream of the interchange and eliminates merging on the mainline US-250 Bypass bridge over US-29. This design does require new structure at the interchange and would add on a level of ramping above the existing bridge over US-29 and would require closing the westbound-to-southbound left-turn movement on the US-250 Bypass.

The other design for Option B (see Figure AD-7) replaces the eastbound side of the US-29/US-250 Bypass interchange with a par-clo design. In this modified design, an eastbound off-ramp is used in place of the existing off-loop and a CD road is not required. An auxiliary lane is added to eastbound US-250 Bypass from the Barracks Road on-ramp nose to provide for a two-lane exit ramp onto the new off-ramp. The off-ramp would ultimately have to widen to provide for three left-turn lanes and a right-turn lane where it intersects with Emmet Street near Morton Drive. The off-ramp intersection would operate under signal control, which would be interconnected with the signal at Morton Drive as illustrated in Figure AD-8. The southbound-to-eastbound on-loop would be reduced in dimension as it would not have to climb as high as the other Option B design (since it would be connecting to the existing bridge over US-29, not the new CD road). Similarly, the northbound-to-eastbound on-ramp would be relocated closer to the US-250 Bypass since the eastbound-to-northbound off-loop would be removed.

As with Option A, the southbound to westbound on-ramp would be expanded to two lanes and a westbound auxiliary lane would be added to the US-250 Bypass to connect to the off-ramp at Barracks Road. The same concern about weaving conditions would be present as described above for Option A. Rather than replacing the diamond configuration at the US-250 Bypass/Barracks Road interchange, Option B retains that configuration, but addresses the weaving issues in two ways. One is the inclusion of a westbound “escape” lane where the westbound auxiliary lane is continued past the Barracks Road off-ramp for a sufficient distance downstream and than merged back into the mainline lanes. This treatment would allow the Barracks off-ramp to remain near its present location, but would require adding to the bridge deck over Barracks Road to accommodate the extra lane. The other element in Option B is to replace the ramp terminal signals with modern roundabouts to reduce queuing on the ramps.

As with Option A, the added future traffic south of Hydraulic Road on US-29 would require adding one through lane to each direction on US-29 from the US-250 Bypass to Hydraulic Road. In Option B, the added lane in the northbound direction would start north of Morton Drive. The basic eight through lane cross section north of Hydraulic Road on US-29 to Greenbrier Road would be adequate to accommodate future traffic volumes. Similarly, Option B uses the Option A design that redirects the westbound to northbound movement from US-250 Bypass to Hydraulic to a new off-ramp that would connect to Holiday Drive. The ramps in the northeast quadrant of the US-29/US-250 Bypass interchange would be removed and the intersection of Holiday Drive and Angus Road would be realigned to form a single intersection.

Option B reconfigures Hydraulic Road between US-29 and the US-250 Bypass as a two-lane roadway. Intersections on Hydraulic Road would be modern roundabouts. Curb parking would be introduced in parking bays northwest of the new intersection with the Hillsdale Drive extension and a widened landscaped median would be provided between that intersection and Michie Drive.

The intersection of Hydraulic Road with the US-250 Bypass would be modified to redirect traffic. The Rugby Road approach would be changed to provide only for right-in and right-out traffic and the Hydraulic Road approach would provide for right-in, right-out and left-out traffic. Through movements between Rugby Road and Hydraulic Road would be eliminated, as would eastbound left turns from the US-250 Bypass. The westbound right-turn lane that currently exits onto Hydraulic Road would be reconfigured into a through lane to serve the new off-ramp to Holiday Drive. The proposed changes in traffic operations would allow the intersection area to serve future traffic with about the same overall space requirements as the existing configuration, although minor widening for an eastbound acceleration lane would be required.

Similar to Option A, Option B would incorporate additional local-serving roadways parallel to US-29 for connectivity among local and regional serving land uses in Albemarle Place and at Seminole Square. The Hillsdale Drive extension and potential local-serving connections to the Kroger site and to Holiday Drive are also included in the design as two-lane streets with parking and turn lanes at intersections. In Option B, the existing driveways to Kroger and K-Mart from Hydraulic Road (currently a signalized intersection) would be changed to a modern roundabout.

Option C

The rationale for Option C was to separate the regional traffic from US-29, move it along a separate corridor following the alignment of the existing Hydraulic Road, and provide a new interchange at the Hydraulic/US-250 Bypass intersection that would allow smooth and continuous flow of the regional traffic. US-29 (between Hydraulic and the US-250 Bypass) could then be deemphasized to an extension of the existing Emmett Street, which would allow for improved connectivity between parcels on the east and west sides of US-29 as well as provide space for an improved pedestrian realm along the street. The major infrastructure investment would be focused on the US-29/Hydraulic and the Hydraulic/US-250 Bypass intersections.

An early preliminary design for Option C provided a four-lane divided road in the center of US-29 (north of the Hydraulic Road intersection) to separate the regional traffic. This roadway descended underneath the US-29/Hydraulic intersection, followed the general alignment of the existing Hydraulic Road, passed under the proposed Hillsdale Drive Extension, and then intersected the 250 Bypass at the existing Hydraulic/250 Bypass intersection. The existing Hydraulic Road was shifted northward and reduced to a local access road.

The design was later refined as a raised structure that passed over the US-29/Hydraulic intersection and included the elimination of ramps at the US-29/US-250 Bypass intersection. This concept was further refined to add center ramps to provide access to and from Hydraulic Road (West). Figure AD-9 illustrates the roadway changes included with Option C.

Option C also includes development of an interchange to replace the existing intersection at Hydraulic Road/US-250 Bypass. The new interchange would raise the grade of the US-250 Bypass to cross over Hydraulic Road, which would allow the ramps to and from eastbound US-250 Bypass to pass under the mainline roadway. The new interchange would require Rugby Road to be closed on the south side of the US-250 Bypass. Westbound ramp movements would occur on the north side of the Bypass and would allow exiting traffic to connect to either the

elevated Hydraulic or the at-grade access road, which would connect to Brandywine, Michie, and Hillsdale Drives.

The westbound on-ramp would pass under a new westbound off-ramp that would connect to Angus Drive at US-29/Emmet Street. While this new off-ramp is similar to that proposed in Options A and B, the vertical alignment required to work with the westbound entrance ramp from Hydraulic Road would not allow the off-ramp to align with Holiday Drive as it does in Options A and B. Rather, the new ramp would require replacing Holiday Drive with an extension of Angus Road, which would require acquiring new right of way and removal of existing buildings.

The existing interchange at US-29/US-250 Bypass would be removed and new ramps in a diamond configuration with a traffic signal would be installed to allow traffic on Emmet Street to access the eastbound lanes of the US-250 Bypass.

Similar to Options A and B, Option C would incorporate additional local-serving roadways parallel to US-29 for connectivity among local and regional serving land uses in Albemarle Place and at Seminole Square. The Hillsdale Drive extension and potential local-serving connections to the Kroger site and to Holiday Drive are also included in the design as two-lane streets with parking and turn lanes at intersections. In Option C, Hillsdale Drive would pass under the elevated Hydraulic Road and the existing driveways to Kroger and K-Mart from Hydraulic Road would be removed and access rerouted to connect to Hillsdale Drive.

Network Concepts

The concept of creating a network of local streets north of Hydraulic Road and within the triangle area to the south is a critical component to improving congestion on US-29, expanding multimodal access to local destinations, enhancing economic vitality, and improving the general quality of life in the area. Creating travel routes that parallel US-29, Hillsdale Drive extended east of US-29 and Cedar Hill Road to the west, and providing regular connections between US-29 and these parallel streets allows for trips between (multiple) local destinations without using US-29 (see Figures AD 10 and AD 11). The proposed network of public and private roads will also create and improve pedestrian and bicycle circulation and access to destinations in the area that significantly lessens the need to use US-29 for local access purposes, which is of particular benefit to nearby residents.

The new access pattern will also benefit commercial development as it provides improved and convenient access to businesses and office development, and better connections between these and nearby residential areas. The creation of parallel routes through commercial development on both sides of US-29 also creates the opportunity for new commercial frontages along those streets, which increases the value of development and the viability of businesses. The different character of these streets compared to US-29 will invite a new type of development and street-oriented shopping experience to the area.

Figures AD 10 and AD 11 also illustrate the possible sequencing of public and privately financed road improvements throughout the proposed network. Hillsdale Drive extension, new Holiday Drive, and two new on/off ramps at the US-250 Bypass east of US-29, as well as Cedar Hill Road and a new connector to Commonwealth Drive west of the highway, will be the only new publicly funded roads in the initial phase of the proposed roadway network. New privately

funded roads will be built on an as-needed basis, dependent on the requirements arising from new development or other redevelopment activity. To complete the road network suggested in Figure AD 11, only a few segments of public roadways need to be added in the long-term future. Almost all of these segments are located east of US-29.

The following paragraphs describe key characteristics of the public roadways within the proposed network of streets:

Hillsdale Drive Extension

The extension of Hillsdale Drive between Greenbrier and Hydraulic Roads is the most important publicly financed addition to the roadway network north of Hydraulic Road. It provides for all modes of circulation – auto, truck, transit, bicycle, and pedestrian while also providing for improved aesthetics of public space in the area. The proposed extension of Hillsdale Drive south beyond Hydraulic Road to the proposed westbound off-ramp from the US-250 Bypass at Holiday Drive provides the necessary linkages to complete the local circulation system on the east side of US-29.

With its two travel lanes and center turn lane this street is designed to accommodate local traffic that accesses land uses alongside of it and as a distributor to various proposed roadways that tie Hillsdale Drive back to US-29. Travel and turn-lanes are dimensioned to encourage lower speeds and to keep the overall roadway width to the needed minimum. On-street parking is provided in parking lanes on both sides of the street to provide parking for adjacent uses, help to calm traffic speeds, and to provide pedestrians with a buffer from moving traffic. The 14-foot wide sidewalks are dimensioned to comfortably accommodate pedestrians traveling along the street between destinations or strolling along commercial first-floor uses facing onto the Hillsdale (see Figure AD 12). Where left-turns occur into streets or properties on only one side, the proposed three-lane configuration of the street allows for the installation of a pedestrian refuge in a landscaped median installed opposite from the turn pocket in the center of the street. This design provides pedestrians with a safe crossing in locations with high turning movements, where drivers often get distracted from observing crossing pedestrians. The configuration also provides opportunities for landscaping and street beautification.

Beyond the accommodation of pedestrian travel and activities the proposed cross-section for Hillsdale Drive extension also includes bicycle lanes. These provide safety for bicycle travel in north-south direction and good access to all destinations throughout the area. Most bicyclists do not feel comfortable riding on US-29 given the amount and speed of the traffic traveling along it; Hillsdale Drive provides a more accommodating alternative. The Hillsdale Drive bicycle lanes furthermore tie into the larger existing and proposed bicycle network by connecting to the existing bicycle lanes on Hillsdale Drive north of Greenbrier and to the east-west bicycle routes on Greenbrier (route only) and Hydraulic Road (bicycle lanes proposed).

To complete the multi-modal character of the street, it is also designed to be able to easily accommodate bus transit. Bus stops can either be provided by extending bulb-outs into the parking lane or in a traditional configuration with buses pulling into the parking lane.

The importance of Hillsdale Drive extension for the future development and revitalization of the area is given further emphasis by incorporating modern roundabouts and small-scale open spaces. Roundabouts similar to the one shown in the photo simulation in the Alternatives

Evaluation chapter Figure AE 2 are proposed for four locations along the Hillsdale Drive extension, including its segment within the triangle area. The single-lane roundabouts help to manage traffic speeds while maintaining good traffic flows, as well as provide the visual amenity of landscaping in the center of intersections. In the longer term there is the potential to create more significant open spaces that are integrated with street network. These have been illustrated at the center of the existing Seminole Square shopping complex and on the Seminole Cinema property where the Hillsdale alignment curves along the edge of the property. The roadway would form a one-way couplet around these open spaces serving to activate the open space and calming traffic speeds. These "greens" functions as unique public gathering spaces and visual amenity for the shopping area and future mixed-use residential development.

At Greenbrier, it is proposed to realign the southernmost segment of existing Hillsdale Drive with the future alignment of Hillsdale Extension south of Greenbrier. This realignment requires the relocation of an existing retention pond to a location immediately east of the new roadway alignment.

If a viaduct (elevated roadway) is built as proposed in the overall transportation Option C (Figure AD 9), Hillsdale Drive extension will continue south of Hydraulic through an underpass under the viaduct. Figure AD 13 illustrates in cross-section and elevation the desirable design characteristics of such an underpass. Particular attention was given to pedestrians' sense of comfort and safety while passing through the underpass, which are reflected by the decorative concrete balustrade between sidewalk and roadway and the frequent pedestrian-scale lighting provided throughout the underpass. Travel lanes and bicycle lanes were given some additional width to safely accommodate bicycles and motor vehicles, including trucks and buses.

Cedar Hill Road

Extending north from Hydraulic Road through the proposed Albemarle Place development west of US-29, Cedar Hill Road has the potential to serve as a north-south connection similar to the Hillsdale Drive extension. However, in order to capitalize on this potential it is proposed to extend this privately funded road with a publicly funded segment that completes the street's connection north to Greenbrier. It is proposed that both the publicly and privately funded segments of this road are built to the same cross sectional dimensions as proposed for Hillsdale Drive extension. This would require changes in the current plans for the Albemarle Place development, which shows the road as a 4-lane facility with an overall curb-to-curb width of 44 feet plus parking. The change is proposed because Cedar Hill Road as currently planned does not include bicycle lanes, and because its large curb-to-curb width would likely fail to encourage drivers to drive at speeds intended by the designated design speed of 20 to 25 mph.

Multi-way and Standard Boulevard Options for US-29

Both a Multi-way Boulevard Option and Non-Boulevard Option were considered for US-29 between Hydraulic and Greenbrier. At Hydraulic Road, the respective cross-section treatment would transition into the street cross section and intersection design selected for US-29 at Hydraulic (at-grade intersection, SPUI, or viaduct).

Multi-way Boulevard Option

Figure AD 14 illustrates the cross-section for the possible Multi-way Boulevard configuration of US-29. The Multi-way Boulevard Option requires 196 feet of overall right of way, compared with the 145 to 157 feet that exists today. This street configuration accommodates faster moving

through traffic on travel lanes in the center (four in each direction) and slow moving traffic seeking on-street parking or access to adjacent development (entries into minor streets, parking lots, or parking garages) on a local access lane that is separated from the center lanes by a tree-lined median. The added buffer of the side medians, local access lane, and on-street parking creates an environment that is comfortable for pedestrians strolling along the tree-lined, 14-foot sidewalks. The low speed nature of traffic on the local access lane allows for the introduction of on-street parking and bicycle travel while also providing the option of building to develop up to the property line and oriented toward US-29. Transit can be accommodated in the form of side-running streetcars or BRT operation by sharing of the outside lane with the vehicular traffic.

The median that separates local access lanes and center travel lanes is interrupted at major intersections and at critical access points to allow for vehicles to enter or exit the respective zone of travel. Research by Allan B. Jacobs et al[1] shows that these intersections and entry/exit points can be designed to operate safely.

Multi-way Boulevard Option with LRT/BRT in dedicated right of way

Figure AD 15 illustrates how it is possible to accommodate Light Rail Transit (LRT) or Bus Rapid Transit (BRT) in a dedicated right of way if this is desired. Doing so will not increase the overall needed right of way (196 feet) if the number of through travel lanes can be reduced by one in each direction based on modal shift from automobiles to transit. The illustrated medians planted with columnar trees should not be viewed as dispensable as the trees are critical for dividing the visual expanse of the roadway on US-29 and the stark visual appearance of a LRT tracks or a BRT busway.

Standard Boulevard Option

Figure AD 16 illustrates the cross-section for a potential Standard Boulevard configuration of US-29—a tree-lined thoroughfare without side access lanes. The Standard Boulevard Option requires 148 feet of total right of way. It is characterized by a tree-lined 18-foot wide center median, four travel lanes in each direction and an 18-foot wide pedestrian zone consisting of a 12-foot wide tree-lined planter with 6-foot wide sidewalks. The wide planter width provides some buffering between fast-moving highway traffic and pedestrians that travel along the street. This buffer is needed as the cross section neither includes on-street parking nor a separation between faster and slower traffic. At intersections, the 18-foot median narrows down to 8 feet in width, which allows space for a single 10-foot turn lane. At the end of the narrow median an 8-foot wide pedestrian refuge is provided for pedestrians crossing US-29 to stop if they cannot complete a full crossing of the street in one signal cycle. Transit can be accommodated in the form of side-running streetcars or BRT operation by sharing of the outside lane with the vehicular traffic.

Standard Boulevard Option with LRT/BRT in dedicated right of way

Figure AD 17 illustrates how it is possible to accommodate Light Rail Transit (LRT) or Bus Rapid Transit (BRT) in a dedicated right of way if this is desired. Doing so will not increase the

[1] Allan B. Jacobs, Jodan Rofe, and Elizabeth Macdonald, Boulevards – A Study of Safety, Behavior, and Usefulness, IURD – Working Paper 625, University of California at Berkeley, 1994.
Allan B. Jacobs, Jodan Rofe, and Elizabeth Macdonald, Boulevards – Multiple roadway Boulevards: Case Studies, Designs, and Design Guidelines. A Study of Safety, Behavior, and Usefulness, IURD – Working Paper 652, University of California at Berkeley, 1995.

overall needed right of way width (148 feet) if the number of travel lanes can be reduced by one in each direction based on modal shift from automobiles to transit. The illustrated medians planted with columnar trees should not be viewed as optional as the trees are critical for dividing the visual expanse of the roadway on US-29 and the stark visual appearance of light rail tracks or BRT busway.

A Brief Comparison of Multi-way and Standard Boulevard Options

The cross-section of the Multi-way Boulevard Option requires an additional 48 feet of right of way over the Standard Boulevard option, a difference that can be significant where topographic and other constraints come into play. However, key tradeoffs to be considered in the decision-making process are the Multi-way Boulevard option's significantly better performance with respect to the buffering of pedestrians (and bicyclists) and adjacent uses from the faster-moving traffic at the center of the street. Only under the Multi-way Boulevard Option can it be considered to allow bicyclists along US-29. Locating development at the property line, oriented toward US-29 is much less attractive under the Standard Boulevard Option with its lack of on-street parking and close proximity of uses to fast-moving traffic. The Multi-way Boulevard also offers significant advantages with respect to the management of access to minor streets, driveways, and other access points, a particular problem along US-29 in its current configuration.

US-29 South of Hydraulic Road

For Options A and B the roadway cross-section of US-29 between Hydraulic Road and the US-250 Bypass interchange is similar to that of the Standard Boulevard discussed above. The cross-section varies somewhat to reflect differences in improvements at the interchange and at the Hydraulic Road intersection. The width of sidewalks along US-29 in all Options is the same as illustrated in the cross-section for the Standard Boulevard (18 feet, including 12 feet for tree planting and buffer landscaping). However, the reduced number of travel lanes in Option C (see Figure AD 18) reduces the needed right of way width for US-29 in this segment to 112 feet. Sidewalks under Option C are 14 feet wide. This reduction in width is based on the lower driving speeds of traffic in this segment of the highway. The lesser number of travel lanes compared to the boulevard options north of Hydraulic Road also result in shorter crossing distances for pedestrians and provide for greater proximity of uses on either side of the thoroughfare.

Hydraulic Road

Options A, B, and C propose different cross-sections for Hydraulic Road, with each reflecting the specific transportation function assigned to the street under the respective Option. Each of these designs has a different effect on the connectivity along and across Hydraulic Road and particularly affects the potential for development along the roadway.

Option A maintains two travel lanes in each direction but improves the street by adding a 16-foot, tree-lined median and 14-foot wide sidewalks within an overall right of way of 102 feet. As per bicycle network planning goals for the area, 6-foot bicycle lanes are added to the roadway section. Parking lanes are not provided, as this would create potential conflicts with the large volumes of vehicles on this section of Hydraulic Road (see Figure AD 19).

The number of travel lanes on Hydraulic Road under Option B is reduced to one in each direction and the medians are reconfigured to have the character of linear parks. In addition to the bicycle lanes and 14-foot wide sidewalks also provided under Option A, Option B includes parking lanes (Figure AD 20). The provided parking is intended to serve the anticipated retail

and mixed-use development along the street. Fewer lanes, on-street parking, buildings that directly front onto the street, and the proposed roundabout at Hillsdale Drive combine to create an environment that encourages drivers to drive at low speeds.

Figure AD 21 illustrates the cross-section of the local access road adjacent to the elevated Hydraulic Road viaduct proposed under Option C. Because the access street is fronted by buildings only along its north side, on-street parking is limited to this side of the street. The sidewalk on the south side of the street is buffered from the adjacent viaduct structure by a 6-foot wide landscape buffer. Sidewalks and bicycle lanes are of equal width as those proposed under Options A and B. Connectivity to the south side of Hydraulic Road is limited to a single crossing at Hillsdale Drive.

Holiday Drive

Figure AD 22 illustrates the proposed cross-section for a reconfiguration of Holiday Drive. Due to the additional lane needed to accommodate traffic coming from the US-250 Bypass off-ramp, parking is limited to one side of the street. This keeps the needed right of way width close to its current extent and maximizes the land area available for development in the already confined Triangle area. However, because of the importance of sidewalks for the redevelopment in this area, walkway width is increased to the same minimum of 14 feet as proposed for Hillsdale Drive and other streets in the study area.

Other Public Streets

Figure AD 11 proposes the implementation of some additional segments of public streets to complete the suggested street network in the area north of Hydraulic Road. The two street segments that connect Hillsdale Drive and Cedar Hill Road with US-29 and Commonwealth Drive respectively are based on the cross-section for the latter streets but do not include a bicycle lane (Figure AD 23). The roadway of the street that would parallel portions of Hillsdale Drive and run along the edge of the Meadow Creek open space, as well as the street segment between Hillsdale Drive and Michie Drive are designed to provide the minimum width required for travel and parking lanes, which emphasizes their predominantly residential character and encourages slow driving. The cross-sections vary in the provision of parking, which is omitted where residential uses front on only one side of the street (Figures AD 24 and AD 25). All streets discussed above provide 14-foot wide sidewalks with space for street trees, which should be planted in tree wells along mixed-use buildings and in planter strips along residential uses.

Extensions of Concepts North Beyond Greenbrier

It is expected that the concept of establishing routes parallel to US-29 for local traffic as outlined above will result in a significant reduction of trips that use US-29 for access to local destinations. Can a similar approach be used for areas along US-29 north of Greenbrier?

The answer to this question requires additional research and largely depends on local conditions alongside US-29, particularly with respect to topography and existing land uses. Where the topography right adjacent to US-29 is too steep it may be infeasible or too costly to build the street in a multi-way boulevard configuration. The same would apply in locations where the demolition of development with vital uses would be required that have little or no potential for change (in the mid-term) come close to the street. However, it is conceivable to ‘fluctuate’ design and cross-sections of US-29 between multi-way boulevard and standard boulevard configurations as long as there is sufficient length to each segment and sufficient space for the

required transition treatments between the two. The shifts should also be related to adjacent land use context where feasible. For example, the multi-way boulevard configuration will be most appropriate where US-29 is passing through mixed-use activity centers while the standard boulevard configuration can be used in the segments in between activity centers where access to adjacent uses is a lower priority.

The concept of parallel routes on either side of US-29 can conceivably be extended north beyond Greenbrier. However, this will require careful analysis of existing uses and particular sensitivity to existing residential uses just beyond the commercial properties that line US-29. Although the parallel routes are not intended for high-volume sub-regional trips, they will carry volumes of traffic that could be incompatible with a neighborhood comprised of single-family homes. As the length of connected parallel routes increases, close attention has to be paid to speed management and needed traffic calming measures.

Development Opportunities

At present, the existing land uses in the US-29 project area consist of a variety of strip shopping centers, hotels, some manufacturing, and housing beyond the immediate highway frontage. Commercial uses are almost exclusively oriented toward US-29, which adds a high share of local trips to the heavy regional traffic on the highway. While congestion on US-29 has largely prompted the current planning effort, it is equally important to take a close look at potential future land use changes in the area, because any changes in how the network and types of roads serve the area is closely related to what types of development the area will retain or attract in the future. The Project Team therefore reviewed current and past planning efforts for the area and invited comments and input from City and County agencies, from property and business owners in the area, as well as from developers involved with ongoing development proposals. Following is a summary of key factors and information that formed the basis for the development of two scenarios for a possible future land use pattern (discussed in greater detail below) and previously discussed street network in the study area:

1. The City of Charlottesville and Albemarle County are interested in the economic revitalization of the area.

2. The City considers the area as part of its urban fringe, where it considers location of larger-scale commercial uses as appropriate.

3. The City heavily relies on tax revenues from development in the area, and future transportation and land use changes should enhance revenues not negatively impact them.

4. The County considers the area as part of its urban core, where mixed-use, higher density development is appropriate.

5. Albemarle Place, a major development project proposed on the county-side of US-29, currently in the project planning and review process.

6. The Sperry property west of US-29 is to be considered a long-term employment use that requires buffering and limited secure access.

7. Land use scenarios may consider redevelopment of the Charlottesville Housing Authority's development on Michie Drive.

8. The construction of Hillsdale Drive Extension can be considered as reasonably certain in the near-term as the project is on the Six-Year Improvement Program funding. Construction of the street through the parking lot of Seminole Square and through one bay of its northernmost building have received tentative support by the property owner.

9. K-Mart, Pepsi Bottling Plant, and the U.S. Postal Service facility do not have near-term plans for redevelopment or relocation. However, their redevelopment or relocation may be assumed as a possibility in the longer-term.

10. The Comdial property has the potential for future revitalization as a mixed-use development site; although it is also an attractive site for larger-scale commercial retail development.

In order to illustrate some of the envisioned physical qualities of the development within this land use framework, the Project Team also prepared sketches of sample development scenarios for particular sites. These are defined in the discussion of the overall Initial and Potential Future Land Use Patterns.

Initial Land Use Pattern

Figure AD 26 illustrates the Initial Land Use Pattern for the project area. It envisions that implementation of the initial development of Albemarle Place will begin to establish a pattern of mixed-use, retail, and residential uses west of US-29 (The pattern indicated in the diagram is consistent with the ZMA Code of Development for Albemarle Place, dated 10-15-2003). North of the Albemarle Place property, the diagram shows the potential for more commercial development on the current Comdial site, with uses along Greenbrier remaining largely unchanged. A critical component of the land use pattern is the connection of north-south running Cedar Hill Road to Greenbrier. Accomplishing this creates the potential for Cedar Hill Road to develop into a Main Street for the area beyond Albemarle Place and reduce the use of US-29 for traffic that is moving locally.

East of US-29, the implementation of Hillsdale Drive extension creates a similar if not greater potential for long-term development of this street into a Main Street. Initially, it is not expected that existing uses will dramatically change. In areas where major development activity may occur in the near-term (the Triangle and K-Mart Areas), however, new commercial and mixed-use development should orient towards Hillsdale Drive and begin to define it as a Main Street.

Potential Future Land Use Pattern

The Potential Future Land Use Pattern (Figure AD 27) illustrates the potential for the planned circulation improvements to US-29, Hydraulic, and the 250 Bypass to support the expansion of the mixed-use areas that are illustrated in the Initial Land Use Pattern. The market economic and fiscal analyses indicate that there is a strong potential for mixed-use and residential development in this area of Charlottesville and Albemarle County.

West of US-29 potential long-term development includes the completion of a full-fledged network of roadways north of the Sperry property. This occurs in tandem with the emergence of a more diversified land use pattern in the area which includes residential and mixed uses (including residential and office, and ground floor retail shops), and extends north as far as Greenbrier. Larger scale commercial uses would be focused along the US-29 frontage and also

include new frontage along Greenbrier. The diagram further suggests the incorporation of two moderately sized greens into the fabric of land uses to create community gathering places and some opportunities for recreation for the new residents in the area.

A comparison of the diagrams of initial and potential future land use patterns for the area east of US-29, illustrates the potential future transformation of Hillsdale Drive from an access road to existing uses and local connector street, into a street with a Main Street character with uses fronting directly onto it for most of its length. The potential future also includes the possible conversion of such uses as the Pepsi bottling and U.S. Postal Service facilities. The land use pattern is defined by three north-south tiers between US-29 in the west and the open space along Meadow Creek in the east. Retail and commercial uses front directly onto US-29 to take advantage of the connection with high volumes of traffic. A zone of mixed-used development centers on Hillsdale Drive, creating the desired Main Street character along the street and includes small-scale, landscaped open spaces and roundabout intersections that encourage traffic to slow as people come to and pass through the area. Toward and within the Triangle area, mixed-use development becomes the prevailing use. To the east of this mixed-use zone, a third land use tier is comprised of residential uses that take advantage of the amenities provided by the adjacent open space along Meadow Creek, as well as easy walking and bicycling access to the shops, services, and jobs in the area. The diagram also shows how existing natural drainages and the Meadow Creek open space can be incorporated into the land use pattern in a way that creates additional amenities to adjacent uses. This approach weaves together elements of the landscape and built environments rather than creating an abrupt edge between the two. The approach also provides the opportunity for "green infrastructure" storm water runoff amelioration measures (please also refer to the environmental analysis in the Alternatives Evaluation chapter), which make storm water infrastructure an amenity as opposed to the lack of amenity created by more "engineered" stormwater basins.

Sample Development Scenarios

The following, more detailed development scenarios illustrate in sketch site-plan format some of the qualities of future development on the selected sample sites. The sketch site plans illustrate the scale, location, orientation, and access of each building prototype of the development program. Two sketch plans and illustrative development programs were identified for each of the considered sites. The 'A' Concepts are typically based on the potential for short-term change (within time frame of 1 to 5 years), and a focus on single-use retail commercial development with some housing in some cases; it therefore shows more existing uses and buildings as remaining. The 'B' Concepts are an illustration of potential future redevelopment of a site in the longer term and typically more aggressive about the introduction of comprehensive land use changes particularly in providing a mixed-use environment. In some cases one scenario builds on the other and can be interpreted as a later phase within the continued redevelopment of a site.

The comparison of single-use development and mixed-use, new urbanist development was intentional as there is an on-going discussion in both the City and the County as to the viability of mixed-use development and the ability of either development pattern to contribute an increase in revenue to the City and the County. The economic impact assessment prepared by ZHA used these development scenarios as a starting point.

It should be noted that while these scenarios were prepared after discussions and review by key current and potential landowners and developers, there is no implied endorsement of these

specific scenarios. The main purpose of the scenarios is to outline the potential for changes in development patterns that could be stimulated and served by the transportation investments.

Hydraulic/US-29/I250 Bypass Triangle

This site (see Figure AD 28) is characterized by relatively large grade differences between the majority of the site and the elevation of adjacent streets (US-29 and Hydraulic Road). This grade difference is most pronounced at the corner of Hydraulic Road/US-29. An important landscape feature located at the southeastern edge of the site is Meadow Creek. The creek is lined by riparian vegetation. A tributary to the creek flows in a heavily vegetated steeply sloped creek bed that bisects the site from northwest to southeast. Partially aligned with this creek bed are overhead, high-voltage power lines that require a 50-foot setback of any residential uses. The power lines' support towers are also a constraint to future street and building locations.

Concept A

The potential development program for Concept A (Figure AD 29) largely retains existing uses such as the Days Inn and the horizontal mixed-use area directly north of Holiday Drive. The Kroger grocery store is also retained with 15,000 square feet of retail added to the site in a one-story building along the new street between the proposed roundabout at the center of the site and US-29. The centerpiece of Concept A is the addition of a 120,000-square foot anchor retail store located at the corner of Hydraulic Road and the extension of Hillsdale Drive into the triangle area; the site plan also provides 34,400-square feet of retail space for smaller shops fronting onto Hillsdale Drive. While Customers will access the parking lot off of Hillsdale Drive, truck access occurs from Hydraulic Road. Uses in the triangle are afforded excellent access from Hydraulic Road, US-29, and by means of the proposed off-ramp from westbound 250 Bypass. The new off-ramp from the US-250 Bypass provides high-quality visibility and access to the potential big box retail center. All parking required for the illustrated development is accommodated in surface parking lots. Only the retail uses in the one-story and liner retail buildings are oriented toward and directly accessible from adjacent sidewalks. Customer access to the anchor retail buildings as well as the remaining existing uses is almost exclusively oriented toward the parking lots associated with those uses.

Concept B

Like Concept A, Concept B (Figure AD 30) retains the Kroger grocery store and adds some new retail uses to the Kroger site along the new street running from Hillsdale to US-29. The remainder of the site, however, accommodates a series of medium-sized horizontal and vertical mixed-use developments including two moderately sized anchor retail stores (35,000 and 16,750 sq ft), a total of 148,500 square feet of additional retail uses in mixed-use and individual one-story buildings, a new 400-bedroom hotel with conference facilities and restaurant south of Holiday Drive, and a 92 unit, 3-story, mixed-use residential development on Hydraulic Road. New and existing roadways provide access to the area similar to Concept A, with the addition of a second local road off Hydraulic Road southeast of the mixed-use residential building. A small "green" is located between this new street and Meadow Creek. The green is framed by a one story retail building on the south, and three-story mixed-use building to the west.

Required parking for the illustrated development is largely accommodated in structured parking and a few moderately sized surface parking lots. Retail and residential uses in this concept are fully or partially oriented toward the adjacent street and sidewalks. In conjunction with the well-developed roadway network, this creates the opportunity for people to access stores and other uses directly from the street and supports convenient pedestrian circulation between uses,

encourages the use of transit access to the area, and still provides good access by car. Concept B combines particularly well with the preferred alternative redesign of Hydraulic Road, which proposes a streetscape treatment with landscaped medians and reduced volumes of traffic.

K-Mart Area

The K-Mart Area site stretches along the northern edge of Hydraulic Road between US-29 and Michie Drive. The northern limit of the study site area is defined by India Road with the site including Regal Cinema and its parking lot. Significant grade changes exist along portions of Hydraulic Road, and particularly at the corner of Hydraulic Road/US-29 as well as between the K-Mart site and the adjacent, vacant property to the southeast. The K-Mart building and its extensive parking lot constitute the dominant use on the site. Aside from K-Mart itself it includes a few additional smaller retail spaces. The site also includes the Regal movie theater, the now closed Seminole Square Cinema, east of the K-Mart building, and a few stand-alone retail buildings as well as a car wash (see Figure AD 31). Three residential buildings with units owned by the Charlottesville Housing Authority are located on Michie Drive, at the southeastern edge of the site. The key plan at the lower left corner of Figure AD 32 illustrates how the site was divided up into distinct building blocks.

Concept A

The redevelopment approach illustrated in Concept A (Figure AD 32) suggests the replacement of the K-Mart building with a modern, large-pad retail building (62,000 sq ft) that can accommodate one large or two moderately-sized anchor tenants. The concept also proposes to add five small-scale, single-story retail buildings (57,900 sq ft) along the edges of the large surface parking lot that accommodates the required parking spaces for all retail uses. These buildings are oriented toward and built directly along the sidewalks of Hydraulic Road and the new Hillsdale Drive extension. The Regal movie theater is retained to the north of K-Mart. East of Hillsdale Drive, the presently vacant parcel and the property of the Housing Authority are suggested for redevelopment with three-story mixed-use buildings, with two stories of residential (70 units) above first floor retail (44,100 sq ft) along Hydraulic Road and Hillsdale Drive and three stories of residential (66 units) along Michie Drive. Parking is accommodated in a parking garage at the center of the site.

Primary vehicular access to the retail center occurs off of Hydraulic Road with secondary access from the new Hillsdale Drive extension and India Road. Loading for anchor retail uses and vehicular access to the structured parking of the mixed-use development are oriented toward the roadway located in back of the anchor retail. While the new anchor retail buildings retain the present orientation of the K-Mart building toward the parking lot, all other buildings in Concept A establish a direct street frontage along Hydraulic Road and Hillsdale Drive. The small retail buildings of building Block A partially screen the large surface parking lot while maintaining a visual connection between setback anchor retail and Hydraulic Road. The parking for the mixed-use buildings to the east of the K-Mart site can be accessed from Hillsdale and the new road on the northern edge of the site which connects Michie and Hillsdale.

Concept B

Concept B (Figure AD 33) illustrates how the site could develop more intensively if market conditions allowed for structured parking throughout the entire area, which also includes the redevelopment of the Regal movie theater site. The new development includes a new movie theater complex with 14 screens and adjacent one-story retail buildings (a total of 92,600 sq ft).

The multi-story theater building resolves the grade differences at the corner of Hydraulic Road and US-29 and provides the opportunity for the building to front onto this important intersection providing important visibility to the cinema while providing a more active frontage onto surrounding streets. A new local road southeast of the complex provides access to the center of the site, which includes a landscaped pedestrian mall and plaza that are lined with one to three-story retail, residential and mixed-use buildings. The eastern portion of Block A accommodates 213 residential units around structured parking that is lined with one-story retail along the new access road.

Block B is developed in similar fashion to Concept A, but is expanded to also include the site of a retail use at the corner of Hydraulic Road and Michie Drive. The development program for this bock includes 7 townhomes and 170 residential units as well as 59,000 square feet of first floor retail uses. Parking garages serving the cinema complex and mixed-use residential development on the former Regal theater site are oriented toward India Road, which provides the principal access to the garages off of US-29. A new internal circulation network and the redesigned existing streets combine to create a high-quality circulation system for pedestrians and bicyclists. The orientation of all buildings toward adjacent streets and the mix of uses afford the opportunity for multi-destination walking/biking trips and sidewalks activated by pedestrian-oriented activities and travel.

Albemarle Place

This currently vacant site is located in Albemarle County to the north of Hydraulic Road and west of US-29. It is slated to be developed into the proposed Albemarle Place, a development that is planned to include residential, retail, and non-retail commercial uses (see Figure AD 34). The master plan for the site has been approved by Albemarle County and development is expected to begin shortly. As illustrated in a recent site plan for the project (Figure AD 34), a closely knit network of roads and access ways will be provided for convenient access to land uses and associated structured parking, which is located throughout the site. The Albemarle Place development is built around the Sperry property, which will remain as a key employment generator for the foreseeable future. Land uses include a hotel on US-29 near the Hydraulic Road intersection, a department store, stand-alone and mixed-use (residential and office) in buildings between one and five stories in height. Major retail uses located in the northern portion of the site have their required parking accommodated in large surface parking lots rather than in structured parking garages which are provided for other uses. Throughout the majority of the site, buildings and land uses are oriented toward the newly established network of streets and sidewalks. This will provide good pedestrian access and circulation, while the mix of uses will help to reduce the number of trips involving US-29.

It should be pointed out that it is suggested in other sections of this document that Cedar Hill Road, the principal north-south street in the site plan (west of the Sperry property) be extended across the Comdial property to Greenbrier and be reconfigured into a three-lane roadway with parking and bike lanes (instead of the proposed four lanes with parking).

Comdial Area

The Comdial site is currently occupied by the – now defunct – Comdial industrial complex. Grade differences between the majority of the Comdial site and adjacent streets exist along US-29 and sections of Greenbrier (see Figure AD 35). The current property owner is working to lease the existing buildings and some retail developers have made tentative proposals for the

redevelopment of the property to include a retail center of large-floorplate retail buildings. However, no firm commitment has been made at the time of writing this report.

Concept A

Concept A takes an approach to the site somewhat similar to the above-mentioned recent proposals. The sketch site plan (Figure AD 36) illustrates how the site can be maximized for anchor retail uses with large floorplates (totaling 195,500 sq ft) and a few small-scale retail buildings (33,000 sq ft) and a restaurant (8,000 sq ft). The smaller buildings are located so as to mark or frame the principal entrances to the site. All required parking is accommodated in surface parking lots along the two main access isles that enter the site from US-29 and Greenbrier. A roadway (extension of Cedar Hill Road) that connects development on the Comdial site with that on the Albemarle Place site is not illustrated here but could be integrated if implementation of Albemarle Place has sufficiently progressed to allow for this to occur.

Concept A can be interpreted as a precursor of later development illustrated by Concept B. Streets and parking aisles are located so that major utilities provided for the retail development in Concept A can be reused in street alignments for the mixed-use development illustrated in Concept B.

Concept B

Concept B illustrates the potential long-term development of the site and assumes that rising market demands justify the inclusion of properties along Greenbrier into the potential development program (Figure AD 37). Uses accommodated on the site now include a substantial component of housing with 105 units of apartments/condominiums in all residential, three-story buildings, 302 units of residential in mixed-use buildings, and 14 townhouse units. Anchor retail uses (129,000 sq ft) and stand-alone retail (16,000 sq ft) are focused along the US-29 frontage of the property, where two restaurants frame the landscaped entry into the site and largely screen the surface parking lots from view. The cluster of mixed-use buildings (118,000 sq ft of retail; 196,000 sq ft of office) located around a central open space forms the core of the site. With the exception of two moderately sized surface parking lots, all parking is accommodated in parking garages. In the northwestern portion of the site structured parking is typically located behind or at the center of residential or mixed-use buildings, while the garages in the southeasten section are lined with first floor ‘liner’ retail and located toward the surface parking lots. The topography of the site allows for the effective subsurface accommodation of additional parking underneath the residential/office mixed-use building. Concept B establishes a closely spaced network of streets that can easily be connected to streets within the adjacent future Albemarle Place development. Building orientation, street network and the mix of uses on the site combine to an environment conducive to pedestrian activities and travel to multiple destinations within the site area.

Seminole Square Area

No sketch development concept was prepared for the Seminole Square area. Following is a summary of key outcomes of discussion with the principal property owner of the development and a discussion of the general development potential of the area as illustrated in the previously referenced diagrams of Initial and Potential Future Land Use Patterns (Figures AD 26 and AD 27). The uses illustrated in the potential future diagram are prefaced on long-term market demand for such uses, with long-term referring to a time horizon of 15 to 20 years.

Seminole Square

One stated assumption for work on the initial and potential future land use patterns in the project area, is that Seminole Square will not redevelop in the foreseeable future. However, the critical concept of extending Hillsdale Drive to Hydraulic Road implicitly requires a break in the now continuous east-west retail building on the northern edge of Seminole Square. In discussions with the property owner, it was established that the elimination of a 63-foot wide building bay is possible. While this eliminates a single retail tenant space and requires some reconfiguration of the shopping mall's surface parking lot to allow for the new street to pass through, it does not have a significant negative impact on Seminole Square's buildings and their uses. On the contrary it should be expected that the new public road provides improved access to stores and services, and in addition that retail space in the existing buildings that remain can be reconfigured to front onto the new Hillsdale Drive (see Figure AD 26 and AD 38).

The diagram of the potential future land use pattern (see Figure AD 27) illustrates in general terms how land uses in the Seminole Square area might develop in the long term. The diagram shows how the construction of Hillsdale Drive extension provides the potential for future development to front directly onto this street, which is specifically designed to equally accommodate all transportation modes (vehicular, pedestrian, bicycle and transit). While traditionally car-oriented retail uses may continue to be oriented toward US-29, residential mixed-use buildings may be located along Hillsdale Drive and along new, privately funded roads that connect Hillsdale with US-29. Together Hillsdale Drive and these new roads create a closely spaced grid of pedestrian-friendly connections and human-scaled blocks of development. In addition, the diagram illustrates how residential uses can be accommodated toward the eastern edge of the Seminole Square site. Residential buildings in this location can take full advantage of the open space along Meadow Creek, which represents a major visual and recreational asset for the area. This concept would result in a vibrant mixed-use neighborhood providing a variety of housing opportunities and a mix of major retail, restaurant, and entertainment uses, as well as some office development.

Area North of Seminole Square

Similar to the case of Seminole Square, the diagrams illustrate for the area north of Seminole Square how the preferred alignment of Hillsdale Drive does not interfere with key existing land uses, such as the Post Office and sorting/distribution center, and the Pepsi bottling plant; both can continue to operate and function well in their present locations. The diagram of a potential future land pattern suggests what might occur when both of the above uses are no longer the most viable from a market perspective and how new uses can take advantage of the central alignment, added access, and pedestrian-friendly environment presented by the multi-modal design of Hillsdale Drive. As with Seminole Square, the diagram shows an emerging pattern of car-oriented uses along US-29, mixed-use development along Hillsdale Drive, and residential uses along the eastern edge of the site. This development is accompanied by the construction of privately funded roadways that provide additional east-west connections and facilitate smaller block sizes.

Best Buy and Holiday Inn Area

Best Buy and the Holiday Inn function as anchor uses for the area under all three options. The construction of a single-point urban interchange (SPUI) and particularly its ramps connecting to Hydraulic Road under Option A will have impacts on access and existing circulation pattern in the immediate area of the SPUI. The necessary changes in grade require that access to businesses

close to Hydraulic Road be relocated from direct access from US-29 to occur via an access drive that begins at Hydraulic, runs through the Holiday Inn parking lot and south to the access road north of the old Krispy Kreme location which also provides access to the Comfort Inn, where the new access drive would reconnect to US-29 (see Figure AD 39). While the access drive allows sufficient access to existing uses along the street it may be that some restructuring in the orientation of uses occur.

Option B does not directly impact site access to existing uses in the area west of US-29, while the improvements to regional accessibility would be a benefit to these businesses as indicated in the economic assessment.

As implementing Option C significantly reduces traffic volumes on US-29 to the south of Hydraulic and narrows the overall width of the street, this alternative creates the potential for redevelopment of the area with significant land use changes. Reduced traffic and barrier effects allow for development to front directly onto US-29 with parking to be provided behind the street-fronting buildings and a mix of uses encouraged by a more pedestrian-friendly character along US-29. Incorporation of an access lane through parking lots as described for Option A and non-vehicular linkages to adjacent neighborhoods can further improve the viability of new commercial and retail development under this option.

Enhancements for Pedestrian, Bicycle, Transit and Traffic Operations

The Phase 2 concepts include a common set of enhancements for traffic, pedestrian, bicycle, and transit operations in the project area. The following paragraphs describe the overarching concepts for enhancements throughout the project area. Enhancements or concepts specific to one individual transportation option are pointed out where is pertinent.

Pedestrian

All three transportation options suggest providing 14-foot wide sidewalks along Hydraulic Road and new or remodeled streets within the triangle area. This sidewalk width is selected to accommodate all basic elements needed for a safe and functional pedestrian environment (Figure AD 40). In combination with adjacent parking, this sidewalk-width provides a good buffer between moving traffic and pedestrian activities. Bicycle lanes along Hillsdale and Cedar Hill Road provide additional buffer width. Along US-29, it is recommended to increase the 'pedestrian zone' width to 18 feet – a 12-foot wide landscaped strip with a 6-foot wide sidewalk (alternatively an 8 or 10-foot wide multi-use pedestrian and bicycle path could be provided in this zone). The additional width is needed to provide a landscaped buffer between pedestrians and highway traffic that can be planted with large canopy trees and (if desired) additional landscaping (Figure AD 41). This treatment is of particular importance as parking is prohibited along US-29, which eliminates the buffer function typically provided by parked cars. Local access lane, parking and a secondary median provide this additional buffer in the potential multi-way boulevard configuration for US-29 north of Hydraulic Road (Figure AD 42), which allows the sidewalk width to remain at the typical 14 feet.

The possibility of a combined pedestrian/bicycle path along US-29 between Greenbrier and south beyond the US-250 Bypass interchange was also explored. A conceptual sketch of such a multi-use path and how it crosses the side streets and ramps in the US-250 Bypass area is illustrated in Figure AD 43. The concept of such a facility was not incorporated into the final cross-sections for US-29 but should be considered again in the future if a standard boulevard is

selected for implementation and when a final determination of the available right of way has been made. Under Option C, US 29 south of the Hydraulic road intersection functions more like a Main Street, for which the multi-use path approach is not appropriate.

Drivers making turns onto or off of freeway ramps often are more focused on making the intended turning maneuvers rather than the presence of pedestrians on sidewalks or in crossings. The on/off ramps on US-29 at the US-250 Bypass interchange therefore present a significant safety hazard for pedestrians (and bicyclists) traveling along US-29. While Options A and B1 include the same number of ramps, they are somewhat farther spaced apart in Option B1.The triple left turn lane configuration at US-29 proposed for the eastbound US-250 Bypass off-ramp under Option B 2, however, requires careful consideration of pedestrian signal time allocation and signage to ensure pedestrian safety at the crossing and may require a pedestrian median island at the end of the off-ramp separating the right and left turning lanes. Option C with its reduced number of on/off ramps at the interchange produces the safest pedestrian environment in this location, as the number of needed crossings is limited to two.

Pedestrian crossings throughout the project area will include high-visibility striping (zebra-type striping), and pedestrian refuges in median locations as appropriate (see Figure AD 44). For example, pedestrian median refuges are proposed for the short segments of landscaped medians opposite from left turn pockets along Hillsdale Drive extension and Cedar Hill Road (please refer to Figure AD 12). The ample, landscaped medians on Hydraulic Road proposed in Option B do not only provide the opportunity for pedestrian refuges, but also create a visual amenity for pedestrians in the area.

As the network of publicly and privately funded roads matures over time, new travel routes for pedestrians are created. It is therefore recommended to provide pedestrian crossings at all intersections throughout the proposed initial and potential future network of roads. In addition, mid-block crossings should be provided where this is needed to safely connect pedestrian travel routes away from intersections. All rebuilt and new sidewalks should incorporate the following streetscape elements:

- pedestrian-scale lighting;
- street trees with broad canopies,
- landscaped planter strips, planter cut-outs around trees, or tree grates depending upon the intensity of pedestrian activity and adjacent use;
- trash receptacles,
- pedestrian signals (to include audible signals for visually-impaired pedestrians)
- benches, special paving, and other amenities (in locations where these are appropriate and safe to use),
- ADA accessible ramps, and tactile warning surface for the visually impaired, and
- area-specific municipal way-finding signage.

Providing uniformly designed business directories should be considered (upon private initiative) and would be particularly effective in the vicinity of transit stops.

Bicycle

Improved bicycle access is provided in all three options. However, routing bicycles across the US-29/Hydraulic intersection underneath the viaduct in Option C is complicated by the fact that cyclists traveling west on Hydraulic have to cross the main access road into the parking lot of development in the K-Mart area.

As discussed relative to the pedestrian environment, the triple left turn lanes proposed for the eastbound US-250 Bypass off-ramp at US-29 under Option B 2, require a careful consideration of signal time allocation and signage details to ensure safe crossing by bicyclists traveling south along US-29. The possibility of a combined pedestrian and bicycle path on either side of US-29 north and south of the Hydraulic Road intersection should be considered if a standard boulevard cross-section is selected for implementation. Under Option C, US-29 south of the Hydraulic Road intersection functions more like a Main Street, for which the multi-use path approach is not appropriate.

The most critical bicycle improvements included in all three options are the incorporation of bicycle lanes on the Hillsdale Drive extension (including the triangle area), on Cedar Hill Road (proposed change to developer's design), and on Hydraulic Road east of US-29. Other (privately funded) streets in the evolving roadway network should be designed to allow for safe accommodation of bicyclists. It is furthermore suggested to require developers to provide bicycle parking at convenient and safe locations in conjunction with redevelopment activities throughout the area. In this event, incentives may exist which include the City's agreement to offer a corresponding parking requirement reduction. If US-29 is remodeled into the multi-way boulevard configuration discussed above, this would create the opportunity for bicyclists to travel along US-29 by using the local access lanes on either side of the highway. If the standard boulevard configuration is chosen for US-29, consideration could be given to design the 'pedestrian zone' along US-29 to provide multi-use paths for both bicycles and pedestrians.

Transit

The configuration of Hillsdale Drive extension as a 3-lane street, where through traffic will not be stopped by turning vehicles, makes the street attractive as a local transit route. Similarly, Cedar Hill Road east of US-29, which is slated for accessing a varied mix of uses, is an ideal street for a local transit route. As the variety of uses and destinations developed along and oriented toward either of these two streets increases, the more attractive and efficient transit service through the area will become. As the typical width of 14 feet (min.) for sidewalks throughout the project area allows for the comfortable accommodation of 4-foot deep bus shelters and the required ADA clearances, this also creates flexibility in how buses are routed through the area and where transit stops may be located. Figures AD 15 and AD 17 illustrate how future enhanced transit service on US-29 could be accommodated. With express service on US-29 to a few centrally located stops and local bus service on Hillsdale Drive and Cedar Hill Road, transit to and from the area could become a much more viable alternative to automobile use for residents and customers alike.

There are several new initiatives slated to improve transit operations which will benefit from the improvements proposed. The City is currently conducting a transit study looking at origin and

destination locations which will be used to analyze current routes and schedules and help plan future transit investments. Other upcoming studies include a look at BRT options on the 29N corridor and streetcar travel in the downtown area. Transit is also receiving immediate priority through the City's decision to flex urban roadway funding to transit operations. Additionally, the long-range UnJAM Plan allocated $6.5 million to transit corridor improvements with some potential improvements being transit signal priority and queue jumpers, special lane markings, BRT or streetcars on exclusive median lanes, and significantly improved transit stops, shelters, and pedestrian improvements at stations.

Traffic

Various traffic management techniques and technology applications to ease congestion while improving safety have been included in the concepts. Primary among these are Intelligent Transportation Systems (ITS) applications to assist in the proactive management of traffic. These applications have proven to be very effective across the country to reduce congestion, improve safety, manage incidents, and better inform the traveling public. The following elements are included:

- ***Traffic monitoring.*** A better understanding of near real-time traffic demand and incident detection would be used by traffic managers to respond more quickly to traffic congestion and emergency response. Collection of this type of information (speed and volume), which is essential to the successful implementation of other ITS elements, would be accomplished by installing (where not already in place) inductive loops or video detection at signalized intersections on US-29 and at key locations on the US-250 Bypass. To be effective, this information is reviewed at a central location (see *Management Center* below).

- ***Traffic Signal Improvements.*** Various levels of signal improvements have been assumed to occur prior to and subsequent to any physical changes in the study area. Primary among these improvements are modified signal phasing and timing (on the basis of better traffic monitoring), coordinated signals on US-29 and Hydraulic to provide arterial progression for traffic that varies to match changes in traffic flow, and central management of the corridor signal system (state and city together – see *Management Center* below) to provide for seamless operation of the corridor.

- ***Communications Infrastructure.*** One of the primary enabling technologies that allows much of these applications to be possible is a communications network to allow for data to be transmitted from device to a central location and then disseminated to the public. An enhanced communications infrastructure has been presumed to occur as part of roadway improvements in the study area.

- ***Management Center.*** A central location with remote access capabilities to collect, view, and analyze information to support traffic management decisions and disseminate traveler information would be required for the level of integrated traffic management necessary to allow US-29 to function as a signalized arterial in the future.

The following ITS applications would be appropriate depending upon the readiness of the roadway system and the transit system:

- ***Transit Priority.*** As higher levels of transit service are implemented on US-29, particularly Bus Rapid Transit (BRT) service, traffic signal operation in the corridor will need to be adjusted to provide for priority operation of transit vehicles. Transit priority requires the identification of transit vehicles by the traffic signal system and pre-emption strategies to provide early or extended green signal time for buses at those signals.

- ***Transit Queue Jumps.*** At intersections where priority signal strategies may not be possible, installation of queue jump lanes would allow transit vehicles to gain head of queue status at intersections. Applications of these lanes in other cities take advantage of right turn lanes and, in conjunction with signal priority applications, allow buses to enter the traffic stream at the start of green. Figure AD 45 illustrates a typical queue jump lane in use in California.

- ***Traveler Information.*** One critical element of ITS is providing information to motorists and commercial vehicles so that they can make more informed decisions regarding their travel. This can be achieved through such dissemination techniques as websites, radio and television broadcasts, advisory radio, and Dynamic Message Signs (DMS). DMS are the large and small illuminated message boards that provide limited information to travelers during their route and can provide warnings, detours, or general traffic information. As parallel roadway networks develop along US-29 in the study area and traffic monitoring is implemented, a role for DMS-type information on US-29 to the north and on the US-250 Bypass and I-64 may develop to direct traffic through the study area.

Figure AD 1: Enhanced Phase 1 Concepts: Option A

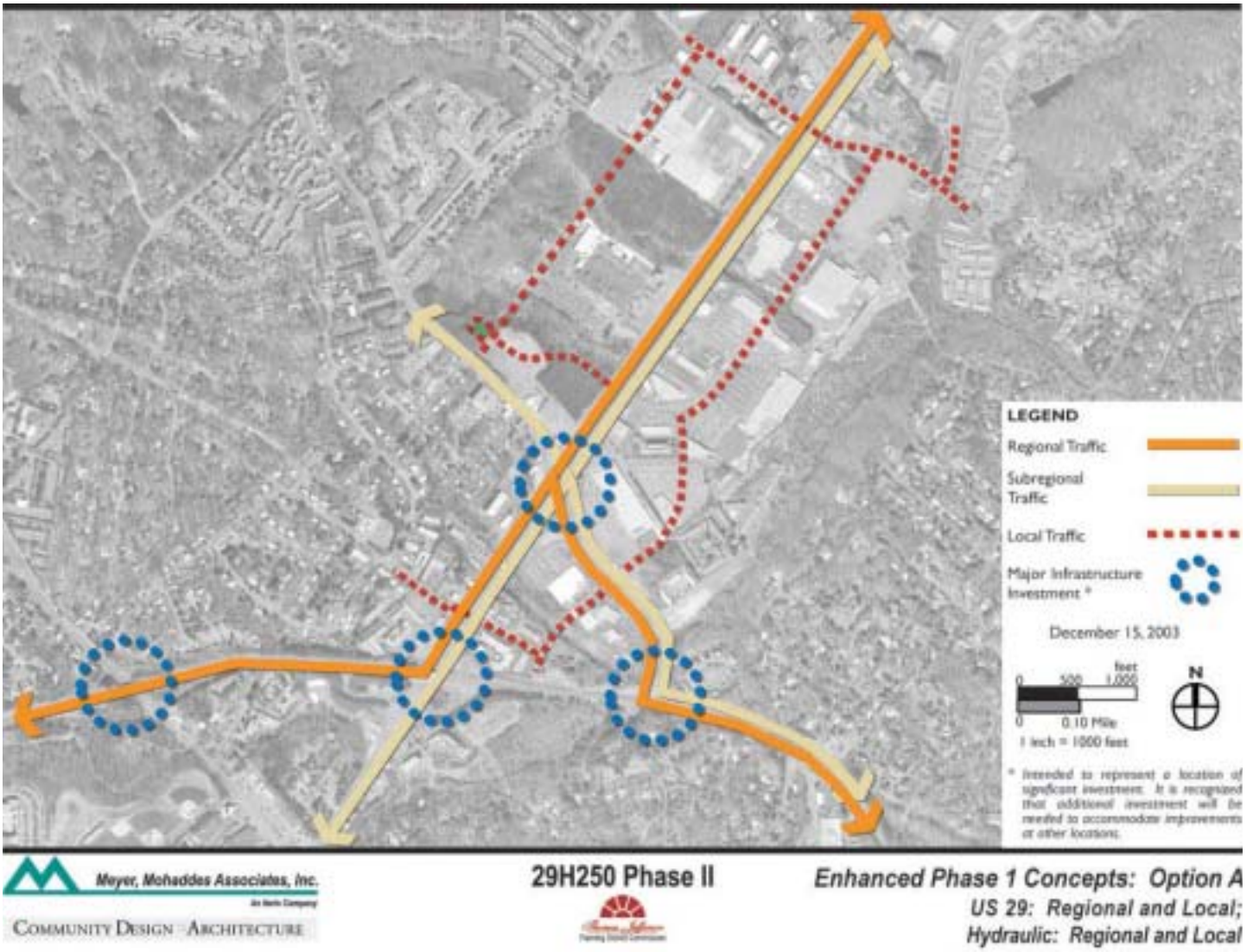


Figure AD 2: Enhanced Phase 1 Concepts: Option B

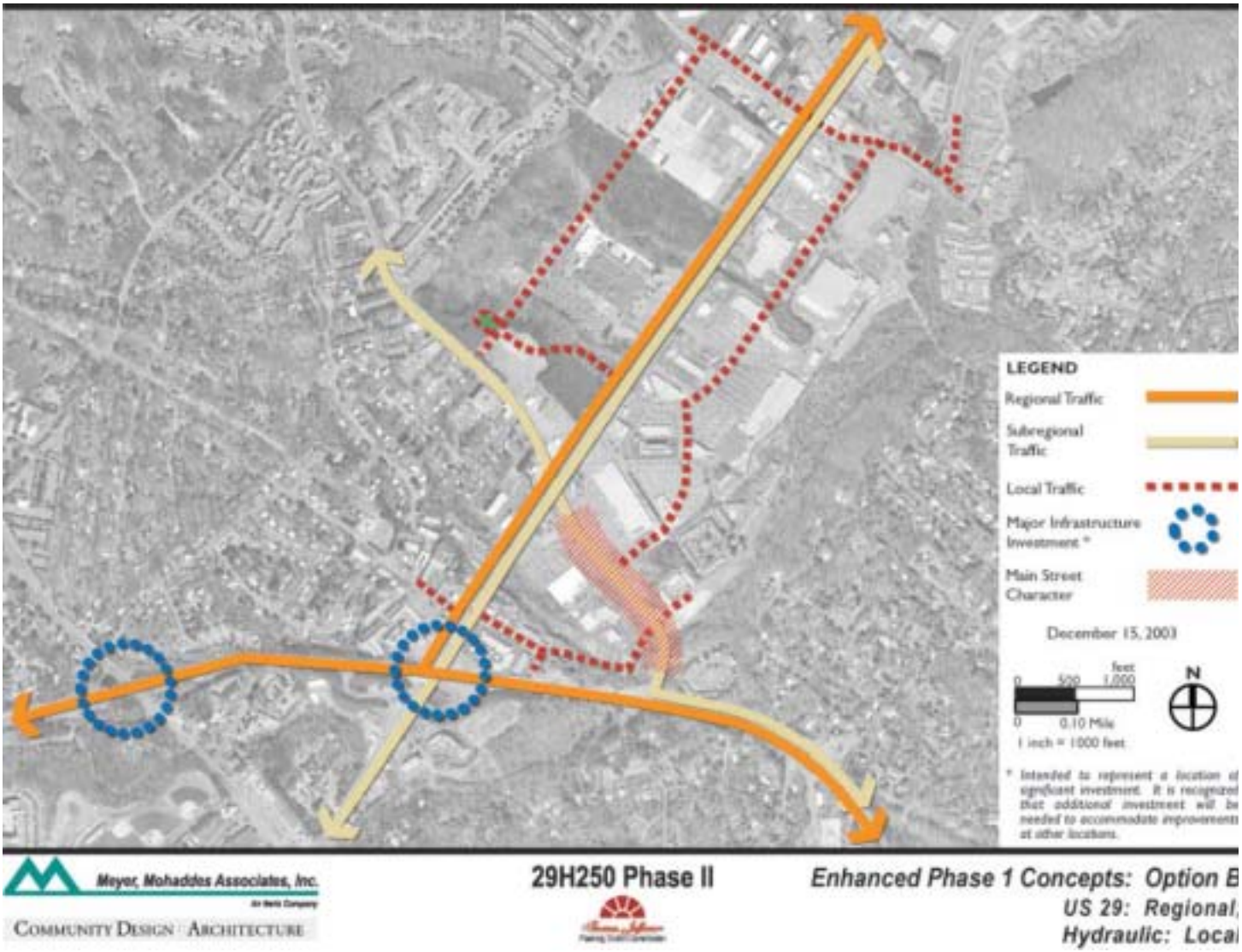


Figure AD 3: Enhanced Phase 1 Concepts: Option C

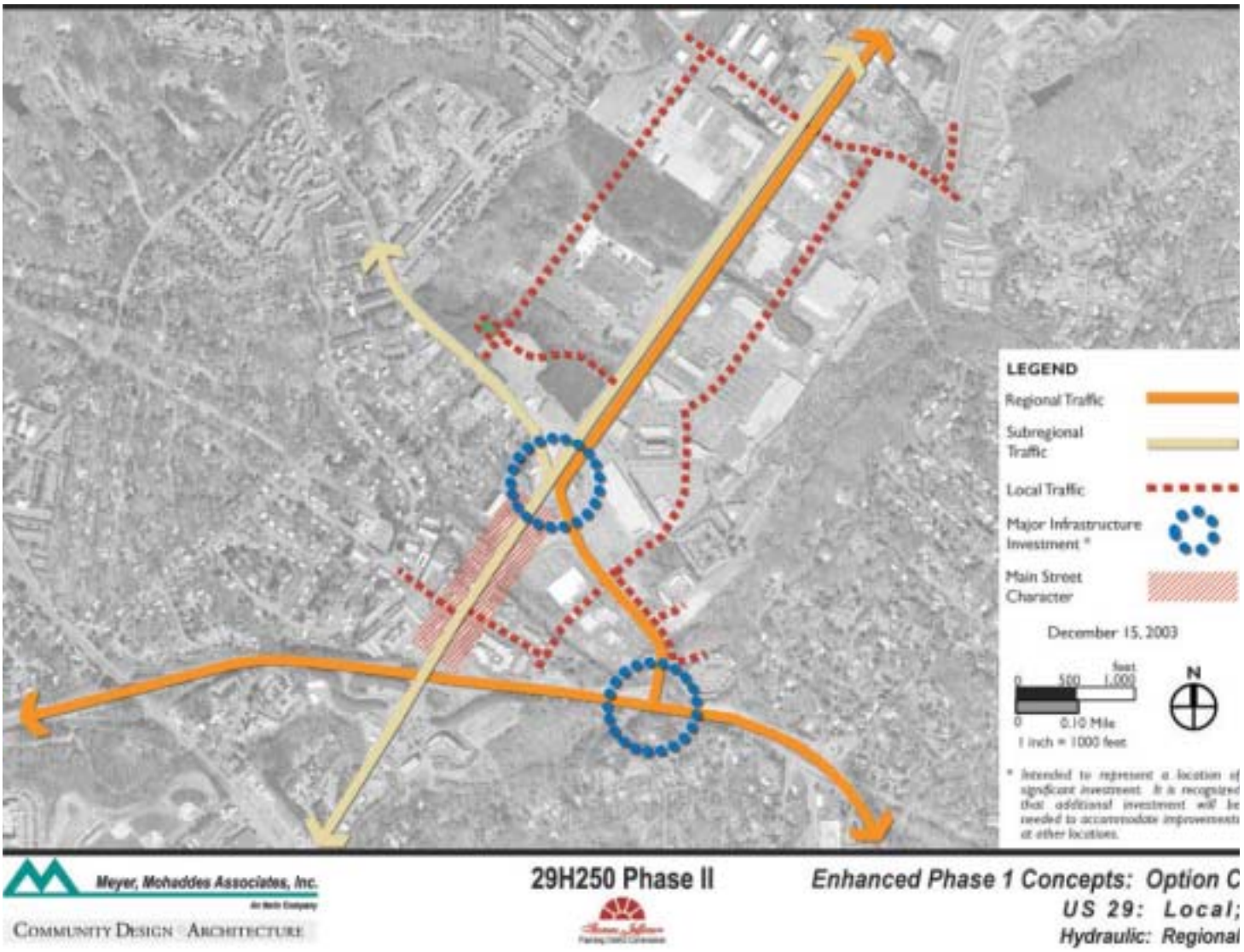
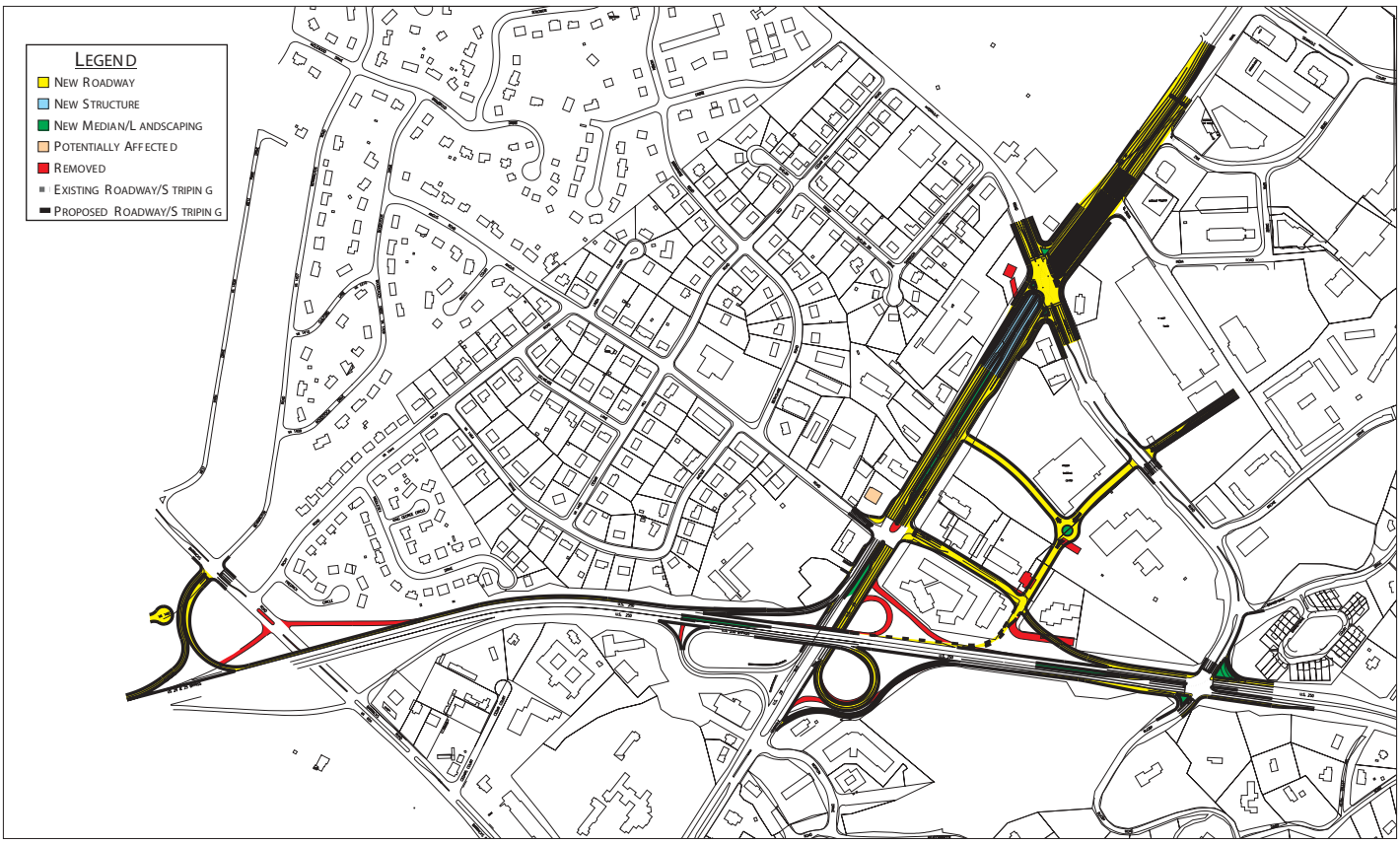


Figure AD 4: Option A1



OPTION A1

29H250 Phase II

0 200 400 800

1"=200'

Figure AD 5: Option A2

OPTION A2

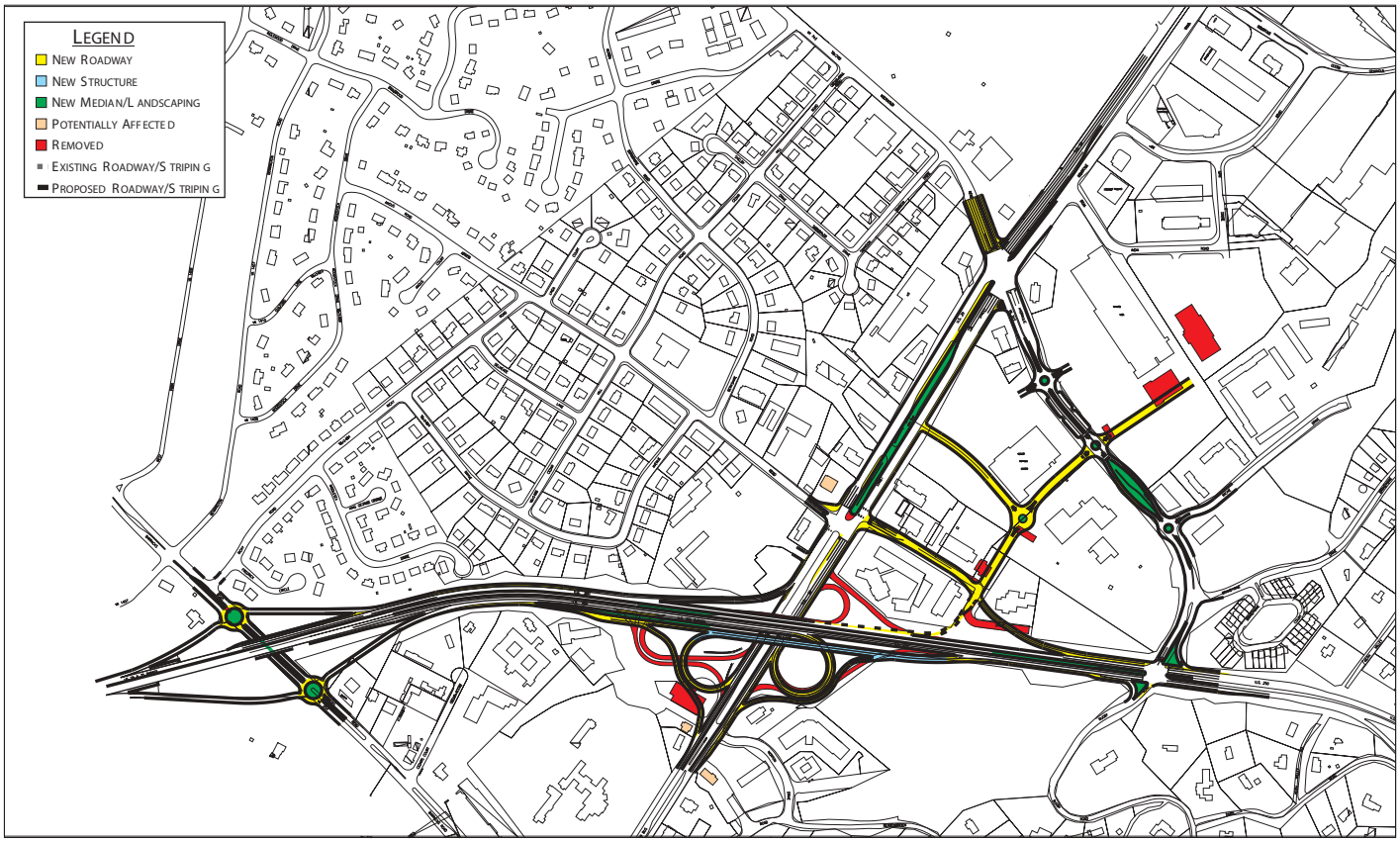
29H250 Phase II

Changes from Option A (1)

0 200 400 800

1"=200'

Figure AD 6: Option B1



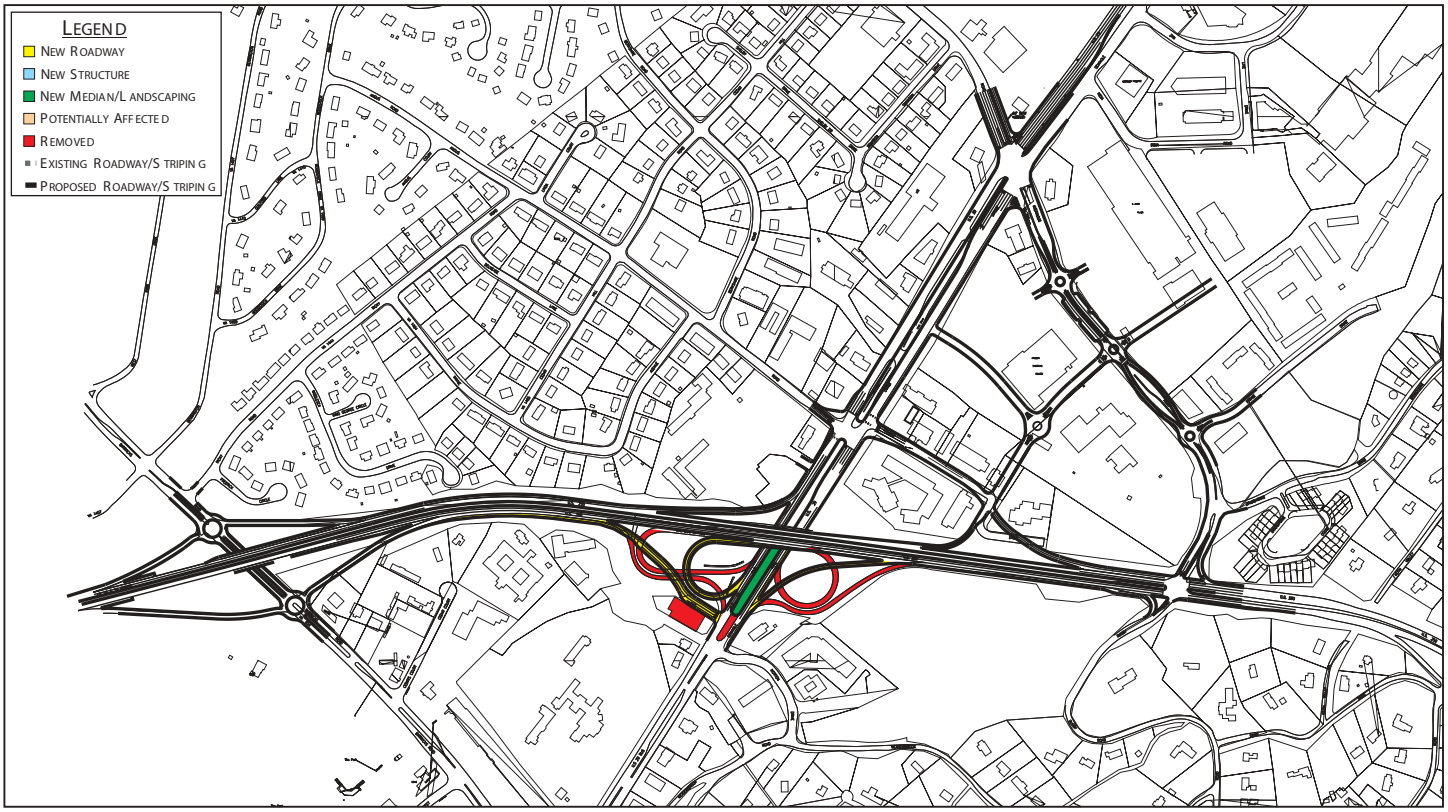
OPTION B (1)

29H250 Phase II

0 200 400 800

1"=200'

Figure AD 7: Option B2

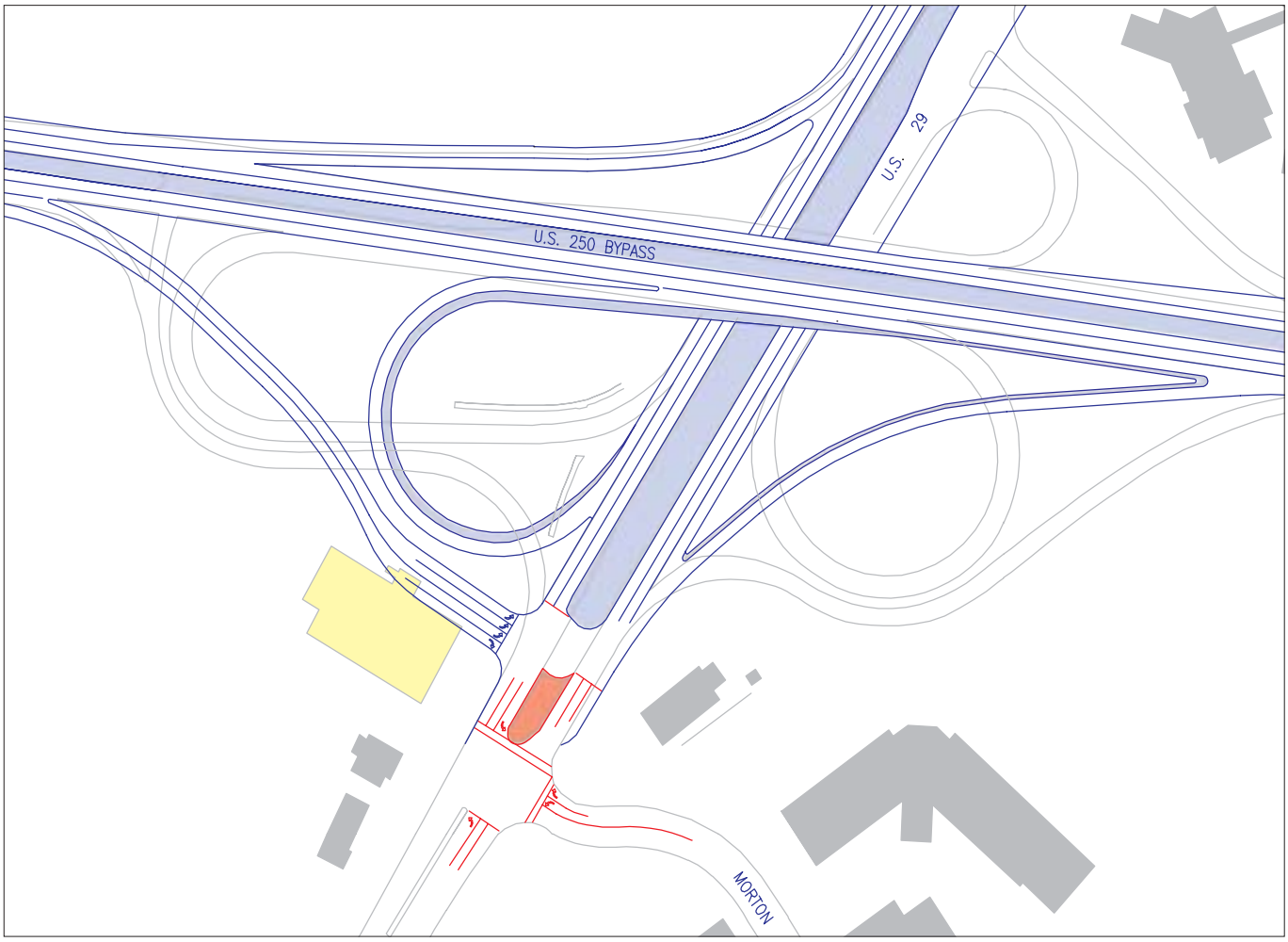


OPTION B (2)
29H250 Phase II

Changes from Option B (1)

0 100 200 400
1"=200'

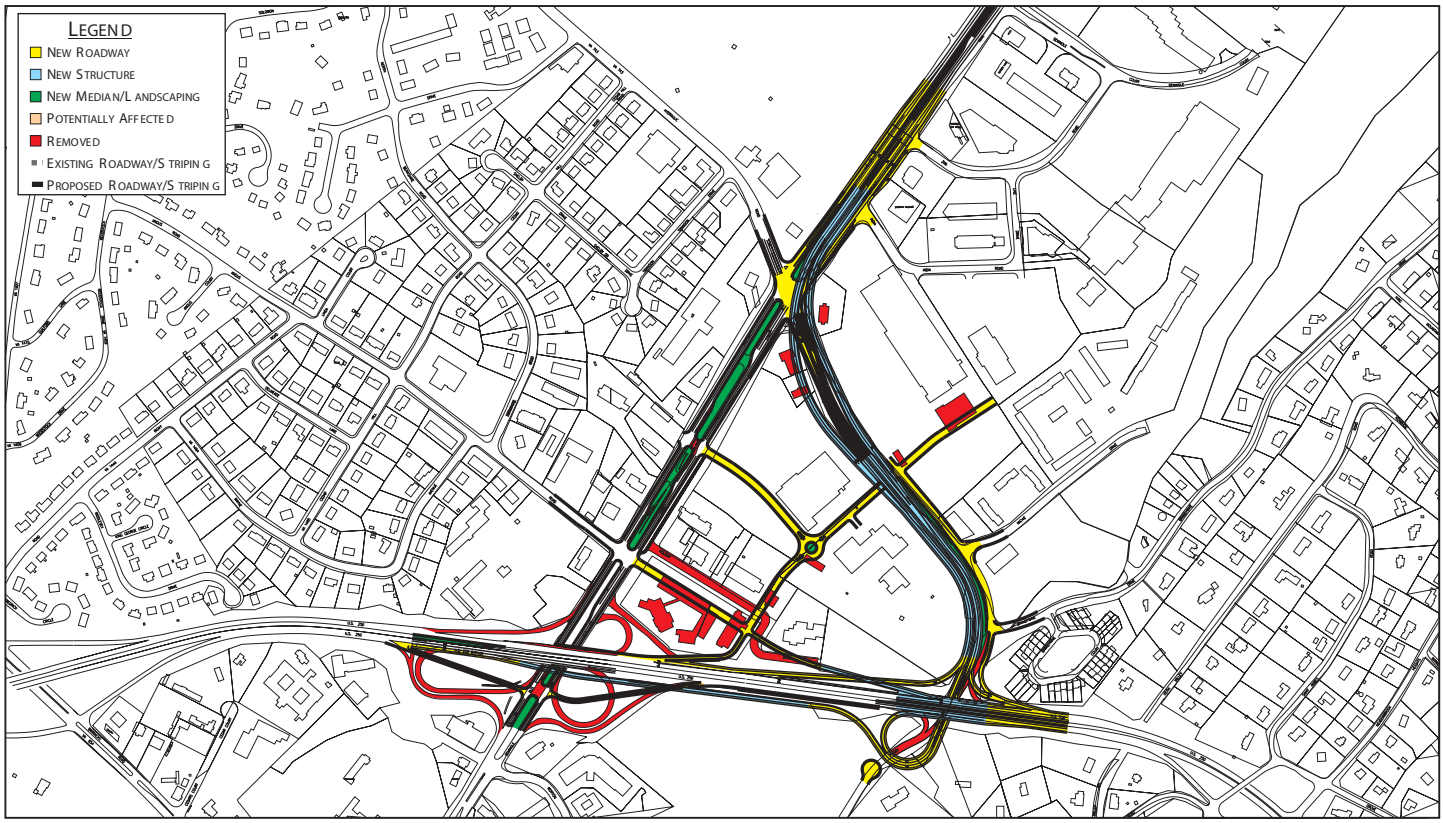
Figure AD 8: Option B2 Morton Signal



Option B2

New Ramp and Morton Drive would operate as an offset intersection with one signal

Figure AD 9: Option C1



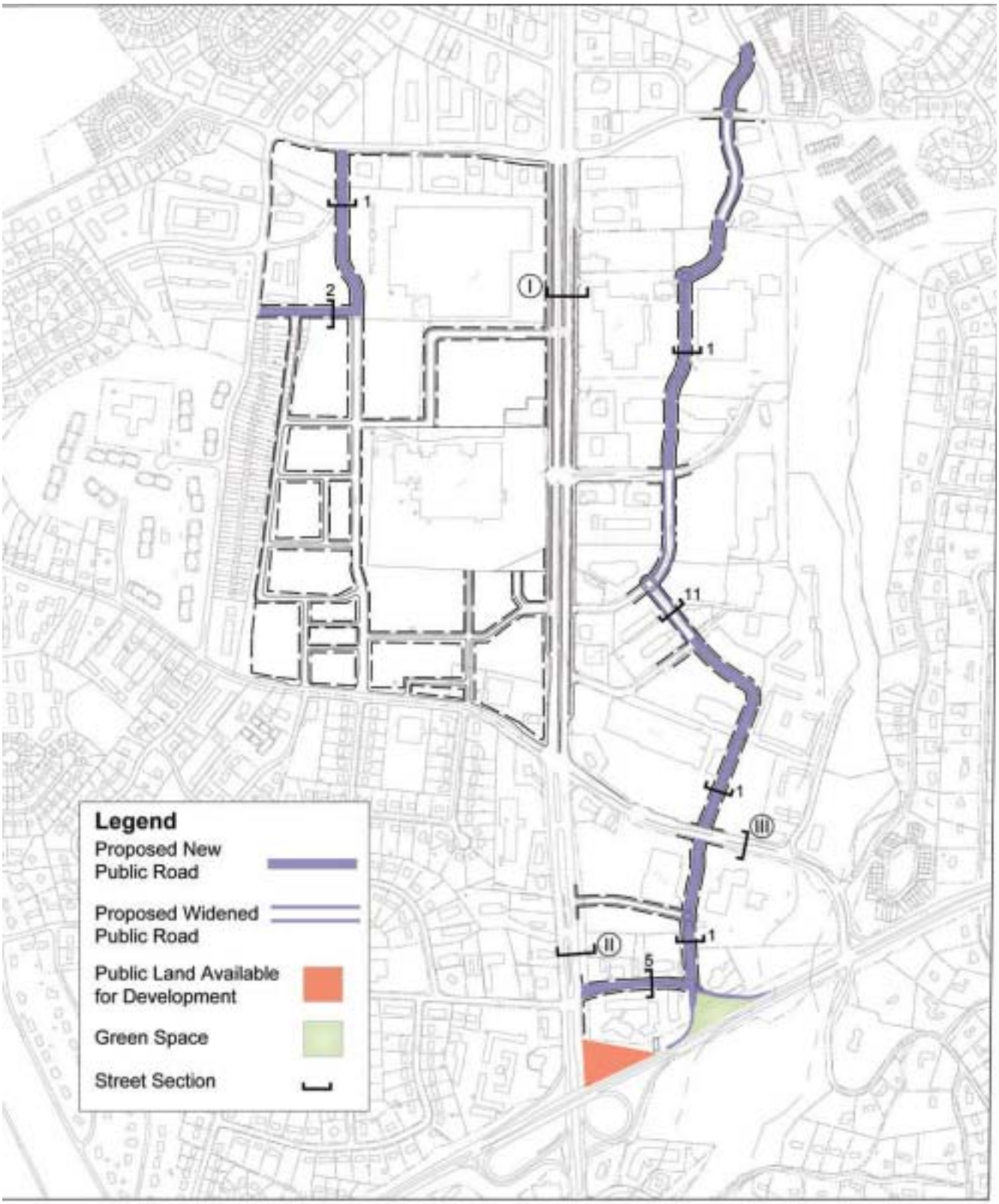
OPTION C

29H250 Phase II

0 200 400 800

1"=200'

Figure AD 10: Initial Public Roads



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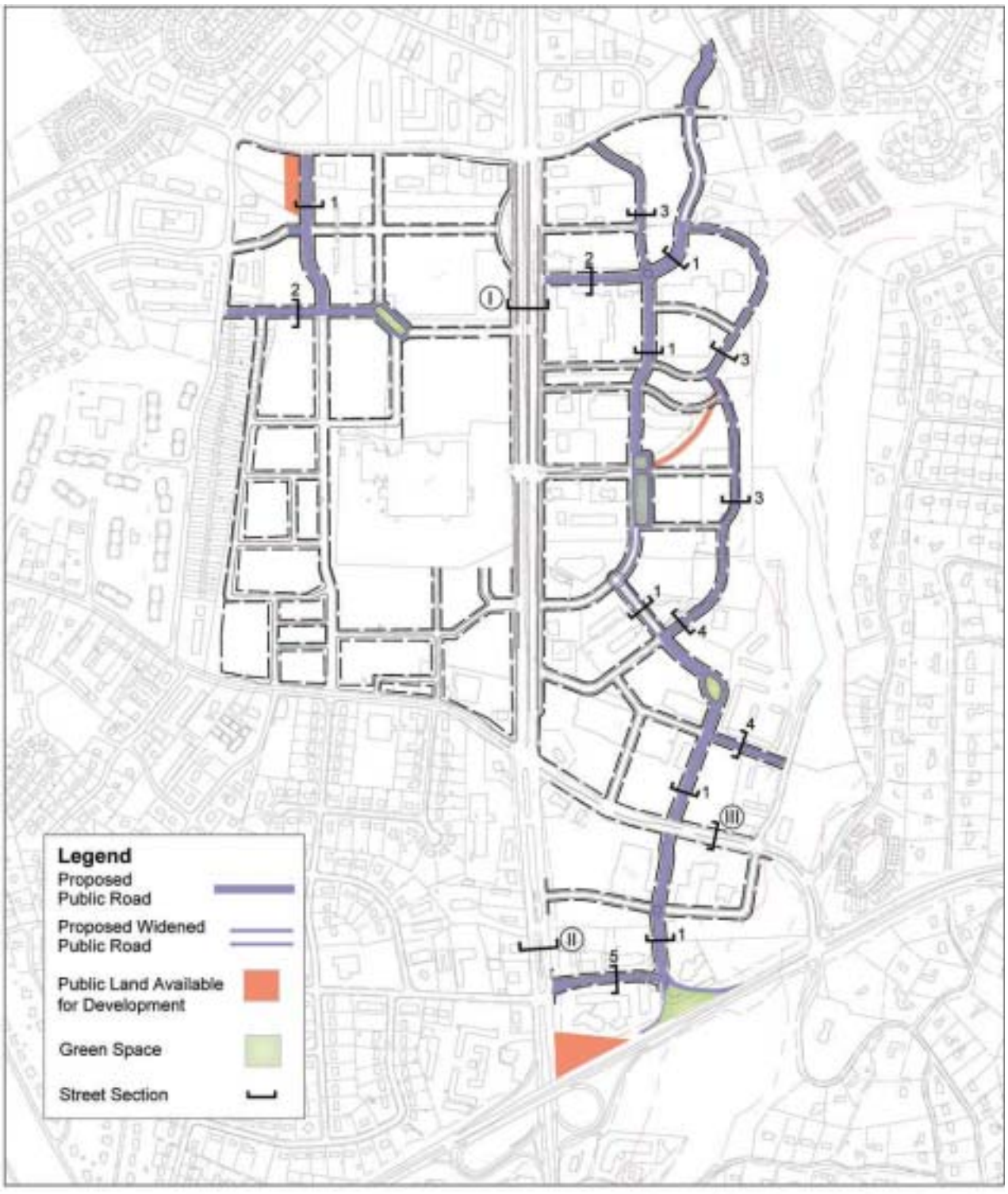
Initial Land Use Pattern:
Proposed Public Roads and Street Sections

0 200 400 800
Scale: 1"=800'

Figure AD 11: Future Public Roads



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Potential Future: Public Roads and Street Sections

0 200 400 800
Scale: 1"=800'

Figure AD 12: Hillsdale Typical Cross Section

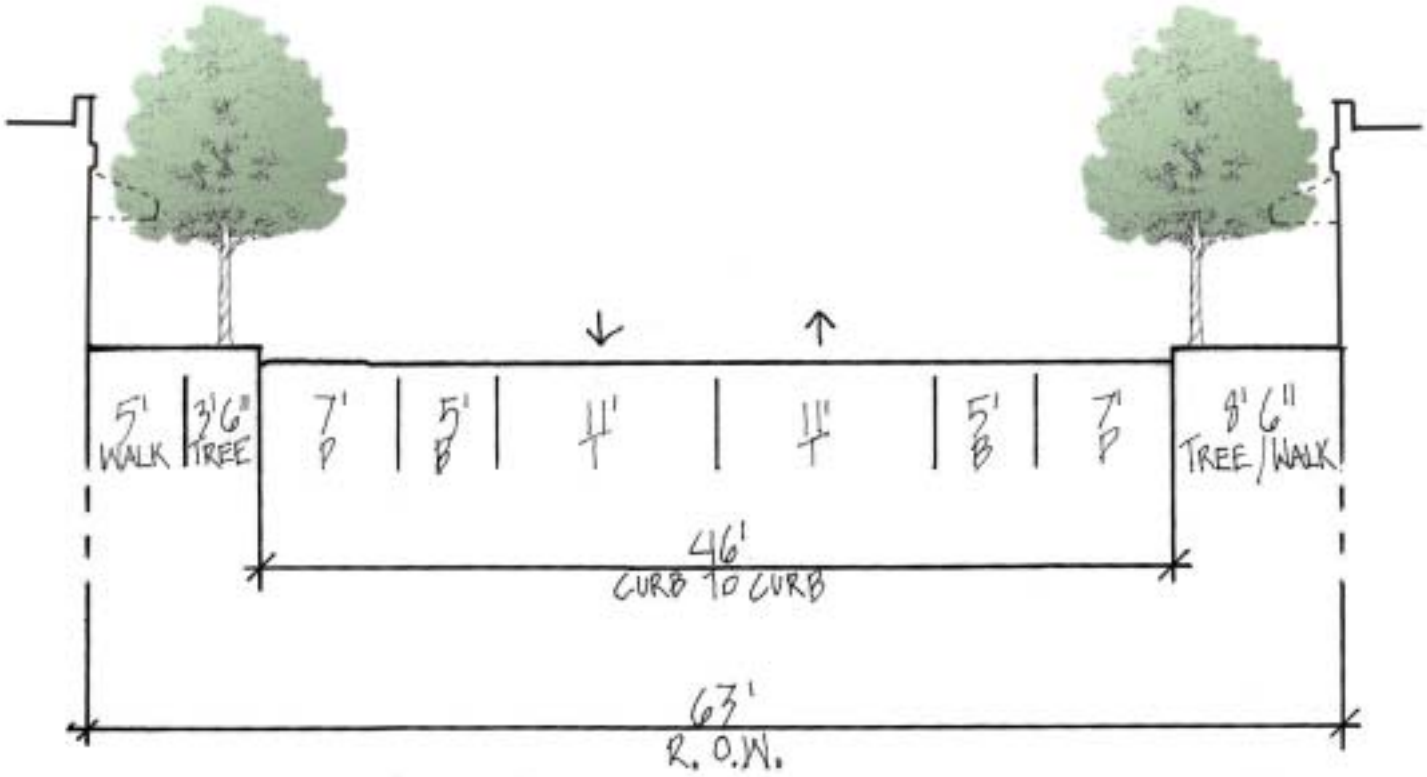


Figure AD13: Hillsdale Underpass

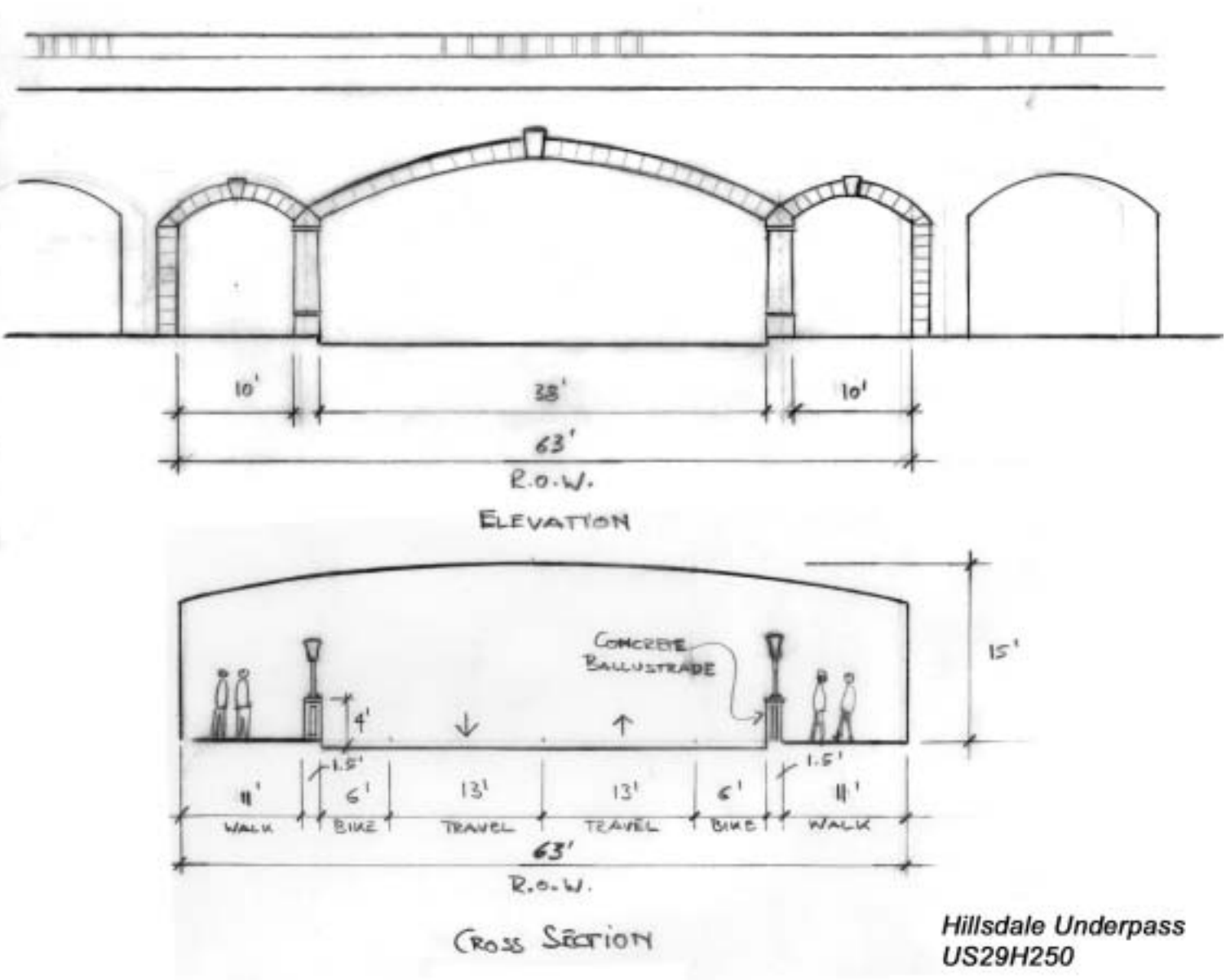


Figure AD 14 - Multi-way Boulevard Cross Section US 29

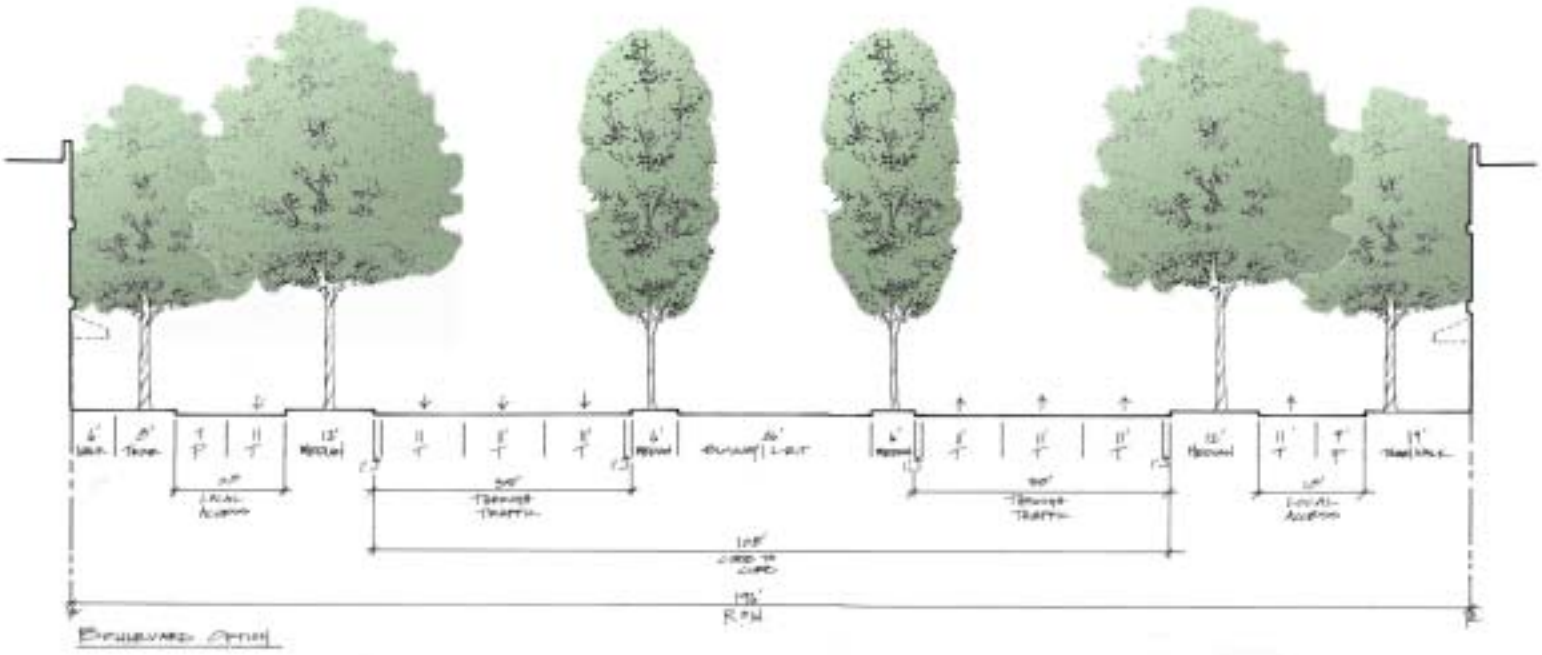


Figure AD 15: Transit Multi-way Boulevard US 29

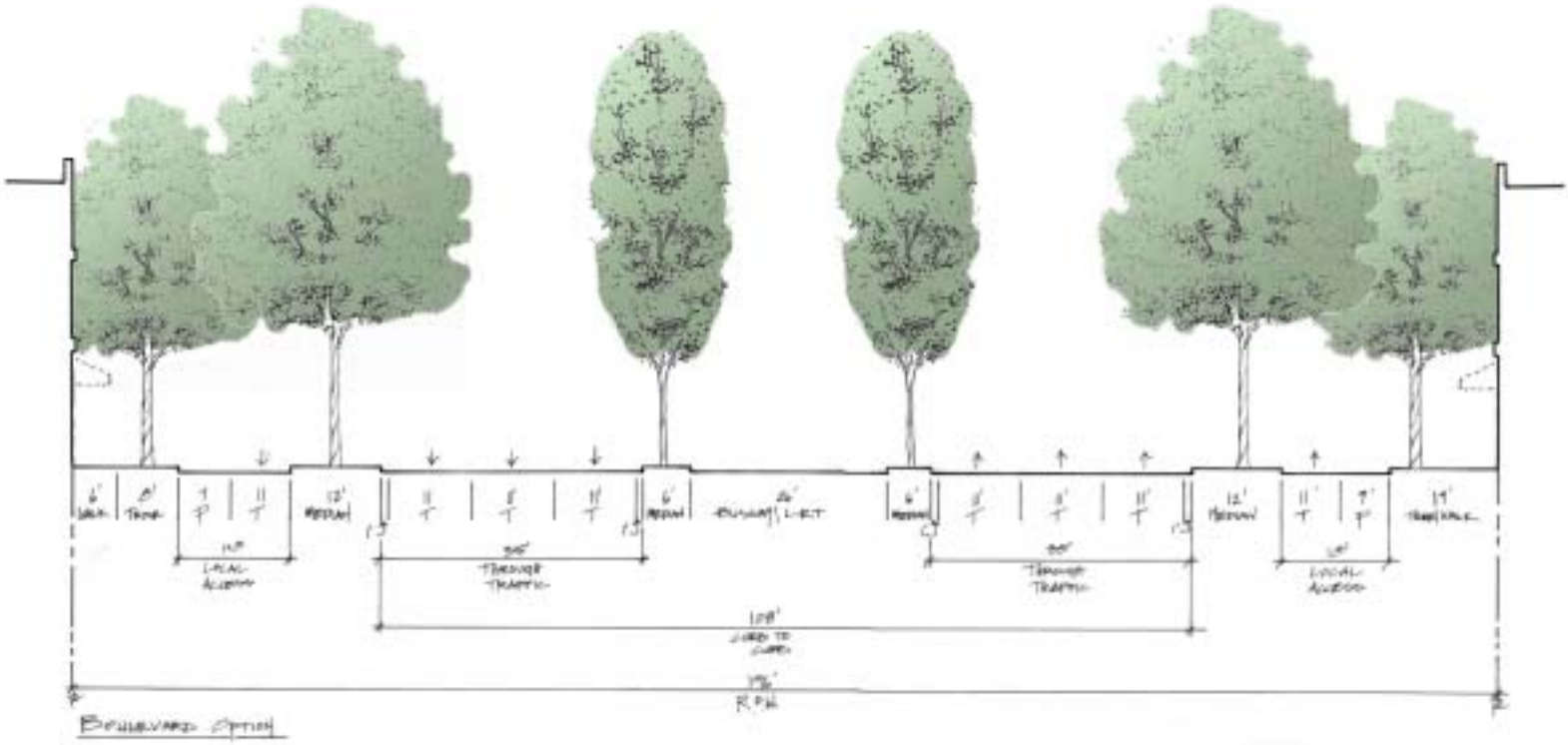


Figure AD 16: Standard Boulevard Cross Section US 29

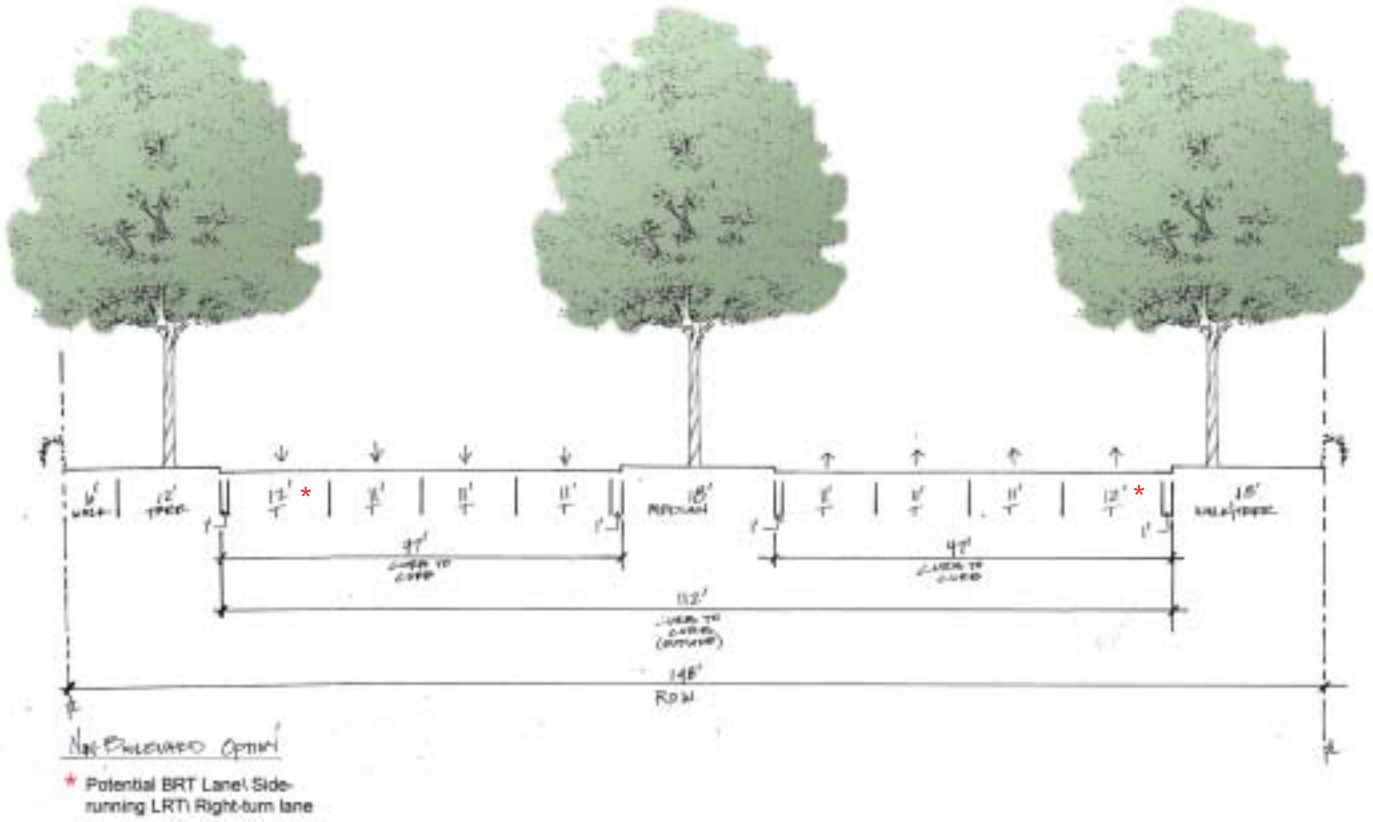


Figure AD17: Transit Standard Boulevard US29

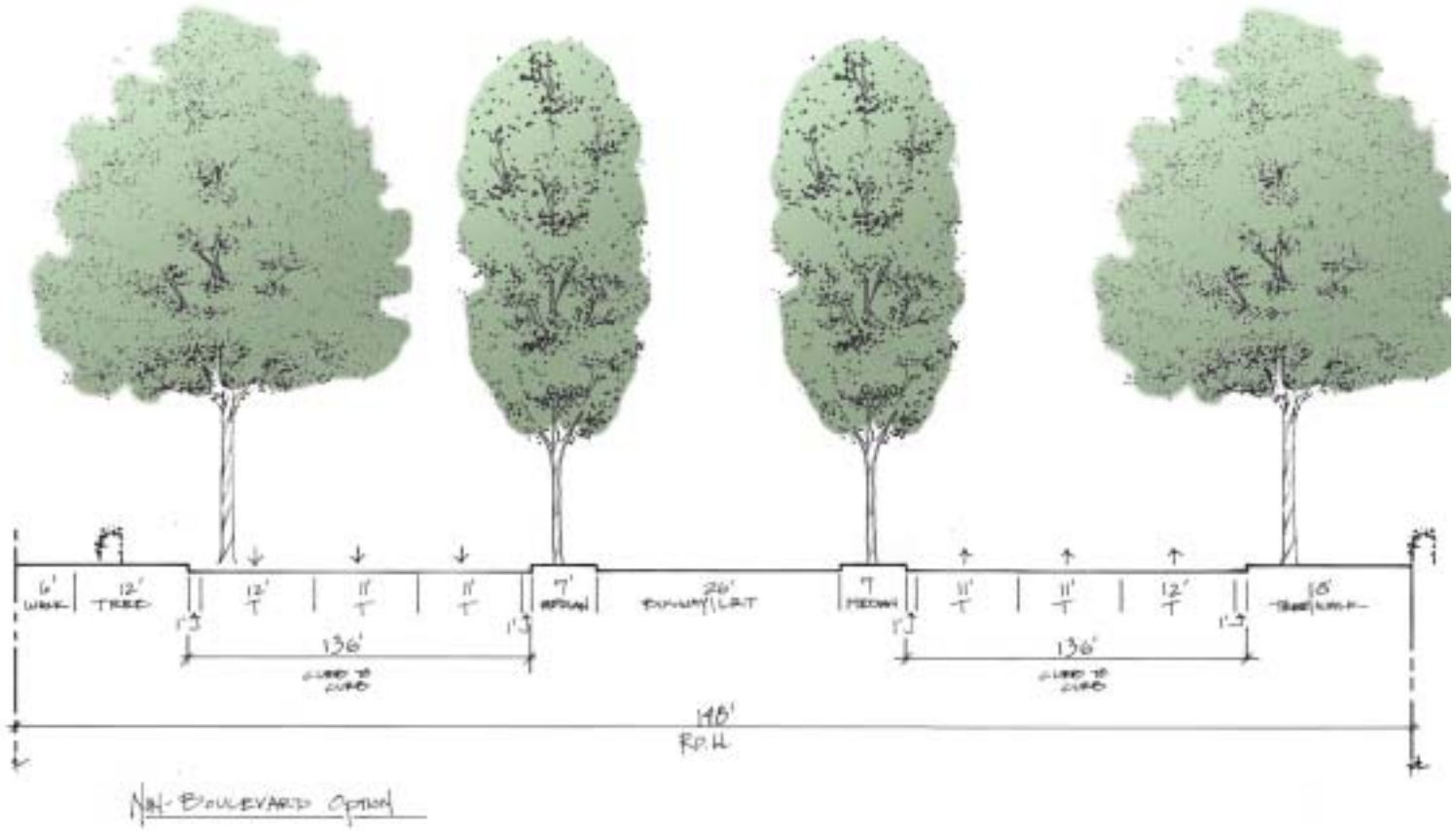


Figure AD18: US 29 South of Hydraulic - Option C Cross Section

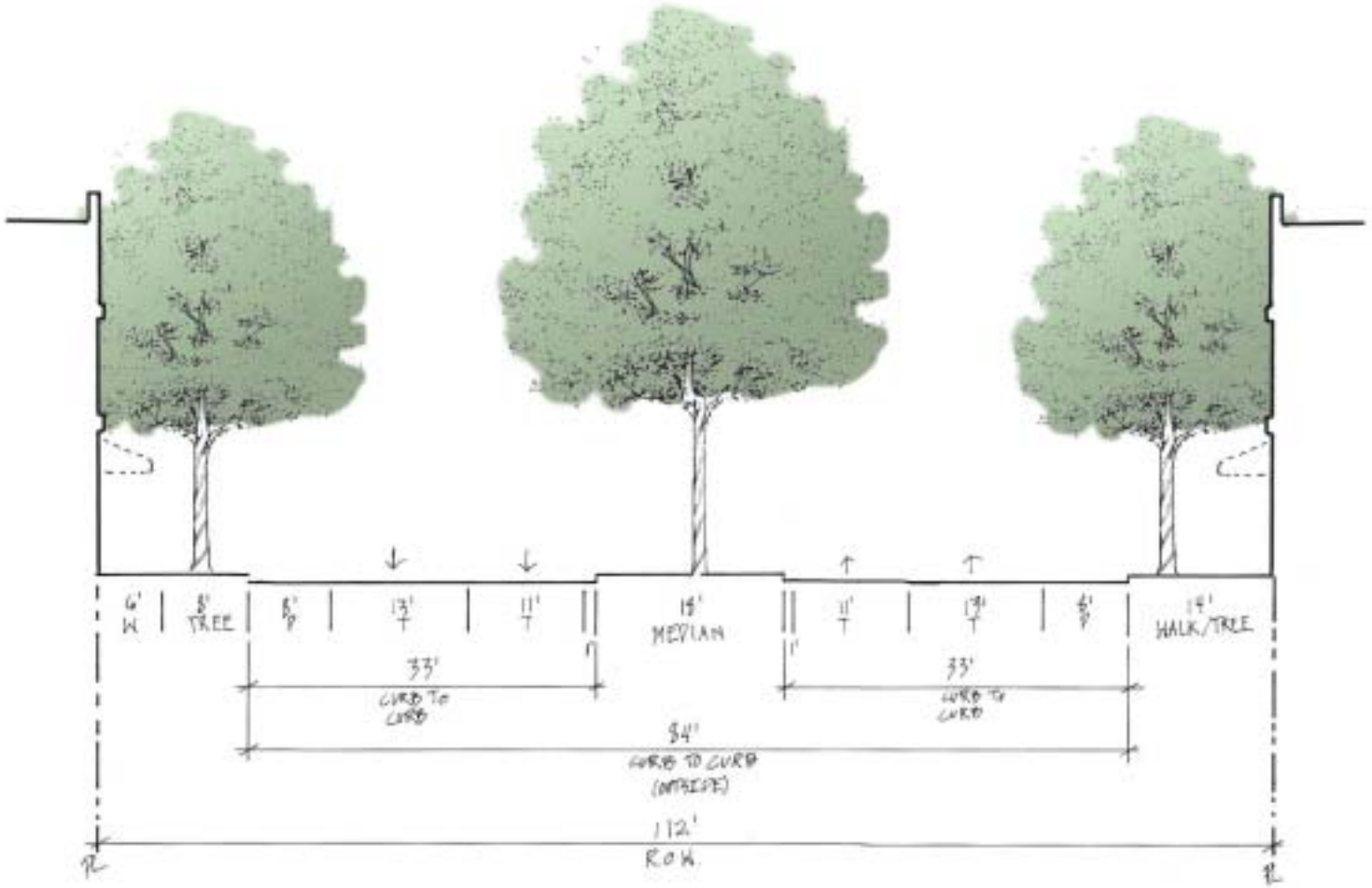


Figure AD 19: Hydraulic Road Option A Cross Section

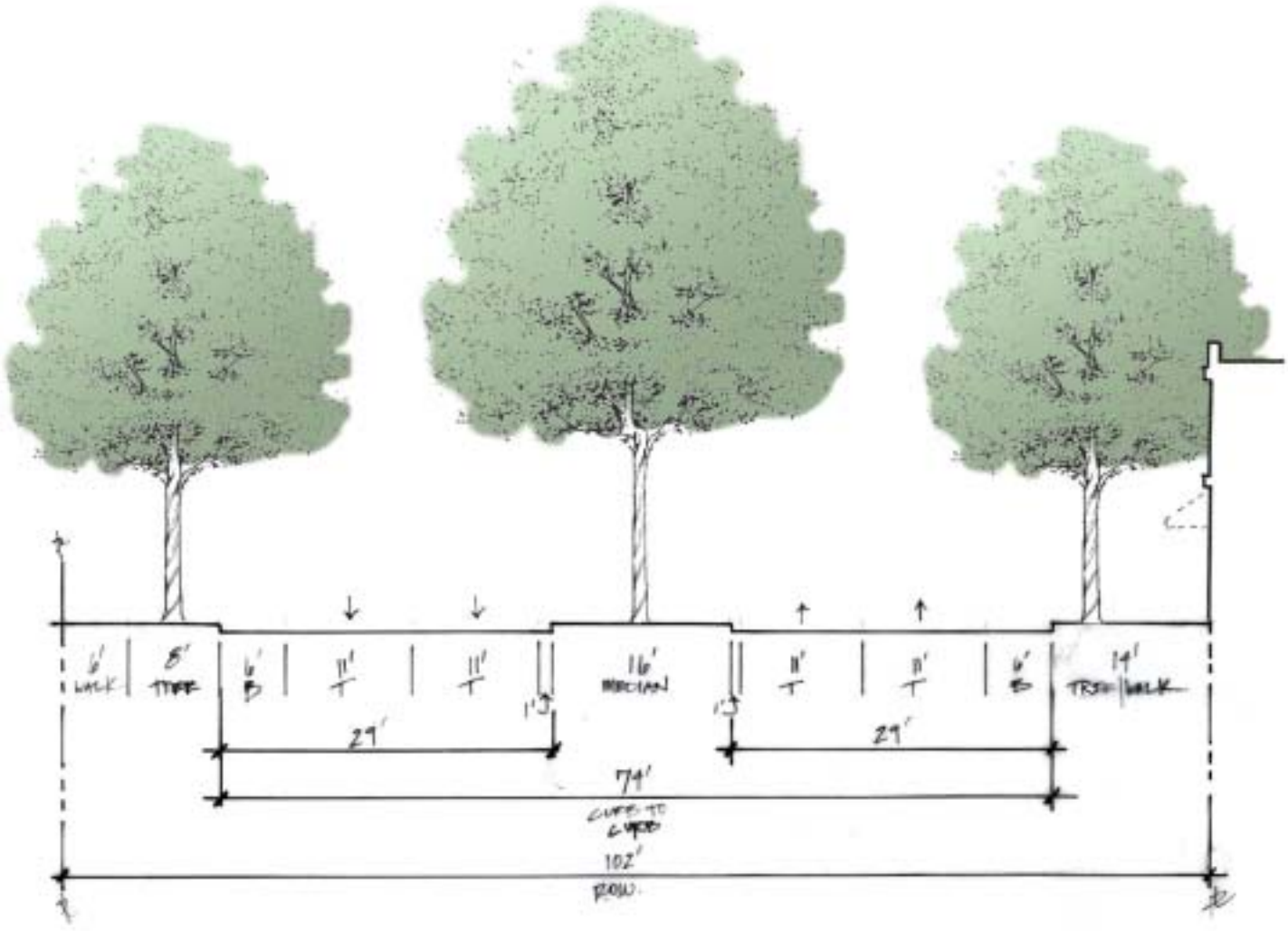


Figure AD 20: Hydraulic Road Option B Cross Section

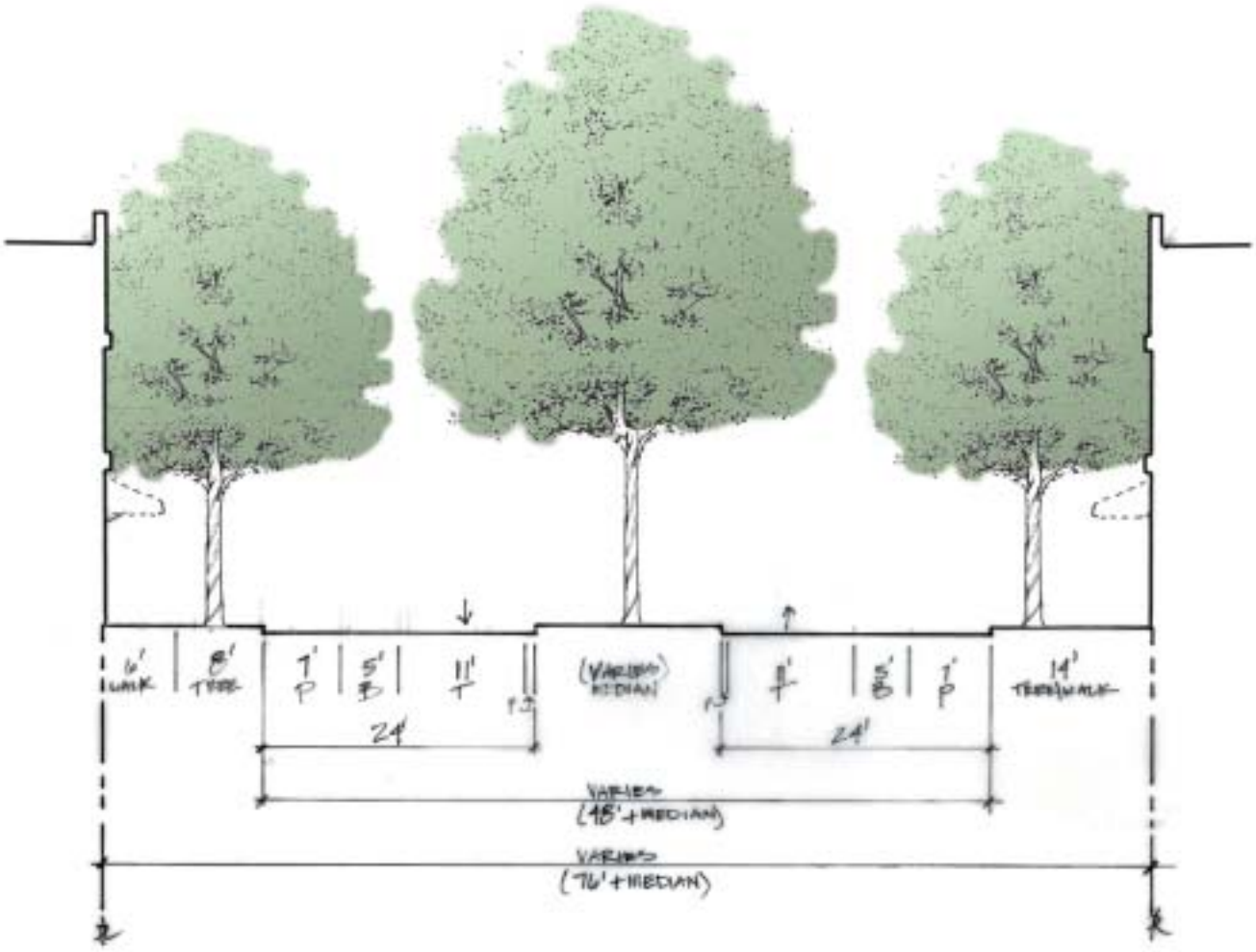


Figure AD 21: Hydraulic Road Option C Cross Section

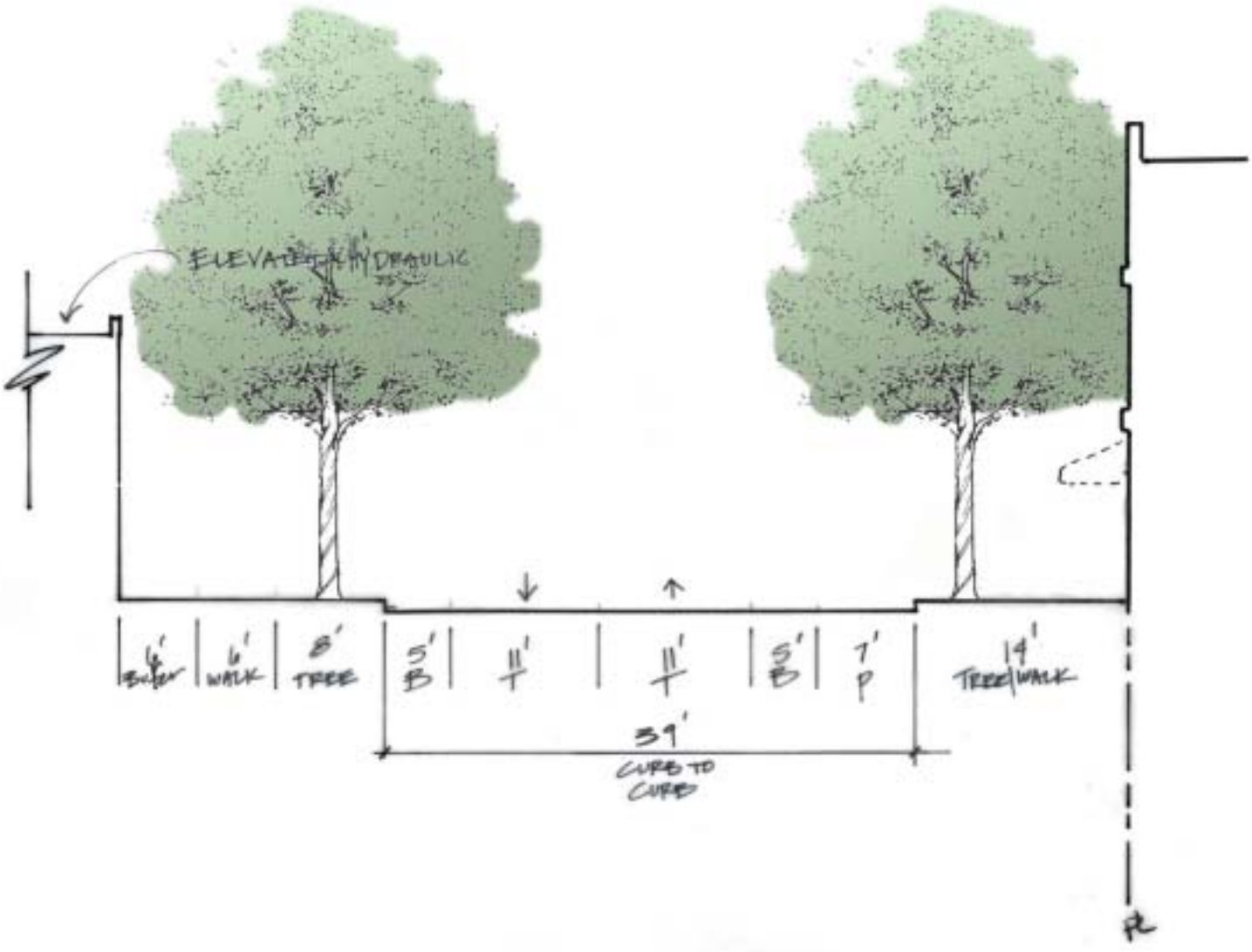


Figure AD22: New Proposed Road Cross Section #6 - Holiday Drive

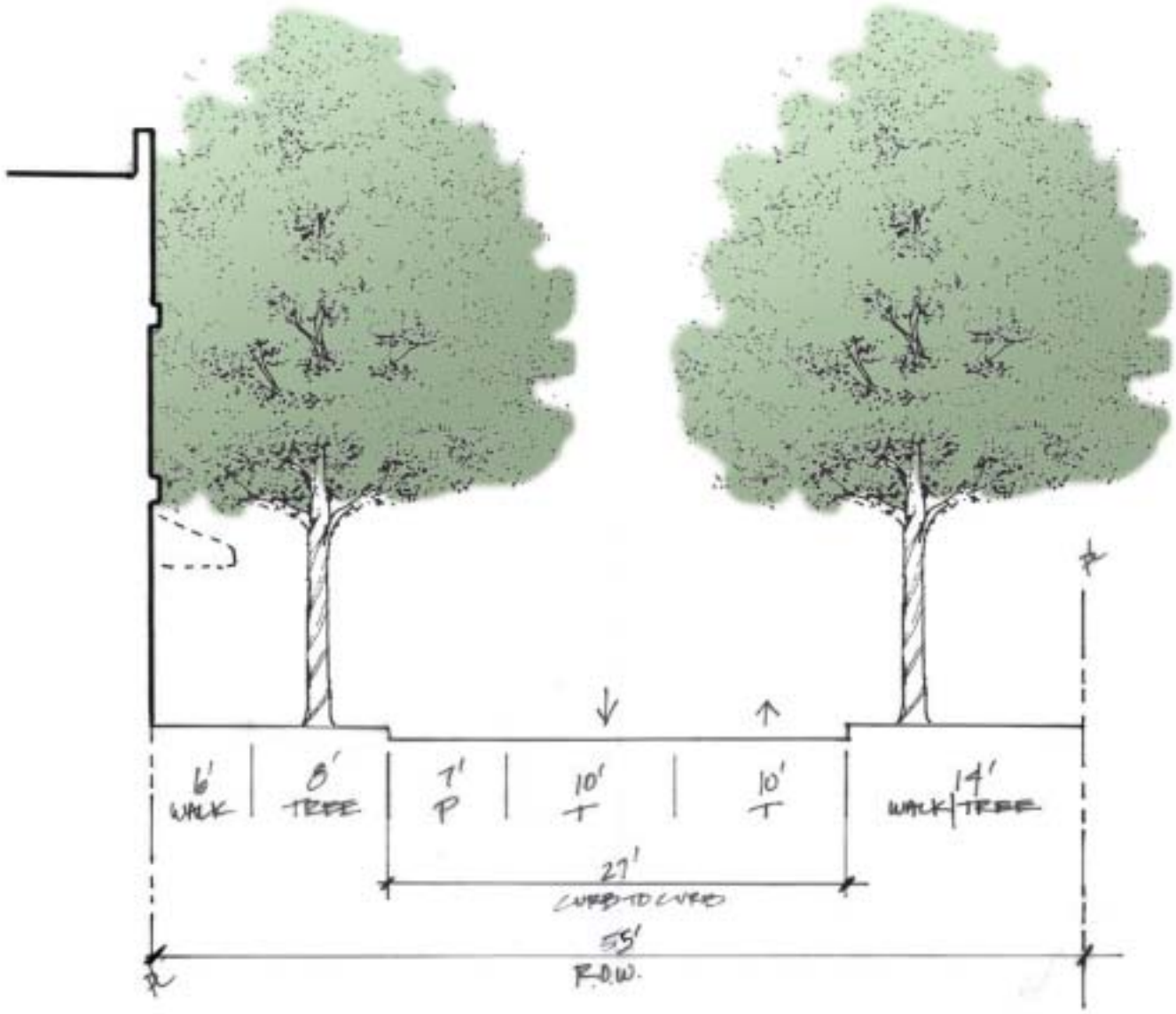


Figure AD 23: New Proposed Road Cross Section #2

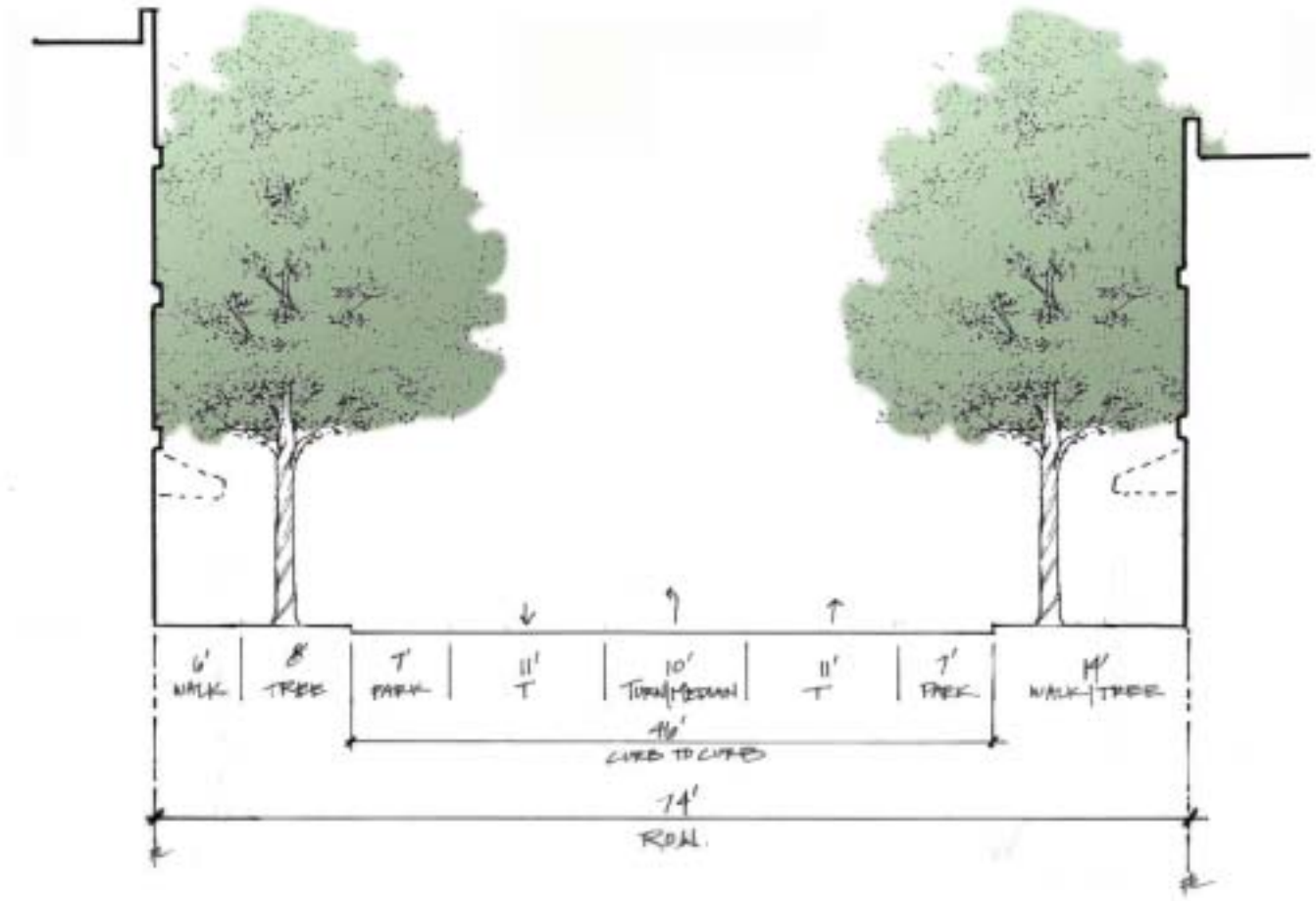


Figure AD 24: New Proposed Road Cross Section #4

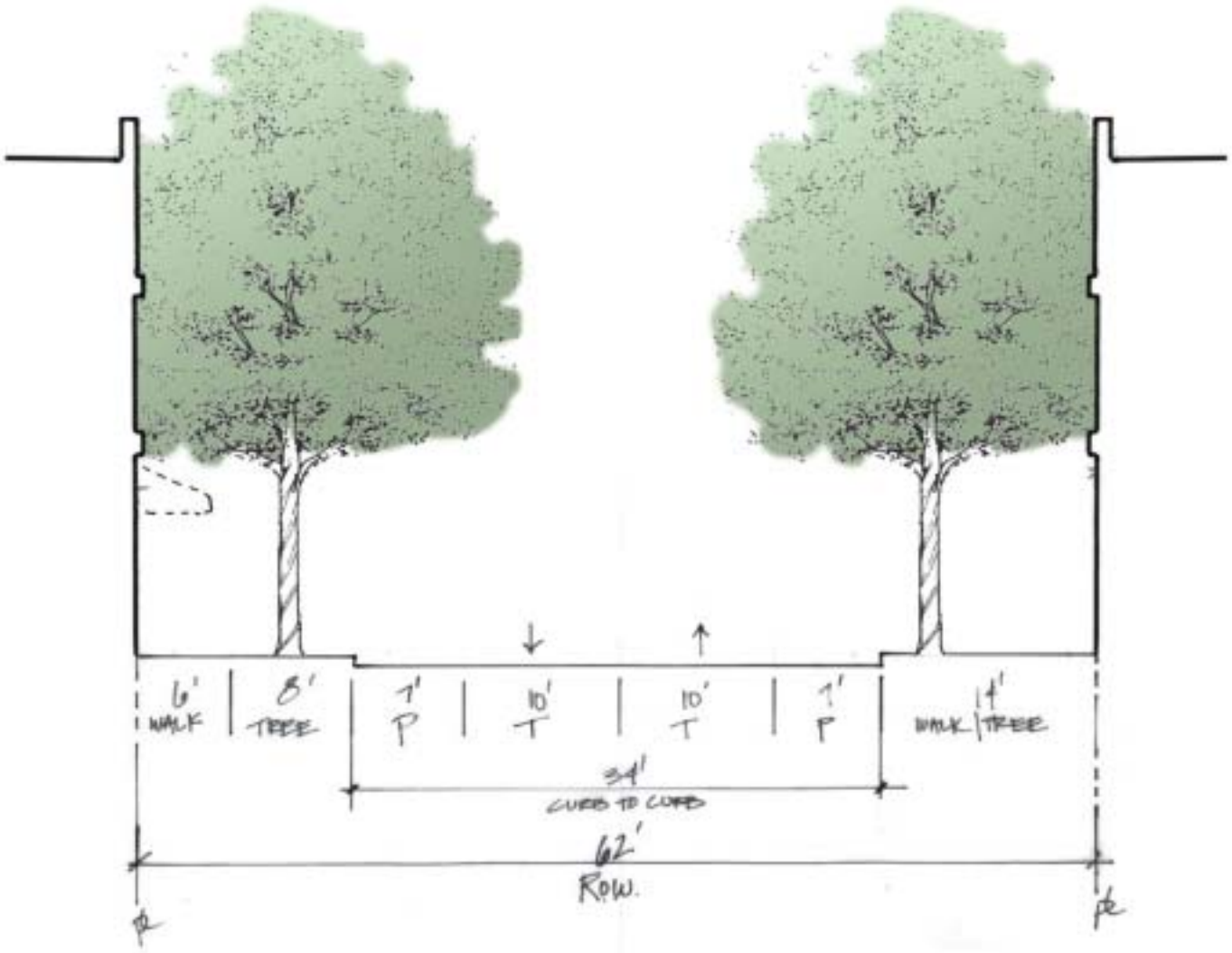


Figure AD 25: New Proposed Road Cross Section #5

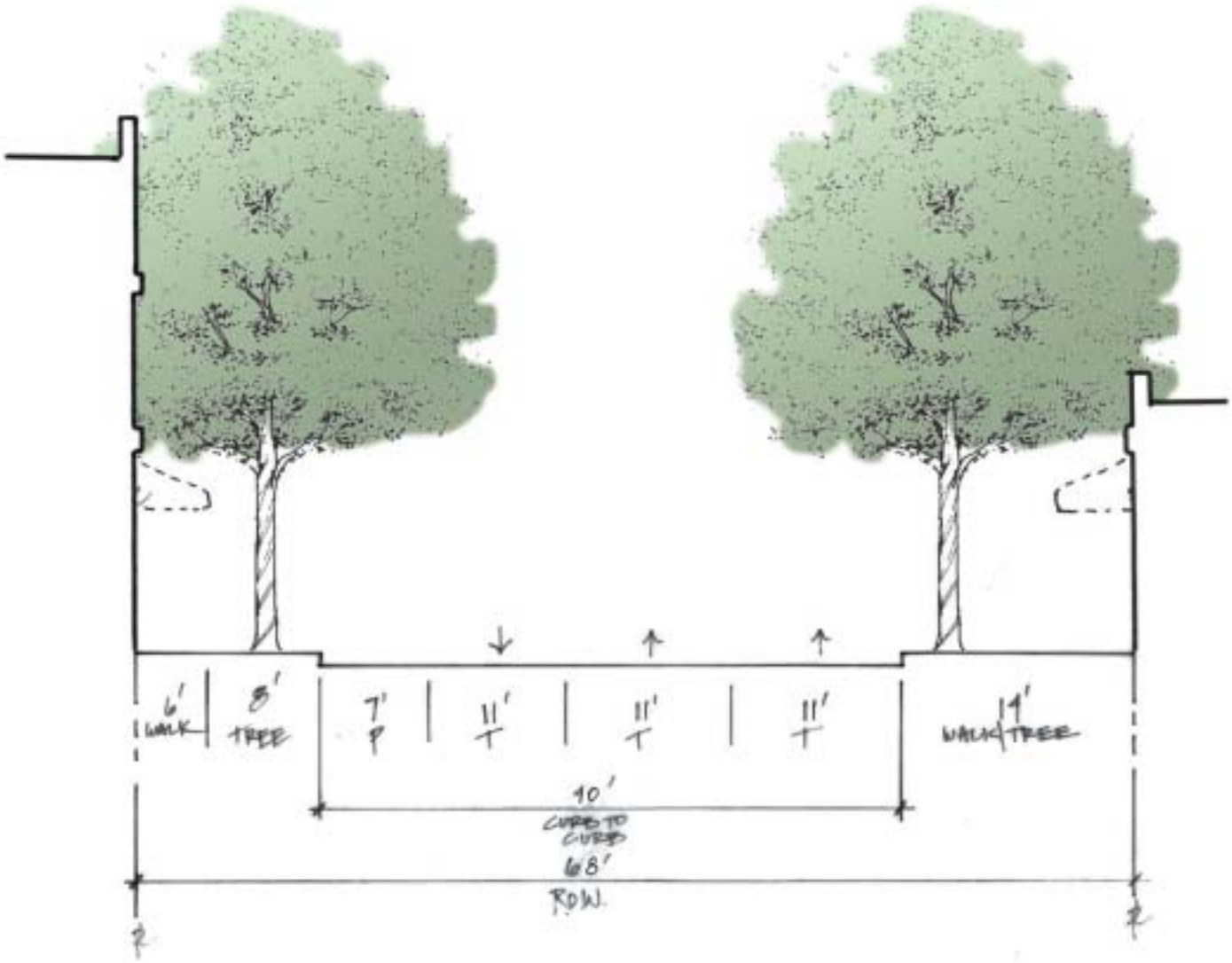
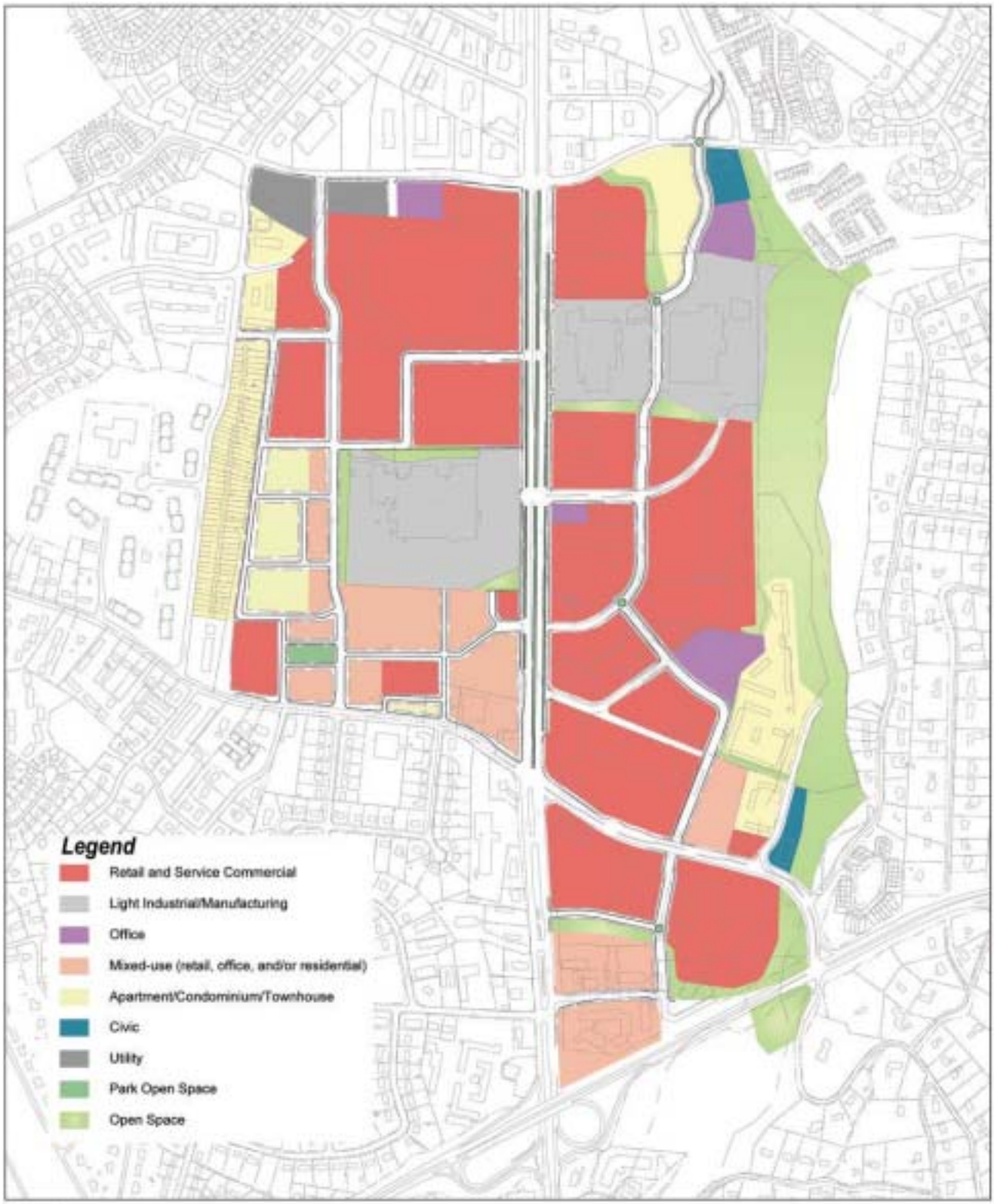


Figure AD 26: Initial Land Use Pattern



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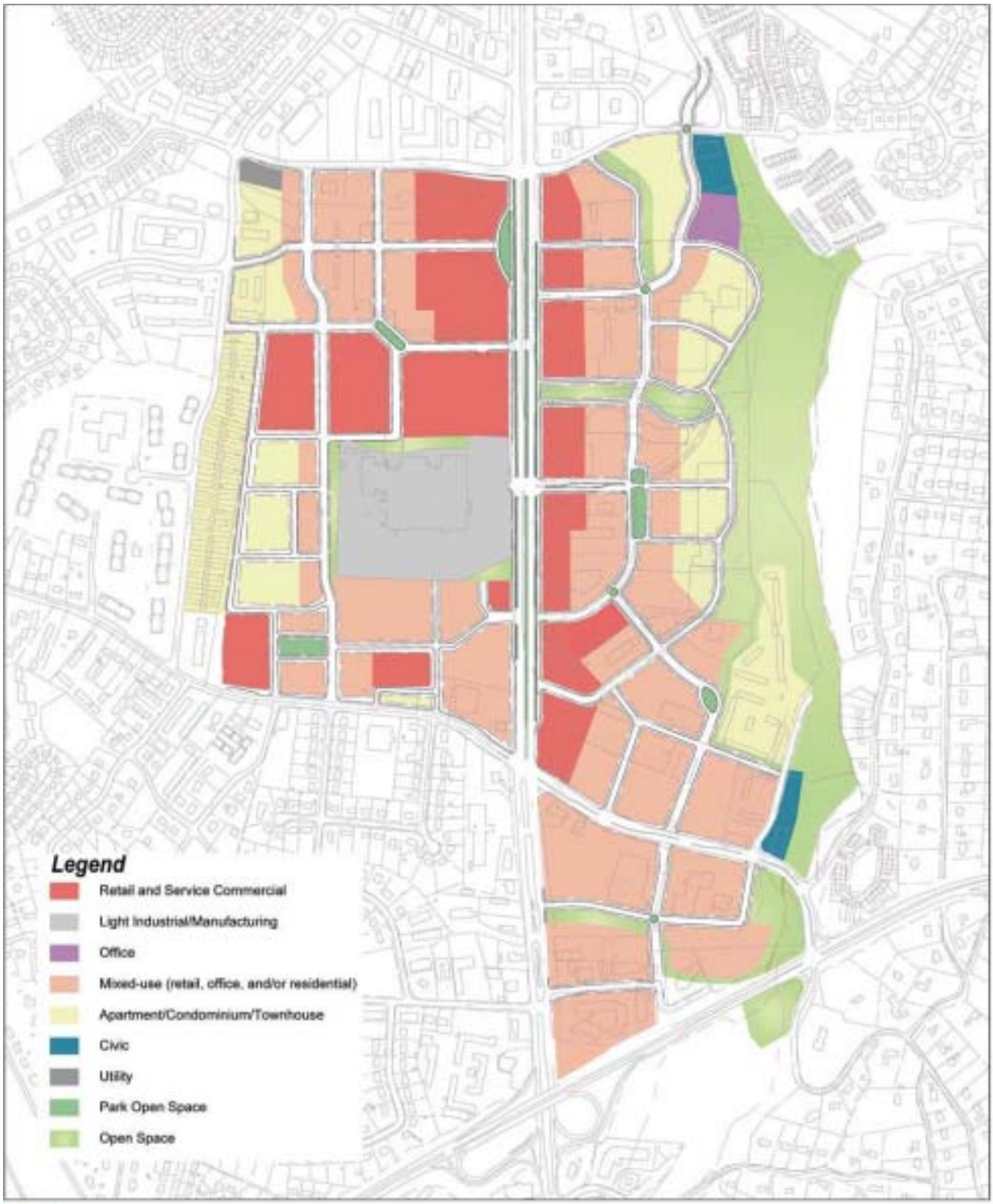
29H250 Phase II

Initial Land Use Pattern

0 200 400 800
Scale: 1"=800'
April 13, 2004

Figure AD 27: Future Land Use Pattern



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29H250 Phase II ***Potential Future Land Use Pattern***

0 200 400 800
Scale: 1"=800'
April 13, 2004

Figure AD 28: Triangle Site Existing

Figure AD 29: Triangle Concept A

Concept A	Development Type	Square Footage	Parking Needs
	Anchor Retail A	120,000	600
	"Liner" & "Pad" Retail	43,400	174

Figure AD 30: Triangle Concept B

Concept B	Development Type	Square Footage	Parking Needs
	Anchor Retail A	35,000	140
	Anchor Retail B	16,750	67
	"Liner" & "Pad" Retail	143,400	574
	Restaurant	9,000	90
	Hotel	401 rooms	401
	Hotel - Conference & Restaurant	29,000	120
	Apartments/Condominiums	92 units	138

Figure AD 31: KMart Site Existing

Figure AD 32: K-Mart Concept A

Concept A	Development Type	Square Footage	Parking Needs
	Block A: Brandywine		
	Anchor Retail A	40,500	203
	Anchor Retail B	21,250	85
	"Liner" & "Pad" Retail	57,900	232
	Block B: Brandywine		
	"Liner" & "Pad" Retail	44,100	177
	Apartments/Condominiums	70	105
	Block B: Housing Authority		
	Apartments/Condominiums	66 units	99
	Block C: Existing Regal Cinema Remains		

Figure AD 33: K-Mart Concept B

Concept B	Development Type	Square Footage	Parking Needs
	Block A: Brandywine & Portion of Seminole Sq. Cinema		
	Retail	92,630	370
	Cinema (14 Screens)	54,550	540
	Apartments/Condominiums	213 units	320
	Block B: Brandywine & Housing Authority		
	Retail	59,150	237
	Apartments/Condominiums	7	14
	Apartments/Condominiums	170	255
	Block C: Existing Regal Cinema		
	Retail	23,200	93
	Apartments/Condominiums	132 units	201

EXHIBIT A

DEVELOPMENT GROUP			DESIGN TEAM	SHEET NUMBER
LANDONOMICS GROUP		ALBEMARLE PLACE TOWN · CENTER COUNTY of ALBEMARLE, VIRGINIA	The COX Company KA, Inc.	SP1

Figure AD 35: Comdial Site Existing

Figure AD 36: Comdial Concept A

Concept A	Development Type	Square Footage	Parking Needs
	Anchor Retail A	84,000	420
	Anchor Retail B	43,000	215
	Anchor Retail C	68,500	343
	"Liner" & "Pad" Retail	32,900	131
	Restaurant	8,000	80

Figure AD 37: Comdial Concept B

Concept B	Development Type	Square Footage	Parking Needs
	Anchor Retail A	45,000	225
	Anchor Retail B	42,000	210
	Anchor Retail C	42,000	210
	"Liner" & "Pad" Retail	134,900	540
	Restaurant	16,000	160
	Office	196,100	588
	Apartments/Condominiums	407 units	611
	Townhouses	14 units	28

Figure AD38: Hillsdale at Break in Retail Building Cross Section

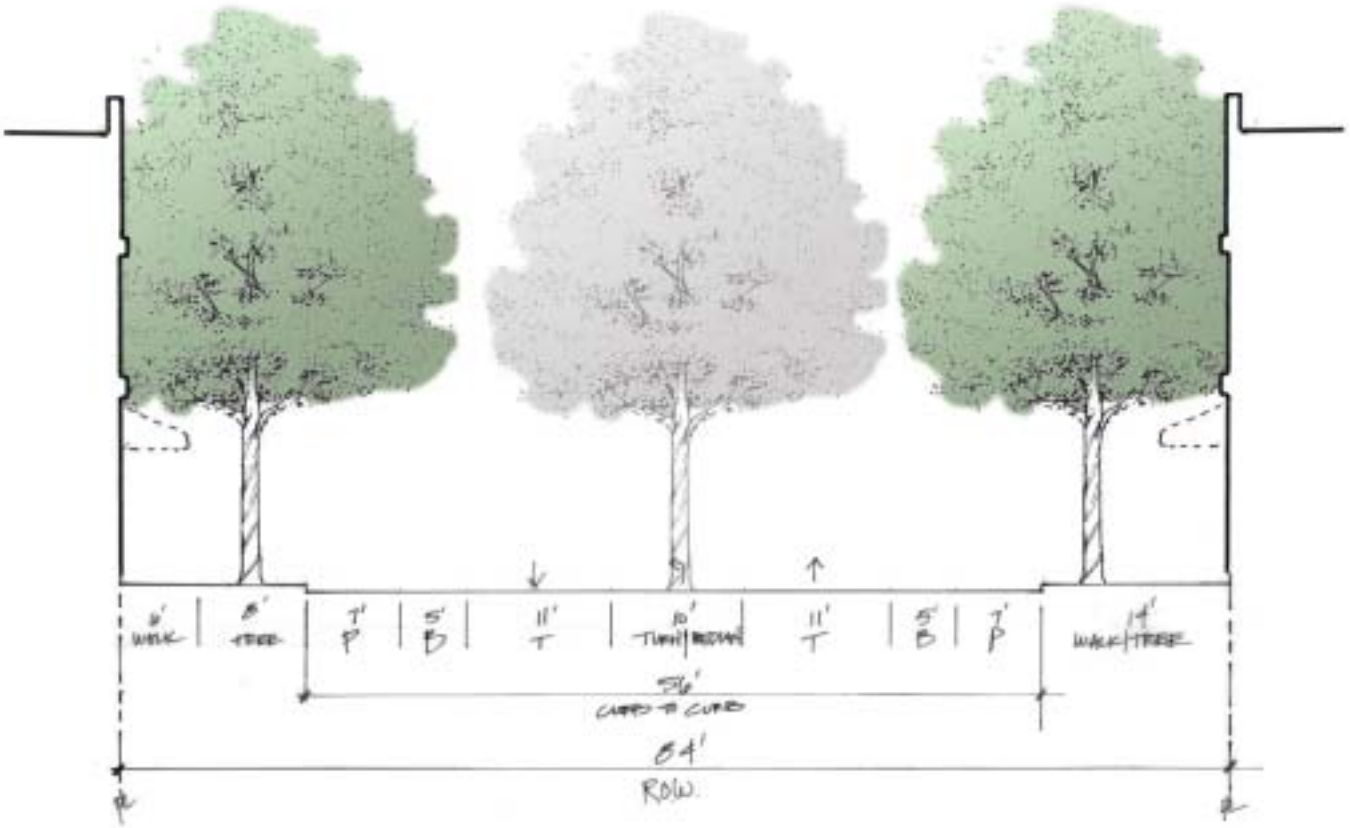


Figure AD 39: US 29 Option A Access Diagram

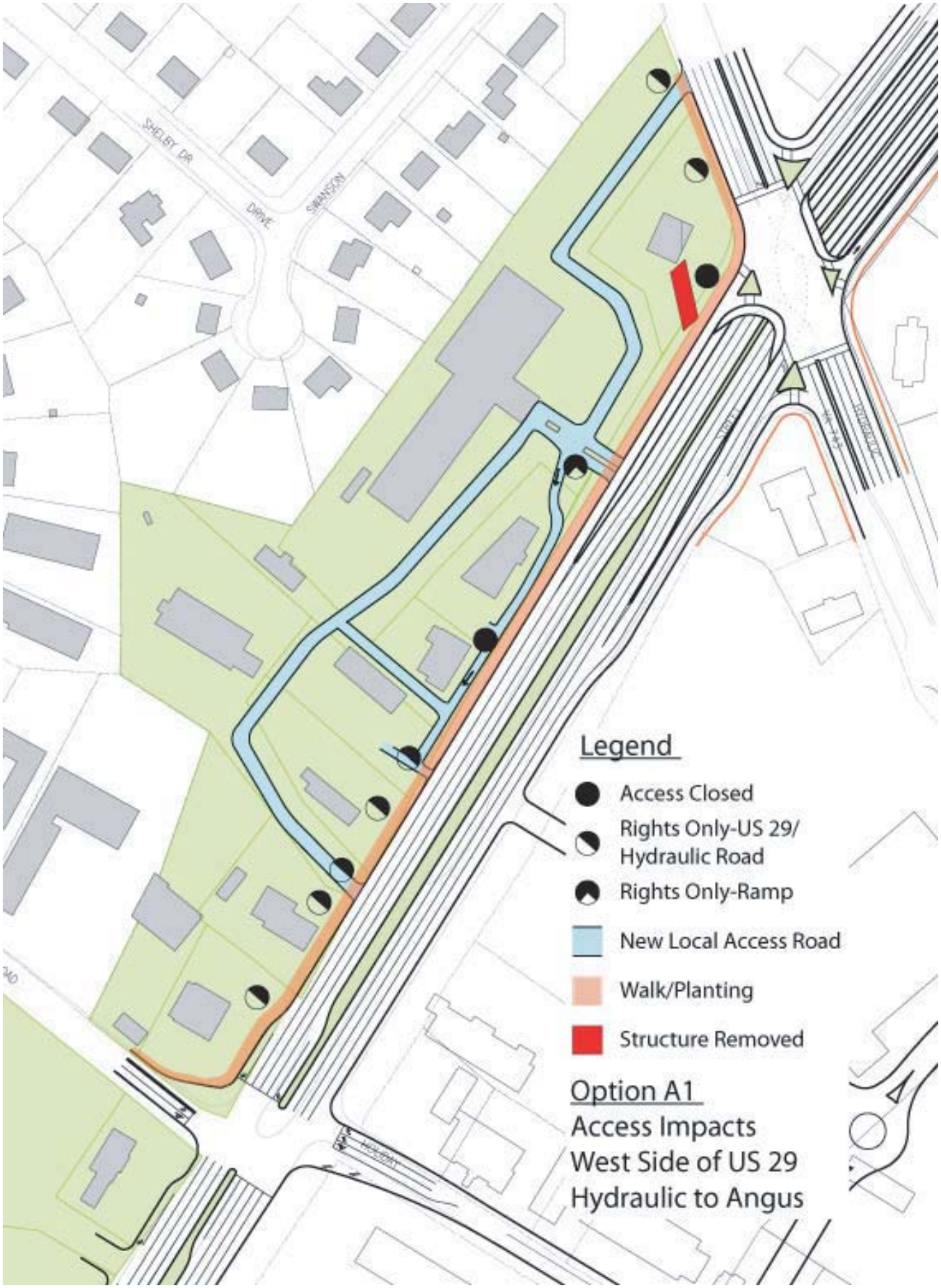
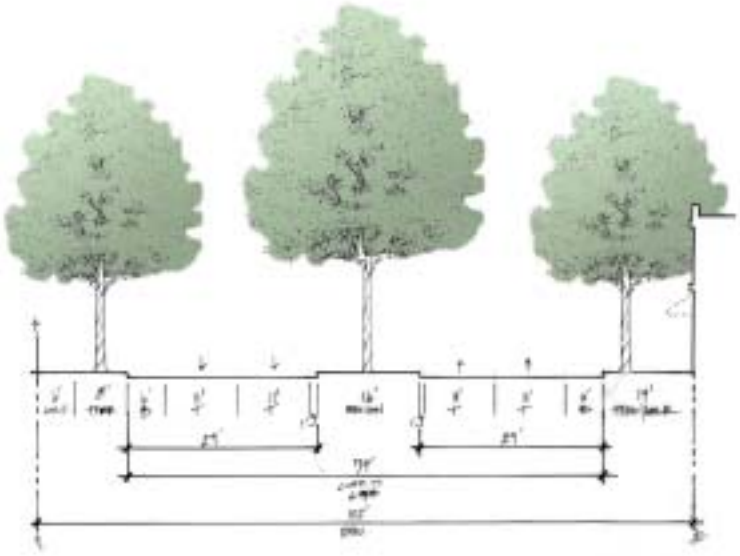
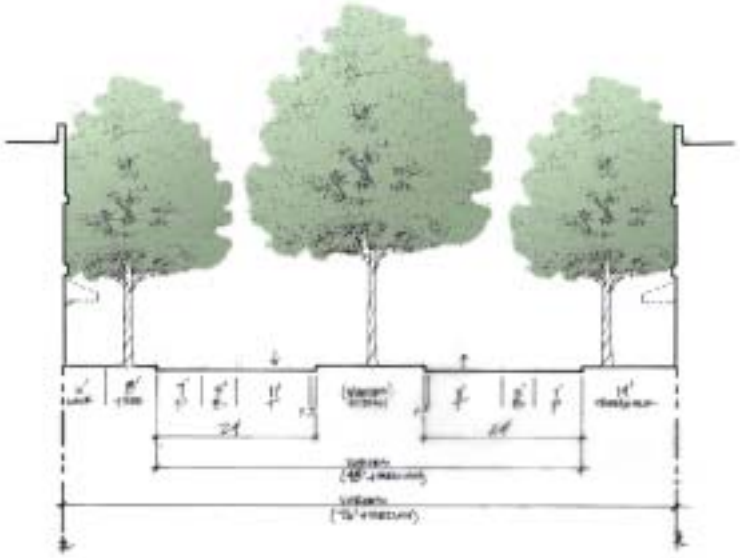


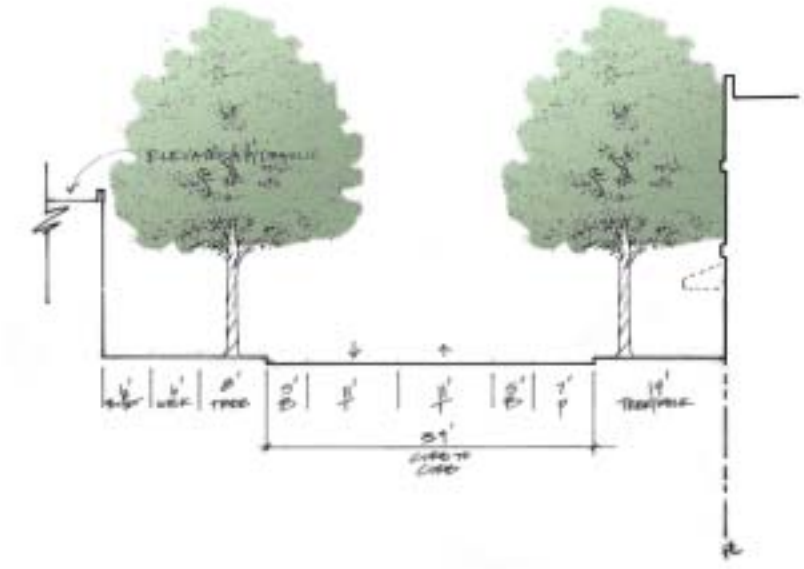
Figure AD40: Hydraulic Road Pedestrian Realm



Option A

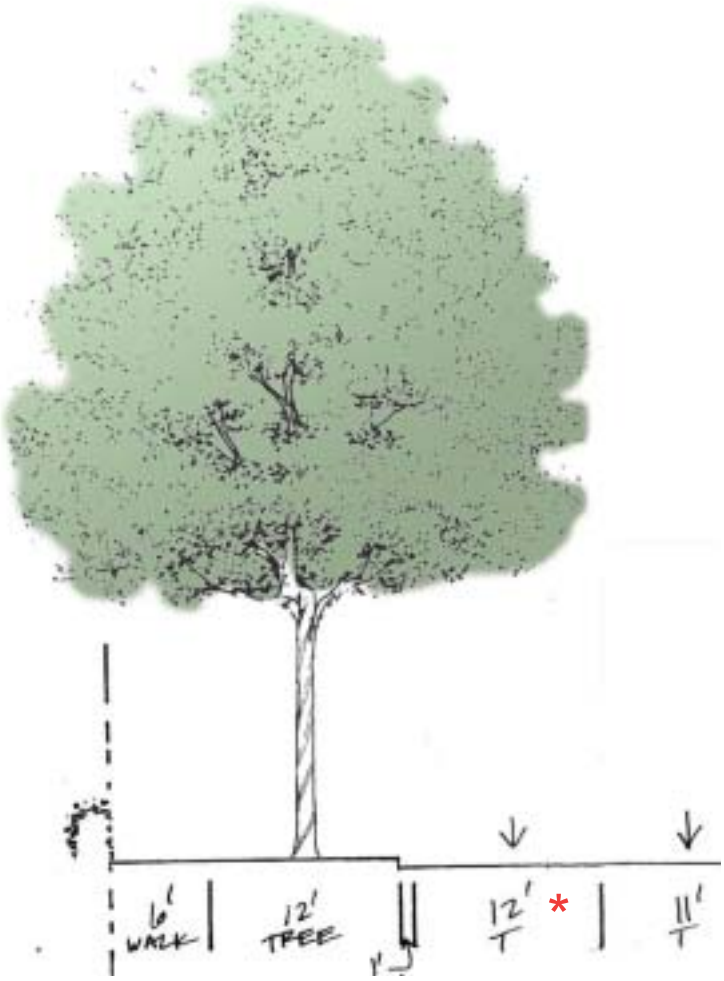


Option B



Option C

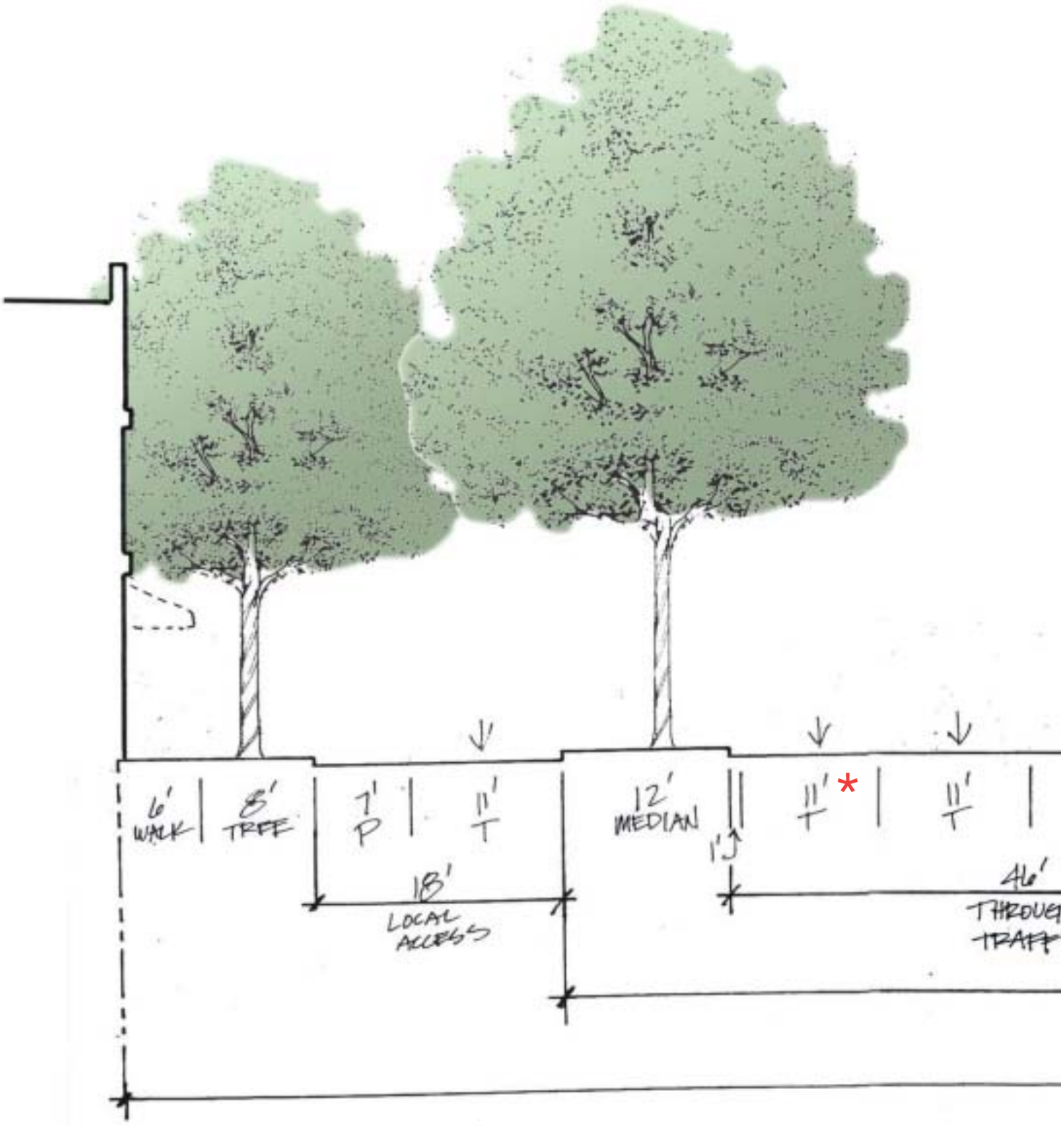
Figure AD 41: US 29 Standard Blvd. Pedestrian Realm



Non-Boulevard Option

* Potential BRT Lane\ Side-running LRT\ Right-turn lane

Figure AD42: US 29 Multi-way Boulevard Pedestrian Realm



* Potential BRT Lane\ Side-running LRT\ Right-turn lane

Figure AD 43: US 29 Combined Pedestrian/Bicycle Path

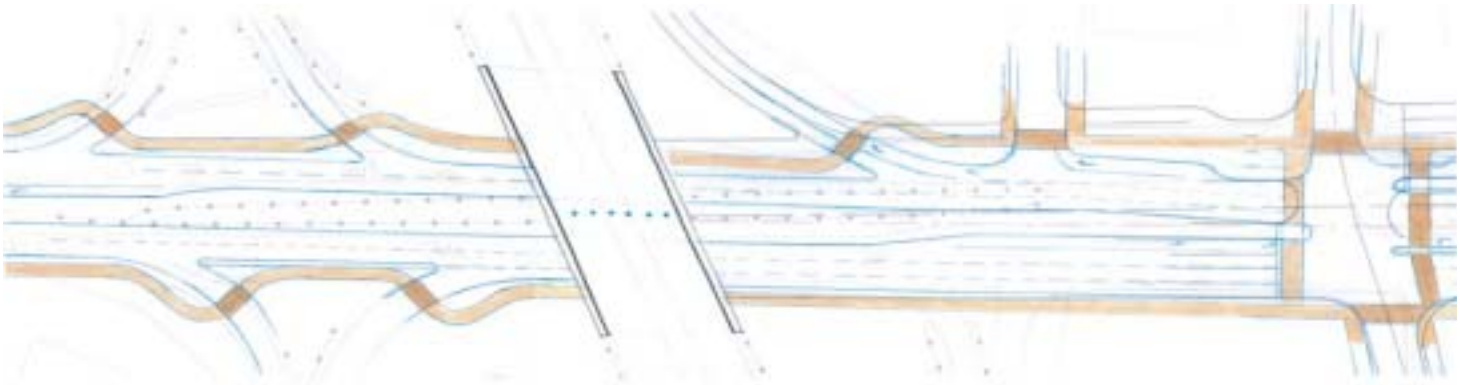


Figure AD44: Hillsdale Plan

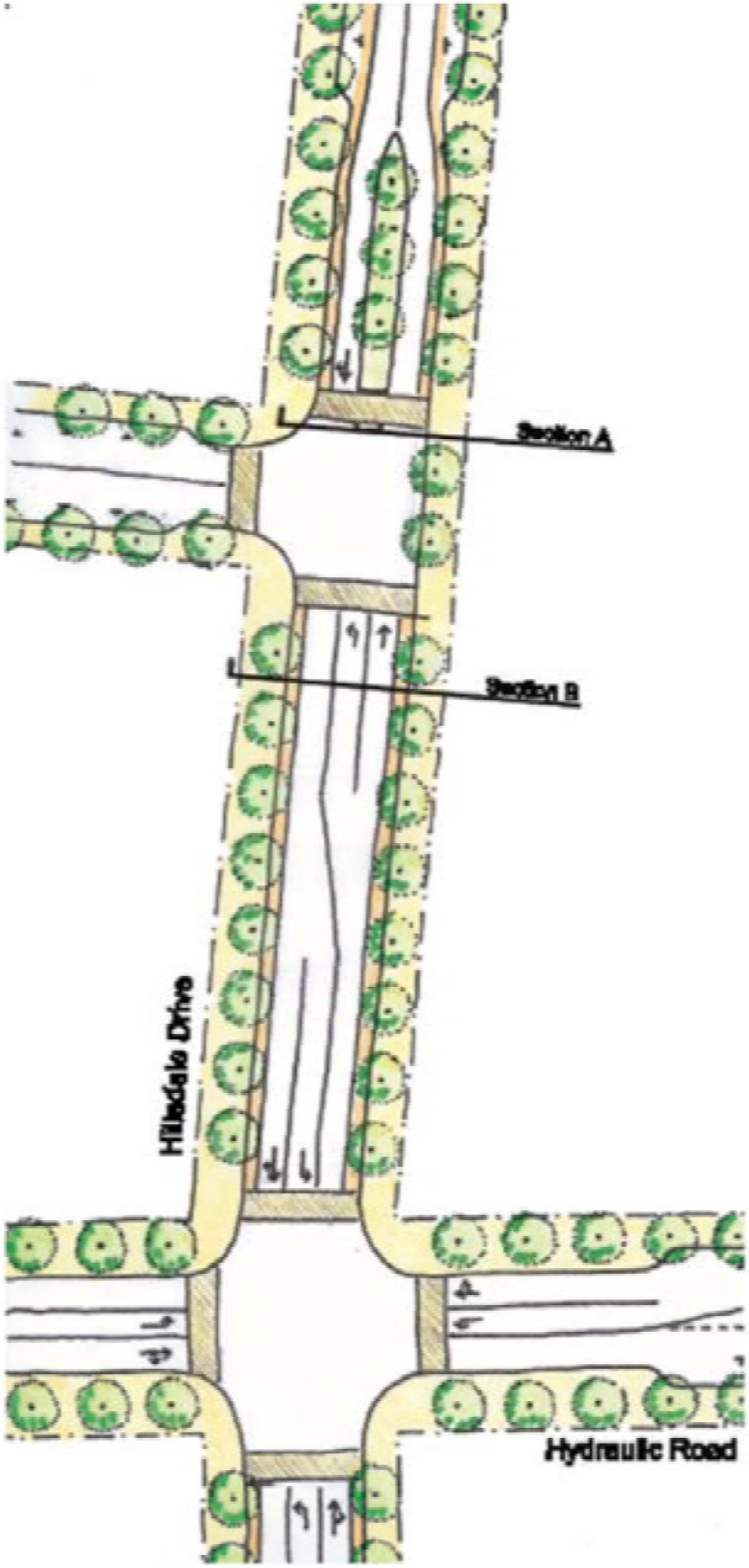


Figure AD 45: Queue Jump

Table AD-1: 29H250 Enhancement Alternatives

Last Updated: November 19, 2003

				Enhanced Concept		
Design	**U.S. 29 @ U.S. 250 Interchange**	**U.S. 29 @ Hydraulic Road**	**U.S. 250 @ Hydraulic Road**	**A**	**B**	**C** (a)
1		- Grade separation of thru lanes on US 29 (Hydraulic over US29) - Signal modification at Hydraulic		2	NO	NO
2	~~- Flyover of SB US29 to US250 (both directions)~~	~~- At-grade intersection with limited turning movements~~ ~~- NB one-way traffic on Hydraulic~~	~~- NB US250 grade separation~~ ~~- Additional turning lane from both directions of US250 onto Hydraulic~~ ~~- Closure of 3 median openings between US29 and US250~~			
2 (revised)		- At-grade intersection with limited turning movements	- NB US250 grade separation - Additional turning lane from both directions of US250 onto Hydraulic - Closure of 3 median openings between	NO	2	2
~~3~~	~~- SB reconfigure (one-way with two-way frontage roads)~~ ~~- Shift US29 NB ramps to Hydraulic/US250~~	~~- Grade separation~~ ~~- Hydraulic under US29~~ ~~- Southbound US29 ramps in the median~~	~~- Grade separation~~ ~~- NB one-way with two-way frontage roads~~			
4	- Flyover of SB US29 to US250 WB	- Flyover of SB US29		2	2	NO
~~5~~	~~- Single Point Urban Interchange with a signal~~					
~~6~~	~~- Several scenarios of interchange improvements~~		~~- Grade separation~~ ~~- Roundabout on the south side of US250~~			
6 (revised)	- Several scenarios of interchange improvements - Additional SB & NB lane	- Additional SB & NB lane	- Grade separation - Roundabout on the south side of US250	1	1 (No improvement at Hydraulic/250)	NO
7		- Reconfiguration of Hydraulic (Hydraulic under) - Grade separation of US29 - Large roundabout "Oval-about" of Hydraulic		1	NO	NO
8		- Grade separation of thru lanes on US 29 (Hydraulic under US29) - Roundabout of Hydraulic		1	NO	NO
9		- Grade separation of thru lanes on US 29 - Provision of roundabout for Hydraulic and turning movements		2	NO	NO
10		- Grade separation of thru lanes on US 29 (Hydraulic over US29) - Frontage road access to business along US29 - Free U-Turn upstream of intersection - Signal modification at Hydraulic		1	NO	NO
11 (b)	- Flyover of SB US29 to US250	- Grade separation		2	NO	NO
12		- Realignment of Hydraulic onto India Rd to connect to Hillsdale	-Right-in/right-out at Rugby	NO	1	NO
13	TSM (c)	TSM (c)	TSM (c)	1	1	1
14	No Build	No Build	No Build	1	1	1

(a) Concept C was developed during the November workshop, so no Phase 1 designs exist that are applicable to Concept C
(b) Combination of 4 & 10
(c) Transportation System Management (TSM): Signal coordination, ITS improvements (i.e. DMS), Demand management, Access management, Transit enhancements, Intersection enhancements (operational, markings, ped crossings, safety, etc), Improved sig

Alternatives Evaluation

A key aspect of the alternatives evaluation is analysis of projected future conditions in the study area, which required that estimates of future demand be prepared – both for traffic volumes and for economic activity. Measuring the effectiveness of the conceptual design alternatives, as well as that of individual intersection and street treatments, required a multi-faceted approach to evaluation that incorporated the following elements:

- General criteria, such as constructability, right of way requirements, and funding
- Transportation criteria related to vehicular, transit, pedestrian, and bicycle traffic
- Economic criteria, such as tax base, redevelopment opportunities, and the balancing of near-term impacts and long-term gains
- Relevant quality of life and environmental criteria that address land use mixes, stormwater systems, and landscape quality.

Before discussing the findings of the alternatives evaluation, it is important to understand what is included in the future demand forecasts, how they relate to existing conditions, and how the evaluation criteria were applied. Following are discussions of those components of the study.

Future Demand Forecasts

Future conditions for the study area were developed for both traffic and for economic activity. While working from a common basis, each forecast was derived independently using methods specific to each discipline. Each is discussed separately below.

Traffic Forecasts

Future demand on the transportation system was estimated for a 20-year planning horizon by the Virginia Department of Transportation's forecasting unit on the basis of land use forecasts and future transportation system changes prepared by the Thomas Jefferson Planning District Commission for the UnJAM 2025 plan.[2] VDOT used a travel demand forecasting model (MINUTP) that calculates future traffic demand on roadway segments on the basis of projected employment and households in the region. The model is calibrated using existing counts and census data about trip making in the Charlottesville region. VDOT maintains a database of historic region-to-region traffic movements that was used to incorporate changes in traffic external to the area included in the model.

Future demand on any segment of the roadway network is dependent upon future changes in that network. For this study, all of the roadway projects funded in the UnJAM network for 2025 were assumed to be in place, except for the second phase of the proposed Meadow Creek Parkway. The model forecasts for traffic on roadway segments were converted by VDOT to peak hour turning movement volumes for selected intersections in the project area. These future turning movement volumes became the basis for the future baseline (or no-build) conditions against which the alternatives were compared. Working with existing turning movement data, the model forecasts were expanded to provide turning movements at all of the intersections in the study area. Because each of the three alternatives modifies the roadway system in the project area differently, it was necessary to adjust the future volume forecasts to reflect conditions for

[2] Charlottesville-Metropolitan Planning Organization United Jefferson Area Mobility Plan (UnJAM 2025)--MPO area sections, Adopted May 2004

each alternative. Working from the expanded baseline data, future traffic was held constant at external cordon points (i.e., entering the network at Greenbrier, Barracks, Emmet and Hydraulic) across the three alternatives. Interior to the cordon points, traffic was reassigned to the roadway connections in each of the alternatives and balanced between routes to reflect the characteristics of each alternative. This process resulted in three sets of future traffic volumes, one for each alternative, that were used as the basis for the analysis of future conditions.

Economic Conditions

Calculations of future revenue required that a forecast of potential land use be made on a parcel by parcel basis for the study area for the next seven years. The land use forecasts were informed by the development opportunities described in the Alternatives Development section of this report. In the case of Options A and C, it was assumed that suburban densities will prevail over the next seven years. In the case of Option B, where a Main Street environment is envisioned along Hydraulic Road, a higher density redevelopment was assumed on Hydraulic Road. Where restaurants are projected for development, future sales per square foot were estimated to reflect today's development economics.

The impacts of each transportation improvement option are summarized in the tables below. The immediate impact of the transportation improvement reflects the impact of land and building takings as well as the benefits accruing to the property from access and visibility enhancements.

Immediate Impact of Transportation Improvement
29H250 Study Area

	Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Land (Acres)	-5.85%	-6.50%	-4.93%	-7.82%
Building (Sq. Ft.)	-3.02%	-3.77%	-4.00%	-7.67%
Property Value (000's)	1.52%	-0.66%	0.94%	-4.30%
Employment	-2.07%	-3.01%	-2.96%	-13.10%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	-3.08%	-5.63%	-5.35%	-5.31%

Source: ZHA
impact summary/sum imm

The construction of Option A-1 has the least impact on existing properties and their operations.

7 Year Projected Impact of Transportation Improvement
29H250 Study Area

	7 Yr. Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Building (Sq. Ft.)	27.77%	26.99%	45.78%	24.16%
Property Value (000's)	40.54%	39.44%	66.95%	34.66%
Employment	22.73%	21.12%	26.47%	14.41%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	48.61%	45.76%	67.25%	40.42%

Source: ZHA
impact summary/sum 7

Over a seven year time period, Option B provides the greatest positive impact on existing properties' development potential.

In terms of tax revenues, the implications of all Options are provided in the table below.

Net New Tax Revenues
Seven Years After Transportation Improvements

Area	A-1	A-2	B-1/2	C
Triangle Area	$480,400	$468,500	$853,700	$376,100
Kmart Area	$220,800	$194,500	$635,000	$69,000
Best Buy Area	$216,900	$216,400	$216,900	$222,400
Holiday Inn Area	$27,300	-$29,400	$26,400	$40,000
250 Interchange Area	$97,300	$97,300	-$31,600	$97,400
Hillsdale	$554,400	$554,400	$554,400	$554,400
Barracks Road Area	$32,845	$32,845	$0	$0
Net New Revenue	$1,629,945	$1,534,545	$2,254,800	$1,359,300

Source: ZHA, Inc.
impact summary/sum

Fiscal impacts range from $1.4 to $2.25 million per year depending upon the transportation Option selected. At an interest rate of 5 percent over 20 years this stream of new tax revenue could generate $17 to $28 million in capital.

Evaluation Criteria

The evaluation criteria were established during the first workshop in November 2003 and further refined prior to the workshop in January 2004 where the key criteria were used to refine design alternatives. Table AE 1 shows a summary of the criteria. Brief descriptions of the techniques used follow.

Table AE 1. Evaluation Criteria

General

Constructability
Minimize disruption to business
Maintain existing traffic operations
Minimize Right-of-Way requirements
Minimize construction cost/funding requirements

Transportation

Pedestrian access and safety
- Within the corridor
- Along and across streets
- From streets to buildings and within parking lots
- Connecting with adjacent neighborhoods

Bicycle access and safety
- Within the corridor
- Along and across streets
- Within sites
- Bicycle parking
- Connecting with adjacent neighborhoods and the region

Transit access and safety
- Transit customer access to businesses and neighborhoods
- Provide for planned transit improvements
- Create safe and comfortable transit stops

Vehicular access and safety
- Maintain access and safety during construction
- Provide for both local and through trips
- Separate local and through trips when possible
- Improve "way finding" – local and directional signs

Quality of Life/Sustainability

Maximize transportation choice

Provide a mix of land uses
- Support transit and internal trips
- Mix housing for household types and income levels
- Mix retail for both regional and local needs
- Mix employment opportunities – office, industrial, service, & retail

Improve stormwater systems
- Enhance water quality
- Reduce peak flows to Meadow Creek
- Make water quality system an amenity

Improve landscape quality
- Street trees
- Enhance and protect on-site landscape

Improve visual character of private development

Improve visual character of streetscape

Economic

Revenues are concern for City and County
- Sales tax
- Property tax

Desired development needs to provide value to property owners

Planned improvements must be financially feasible

Balance near-term economic impacts and long-term gains

General

One set of criteria that guided the designs concerned their general constructability. Comments received during the Phase 1 work emphasized the need to strongly consider the effects of disruption to local business and disruption of traffic flow for the design concepts. If a design could not be constructed under traffic operation or would require eliminating access to businesses for substantial periods of time, it was deemed to be less effective, even if it might be lest costly in terms of design/construction cost or right of way. The overall ability to phase the construction of each design in a cost-effective way also entered into the constructability criteria. The ability to incrementally implement a design over time as self-contained projects would be more beneficial than a design that required large scale construction over a long period of time.

Minimizing right of way acquisition and design/construction cost were two key criteria for all of the designs. While these elements were important, they were not considered alone, but were grouped with the constructability issues and with the economic indicators related to tax revenue and return on development investment potential. In this way, the overall cost effectiveness of the design concepts were evaluated in terms of return on community investment, rather than just looking at the cost of constructing the facility.

Transportation

Evaluation of the transportation effectiveness of the three concepts focused on the extent to which the transportation characteristics of each would improve the function and safety for all types of transportation (auto, truck, transit, pedestrian, bicycle) in the study area. As noted in Table AE 1, separate criteria were established for each mode. Pedestrian and bicycle criteria focus on a more connected street system, providing a safe, attractive space along streets, and minimizing crossing times at intersections. Transit criteria fall into two regimes—one is focused on reducing travel time for transit vehicles and shares many of the same measures as for auto traffic, the other is focused on accessibility and connectivity and shares the attributes of pedestrian travel.

Traffic criteria are focused on improved safety, improved access for business in the corridor, managing congestion along streets, and maintaining reasonable travel times on main through routes. A two-tiered approach to traffic operations was used in the evaluation. Initial indicators of performance were calculated using *Highway Capacity Manual* [3] (HCM) methods that calculate vehicular delay at specific locations on the basis of highway capacity. Intersections, weaving areas and freeway mainline lanes were evaluated in this fashion during the design process to adequately size the network elements and identify areas where further analysis would be needed. Because of the complex nature of traffic operations in the study area HCM analysis alone is not adequate to evaluate conditions. Supplemental analysis was conducted using traffic simulation modeling that allowed the interaction among adjacent segments of the roadway network to be accurately evaluated. Traffic simulation is discussed below.

The HCM uses a scale of Level of Service to describe traffic operations that ranges from A to F and describes conditions from free-flow (A) to jammed (F). That scale is used as one of the measures of effectiveness for traffic operations in this analysis. Target levels for future operations were LOS D/E, which is an appropriate threshold value for design in urbanized areas.

Since LOS measures delay at specific points, it does not adequately address network operations. The main evaluation criteria used to address network performance was travel time over the network for several selected routes that would be indicative of typical trips. The following routes were evaluated:

- US-250 Bypass west of Barracks to/from US-29 north of Greenbrier (the Lynchburg to Culpeper regional movement)
- US-250 Bypass east of Hydraulic to/from US-29 north of Greenbrier both via Hydraulic and via the US-29/US-250 Bypass interchange
- Emmet Street from the US-250 Bypass to/from US-29 north of Greenbrier

Travel time data was collected in the field for existing conditions and used to calibrate the traffic simulation model. Travel time data was extracted from the simulation model output for each of the future conditions (baseline/no-build and the three alternatives).

Traffic Simulation

In order to evaluate the feasibility and merits of the various improvement scenarios, a series of traffic micro-simulation models were developed using the modeling platform VISSIM. When using VISSIM, a model of the transportation facilities is developed that includes road geometrics, signal parameters, and driver behavior characteristics. Unlike analyses conducted according to the *Highway Capacity Manual*, a simulation model has virtual drivers that travel through the model network, from the entry nodes to the exit nodes, typically along network paths that are assigned by the analyst. The model uses random seeds and probability distributions for a number of traffic flow characteristics, such that each model run (with different seed values) will produce slightly different outputs. This is the defining characteristic of a stochastic micro-simulation model, and it allows for simulation of random fluctuations that are typically observed in real traffic networks. This feature can make the results more robust, because the average of

[3] Transportation Research Board, Special Report 209, *Highway Capacity Manual,* Washington, D.C. 2001

multiple observations or model runs can be calculated, rather than relying upon a single observation.

In traveling through a VISSIM network, the virtual drivers respond to speed limits, traffic control devices, lane markings, and other vehicles, according to the logic of the model and the parameters set by the analyst. The program collects data about the operational characteristics, such as speed, travel time, delay, the number of times a driver stops, and other measures of effectiveness for *each* vehicle in the network and aggregates and tabulates these data in a number of ways. Some of the data reported can be directly used in certain *Highway Capacity Manual* level-of-service analyses. VISSIM also produces two and three dimensional animations of the network, which provides the ability to "watch" the traffic and observe queue lengths, traffic progression between signals, and driver interactions.

For this study, VISSIM models were developed for existing conditions (which was used to calibrate and validate VISSIM to account for local conditions), future no-build (used to evaluate conditions if no option is selected), and separate models for Options A, B, and C. The A, B, and C models were used to refine specific recommendations, such as number of lanes or length of turn lanes, until the model either predicted satisfactory operations, or it became clear that the option tested was not feasible or reasonable due to conflict with other goals of the study.

Economic Indicators

The alternatives were evaluated for impacts on land use, property value, and tax revenues, which required that existing values for these components be established for various sub-areas of the Study Area. Parcel land use data was obtained from the City's and County's property tax records. Parcel property value was obtained from the property tax records. Property tax revenue was calculated from parcel property value using current tax rates. Sales tax revenue was estimated based on industry standards regarding sales per square foot. Separate assumptions were made for value and tax rates for residential and commercial property, with retail land uses, gasoline/service stations, and restaurants being calculated separately in the City and in the County. To evaluate an alternative's impact on future land use, every individual parcel in the Study Area was evaluated. Impacts were assessed as follows:

- *Land and Property Value*: If a parcel is subject to a taking of land under a given transportation, option property value is decreased by the amount of land taken. In cases where the taking of land makes business operation impossible, the land value is decreased on a pro-rated basis and the improvement value is reduced to zero. In cases where the land taking does not significantly impact land use operations, the land value (not building value) is reduced by the amount of land taken.

- *Access and Property Value*: In cases where a parcel gains an additional point of access or significantly improved access as a result of the transportation improvement, the land value is increased by 0 to 25 percent depending upon the level of enhancement.

- *Re-Use/Redevelopment*: In the near term, new development was projected on those parcels that are clearly under-utilized and/or those parcels where a building has been demolished for the improvements and there is sufficient land available for re-development.

Quality of Life and Sustainability

Quality of life and sustainability criteria were evaluated from the standpoint of how each alternative would enhance the livability of the urban form and how it would affect the nature of the blue and green infrastructure in the study area.

Urban Design

The criteria used to evaluate each alternative with respect to urban design include the level of active street frontages and supported land use mix, attractiveness of streetscape, achieved pedestrian-orientation, provision of parks and plazas, and the relationship to open spaces.

Environmental

The blue infrastructure in the study area includes Meadow Creek and the stormwater systems that drain into it. The alternatives were evaluated for their potential to improve stormwater systems by enhancing water quality and reducing peak flows to Meadow Creek.

The green infrastructure includes the stormwater system and the landscaped areas along streets and adjacent to development in the study area. The alternatives were reviewed for their ability to improve landscape quality, to make the water quality system an amenity, to add street trees, and to improve the visual character of private development and the streetscape.

Outcomes

Evaluation of the alternatives started with an analysis of conditions that could be expected if no roadway improvements were made in the study area. This analysis primarily considered the transportation effects and was accomplished using the traffic simulation model for the no-build condition. Future baseline conditions were generally found to be unacceptable, with traffic operations at LOS E and F at most intersections in the study area. Travel time was projected to at least double in the northbound direction and triple in the southbound direction in the evening commute peak. Figure AE 1 shows the comparisons of travel times for the existing and future conditions for the routes evaluated. Note that in all cases, the no-build future travel time is projected to be much longer than the existing time.

The evaluation moved forward with an iterative analysis of the alternatives as noted above. An important aspect of the work was the process of incorporating adjustments to the designs into the alternatives to achieve acceptable operations. As a consequence, almost all of the individual elements of the roadway system in all three alternatives are shown to function at acceptable levels of service in the future. What should be noted is that the physical geometry at these individual locations varies among the alternatives and some work better than others, although all versions of the designs are functional. More detailed discussion of the differences among alternatives is provided under Roadway Elements below.

The final analyses of Options A and C showed that the roadway changes proposed would provide an acceptable level of operations at the intersections in the study area with few areas of extended queuing. The analysis of Option B indicated that all areas except the intersection of US-29 and Hydraulic Road would function at acceptable levels in the future. Under Option B, the US-29/Hydraulic intersection would be in LOS E/F conditions at the end of the 20-year analysis period. For Options A and B, the intersection of Holiday Drive/Angus Road/US-29 would be at the LOS D/E limit with Option B projected to experience more delay than Option A. The revised interchange designs at Barracks Road were found to be functional in all Options, as

was the extended merge on the US-250 Bypass between US-29 and Barracks Road. This finding allows for consideration of separating the freeway elements of the merge (which were shown to be necessary) from the changes at the ramp terminals, which were not shown to be required.

Travel time results from the analyses of the Options are also shown in Figure AE 1. The roadway changes proposed in the alternatives would generally result in travel times that are lower than existing and substantially lower than the no-build travel times. For critical regional movements such as the southbound US-29 to westbound US-250 Bypass, the Options would be expected to reduce travel times by between 15 percent for Option A, 65 percent for Option B, and 40 percent for Option C from existing. These changes are the result of adding new ramp capacity between US-29 and the US-250 Bypass and by reducing intersection delay at US-29/Hydraulic Road (two large bottlenecks in the current system). Option B makes more improvements to the interchange between US-29 and the US-250 Bypass than does Option A and, while Option C makes a higher speed connection for southbound to westbound traffic, it adds distance to the route. In the northbound direction, the future travel times show a similar story, but Option B is shown to result in higher travel times than Options A and C, primarily as a result of delay at the US-29/Hydraulic intersection.

The net results of the analyses of the three alternatives is that all were found to operate in largely acceptable conditions and that all would be expected to produce equivalent (at the worst) or much better than existing travel times over the roadway network. Conversely, variations in these results occurred at different places in each of the three alternatives (note that in Figure AE 1, one Option is not consistently better than the other two Options for all routes). Similarly, the varied geometric requirements among the Options result in some designs being more cost-effective than others, which emphasizes the need to consider other aspects of the designs to make a decision about which to choose. Following are summaries of those other findings, starting with a discussion of the variations in the designs at roadway elements, progressing to urban design and economics, and culminating with a discussion of phasing and cost.

Roadway Elements

Barracks Road/US-250 Bypass Interchange

This interchange is currently a diamond configuration with signals at the ramp terminals. The configuration of the interchange is affected in the future designs by the need to add a lane to the westbound on-ramp from US-29 and the US-250 Bypass in Options A and B. However, in Option C, the Barracks Road interchange configuration is unchanged from the existing. The Option C analysis shows that the signals at the ramp terminals can function acceptably in the future, if queuing on the westbound off-ramp does not extend sufficiently far up the ramp to affect operations on the US-250 Bypass. The Option A and B analysis demonstrate that the parcel design and the dual roundabouts also provide acceptable operations at the ramp terminals.

In Options A and B, the need for an auxiliary lane between the US-29 and Barracks Road interchanges drives the requirement for modifications at the Barracks Road interchange. With the auxiliary lane in place, the extended weave between the two interchanges needs a longer distance to function effectively. Option A achieves this longer distance by moving the point where the ramps diverge from the mainline. While this works for the weave operation, it results in impact to the residential neighborhood adjacent to the ramps. Option B achieves the same effect for the weave by adding an ‘escape’ lane downstream of the diverge point, but leaves the

ramp in the same location as existing. The roundabouts were selected to reduce queuing on the off-ramp, which they do, but at the expense of larger intersection areas at the ramp terminals.

When the three alternatives are compared, if an auxiliary lane is added to the US-250 Bypass, the escape lane in Option B would be the preferred design and the existing signalized ramp terminal design would work effectively. Analysis of operations over time indicates that the escape lane is not needed immediately, but in the mid-term to long term once the auxiliary lane is added and traffic grows. Option C would not require new construction at this interchange.

US-29/US-250 Bypass Interchange

This interchange area has four ramps, each of which are treated slightly differently in the three alternatives. Each ramp set is discussed separately below.

Eastbound to Northbound and Northbound to Eastbound

This movement is currently handled with a single-lane loop ramp that is of nominally adequate radius. Future volume growth requires that this ramp be expanded to two lanes in either Option A or B. Option A accomplishes this by widening the existing ramp, but not modifying the mainline diverge on the US-250 Bypass substantially since the southbound to eastbound ramps are not modified by Option A. The Option A design results in some congestion on the bridge over US-29 where entering traffic would weave across the heavy exiting move to the widened loop ramp. The widened loop requires that the existing eastbound on-ramp be relocated slightly to the south.

Option B addresses the need to enlarge the off-loop in two ways. The B1 design adds a lane to the loop ramp much as Option A does, but B1 rebuilds the southbound to eastbound ramp set to add a collector-distributor (CD) road that eliminates the weave that currently exists between the two ramp sets. The B1 design for the off-loop is very similar to Option A, but it differs significantly for the southbound to eastbound ramps (see below). The B2 design replaces the off-loop with an off-ramp that would come to grade at an intersection with US-29/Emmet Street south of the US-250 Bypass. An auxiliary eastbound lane would be added to the Bypass between the Barracks Road on-ramp and the new off-ramp as US-29. To function effectively with the future volumes, the off-ramp would eventually require a triple-left turn onto US-29, but could function with a dual lane through the mid-term. The off-ramp would be located south of the existing eastbound to southbound off-ramp to accommodate the expanded southbound to eastbound on-loop and would require right of way and relocation of one business.

Under Option C, this interchange would be modified to eliminate the cloverleaf configuration and replaced by a diamond configuration on the eastbound side of the Bypass.

Southbound to Westbound

This move is currently a one-lane on-ramp. Options A and B widen this ramp to two lanes and add an auxiliary lane westbound on the Bypass. Both Options provide for reconfiguring US-29 southbound to make the outside lane exit only to the on-ramp and the second lane an optional lane that feeds the second lane of the on-ramp and allows traffic to proceed south under the US-250 Bypass bridge. The dual lane ramp addresses the congestion caused by heavy trucks slowing to climb the ramp by providing a bypass lane. The design resolves congestion on US-29 south of Angus that is caused by confusion about lane usage in the interchange area by adding an optional lane through the interchange area. Closure of the westbound left turn on the Bypass is

required by this design to provide adequate merging room on the Bypass. Option C removes the on-ramp.

Northbound to Westbound and Westbound to Northbound

This ramp set is currently a modified cloverleaf configuration that shares a signal on US-29 with Holiday Drive and Angus Road. The City of Charlottesville has plans to modify the ramp terminal to open a median break and connect the ramp terminal with a driveway across US-29 and add a traffic signal. The operation of the signal at the ramp terminal introduces substantial northbound delay on US-29 in the area between the interchange and the signal at Angus Road and Holiday Drive. The on-loop is of substandard radius for current traffic speeds and needs to be expanded if it remains in service. All three Options remove this ramp set and relocate the off-ramp movement to a realigned Holiday Drive. Realigning this ramp set to Holiday Drive would have two effects on traffic on US-29. The relatively low volume of traffic that uses the on-loop would be expected to use the Barracks Road intersection with the US-250 Bypass. Relocating the off-ramp and eliminating the signal at the ramp terminal would substantially reduce delay on US-29 northbound and would provide room to add a northbound lane to accept the widened ramps south of the Bypass. Bringing the off-ramp to a full-access intersection on US-29 also allows for the westbound left turn on the Bypass to be closed.

Southbound to Eastbound and Eastbound to Southbound

This ramp set is currently a modified cloverleaf that stretches out the conventional loop design. This ramp set also accommodates a westbound left turn on the US-250 Bypass. Option A closes the left turn, but doesn't otherwise modify this ramp set. As noted above, this design results in congested operations in the weave area on the bridge over US-29. Option B rebuilds the on-loop to a more conventional design, but does so in two ways. The B1 design, which uses a CD road, would require a larger diameter loop ramp since the ramp would have to climb higher than the existing grade of the US-250 Bypass (because the CD road crosses over the eastbound exit from the Bypass). The larger loop diameter would relocate the existing eastbound to southbound off-ramp further south of its existing location. The B2 design would use the same single lane on-loop design, but the diameter would be smaller since the ramp would only have to climb to meet the existing US-250 Bypass grade. The B2 design would relocate the off-ramp as noted above. Option C would eliminate the off-loop.

Under Options A or B, the Option B designs would provide better operations. When comparing the B1 and B2 designs, both would provide for acceptable operations, but the B1 design achieves this with a substantial amount of new structure by adding a roadway level to the interchange area with the CD road. The widened off-loop in Options A and B1 would require closing the ramp to reconstruct it, whereas the off-ramp in Option B2 could be constructed under traffic with minimal disruption to traffic operations. The B2 design would be the least disruptive during construction and would be lower cost than Option B1 since it does not include the CD road and new structure, but would be more expensive than Option A. Option C would result in a simpler interchange design, which would be less expensive, but would be linked to the effectiveness of the new roadway and interchange at Hydraulic Road.

From a construction phasing standpoint, the four quadrants of this interchange can be constructed sequentially under Options A, B2, and C, but would require concurrent construction under Option B1. Coordination with construction at the Holiday/Angus intersection would be necessary to provide for appropriate lane patterns on US-29 as ramp construction proceeds in the

interchange area. Similarly, coordination of the widened southbound to westbound ramp would be required with the addition of a westbound auxiliary lane on the US-250 Bypass to Barracks Road.

Hydraulic Road/US-250 Bypass

This location is currently a signalized intersection that provides for all movements except for the northbound through movement on Rugby Road and the westbound left turn on the US-250 Bypass. Option A retains this configuration and the signalized operation, but modifies the intersection to add a westbound through lane in place of the existing right turn lane. The westbound lane pattern change is necessary to support the relocated westbound off-ramp to US-29. Under Option A, additional lanes are needed in the intersection in the eastbound direction and in the north and southbound directions. Option B retains the signalized intersection, but changes it to have a ¾ access configuration that changes Rugby Road to right-in/right-out, eliminates the eastbound left turn, and retains Hydraulic Road as right-in/right-out/left-out. Option C replaces the signalized intersection with an interchange, which eliminates access to Rugby Road at this location. Rugby Road traffic would be expected to relocate to US-29/Emmet Street under Option C.

The Option C design would provide the best operations at this location, followed by Option B and Option A in that order. Under Option B, closure of the median on the US-250 Bypass and removal of the signal might be possible in the long term if sufficient traffic relocates away from this location.

Construction of Options A and B would be similar and would be accomplished under traffic operation, whereas Option C would require detours for both Hydraulic Road and the US-250 Bypass. During the period where the grade on the US-250 Bypass is being raised, construction detours/temporary roadway would be necessary to maintain operations on the Bypass. Construction of the Hydraulic interchange ramps could proceed without further disruption to traffic on the Bypass following raising the grade on the Bypass. Hydraulic Road would be closed during construction of the interchange area and traffic would need to be rerouted to US-29.

US-29/Hydraulic Road

This intersection is currently signalized. Option A would replace the intersection with a grade separated interchange. Two designs were evaluated for the interchange. The A1 design uses a modified single point urban (SPUI) design that takes US-29 under Hydraulic Road. The SPUI design would have signal-controlled ramp terminals on Hydraulic Road. Conventional SPUI's are designed to allow left turns on both ramps to operate simultaneously. Because of the skew of the intersecting roadways, separate signal phases would be necessary for this design, which would increase delay at the signal for traffic on Hydraulic Road. The A2 design would bring Hydraulic Road under US-29 and would use roundabouts at the ramp terminals. Analysis of these two designs indicates that the roundabout design would have a higher level of congestion than the SPUI, which would function within the acceptable range of Level of Service. Both of these designs would have right of way and business impacts.

Under Option B, the intersection would be retained, but would be widened on the eastbound Hydraulic Road approach and on the northbound US-29 approach. A fourth lane would be added on southbound US-29 from Hydraulic Road to Angus Road. Because the Option B design

deemphasizes Hydraulic Road to the east, there would be less traffic using the intersection to and from the east, which would allow the intersection to operate adequately into the mid-term. However, traffic growth in the long term would cause this location to operate in LOS E/F under Option B.

Under Option C, this intersection is reconfigured to replace the approaches on the north and east with ramps to the new elevated Hydraulic Road. While the intersection would operate at acceptable levels, the merging areas on the elevated roadway where the ramps connect would experience congestion.

Long term for this location, under Options A and B, a grade separation is necessary to provide acceptable operations. The SPUI configuration has less right of way impact than the double roundabout configuration and provides better operations. Construction of the grade separation for any of the Options will have an impact on access to business. Temporary roadways will be needed during construction, which will restrict access to business. Following construction, access to business will be retained, but will be to the interchange ramps rather than to US-29 directly as it is today. Grade changes near the interchange may also require relocation of access points as illustrated in Figure AD 39.

For Option C, the intersection would remain at grade, but the elevated roadway would introduce similar access issues (see below). Construction of the elevated roadway ramps to US-29 would require temporary roadways for US-29 and would ultimately require Hydraulic to be closed for construction of the elevated viaduct.

Hydraulic Road: US-29 to US-250 Bypass

The three alternatives provide three distinctly different options for this section of Hydraulic Road—continuation as a four-lane arterial under Option A, narrowing to a two-lane "Main Street" under Option B, and expanding to a controlled-access four-lane freeway under Option C. Figure AE 2 shows the differing character of each of the Options in relation to existing conditions.

Consistent with each of the three designs, the treatment of intersections on Hydraulic Road is different with each of the three Options. Option A would shift the existing traffic signal at the K-Mart/Kroger intersection to the new intersection at Hillsdale Drive extended and would reorient K-Mart and Kroger access to Hillsdale Drive extended. This change would be necessary to address operations at US-29/Hydraulic. Michie and Brandywine Drives would continue to be stop-controlled tee intersections. Travel speeds on Hydraulic would be expected to stay in the 35 mph range and curb parking would not be allowed in favor of providing bicycle lanes.

Option B would narrow the design to two slower moving lanes and would introduce roundabouts as the primary treatment for intersections. The K-Mart/Kroger drives would remain open, and along with Hillsdale Drive extended and Michie Drive, would become roundabouts. Curb parking and landscaped medians/linear parks would be introduced along the street. Brandywine Drive would remain as a stop-controlled tee intersection.

Under Option C, Hydraulic Road does not technically have any intersections, as it is elevated and access controlled. A parallel service road is introduced that connects from Hillsdale Drive extended to Michie and Brandywine Drives that would have stop-controlled intersections.

Hillsdale Drive extended would cross under the elevated Hydraulic Road. Sight distance constraints at this crossing would require that the intersection between Hillsdale Drive extended and the service road be signal controlled.

In terms of transportation operations, these three designs are shown to function adequately. However, the regional role of Hydraulic Road differs among the three Options, which affects the emphasis that should be placed on traffic operations as a determinant for selecting one Option over the others. From a travel time standpoint, the three Options are shown to have a similar effect on future travel—each would result in better than existing conditions. There are variations among the three Options and, in each case, some areas are improved more than others. Cost of acquisition and construction, phasing considerations and the potential to affect local revenues through development decisions need to enter into a recommendation about Hydraulic Road, perhaps more so than any other roadway element in the study area.

From a construction phasing standpoint, Options A and B could be constructed under traffic, but Option C would require closure of Hydraulic Road during viaduct construction.

US-29: Hydraulic Road to Greenbrier Road

Options A, B, and C provide three different treatments for this portion of US-29. Options A and B proposed a variation in a boulevard configuration for the roadway, while Option C introduces the ramping necessary with the elevated Hydraulic Road concept. Figure AE 3 shows the three Options in relation to existing conditions. All of the Options retain the eight-lane divided existing configuration, which is required to serve future traffic volumes at acceptable levels of service.

This segment of US-29 contains two signalized intersection at Greenbrier Road and at Seminole Court and two unsignalized right-in/right-out intersections at Zan and India Roads. Future traffic operations at the signalized intersections are shown to be in acceptable conditions with all options. The approaches on Greenbrier Road at US-29 would require additional turn lanes to serve the projected traffic volumes, but modifications would not be necessary on the US-29 approaches. Seminole Court would require signal timing changes, but not lane additions, to meet future operations requirements. The right-in/right-out status at Zan and India Roads would be retained into the future, either as a result of the grade separation at Hydraulic Road on US-29 under Options A and C or to accommodate traffic queues under Option B. Two additional intersections have been assumed along this segment of US-29 in the future. A right-in/right-out intersection opposite India Road would access the Albemarle Place site and a tee intersection would be added between Seminole Court and Greenbrier Road to access Albemarle Place. These locations were included in the simulation analyses and shown to function at acceptable levels of service in the future.

The multi-way boulevard design for this segment of US-29 would provide a more beneficial environment for pedestrians, bicycles, transit (see below) and would provide a different type of development potential than the non-boulevard design would. However, a wider cross section would be required for the multi-way boulevard and some intersection operational issues are introduced by the close proximity of the access lanes that have not yet been resolved. Under the multi-way boulevard design, Zan Road would connect only to the access lane, while India Road would connect to US-29 directly. The benefits of a multi-way boulevard, particularly for transit, are realized over a longer distance on US-29 to the north. The segment of US-29 included in this

study is but a small part of the corridor to the northern areas of Albemarle County, which is slated for analysis in the next phase of a larger US-29 North corridor study.

This study has effectively established that either of the boulevard design treatments with the existing eight-lane divided configuration can adequately serve future traffic in the US-29 corridor. Because of the added right of way and construction cost of the multi-way boulevard and the need to change urban form along the corridor to realize the most benefit from that design, it may be appropriate to defer a decision on this segment of US-29 until the outcome of the proposed study of US-29 to the northern County limits is better known. With either boulevard design, intersection improvements at Greenbrier Road would be required to meet future traffic needs.

US-29: US-250 Bypass to Hydraulic Road

This segment of US-29 has been discussed above in terms of changes at the intersections with Hydraulic Road, Holiday Drive, Angus Road and the interchange ramps. In the aggregate, this section of US-29, which is a divided six-lane configuration with intermittent median openings to allow for property access, would be expanded to an eight-lane cross section by Options A and B and would be reduced to a four-lane configuration by Option C. The lane expansion in Options A and B would be taken out of the median and the east edge of the roadway, which would preclude the opportunity for mid-block median openings between Hydraulic and Holiday and would effectively make existing driveways right-in/right-out. Cross-access easements would be required to provide for adequate circulation under Options A and B. Additional width would also be needed to provide an adequate pedestrian realm along this portion of the corridor as noted below, which would also affect some property access in areas of existing steep slopes.

Option C introduces the opportunity to narrow the cross section to a configuration similar to Emmet Street south of the US-250 Bypass and to provide for more frequent intersections south of Hydraulic Road. Option C includes a full access intersection midway between Hydraulic and Holiday that would provide future access parcels on either side of US-29.

As noted above, all of three Options would realign the westbound US-250 Bypass interchange ramps to use an improved Holiday/Angus intersection. This change would align the westbound off-ramp with Angus Drive and would reduce the need for the signal proposed at the Best Buy driveway on existing US-29 between Angus Road and the Bypass interchange. Traffic operations under Options A and B would require this driveway to remain as a right-in/right-out.

Hillsdale Drive Extension and Cedar Hill Road

As discussed in the Alternatives Development section, the proposed design for both of these streets is based on the project goals and address the following specific design parameters:

- A low-speed driving environment (maximum 25 mph) that provides efficient access to all destinations along both streets;
- Accommodation of all transportation modes: pedestrian, bicycle, transit, and vehicular;
- Incorporation of safe crossings in locations that mesh with the pedestrian route network, including mid-block locations;

- Flexible design that can be adapted to specific local conditions without compromising pedestrian and bicycle safety or encouraging higher vehicle speeds; and,
- Vehicular, bicycle, and pedestrian design elements that provide sufficient space to fulfill safety, convenience, and access functions without occupying excessive or unnecessary right of way width.

The design for Hillsdale Drive extension and Cedar Hill Road achieve all of the above criteria. The center lane of the three-lane cross section provides flexibility by accommodating left turns into cross streets, driveways, and parking lots. Where left turn lanes are not needed, a landscaped median is constructed to increase the streets' attractiveness, to provide pedestrian refuges at crossings, and to narrow the roadway width in order to manage the speed of traffic. The parking lanes on both sides of the street add another flexible design element, as segments of parking can be eliminated near intersections in order to provide curb extensions to shorten pedestrian crossing distances and encourage traffic to maintain a slow speed when moving through intersections; when needed right-turn lanes can be provided while still maintaining a relatively short crossing distance for pedestrians.

The speed of traffic traveling along the streets is encouraged to move at the speed limit by use of somewhat narrowed dimensions for parking (7 ft.) and travel (11 ft.) lanes, consistent use of curb extensions, periodic center medians, and the consistent provision of large street trees along the streets. Both streets incorporate continuous bicycle lanes of a width (6 ft.) that provides for a safe and comfortable cycling environment.

The selected standard sidewalk width of 14 feet provides the appropriate accommodation of street trees, ADA-required clear path of travel, and space for high-quality pedestrian environment supporting window shopping, strolling, people watching, and for outdoor café seating. Restaurants can provide outdoor dining by combining a portion of the sidewalk width with a small courtyard setback. At bus stop locations, curb extensions and the sidewalk combine to provide comfortable access to transit and generous space for bus stop facilities, such as shelters, benches, and trash receptacles. Where bus pullouts are preferred, these can be created by eliminating a section of the parking lane. In this case bus stop amenities, including bus shelters, would be located within the 14-foot sidewalk space in a somewhat tighter arrangement that still meets all access needs and requirements.

Pedestrian Realm

If compared to the existing conditions, all three transportation Options achieve significant improvements in the accommodation of pedestrian needs within the triangle area formed by US-29, the US-250 Bypass, and Hydraulic Road. However, while only minor differences exist between the options with respect to the roadway network and street design within the triangle, critical differences exist between the cross-section designs for US-29 and Hydraulic Road, and therefore, between the ways in which pedestrians cross these facilities and move from one area (i.e. the triangle) to the other (area north of Hydraulic Road).

Triangle Circulation Options A, B, and C

Although Option A sidewalks along Hydraulic Road are as wide (14 feet) as under Options B and C, the pedestrian environment on Hydraulic in this Option is of a lesser quality compared to the other two. This is primarily based on the relative higher volumes of traffic that remain on Hydraulic Road under this Option (27,000 vehicles per day versus under 10,000 with Option B),

and the fact that there is no on-street parking along the street to provide a buffer between the considerable traffic and pedestrians on the sidewalks (see Figure AE 1). At signal locations, crossing distances are longer and available green signal time for pedestrian movements across Hydraulic is limited if compared with the other Options. This is related to the higher traffic volume under Option A, which demands a greater number of lanes and the allocation of more green time to vehicular traffic. Both of these characteristics lessen the ease with which destinations on the other side of the street can be accessed and reduce the connectivity between land uses in the triangle and the area north of Hydraulic Road.

True Single Point Urban Interchanges (SPUI), controlled by a single traffic light at the center of the interchange, often provide safety and convenience issues for pedestrians. This is based on the limited number of signal-controlled crosswalks and the often circuitous routing of sidewalks along the edges of the interchange and its structures. The particular SPUI configuration proposed for the US-29/Hydraulic Road intersection overcomes some of these shortcomings by providing signalized pedestrian crossings at both the eastern and western approaches of Hydraulic Road (see illustrative plan in Figure AE 4). Pedestrians using sidewalks along US-29 do not have to be significantly diverted from their direct path of travel in order to use the signalized crossings across Hydraulic Road. Figure AE 4 also illustrates the relative directness of the pedestrian route across US-29, which is only slightly lessened by pedestrian islands integral to the SPUI design.

Option B leads to the highest level of improvement of the pedestrian environment along Hydraulic Road compared to existing conditions and Options A and C. Reduction in traffic volumes, widened sidewalks, generous landscaped medians, a low-speed traffic environment, and the potential for buildings to front directly onto the street create conditions for safe pedestrian travel along and across the street. The combined effect allows this portion of Hydraulic to become a pedestrian-oriented Main Street that supports civic use of the sidewalks for strolling, window shopping, and stopping to spend time with friends at sidewalk cafes.

Although Option C also provides a low volume, low-speed traffic environment on the service road along elevated Hydraulic, the quality of the resulting pedestrian environment is reduced by the visual and noise impacts of the viaduct and the limitation of development to one side of the street. It is also less likely that mixed-use development will include housing on upper floors given the proximity of the viaduct. At new Hillsdale Drive, Option C also necessitates routing pedestrians through a tunnel underneath the viaduct, which creates a less seamless and comfortable pedestrian connection to the land uses in the Triangle area.

The pedestrian environment along US-29, south of Hydraulic Road, is most improved under Option C, which would remove a significant amount of traffic from the highway and to reduce the number of lanes (Figure AE 5). This makes it easier for pedestrians to cross the street (shortened crossing distance) and reduces pedestrian exposure to negative traffic impacts. It also makes it possible for development to be directly oriented toward the street, which significantly changes the physical character of the pedestrian realm and the range of pedestrian activities that may occur along the sidewalk. But it is unlikely that the redesigned street and the potential for reuse and infill of adjacent properties will create an environment that is as pedestrian-supportive as Hydraulic in Option B. Pedestrian refuges at the center median of US-29 in Option C are the most generous among all Options. Options A and B require the consideration of landscape strips planted with hedges between tree locations in the sidewalks in order to provide sufficient buffering between pedestrians and fast moving traffic on US-29.

Area North of Hydraulic Road

The network of continuous sidewalks north of Hydraulic Road is – for the most part – independent from the selection of a preferred transportation options. The quality of the pedestrian environment in this area is more dependent on the consistency of all publicly and privately funded roads with the recommended minimums for sidewalk widths and crosswalk improvements. However, a large difference exists between the two principal design options for US-29 in this area (see Photo Simulations in Figure AE 3). The critical differences with respect to the design of the pedestrian realm are the different ways in which a buffer is created between the faster moving highway traffic and pedestrians on the sidewalk. In the standard boulevard this is achieved through an increased width to the pedestrian zone as described earlier. In the multi-way boulevard option, this end is achieved by the local access lane and its parking and secondary median. Sidewalks along the boulevard remain at the 14 foot typical width. Clearly the multi-way boulevard option is superior in achieving a pedestrian-friendly environment. If it is desired to create the opportunity for some uses along US-29 to front directly onto the highway (without substantial setbacks) and to increase pedestrian activity along the street, the multi-way boulevard option can achieve this goal.

Bicycle

Triangle Circulation Options A, B, and C

Only minor differences exist between the three Options with respect to improvements of the bicycle network, as all three include new bicycle lanes on Hydraulic Road and on Hillsdale Drive extension (within the triangle) and improvements for bicycles at the US-29 and US-250 Bypass interchange. However, some differences exist in convenience and safety aspects of the bicycle accommodation. Option B achieves the safest bicycle accommodation on Hydraulic as the number of vehicles traveling next to bicyclists would be the lowest. This option also creates the closest spatial relationship between adjacent uses and bicyclists accessing these uses. While traffic volumes in Option C are also low on the service road in this area, it provides a less direct relationship to adjacent uses, which are limited to the north side of the road and less likely to be oriented toward the street because of the presence of the viaduct. In addition, westbound bicyclists are forced to cross the main access to the K-Mart area parking lot in order to reach the US-29/Hydraulic intersection underneath the viaduct; and southbound riders on Hillsdale Drive have to cross under the viaduct to access uses within the triangle area. Although such an underpass can be designed to safely accommodate bicyclists it may represent an obstacle for less experienced riders. In summary, Option B provides the safest and most convenient bicycle accommodation in the triangle area.

Area North of Hydraulic Road

The safety and convenience for bicycling in this area are critically linked to the implementation of bicycle lanes for north-south travel on Hillsdale and Cedar Hill Roads. Beyond these two routes, convenience and access to destinations for bicyclists will increase with every new street connection that is added to the network of roadways in this area (as illustrated in the network diagrams). The quality of the bicycling experience in the area is further determined by the cross-section selection for the redesign of US-29. If the multi-way boulevard configuration is implemented, this will enable bicyclists to ride within the local access lane and use US-29 for trips to destinations along the highway. The standard boulevard option, with its potential for relatively high vehicle speeds in the curbside lanes, would not support any type of bicycle facility or route, unless multi-use paths are provided on both sides of the street. Higher turning

speeds of vehicles seeking access to uses off of US-29 present an additional potential safety concern in the standard boulevard configuration, and could create a safety concern if multi-use paths are provided.

Transit

Triangle Circulation Options A, B, and C

Conditions for transit operations within the Triangle area are identical between the three Options. Some differences exist for transit routes on US-29 south of Hydraulic Road and on Hydraulic Road. These differences correlate with the safety and comfort of access to transit afforded by the pedestrian environment along these two streets (see discussion of the pedestrian environment above). Option B, therefore provides better improvements for Hydraulic Road, whereas Option C improves conditions along US-29 more than the other options, but not to the extent that Option B improves Hydraulic. Option A provides all base improvements associated with the implementation of new sidewalks. Conditions around the SPUI may make transit service somewhat less direct as buses would have to leave US-29 in order to reach stops at the Hydraulic Road overcrossing.

Area North of Hydraulic Road

The implementation of a well-connected roadway network brings new opportunities for transit to the area, as the new streets allow for a more convenient routing of buses. Particularly Hillsdale and Cedar Hill Roads, with their many planned and potential new uses and destination, provide the potential for new bus routes attractive to customers, employees, and residents. The future reconfiguration of US-29 also has potential for the improvement of future transit service to and from the project area, options for which include Express Bus, Bus Rapid Transit (BRT), side-running streetcar, or Light Rail Transit (LRT). Although no firm plans exist at the moment, it is important that the new cross-section for US-29 provide the flexibility to implement future transit improvements. As discussed above, both standard boulevard and multi-way boulevard design options can accommodate Light Rail Transit (LRT) or Bus Rapid Transit (BRT) in a dedicated right of way. Doing so will not increase the needed right of way (196 feet), if the number of travel lanes can be reduced by one in each direction based on modal shift from automobiles to transit. Prior to the implementation of transit in a dedicated right of way, both design alternatives allow for the accommodation of enhanced transit service vehicles (Enhanced Bus or Side-running Streetcar) in the curbside lane. In the multi-way boulevard design, transit stops are located in the median between center travel and local access lane. From a transit operations perspective, the multi-way boulevard and standard boulevard design options can be considered as working equally well.

Urban Design

The criteria used to evaluate each Option with respect to urban design include, the level of active street frontages and supported land use mix, attractiveness of streetscape, achieved pedestrian-orientation, provision of parks and plazas, and the relationship to open spaces. The results of this evaluation are summarized in Table AE 2 below. Option A, while clearly achieving improvements compared with existing conditions, does not create the same level improvements in urban design quality as the other two Options. Improvements generated by Options C are focused on the US-29 area, with some positive changes along Hydraulic Road. The latter are limited by negative impacts from the raised viaduct. Positive changes in Option B are focused on

the Hydraulic Road area and result in a higher-quality environment than can be achieved along US-29 in Option C.

Table AE 2. Urban Design Evaluation of Transportation Options

Criteria	Option A	Option B	Option C
Extent of Active Street Frontage	**+** Improved potential due to sidewalk improvements on Hydraulic & US-29, however potential remains limited due to high traffic levels	**+++** High potential on Hydraulic due to character change; Comparable to Option A on US-29 due to high traffic level	**++** Improved potential on US-29, south of Hydraulic due to character change, but still limited due to topography constraints; Viaduct limits potential on Hydraulic
	US-29 North of Hydraulic: potential for significant improvement if multi-way boulevard is created on US-29		
	Along streets within triangle: potential mostly dependent on approach to development: 'big box' vs. mixed-use		
Attractiveness of Streetscape/ Landscaping	**++** General improvement over existing conditions; SPUI requires particular design attention to ensure improved conditions	**+++** Significantly improved on Hydraulic; Improved over existing conditions on US-29	**+** Improved on US-29 south of Hydraulic; Hydraulic improved but negatively affected by viaduct
	+++ *Along streets within triangle:* significantly improved	**+** Hillsdale tunnel imposes some limitations	
Land Use Mix Achieved	**+** Potential for ground floor shops and upper floor housing along Hydraulic & US-29 limited due to remaining high level of traffic	**+++** Potential high along Hydraulic; undesirable along US-29 due to high level of traffic	**++** Potential for housing uses somewhat reduced along Hydraulic due to viaduct; undesirable along US-29 due to high level of traffic
	Along streets within triangle: potential mostly dependent on approach to development: 'big box' vs. mixed-use		
Pedestrian Orientation	**O** Limited potential on Hydraulic & US-29 due to high traffic level; SPUI requires particular design attention	**++** High potential on Hydraulic; Limited on US-29 due to high traffic level	**+** Increased potential on US-29, but still limited due to topography constraints; Potential limited on Hydraulic by viaduct
	Along streets within triangle: potential mostly dependent on approach to development: 'big box' vs. mixed-use		
Provision of Parks & Plazas	**O** No public parks; Potential for private parks/plazas dependent on private development	**++** New public park on Hydraulic; Potential for private parks/plazas dependent on private development	**O** No public parks; Potential for private parks/plazas dependent on private development
Relationship to Open Space	**O** Similar to status quo	**+** Park-like medians along Hydraulic provide linkage to Meadow Creek	**–** Viaduct structure and approaches constitute barrier between Meadow Creek in triangle and its northern segment
Overall Summary	**+7**	**+17**	**+6**

Urban Form Evaluation of Development Opportunities

Table AE 3 below summarizes the qualitative evaluation of the alternative sketch concepts created for three of the development opportunity sites. The table is followed by a brief discussion of each area (please also refer to Figures AD 26 through AD 37 in the Alternatives Development Section).

Table AE 3. Urban Design Evaluation of Concepts for Development Opportunity Sites

Criteria	Triangle area		K-Mart Area		Comdial Area	
	Concept A	Concept B	Concept A	Concept B	Concept A	Concept B
Extent of Active Street Frontage	**Low**: limited to short segments on Hillsdale & street south of Kroger	**High**: includes Holiday Dr.; street south of Kroger and parking garage; segments of US-29 & Hydraulic	**Low to Medium**: discontinuous segments of Hydraulic; all of Hillsdale Dr.	**Very High** (except edge along India Road)	**Very Low:** short segment on access road off Greenbrier	**Very High**: except for retail area along US-29
Compactness/ Walkability/ Attractiveness for Transit	**Low**: uses spread out due to surface pkg.; low number of destinations and little mix of uses	**Medium to High**: more compact due to mix of structured & surface parking; in-creased number of destinations and mix of uses	*Block A:* **Low to Medium**: low around anchor store; increases along Hillsdale *Block B:* **High**: due to mix of structured & surface parking; increased number of destinations and mix of uses	*Blocks A, B & C:* **Very High**: due to sole use of structured parking; high number of destinations and mix of uses	**Very Low**: uses spread out far apart due to surface parking; low number of destinations and mix of uses	*Anchor Retail Area:* **Medium**: some proximity of uses *Remaining Site:* **Very High**: due to sole use of structured parking; high number of destinations and mix of uses
Land Use Mix Achieved	No mixed-use – all commercial	Some vertical mixed-use (retail & housing)	*Block A: no mixed-use* *Block B:* Some vertical mixed-use (retail & housing)	High level of vertical & horizontal mixed-use (retail, housing, & entertain-ment)	No mixed-use – all commercial retail	High level of vertical & horizontal mixed-use (retail, housing, & office)
Parking Solutions	surface parking	mix of struc-tured & surface parking; shared parking pos-sible	mix of struc-tured & surface parking; shared parking possible for *Block B*	Structured parking; shared parking possible	surface parking	mix of struc-tured & surface parking; shared parking possible
Provision of Parks & Plazas	Provides minimum necessary to accommodate creek and drainages	Provides added open space for creek and drainages & new public park	Provides No public open spaces & plazas	Provides series of small public open spaces & plazas	Provides one public open space at US-29	Provides three public open spaces & plazas

Triangle area

Development of this area is somewhat challenged and constrained by its location between three major thoroughfares, by the space needed to appropriately accommodate Meadow Creek and associated drainages, by high-voltage power lines and their supports which pass through the area, and by steep grade changes in some areas of the site. A comparison of the two presented concept alternatives illustrates that the site can only be developed into a pedestrian-friendly environment that includes active street frontages and some degree of mixed-use (retail with housing above) if the incorporation of structured parking is a viable and integral part of the development approach. Large-pad development with surface parking leaves no room for a mixed-use approach, and can

at best integrate some pedestrian-oriented liner retail along a few street segments. Redevelopment of the hotel uses along Holiday Drive can potentially occur under Concept A and, if implemented in a fashion illustrated in Concept B, introduce development that advances project goals, such as active street frontages and some added local walkability.

K-Mart Site

Concept A includes the short-term conversion of the eastern portion of the area (Block B) into mixed-use development (retail/housing). The 3-story buildings on this block face modest, one-story retail buildings on the east side of Hillsdale Drive. Together, these components of the scenario achieve a block's length of active street frontage, which begins to establish a walkable and pedestrian-oriented environment on Hillsdale Drive that can be extended by future development to the north. The prevalence of surface parking and large-pad development on the major portion of the site (Block A) to the west of Hillsdale Drive, however, produces an environment dominated by automobile access and parking. This leaves individual retail buildings and uses pushed far apart and hampers walkability. One-story retail buildings located along the edges of the site provide some screening of the large parking lots. If seen in the context of the more compact development along Hillsdale and parking lot landscaping and pedestrian paths, are somewhat accessible by walking and transit.

The development illustrated in Concept B produces a much greater amount of active street frontage and provides a compact, walkable environment that is rich in diverse land uses accommodated in mixed-use buildings. A cinema at the corner of Hydraulic Road and US-29 creates an anchor use that takes full advantage of this visually exposed and highly accessible location and that will support other entertainment and restaurant uses in the area. After parking their automobiles in the adjacent parking garage, visitors to the cinema and shops can use the many provided walkways and sidewalks to reach other destinations within the completely redeveloped area. Residents of the adjacent housing and mixed-use buildings can shop by walking to retail locations without using their vehicles. The area also constitutes an attractive location for a transit stop, which further increases the development's accessibility by modes other than the automobile.

Comdial Area

Similarly to the triangle site, the two concepts for the Comdial Area illustrates that an extensive area of big-box development with surface parking produces an environment that is not conducive for walking or transit use, and is invariably oriented toward automobile access. The resulting site plan is even dependent on the car for internal circulation as uses are so spread out around a large central area of surface parking.

Concept B illustrates how a big-box development could be redeveloped into a mixed-use area including moderately scaled anchor stores along US-29 combined with a variety of mixed-use buildings on the remainder of the site. Concept B transforms the streets and major parking lot aisles of Concept A into an interconnected system of multi-modal streets in Concept B. This also preserves the investment in major infrastructure from Concept A. This combination of retail, housing, and office can produce an environment that is richly diverse with active street frontages, compact due to the use of structured parking, and pedestrian-scaled through the moderate size of the individual blocks of development. Because of its proximity to the diverse uses within Albemarle Place and the convenient access from US-29 and via new Cedar Hill Road, the development as illustrated in Concept B creates a destination attractive for transit service.

Economic Indicators

The evaluation of economic indicators is described in detail under separate cover[4] and summarized below. Analysis of each of the transportation and development options resulted in three summary indices—one addressing immediate impact of the transportation changes, another addressing the 7-year impact of the transportation changes, and third addressing tax revenues.

The immediate impact of the transportation improvements reflects the impact of land and building takings as well as the benefits accruing to the property from access and visibility enhancements. Table AE 4 shows the immediate impact findings.

Table AE 4. Immediate Impact of Transportation Improvement

	Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Land (Acres)	-5.85%	-6.50%	-4.93%	-7.82%
Building (Sq. Ft.)	-3.02%	-3.77%	-4.00%	-7.67%
Property Value (000's)	1.52%	-0.66%	0.94%	-4.30%
Employment	-2.07%	-3.01%	-2.96%	-13.10%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	-3.08%	-5.63%	-5.35%	-5.31%

The construction of Option A-1 has the least impact on existing properties and their operations.

Table AE 5 shows the impact of the transportation changes over a seven-year planning horizon.

Table AE 5. 7-Year Projected Impact of Transportation Improvement

	7 Yr. Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Building (Sq. Ft.)	27.77%	26.99%	45.78%	24.16%
Property Value (000's)	40.54%	39.44%	66.95%	34.66%
Employment	22.73%	21.12%	26.47%	14.41%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	48.61%	45.76%	67.25%	40.42%

[4] ZHA, Inc., *Land Use And Economic Analysis, Route 29, Hydraulic Road And Route 250 Transportation Improvements*, Annapolis, MD, July 2004.

Over a seven year time period, Option B provides the greatest positive impact on existing properties' development potential.

In terms of tax revenues seven years after the transportation improvements, the implications of all Options are provided in Table AE 6 below.

Table AE 6. Net New Tax Revenues

Area	A-1	A-2	B-1/2	C
Triangle Area	$480,400	$468,500	$853,700	$376,100
Kmart Area	$220,800	$194,500	$635,000	$69,000
Best Buy Area	$216,900	$216,400	$216,900	$222,400
Holiday Inn Area	$27,300	-$29,400	$26,400	$40,000
250 Interchange Area	$97,300	$97,300	-$31,600	$97,400
Hillsdale	$554,400	$554,400	$554,400	$554,400
Barracks Road Area	$32,845	$32,845	$0	$0
Net New Revenue	$1,629,945	$1,534,545	$2,254,800	$1,359,300

Fiscal impacts range from $1.4 to $2.25 million per year depending upon the transportation Option selected. At an interest rate of 5 percent over 20 years this stream of new tax revenue could generate $17 to $28 million in capital. Option B provides the highest net return of the three Options.

Environment

Green Streets

The construction of new roadways and the possible redevelopment of significant portions of land in the project area provide the unique opportunity to implement measures to reduce the extent of impervious surfaces, and attenuate and treat polluted urban runoff from within the public right of way and that from private development. The latter includes runoff from roofs and paved surfaces, such as parking lots and driveways. The following paragraphs focus on the discussion of design solutions for runoff from the public right of way. In addition, solutions for parking lots are presented here because of the prevalence and extent of parking lots in the project area today and in the foreseeable future. This approach improves the quality of existing open spaces and drainages while helping to ensure a new lush landscaped character for the area.

While a reduction in the amount of runoff flows and water quality treatment can be achieved by using a 'pipe and pond' approach combined with mechanical filter systems, they can be achieved in a more sensible and environmentally sustainable way by employing an approach often referred to as 'Green Streets'[5]. Green Streets solutions help control stormwater while enriching the character of urban neighborhoods. The approach is based in the understanding that pedestrian-oriented street facilities can be designed in such a way to achieve water management goals as well as pedestrian goals. In particular, the same landscaping components of a street that add to pedestrian comfort can also perform stormwater retention and treatment functions, contributing to better flood control and water quality. Planting strips, planted medians, tree wells, and other

[5] Metro, 'Green Streets – Innovative Solutions for Stormwater and Stream Crossings', Portland, June 2002.

planted areas can reduce urban runoff by retaining stormwater. The soils in these planted areas also remove pollutants as it filters through or runs off, providing natural water treatment. Paved areas, such as parking lots and lanes, sidewalks, and ball courts, if designed with porous surfaces and ample reservoir or infiltration capabilities beneath, can be used to improve water management. Considering these ideas will ensure that environmental sustainability and quality-of-life objectives are incorporated into the planning and engineering analyses of collection system improvements.

Green Streets design elements appropriate for the project area include the following:

- Use of permeable paving materials (illustrated in Figure AE 6);
- Filter strips and swales in street medians (illustrated in Figure AE 7);
- Linear detention basins (illustrated in Figure AE 8); and
- Street tree wells (illustrated in Figure AE 9).

These elements can be used individually or in combination depending on the envisioned overall stormwater collection system. Figure AE 10 shows an illustrative example of how some of these features can be integrated into a street similar to the proposed Hillsdale Drive extension and Figure AE 11 illustrate how swales and permeable paving can be integrated into the design of a parking lot.

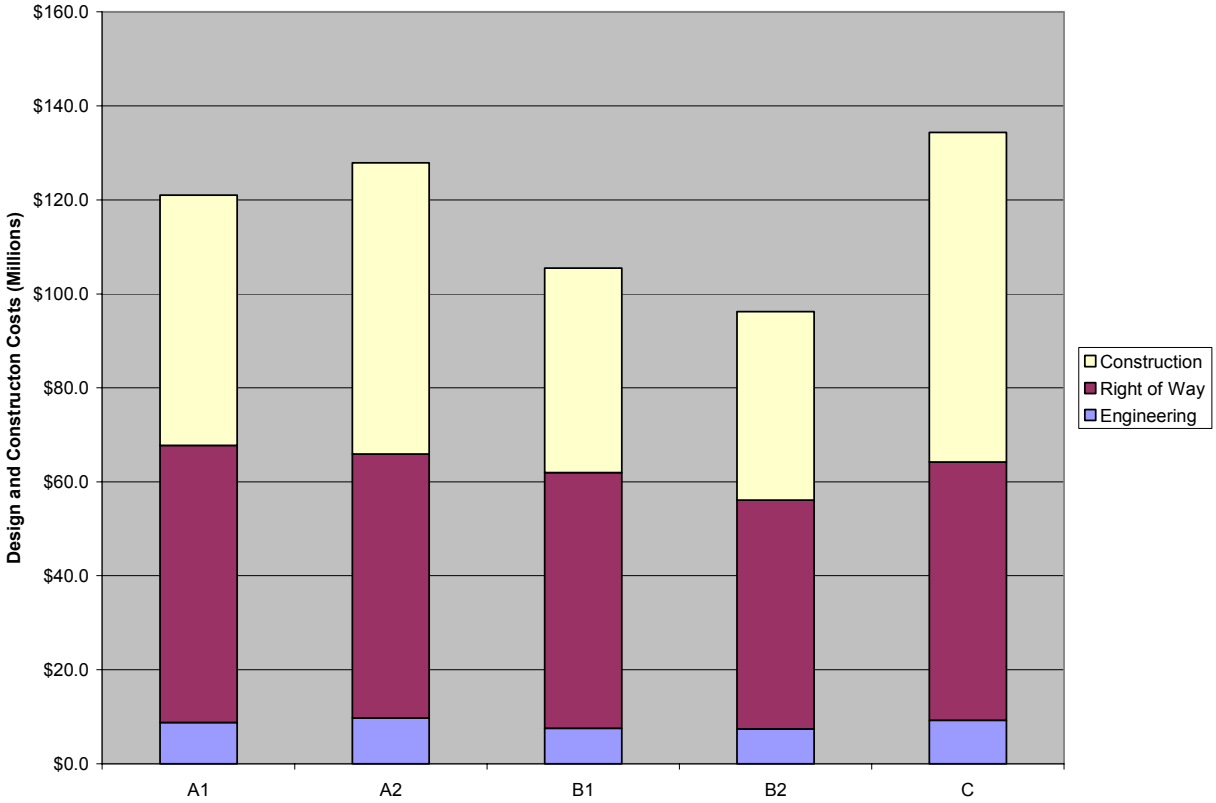
It is important to plan the implementation of green streets solutions as an overall system or network of elements and to include the tie-ins with the existing natural and built drainage system in the area. The diagram of the potential future land use pattern (see Figure AD 27) discussed earlier illustrates how existing elements of the natural drainage system in the project area can be woven into the emerging new land use pattern, and provide excellent opportunities for the tying in of green streets elements constructed within and adjacent to public right of ways.

Both Albemarle County and Charlottesville are in the process of reviewing current stormwater and watershed protection ordinances, allowing introduction of these design solutions as preferred options in site design review of developments.

Construction Cost

Costs for design and construction of the transportation options were prepared by the Virginia Department of Transportation. Construction costs were developed on the basis of quantities of materials calculated from the designs developed for the transportation options using locally applicable unit costs. Right of way costs were estimated on the basis of VDOT experience for property acquisition in the Albemarle County area using estimates of takings developed from the designs. To complete the cost estimates, VDOT also estimated engineering design costs to prepare construction documents. Figure AE 12 shows a summary of construction cost for the transportation options with a standard boulevard design on US-29 north of Hydraulic.

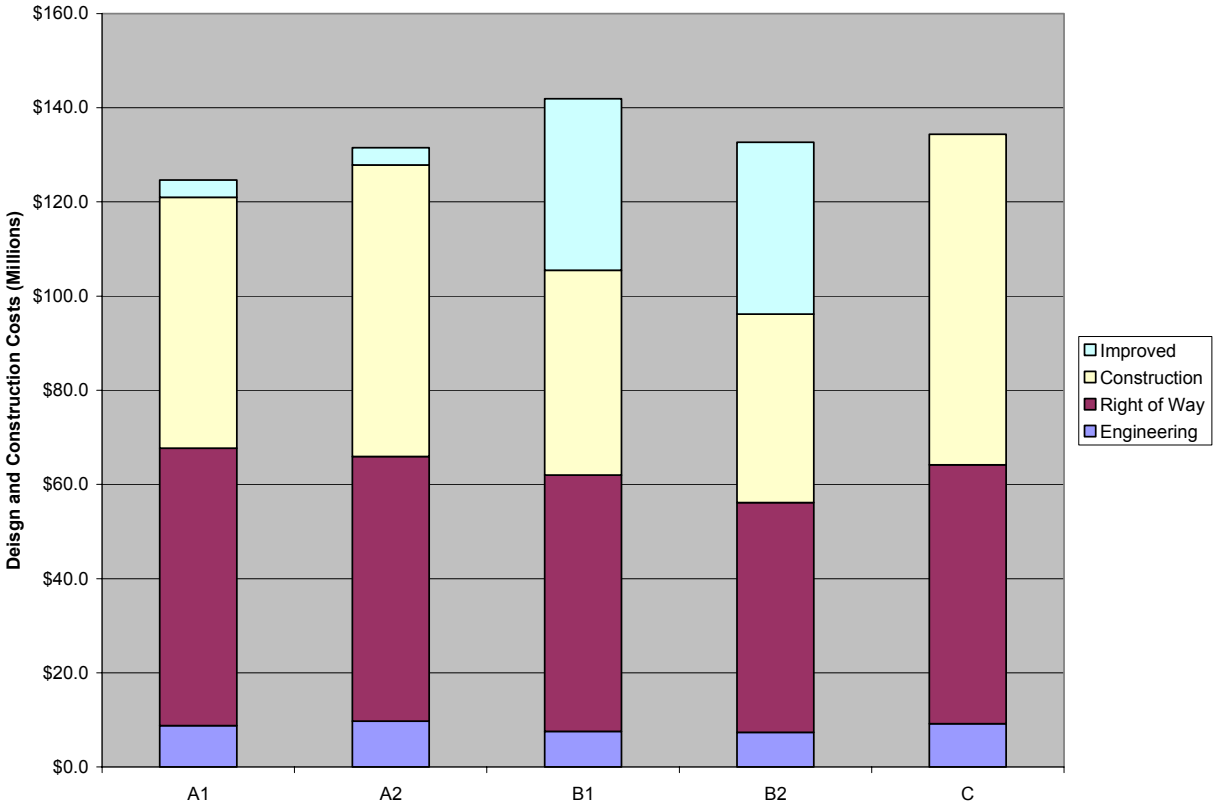
Figure AE 12. Base Cost Estimates – Standard Boulevard



If a multi-way boulevard design is used on US-29 north of Hydraulic, the costs in Figure AE 12 would increase about $2 million for Options A and C and about $3 million for Option B. When the cost components are considered, Option C has the highest construction cost followed by Option A2 and Option B2 has the lowest. Option A1 has the highest right of way costs and Option B2 has the lowest. Options A2, B1 and C have similar right of way costs. Options A2 and C have higher engineering costs than the other Options and Option B2 has the lowest cost. When comparing total cost, Option B is shown to have the lowest cost for the options as presented in the Alternatives Development section.

As noted in this section, Option A would require additional improvements at the US-29/US-250 Bypass interchange and Option B would require additional improvements at the US-29/Hydraulic Road intersection. The estimates in Figure AE 12 do not reflect the costs of these additional improvements. Figure AE 13, below, shows what the costs would look like if the additional improvements are included. For Option A, additional interchange improvements at US-29/US-250 Bypass are included similar to those included for Option B. For Option B, a SPUI interchange at US-29/Hydraulic Road is included.

Figure AE 13. Costs for Improved Options – Standard Boulevard



When the total improved costs are considered, the spread among the Options is narrowed and Option A1 shows the lowest cost, followed closely by Options A2, B2, and C, with Option B1 having the highest cost.

Although the total costs for any of the alternatives are substantial, several factors make the package-of-improvements approach into a workable set of solutions.

- Compared with a single new roadway project, each of the 'packages' - a set of improvements around one physical location, as summarized on the following estimate table - will produce transportation benefits immediately on completion of that segment, as opposed to waiting decades for a large project to be completed before benefits are realized.

- Many of the improvements to the parallel roadway network could be built at significantly reduced costs if completed in conjunction with private developers. Since the new roads would provide substantially improved customer access to the shopping centers, and increase the value of frontage properties, it would be reasonable to accept proffers of land in the shopping centers in return for accelerating construction of the roadway. For instance, the Hillsdale Drive Extended project (an existing project, currently partially funded) would cost close to $20 million from Greenbrier to Hydraulic. Proffered right of way could possibly save more than half the costs. Inside the 'Triangle' properties, the savings could be even more substantial. Similarly, much of the right of way required to add a lane to the 250W on-ramp from 29 could be proffered by the owners of the Best Buy site. This ramp improvement would directly improve access to their site by reducing congestion on 29 at the Best Buy entrance and Angus Road stoplight.

- Since much of the new roadway network is designed as a more urban roadway grid, it would be more efficient to build the roads and utilities concurrently with site development/redevelopment and building construction-as would be done by the developer of a large new site like Albemarle Place. If a developer - or contiguous property owners - chose to both contribute land and build the road and infrastructure, they could be reimbursed for the construction cost over time by VDOT (or a combination of funding sources). This approach could potentially lower costs while accelerating project delivery.

- The 'package-of-projects' approach can also allow access to other potential funding sources. Due to long-time safety concerns at the existing tight loop ramp at the southeastern corner of 29/250, reconstruction of these ramps could qualify for Hazard Elimination or other safety funds as a portion of the project cost. As noted in the economic analysis, potential redevelopment around the new grid could increase local tax revenues substantially ($2.25 million/yr increase after 7 years in City alone could bond $28 million in capital). Although the economic analysis was limited to largely City areas, since Albemarle Place in the County was assumed underway, a similar amount could be generated for improvements from the increase in Albemarle Place revenue.

29H250 Cost Estimates

		A1	A2	B1	B2	C
US-250/Barracks Road Interchange Modifications	PE	$624,000	$624,000	$852,000	$852,000	N/A
	RW	$3,184,202	$3,184,202	$2,778,950	$2,778,950	N/A
	CN	$2,918,000	$2,918,000	$4,536,000	$4,536,000	N/A
	TOT	$6,726,202	$6,726,202	$8,166,950	$8,166,950	N/A
Emmet Street Improvements	PE	$665,000	$665,000	$915,000	$915,000	$802,000
	RW	$4,770,994	$4,770,994	$5,465,590	$5,465,590	$2,803,650
	CN	$3,099,000	$3,099,000	$4,767,000	$4,767,000	$4,011,000
	TOT	$8,534,994	$8,534,994	$11,147,590	$11,147,590	$7,616,650
Hydraulic Road Modifications	PE	$485,000	Included in	$1,029,000	$1,029,000	$5,690,000
	RW	$3,150,345	29/Hydraulic	$7,887,250	$7,887,250	$19,060,988
	CN	$1,897,000	Interchange	$5,529,000	$5,529,000	$51,813,000
	TOT	$5,532,345	$0	$14,445,250	$14,445,250	$76,563,988
New Road Network "Inside the Triangle"	PE	$785,000	$785,000	$778,000	$778,000	$788,000
	RW	$20,377,525	$20,377,525	$20,377,525	$20,377,525	$25,956,235
	CN	$3,899,000	$3,899,000	$3,852,000	$3,852,000	$3,921,000
	TOT	$25,061,525	$25,061,525	$25,007,525	$25,007,525	$30,665,235
US-250/Hydraulic Intersection Modifications	PE	$654,000	$654,000	$608,000	$608,000	Included in
	RW	$4,444,860	$4,444,860	$1,367,538	$1,367,538	Hydraulic Rd.
	CN	$2,684,000	$2,684,000	$2,718,000	$2,718,000	Modifications
	TOT	$7,782,860	$7,782,860	$4,693,538	$4,693,538	$0
US-250/US-29 Interchange Modifications	PE	$1,230,000	$1,230,000	$1,707,000	$1,534,000	$773,000
	RW	$4,591,462	$4,591,462	$11,593,571	$5,915,632	$959,150
	CN	$6,866,000	$6,866,000	$12,309,000	$8,891,000	$3,818,000
	TOT	$12,687,462	$12,687,462	$25,609,571	$16,340,632	$5,550,150
US-29 Boulevard Option	PE	$1,341,000	$1,516,000	$1,848,000	$1,848,000	$1,341,000
	RW	$4,490,870	$5,038,645	$6,467,300	$6,467,300	$4,490,870
	CN	$7,604,000	$8,772,000	$11,235,000	$11,235,000	$7,604,000
	TOT	$13,435,870	$15,326,645	$19,550,300	$19,550,300	$13,435,870

US-29 Non-Boulevard Option	PE	$1,189,000	$1,369,000	$1,665,000	$1,665,000	$1,189,000
	RW	$3,571,105	$3,928,322	$4,957,190	$4,957,190	$3,571,105
	CN	$6,596,000	$7,795,000	$9,764,000	$9,764,000	$6,596,000
	TOT	$11,356,105	$13,092,322	$16,386,190	$16,386,190	$11,356,105
US-29/Hydraulic	PE	$3,141,000	$4,389,000	Included in	Included in	Included in
	RW	$14,863,931	$14,887,961	Hydraulic Rd.	Hydraulic Rd.	Hydraulic Rd.
	CN	$25,290,000	$34,692,000	Modifications	Modifications	Modifications
	TOT	$43,294,931	$53,968,961	$0	$0	$0
GRAND TOTAL (w/US-29 Blvd.)	PE	$8,925,000	$9,863,000	$7,737,000	$7,564,000	$9,394,000
	RW	$59,874,189	$57,295,649	$55,937,724	$50,259,785	$53,270,893
	CN	$54,257,000	$62,930,000	$44,946,000	$41,528,000	$71,167,000
	TOT	**$123,056,189**	**$130,088,649**	**$108,620,724**	**$99,351,785**	**$133,831,893**
GRAND TOTAL (w/US-29 Non-Blvd.)	PE	$8,773,000	$9,716,000	$7,554,000	$7,381,000	$9,242,000
	RW	$58,954,424	$56,185,326	$54,427,614	$48,749,675	$52,351,128
	CN	$53,249,000	$61,953,000	$43,475,000	$40,057,000	$70,159,000
	TOT	**$120,976,424**	**$127,854,326**	**$105,456,614**	**$96,187,675**	**$131,752,128**

PE=Preliminary Engineering
RW=Right of Way
CN=Construction

Figure AE-1: Northbound US 29 Travel Time Comparisons

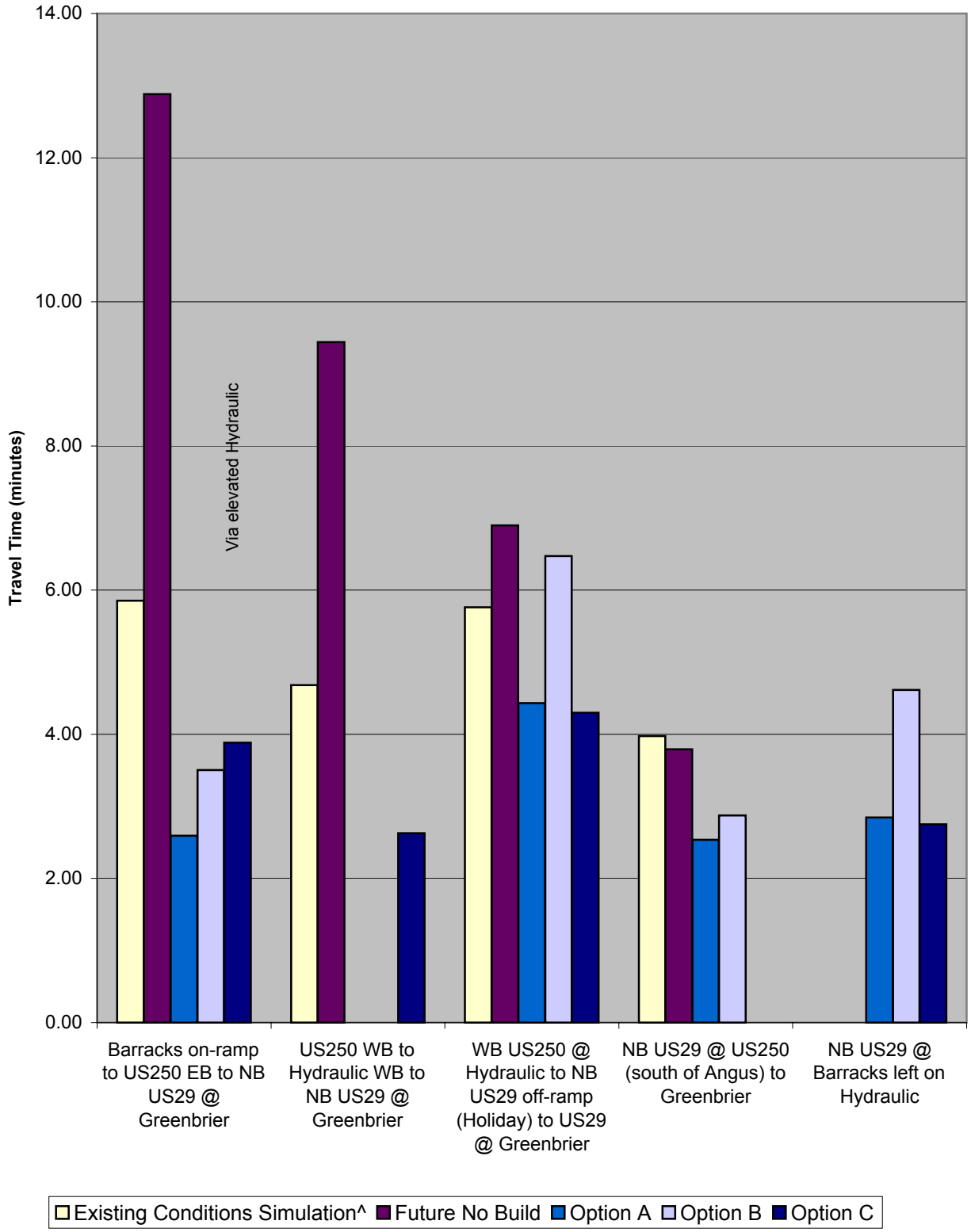


Figure AE-1: Southbound US 29 Travel Time Comparisons

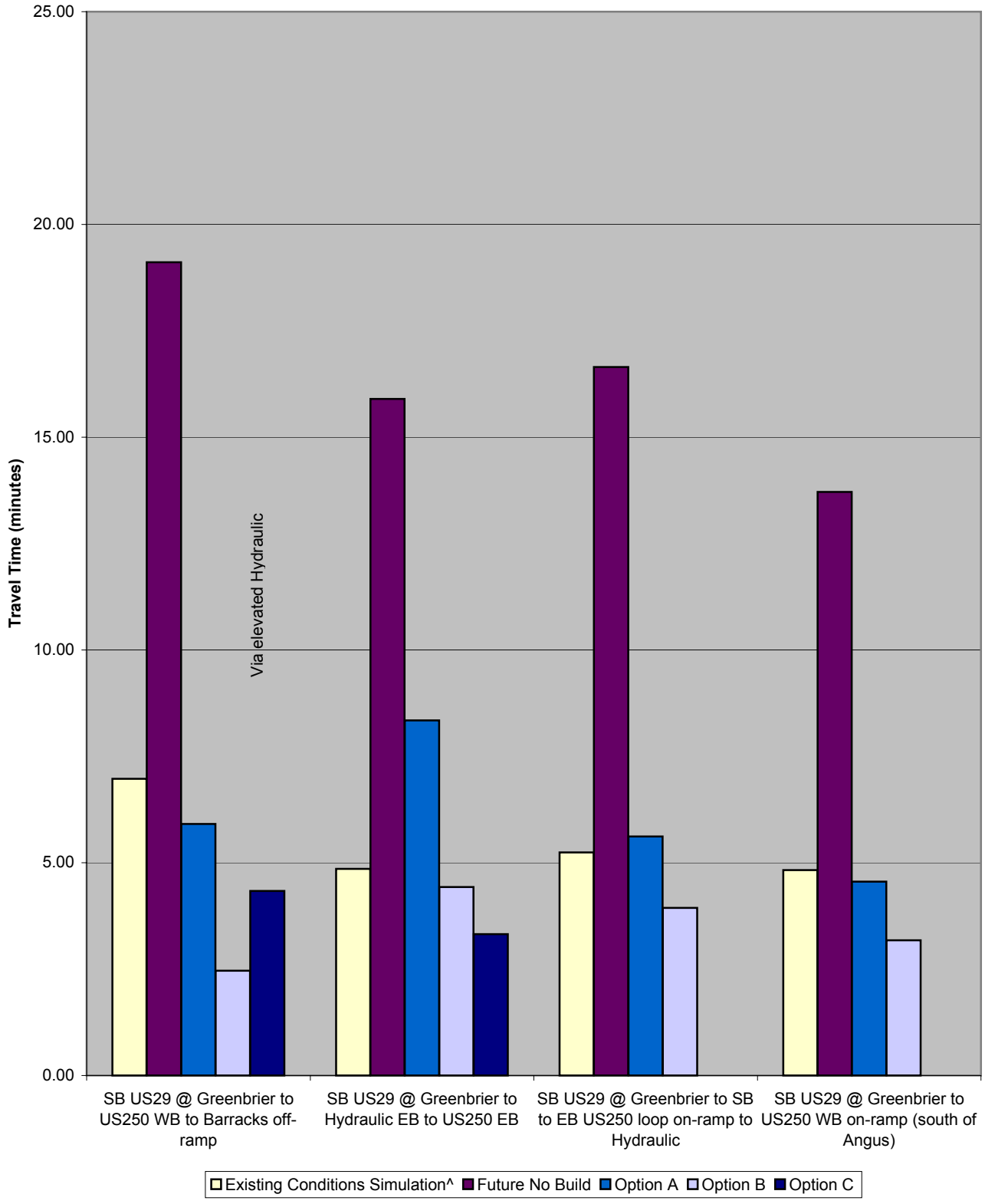


Figure AE-2: Hydraulic Road Photo Simulations

Existing Conditions

Option A

Option B

Option C

Figure AE-3: Route 29 Photo Simulations

Existing Conditions

Option A

Option B

Option C

Figure AE4: Pedestrian Circulation at SPUI Diagram

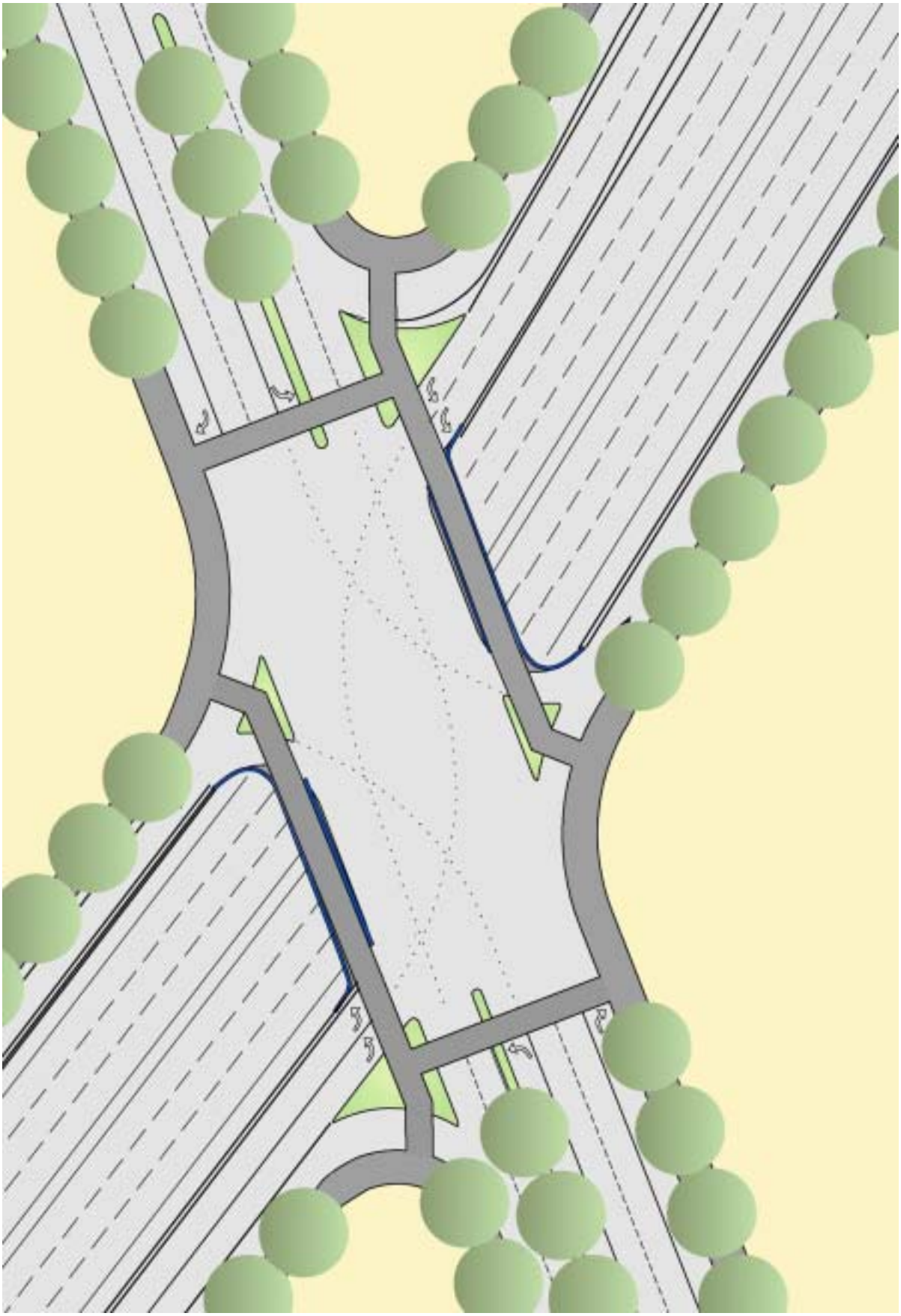


Figure AE: 5: US29 South of Hydraulic Rd. Pedestrian Realm

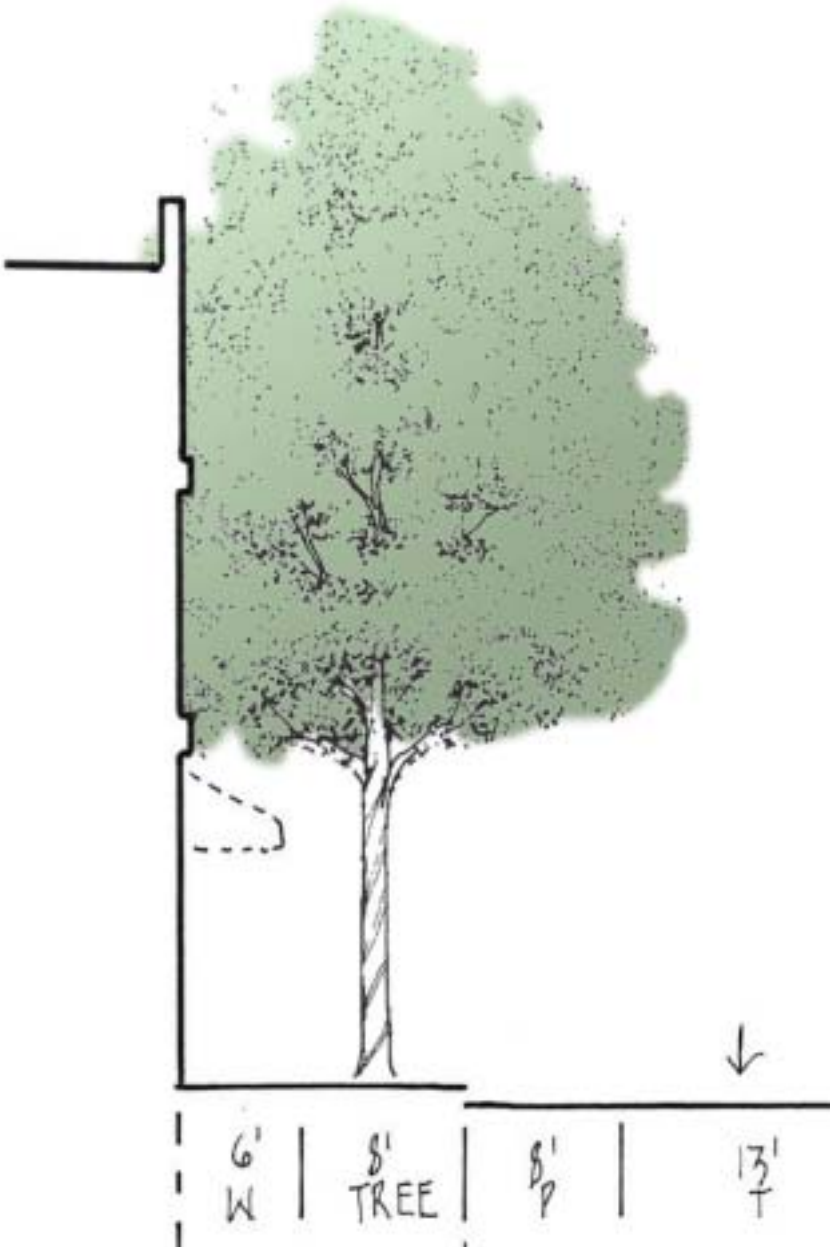
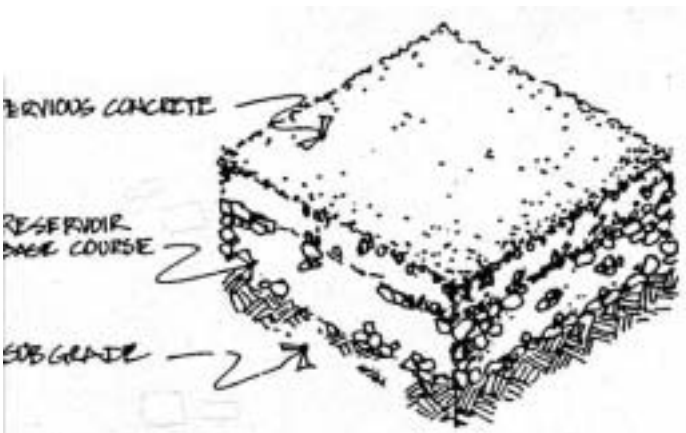
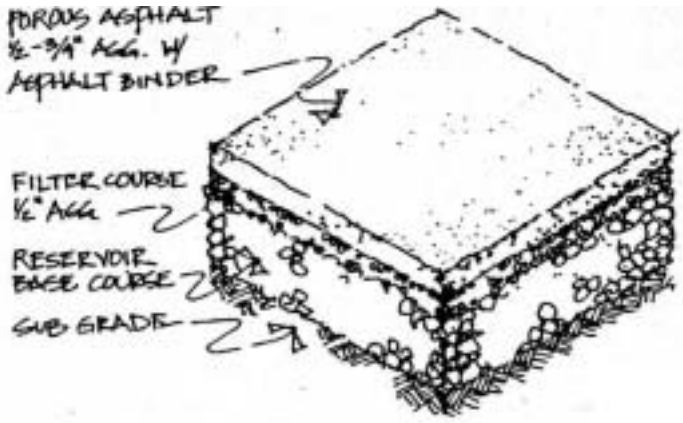


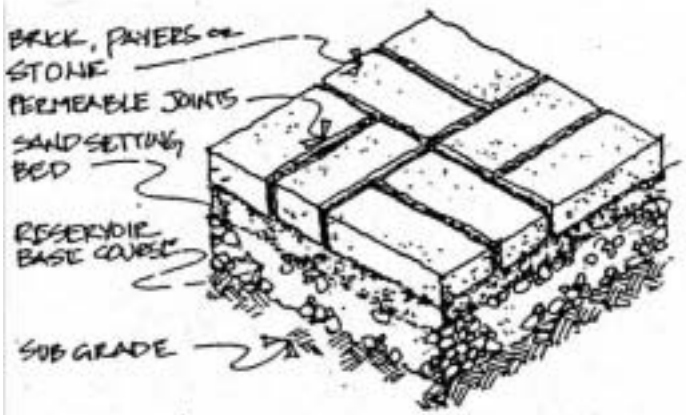
Figure AE 6: Green Streets Solutions - Permeable Pavement



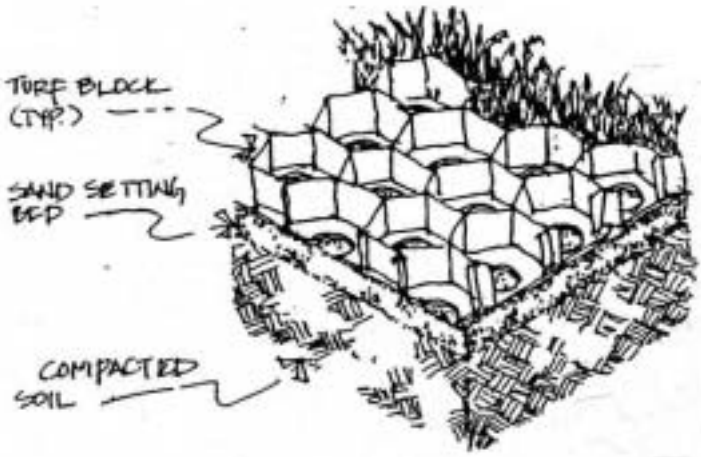
a) Pervious concrete.



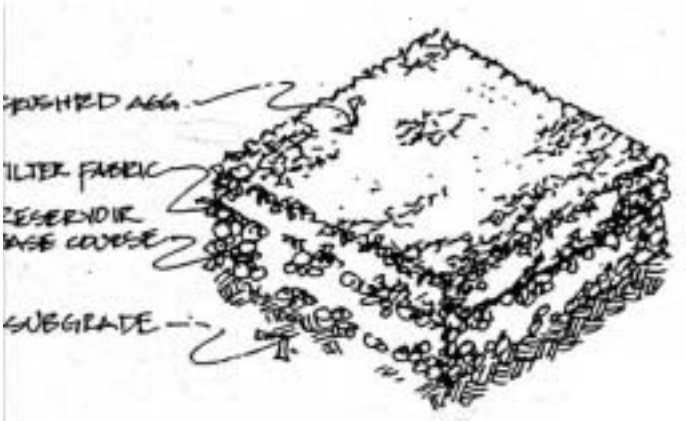
b) Pourous asphalt.



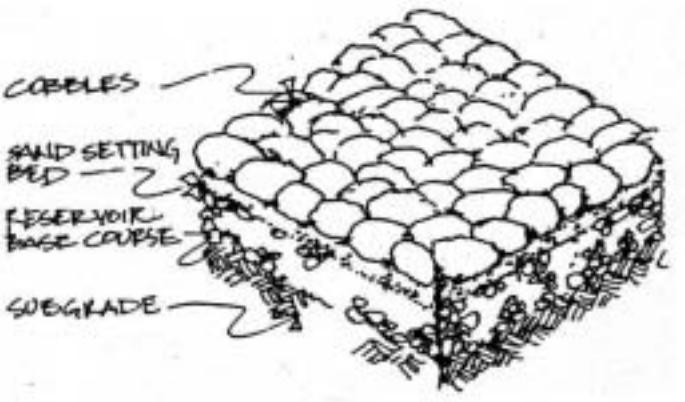
c) Unit pavers/bricks/stone



d) Turf block.



e) Crushed aggregate



f) Cobbles.

Figure AE 7: Green Streets Solutions - Swales

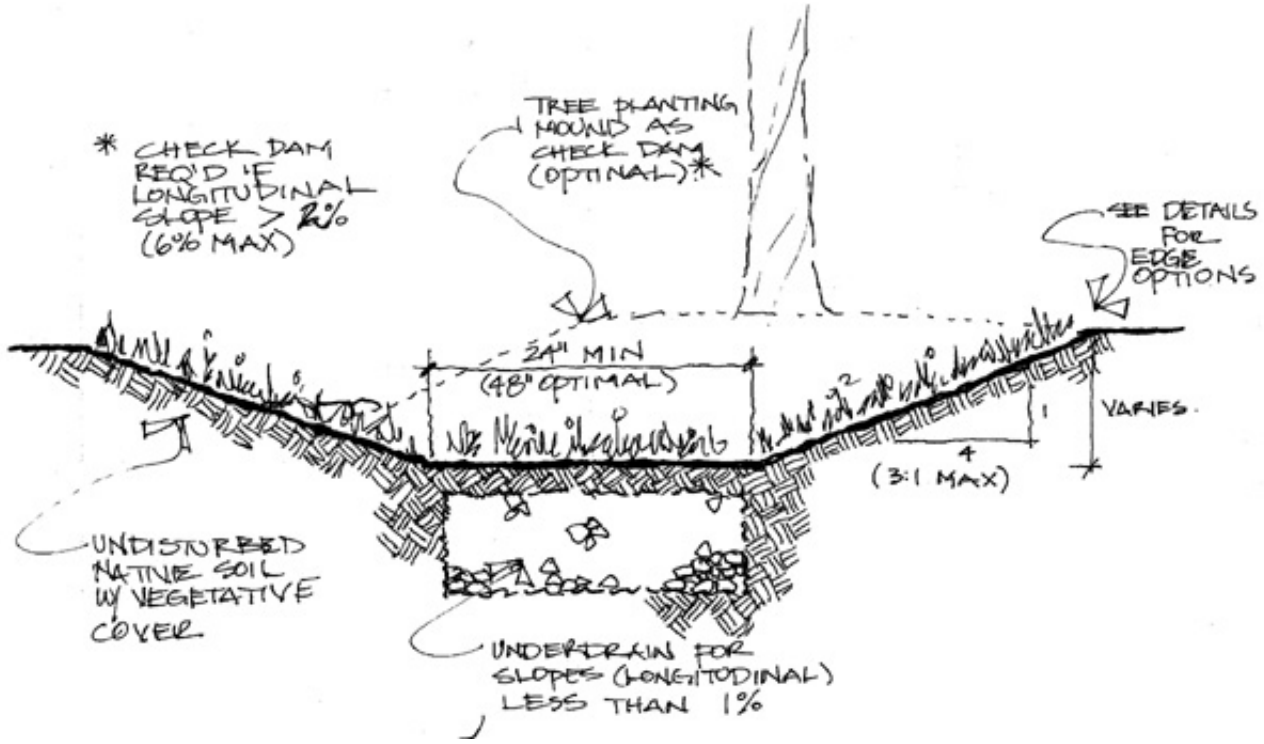


Figure AE 8: Green Streets Solutions - Linear Detention Basin

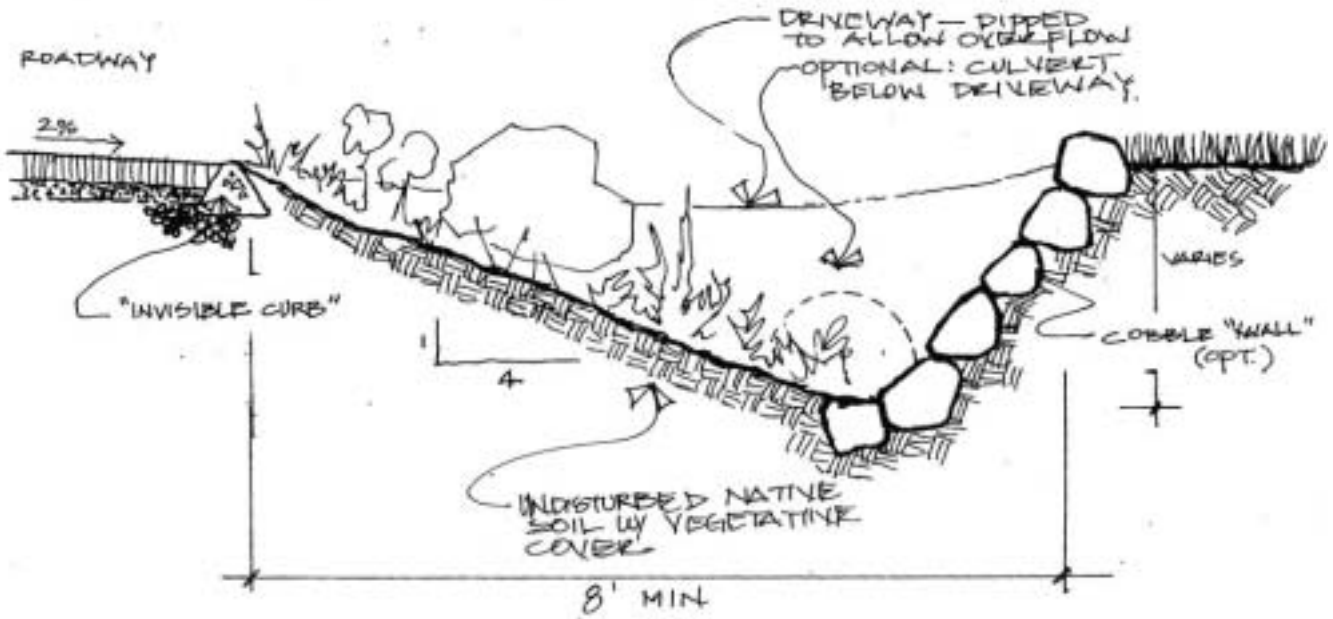


Figure AE 9: Green Streets Solutions - Tree Wells

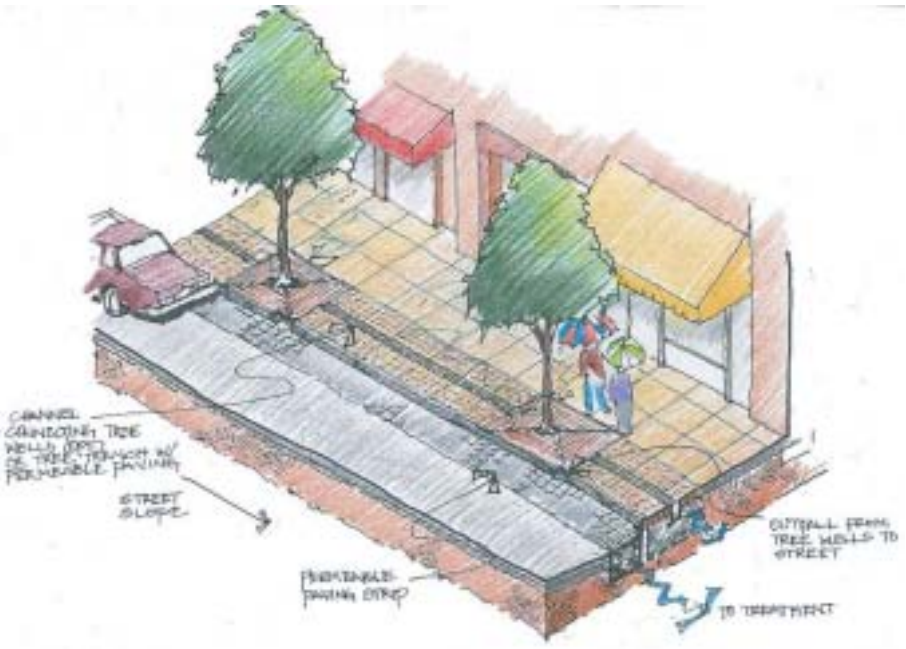


Figure AE 10: Green Streets Solutions - Example Street

Figure AE 11: Green Streets Solutions - Example Parking Lot

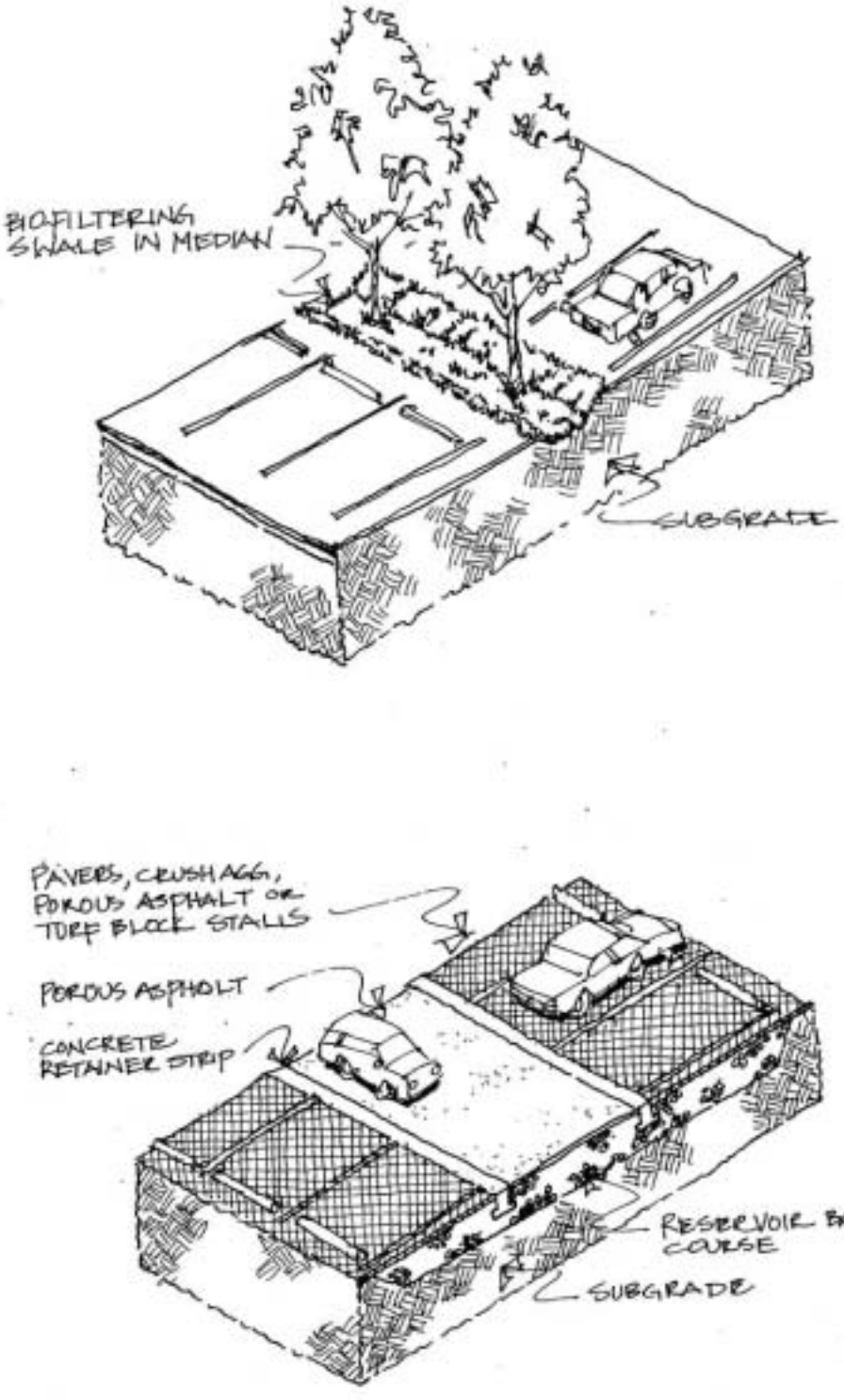


Figure AE 12: Base Cost Estimates – Standard Boulevard

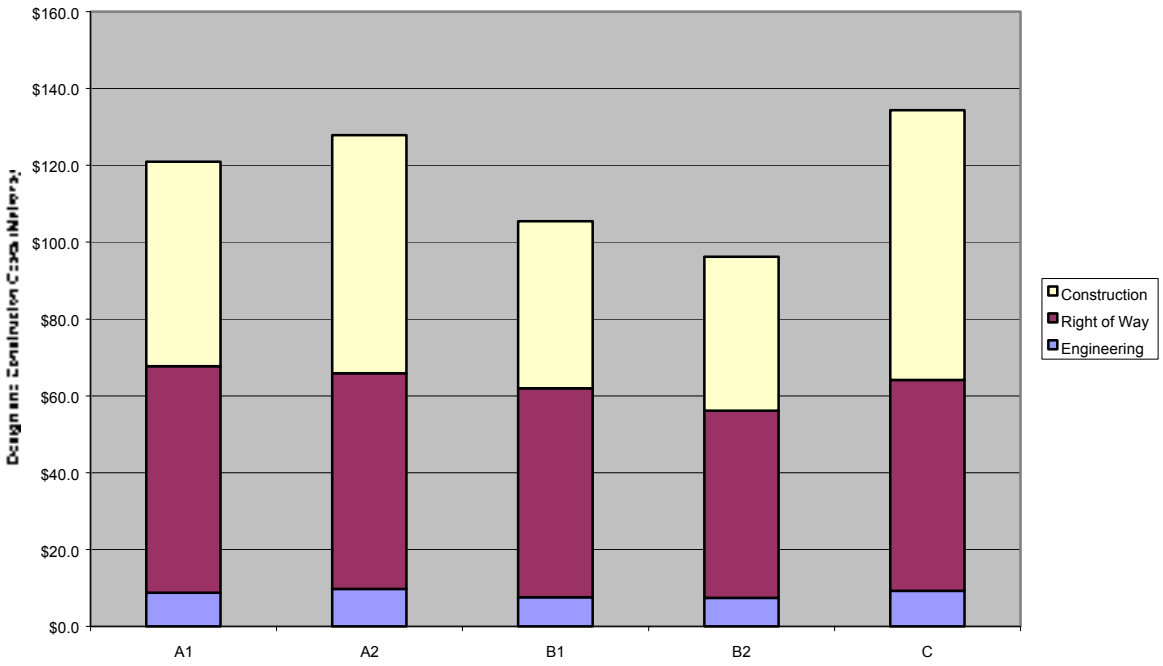


Figure AE 13: Costs for Improved Options – Standard Boulevard

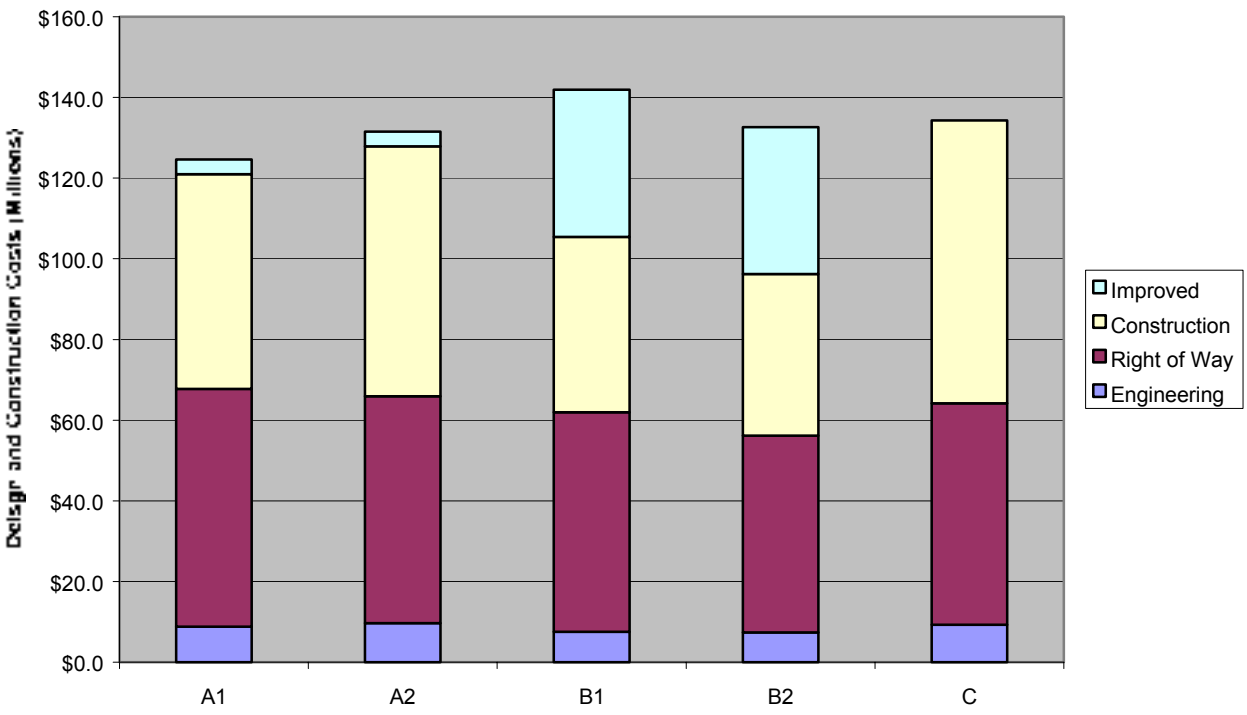


Table AE 1: Evaluation Criteria

General

Constructability
Minimize disruption to business
Maintain existing traffic operations
Minimize Right-of-Way requirements
Minimize construction cost/funding requirements

Transportation

Pedestrian access and safety

- Within the corridor
- Along and across streets
- From streets to buildings and within parking lots
- Connecting with adjacent neighborhoods

Bicycle access and safety

- Within the corridor
- Along and across streets
- Within sites
- Bicycle parking
- Connecting with adjacent neighborhoods and the region

Transit access and safety

- Transit customer access to businesses and neighborhoods
- Provide for planned transit improvements
- Create safe and comfortable transit stops

Vehicular access and safety

- Maintain access and safety during construction
- Provide for both local and through trips
- Separate local and through trips when possible
- Improve “way finding” – local and directional signs

Quality of Life/Sustainability

Maximize transportation choice

Provide a mix of land uses

- Support transit and internal trips
- Mix housing for household types and income levels
- Mix retail for both regional and local needs
- Mix employment opportunities – office, industrial, service, & retail

Improve stormwater systems

- Enhance water quality
- Reduce peak flows to Meadow Creek
- Make water quality system an amenity

Improve landscape quality

- Street trees
- Enhance and protect on-site landscape

Improve visual character of private development

Improve visual character of streetscape

Economic

Revenues are concern for City and County

- Sales tax
- Property tax

Desired development needs to provide value to property owners

Planned improvements must be financially feasible

Balance near-term economic impacts and long-term gains

Table AE 4

Immediate Impact of Transportation Improvement
29H250 Study Area

	Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Land (Acres)	-5.85%	-6.50%	-4.93%	-7.82%
Building (Sq. Ft.)	-3.02%	-3.77%	-4.00%	-7.67%
Property Value (000's)	1.52%	-0.66%	0.94%	-4.30%
Employment	-2.07%	-3.01%	-2.96%	-13.10%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	-3.08%	-5.63%	-5.35%	-5.31%

Source: ZHA

impact summary/sum imm

Table AE 5

7 Year Projected Impact of Transportation Improvement
29H250 Study Area

	7 Yr. Impact of Improvement Vs. Existing Condition			
	A-1	**A-2**	**B-1/2**	**C**
Building (Sq. Ft.)	27.77%	26.99%	45.78%	24.16%
Property Value (000's)	40.54%	39.44%	66.95%	34.66%
Employment	22.73%	21.12%	26.47%	14.41%
Est. City Tax Revenue from Property, Sales, and Meal Taxes	48.61%	45.76%	67.25%	40.42%

Source: ZHA

impact summary/sum 7

Table AE 6

Net New Tax Revenues
Seven Years After Transportation Improvements

Area	A-1	A-2	B-1/2	C
Triangle Area	$480,400	$468,500	$853,700	$376,100
Kmart Area	$220,800	$194,500	$635,000	$69,000
Best Buy Area	$216,900	$216,400	$216,900	$222,400
Holiday Inn Area	$27,300	-$29,400	$26,400	$40,000
250 Interchange Area	$97,300	$97,300	-$31,600	$97,400
Hillsdale	$554,400	$554,400	$554,400	$554,400
Barracks Road Area	$32,845	$32,845	$0	$0
Net New Revenue	$1,629,945	$1,534,545	$2,254,800	$1,359,300

Source: ZHA, Inc.
impact summary/sum

Public Involvement Results Summary

0Following the public involvement model from the Phase 1 study, the 29H250 Phase 2 study held several public workshops to obtain feedback and hear concerns of residents and business owners. The first workshop was held in November 2003 at the beginning of the study. Participants received an overview of the Phase 1 process and were presented with a summary of the goals for the Phase 2 project and the key multi-modal transportation, economic, and quality of life/sustainability issues. During this session, examples of work on other projects were shown to illustrate how major arterial streets can be redesigned to better serve a variety of transportation modes, provide stormwater improvements, and create opportunities for economic investment.

Elements of the Phase 1 work were presented within the framework of the three alternative concepts. Also presented were concepts for the enhancements that could be provided through the Phase 2 work, such as: ITS signalization, access management, and bus transit improvement concepts. A short question and answer period provided an opportunity for members of the public to discuss their concerns regarding the study that is underway on the Hillsdale extension. People expressed concerns about the potential for through traffic to increase and any decrease in pedestrian safety that could result.

After the presentation and question and answer period, participants broke up into small groups to discuss the general issues and concerns regarding transportation and land use in the study area using the goals and issues developed in Phase 1 as a guide, and a review of the intersection improvement concepts developed in Phase 1.

Overall, residents were pleased with the design options presented in Phase 1 of the study, as it was clear there were feasible solutions to improving mobility in the study area as well as the US-29 corridor. Several key concepts were iterated at the November workshop: Grade separate 29 and Hydraulic Road; study Bus Rapid Transit (BRT) or an enhanced bus system; establish dedicated bus and High Occupancy Vehicle lanes (HOV); and provide a parallel road network and connected street system to reduce congestion on US-29. Some residents expressed concerns about extending Hillsdale Drive to Hydraulic Road, as it would make the road less friendly for pedestrians. Many suggested that if Hillsdale Drive was extended to Hydraulic Road, that it be done without limiting pedestrian mobility and preserving the environmental character. Residents who lived in the adjacent neighborhoods along Hillsdale Drive supported the recommendations made from the Hillsdale Drive Safety Study, which was completed in the Spring 2003 by the PDC.

The Project Team held a drop-in session in January to allow the public to come and review the work in progress. All the conceptual maps, drawings, etc. were on display and members of the Project Team were on hand to answer questions and demonstrate the simulated modeling. A formal workshop was held in February to present the public with the design alternatives and analysis to date. This included presentation of the three Options the Project Team had developed as well as other scenarios, including the concept of US-29 as a corridor and potential land use changes. Environmental issues were also presented as being a key part of the design solutions with examples shown of how environmentally friendly elements could be integrated into the overall designs. Three- dimensional modeling was also presented to show participants what traffic would look like under the three Options in future years.

After the presentation, workshop participants were given worksheets which included the drawings of the design concepts. The worksheets, along with large drawings of each Option and element presented were provided to allow participants to ask questions and make comments on the proposed Options. Comments on the three Options varied. The majority of comments did not favor Option A, citing it does not do enough to solve traffic problems. Option B comments were split, with nearly half supporting this option. Comments also varied on the roundabouts proposed in this design, with some favoring them and others questioning how they work. Comments for Option C also varied, with the majority viewing this as a good design though some were concerned with the appearance of elevated structures. All the public comments were considered by the Project Team and factored into the detailed technical analysis. Final design alternatives were produced.

The final workshop for the Phase 2 study was held in April 2003. At this workshop, participants were presented with the final design alternatives. Economic analysis was also presented and was the first look the public had into the impacts of each Option. The large drawings of each Option and elements were displayed and participants were asked to review these and record comments on the questionnaires that were handed out. Comments varied on the three Options. Assessing answers in moving towards a preferred concept, many participants seemed to favor Option C. This preferred option seemed to meet the needs of the study area's future roadway system. Option B was the next preferred option, with Option A receiving only a few marks.

Recommended Improvements/Implementation Strategy

The findings from the Alternatives Evaluation were considered with the intent of recommending a preferred design. During this process, the underlying study design requirement to use a multi-faceted approach to evaluation was validated several times over, since relying on any single evaluation criteria was shown to produce less than optimum results. It was only in the aggregate comparison of findings that a clear recommendation was identified for the study area. This variation in optimums is illustrated in Table RI 1, which summarizes the outcomes from the various evaluation criteria.

Table RI 1. Comparison of Transportation Options

Criteria	Option A	Option B	Option C
Traffic Operations			
Intersections	**Acceptable operations at all intersections**	**Unacceptable operations at US-29/Hydraulic Road intersection; acceptable conditions at other locations**	**Acceptable operations at all intersections**
Freeways	**Poor operations (queuing) on US-250 Bypass eastbound at US-29 interchange**	**Best freeway operation**	**Poor operation (queuing) on ramps from Hydraulic onto viaduct**
Travel Time	**Improved northbound travel times the most over existing conditions; less improvement for southbound travel**	**Improved southbound travel times the most over existing conditions; mixed improvements for northbound**	**Mixed Improvements in both directions**
Connectivity	**Maintains existing movements**	**Restricts northbound Rugby Road traffic; eliminates eastbound left on US-250 Bypass at Hydraulic**	**Closes Rugby Road connection to US-250 Bypass**
Pedestrian	**Moderate improvement over existing**	**Most improvement over existing**	**Least improvement over existing**
Bicycle	**Moderate improvement over existing**	**Most improvement over existing**	**Least improvement over existing**
Transit	**Moderate improvement over existing**	**Moderate improvement over existing**	**Moderate improvement over existing**
Urban Design	**Low to Moderate improvement over existing**	**Most improvement over existing**	**Low to Moderate improvement over existing**
Economic			
Immediate Impact	**3% to 5.6% reduction**	**5.4% reduction**	**5.3% reduction**
Net New Revenue	**46% to 49% increase**	**67% increase**	**40% increase**
Constructability	**Moderate disruption; US-29/US-250 Bypass interchange and US-29/Hydraulic most affected by temporary closures**	**Least disruption; best able to stage incrementally**	**Most disruption; requires closing of Hydraulic Road to construct viaduct**
Cost			
As designed	**$121 to $128 million**	**$96 to $105 million**	**$134 million**
With improvements	**$125 to $132 million**	**$133 to $142 million**	**$134 million**

Were one or two of the criteria used to make a recommendation, it is obvious from Table RI 1 that any of the three Options could form the basis for a selected design. All provide some improvement over existing conditions for traffic operations. Construction costs are similar, particularly when the additional elements necessary to achieve acceptable traffic operations at all locations are included. All would result in about the same amount of lost tax revenue from construction and all add back new net revenues over time.

However, as all of the criteria are considered together, differences emerge that support recommendation of Option B, which emphasizes improving US-29 to serve regional trips and changing the character of Hydraulic Road between US-29 and the US-250 Bypass, as the basis for the preferred design. The Option B designs were found to deliver a similar level of regional travel improvement as the other two options, while providing more cost effective construction and resulting in a higher overall fiscal return from ensuing development opportunities. Of the two Option B designs, the B2 design that uses a diamond off-ramp configuration with one loop ramp rather than the modified cloverleaf design currently in place at the US-29/US-250 Bypass interchange was shown to be a more cost-effective configuration and was selected as the basis for the recommended design.

The recommended design (shown in Figure RI 1) changes the Option B2 design in three areas to make it more effective in meeting study area demands throughout the 20-year design horizon:

1. At Barracks Road and US-250 Bypass, the existing design that uses traffic signals at the ramp terminals would be more cost effective in the near term than the double roundabout design shown in Option B, although the roundabouts might eventually be needed as traffic increases on Barracks Road. The recommended design also includes an extended merge (escape) in the westbound direction that would accommodate traffic using the new auxiliary lane that wants to continue westbound on US-250 Bypass.
2. At US-29/Hydraulic Road, a grade separation of the intersection would be necessary to meet the long-term traffic projections. A single point urban interchange configuration with US-29 under Hydraulic is recommended.
3. North of Hydraulic Road on US-29, a non-boulevard cross section would be more economical since reconstruction of US-29 would not be necessary. However, the recommended design at US-29/Hydraulic is compatible with either a boulevard or non-boulevard cross section to the north. The decision about the cross section on US-29 north of Hydraulic should be linked with the findings of the upcoming expanded corridor study on US-29 north.

With these changes, the cost of the recommended design is $132.4 million as shown in Figure RI 2, which compares the cost of the Options with improvements.

The recommended design has been chosen for the following reasons:

Deemphasizing Hydraulic as a major connector between US-29 and US-250 allows it to:

- Function for more local level transportation trips;
- Support a vital commercial and mixed-use area between Greenbrier and US-250; and,
- Provides good access to businesses and services for pedestrians, bicyclists, and transit.

Transportation and urban design improvements for Hydraulic Road with sidewalks, bicycle lanes, park-like medians and roundabouts transforms its character from a street dominated by freeway traffic to one that:

- Provides an improved streetscape and multi-modal access that encourages new commercial and mixed-use development to front onto the street;
- Safely accommodates the important east/west bicycle connection adjacent to slower speed traffic;
- Creates an attractive streetscape with wide sidewalks, street trees, medians, and pedestrian-scale lighting that provides a safe and pleasant pedestrian environment, access, and circulation, and safe pedestrian crossings with median refuges;
- Connects development within the parcels in the triangle area and that north of Hydraulic Road; and,
- Provides a higher potential for 'Green Streets' landscaped water-quality treatments in proposed medians.

Construction of a single point urban interchange (SPUI) at US-29/Hydraulic Road supports multi-modal, economic, and urban design goals. If designed correctly, it:

- Protects pedestrians and bicyclists from exposure to heavy traffic on US-29 and provides a safe connection between areas east and west of US-29;
- Works most efficiently with the existing topography in the area;
- The SPUI can work well with the concept of a multi-way boulevard to the north, if that proves to be a desired choice in the future corridor planning effort;
- Can be phased to follow the other planned improvements to satisfy building impact and project financing issues;
- Supports the deemphasizing of Hydraulic; and,
- Fits with the redirection of more local trips to the Hillsdale extension and connector roads to the west of US-29.

The reconfiguration of the US-29/US-250 interchange supports transportation, fiscal, and urban design goals as it:

- Reduces the amount of land occupied by off/on ramps, and creates new developable land in the triangle area;
- Provides high-quality access to Bodo's and nearby businesses, and creates the potential to expand the Bodo's site to the north;
- Requires pedestrian and bicycle access improvements through the interchange similar to the other options, but with particularly high-quality access potential on the east side of US-29; and,
- Allows a sequence of construction that leaves the existing interchange in operation until the new interchange ramps are built, which minimizes regional delay.

Construction of the Hillsdale Drive extension on the east of US-29 and Cedar Hill Drive on the west support:

- Near- to long-term private reinvestment on both sides of US-29 which will improve Charlottesville's and Albemarle County's sales and property tax base;
- High quality pedestrian and bicycle areas to the east and west of US-29 that can be connected to transit service and multi-use paths along US-29;

- Opportunities for public/private cost sharing, particularly in the proffering of right of way for road construction;
- The Hillsdale extension integrates with the redesign of the US-250 west-bound off-ramp, the redesign of Hydraulic, and the catalyst development opportunities in the Triangle and the Brandywine properties to significantly improve the economic and urban design character of this part of Charlottesville; and,
- The potential for mixed-use development in the area that will be more economically and environmentally sustainable.

From the standpoint of construction cost, the following reasons support the recommended design:

- When design, right of way, and construction cost is considered, Option B (as originally designed) is lowest of the alternatives;
- When recommended design improvements are added to Options A and B, the overall costs are roughly equal, at about $130 million for all the alternatives;
- The recommended alternative is slightly more costly than Option A and slightly less costly than Option C; and,
- Overall costs could be significantly less with right of way proffered, and potential private construction of some portions in conjunction with redevelopment.

As tax revenue implications are considered, less than five percent of the land and building square footage are taken off the tax rolls as a result of the transportation improvements under Option B. Much of this is along existing property lines and provides increased road frontage at the same time. The projected increase in property value within seven years of investment under Option B is 50 to 100 percent greater than with the other Options.

Phasing

The recommended design provides flexibility in two areas—construction timing of future improvements and the sequence of construction for each improvement. This allows the package of improvements to be implemented as a series of independent roadway projects. Many individual design elements can be implemented concurrent with redevelopment activities. The recommended design also provides for existing interchange movements to operate relatively unimpeded during construction of the new ramps. The following sequencing of design elements is suggested, although planning, design, and right of way acquisition for these elements may need to start in the short term. The recommended sequencing should also be adjusted to meet specific development plans of major property owners in the study area.

Short-term: (1-5 years)

- VDOT/City/County implement ITS strategies (management center, improved monitoring, communications infrastructure, and traffic signal improvements)
- Construct Hillsdale north of Hydraulic (the current City/VDOT project), and
- Expand southbound-to-westbound ramp at US-29/US-250 Bypass (near Best Buy) with auxiliary lane to Barracks Road off-ramp

Mid-term (5-15 years)

- Construct Hillsdale extension south of Hydraulic as property redevelops
- Construct eastbound to northbound/southbound off-ramp at US-29/US-250 Bypass

- Close eastbound to northbound/southbound off-loop at US-29/US-250 Bypass and reconstruct northbound to eastbound on-ramp
- Construct new off-ramp at Holiday Drive
- Reconstruct Hydraulic Road from US-29 to US-250
- Reconstruct southbound to eastbound on-loop at US-29/US-250 Bypass
- Construct westbound merge lane on US-250 Bypass at Barracks Road interchange

Long-term (15-20 years)

- Replace US-29/Hydraulic intersection with single point urban interchange

Implementation Strategy

The strategy for implementation of the recommended design involves several additional steps in the planning and funding process before design and construction can proceed. These steps include review of these recommendations by decision makers and the public, integration of the findings from this study with the future corridor study on US-29 north, project-level environmental review, and coordination with on-going VDOT/City/County transportation projects in the study area. Following are suggested actions related to each of these areas:

Review of Recommendations

- This Technical Report will be available for comments through November, which will be either answered in the final report, addressed in project design and engineering, or in the Phase 3 29N Corridor Project.
- More detailed review by developers and locality staff reviewing specific project proposals is encouraged, and their concerns will be incorporated into the final report.

Phase 3 29N Corridor Project

- Planning and fund raising is under way to conduct the long-awaited multimodal study of the full 29 North Corridor from the 29H250 area to the northern County limit.
- This next phase would be conducted in concert with Albemarle County's Northern Development Area Master Plan, with an added goal of fully linking County land use and development plans and regulations with VDOT and local transportation project planning.

Coordination

- The Hillsdale Extension project is completing the Location phase, and should proceed into the Design phase shortly. Care should be taken to incorporate the multimodal and redevelopment goals of this study. Negotiations should be conducted between the City, VDOT, and landowners to determine the feasibility of accelerating construction via a combination of proffered right of way, construction contributions, concurrent re-development, and financing instruments.
- Funding should be allocated for the second recommended short-term project, expansion of the southbound to westbound on-ramp at US-29/US-250 Bypass with auxiliary lane to Barracks Road off-ramp.
- Explore establishment of a Regional Transportation Authority (MPO, City, County) to demonstrate localities' willingness to 1) work together on transportation and development projects, and 2) raise public-private funding contributions to accelerate project completion.

Extensions of Concepts North Beyond Greenbrier

It is expected that the concept of establishing routes parallel to US-29 for local traffic as outlined in the preceding sections of this report will result in a significant reduction of trips that use US-29 for access to local destinations. Can a similar approach be used for areas along US-29 north of Greenbrier?

The answer to this question requires additional research and largely depends on local conditions alongside US-29, particularly with respect to topography and existing land uses. Where the topography directly adjacent to US-29 is too steep it may be infeasible or too costly to build the street in a multi-way boulevard configuration. The same would apply in locations where the demolition of development with vital uses would be required that have little or no potential for change (in the mid-term) come close to the street. However, it is conceivable to 'fluctuate' design and cross-sections of US-29 between multi-way boulevard and standard boulevard configurations as long as there is sufficient length to each segment and sufficient space for the required transition treatments between the two. The shifts should also be related to adjacent land use context where feasible. For example, the multi-way boulevard configuration will be most appropriate where US-29 is passing through mixed-use activity centers while the standard boulevard configuration can be used in the segments in between activity centers where access to adjacent uses is a lower priority.

The concept of parallel routes on either side of US-29 can conceivably be extended north beyond Greenbrier. However, this will require careful analysis of existing uses and particular sensitivity to existing residential uses just beyond the commercial properties that line US-29. Although the parallel routes are not intended for high-volume sub-regional trips, they will carry volumes of traffic that could be incompatible with a neighborhood comprised of single-family homes. As the length of connected parallel routes increases, close attention has to be paid to speed management and needed traffic calming measures.

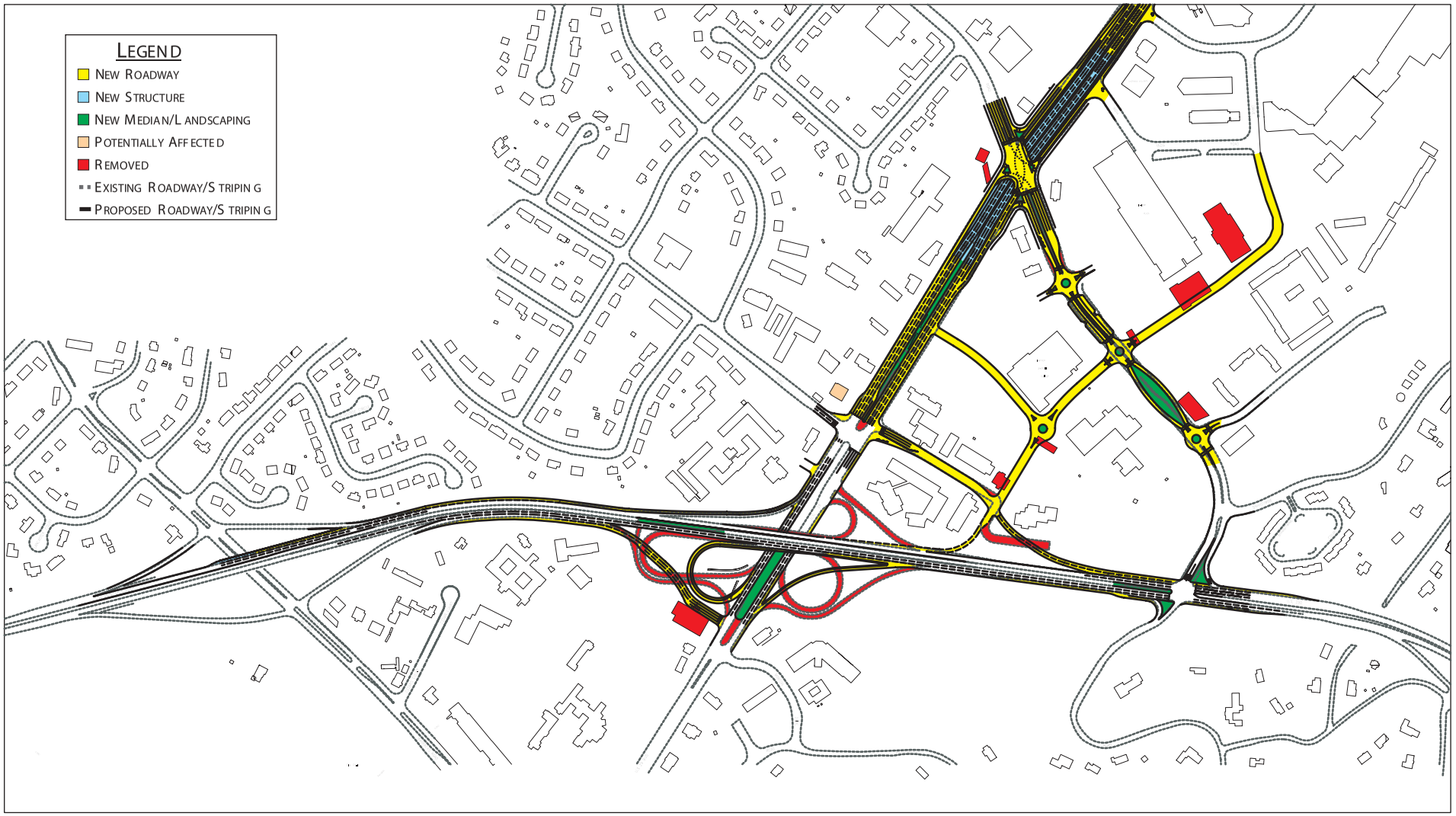


Figure RI 1 - Recommended Design

RECOMMENDED DESIGN
29H250 PHASE 2

0 100 200 400
1"=200'

Figure RI 2 – Costs for Improved Options – Standard Boulevard

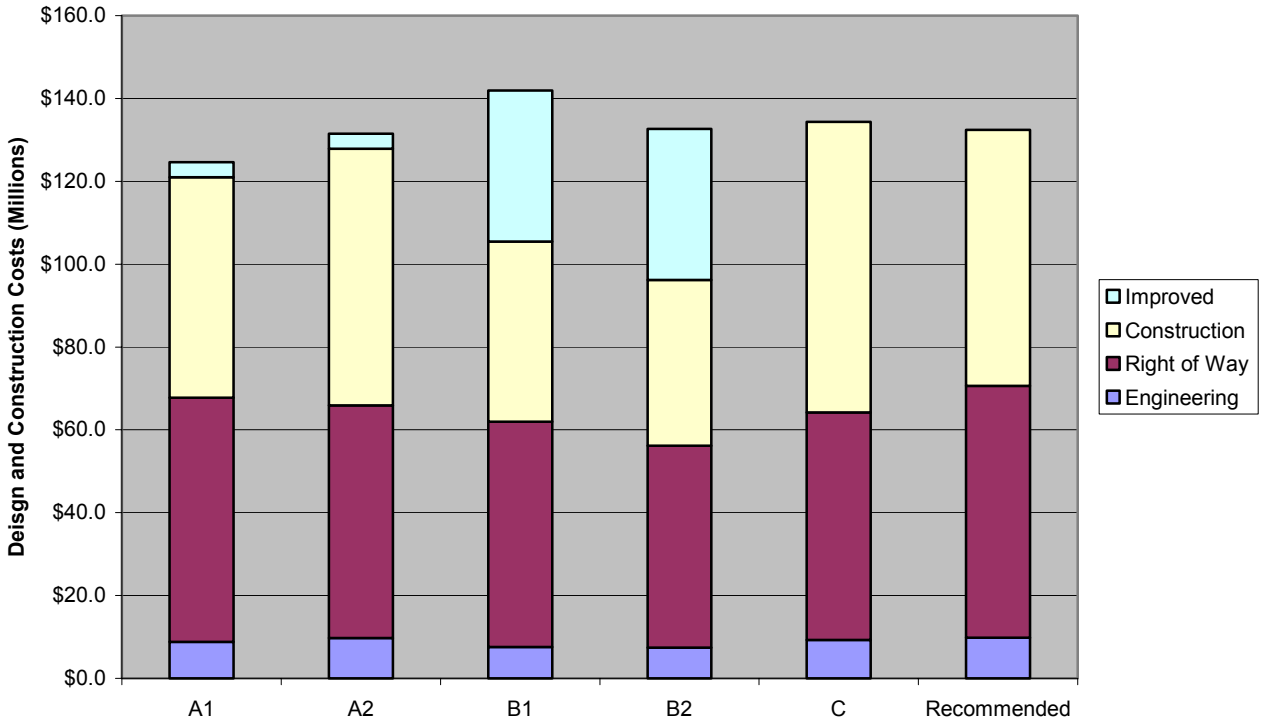
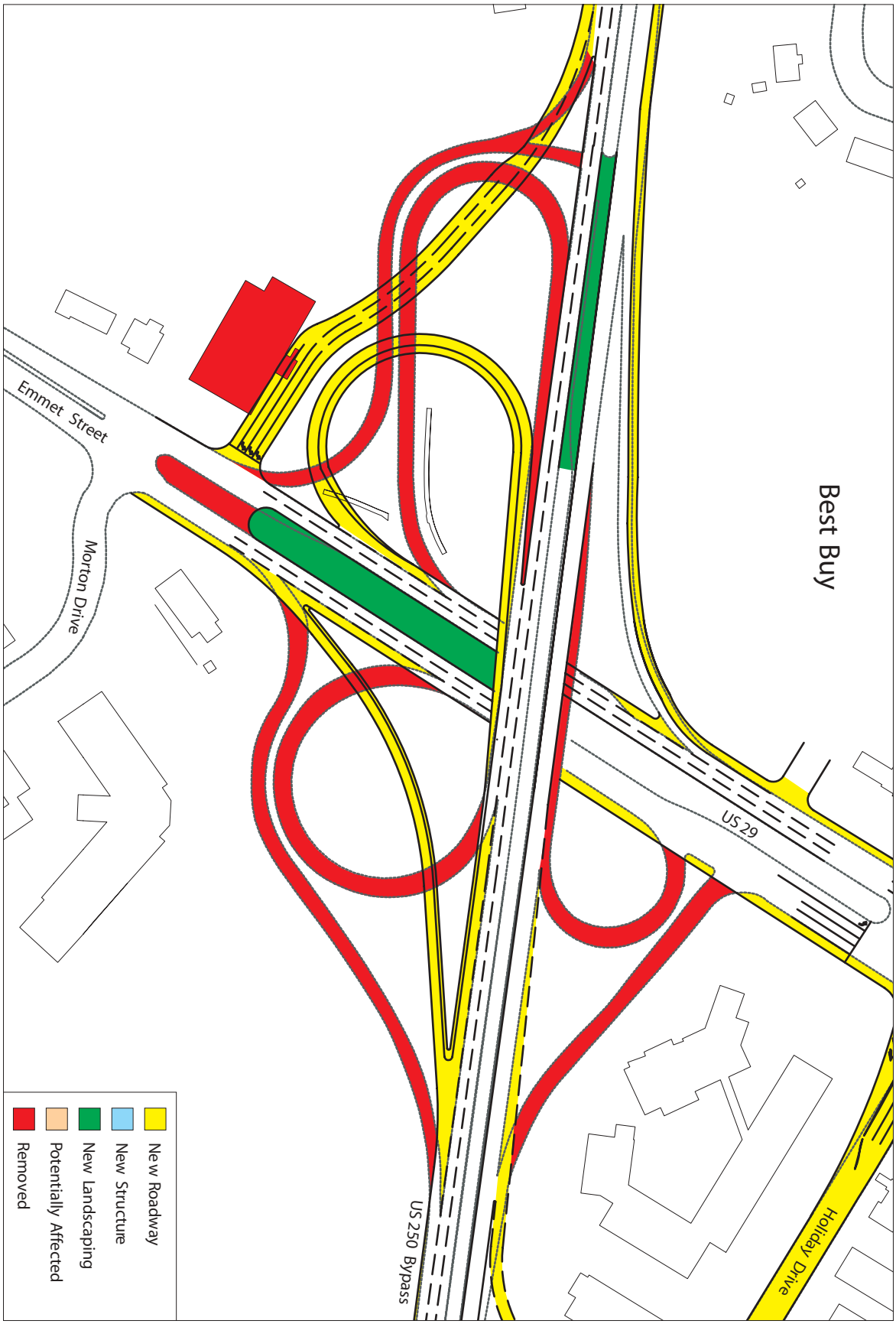
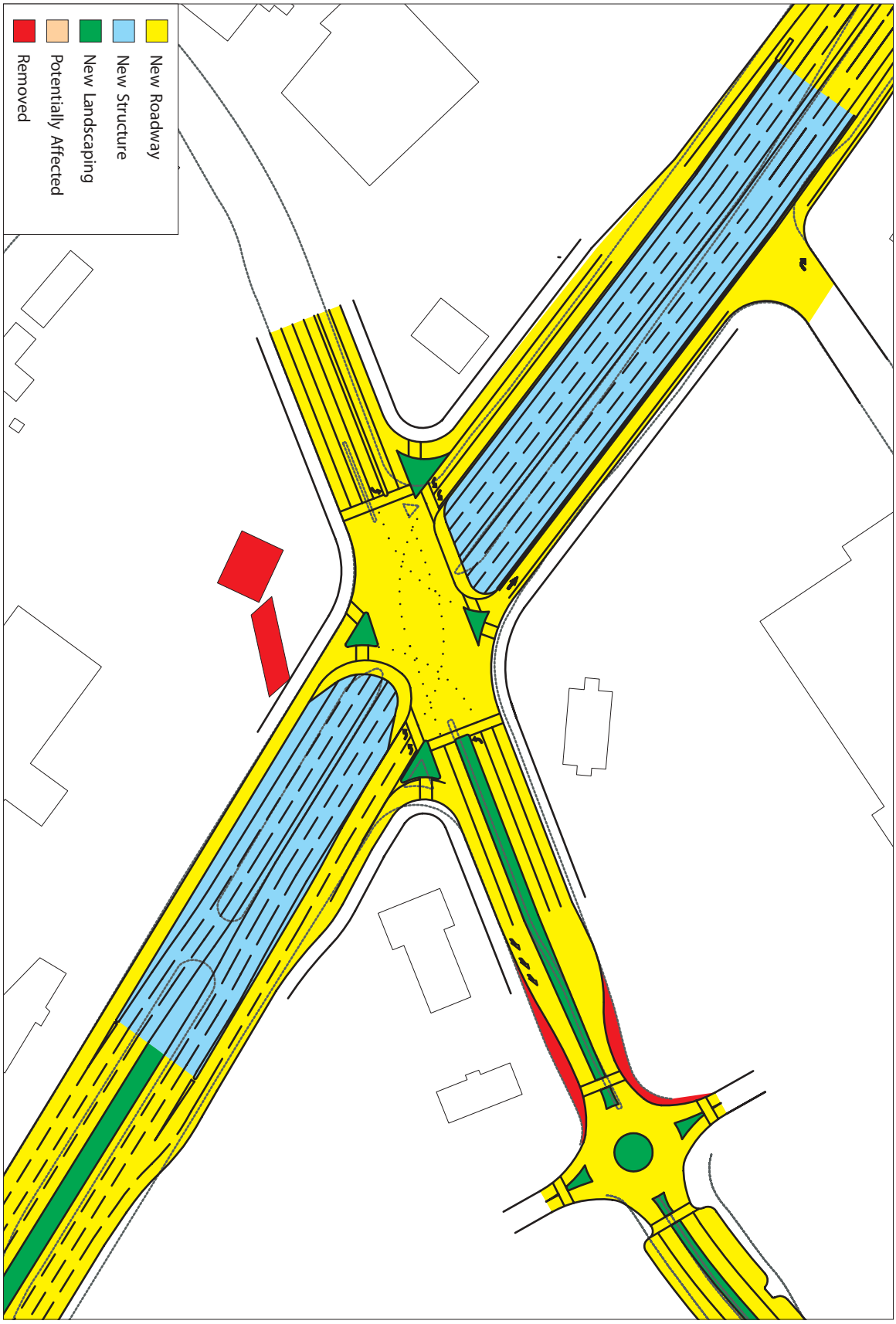


Figure RI-3: Recommended Design for 29 and 250



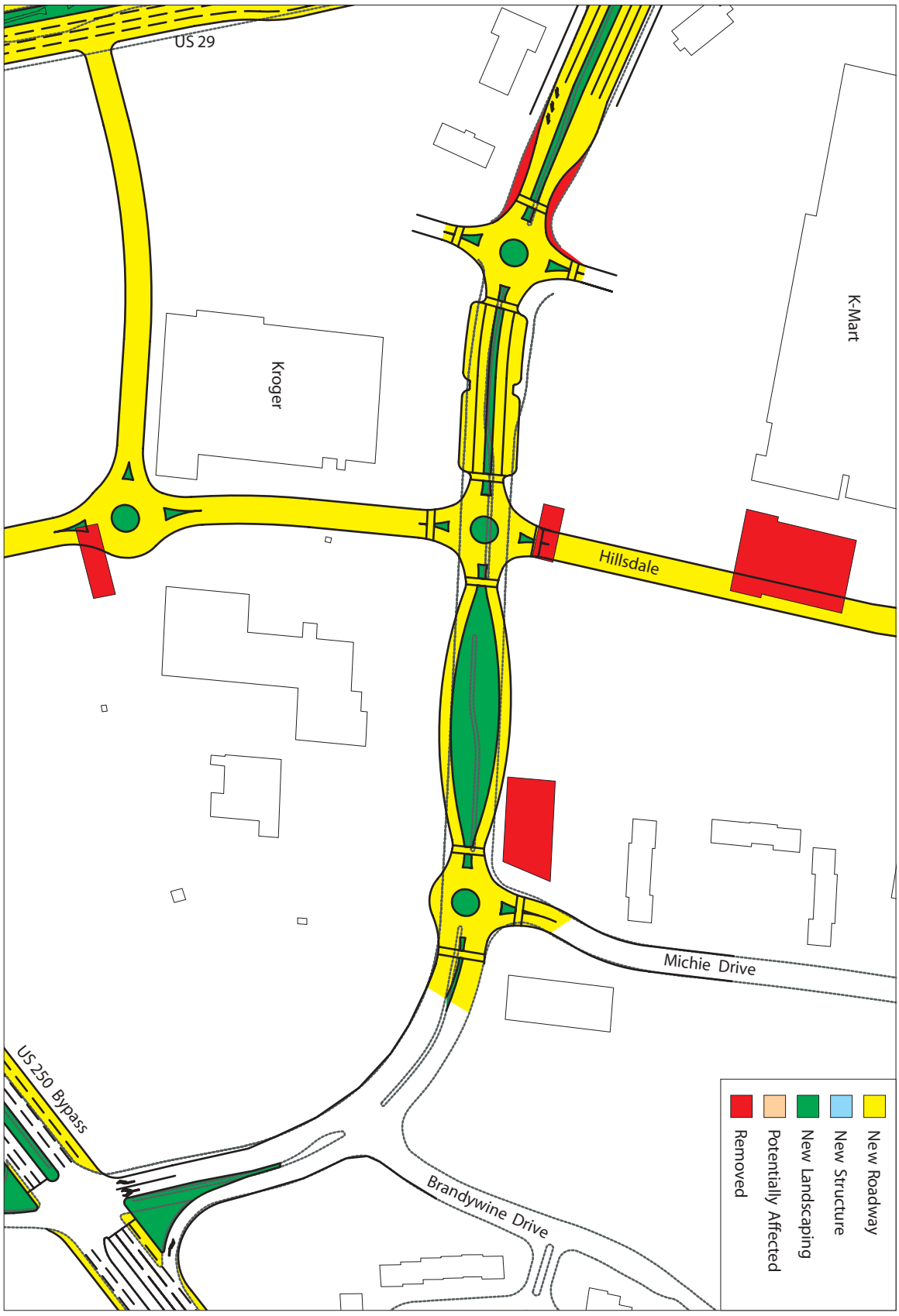
Recommended Design
US 29/250 Interchange Area

Figure RI-4: Recommended Design US 29 at Hydraulic



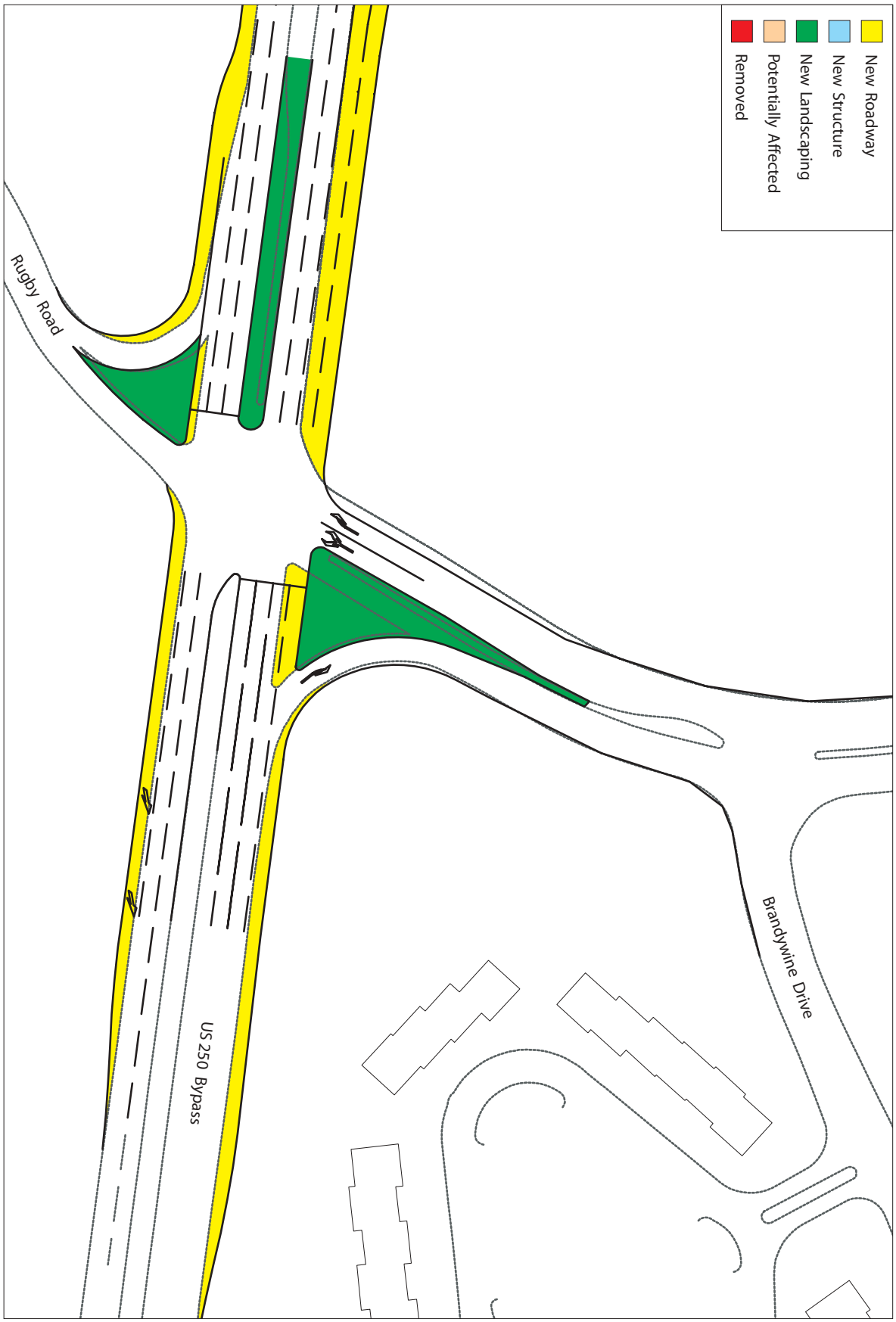
Recommended Design
US 29/Hydraulic Road

Figure RI-5: Recommended Design Hydraulic Road



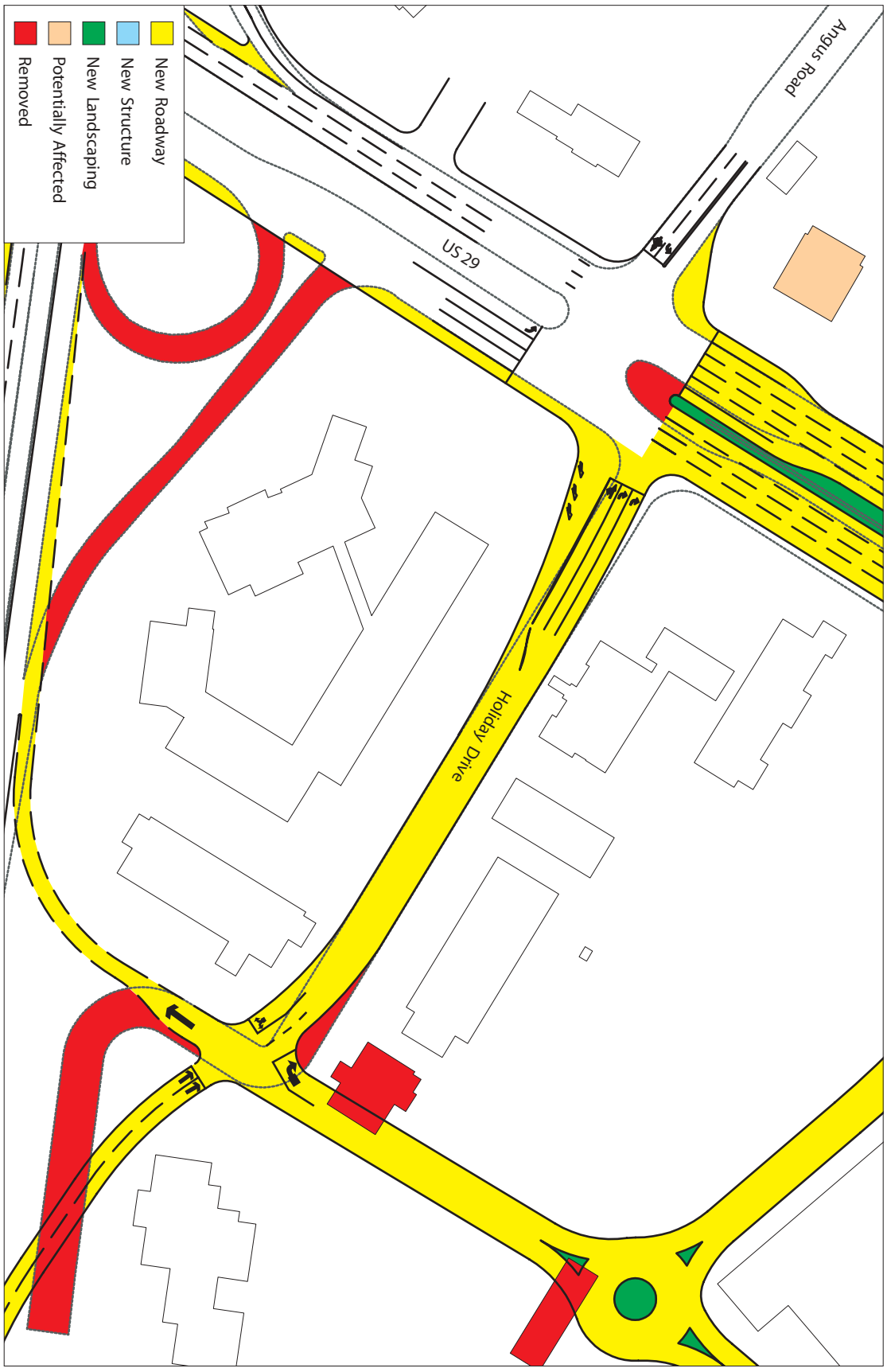
Recommended Design Hydraulic Road

Figure RI-6: Recommended Design Hydraulic at 250



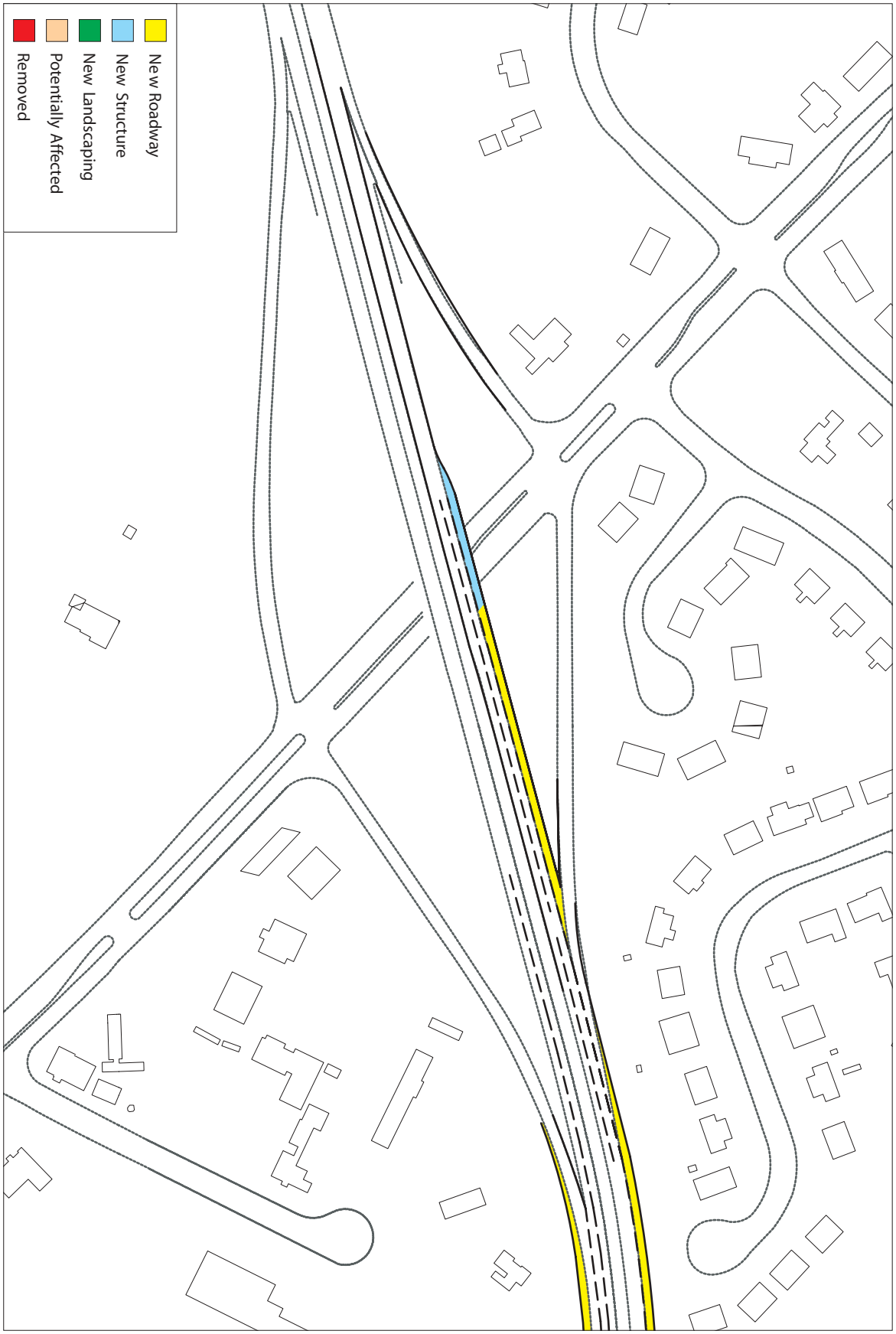
Recommended Design
Hydraulic/250 Interchange Area

Figure RI7: Recommended Design: Holiday Drive



Recommended Design
US 29/Holiday/Angus/250 Interchange Area

Figure RI-8: Recommended Design 250 at Barracks Road



Recommended Design
Barracks/250 Interchange Area

29H250 Phase 2 Project Team

Project Management Team

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Project Coordinator: Rhonda Edmunds

Technical Team

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Thomas Kronemeyer

ZHA, Inc.
Sarah Woodworth, ZHA, Inc.
Don Zuchelli, ZHA, Inc.

Urban Advantage
Steve Price

Study Steering Committee

Community business representatives served on the Study Steering Committee.

Members:
Katy Clossin, City of Charlottesville Economic Development Department
Chuck Lebo, Lebo Commercial Properties, Inc.
Chris Lee, Piedmont Virginia Companies
Leigh Middleditch, 5-Cs
Aubrey Watts, City of Charlottesville Economic Development Department

CHART Citizens Committee

The MPO's CHART Citizens' Committee helped plan and facilitate the public process, identified focus group participants and issues, and reviewed design concepts for presentation at the second public workshop.

Members:
Stephen Bach
Michael Crafaik
Maurice Davis
Mare Hunter
Rachel Lloyd
Shirley Midyette
Cal Morris
Harry Smith
Frank Stoner
Rebecca White
Robert Burke
Jerry Deily
Becky Graves
Peter Kleeman
Ann Mallek
Milton Moore
Will Reily
Sandy Snook
Howard Trail

Supporting Data / Appendices

Portions of these documents are still in progress and will be included in separate cover at a later date.

Volume 1: Alternatives Development and Analysis

- **Future volume development**
- **Traffic operations analyses**
  - Roundabouts
  - Synchro
- **VISSIM simulation**
- **Detailed drawings of Options**
- **Land Use analysis Phasing analysis Cost**

Volume 2: Economic/Fiscal Analysis

- **ZHA findings analysis**

Volume 3: Public Involvement Process and Results

- **Overall process**
- **November ’03 Workshop**
- **February ’04 Workshop**
- **April ’04 Workshop**
- **Other Meetings**