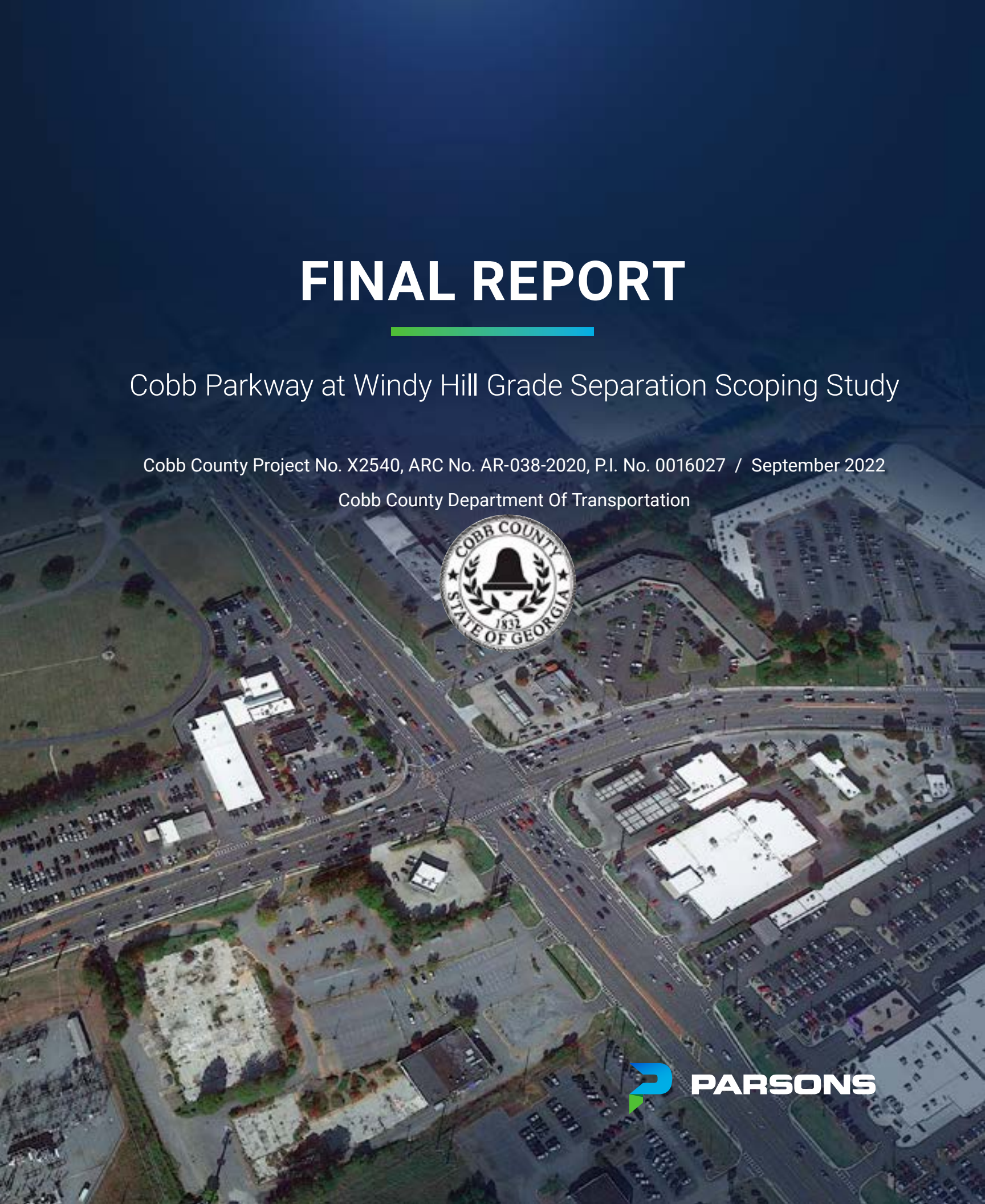
FINAL REPORT

Cobb Parkway at Windy Hill Grade Separation Scoping Study

Cobb County Project No. X2540, ARC No. AR-038-2020, P.I. No. 0016027 / September 2022

Cobb County Department Of Transportation



PARSONS

Table of Contents

List of Figures

List of Tables

List of Appendices

1. EXECUTIVE SUMMARY

The Cobb Parkway at Windy Hill Road Grade Separation scoping study was initiated from recommendation of the recent Cobb County Comprehensive Transportation Plan (CTP) update. Collectively, 10 options were appraised that were variations of four primary concepts. Two of the primary concepts (Single Point Urban Interchange (SPUI) and Continuous Flow Interchange (CFI)) were developed by Arcadis and GDOT, respectfully, during previous studies, while Parsons developed the two additional primary concepts. The Parsons' Flyover Ramp concept is predicated on high east-west travel demand to access the new express lanes interchange at I-75/Terrell Mill Road, something that may not have been fully considered previously.

This report provides an objective method of comparing the various options, including the traffic operations and historic crash analyses that were performed. It includes descriptions and figures and is accompanied by drawings that illustrate each option's layout, typical sections, and profiles for every grade separated alternative.

Project Goal:

Develop a recommended concept that balances between key factors (i.e., traffic operations, cost, safety, etc.). The following ten options, variations of four primary concepts, were evaluated.

- 1A – SPUI including Bridge
- 1B – SPUI including Bridge and Tunnel
- 1C* - SPUI including Bridge and Tunnel with Windy Hill Capacity Improvements
- 2A - Partial CFI on Cobb Parkway
- 2B* - Partial CFI on Cobb Parkway with Windy Hill Capacity Improvements
- 2C – Partial "L-Shaped" CFI on Cobb Pkwy and Windy Hill with Windy Hill Capacity Imp.
- 2D – Single Leg CFI on West Leg of Windy Hill with Windy Hill Capacity Improvements
- 3 – Windy Hill Capacity Improvements
- 4A – Flyover Ramp
- 4B* – Flyover Ramp with Windy Hill Capacity Improvements

An Existing Conditions Analysis was performed, and a comprehensive Existing Conditions Report detailed the findings. Historic traffic counts at the location of the intersection show stagnant or even negative traffic growth for three of the four legs of the intersection. The west leg is the only one to show a positive historic growth rate in the past 20 years, primarily due to population /employment increases

observed in the City of Smyrna as well as with the opening of the Northwest Corridor express lanes on I-75 which are accessed from Terrell Mill Road.

As the traffic analysis progressed, it was determined that Windy Hill Capacity Improvements (Option 3) benefited all options. Accordingly, the best option from each of the other three primary concepts was selected for the detailed comparative analysis (refer to **Table 1**), with each including Option 3's capacity improvements.

Table 1: Final Concept Options

Option	Logical Description
1C	SPUI – Bridge & Tunnel with Windy Hill Capacity Improvements
2B	Partial CFI on Cobb Pkwy with Windy Hill Capacity Improvements
4B	Flyover Ramp with Windy Hill Capacity Improvements

Based on a weighted, comprehensive appraisal, Option 4B, which would provide a multi-span flyover that would allow continuous, uninterrupted movement between Windy Hill Road and Terrell Mill Road as well as capacity improvements along Windy Hill Road west of Cobb Parkway was deemed the best option. It ranked first in four of the ten evaluation categories: Traffic/Network Performance, Pedestrian Safety/Convenience, Impact to Transit and Ease of Construction. Collectively these first-place rankings represent 45% of the total weighting, meaning it ranks first in most of the heavily weighted (10% or greater) categories. It also ranked second in 5 other categories, including ROW/Construction Cost, vehicular safety and property access. While Option 4B has a high price tag, it will provide the best level of service (LOS) in the 2050 Design Year among other comparative advantages including providing improved access to Terrell Mill / I-75 Express Lanes Interchange. A transportation project of the magnitude of Option 4B would likely require a combination of local, state, and federal funding. Since this report introduces Option 4B, there is no current programmed budget to fund these improvements. A phased approach (e.g., ROW acquisition, utility relocation, at-grade improvements) is recommended. The grade-separated improvements could be implemented when the initial widening improvements will no longer provide tenable LOS and peak-hour delays, which is estimated sometime between 2030 and 2035.

2. PROJECT DESCRIPTION

This Final Report is the second principal technical deliverable for the Cobb Parkway (US 41/SR 3) at Windy Hill Road Scoping Study (Cobb County Project No. X2540). It presents to Cobb County Department of Transportation (hereafter referred to as CCDOT) a summary of the concepts considered to relieve congestion, improve operations for all users, and reduce the potential number of future crashes in the vicinity of the signalized Cobb Parkway at Windy Hill Road intersection. This report is supplemented by the previously submitted Existing Conditions Analysis Report (February 2022), which provided a comprehensive summary of the existing conditions, traffic volumes and operations, crash history, future proposed developments, and prior concepts that were considered for the Cobb Parkway / Windy Hill Road intersection and within the study area. This Final Report frequently refers to the Existing Conditions Analysis Report, rather than repeating the previously published background data.

The Cobb Parkway at Windy Hill Road Grade Separation scoping study was initiated from a recommendation of the recent Cobb County Comprehensive Transportation Plan (CTP) update which is seeking to explore alternatives to improve traffic operations and safety at this heavily travelled intersection. In 2017, Cobb Parkway in the northbound approach at Windy Hill Road was identified as the #8 worst bottleneck location (based on INRIX data) within the County's second commission district. By 2018, this approach was ranked #1, and all four directions at this intersection were ranked within the top ten worst bottlenecks in Cobb County.

In addition to long travel delays on all four approaches of this intersection, Cobb County Police Department reported a total of 77 crashes at this location between July 2017 and June 2019. The purpose of this current study is to investigate the feasibility of a proposed grade separation and other potential alternatives to address and mitigate current and future travel needs for all users of this intersection.

The project area lays within three jurisdictional areas (unincorporated Cobb County, City of Marietta, and City of Smyrna). Georgia DOT (GDOT) classifies Cobb Parkway (US 41/SR 3) as a principal arterial with a 45 MPH posted speed. As illustrated in **Figure 1** (Location Map), Cobb Parkway is generally oriented in a north/south direction. It is parallel to and less than one mile west of I-75 and provides an alternate route to the interstate system. Windy Hill Road, which GDOT classifies as a minor arterial with a 35 MPH posted speed, intersects with Cobb Parkway, and then travels east where it crosses over I-75 utilizing a diverging diamond interchange. Cobb Parkway and Windy Hill Road (west of Cobb Parkway) are typically four-lane roads (two lanes in each direction) but expand at intersections to include additional through and/or turn lanes. East of Cobb Parkway, Windy Hill Road is typically a six-lane road (three lanes in each direction). For additional details about the project area, refer to Section 2 of the Existing Conditions Analysis Report.

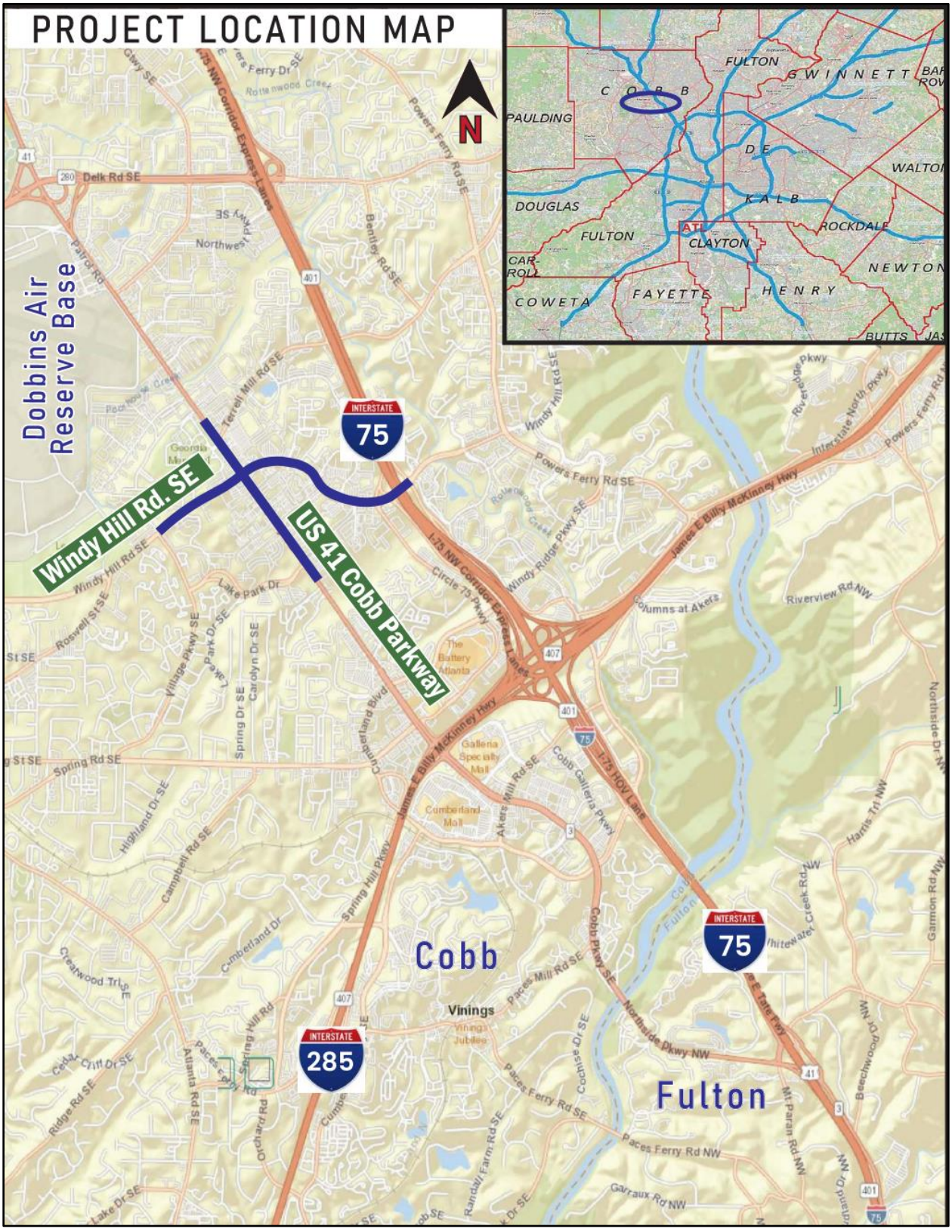


Figure 1: Location Map

3. EXISTING CONDITIONS

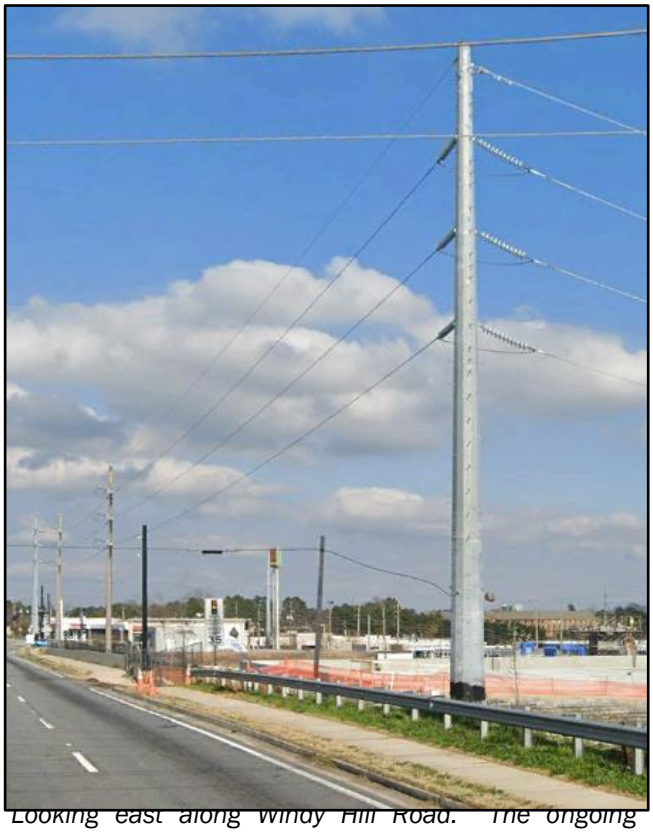
To properly develop solutions to meet the goals of this study, it is crucial to understand the existing conditions of this critical intersection and its surrounding environment. Refer to Section 3 of the Existing Conditions Analysis Report for a discussion of the features within the study area that were considered when new concepts were developed to improve the operation and safety of the Cobb Parkway / Windy Hill Road intersection. Refer to **Figure 2** for a location map that had been presented in the Existing Conditions Analysis Report of major existing topographic and geometric constraints in the vicinity of the Project area.

3.1 Windy Hill Multifamily Project

One of the significant features that will affect the analysis of an optimal concept is the planned Windy Hill Multifamily complex. In February 2021, the Marietta City Council approved the planned 303-unit apartment complex and two commercial buildings that are being constructed in the southwest quadrant of the Cobb Parkway/Windy Hill Road intersection. The high-density project is expected to include about 8,500 square feet of retail or restaurant space and another 7,000 square feet for dedicated apartment amenities, like a swimming pool and fitness center. Construction is ongoing. Refer to **Figure 3** for a site plan and to **Figure 4** for a rendering of the planned development (downloaded from www.bizjournals.com).

On the site plan, the pink indicates where four and five-story apartments are to be built. The two orange buildings are allocated for retail and/or restaurants. The gray color indicates parking areas including a new deck.

One of the constraints that the Windy Hill Multifamily complex will have on the concepts for Windy Hill Road is that the planned apartment buildings restrict the possibility of relocating the existing overhead transmission lines to the south. It is estimated that the lines would need a lateral clearance of at least 26 feet, which would account for potential shifts due to wind gusts. The face of the apartment buildings are approximately 28 feet (estimated by scale from the site plans) from the existing transmission lines. Thus, if there is any widening of Windy Hill Road to the south, the transmission lines would need to either be relocated to the north side of Windy Hill Road or placed underground.



Looking east along Windy Hill Road. The ongoing construction of the Windy Hill Multifamily complex is on the right. Utility plans indicate that the existing transmission lines are to remain in place and spaced approximately 28' (estimated by scale) from the planned multi-story apartment buildings.

Existing Restrictions

1. Georgia Memorial Park (cemetery) located in the northwest quadrant of the intersection is to be avoided to minimize impacts to Section 4(f) resources.
2. Terrell Mill Road intersection with Cobb Parkway is located approximately 1000-ft north of the Cobb Parkway and Windy Hill Road intersection.
3. Windy Hill Road and Cobb Parkway Intersection is offset along both roadways. Additional lanes over the years have resulted in a centerline that varies throughout the corridor.
4. Dobbins ARB has planes flying low within the area and coordination needs to be performed to ensure proper clearance is available after grade separation.
5. Available right-of-way and potential displacements. Windy Hill Road corridor will require displacements to commercial and/or residential properties if additional lanes are added. Cobb Parkway has room to maximize right-of-way footprint without having to require any property displacements.
6. Overhead transmission lines are present on all intersection approaches and a transmission substation is located on the west approach along Windy Hill Road. Any potential alternatives will have some impact on transmission lines, and there are limited locations to relocate without impacting an existing development.
7. City of Marietta Mixed-Use Future Development. The city of Marietta is currently permitting work on mixed-use development that will consists of 303 apartments and some businesses.

Legend

- Overhead Transmission / Electrical Line
- Overhead Transmission Pole
- Bus Lane
- MARTA Bus Stop Locations

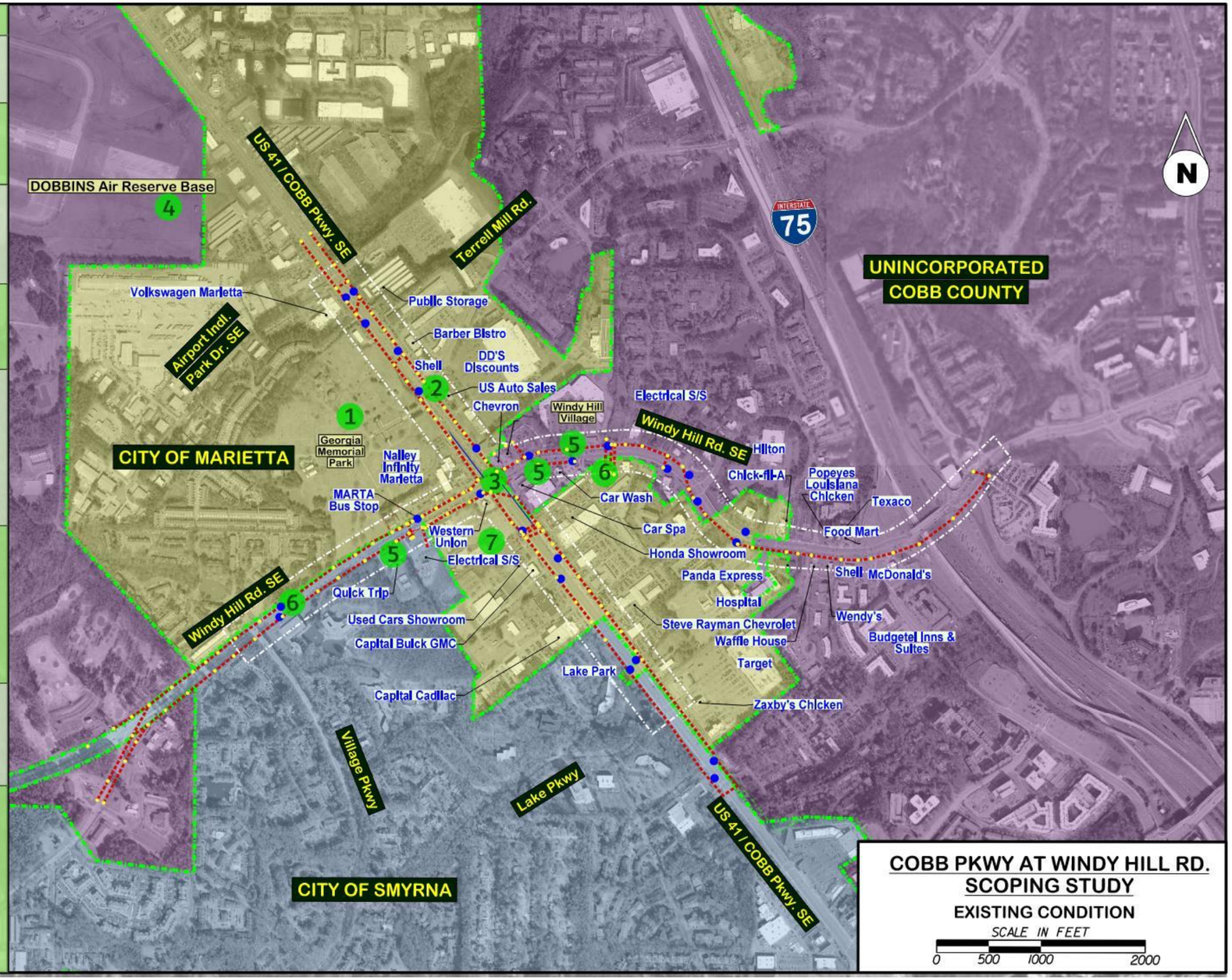


Figure 2: Major Existing Topographic and Geometric Constraints

WINDY HILL MULTIFAMILY		
SITE DATA		
TOTAL DEVELOPMENT, APPROX.	7.7	AC
RETAIL OUTPARCELS	1.53	AC
MULTIFAMILY	6.17	AC
CURRENT ZONING	CRC	
PROPOSED ZONING	PRD	
PARKING VARIANCE REQUIRED		
BUILDING DATA		
RETAIL OUTPARCELS	8,500	SF
LEASING/CLUB/FITNESS	7,000	SF
4/5 SPLIT TYPE VA MULTIFAMILY - 2 BUILDINGS		
TOTAL UNIT COUNT	303	UNITS
AVERAGE HEATED PER UNIT	825	SF
UNIT MIX		
ONE BEDROOM	70%	
TWO BEDROOM	30%	
PARKING DATA		
PARKING VARIANCE REQUIRED		
1.5 SPACES PER UNIT	455	SPACES
TOTAL PARKING REQUIRED	455	SPACES
PARKING PROVIDED		
ONE LEVEL SUP DECK	156	SPACES
SURFACE PARKING	300	SPACES
TOTAL PARKING PROVIDED	456	SPACES
RESIDENTIAL PARKING RATIO	1.50	SP/DU
RETAIL PARKING	78	SPACES
RETAIL PARKING RATIO	9.18	SP/1,000SF

SOUTH CITY PARTNERS

WINDY HILL MULTIFAMILY
MARIETTA, GA
DENSITY STUDY • 12-22-2020
SCP2020-05

DYNAMIK DESIGN

Figure 3: Site Plan of Windy Hill Multifamily Complex

Figure 4: Rendering of Windy Hill Multifamily Complex

4. CONCEPT OPTIONS

4.1 Methodology

The target of the concept selection phase is to develop a geometric design that Cobb County, GDOT and FHWA could agree on, fund and build. As discussed throughout this report, multiple factors were considered while the various options were developed. First and foremost, a concept must appreciably improve the traffic operations of the intersection of Cobb Parkway and Windy Hill Road, which is the Project's primary goal, to be considered viable. But other factors such as safety, improved mobility for all users (pedestrian, bicycle, transit) and access impacts to local businesses and impacts to right-of-way are also important. Impacts to existing utilities, impacts to Dobbins Air Reserve Base, environmental impacts, and constructability were also weighed into consideration. Finally, costs associated with construction, utility relocations and right-of-way are also key factors.

Geometric layouts were developed and refined, resulting in multiple iterations of the same basic concepts, as described in the following subsections. Detailed traffic analyses were conducted to determine the traffic operations of each concept option, as well as their safety implications. Operational and safety impacts to transit users, pedestrians and cyclists were analyzed in tandem with these traffic analyses. Right-of-way and utility impacts and their correlating costs were estimate, as well as the overall construction cost of the options. Environmental impacts were studied and impact minimization was implemented. FAA requirements and consultation with Dobbins staff were utilized in evaluating the impacts to the Air Reserve Base. Right-of-way, utility, environmental, and construction estimating experts were consulted in these studies.

4.2 Concept Option Progression

The process of developing and analyzing potential options has undergone many facets including analysis of earlier concepts (developed by others), brainstorming to generate new ideas, presenting to and incorporating feedback from stakeholders and the public, and concept refinements as the project progressed. As tabulated in **Table 2 and Table 3**, 10 options were appraised that were variations of four primary concepts. As discussed in the Existing Conditions Analysis Report, two of the primary concepts were developed by others during previous studies. Parsons developed two additional primary concepts. Each of these concept options are defined in more detail in later subsections of this chapter, with a summary of the full set provided in the next few paragraphs.

Table 2: Concept Options

Number	Option	Description
1	1A	SPUI including Bridge
2	1B	SPUI including Bridge & Tunnel
3	1C*	SPUI including Bridge & Tunnel with Windy Hill Capacity Improvements
4	2A	Partial CFI on Cobb Pkwy
5	2B*	Partial CFI on Cobb Pkwy with Windy Hill Capacity Improvements

Number	Option	Description
6	2C	Partial "L-Shaped" CFI on Cobb Pkwy and Windy Hill with Windy Hill Capacity Improvements
7	2D	Single Leg CFI on West Leg of Windy Hill with Windy Hill Capacity Improvements
8	3	Windy Hill Capacity Improvements
9	4A	Flyover Ramp
10	4B*	Flyover Ramp with Windy Hill Capacity Improvements

*Selected as a Final Concept Alternative

The initial concepts studied (Options 1A, 1B, 2A and 4A) focused on improvements to Cobb Parkway but did not include capacity improvements to Windy Hill Road. The initial expectation was that capacity issues along Cobb Parkway, a Principal Arterial, were the primary source of traffic delays and crashes rather than along Windy Hill Road or Terrell Mill Road, which GDOT classifies as Minor Arterials. However, based on an early traffic operations evaluation, capacity improvements to Windy Hill Road west of Cobb Parkway (Option 3) were shown to be necessary. Concepts 1A, 2A, 3 and 4A were then presented at the Stakeholder Steering Committee meeting held on February 2, 2022. Feedback from that meeting was incorporated into further refined concepts plus several new concepts.

An initial traffic analysis of Options 1A/1B (which operate similarly), 2A, 3 and 4A concluded that Option 2A would provide a better level of service (LOS) at the intersection of Cobb Parkway and Windy Hill Road than Options 1A/1B, 3, and 4A in the Design Year of 2050. Option 3 would appreciably reduce delays at the Cobb Parkway and Windy Hill Road intersection compared to existing conditions and was not nearly as costly to build as the others (Options 1A, 1B, 2A, and 4A). However, although each option showed significant benefit versus the No-Build condition, none of these concepts (Options 1A, 1B, 2A, 3, and 4A) were forecast to provide an acceptable LOS in the 2050 Design Year. Thus, with the desire to produce the optimal concept that would operate efficiently in 2050, Options 3 and 4A were combined to form Option 4B, which showed early promise of operating satisfactorily in the design year.

At the same time, Options 1A and 1B were inspected in greater detail. Option 1A was found to cost (construction, ROW, and utilities combined) approximately $20 million more than Option 1B. For this reason, despite being considerably easier to construct than Option 1B, Option 1A was no longer progressed as a viable concept. To keep stakeholders and the public focused only on concepts that were considered viable, only Options 1B, 2A, 3 and 4B were presented at the Public Information Open House (PIOH) that was held on March 16, 2022.

Following the PIOH, the focus was to combine the knowledge from the earlier traffic analysis with feedback from the stakeholders and the public to develop and analyze three preferred concepts. Therefore, the focus of the analysis after the PIOH became Options 1C, 2B and 4B that combined Windy Hill west leg capacity improvements with each of the other three primary concepts (i.e., SPUI, CFI, and flyover, respectively).

In early April 2022, a representative of GDOT's Roundabout & Alternative Intersection Design Department requested that an additional option (Option 2C) be investigated. Option 2C would implement

an innovative partial CFI with displaced left turns on the eastbound Windy Hill Road and northbound Cobb Parkway approaches, both of which have the greatest left turn volumes at this intersection.

The three refined options (Options 1C, 2B and 4B) and Option 2C were presented at the Stakeholder Steering Meeting held on April 13, 2022. Although Option 2C appeared to operate reasonably well for vehicular traffic, two distinct disadvantages were raised, which included impacts to transit along Cobb Parkway and potentially hazardous pedestrian movement across the non-stop SB Cobb Parkway to WB Windy Hill Road dual right-turn lanes. To mitigate the transit impacts and allow for safe pedestrian movement, GDOT suggested a new Option 2D be investigated, which would employ a partial CFI with displaced left turns only along Windy Hill Road west of Cobb Parkway and provide a pedestrian overpass across the west leg of Windy Hill Road to mitigate the pedestrian crossing at this location.

Options 1C, 2B, 2D and 4B were presented at the Project Management Team (PMT) Meeting held on April 22, 2022. At that meeting, the draft Concept Evaluation Matrix was also presented that indicated that Option 4B was the highest scoring among the ten evaluated factors. The new concept Option 2D was presented but it required a signalized SB to WB dual right turn, which ended up creating lengthy queues during the peak hours for these two lanes, backing up into southbound Cobb Parkway through lanes. In addition, Option 2D would not include any improvements along Cobb Parkway that would reduce the number of historic crashes, which was one of the project goals. Thus, Option 2D was not considered viable.

Following the April PMT meeting, the project team focused upon refining the best option from each of the three primary concepts (SPUI – Option 1C, CFI – Option 2B and Flyover – Option 4B) that would result in the most favorable evaluation factors (including traffic operations in the 2050 Design Year). These three options along with the other seven (Options 1A, 1B, 2A, 2C, 2D, 3 and 4A) are discussed in the following subsections coupled with drawings that illustrate each option's layout, typical sections, and profiles (for grade separations).

Note that none of the options investigated explicitly incorporate the planned Cobb Parkway Trail (central) Part A from Rottenwood Creek Trail Phase 1 to Windy Ridge Parkway (BP_334), which is on the County's 5-year trail plan, because details of this project are not available. Nevertheless, each option could be modified to incorporate the planned trail. The typical sections of each option include 5-foot sidewalks on both sides of Cobb Parkway. If a sidewalk were to be expanded to a 10-foot multi-use trail, approximately 5 feet of additional ROW would be required. The cost and ROW impacts of the options would increase but the modifications are feasible.

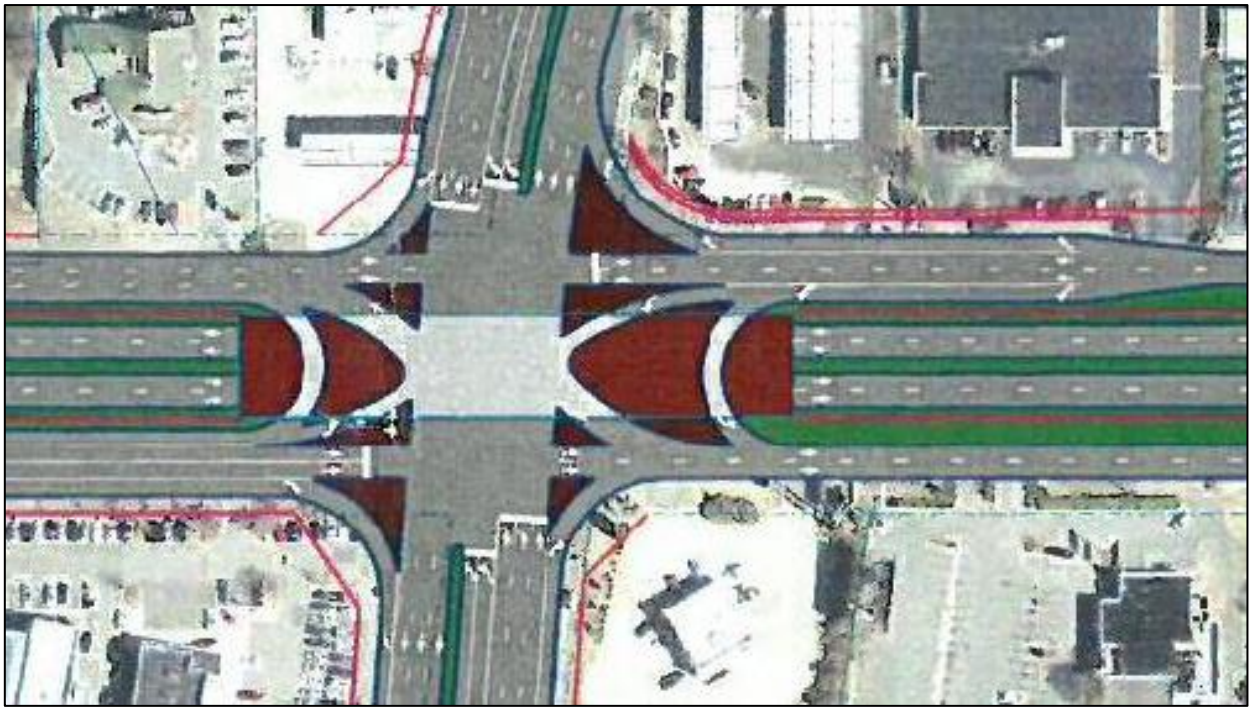
Table 3: Summary of Concepts Evaluated

No.	Option	Description	Prior Concept by Others	Presented at SSC Meeting 2/2/22	Presented at PIOH 3/16/22	Presented at SSC Meeting 4/13/22	Presented at PMT Meeting 4/20/22	Analyzed in Final Report	Cobb Parkway/Windy Hill Intersection LOS E (or better) Design Year 2050	Cobb Parkway/Terrell Mill Intersection LOS E (or better) Design Year 2050
1	1A	SPUI, Cobb Parkway over Windy Hill Road & Terrell Mill Road		✓				✓		✓
2	1B	SPUI, Cobb Parkway under Windy Hill Road & over Terrell Mill Road			✓	✓	✓	✓		✓
3	1C	SPUI, Cobb Pkwy under Windy Hill Road & over Terrell Mill Road, Windy Hill Capacity Improvements	✓					✓		✓
4	2A	Partial Continuous Flow Intersection (CFI) along Cobb Parkway	✓	✓	✓			✓		
5	2B	Partial CFI along Cobb Parkway, Windy Hill Capacity Improvements				✓	✓	✓	✓	
6	2C	Partial CFI along Cobb Parkway and Windy Hill Road and Windy Hill Road Capacity Improvements		✓		✓		✓		✓
7	2D	Partial CFI along Windy Hill Road, Windy Hill Road Capacity Improvements, and Pedestrian Bridge		✓			✓	✓	✓	✓
8	3	Windy Hill Capacity Improvements		✓	✓			✓		✓
9	4A	Flyover Ramp (Windy Hill Road to/from Terrell Mill Road)		✓				✓		✓
10	4B	Flyover Ramp (Windy Hill Road to/from Terrell Mill Road), Windy Hill Road Capacity Improvements			✓	✓	✓	✓	✓	✓

4.3 Primary Concept 1 – Single-Point Urban Interchange (SPUI)

Primary Concept 1 is a variation of Prior Concept 1, which Arcadis developed and is discussed in the Existing Conditions Analysis Report. It converts Cobb Parkway's intersections with Windy Hill Road and Terrell Mill Road into modified single-point urban interchanges (SPUIs) that are connected by frontage roads.

Prior Concept 1 proposed that Cobb Parkway's northbound and southbound through lanes are depressed under an at-grade intersection with Windy Hill Road and elevated over an at-grade intersection with Terrell Mill Road. Prior Concept 1 also includes capacity improvements along Windy Hill Road west of Cobb Parkway.



Prior Concept 1 – Cobb Parkway / Windy Hill Road SPUI (Cobb Parkway under at-grade Windy Hill Road)

SPUIs are typically favorable choices in densely developed urban environments with high-priced ROW because they are compact, relatively safe and accommodate high traffic volumes. The frontage roads would retain the at-grade commercial driveway access and serve the CobbLinc bus routes along Cobb Parkway. The bridges would be supported by hammer-head pier columns placed to minimize visual disruption for any drivers on the at-grade level. Retaining walls are needed north, south and between the bridges to support the elevated portion of Cobb Parkway.

One of the major benefits of the frontage roads is that they would separate the Cobb Parkway through lanes from the turbulence caused by the multiple right-in/right-out commercial driveways. These driveways likely contribute to the large number of collisions and poor traffic operations of Cobb Parkway. However, the frontage roads would negate one of the primary advantages of SPUIs by requiring four signal phases at the Windy Hill Road and Terrell Mill Road intersections instead of the typical three phases at conventional SPUI intersections.

The proposed at-grade Windy Hill Road intersection would allow simultaneous left turn movement on both Cobb Parkway and Windy Hill Road. U-turn lanes would be provided along Cobb Parkway.

Both frontage roads would originate and terminate beyond existing signalized intersections. The frontage roads begin and end south of the signalized Cobb Parkway/Airport Industrial Park Drive intersection, and north of the Cobb Parkway/Lake Park Drive intersection. Overhead signage is required to give advanced notice of the frontage roads to mitigate the possibility of unsafe maneuvers by unfamiliar motorists.

Where Cobb Parkway returns to grade, it may be necessary to have additional coordinated traffic signals to enable traffic on the frontage roads to safely merge with the NB and SB through lanes on Cobb Parkway. Motorists along Cobb Parkway might not anticipate the signalized stops while descending from the bridge or ascending from the underpass, which carries a risk of rear-end and side-swipe collisions. This situation would be most pronounced at the Airport Industrial Road intersection north of Terrell Mill, where significant truck traffic wishes to enter the NB left turn lane from the NB frontage road, with little room to perform this merging operation.

Most of the wider footprint needed for the Cobb Parkway improvements for the SPUI option would be constructed within the clear space located between Cobb Parkway and the existing ROW. However, additional ROW and easements would be required on several properties east and west of Cobb Parkway to enable the existing number of through and turn lanes, using temporary pavement, to remain operational while the permanent grade separated through lanes are built. The widening and grade-separating of Cobb Parkway would conflict with existing underground and overhead utilities including transmission lines, which must be relocated. The overhead electrical lines must be diverted to avoid conflicting with both the permanent and temporary pavement.

Variations of Primary Concept 1 that were considered are further discussed in Sections 4.3.1, 4.3.2, and 4.3.3.

4.3.1 Option 1A – SPUI (Cobb Parkway over Windy Hill Road and Terrell Mill Road)

Option 1A, which is a variation of Prior Concept 1's improvements along Cobb Parkway, includes separate bridges to carry Cobb Parkway's northbound and southbound through lanes over the at-grade intersections with Windy Hill Road and Terrell Mill Road, which are spaced approximately 1,100 feet apart. Option 1A, like Option 1B, does not include any widening along Windy Hill Road. Refer to **Figure 5** for a layout and typical sections of Option 1A. Refer to **Figure 6** for Option 1A's profile of Cobb Parkway.

Both frontage roads would originate and terminate just beyond existing signalized intersections. The frontage roads begin and end approximately 200 feet south of the signalized Cobb Parkway/Airport Industrial Park Drive intersection, and 200 feet north of the Cobb Parkway/Lake Park Drive intersection. Overhead signage is required to give advanced notice of the frontage roads to mitigate the possibility of unsafe maneuvers by unfamiliar motorists.

The proposed at-grade Windy Hill Road intersection would allow simultaneous left turn movement on both Cobb Parkway and Windy Hill Road. U-turn lanes would be provided along Cobb Parkway. All improvements are limited to Cobb Parkway.

One of the most complex and costly aspects of Option 1A is the required relocation of overhead electrical transmission and distribution lines that are adjacent to Cobb Parkway and which cross Cobb Parkway at six locations. At these locations, the electrical lines would need to either be raised by approximately 30 feet to cross over the elevated Cobb Parkway or lowered to cross Cobb Parkway below grade. If the electric lines are raised, the taller poles and higher lines might encroach above the 50:1 obstruction zone from the Dobbins Air Reserve Base runway and, consequently, would require FAA approval. Moreover, additional poles downstream and upstream would also have to be raised. If the electric lines are lowered, they would need to be placed in concrete duct banks. Both alternatives for electric lines crossing Cobb Parkway appreciably increase the cost of Option 1A.

Option 1A was investigated as a possible alternative to Options 1B (Prior Concept 1 without Windy Hill Road capacity improvements) and 1C (i.e., Prior Concept 1), which are more complicated and time-consuming to construct and would impose a burden on the public due to nighttime and weekend closures while the walls and top slab of the underpass under Windy Hill Road are built. Nevertheless, although Option 1A has an identical at-grade lane configuration and, therefore, would operate as efficiently and safely as Option 1B, Option 1A is estimated to cost approximately $20 million more than Option 1B. Furthermore, Option 1A's elevated Cobb Parkway over Windy Hill Road would have greater noise and visual impacts as compared to Options 1B and 1C. In addition, the highest elevation along Cobb Parkway of Option 1A is about 25 feet higher than the highest elevation of Options 1B or 1C. The higher Cobb Parkway profile and long 6% upgrade would impose added user costs (i.e., gas) and traffic emissions. Finally, without improvements to Windy Hill Road, the Cobb Parkway / Windy Hill Road intersection would not operate at an acceptable LOS in the 2050 Design Year. For these reasons, Option 1A is not considered viable.

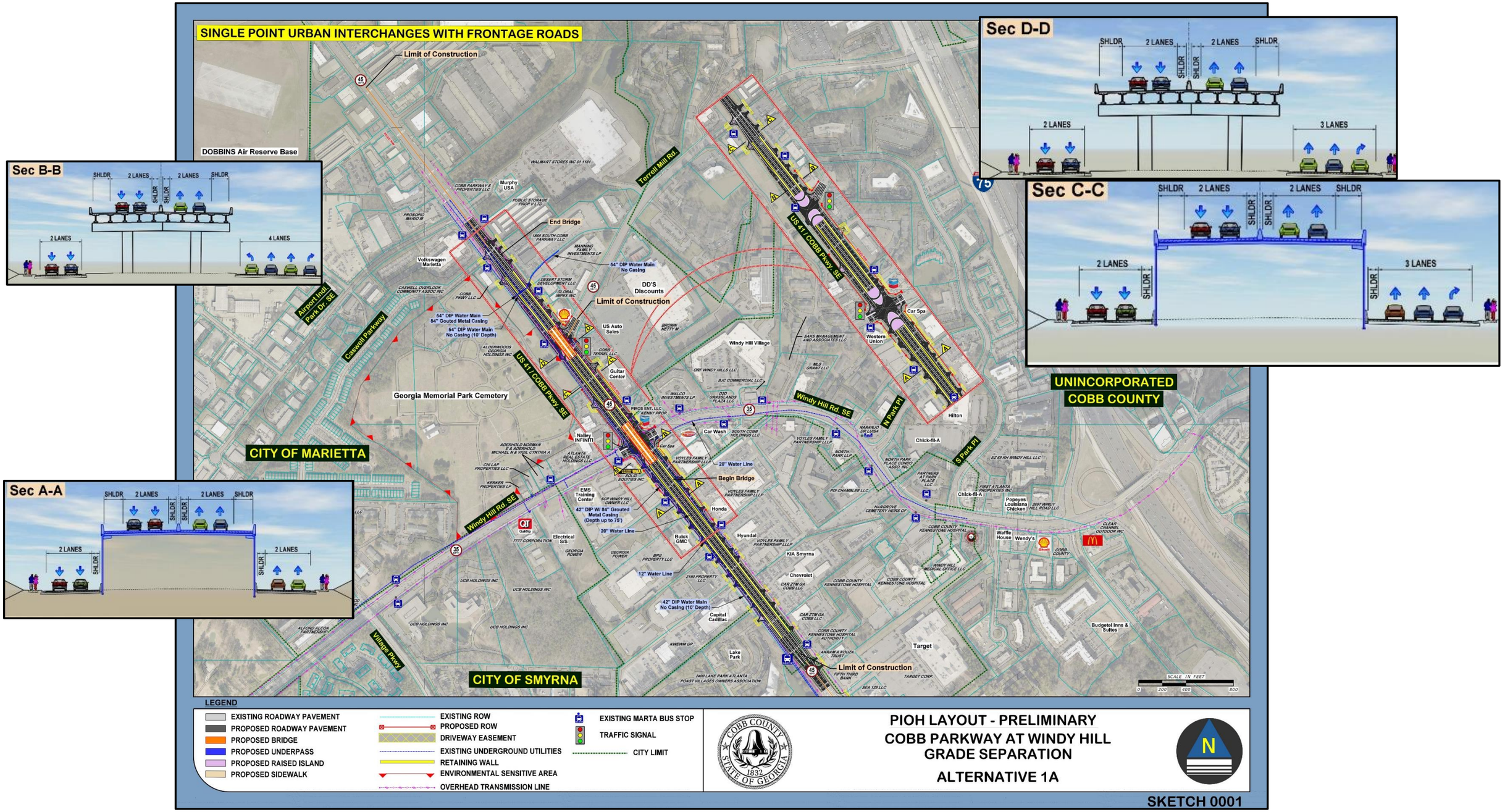
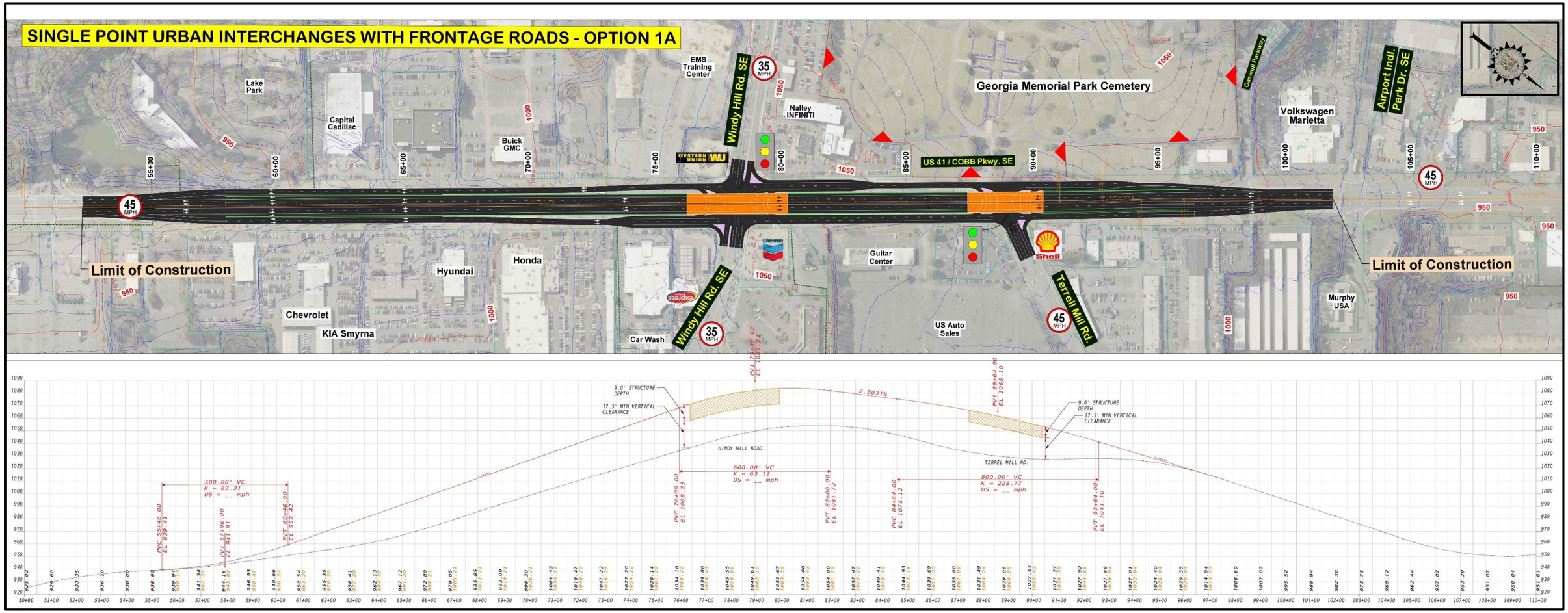


Figure 5: Option 1A Layout and Typical Sections



EXISTING ROADWAY PAVEMENT

PROPOSED ROADWAY PAVEMENT

PROPOSED BRIDGE

PROPOSED RAISED ISLAND

PROPOSED SIDEWALK

Figure 6: Option 1A Cobb Parkway Profile

4.3.2 Option 1B - SPUI (Cobb Parkway under Windy Hill Road and over Terrell Mill Road)

Option 1B, like Option 1A, converts Cobb Parkway's intersections with Windy Hill Road and Terrell Mill Road into modified SPUIs that are connected by frontage roads. The primary difference between the two options is that Option 1B proposes that Cobb Parkway's northbound and southbound through lanes are depressed under an at-grade intersection with Windy Hill Road. Like Option 1A, Option 1B is a refinement of Prior Concept 1 to include the necessary additional turn lanes to account for changes in the road configuration and increases in traffic volumes since Prior Concept 1 was developed in 2012. Refer to **Figure 7** for a layout and typical sections of Option 1B. Refer to **Figure 9** for Option 1B's profile of Cobb Parkway.

Like Option 1A, without improvements to Windy Hill Road, the Cobb Parkway/Windy Hill Road Intersection, Option 1B would not operate at acceptable LOS (AM and PM Peaks) in the Design Year 2050. For this reason, Option 1B is not considered viable.

Nevertheless, the use of SPUIs was still considered a possible option to improve the operation and safety of the Cobb Parkway / Windy Hill Road intersection. Accordingly, as discussed in **Section 4.3.3**, the Windy Hill capacity improvements (Option 3) were added to Option 1B to form Option 1C.

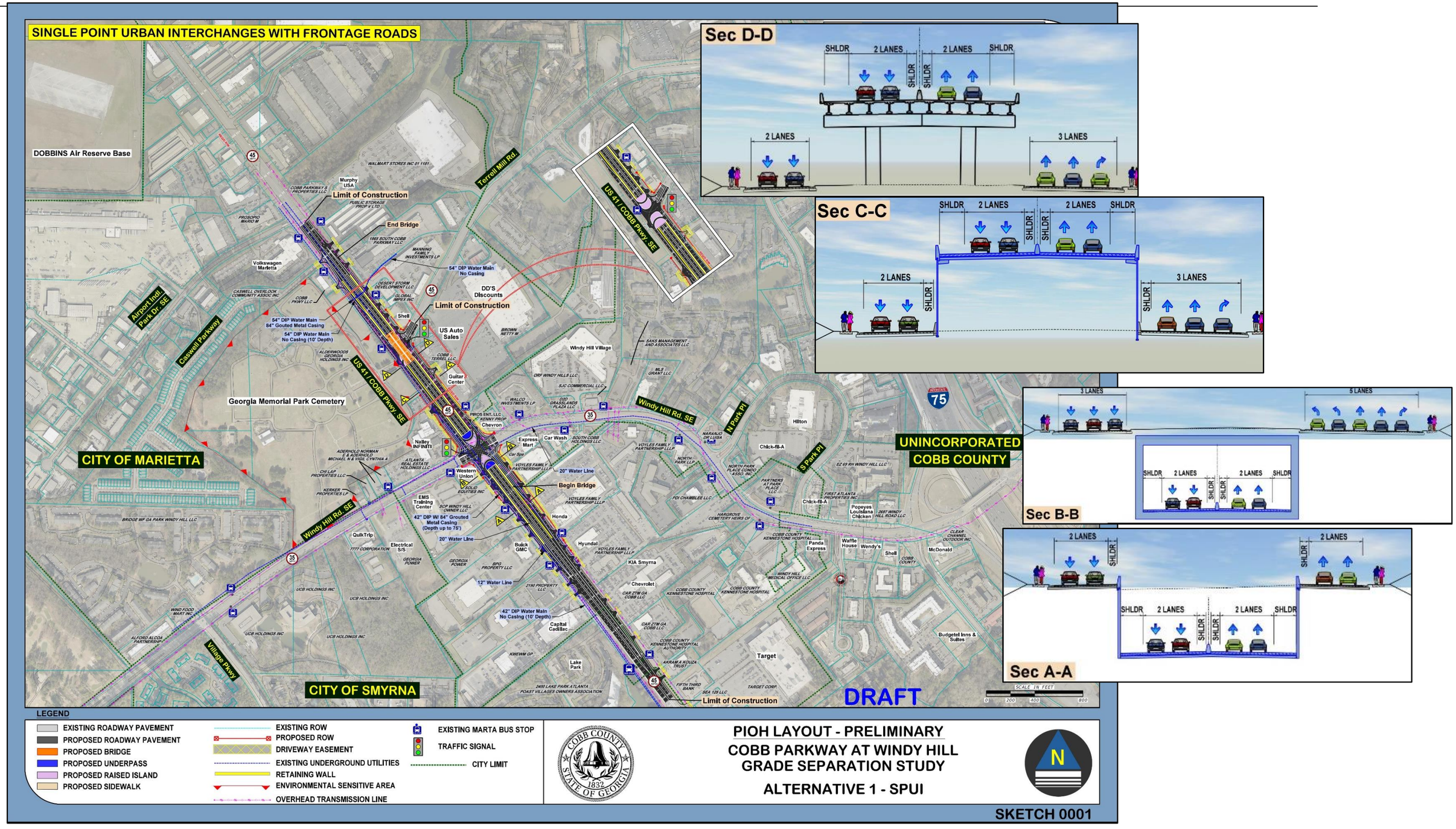

SINGLE POINT URBAN INTERCHANGES WITH FRONTAGE ROADS
DOBBINS Air Reserve Base
CITY OF MARIETTA
CITY OF SMYRNA
UNINCORPORATED COBB COUNTY
Georgia Memorial Park Cemetery
Limit of Construction
End Bridge
Begin Bridge
Terrell Mill Rd.
Windy Hill Rd. SE
US 41 / COBB Pkwy. SE
Airport Indl Park Dr. SE
Caswell Parkway
Village Pkwy
N Park Pl
S Park Pl
54" DIP Water Main No Casing
54" DIP Water Main 84" Gouted Metal Casing
54" DIP Water Main No Casing (10' Depth)
42" DIP W/ 84" Grouted Metal Casing (Depth up to 75')
42" DIP Water Main No Casing (10' Depth)
20" Water Line
12" Water Line
Murphy USA
Volkswagen Marietta
DD'S Discounts
US Auto Sales
Shell
Guitar Center
Chevron
Express Mart
Car Wash
Nalley INFINITI
Western Union
EMS Training Center
QuikTrip
Electrical S/S
Buick GMC
Honda
Hyundai
KIA Smyrna
Chevrolet
Capital Cadillac
Windy Hill Village
Hilton
Chick-fil-A
Popeyes Louisiana Chicken
Panda Express
Waffle House
Wendy's
McDonald
Budgetel Inns & Suites
Target
Lake Park
Sec D-D
SHLDR
2 LANES
3 LANES
Sec C-C
Sec B-B
5 LANES
Sec A-A
SCALE IN FEET
0 200 400 800
DRAFT
LEGEND
EXISTING ROADWAY PAVEMENT
PROPOSED ROADWAY PAVEMENT
PROPOSED BRIDGE
PROPOSED UNDERPASS
PROPOSED RAISED ISLAND
PROPOSED SIDEWALK
EXISTING ROW
PROPOSED ROW
DRIVEWAY EASEMENT
EXISTING UNDERGROUND UTILITIES
RETAINING WALL
ENVIRONMENTAL SENSITIVE AREA
OVERHEAD TRANSMISSION LINE
EXISTING MARTA BUS STOP
TRAFFIC SIGNAL
CITY LIMIT
COBB COUNTY STATE OF GEORGIA 1832
PIOH LAYOUT - PRELIMINARY
COBB PARKWAY AT WINDY HILL GRADE SEPARATION STUDY
ALTERNATIVE 1 - SPUI
N
SKETCH 0001

Figure 7: Option 1B Layout and Typical Sections

4.3.3 Option 1C - SPUI (Cobb Parkway under Windy Hill Road and over Terrell Mill Road) and Windy Hill Road Capacity Improvements

Option 1C, like Options 1A and 1B, converts Cobb Parkway's intersections with Windy Hill Road and Terrell Mill Road into modified SPUIs that are connected by frontage roads. It is a refinement of Prior Concept 1 to include the necessary additional turn lanes to account for changes in the road configuration and increases in traffic volumes since Prior Concept 1 was developed in 2012. The following are the key differences between Options 1A, 1B and 1C.

- Unlike Options 1A and 1B, Option 1C expands Windy Hill Road from two to three through lanes in each direction across and west of Cobb Parkway. Refer to **Figure 8** for a layout and typical sections of Option 1C.
- Unlike Option 1A but similar to Option 1B, Option 1C proposes Cobb Parkway's northbound and southbound through lanes be depressed under an at-grade intersection with Windy Hill Road. Refer to **Figure 9** for Option 1C's profile of Cobb Parkway.

Option 1C includes an underpass to convey the Cobb Parkway through lanes under Windy Hill Road. In accordance with National Fire Protection Association (NFPA) standard 502 (Standard for Road Tunnels, Bridges, and other Limited Access Highways), an underpass is deemed to be a tunnel if the length of the continuous cover exceeds 300 feet. It would then require a standpipe for firefighting and a traffic control system to prevent and/or redirect traffic from entering the tunnel during emergencies. The tunnel design would also require a computational fluid dynamics (CFS) analysis to ensure emergency ventilation. These requirements could be avoided by constructing the SPUI with separate bridges for the Windy Hill Road crossing and the two U-turns.

The bridge over Terrell Mill Road would be supported by hammer-head pier columns placed to minimize visual disruption for drivers on the at-grade level. To minimize ROW impacts, retaining walls are proposed south of Windy Hill Road, between Windy Hill Road and Terrell Mill Road, and north of the bridge over Terrill Mill Road.

Option 1C
Single-Point Urban Interchange (Cobb Parkway under Windy Hill Road and over Terrell Mill Road) and Windy Hill Road Capacity Improvements

Key Advantages (vs. Options 2B and 4B)

- Highest estimated annual savings ($3.6 million) from future potential crash reductions
- No significant environmental impacts. However, elevated structure results in noise, visual impacts, greater number of lanes on Windy Hill may increase peak hour noise, ROW required from electrical substation property, which is eligible for listing in National Register of Historic Resources.
- Considered more optimal to Options 2B and 4B for pedestrian convenience and safety.

Key Disadvantages (vs. Options 2B and 4B)

- **Cobb Parkway/Windy Hill Road intersection would not operate at acceptable LOS during the PM Peak Period in the 2050 Design Year.**
- Highest construction/ROW cost ($150.4 million).
- Significant impact on transit users' transfer activities (4 transit stop pairs) and walking distance (300 feet)
- Grade change could impact imaginary approach surface (50:1) to Dobbins ARB.
- 16 driveways and 7 land parcels impacted.
- Highest utility relocation cost ($15.0 million).
- Complex construction - Requires construction of new temporary pavement to maintain existing lanes on Cobb Parkway while new lanes are built, overhead construction of bents and girders above operating intersection, significant staging to maintain traffic at Cobb/Windy Hill intersection, shoring and multiple stages anticipated, night and weekend lane closures.

One of the key factors that would influence the viability of Option 1C is whether a "top-down" or "bottom-up" method would be used for the construction of the underpass beneath Windy Hill Road. "Bottom-up" construction is a practical and cost-effective approach to build a cut–and-cover underpass when there is sufficient ROW available to divert traffic and utilities, and to construct an independent containment/support system. "Top-down" tunnel construction is necessary where there is not sufficient ROW to accommodate the temporary traffic, utilities, and an independent containment outside the permanent roadway cross-section.

Due to the tight ROW constraints, it is assumed that the "top-down" approach would be used to build the underpass. Weekend and nighttime lane reductions and closures would be required to enable the construction of the top slab of the underpass. During the construction period, the pavement of the closed lanes would need to be temporarily removed to build the underpass's walls and its top. The top of the underpass would need to be as much as eight feet below grade to allow for utility crossings and full-depth pavement. The estimated 30-month construction period of Option 1C is longer than the estimated construction period for Option 2B.

One of the advantages of Options 1B and 1C in comparison to Option 1A is that the lower Cobb Parkway profile would enable the southbound frontage road to merge into Cobb Parkway approximately 1,000 feet sooner (i.e., the southbound frontage road is approximately 1,000 feet shorter). Furthermore, Options 1B's and 1C's lower Cobb Parkway profile would have less noise and visual impacts and would impose less user costs (i.e., gas) and traffic emissions than Option 1A. Another advantage of Options 1B and 1C is that the depressed Cobb Parkway would not conflict with the existing overhead electrical transmission lines that cross Cobb Parkway just south of Windy Hill Road.

The only potential property displacement would be the existing Chevron station that is in the northeast quadrant of the Cobb Parkway/Windy Hill Road intersection. Whenever ROW from an existing gas station is procured, there would be a risk that hazardous material (petroleum) potentially leaking from the existing tanks would need to be removed and disposed.

If Option 1C were to be modified to allow for a future BRT along Cobb Parkway, it is assumed that the dedicated BRT lanes would be aligned along the outside edge of pavement on the ramps and frontage roads. Although an outside BRT alignment would not be as safe and efficient as a median alignment, all costs and ROW impacts to implement it could be deferred to the future. The cost to allow for future median BRT lanes is considered prohibitive and unfeasible from a user-convenience viewpoint. If Option 1C is to allow for future median BRT lanes, the tunnel under Windy Hill Road would need to be built at least 24 feet (i.e., two 12-foot lanes) wider, which would increase the width and cost of the tunnel and require additional ROW along Cobb Parkway north and south of Windy Hill Road. Also, the bridge over the Terrell Mill Road would need to be installed with enough height clearance to allow future widening. Furthermore, median bus stations would need to be built at least 800 feet north of the Terrell Mill Road intersection and 500 feet south of the Windy Hill Road intersection where the Cobb Parkway through lanes are at grade. These distances would make a median BRT impractical for most transit users.

From a traffic operations perspective, Option 1C is superior to Options 1A and 1B. The Cobb Parkway / Windy Hill Road intersection would operate at an acceptable LOS during the AM Peak Hour in the 2050 Design Year and is anticipated to fail as early as 2040. In addition, the Cobb Parkway / Terrell Mill Road intersection would also operate better. Nevertheless, despite the Option 1C improvements, the Cobb Parkway / Windy Hill Road intersection would operate at LOS F during the PM Peak Hour during the 2050 Design Year.

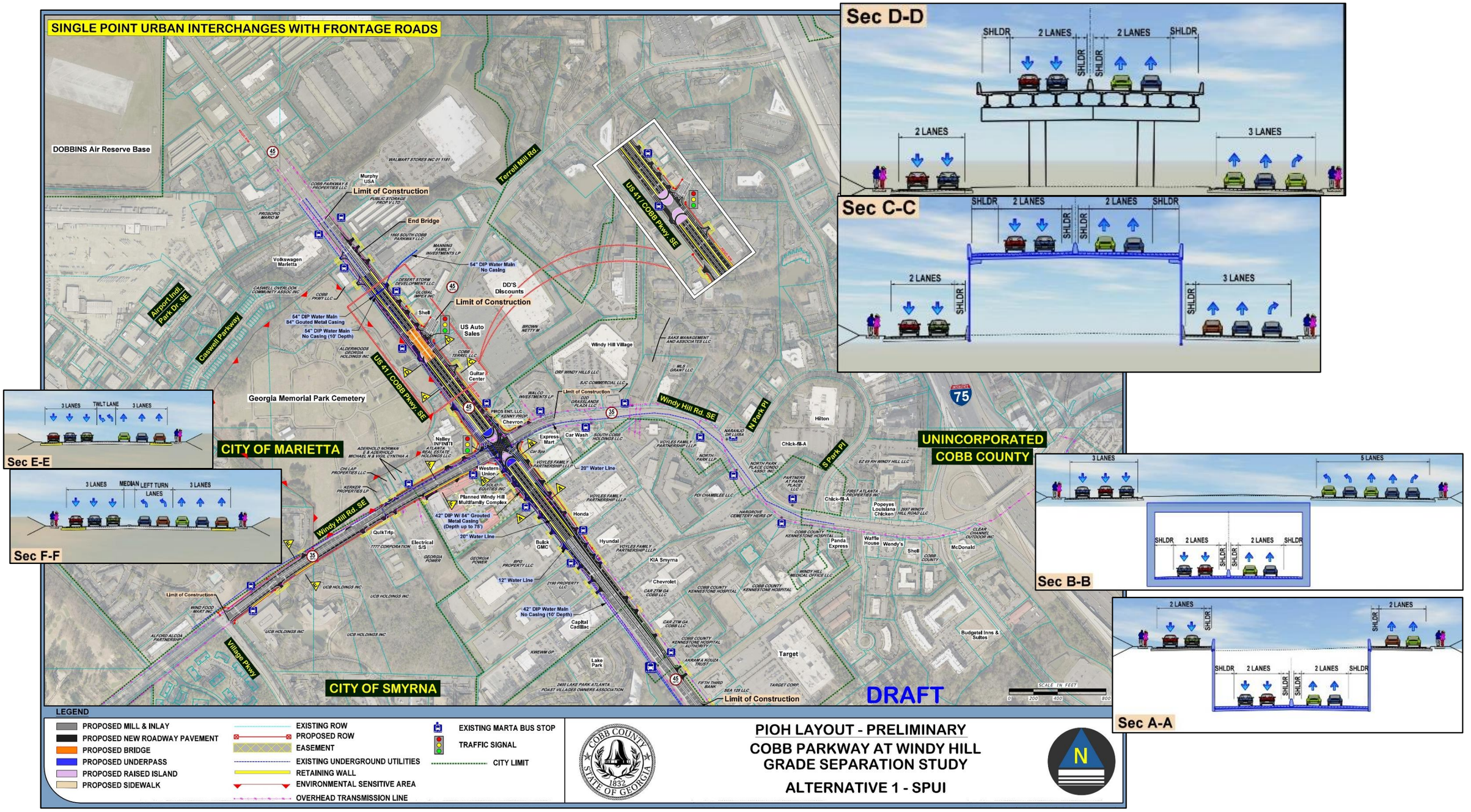


Figure 8: Option 1C Layout and Typical Sections

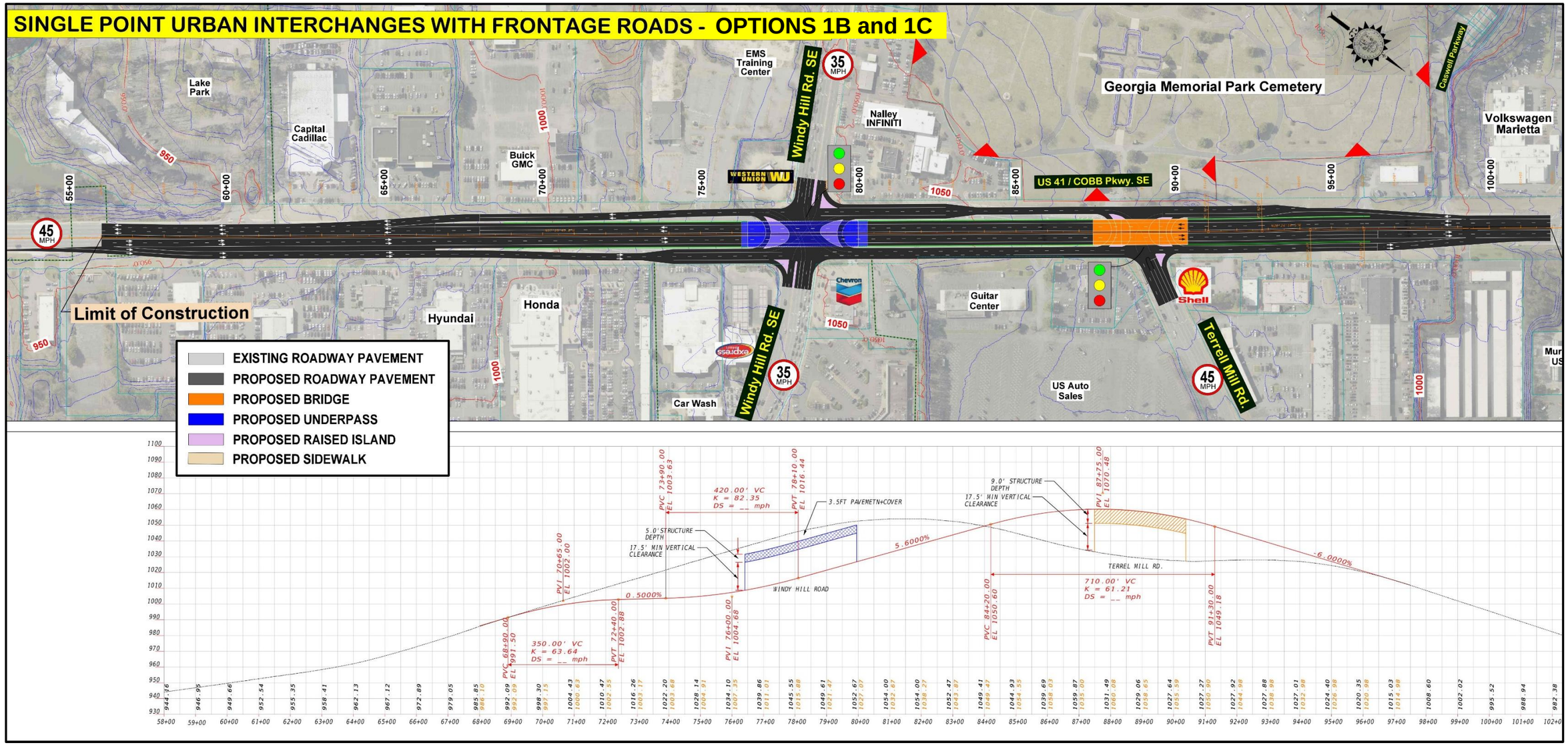
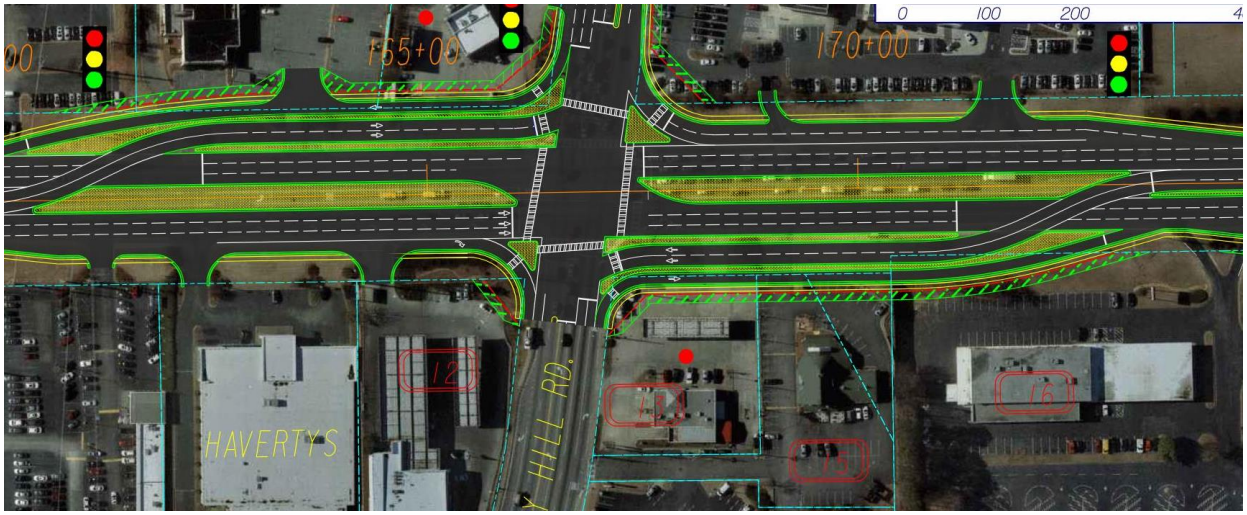


Figure 9: Options 1B and 1C Cobb Parkway Profile

4.4 Primary Concept 2 – Partial Continuous Flow Intersection (CFI)

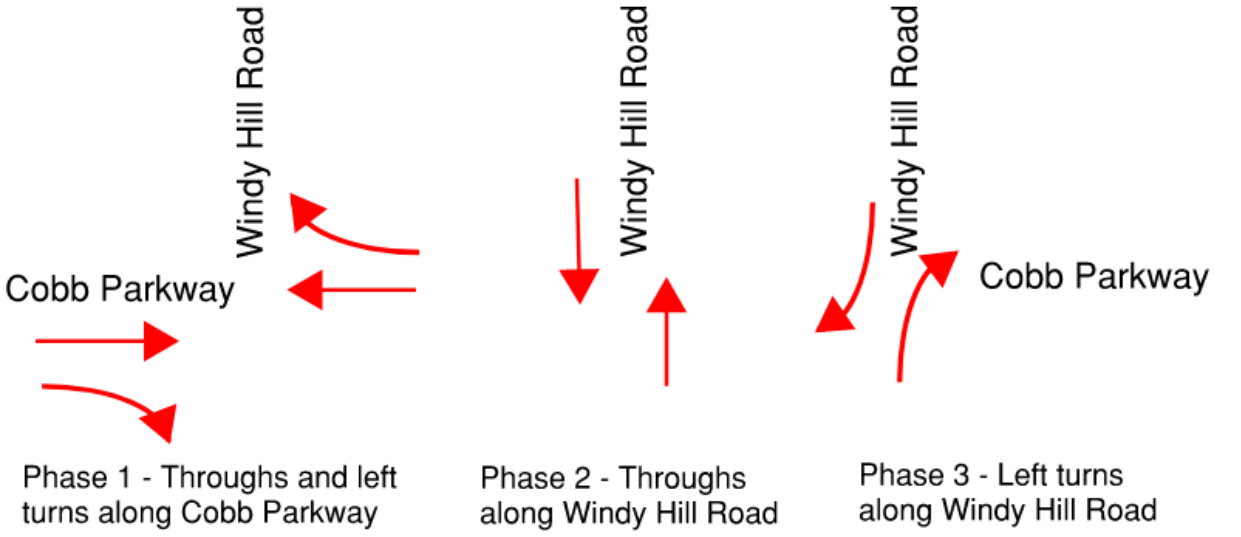
Primary Concept 2 is a variation of Prior Concept 2, which Moreland Altobelli developed. It converts Cobb Parkway's intersection with Windy Hill Road into a partial continuous flow intersection (CFI), which is also commonly called a Displaced Left Turn (DLT) intersection. A CFI is an innovative concept that targets improving the operation of at-grade signalized intersections that have high left-turn volumes. It allows left-turn movements to proceed simultaneously with through movements, thereby eliminating a left-turn signal phase.



Prior Concept 2 – Cobb Parkway / Windy Hill Road CFI

Primary Concept 2 proposes one new at-grade traffic signal along Cobb Parkway approximately 600 feet south of the signalized intersection with Windy Hill Road. This signal is required to allow for northbound left-turning traffic to safely cross the southbound Cobb Parkway through lanes. Due to the close spacing at the north end of Primary Concept 2, the existing traffic signal for Terrell Mill Road would also serve as the crossover point for the southbound left turn lanes for cars wishing to turn onto eastbound Windy Hill Road. These crossover signals would enable left-turning traffic to drive across the opposing through lanes and queue left of the opposing through lanes. The queued vehicles would then be able to turn left onto Windy Hill Road during the green signal phase for through traffic on Cobb Parkway across Windy Hill Road.

One of the primary advantages of a CFI is that it would have a lower construction cost than a grade-separated concept. Since all movements would be at grade, it would not require an overpass. Additionally, CFIs provide less conflict points than interchanges and conventional intersections. CFIs also include refuges for cyclists and pedestrians to wait for the signal cycle to process the two-stage left turns.



Prior Concept 2's CFI would improve the capacity of the Cobb Parkway / Windy Hill Road intersection by only requiring three signal phases instead of the four phases required at the existing conventional intersection.

One of the primary disadvantages of Primary Concept 2 is that although it would improve the traffic operation of the Cobb Parkway / Windy Hill Road intersection, it would negatively impact the LOS of the Cobb Parkway / Terrell Mill Road intersection. In fact, the Cobb Parkway / Terrell Mill Road intersection would operate at LOS C during the PM peak period in the 2050 Design Year in the "No-Build" option but would fail if Primary Concept 2 is implemented. This is chiefly caused by the southbound left turns at this intersection being queued for both eastbound Terrell Mill movements as well as eastbound Windy Hill Road movements.

Another disadvantage of Primary Concept 2 is that through motorists who are not familiar with a CFI might become disoriented because opposing traffic will be driving on both the left and right of them, and there is potential for wrong-way movement. The visual impact and headlight glare could be mitigated by installing concrete barriers or planting narrow native species shrubs on the separator islands or by widening the separator islands. Although wider separator islands might improve safety by providing greater pedestrian refuge, they would require additional required ROW and extend the length of pedestrian crossings.

CFIs might also be more complicated for unfamiliar bicyclists and pedestrians due to longer crossing distances and unique traffic flows that might prevent some crossings from being completed within one signal cycle. Pedestrians and cyclists would need to be particularly careful to check for oncoming traffic traveling the opposite direction as the mainline through lanes when crossing the left-turn lanes.

An additional major disadvantage with Primary Concept 2 is that it would restrict direct access to the commercial properties along NB Cobb Parkway (north of Windy Hill Road) and along SB Cobb Parkway (south of Windy Hill Road). Many vehicles intending to access these properties would need to drive longer, indirect routes that include making a U-turn on Windy Hill Road, which could be particularly problematic for trucks that have large turn radii that are making deliveries to these properties.

Additional ROW is required where Cobb Parkway's footprint is widened to include the left-turn lanes on the left side of the oncoming traffic. Many overhead and underground utilities would be impacted by the

wider footprint. The only potential displacement would be the existing Chevron station located in the northeast quadrant of the Cobb Parkway/Windy Hill Road intersection. Whenever ROW is procured from an existing gas station, there would be a risk that hazardous material (petroleum) potentially leaking from the existing tanks would need to be removed and disposed.

Another disadvantage is that the left-turn lanes would obstruct existing CobbLinc bus stops and local driveway access from Cobb Parkway. Transit users face longer walk distances to reach relocated transit stops, particularly any users that wish to transfer at this intersection. Many vehicles intending to enter or depart from these impacted commercial properties would need to drive longer, indirect routes.

A CFI could potentially increase delays during off-peak hours since vehicles on the through lanes would have to pass an additional traffic signal before being able to turn left.

Variations of Primary Concept 2 that were considered are discussed in Sections 4.4.1, and 4.4.4.

4.4.1 Option 2A – Partial CFI along Cobb Parkway

As illustrated in **Figure 10**, Option 2A resembles Prior Concept 2. It converts Cobb Parkway's intersection with Windy Hill Road into a partial continuous flow intersection (CFI), which targets improving the operation of an at-grade signalized intersection that has high left-turn volumes. It allows northbound and southbound left-turn movements to proceed simultaneously with northbound and southbound through movements, thereby eliminating a left-turn signal phase. Like Prior Concept 2, Option 2A does not include capacity improvements along Windy Hill Road. Without improvements to Windy Hill Road, **both the Cobb Parkway / Windy Hill Road intersection and the Cobb Parkway / Terrell Mill Road intersection would fail in the 2050 Design Year**. For this reason, **Option 2A is not considered viable**.

Another critical issue caused by any of these CFI alternatives, as noted above in Section 4.3, is inter-parcel access. Due to the addition of the raised medians, direct access to many parcels is severely restricted. During one of the Monthly PMT Meetings, it was suggested to see if access roads could be proposed to provide access between parcels. These access roads were included in the layout for Option 2A. However, after feedback from property owners at the public meeting in addition to consultation with Right-of-Way negotiation and acquisition experts, these access roads were deemed inviable and were removed for subsequent options. Therefore, the access management issues caused by the CFI options remain.

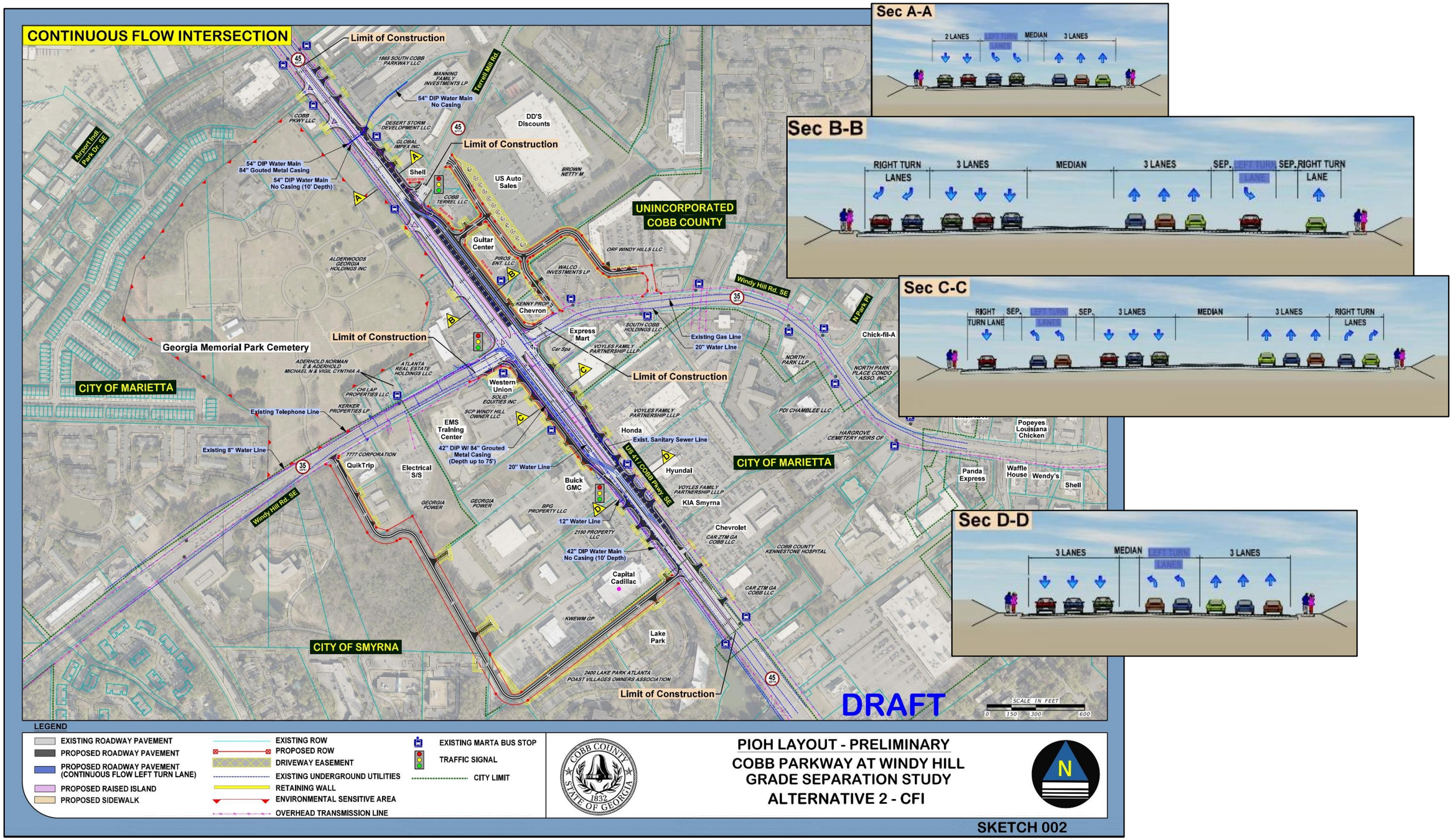


Figure 10: Option 2A Layout and Typical Sections

4.4.2 Option 2B – Partial CFI along Cobb Parkway and Windy Hill Road Capacity Improvements

As illustrated in **Figure 11**, Option 2B, like Option 2A, converts Cobb Parkway's intersection with Windy Hill Road into a partial CFI with displaced left turns in both directions along Cobb Parkway. Option 2B also expands Windy Hill Road from two to three through lanes in each direction across and west of the Cobb Parkway intersection.

One of the primary advantages of Option 2B is that it would have a lower construction cost than a grade-separated concept (Primary Concepts 1 and 4). Since all movements would be at grade, it would not require an overpass. Additionally, CFIs provide less conflict points than interchanges and conventional intersections. CFIs also include refuges for cyclists and pedestrians for the two-stage left turns. Option 2B performs at an acceptable LOS in the 2050 design year at the Cobb Parkway and Windy Hill Road Intersection. However, it does fail in the 2050 design year at the Cobb Parkway and Terrell Mill Road Intersection.

One of the primary disadvantages of Option 2B is that through motorists who are not familiar with a CFI might become disoriented because opposing traffic will be driving on both the left and right of them, and there is potential for wrong-way movements. The visual impact and headlight glare could be mitigated by installing concrete barriers or planting narrow native species shrubs on the separator islands or by widening the separator islands.

CFIs might also be more complicated for bicyclists and pedestrians due to longer crossing distances and unique traffic flows that might prevent some crossings from being completed within one signal cycle.

Another major disadvantage with Option 2B is that it would restrict direct access to parcels along NB Cobb Parkway (north of Windy Hill Road) and along SB Cobb Parkway (south of Windy Hill Road). Many vehicles intending to access these properties would need to drive longer, indirect routes that include making a U-turn on Windy Hill Road, which could be inconvenient for trucks that have large turn radii that are making deliveries to these properties. U-turns would not be allowed along Cobb Parkway at the Cobb Parkway/Windy Hill intersection.

Option 2B
Partial CFI along Cobb Parkway and Windy Hill Road Capacity Improvements

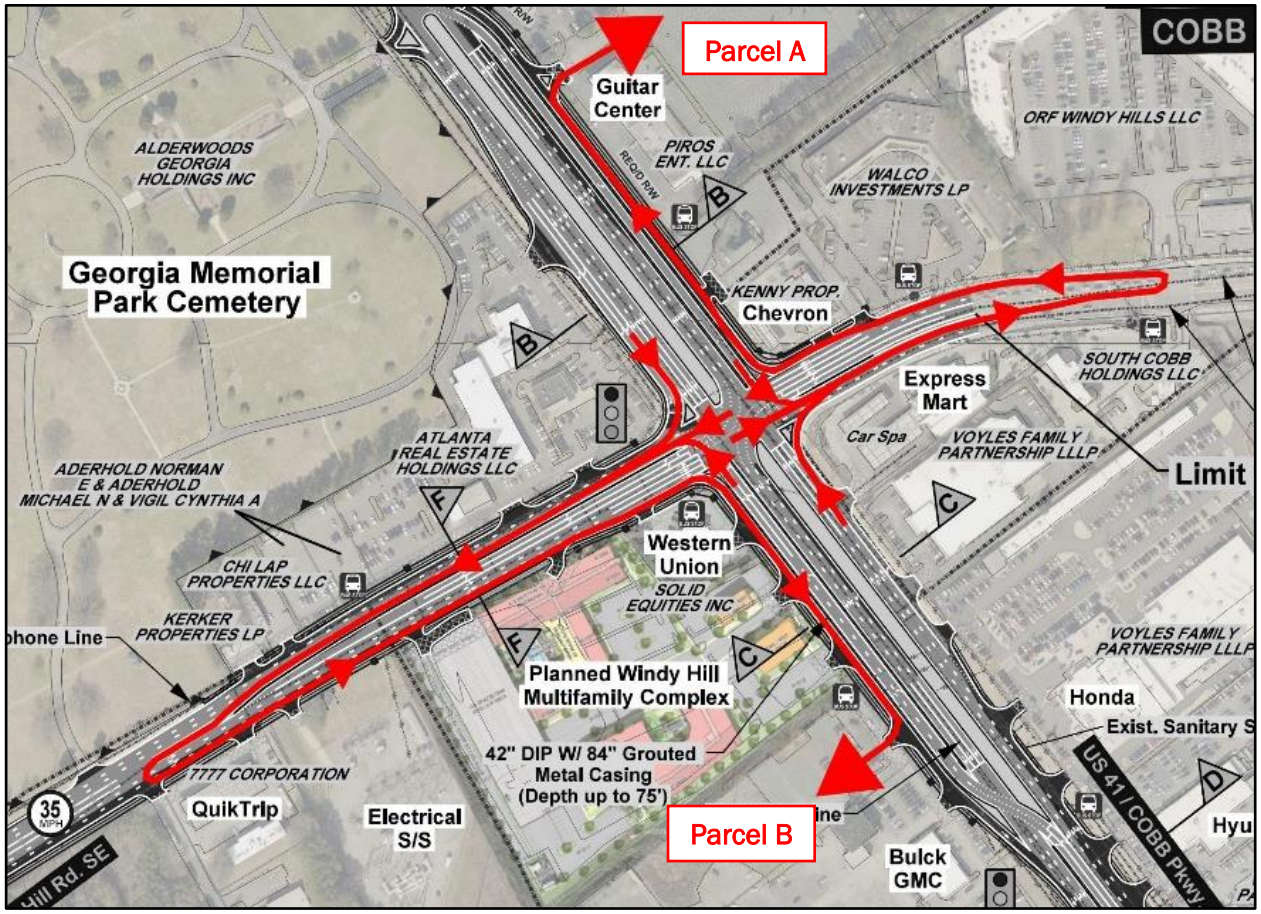
Key Advantages (vs. Options 1C and 4B)

- Lowest construction/ROW cost ($62.5 million).
- Minimal impact to Dobbins ARB runway, insignificant grade change.
- Lowest utility relocation cost ($9.6 million).
- Low environmental impacts. Requires acquisition of portion of Chevron Station property which could impact one or more petroleum tanks (hazmat). Additional lanes on Windy Hill should increase peak hour noise, ROW required from electrical substation property, which is eligible for listing in National Register of Historic Resources.

Key Disadvantages (vs. Options 1C and 4B)

- **Cobb Parkway / Terrell Mill Road intersection would not operate at acceptable LOS during the PM Peak Period in the 2050 Design Year.**
- 17 driveways and 14 land parcels impacted
- Significant ingress/egress limitations in NE & SW quadrants
- Significant impact on transit users' transfer activities (3 transit stop pairs), walking distance (500 feet) and transit stop locations (1 stop to be moved)
- Unconventional intersection discourages pedestrian crossings within one signal cycle.
- Complex construction staging due to restricted pedestrian access, driver confusion with shifts and redistribution of turn lanes.

Concept 2B increases Cobb Parkway from two to three through lanes in each direction across Windy Hill Road but does not retain the existing dedicated bus lanes. Furthermore, the existing transit stops along both SB Cobb Parkway, south of Windy Hill, and NB Cobb Parkway, north of Windy Hill will need to be shifted hundreds of feet further from their current location, making it more challenging for transit users to access these bus stops.



The need to make U-turns to access properties is a major disadvantage of CFIs, such as Option 2B, in an urban, commercial area. CFIs in urban, commercial areas are particularly problematic for large delivery trucks that have large turn radii and cannot navigate U-turns. The example above shows how traffic on Cobb Parkway would need to maneuver to reach Parcels A and B.

Due to its unconventional configuration that has left-turn lanes on the right side of opposing through lanes, Option 2B is the least adaptable of the short-listed options to serve at-grade dedicated BRT lanes. Moreover, as discussed above, passengers utilizing a conventional transit system would need to walk greater distances to reach their bus stops along Cobb Parkway. It appears feasible to construct future elevated median BRT lanes that would cross over Terrell Mill Road and Windy Hill Road. Elevated BRT lanes would eliminate the conflicts with the turn lanes but would be very costly and like Option 1C, would require bus stations to be built at least 800 feet north of the Terrell Mill Road intersection and 500 feet south of the Windy Hill Road intersection where the bus lanes would return to grade. These distances would make an elevated BRT impractical for most transit users.

Additional ROW is required where Cobb Parkway's footprint is widened to include the left-turn lanes on the left side of the oncoming traffic. Many overhead and underground utilities would be impacted by this wider footprint. A potential displacement would be the existing Chevron station located in the northeast quadrant of the Cobb Parkway/Windy Hill Road intersection. Whenever ROW is procured from an existing gas station, there would be a risk that hazardous material (petroleum) potentially leaking from the existing tanks would need to be removed and disposed.

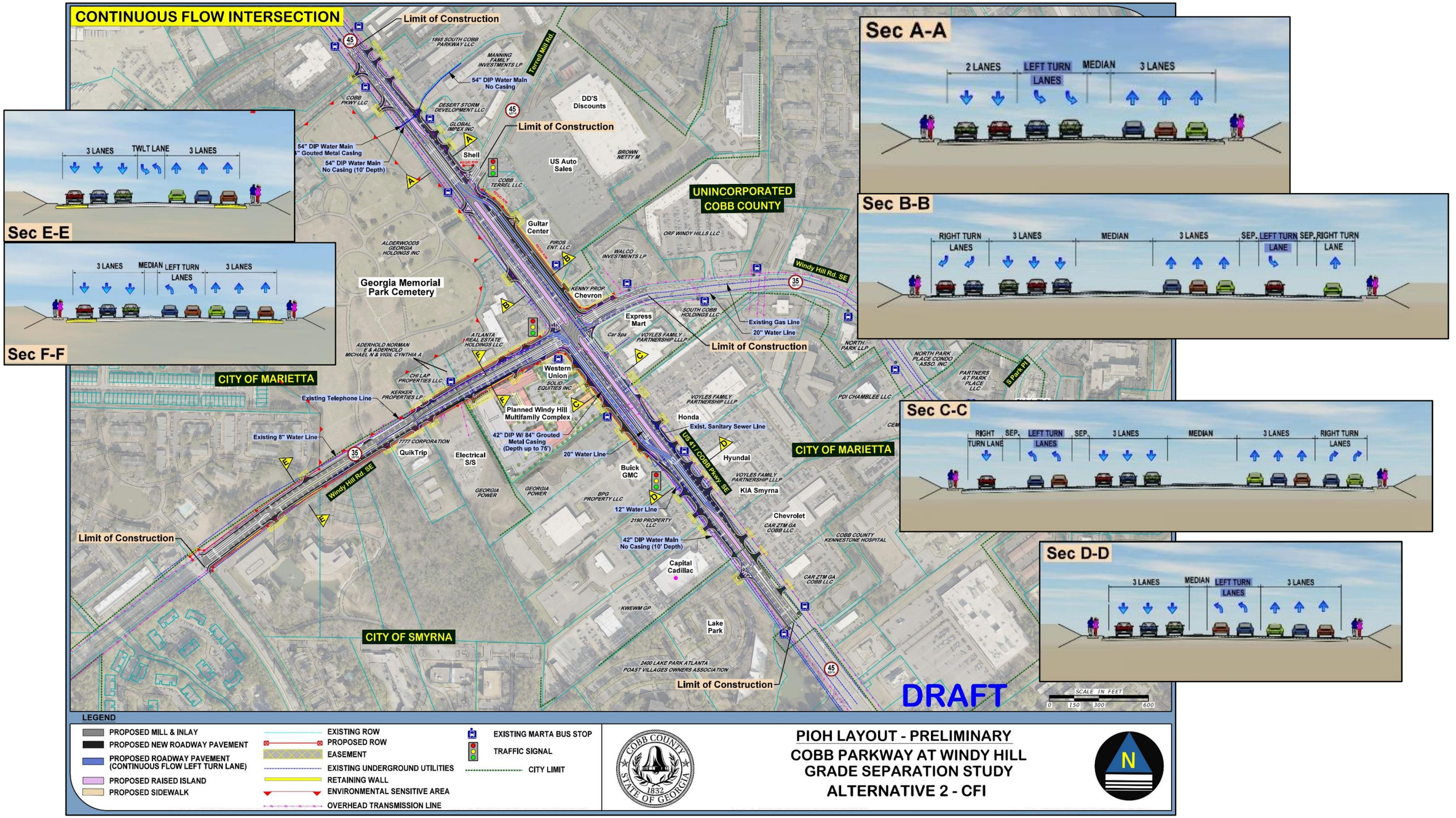


Figure 11: Option 2B Layout and Typical Sections

4.4.3 Option 2C – Partial CFI along Cobb Parkway and Windy Hill Road and Windy Hill Road Capacity Improvements

As illustrated in **Figure 12**, Option 2C converts Cobb Parkway's intersection with Windy Hill Road into a partial CFI with displaced left turns along the northbound Cobb Parkway and eastbound Windy Hill Road approaches. Option 2C also expands Windy Hill Road from two to three through lanes in each direction across and west of the Cobb Parkway intersection.

A representative of GDOT's Roundabout & Alternative Intersection Design Department requested Option 2C as a potential optimized CFI that places displaced left turns at the two approaches to the Cobb Parkway / Windy Hill Road Intersection that have the largest left-turn volumes. Unlike Option 2B, Option 2C does not include displaced left-turn lanes on the southbound approach to the Cobb Parkway / Windy Hill Road intersection. Eliminating the southbound approach would enable the Cobb Parkway / Terrell Mill Road intersection to operate at acceptable LOS during the PM Peak Period in the 2050 Design Year. This gives Option 2C a distinct advantage over Option 2B with regards to vehicular level of service. Like Option 2B, with displaced left-turn lanes along Cobb Parkway, Option 2C would significantly impact transit along Cobb Parkway.

Unfortunately, the "L" shaped CFI would not take advantage of one of the major benefits of a typical CFI since it does not have displaced left turns in opposing directions and, consequently, would require four signal phases at the Cobb Parkway / Windy Hill Road intersection. Additionally, a new signal is required along westbound Windy Hill Road to enable the large volume of vehicles turning right from southbound Cobb Parkway to merge onto westbound Windy Hill Road. This same signal would control the crossover necessary for shifting the dual eastbound left-turn lanes across the westbound through lanes.

If Option 2C were to be implemented, the queues of the dual southbound Cobb Parkway to westbound Windy Hill Road right-turn lanes would backup onto southbound Cobb Parkway during peak periods because of the reduced phase time given to this movement. In addition, due to the high volume of traffic turning right from southbound Cobb Parkway onto westbound Windy Hill Road, it could be unsafe for pedestrians to cross on the west side of Cobb Parkway. For these reasons, Option 2C is not considered viable.

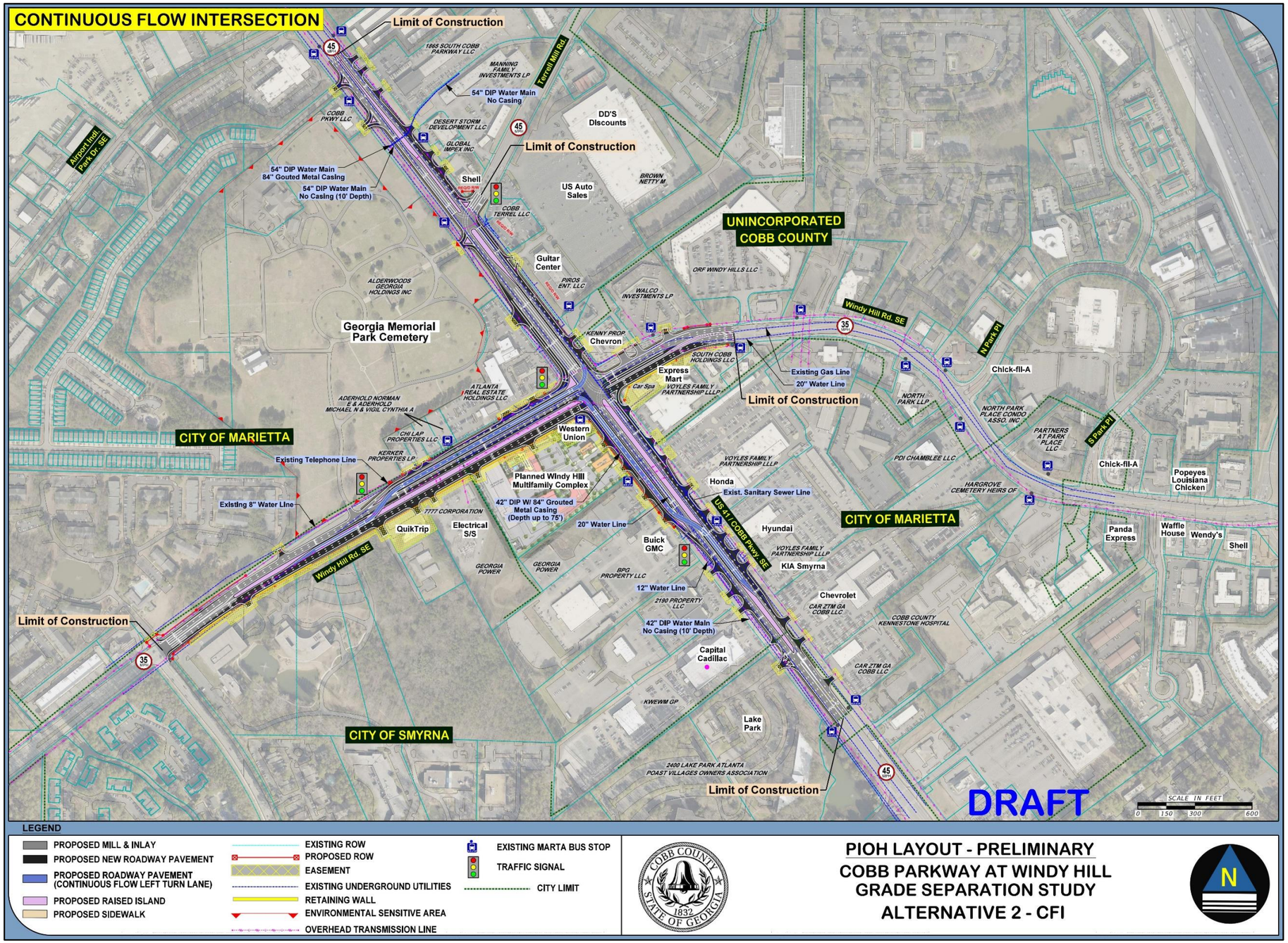


Figure 12: Option 2C Layout

4.4.4 Option 2D – Partial CFI along Windy Hill Road, Windy Hill Road Capacity Improvements, and Pedestrian Bridge

As illustrated in **Figure 13**, Option 2D converts Cobb Parkway's intersection with Windy Hill Road into a partial CFI with displaced left turns only along the eastbound Windy Hill Road approach. Like Option 2C, a new signal is required along westbound Windy Hill Road to enable the large volume of vehicles turning right from southbound Cobb Parkway to merge onto westbound Windy Hill Road, plus to cross the eastbound left turns over the westbound through lanes. To mitigate the risk of vehicles colliding with pedestrians and improve the operation of the intersection, a pedestrian bridge is also proposed across Windy Hill Road on the west side of Cobb Parkway.

A representative of GDOT's Roundabout & Alternative Intersection Design Department requested Option 2D as a potential optimized CFI during the Stakeholder Steering Committee Meeting held on April 13, 2022. Option 2D places displaced left turns at the approach to the Cobb Parkway / Windy Hill Road Intersection that has the largest left-turn volume. Unfortunately, the single-leg CFI would not take advantage of one of the major benefits of a typical CFI since it does not have displaced left turns in opposing directions and, consequently, would require four signal phases at the Cobb Parkway / Windy Hill Road intersection. If Option 2D were to be implemented, Cobb Parkway's intersections with Windy Hill Road and Terrell Mill Road would both be expected to operate at an acceptable LOS.

Despite these benefits, Option 2D has two major issues. The queues of the dual southbound Cobb Parkway to westbound Windy Hill Road right-turn lanes would backup onto southbound Cobb Parkway due to the need to signalize this movement giving this large volume of vehicles less green phase time. Moreover, Option 2D would not include any improvements along Cobb Parkway that would potentially reduce the future number of crashes, which is one of the project goals. For these reasons, Option 2D is not considered viable.

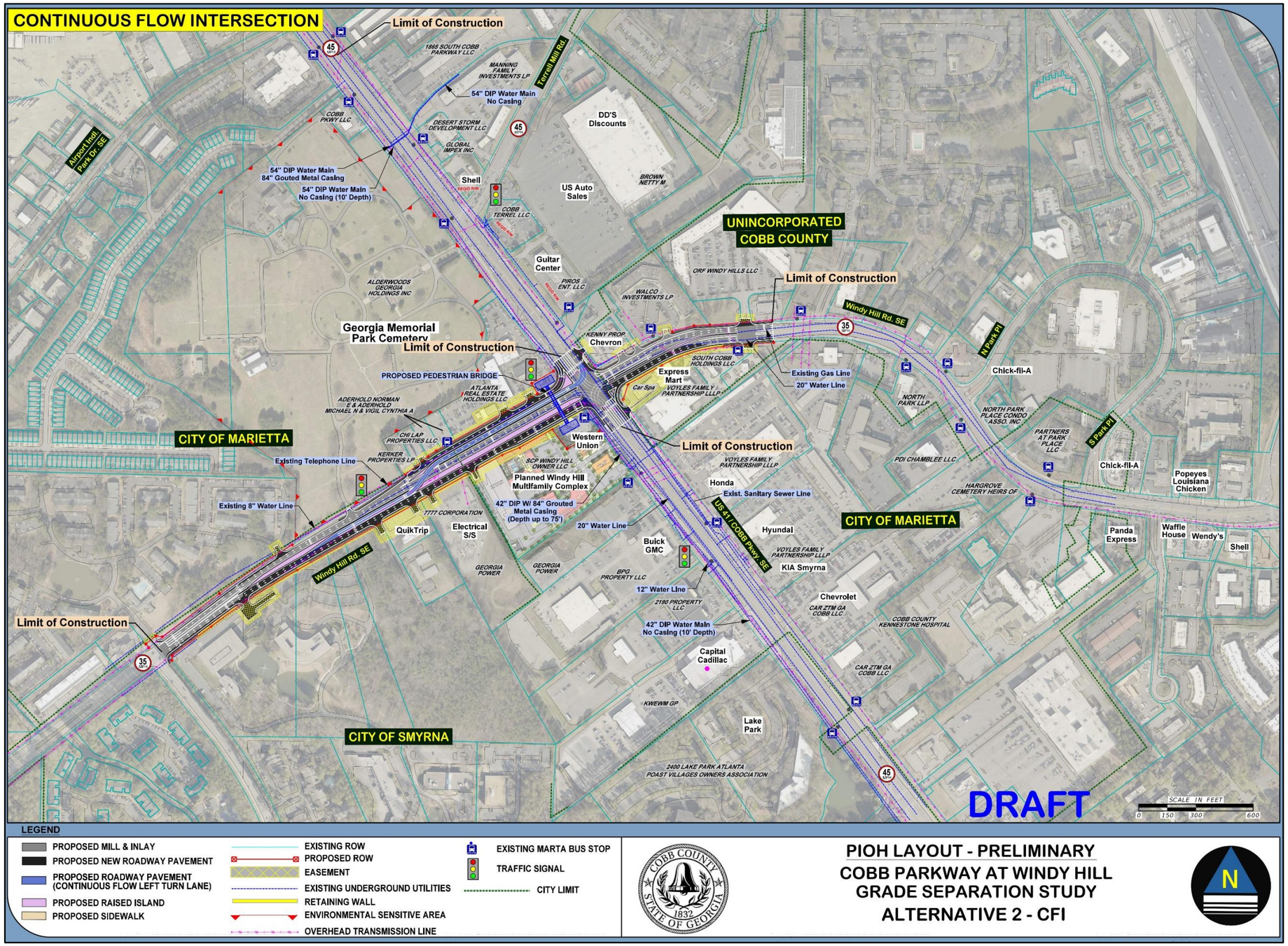


Figure 13: Option 2D Layout

4.5 Primary Concept 3 (Option 3) – Windy Hill Road Capacity Improvements west of Cobb Parkway

Option 3 is the simplest and the lowest cost of the four primary options. It consists of widening Windy Hill Road by one lane in each direction from Cobb Parkway to Village Parkway. It provides the highest benefit-cost ratio of the four primary concepts over the short term but is not able to handle increasing growth of traffic and therefore fails in the 2050 Design Year; thus Option 3 is not a viable option. Note that this option begins to fail in 2035.

As shown on **Figure 14**, Windy Hill Road currently consists of three through lanes in each direction east of Cobb Parkway and two through lanes in each direction west of Cobb Parkway. The outside westbound lane approaching Cobb Parkway currently transitions from a through lane to a right-turn lane. Unfamiliar motorists that are expecting to continue through the Cobb Parkway intersection could get "trapped" into making a right turn or might make an abrupt weave to the left across the solid white line into the adjacent westbound through lane. Option 3 mitigates this safety concern by extending the outside EB and WB through lanes continuously to the Village Parkway intersection. Refer to **Figure 15** for a layout and typical sections of Option 3.

Option 3 is consistent with the Cobb FORWARD Comprehensive Transportation Plan 2050 Recommendations Report (December 2021) which proposes widening Windy Hill Road from Atlanta Road to Cobb Parkway as part of Capacity Improvement Project ID R_662. This project is listed within the 10-year scenario with expectation for funding to be established in approximately 5 years.

At the Windy Hill Road / Village Parkway intersection, the westbound outside through lane would be dropped as a right turn only lane. This will create some additional weaving concerns as through drivers might be unexpectedly "trapped" in the right-turn lane and would need to merge over by one lane. Proper signage and lane markings would be required to alert unfamiliar drivers of this lane drop. This deficiency would eventually be eliminated once Project R_662 is built and Windy Hill Road is widened further west to Atlanta Road, which is approximately 1.5 miles west of Village Parkway.

Because of its relatively low cost and significant benefits, the widening of Windy Hill Road is considered both a stand-alone project (Option 3) and as part of the other options that also include improvements on Cobb Parkway (Options 1C, 2B, 2C, 2D and 4B). A phased implementation is presented later in this document that considers how the widening of Windy Hill Road can be incorporated into the recommended alternative.

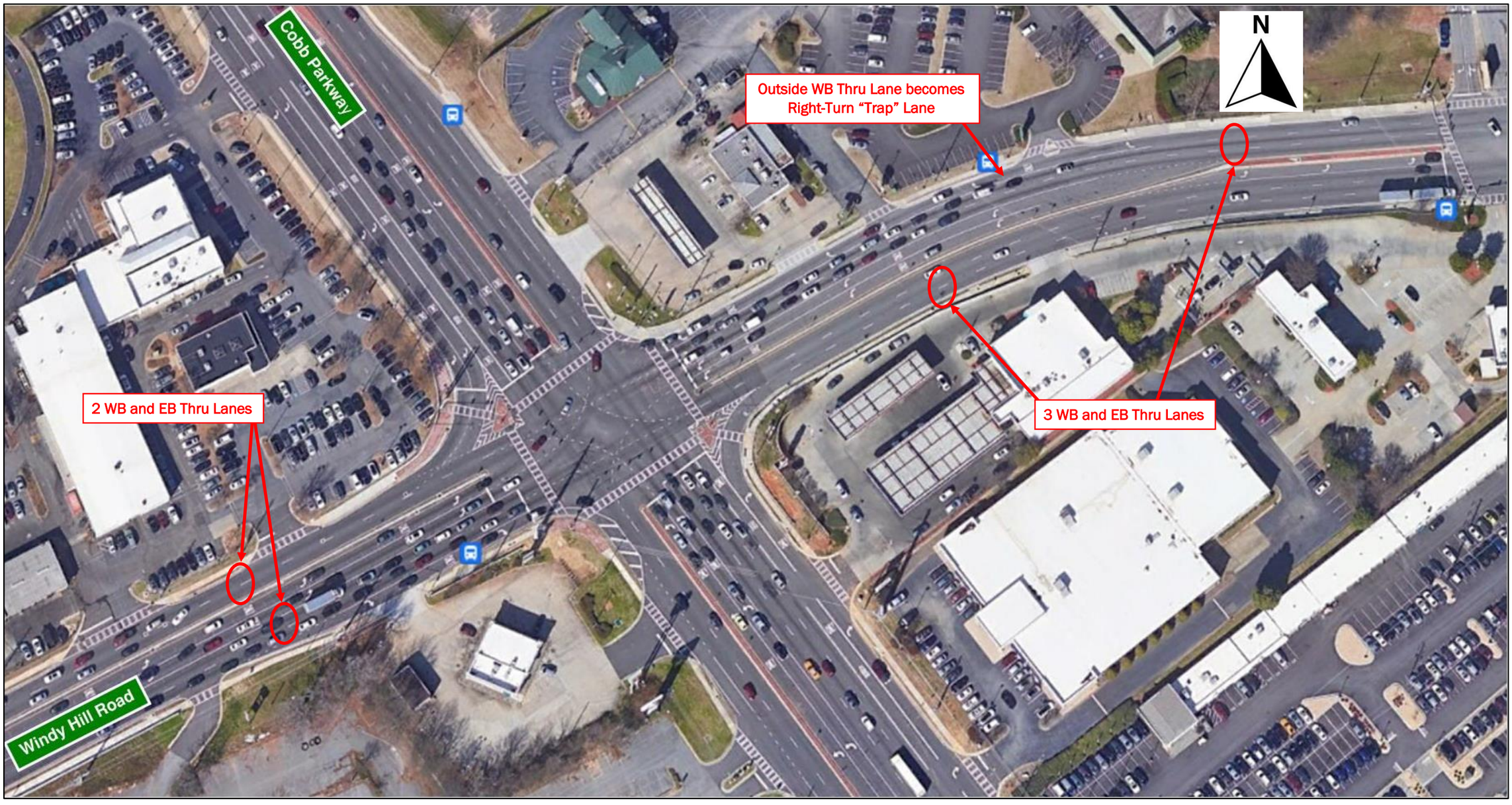


Figure 14: Existing Windy Hill Road Lane Balance Across Cobb Parkway

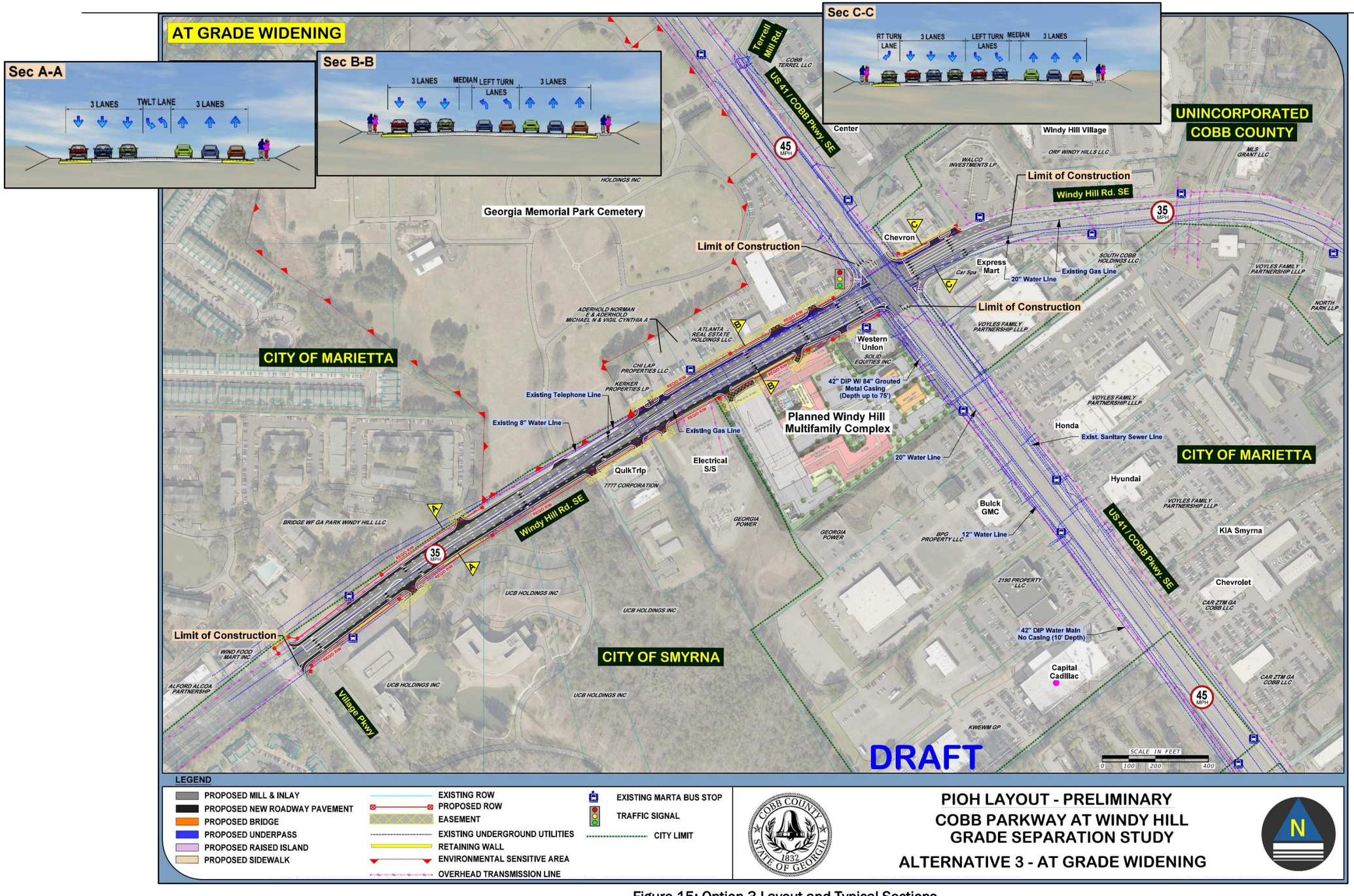


Figure 15: Option 3 Layout and Typical Sections

4.6 Primary Concept 4 – Flyover between Windy Hill and Terrell Mill Roads

Primary Concept 4 focuses on facilitating the heavy traffic movement between Windy Hill Road (west of Cobb Parkway) and Terrell Mill Road. Primary Concept 4 would include a multi-span flyover that would allow continuous, uninterrupted movement from EB Windy Hill Road to EB Terrell Mill Road, and the reciprocal movement from WB Terrell Mill Road to WB Windy Hill Road. These heavily traveled movements were identified during our extensive data collection that was documented in our Existing Conditions Report, as well as informed to the project team by multiple stakeholders and members of the public. The purpose of the flyover would eliminate the need for those travelling from Smyrna and the I-75 express lane access point (as well as to those portions of Cobb County east of I-75), from having to drive through Cobb Parkway's signalized intersections with Windy Hill and Terrell Mill Road. Several hundred vehicles per hour would be removed from both intersections, which would in turn improve their LOS.

The design speed/posted speed of the flyover is 30 MPH, which is 15 MPH slower than the 45 MPH design/posted speed of Terrell Mill Road and the 5 MPH slower than the 35 MPH design/posted speed of Windy Hill Road. Although the radii of the flyover's two curves would allow for a 35 MPH design/posted speed, a 30 MPH design/posted speed is proposed to allow for constant 8-foot-wide outside shoulders in both directions throughout the flyover. A Design Variance might be required for approval of the proposed flyover's 30-MPH design/posted speed.

Primary Concept 4 facilitates travel between Windy Hill Road (west of Cobb Parkway.) and Terrell Mill Road.

The flyover's profile (**Figure 17**) provides excess clearance to allow for straddle bents at the two curves where the flyover crosses Windy Hill Road, Cobb Parkway and Terrell Mill Road on large skews. Cobb Parkway's median is proposed to be widened to allow for column placement. To avoid ROW impact on the west side of Cobb Parkway between Windy Hill and Terrell Mill Roads, the flyover is aligned east of Cobb Parkway. Consequently, additional ROW and the relocation of overhead electrical lines are required in this location. The columns of the flyover must be placed to avoid obstructing the existing driveways and their intersection sight distance and, if possible, to avoid conflicts with the existing gas lines adjacent to NB Cobb Parkway.

Retaining walls are proposed in the medians of Windy Hill and Terrell Mill Roads to minimize the ROW required along these roads. Nevertheless, the additional ROW required along Windy Hill and Terrell Mill Roads, including potential displacements of existing businesses, is a notable disadvantage of Concept 4.

One of the most complex and costly aspects of Primary Concept 4 is the required relocation of overhead electrical transmission and distribution lines that are adjacent to or cross over Cobb Parkway, Windy Hill Road, and Terrell Mill Road. Where the electric distribution lines cross over Terrell Mill Road, the lines would either need to be raised by approximately 35 feet to cross over the elevated flyover or lowered to cross Terrell Mill Road below grade. If the electric lines are raised, the taller poles and higher lines might encroach above the 50:1 obstruction zone from the nearby Dobbins Air Reserve Base runway and, consequently, would require FAA approval. Moreover, additional poles downstream and upstream might also have to be raised. If the electric lines are lowered, they would need to be placed in concrete duct banks. Both alternatives for crossing Terrell Mill Road appreciably increase the cost of Primary Concept 4.

Variations of Primary Concept 4 that were considered are discussed in the following subsections.

4.6.1 Option 4A - Flyover Ramp between Windy Hill and Terrell Mill Roads

As illustrated in **Figure 16**, Option 4A would include a ramp with a multi-span flyover that would allow continuous, uninterrupted movement from EB Windy Hill Road to EB Terrell Mill Road and the reciprocal movement from WB Terrell Mill Road to WB Windy Hill Road. The flyover's profile (**Figure 17**) provides excess clearance to allow for straddle bents at the two curves where the flyover crosses Cobb Parkway on a large skew.

Option 4A does not include capacity improvements to expand Windy Hill Road from two to three through lanes in each direction across and west of the Cobb Parkway intersection. Without such improvements to Windy Hill Road, both the Cobb Parkway / Windy Hill Road intersection and the nearby Cobb Parkway / Lake Park Road/Target Road at-grade intersections would fail during the PM Peak in the 2050 Design Year. For this reason, Option 4A is not considered viable.

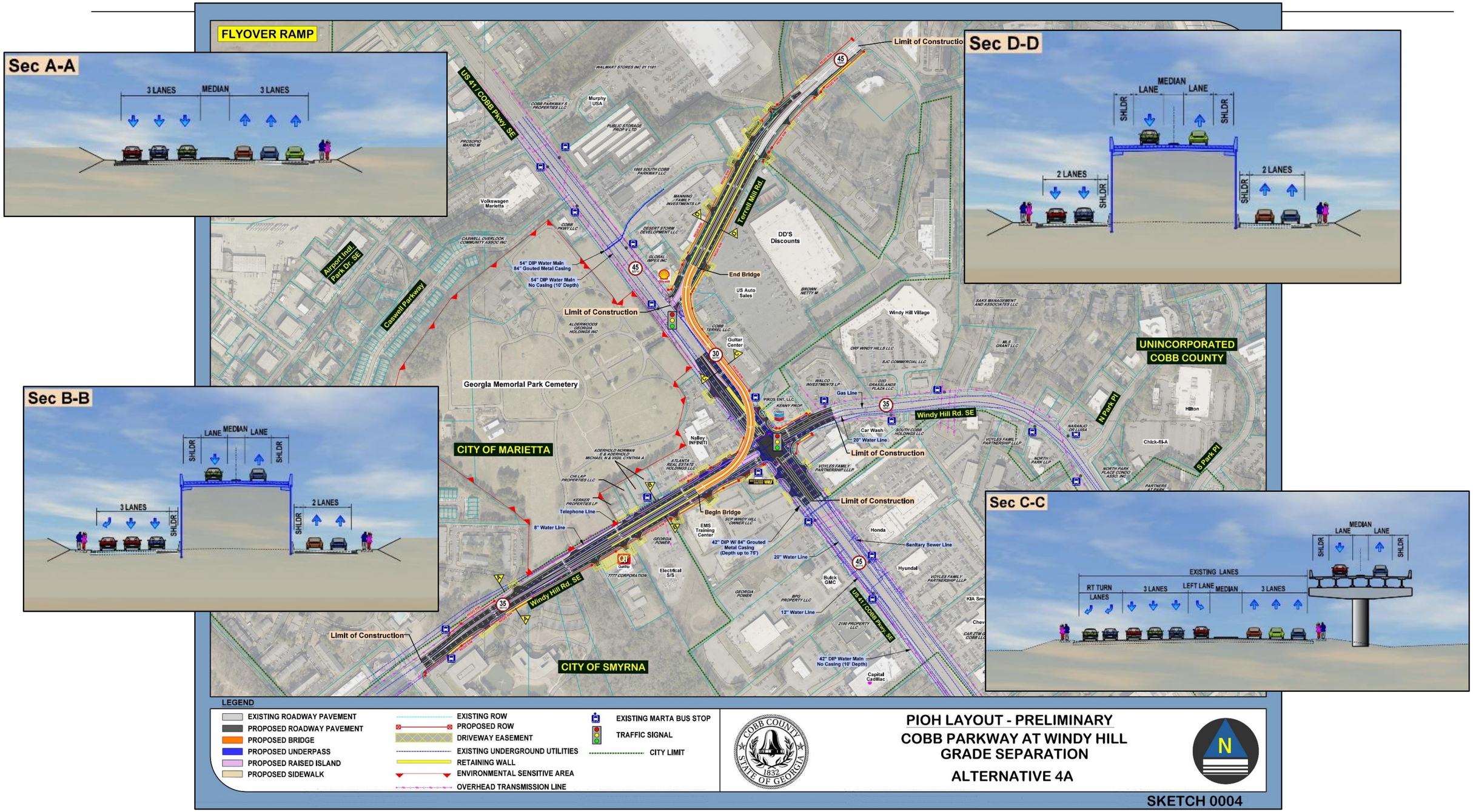


Figure 16: Option 4A Layout and Typical Sections

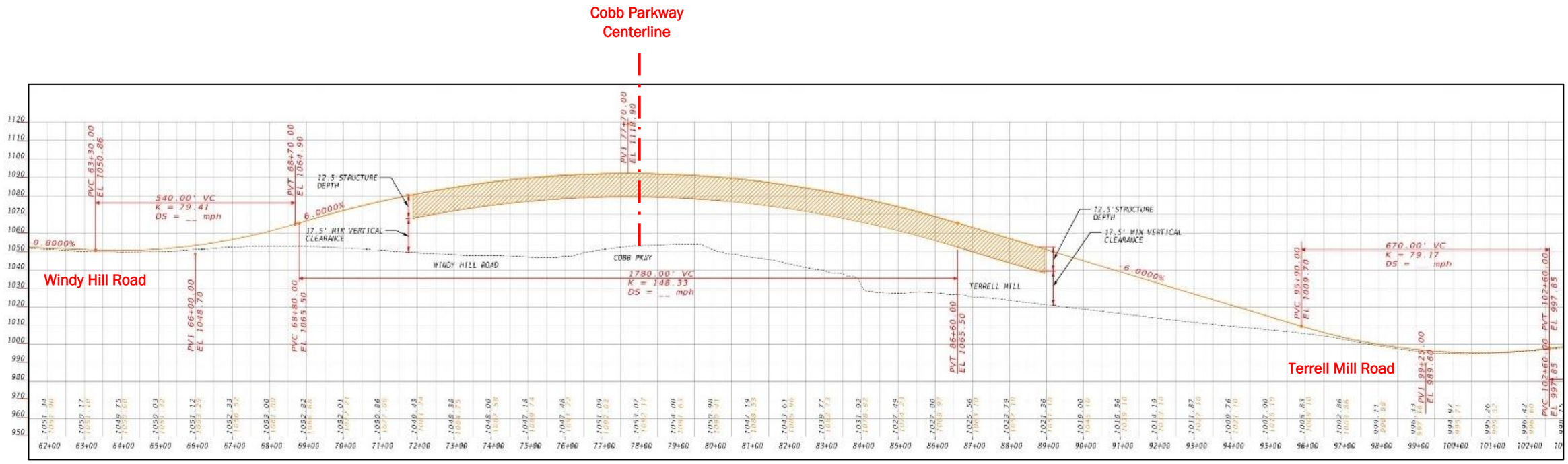


Figure 17: Options 4A and 4B Flyover Profile

4.6.2 Option 4B - Flyover Ramp and Windy Hill Road Capacity Improvements

As illustrated in **Figure 18**, Option 4B expands on Option 4A to include one additional lane in each direction between Cobb Parkway and Village Parkway. Option 4B would provide an acceptable LOS at the Cobb Parkway / Windy Hill Road intersection. In fact, **Option 4B is the only option in which both the Cobb Parkway / Windy Hill Road intersection and the Cobb Parkway / Terrell Mill Road intersection operate at acceptable LOS during both peak periods in the Design Year 2050.**

One of the disadvantages of Option 4B compared with the other options is that it requires the most additional ROW along Windy Hill Road. This ROW would primarily be obtained from the south side of Windy Hill Road including the existing electrical substation property, which is eligible for listing in the National Register of Historic Resources (for details, refer to subsection 9.7.5), and the QuikTrip gas station. The ROW limit overlaps the gas pumps of the QuikTrip station. Whenever ROW is procured from an existing gas station, there would be a risk that hazardous material (petroleum) potentially leaking from the existing tanks would need to be removed and disposed. The north side of Windy Hill Road has the Georgia Memorial Grounds cemetery and Infinity dealership that were avoided for ROW impacts.

In addition to the QuikTrip station, ROW might be required from the Shell station located in the northeast quadrant of the Cobb Parkway/Terrell Mill Road intersection. Additionally, the required ROW along the north side of Terrell Mill Road overlaps existing commercial structures and will require several displacements.

The construction of the flyover would be above live traffic where it crosses over Windy Hill Road, Cobb Parkway and Terrell Mill Road. Nighttime closures will be required for overhead work such as girder erection and deck placement. Otherwise, much of the flyover construction will be adjacent to Cobb Parkway and would not significantly impact traffic.

Option 4B
Flyover Ramp and
Windy Hill Road Capacity Improvements

Key Advantages (vs. Options 1C and 2B)

- Only option in which both the Cobb Parkway / Windy Hill Road intersection and the Cobb Parkway / Terrell Mill Road intersection operate at acceptable LOS in the Design Year 2050.
- Estimated annual savings ($2.4 million) from potential crash reductions, which is less than Option 1C but higher than Option 2B.
- Low impact on transit users' transfer activities. No impact on walking distance or transit stop locations.
- Construction of substructure and walls remain within existing Windy Hill and Terrell Mill roadway limits. Bents along Cobb Parkway will cause minimal traffic shifts. Construction of flyover above live traffic.

Key Disadvantages (vs. Options 1C and 2B)

- High construction/ROW cost ($131.8 million).
- 11 driveways and 12 land parcels impacted. Commercial displacements along the north side of Terrell Mill Road.
- Grade change could impact imaginary approach surface (50:1) to Dobbins ARB.
- Elevated structure results in noise, visual impacts, greater number of lanes on Windy Hill may increase peak hour noise, potential acquisition of part of petroleum tanks (hazmat) for Shell Station and QuikTrip, greatest amount of ROW of all options required from electrical substation property, which is eligible for listing in National Register of Historic Resources.
- Lower utility cost ($11.9 million) than Option 1C but higher than Option 2B.

This option can retain the existing transit stops and thus has the least negative impact to transit users. Additionally, with the removal of hundreds of turning vehicles at both the Windy Hill and Terrell Mill intersection, the conflict with crossing pedestrians is reduced. Of the three shortlisted options, Option 4B is the most adaptable to future dedicated BRT lanes within the Cobb Parkway median but would

require modifications that would increase its cost and required ROW. The columns of the flyover adjacent to Cobb Parkway would need to be placed at least 12 feet further from the Cobb Parkway centerline on both sides. This would result in longer spans and a deeper structural depth of the flyover as well as additional ROW on the east side of Cobb Parkway between Windy Hill Road and Terrell Mill Road. Median BRT stations should be situated just north of Terrell Mill Road and just south of Windy Hill Road so that a pedestrian bridge that leads to the median stations would not cross under the flyover.

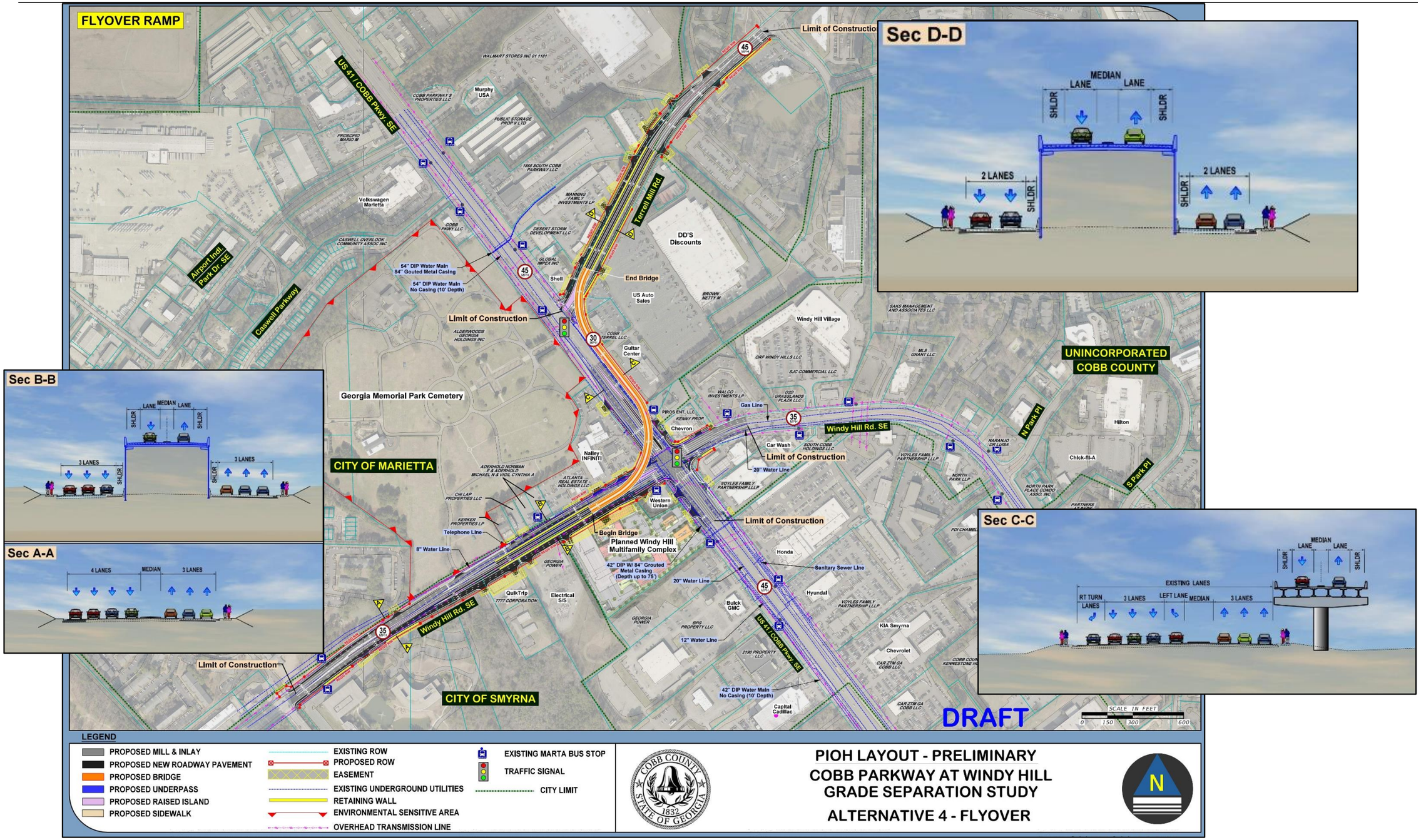


Figure 18: Option 4B Layout and Typical Sections

5. PUBLIC INVOLVEMENT SUMMARY

Stakeholder and public involvement are key components of the Cobb Parkway and Windy Hill Road Study and successfully helped the Project Management Team to identify, better understand, and evaluate recommendations to best address the issues, needs and challenges of the intersection and surrounding area. The study's engagement process utilized a variety of techniques; a summary is included below.

5.1 Stakeholder and Public Outreach Plan

The plan was developed and used as the guiding document for all outreach, identifying strategies, tools and techniques and audiences for engagement.

5.2 Project Management Team (PMT)

A Project Management Team (PMT) was established to provide oversight to the study, consisting of representatives from Cobb County DOT (CCDOT), Atlanta Regional Commission (ARC), City of Smyrna, City of Marietta, and members of the consultant team. The PMT met at least monthly throughout the duration of the study.

5.3 Stakeholder Steering Committee (SSC)

A Stakeholder Steering Committee (SSC) was convened to provide guidance on the study, specifically providing data and identifying issues, opportunities, solutions, and any potential challenges to implementation. Members of the SSC included representatives of the following entities:

- Cobb County DOT,
- Cobb County District 2 Commissioner Richardson's office,
- CobbLinc,
- Georgia DOT District 7,
- Georgia DOT TMC,
- Georgia DOT Roundabout and Alternative Intersection Design Group,
- Atlanta Regional Commission (ARC),
- City of Smyrna,
- City of Marietta,
- Dobbins Air Reserve Base,
- Cumberland Community Improvement District,
- Cobb Chamber of Commerce, and
- Georgia Commute Options.

Kennesaw State University and Life University were also invited to send representatives to the SSC meetings, but none attended.

The SSC met four times over the course of the study: November 15, 2021 (virtual), December 15, 2021 (virtual), February 2, 2022 (in-person), and April 13, 2022 (in-person). Feedback from the February 2, 2022, SSC meeting is included as **Appendix A**.

5.4 Website and Social Media Content

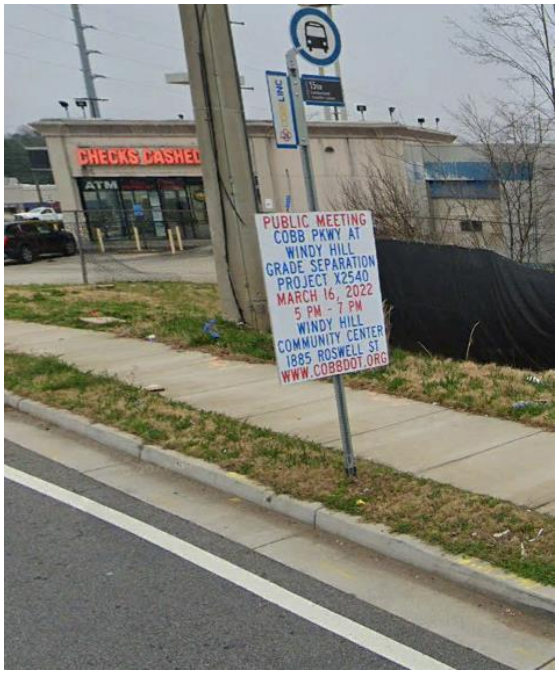
The project team worked with Cobb DOT to launch a webpage off the main Cobb DOT website in December 2021. The webpage served as a resource for information about the study where updates,

documents and announcements were posted for the public including links to the public survey and the public meeting presentation. The team also developed social media content and schedules for posting and shared with Cobb County and the SSC committee for their use in helping to advertise outreach activities.

5.5 Online Survey

As an initial public outreach event, an online survey in English and Spanish was developed and administered in December 2021 to obtain public and stakeholder insight on needs and challenges of the intersection, as well as potential solutions. The survey was advertised through social media as well as paper advertisement distributed at transit stops, businesses, and residential areas around the intersection. A total of 872 responses were received and a summary of the results were provided in Appendix A of the Existing Conditions Analysis Report. The survey results were used as input into the project alternatives and evaluation criteria.

In summary, respondents described a broad range of issues experienced at the study intersection including significant delay and congestion; safety issues with left turns, pedestrian crossings; drivers weaving between lanes, braking abruptly, and driving aggressively; and feelings of frustration, confusion, anxiety, and fear. Looking towards future improvements, congestion relief and increased capacity were ranked as the top two most beneficial improvements. The top three ranked safety issues were signal timing, driver behavior, and left turns. Overall, respondents stated that improvements to the intersection would make a measurable positive impact on the intersection's safety and operations and users' quality of life, as well as a potential economic boost for area businesses and overall aesthetics of the surrounding area. Respondents stated several factors to consider as improvements are developed, including prioritizing safety for all users; revisiting signal timing and photo enforcement cameras; grade separation; increased transit opportunities; and the impact of surrounding development and future growth on the intersection.



Ground Mounted Sign along Windy Hill Road giving notice of 03/16/2022 Public Meeting

5.6 Public Meeting

A second public outreach effort in the form of a public information open house (PIOH) was held on March 16, 2022, at the Windy Hill Community Center in Smyrna. The primary goal of the PIOH was to provide stakeholders and the public an opportunity to review and provide feedback on Options 1B, 2A, 3 and 4B (for details, refer to Section 4). Displays of the options were posted for attendees to view and project staff were available for questions and comments. An input form was provided to capture attendee opinions.

Advertisement was comprehensive and included:

- Distribution of flyers electronically to the SSC and individuals on the project mailing list and in paper format at transit stops;
- Posting of a legal advertisement in the Marietta Daily Journal;

- Posting of physical roadway signs near the study intersection; and
- Posting of social media.

Twenty members of the public attended the PIOH. Following the PIOH, the presentation was posted to the project website, in addition to a short online survey to capture additional input. A total of 29 paper and online comment forms were received as part of this effort. The PowerPoint that was presented at the public meeting and a compilation of the public's comments are included in **Appendix B**.

As presented in **Table 4**, the 29 respondents were asked to rank the four options in order of their preference from 1 (most preferred) to 4 (least preferred). Some individuals did not rank all four options, which explains why there was not an equal number of votes for each rank.

Table 4: Public Ranking of Options Presented at Public Meeting

Option	Public Rank (Number of Votes)				Average Score
	1	2	3	4	
1B	7	6	8	3	2.29
2A	3	4	6	10	3.00
3	5	7	6	6	2.54
4B	12	7	2	4	1.92
Total	27	24	22	23	2.43

Although the public did not unanimously prefer any option, Option 4B was clearly the consensus favorite and received the most #1 and #2 rankings. Option 2A was the least favorite and received the most #4 rankings.

In addition to the rankings, the public provided diverse feedback. One of the recurring comments was that Option 3 would only provide a short-term solution. Other notable comments included:

- Consider burying utility lines.
- Consider New Jersey jug handle intersections
- Provide more emphasis to pedestrian movements

For minutes of PIOH, stakeholder and PMT meetings, refer to **Appendix C**.

6. TRAFFIC OPERATIONS ANALYSIS

An operational analysis was conducted for six adjacent signalized intersections within the study network to evaluate the base network (No-Build) in addition to each of the following concept options:

- 1A: SPUI including Bridge
- 1B: SPUI including Bridge and Tunnel
- 1C: SPUI with Capacity Improvement of Windy Hill Rd
- 2A: Partial CFI along Cobb Parkway
- 2B: Partial CFI along Cobb Parkway with Capacity Improvement of Windy Hill Rd
- 2C: Partial CFI along Cobb Parkway & Windy Hill Rd with Capacity Improvement of Windy Hill Rd
- 2D: Partial CFI along Windy Hill Rd with Capacity Improvement of Windy Hill Rd
- 3: Capacity Improvement of Windy Hill Rd
- 4A: Flyover Ramp
- 4B: Flyover Ramp with Capacity Improvement of Windy Hill Rd

Synchro software v10 was utilized to analyze operational measures of effectiveness (MOEs) including vehicular control delay, LOS, and queue lengths. The analysis was performed for the AM and PM peak hours under existing 2021 conditions, Open Year 2030 conditions, and Design Year 2050 conditions. Existing conditions Synchro reports are documented in the Existing Conditions Analysis Report and are not repeated in this document. Any reference to the No Build, however, reflects the existing roadway layouts that are currently in place but with projected traffic volumes in the Design Year 2050 to reflect comparable numbers with the other alternatives.

For evaluation of the various concept options, the study network included six signalized intersections, consisting of the nearest intersections to the primary study intersection of Cobb Parkway and Windy Hill Road. The six study locations are listed below:

1. Cobb Parkway and Windy Hill Road
2. Cobb Parkway and Terrel Mill Road
3. Cobb Parkway and Lake Park Road/Target Drive
4. Cobb Parkway and Airport Industrial Park Road
5. Windy Hill Road and Windy Hill Village Driveway
6. Windy Hill Road and Village Parkway

6.1 Existing Conditions Analysis

Existing 2021 traffic conditions were analyzed using the Synchro Percentile Delay method (rather than HCM method) based on field-collected traffic data, signal timing sheets (provided by City of Marietta and Cobb County), and proposed geometrical layouts for Options 1A/1B, 2A, 2B, 2C, 2D, 3, 4A, and 4B as previously described in Section 5 of this report. Field-collected traffic data were comprised of vehicular turning movement counts, heavy vehicle percentages, pedestrian volumes, and estimated specific origin-destination turning volumes for several of the proposed options. Vehicular and pedestrian volumes were collected during the AM and PM peak hours in 15-minute intervals. Reported Synchro MOEs include delays, LOS, and 95th percentile queue lengths. Detailed Synchro analysis results for the six study intersections under existing 2021 conditions were previously presented in the Existing Conditions Analysis Report.

6.2 Review of Traffic Conditions Analysis

Annual growth rates were estimated based on historical Annual Average Daily Traffic (AADT) as obtained from local GDOT count stations. It is noted that historic counts dating back 20 years indicate that traffic volumes are fairly stagnant or even decreasing slightly on the north, south and east legs of the Windy Hill/Cobb Parkway intersection. The west leg, however, does show a positive historic growth rate primarily due to the population/employment increases observed in the City of Smyrna. Due to the variability of future growth in this region, a conservative positive annual growth rate of 2% was assumed for the west leg of Windy Hill Road and 1% for the other three intersection legs. In order to control for approach/departure traffic volume balancing, the 2% growth rate on the west leg included the same applied growth factor for the southbound right turn movement, northbound left turn movement, and westbound through movement.

Reported Synchro MOEs include delays, LOS, and 95th percentile queue lengths. Due to considerable uncertainty about when the funding will be allocated for this project, a design year of 2050 was assumed to provide a comparative operational analysis for the options being evaluated.

6.3 Design Year 2050 Conditions Analysis

Design Year 2050 traffic conditions were analyzed using Synchro Percentile Delay method based on projected traffic growth within the study network as discussed in the previous section. Reported Synchro MOEs include vehicle delays, LOS, and 95th percentile queue lengths. Resulting MOEs generated by Synchro simulation models for Options 1A/1B, 1C, 2A, 2B, 2C, 2D, 3, 4A, and 4B are provided in **Appendix D**.

Since a comparison of all options evaluated in the current concept study is exhaustive, detailed findings of the three most favorable options for the design year of 2050 along with the No Build scenario are presented in this document for purposes of comparative evaluation. Analysis results for all options considered in the evaluation processes can be similarly reviewed in **Appendix D**.

Table 5, **Table 6**, **Table 7**, and **Table 8** display vehicle delay and LOS for the No-Build scenario and Options 1C, 2B, and 4B, respectively. Motorized Vehicle Delay is reported in seconds per vehicle and is used as a service measure in compliance with the Highway Capacity Manual (HCM). Vehicle delay is presented at both the intersection approach level and intersection level during the AM and PM peak hours. The Synchro LOS thresholds reported are compliant with HCM 6 methodology. Red fonts indicate excessive delay and inadequate LOS F.

Table 5: Delay and LOS for Base Network (No-Build)

Design Year	Base Network 2050								
Peak Hour	AM		PM		Peak Hour	AM		PM	
Intersection	Delay	LOS	Delay	LOS	Approach	Delay	LOS	Delay	LOS
Cobb Pkwy @ Windy Hill Rd	78.1	E	199.0	F	EB	89.4	F	222.5	F
					WB	58.0	E	90.8	F
					NB	82.4	F	250.0	F
					SB	74.0	E	205.0	F
Cobb Pkwy @ Terrel Mill Rd	18.9	B	27.9	C	EB	--	--	--	--
					WB	55.8	E	63.9	E
					NB	7.3	A	13.4	B
					SB	10.6	B	26.9	C
Cobb Pkwy @ Lake Park Rd/ Target Dr	43.3	D	53.5	D	EB	46.2	D	31.7	C
					WB	20.7	C	68.3	E
					NB	39.5	D	54.3	D
					SB	46.4	D	55.2	E
Cobb Pkwy @ Airport Ind Park Dr	10.4	B	19.5	B	EB	52.6	D	34.8	C
					WB	61.4	E	64.2	E
					NB	5.1	A	6.7	A
					SB	7.9	A	21.0	C
Windy Hill Rd @ Windy Hill Village Dwy	12.0	B	13.6	B	EB	13.4	B	13.0	B
					WB	10.4	B	14.5	B
					NB	11.3	B	6.0	A
					SB	11.5	B	10.1	B
Windy Hill Rd @ Village Pkwy	147.0	F	145.8	F	EB	221.2	F	134.2	F
					WB	44.3	D	162.5	F
					NB	44.0	D	62.9	E
					SB	190.7	F	175.0	F

Note: *Red fonts indicate excessive delay and LOS F*

Table 6: Delay and LOS for Option 1C

Design Year	Build - (1C) SPUI with Capacity Improvement 2050								
Peak Hour	AM		PM		Peak Hour	AM		PM	
Intersection	Delay	LOS	Delay	LOS	Approach	Delay	LOS	Delay	LOS
Cobb Pkwy @ Windy Hill Rd	67.2	E	127.6	F	EB	79.5	E	122.2	F
					WB	59.5	E	90.3	F
					NB	54.9	D	180.4	F
					SB	54.6	D	123.3	F
Cobb Pkwy @ Terrel Mill Rd	17.8	B	24.5	C	EB	--	--	--	--
					WB	30.2	C	60.5	E
					NB	12.3	B	12.5	B
					SB	12.1	B	9.3	A
Cobb Pkwy @ Lake Park Rd/ Target Dr	43.3	D	53.5	D	EB	46.2	D	31.7	C
					WB	20.7	C	68.3	E
					NB	39.5	D	54.3	D
					SB	46.4	D	55.2	E
Cobb Pkwy @ Airport Ind Park Dr	10.4	B	23.2	C	EB	54.0	D	38.8	D
					WB	61.8	E	69.3	E
					NB	3.3	A	14.0	B
					SB	9.5	A	21.3	C
Windy Hill Rd @ Windy Hill Village Dwy	12.0	B	13.6	B	EB	13.4	B	13.0	B
					WB	10.4	B	14.5	B
					NB	11.3	B	6.0	A
					SB	11.5	B	10.1	B
Windy Hill Rd @ Village Pkwy	146.6	F	121.0	F	EB	221.2	F	137.0	F
					WB	43.2	D	116.6	F
					NB	44.0	D	66.4	E
					SB	190.7	F	179.0	F

Note: *Red fonts indicate excessive delay and LOS F*

Table 7: Delay and LOS for Option 2B

Design Year	Build - (2B) Partial CFI with Capacity Improvement 2050								
Peak Hour	AM		PM		Peak Hour	AM		PM	
Intersection	Delay	LOS	Delay	LOS	Approach	Delay	LOS	Delay	LOS
Cobb Pkwy @ Windy Hill Rd	45.7	D	68.9	E	EB	52.4	D	95.9	F
					WB	62.7	E	83.1	F
					NB	34.1	C	65.7	E
					SB	32.0	C	46.5	D
Cobb Pkwy @ Terrel Mill Rd	74.4	E	160.2	F	EB	--	--	--	--
					WB	87.6	F	127.0	F
					NB	57.9	E	219.0	F
					SB	71.4	E	91.2	F
Cobb Pkwy @ Lake Park Rd/ Target Dr	40.6	D	51.2	D	EB	45.8	D	33.0	C
					WB	21.1	C	65.7	E
					NB	36.9	D	51.4	D
					SB	41.2	D	52.8	D
Cobb Pkwy @ Airport Ind Park Dr	8.4	A	23.8	C	EB	60.9	E	39.2	D
					WB	70.2	E	70.5	E
					NB	1.0	A	13.8	B
					SB	6.2	A	22.3	C
Windy Hill Rd @ Windy Hill Village Dwy	12.0	B	11.9	B	EB	13.3	B	10.7	B
					WB	10.4	B	13.1	B
					NB	11.3	B	6.8	A
					SB	11.5	B	12.0	B
Windy Hill Rd @ Village Pkwy	146.6	F	129.1	F	EB	221.2	F	143.9	F
					WB	43.2	D	127.3	F
					NB	44.0	D	60.5	E
					SB	190.7	F	187.1	F

Note: *Red fonts indicate excessive delay and LOS F*

Table 8: Delay and LOS for Option 4B

Design Year	Build - (4B) Flyover Ramp & Capacity Improvement 2050								
Peak Hour	AM		PM		Peak Hour	AM		PM	
Intersection	Delay	LOS	Delay	LOS	Approach	Delay	LOS	Delay	LOS
Cobb Pkwy @ Windy Hill Rd	42.2	D	65.5	E	EB	46.3	D	48.2	D
					WB	39.6	D	78.2	E
					NB	36.9	D	67.5	E
					SB	42.3	D	66.0	E
Cobb Pkwy @ Terrel Mill Rd	14.4	B	17.6	B	EB	--	--	--	--
					WB	38.9	D	64.8	E
					NB	8.0	A	7.5	A
					SB	12.2	B	15.3	B
Cobb Pkwy @ Lake Park Rd/ Target Dr	43.3	D	51.2	D	EB	46.2	D	34.1	C
					WB	20.7	C	76.1	E
					NB	39.5	D	48.0	D
					SB	46.4	D	54.1	D
Cobb Pkwy @ Airport Ind Park Dr	8.7	B	24.3	C	EB	39.8	D	32.4	C
					WB	43.6	D	62.6	E
					NB	2.4	A	18.3	B
					SB	9.4	A	21.6	C
Windy Hill Rd @ Windy Hill Village Dwy	12.0	B	13.6	B	EB	13.4	B	13.0	B
					WB	10.4	B	14.5	B
					NB	11.3	B	6.0	A
					SB	11.5	B	10.1	B
Windy Hill Rd @ Village Pkwy	144.0	F	123.0	F	EB	213.3	F	132.7	F
					WB	44.8	D	122.6	F
					NB	49.4	D	63.3	E
					SB	212.7	F	188.5	F

Note: *Red fonts indicate excessive delay and LOS F*

While traffic operations for most intersections are improved for any of these options versus the No-Build, there are some notable impacts to some of the network intersections outside of Cobb Parkway/Windy Hill Road. This includes the intersection of Windy Hill and Village Parkway, located to the west of Cobb Parkway. The increase in traffic volumes becomes significant with the application of 2% growth rate until the year 2050, and this volume of traffic becomes metered by the transition from the six-lane cross section east of Village Parkway to a four-lane cross section west of Village Parkway. Future improvements, as indicated in Cobb County's plan, to widen Windy Hill Road further west to Atlanta Road, will certainly provide significant operational benefits. Since funding is not in place; however, this widening was not assumed for this report.

For the partial CFI option, it is noted that significant impacts occur to traffic operations at Terrel Mill Road. The existing signalized intersection of Cobb Parkway and Terrell Mill Road would be modified to create an additional phase to allow for SB left turn movements destined for eastbound Windy Hill Road to cross over the northbound through movements on Cobb Parkway, while it still allows other SB left turning vehicles to make their ways to Terrell Mill Road.

In a similar fashion, **Table 9**, **Table 10**, **Table 11**, and **Table 12** provide projected 95th percentile queue lengths and queue storage ratios during the Design Year 2050 for the No-Build condition and Options 1C, 2B, and 4B, respectively. The 95th-percentile queue is the queue length (measured in feet based on average passenger car and truck vehicle lengths) that has only a 5-percent probability of being exceeded during the peak period. A queue storage ratio is the ratio of the predicted back-of-queue length to the available vehicle storage length. Values greater than 1.0, as shown in red font, indicate insufficient storage of bay lengths and locations where queue spillbacks are most likely to occur.

One of the spillback locations shown across every option and the No-Build is for the northbound left turns from Cobb Parkway to Lake Park Road. It is currently observed that due to the congestion at the Windy Hill Road/Cobb Parkway intersection, local drivers have utilized the Lake Park Road, which connects with Village Parkway and Windy Hill Road, to head west towards Smyrna. For purposes of this study, the existing northbound lefts at Lake Park Road were assumed would continue growing until 2050. However, with improvements proposed at the Cobb Parkway/Windy Hill Road intersection by any of the options, this level of queueing at Lake Park Road may decrease in future years.

Table 9: 95th Percentile Queue Length for Base Network (No-Build)

Base Network 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Cobb Pkwy @ Windy Hill Rd	EBL	Dual	735	689	686	0.94
	EBR	Single	185	138	88	0.75
	WBL	Dual	390	147	180	0.46
	WBR	Single	Continuous	328	291	0.00
	NBL	Dual	400	192	980	2.45
	NBR	Single	540	18	61	0.11
	SBL	Dual	530	180	267	0.50
	SBR	Dual	625	442	1,698	2.72
Cobb Pkwy @ Terrel Mill Rd	WBL	Dual	Continuous	210	630	0.00
	WBR	Single	595	52	82	0.14
	NBL	--	--	--	--	--
	NBR	Single	Continuous	245	133	0.00
	SBL	Single	140	161	300	2.14
	SBR	--	--	--	--	0.00
Cobb Pkwy @ Lake Park Rd/ Target Dr	EBL	Single	100	218	137	2.18
	EBR	Single	Continuous	724	191	0.00
	WBL	Single	Continuous	37	275	0.00
	WBR	--	--	--	--	--
	NBL	Single	105	248	575	5.48
	NBR	Single	110	0	108	0.98
	SBL	Single	105	30	141	1.34
	SBR	Single	1000	0	12	0.01
Cobb Pkwy @ Airport Ind Park Dr	EBL	--	--	--	--	--
	EBR	Single	220	15	18	0.08
	WBL	Single	195	128	170	0.87
	WBR	Single	210	0	58	0.28
	NBL	Single	130	15	28	0.22
	NBR	Single	130	6	64	0.49
	SBL	Single	175	18	139	0.79
	SBR	Single	600	16	11	0.03
	EBL	Single	195	16	36	0.18

Base Network 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Windy Hill Rd @ Windy Hill Village Dwy	EBR	--	--	--	--	--
	WBL	Single	385	56	36	0.15
	WBR	--	--	--	--	--
	NBL	--	--	--	--	--
	NBR	Single	Continuous	3	0	0.00
	SBL	--	--	--	--	--
	SBR	Single	Continuous	0	9	0.00
Windy Hill Rd @ Village Pkwy	EBL	Single	140	42	109	0.78
	EBR	--	--	--	--	--
	WBL	Single	210	314	281	1.50
	WBR	--	--	--	--	--
	NBL	Single	Continuous	116	469	0.00
	NBR	--	--	--	--	--
	SBL	--	--	--	--	--
	SBR	--	--	--	--	--

Note: *Red fonts indicate insufficient storage bay length and potential queuing issues*

Table 10: 95th Percentile Queue Length for Option 1C

(1C) SPUI with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Cobb Pkwy @ Windy Hill Rd	EBL	Dual	695	906	676	1.30
	EBR	Single	185	190	61	1.03
	WBL	Dual	390	111	137	0.35
	WBR	Single	255	0	0	0.00
	NBL	Dual	400	145	836	2.09
	NBR	Single	325	58	67	0.00
	SBL	Single	390	502	570	1.46
	SBR	Dual	315	258	1,402	4.45
Cobb Pkwy @ Terrel Mill Rd	WBL	Dual	Continuous	210	545	0.00
	WBR	Single	595	52	68	0.11
	NBL	--	--	--	--	--
	NBR	Single	Continuous	371	750	0.00
	SBL	Single	355	102	68	0.29
	SBR	--	--	--	--	--
Cobb Pkwy @ Lake Park Rd/ Target Dr	EBL	Single	100	218	137	2.18
	EBR	Single	Continuous	724	191	0.00
	WBL	Single	Continuous	37	275	0.00
	WBR	--	--	--	--	--
	NBL	Single	105	260	575	5.48
	NBR	Single	110	0	108	0.98
	SBL	Single	105	30	143	1.36
	SBR	Single	1000	0	12	0.01
Cobb Pkwy @ Airport Ind Park Dr	EBL	--	--	--	--	--
	EBR	Single	220	14	34	0.15
	WBL	Single	195	126	327	1.68
	WBR	Single	210	0	64	0.30
	NBL	Single	130	15	43	0.33
	NBR	Single	130	0	24	0.18
	SBL	Single	175	19	148	0.85
	SBR	Single	600	17	21	0.04
	EBL	Single	195	16	36	0.18

(1C) SPUI with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Windy Hill Rd @ Windy Hill Village Dwy	EBR	--	--	--	--	--
	WBL	Single	385	46	36	0.12
	WBR	--	--	--	--	--
	NBL	--	--	--	--	--
	NBR	Single	Continuous	5	0	0.00
	SBL	--	--	--	--	--
	SBR	Single	Continuous	0	9	0.00
Windy Hill Rd @ Village Pkwy	EBL	Single	140	38	105	0.75
	EBR	--	--	--	--	--
	WBL	Single	360	445	417	1.24
	WBR	Single	Continuous	15	12	0.00
	NBL	Single	Continuous	175	464	0.00
	NBR	--	--	--	--	--
	SBL	--	--	--	--	--
	SBR	--	--	--	--	--

Note: *Red fonts indicate insufficient storage bay length and potential queuing issues*

Table 11: 95th Percentile Queue Length for Option 2B

(2B) Partial CFI with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Cobb Pkwy @ Windy Hill Rd	EBL	Dual	695	669	669	0.96
	EBR	Single	185	0	0	0.00
	WBL	Dual	390	68	115	0.29
	WBR	Single	255	0	0	0.00
	NBL	Dual	Continuous	138	722	0.00
	NBR	Single	475	51	57	0.12
	SBL	Single	Continuous	144	3	0.00
	SBR	Dual	450	90	619	1.38
Cobb Pkwy @ Terrel Mill Rd	WBL	Dual	Continuous	518	751	0.00
	WBR	Single	595	83	114	0.19
	NBL	--	--	--	--	--
	NBR	--	--	--	--	--
	SBL	Dual	315	496	658	2.09
	SBR	--	--	--	--	--
Cobb Pkwy @ Lake Park Rd/ Target Dr	EBL	Single	100	225	137	2.25
	EBR	Single	Continuous	695	190	0.00
	WBL	Single	Continuous	38	271	0.00
	WBR	--	--	--	--	--
	NBL	Single	105	262	575	5.48
	NBR	Single	110	0	108	0.98
	SBL	Single	105	36	143	1.36
	SBR	Single	1000	21	12	0.02
Cobb Pkwy @ Airport Ind Park Dr	EBL	--	--	--	--	--
	EBR	Single	220	10	33	0.15
	WBL	Single	195	127	332	1.70
	WBR	Single	210	0	64	0.30
	NBL	Single	130	4	10	0.08
	NBR	Single	130	0	8	0.06
	SBL	Single	175	26	183	1.05
	SBR	Single	600	14	21	0.04
	EBL	Single	195	20	36	0.18

(2B) Partial CFI with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Windy Hill Rd @ Windy Hill Village Dwy	EBR	--	--	--	--	--
	WBL	Single	385	46	20	0.12
	WBR	--	--	--	--	--
	NBL	--	--	--	--	--
	NBR	Single	Continuous	5	0	0.00
	SBL	--	--	--	--	--
	SBR	Single	Continuous	0	12	0.00
Windy Hill Rd @ Village Pkwy	EBL	Single	140	38	109	0.78
	EBR	--	--	--	--	--
	WBL	Single	360	445	779	0.00
	WBR	Single	Continuous	15	31	0.00
	NBL	Single	Continuous	175	452	0.00
	NBR	--	--	--	--	--
	SBL	--	--	--	--	--
	SBR	--	--	--	--	--

Note: *Red fonts indicate insufficient storage bay length and potential queuing issues*

Table 12: 95th Percentile Queue Length for Option 4B

(4B) Flyover Ramp with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Cobb Pkwy @ Windy Hill Rd	EBL	Dual	110	146	155	1.41
	EBR	Single	185	37	22	0.20
	WBL	Dual	390	46	140	0.36
	WBR	Single	255	106	178	0.70
	NBL	Dual	400	64	605	1.51
	NBR	Single	540	0	33	0.06
	SBL	Dual	530	92	231	0.44
	SBR	Dual	490	35	628	1.28
Cobb Pkwy @ Terrel Mill Rd	WBL	Dual	Continuous	157	299	0.00
	WBR	--	--	--	--	--
	NBL	--	--	--	--	--
	NBR	Single	Continuous	0	0	0.00
	SBL	Single	140	199	288	2.06
	SBR	--	--	--	--	--
Cobb Pkwy @ Lake Park Rd/ Target Dr	EBL	Single	100	218	149	2.18
	EBR	Single	Continuous	724	191	0.00
	WBL	Single	Continuous	37	300	0.00
	WBR	--	--	--	--	--
	NBL	Single	105	260	591	5.63
	NBR	Single	110	0	111	1.01
	SBL	Single	105	30	159	1.51
	SBR	Single	1000	0	17	0.02
Cobb Pkwy @ Airport Ind Park Dr	EBL	--	--	--	--	--
	EBR	Single	220	22	20	0.10
	WBL	Single	195	89	304	1.56
	WBR	Single	210	5	86	0.41
	NBL	Single	130	18	23	0.18
	NBR	Single	130	0	34	0.26
	SBL	Single	175	17	144	0.82
	SBR	Single	600	6	19	0.03
	EBL	Single	195	16	36	0.18

(4B) Flyover Ramp with Capacity Improvement 2050						
Intersection	Turning Movement	Number of Lanes	Storage Bay Length (ft)	95th Percentile Queue Length (ft)		Queue Storage Ratio
				AM	PM	
Windy Hill Rd @ Windy Hill Village Dwy	EBR	--	--	--	--	--
	WBL	Single	385	46	36	0.12
	WBR	--	--	--	--	--
	NBL	--	--	--	--	--
	NBR	Single	Continuous	5	0	0.00
	SBL	--	--	--	--	--
	SBR	Single	Continuous	0	9	0.00
Windy Hill Rd @ Village Pkwy	EBL	Single	140	42	88	0.63
	EBR	--	--	--	--	--
	WBL	Single	330	522	580	0.00
	WBR	Single	Continuous	17	13	0.00
	NBL	Single	Continuous	203	420	0.00
	NBR	--	--	--	--	--
	SBL	--	--	--	--	--
	SBR	--	--	--	--	--

***Note**: Red fonts indicate insufficient storage bay length and potential queuing issues*

6.4 Overall Network Evaluation

As part of the traffic analysis of the study network, a combination of individual intersection and overall network evaluations were considered for the top three options (1C, 2B, and 4B); each of which was given a numerical rating based on two parameters: individual intersection delay and average network delay. This quantitative evaluation aims to rank the three options and to facilitate the decision-making process.

6.4.1 Intersection Performance

Individual intersection performance is associated with the overall delay experienced at the intersection of Cobb Parkway and Windy Hill Rd during the AM and PM peak hours. Intersection delay for Options 1C, 2B, and 4B were previously presented in **Table 6**, **Table 7**, and **Table 8**, respectively. For convenience, **Table 13** summarizes the overall intersection delay for these three options.

Table 13: Cobb Parkway/Windy Hill Road Intersection Delay

Design Year 2050	Option	Cobb Pkwy & Windy Hill Rd Delay (seconds/vehicle)	
Description	Peak Hour	AM	PM
SPUI with Capacity Improvement	1C	67.2	127.6
Partial CFI with Capacity Improvement	2B	45.7	68.9
Flyover Ramp with Capacity Improvement	4B	42.2	65.5

***Note**: Red fonts indicate excessive delay and LOS F*

6.4.2 Network Performance

The network performance is associated with the weighted average overall delay for the study network of the six adjacent intersections during the AM and PM peak hours. The network delay aggregates vehicle delay for each intersection weighted by intersection total vehicular volumes. The weighted average network delay was calculated for each of the three options as presented in **Table 14**.

Table 14: Weighted Average Network Delay

Design Year 2050	Option	Weighted Network Delay Delay (seconds/vehicle)	
Description	Peak Hour	AM	PM
SPUI with Capacity Improvement	1C	49.2	64.1
Partial CFI with Capacity Improvement	2B	51.3	71.0
Flyover Ramp with Capacity Improvement	4B	41.4	44.9

6.4.3 Rating of Options

To quantify the performance of each option, two steps were followed. First, each of the above two evaluation parameters, i.e., intersection performance and network performance, were given a different weight. Since the focus of this study is the intersection of Cobb Parkway and Windy Hill Road, 70% of the total score was allocated to this specific intersection performance, while the remaining 30% was allocated to the overall network performance. Second, each of the two parameters was rated separately during the AM and PM peak hours. The option that incurs the lowest delay was given the highest rating. Finally, an average rating was taken accounting for both peak hours combined for each option (**Table 15**) presents average ratings of the best performing options.

Table 15: Quantitative Operational Evaluation

Intersection Performance (70/70)					
Option	**AM Delay**	**AM Rating**	**PM Delay**	**PM Rating**	**Average Rating**
1C	67.2	44	127.6	36	40
2B	45.7	65	68.9	67	66
4B	42.2	70	65.5	70	70
Network Performance (30/30)					
Option	**AM Delay**	**AM Rating**	**PM Delay**	**PM Rating**	**Average Rating**
1C	49.2	25	64.1	21	23
2B	51.3	24	71.0	19	22
4B	41.4	30	44.9	30	30

6.4.5 Ranking of Options

Based on the two evaluation parameters and the average rating assigned to each option, the best performing option can be determined. **Table 16** presents a summary of the top three options ranked based on intersection and network operational performance. As noted in **Table 16**, Option 4B secured an average total rating of 100 out of 100 points versus the other two competing options. Therefore, based on this quantitative evaluation, Option 4B is the best performing option specifically in terms of traffic operations of the study network.

Table 16: Ranking of Options

Intersection & Network Performance (100/100)		
Option	**Total Rating**	**Rank**
1C	63	3
2B	87	2
4B	100	1

6.5 Delay Cost Analysis

A cost of delay analysis was performed to determine how much money could be saved by reducing motorized vehicular delay that drivers will experience with each of the top three options: 1C, 2B, and 4B. Road users cost was determined based on Texas Transportation Institute (TTI) data published in 2021. The initial year used for the cost analysis was 2035 since it is beyond this year that the widening of Windy Hill Road (common to all three options) is projected to fail due to excessive delay. The reference scenario used for calculation of comparative projected delay cost is the No Build. Two daily peak hours in 250 working days a year were considered in the analysis. It should be noted that the calculations of potential delay savings resulted from each one of the three options were associated with the study network as a whole and were not part of the ranking process introduced in the preceding section. In other words, the ranking process in Section 6.4.5 was solely based on motorized vehicle delay experienced by drivers at both the intersection level and the network level. **Note** that the negative values in this table represent those locations where average delays will be greater than that expected in the No Build condition; hence the “savings” to drivers will be negative since they will incur more stopped time at these intersections. Most of these negative values are a magnitude smaller than the much higher positive values encountered at the Cobb Parkway/Windy Hill Road intersection, which then improves the overall time savings for motorists through the combination of the six studied intersections.

Table 17 presents a summary of average annual peak hour delay savings in the Design Year of 2050. Note that the negative values in this table represent those locations where average delays will be greater than that expected in the No Build condition; hence the “savings” to drivers will be negative since they will incur more stopped time at these intersections. Most of these negative values are a magnitude smaller than the much higher positive values encountered at the Cobb Parkway/Windy Hill Road intersection, which then improves the overall time savings for motorists through the combination of the six studied intersections.

Table 17: Driver Delay Savings

Intersection	Peak Hour	Delay Unit Cost ($/vehicle-hour)		Average Annual Peak Hour Delay Savings		
		PC	Trucks	1C	2B	4B
Cobb Pkwy @ Windy Hill Rd	AM	30.54	41.91	$56,468	$242,979	$273,423
	PM			$1,252,211	$1,914,544	$1,940,904
Cobb Pkwy @ Terrel Mill Rd	AM	30.54	41.91	$13,853	-$302,078	$40,318
	PM			$63,153	-$1,085,539	$117,508
Cobb Pkwy @ Lake Park Rd/Target Dr	AM	30.54	41.91	$3,867	$14,547	$3,867
	PM			$2,751	$16,228	$10,727
Cobb Pkwy @ Airport Ind Park Dr	AM	30.54	41.91	-$2,843	$5,387	$4,339
	PM			-$10,946	-$3,028	-$9,083
Windy Hill Rd @ Windy Hill Village Dwy	AM	30.54	41.91	-$12,021	-$12,021	-$12,021
	PM			-$2,622	$11,652	-$2,622
Windy Hill Rd @ Village Pkwy	AM	30.54	41.91	$59,930	$73,090	$64,732
	PM			$164,532	$48,699	$66,265
Total Network Average Annual Peak Hour Delay Savings				**$1,588,332**	**$924,459**	**$2,498,359**

***Note**: Red fonts indicate an increase in delay cost in comparison with the reference No Build scenario*

7. CRASH ANALYSIS

A crash analysis was conducted for the impacted intersections within the study network to evaluate the potential for crash reductions for each option, utilizing historical crash data obtained from Georgia Electronic Accident Reporting System (GEARS) for a five-year period from 2015 to 2019. The historical data was previously presented in the Existing Conditions Analysis Report. Crash diagrams are included in **Appendix E.**

The network study intersections are, as previously noted, as follows:

1. Cobb Parkway and Windy Hill Road
2. Cobb Parkway and Terrell Mill Road
3. Cobb Parkway and Lake Park Road/Target Drive
4. Cobb Parkway and Airport Industrial Park Road
5. Windy Hill Road and Windy Hill Village Driveway
6. Windy Hill Road and Village Parkway

7.1 Crash Reduction

The following highlights critical changes in conflict points and traffic volumes, estimates predicted future collisions, and calculates crash cost reduction or increases for each of the top three performing options: 1C, 2B, and 4B. Future predicted crashes were determined by applying the following assumptions to the relevant proposed concept options:

- Traffic volume is directly proportional to the collision frequency.
- Conflict points are directly proportional to the collision frequency.
- 95% of angle and head-on collision occurs within the boundaries of the intersection functional area. Remainder of crashes are along the roadway but in front of nearby driveways.
- Crossing and turning conflict points are the main contributors to angle and head-on crashes.

Crash analysis and results for the remaining options can be found in **Appendix E**. A full description of each option considered in the analysis is previously discussed in Section 4 of this document.

7.1.1 Option 1C

- Cobb Parkway and Windy Hill Road:
  - Reduction in crossing and turning conflicts by 12% due to reduction of at-grade northbound and southbound through lanes.
  - Decrease in average northbound and southbound through traffic on Cobb Parkway by 59%.
  - Decrease in average northbound and southbound total traffic by 33%. Thus, sideswipe and rear-end crashes may reduce 33% for these same approaches.
  - The overall intersection at-grade entering vehicular volume reduces by 17%; therefore, other types of crashes may reduce by nearly 17%.
- Cobb Parkway and Terrell Mill Road:
  - No changes in crossing and turning conflict points as the intersection layout and lane configuration remain unchanged.
  - Decrease in average northbound and southbound through traffic on Cobb Parkway by 52%.
  - Decrease in average northbound and southbound total traffic by 41%. Thus, sideswipe and rear-end crashes may reduce 41% on the northbound and southbound approaches.
  - The overall at-grade entering vehicular volume reduces by 32%; therefore, other types of crashes may reduce by 32%.

- Cobb Parkway and Airport Industrial Park Drive:
  - Angle crashes and head-on crashes may remain the same since the intersection geometry and traffic volume remain unchanged.
  - Rear-end crashes and sideswipe crashes along the northbound and southbound approaches may increase by approximately 5-6% due to increase in the northbound approach speed since traffic is coming downhill from the bridge over Terrell Mill Road.

Table 18 displays a comparison between reported crashes and predicted crashes by crash type per intersection, along with a crash reduction percentage.

Table 18: Crash Reduction for Option 1C

Intersection	Crash Type	Annual Average Reported Crashes	Predicted Crashes	Crash Reduction
Cobb Pkwy @ Windy Hill Rd	Angle	278	160	42%
	Head on	9	5	44%
	Sideswipe	134	122	9%
	Others	12	10	17%
	Rear End	419	294	30%
Cobb Pkwy @ Terrell Mill Rd	Angle	109	67	39%
	Head on	3	2	33%
	Sideswipe	40	30	25%
	Others	11	8	27%
	Rear End	161	111	31%
Cobb Pkwy @ Airport Industrial Park Dr	Angle	35	35	0%
	Head on	2	2	0%
	Sideswipe	16	17	-6%
	Others	3	3	0%
	Rear End	62	65	-5%

Note: *Red fonts indicate an increase in predicted crashes in comparison with the reference No Build scenario*

7.1.2 Option 2B

- Cobb Parkway and Windy Hill Road & Northbound Left Turn Crossover:
  - Due to an additional through lane on each approach of Windy Hill Road, the total number of crossing and turning conflict points (main intersection and northbound crossover) are comparable to the existing conflict points. Therefore, angle and head-on crashes may remain the same.
  - The intersection total entering traffic volume remains unchanged since no grade separation exists.

- Sideswipe and rear-end crashes may increase by approximately 10% due to the complexity of lane selection and potential confusion to unfamiliar drivers.

- Cobb Parkway and Terrell Mill Road & Southbound left turn Crossover for Windy Hill Road:
  - Increase in crossing and turning conflict points by 1.9 times. As a result, angle and head-on crashes may increase by 1.9 times as well.
  - Rear-end crashes may increase by approximately 10% due to complexity of lane selection and potential confusion to unfamiliar drivers.

Table 19 shows a comparison between reported crashes and predicted crashes by crash type per intersection, along with a crash reduction percentage.

Table 19: Crash Reduction for Option 2B

Intersection	Crash Type	Annual Average Reported Crashes	Predicted Crashes	Crash Reduction
Cobb Pkwy @ Windy Hill Rd & NB Crossover	Angle	278	278	0%
	Head on	9	9	0%
	Sideswipe	134	147	-10%
	Others	12	13	-8%
	Rear End	419	461	-10%
Cobb Pkwy @ Terrell Mill Rd & SB Crossover	Angle	109	207	-90%
	Head on	3	6	-100%
	Sideswipe	40	44	-10%
	Others	11	12	-10%
	Rear End	161	177	-10%

Note: *Red fonts indicate an increase in predicted crashes in comparison with the reference No Build scenario*

7.1.3 Option 4B

- Cobb Parkway and Windy Hill Road:
  - Increase in crossing and turning conflict by 24% due to intersection widening (adding through lanes).
  - Reduction in average eastbound left turn traffic volume by 55% and southbound right turn volume by 57%.
  - Decrease in average eastbound traffic volume by 18% and southbound traffic volume by 22 %; therefore, sideswipe and rear-end crashes may reduce on the eastbound approach by 18% and on the southbound approach by 22%. In addition, sideswipe, rear-end and other crashes may increase by 5% due the complexity of lane selection.
- Cobb Parkway and Terrell Mill Road:
  - Increase in crossing and turning conflicts by 56%.
  - Reduction in average westbound left turn traffic volume by 60%.
  - Reduction in average westbound entering traffic volume by 45%. Thus, sideswipe and rear-end crashes may reduce by 45% on the westbound approach.

- The overall intersection entering vehicular volume reduces by 32%, and consequently other types of crashes may reduce by 32%.

- Windy Hill Road and Village Parkway:
  - Angle and head-on crashes may remain the same because of no changes in crossing and turning conflict points.
  - It is assumed that sideswipe and rear-end crashes may increase by approximately 10% due to the westbound right turn lane drop plus the merge from the southbound to westbound bridge traffic entering the Windy Hill Road traffic stream.

Table 20 displays a comparison between reported crashes and predicted crashes by crash type per intersection, along with a crash reduction percentage.

Table 20: Crash Reduction for Option 4B

Intersection	Crash Type	Annual Average Reported Crashes	Predicted crashes	Crash Reduction
Cobb Pkwy @ Windy Hill Rd	Angle	278	227	18%
	Head on	9	7	22%
	Sideswipe	134	120	10%
	Others	12	11	8%
	Rear End	419	374	11%
Cobb Pkwy @ Terrell Mill Rd	Angle	109	37	66%
	Head on	3	1	67%
	Sideswipe	40	35	13%
	Others	11	9	18%
	Rear End	161	146	9%
Windy Hill Rd @ Village Pkwy	Angle	64	64	0%
	Head on	4	4	0%
	Sideswipe	26	29	-12%
	Others	5	5	0%
	Read End	138	152	-10%

Note: *Red fonts indicate an increase in predicted crashes in comparison with the reference No Build scenario*

7.2 Average Annual Crash Cost Reduction

An analysis of crash cost was performed to estimate the average annual crash cost reduction or increase, utilizing the latest crash cost data published by Georgia Department of Transportation (GDOT) as shown in **Table 21**.

Table 21: GDOT Crash Cost by Crash Severity

Degree of Severity	Cost (Each Incident)
(K) Fatal Injury	$10,451,000
(A) Suspected Serious Injury	$2,285,000
(B) Suspected Minor / Visible Injury	$501,000
(C) Possible Injury / Complaint	$110,000
(O) No Injury	$24,000

Table 22 presents a summary of average annual crash cost reduction for the top three concept options at the impacted intersections within the study network. A summary of average annual crash cost for the remaining options are provided in Appendix E. Clearly, it is evident that Option 2B would result in additional potential crash risks, thereby making it less safe as compared to the current geometry in the study area. The other two grade separation options would offer overall safety benefits within the study area, with the SPUI (Option 1C) providing a greater amount of predicted crash reductions versus the flyover option (Option 4B).

Table 22: Average Annual Crash Cost Reduction

Intersection	Option 1C	Option 2B	Option 4B
Cobb Pkwy @ Windy Hill Rd	$2,711,283	-$603,940	$1,219,383
Cobb Pkwy @ Terrell Mill Rd	$1,358,476	-$1,737,120	$1,352,429
Cobb Parkway @ Airport Industrial Park Dr	-$495,300	N/A	N/A
Windy Hill Rd @ Village Pkwy	N/A	N/A	-$202,750
Total Reduction	**$3,574,459**	**-$2,341,060**	**$2,369,062**

Note: *Red fonts indicate an increase in annual crash cost in comparison with the reference No Build scenario*

8. COST ESTIMATES

One of the determining factors in the selection of the preferred option for the Cobb Parkway / Windy Hill Road intersection is the total cost. This section of the report describes the assumptions made while developing high-level cost estimates of the options of the three primary concepts that would provide the best traffic operations (i.e., Options 1C, 2B and 4B).

For each option that is being analyzed, the estimated construction, ROW, and utility costs are compared. The assumptions used to develop these estimates are discussed in separate subsections. These cost estimates are based on the limited design information available at the time they were prepared and are subject to refinement as the design advances.

All costs are escalated for Year 2025, as later implementation years would carry a greater risk of inaccuracy due to the uncertainty of long-term inflation.

Refer to **Appendix F** for spreadsheets with summaries of the estimated construction, ROW, and utility costs for each option, which are among the evaluation categories in the matrix (see Section 10). Grand Total Project Costs that also include estimated costs for design, environmental mitigation, and construction engineering and inspection are also summarized in Appendix F.

8.1 Construction Cost

The high-level construction cost estimates of the options consider the following components. Where feasible, estimated conceptual design level quantities are measured (i.e., new pavement). Where the concept designs do not provide sufficient details to measure quantities (i.e., traffic control), the costs are estimated as a factored percent of the quantifiable scope. Listed below are several key components that drive the construction cost for the evaluated options:

- Civil Sitework
  - Clearing, Grubbing and Demolition
  - Excavation, including rock excavation. Only Option 1C, which includes the underpass, was assumed to include rock excavation.
  - Embankment
  - MSE/Cast-in-Place Walls – Note: walls are considered part of the civil sitework, not part of structures.
  - Asphalt Concrete (AC) Paving – All AC pavement is considered full-depth to include road sub-base and base layers. Furthermore, all new driveway pavement was considered AC.
  - Milling and overlay of existing AC pavement
  - Reconstructed or New Sidewalk
  - Concrete Barriers
  - Drainage – Assumed to be 8% to 15% of the sum of the costs of the roadway items. In general, there should not be much variability between the three options since drainage is more a function of land area and volume of runoff than cost of built improvements. The variable assumed percentages balances the estimated drainage costs.
  - Utilities (refer to Section 8.2)
- Structures
  - Bridge (Overpass) – Per square foot of superstructure.

- Bridge (Underpass) – Per square foot of the top of the underpass which includes the cost of the support of excavation (SOE).

- Traffic
  - Traffic Signals.
  - Traffic Control (Maintenance of Traffic) – Considered as 10% of the sum of the measured roadway items for the at-grade improvements (Option 2B) and 4% for options with structures (Options 1C and 4B).
  - Traffic signs, pavement road markings and street lighting - Considered as 5% of the sum of the measured roadway items
- Miscellaneous
  - Erosion control – Considered as 1.5% for at-grade improvements and 5% for grade separations.
  - Maintenance during construction and temporary conditions
  - Landscaping

Other indirect construction costs that were estimated as an assumed percent of the measured construction cost include:

- General conditions/requirements (7%)
- Mobilization (3%)
- Profit (10%)
- Bonding/insurance (3%)

The subtotal was then escalated at an assumed 7% per year to derive an estimated cost of construction in Year 2025.

Refer to **Table 23** for a summary of the estimated construction costs (Year 2025) of the three options.

Table 23: Estimated Construction Costs ($ Millions)

Options		
1C	**2B**	**4B**
$133.7	$44.5	$96.6

8.2 Utility Relocation Cost

The high-level utility cost estimates of the options, which can be considered as part of the total construction costs, considered the following components:

- Electric Power Line Relocation
  - Overhead
    - Transmission Lines (all options)
    - Distribution Lines (all options)
  - Underground
    - Distribution Lines (Options 1C and 4B)
- Water Line Relocation
  - 2” Line (all options)

  - 8” Line (all options)
  - 10” Line (all options)
  - 12” Line (Options 1C and 2B)
- Gas Line Relocation
  - 4” Line (all options)
  - 8” Line (all options)
  - 10” Line (all options)
  - 12” Line (all options)
- Communication Line Relocation (all options)
- Sanitary Sewer Relocation (Option 1B)
- Business connections (all options)

Refer to **Table 24** for a summary of the estimated utility relocation costs of the various concepts. These costs are escalated as part of the comprehensive construction cost estimates.

Table 24: Estimated Utility Costs ($ Millions)

Options		
1C	2B	4B
$15.0	$9.6	$11.9

Note that the estimates in **Table 24** are based on the conservative assumption that all utilities have prior rights and, consequently, Cobb County would be responsible for all diversions. Upon investigation of prior rights in the preliminary engineering phase, the estimated utility diversion cost might be reduced.

8.3 Right of Way (ROW) Cost

The project is in an established primarily commercial area of Cobb County. Consequently, the cost of additional ROW, damages for impaired access, and displacements could be one of the key factors in determining the preferred option or even whether an option is viable.

The required ROW depicted on the layouts of the various options is the estimated minimum property required based on the arterial border areas suggested in Section 6 of the GDOT Design Policy Manual (DPM). The proposed ROW does not account for interfacing future projects such as the Cobb Parkway Trail (central) Part A (for details, refer to the Existing Conditions Analysis Report, Section 7.2). Furthermore, Cobb County might consider acquiring additional ROW beyond these limits for the following reasons:

- For potential future expansions and enhancements (i.e., additional thru or turn lanes, bus/transit lanes, wider medians, bike lanes or shared use paths, parking, etc.),
- For future utilities,
- To provide wider offsets to off-road obstacles such as guardrail and utility poles to minimize the potential for off-road collisions and to improve sight distances,
- To allow for landscaping and other aesthetic enhancements.

Items that are quantified in the ROW estimate include:

- ROW* - $1,250,000 per acre
- Permanent Easement* - $937,500 per acre (75% of ROW)
- Trade Fixtures – Trade fixtures are items attached to rented property that the lessee would be entitled to take with them when the lease ends.
- Sign Value and Valuation – Estimated cost accounts for additional value above the material costs that the owner places on it due to prestige and goodwill.
- Damages to Remainder – Considers the fair market value of the remainder of a property after the initial take. An example might be the loss of value to a combined gas station and convenience store if the gas pumps are acquired or the loss of direct access to a property.
- Business Relocation – The majority of business relocations would be for Option 4B along Windy Hill Road and the north side of Terrell Mill Road.
- Residential Relocation – For Option 4B, this would involve potentially relocating several residents of the Windy Hill Multifamily complex.
- Underground Storage Tank (UST) - This considers the UST of the QuikTrip along Windy Hill Road that is assumed to be impacted by Option 4B.
- Cost-to-Cure Damages and Report (Parking) – A cost to cure would mitigate the damages from the loss of some property. For this estimate, it considers the cost of a potential means of restoring lost parking spaces.
- Damages Due to Change of Usage – This accounts for the diminished market value of a property after the improvements are in place and it can no longer sustain its previous function. For example, a convenience center might be impacted by a loss of convenient access and, therefore, the property would need to serve a different business type.
- Leasehold Value – This refers to the value of a long-term lease when the rent under the lease is lower than the current market rates.

*Includes estimated land value only. Does not include cost of Trade Fixtures, Damages, Relocations, Cost-to-Cures, Etc. These items have been estimated separately per parcel and added to the cost of procuring the land.

Refer to **Appendix F** for a tabulated breakdown of the estimated costs for each option. Cobb County will ultimately be responsible for determining the cost of land and buildings of the selected concept that is developed in the next stage.

Refer to **Table 25** for a summary of the estimated ROW costs of the various concepts.

Table 25: Estimated ROW Costs ($ Millions)

Options		
1C	2B	4B
$16.7	$18.0*	$35.2

*This price does not consider critical access management issues that will severely impact property owners in the area.

8.3.1 Optimizing Alignments to Minimize ROW Costs

For this scoping study, the proposed roadway alignments of the various options maintain their existing alignments while ensuring that ROW is not required from the Georgia Memorial Park Cemetery. This approach provides balanced, symmetrical widening around the existing centerline except on CFIs or where right-turn lanes bring about greater widening on one side. In the next phase, CCDOT should investigate optimizing the alignments of the options being considered to minimize the ROW impacts and their costs based on existing conditions at the time of design and construction.

One of the locations where a shift in the alignment could have a significant impact on the ROW cost is along Windy Hill Road west of Cobb Parkway. At this location, an Infinity car dealership is located on the north side of Windy Hill Road while the Windy Hill Multifamily complex is under construction on the south side. Option 4B, which retains the existing Windy Hill Road centerline, is widened symmetrically around the existing Windy Hill Road, which, based on present day conditions at the writing of this report, would result in ROW being required from both the Infinity car dealership and the Windy Hill Multifamily complex. Even a small encroachment into the Windy Hill Multifamily complex could result in prohibitive ROW costs since approximately 250 feet of four- to five-story apartment buildings and 105 feet of a concrete parking deck are currently under construction approximately 25 feet from the limits of the existing ROW.

As illustrated in **Figure 19**, it may be possible to avoid the Windy Hill Multifamily complex altogether with an asymmetric alignment that meets GDOT design standards and would not require a Design Variance. But this would require a substantial amount of ROW from the north side of Windy Hill Road including the demolition of the existing service & parts building of the Infinity Dealership, the full acquisition of the Chevron station, and parking from “The Crossings at Windy Hill” shopping center. Ultimately, when this intersection improvement project is progressed, the site conditions at that time should be assessed to determine the most optimized and cost-effective alignment. **Figure 19** is provided as a sample of what an optimized alignment could look like.

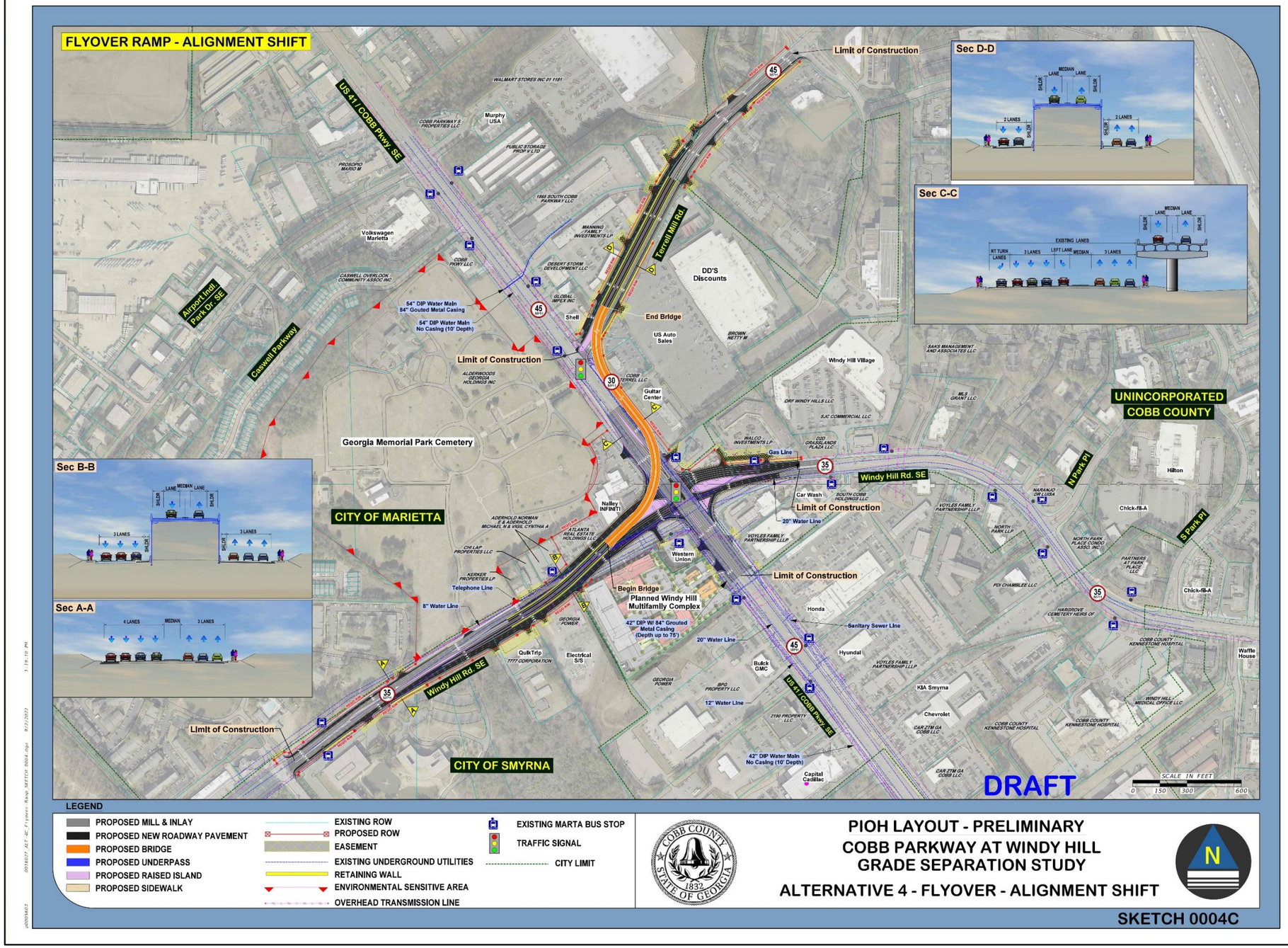


Figure 19: Option 4B Alternative Windy Hill Alignment to Avoid Multifamily Complex

9. NON-MOTORIZED KEY CONCEPT CONSIDERATIONS

The following are discussions of additional parameters that were considered when appraising the various options.

9.1 Pedestrian Convenience and Safety

This parameter was considered to determine convenience and safety at the pedestrian scale for each option. The convenience level was determined based on the total crossing distance, inclusive of median and channelized islands, for both east-west and north-south approaches, particularly at the Windy Hill Road/Cobb Parkway intersection. A shorter crossing distance yields a higher rating. Importantly, a CFI has some disadvantages and raises some pedestrian safety concerns that cannot be overlooked. FHWA's Alternative Intersections/Interchanges: Informational Report (AIIR), April 2010 notes:

> *"…pedestrians cannot cross all four legs as at conventional intersections, and the intersection design can present challenges to pedestrians with visual impairments since the pedestrian paths and some of the traffic movements are not typical."*

Therefore, an adjustment factor of 1.3 was applied to the EB-WB crosswalk distance of Option 2B to account for FHWA's serious concerns over safety of pedestrians at CFIs. There were no significant impacts to pedestrian movements caused by the other two final concepts, so no adjustment factor was required for 1C and 4B. **Table 26** summarizes pedestrian convenience and safety ratings for Options 1C, 2B, and 4B.

Table 26: Pedestrian Convenience and Safety

Total Crossing Distance (feet)					
Option	EB-WB Crosswalks	Rating	NB-SB Crosswalks	Rating	Average Rating
1C	168	86	121	100	93
2B	218	66	121	100	83
4B	144	100	121	100	100

Note that none of the options investigated explicitly incorporate the planned Cobb Parkway Trail (central) Part A from Rottenwood Creek Trail Phase 1 to Windy Ridge Parkway (BP_334), which is on the County's 5-year trail plan, because details of this project are not available. Nevertheless, each option could be modified to incorporate the planned trail.

9.2 Impact on Transit

Impacts on both transit-stop locations and transfer activities of transit users at nine existing transit stops were considered within the study area. For example, two existing transit stops cannot be accessed under Option 2B, which forces their relocation several hundred feet from the intersection where transfers typically would occur. The transit users' walking distance will also be increased due to relocation of transit stops. **Table 27** presents the rating for each option.

Table 27: Impact on Transit

Option	Increased Transfer Walking Distance	Transit Stop Locations Impacted	Rating
1C	-	-	90
2B	1,250 ft	2	30
4B	-	-	90

All options were developed and appraised based on the expectation that the planned future Marietta to Cumberland Bus Rapid Transit (BRT) would be implemented along Powers Ferry Road as shown in the current available Cobb County Comprehensive Transportation Plan for 2050, which is approximately parallel to and 1.2 miles east of Cobb Parkway. As presented in Section 7.3 of the Existing Conditions Report, the Marietta to Cumberland BRT is a long-range (30-year) recommendation in the CobbForward Comprehensive Transportation Plan 2050. Although the plan does not provide details of the future BRT, it describes the BRT as follows:

> *Rubber-tire vehicles are proposed to operate in primarily dedicated lanes with off-board fare collection, high quality stations every ½ to 1 mile, and other corridor- wide enhancements.*

It is possible to amend the three shortlisted options to allow for future dedicated BRT lanes and off-board fare collection stations along Cobb Parkway but these amendments would appreciably increase the project's construction and ROW costs. One of the primary considerations would be whether the future dedicated BRT lanes would be installed in the Cobb Parkway median or along the outside edge of pavement. A median alignment would be more efficient and safer because BRT lanes installed along the outside edge of pavement would conflict with vehicles turning right across the BRT lanes to/from crossroads and driveways. However, an option that allows for a future median BRT alignment with stations in the Cobb Parkway median and pedestrian bridges would have a wider footprint that would require additional ROW and be costlier to build. Discussions of the required amendments to each of the shortlisted options to allow for a future BRT along Cobb Parkway are in the individual option descriptions in Section 4.

9.3 Impact to Runway at Dobbins Air Reserve Base

Due to the proximity of the Dobbins Air Reserve Base (ARB), it is common to see planes that cross over Cobb Parkway and Terrell Mill Road just north of the study intersection. Coordination with Dobbins ARB was initiated during this scoping study and should be continued during future project execution to ensure proper flight path clearance is available from both permanent structures such as the elevated bridges and light poles, as well as temporary facilities such as cranes and trucks to confirm that there is no interference with Dobbins ARB signal reception.

The Federal Aviation Administration (FAA) requires a 7460-1 permit, typically filed by the construction contractor, whenever construction cranes would exceed an imaginary 100:1 sloped surface from the nearest point of the nearest runway out to 20,000 feet or 200 feet AGL (above ground level) beyond. The distance may be increased if the work is in the direct line of a runway – considered to be within the "glide path" of aircraft during takeoff or landing.

The most critical area of emphasis per the coordination with Dobbins ARB is the flight path zone (conical surface area that is shown on **Figure 20**). The intersection of Cobb Parkway and Terrell Mill Road is within this area as planes approach the runway.

The flyover structure in Option 4B is the nearest potential elevated feature to the runway, which is approximately 3,300 feet to the west. The permanent works of Option 1C and 4B are encroaching in the 100:1 slope and would require submission of Form 7460-1. The construction equipment and relocated utility poles of Option 2B would also encroach. Thus, coordination with FAA would be required prior to construction whatever option is implemented. FAA would likely accept cranes encroaching within the zone if work is limited to between 11:00 PM and 7:00 AM when Dobbins is closed. Other time periods would require agreement from FAA.

If construction encroaches within an imaginary surface which contains a 50:1 approach and departure angle, then the potential obstructions to operational impacts as defined by Terminal Instrument Procedures (TERPS) must be checked. Alternatives 1C and 4B are close to the imaginary surface as defined in **Figure 20**. For intrusions into the imaginary surface, coordination with FAA is required to implement acceptable mitigations.

Although Form 7460-1 would typically not be submitted until the preliminary design phase, once Cobb County endorses a concept, it would be prudent to submit the form to confirm whether FAA considers the concept feasible or what the thresholds of acceptance would be. Early coordination of the options was vetted during a meeting with Dobbins Air Reserve Base on March 23rd, 2022. Representatives from Dobbins conducted a study with the TERPS staff and expressed no concerns about the grade separation alternatives. Form 7460-1 will still be necessary for submission of the preferred alternative and formal approval from the FAA will be required prior to construction.

The proposed profiles of the structures at the Terrell Mill Road intersection in both Options 1C and 4B are elevated above the existing terrain at a comparative height, which justifies the equal rating.

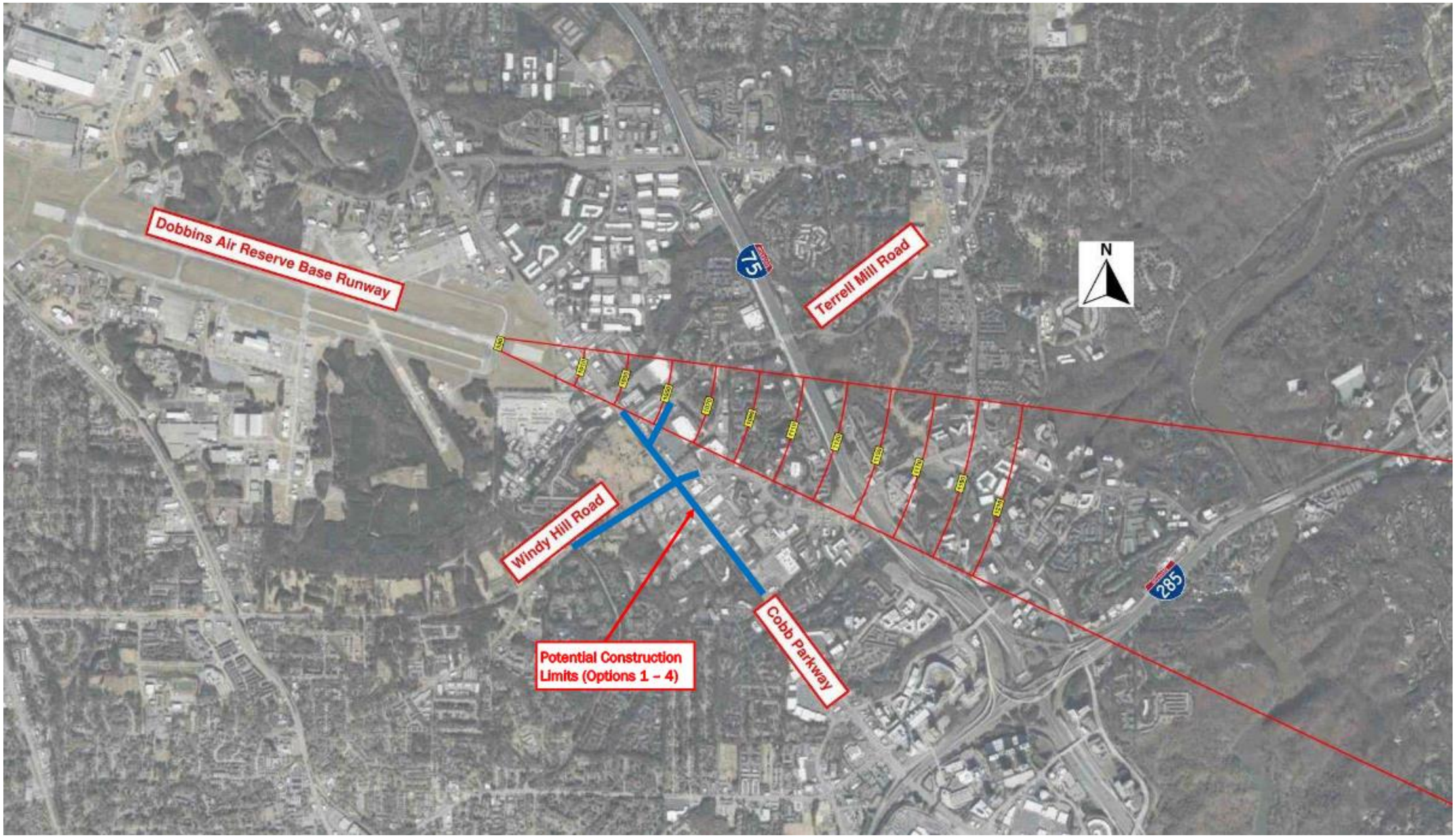


Figure 20: Dobbins Air Reserve Base – Imaginary Surface (Established with February 2015 DARB Joint Land Use Study & FAA "Part 77")

9.4 Access to Nearby Land Parcels

In terms of land use, impacts by each of the options on access to nearby land parcels are important considerations. Additionally, the number of impacted driveways connecting each land parcel to Cobb Parkway, Windy Hill Road and Terrell Mill Road were investigated. Some options will limit vehicular turning movements due to geometrical design constraints and become right-in/right-out only movements. **Table 28** summarizes the impacts of each option on access to neighboring land parcels. The greater the number of impacts, the lower the rating.

Table 28: Numbers of Impacted Driveways and Land Parcels

Option	Land Parcels Impacted	Driveways Impacted	Rating
1C	7	16	75
2B	14	17	50
4B	12	11	70

9.5 Impact on Existing Utilities

Among the critical constraints that must be considered when evaluating the prospective conceptual options is their impact on existing utilities. The project study area is densely congested with existing utilities, both overhead and underground, with limited space for relocation within the existing ROW. An objective way of appraising the various options under the evaluation parameter "Impact on Existing Utilities" is by comparing their utility costs as discussed in Section 8.2.

Example of transition from overhead to underground transmission lines.

The largest portion of the estimated utility cost of the various options is the cost to relocate the existing overhead electric lines, which are aligned adjacent to Windy Hill Road, Cobb Parkway and Terrell Mill Road. Most diversions will consist of relocating the overhead lines to new poles that are to be placed outside the proposed wider pavement limits. Where overhead lines would be obstructed by proposed elevated structures (Options 1C and 4B), the lines could either raised to cross over the structures or lowered to below grade.

Typically, overhead lines would cost significantly less to install than underground cables. Overhead lines are air cooled and widely spaced for safety. However, overhead lines are more vulnerable to damage and outages caused by inclement weather.

Underground cables would be installed in concrete encased PVC duct banks. Heat generated by the cables would be dissipated through the earth to the surface. Buried transmission lines have more environmental impacts than overhead.

Where existing electric lines conflict with proposed elevated structures (i.e., bridges or retaining walls), it is assumed that the electric lines would be lowered to cross below grade for the following reasons.

The taller poles and higher overhead cables would encroach further above the imaginary 50:1 sloped surface from the Dobbins ARB runway.

- If the height of an electric pole were to be substantially increased, depending on the requirements of the utility owner, the heights of adjacent poles might also need to be raised or the spacing between poles decreased, to retain acceptable tension in the cables and the connections to the poles.

9.6 Ease of Construction (Constructability)

A constructability review would consider a proposed concept's risks and assumed construction techniques to determine whether the concept is buildable. To appraise this category, the following factors are considered.

- Project Duration – The estimated overall project duration is one of the key factors considered when evaluating the constructability of an option. A project that provides equal benefits but could be implemented over a shorter duration would be favorable over a similar project with a longer duration. Furthermore, the estimated durations could influence the selection of a preferred delivery method (i.e., design-bid-build, design/build, etc.). **Table 29** provides a high-level summary of the estimated durations to procure the project's ROW, divert the utilities, and to construct the project.

Table 29: Estimated Project Durations (months)

Option	ROW	Utilities	Construction	Total
1C	12	18	30	42
2B	24	12	18	42
4B	24	12	30	54

The first step of any road improvement project involves procurement of the required ROW and should be completed prior to issuing Notice To Proceed (NTP) to a construction contractor to build the project. Options 2B and 4B are estimated to require longer time for ROW procurement, due to the larger area of required ROW and due to the potential displacements.

ROW procurement and utility diversions could be performed with minimal impact to the public. If Cobb County were to implement a design-bid-build delivery method and possessed an approved final design, Cobb County might consider diverting the utilities before issuing a construction NTP. In this case, it might be possible to overlap some of the utility work with the ROW procurement. If Cobb County were to choose a design/build delivery method, it might consider making the design/builder responsible for utility diversions since the design/builder's design would influence the design of the diversions. In this case, the design/builder might be able to overlap the utility diversion and construction periods.

Since road construction would inevitably burden the public, concepts that could be built over a shorter duration would be appraised higher than concepts requiring a longer duration. The

grade-separated options are assumed to require longer durations to build. The project area also highly influences the estimated durations. Since there do not appear to be viable detours to reroute traffic during construction, lane closures would need to be limited to nights and weekends due to the high existing traffic volumes. Also, the tight ROW does not appear to allow for convenient areas for laydowns or stockpiling of materials.

- Maintenance of Traffic – All options would require some staging in one manner (diversions) or another (temporary closures). Option 1C is assumed to include nightly and weekend lane closures to allow for the top-down construction of an underpass beneath the Cobb Parkway / Windy Hill Road intersection. Even when the traffic lanes are restored during the workweek, full depth pavement is not expected to be fully restored, which would result in a substandard rideability until the top of the underpass is built and the permanent pavement is re-installed.
- Complexity – Concepts with more complex designs and require uncommon construction equipment and methods carry a greater risk of design delays, construction errors and safety issues. Experienced and qualified contractors would be required to build complex concepts such as Option 1C.
- Safety during Construction – Considered for both the public and construction workers.
- Impact to Adjacent Commercial Development – Options 1C, 2B, and 4B will require construction easements beyond the proposed ROW limits to maintain the existing number of through and turn lanes while construction is ongoing. The temporary loss of portions of commercial parking lots will hamper these businesses during the construction period. Furthermore, safe access to all adjacent properties must be maintained throughout the construction period, which will be more complex for Option 2B than the other options.

9.7 Environmental

The following subsections provide brief summaries of comparative impacts of each option. If Federal Funds will be used for this future project, the NEPA process will be followed for environmental documentation.

9.7.1 Waters of the U.S. and State Waters

Jurisdictional Waters of the U.S. are defined by 33 CFR Part 328.3(b) and are protected by Section 404 of the Clean Water Act (33 USC 1344), which is administered and enforced by the U.S. Army Corps of Engineers (USACE). The Natural Resource Conservation Service Web Soil Survey was reviewed for the presence of hydric soils. Additionally, the U.S. Geological Service (USGS) 7.5-minute topographic quadrangle maps and the associated National Wetlands Inventory (NWI) maps were reviewed to identify potential Jurisdictional Waters of the U.S. that occur within the vicinity of the proposed project. State Waters are defined by the Official Code of Georgia 12-7-1 and are protected by the Georgia Erosion and Sedimentation Control Act of 1975. All Jurisdictional Waters of the U.S. are also State Waters.

The project area does not appear to contain any waters of the U.S or state waters. However, field surveys would be required to confirm this expectation. There is no apparent comparative difference between the options in this environmental sub-category.

9.7.2 Permits and Mitigation

Any discharge of dredge or fill material into a Water of the U.S. must comply with Section 404 of the Clean Water Act. All impacts will require compensatory mitigation if stream impacts exceed 100 linear feet or wetland impacts exceed 0.10 acre, per the USACE, Savannah District, Standard

Operating Procedure for Compensatory Mitigation Requirements for Adverse Impacts to Wetlands, Open Waters and Streams, dated May 2018.

Additionally, in compliance with the Georgia Erosion and Sedimentation Act, any encroachments within the designated 25-foot or 50-foot buffer of a state water must be described, and the need for a variance should be indicated. Compensatory mitigation for buffer encroachments not associated with Section 404 impacts may be also required.

No permits are expected to be required due to the lack of Waters of the U.S. or state waters in the project area. There is no apparent comparative difference between the options in this environmental sub-category.

9.7.3 Threatened and Endangered Species

To identify the potential for protected species within the project concept area, the team reviewed the US Fish and Wildlife Service (USFWS) online Information, Planning and Consultation (IPaC) portal and the Georgia Department of Natural Resources (GADNR) online Rare Species and Natural Communities portal to identify federal and state protected species that could potentially occur within Cobb County. They included the following:

Background research of relevant published and online information sources was to identify potential ecological resources within the study area. Sources included:

- US Geological Survey (USGS) topographic maps,
- National Wetland Inventory (NWI) maps, and
- US Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) soil survey maps.

Ecologists reviewed:

- The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) website,
- USFWS Georgia Ecological Services Field Office – Southeast Region HUC 10 Watershed Reports, and
- The Georgia Natural Archaeological Historical Resources GIS (GNAHRGIS) Ecology Review and Surveys Module.

Due to the highly developed nature of the project area, the potential for protected species is considered low. However, field surveys would be required to assess if suitable habitat exists in the project area. There is no apparent comparative difference between the options in this environmental sub-category.

9.7.4 Archaeological Resources

A review of Georgia's Natural, Archaeological, and Historic Resources GIS (GNAHRGIS) has been completed for the proposed project. The background screening aimed to identify any previously recorded archaeological resources, including previous archaeological survey work, located within the concept study area.

As a result of this background screening effort, one previously recorded archaeological resource was identified located within the concept study area. This resource is the Georgia Memorial Park cemetery at the intersection of US 41/Cobb Parkway and Windy Hill Road. This resource was

identified as part of a Phase I survey conducted in 2013 for another project as US 41/Cobb Parkway and Windy Hill Road (GDOT PI #0011738). This survey covered much of the current project area, especially along US 41. An additional survey effort was conducted in 2014 for the Cobb County Department of Transportation as part of proposed transit projects also along US 41/Cobb Parkway. No additional resources were located in the project area as a result of this effort.

The project area is highly developed and has minimal potential for additional resources. Since none of the options require ROW from the Georgia Memorial Park Cemetery, there is no apparent comparative difference between the options in this environmental sub-category.

9.7.5 Historic Resources

Based on a screening of historic resources, there are three properties within the potential limits of construction of the various options that could be potentially eligible for listing in the National Register. Effort should be taken to avoid or minimize any impacts to these properties, which include:

- Georgia Memorial Park Cemetery (constructed 1964)
- Prefab Building (Transformer Center) on the south side of Windy Hill Road (constructed mid-20th century)
- US Highway 41 (Dixie Highway), i.e., Cobb Parkway (constructed 1915)

Although US 41 (Cobb Parkway) is eligible due to the history of this corridor as a major roadway, this section of the road has already been heavily impacted by previous widenings and other improvements. Approvals from GDOT and the Georgia State Historic Preservation Office (SHPO) would be required; however, a future determination of "No Adverse Effect" is expected due to the previous extensive changes in this segment of US 41. In addition, as previously noted, none of the options require ROW from the Georgia Memorial Park Cemetery.

As illustrated in **Figure 21**, the historic-age property with the prefab building along the south side of Windy Hill Road is part of an electrical substation. Unfortunately, Windy Hill Road is located between the Georgia Memorial Park Cemetery and this substation property. Consequently, the Windy Hill Road widening provided in all options would require a varying amount of ROW from one property and/or the other. Given this choice, Windy Hill Road has been aligned to avoid the Georgia Memorial Park Cemetery on all options.

As can be seen in the photo inset in **Figure 21**, the substation is at a lower elevation than Windy Hill Road. Thus, a retaining wall is proposed to minimize the amount of ROW required from the substation property. Option 4B, which has the widest footprint in front of the substation among the options would likely require the most ROW from the substation.

9.7.6 Hazardous Materials

The project team studied the potential of encountering underground storage tank/hazardous materials sites within the construction limits. The project area is a busy commercial corridor, and many of the local businesses include gas stations and car dealerships, which are likely to have underground storage tanks or other hazardous materials.

The gas stations that are adjacent to or within the construction limits of the options include:

- Chevron station (northeast corner of the Cobb Parkway / Windy Hill Road intersection) – Most options appear to require ROW from this gas station. However, the ROW required for Option 2B appears to overlap the underground gas tank and is closest to the pumps.

- Shell station (northeast corner of the Cobb Parkway / Terrell Mill Road intersection) – Option 4B appears to require ROW from this gas station.
- QuikTrip (south side of Windy Hill Road just west of the substation) – All options that include Windy Hill Road capacity improvements appear to require ROW from the QuikTrip property. Option 4B appears to have the most substantial conflict with this gas station.

9.7.7 Noise Impacts

Although any horizontal shifts within the intersection are expected to be minimal, a potential elevated grade separation could contribute to moderate increases in noise. Noise modeling would be required, but even without modeling, it is assumed that the elevated options (Options 1C and 4B) would have moderately greater noise impacts than the at-grade CFI option. All options that add lanes to Windy Hill Road would be expected to greater noise impacts during the peak hours.

9.7.8 Visual Impacts

The elevated options (Options 1C and 4B) would have moderately greater visual impacts than the CFI at-grade option (2B). However, since the project area is predominantly a commercial area, the visual impacts are considered acceptable.

9.7.9 Air Quality

The project would not result in changes in traffic volumes, vehicle mix, the intersection location, or any other factor with the potential for a meaningful increase in Mobile Source Air Toxics (MSATs) impacts. There is no apparent comparative difference between the options in this environmental sub-category.

9.7.10 NEPA Process

If federal funding is utilized, any of these three concepts should be presented to FHWA early in the process to ensure these can be processed smoothly as Categorical Exclusions (CEs). If displacements are not minimized and mitigated as much as possible, there is a risk that the document could be escalated to an Environmental Assessment (EA), as FHWA would see this as major impacts to businesses. Additionally, this CE document should be written carefully and thoughtfully to provide FHWA no reason to delay approval or request escalation to an EA. Early and close coordination with FHWA will be critical in maintaining the schedule. Discussion of environmental documentation is continued in **Section 11: Implementation and Management Plan**.

Figure 21: Aerial View of Electrical Substation

Looking south from Windy Hill Road at substation.

10. OPTIONS ANALYSIS

This section presents the methodology followed to compare the three shortlisted concepts (Options 1C, 2B and 4B) discussed in Sections 4.3 through 4.6.2. Each option is comparatively appraised based on key categories described in the previous chapters of this report in order to derive a weighted technical score. This approach provides a systematic method of comparing options. It provides relative scores among the options and results in the recommended option.

One of the main drawbacks of this methodology is that some categories could have constraints, or "filters", which each option must achieve to be acceptable; for instance, one option could achieve a high score based on traffic performance but have a very high cost which would not be achievable. Cobb County has the option of excluding ("filtering") options that do not meet minimum requirements regardless of their "benefit". Potential filters include:

- Does not achieve an acceptable LOS in the 2050 Design Year. Because of this filter, Options 1A, 1B, 2A, 2C, 2D, 3 and 4A have been eliminated from consideration. Only Options 1C, 2B, and 4B, which provide the best traffic operations of Primary Concepts 1, 2, and 4 are analyzed.
- Is not considered safe in either the permanent condition or during construction.
- Has an unaffordable cost
- Has prohibitive ROW requirements and displacements.
- Has elevated option that FAA would likely not accept.

10.1 Evaluation Parameters and Relative Weights

Table 30 summarizes the parameters and their relative weights used to analyze and evaluate the shortlisted options. The evaluation parameters were established with concurrence with Cobb County PMT and discussed during the Stakeholder Steering Committee meeting held on February 2, 2022.

The final weighting of each evaluation metric was derived based on comments collected at the PMT and Stakeholder Steering Committee Meetings as well as feedback from the public. Their relative weights were derived based on how the stakeholders and public would prioritize the parameters.

The evaluation matrix and metrics were first presented and discussed at the February 16, 2022 PMT meeting. The matrix and metrics were refined and presented at the March 2, 2022 and March 9, 2022 PMT Meetings. At the March 16, 2022 Public Information Open House, the unweighted evaluation metrics were presented, and feedback collected both verbally and through written comments were incorporated into updated evaluation metrics. The final accepted evaluation metrics were presented at the April 13, 2022 Stakeholder Steering Committee Workshop. For the stakeholder input forms that were collected during and after the Stakeholder Steering Committee, please refer to Appendix A.

Table 30: Option Evaluation Categories and Relative Weights

No.	Parameter	Relative Weight (%)	Remarks
1	Traffic and Network Performance	20%	Forecast LOS and delay during peak hours at the Cobb Parkway / Windy Hill Road intersection and throughout the study area.
2	Safety Improvement (Vehicular)	15%	Estimate annual savings from reduced number and severity of crashes.
3	Construction & ROW Cost	15%	Estimated collective construction and ROW cost of each option.
4	Impact to Transit	15%	Impacts to transit users' transfer activities, users' walking distance, and transit stop locations.
5	Pedestrian Convenience and Safety	10%	Total crossing distances and number of phases per crossing.
6	Impact to Runway at Dobbins Air Reserve Base	5%	Required FAA coordination and impact to imaginary approach surface (50:1) to Dobbins ARB.
7	Access to Nearby Land Parcels	5%	The ability to maintain the existing land use access and the extra length of the alternative access if existing access cannot be maintained.
8	Impact on Existing Utilities and Services	5%	Impact on existing utilities and the cost and complexity to divert them.
9	Ease of Construction (Constructability)	5%	Construction schedule, lane closures, driver safety, complexity to construct.
10	Environmental	5%	Noise, Visual, HazMat and Historic Resource impacts.
Total Weight		**100%**	

10.2 Basis of Scoring

Scores for the individual categories are generally ranked between 0 to 100%, where a superior option for each category would receive a score of 100% and the others getting a calculated score based on its relative performance in comparison to the best option. For other parameters, the score is based on the minimum and maximum value being considered which results in comparative scores, but not necessarily at 100% for any option.

A color coding is provided to illustrate which alternative is the closest to the desired objectives. Dark red shading indicates cells with less desirable scores and green shading shows cells with more desirable scores. **Table 31** presents the color coding of scores.

Table 31: Scores Color Coding

Score	Description
0 % - 60 %	Poor
61 % - 75 %	Intermediate
76 % - 100 %	Distinctive

10.3 Advantages and Disadvantages of Concepts

Table 32 summarizes the comparative advantages and disadvantages of Options 1C, 2B and 4B. **Table 33** is a matrix that provides a weighted scoring comparison between the three shortlisted options.

As summarized at the bottom of the matrix, Option 4B is collectively ranked as the best among the three options by an appreciable margin. Also, as discussed in Section 5.6, Option 4B was the preferred option based on public feedback from the PIOH.

Table 32: Advantages / Disadvantages of Options 1C, 2B and 4B

Option	Advantages	Disadvantages
1C	1- Highest estimated annual savings ($3.6 million) from future potential crash reductions. 2- No significant environmental impacts. However, elevated structure results in noise, visual impacts, greater number of lanes on Windy Hill may increase peak hour noise, ROW required from electrical substation property, which is eligible for listing in National Register of Historic Resources. 3- Considered superior to Options 2B and 4B for pedestrian convenience and safety.	1- Cobb Parkway/Windy Hill Road intersection would not operate at acceptable LOS in the 2050 Design Year. 2- Highest construction/ROW cost ($154.1 million). 3- Significant impact on transit users' transfer activities (4 transit stop pairs) and walking distance (300 feet). 4- Grade change could impact imaginary approach surface (50:1) to Dobbins ARB. 5- Potential temporary impacts to imaginary approach surface to Dobbins ARB during construction including cranes, trucks, etc. – Will require FAA coordination. 6- 16 driveways and 7 land parcels impacted. 7- Highest utility relocation cost ($15.0 million) of all options. 8- Complex construction - Requires construction of new temporary pavement to maintain existing lanes on Cobb Parkway while new lanes are built, overhead construction of bents and girders above operating intersection, significant staging to maintain traffic at Cobb/Windy Hill intersection, shoring and multiple stages anticipated, night and weekend lane closures.

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Option	Advantages	Disadvantages
2B	1- Lowest construction/ROW cost ($68.9 million). 2- Minimal impact to Dobbins ARB runway, insignificant grade change. 3- Lowest utility relocation cost ($9.6 million). 4- Low environmental impacts. Requires acquisition of portion of Chevron Station property, which could impact one or more petroleum tanks (hazmat). Greater number of lanes on Windy Hill may increase peak hour noise, ROW required from electrical substation property, which is eligible for listing in National Register of Historic Resources.	1- Cobb Parkway / Terrell Mill Road intersection would not operate at acceptable LOS during the PM Peak Period in the 2050 Design Year. 2- 17 driveways and 14 land parcels impacted 3- Significant ingress/egress limitations in NE & SW quadrants. 4- Significant impact on transit users' transfer activities (3 transit stop pairs), walking distance (500 feet) and transit stop locations (1 stop to be moved). 5- Unconventional intersection discourages pedestrian crossings within one signal cycle, potentially stranding pedestrians on median island. 6- Complex construction staging due to restricted pedestrian access, driver confusion with shifts and redistribution of turn lanes.
4B	1- Only option in which both the Cobb Parkway / Windy Hill Road intersection and the Cobb Parkway / Terrell Mill Road intersection would operate at acceptable LOS in the Design Year 2050. 2- Provides regional connectivity between the I-75 express lanes, Northern Cobb County, and the growing City of Smyrna 3- Estimated annual savings ($2.4 million) from potential crash reductions, which is less than Option 1C but higher than Option 2B. 4- Low impact on transit users' transfer activities. No impact on walking distance or transit stop locations. 5- Construction of substructure and walls within existing Windy Hill and Terrell Mill roadway limits. Bents along Cobb Parkway will cause minimal traffic shifts. Construction of flyover above live traffic.	1- High construction/ROW cost ($138 million). 2- 11 driveways and 12 land parcels impacted. Commercial displacements along the north side of Terrell Mill Road 3- Grade change could impact imaginary approach surface (50:1) to Dobbins ARB. 4- Potential temporary impacts to imaginary approach surface to Dobbins ARB during construction including cranes, trucks, etc. – Will require FAA coordination. 5- Elevated structure results in noise, visual impacts, greater number of lanes on Windy Hill may increase peak hour noise, potential acquisition of part of petroleum tanks (hazmat) for Shell Station and QuikTrip, greatest amount of ROW of all options required from electrical substation property, which is eligible for listing in National Register of Historic Resources. 6- Lower utility cost ($11.9 million) than Option 1C but higher than Option 2B.

Option	Advantages	Disadvantages
		7- Complex construction due to elevated structures and numerous nighttime closures for overhead work.

Table 33: Option Evaluation Matrix (Options 1C, 2B and 4B)

No.	Evaluation Parameter	*Wt. (%)*	Option 1C – SPUIs (Under Windy Hill and Over Terrell Mill, Windy Hill Capacity Improvements)		Option 2B – Continuous Flow Intersection (CFI), Windy Hill Capacity Improvements		Option 4B - Flyover with Windy Hill Capacity Improvements	
			Rating	**Score**	**Rating**	**Score**	**Rating**	**Score**
1	Traffic and Network Performance.	**20%**	**63**	**12.60**	**87**	**17.40**	**100**	**20.00**
			Intersection performance (70%) - 40 Network performance (30%) - 23 **Total - 63**		Intersection performance (70%) - 66 Network performance (30%) - 22 **Total - 87**		Intersection performance (70%) - 70 Network performance (30%) - 30 **Total - 100**	
2	Construction & ROW Cost	**15%**	**40**	**6.00**	**80**	**12.00**	**50**	**7.50**
			$137.4M in CST $16.7M in ROW **$154.1M TOTAL**		$50.9M in CST $18.0M in ROW **$68.9M TOTAL**		$102.8M in CST $35.2M in ROW **$138M TOTAL**	
3	Pedestrian Convenience and Safety.	**10%**	**93**	**9.30**	**83**	**6.50**	**100**	**10.00**
			Based on average crossing distance (ft) and convenience		Based on average crossing distance (ft) and convenience		Based on average crossing distance (ft) and convenience	
4	Safety Improvement (Vehicular)	**10%**	**100**	**10.0**	**0**	**0.00**	**75**	**7.50**
			$3.6 million in annual crash reduction		$2.3 million annual increase in cost of crashes		$2.4 million in annual crash reduction	
5	Impact to Transit	**10%**	**45**	**4.50**	**30**	**3.00**	**90**	**9.00**
			• Significant impact on transit users' transfer activities: 4 transit stop pairs • Significant impact on walking distances: 300 ft		• Significant impact on transit users' transfer activities: 3 transit stop pairs • Significant impact on walking distances: 500 ft • 1 stop needs to be moved		• Low impact on transit users' transfer activities • No impact on walking distances • No impact on transit stop locations	
6	Impacts to Runway at Dobbins Air Reserve Base	**10%**	**70**	**7.00**	**80**	**8.00**	**70**	**7.00**
			• Will require FAA Coordination in Design • Grade Change could impact Imaginary Approach Surface (50:1) to Dobbins ARB. • Potential temporary impacts to Imaginary Approach Surface during construction, including cranes, trucks, etc. • Further Studies and Mitigation is possible • Coordination with FAA through Construction required		• Will require FAA Coordination in Design • Insignificant Grade Change to existing Terrain • Coordination with FAA through Construction required		• Will require FAA Coordination in Design • Grade Change could impact Imaginary Approach Surface (50:1) to Dobbins ARB. • Potential temporary impacts to Imaginary Approach Surface during construction, including cranes, trucks, etc. • Further Studies and Mitigation is possible • Coordination with FAA through Construction require	

No.	Evaluation Parameter	Wt. (%)	Option 1C – SPUIs (Under Windy Hill and Over Terrell Mill, Windy Hill Capacity Improvements)		Option 2B – Continuous Flow Intersection (CFI), Windy Hill Capacity Improvements		Option 4B - Flyover with Windy Hill Capacity Improvements	
			Rating	Score	Rating	Score	Rating	Score
7	Access to Nearby Land Parcels	10%	75	7.50	50	5.00	70	7.00
			• 16 driveways impacted • 7 land parcels impacted		• 17 driveways impacted • 14 land parcels impacted • Significant Ingress/Egress limitations in NE & SW Quadrants		• 11 driveways impacted • 12 land parcels impacted • Limited access to/from the flyover from parcels in immediate vicinity of Cobb Pkwy & Windy Hill	
8	Impact on Existing Utilities and Services	5%	65	3.25	80	4.00	70	3.50
			$15.0 Million Estimated Utility Relocation Costs		$9.4 Million Estimated Utility Relocation Costs		$12.3 Million Estimated Utility Relocation Costs	
9	Ease of Construction (Constructability)	5%	20	1.00	60	3.00	70	3.50
			• Requires construction of new temporary pavement to maintain the existing number of thru and turn lanes on Cobb Parkway while the future thru lanes are built. • Construction of substructure and Walls within the existing limits of Cobb Parkway • Significant overhead construction of bents and girders • Significant staging required to maintain traffic at Cobb Pkwy and Windy Hill Road with the grade change to Cobb Pkwy. • Requires night and weekend lane closures along Windy Hill Road and Cobb Parkway. • Shoring and multiple stages anticipated.		• Construction on the outside of existing lanes in early stages • Minimal grade change • Pedestrian access during construction will be cause of concern • Driver confusion with shifts and redistribution of turn lanes in later stages.		• Construction of substructure and Walls within the existing limits of Windy Hill Road and Terrell Mill Road • Bent locations along Cobb Parkway will cause minimal traffic shifts and impacts along Cobb Pkwy. • Construction above live traffic. • Numerous nighttime closures will be required for overhead work activities such as girder erection and bridge deck placement.	
10	Environmental	5%	85	4.25	85	4.25	60	3.00
			• Elevated structure (noise, visual impact) • Greater number of thru lanes on Windy Hill Road expected to elevate peak hour noise impacts. • ROW required from electrical substation along EB Windy Hill Road, property is eligible for listing in National Register of Historic Resources.		• Requires acquisition of part of petroleum tanks (hazmat) for Chevron Station (NE quadrant of Cobb/Windy Hill Intersection) • Greater number of thru lanes on Windy Hill Road expected to elevate peak hour noise impacts. • ROW required from substation along EB Windy Hill Road, property is eligible for listing in National Register of Historic Resources.		• Elevated structures (noise, visual impact) • Potential acquisition of part of petroleum tank (hazmat) for Shell Station (NE quadrant of Cobb/Terrell Mill Intersection) and QuikTrip along Windy Hill Road. • Greater number of thru lanes on Windy Hill Road expected to elevate pear hour noise impacts. • Greatest amount of ROW among the options required from substation property along EB Windy Hill Road, which is eligible for listing in National Register of Historic Resources	
Total scores			**65.40**		**64.95**		**78.00**	
Rank			**2**		**3**		**1**	

11. IMPLEMENTATION AND MANAGEMENT PLAN

This section provides a potential timeline to implement Option 4B, which achieved the highest score on the Options Evaluation Matrix (see Error! Reference source not found. **33**). As summarized in Section 10, Option 4B is costlier than Option 2B but would provide the best LOS in the 2050 Design Year of the shortlisted options and is collectively, considering all parameters, deemed to be the best option.

Since this report introduces Option 4B, there were no scope, costs, or benefits to consider when the Cobb FORWARD Comprehensive Transportation Plan (CTP) 2050 Recommendations Report (December 2021) was prepared. Consequently, there is no programmed budget to fund these improvements. Furthermore, Option 4B would cost more to implement than what is currently identified in the fiscally constrained Special Purpose Local Option Sales Tax (SPLOST) funding. A transportation project of the magnitude of Option 4B would likely require a combination of local, state, and federal funding. Considering that a portion of the project would be federally funded, the project would be required to follow federal processes.

Since transportation plans that support the Statewide Transportation Improvement Program (STIP), Georgia's transportation and capital improvements program, are typically updated in four-to-six-year cycles, it is not reasonable to expect that the Option 4B improvements could be programmed for full funding in future cycles of the STIP. A phased approach that would begin by implementing short-range at-grade improvements (Phase 1) to relieve the current congestion is considered a practical solution. The grade-separated improvements (Phase 2) could be programmed mid-range based when the at-grade improvements would no longer provide a tenable LOS and peak-hour delays would begin to increase again.

11.1 Phase 1 – Windy Hill Road Capacity Improvement

As discussed in Section 5, the capacity improvements to Windy Hill Road (Option 3) are a cost-effective, albeit short-term, way to improve the LOS at the Cobb Parkway / Windy Hill Road intersection. Widening from Atlanta Road to Cobb Parkway (R_662) is already identified as a mid-range (10-year) project in the Cobb FORWARD CTP. Phasing the implementation of Option 4B would enable the Windy Hill capacity improvements to be built sooner and provide congestion relief to motorists while funding is secured to build the grade-separated improvements as a second phase. Note that this relief is anticipated to expire between the years 2030 and 2035 when the intersection would again be operating at a LOS F.

To enable a seamless future upgrade when Phase 2 is implemented, the full required ROW to build Option 4B should be procured along Windy Hill Road during the first phase. In addition, during the first phase, the utilities should be diverted to their ultimate locations and retaining walls built that would not preclude the Phase 2 upgrade. The advanced knowledge of the required ROW would enable Cobb County to acquire the additional needed land along Cobb Parkway and Terrell Mill Road when ROW is acquired for the Cobb Parkway Trail (central) Part A (for details, refer to the Existing Conditions Analysis Report, Section 7.2) and/or withhold permits from landowners proposing to make capital improvements to the portions of their properties that are within the planned Option 4B ROW.

A key factor in this phased approach is the environmental document. It could be difficult to get FHWA approval of a CE document if they are aware that a second phase of the same improvement project is already planned. For this reason, it is recommended that Phase 1 be funded with local and/or state funds, to prevent difficulty in environmental document approval and schedule impacts.

The estimated cost of Phase 1 would be as summarized in **Table 34**.

Table 34: Estimated Cost – Phase 1

Description of Cost	Estimated Cost (2025 dollars)
Construction[2]	$29.4 million
Utilities[1, 2]	$5.9 million
ROW[2]	$7.2 million
Sub Total	**$36.6 million**
Preliminary Engineering[2]	$2.6 million
Construction Engineering and Inspection[2]	$4.5 million
Grand Total[2]	**$43.7 million**

1. Utility costs are included in the construction cost.
2. Contingency is included in the cost.

11.2 Phase 2 - Flyover

Sometime thereafter when funding is secured, the flyover would be designed and constructed. The estimated cost of Phase 2 would be as summarized in **Table 35**. These costs are expressed in 2025 dollars due to the indefinite implementation timeline.

Table 35: Estimated Cost – Phase 2

Description of Cost	Estimated Cost (2025 dollars)
Construction[2]	$67.2 million
Utilities[1, 2]	$6.0 million
ROW[2]	$28.0 million
Sub Total	**$95.2 million**
Preliminary Engineering[2]	**$6.8 million**
Construction Engineering and Inspection[2]	**$8.9 million**
Grand Total[2]	**$110.9 million**

1. Utility costs are included in the construction cost.
2. Contingency is included in the cost.

The estimated construction, utilities and ROW costs presented of the potential phased approach in **Table 34** and **Table 35** are provided for comparison with the estimates of each shortlisted option in **Section 8** that were used for the evaluation matrix. The estimated grand total costs of each include construction, utilities, and ROW as well as preliminary engineering, construction engineering and inspection, environmental mitigation, and contingency. In total, the cost of implementing option 4B is approximately **$154.6 million.**

This phase would likely utilize some portion of federal funds, which means the NEPA process would be required for environmental documentation. This CE will be complex and is critical to the success of the

project, so it should be thoughtfully crafted in a way to emphasize that the improvements provided by the project are operational improvements rather than capacity improvements. This will assist in preventing FHWA from requesting the document be escalated from a CE to an EA.

It should be noted that the county may choose to partner with GDOT on the execution of this project, wherein GDOT could manage and let the project, assign a Project Manager, and the project would follow the GDOT Project Development Process (PDP). This implementation and management approach would help ensure federal funding eligibility.

12. CONCLUSION

Improvements to the road network in the project area are presently needed to relieve the public from severe delays at the Cobb Parkway / Windy Hill Road intersection during peak periods, and to reduce the number and severity of crashes. The delays at this heavily travelled intersection will continue to worsen until improvements are implemented. The programmed mid-range (10-year) capacity improvements to Windy Hill Road from Atlanta Road to Cobb Parkway (R_662) would only provide a temporary solution until the intersection would again begin to fail shortly thereafter, which could be as soon as 2030. A long-term solution is required.

Multiple concepts and options were analyzed to identify the best long-term solution to improve traffic operations and safety, each with comparative advantages and disadvantages. However, the only option analyzed that would provide an acceptable LOS E at Cobb Parkway's intersections with both Windy Hill Road and Terrell Mill Road during the PM Peak of the 2050 Design Year is Option 4B, which includes a flyover that would allow continuous, uninterrupted movement between Windy Hill Road (west of Cobb Parkway) and Terrell Mill Road. Among its other advantages, Option 4B is more compatible than the other primary options at interfacing with other planned projects that would enhance the movement of pedestrians, bicyclists, and transit users. Furthermore, Option 4B provides significant regional connectivity between the I-75 express lanes, northern Cobb County and the rapidly growing City of Smyrna.

Option 4B carries an estimated total project cost of nearly $155 million (in Year 2025 dollars). This high-level estimate could vary up or down as the structural, utility and ROW requirements are better defined. Nevertheless, this project will need to be programmed in a Transportation Management Plan (TIP) that includes State and Federal funding. It should be taken into consideration that this area is of significant economic interest to the county as it is not only a hub for commerce and employment, but also a central fixture between major thoroughfares carrying passengers to, from, and around metro-Atlanta. Improving this connectivity could greatly benefit drivers and those who visit or are employed at businesses around this major intersection.

The results of the study were derived using the available data within the allotted timeline and have limitations as far as completeness and accuracy. Cobb County DOT should consider the following recommendations as the project advances, which should aid in budgeting and programming.

- Synchro software, which was used to forecast the performance of each option, has limitations. Consider performing a microsimulation analysis of the three shortlisted options. Microsimulation would reveal potential queues at locations of merging and weaving that Synchro

might not identify. Microsimulation could also quantify time and user cost savings throughout the surrounding road network for each option. The analysis should either validate the recommendation of Option 4B or provide evidence to support another option. It should also help to identify any adjustments in the options, such as weaving and storage lengths, to improve their efficiency.

- The estimated costs of utility diversions were based on the conservative assumption that all utilities have prior rights and, consequently, Cobb County would be responsible for all diversions. Consider investigating prior rights in the next phase and updating the utility cost estimates. It is likely that the estimated utility diversion cost and, accordingly, the grand total cost of each option would reduce.
- For this scoping study, the proposed roadway alignments of the various options maintain their existing alignments while ensuring that ROW is not required from the Georgia Memorial Park Cemetery. This approach provides balanced widening around the existing centerline except on CFIs or where right-turn lanes bring about greater widening on one side. In the next phase, CCDOT should investigate optimizing the alignments of the options being considered to minimize the ROW impacts and their costs. An example of a location where the Windy Hill Road alignment might be optimized to reduce the ROW cost is discussed in Section 8.3.1.