The Department of Community Development

City Hall, Lynchburg, VA 24504 **434-455-3900**

To: Planning Commission
From: Planning Division
Date: February 26, 2014
Re: **Rosedale Farm – 1600 and 1220 Graves Mill Road**
Rezoning: R-1, Low Density Residential District, and B-5C, General Business District (Conditional), to B-3C, Community Business District (Conditional)
Conditional Use Permit (CUP): Cluster Commercial Development (CCD)

I. PETITIONER

Rosedale Farm LLC, 1600 Graves Mill Road, Lynchburg, VA 24502 and
Bella Rose Plantation LLC, 1220 Graves Mill Road, Lynchburg, VA 24502
Representative: Ron Cox and Bryant Hare, Hopkins Brothers Legacy Planning & Development, P.O. Box 753, Lynchburg, VA

II. LOCATION

The subject property includes two (2) tracts totaling approximately seventy and eighty-six thousandths (70.086) acres located at 1600 and 1220 Graves Mill Road. Forty-three and two tenths (43.2) acres are proposed to be rezoned and for Conditional Use Permit (CUP) for the Cluster Commercial Development (CCD).
Property Owner: Rosedale Farm LLC and Bella Rose Plantation LLC

III. PURPOSE

The purpose of this petition is to rezone approximately forty-three and two tenths (43.2) acres to allow for the construction of a mixed use commercial and residential development at 1600 Graves Mill Road and to allow a variety of uses for the existing historic buildings at 1220 Graves Mill Road, such as art studios, shops, and space for outdoor receptions and events, which is not included in the *Zoning Ordinance*.

IV. SUMMARY

- Petition agrees with the *Zoning Ordinance* which permits uses allowed by right in R-3 through B-5 districts in a CCD by approval of a CUP.
- The *Comprehensive Plan 2013-2030's Future Land Use Map* recommends a Mixed Use and a Resource Conservation use for the subject property.
- The proposed development density would be an average of one (1) residential unit per acre plus 165,000 square feet of commercial space (mixed with residential and separate) and approximately eight and eight tenths (8.8) acres of open space. Preserved open space includes onsite amenities of a lawn/park area and a system of trails.
- The site layout follows development principles for connectivity, mixed use, and building placement as called for by the *Comprehensive Plan 2013-2030's Goals and Policies* or *Chapter 6: Land Use Development & Community Design.*
- The property is one of few remaining vacant large tracts of land in the City of Lynchburg.
- The property falls within the Scenic Corridor Overlay District.
- Outdoor events are not mentioned in the zoning ordinance and are therefore not allowed unless deemed compatible with the uses in B-3, B-4, or B-5 by the Lynchburg City Council.

- The petition would exacerbate and accelerate level of service (LOS) issues with the Lynchburg Expressway interchange.

<u>The Planning Division recommends approval of the rezoning and CUP petitions.</u>

V. FINDINGS OF FACT

1. **Comprehensive Plan.** The property is indicated for Mixed Use and Resource Conservation use on the *Future Land Use Map (FLUM).*

   The *Comprehensive Plan 2013-2030* provides that Mixed Use developments do not fit into any single use category as they are planned for a mix of uses carefully designed so as to mitigate any potential land use conflicts. The mixed use areas generally consist of large undeveloped or greenfield areas that are intended to be developed for a balanced mix of residential, neighborhood commercial, civic uses, parks and open spaces. The mix of uses in these areas is intended to be determined at the time of development review and approval. (**pg 76**)

   Land use decisions made by the City should take into account not only the land uses depicted on the FLUM, but also the *Plan Framework Map* and *Goals and Policies* contained within the *Comprehensive Plan.* The *Plan Framework Map* shows the tract of land as within the Graves Mill Business / Technology Area and states that given the size and location of the Graves Mill Area, a mixed use core with higher density residential development and retail uses is appropriate for the area south and west of the interchange of Graves Mill Road and the Lynchburg Expressway. (**pg 70**)

   The Comprehensive Plan contains *goals* specific to new development and *policies* to follow to achieve those goals. Those applicable from the Land Use and Development section are listed here:

   Goal LU-1: Land Availability. Make efficient use of land and resources in the City to serve the needs of the region through new development, redevelopment and infill that accomplishes the Plan's goals. (**pg 13**)

   Goal LU-1.4: Consider the Planning Framework, land availability, existing land use and zoning patterns, site constraints, transportation capacity, utility availability and natural systems when evaluating zoning and Future Land Use Map amendments. (**pg 14**)

   Goal LU-1.6: When the FLUM allows for greater density than allowed by existing zoning, determine whether a zoning change would be appropriate pursuant to policy LU-1.4 or whether the site is appropriate for density bonuses based on community benefits specified in the City's zoning ordinance. (**pg 14**)

   Goal LU-3: Compatibility, Character and Design. Reinforce Lynchburg's unique character through public and private strategies that preserve historic elements, enhance transportation options, use existing infrastructure and improve access between land uses. (**pg 15**)

   LU-3.2 Coordinate site and building design with the design of streets and public facilities.(**pg 15**)

   LU-3.5 Facilitate creative residential, commercial and mixed-use development designs that create vibrant, healthy neighborhoods. (**pg 15**)

LU-3.6 Ensure that developments and public improvements within Scenic Conservation Areas are designed to protect or enhance the areas' scenic and environmental qualities. (**pg 16**)

LU-3.7 When addressing compatibility and connectivity between adjacent land uses, ensure that building orientation, building location, parking locations, parking design, lighting, walkways and other building and site design factors provide safe and convenient access to sites for drivers, pedestrians, bicyclists and transit riders. [See design discussion in Chapter 6] (**pg 16**)

LU-3.10 Encourage the development of built environments that support the integration of healthy and active living in day-to-day life and foster human interaction. (**pg 16**)

Goal NH-2: Neighborhood Character. Promote well-designed mixed-use residential neighborhoods that incorporate a variety of housing types and densities with pedestrian-oriented streets, small-scale neighborhood oriented services and parks to where residents are able to live, work and play close to home. (**pg 25**)

The proposed Rosedale Development has a desirable mix of land uses that meet the goals of the Comprehensive Plan's FLUM, Framework Map, and text by providing a combination of retail, residential, and office uses within a single site. Mixed use developments called for by the goals in the Comprehensive Plan should follow "Main Street" design conventions. Buildings following this style are pedestrian oriented with facades and main entrances facing streets, human-scale massing and fenestration, and contain a mix of uses within individual buildings, where lower floors are used for commercial uses and the upper floors are used for residential. Buildings should have unified design characteristics with similar height and massing to create a "street wall," an essential component of a walkable design. Parking should be accommodated by on street parking and disguised in the rear of buildings, rather than having large open parking lots depleting the character from a development. Rosedale's site plan meets many of the above concepts and sets the stage for future development of both adjacent undeveloped areas, as well as providing the framework for more density within the existing site plan as the market dictates. The Planning Division sees providing that framework, which involves building a connected street grid with multimodal facilities, and creating a context where buildings are human scale and placed close to the streets as the most crucial goal of site planning. Rosedale meets those goals and it is envisioned that through time, Rosedale will become a hub for this area of the city and the future development of the remaining vacant land on site and off.

Additionally, the proposed development provides both public needs and amenities. These include right of way connections, trails, sidewalks, shared use paths for walkers and bikers, and a bus pull off for potential bus routes, offering a choice of travel modes for trips within and out of the site. The trail and lawn / park area are also highly valued as needed public spaces for recreation and social interaction.

2. **Zoning.** The subject property was annexed into the City in 1976 and the existing R-1, Low-Density Residential zoning was established in 1978 with the adoption of the current *Zoning Ordinance.*

   The proposed B-3, Community Business District and Cluster Commercial Development (CCD), would allow for all uses permitted by right in R-3 through B-5 districts and all uses illustrated on the site plan. The *Zoning Ordinance characterizes* CCD districts with three key features: an increased public amenity, shared parking areas between land uses, and a general "clustering" of development on site. The proposed site plan provides for amenity areas, but could make better

use of the provisions for clustering and sharing parking. "Clustering" refers to placing buildings close together on a single site. Clustering buildings automatically leads various uses to share parking. If the mix of land uses work together, then fewer parking spaces would be necessary on site, a desirable outcome for a number of reasons including stormwater management, maintenance, and a general flexibility for future development of the site.

CCDs are permitted in places consistent with the Comprehensive Plan and in areas where public services certified to be adequate for the proposed development by the Director of Planning for the City of Lynchburg. Consideration should be given to the effects of the development on the ramps with the Lynchburg Expressway (see section below on Traffic).

3. **Proffers.** The petitioner has voluntarily submitted the following proffers:

- The property will be developed as a Cluster Commercial Development (CCD). With regards to setbacks, the front setback from Graves Mill Road will be 30'. All other setbacks for front, side and rear yards will be zero feet. Excluding Graves Mill Road, the maximum setback shall be 15' from the public right of ways or back of sidewalk on private streets. Buildings labeled "A," "B," "C," "D," "E," and "F" are exempt from the maximum setback.
- The property will be developed with a combination of sidewalks, bike path and walking trails to promote interconnectivity.
- The property will be developed with a park area with a combination of lawns and trees.
- The property will be developed with two public rights of way access to promote connectivity with adjoining properties (PIN 23405002 and 23902005). The connection points are subject to adjustment to accommodate changes with the projects internal layout.
- The project will be developed to accommodate bus stops for mass transit. The project will include a bus shelter and turn-out.
- The property will be developed such that all exterior lighting will be glare shielded and designed to prevent illumination beyond the external developments property lines.
- Turn lanes will be installed along Graves Mill Road as determined necessary by the current traffic study dated January 2014 or as determined by an updated traffic study provided by the developer.
- Streets will have ornamental street lights.
- Uses shall be as permitted by right in B-3 and lesser intense districts. However, the following uses will not be included within the development of the site: billboards, building material and construction or farm equipment sales, contractors' establishments, exterminators, kennels, storage, warehouses and yards, manufacturing uses, automobile oriented uses, including automobile, trailer, and truck rentals and sales, tire retail sales, painting/body repair shops and service stations, excluding fueling stations, which will be allowed within the development.
- The property will be developed in substantial compliance with the approved site plan dated February 20, 2014.

4. **Board of Zoning Appeals (BZA).** N/A

5. **Surrounding Area.** There have been several items requiring City Council approval in the immediate area:

- On April 14, 1981, Council approved the petition of Woodrow Iseman and William Milton to rezone approximately eight (8) acres from R-1, Low Density Residential District, to R-2C, Low-Medium Density Residential District (Conditional)to allow the construction of single-family residential homes on smaller lots around the intersection of Omega Drive and Omega Court.
- On August 12, 1986, Council approved the petition of Dreaming Creek Properties to rezone approximately four and half (4.5) acres from I-1, Restricted Industrial District to B-5C, General Business District (Conditional), and for a CUP for a Cluster Commercial Development (CCD) of office, showroom, and warehouse uses at the southwest corner of the intersection of Old Graves Mill and Graves Mill Roads.
- On December 8, 1987, Council approved the petition of Hutter Associates, Inc to rezone approximately thirty and a half (30.5) acres from R-2, Low-Medium Density Residential District to B-5C, General Business District (Conditional) and approximately thirty-two and a half (32.5) acres from R-1, Low Density Residential District to R-4, Medium-High Density Residential District, to allow speculative development with commercial and multi-family uses at the corner of Graves Mill Road and Creekside Drive.
- On December 11, 1990, Council approved the petition of Frank Davidson to amend a previously approved site plan and proffers by rezoning approximately four and a half (4.5) acres from B-5C, General Business District (Conditional), to B-5C, General Business District (Conditional), to allow office, professional, and commercial uses of the property according to a new site plan at the southwest corner of the intersection of Old Graves Mill and Graves Mill Roads.
- On October 13, 1992, Council rezoned fifty four (54) acres to the west of this site along Graves Mill Road from R-1, Low Density Residential District, and R-3, Medium Density Residential District to B-1, Limited Business District as part of the Graves Mill Road / US 221 Area Land Use Study, Growth Management Program.
- On January 12, 1999, Council approved the petition of Petrie, Dierman, and Kughn, to rezone approximately sixty-five (65) acres from R-4, Medium-High Density Residential District, and B-5C, General Business District (Conditional), to B-5C, General Business District (Conditional) and for two (2) Conditional Use Permits (CUP) to fill in a flood plain to allow the construction of a shopping center and parking lot on the properties adjacent to Creekside Drive.
- On July 13, 1999, Council approved the petition of Paul G. Graves to rezone approximately one (1) acre at 1220 Graves Mill Road from R-C, Resource Conservation District, and R-1, Low Density Residential District, to B-5C, General Business District (Conditional) to allow the reconstruction of the historic Graves Mill and its use for various commercial uses, including consignments, antiques, restaurant, gift shop, and the installation of 33 parking spaces.
- On September 12, 2000, Council approved the petition of First Assembly of God for a CUP to allow the construction of a church and parking area in a residential district at 1210 Graves Mill Road.
- On December 12, 2000, Council approved the petition of Lowe's Home Centers for a CUP to allow filling in a flood plain for the construction of a new building and parking lot in a B-5C, General Business District (Conditional), at 1200 Graves Mill Road.

- On August 13, 2002, Council approved the petition of Miller-Motte Technical College for a CUP for a technical college for up to 250 students in a B-5C, General Business District (Conditional), at 1011 Creekside Drive.
- On January 11, 2005, Council approved the petition of Millside Development LLC for a CUP to allow the construction of a Cluster Commercial Development (CCD) in a B-1, Limited Business District at the corner of Graves Mill Road and Lillian Lane.
- On September 13, 2011, Council approved the petition of the Lynchburg Humane Society to amend the FLUM from Resource Conservation and Medium Density Residential to Regional Commercial and to rezone the property from R-2 Low-Medium Density Single Family Residential District to B-5C, General Business District (Conditional) to allow the construction of a new animal shelter and associated parking at 1211 Old Graves Mill Road.

6. **Site Description.** The subject property is two (2) tracts of land totaling approximately seventy and eighty-six thousandths (70.086) acres located at 1600 and 1220 Graves Mill Road. Forty-three and two tenths (43.2) acres are proposed to be rezoned and for Conditional Use Permit (CUP) for the Cluster Commercial Development (CCD).

   The property is bounded to the north by low density residential and currently underdeveloped land, zoned R-1, Low Density Residential, and B-5C, General Business District (Conditional), to the west by the Millside Development Center, to the east by Tomahawk Creek and vacant property owned by First Assembly of God Church, and to the south by Graves Mill Road. Across Graves Mill, property is largely undeveloped and zoned R-C, Resource Conservation District. The site had significant topographic challenges associated with it, rising over 100 feet from the east side of the property where Tomahawk Creek lies to the western ridge designated for future development. As you enter the site from Graves Mill Road, the site rises up and follows the contours of the hillside, parallel to Tomahawk Creek.

7. **Proposed Use of Property.** The purpose of these petitions is to rezone the property from R-1, Low Density Residential District and B-5C, General Business District (Conditional) to B-3C, Community Business District, and for a CUP to allow the construction of a CCD. The CCD would allow the construction of 165,000 square feet of commercial space, 35 apartments, and a system of trails, parks and open space on the 1600 Graves Mill Road Tract. It would also allow the use of the historic buildings and property at 1220 Graves Mill Road as art studios, shops, and an outdoor reception venue (if Council finds the outdoor reception and event use compatible with B-3 uses).

8. **Traffic, Parking and Public Transit.**

   Expressway. A traffic study was required detailing the internal and external trips, internal and external traffic circulation, necessary travel lane requirements, and impacts on Graves Mill Road. As the property is adjacent to a major city corridor, Graves Mill Road, and approximately a half mile from the Lynchburg Expressway, impacts to these facilities should be closely considered. The provided traffic study indicates there are existing operational issues at the Expressway interchange and that improvements will be needed to accommodate natural growth of the city occurring outside of this proposed development. However, the Rosedale CCD will exacerbate and accelerate issues already projected. All ramp movements currently function at a level of service (LOS) C or better (except for the southbound off ramp right turn which functions at a LOS D). The northbound off ramp will fall to a LOS F in both the AM and PM peak hours, and the southbound off ramp will fall to a LOS E in the PM peak hour. The developer does not intend to address these issues as they will happen naturally over time. The traffic study was also

done for a more intense version of the development, and it is believed that the immediate impacts on the ramps will be reduced due to a reduction of trips created by the revised site plan.

Graves Mill Road. The traffic study also indicates the need for dedicated turn lanes for the Rosedale development on Graves Mill Road. At the build out of the site, two left turn lanes and a right turn lane will be required on Graves Mill Road, which will require widening the road. As this development will be phased, lanes can be added as needed with phases. The developer has agreed to provide the turn lanes as phasing indicates their need.

Internal Traffic. The site plan has gone through numerous iterations, and the proposed internal layout satisfies technical traffic concerns, and illustrates an extra effort to provide pedestrian and cycle infrastructure. Further street connectivity could potentially decrease the demand for such a large intersection at Graves Mill Road, reduce pressure on immediately adjacent intersections, and set the stage for creating a more complete street grid, improving large scale traffic issues over a long term. While pedestrian and cycle facilities are provided on site, the development layout could promote walkability further by clustering uses into one area of the site to create a compact walkable core.

Parking. One tenet of Cluster Commercial Zoning (CCD) is that uses within a development should share parking facilities with the intent of reducing the number of total parking spaces needed. The Planning Division believes this could be met better by a further clustering of buildings and parking. Parking is separated by use on the provided site plan and the excess parking spaces do not represent an efficient use of Lynchburg's limited land resources. It is preferred that parking be accommodated by on-street facilities, as well as in lots placed behind buildings, disguised from the street.

Public Transit. Greater Lynchburg Transit Company Route 7 runs along Graves Mill Road in front of this property. The site plan provides for a bus pull off within the development, though discussions with GLTC will be needed to coordinate potential routing into the development.

9. **Stormwater Management.** A stormwater management plan addressing both quantity and quality of stormwater related to the entire development of the property will be required at time of individual site plan submittal. The stormwater management pond currently shown within the floodplain will need to be adjusted during the site plan review process.

10. **Emergency Services.** The City's Fire Marshal and Police Department had no comments of concern.

11. **Impact.** The submitted rezoning petition would allow the construction of 165,000 square feet of commercial space, 35 apartments, and a system of trails, parks and open space on the 1600 Graves Mill Road tract and allow the use of the historic buildings and property at 1220 Graves Mill Road as art studios, shops, and an outdoor reception venue (if Council finds the reception use compatible with B-3 uses).

    The proposed land uses agree with the Comprehensive Plan, which recommends a mix of uses for the site. The site plan both uses design concepts outlined in the Comprehensive Plan and sets the stage for future development to follow those same desired features. The provision for multimodal facilities, park / recreation space, and street connectivity is highly valued by the Planning Division and a desired use for the subject property.

    Impacts to the ramps of the Lynchburg Expressway are a critical concern. The ramps will need significant improvements in the long term, and should the proposed development be approved, the ramps will demand costly infrastructure investments sooner. As this development just

happens to be the tipping point and the site plan and land uses are desired by the Comprehensive Plan, the Planning Division recommends approving the rezoning and CUP petition.

12. **Design Review Board.** CCDs require review by the Design Review Board (DRB) upon a complete submittal of the sketch plan, however the Design Review Board's Review shall be restricted to the following elements by Section 35.1-42.5 (3) of the Zoning Ordinance:

    a. Aesthetic and architectural relationships with the surrounding communities;

    b. Conclusions regarding on-site amenities and improvements;

    c. On-site arrangement of improvements and structures;

    d. Consistency with the Housing Assistance Plan for Federal and/or State funded projects. *(The project is not State or Federally Funded)*

    The DRB reviewed the sketch plan on December 3, 2013. The more recently proposed site plans have a reduced footprint from the plans that went through DRB's review, with most of the residential portions of the site being removed from the rezoning. Future development of the portions to remain R-1, Low Density Residential will be determined at a later date. Comments from the DRB centered on the proposed architectural style, phasing concerns, traffic, and parking.

    Architecture. It was noted specifically that the architecture of the proposed buildings have severe contrasts. The two glass office buildings seem to be of a modern style while other buildings on site have rustic or neoclassical architecture derived from the historic farm and mill structures. It was noted by board members that the sketches do not necessarily match what is proposed.

    Phasing. Phasing was a concern due to the size of the development. With a development this large and the community amenities being part of the agreement of the rezoning, there was fear that part of the development would be built but the amenities would fall by the wayside if the development never reached full completion. The conditions of the CUP should address phasing and when the amenities will be installed.

    Parking. The board also noted that the plan appears to have excess surface parking and that it was a large quantity of asphalt concentrated in single locations. The board recommended on-street parking as a way to mitigate the need for that amount of parking. The developer noted that the parking would likely need to be a combination of asphalt and permeable pavers.

    Traffic. Though not an explicit subject for DRB comment, board members expressed concern over the single entrance to the development and what kind of traffic that might cause within the development during peak traffic times and on the adjacent Graves Mill Road. The DRB commented on how a connection to Breezewood Drive and other adjacent stubbed right-of-way through the back of the development would improve traffic flow.

13. **Technical Review Committee.** The Technical Review Committee (TRC) reviewed the preliminary rezoning plan on October 22, 2013. The plans have gone through numerous iterations since TRC review, but all technical comments related to the proposed development have been or will be addressed prior to final approval.

VI. PLANNING DIVISION RECOMMENDATION(s)

Based on the preceding Findings of Fact, the Planning Commission recommends to City Council approval of the petition of Rosedale Farm LLC and Bella Rose Plantation LLC to:

1. **Waive the twenty-one (21)-day submittal requirement for proffers.**
2. **Rezone approximately forty-three and two tenths (43.2) acres at 1220 and 1600 Graves Mill Road from R-1, Low Density Residential District, and B-5C, General Business District (Conditional), to B-3C, Community Business District (Conditional), subject to the following voluntarily submitted proffers:**
    a. **The property will be developed as a Cluster Commercial Development (CCD). With regards to setbacks, the front setback from Graves Mill Road will be 30'. All other setbacks for front, side and rear yards will be zero feet. Excluding Graves Mill Road, the maximum setback shall be 15' from the public right of ways or back of sidewalk on private streets. Buildings labeled "A," "B," "C," "D," "E," and "F" are exempt from the maximum setback.**
    b. **The property will be developed with a combination of sidewalks, bike paths and walking trails to promote interconnectivity.**
    c. **The property will be developed with a park area with a combination of lawns and trees.**
    d. **The property will be developed with two public rights of way access to promote connectivity with adjoining properties (PIN 23405002 and 23902005). The connection points are subject to adjustment to accommodate changes with the projects internal layout.**
    e. **The project will be developed to accommodate bus stops for mass transit. The project will include a bus shelter and turn-out.**
    f. **The property will be developed such that all exterior lighting will be glare shielded and designed to prevent illumination beyond the external developments property lines.**
    g. **Turn lanes will be installed along Graves Mill Road as determined necessary by the current traffic study dated January 2014 or as determined by an updated traffic study provided by the developer.**
    h. **Streets will have ornamental street lights.**

i. **Uses shall be as permitted by right in B-3 and lesser intense districts. However, the following uses will not be included within the development of the site: billboards, building material and construction or farm equipment sales, contractors' establishments, exterminators, kennels, storage, warehouses and yards, manufacturing uses, automobile oriented uses, including automobile, trailer, and truck rentals and sales, tire retail sales, painting/body repair shops and service stations, excluding fueling stations, which will be allowed within the development.**

j. **The property will be developed in substantial compliance with the approved site plan dated February 20, 2014.**

3. **Grant a Conditional Use Permit (CUP) to allow the construction of a Cluster Commercial Development (CCD), subject to the following conditions:**

   a. **The property shall be developed in substantial compliance with the submitted rezoning plan entitled "Concept Plan for Rezoning & Conditional Use Permit for Rosedale Farm , LLC & Tomahawk Mill Development, LLC & Bella Rose Plantation , LLC" dated February 20, 2014 and prepared by Berkeley-Howell & Associates, P.C., though where in conflict with conditions outlined below, the conditions will take precedence.**

   b. **Petitioner will construct dual left turn lanes and right in turn lanes on Graves Mill Road required by the approved traffic study when designated threshold of 300 trips within the peak hour is reached.**

   c. **Public right of way will be dedicated along the main corridor through the development to property with PIN: 23405002. Additionally, 50' of public right of way will be dedicated to connect to the property with PIN: 23902005. Private roads will be provided to the east and west of the roundabout.**

   d. **An overall Stormwater Management Plan addressing both quality and quantity will be submitted prior to individual site plan approval.**

   e. **Stormwater management facilities will be integrated into the overall design of the development and design is subject to the approval of the City's Environmental Plan Reviewer.**

   f. **Water quality will be addressed through a combination of Best Management Practices (BMPs) and Low Impact Development**

(LID) standards. Design of water quality measures is subject to approval of the City's Environmental Plan Reviewer.

g. **Front loading garages will not be permitted within the development.**

h. **Buildings will have entrances on public and private street frontages.**

i. **All amenities in the area designated as a park on the submitted master plan shall be the responsibility of the developer. All park areas shall be connected to the overall development by a series of trails and or sidewalks.**

j. **Crosswalks will connect sidewalks at all significant intersections and driveways and be ten (10) feet wide, high intensity style.**

k. **Streets will have pedestrian oriented lighting.**

l. **Architecture of the buildings will be in substantial compliance with the renderings submitted in the Sketch Plan Application for Design Review Board.**

m. **Project will be phased so that the public lawn / park area will be constructed with buildings "C" and "D" as labeled on the rezoning plan.**

n. **Driveway entrances on public and private roads will be a minimum of 100' apart.**

o. **Subdivision plat must be submitted for the dedication of any public streets and the approval of any street names.**

4. **Declare the use of the Bella Rose Plantation property as a venue for outdoor receptions and events as compatible with B-3, Community Business District uses.**

Anne Leslie Nygaard
Planner

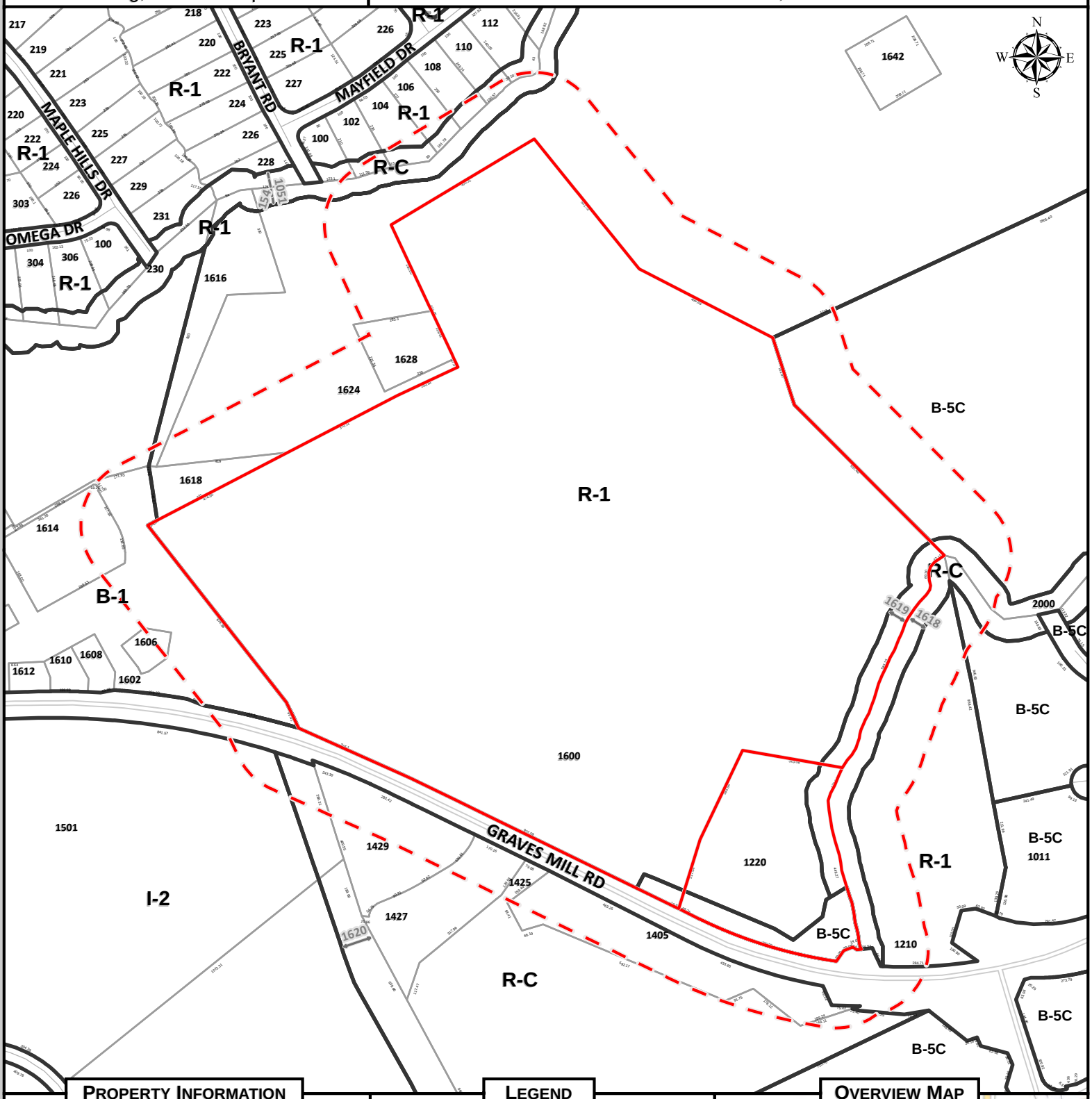
pc: Mr. L. Kimball Payne, III, City Manager
Ms. Bonnie M. Svrcek, Deputy City Manager
Mr. Walter C. Erwin, City Attorney
Mr. Kent L. White, Director of Community Development
Mr. J. Lee Newland, City Engineer
Ms. Cynthia Kozerow, Lynchburg Police Department

Captain Thomas Mack, Acting Fire Marshal
Mr. Donald DeBerry, Transportation Engineer
Mr. Doug Saunders, Building Commissioner
Mr. Robert Fowler, Zoning Administrator
Mr. Jacob Dorman, Environmental Reviewer
Ms. Marjette Upshur, Director of Economic Development

VII. ATTACHMENTS

1. **Vicinity Zoning Pattern Map**
2. **Vicinity Proposed Land Use Map**
3. **Watershed Location Map**
4. **Planimetric and Topographic Map**
5. **Proposed Concept Plan**
6. **Project Narratives (Rosedale Farm and Bella Rose)**
7. **Architectural Renderings**
8. **Street Cross Sections**
9. **Traffic Study and Addendums**
10. **Property Photo**

Zoning Map	REZONING FROM R-1 AND B-5C TO B-3C
Zoning, & CUP Request	Rosedale Farms, LLC



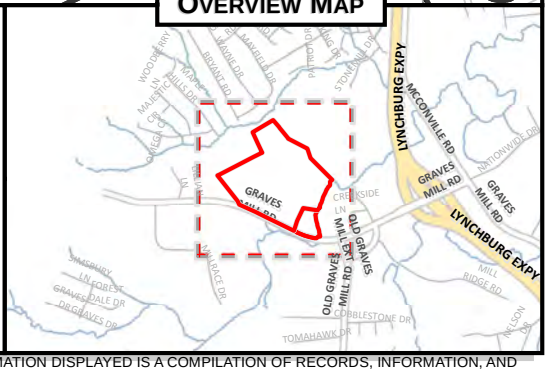
Property Information

Parcel ID	Address
23904004	1600 GRAVES MILL RD
23904001	1220 GRAVES MILL RD

Legend

- Subject Property
- 200' Buffer
- Zoning Boundary

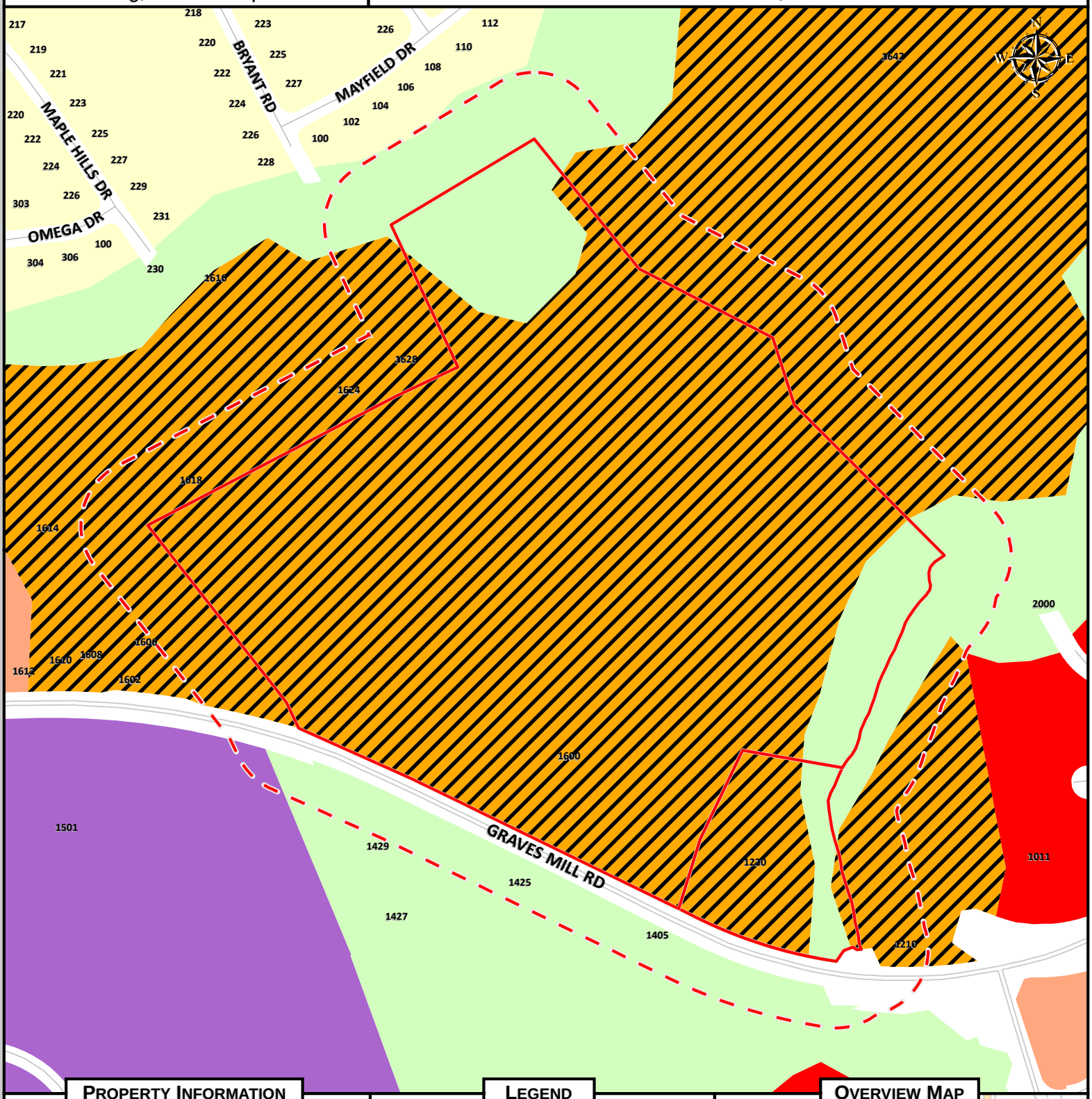
Overview Map



Map Scale: 1 " to 400 ' **Date Printed:** 2/21/2014

DISCLAIMER: THIS MAP IS NEITHER A LEGALLY RECORDED MAP NOR A SURVEY AND IS NOT INTENDED TO BE USED AS SUCH. THE INFORMATION DISPLAYED IS A COMPILATION OF RECORDS, INFORMATION, AND DATA OBTAINED FROM VARIOUS SOURCES. THE CITY OF LYNCHBURG IS NOT RESPONSIBLE FOR ITS ACCURACY OR HOW CURRENT IT MAY BE.

FLUM Map	REZONING FROM R-1 AND B-5C TO B-3C
Zoning, & CUP Request	Rosedale Farms, LLC



Property Information

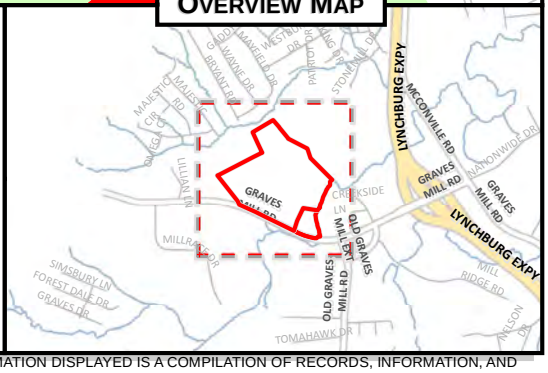
Parcel ID	Address
23904004	1600 GRAVES MILL RD
23904001	1220 GRAVES MILL RD

Legend

- Local Historic District
- Traditional Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Neighborhood Commercial
- Community Commercial
- Employment 1
- Employment 2
- Downtown
- Institution
- Public Use
- Public Parks
- Resource Conservation
- Mixed Use

Map Scale: 1 " to 400 ' **Date Printed:** 2/21/2014

Overview Map



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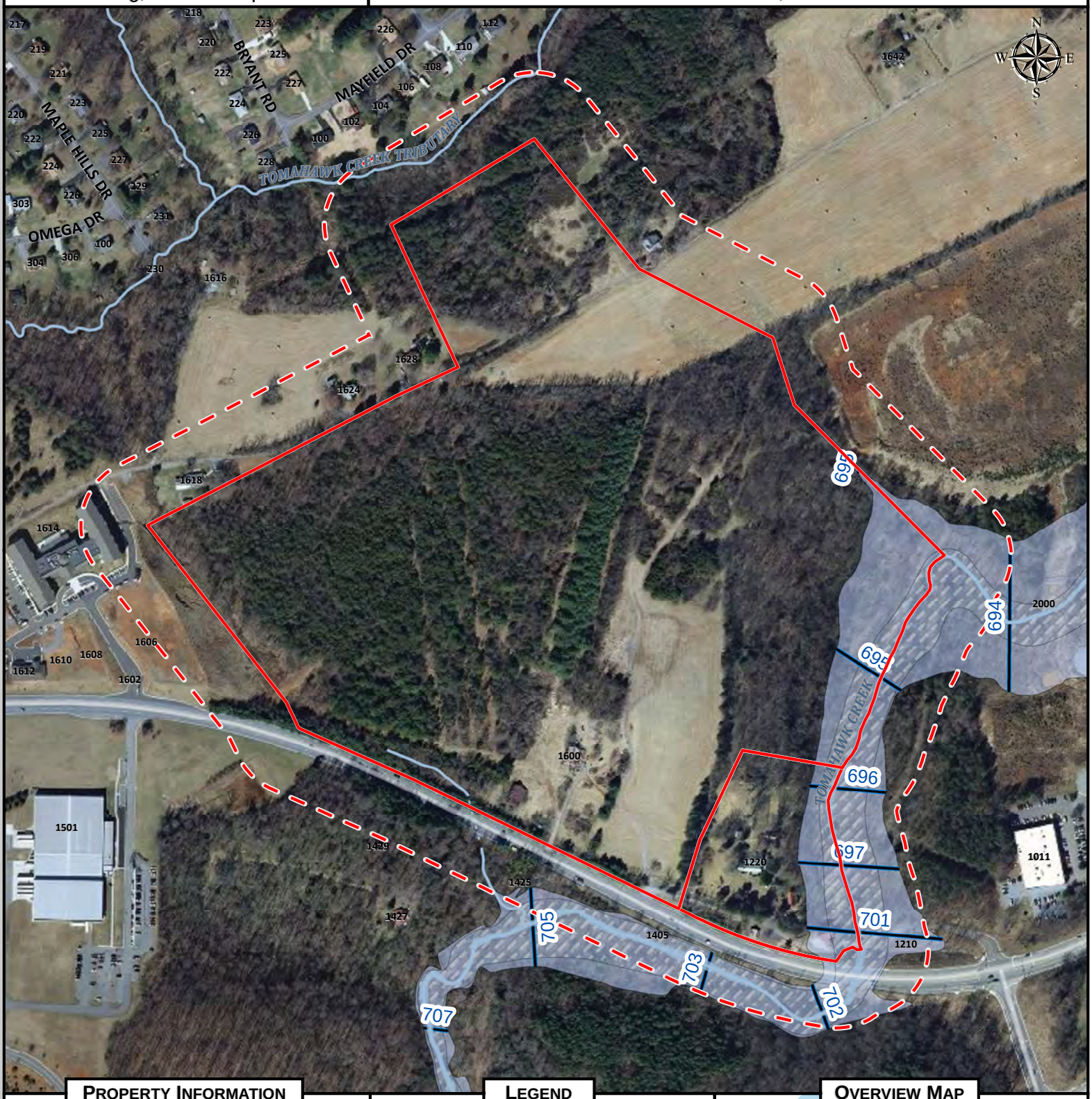
Watershed Map	REZONING FROM R-1 AND B-5C TO B-3C
Zoning, & CUP Request	Rosedale Farms, LLC



Property Information

Parcel ID	Address
23904004	1600 GRAVES MILL RD
23904001	1220 GRAVES MILL RD

Legend

- Subject Property
- Base Flood Elevation
- Floodway
- Floodzone
- River / Lake / Stream

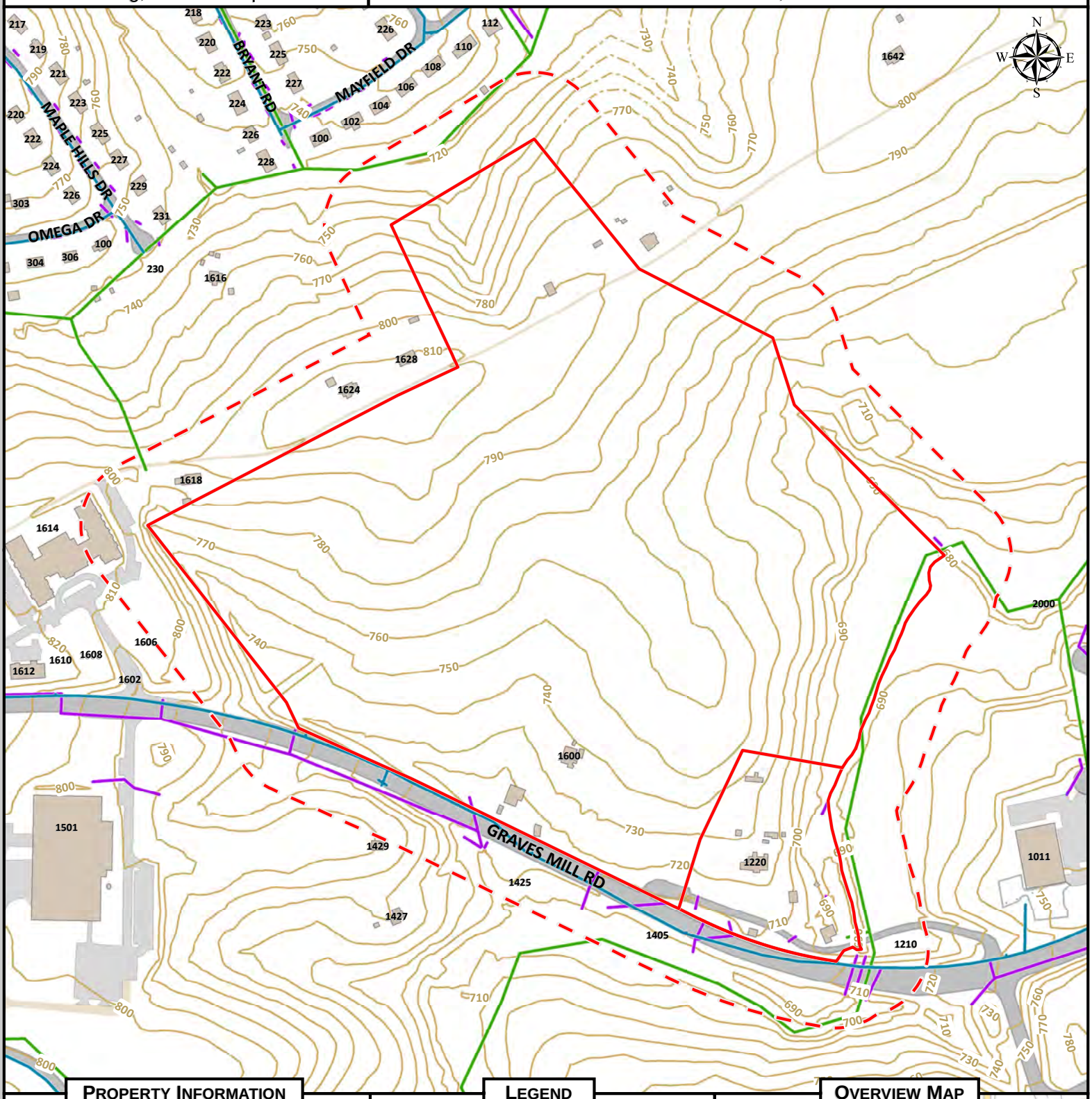
Map Scale: 1 " to 400 ' **Date Printed:** 2/21/2014

Overview Map

Blackwater Creek

DISCLAIMER: THIS MAP IS NEITHER A LEGALLY RECORDED MAP NOR A SURVEY AND IS NOT INTENDED TO BE USED AS SUCH. THE INFORMATION DISPLAYED IS A COMPILATION OF RECORDS, INFORMATION, AND DATA OBTAINED FROM VARIOUS SOURCES. THE CITY OF LYNCHBURG IS NOT RESPONSIBLE FOR ITS ACCURACY OR HOW CURRENT IT MAY BE.

Planimetric and Topographic Map	REZONING FROM R-1 AND B-5C TO B-3C
Zoning, & CUP Request	Rosedale Farms, LLC



Property Information

Parcel ID	Address
23904004	1600 GRAVES MILL RD
23904001	1220 GRAVES MILL RD

Legend

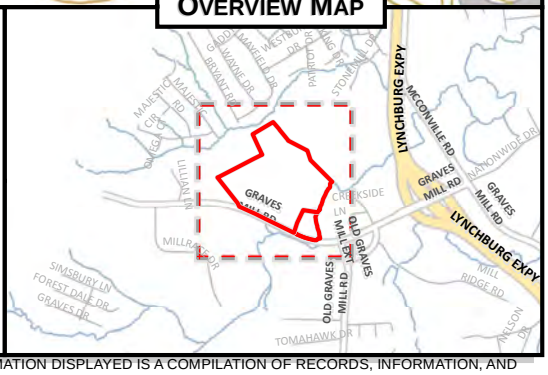
		Active	Proposed	Abandoned
Utilities	Water			
	Sanitary			
	Storm			

		Paved	Unpaved	Other
Planimetrics	Structure	-	-	
	Roadway			-
	Parking			-
	Sidewalk		-	-
	Driveway	-	-	

		10'	10' Obs
Topography	Contour		

Map Scale: 1 " to 400 ' **Date Printed:** 2/21/2014

Overview Map



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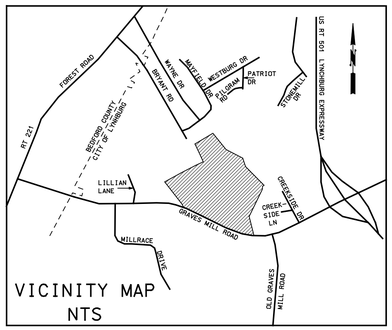


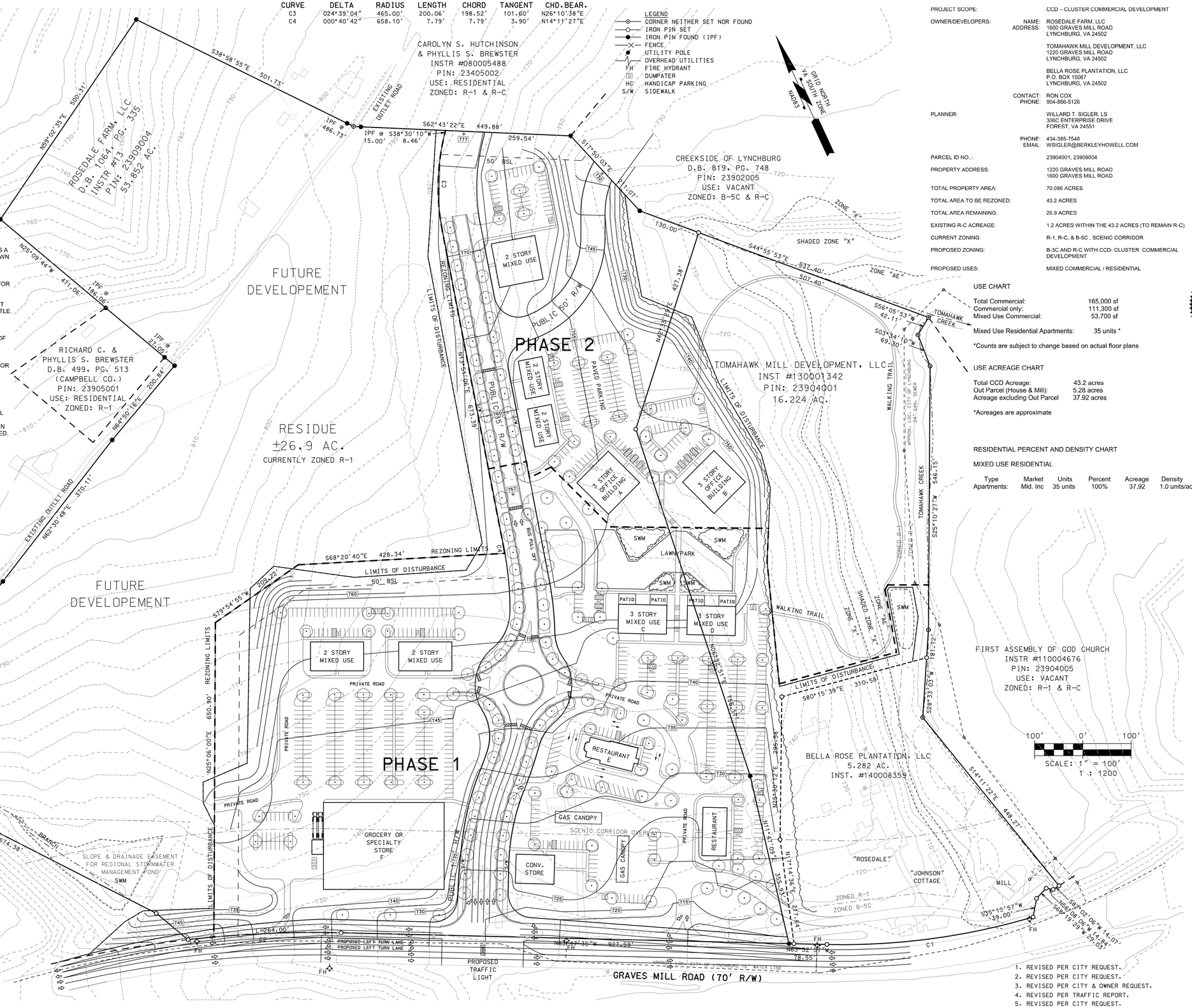
VICINITY MAP
NTS

NOTES:

1. THIS PLAN HAS BEEN PREPARED IN ORDER TO DEVELOP THE PROPERTY AS A CCD- CLUSTER COMMERCIAL DEVELOPMENT. THE USES AND LAYOUT SHOWN ARE FOR CONCEPT ONLY AND ARE SUBJECT TO CHANGE BASED ON THE FUTURE NEEDS FOR BOTH RESIDENTIAL AND COMMERCIAL USES IN THE LYNCHBURG AREA. AS PORTIONS OF THE PROPERTY ARE DEVELOPED, INDIVIDUAL SITE PLANS WILL BE SUBMITTED TO THE CITY OF LYNCHBURG FOR CODE COMPLIANCE AND APPROVAL.
2. THIS PLAN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND DOES NOT NECESSARILY INDICATE ALL ENCUMBRANCES UPON THE TITLE.
3. BY GRAPHIC SCALING ONLY, A PORTION OF THIS PROPERTY IS LOCATED IN SHADED ZONE "X " AND ZONE "AE" (DESIGNATED FLOOD HAZARD AREAS) ACCORDING TO THE F.E.M.A. FLOOD INSURANCE RATE MAP FOR THE CITY OF LYNCHBURG, VIRGINIA (#5100930038D) DATED JUNE 3, 2008. NO FIELD SURVEYING WAS PERFORMED TO MAKE THIS DETERMINATION.
4. THIS PLAN DOES NOT PURPORT TO ADDRESS THE EXISTENCE, DETECTION OR DELINEATION OF ANY ENVIRONMENTALLY SENSITIVE AREAS OR ANY ENVIRONMENTAL PROBLEMS LOCATED WITHIN THE PERIMETER OF THE PROPERTY SHOWN.
5. THIS PLAN IS BASED ON A CURRENT FIELD SURVEY.
6. PRIOR TO THE DEMOLITON OF ANY BUILDING, UTILITY DISCONNECT FOR ALL SERVICES MUST BE FURNISHED TO THE CITY OF LYNCHBURG INSPECTION DIVISION. BEFORE ISSUING A DEMOLITION PERMIT, AN ASBESTOS SURVEY IN ACCORDANCE WITH SECTION 36-99.7 OF THE CODE OF VIRGINIA IS REQUIRED.
7. THE PROPOSED DEVELOPMENT WILL BE SERVED BY CITY OF LYNCHBURG WATER AND SANITARY SEWER CONNECTIONS.
8. STORMWATER MANAGEMENT WILL MEET STATE AND LOCAL CODES.
9. VERTICAL DATUM – NGVD29

CURVE	DELTA	RADIUS	LENGTH	CHORD	TANGENT	CHD.BEAR.
C3	024°39'04"	465.00'	200.06'	198.52'	101.60'	N26°10'38"E
C4	000°40'42"	658.10'	7.79'	7.79'	3.90'	N14°11'27"E

LEGEND
- CORNER NEITHER SET NOR FOUND
- IRON PIN SET
- IRON PIN FOUND (IPF)
- FENCE
- UTILITY POLE
- OVERHEAD UTILITIES
- FH FIRE HYDRANT
- D DUMPATER
- HC HANDICAP PARKING
- S/W SIDEWALK



CURVE DATA CHART

CURVE	DELTA	RADIUS	LENGTH	CHORD	CHD BEARING
C1	017°47'23"	1393.13'	432.55'	430.81'	N72°46'39"W
C2	007°50'35"	2320.92'	317.70'	317.45'	N67°46'52"W

PROJECT SCOPE:	CCD – CLUSTER COMMERCIAL DEVELOPMENT
OWNER/DEVELOPERS: NAME:	ROSEDALE FARM, LLC
ADDRESS:	1600 GRAVES MILL ROAD LYNCHBURG, VA 24502
	TOMAHAWK MILL DEVELOPMENT, LLC 1220 GRAVES MILL ROAD LYNCHBURG, VA 24502
	BELLA ROSE PLANTATION, LLC P.O. BOX 15067 LYNCHBURG, VA 24502
CONTACT:	RON COX
PHONE:	904-866-5126
PLANNER:	WILLARD T. SIGLER, LS 306C ENTERPRISE DRIVE FOREST, VA 24551
PHONE:	434-385-7548
EMAIL:	WSIGLER@BERKLEYHOWELL.COM
PARCEL ID NO..:	23904001, 23909004
PROPERTY ADDRESS:	1220 GRAVES MILL ROAD 1600 GRAVES MILL ROAD
TOTAL PROPERTY AREA:	70.086 ACRES
TOTAL AREA TO BE REZONED:	43.2 ACRES
TOTAL AREA REMAINING:	26.9 ACRES
EXISTING R-C ACREAGE:	1.2 ACRES WITHIN THE 43.2 ACRES (TO REMAIN R-C)
CURRENT ZONING:	R-1, R-C, & B-5C , SCENIC CORRIDOR
PROPOSED ZONING:	B-3C AND R-C WITH CCD- CLUSTER COMMERCIAL DEVELOPMENT
PROPOSED USES:	MIXED COMMERCIAL / RESIDENTIAL

USE CHART

Total Commercial:	165,000 sf
Commercial only:	111,300 sf
Mixed Use Commercial:	53,700 sf
Mixed Use Residential Apartments:	35 units *

*Counts are subject to change based on actual floor plans

USE ACREAGE CHART

Total CCD Acreage:	43.2 acres
Out Parcel (House & Mill):	5.28 acres
Acreage excluding Out Parcel	37.92 acres

*Acreages are approximate

RESIDENTIAL PERCENT AND DENSITY CHART

MIXED USE RESIDENTIAL

Type	Market	Units	Percent	Acreage	Density
Apartments:	Mid. Inc	35 units	100%	37.92	1.0 units/ac

BERKLEY HOWELL & ASSOC., P.C.
ENGINEERS • SURVEYORS • PLANNERS
306 ENTERPRISE DRIVE, SUITE C
FOREST, VIRGINIA 24551
PHONE: (434)385-7548 FAX: (434)385-6178

COMMONWEALTH OF VIRGINIA
WILLARD BERKLEY, JR.
Lic. No. 10759
2-20-14
PROFESSIONAL ENGINEER

CONCEPT PLAN FOR
REZONING & CONDITIONAL USE PERMIT
FOR ROSEDALE FARM, LLC &
TOMAHAWK MILL DEVELOPMENT, LLC &
BELLA ROSE PLANTATION, LLC
CITY OF LYNCHBURG, VIRGINIA

DATE: 11-6-13
DRAWN:
CHECKED:

REVISIONS

NO.	DATE
1	11-20-13
2	12-20-13
3	1-30-14
4	2-7-14
5	2-20-14

SCALES
HORIZ: AS SHOWN
VERT: AS SHOWN

COMM. NO. 120012

SHEET NO. 1 OF 1

1. REVISED PER CITY REQUEST.
2. REVISED PER CITY REQUEST.
3. REVISED PER CITY & OWNER REQUEST.
4. REVISED PER TRAFFIC REPORT.
5. REVISED PER CITY REQUEST.

M:\Projects-BHA\120012\ref\SITE\MASTER DESIGN.dgn - Default

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Bella Rose Plantation

Bella Rose Plantation will consist of several different concepts… nested on 6 acres, the estate formally known as the ROSEDALE MANSION will play a very intricate part to be the anchor of this plantation, as it will be used as a 19th century backdrop for weddings and events . The name "Bella Rose Plantation" is derived from Bella meaning 'beautiful" and Rose for the Rosedale Estate. The property truly lends itself to an overall grand Master plan.

It will serve as a designer decor exhibit for furnishings and furniture as well as wall art techniques which will be open to the public Monday thru Friday. On the weekends it will serve as a Bridal Haven for brides to use to make their wedding dreams come true. The top floor of the house will be renovated to have an elaborate expansive wedding suite for brides to use to get ready on their special day, and can be used for wedding portraits taken throughout the week. Caretakers will live on site to manage the plantation.

We will use vintage style themed lighting throughout the estate and the grounds….Circa 18th century design elements will be used to preserve and create a Williamsburg type feel for the property. An EXPERIENCE of the bygone era will attempt to be created on the property while bringing the elements of grandeur to the property with manicured landscaping to include the MILL being operational with the wheel turning by an electric motor. The main house can serve as the anchor for a wedding venue either in the front yard or in the backyard for events that need to serve larger groups. The back of the house will be cleared and re-landscaped to create a large area for larger groups and large tents can be used to cater special events.

There will be water flowing in the ponds that will be flowing over the waterwheel and through tiered garden areas for the brides to be married with an active mill as their backdrop. THE MILL will be used as a fully operational event venue for wedding receptions and several other special occasion rentals. The bottom of the mill will still be used a wood working shop for the furniture that is being sold inside the mansion to be restored and refinished on site. The carriage house will be kept and used as signage again to create the Williamsburg type feel for the plantation and provide great visibility for the venue.

The Christopher Johnson Cottage will be used possibly as a coffee/bakery shop and also an art studio for the caretaker who is an artist to display her work in this beautiful historic cottage. Walkways of pea gravel will be created throughout the grounds to again tie into the 19th century era. We will plan to have an artist exhibit on the estate grounds once a year to reach out to the artist in the area which should be a great response from the artist community. The venue will also hopefully host numerous civic and cultural events throughout the year for the community.

REZONING AND DESIGN REVIEW BOARD NARRATIVE
FOR

ROSEDALE FARM, LLC
1600 GRAVES MILL ROAD
LYNCHBURG, VIRGINIA
AND
TOMAHAWK MILL DEVELOPMENT, LLC
1220 GRAVES MILL ROAD
LYNCHBURG, VIRGINIA
AND
BELLA ROSE PLANTATION, LLC
P.O. BOX 15067
LYNCHBURG, VA 24502

PREPARED FOR:

ROSEDALE FARM, LLC
1600 GRAVES MILL ROAD
LYNCHBURG, VIRGINIA
AND
TOMAHAWK MILL DEVELOPMENT, LLC
1220 GRAVES MILL ROAD
LYNCHBURG, VIRGINIA 24502
AND
BELLA ROSE PLANTATION, LLC
P.O. BOX 15067
LYNCHBURG, VA 24502

(C/O RON COX)

BY

BERKLEY-HOWELL & ASSOCIATES, P.C.
ENGINEERS-SURVEYORS-PLANNERS

306 ENTERPRISE DRIVE, SUITE C.
FOREST, VIRGINIA 24551
(434) 385-7548

COMM. NO. 120012

SEPTEMBER 24, 2013
REVISED FEBRUARY 21, 2014

PROJECT SCOPE

Request Rezoning from R-1, B-5C, R-C with Scenic Corridor to B-3C, R-C to allow for CCD, Commercial Cluster Development. The CCD will encompass 43.2 acres of the 70 acre property. The property is currently substantially undeveloped, but includes an existing residential house, residential cottage and commercial building (refurbished mill). The proposed Commercial Cluster Development will be multi use with a combination of commercial and residential development. Below are narratives specifically requested by the City of Lynchburg for the Rezoning application and Design Review Board application.

PROJECT DESCRIPTION

Rosedale is a proposed 43.2 acre mixed-use development located on Graves Mill Road. The site is currently a partially wooded farm tract with historic structures dating back to the 1760's. The concept for Rosedale incorporates the modern trends of mixed-use developments that will be attractive to families, young professionals, students, older residents, and businesses that are expanding or considering relocating to the Region 2000 area. It's residential, commercial, and recreational areas will be connected by a shared lawn and attractive, pedestrian-oriented streets, corridors, and walkways.

As per the City of Lynchburg 2030 Comprehensive Plan, this area of Graves Mill Road is listed appropriate for a mixed use core of higher density residential and retail uses. The current development plan has evolved after numerous meetings with City planning staff to insure that the project is on target to satisfy Lynchburg's general plan by utilizing a mix of appropriate residential and commercial uses to meet the predicted needs of the area.

The proposed restaurant, retail, grocery, gas, and convenience sites, etc. in the commercial area are designed to enhance the quality of life for residents and employees of businesses located within the development, as well as the surrounding community.

The proposed buildings in the business and technology center are designed to establish Rosedale's identity as Region 2000's premium location for professional and corporate office space.

The commercial areas provide for upper level residential living. The mixed use concept provides for an urban living experience and allows for efficient use of space and parking.

The proposed lawn and creek side recreational area offer shared open spaces, walking trails, bike paths, and lawn-side commercial establishments that create the social hub of the development. The non vehicular routes promote travel between uses. The user may benefit from healthy exercise while enjoying a walk down a landscaped urban street, across the lawn or through the woods beside a creek. Public walks will be concrete, shared bike paths will be paved, and natural trails will be mulched. The lawn which adjoins the commercial area will provide green space for a Frisbee, or blanket and a good book. A minimum of three lawn benches will offer a moments rest.

Common areas will be owned and maintained by property owners associations.

With regards to community facilities, the project is centrally located and nearby to many schools, fire station, and cultural facilities. Heritage High School, CVCC, Liberty University, and Lynchburg College range from two to four miles away. With a combination of apartments and townhomes, the development will provide a possible residential housing for the college community. The Lynchburg Fire Station number 7 is approximately 2 miles away on Lakeside Drive and is available for timely emergency response. To experience local history or to enjoy a day outside, with a drive of less than 4 miles, a resident can visit to Poplar Forest or Peaks View Park.

The development is planned as an up scale mixed use residential and commercial community. Located on a side slope, the proposed 13 buildings are planned with a scenic combination of landscaping, lawn, open space and wooded areas with connecting roadways, sidewalks, trails, and paths. The buildings architecture will be stylish and upscale. With such a large project scope of 13 buildings a varying palette of materials and colors will be required to produce a unique but tasteful appearance. While the developer is providing several architectural renderings and samples of building materials and colors, the submittal is not intended to limit architectural style and creativity. Architectural integrity will be facilitated and enforced by a diligent Architectural Review Committee.

Hopkins Brothers LP&D sees a potential in this property and the proposed Rosedale development to establish a business and technology center that will attract quality businesses, and the jobs they bring to Lynchburg, Region 2000, and the Lynchburg 2030 vision for many years to come.

WATER/SEWER CAPACITY NARRATIVE:

The property is served by an existing City of Lynchburg Public water via 16" line along Graves Mill Road. The 16" water line will adequately serve the development.

The property is served by an existing 24" sanitary sewer line along Tomahawk Creek. The 24" sanitary sewer line will adequately serve the development.

STORMWATER NARRATIVE FOR ADEQUATE CHANNEL AND STORMWATER MEASURES

The proposed development will require storm water management for both water quality and quantity. Due to the vast size of the project, a variety of storm water management measures will be utilized throughout the project in a combination of both local and regional treatment. The project will be designed to meet state and local codes. During development of individual sites, specific designs will be submitted for City review and approval.

Water quality will be handled by a combination of measures such as Rooftop Disconnection, Rainwater Harvesting, Soil Amendments, Permeable Pavement, Grass Channel, Bio-retention, Infiltration, Dry Swale, Wet Swale, Sheet Flow to Filter/Open Space, Extended Detention Pond, Filtering Practice, and Constructed Wetlands.

In regards to storm water quantity, the development discharges to Tomahawk Creek which is a listed FEMA flood zone. To provide channel protection, the project will satisfy the equation $Qdev \leq I.F*(Qpredev*RVpredev)/RVdev$ since discharging to an existing natural storm water conveyance. In regards to flood protection, no additional storm water management is required since the project discharges to Tomahawk Creek which is a mapped flood plain.

PARKING

As the end users are defined, parking will be designed to meet the specific needs and exceed the City required minimum. When practical, overflow parking will be designed as "green" parking. Shared parking will be utilized for mixed use areas.

LAWN-SIDE COMMERCIAL BUILDINGS

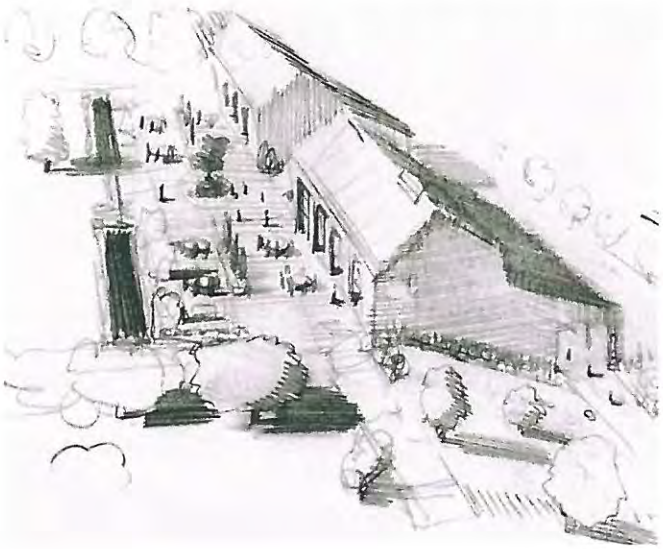
Description:

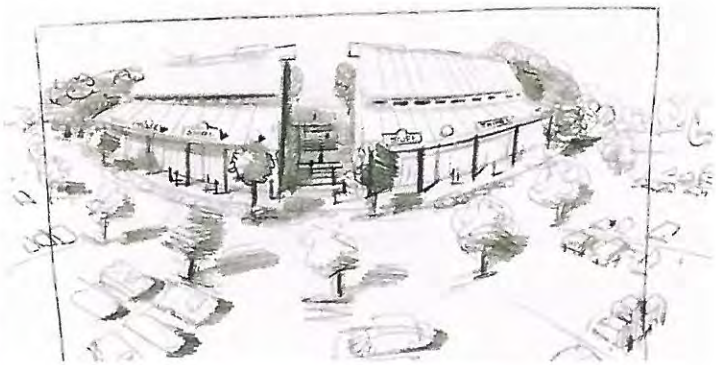
These two buildings will be designed to compliment the neighboring historic Rosedale property, while offering a unique, modern commercial setting with a strong identity. The exterior design is reminiscent of Traditional American Timber-Frame Barns build in the 1800s, with an iconic roof line and vertical board and batten exterior. The building design is dominated by glass and unpainted, galvinized, metal roofs. Graves Mill Road-front commercial spaces will have full glass storefronts, designed to maximize business exposure and natural light. The lawn facing side of the buildings will offer commercial spaces with elivated ceilings and patio space. The lawn facing spaces will have prominant glass windows opening up views of the scenic lawn area and ajoining patios.

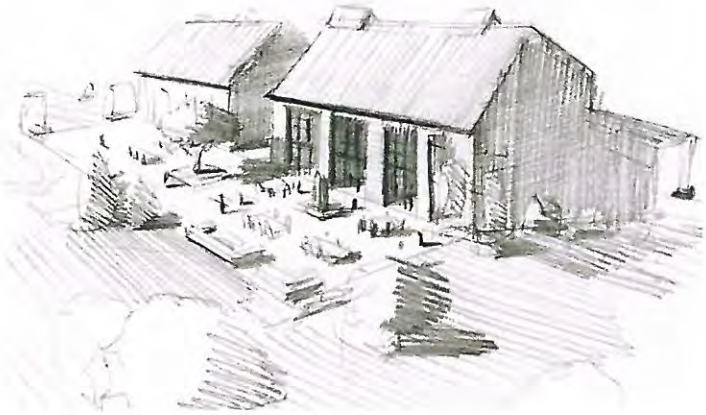
Exterior Materials:

build on a concrete slab
stacked stone foundation
hardy board (wood-like masonry siding), applied in a vertical board and batten style
galvanized unpainted metal roofing, reflective of traditional barn roofing
windows:
Large, modern, dominating glass windows for optimal natural light and commercial exposure.
metal frames with powder coat finishes

LAWN-SIDE COMMERCIAL BUILDINGS: SUPPORTING IMAGES







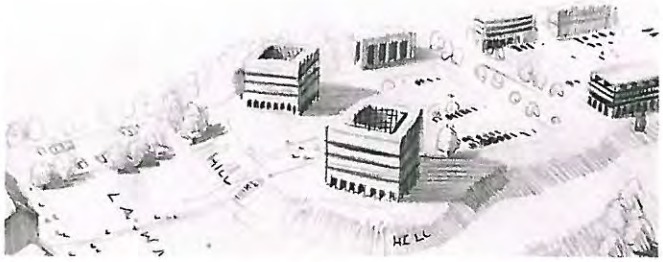
COMMERCIAL PAD SITES ALONG GRAVES MILL ROAD

The Graves Mill Road fronting commercial pad sites will likely be purchased by franchise restaurants and retail businesses. We will take every opportunity to influence the architecture of these buildings, but also recognize that many of these businesses guard their brand and building designs closely.

BUSINESS & TECHNOLOGY BUILDINGS

Description:

These buildings will be designed to compliment what we believe will be the premium location for office space in the region 2000 market. The architecture will be of a modern corporate style wrapped in glass.



A — COMMERCIAL

DESIGNED TO BE CONVENIENT AND ACCESSIBLE FOR RESIDENTS, EMPLOYEES & PATRONS

SHOPS, RESTAURANTS, OFFICES & RESIDENTIAL

GROCERY, GAS, DELI & CONVENIENCE

ROAD-FRONT & CORNER COMMERCIAL SPACES

LAWN-SIDE PATIOS

C — THE LAWN & CREEK-SIDE NATURAL AREA

DESIGNED TO ENHANCE CONNECTIVITY & QUALITY OF LIFE

LANDSCAPED OPEN SPACES & NATURAL AREA

TOMAHAWK CREEK RECREATIONAL AREA

BICYCLE & PEDESTRIAN FRIENDLY WALKWAYS & SCENIC BIKE TRAILS

LAWN-SIDE PATIOS

D — BUSINESS & TECHNOLOGY CENTER

DESIGNED TO ATTRACT NEW & EXPANDING BUSINESSES

RESTAURANTS, OFFICES, SPECIALTY RETAIL & RESIDENTIAL

LAWN & NATURAL AREA

LAWN-SIDE PATIOS

★ — LAWN-SIDE COMMERCIAL BUILDINGS

DESIGNED TO BE UPSCALE, UNIQUE, AND CONVENIENT

LAWN & NATURAL AREA

LAWN-SIDE PATIOS

RESTAURANTS, OFFICES, SPECIALTY RETAIL & RESIDENTIAL

✱ — THE LAWN

DESIGNED TO BE A CENTRAL HUB CONNECTING RESIDENTS, EMPLOYEES & PATRONS

BICYCLE & PEDESTRIAN-FRIENDLY WALKWAYS

ACCESS TO BIKE TRAILS & CREEK-SIDE RECREATIONAL AREA

LAWN-SIDE PATIOS

OPEN GREEN SPACE

LAWN-SIDE COMMERCIAL BUILDINGS

Lawn-side commercial buildings offer a unique, strong identity for businesses seeking the modern trends of an interactive workspace.

MIXED-USE COMMERCIAL BUILDINGS FRONTING GRAVES MILL ROAD ARCHITECTURE & DESIGN ELEMENTS

THE ARCHITECTURE OF THESE BUILDINGS AND THEIR SITE PLAN WILL BE SUBJECT TO DEVELOPER APPROVAL.

DEVELOPER WILL STRIVE TO ENSURE THAT THESE BUILDINGS INCORPORATE DESIGN ELEMENTS THAT WILL REFLECT THE LARGER THEME OF THE PROJECT.

MIXED-USE BUSINESS & TECHNOLOGY BUILDINGS ARCHITECTURE & DESIGN ELEMENTS

THE ARCHITECTURE OF THESE BUILDINGS AND THEIR SITE PLAN WILL BE SUBJECT TO DEVELOPER APPROVAL.

DEVELOPER WILL STRIVE TO ENSURE THAT THESE BUILDINGS INCORPORATE DESIGN ELEMENTS THAT ARE REFLECTIVE OF AN UPSCALE CORPORATE ENVIRONMENT WITH TRADITIONAL ARCHITECTURAL ELEMENTS.

LAWN-SIDE COMMERCIAL BUILDINGS ARCHITECTURE & DESIGN ELEMENTS

STACKED-STONE EXTERIOR FOUNDATION

POST AND BEAM INTERIOR STRUCTURE

VERTICAL BOARD & BATTEN EXTERIOR

FLOOR-TO-CEILING METAL FRAME WINDOWS

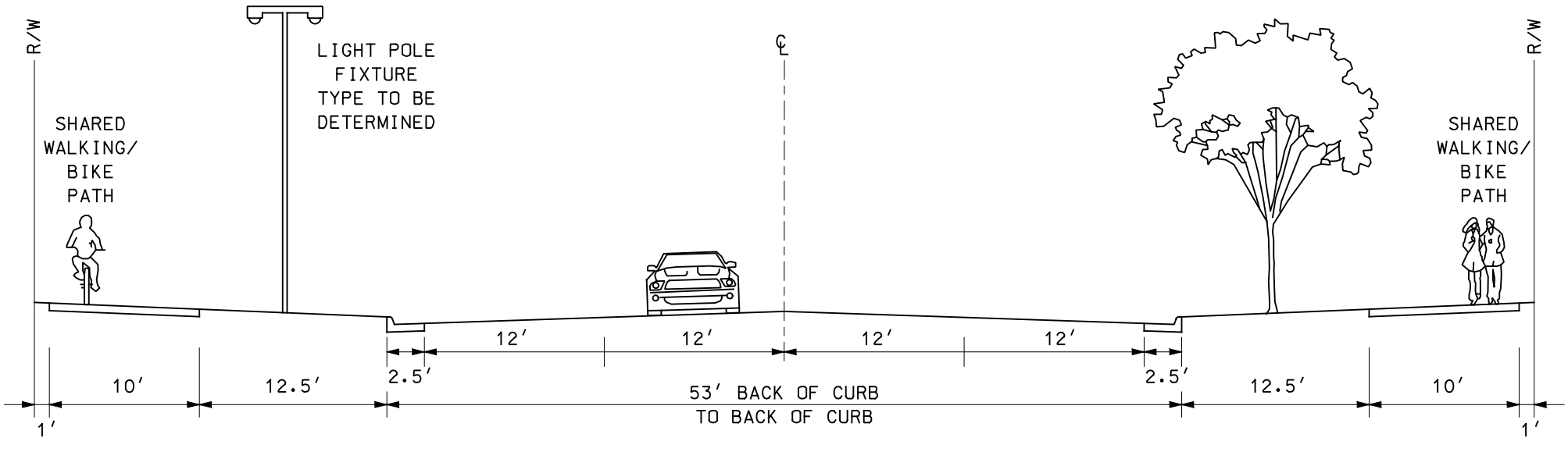
TRADITIONAL AMERICAN TIMBER-FRAME BARN ARCHITECTURAL DETAILS

TRADITIONAL GALVANIZED METAL BARN ROOF

COVERED FRONT WALKWAY (FRONT GRAVES MILL ROAD-FRONT COMMERCIAL SPACES)

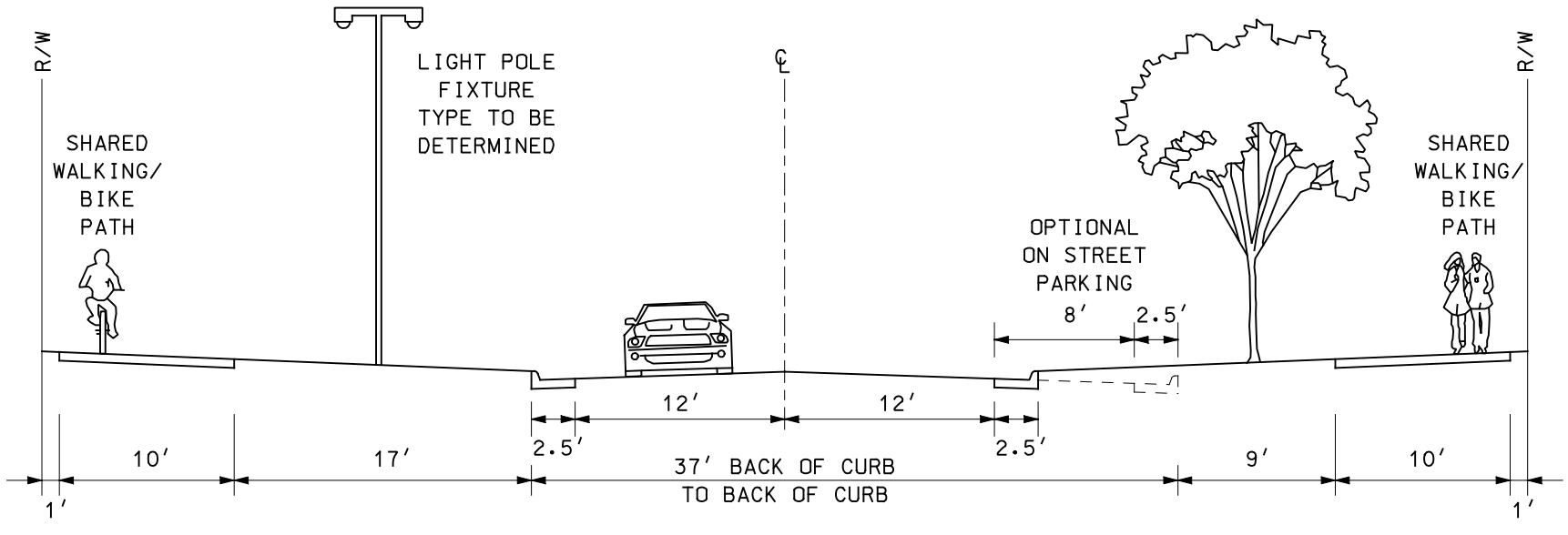
OPEN PATIO FACING THE BUSINESS & TECHNOLOGY CENTER (REAR LAWN-SIDE COMMERCIAL SPACES)

ROSEDALE



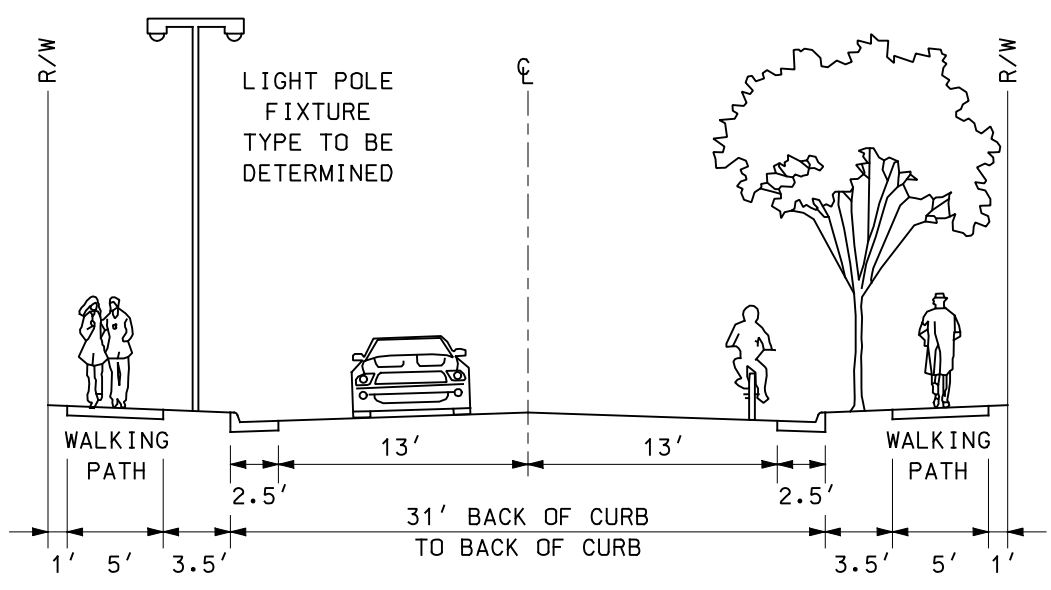
FOUR LANE
100′ R/W CROSS SECTION

NTS



TWO LANE
85′ R/W CROSS SECTION

NTS



TWO LANE
50′ R/W CROSS SECTION

NTS

REVISED 11-20-13
REVISED 1-30-14

Technical Memorandum

Traffic Impact Analysis

Rosedale Farms
Lynchburg, Virginia

Prepared for:

Mr. Ron Cox
Rosedale Farm Development LLC
2217 Surrey Pl.
Lynchburg, VA 24503

By:

Bill Wuensch, P.E., PTOE; Charles Smith, P.E., PTOE; Wei He
EPR, P.C.
637 Berkmar Circle
Charlottesville, Virginia 22901

November, 2013

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3 Existing conditions
4 No build conditions
5 Site trip generation
6 Site trip distribution and assignment
7 Build conditions
8 Mitigation
9 Summary of conclusions and recommendations

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Appendix G Peak Hour Signal Warrant Sheets
Appendix H 2024 Mitigation Syncho and SimTraffic Reports

Traffic Impact Analysis

Rosedale Farms, Lynchburg, Virginia

1. Introduction

This technical memorandum summarizes the traffic analyses conducted to evaluate potential traffic impacts of a proposed Rosedale Farms development in Lynchburg, VA. The development is generally located north of Graves Mill Road and west of the Expressway.

This memo includes analyses of existing conditions, future no build conditions, and future build conditions for the horizon (full build) year 2024.

2. Description of site, site plan, and the study intersections

The proposed development is located just west of the existing Home Depot side off of Graves Mill Road in Lynchburg, VA. The proposed site includes three entrance locations on Graves Mill Road – one right in only, one right out only and one full entrance. **Figure 1** provides the illustration of the site location and its vicinity. The development concept plan is provided on the aerial map in **Figure 2**.

In the development concept prepared to date, the site is planned to be constructed in three phases with an ultimate build-out year of 2024. Note that this study evaluates one total future build year (Build Year 2024). The proposed development land use is identified in Table 1.

TABLE 1
Proposed Development Land Use

LAND USE	QUANTITY	UNIT
Multi-Family Residential	102	Residential units
Condo / Townhouse	175	Residential units
Office	68,600	Square feet
Retail (Shopping Center)	25,800	Square feet
General Commercial (Use Unknown)	8,100	Square feet
Grocery / Specialty Store	45,000	Square feet
Conveniencce Store with Gas Pump	12	Vehicle fueling positions
High Turnover (Sit Down) Restaurant	5,000	Square feet
Fast Food Restaurant with Drive-Through	7,000	Square feet

For this study, traffic operations will be examined at the following intersections (see **Figure 3**):

Figure 1 Site Location and Vicinity

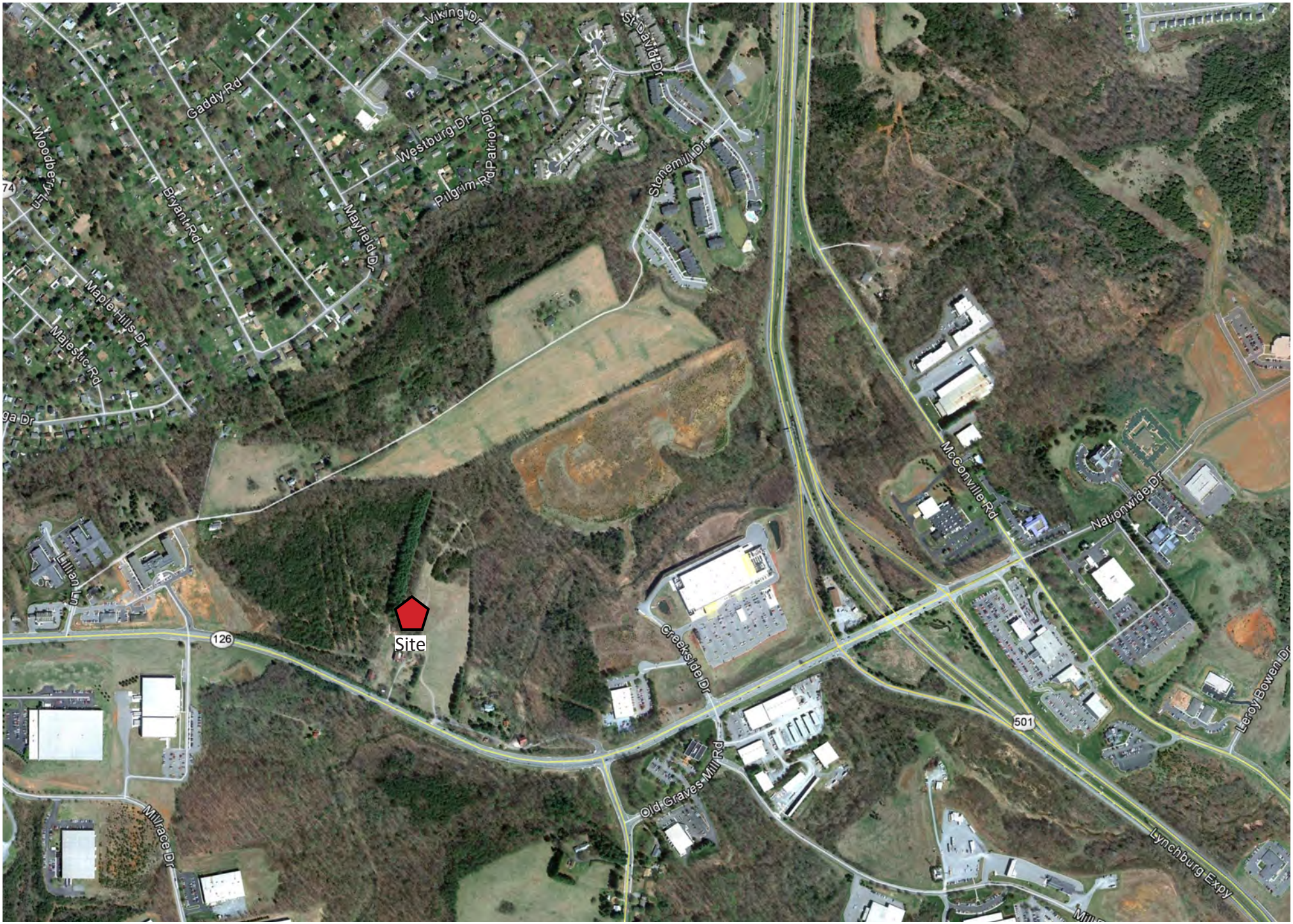
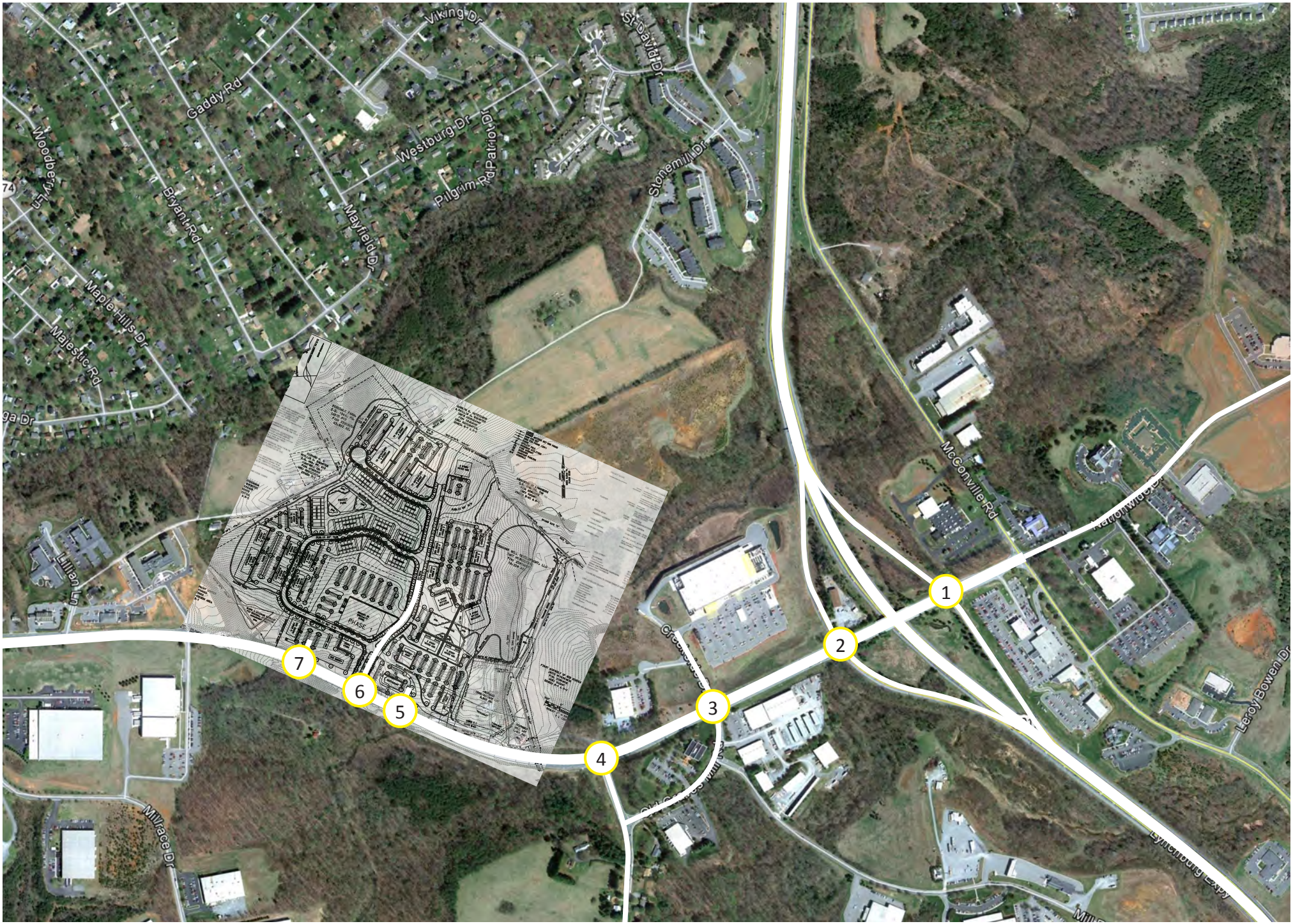


Figure 2 Site Plan

Figure 3 Study Intersections



- Graves Mill Road and Expressway Ramp Intersection (northbound)
- Graves Mill Road and Expressway Ramp Intersection (soutbound)
- Graves Mill Road and Creekside Drive (at Home Depot)
- Graves Mill Road and Old Graves Mill Road
- Graves Mill Road and Site Entrance (right in only) [only show future traffic volumes and provide turn lane analysis]
- Graves Mill Road and Site Entrance (full entrance)
- Graves Mill Road and Site Entrance (right out only) [only show future traffic volumes]

3. Existing conditions

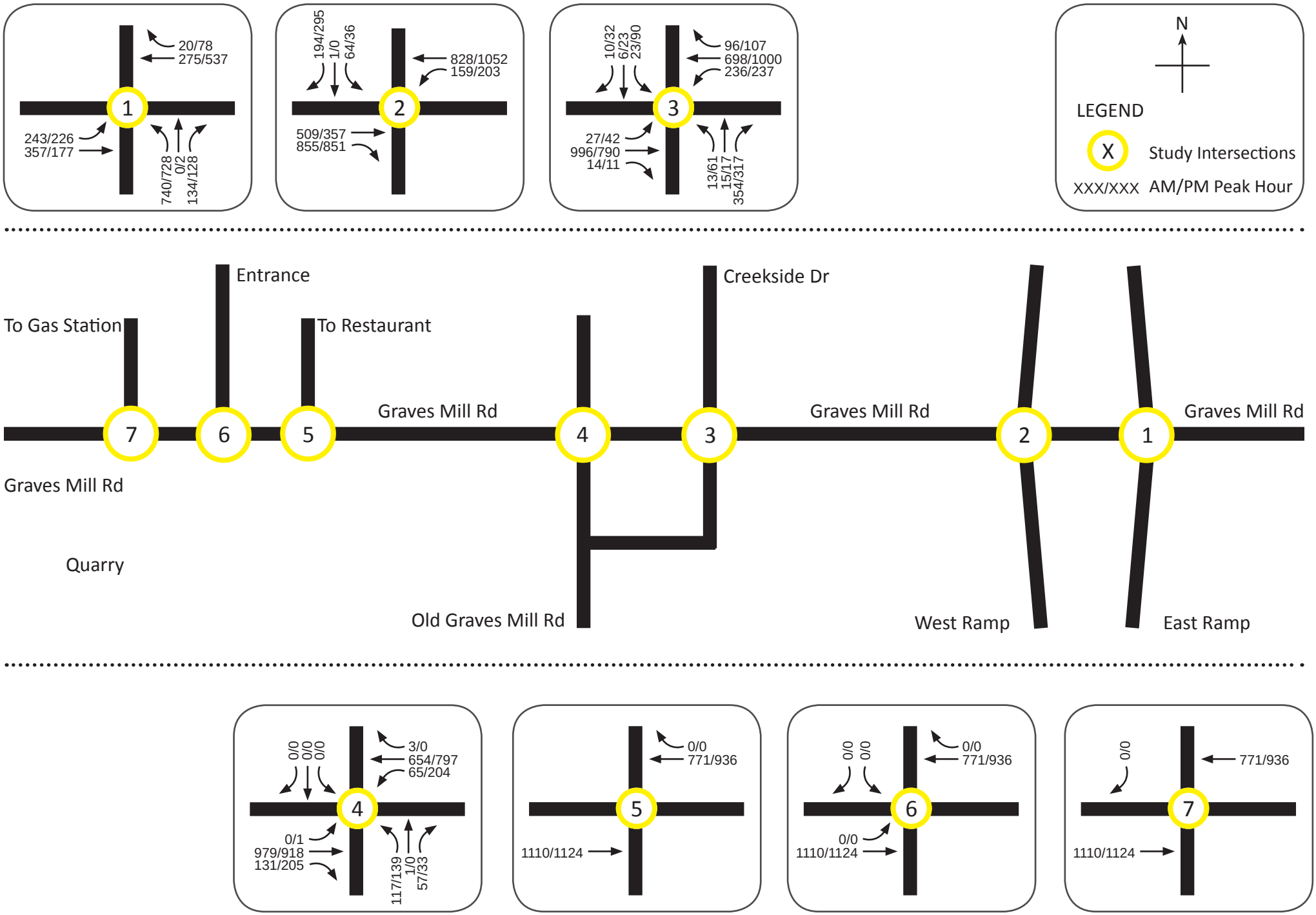
AM and PM peak hour (7-9AM and 4-6PM) traffic counts were conducted for the four existing intersections on Tuesday, Wednesday or Thursday between October 9, 2013 and October 16, 2013.

See **Figure 4** for the illustration of the existing traffic volumes at the study intersections. The original traffic count reports are provided in **Appendix A**.

Traffic Analysis
Synchro and SimTraffic models (ver 7) were utilized to evaluate existing traffic operations at the study intersections. For existing conditions, we used optimized timings since we are aware that the field timings will be updated soon. We do however provide a comparison between the optimized and the actual existing timings, within the discussion. The delay, level of service (LOS) and queuing (from both Synchro and SimTraffic) are summarized in a series of tables in **Appendix B**. The Synchro and SimTraffic reports are provided in **Appendix C**.

<u>Graves Mill Road and Expressway Ramps</u>
The analyses indicate that the two ramp junction intersections, from an intersection capacity standpoint, can currently operate at acceptable levels of service with all movements operating at LOS C or better, with the one exception of the southbound exit ramp right turn movement which operates at LOS D during the PM peak hour. *Note that if using existing signal timings then we see LOS F for the northbound off-ramp in both the AM and PM peak hours, and LOS E at the southbound off ramp right turn in the PM peak hour*. While this (southbound) right turn movement is fairly high at 295 vph, the westbound through movement is very high with 1,052 vph thus limiting opportunities for right turns on red. However, the SimTraffic model indicates queuing along the heavy volume approaches, particularly the northbound off ramp, southbound off ramp, eastbound right turn to the on ramp and westbound through movement between the ramps. Field observations indicate that the queuing has negative impacts on the corridor. *Note that under existing timings the northbound queues are shown to be excessively long in the AM and PM peak hours. The northbound left turn queue is 440 feet in the AM and 450 feet in the PM peak hours. The northbound right is 874 feet in the AM and 942*

Figure 4 Existing Traffic Volumes



feet in the PM peak hour. The tables in Appendix C show the optimized queues which are less than these existing condition lengths by approximately 200 feet.

Graves Mill Road and Creekside Drive (Home Depot)
During the AM peak hour, the analyses indicate that all movements currently operate at LOS D or better. The SimTraffic model indicates considerable queuing (547 feet – existing timings result in 200 feet longer queue) in the eastbound direction as motorists are destined for the Expressway. A right lane bias (motorists utilizing the right through lane in anticipation of the right turn downstream onto the Expressway southbound on ramp) increases the queuing at this intersection.
During the PM peak hour, the analyses indicate that all movements currently operate at LOS C or better. Again, the SimTraffic model indicates very heavy queuing (751 feet) in the eastbound direction.

Graves Mill Road and Old Graves Mill Road
During both peak hours, the analyses indicate that all movements operate at LOS D or better. The SimTraffic model indicates the AM and PM peak hour queuing along the eastbound approaches as 177 feet and 415 feet respectively as the lane bias approaching the Expressway starts to affect driver behavior. *Note that under existing (actual existing signal timings) the model indicates the eastbound left to operate at LOS E in the PM peak hour. Also the eastbound approach is 353 feet in the AM and 894 feet in the PM.*

4. No build conditions

Historical traffic volume data from the Virginia Department of Transportation was evaluated to determine a reasonable background traffic growth rate for the study intersections. This evaluation resulted in the following background growth rates:

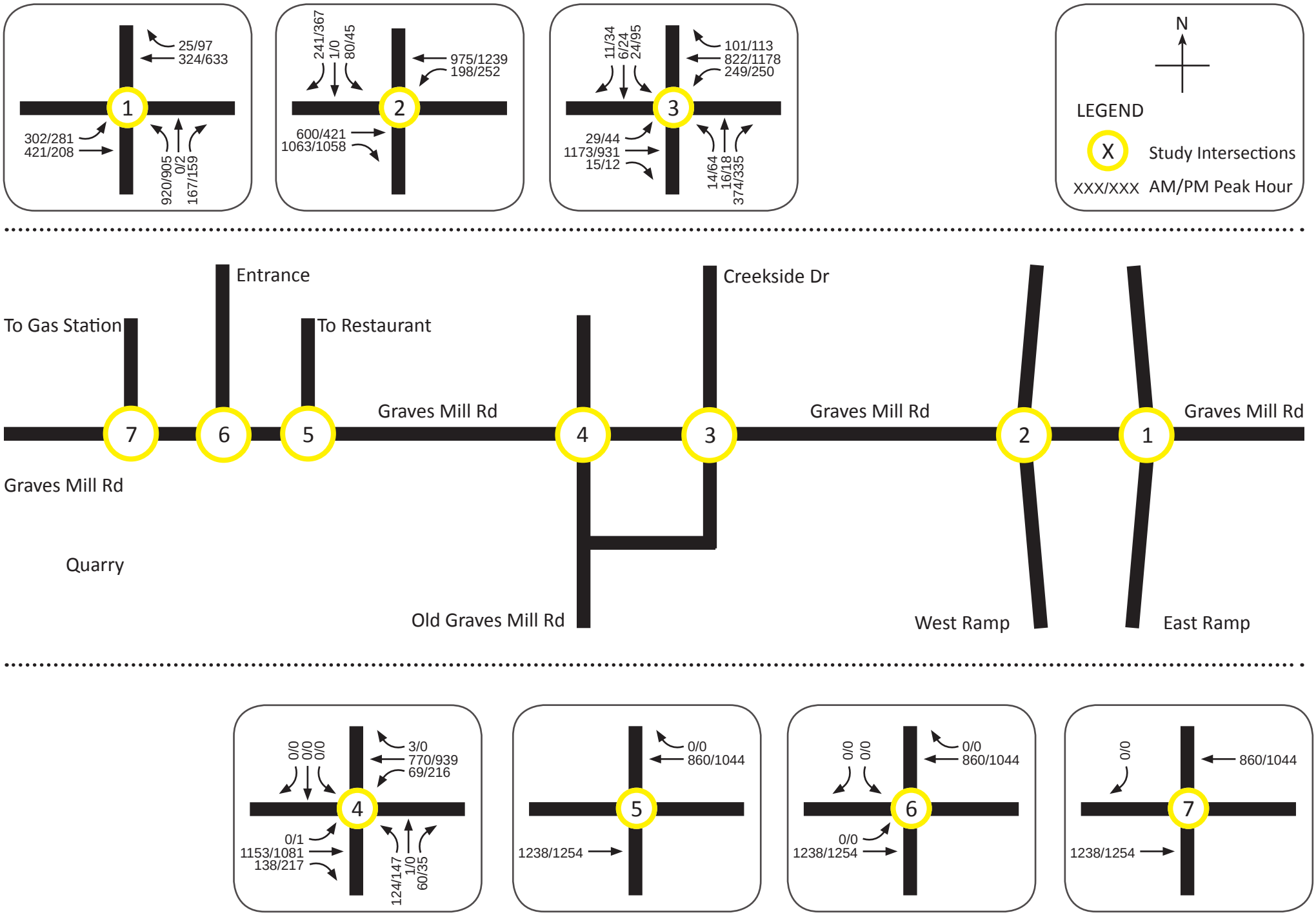
- Graves Mill Road west of Old Graves Mill Road – 1%
- Graves Mill Road east of and inclusive of Old Graves Mill Road – 1.5%
- All turns to / from Graves Mill Road (except Expressway Ramp movements) – 0.5%
- All turns to / from Expressway Ramps – 2%

These background growth rates were utilized to increase the background traffic volumes to the horizon year 2024.

See **Figure 5** for the illustration of the no build traffic volumes at the study intersections in 2024.

Traffic Analysis
The Synchro and SimTraffic models were updated to reflect the no-build 2024 traffic volumes. The delay, level of service (LOS) and queuing (from both Synchro and

Figure 5 2024 No Build Traffic Volumes



SimTraffic) are summarized in a series of tables in **Appendix B**. The Synchro and SimTraffic reports are provided in **Appendix D**.

Graves Mill Road and Expressway Ramps – Northbound Ramps on East Side of Interchange

During the AM peak hour, it is projected that all movements will operate at LOS C or better based on the Synchro analysis, which only considers the individual intersection. However, the SimTraffic model projects an increase in queuing, particularly on the northbound off ramp and for the eastbound through movement.

During the PM peak hour, it is projected that all movements will operate at LOS C or better with the exception of the left turn movement from the off ramp that is expected to operate at LOS D. The SimTraffic model projects significant increases in queue lengths, especially for the northbound off ramp (over 900 feet which is near the Expressway mainline) and the westbound through movement (also over 900 feet which queues beyond the next intersection to the east).

Graves Mill Road and Expressway Ramps – Southbound Ramps on West Side of Interchange

During the AM peak hour, it is projected that all movements will operate at LOS C or better with the exception of three movements that are projected to operate at LOS E – the eastbound right turn movement, the southbound shared left / through movement, and the southbound right turn movement. The SimTraffic model projects an increase in queuing, particularly for the eastbound movement (through movement over 600 feet and right turn movement over 400 feet) and the westbound through movement between the ramp intersections (595 feet).

During the PM peak hour, it is projected that all movements will operate at LOS D or better with the exception of two movements. The eastbound right turn movement is projected to operate at LOS E and the southbound right turn movement from the off ramp is projected to operate at LOS F. Again, the SimTraffic model projects an increase in queuing, especially for the westbound through movement. This queue is projected to be 749 feet which results in a queue back to the adjacent ramp intersection.

Graves Mill Road and Creekside Drive (Home Depot)

During the AM peak hour, it is projected that all movements will operate at LOS D or better with the exception of two side street movements. The southbound left movement and the southbound shared through / right movement are both projected to operate at LOS E. These movements are low volume with a total of only 41 vehicles for both lanes for the entire hour and a resulting queue of 70 feet. The SimTraffic model projects an increase in the eastbound queue to total 766 feet which results in a queue back to the Old Graves Mill intersection.

During the PM peak hour, it is projected that all movements will operate at LOS D or better with the exception of three side street movements. The southbound left movement, the southbound shared through / right movement and the northbound shared left / through movement are all projected to operate at LOS E. The southbound movements are low volume with a total of only 153 vehicles for both lanes for the entire hour and a resulting queue of 159 feet. The northbound movement is also low volume

with a total of only 82 vehicles for the entire hour. Again, the SimTraffic model projects considerable queuing in the eastbound direction (665 feet, slightly lower than during the AM peak hour, but still significant).

Graves Mill Road and Old Graves Mill Road

During the AM peak hour, it is projected that all movements will operate at LOS D or better with the exception of two side street movements. The northbound shared left / through movement and the right turn movement are expected to operate at LOS E. These movements are relatively low volume (shared left / through volume is 125 vph combined and the right turn volume is 60 vph) and the projected queues are modest (209 feet and 88 feet respectively). The SimTraffic model projects an increase in eastbound queuing (530 foot total queue) as the heavy movement towards the Expressway plus the right lane bias causes traffic to slow down and queue through the Creekside Drive signal and through the Old Graves Mill Road signal.

During the PM peak hour, it is projected that all movements will operate at LOS D or better with the exception of two movements. The eastbound left turn movement and the northbound shared left / through movement are projected to operate at LOS E. The eastbound left turn movement is very low volume (only 1 vehicle in the PM peak hour) so with a short green time, the average delay (spread over just one vehicle) is high. The northbound movement is also relatively low volume (147 vph) and the resulting queue is only 213 feet.

Queuing Discussion

While most of the individual movements seem to operate at reasonable levels of service from an individual intersection capacity perspective, in the no build 2024 condition the SimTraffic model indicates that the existing queuing issues related to the Expressway interchange will be exacerbated by the background growth in the corridor. The result is significant queuing on the off ramps, on Graves Mill Road between the ramp signals, and eastbound along Graves Mill Road approaching the Expressway (queuing and slow traffic beyond Old Graves Mill Road).

5. Site trip generation

The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 9th Edition,* was utilized to project the new trips associated with the proposed development. In addition to the projected trip generation, per VDOT's Traffic Impact Analysis Regulations Administrative Guidelines, reductions are allowed for internal capture and pass-by. The allowable internal capture rates for this development are 15% of residential trips, and the pass-by rates are 25% of retail trips and 40% of convenience store and food service trips.

Table 2 provides a summary of the projected development trip generation.

TABLE 2
Site Trip Generation

				AM		PM	
Use Description	**ITE**	**Qty**	**Daily**	**in**	**out**	**in**	**out**
Multi-Family Residential	220	102	742	11	43	48	26
Condo/Townhouse	230	175	1,047	14	67	64	31
Office	710	68,600	986	125	17	26	129
Retail (Shopping Center)	820	25,800	2,815	42	26	116	126
General Commercial (Use Unknown)	826	8,100	359	0	0	18	23
Grocery/Specialty Store	850	45,000	4,601	95	58	218	209
Convenience Store with Gas Pump	853	12	6,511	99	99	114	114
High-Turnover (Sit-Down) Restaurant	932	5,000	636	30	24	30	20
Fast Food Restaurant with Drive-Through	934	7,000	3,473	80	77	59	54
	total		21,169	496	412	693	732
internal capture			268	4	17	17	9
Peak Hour Trips After Reductions (driveway trips)			20,901	492	396	676	724
Pass-by			6,096	114	98	165	162
Primary Trips			14,804	378	298	511	562
	total peak		14,804	676		1,073	

6. Site trip distribution and assignment

The site trip distributions used in this study were generated based on the layout of the development plan and evaluation of the existing traffic patterns in the Graves Mill Road corridor.

Given the three entrances (eastern entrance right-in only, center entrance full access, and western entrance right-out only) trips were assigned to entrances based on the site plan. The proposed restaurant uses are near the eastern entrance and the proposed gas station use is near the western entrance so those respective trips are more heavily biased towards those entrances (80 percent of the appropriate trip by direction). All other trips are assigned to the full entrance with a distribution similar to the current distribution in the vicinity.

See **Figures 6-1 through 6-3** for an illustration of the assumed trip distribution percentages and **Figure 7** for an illustration of the projected site related volumes.

7. Build conditions

The trips generated from the development, calculated and assigned to the study intersections as documented in the previous sections, were added to the background no build 2024 traffic volumes.

See **Figure 8** for the illustration of the build traffic volumes in 2024.

Figure 6-1 Site Trip Distribution (Major Part)

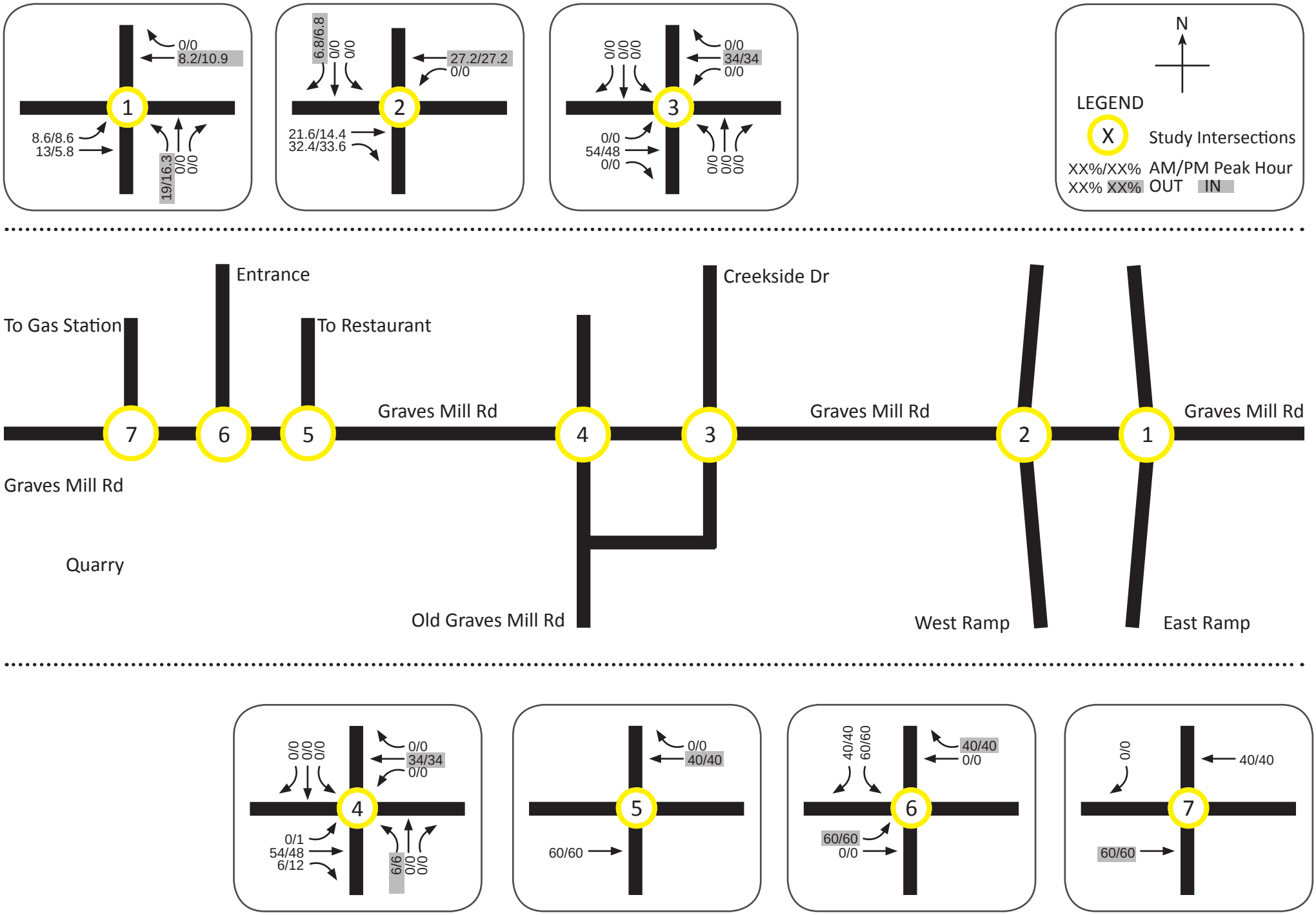


Figure 6-2 Site Trip Distribution (Gas Station Part)

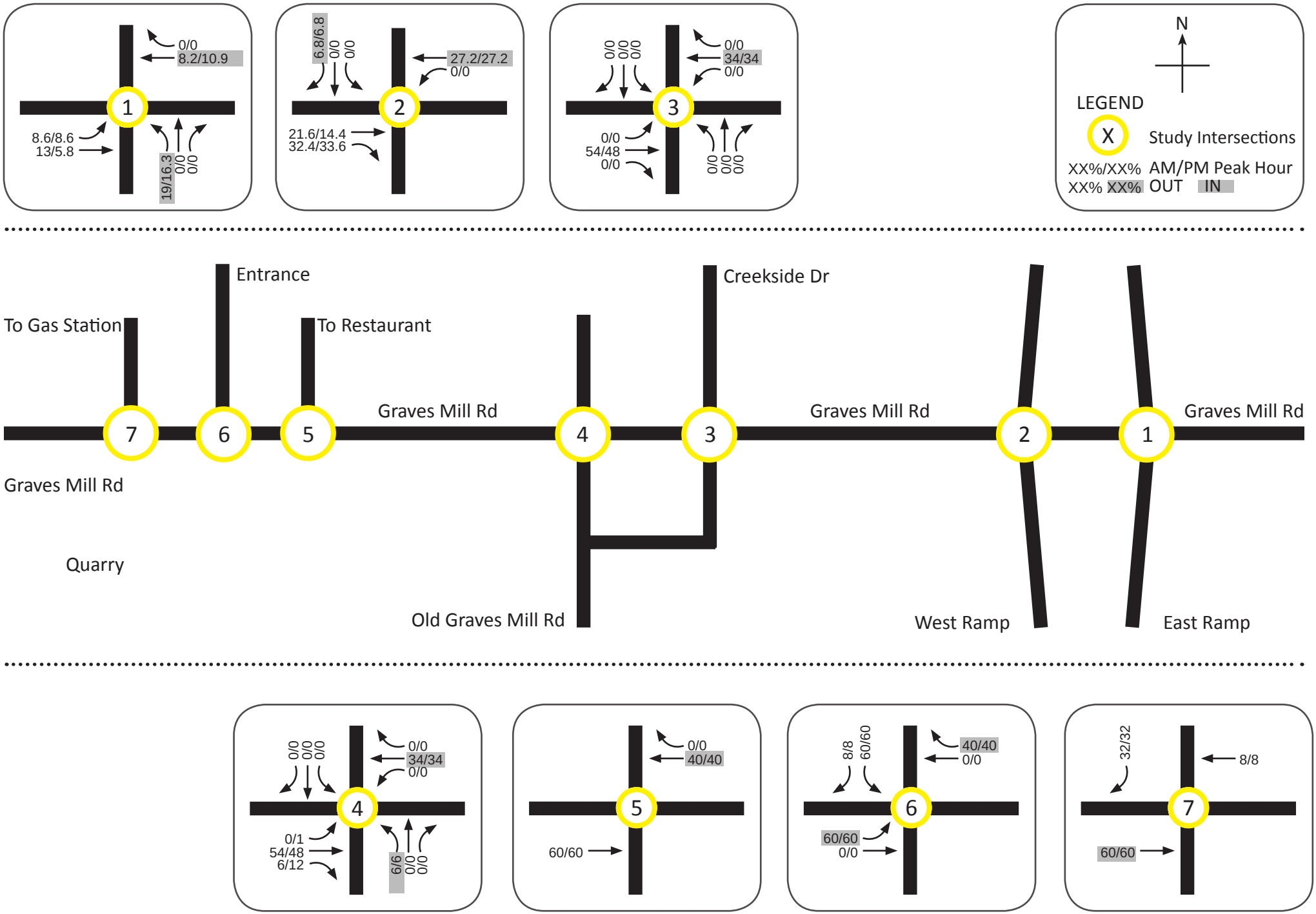


Figure 6-3 Site Trip Distribution (Restaurant Part)

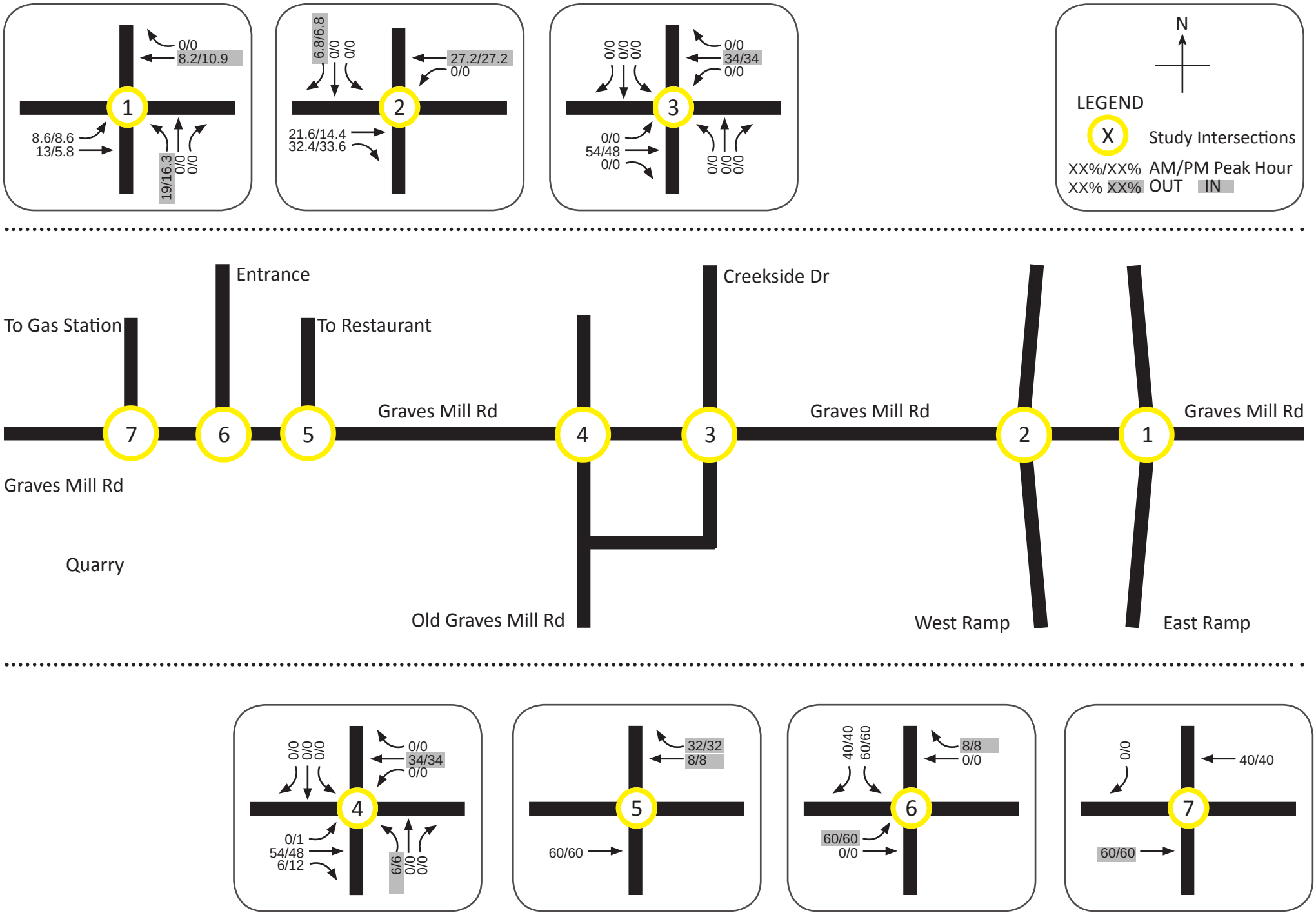


Figure 7 Site Trips

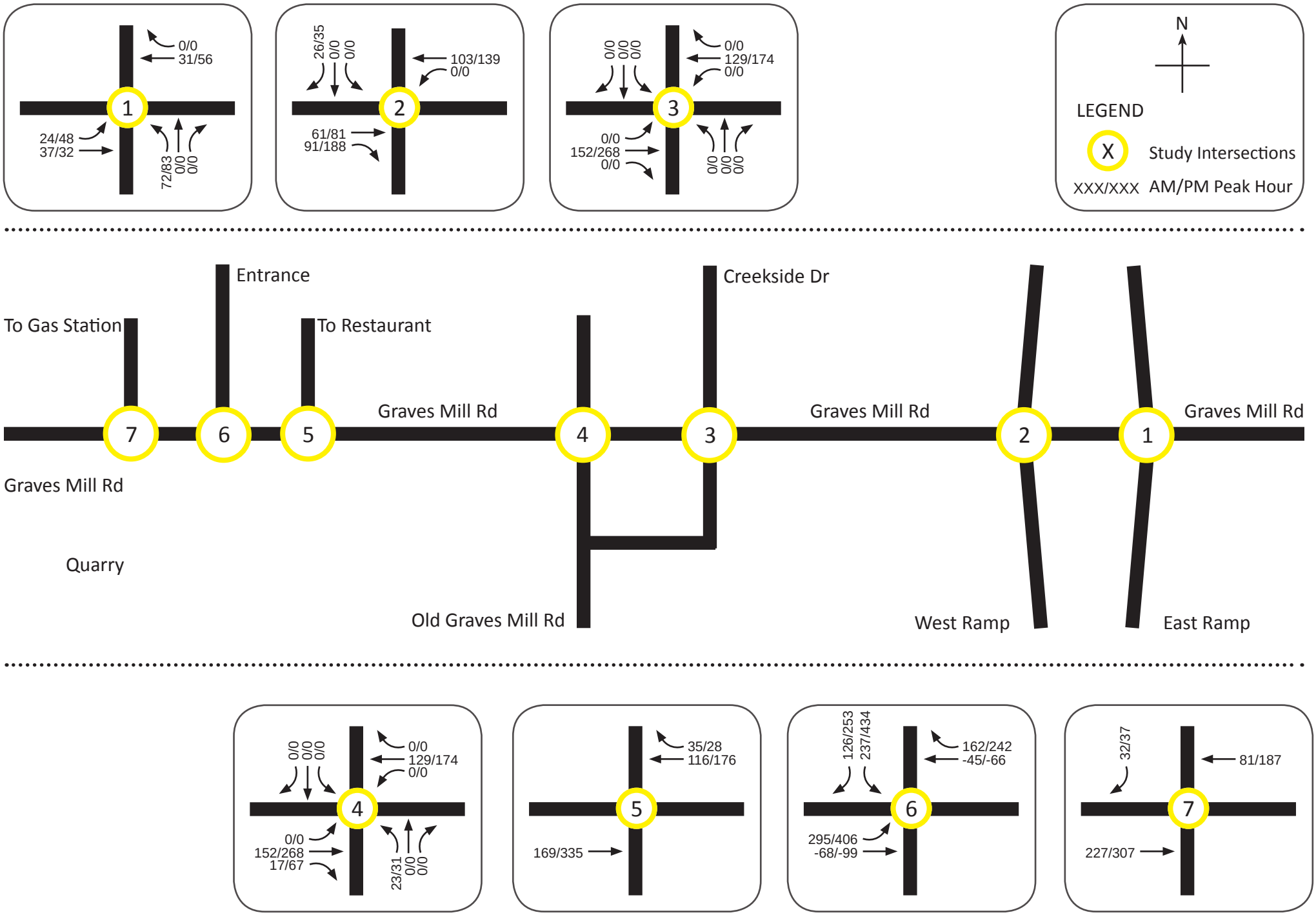
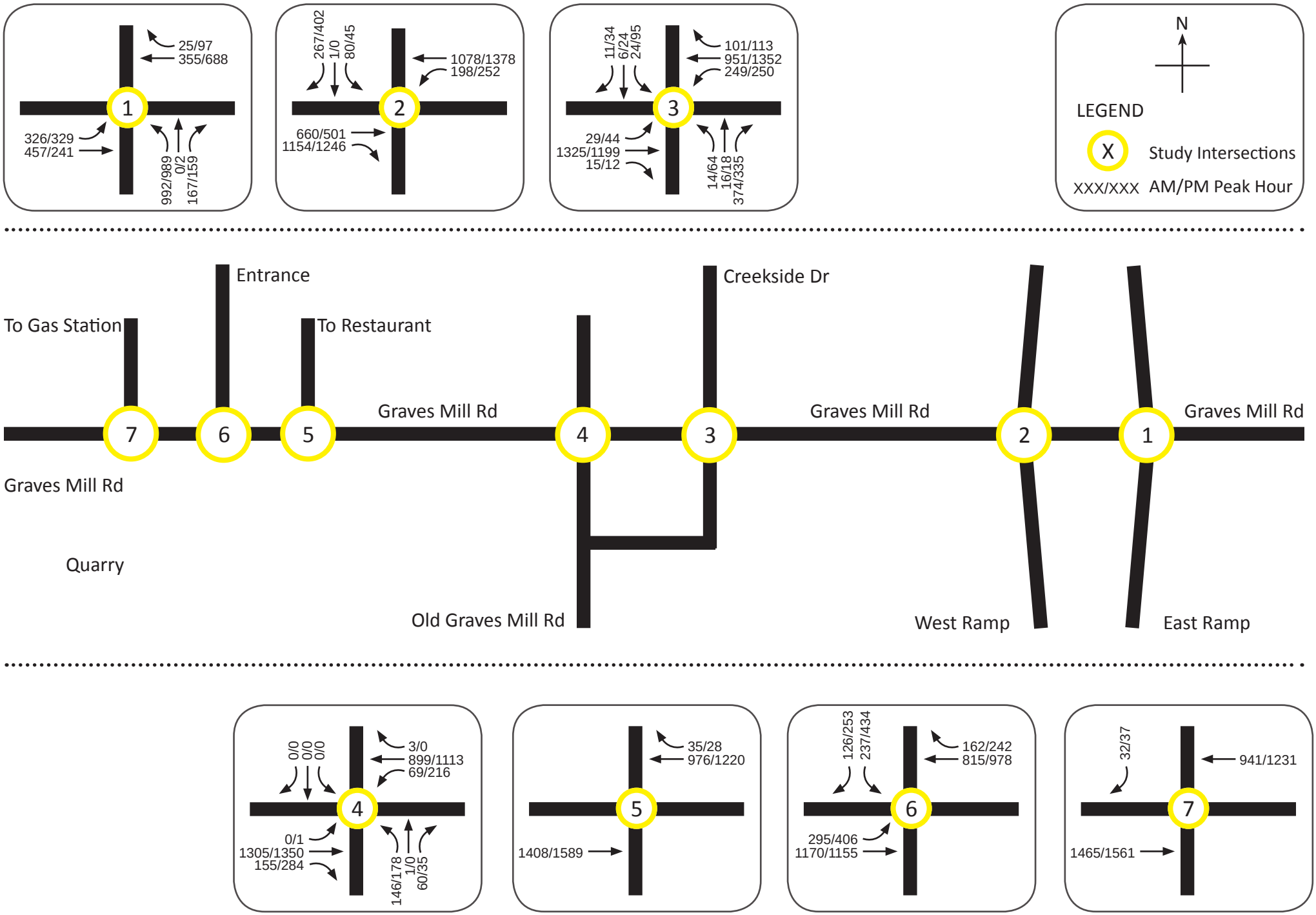


Figure 8 2024 Build Traffic Volumes



Traffic Analysis

The Synchro and SimTraffic models were updated to reflect the build 2024 traffic volumes. The delay, level of service (LOS) and queuing (from both Synchro and SimTraffic) are summarized in a series of tables in **Appendix B**. The Synchro and SimTraffic reports are provided in **Appendix E**.

Except for the site entrance, the build scenario is very similar to the no build scenario. Examination of **Figure 7** indicates that the traffic volumes for the no build and build scenarios are similar near the Graves Mill Road interchange. As would be expected, the projected operations issues are the same as in the no build scenario, related to excessive interchange operations queuing.

Graves Mill Road and Expressway Ramps – Northbound Ramps on East Side of Interchange

For both peak periods, the individual intersection capacity results are projected to be basically the same as the no build scenario with all individual movements operating at LOS D or better. However, also similar to the no build scenario, the SimTraffic model projects significant queuing at this ramp junction, with the same impacts to the northbound off ramp and the westbound through movement.

Graves Mill Road and Expressway Ramps – Southbound Ramps on West Side of Interchange

For both peak periods, the individual intersection capacity results are projected to be basically the same as the no build scenario with the same failing movements. Also similar to the no build scenario, the SimTraffic model projects significant queuing for the same movements – eastbound right turn onto the Expressway on ramp and westbound through between the ramp intersections. The projected queues are basically the same as in the no build condition.

Graves Mill Road and Creekside Drive (Home Depot)

For both peak periods, the individual intersection capacity results are projected to be basically the same as the no build scenario with the same failing movements with one exception – the westbound left turn movement is also projected to operate at LOS E (was LOS D in the no build scenario). Again, the SimTraffic model projects significant queuing in the eastbound direction (only slightly different than the no build scenario with one additional vehicle in the AM peak hour and four additional vehicles in the PM peak hour).

Graves Mill Road and Old Graves Mill Road

For both peak periods, the individual intersection capacity results are projected to be basically the same as the no build scenario. The SimTraffic model does project significant queuing in the eastbound direction, including an increase over the no build condition (approximately 800 additional feet). As with the no build scenario, the additional queuing is related to the heavy movement towards the Expressway plus the right lane bias causing traffic to slow down and queue through the Creekside Drive signal and through the Old Graves Mill Road signal.

Graves Mill Road and Full Site Entrance

Note that the build scenario included signalizing this entrance as the high traffic volumes obviously require signalization. A peak hour signal warrant is provided later in this section. For the build condition, all turn movements were assumed to have a single exclusive turn lane.

During the AM peak hour all movements are expected to operate at LOS C or better. During the PM peak hour, two of the individual movements are expected to operate at LOS E – the eastbound left turn movement (into the site) and the southbound left turn movement (exiting the site).

Graves Mill Road and Right-in Only Entrance

Exclusive right turn lane was not warranted through VDOT Turn Lane Warrant for the Right-in Only Entrance. The turn lane warrant sheets were provided in **Appendix F**.

Queuing Discussion

The SimTraffic model indicates that the queuing issues related to the Expressway interchange will have significant impacts to the Graves Mill Road corridor. Similar to the no build scenario, the result is significant queuing on the off ramps, on Graves Mill Road between the ramp signals, and eastbound along Graves Mill Road approaching the Expressway (queuing and slow traffic beyond Old Graves Mill Road).

Site Entrance MUTCD Peak Hour Signal Warrant

The site entrance was evaluated per the MUTCD peak hour signal warrant. The graph is provided in **Appendix G**. Both the AM and PM peak hour volumes substantially meet the MUTCD peak hour warrant. Note that the southbound right turn volume (exiting the site) was not included in the volume. It is typical practice to not include right turn volume in this analysis if it can be assumed that the right turn traffic would be able to turn right on red.

8. Mitigation

This section identifies mitigation measures to alleviate the traffic operations identified in the various analyses. The issues can be categorized into two main categories – the Expressway interchange (which includes the queuing throughout the corridor) and the site entrance.

Traffic Analysis

The delay, level of service (LOS) and queuing (from both Synchro and SimTraffic) are summarized in a series of tables in **Appendix B**. The Synchro and SimTraffic reports are provided in **Appendix H**.

Expressway Interchange and Related Corridor Queuing Issues

Even in the existing conditions, there are several operational issues at the Expressway interchange that result in queuing throughout the Graves Mill Road corridor. These issues are exacerbated in the no build 2024 scenario, and further reflected in the build scenario. The following improvements can help mitigate the negative impacts documented in the analyses.

Note that overall, it appears that the conventional diamond style interchange, which is adjacent to congested signalized intersections, may need to be substantially modified in the future to keep pace, in terms of providing sufficient traffic capacity, with traffic growth in the area. Specific improvement opportunities identified in this study, for the interchange, include the following:

1. Eastbound to Southbound Expressway Ramp

The very high right turn volumes onto the southbound ramp will necessitate a free flow turn, thus requiring ramp widening and possible extension. We still see extensive queuing in the model, and in fact a dual free flow right turn onto the ramp begins to relieve the queuing. However, feasibility of a dual right turn lane ramp is questionable. This should be more closely examined in a future study of the entire interchange.

2. Northbound Off Ramp

The northbound ramp should be widened to provide for an additional approach lane to the intersection consisting of an exclusive right turn lane, which will then provide an opportunity to implement dual left turns.

3. Southbound Off ramp

The queuing and delay issues could be improved by widening the ramp to allow for a free flow right turn lane onto Graves Mill Road, which then has implications for a downstream receiving lane.

4. Westbound Queuing Between the Ramp Intersections

The two ramp signals should be signalized, with improved adaptive traffic coordination equipment in the future. Modifications to phasing should allow for continuous movements from the heavy ramp movements through the downstream signals.

5. Continued Signal Retiming and Optimization

Into the future, the signal timings should be revisited periodically, and as noted above, traffic adaptive signal coordination should be considered to help maximize travel capacity.

6. Transportation Demand Management (TDM)

Given the high concentration of employment centers near the corridor, it is possible that a specific TDM program could make a significant improvement to peak hour operations in the corridor. Examples include small shifts in arrival and exit times (to spread out the peak hour) and ride sharing.

7. Detailed Interchange Modification Study

Note that a more detailed interchange study would be helpful to identify a full range of improvements that might be needed in the future as a more regional improvement.

Site Entrance

1. Signalization

The analyses assumed that the entrance would be signalized. See **Appendix G** for the peak hour warrant for the full build condition, and also the peak hour warrant for the threshold of when a signal would meet the peak hour requirements. Given the very large volumes on Graves Mill Road, the peak hour warrant is met with just 100 egress left turn lanes out of the site. This equates to a total of approximately 23% of the build program as shown in the trip generation **Table 2** (i.e. 100 egress lefts / 423 peak PM egress lefts per **Figure 7** box 6 = 23%). This would equate to a grocery store, or some combination of the rest of the development that would result in approximately 160-170 total trip in the PM peak hour. Given the uncertainty of when the various elements, as shown in the concept plan, would be constructed, development will need to be monitored and a commitment made to perform a warrant analysis once construction begins on the sections of the development.

Due to the long lead time required for obtaining poles and signal control equipment, the traffic signal should be designed as part of the site plan process, and the infrastructure should be put in place with the entrance intersection improvements. The signal could then be activated once the traffic volumes to the newly opened uses materialize.

2. Dual Left Turn Lanes (Ingress and Egress)

Analyses indicate that dual left turn lanes are needed for ingress (eastbound left turn) and egress (southbound left turn). However, due to environmental constraints, construction of the dual left turn lane for ingress is not feasible. Since this is a "T" intersection, the ingress left turn lane could be configured as a single left turn with 350 feet of storage, and the intersection will operate at a satisfactory level of service, with the left turn operating right at LOS E. If the ingress left turn volume were reduced by just 5%, then the movement would achieve LOS D. Given that internal capture rates are arguably conservatively low using the VDOT standard rates, and considering the gross nature of site trip distribution assumptions, it is likely that the volumes shown for the left turn ingress movements are higher than what might actually occur. Given the constraints and the nature of the volume assumptions, engineering judgment suggests that the long single left turn lane into the site would suffice with all vehicles clearing the queue each cycle. Notice also that the single left turn lane provides an opportunity to utilize permitted/protected phasing, versus the protected only phasing that is required for dual lefts. The permitted/protected phasing will serve traffic more efficiently in the off-peak periods of the day. This mitigation results in satisfactory operations with nearly all movements operating at LOS C or better.

3. For the right-in entrance, exclusive right turn lane was not warranted.

9. Summary of conclusions and recommendations

The analyses conducted for this effort lead to the following principal conclusions:

1. The study area is already experiencing congestion in peak hours.

2. In existing conditions, the eastbound volumes desiring to go southbound at the interchange cause a bias towards heavy traffic in the right lane. This lane bias results in congestion and queuing in the peak hours.

3. In the no-build condition we expect to see the need for substantial improvements at the interchange, in order to manage congestion and mitigate potential gridlock, or queues extending back to the deceleration portion of the off-ramps.

4. For the build condition, the no-build conditions are exacerbated, though mitigation strategies and improvements that are needed for the no-build condition would also relieve the build conditions.

5. The site entrance should be signalized at such time that occupancy of the site generates enough traffic to require activating the signal. The developer should be responsible for conducting a full signal warrant study once the site has been increasing in occupancy and at the request of the City.

6. The site entrance will require a long single left for ingress and dual lefts for egress. The entrance road will need to be designed to consider these laneage needs, and the resulting queuing within the site. Thus, the functional distance for the southbound approach to Graves Mill Road is projected to be 250' (i.e. distance occupied by queuing).
7. The signal design for the site entrance needs to include the required traffic coordination equipment per direction from the City.

8. Exclusive right turn lane is not needed at the development's right-in only entrance.

Recommendations for this Development (i.e. developer driven improvements):

1. Site Entrance – construct with a long single left turn for ingress and dual left turns egress. In the short term, hatch out the 2nd left turn lane on the egress approach. Provide a signal warrant analysis when directed by the City.

2. Construct the intersection to be ready for signalization once warranted (i.e. install conduits, foundations, etc.. with initial intersection construction).

3. Provide an exclusive right turn lane into the site along Graves Mill Road.

4. Look for opportunities to expand the road network for connections to the north and east. This will help to disperse traffic away from Graves Mill Road.

Appendices

Appendix A Traffic Count Reports

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill AM
Site Code : 00001111
Start Date : 10/9/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	Old Graves Mill From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	3	92	0	0	95	28	0	5	0	33	0	181	17	0	198	326
07:15 AM	0	0	0	0	0	15	165	0	0	180	27	0	4	0	31	0	207	20	0	227	438
07:30 AM	0	0	0	0	0	10	156	2	0	168	20	0	18	0	38	0	257	26	1	284	490
07:45 AM	0	0	0	0	0	26	187	0	0	213	33	0	14	0	47	0	326	36	0	362	622
Total	0	0	0	0	0	54	600	2	0	656	108	0	41	0	149	0	971	99	1	1071	1876
08:00 AM	0	0	0	0	0	19	161	0	0	180	31	0	13	0	44	0	201	32	0	233	457
08:15 AM	0	0	0	0	0	10	150	1	0	161	33	1	12	0	46	0	195	37	0	232	439
08:30 AM	0	0	0	0	0	10	114	0	0	124	28	0	12	0	40	0	155	45	0	200	364
08:45 AM	0	0	0	0	0	8	125	0	0	133	22	0	11	0	33	0	170	30	0	200	366
Total	0	0	0	0	0	47	550	1	0	598	114	1	48	0	163	0	721	144	0	865	1626
Grand Total	0	0	0	0	0	101	1150	3	0	1254	222	1	89	0	312	0	1692	243	1	1936	3502
Apprch %	0	0	0	0		8.1	91.7	0.2	0		71.2	0.3	28.5	0		0	87.4	12.6	0.1		
Total %	0	0	0	0	0	2.9	32.8	0.1	0	35.8	6.3	0	2.5	0	8.9	0	48.3	6.9	0	55.3	
Passenger Veh	0	0	0	0	0	97	1126	3	0	1226	217	1	87	0	305	0	1659	233	1	1893	3424
% Passenger Veh	0	0	0	0	0	96	97.9	100	0	97.8	97.7	100	97.8	0	97.8	0	98	95.9	100	97.8	97.8
Trucks	0	0	0	0	0	4	24	0	0	28	5	0	2	0	7	0	33	10	0	43	78
% Trucks	0	0	0	0	0	4	2.1	0	0	2.2	2.3	0	2.2	0	2.2	0	2	4.1	0	2.2	2.2

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill AM
Site Code : 00001111
Start Date : 10/9/2013
Page No : 2

	Old Graves Mill From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	10	156	**2**	0	168	20	0	**18**	0	38	0	257	26	**1**	284	490
07:45 AM	0	0	0	0	0	**26**	**187**	0	0	**213**	**33**	0	14	0	**47**	0	**326**	36	0	**362**	**622**
08:00 AM	0	0	0	0	0	19	161	0	0	180	31	0	13	0	44	0	201	32	0	233	457
08:15 AM	0	0	0	0	0	10	150	1	0	161	33	**1**	12	0	46	0	195	**37**	0	232	439
Total Volume	0	0	0	0	0	65	654	3	0	722	117	1	57	0	175	0	979	131	1	1111	2008
% App. Total	0	0	0	0		9	90.6	0.4	0		66.9	0.6	32.6	0		0	88.1	11.8	0.1		
PHF	.000	.000	.000	.000	.000	.625	.874	.375	.000	.847	.886	.250	.792	.000	.931	.000	.751	.885	.250	.767	.807
Passenger Veh	0	0	0	0	0	63	645	3	0	711	115	1	56	0	172	0	962	125	1	1088	1971
% Passenger Veh	0	0	0	0	0	96.9	98.6	100	0	98.5	98.3	100	98.2	0	98.3	0	98.3	95.4	100	97.9	98.2
Trucks	0	0	0	0	0	2	9	0	0	11	2	0	1	0	3	0	17	6	0	23	37
% Trucks	0	0	0	0	0	3.1	1.4	0	0	1.5	1.7	0	1.8	0	1.7	0	1.7	4.6	0	2.1	1.8

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill AM
Site Code : 00001111
Start Date : 10/9/2013
Page No : 3

Peak Hour Data

North

Peak Hour Begins at 07:30 AM

Passenger Veh
Trucks

Old Graves Mill

	Out	In	Total
	4	0	4
	0	0	0
	4	0	4

	Right	Thru	Left	Peds
	0	0	0	0
	0	0	0	0
	0	0	0	0

Graves Mill

	Out	In	Total
	760	1088	1848
	11	23	34
	771	1111	1882

	Left	Thru	Right	Peds
	0	962	125	1
	0	17	6	0
	0	979	131	1

Graves Mill

	Out	In	Total
	1018	711	1729
	18	11	29
	1036	722	1758

	Right	Thru	Left	Peds
	3	645	63	0
	0	9	2	0
	3	654	65	0

Old Graves Mill

	Left	Thru	Right	Peds
	115	1	56	0
	2	0	1	0
	117	1	57	0

	Out	In	Total
	188	172	360
	8	3	11
	196	175	371

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill PM
Site Code : 00000444
Start Date : 10/9/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	Old Graves Mill From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	28	184	0	0	212	25	0	5	0	30	0	191	45	0	236	478
04:15 PM	0	0	0	0	0	33	173	0	0	206	33	0	6	0	39	0	162	37	0	199	444
04:30 PM	0	0	0	0	0	35	170	0	0	205	30	0	6	0	36	0	196	47	0	243	484
04:45 PM	0	0	0	0	0	36	201	0	0	237	37	0	8	0	45	0	214	41	0	255	537
Total	0	0	0	0	0	132	728	0	0	860	125	0	25	0	150	0	763	170	0	933	1943
05:00 PM	0	0	0	0	0	66	194	0	0	260	44	0	7	0	51	1	241	56	0	298	609
05:15 PM	0	0	0	0	0	51	198	0	0	249	34	0	11	0	45	0	243	61	0	304	598
05:30 PM	0	0	0	0	0	51	204	0	0	255	24	0	7	0	31	0	220	47	0	267	553
05:45 PM	0	0	0	0	0	33	169	0	0	202	37	0	11	0	48	0	150	43	0	193	443
Total	0	0	0	0	0	201	765	0	0	966	139	0	36	0	175	1	854	207	0	1062	2203
Grand Total	0	0	0	0	0	333	1493	0	0	1826	264	0	61	0	325	1	1617	377	0	1995	4146
Apprch %	0	0	0	0		18.2	81.8	0	0		81.2	0	18.8	0		0.1	81.1	18.9	0		
Total %	0	0	0	0	0	8	36	0	0	44	6.4	0	1.5	0	7.8	0	39	9.1	0	48.1	
Passenger Veh	0	0	0	0	0	328	1477	0	0	1805	259	0	61	0	320	1	1601	372	0	1974	4099
% Passenger Veh	0	0	0	0	0	98.5	98.9	0	0	98.8	98.1	0	100	0	98.5	100	99	98.7	0	98.9	98.9
Trucks	0	0	0	0	0	5	16	0	0	21	5	0	0	0	5	0	16	5	0	21	47
% Trucks	0	0	0	0	0	1.5	1.1	0	0	1.2	1.9	0	0	0	1.5	0	1	1.3	0	1.1	1.1

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill PM
Site Code : 00000444
Start Date : 10/9/2013
Page No : 2

	Old Graves Mill From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	36	201	0	0	237	37	0	8	0	45	0	214	41	0	255	537
05:00 PM	0	0	0	0	0	**66**	194	0	0	**260**	**44**	0	7	0	**51**	**1**	241	56	0	298	**609**
05:15 PM	0	0	0	0	0	51	198	0	0	249	34	0	**11**	0	45	0	**243**	**61**	0	**304**	598
05:30 PM	0	0	0	0	0	51	**204**	0	0	255	24	0	7	0	31	0	220	47	0	267	553
Total Volume	0	0	0	0	0	204	797	0	0	1001	139	0	33	0	172	1	918	205	0	1124	2297
% App. Total	0	0	0	0		20.4	79.6	0	0		80.8	0	19.2	0		0.1	81.7	18.2	0		
PHF	.000	.000	.000	.000	.000	.773	.977	.000	.000	.963	.790	.000	.750	.000	.843	.250	.944	.840	.000	.924	.943
Passenger Veh	0	0	0	0	0	201	788	0	0	989	137	0	33	0	170	1	908	201	0	1110	2269
% Passenger Veh	0	0	0	0	0	98.5	98.9	0	0	98.8	98.6	0	100	0	98.8	100	98.9	98.0	0	98.8	98.8
Trucks	0	0	0	0	0	3	9	0	0	12	2	0	0	0	2	0	10	4	0	14	28
% Trucks	0	0	0	0	0	1.5	1.1	0	0	1.2	1.4	0	0	0	1.2	0	1.1	2.0	0	1.2	1.2

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Old Graves Mill PM
Site Code : 00000444
Start Date : 10/9/2013
Page No : 3

Peak Hour Data

North

Peak Hour Begins at 04:45 PM

Passenger Veh
Trucks

Old Graves Mill

	Out	In	Total
	1	0	1
	0	0	0
	1	0	1

	Right	Thru	Left	Peds
	0	0	0	0
	0	0	0	0
	0	0	0	0

Graves Mill

	Out	In	Total
	941	989	1930
	10	12	22
	951	1001	1952

	Right	Thru	Left	Peds
	0	788	201	0
	0	9	3	0
	0	797	204	0

Graves Mill

	Out	In	Total
	925	1110	2035
	11	14	25
	936	1124	2060

	Left	Thru	Right	Peds
	1	908	201	0
	0	10	4	0
	1	918	205	0

Old Graves Mill

	Left	Thru	Right	Peds
	137	0	33	0
	2	0	0	0
	139	0	33	0

	Out	In	Total
	402	170	572
	7	2	9
	409	172	581

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot AM
Site Code : 00006677
Start Date : 10/16/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	Creekside Dr (Home Depot) From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	1	0	0	0	1	45	89	7	0	141	3	1	45	0	49	1	197	6	0	204	395
07:15 AM	4	1	2	0	7	52	155	14	0	221	5	2	79	0	86	5	202	4	0	211	525
07:30 AM	7	1	4	0	12	58	169	27	0	254	3	2	98	0	103	7	255	2	0	264	633
07:45 AM	4	2	2	0	8	62	229	35	0	326	3	5	90	0	98	12	327	4	0	343	775
Total	16	4	8	0	28	217	642	83	0	942	14	10	312	0	336	25	981	16	0	1022	2328
08:00 AM	8	2	2	0	12	64	145	20	0	229	2	6	87	0	95	3	212	4	0	219	555
08:15 AM	6	3	8	0	17	55	170	21	0	246	1	6	64	0	71	8	160	1	0	169	503
08:30 AM	8	1	6	0	15	37	139	13	0	189	6	6	64	0	76	7	148	5	0	160	440
08:45 AM	15	4	7	0	26	40	124	19	0	183	2	4	53	0	59	8	193	3	0	204	472
Total	37	10	23	0	70	196	578	73	0	847	11	22	268	0	301	26	713	13	0	752	1970
Grand Total	53	14	31	0	98	413	1220	156	0	1789	25	32	580	0	637	51	1694	29	0	1774	4298
Apprch %	54.1	14.3	31.6	0		23.1	68.2	8.7	0		3.9	5	91.1	0		2.9	95.5	1.6	0		
Total %	1.2	0.3	0.7	0	2.3	9.6	28.4	3.6	0	41.6	0.6	0.7	13.5	0	14.8	1.2	39.4	0.7	0	41.3	
Passenger Veh	51	12	30	0	93	398	1205	152	0	1755	15	30	561	0	606	51	1680	28	0	1759	4213
% Passenger Veh	96.2	85.7	96.8	0	94.9	96.4	98.8	97.4	0	98.1	60	93.8	96.7	0	95.1	100	99.2	96.6	0	99.2	98
Trucks	2	2	1	0	5	15	15	4	0	34	10	2	19	0	31	0	14	1	0	15	85
% Trucks	3.8	14.3	3.2	0	5.1	3.6	1.2	2.6	0	1.9	40	6.2	3.3	0	4.9	0	0.8	3.4	0	0.8	2

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot AM
Site Code : 00006677
Start Date : 10/16/2013
Page No : 2

	Creekside Dr (Home Depot) From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	4	1	2	0	7	52	155	14	0	221	**5**	2	79	0	86	5	202	**4**	0	211	525
07:30 AM	7	1	**4**	0	**12**	58	169	27	0	254	3	2	**98**	0	**103**	7	255	2	0	264	633
07:45 AM	4	**2**	2	0	8	62	**229**	**35**	0	**326**	3	5	90	0	98	**12**	**327**	4	0	**343**	**775**
08:00 AM	**8**	2	2	0	12	**64**	145	20	0	229	2	**6**	87	0	95	3	212	4	0	219	555
Total Volume	23	6	10	0	39	236	698	96	0	1030	13	15	354	0	382	27	996	14	0	1037	2488
% App. Total	59	15.4	25.6	0		22.9	67.8	9.3	0		3.4	3.9	92.7	0		2.6	96	1.4	0		
PHF	.719	.750	.625	.000	.813	.922	.762	.686	.000	.790	.650	.625	.903	.000	.927	.563	.761	.875	.000	.756	.803
Passenger Veh	23	5	10	0	38	230	690	95	0	1015	7	15	344	0	366	27	989	13	0	1029	2448
% Passenger Veh	100	83.3	100	0	97.4	97.5	98.9	99.0	0	98.5	53.8	100	97.2	0	95.8	100	99.3	92.9	0	99.2	98.4
Trucks	0	1	0	0	1	6	8	1	0	15	6	0	10	0	16	0	7	1	0	8	40
% Trucks	0	16.7	0	0	2.6	2.5	1.1	1.0	0	1.5	46.2	0	2.8	0	4.2	0	0.7	7.1	0	0.8	1.6

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot AM
Site Code : 00006677
Start Date : 10/16/2013
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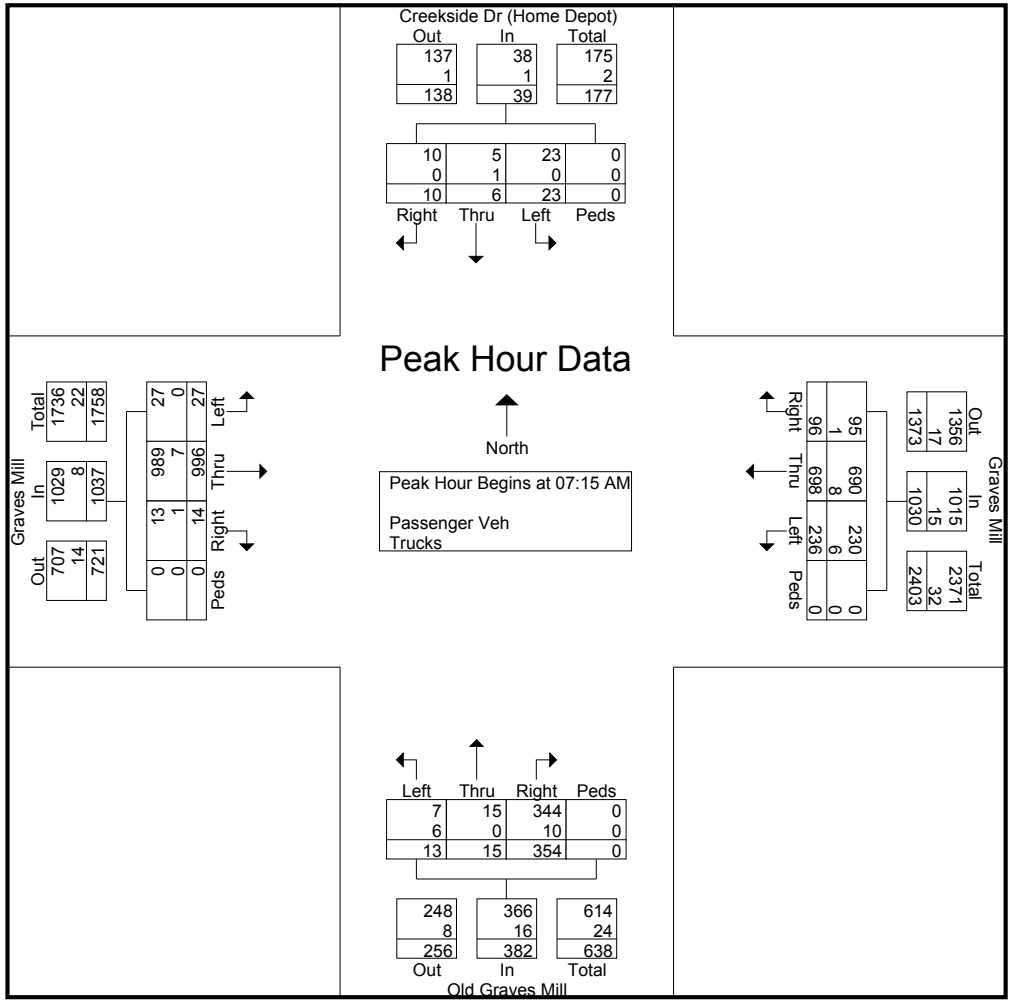

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot PM
Site Code : 00008888
Start Date : 10/16/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	Creekside (Home Depot) From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	32	3	15	0	50	63	214	12	0	289	12	3	67	0	82	4	176	2	0	182	603
04:15 PM	40	11	14	0	65	62	184	18	0	264	5	5	64	0	74	9	136	2	0	147	550
04:30 PM	23	9	15	0	47	33	238	19	0	290	13	4	80	0	97	5	183	4	0	192	626
04:45 PM	24	6	7	0	37	52	204	26	0	282	16	2	83	0	101	6	160	1	0	167	587
Total	119	29	51	0	199	210	840	75	0	1125	46	14	294	0	354	24	655	9	0	688	2366
05:00 PM	18	7	11	0	36	60	290	21	0	371	18	5	80	0	103	14	213	2	0	229	739
05:15 PM	26	6	9	0	41	63	285	23	0	371	17	7	84	0	108	12	185	4	0	201	721
05:30 PM	22	4	5	0	31	62	221	37	0	320	10	3	70	0	83	10	232	4	0	246	680
05:45 PM	15	4	13	0	32	65	185	35	0	285	4	3	56	0	63	18	149	2	0	169	549
Total	81	21	38	0	140	250	981	116	0	1347	49	18	290	0	357	54	779	12	0	845	2689
Grand Total	200	50	89	0	339	460	1821	191	0	2472	95	32	584	0	711	78	1434	21	0	1533	5055
Apprch %	59	14.7	26.3	0		18.6	73.7	7.7	0		13.4	4.5	82.1	0		5.1	93.5	1.4	0		
Total %	4	1	1.8	0	6.7	9.1	36	3.8	0	48.9	1.9	0.6	11.6	0	14.1	1.5	28.4	0.4	0	30.3	
Passenger Veh	198	50	89	0	337	453	1809	191	0	2453	95	32	574	0	701	78	1422	21	0	1521	5012
% Passenger Veh	99	100	100	0	99.4	98.5	99.3	100	0	99.2	100	100	98.3	0	98.6	100	99.2	100	0	99.2	99.1
Trucks	2	0	0	0	2	7	12	0	0	19	0	0	10	0	10	0	12	0	0	12	43
% Trucks	1	0	0	0	0.6	1.5	0.7	0	0	0.8	0	0	1.7	0	1.4	0	0.8	0	0	0.8	0.9

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot PM
Site Code : 00008888
Start Date : 10/16/2013
Page No : 2

	Creekside (Home Depot) From North					Graves Mill From East					Old Graves Mill From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	24	6	7	0	37	52	204	26	0	282	16	2	83	0	101	6	160	1	0	167	587
05:00 PM	18	**7**	**11**	0	36	60	**290**	21	0	**371**	**18**	5	80	0	103	**14**	213	2	0	229	**739**
05:15 PM	**26**	6	9	0	**41**	**63**	285	23	0	371	17	**7**	**84**	0	**108**	12	185	**4**	0	201	721
05:30 PM	22	4	5	0	31	62	221	**37**	0	320	10	3	70	0	83	10	**232**	4	0	**246**	680
Total Volume	90	23	32	0	145	237	1000	107	0	1344	61	17	317	0	395	42	790	11	0	843	2727
% App. Total	62.1	15.9	22.1	0		17.6	74.4	8	0		15.4	4.3	80.3	0		5	93.7	1.3	0		
PHF	.865	.821	.727	.000	.884	.940	.862	.723	.000	.906	.847	.607	.943	.000	.914	.750	.851	.688	.000	.857	.923
Passenger Veh	89	23	32	0	144	233	993	107	0	1333	61	17	315	0	393	42	785	11	0	838	2708
% Passenger Veh	98.9	100	100	0	99.3	98.3	99.3	100	0	99.2	100	100	99.4	0	99.5	100	99.4	100	0	99.4	99.3
Trucks	1	0	0	0	1	4	7	0	0	11	0	0	2	0	2	0	5	0	0	5	19
% Trucks	1.1	0	0	0	0.7	1.7	0.7	0	0	0.8	0	0	0.6	0	0.5	0	0.6	0	0	0.6	0.7

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Home Depot PM
Site Code : 00008888
Start Date : 10/16/2013
Page No : 3

Peak Hour Data

Peak Hour Begins at 04:45 PM

Passenger Veh
Trucks

North

Creekside (Home Depot)

	Out	In	Total
	166	144	310
	0	1	1
	166	145	311

	Right	Thru	Left	Peds
	32	23	89	0
	0	0	1	0
	32	23	90	0

Graves Mill

	Out	In	Total
	1189	1333	2522
	8	11	19
	1197	1344	2541

	Right	Thru	Left	Peds
	107	993	233	0
	0	7	4	0
	107	1000	237	0

Graves Mill

	Out	In	Total
	1086	838	1924
	7	5	12
	1093	843	1936

	Left	Thru	Right	Peds
	42	785	11	0
	0	5	0	0
	42	790	11	0

Old Graves Mill

	Left	Thru	Right	Peds
	61	17	315	0
	0	0	2	0
	61	17	317	0

	Out	In	Total
	267	393	660
	4	2	6
	271	395	666

Data Collection Group

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File Name : Graves Mill and Ramp W Side Combined
Site Code : 00003333
Start Date : 10/10/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	SB 501 Off Ramp From North					Graves Mill From East					SB 501 On Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	4	0	22	0	26	26	117	0	0	143	0	0	0	0	0	0	76	165	0	241	410
07:15 AM	8	0	40	0	48	34	179	0	0	213	0	0	0	0	0	0	92	193	0	285	546
07:30 AM	14	0	43	0	57	38	209	0	0	247	0	0	0	0	0	0	137	215	0	352	656
07:45 AM	18	1	57	0	76	47	269	0	0	316	0	0	0	0	0	0	171	247	0	418	810
Total	44	1	162	0	207	145	774	0	0	919	0	0	0	0	0	0	476	820	0	1296	2422
08:00 AM	24	0	54	0	78	40	171	0	0	211	0	0	0	0	0	0	109	200	0	309	598
08:15 AM	19	2	53	0	74	37	189	0	0	226	0	0	0	0	0	0	102	123	0	225	525
08:30 AM	18	2	40	0	60	42	142	0	0	184	0	0	0	0	0	0	77	142	0	219	463
08:45 AM	20	2	47	0	69	46	134	0	0	180	0	0	0	0	0	0	109	145	0	254	503
Total	81	6	194	0	281	165	636	0	0	801	0	0	0	0	0	0	397	610	0	1007	2089
*** BREAK ***																					
04:00 PM	10	0	63	0	73	25	227	0	0	252	0	0	0	0	0	0	93	183	0	276	601
04:15 PM	16	1	71	0	88	37	195	0	0	232	0	0	0	0	0	0	63	178	0	241	561
04:30 PM	10	1	60	0	71	55	232	0	0	287	0	0	0	0	0	0	81	202	0	283	641
04:45 PM	7	0	66	0	73	56	219	0	0	275	0	0	0	0	0	0	77	193	0	270	618
Total	43	2	260	0	305	173	873	0	0	1046	0	0	0	0	0	0	314	756	0	1070	2421
05:00 PM	10	0	98	0	108	68	274	0	0	342	0	0	0	0	0	0	102	212	0	314	764
05:15 PM	12	0	67	0	79	38	303	0	0	341	0	0	0	0	0	0	81	216	0	297	717
05:30 PM	7	0	64	0	71	41	256	0	0	297	0	0	0	0	0	0	97	230	0	327	695
05:45 PM	8	0	59	0	67	30	228	0	0	258	0	0	0	0	0	0	63	160	0	223	548
Total	37	0	288	0	325	177	1061	0	0	1238	0	0	0	0	0	0	343	818	0	1161	2724
Grand Total	205	9	904	0	1118	660	3344	0	0	4004	0	0	0	0	0	0	1530	3004	0	4534	9656
Apprch %	18.3	0.8	80.9	0		16.5	83.5	0	0		0	0	0	0		0	33.7	66.3	0		
Total %	2.1	0.1	9.4	0	11.6	6.8	34.6	0	0	41.5	0	0	0	0	0	0	15.8	31.1	0	47	
Passenger Veh	197	9	895	0	1101	651	3313	0	0	3964	0	0	0	0	0	0	1520	2966	0	4486	9551
% Passenger Veh	96.1	100	99	0	98.5	98.6	99.1	0	0	99	0	0	0	0	0	0	99.3	98.7	0	98.9	98.9
Trucks	8	0	9	0	17	9	31	0	0	40	0	0	0	0	0	0	10	38	0	48	105
% Trucks	3.9	0	1	0	1.5	1.4	0.9	0	0	1	0	0	0	0	0	0	0.7	1.3	0	1.1	1.1

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Graves Mill and Ramp W Side Combined
Site Code : 00003333
Start Date : 10/10/2013
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	SB 501 Off Ramp From North					Graves Mill From East					SB 501 On Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	8	0	40	0	48	34	179	0	0	213	0	0	0	0	0	0	92	193	0	285	546
07:30 AM	14	0	43	0	57	38	209	0	0	247	0	0	0	0	0	0	137	215	0	352	656
07:45 AM	18	**1**	**57**	0	76	**47**	**269**	0	0	**316**	0	0	0	0	0	0	**171**	**247**	0	**418**	**810**
08:00 AM	**24**	0	54	0	**78**	40	171	0	0	211	0	0	0	0	0	0	109	200	0	309	598
Total Volume	64	1	194	0	259	159	828	0	0	987	0	0	0	0	0	0	509	855	0	1364	2610
% App. Total	24.7	0.4	74.9	0		16.1	83.9	0	0		0	0	0	0		0	37.3	62.7	0		
PHF	.667	.250	.851	.000	.830	.846	.770	.000	.000	.781	.000	.000	.000	.000	.000	.000	.744	.865	.000	.816	.806
Passenger Veh	62	1	192	0	255	158	823	0	0	981	0	0	0	0	0	0	506	850	0	1356	2592
% Passenger Veh	96.9	100	99.0	0	98.5	99.4	99.4	0	0	99.4	0	0	0	0	0	0	99.4	99.4	0	99.4	99.3
Trucks	2	0	2	0	4	1	5	0	0	6	0	0	0	0	0	0	3	5	0	8	18
% Trucks	3.1	0	1.0	0	1.5	0.6	0.6	0	0	0.6	0	0	0	0	0	0	0.6	0.6	0	0.6	0.7

Data Collection Group

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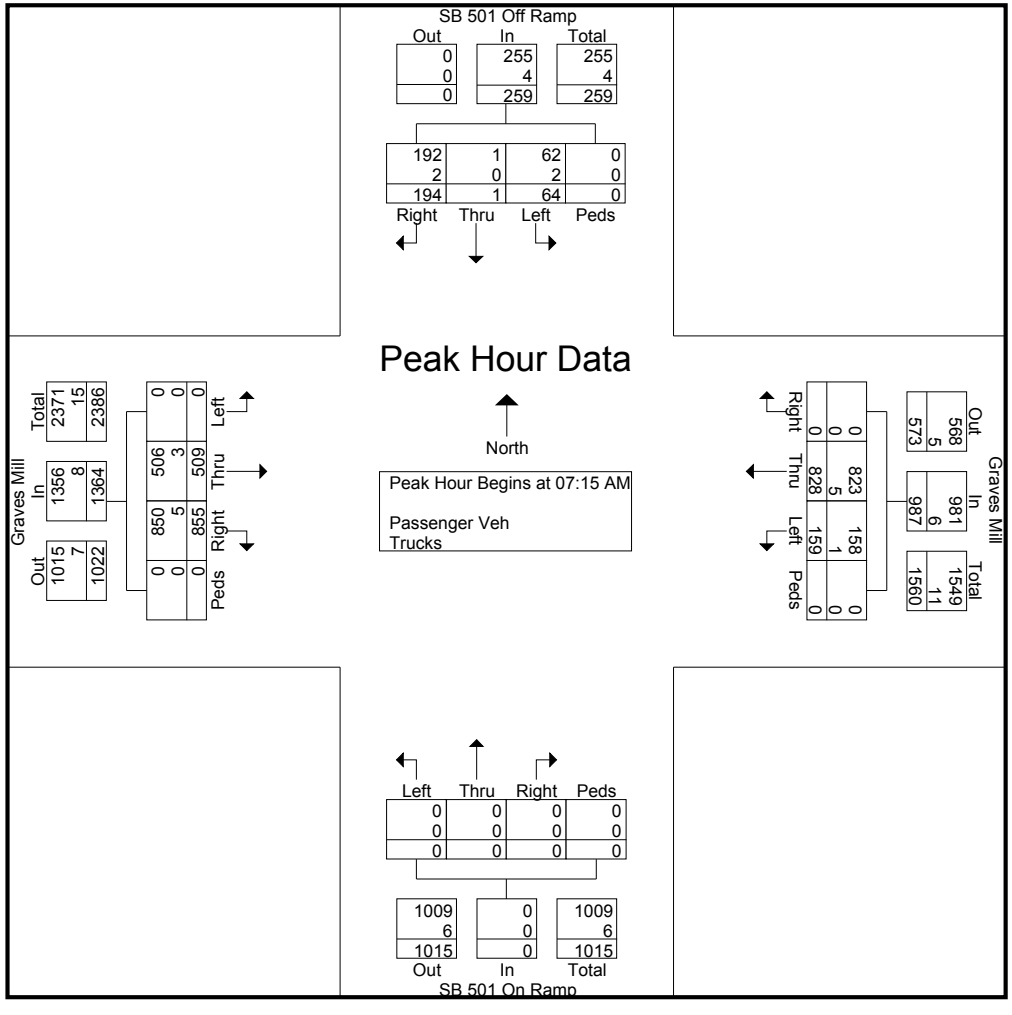

Data Collection Group

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File Name : Graves Mill and Ramp W Side Combined
Site Code : 00003333
Start Date : 10/10/2013
Page No : 4

	SB 501 Off Ramp From North					Graves Mill From East					SB 501 On Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	7	0	66	0	73	56	219	0	0	275	0	0	0	0	0	0	77	193	0	270	618
05:00 PM	10	0	**98**	0	**108**	**68**	274	0	0	**342**	0	0	0	0	0	0	**102**	212	0	314	**764**
05:15 PM	**12**	0	67	0	79	38	**303**	0	0	341	0	0	0	0	0	0	81	216	0	297	717
05:30 PM	7	0	64	0	71	41	256	0	0	297	0	0	0	0	0	0	97	**230**	0	**327**	695
Total Volume	36	0	295	0	331	203	1052	0	0	1255	0	0	0	0	0	0	357	851	0	1208	2794
% App. Total	10.9	0	89.1	0		16.2	83.8	0	0		0	0	0	0		0	29.6	70.4	0		
PHF	.750	.000	.753	.000	.766	.746	.868	.000	.000	.917	.000	.000	.000	.000	.000	.000	.875	.925	.000	.924	.914
Passenger Veh	35	0	291	0	326	200	1042	0	0	1242	0	0	0	0	0	0	354	835	0	1189	2757
% Passenger Veh	97.2	0	98.6	0	98.5	98.5	99.0	0	0	99.0	0	0	0	0	0	0	99.2	98.1	0	98.4	98.7
Trucks	1	0	4	0	5	3	10	0	0	13	0	0	0	0	0	0	3	16	0	19	37
% Trucks	2.8	0	1.4	0	1.5	1.5	1.0	0	0	1.0	0	0	0	0	0	0	0.8	1.9	0	1.6	1.3

Data Collection Group

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File Name : Graves Mill and Ramp W Side Combined
Site Code : 00003333
Start Date : 10/10/2013
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Peak Hour Data

Peak Hour Begins at 04:45 PM

Passenger Veh
Trucks

North

SB 501 Off Ramp

	Out	In	Total
	0	326	326
	0	5	5
	0	331	331

	Right	Thru	Left	Peds
	291	0	35	0
	4	0	1	0
	295	0	36	0

Graves Mill

	Out	In	Total
	1333	1189	2522
	14	19	33
	1347	1208	2555

	Left	Thru	Right	Peds
	0	354	835	0
	0	3	16	0
	0	357	851	0

Graves Mill

	Out	In	Total
	389	1242	1631
	4	13	17
	393	1255	1648

	Right	Thru	Left	Peds
	0	1042	200	0
	0	10	3	0
	0	1052	203	0

SB 501 On Ramp

	Left	Thru	Right	Peds
	0	0	0	0
	0	0	0	0
	0	0	0	0

	Out	In	Total
	1035	0	1035
	19	0	19
	1054	0	1054

Data Collection Group

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File Name : Ramp E Side AM
Site Code : 00004444
Start Date : 10/15/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	NB 501 On Ramp From North					Graves Mill From East					NB 501 Off Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	38	4	0	42	108	0	12	0	120	38	43	0	0	81	243
07:15 AM	0	0	0	0	0	0	87	5	0	92	129	0	31	0	160	50	49	0	0	99	351
07:30 AM	0	0	0	0	0	0	48	6	0	54	203	0	22	0	225	68	85	0	0	153	432
07:45 AM	0	0	0	0	0	0	107	3	0	110	213	0	49	0	262	69	121	0	0	190	562
Total	0	0	0	0	0	0	280	18	0	298	653	0	114	0	767	225	298	0	0	523	1588
08:00 AM	0	0	0	0	0	0	45	1	0	46	169	0	33	0	202	54	83	0	0	137	385
08:15 AM	0	0	0	0	0	0	75	10	0	85	155	0	30	0	185	52	68	0	0	120	390
08:30 AM	0	0	0	0	0	0	63	12	0	75	124	1	21	0	146	45	47	0	0	92	313
08:45 AM	0	0	0	0	0	0	49	4	0	53	134	0	35	0	169	51	81	0	0	132	354
Total	0	0	0	0	0	0	232	27	0	259	582	1	119	0	702	202	279	0	0	481	1442
Grand Total	0	0	0	0	0	0	512	45	0	557	1235	1	233	0	1469	427	577	0	0	1004	3030
Apprch %	0	0	0	0		0	91.9	8.1	0		84.1	0.1	15.9	0		42.5	57.5	0	0		
Total %	0	0	0	0	0	0	16.9	1.5	0	18.4	40.8	0	7.7	0	48.5	14.1	19	0	0	33.1	
Passenger Veh	0	0	0	0	0	0	501	45	0	546	1208	1	233	0	1442	422	566	0	0	988	2976
% Passenger Veh	0	0	0	0	0	0	97.9	100	0	98	97.8	100	100	0	98.2	98.8	98.1	0	0	98.4	98.2
Trucks	0	0	0	0	0	0	11	0	0	11	27	0	0	0	27	5	11	0	0	16	54
% Trucks	0	0	0	0	0	0	2.1	0	0	2	2.2	0	0	0	1.8	1.2	1.9	0	0	1.6	1.8

Data Collection Group

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File Name : Ramp E Side AM
Site Code : 00004444
Start Date : 10/15/2013
Page No : 2

	NB 501 On Ramp From North					Graves Mill From East					NB 501 Off Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	48	6	0	54	203	0	22	0	225	68	85	0	0	153	432
07:45 AM	0	0	0	0	0	0	**107**	3	0	**110**	**213**	0	**49**	0	**262**	**69**	**121**	0	0	**190**	**562**
08:00 AM	0	0	0	0	0	0	45	1	0	46	169	0	33	0	202	54	83	0	0	137	385
08:15 AM	0	0	0	0	0	0	75	**10**	0	85	155	0	30	0	185	52	68	0	0	120	390
Total Volume	0	0	0	0	0	0	275	20	0	295	740	0	134	0	874	243	357	0	0	600	1769
% App. Total	0	0	0	0		0	93.2	6.8	0		84.7	0	15.3	0		40.5	59.5	0	0		
PHF	.000	.000	.000	.000	.000	.000	.643	.500	.000	.670	.869	.000	.684	.000	.834	.880	.738	.000	.000	.789	.787
Passenger Veh	0	0	0	0	0	0	269	20	0	289	724	0	134	0	858	240	349	0	0	589	1736
% Passenger Veh	0	0	0	0	0	0	97.8	100	0	98.0	97.8	0	100	0	98.2	98.8	97.8	0	0	98.2	98.1
Trucks	0	0	0	0	0	0	6	0	0	6	16	0	0	0	16	3	8	0	0	11	33
% Trucks	0	0	0	0	0	0	2.2	0	0	2.0	2.2	0	0	0	1.8	1.2	2.2	0	0	1.8	1.9

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Ramp E Side AM
Site Code : 00004444
Start Date : 10/15/2013
Page No : 3

Peak Hour Data

Peak Hour Begins at 07:30 AM

Passenger Veh
Trucks

North

NB 501 On Ramp

	Out	In	Total
	260	0	260
	3	0	3
	263	0	263

	Right	Thru	Left	Peds
	0	0	0	0
	0	0	0	0
	0	0	0	0

Graves Mill

	Out	In	Total
	993	589	1582
	22	11	33
	1015	600	1615

	Left	Thru	Right	Peds
	240	349	0	0
	3	8	0	0
	243	357	0	0

Graves Mill

	Out	In	Total
	483	289	772
	8	6	14
	491	295	786

	Right	Thru	Left	Peds
	20	275	0	0
	0	6	0	0
	20	269	0	0

NB 501 Off Ramp

	Left	Thru	Right	Peds
	724	0	134	0
	16	0	0	0
	740	0	134	0

	Out	In	Total
	0	858	858
	0	16	16
	0	874	874

Data Collection Group

LSmith@DataCollectionGroup.net

File Name : Ramp E Side PM
Site Code : 00006789
Start Date : 10/15/2013
Page No : 1

Groups Printed- Passenger Veh - Trucks

	NB 501 On Ramp From North					Graves Mill From East					NB 501 Off Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	129	23	0	152	120	1	30	0	151	54	49	0	0	103	406
04:15 PM	0	0	0	0	0	0	97	16	0	113	137	0	23	0	160	45	36	0	0	81	354
04:30 PM	0	0	0	0	0	0	158	16	0	174	131	0	25	0	156	49	41	0	0	90	420
04:45 PM	0	0	0	0	0	0	110	15	0	125	166	2	31	0	199	47	39	0	0	86	410
Total	0	0	0	0	0	0	494	70	0	564	554	3	109	0	666	195	165	0	0	360	1590
05:00 PM	0	0	0	0	0	0	164	22	0	186	181	0	31	0	212	62	56	0	0	118	516
05:15 PM	0	0	0	0	0	0	151	21	0	172	195	0	42	0	237	63	31	0	0	94	503
05:30 PM	0	0	0	0	0	0	112	20	0	132	186	0	24	0	210	54	51	0	0	105	447
05:45 PM	0	0	0	0	0	0	95	21	0	116	166	0	27	0	193	51	19	0	0	70	379
Total	0	0	0	0	0	0	522	84	0	606	728	0	124	0	852	230	157	0	0	387	1845
Grand Total	0	0	0	0	0	0	1016	154	0	1170	1282	3	233	0	1518	425	322	0	0	747	3435
Apprch %	0	0	0	0		0	86.8	13.2	0		84.5	0.2	15.3	0		56.9	43.1	0	0		
Total %	0	0	0	0	0	0	29.6	4.5	0	34.1	37.3	0.1	6.8	0	44.2	12.4	9.4	0	0	21.7	
Passenger Veh	0	0	0	0	0	0	1001	153	0	1154	1254	3	232	0	1489	421	308	0	0	729	3372
% Passenger Veh	0	0	0	0	0	0	98.5	99.4	0	98.6	97.8	100	99.6	0	98.1	99.1	95.7	0	0	97.6	98.2
Trucks	0	0	0	0	0	0	15	1	0	16	28	0	1	0	29	4	14	0	0	18	63
% Trucks	0	0	0	0	0	0	1.5	0.6	0	1.4	2.2	0	0.4	0	1.9	0.9	4.3	0	0	2.4	1.8

Data Collection Group

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File Name : Ramp E Side PM
Site Code : 00006789
Start Date : 10/15/2013
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	NB 501 On Ramp From North					Graves Mill From East					NB 501 Off Ramp From South					Graves Mill From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	0	110	15	0	125	166	**2**	31	0	199	47	39	0	0	86	410
05:00 PM	0	0	0	0	0	0	**164**	**22**	0	**186**	181	0	31	0	212	62	**56**	0	0	**118**	**516**
05:15 PM	0	0	0	0	0	0	151	21	0	172	**195**	0	**42**	0	**237**	**63**	31	0	0	94	503
05:30 PM	0	0	0	0	0	0	112	20	0	132	186	0	24	0	210	54	51	0	0	105	447
Total Volume	0	0	0	0	0	0	537	78	0	615	728	2	128	0	858	226	177	0	0	403	1876
% App. Total	0	0	0	0		0	87.3	12.7	0		84.8	0.2	14.9	0		56.1	43.9	0	0		
PHF	.000	.000	.000	.000	.000	.000	.819	.886	.000	.827	.933	.250	.762	.000	.905	.897	.790	.000	.000	.854	.909
Passenger Veh	0	0	0	0	0	0	528	78	0	606	714	2	127	0	843	222	167	0	0	389	1838
% Passenger Veh	0	0	0	0	0	0	98.3	100	0	98.5	98.1	100	99.2	0	98.3	98.2	94.4	0	0	96.5	98.0
Trucks	0	0	0	0	0	0	9	0	0	9	14	0	1	0	15	4	10	0	0	14	38
% Trucks	0	0	0	0	0	0	1.7	0	0	1.5	1.9	0	0.8	0	1.7	1.8	5.6	0	0	3.5	2.0

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Start Date : 10/15/2013
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Peak Hour Data

Peak Hour Begins at 04:45 PM

Passenger Veh
Trucks

North

NB 501 On Ramp

Out	In	Total
302	0	302
4	0	4
306	0	306

Right	Thru	Left	Peds
0	0	0	0
0	0	0	0
0	0	0	0

Graves Mill

	Out	In	Total
	1242	389	1631
	23	14	37
	1265	403	1668

Peds	Right	Thru	Left
0	0	167	222
0	0	10	4
0	0	177	226

Graves Mill

	Out	In	Total
	294	606	900
	11	9	20
	305	615	920

Peds	Left	Thru	Right
0	0	537	78
0	0	9	0
0	0	528	78

NB 501 Off Ramp

Left	Thru	Right	Peds
714	2	127	0
14	0	1	0
728	2	128	0

Out	In	Total
0	843	843
0	15	15
0	858	858

Appendix B LOS, Delays, and Queues Summary

LOS, Delays, and Queues - Graves Mill Road and Northbound Ramps

			Existing				No Build 2024				Build 2024						Build with Mitigation 2024			
			AM				AM				AM						AM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)			(sec/veh)		(ft)	(ft)
1	**Graves Mill/East Ramp**																			
	Graves Mill EB	Left	14.1	B	106	189	22.8	C	170	225	17.3	B	269	224	Graves Mill EB	Left	22.5	C	227	224
	Graves Mill EB	Through	9.8	A	66	103	10.8	A	83	342	11.9	B	155	334	Graves Mill EB	Through	9.4	A	101	268
	Graves Mill WB	Through	17.4	B	68	102	24.4	C	106	125	44.2	D	233	209	Graves Mill WB	Through	25.6	C	123	228
	Graves Mill WB	Right	14.4	B	6	18	20.7	C	18	22	38.5	D	30	40	Graves Mill WB	Right	21.5	C	19	19
	Ramp NB	Left	23.4	C	285	203	33.8	C	436	317	44.6	D	661	444	Ramp NB	Left/Through	32.0	C	403	276
	Ramp NB	Left/Through/Right	19.7	B	31	223	29.4	C	404	352	43.5	D	633	647	Ramp NB	Right	15.3	B	35	85
	Intersection		17.3	B			25.1	C			33.9	C			Intersection		23.9	C		

			Existing				No Build 2024				Build 2024						Build with Mitigation 2024			
			PM				PM				PM						PM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)			(sec/veh)		(ft)	(ft)
1	**Graves Mill/East Ramp**																			
	Graves Mill EB	Left	16.0	B	92	203	33.8	C	231	225	40.7	D	355	225	Graves Mill EB	Left	27.8	C	305	224
	Graves Mill EB	Through	7.0	A	27	73	9.7	A	66	318	6.9	A	50	418	Graves Mill EB	Through	9.4	A	75	303
	Graves Mill WB	Through	15.6	B	111	144	31.4	C	225	979	48.1	D	373	812	Graves Mill WB	Through	39.0	D	358	327
	Graves Mill WB	Right	11.5	B	22	25	20.4	C	34	225	34.3	C	71	225	Graves Mill WB	Right	29.8	C	69	224
	Ramp NB	Left	25.9	C	283	200	39.8	D	448	450	51.2	D	708	450	Ramp NB	Left/Through	51.0	D	594	411
	Ramp NB	Left/Through/Right	19.9	B	26	205	33.5	C	414	962	47.7	D	672	950	Ramp NB	Right	25.7	C	45	104
	Intersection		17.8	B			31.7	C			43.3	D			Intersection		38.2	D		

LOS, Delays, and Queues - Graves Mill Road and Southbound Ramps

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			AM				AM				AM				AM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
2	**Graves Mill/West Ramp**																	
	Graves Mill EB	Through	7.6	A	91	113	2.9	A	58	602	3.3	A	60	650	3.5	A	141	122
	Graves Mill EB	Right	12.3	B	55	295	65.7	E	403	400	73.0	E	626	400	2.6	A	553	223
	Graves Mill WB	Left	5.5	A	46	209	2.6	A	65	299	3.8	A	59	299	0.6	A	10	134
	Graves Mill WB	Through	4.8	A	111	148	3.4	A	248	595	4.1	A	178	612	0.7	A	44	131
	Ramp SB	Left/Through	20.1	C	16	85	62.2	E	129	177	57.2	E	127	170	71.6	E	142	159
	Ramp SB	Right	21.6	C	82	108	68.6	E	171	183	80.9	F	269	217	0.2	A	0	53
	Intersection		9.3	A			30.7	C			34.2	C			3.5	A		

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			PM				PM				PM				PM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
2	**Graves Mill/West Ramp**																	
	Graves Mill EB	Through	9.4	A	66	110	8.9	A	68	343	5.5	A	56	809	2.5	A	38	96
	Graves Mill EB	Right	14.3	B	55	239	70.3	E	477	399	102.7	F	497	400	3.7	A	593	221
	Graves Mill WB	Left	6.7	A	57	276	7.6	A	102	300	1.4	A	14	300	2.2	A	51	151
	Graves Mill WB	Through	7.7	A	158	317	7.8	A	381	749	2.5	A	81	794	4.0	A	299	245
	Ramp SB	Left/Through	17.0	B	9	65	42.6	D	70	110	37.2	D	65	458	56.9	E	76	112
	Ramp SB	Right	35.1	D	154	161	80.8	F	481	266	121.4	F	551	300	0.4	A	0	62
	Intersection		13.2	B			35.9	D			48.4	D			3.9	A		

LOS, Delays, and Queues - Graves Mill Road and Creekside Drive

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			AM				AM				AM				AM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
3	**Graves Mill/Creekside**																	
	Graves Mill EB	Left	12.9	B	15	55	16.0	B	19	58	13.1	B	12	200	12.4	B	13	172
	Graves Mill EB	Through/Right	29.4	C	340	547	27.7	C	657	766	29.2	C	798	770	25.9	C	640	775
	Graves Mill WB	Left	35.5	D	216	217	53.0	D	231	378	78.1	E	304	341	62.2	E	326	309
	Graves Mill WB	Through	12.8	B	183	177	10.4	B	236	178	6.4	A	129	160	12.0	B	335	275
	Graves Mill WB	Right	9.8	A	13	40	6.3	A	6	47	1.6	A	4	25	9.3	A	16	43
	Old Graves Mill NB	Left/Through	27.5	C	32	236	47.5	D	58	380	47.5	D	58	397	52.7	D	62	434
	Old Graves Mill NB	Right	20.9	C	108	174	36.8	D	266	175	37.3	D	281	175	41.8	D	315	175
	Creekside SB	Left	38.5	D	33	62	66.8	E	55	70	66.8	E	55	78	72.0	E	58	71
	Creekside SB	Through/Right	36.7	D	20	50	64.7	E	34	64	64.7	E	34	56	69.5	E	35	63
	Intersection		23.1	C			26.0	C			26.7	C			26.7	C		

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			PM				PM				PM				PM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
3	**Graves Mill/Creekside**																	
	Graves Mill EB	Left	17.5	B	27	74	8.9	A	13	77	16.1	B	9	78	23.3	C	6	92
	Graves Mill EB	Through/Right	27.3	C	304	751	11.0	B	491	665	21.2	C	647	769	26.8	C	640	773
	Graves Mill WB	Left	26.9	C	198	273	31.2	C	207	312	66.1	E	264	372	50.9	D	315	369
	Graves Mill WB	Through	20.3	C	366	240	14.4	B	332	244	23.6	C	431	515	14.7	B	450	471
	Graves Mill WB	Right	12.7	B	18	48	13.3	B	15	28	18.9	B	20	162	1.3	A	0	44
	Old Graves Mill NB	Left/Through	25.5	C	53	119	58.9	E	136	375	46.3	D	118	337	45.5	D	118	302
	Old Graves Mill NB	Right	18.2	B	92	169	46.3	D	300	175	35.2	D	262	175	35.5	D	189	174
	Creekside SB	Left	34.1	C	85	117	68.4	E	153	159	56.0	E	132	164	56.0	E	132	160
	Creekside SB	Through/Right	30.5	C	40	79	59.2	E	68	96	49.9	D	61	100	49.9	D	61	99
	Intersection		23.1	C			21.7	C			28.4	C			25.5	C		

LOS, Delays, and Queues - Graves Mill Road and Old Graves Mill Road

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			AM				AM				AM				AM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
4	**Graves Mill/Old Graves Mill**																	
	Graves Mill EB	Left	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0
	Graves Mill EB	Through	10.4	B	195	177	11.6	B	385	530	10.6	B	457	1177	10.9	B	484	1167
	Graves Mill EB	Right	6.2	A	26	50	7.8	A	42	325	3.5	A	29	500	4.6	A	13	500
	Graves Mill WB	Left	33.2	C	60	98	50.5	D	117	147	52.4	D	122	142	52.4	D	123	154
	Graves Mill WB	Through/Right	2.8	A	74	140	0.4	A	12	73	0.4	A	14	69	0.6	A	18	106
	Old Graves Mill NB	Left/Through	28.7	C	24	131	67.6	E	186	209	68.3	E	211	231	74.3	E	225	267
	Old Graves Mill NB	Right	23.8	C	23	59	55.3	E	44	88	53.7	D	43	98	57.8	E	44	114
	Old Graves Mill SB	Left/Through/Right	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0
	Intersection		10.1	B			13.0	B			12.0	B			12.7	B		

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			PM				PM				PM				PM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
4	**Graves Mill/Old Graves Mill**																	
	Graves Mill EB	Left	39.7	D	3	63	70.7	E	7	10	47.6	D	1	4	68.2	E	1	104
	Graves Mill EB	Through	19.9	B	247	415	22.6	C	471	382	17.1	B	367	1180	18.0	B	461	1161
	Graves Mill EB	Right	13.8	B	32	208	16.5	B	90	91	6.5	A	32	500	7.3	A	48	500
	Graves Mill WB	Left	24.0	C	149	292	44.8	D	315	266	47.7	D	299	362	32.3	C	280	359
	Graves Mill WB	Through/Right	5.7	A	138	237	1.0	A	35	88	1.2	A	50	299	1.7	A	52	291
	Old Graves Mill NB	Left/Through	28.8	C	29	183	67.9	E	211	213	54.7	D	212	238	54.7	D	212	247
	Old Graves Mill NB	Right	23.7	C	17	52	53.5	D	33	52	42.9	D	30	56	42.9	D	30	55
	Old Graves Mill SB	Left/Through/Right	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0
	Intersection		15.9	B			19.2	B			15.1	B			14.7	B		

LOS, Delays, and Queues - Graves Mill Road and Site Entrance

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			AM				AM				AM				AM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
6	**Graves Mill/Entrance**																	
	Graves Mill EB	Left	-	-	-	-	-	-	-	-	19.8	B	178	196	33.1	C	253	197
	Graves Mill EB	Through	-	-	-	-	-	-	-	-	10.0	B	215	229	9.2	A	212	215
	Graves Mill WB	Through	-	-	-	-	-	-	-	-	17.9	B	195	202	21.8	C	250	194
	Graves Mill WB	Right	-	-	-	-	-	-	-	-	20.9	C	32	88	12.8	B	18	115
	Entrance SB	Left	-	-	-	-	-	-	-	-	31.3	C	172	250	26.3	C	85	125
	Entrance SB	Right	-	-	-	-	-	-	-	-	21.7	C	40	161	24.1	C	42	88
	Intersection		-	-			-	-			16.3	B			17.7	B		

			Existing				No Build 2024				Build 2024				Build with Mitigation 2024			
			PM				PM				PM				PM			
No.	Intersection	Movement	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue	Synchro Delay	LOS	Synchro Queue	SimTraffic Queue
			(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)	(sec/veh)		(ft)	(ft)
6	**Graves Mill/Entrance**																	
	Graves Mill EB	Left	-	-	-	-	-	-	-	-	68.0	E	487	231	42.7	D	436	240
	Graves Mill EB	Through	-	-	-	-	-	-	-	-	15.3	B	352	267	7.2	A	223	261
	Graves Mill WB	Through	-	-	-	-	-	-	-	-	28.3	C	479	233	19.6	B	381	225
	Graves Mill WB	Right	-	-	-	-	-	-	-	-	8.0	A	25	102	5.2	A	7	138
	Entrance SB	Left	-	-	-	-	-	-	-	-	61.4	E	544	349	59.6	E	256	350
	Entrance SB	Right	-	-	-	-	-	-	-	-	32.6	C	65	238	44.3	D	77	324
	Intersection		-	-			-	-			31.7	C			25.7	C		

Appendix C Existing Syncho and SimTraffic Reports

Queues
2: Graves Mill Rd & East Ramp

11/14/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	276	482	430	40	536	512
v/c Ratio	0.55	0.29	0.41	0.08	0.82	0.76
Control Delay	18.5	10.6	18.4	6.7	27.8	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	10.6	18.4	6.7	27.8	21.7
Queue Length 50th (ft)	61	55	66	0	166	134
Queue Length 95th (ft)	106	66	68	6	#285	31
Internal Link Dist (ft)		689	899			900
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	502	1666	1049	507	732	746
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.29	0.41	0.08	0.73	0.69

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	243	357	0	0	275	20	0	0	0	740	0	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0				4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.94	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1787	3539			3539	1615				1681	1630	
Flt Permitted	0.46	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	862	3539			3539	1615				1681	1630	
Peak-hour factor, PHF	0.88	0.74	0.25	0.25	0.64	0.50	0.25	0.25	0.25	0.87	0.25	0.68
Adj. Flow (vph)	276	482	0	0	430	40	0	0	0	851	0	197
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	0	0	39	0
Lane Group Flow (vph)	276	482	0	0	430	12	0	0	0	536	473	0
Heavy Vehicles (%)	1%	2%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	27.1	27.1			17.1	17.1				22.5	22.5	
Effective Green, g (s)	27.1	27.1			17.1	17.1				22.5	22.5	
Actuated g/C Ratio	0.47	0.47			0.30	0.30				0.39	0.39	
Clearance Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	502	1665			1051	479				657	637	
v/s Ratio Prot	c0.06	0.14			0.12					c0.32	0.29	
v/s Ratio Perm	c0.20					0.01						
v/c Ratio	0.55	0.29			0.41	0.02				0.82	0.74	
Uniform Delay, d1	12.8	9.3			16.2	14.3				15.7	15.1	
Progression Factor	1.00	1.00			1.00	1.00				1.00	1.00	
Incremental Delay, d2	1.2	0.4			1.2	0.1				7.7	4.7	
Delay (s)	14.1	9.8			17.4	14.4				23.4	19.7	
Level of Service	B	A			B	B				C	B	
Approach Delay (s)		11.3			17.1			0.0			21.6	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	57.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	688	983	187	1075	100	228
v/c Ratio	0.35	0.75	0.35	0.45	0.31	0.60
Control Delay	8.7	6.0	7.8	5.6	21.1	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	6.0	7.8	5.6	21.1	18.5
Queue Length 50th (ft)	61	5	17	66	28	36
Queue Length 95th (ft)	91	55	46	111	16	82
Internal Link Dist (ft)	795			689	505	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	1970	1306	537	2384	520	545
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.75	0.35	0.45	0.19	0.42

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	509	855	159	828	0	64	1	194	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1599	1787	3574			1754	1599		
Flt Permitted		1.00	1.00	0.36	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1599	683	3574			1754	1599		
Peak-hour factor, PHF	0.25	0.74	0.87	0.85	0.77	0.25	0.67	0.25	0.85	0.25	0.25
Adj. Flow (vph)	0	688	983	187	1075	0	96	4	228	0	0
RTOR Reduction (vph)	0	0	432	0	0	0	0	0	83	0	0
Lane Group Flow (vph)	0	688	551	187	1075	0	0	100	145	0	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		29.9	29.9	37.0	37.0			10.0	10.0		
Effective Green, g (s)		29.9	29.9	37.0	37.0			10.0	10.0		
Actuated g/C Ratio		0.54	0.54	0.67	0.67			0.18	0.18		
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		1943	869	522	2404			319	291		
v/s Ratio Prot		0.19		0.02	c0.30			0.06			
v/s Ratio Perm			c0.34	0.22					c0.09		
v/c Ratio		0.35	0.63	0.36	0.45			0.31	0.50		
Uniform Delay, d1		7.1	8.7	5.0	4.2			19.5	20.2		
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		
Incremental Delay, d2		0.5	3.5	0.4	0.6			0.6	1.4		
Delay (s)		7.6	12.3	5.5	4.8			20.1	21.6		
Level of Service		A	B	A	A			C	C		
Approach Delay (s)		10.3			4.9			21.1		0.0	
Approach LOS		B			A			C		A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	1327	257	918	139	44	393	32	24
v/c Ratio	0.15	0.89	0.80	0.47	0.15	0.14	0.50	0.20	0.15
Control Delay	9.6	31.5	37.0	13.9	3.0	28.3	7.8	36.9	22.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.6	31.5	37.0	13.9	3.0	28.3	7.8	36.9	22.5
Queue Length 50th (ft)	10	331	78	166	0	18	33	15	4
Queue Length 95th (ft)	15	340	#216	183	13	32	108	33	20
Internal Link Dist (ft)		697		795		450			535
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	323	1489	321	1936	930	321	793	377	350
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.89	0.80	0.47	0.15	0.14	0.50	0.08	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	996	14	236	698	96	13	15	354	23	6	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3565		1752	3574	1599		1537	1568	1805	1618	
Flt Permitted	0.29	1.00		0.11	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (perm)	548	3565		195	3574	1599		1537	1568	1805	1618	
Peak-hour factor, PHF	0.56	0.76	0.88	0.92	0.76	0.69	0.65	0.63	0.90	0.72	0.75	0.63
Adj. Flow (vph)	48	1311	16	257	918	139	20	24	393	32	8	16
RTOR Reduction (vph)	0	1	0	0	0	67	0	0	198	0	15	0
Lane Group Flow (vph)	48	1326	0	257	918	72	0	44	195	32	9	0
Heavy Vehicles (%)	0%	1%	7%	3%	1%	1%	46%	0%	3%	0%	17%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	36.2	33.9		48.0	41.7	41.7		16.1	26.2	4.4	4.4	
Effective Green, g (s)	36.2	33.9		48.0	41.7	41.7		16.1	26.2	4.4	4.4	
Actuated g/C Ratio	0.45	0.42		0.60	0.52	0.52		0.20	0.33	0.05	0.05	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	282	1501		312	1851	828		307	588	99	88	
v/s Ratio Prot	0.00	0.37		c0.10	0.26			0.03	c0.04	c0.02	0.01	
v/s Ratio Perm	0.07			c0.39		0.05			0.08			
v/c Ratio	0.17	0.88		0.82	0.50	0.09		0.14	0.33	0.32	0.10	
Uniform Delay, d1	12.6	21.5		19.6	12.6	9.8		26.5	20.5	36.6	36.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	7.9		16.0	0.2	0.0		1.0	0.3	1.9	0.5	
Delay (s)	12.9	29.4		35.5	12.8	9.8		27.5	20.9	38.5	36.7	
Level of Service	B	C		D	B	A		C	C	D	D	
Approach Delay (s)		28.8			16.9			21.5			37.7	
Approach LOS		C			B			C			D	

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1305	147	103	760	135	72
v/c Ratio	0.63	0.15	0.60	0.28	0.47	0.23
Control Delay	11.4	2.7	46.4	3.6	30.0	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.4	2.7	46.4	3.6	30.0	8.6
Queue Length 50th (ft)	167	3	40	42	49	0
Queue Length 95th (ft)	195	26	60	74	24	23
Internal Link Dist (ft)	1366			697	768	
Turn Bay Length (ft)		200	250			300
Base Capacity (vph)	2078	956	171	2733	464	467
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.15	0.60	0.28	0.29	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	979	131	65	654	3	117	1	57	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1538	1752	3569			1778	1583			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1538	1752	3569			1778	1583			
Peak-hour factor, PHF	0.25	0.75	0.89	0.63	0.87	0.38	0.89	0.25	0.79	0.25	0.25	0.25
Adj. Flow (vph)	0	1305	147	103	752	8	131	4	72	0	0	0
RTOR Reduction (vph)	0	0	54	0	0	0	0	0	62	0	0	0
Lane Group Flow (vph)	0	1305	93	103	760	0	0	135	10	0	0	0
Heavy Vehicles (%)	0%	2%	5%	3%	1%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)		36.4	36.4	6.1	46.5			8.4	8.4			
Effective Green, g (s)		36.4	36.4	6.1	46.5			8.4	8.4			
Actuated g/C Ratio		0.58	0.58	0.10	0.74			0.13	0.13			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		2048	890	170	2638			237	211			
v/s Ratio Prot		c0.37		c0.06	0.21			c0.08				
v/s Ratio Perm			0.06						0.01			
v/c Ratio		0.64	0.10	0.61	0.29			0.57	0.05			
Uniform Delay, d1		8.8	5.9	27.2	2.7			25.6	23.8			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.5	0.2	6.0	0.1			3.1	0.1			
Delay (s)		10.4	6.2	33.2	2.8			28.7	23.8			
Level of Service		B	A	C	A			C	C			
Approach Delay (s)		9.9			6.4			27.0			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM Average Control Delay	10.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues
2: Graves Mill Rd & East Ramp

11/14/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	251	224	655	88	493	466
v/c Ratio	0.64	0.13	0.57	0.15	0.85	0.77
Control Delay	21.9	7.4	16.2	4.4	31.7	23.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	7.4	16.2	4.4	31.7	23.2
Queue Length 50th (ft)	41	17	82	0	132	103
Queue Length 95th (ft)	#92	27	111	22	#283	26
Internal Link Dist (ft)		689	903			891
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	393	1672	1158	588	619	640
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.13	0.57	0.15	0.80	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	226	177	0	0	537	78	0	0	0	728	2	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0				4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.95	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1770	3406			3539	1615				1681	1630	
Flt Permitted	0.33	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	608	3406			3539	1615				1681	1630	
Peak-hour factor, PHF	0.90	0.79	0.25	0.25	0.82	0.89	0.25	0.25	0.25	0.93	0.25	0.76
Adj. Flow (vph)	251	224	0	0	655	88	0	0	0	783	8	168
RTOR Reduction (vph)	0	0	0	0	0	59	0	0	0	0	41	0
Lane Group Flow (vph)	251	224	0	0	655	29	0	0	0	493	425	0
Heavy Vehicles (%)	2%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	1%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	24.0	24.0			16.0	16.0				16.9	16.9	
Effective Green, g (s)	24.0	24.0			16.0	16.0				16.9	16.9	
Actuated g/C Ratio	0.49	0.49			0.33	0.33				0.35	0.35	
Clearance Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	393	1672			1158	528				581	563	
v/s Ratio Prot	c0.05	0.07			0.19					c0.29	0.26	
v/s Ratio Perm	c0.26					0.02						
v/c Ratio	0.64	0.13			0.57	0.05				0.85	0.75	
Uniform Delay, d1	12.6	6.8			13.6	11.3				14.8	14.2	
Progression Factor	1.00	1.00			1.00	1.00				1.00	1.00	
Incremental Delay, d2	3.4	0.2			2.0	0.2				11.1	5.7	
Delay (s)	16.0	7.0			15.6	11.5				25.9	19.9	
Level of Service	B	A			B	B				C	B	
Approach Delay (s)		11.8			15.1			0.0			23.0	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	406	915	271	1209	48	393
v/c Ratio	0.24	0.74	0.42	0.55	0.11	0.86
Control Delay	9.9	5.4	9.3	8.2	17.4	37.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.9	5.4	9.3	8.2	17.4	37.5
Queue Length 50th (ft)	43	0	40	120	13	108
Queue Length 95th (ft)	66	55	57	158	9	#154
Internal Link Dist (ft)	795			689	509	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	1701	1233	638	2187	476	489
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.74	0.42	0.55	0.10	0.80

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	357	851	203	1052	0	36	0	295	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1583	1770	3574			1752	1599		
Flt Permitted		1.00	1.00	0.51	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1583	952	3574			1752	1599		
Peak-hour factor, PHF	0.25	0.88	0.93	0.75	0.87	0.25	0.75	0.25	0.75	0.25	0.25
Adj. Flow (vph)	0	406	915	271	1209	0	48	0	393	0	0
RTOR Reduction (vph)	0	0	479	0	0	0	0	0	55	0	0
Lane Group Flow (vph)	0	406	436	271	1209	0	0	48	338	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		28.0	28.0	36.0	36.0			14.8	14.8		
Effective Green, g (s)		28.0	28.0	36.0	36.0			14.8	14.8		
Actuated g/C Ratio		0.48	0.48	0.61	0.61			0.25	0.25		
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		1702	754	639	2188			441	402		
v/s Ratio Prot		0.11		0.03	c0.34			0.03			
v/s Ratio Perm			0.28	0.23					c0.21		
v/c Ratio		0.24	0.58	0.42	0.55			0.11	0.84		
Uniform Delay, d1		9.1	11.1	6.2	6.7			16.9	20.9		
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		
Incremental Delay, d2		0.3	3.2	0.5	1.0			0.1	14.3		
Delay (s)		9.4	14.3	6.7	7.7			17.0	35.1		
Level of Service		A	B	A	A			B	D		
Approach Delay (s)		12.8			7.5			33.2		0.0	
Approach LOS		B			A			C		A	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	58.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	56	945	252	1163	149	100	337	103	72
v/c Ratio	0.28	0.82	0.78	0.73	0.19	0.24	0.42	0.44	0.27
Control Delay	15.1	30.8	34.0	22.9	3.9	26.6	7.3	35.3	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.1	30.8	34.0	22.9	3.9	26.6	7.3	35.3	17.2
Queue Length 50th (ft)	13	208	64	249	0	38	28	44	11
Queue Length 95th (ft)	27	#304	#198	#366	18	53	92	85	40
Internal Link Dist (ft)		697		795		463			536
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	200	1156	322	1583	798	413	795	403	423
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.82	0.78	0.73	0.19	0.24	0.42	0.26	0.17

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	790	11	237	1000	107	61	17	317	90	23	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3566		1770	3574	1615		1834	1599	1787	1726	
Flt Permitted	0.16	1.00		0.14	1.00	1.00		0.97	1.00	0.95	1.00	
Satd. Flow (perm)	304	3566		257	3574	1615		1834	1599	1787	1726	
Peak-hour factor, PHF	0.75	0.85	0.69	0.94	0.86	0.72	0.85	0.61	0.94	0.87	0.82	0.73
Adj. Flow (vph)	56	929	16	252	1163	149	72	28	337	103	28	44
RTOR Reduction (vph)	0	1	0	0	0	85	0	0	158	0	39	0
Lane Group Flow (vph)	56	944	0	252	1163	64	0	100	179	103	33	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	27.3	25.0		38.0	31.7	31.7		16.1	25.1	8.0	8.0	
Effective Green, g (s)	27.3	25.0		38.0	31.7	31.7		16.1	25.1	8.0	8.0	
Actuated g/C Ratio	0.37	0.34		0.51	0.43	0.43		0.22	0.34	0.11	0.11	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	159	1203		316	1529	691		398	628	193	186	
v/s Ratio Prot	0.01	0.26		c0.10	0.33			0.05	c0.03	c0.06	0.02	
v/s Ratio Perm	0.12			c0.31		0.04			0.08			
v/c Ratio	0.35	0.78		0.80	0.76	0.09		0.25	0.28	0.53	0.18	
Uniform Delay, d1	16.2	22.1		13.9	18.0	12.6		24.0	17.9	31.3	30.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	5.2		13.1	2.3	0.1		1.5	0.3	2.8	0.5	
Delay (s)	17.5	27.3		26.9	20.3	12.7		25.5	18.2	34.1	30.5	
Level of Service	B	C		C	C	B		C	B	C	C	
Approach Delay (s)		26.7			20.6			19.9			32.6	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	74.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	4	977	244	265	813	176	44
v/c Ratio	0.04	0.66	0.30	0.68	0.34	0.55	0.14
Control Delay	31.0	18.6	3.4	34.3	5.8	31.4	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	18.6	3.4	34.3	5.8	31.4	8.8
Queue Length 50th (ft)	2	160	0	97	52	65	0
Queue Length 95th (ft)	3	247	32	149	138	29	17
Internal Link Dist (ft)		1366			697	761	
Turn Bay Length (ft)	200		200	250			300
Base Capacity (vph)	111	1486	800	409	2415	440	431
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.66	0.30	0.65	0.34	0.40	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	918	205	204	797	0	139	0	33	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0			
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00			
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)	1805	3574	1583	1770	3574			1787	1615			
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)	1805	3574	1583	1770	3574			1787	1615			
Peak-hour factor, PHF	0.25	0.94	0.84	0.77	0.98	0.25	0.79	0.25	0.75	0.25	0.25	0.25
Adj. Flow (vph)	4	977	244	265	813	0	176	0	44	0	0	0
RTOR Reduction (vph)	0	0	147	0	0	0	0	0	37	0	0	0
Lane Group Flow (vph)	4	977	97	265	813	0	0	176	7	0	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	1%	0%	0%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)	0.7	27.1	27.1	17.6	44.0			11.6	11.6			
Effective Green, g (s)	0.7	27.1	27.1	17.6	44.0			11.6	11.6			
Actuated g/C Ratio	0.01	0.40	0.40	0.26	0.64			0.17	0.17			
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	18	1418	628	456	2302			304	274			
v/s Ratio Prot	0.00	c0.27		c0.15	0.23			c0.10				
v/s Ratio Perm			0.06						0.00			
v/c Ratio	0.22	0.69	0.15	0.58	0.35			0.58	0.03			
Uniform Delay, d1	33.5	17.1	13.2	22.1	5.6			26.1	23.6			
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2	6.2	2.8	0.5	1.9	0.1			2.7	0.0			
Delay (s)	39.7	19.9	13.8	24.0	5.7			28.8	23.7			
Level of Service	D	B	B	C	A			C	C			
Approach Delay (s)		18.7			10.2			27.8			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	68.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	3166	3160	3180	3248	3099	3156	3226
Vehs Exited	3155	3140	3185	3243	3102	3183	3209
Starting Vehs	101	85	100	89	104	111	86
Ending Vehs	112	105	95	94	101	84	103
Denied Entry Before	6	0	3	4	2	1	1
Denied Entry After	2	5	0	2	5	4	6
Travel Distance (mi)	2282	2282	2289	2308	2196	2288	2308
Travel Time (hr)	98.8	99.2	97.8	100.7	94.0	98.9	104.5
Total Delay (hr)	35.8	36.4	34.8	37.2	33.1	36.1	40.9
Total Stops	4062	4136	3972	4167	3873	4189	4400
Fuel Used (gal)	90.9	91.3	91.6	92.4	87.5	91.4	93.2

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	3190	3135	3218	3179
Vehs Exited	3193	3132	3224	3176
Starting Vehs	83	106	107	93
Ending Vehs	80	109	101	97
Denied Entry Before	1	0	0	2
Denied Entry After	2	0	0	2
Travel Distance (mi)	2290	2252	2308	2280
Travel Time (hr)	99.8	98.4	98.9	99.1
Total Delay (hr)	36.7	36.5	35.4	36.3
Total Stops	4130	4129	4059	4113
Fuel Used (gal)	91.3	90.5	92.3	91.2

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3166	3160	3180	3248	3099	3156	3226
Vehs Exited	3155	3140	3185	3243	3102	3183	3209
Starting Vehs	101	85	100	89	104	111	86
Ending Vehs	112	105	95	94	101	84	103
Denied Entry Before	6	0	3	4	2	1	1
Denied Entry After	2	5	0	2	5	4	6
Travel Distance (mi)	2282	2282	2289	2308	2196	2288	2308
Travel Time (hr)	98.8	99.2	97.8	100.7	94.0	98.9	104.5
Total Delay (hr)	35.8	36.4	34.8	37.2	33.1	36.1	40.9
Total Stops	4062	4136	3972	4167	3873	4189	4400
Fuel Used (gal)	90.9	91.3	91.6	92.4	87.5	91.4	93.2

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3190	3135	3218	3179
Vehs Exited	3193	3132	3224	3176
Starting Vehs	83	106	107	93
Ending Vehs	80	109	101	97
Denied Entry Before	1	0	0	2
Denied Entry After	2	0	0	2
Travel Distance (mi)	2290	2252	2308	2280
Travel Time (hr)	99.8	98.4	98.9	99.1
Total Delay (hr)	36.7	36.5	35.4	36.3
Total Stops	4130	4129	4059	4113
Fuel Used (gal)	91.3	90.5	92.3	91.2

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWR	All
Total Delay (hr)	1.3	1.0	1.0	0.0	3.9	0.6	7.8
Delay / Veh (s)	19.8	10.0	12.3	6.4	19.3	16.2	16.0
Total Stops	182	136	140	10	468	93	1029
Travel Dist (mi)	33.6	50.4	50.6	3.6	129.5	24.9	292.7
Travel Time (hr)	2.3	2.2	2.2	0.1	8.1	1.5	16.5
Avg Speed (mph)	15	23	23	31	18	18	19
Fuel Used (gal)	1.3	2.1	1.9	0.1	4.1	0.7	10.2
HC Emissions (g)	10	30	25	1	37	3	106
CO Emissions (g)	613	1486	1257	75	1236	121	4789
NOx Emissions (g)	38	101	86	4	111	11	351
Vehicles Entered	235	354	282	20	733	142	1766
Vehicles Exited	234	354	283	20	734	141	1766
Hourly Exit Rate	234	354	283	20	734	141	1766
Input Volume	243	357	275	20	740	134	1769
% of Volume	96	99	103	100	99	105	100
Denied Entry Before	0	0	0	0	1	0	1
Denied Entry After	0	0	0	0	1	0	1

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Total Delay (hr)	1.0	3.2	1.8	1.1	0.4	0.0	0.6	8.1
Delay / Veh (s)	7.3	13.6	39.0	4.4	21.8	11.3	11.8	11.1
Total Stops	113	396	165	108	49	1	157	989
Travel Dist (mi)	84.4	143.6	24.7	126.6	6.1	0.1	19.4	404.9
Travel Time (hr)	3.2	8.3	2.7	4.7	0.6	0.0	1.4	20.8
Avg Speed (mph)	27	17	9	27	11	15	18	20
Fuel Used (gal)	4.5	5.6	1.5	7.5	0.3	0.0	0.7	20.1
HC Emissions (g)	65	50	14	110	3	0	6	249
CO Emissions (g)	3564	2358	806	6052	104	1	280	13165
NOx Emissions (g)	225	197	49	378	8	0	18	876
Vehicles Entered	510	858	166	851	60	1	190	2636
Vehicles Exited	510	857	166	853	60	1	190	2637
Hourly Exit Rate	510	857	166	853	60	1	190	2637
Input Volume	518	855	159	856	64	1	194	2647
% of Volume	98	100	104	100	94	100	98	100
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.1	7.7	0.1	1.9	1.8	0.1	0.1	0.1	2.1	0.3	0.1	0.0
Delay / Veh (s)	14.3	28.0	29.3	29.2	9.4	2.5	30.1	29.4	20.7	42.8	37.3	7.3
Total Stops	22	695	12	224	226	35	9	12	231	22	6	9
Travel Dist (mi)	3.9	141.3	1.9	36.9	113.4	15.5	1.0	1.5	33.2	2.5	0.7	1.0
Travel Time (hr)	0.2	11.0	0.2	3.0	4.6	0.6	0.1	0.2	3.4	0.4	0.1	0.1
Avg Speed (mph)	17	13	11	12	25	28	8	9	12	8	8	17
Fuel Used (gal)	0.2	6.4	0.1	1.5	4.5	0.6	0.0	0.1	1.3	0.1	0.0	0.0
HC Emissions (g)	1	60	2	17	46	9	4	0	15	0	0	0
CO Emissions (g)	87	2576	45	744	2610	444	69	20	532	19	10	6
NOx Emissions (g)	5	222	5	55	181	28	8	1	40	1	1	1
Vehicles Entered	27	995	13	229	700	96	11	16	361	23	7	10
Vehicles Exited	27	995	13	230	698	96	11	16	360	23	7	10
Hourly Exit Rate	27	995	13	230	698	96	11	16	360	23	7	10
Input Volume	27	1006	14	236	698	96	13	15	354	23	6	10
% of Volume	100	99	93	97	100	100	85	107	102	100	117	100
Denied Entry Before	0	0	0	0	0	0	0	0	1	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	1	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	14.4
Delay / Veh (s)	20.8
Total Stops	1503
Travel Dist (mi)	352.8
Travel Time (hr)	23.7
Avg Speed (mph)	15
Fuel Used (gal)	14.9
HC Emissions (g)	156
CO Emissions (g)	7161
NOx Emissions (g)	548
Vehicles Entered	2488
Vehicles Exited	2486
Hourly Exit Rate	2486
Input Volume	2498
% of Volume	100
Denied Entry Before	1
Denied Entry After	1

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	All
Total Delay (hr)	2.1	0.1	0.6	0.9	0.0	0.8	0.0	0.2	4.6
Delay / Veh (s)	7.8	2.6	30.8	4.9	2.8	24.2	26.8	12.6	8.4
Total Stops	262	36	63	86	0	97	1	47	592
Travel Dist (mi)	265.2	35.6	9.7	95.7	0.5	17.2	0.2	8.5	432.7
Travel Time (hr)	8.1	1.1	0.9	3.1	0.0	1.4	0.0	0.5	15.0
Avg Speed (mph)	33	33	11	31	28	13	14	20	29
Fuel Used (gal)	6.5	0.9	0.5	4.2	0.0	0.7	0.0	0.3	13.1
HC Emissions (g)	77	23	6	53	0	5	0	5	170
CO Emissions (g)	2231	637	272	2739	11	261	3	173	6327
NOx Emissions (g)	321	68	19	207	1	18	0	15	650
Vehicles Entered	969	130	67	653	4	114	1	56	1994
Vehicles Exited	969	130	66	654	4	114	1	56	1994
Hourly Exit Rate	969	130	66	654	4	114	1	56	1994
Input Volume	979	131	65	658	3	117	1	57	2011
% of Volume	99	99	102	99	133	97	100	98	99
Denied Entry Before	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	36.3
Delay / Veh (s)	41.1
Total Stops	4113
Travel Dist (mi)	2280.1
Travel Time (hr)	99.1
Avg Speed (mph)	24
Fuel Used (gal)	91.2
HC Emissions (g)	1087
CO Emissions (g)	49924
NOx Emissions (g)	4035
Vehicles Entered	3179
Vehicles Exited	3176
Hourly Exit Rate	3176
Input Volume	13940
% of Volume	23
Denied Entry Before	2
Denied Entry After	2

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LR
Maximum Queue (ft)	189	85	103	102	89	18	203	223
Average Queue (ft)	88	33	42	41	32	4	124	132
95th Queue (ft)	158	70	82	81	65	15	185	195
Link Distance (ft)		717	717	937	937			928
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	2	0			0			
Queuing Penalty (veh)	4	0			0			

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	110	113	295	209	144	148	85	108
Average Queue (ft)	35	26	126	89	33	36	36	50
95th Queue (ft)	81	77	228	174	101	95	73	87
Link Distance (ft)	799	799			717	717	539	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			1	2	0			0
Queuing Penalty (veh)			2	9	0			0

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	55	417	547	217	165	177	40	236	174	62	50
Average Queue (ft)	17	143	272	103	61	80	14	32	114	18	12
95th Queue (ft)	45	310	472	181	125	143	32	128	182	48	36
Link Distance (ft)		702	702		799	799		480			557
Upstream Blk Time (%)			0								
Queuing Penalty (veh)			0								
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		1							6		
Queuing Penalty (veh)		0							2		

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	169	177	50	98	113	140	131	59
Average Queue (ft)	59	77	13	40	23	40	56	19
95th Queue (ft)	125	149	33	80	76	104	105	44
Link Distance (ft)	1380	1380			702	702	790	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			200	250				300
Storage Blk Time (%)	0	0						
Queuing Penalty (veh)	0	0						

Network Summary

Network wide Queuing Penalty: 17

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	3573	3732	3752	3617	3657	3581	3752
Vehs Exited	3551	3705	3665	3628	3651	3542	3717
Starting Vehs	106	107	117	127	114	87	103
Ending Vehs	128	134	204	116	120	126	138
Denied Entry Before	1	4	7	4	5	1	4
Denied Entry After	1	0	3	2	2	4	3
Travel Distance (mi)	2451	2561	2559	2500	2510	2452	2554
Travel Time (hr)	119.8	147.8	182.2	123.2	123.8	132.3	126.2
Total Delay (hr)	51.8	76.7	111.4	53.9	54.0	64.4	55.3
Total Stops	5492	7056	8965	5636	5673	6123	5737
Fuel Used (gal)	102.1	112.2	120.8	104.0	105.1	105.2	106.9

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	3669	3676	3686	3669
Vehs Exited	3637	3663	3656	3643
Starting Vehs	118	123	124	111
Ending Vehs	150	136	154	138
Denied Entry Before	2	2	3	2
Denied Entry After	10	1	2	1
Travel Distance (mi)	2515	2506	2513	2512
Travel Time (hr)	155.3	128.1	123.9	136.3
Total Delay (hr)	85.4	58.6	54.1	66.6
Total Stops	7338	5969	5750	6374
Fuel Used (gal)	112.3	106.2	104.7	108.0

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3573	3732	3752	3617	3657	3581	3752
Vehs Exited	3551	3705	3665	3628	3651	3542	3717
Starting Vehs	106	107	117	127	114	87	103
Ending Vehs	128	134	204	116	120	126	138
Denied Entry Before	1	4	7	4	5	1	4
Denied Entry After	1	0	3	2	2	4	3
Travel Distance (mi)	2451	2561	2559	2500	2510	2452	2554
Travel Time (hr)	119.8	147.8	182.2	123.2	123.8	132.3	126.2
Total Delay (hr)	51.8	76.7	111.4	53.9	54.0	64.4	55.3
Total Stops	5492	7056	8965	5636	5673	6123	5737
Fuel Used (gal)	102.1	112.2	120.8	104.0	105.1	105.2	106.9

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3669	3676	3686	3669
Vehs Exited	3637	3663	3656	3643
Starting Vehs	118	123	124	111
Ending Vehs	150	136	154	138
Denied Entry Before	2	2	3	2
Denied Entry After	10	1	2	1
Travel Distance (mi)	2515	2506	2513	2512
Travel Time (hr)	155.3	128.1	123.9	136.3
Total Delay (hr)	85.4	58.6	54.1	66.6
Total Stops	7338	5969	5750	6374
Fuel Used (gal)	112.3	106.2	104.7	108.0

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWT	NWR	All
Total Delay (hr)	1.5	0.4	1.9	0.2	4.2	0.0	0.6	8.7
Delay / Veh (s)	25.1	7.4	12.7	7.6	20.4	27.2	15.7	16.7
Total Stops	200	54	270	45	520	2	91	1182
Travel Dist (mi)	32.3	25.3	96.1	14.3	128.5	0.4	22.3	319.2
Travel Time (hr)	2.5	1.0	4.2	0.6	8.3	0.0	1.3	18.0
Avg Speed (mph)	13	26	23	29	17	15	18	19
Fuel Used (gal)	1.4	1.1	3.5	0.5	4.1	0.0	0.6	11.3
HC Emissions (g)	12	21	50	5	37	0	4	130
CO Emissions (g)	675	935	2404	372	1245	3	137	5771
NOx Emissions (g)	42	66	162	17	112	0	13	411
Vehicles Entered	223	177	534	79	735	2	128	1878
Vehicles Exited	222	176	532	79	736	2	128	1875
Hourly Exit Rate	222	176	532	79	736	2	128	1875
Input Volume	226	178	537	78	728	2	128	1877
% of Volume	98	99	99	101	101	100	100	100
Denied Entry Before	0	0	0	0	2	0	0	2
Denied Entry After	0	0	0	0	1	0	0	1

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBR	All
Total Delay (hr)	0.8	3.1	3.7	1.9	0.2	1.3	11.0
Delay / Veh (s)	8.2	13.2	65.6	6.5	21.1	15.2	14.2
Total Stops	98	412	240	182	27	234	1193
Travel Dist (mi)	59.1	140.4	30.4	158.8	3.5	30.4	422.6
Travel Time (hr)	2.3	8.1	4.8	6.3	0.3	2.4	24.2
Avg Speed (mph)	25	17	6	25	11	15	18
Fuel Used (gal)	3.3	5.8	2.1	8.9	0.1	1.0	21.3
HC Emissions (g)	37	59	17	123	1	8	245
CO Emissions (g)	2501	2699	837	6519	48	363	12967
NOx Emissions (g)	135	219	61	436	3	23	876
Vehicles Entered	355	840	205	1064	34	296	2794
Vehicles Exited	355	839	203	1062	34	296	2789
Hourly Exit Rate	355	839	203	1062	34	296	2789
Input Volume	357	851	203	1063	36	295	2805
% of Volume	99	99	100	100	94	100	99
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.3	17.5	0.3	2.6	4.7	0.1	0.4	0.1	1.6	0.9	0.2	0.1
Delay / Veh (s)	23.7	71.3	100.6	38.6	17.0	3.7	25.3	25.0	18.3	37.4	32.9	10.7
Total Stops	40	1290	25	267	504	54	46	12	195	79	18	28
Travel Dist (mi)	6.0	119.7	1.7	38.8	161.9	17.2	5.7	1.6	30.2	9.5	2.3	3.6
Travel Time (hr)	0.5	20.2	0.4	3.8	8.7	0.7	0.6	0.2	2.8	1.3	0.3	0.2
Avg Speed (mph)	13	6	4	10	19	26	10	10	13	8	9	15
Fuel Used (gal)	0.3	8.5	0.1	1.8	6.7	0.7	0.3	0.1	1.2	0.5	0.1	0.1
HC Emissions (g)	2	48	0	19	65	6	1	0	8	3	0	1
CO Emissions (g)	163	2323	16	848	3382	450	76	24	453	140	28	37
NOx Emissions (g)	9	193	2	61	241	22	5	1	28	10	2	2
Vehicles Entered	42	887	12	240	1001	106	61	17	319	89	22	33
Vehicles Exited	42	880	12	239	999	106	60	17	319	89	22	34
Hourly Exit Rate	42	880	12	239	999	106	60	17	319	89	22	34
Input Volume	42	898	11	237	1004	107	61	17	317	90	23	32
% of Volume	100	98	109	101	100	99	98	100	101	99	96	106
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	28.9
Delay / Veh (s)	36.8
Total Stops	2558
Travel Dist (mi)	398.3
Travel Time (hr)	39.7
Avg Speed (mph)	10
Fuel Used (gal)	20.4
HC Emissions (g)	155
CO Emissions (g)	7939
NOx Emissions (g)	576
Vehicles Entered	2829
Vehicles Exited	2819
Hourly Exit Rate	2819
Input Volume	2839
% of Volume	99
Denied Entry Before	0
Denied Entry After	0

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	All
Total Delay (hr)	0.0	10.2	0.6	2.6	1.7	1.2	0.2	16.5
Delay / Veh (s)	26.6	40.2	11.1	45.6	6.9	30.1	20.0	24.9
Total Stops	1	832	127	202	130	120	29	1441
Travel Dist (mi)	0.2	249.2	57.1	30.2	124.1	21.0	5.1	487.0
Travel Time (hr)	0.0	15.8	2.2	3.5	4.6	1.9	0.4	28.4
Avg Speed (mph)	16	16	25	9	27	11	15	17
Fuel Used (gal)	0.0	7.5	1.5	1.7	6.6	1.0	0.2	18.6
HC Emissions (g)	0	49	21	16	72	7	1	165
CO Emissions (g)	3	1682	802	721	4288	356	89	7941
NOx Emissions (g)	0	216	69	55	290	23	5	658
Vehicles Entered	1	913	208	205	885	140	34	2386
Vehicles Exited	1	907	208	204	888	140	34	2382
Hourly Exit Rate	1	907	208	204	888	140	34	2382
Input Volume	1	918	205	204	891	139	33	2391
% of Volume	100	99	101	100	100	101	103	100
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	66.6
Delay / Veh (s)	65.5
Total Stops	6374
Travel Dist (mi)	2512.0
Travel Time (hr)	136.3
Avg Speed (mph)	19
Fuel Used (gal)	108.0
HC Emissions (g)	1154
CO Emissions (g)	54902
NOx Emissions (g)	4320
Vehicles Entered	3669
Vehicles Exited	3643
Hourly Exit Rate	3643
Input Volume	15420
% of Volume	24
Denied Entry Before	2
Denied Entry After	1

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LTR
Maximum Queue (ft)	203	73	67	144	123	25	200	205
Average Queue (ft)	94	14	22	67	52	13	124	125
95th Queue (ft)	164	50	55	118	97	25	180	186
Link Distance (ft)		718	718	941	941			919
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	5				0			
Queuing Penalty (veh)	4				0			

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	110	64	239	276	317	304	65	161
Average Queue (ft)	36	17	121	139	76	62	22	76
95th Queue (ft)	83	46	201	267	260	205	54	130
Link Distance (ft)	799	799			718	718	542	
Upstream Blk Time (%)					0	0		
Queuing Penalty (veh)					0	0		
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			0	13				0
Queuing Penalty (veh)			1	69				0

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	74	751	732	273	238	240	48	119	169	117	79
Average Queue (ft)	25	391	525	124	135	149	20	40	91	54	26
95th Queue (ft)	58	878	854	225	214	226	37	87	158	100	59
Link Distance (ft)		698	698		799	799		490			558
Upstream Blk Time (%)		4	12								
Queuing Penalty (veh)		18	57								
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		0						0	2	0	0
Queuing Penalty (veh)		0						0	2	0	0

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	63	383	415	208	292	226	237	183	52
Average Queue (ft)	2	190	218	75	133	41	58	71	14
95th Queue (ft)	50	533	582	306	266	149	167	145	36
Link Distance (ft)		1381	1381			698	698	783	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	200			200	250				300
Storage Blk Time (%)		11	16		4	0		0	
Queuing Penalty (veh)		0	32		15	0		0	

Network Summary

Network wide Queuing Penalty: 200

Appendix D 2024 No Build Syncho and SimTraffic Reports

Queues
2: Graves Mill Rd & East Ramp

11/11/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	328	458	352	27	600	582
v/c Ratio	0.76	0.30	0.43	0.07	0.89	0.85
Control Delay	28.1	11.1	24.9	9.6	37.6	32.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.1	11.1	24.9	9.6	37.6	32.1
Queue Length 50th (ft)	93	60	68	0	238	211
Queue Length 95th (ft)	#170	83	106	18	#436	#404
Internal Link Dist (ft)		689	909			889
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	430	1516	827	398	696	703
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.30	0.43	0.07	0.86	0.83

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	302	421	0	0	324	25	0	0	0	920	0	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.95	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1787	3539			3539	1615				1681	1641	
Flt Permitted	0.39	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	738	3539			3539	1615				1681	1641	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	328	458	0	0	352	27	0	0	0	1000	0	182
RTOR Reduction (vph)	0	0	0	0	0	21	0	0	0	0	24	0
Lane Group Flow (vph)	328	458	0	0	352	6	0	0	0	600	558	0
Heavy Vehicles (%)	1%	2%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	30.0	30.0			16.4	16.4				28.0	28.0	
Effective Green, g (s)	30.0	30.0			16.4	16.4				28.0	28.0	
Actuated g/C Ratio	0.43	0.43			0.23	0.23				0.40	0.40	
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	430	1517			829	378				672	656	
v/s Ratio Prot	c0.08	0.13			0.10					c0.36	0.34	
v/s Ratio Perm	c0.24					0.00						
v/c Ratio	0.76	0.30			0.42	0.02				0.89	0.85	
Uniform Delay, d1	15.3	13.1			22.8	20.6				19.6	19.1	
Progression Factor	0.99	0.79			1.00	1.00				1.00	1.00	
Incremental Delay, d2	7.7	0.5			1.6	0.1				14.2	10.3	
Delay (s)	22.8	10.8			24.4	20.7				33.8	29.4	
Level of Service	C	B			C	C				C	C	
Approach Delay (s)		15.8			24.1			0.0			31.6	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM Average Control Delay	25.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	652	1155	215	1060	88	262
v/c Ratio	0.25	0.82	0.34	0.36	0.51	0.82
Control Delay	3.1	18.5	3.4	3.8	69.0	40.2
Queue Delay	0.0	0.9	0.0	0.0	0.0	0.0
Total Delay	3.1	19.3	3.4	3.8	69.0	40.2
Queue Length 50th (ft)	50	411	24	124	78	73
Queue Length 95th (ft)	58	403	m65	248	129	171
Internal Link Dist (ft)	795			689	507	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2557	1407	628	2916	250	383
Starvation Cap Reductn	0	78	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.87	0.34	0.36	0.35	0.68

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	600	1063	198	975	0	80	1	241	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1599	1787	3574			1753	1599		
Flt Permitted		1.00	1.00	0.37	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1599	693	3574			1753	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	652	1155	215	1060	0	87	1	262	0	0
RTOR Reduction (vph)	0	0	262	0	0	0	0	0	162	0	0
Lane Group Flow (vph)	0	652	893	215	1060	0	0	88	100	0	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		100.2	100.2	114.2	114.2			13.8	13.8		
Effective Green, g (s)		100.2	100.2	114.2	114.2			13.8	13.8		
Actuated g/C Ratio		0.72	0.72	0.82	0.82			0.10	0.10		
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		2558	1144	628	2915			173	158		
v/s Ratio Prot		0.18		0.02	c0.30			0.05			
v/s Ratio Perm			c0.56	0.26					c0.06		
v/c Ratio		0.25	0.78	0.34	0.36			0.51	0.63		
Uniform Delay, d1		6.9	12.8	3.1	3.4			59.9	60.7		
Progression Factor		0.39	4.83	0.77	0.95			1.00	1.00		
Incremental Delay, d2		0.2	3.8	0.2	0.2			2.3	8.0		
Delay (s)		2.9	65.7	2.6	3.4			62.2	68.6		
Level of Service		A	E	A	A			E	E		
Approach Delay (s)		43.1			3.3			67.0		0.0	
Approach LOS		D			A			E		A	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Queues
4: Graves Mill Rd & Creekside Dr

11/11/2013

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	32	1291	271	893	110	32	407	26	19
v/c Ratio	0.10	0.80	0.84	0.42	0.11	0.11	0.57	0.27	0.19
Control Delay	9.5	27.3	52.6	10.1	1.3	51.0	21.0	69.6	40.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	27.4	52.6	10.1	1.3	51.0	21.0	69.6	40.8
Queue Length 50th (ft)	12	534	160	243	4	25	156	23	6
Queue Length 95th (ft)	m19	657	231	236	m6	58	266	55	34
Internal Link Dist (ft)		697		795		461			536
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	325	1607	369	2144	1003	292	757	206	196
Starvation Cap Reductn	0	3	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.80	0.73	0.42	0.11	0.11	0.54	0.13	0.10

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	1173	15	249	822	101	14	16	374	24	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3565		1752	3574	1599		1527	1568	1805	1619	
Flt Permitted	0.32	1.00		0.06	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (perm)	606	3565		120	3574	1599		1527	1568	1805	1619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	1275	16	271	893	110	15	17	407	26	7	12
RTOR Reduction (vph)	0	1	0	0	0	47	0	0	124	0	11	0
Lane Group Flow (vph)	32	1290	0	271	893	63	0	32	283	26	8	0
Heavy Vehicles (%)	0%	1%	7%	3%	1%	1%	46%	0%	3%	0%	17%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	64.3	61.9		88.8	80.4	80.4		26.8	47.7	6.4	6.4	
Effective Green, g (s)	64.3	61.9		88.8	80.4	80.4		26.8	47.7	6.4	6.4	
Actuated g/C Ratio	0.46	0.44		0.63	0.57	0.57		0.19	0.34	0.05	0.05	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	299	1576		320	2052	918		292	601	83	74	
v/s Ratio Prot	0.00	0.36		c0.13	0.25			0.02	c0.07	c0.01	0.00	
v/s Ratio Perm	0.05			c0.41		0.04			0.11			
v/c Ratio	0.11	0.82		0.85	0.44	0.07		0.11	0.47	0.31	0.10	
Uniform Delay, d1	20.8	34.1		42.7	16.9	13.2		46.7	36.2	64.7	64.0	
Progression Factor	0.76	0.68		0.84	0.61	0.47		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	4.3		17.1	0.1	0.0		0.8	0.6	2.2	0.6	
Delay (s)	16.0	27.7		53.0	10.4	6.3		47.5	36.8	66.8	64.7	
Level of Service	B	C		D	B	A		D	D	E	E	
Approach Delay (s)		27.4			19.1			37.6			65.9	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1253	150	75	840	136	65
v/c Ratio	0.52	0.14	0.58	0.29	0.67	0.27
Control Delay	12.5	3.5	60.8	0.6	75.2	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.5	3.5	60.8	0.6	75.2	14.6
Queue Length 50th (ft)	278	13	66	9	121	0
Queue Length 95th (ft)	385	42	117	12	186	44
Internal Link Dist (ft)	1366			697	749	
Turn Bay Length (ft)		200	250			300
Base Capacity (vph)	2419	1084	150	2858	248	277
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	70	0	0	0	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.14	0.50	0.29	0.55	0.24

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1153	138	69	770	3	124	1	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1538	1752	3572			1775	1583			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1538	1752	3572			1775	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1253	150	75	837	3	135	1	65	0	0	0
RTOR Reduction (vph)	0	0	33	0	0	0	0	0	58	0	0	0
Lane Group Flow (vph)	0	1253	117	75	840	0	0	136	7	0	0	0
Heavy Vehicles (%)	0%	2%	5%	3%	1%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)		95.7	95.7	10.3	112.0			16.0	16.0			
Effective Green, g (s)		95.7	95.7	10.3	112.0			16.0	16.0			
Actuated g/C Ratio		0.68	0.68	0.07	0.80			0.11	0.11			
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		2419	1051	129	2858			203	181			
v/s Ratio Prot		c0.35		c0.04	0.24			c0.08				
v/s Ratio Perm			0.08						0.00			
v/c Ratio		0.52	0.11	0.58	0.29			0.67	0.04			
Uniform Delay, d1		10.9	7.6	62.8	3.7			59.5	55.2			
Progression Factor		1.00	1.00	0.71	0.08			1.00	1.00			
Incremental Delay, d2		0.8	0.2	6.1	0.1			8.1	0.1			
Delay (s)		11.6	7.8	50.5	0.4			67.6	55.3			
Level of Service		B	A	D	A			E	E			
Approach Delay (s)		11.2			4.5			63.6			0.0	
Approach LOS		B			A			E			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues
2: Graves Mill Rd & East Ramp

11/11/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	305	226	688	105	590	569
v/c Ratio	0.82	0.15	0.78	0.22	0.92	0.88
Control Delay	40.3	9.8	32.4	6.4	44.4	37.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	9.8	32.4	6.4	44.4	37.0
Queue Length 50th (ft)	105	25	146	0	246	217
Queue Length 95th (ft)	#231	66	#225	34	#448	#414
Internal Link Dist (ft)		689	904			897
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	370	1529	881	481	648	654
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.15	0.78	0.22	0.91	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	281	208	0	0	633	97	0	0	0	905	2	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.95	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1770	3406			3539	1615				1681	1637	
Flt Permitted	0.27	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	502	3406			3539	1615				1681	1637	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	305	226	0	0	688	105	0	0	0	984	2	173
RTOR Reduction (vph)	0	0	0	0	0	79	0	0	0	0	23	0
Lane Group Flow (vph)	305	226	0	0	688	26	0	0	0	590	546	0
Heavy Vehicles (%)	2%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	1%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	31.4	31.4			17.4	17.4				26.6	26.6	
Effective Green, g (s)	31.4	31.4			17.4	17.4				26.6	26.6	
Actuated g/C Ratio	0.45	0.45			0.25	0.25				0.38	0.38	
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	370	1528			880	401				639	622	
v/s Ratio Prot	c0.09	0.07			0.19					c0.35	0.33	
v/s Ratio Perm	c0.28					0.02						
v/c Ratio	0.82	0.15			0.78	0.07				0.92	0.88	
Uniform Delay, d1	21.2	11.4			24.5	20.1				20.7	20.2	
Progression Factor	0.95	0.83			1.00	1.00				1.00	1.00	
Incremental Delay, d2	13.7	0.2			6.9	0.3				19.1	13.3	
Delay (s)	33.8	9.7			31.4	20.4				39.8	33.5	
Level of Service	C	A			C	C				D	C	
Approach Delay (s)		23.5			29.9			0.0			36.7	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	31.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	458	1150	274	1347	49	399
v/c Ratio	0.22	0.86	0.43	0.55	0.12	0.93
Control Delay	9.2	17.3	8.3	8.1	41.9	72.0
Queue Delay	0.0	1.8	0.0	0.3	0.0	0.0
Total Delay	9.2	19.1	8.3	8.4	41.9	72.0
Queue Length 50th (ft)	75	738	77	214	35	295
Queue Length 95th (ft)	68	477	m102	m381	70	#481
Internal Link Dist (ft)	795			689	526	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2105	1334	644	2437	438	455
Starvation Cap Reductn	0	79	0	415	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.92	0.43	0.67	0.11	0.88

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	421	1058	252	1239	0	45	0	367	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1583	1770	3574			1752	1599		
Flt Permitted		1.00	1.00	0.47	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1583	880	3574			1752	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	458	1150	274	1347	0	49	0	399	0	0
RTOR Reduction (vph)	0	0	401	0	0	0	0	0	56	0	0
Lane Group Flow (vph)	0	458	749	274	1347	0	0	49	343	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		82.5	82.5	95.5	95.5			32.5	32.5		
Effective Green, g (s)		82.5	82.5	95.5	95.5			32.5	32.5		
Actuated g/C Ratio		0.59	0.59	0.68	0.68			0.23	0.23		
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		2106	933	645	2438			407	371		
v/s Ratio Prot		0.13		0.02	c0.38			0.03			
v/s Ratio Perm			c0.47	0.27					c0.21		
v/c Ratio		0.22	0.80	0.42	0.55			0.12	0.92		
Uniform Delay, d1		13.5	22.4	11.5	11.3			42.5	52.5		
Progression Factor		0.64	2.86	0.64	0.64			1.00	1.00		
Incremental Delay, d2		0.2	6.3	0.2	0.5			0.1	28.3		
Delay (s)		8.9	70.3	7.6	7.8			42.6	80.8		
Level of Service		A	E	A	A			D	F		
Approach Delay (s)		52.8			7.7			76.6		0.0	
Approach LOS		D			A			E		A	

Intersection Summary			
HCM Average Control Delay	35.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	1025	272	1280	123	90	364	103	63
v/c Ratio	0.23	0.61	0.72	0.62	0.12	0.36	0.64	0.63	0.33
Control Delay	7.3	11.4	29.5	14.9	2.5	60.8	34.6	77.5	32.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	7.3	11.4	29.5	14.9	2.5	60.8	34.6	77.6	32.9
Queue Length 50th (ft)	6	353	127	315	5	76	211	92	22
Queue Length 95th (ft)	m13	491	m207	332	m15	136	300	153	68
Internal Link Dist (ft)		697		795		453			535
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	212	1677	483	2073	988	250	671	204	231
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	4	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.61	0.56	0.62	0.12	0.36	0.54	0.52	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	931	12	250	1178	113	64	18	335	95	24	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3568		1770	3574	1615		1829	1599	1787	1733	
Flt Permitted	0.16	1.00		0.16	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (perm)	313	3568		290	3574	1615		1829	1599	1787	1733	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	1012	13	272	1280	123	70	20	364	103	26	37
RTOR Reduction (vph)	0	1	0	0	0	53	0	0	76	0	34	0
Lane Group Flow (vph)	48	1024	0	272	1280	70	0	90	288	103	29	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	69.8	65.8		90.0	80.0	80.0		19.1	37.3	12.9	12.9	
Effective Green, g (s)	69.8	65.8		90.0	80.0	80.0		19.1	37.3	12.9	12.9	
Actuated g/C Ratio	0.50	0.47		0.64	0.57	0.57		0.14	0.27	0.09	0.09	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	199	1677		379	2042	923		250	495	165	160	
v/s Ratio Prot	0.01	0.29		c0.09	0.36			0.05	c0.08	c0.06	0.02	
v/s Ratio Perm	0.11			c0.37		0.04			0.10			
v/c Ratio	0.24	0.61		0.72	0.63	0.08		0.36	0.58	0.62	0.18	
Uniform Delay, d1	19.1	27.6		18.1	20.0	13.4		54.9	44.6	61.2	58.7	
Progression Factor	0.44	0.35		1.45	0.69	0.99		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.5	1.4		5.0	0.5	0.0		4.0	1.8	7.2	0.6	
Delay (s)	8.9	11.0		31.2	14.4	13.3		58.9	46.3	68.4	59.2	
Level of Service	A	B		C	B	B		E	D	E	E	
Approach Delay (s)		10.9			17.0			48.8			64.9	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1	1175	236	235	1021	160	38
v/c Ratio	0.01	0.56	0.24	0.82	0.37	0.70	0.16
Control Delay	65.0	20.7	6.9	62.9	1.1	74.1	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.0	20.7	6.9	62.9	1.1	74.1	16.0
Queue Length 50th (ft)	1	344	35	226	26	142	0
Queue Length 95th (ft)	7	471	90	315	35	211	33
Internal Link Dist (ft)		1366			697	762	
Turn Bay Length (ft)	200		200	250			300
Base Capacity (vph)	73	2083	984	329	2749	251	260
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.56	0.24	0.71	0.37	0.64	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1081	217	216	939	0	147	0	35	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00			
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)	1805	3574	1583	1770	3574			1787	1615			
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)	1805	3574	1583	1770	3574			1787	1615			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1175	236	235	1021	0	160	0	38	0	0	0
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	1	1175	170	235	1021	0	0	160	5	0	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	1%	0%	0%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.2	76.8	76.8	27.3	102.9			17.9	17.9			
Effective Green, g (s)	1.2	76.8	76.8	27.3	102.9			17.9	17.9			
Actuated g/C Ratio	0.01	0.55	0.55	0.20	0.74			0.13	0.13			
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	15	1961	868	345	2627			228	206			
v/s Ratio Prot	0.00	c0.33		c0.13	0.29			c0.09				
v/s Ratio Perm			0.11						0.00			
v/c Ratio	0.07	0.60	0.20	0.68	0.39			0.70	0.02			
Uniform Delay, d1	68.8	21.2	16.0	52.3	6.9			58.5	53.4			
Progression Factor	1.00	1.00	1.00	0.77	0.13			1.00	1.00			
Incremental Delay, d2	1.9	1.4	0.5	4.4	0.1			9.4	0.0			
Delay (s)	70.7	22.6	16.5	44.8	1.0			67.9	53.5			
Level of Service	E	C	B	D	A			E	D			
Approach Delay (s)		21.6			9.2			65.1			0.0	
Approach LOS		C			A			E			A	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	3791	3879	3812	3803	3824	3796	3874
Vehs Exited	3742	3884	3810	3815	3812	3762	3807
Starting Vehs	114	166	123	143	140	136	114
Ending Vehs	163	161	125	131	152	170	181
Denied Entry Before	8	0	3	8	4	5	2
Denied Entry After	15	13	3	4	2	5	18
Travel Distance (mi)	2657	2701	2677	2682	2693	2654	2683
Travel Time (hr)	159.7	158.3	148.9	144.5	147.2	149.5	166.2
Total Delay (hr)	86.2	83.6	74.8	70.8	73.2	76.0	92.2
Total Stops	6209	6219	5485	5390	5471	5598	6257
Fuel Used (gal)	113.9	115.4	112.0	111.6	112.5	111.3	116.8

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	3828	3814	3894	3831
Vehs Exited	3811	3804	3831	3808
Starting Vehs	129	142	128	134
Ending Vehs	146	152	191	158
Denied Entry Before	5	2	5	5
Denied Entry After	1	4	3	5
Travel Distance (mi)	2689	2665	2726	2683
Travel Time (hr)	145.9	151.9	176.6	154.9
Total Delay (hr)	71.8	78.5	101.4	80.8
Total Stops	5439	5581	6982	5864
Fuel Used (gal)	111.9	112.3	119.8	113.7

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3791	3879	3812	3803	3824	3796	3874
Vehs Exited	3742	3884	3810	3815	3812	3762	3807
Starting Vehs	114	166	123	143	140	136	114
Ending Vehs	163	161	125	131	152	170	181
Denied Entry Before	8	0	3	8	4	5	2
Denied Entry After	15	13	3	4	2	5	18
Travel Distance (mi)	2657	2701	2677	2682	2693	2654	2683
Travel Time (hr)	159.7	158.3	148.9	144.5	147.2	149.5	166.2
Total Delay (hr)	86.2	83.6	74.8	70.8	73.2	76.0	92.2
Total Stops	6209	6219	5485	5390	5471	5598	6257
Fuel Used (gal)	113.9	115.4	112.0	111.6	112.5	111.3	116.8

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3828	3814	3894	3831
Vehs Exited	3811	3804	3831	3808
Starting Vehs	129	142	128	134
Ending Vehs	146	152	191	158
Denied Entry Before	5	2	5	5
Denied Entry After	1	4	3	5
Travel Distance (mi)	2689	2665	2726	2683
Travel Time (hr)	145.9	151.9	176.6	154.9
Total Delay (hr)	71.8	78.5	101.4	80.8
Total Stops	5439	5581	6982	5864
Fuel Used (gal)	111.9	112.3	119.8	113.7

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWR	All
Total Delay (hr)	3.7	1.2	2.1	0.1	7.5	1.2	15.8
Delay / Veh (s)	42.3	10.8	23.3	8.4	29.6	26.7	26.5
Total Stops	399	154	222	19	677	128	1599
Travel Dist (mi)	44.2	58.0	58.1	4.4	159.4	28.8	352.9
Travel Time (hr)	5.0	2.6	3.5	0.2	12.7	2.2	26.2
Avg Speed (mph)	9	22	17	28	14	15	15
Fuel Used (gal)	1.9	2.2	2.4	0.2	5.6	0.9	13.3
HC Emissions (g)	10	29	31	2	46	3	121
CO Emissions (g)	537	1388	1611	120	1474	125	5255
NOx Emissions (g)	39	100	99	6	136	11	390
Vehicles Entered	312	410	320	24	914	165	2145
Vehicles Exited	310	407	317	24	920	166	2144
Hourly Exit Rate	310	407	317	24	920	166	2144
Input Volume	302	421	324	25	920	167	2159
% of Volume	103	97	98	96	100	99	99
Denied Entry Before	0	0	0	0	2	0	2
Denied Entry After	0	0	0	0	2	0	2

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Total Delay (hr)	1.6	9.8	7.3	2.3	1.5	0.0	1.2	23.6
Delay / Veh (s)	9.4	33.4	137.2	7.9	65.5	65.6	18.3	26.5
Total Stops	96	605	290	151	75	1	212	1430
Travel Dist (mi)	98.0	171.6	29.0	151.2	8.3	0.1	24.8	483.0
Travel Time (hr)	4.0	15.8	8.3	6.7	1.8	0.0	2.2	38.8
Avg Speed (mph)	27	12	3	23	5	5	13	13
Fuel Used (gal)	5.1	7.2	2.9	9.2	0.6	0.0	1.1	26.1
HC Emissions (g)	70	39	15	123	4	0	10	262
CO Emissions (g)	3534	1506	728	6588	172	1	518	13046
NOx Emissions (g)	261	162	54	442	12	0	34	966
Vehicles Entered	606	1054	198	1040	81	1	242	3222
Vehicles Exited	605	1047	188	1029	82	1	242	3194
Hourly Exit Rate	605	1047	188	1029	82	1	242	3194
Input Volume	606	1063	198	1046	80	1	241	3235
% of Volume	100	98	95	98	102	100	100	99
Denied Entry Before	0	1	0	0	0	0	1	2
Denied Entry After	1	2	0	0	0	0	0	3

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.2	15.5	0.2	4.1	2.2	0.1	0.2	0.2	3.7	0.4	0.1	0.0
Delay / Veh (s)	23.3	47.7	52.6	62.3	9.2	2.5	53.9	49.5	34.8	73.1	66.3	11.7
Total Stops	26	1004	17	219	177	26	12	12	266	21	5	11
Travel Dist (mi)	4.0	165.5	2.3	39.0	136.5	16.3	1.3	1.5	35.9	2.3	0.6	1.2
Travel Time (hr)	0.3	19.3	0.3	5.3	5.5	0.6	0.3	0.3	5.1	0.5	0.1	0.1
Avg Speed (mph)	13	9	8	7	25	28	5	6	8	5	5	15
Fuel Used (gal)	0.2	9.4	0.1	2.1	5.8	0.6	0.1	0.1	1.9	0.2	0.0	0.0
HC Emissions (g)	1	73	3	22	57	8	6	0	17	0	2	0
CO Emissions (g)	93	2668	47	789	3237	401	96	28	597	21	28	9
NOx Emissions (g)	6	269	7	63	234	26	11	2	48	1	3	1
Vehicles Entered	28	1165	16	241	864	101	14	16	380	22	6	11
Vehicles Exited	29	1175	16	237	859	101	14	16	380	22	6	11
Hourly Exit Rate	29	1175	16	237	859	101	14	16	380	22	6	11
Input Volume	29	1184	15	249	870	101	14	16	374	24	6	11
% of Volume	100	99	107	95	99	100	100	100	102	92	100	100
Denied Entry Before	0	0	0	0	0	0	0	0	1	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	27.0
Delay / Veh (s)	34.0
Total Stops	1796
Travel Dist (mi)	406.5
Travel Time (hr)	37.8
Avg Speed (mph)	11
Fuel Used (gal)	20.5
HC Emissions (g)	188
CO Emissions (g)	8015
NOx Emissions (g)	670
Vehicles Entered	2864
Vehicles Exited	2866
Hourly Exit Rate	2866
Input Volume	2893
% of Volume	99
Denied Entry Before	1
Denied Entry After	0

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	All
Total Delay (hr)	8.2	0.2	1.0	0.6	0.0	2.2	0.0	0.6	12.8
Delay / Veh (s)	25.8	6.0	57.1	2.9	2.8	61.2		34.7	20.0
Total Stops	725	47	62	34	0	119	0	52	1039
Travel Dist (mi)	313.2	38.9	9.5	113.5	0.4	19.1	0.1	8.8	503.3
Travel Time (hr)	15.2	1.3	1.3	3.2	0.0	2.9	0.0	0.9	24.8
Avg Speed (mph)	21	30	7	35	30	7	9	11	20
Fuel Used (gal)	8.5	1.0	0.5	4.5	0.0	1.2	0.0	0.5	16.3
HC Emissions (g)	96	24	5	54	0	10	0	7	196
CO Emissions (g)	2749	765	185	2549	5	417	2	260	6933
NOx Emissions (g)	351	70	15	229	0	30	0	19	714
Vehicles Entered	1148	142	64	769	2	130	0	59	2314
Vehicles Exited	1133	142	66	776	2	131	0	60	2310
Hourly Exit Rate	1133	142	66	776	2	131	0	60	2310
Input Volume	1153	138	69	775	3	124	1	60	2323
% of Volume	98	103	96	100	67	106	0	100	99
Denied Entry Before	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	80.8
Delay / Veh (s)	76.2
Total Stops	5864
Travel Dist (mi)	2682.7
Travel Time (hr)	154.9
Avg Speed (mph)	18
Fuel Used (gal)	113.7
HC Emissions (g)	1234
CO Emissions (g)	53738
NOx Emissions (g)	4601
Vehicles Entered	3831
Vehicles Exited	3808
Hourly Exit Rate	3808
Input Volume	16493
% of Volume	23
Denied Entry Before	5
Denied Entry After	5

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LR
Maximum Queue (ft)	225	342	195	121	125	22	317	352
Average Queue (ft)	147	80	57	63	55	8	195	206
95th Queue (ft)	240	251	132	108	100	21	291	322
Link Distance (ft)		718	718	947	947			917
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	23	0			0		1	1
Queuing Penalty (veh)	48	0			0		5	4

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	149	602	400	299	595	518	177	183
Average Queue (ft)	44	187	347	216	167	120	74	75
95th Queue (ft)	105	555	464	343	548	449	143	137
Link Distance (ft)	800	800			718	718	541	
Upstream Blk Time (%)		0			1	0		
Queuing Penalty (veh)		0			5	1		
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			23	38			2	1
Queuing Penalty (veh)			68	184			4	1

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	58	766	738	378	148	178	47	380	175	70	64
Average Queue (ft)	18	459	608	178	67	84	13	131	151	21	13
95th Queue (ft)	47	893	877	307	123	144	34	352	208	56	43
Link Distance (ft)		698	698		800	800		489			558
Upstream Blk Time (%)		5	12					0			
Queuing Penalty (veh)		32	71					0			
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		5		0				0	22		
Queuing Penalty (veh)		1		1				1	7		

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	428	530	325	147	59	73	209	88
Average Queue (ft)	179	261	42	61	9	20	108	31
95th Queue (ft)	380	505	222	119	39	58	185	67
Link Distance (ft)	1382	1382			698	698	771	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			200	250				300
Storage Blk Time (%)	5	17						
Queuing Penalty (veh)	0	24						

Network Summary

Network wide Queuing Penalty: 457

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	3841	4117	3700	3760	3873	3834	3847
Vehs Exited	3806	3993	3629	3716	3783	3747	3779
Starting Vehs	179	142	176	184	152	157	148
Ending Vehs	214	266	247	228	242	244	216
Denied Entry Before	2	6	8	6	3	4	3
Denied Entry After	535	380	607	662	436	508	639
Travel Distance (mi)	2550	2690	2391	2490	2524	2518	2480
Travel Time (hr)	465.1	344.4	507.6	509.7	370.2	422.5	467.0
Total Delay (hr)	394.5	269.7	440.6	440.7	299.9	352.7	397.8
Total Stops	8103	8460	8100	8908	7995	8255	7893
Fuel Used (gal)	181.7	157.9	186.6	189.6	159.0	170.3	179.8

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	3713	3825	3862	3837
Vehs Exited	3699	3726	3777	3765
Starting Vehs	182	176	160	164
Ending Vehs	196	275	245	235
Denied Entry Before	7	5	2	3
Denied Entry After	781	597	516	566
Travel Distance (mi)	2422	2498	2512	2507
Travel Time (hr)	569.5	509.1	437.7	460.3
Total Delay (hr)	501.7	439.6	367.9	390.5
Total Stops	7974	8612	8087	8241
Fuel Used (gal)	201.5	190.2	174.0	179.1

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3841	4117	3700	3760	3873	3834	3847
Vehs Exited	3806	3993	3629	3716	3783	3747	3779
Starting Vehs	179	142	176	184	152	157	148
Ending Vehs	214	266	247	228	242	244	216
Denied Entry Before	2	6	8	6	3	4	3
Denied Entry After	535	380	607	662	436	508	639
Travel Distance (mi)	2550	2690	2391	2490	2524	2518	2480
Travel Time (hr)	465.1	344.4	507.6	509.7	370.2	422.5	467.0
Total Delay (hr)	394.5	269.7	440.6	440.7	299.9	352.7	397.8
Total Stops	8103	8460	8100	8908	7995	8255	7893
Fuel Used (gal)	181.7	157.9	186.6	189.6	159.0	170.3	179.8

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3713	3825	3862	3837
Vehs Exited	3699	3726	3777	3765
Starting Vehs	182	176	160	164
Ending Vehs	196	275	245	235
Denied Entry Before	7	5	2	3
Denied Entry After	781	597	516	566
Travel Distance (mi)	2422	2498	2512	2507
Travel Time (hr)	569.5	509.1	437.7	460.3
Total Delay (hr)	501.7	439.6	367.9	390.5
Total Stops	7974	8612	8087	8241
Fuel Used (gal)	201.5	190.2	174.0	179.1

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWT	NWR	All
Total Delay (hr)	3.6	0.5	89.8	8.6	184.2	0.4	30.6	317.7
Delay / Veh (s)	46.9	9.2	676.4	422.9	1214.5	697.0	1123.8	680.8
Total Stops	318	71	1504	193	1722	4	271	4083
Travel Dist (mi)	40.0	28.9	85.7	13.2	96.3	0.3	17.2	281.6
Travel Time (hr)	4.9	1.2	91.9	9.0	187.3	0.4	31.2	325.9
Avg Speed (mph)	8	24	2	4	3	4	4	3
Fuel Used (gal)	1.9	1.1	23.4	2.4	45.0	0.1	7.5	81.4
HC Emissions (g)	13	20	105	3	139	0	21	301
CO Emissions (g)	546	770	3063	282	4034	5	646	9347
NOx Emissions (g)	41	62	198	16	202	0	32	551
Vehicles Entered	278	204	502	75	561	2	99	1721
Vehicles Exited	280	205	454	72	531	2	96	1640
Hourly Exit Rate	280	205	454	72	531	2	96	1640
Input Volume	281	208	633	97	905	2	159	2285
% of Volume	100	99	72	74	59	100	60	72
Denied Entry Before	0	0	0	0	2	0	0	2
Denied Entry After	0	0	137	20	350	1	58	566

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBR	All
Total Delay (hr)	0.9	6.9	19.4	11.6	0.7	2.4	41.8
Delay / Veh (s)	7.8	23.0	475.0	49.9	61.2	23.7	52.3
Total Stops	71	394	581	537	36	310	1929
Travel Dist (mi)	67.3	172.8	21.6	123.0	4.4	38.0	427.2
Travel Time (hr)	2.6	13.1	20.1	14.9	0.9	3.8	55.4
Avg Speed (mph)	27	14	1	8	5	12	8
Fuel Used (gal)	3.2	6.3	5.2	9.4	0.3	1.6	26.0
HC Emissions (g)	32	49	19	100	2	10	213
CO Emissions (g)	2069	1825	532	4764	86	559	9835
NOx Emissions (g)	128	167	43	361	6	34	739
Vehicles Entered	418	1075	149	836	42	358	2878
Vehicles Exited	420	1076	145	834	41	358	2874
Hourly Exit Rate	420	1076	145	834	41	358	2874
Input Volume	421	1058	252	1286	45	367	3429
% of Volume	100	102	58	65	91	98	84
Denied Entry Before	0	1	0	0	0	0	1
Denied Entry After	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.2	5.7	0.1	2.8	2.8	0.1	1.2	0.3	3.6	1.8	0.3	0.2
Delay / Veh (s)	18.8	19.4	21.6	59.2	11.0	2.3	64.6	63.3	37.9	70.6	54.7	18.3
Total Stops	41	388	9	170	263	25	63	17	276	87	19	28
Travel Dist (mi)	6.7	142.3	1.9	27.8	143.6	13.5	6.0	1.6	32.2	9.7	2.4	3.3
Travel Time (hr)	0.4	8.9	0.1	3.7	6.4	0.5	1.4	0.4	5.0	2.1	0.4	0.3
Avg Speed (mph)	15	16	13	8	22	27	4	5	7	5	6	12
Fuel Used (gal)	0.3	6.5	0.1	1.8	6.5	0.5	0.5	0.1	1.8	0.7	0.1	0.1
HC Emissions (g)	2	49	0	19	75	5	1	0	9	3	1	1
CO Emissions (g)	149	2433	16	872	4115	369	84	25	506	161	36	45
NOx Emissions (g)	9	206	2	61	281	19	6	2	36	10	2	3
Vehicles Entered	47	1049	13	171	906	83	65	18	347	91	22	31
Vehicles Exited	48	1061	13	171	902	83	66	18	346	92	23	31
Hourly Exit Rate	48	1061	13	171	902	83	66	18	346	92	23	31
Input Volume	44	1060	12	250	1244	113	64	18	335	95	24	34
% of Volume	109	100	108	68	73	73	103	100	103	97	96	91
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	19.1
Delay / Veh (s)	24.1
Total Stops	1386
Travel Dist (mi)	391.0
Travel Time (hr)	29.7
Avg Speed (mph)	13
Fuel Used (gal)	19.2
HC Emissions (g)	165
CO Emissions (g)	8811
NOx Emissions (g)	636
Vehicles Entered	2843
Vehicles Exited	2854
Hourly Exit Rate	2854
Input Volume	3293
% of Volume	87
Denied Entry Before	0
Denied Entry After	0

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	All
Total Delay (hr)	0.0	5.1	0.3	1.9	0.7	2.3	0.2	10.5
Delay / Veh (s)	41.9	17.2	5.6	44.1	3.0	59.0	18.1	15.6
Total Stops	1	453	73	139	27	122	28	843
Travel Dist (mi)	0.2	296.5	59.9	22.3	112.0	20.8	5.1	516.8
Travel Time (hr)	0.0	11.8	2.0	2.6	3.3	3.0	0.4	23.1
Avg Speed (mph)	10	25	30	9	34	7	16	22
Fuel Used (gal)	0.0	7.7	1.5	1.1	5.1	1.3	0.2	17.0
HC Emissions (g)	0	58	20	10	57	7	2	154
CO Emissions (g)	1	2085	773	397	3186	414	110	6967
NOx Emissions (g)	0	271	68	30	241	26	6	641
Vehicles Entered	1	1085	219	152	803	139	34	2433
Vehicles Exited	1	1074	219	155	807	140	35	2431
Hourly Exit Rate	1	1074	219	155	807	140	35	2431
Input Volume	1	1081	217	216	1061	147	35	2758
% of Volume	100	99	101	72	76	95	100	88
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	390.5
Delay / Veh (s)	370.0
Total Stops	8241
Travel Dist (mi)	2507.5
Travel Time (hr)	460.3
Avg Speed (mph)	11
Fuel Used (gal)	179.1
HC Emissions (g)	1281
CO Emissions (g)	53962
NOx Emissions (g)	4333
Vehicles Entered	3837
Vehicles Exited	3765
Hourly Exit Rate	3765
Input Volume	18188
% of Volume	21
Denied Entry Before	3
Denied Entry After	566

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LTR
Maximum Queue (ft)	225	318	110	979	974	225	450	962
Average Queue (ft)	150	74	31	759	736	82	428	866
95th Queue (ft)	246	272	76	1237	1235	239	536	1212
Link Distance (ft)		718	718	942	942			925
Upstream Blk Time (%)				47	27			50
Queuing Penalty (veh)				0	0			0
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	23				55		81	42
Queuing Penalty (veh)	24				53		495	189

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	153	343	399	300	743	749	110	266
Average Queue (ft)	37	46	251	298	723	509	39	116
95th Queue (ft)	107	234	435	302	762	995	88	211
Link Distance (ft)	800	800			718	718	560	
Upstream Blk Time (%)					64	16		
Queuing Penalty (veh)					489	120		
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			10	92	2		0	5
Queuing Penalty (veh)			20	569	4		0	2

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	77	455	665	312	223	244	28	375	175	159	96
Average Queue (ft)	27	77	253	132	100	124	10	132	144	80	32
95th Queue (ft)	61	270	572	254	189	217	27	313	211	142	72
Link Distance (ft)		698	698		800	800		481			558
Upstream Blk Time (%)			0					0			
Queuing Penalty (veh)			1					0			
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		0				0		1	22	3	0
Queuing Penalty (veh)		0				0		4	18	2	0

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	10	300	382	91	266	73	88	213	52
Average Queue (ft)	0	143	201	27	127	8	15	109	13
95th Queue (ft)	5	266	336	64	231	42	56	185	36
Link Distance (ft)		1382	1382			698	698	784	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	200			200	250				300
Storage Blk Time (%)		2	6		1	0			
Queuing Penalty (veh)		0	14		3	0			

Network Summary

Network wide Queuing Penalty: 2008

Appendix E 2024 Build Syncho and SimTraffic Reports

Queues
2: Graves Mill Rd & East Ramp

11/11/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	354	497	386	27	636	624
v/c Ratio	0.70	0.30	0.42	0.06	0.86	0.84
Control Delay	21.3	12.6	47.8	18.9	46.7	44.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.3	12.6	47.8	18.9	46.7	44.5
Queue Length 50th (ft)	152	97	158	1	524	495
Queue Length 95th (ft)	269	155	233	30	661	633
Internal Link Dist (ft)		689	906			906
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	558	1670	923	440	828	821
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.30	0.42	0.06	0.77	0.76

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	326	457	0	0	355	25	0	0	0	992	0	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.96	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1787	3539			3539	1615				1681	1644	
Flt Permitted	0.36	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	681	3539			3539	1615				1681	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	354	497	0	0	386	27	0	0	0	1078	0	182
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	0	0	12	0
Lane Group Flow (vph)	354	497	0	0	386	9	0	0	0	636	612	0
Heavy Vehicles (%)	1%	2%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	66.1	66.1			36.6	36.6				61.9	61.9	
Effective Green, g (s)	66.1	66.1			36.6	36.6				61.9	61.9	
Actuated g/C Ratio	0.47	0.47			0.26	0.26				0.44	0.44	
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	507	1671			925	422				743	727	
v/s Ratio Prot	c0.12	0.14			0.11					c0.38	0.37	
v/s Ratio Perm	c0.21					0.01						
v/c Ratio	0.70	0.30			0.42	0.02				0.86	0.84	
Uniform Delay, d1	25.3	22.7			42.9	38.4				35.0	34.7	
Progression Factor	0.52	0.50			1.00	1.00				1.00	1.00	
Incremental Delay, d2	4.1	0.4			1.4	0.1				9.5	8.8	
Delay (s)	17.3	11.9			44.2	38.5				44.6	43.5	
Level of Service	B	B			D	D				D	D	
Approach Delay (s)		14.1			43.9			0.0			44.0	
Approach LOS		B			D			A			D	

Intersection Summary			
HCM Average Control Delay	33.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	717	1254	215	1172	88	290
v/c Ratio	0.29	0.90	0.38	0.42	0.39	0.88
Control Delay	3.4	24.3	4.8	4.4	59.9	57.0
Queue Delay	0.0	3.5	0.0	0.4	0.0	0.0
Total Delay	3.4	27.9	4.8	4.8	59.9	57.0
Queue Length 50th (ft)	55	482	52	157	73	136
Queue Length 95th (ft)	m60	m#626	m59	178	127	#269
Internal Link Dist (ft)	795			689	509	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2460	1389	560	2810	275	371
Starvation Cap Reductn	0	80	0	960	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.96	0.38	0.63	0.32	0.78

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	660	1154	198	1078	0	80	1	267	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1599	1787	3574			1753	1599		
Flt Permitted		1.00	1.00	0.34	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1599	633	3574			1753	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	717	1254	215	1172	0	87	1	290	0	0
RTOR Reduction (vph)	0	0	288	0	0	0	0	0	124	0	0
Lane Group Flow (vph)	0	717	966	215	1172	0	0	88	166	0	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		96.4	96.4	110.1	110.1			17.9	17.9		
Effective Green, g (s)		96.4	96.4	110.1	110.1			17.9	17.9		
Actuated g/C Ratio		0.69	0.69	0.79	0.79			0.13	0.13		
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		2461	1101	561	2811			224	204		
v/s Ratio Prot		0.20		0.02	c0.33			0.05			
v/s Ratio Perm			c0.60	0.28					c0.10		
v/c Ratio		0.29	0.88	0.38	0.42			0.39	0.81		
Uniform Delay, d1		8.5	17.1	4.3	4.8			56.1	59.4		
Progression Factor		0.36	3.89	0.81	0.78			1.00	1.00		
Incremental Delay, d2		0.2	6.4	0.3	0.3			1.1	21.5		
Delay (s)		3.3	73.0	3.8	4.1			57.2	80.9		
Level of Service		A	E	A	A			E	F		
Approach Delay (s)		47.6			4.0			75.4		0.0	
Approach LOS		D			A			E		A	

Intersection Summary			
HCM Average Control Delay	34.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	101.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	32	1456	271	1034	110	32	407	26	19
v/c Ratio	0.11	0.90	0.87	0.48	0.11	0.11	0.58	0.27	0.19
Control Delay	7.9	28.3	73.3	6.4	0.5	51.0	22.4	69.6	40.8
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.9	28.3	73.3	6.4	0.5	51.0	22.4	69.6	40.8
Queue Length 50th (ft)	11	524	150	129	1	25	162	23	6
Queue Length 95th (ft)	m12	#798	m#304	129	m4	58	281	55	34
Internal Link Dist (ft)		697		795		460			536
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	283	1618	340	2144	1003	292	732	206	196
Starvation Cap Reductn	0	3	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.90	0.80	0.48	0.11	0.11	0.56	0.13	0.10

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	1325	15	249	951	101	14	16	374	24	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3566		1752	3574	1599		1527	1568	1805	1619	
Flt Permitted	0.27	1.00		0.06	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (perm)	512	3566		108	3574	1599		1527	1568	1805	1619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	1440	16	271	1034	110	15	17	407	26	7	12
RTOR Reduction (vph)	0	1	0	0	0	47	0	0	119	0	11	0
Lane Group Flow (vph)	32	1455	0	271	1034	63	0	32	288	26	8	0
Heavy Vehicles (%)	0%	1%	7%	3%	1%	1%	46%	0%	3%	0%	17%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	64.7	62.3		88.8	80.4	80.4		26.8	47.3	6.4	6.4	
Effective Green, g (s)	64.7	62.3		88.8	80.4	80.4		26.8	47.3	6.4	6.4	
Actuated g/C Ratio	0.46	0.44		0.63	0.57	0.57		0.19	0.34	0.05	0.05	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	259	1587		309	2052	918		292	597	83	74	
v/s Ratio Prot	0.00	c0.41		c0.13	0.29			0.02	c0.07	c0.01	0.00	
v/s Ratio Perm	0.06			0.43		0.04			0.11			
v/c Ratio	0.12	0.92		0.88	0.50	0.07		0.11	0.48	0.31	0.10	
Uniform Delay, d1	20.6	36.4		45.6	17.9	13.2		46.7	36.7	64.7	64.0	
Progression Factor	0.62	0.57		1.25	0.35	0.12		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	8.4		21.1	0.2	0.0		0.8	0.6	2.2	0.6	
Delay (s)	13.1	29.2		78.1	6.4	1.6		47.5	37.3	66.8	64.7	
Level of Service	B	C		E	A	A		D	D	E	E	
Approach Delay (s)		28.9			19.7			38.0			65.9	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1418	168	75	980	160	65
v/c Ratio	0.59	0.16	0.60	0.35	0.71	0.25
Control Delay	11.4	1.9	63.4	0.6	75.1	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.4	1.9	63.4	0.6	75.1	13.7
Queue Length 50th (ft)	355	2	70	8	142	0
Queue Length 95th (ft)	457	29	122	14	211	43
Internal Link Dist (ft)	1132			697	755	
Turn Bay Length (ft)		200	250			300
Base Capacity (vph)	2385	1070	138	2814	265	291
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	88	0	0	0	0	2
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.16	0.54	0.35	0.60	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1305	155	69	899	3	146	1	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1538	1752	3573			1775	1583			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1538	1752	3573			1775	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1418	168	75	977	3	159	1	65	0	0	0
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	57	0	0	0
Lane Group Flow (vph)	0	1418	134	75	980	0	0	160	8	0	0	0
Heavy Vehicles (%)	0%	2%	5%	3%	1%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)		94.3	94.3	9.9	110.2			17.8	17.8			
Effective Green, g (s)		94.3	94.3	9.9	110.2			17.8	17.8			
Actuated g/C Ratio		0.67	0.67	0.07	0.79			0.13	0.13			
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		2384	1036	124	2812			226	201			
v/s Ratio Prot		c0.40		c0.04	0.27			c0.09				
v/s Ratio Perm			0.09						0.01			
v/c Ratio		0.59	0.13	0.60	0.35			0.71	0.04			
Uniform Delay, d1		12.4	8.2	63.2	4.4			58.6	53.6			
Progression Factor		0.78	0.40	0.72	0.07			1.00	1.00			
Incremental Delay, d2		0.9	0.2	7.3	0.1			9.7	0.1			
Delay (s)		10.6	3.5	52.4	0.4			68.3	53.7			
Level of Service		B	A	D	A			E	D			
Approach Delay (s)		9.9			4.1			64.1			0.0	
Approach LOS		A			A			E			A	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	321	1272	886	176	258	137
v/c Ratio	0.77	0.60	0.70	0.26	0.62	0.29
Control Delay	24.9	10.2	18.2	3.8	32.0	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	10.2	18.2	3.8	32.0	6.4
Queue Length 50th (ft)	66	160	155	11	100	0
Queue Length 95th (ft)	#178	215	195	32	172	40
Internal Link Dist (ft)		164	153		311	
Turn Bay Length (ft)						100
Base Capacity (vph)	437	2123	1260	688	413	475
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.60	0.70	0.26	0.62	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	295	1170	815	162	237	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3539	3539	1615	1805	1615
Flt Permitted	0.16	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	299	3539	3539	1615	1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	1272	886	176	258	137
RTOR Reduction (vph)	0	0	0	113	0	106
Lane Group Flow (vph)	321	1272	886	63	258	31
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%
Turn Type	pm+pt			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	42.0	42.0	24.9	24.9	16.0	16.0
Effective Green, g (s)	42.0	42.0	24.9	24.9	16.0	16.0
Actuated g/C Ratio	0.60	0.60	0.36	0.36	0.23	0.23
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	418	2123	1259	574	413	369
v/s Ratio Prot	c0.12	0.36	0.25		c0.14	
v/s Ratio Perm	c0.34			0.04		0.02
v/c Ratio	0.77	0.60	0.70	0.11	0.62	0.08
Uniform Delay, d1	11.6	8.7	19.4	15.1	24.3	21.2
Progression Factor	1.00	1.00	0.76	1.36	1.00	1.00
Incremental Delay, d2	8.2	1.3	3.1	0.4	7.0	0.5
Delay (s)	19.8	10.0	17.9	20.9	31.3	21.7
Level of Service	B	B	B	C	C	C
Approach Delay (s)		12.0	18.4		27.9	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues
2: Graves Mill Rd & East Ramp

11/11/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT
Lane Group Flow (vph)	358	262	748	105	634	616
v/c Ratio	0.85	0.16	0.80	0.22	0.92	0.90
Control Delay	47.4	7.2	49.1	17.1	53.3	49.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.4	7.2	49.1	17.1	53.3	49.4
Queue Length 50th (ft)	194	31	291	25	468	437
Queue Length 95th (ft)	#355	50	#373	71	#708	#672
Internal Link Dist (ft)		689	908			895
Turn Bay Length (ft)	125			125	300	
Base Capacity (vph)	419	1668	937	475	714	709
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.16	0.80	0.22	0.89	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	329	241	0	0	688	97	0	0	0	989	2	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	
Frt	1.00	1.00			1.00	0.85				1.00	0.96	
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (prot)	1770	3406			3539	1615				1681	1641	
Flt Permitted	0.19	1.00			1.00	1.00				0.95	0.97	
Satd. Flow (perm)	346	3406			3539	1615				1681	1641	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	262	0	0	748	105	0	0	0	1075	2	173
RTOR Reduction (vph)	0	0	0	0	0	47	0	0	0	0	12	0
Lane Group Flow (vph)	358	262	0	0	748	58	0	0	0	634	604	0
Heavy Vehicles (%)	2%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	1%
Turn Type	pm+pt					Perm				Split		
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						
Actuated Green, G (s)	58.8	58.8			31.8	31.8				49.2	49.2	
Effective Green, g (s)	58.8	58.8			31.8	31.8				49.2	49.2	
Actuated g/C Ratio	0.49	0.49			0.27	0.27				0.41	0.41	
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	
Lane Grp Cap (vph)	419	1669			938	428				689	673	
v/s Ratio Prot	c0.15	0.08			0.21					c0.38	0.37	
v/s Ratio Perm	c0.27					0.04						
v/c Ratio	0.85	0.16			0.80	0.14				0.92	0.90	
Uniform Delay, d1	37.2	16.9			41.1	33.6				33.5	33.1	
Progression Factor	0.68	0.40			1.00	1.00				1.00	1.00	
Incremental Delay, d2	15.3	0.2			7.0	0.7				17.6	14.7	
Delay (s)	40.7	6.9			48.1	34.3				51.2	47.7	
Level of Service	D	A			D	C				D	D	
Approach Delay (s)		26.4			46.4			0.0			49.5	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM Average Control Delay	43.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	109.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	545	1354	274	1498	49	437
v/c Ratio	0.26	1.02	0.51	0.62	0.12	1.08
Control Delay	5.5	42.2	2.6	2.6	38.2	108.0
Queue Delay	0.0	10.6	0.0	0.2	0.0	0.0
Total Delay	5.5	52.8	2.6	2.7	38.2	108.0
Queue Length 50th (ft)	41	~696	14	87	30	~344
Queue Length 95th (ft)	m56	m#497	m14	81	65	#551
Internal Link Dist (ft)	795			689	514	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2085	1329	537	2412	394	403
Starvation Cap Reductn	0	39	0	236	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	1.05	0.51	0.69	0.12	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	501	1246	252	1378	0	45	0	402	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1583	1770	3574			1752	1599		
Flt Permitted		1.00	1.00	0.39	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1583	731	3574			1752	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	545	1354	274	1498	0	49	0	437	0	0
RTOR Reduction (vph)	0	0	405	0	0	0	0	0	43	0	0
Lane Group Flow (vph)	0	545	949	274	1498	0	0	49	394	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Perm	pm+pt			Split		Perm		
Protected Phases		2		1	6		4	4			
Permitted Phases			2	6					4		
Actuated Green, G (s)		70.0	70.0	81.0	81.0			27.0	27.0		
Effective Green, g (s)		70.0	70.0	81.0	81.0			27.0	27.0		
Actuated g/C Ratio		0.58	0.58	0.68	0.68			0.22	0.22		
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0		
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)		2085	923	537	2412			394	360		
v/s Ratio Prot		0.15		0.02	c0.42			0.03			
v/s Ratio Perm			c0.60	0.32					c0.25		
v/c Ratio		0.26	1.03	0.51	0.62			0.12	1.09		
Uniform Delay, d1		12.3	25.0	9.6	10.9			37.1	46.5		
Progression Factor		0.43	2.88	0.10	0.17			1.00	1.00		
Incremental Delay, d2		0.2	30.7	0.4	0.6			0.1	74.9		
Delay (s)		5.5	102.7	1.4	2.5			37.2	121.4		
Level of Service		A	F	A	A			D	F		
Approach Delay (s)		74.8			2.3			112.9		0.0	
Approach LOS		E			A			F		A	

Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	109.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	1316	272	1470	123	90	364	103	63
v/c Ratio	0.32	0.92	0.90	0.81	0.14	0.30	0.57	0.58	0.30
Control Delay	17.0	22.4	62.4	24.1	3.6	48.3	25.0	63.7	28.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Total Delay	17.0	22.4	62.4	24.1	3.6	48.3	25.1	63.7	28.1
Queue Length 50th (ft)	7	331	165	374	9	62	149	77	19
Queue Length 95th (ft)	m9	#647	m#264	m431	m20	118	262	132	61
Internal Link Dist (ft)		697		795		478			542
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	151	1427	314	1847	894	305	650	238	263
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	28	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.92	0.87	0.80	0.14	0.30	0.59	0.43	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	1199	12	250	1352	113	64	18	335	95	24	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3569		1770	3574	1615		1829	1599	1787	1733	
Flt Permitted	0.11	1.00		0.09	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (perm)	207	3569		170	3574	1615		1829	1599	1787	1733	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	1303	13	272	1470	123	70	20	364	103	26	37
RTOR Reduction (vph)	0	1	0	0	0	62	0	0	85	0	33	0
Lane Group Flow (vph)	48	1315	0	272	1470	62	0	90	279	103	30	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	47.9	47.9		60.0	60.0	60.0		20.0	36.1	12.0	12.0	
Effective Green, g (s)	47.9	47.9		60.0	60.0	60.0		20.0	36.1	12.0	12.0	
Actuated g/C Ratio	0.40	0.40		0.50	0.50	0.50		0.17	0.30	0.10	0.10	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	136	1425		300	1787	808		305	561	179	173	
v/s Ratio Prot	0.01	c0.37		0.12	c0.41			0.05	c0.07	c0.06	0.02	
v/s Ratio Perm	0.13			0.33		0.04			0.11			
v/c Ratio	0.35	0.92		0.91	0.82	0.08		0.30	0.50	0.58	0.17	
Uniform Delay, d1	38.6	34.3		35.3	25.5	15.6		43.8	34.5	51.6	49.4	
Progression Factor	0.39	0.37		1.26	0.84	1.21		1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	8.3		21.7	2.2	0.0		2.5	0.7	4.4	0.5	
Delay (s)	16.1	21.2		66.1	23.6	18.9		46.3	35.2	56.0	49.9	
Level of Service	B	C		E	C	B		D	D	E	D	
Approach Delay (s)		21.0			29.5			37.4			53.7	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1	1467	309	235	1210	193	38
v/c Ratio	0.01	0.73	0.32	1.00	0.48	0.69	0.13
Control Delay	42.0	14.7	2.9	91.5	1.5	60.2	13.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.0	14.7	2.9	91.5	1.5	60.2	13.4
Queue Length 50th (ft)	1	291	11	194	24	143	0
Queue Length 95th (ft)	m1	367	m32	m#299	50	212	30
Internal Link Dist (ft)		1099			697	750	
Turn Bay Length (ft)	200		200	250			300
Base Capacity (vph)	108	2001	966	236	2539	290	294
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.73	0.32	1.00	0.48	0.67	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1350	284	216	1113	0	178	0	35	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00			
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)	1805	3574	1583	1770	3574			1787	1615			
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)	1805	3574	1583	1770	3574			1787	1615			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1467	309	235	1210	0	193	0	38	0	0	0
RTOR Reduction (vph)	0	0	86	0	0	0	0	0	32	0	0	0
Lane Group Flow (vph)	1	1467	223	235	1210	0	0	193	6	0	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	1%	0%	0%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)	2.7	62.4	62.4	20.8	80.5			18.8	18.8			
Effective Green, g (s)	2.7	62.4	62.4	20.8	80.5			18.8	18.8			
Actuated g/C Ratio	0.02	0.52	0.52	0.17	0.67			0.16	0.16			
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	41	1858	823	307	2398			280	253			
v/s Ratio Prot	0.00	c0.41		c0.13	0.34			c0.11				
v/s Ratio Perm			0.14						0.00			
v/c Ratio	0.02	0.79	0.27	0.77	0.50			0.69	0.02			
Uniform Delay, d1	57.4	23.5	16.1	47.3	9.8			47.8	42.8			
Progression Factor	0.83	0.62	0.36	0.86	0.11			1.00	1.00			
Incremental Delay, d2	0.2	2.7	0.6	7.0	0.1			6.9	0.0			
Delay (s)	47.6	17.1	6.5	47.7	1.2			54.7	42.9			
Level of Service	D	B	A	D	A			D	D			
Approach Delay (s)		15.3			8.8			52.8			0.0	
Approach LOS		B			A			D			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	441	1255	1063	263	472	275
v/c Ratio	0.96	0.58	0.88	0.38	0.90	0.41
Control Delay	67.3	15.5	29.1	2.8	62.2	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.3	15.5	29.1	2.8	62.2	6.1
Queue Length 50th (ft)	284	290	368	10	351	2
Queue Length 95th (ft)	#487	352	#479	25	#544	65
Internal Link Dist (ft)		191	182		311	
Turn Bay Length (ft)						
Base Capacity (vph)	469	2174	1210	701	526	663
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.58	0.88	0.38	0.90	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	406	1155	978	242	434	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3574	3574	1615	1805	1615
Flt Permitted	0.09	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	163	3574	3574	1615	1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	441	1255	1063	263	472	275
RTOR Reduction (vph)	0	0	0	154	0	192
Lane Group Flow (vph)	441	1255	1063	109	472	83
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Turn Type	pm+pt			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	73.0	73.0	40.6	40.6	35.0	35.0
Effective Green, g (s)	73.0	73.0	40.6	40.6	35.0	35.0
Actuated g/C Ratio	0.61	0.61	0.34	0.34	0.29	0.29
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	460	2174	1209	546	526	471
v/s Ratio Prot	c0.21	0.35	0.30		c0.26	
v/s Ratio Perm	c0.37			0.07		0.05
v/c Ratio	0.96	0.58	0.88	0.20	0.90	0.18
Uniform Delay, d1	36.8	14.2	37.4	28.2	40.8	31.7
Progression Factor	1.00	1.00	0.54	0.26	1.00	1.00
Incremental Delay, d2	31.2	1.1	8.3	0.7	20.7	0.8
Delay (s)	68.0	15.3	28.3	8.0	61.4	32.6
Level of Service	E	B	C	A	E	C
Approach Delay (s)		29.0	24.2		50.8	
Approach LOS		C	C		D	

Intersection Summary			
HCM Average Control Delay	31.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	4456	4589	4492	4621	4510	4583	4625
Vehs Exited	4398	4548	4497	4522	4410	4499	4465
Starting Vehs	174	166	199	192	183	194	156
Ending Vehs	232	207	194	291	283	278	316
Denied Entry Before	1	9	3	5	3	2	4
Denied Entry After	18	26	164	33	37	34	22
Travel Distance (mi)	3046	3107	3056	3109	3051	3082	3060
Travel Time (hr)	234.3	230.0	230.5	265.2	265.8	243.3	230.1
Total Delay (hr)	146.8	140.3	142.4	175.6	178.0	154.3	141.9
Total Stops	9843	9392	8574	11346	11563	10371	9613
Fuel Used (gal)	147.7	148.9	148.4	156.3	155.1	151.2	147.7

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	4556	4559	4530	4550
Vehs Exited	4416	4479	4454	4470
Starting Vehs	163	183	178	176
Ending Vehs	303	263	254	259
Denied Entry Before	2	8	0	2
Denied Entry After	75	28	29	46
Travel Distance (mi)	3044	3095	3087	3074
Travel Time (hr)	276.9	260.4	230.9	246.7
Total Delay (hr)	189.5	171.5	142.1	158.2
Total Stops	11789	11342	9431	10324
Fuel Used (gal)	158.0	155.2	148.9	151.7

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	4456	4589	4492	4621	4510	4583	4625
Vehs Exited	4398	4548	4497	4522	4410	4499	4465
Starting Vehs	174	166	199	192	183	194	156
Ending Vehs	232	207	194	291	283	278	316
Denied Entry Before	1	9	3	5	3	2	4
Denied Entry After	18	26	164	33	37	34	22
Travel Distance (mi)	3046	3107	3056	3109	3051	3082	3060
Travel Time (hr)	234.3	230.0	230.5	265.2	265.8	243.3	230.1
Total Delay (hr)	146.8	140.3	142.4	175.6	178.0	154.3	141.9
Total Stops	9843	9392	8574	11346	11563	10371	9613
Fuel Used (gal)	147.7	148.9	148.4	156.3	155.1	151.2	147.7

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	4556	4559	4530	4550
Vehs Exited	4416	4479	4454	4470
Starting Vehs	163	183	178	176
Ending Vehs	303	263	254	259
Denied Entry Before	2	8	0	2
Denied Entry After	75	28	29	46
Travel Distance (mi)	3044	3095	3087	3074
Travel Time (hr)	276.9	260.4	230.9	246.7
Total Delay (hr)	189.5	171.5	142.1	158.2
Total Stops	11789	11342	9431	10324
Fuel Used (gal)	158.0	155.2	148.9	151.7

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWR	All
Total Delay (hr)	2.6	2.5	4.5	0.1	11.5	1.8	23.0
Delay / Veh (s)	30.3	20.3	46.0	10.5	42.3	39.4	36.4
Total Stops	243	209	262	16	689	114	1533
Travel Dist (mi)	43.8	63.2	64.1	4.2	174.0	29.2	378.4
Travel Time (hr)	3.9	4.0	6.2	0.2	17.1	2.8	34.2
Avg Speed (mph)	11	16	10	25	11	12	12
Fuel Used (gal)	1.7	2.6	3.3	0.2	6.9	1.1	15.7
HC Emissions (g)	13	33	39	1	52	2	140
CO Emissions (g)	582	1400	1966	111	1621	125	5804
NOx Emissions (g)	44	106	119	5	153	11	438
Vehicles Entered	308	444	354	23	980	165	2274
Vehicles Exited	310	448	357	23	967	163	2268
Hourly Exit Rate	310	448	357	23	967	163	2268
Input Volume	326	457	355	25	992	167	2322
% of Volume	95	98	101	92	97	98	98
Denied Entry Before	0	0	0	0	2	0	2
Denied Entry After	0	0	0	0	1	0	1

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Total Delay (hr)	2.3	12.3	7.7	2.6	1.4	0.0	1.9	28.2
Delay / Veh (s)	12.9	41.2	144.5	8.1	61.2	62.8	25.1	30.0
Total Stops	105	694	290	179	76	1	228	1573
Travel Dist (mi)	102.8	175.8	29.0	165.9	8.6	0.1	27.5	509.7
Travel Time (hr)	4.8	18.5	8.8	7.4	1.7	0.0	2.9	44.1
Avg Speed (mph)	26	11	3	22	5	5	11	13
Fuel Used (gal)	5.6	7.8	3.0	10.1	0.6	0.0	1.3	28.3
HC Emissions (g)	73	39	11	141	6	0	8	278
CO Emissions (g)	3700	1435	635	7198	200	2	492	13662
NOx Emissions (g)	276	158	48	506	16	0	30	1034
Vehicles Entered	632	1074	195	1129	83	1	267	3381
Vehicles Exited	632	1072	192	1134	84	1	269	3384
Hourly Exit Rate	632	1072	192	1134	84	1	269	3384
Input Volume	665	1154	198	1149	80	1	267	3514
% of Volume	95	93	97	99	105	100	101	96
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	1	0	0	0	0	0	1

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.2	21.2	0.3	5.0	2.1	0.1	0.2	0.3	3.7	0.5	0.1	0.0
Delay / Veh (s)	34.0	62.6	73.7	72.8	7.9	2.1	52.4	55.5	35.7	68.7	66.9	10.9
Total Stops	27	1208	17	239	165	22	10	14	263	23	6	10
Travel Dist (mi)	3.6	172.5	1.9	40.2	155.7	17.0	1.2	1.6	35.4	2.5	0.7	1.2
Travel Time (hr)	0.3	25.2	0.3	6.2	5.9	0.6	0.2	0.3	5.2	0.5	0.2	0.1
Avg Speed (mph)	11	7	6	6	26	28	6	5	8	5	5	15
Fuel Used (gal)	0.2	11.4	0.1	2.3	6.6	0.6	0.1	0.1	1.9	0.2	0.0	0.0
HC Emissions (g)	1	77	1	20	71	7	6	0	18	0	1	0
CO Emissions (g)	88	2921	23	769	3831	384	101	29	605	24	17	11
NOx Emissions (g)	6	292	3	60	283	24	12	2	49	2	1	1
Vehicles Entered	26	1218	13	249	979	104	12	17	377	24	6	11
Vehicles Exited	25	1227	13	245	977	105	12	17	376	24	7	11
Hourly Exit Rate	25	1227	13	245	977	105	12	17	376	24	7	11
Input Volume	29	1338	15	249	999	101	14	16	374	24	6	11
% of Volume	86	92	87	98	98	104	86	106	101	100	117	100
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	1	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	33.7
Delay / Veh (s)	40.0
Total Stops	2004
Travel Dist (mi)	433.5
Travel Time (hr)	45.1
Avg Speed (mph)	10
Fuel Used (gal)	23.5
HC Emissions (g)	202
CO Emissions (g)	8803
NOx Emissions (g)	734
Vehicles Entered	3036
Vehicles Exited	3039
Hourly Exit Rate	3039
Input Volume	3176
% of Volume	96
Denied Entry Before	0
Denied Entry After	1

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	All
Total Delay (hr)	41.2	3.5	0.9	0.6	0.0	2.4	0.0	0.7	49.3
Delay / Veh (s)	123.3	87.6	50.8	2.6	1.3	59.2	53.2	44.8	70.8
Total Stops	2661	221	64	30	0	128	1	50	3155
Travel Dist (mi)	271.2	32.3	9.6	130.5	0.4	21.2	0.1	8.8	474.1
Travel Time (hr)	47.3	4.5	1.2	3.6	0.0	3.1	0.0	1.1	60.7
Avg Speed (mph)	7	9	8	36	31	7	8	9	9
Fuel Used (gal)	16.9	1.9	0.5	4.9	0.0	1.3	0.0	0.5	25.9
HC Emissions (g)	134	41	4	62	0	10	0	6	257
CO Emissions (g)	4380	1059	165	2705	5	441	2	234	8991
NOx Emissions (g)	377	89	13	255	0	31	0	16	782
Vehicles Entered	1227	146	65	887	2	143	1	59	2530
Vehicles Exited	1178	142	67	891	3	144	1	59	2485
Hourly Exit Rate	1178	142	67	891	3	144	1	59	2485
Input Volume	1305	155	69	904	3	146	1	60	2643
% of Volume	90	92	97	99	100	99	100	98	94
Denied Entry Before	0	0	0	0	0	0	0	0	0
Denied Entry After	19	3	0	0	0	0	0	0	22

6: Graves Mill Rd & Entrance Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Total Delay (hr)	1.6	4.4	3.4	0.1	1.9	0.4	11.9
Delay / Veh (s)	20.7	14.2	15.0	3.2	29.6	12.0	15.7
Total Stops	255	506	418	84	204	93	1560
Travel Dist (mi)	12.6	50.3	34.8	6.9	15.1	8.0	127.7
Travel Time (hr)	2.1	5.6	4.2	0.5	2.6	0.8	15.8
Avg Speed (mph)	6	9	8	14	6	12	8
Fuel Used (gal)	0.7	2.4	1.8	0.2	1.0	0.4	6.5
HC Emissions (g)	1	23	13	0	3	2	42
CO Emissions (g)	55	703	430	30	162	112	1493
NOx Emissions (g)	7	78	51	2	16	10	164
Vehicles Entered	282	1125	814	160	236	124	2741
Vehicles Exited	282	1121	815	160	234	123	2735
Hourly Exit Rate	282	1121	815	160	234	123	2735
Input Volume	295	1176	819	162	237	126	2815
% of Volume	96	95	100	99	99	98	97
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

17: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	WBR	All
Total Delay (hr)	2.5	0.9	0.0	3.4
Delay / Veh (s)	6.5	3.4	1.7	5.1
Total Stops	185	10	0	195
Travel Dist (mi)	64.5	226.7	7.4	298.6
Travel Time (hr)	4.2	6.2	0.2	10.7
Avg Speed (mph)	15	36	34	28
Fuel Used (gal)	3.9	6.0	0.2	10.1
HC Emissions (g)	46	75	4	125
CO Emissions (g)	2058	2995	153	5206
NOx Emissions (g)	175	281	12	468
Vehicles Entered	1354	1005	33	2392
Vehicles Exited	1348	1010	33	2391
Hourly Exit Rate	1348	1010	33	2391
Input Volume	1412	1019	35	2466
% of Volume	95	99	94	97
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

19: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	SBR	All
Total Delay (hr)	3.0	0.7	0.1	3.7
Delay / Veh (s)	7.6	2.6	7.6	5.6
Total Stops	180	0	32	212
Travel Dist (mi)	94.3	45.3	1.3	140.8
Travel Time (hr)	5.5	1.9	0.1	7.5
Avg Speed (mph)	17	24	9	19
Fuel Used (gal)	4.5	3.4	0.0	8.0
HC Emissions (g)	66	48	0	114
CO Emissions (g)	3370	2311	9	5690
NOx Emissions (g)	193	184	1	378
Vehicles Entered	1413	938	32	2383
Vehicles Exited	1401	935	32	2368
Hourly Exit Rate	1401	935	32	2368
Input Volume	1465	944	32	2441
% of Volume	96	99	100	97
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

Total Network Performance

Total Delay (hr)	158.2
Delay / Veh (s)	126.3
Total Stops	10324
Travel Dist (mi)	3073.6
Travel Time (hr)	246.7
Avg Speed (mph)	13
Fuel Used (gal)	151.7
HC Emissions (g)	1570
CO Emissions (g)	67945
NOx Emissions (g)	5444
Vehicles Entered	4550
Vehicles Exited	4470
Hourly Exit Rate	4470
Input Volume	26252
% of Volume	17
Denied Entry Before	2
Denied Entry After	46

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LR
Maximum Queue (ft)	224	334	252	199	209	40	444	647
Average Queue (ft)	154	107	103	116	107	7	325	349
95th Queue (ft)	240	237	189	190	181	32	446	539
Link Distance (ft)		718	718	943	943			933
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	13	2			8		9	9
Queuing Penalty (veh)	30	5			2		62	47

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	221	650	400	299	612	563	170	217
Average Queue (ft)	49	286	371	219	164	122	77	101
95th Queue (ft)	132	680	453	342	535	429	136	183
Link Distance (ft)	800	800			718	718	543	
Upstream Blk Time (%)		0			1	0		
Queuing Penalty (veh)		0			10	2		
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			26	41	0		1	3
Queuing Penalty (veh)			85	220	0		2	3

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	200	770	746	341	142	160	25	397	175	78	56
Average Queue (ft)	25	673	707	195	60	80	10	132	153	24	14
95th Queue (ft)	105	987	798	327	117	140	26	348	206	62	41
Link Distance (ft)		698	698		800	800		488			559
Upstream Blk Time (%)		18	26					0			
Queuing Penalty (veh)		122	175					0			
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		7		1				0	22	0	
Queuing Penalty (veh)		2		3				1	7	0	

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	1177	1172	500	142	54	69	231	98
Average Queue (ft)	732	813	238	59	7	17	114	35
95th Queue (ft)	1372	1367	639	116	35	54	200	81
Link Distance (ft)	1148	1148			698	698	778	
Upstream Blk Time (%)	7	11						
Queuing Penalty (veh)	51	80						
Storage Bay Dist (ft)			200	250				300
Storage Blk Time (%)	32	60						
Queuing Penalty (veh)	0	92						

Intersection: 6: Graves Mill Rd & Entrance

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	R	L	R
Maximum Queue (ft)	196	229	226	194	202	88	250	161
Average Queue (ft)	107	128	141	126	144	37	115	37
95th Queue (ft)	176	221	227	192	205	69	197	91
Link Distance (ft)	192	192	192	185	185	185	333	
Upstream Blk Time (%)	1	9	10	1	2		0	
Queuing Penalty (veh)	5	43	51	3	7		0	
Storage Bay Dist (ft)								100
Storage Blk Time (%)							12	0
Queuing Penalty (veh)							15	0

Intersection: 17: Graves Mill Rd &

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	164	169	37	75
Average Queue (ft)	46	51	2	7
95th Queue (ft)	178	185	19	38
Link Distance (ft)	185	185	1148	1148
Upstream Blk Time (%)	5	5		
Queuing Penalty (veh)	32	38		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 19: Graves Mill Rd &

Movement	EB	EB	EB	B7	B7	WB	SB
Directions Served	T	T	T	T	T	T	R
Maximum Queue (ft)	242	252	272	211	226	24	54
Average Queue (ft)	31	45	46	25	26	1	23
95th Queue (ft)	193	209	212	186	189	23	50
Link Distance (ft)	297	297	297	422	422	192	214
Upstream Blk Time (%)	1	1	2	2	3		
Queuing Penalty (veh)	0	0	0	0	0		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Network Summary

Network wide Queuing Penalty: 1194

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	4973	4976	5192	5047	5118	5138	5110
Vehs Exited	4805	4857	5030	4945	5013	4973	4890
Starting Vehs	287	275	269	319	287	289	242
Ending Vehs	455	394	431	421	392	454	462
Denied Entry Before	7	8	9	4	11	7	5
Denied Entry After	772	818	631	752	561	616	717
Travel Distance (mi)	3078	3115	3262	3211	3262	3203	3177
Travel Time (hr)	732.0	702.9	651.0	723.5	599.4	593.3	659.3
Total Delay (hr)	640.8	610.8	554.6	629.1	503.7	498.9	565.7
Total Stops	18467	17213	17544	18587	17468	17604	17539
Fuel Used (gal)	263.4	257.9	251.1	266.0	238.9	235.2	249.0

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	5170	5102	5124	5093
Vehs Exited	4919	4852	4888	4917
Starting Vehs	240	210	199	258
Ending Vehs	491	460	435	433
Denied Entry Before	7	3	1	3
Denied Entry After	605	666	542	668
Travel Distance (mi)	3162	3133	3179	3178
Travel Time (hr)	573.2	628.5	540.4	640.4
Total Delay (hr)	479.5	536.0	446.8	546.6
Total Stops	16886	17185	15943	17444
Fuel Used (gal)	230.2	240.9	222.5	245.5

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	4973	4976	5192	5047	5118	5138	5110
Vehs Exited	4805	4857	5030	4945	5013	4973	4890
Starting Vehs	287	275	269	319	287	289	242
Ending Vehs	455	394	431	421	392	454	462
Denied Entry Before	7	8	9	4	11	7	5
Denied Entry After	772	818	631	752	561	616	717
Travel Distance (mi)	3078	3115	3262	3211	3262	3203	3177
Travel Time (hr)	732.0	702.9	651.0	723.5	599.4	593.3	659.3
Total Delay (hr)	640.8	610.8	554.6	629.1	503.7	498.9	565.7
Total Stops	18467	17213	17544	18587	17468	17604	17539
Fuel Used (gal)	263.4	257.9	251.1	266.0	238.9	235.2	249.0

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	5170	5102	5124	5093
Vehs Exited	4919	4852	4888	4917
Starting Vehs	240	210	199	258
Ending Vehs	491	460	435	433
Denied Entry Before	7	3	1	3
Denied Entry After	605	666	542	668
Travel Distance (mi)	3162	3133	3179	3178
Travel Time (hr)	573.2	628.5	540.4	640.4
Total Delay (hr)	479.5	536.0	446.8	546.6
Total Stops	16886	17185	15943	17444
Fuel Used (gal)	230.2	240.9	222.5	245.5

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWT	NWR	All
Total Delay (hr)	4.4	0.6	30.7	2.3	131.8	0.2	20.1	190.2
Delay / Veh (s)	55.3	10.1	166.6	85.6	646.3	685.3	609.3	324.1
Total Stops	313	63	1254	167	1454	2	209	3462
Travel Dist (mi)	41.6	29.5	120.7	17.7	129.2	0.2	20.8	359.7
Travel Time (hr)	5.7	1.3	33.8	2.9	135.9	0.2	20.9	200.7
Avg Speed (mph)	7	23	4	7	4	5	5	4
Fuel Used (gal)	2.2	1.2	11.0	1.2	33.8	0.0	5.2	54.5
HC Emissions (g)	15	26	66	5	129	0	14	255
CO Emissions (g)	637	942	2599	359	3486	3	447	8473
NOx Emissions (g)	47	76	194	21	218	0	25	582
Vehicles Entered	288	207	682	99	746	1	120	2143
Vehicles Exited	290	208	647	96	722	1	118	2082
Hourly Exit Rate	290	208	647	96	722	1	118	2082
Input Volume	329	241	688	97	989	2	159	2505
% of Volume	88	86	94	99	73	50	74	83
Denied Entry Before	0	0	0	0	1	0	0	1
Denied Entry After	0	0	9	2	249	0	42	302

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBR	All
Total Delay (hr)	1.7	13.9	16.8	10.4	0.6	4.6	48.0
Delay / Veh (s)	14.3	48.0	302.6	32.1	47.9	41.4	52.7
Total Stops	108	899	506	631	39	370	2553
Travel Dist (mi)	69.3	167.6	29.8	171.6	4.7	41.8	484.7
Travel Time (hr)	3.5	19.9	17.8	15.0	0.8	6.2	63.1
Avg Speed (mph)	23	9	2	11	6	8	8
Fuel Used (gal)	3.5	8.2	4.9	11.7	0.3	2.2	30.8
HC Emissions (g)	37	60	19	128	2	11	257
CO Emissions (g)	2196	1723	562	6077	94	562	11214
NOx Emissions (g)	143	189	53	488	6	38	917
Vehicles Entered	430	1041	203	1166	45	403	3288
Vehicles Exited	430	1039	197	1159	45	402	3272
Hourly Exit Rate	430	1039	197	1159	45	402	3272
Input Volume	501	1246	252	1425	45	402	3871
% of Volume	86	83	78	81	100	100	85
Denied Entry Before	0	1	0	0	0	0	1
Denied Entry After	1	3	0	0	0	1	5

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.4	19.5	0.2	4.3	8.0	0.1	0.9	0.3	2.9	1.6	0.3	0.2
Delay / Veh (s)	48.8	68.4	90.1	73.6	23.8	4.2	47.9	52.1	31.3	59.9	50.2	18.5
Total Stops	34	1158	15	237	620	49	54	17	246	88	20	31
Travel Dist (mi)	4.7	139.5	1.3	33.7	193.1	15.7	6.2	1.9	33.0	10.2	2.4	3.9
Travel Time (hr)	0.6	22.7	0.3	5.3	12.9	0.6	1.1	0.3	4.3	1.9	0.4	0.3
Avg Speed (mph)	8	6	5	6	15	25	6	6	9	6	6	12
Fuel Used (gal)	0.3	10.2	0.1	2.1	8.3	0.6	0.4	0.1	1.7	0.7	0.1	0.2
HC Emissions (g)	2	62	0	17	77	5	1	0	9	4	1	1
CO Emissions (g)	143	2747	8	770	3699	353	85	28	534	194	38	56
NOx Emissions (g)	8	243	1	54	288	19	6	2	35	13	2	3
Vehicles Entered	33	1029	9	208	1217	96	64	20	337	94	23	37
Vehicles Exited	32	1026	9	209	1216	97	64	20	338	95	22	36
Hourly Exit Rate	32	1026	9	209	1216	97	64	20	338	95	22	36
Input Volume	44	1329	12	250	1418	113	64	18	335	95	24	34
% of Volume	73	77	75	84	86	86	100	111	101	100	92	106
Denied Entry Before	0	0	0	0	0	0	0	0	1	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	38.7
Delay / Veh (s)	44.0
Total Stops	2569
Travel Dist (mi)	445.7
Travel Time (hr)	50.7
Avg Speed (mph)	9
Fuel Used (gal)	24.9
HC Emissions (g)	179
CO Emissions (g)	8655
NOx Emissions (g)	674
Vehicles Entered	3167
Vehicles Exited	3164
Hourly Exit Rate	3164
Input Volume	3736
% of Volume	85
Denied Entry Before	1
Denied Entry After	0

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	All
Total Delay (hr)	0.0	72.6	10.4	3.8	1.6	2.4	0.3	91.2
Delay / Veh (s)		243.2	168.6	73.8	5.5	48.1	30.4	118.5
Total Stops	1	2909	452	230	45	153	28	3818
Travel Dist (mi)	0.1	236.4	49.2	27.2	151.2	26.2	5.0	495.4
Travel Time (hr)	0.0	78.0	11.9	4.6	5.2	3.3	0.5	103.4
Avg Speed (mph)	7	4	6	6	29	8	12	6
Fuel Used (gal)	0.0	23.3	4.1	1.8	8.2	1.5	0.3	39.0
HC Emissions (g)	0	98	26	14	92	11	2	243
CO Emissions (g)	2	3219	989	563	5276	516	112	10678
NOx Emissions (g)	0	321	83	46	377	34	6	868
Vehicles Entered	0	1100	227	186	1078	178	33	2802
Vehicles Exited	0	1050	220	185	1074	178	34	2741
Hourly Exit Rate	0	1050	220	185	1074	178	34	2741
Input Volume	1	1362	284	216	1235	178	35	3311
% of Volume	0	77	77	86	87	100	97	83
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	41	9	0	0	0	0	50

6: Graves Mill Rd & Entrance Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Total Delay (hr)	4.2	14.3	5.3	0.3	18.3	6.0	48.4
Delay / Veh (s)	46.2	54.8	21.6	4.6	159.6	90.6	57.8
Total Stops	291	798	390	105	418	191	2193
Travel Dist (mi)	16.4	46.5	42.3	10.2	26.5	15.5	157.4
Travel Time (hr)	4.9	15.3	6.2	0.8	19.5	6.8	53.5
Avg Speed (mph)	4	3	7	13	2	9	4
Fuel Used (gal)	1.5	4.8	2.5	0.3	5.2	1.8	16.1
HC Emissions (g)	2	24	16	1	3	2	48
CO Emissions (g)	114	767	490	56	347	162	1936
NOx Emissions (g)	13	80	61	3	25	9	192
Vehicles Entered	330	945	881	211	413	238	3018
Vehicles Exited	333	931	885	213	411	239	3012
Hourly Exit Rate	333	931	885	213	411	239	3012
Input Volume	406	1174	992	242	434	253	3501
% of Volume	82	79	89	88	95	94	86
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	1	4	0	0	27	19	51

17: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	WBR	All
Total Delay (hr)	8.1	1.5	0.0	9.6
Delay / Veh (s)	21.8	4.8	2.3	13.9
Total Stops	583	49	0	632
Travel Dist (mi)	70.5	245.3	6.0	321.8
Travel Time (hr)	10.2	7.3	0.2	17.7
Avg Speed (mph)	7	34	32	18
Fuel Used (gal)	4.9	6.9	0.2	12.0
HC Emissions (g)	40	87	4	131
CO Emissions (g)	1487	3644	155	5286
NOx Emissions (g)	141	313	11	465
Vehicles Entered	1346	1124	27	2497
Vehicles Exited	1337	1129	28	2494
Hourly Exit Rate	1337	1129	28	2494
Input Volume	1609	1275	28	2912
% of Volume	83	89	100	86
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

19: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	SBR	All
Total Delay (hr)	12.0	0.8	0.1	12.9
Delay / Veh (s)	34.0	2.5	9.9	19.1
Total Stops	713	0	39	752
Travel Dist (mi)	58.5	58.7	1.4	118.6
Travel Time (hr)	13.5	2.5	0.2	16.2
Avg Speed (mph)	4	24	8	7
Fuel Used (gal)	5.2	4.0	0.1	9.2
HC Emissions (g)	39	48	0	88
CO Emissions (g)	1436	2426	8	3871
NOx Emissions (g)	133	191	1	325
Vehicles Entered	1274	1125	38	2437
Vehicles Exited	1263	1126	39	2428
Hourly Exit Rate	1263	1126	39	2428
Input Volume	1561	1246	37	2844
% of Volume	81	90	105	85
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

Total Network Performance

Total Delay (hr)	546.6
Delay / Veh (s)	393.2
Total Stops	17444
Travel Dist (mi)	3178.3
Travel Time (hr)	640.4
Avg Speed (mph)	8
Fuel Used (gal)	245.5
HC Emissions (g)	1743
CO Emissions (g)	70228
NOx Emissions (g)	5690
Vehicles Entered	5093
Vehicles Exited	4917
Hourly Exit Rate	4917
Input Volume	30741
% of Volume	16
Denied Entry Before	3
Denied Entry After	668

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW
Directions Served	L	T	T	T	T	R	L	LTR
Maximum Queue (ft)	225	418	206	809	812	225	450	950
Average Queue (ft)	200	187	38	528	515	82	426	819
95th Queue (ft)	261	451	113	976	967	224	510	1199
Link Distance (ft)		717	717	946	946			923
Upstream Blk Time (%)				5	4			35
Queuing Penalty (veh)				0	0			0
Storage Bay Dist (ft)	125					125	300	
Storage Blk Time (%)	31				57	0	65	46
Queuing Penalty (veh)	37				56	1	424	228

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	236	809	400	300	748	794	458	300
Average Queue (ft)	53	344	371	293	666	575	97	209
95th Queue (ft)	144	837	468	336	974	994	319	325
Link Distance (ft)	800	800			717	717	548	
Upstream Blk Time (%)		1			37	7	0	
Queuing Penalty (veh)		6			308	57	0	
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			33	84	0			23
Queuing Penalty (veh)			83	578	0			10

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	78	769	746	372	508	515	162	337	175	164	100
Average Queue (ft)	26	679	701	186	230	249	24	110	140	69	30
95th Queue (ft)	59	998	815	332	395	407	106	272	202	133	69
Link Distance (ft)		697	697		800	800		505			564
Upstream Blk Time (%)		16	21		0	0		0			
Queuing Penalty (veh)		113	145		0	0		0			
Storage Bay Dist (ft)	225			400			300		125	125	
Storage Blk Time (%)		0		1	1	4		1	15	2	0
Queuing Penalty (veh)		0		6	3	5		2	12	1	0

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	4	1180	1164	500	362	299	213	238	56
Average Queue (ft)	0	1030	1037	372	175	29	27	137	16
95th Queue (ft)	4	1474	1420	699	346	189	142	219	42
Link Distance (ft)		1112	1112			697	697	773	
Upstream Blk Time (%)		27	36						
Queuing Penalty (veh)		214	286						
Storage Bay Dist (ft)	200			200	250				300
Storage Blk Time (%)		61	73	0	8	0		0	
Queuing Penalty (veh)		1	207	0	43	1		0	

Intersection: 6: Graves Mill Rd & Entrance

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	R	L	R
Maximum Queue (ft)	231	267	262	233	233	102	349	238
Average Queue (ft)	192	215	218	149	159	46	331	83
95th Queue (ft)	277	278	274	242	249	80	396	186
Link Distance (ft)	218	218	218	211	211	211	334	334
Upstream Blk Time (%)	18	45	48	3	4		44	1
Queuing Penalty (veh)	93	232	250	12	16		0	0
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 17: Graves Mill Rd &

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	281	253	180	227
Average Queue (ft)	173	177	17	24
95th Queue (ft)	331	328	102	124
Link Distance (ft)	211	211	1112	1112
Upstream Blk Time (%)	22	27		
Queuing Penalty (veh)	178	216		
Storage Bay Dist (ft)				
Storage Blk Time (%)				0
Queuing Penalty (veh)				0

Intersection: 19: Graves Mill Rd &

Movement	EB	EB	EB	B7	B7	SB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	281	261	259	666	689	63
Average Queue (ft)	205	178	169	401	428	26
95th Queue (ft)	363	342	339	882	924	56
Link Distance (ft)	204	204	204	642	642	196
Upstream Blk Time (%)	20	36	26	9	37	
Queuing Penalty (veh)	0	0	0	0	0	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

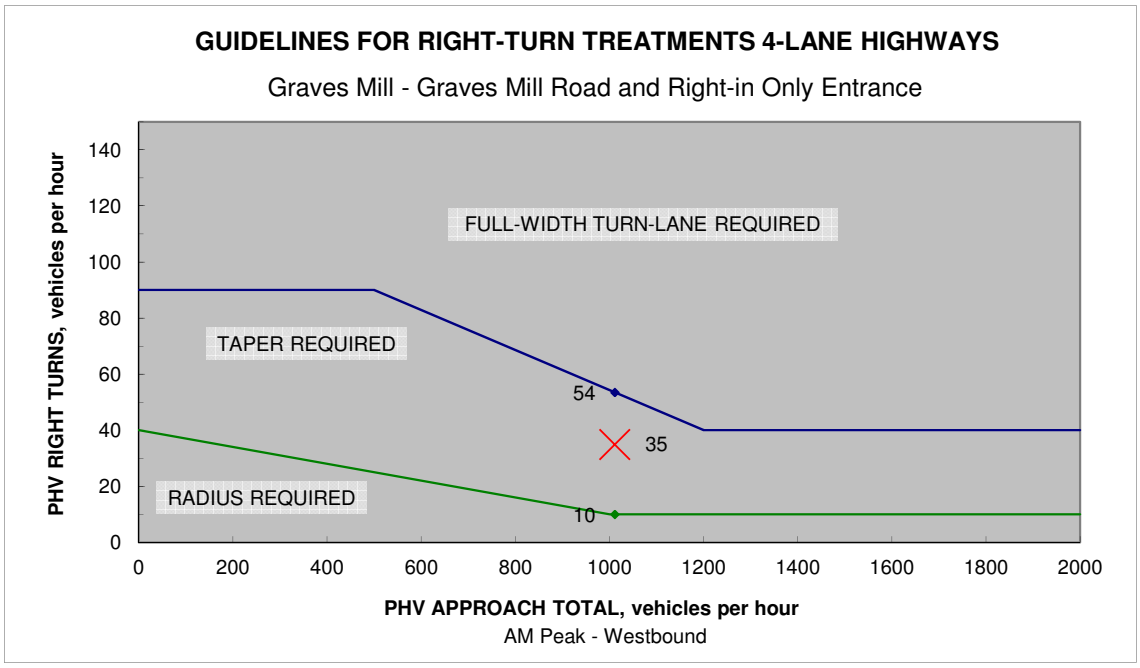
Network wide Queuing Penalty: 3822

Appendix F Turn Lane Warrant Sheets

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Graves Mill			
Intersection:	Graves Mill Road and Right-in Only Entrance			
Approach Direction:	Westbound		Analysis Date:	2013
Peak Hour:	AM Peak		Data Date:	2013
PHV Right Turns:	35	vph	Projection Year:	2024
PHV Approach Total:	1,011	vph		

CONCLUSION: **RIGHT-TURN TAPER REQUIRED**

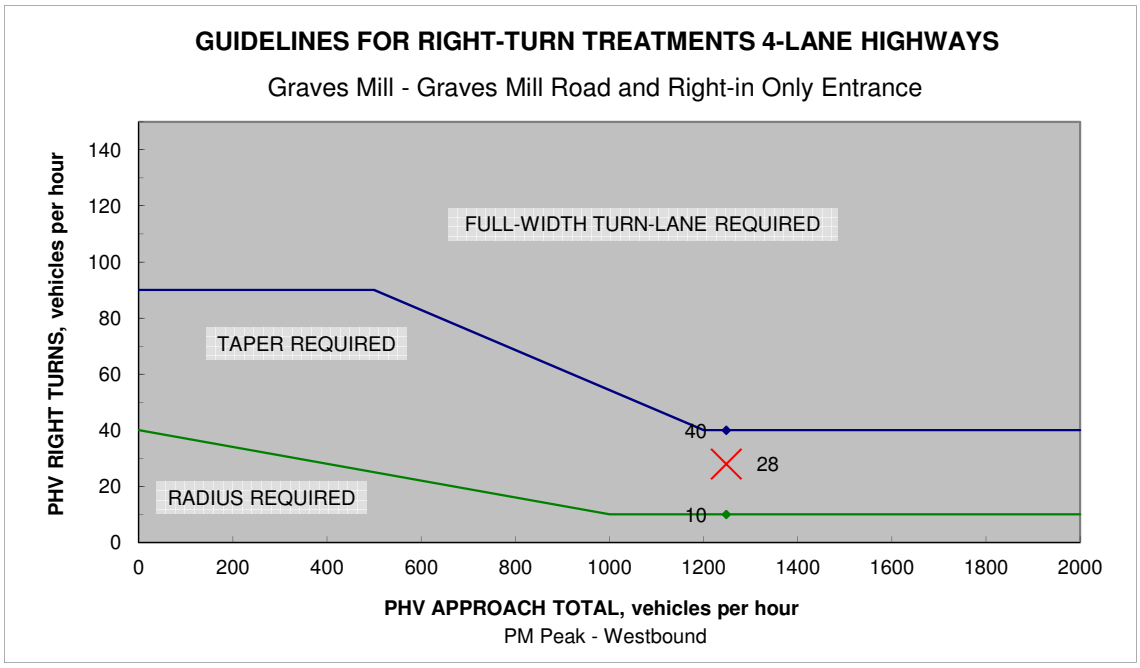


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Graves Mill			
Intersection:	Graves Mill Road and Right-in Only Entrance			
Approach Direction:	Westbound		Analysis Date:	2013
Peak Hour:	PM Peak		Data Date:	2013
PHV Right Turns:	28	vph	Projection Year:	2024
PHV Approach Total:	1,248	vph		

CONCLUSION: **RIGHT-TURN TAPER REQUIRED**



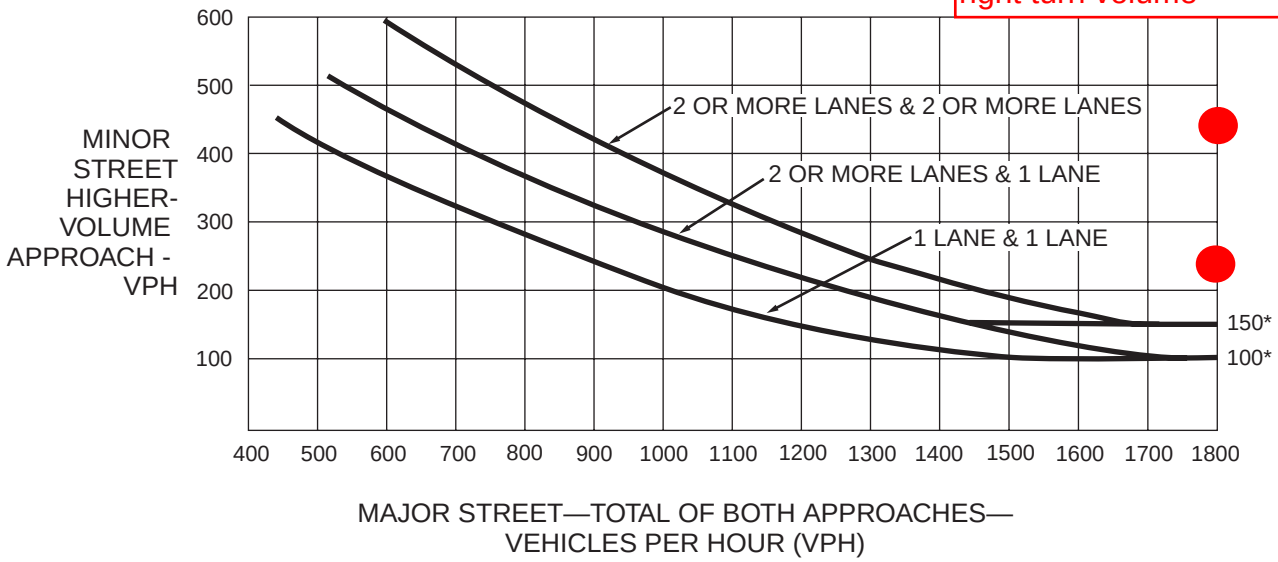
Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

Appendix G Peak Hour Signal Warrant Sheets

Graves Mill Road and Site Entrance

Note that these points do NOT include the SB (exiting) right turn volume

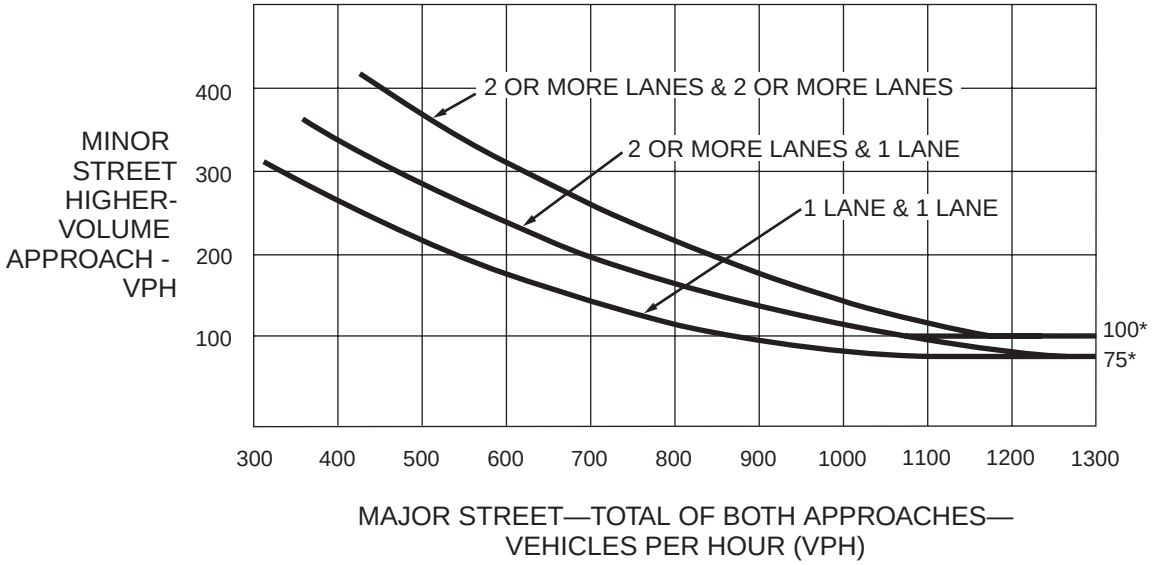
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

Support:

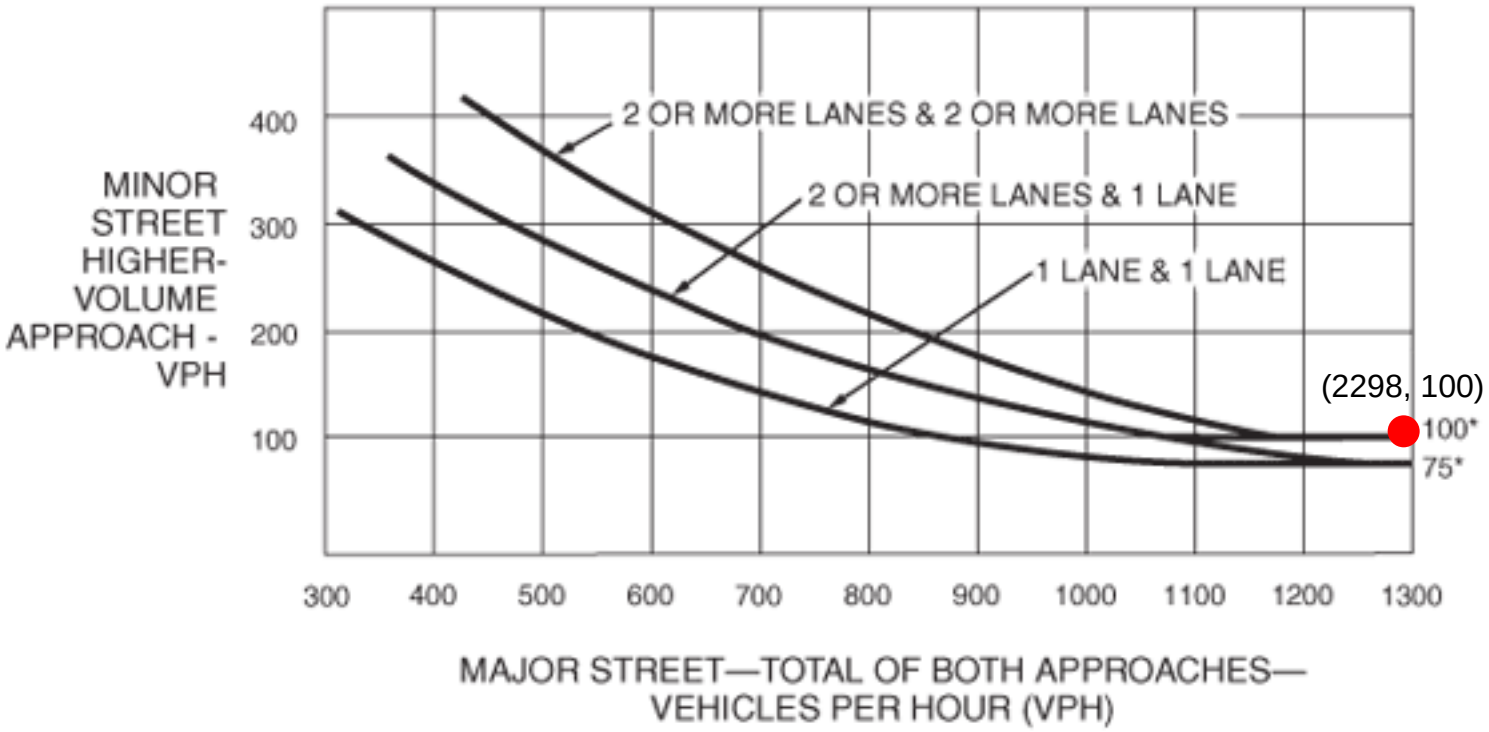
01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word “schoolchildren” includes elementary through high school students.

Standard:

02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.**

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Appendix H 2024 Mitigation Syncho and SimTraffic Reports

Queues
2: Graves Mill Rd & East Ramp

11/22/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	354	497	386	27	539	539	182
v/c Ratio	0.75	0.30	0.44	0.06	0.85	0.85	0.25
Control Delay	27.5	9.7	26.6	10.0	35.7	35.7	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.5	9.7	26.6	10.0	35.7	35.7	3.5
Queue Length 50th (ft)	160	103	82	0	226	226	0
Queue Length 95th (ft)	#227	101	123	19	#403	#403	35
Internal Link Dist (ft)		689	906			906	
Turn Bay Length (ft)	125			125	300		300
Base Capacity (vph)	471	1637	868	417	672	672	755
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.30	0.44	0.06	0.80	0.80	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	326	457	0	0	355	25	0	0	0	992	0	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	6.0
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	1.00
Frt	1.00	1.00			1.00	0.85				1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.95	1.00
Satd. Flow (prot)	1787	3539			3539	1615				1681	1681	1615
Flt Permitted	0.37	1.00			1.00	1.00				0.95	0.95	1.00
Satd. Flow (perm)	694	3539			3539	1615				1681	1681	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	354	497	0	0	386	27	0	0	0	1078	0	182
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	0	0	0	113
Lane Group Flow (vph)	354	497	0	0	386	7	0	0	0	539	539	69
Heavy Vehicles (%)	1%	2%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%
Turn Type	pm+pt					Perm				Split		Perm
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						8
Actuated Green, G (s)	34.7	34.7			18.4	18.4				28.3	28.3	28.3
Effective Green, g (s)	34.7	34.7			18.4	18.4				28.3	28.3	28.3
Actuated g/C Ratio	0.46	0.46			0.25	0.25				0.38	0.38	0.38
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Lane Grp Cap (vph)	471	1637			868	396				634	634	609
v/s Ratio Prot	c0.10	0.14			0.11					c0.32	0.32	
v/s Ratio Perm	c0.24					0.00						0.04
v/c Ratio	0.75	0.30			0.44	0.02				0.85	0.85	0.11
Uniform Delay, d1	14.0	12.6			24.0	21.4				21.4	21.4	15.2
Progression Factor	1.14	0.71			1.00	1.00				1.00	1.00	1.00
Incremental Delay, d2	6.5	0.5			1.6	0.1				10.6	10.6	0.1
Delay (s)	22.5	9.4			25.6	21.5				32.0	32.0	15.3
Level of Service	C	A			C	C				C	C	B
Approach Delay (s)		14.9			25.4			0.0			29.6	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	717	1254	215	1172	88	290
v/c Ratio	0.27	0.78	0.35	0.39	0.59	0.18
Control Delay	3.7	15.7	1.4	0.7	80.8	0.3
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0
Total Delay	3.7	15.7	1.4	0.9	80.8	0.3
Queue Length 50th (ft)	65	611	0	0	84	0
Queue Length 95th (ft)	m141	553	m10	44	142	0
Internal Link Dist (ft)	795			689	509	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2622	1599	790	2981	327	1599
Starvation Cap Reductn	0	0	0	820	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.78	0.27	0.54	0.27	0.18

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	660	1154	198	1078	0	80	1	267	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0	6.0	6.0			6.0	4.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1599	1787	3574			1753	1599		
Flt Permitted		1.00	1.00	0.34	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1599	648	3574			1753	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	717	1254	215	1172	0	87	1	290	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	717	1254	215	1172	0	0	88	290	0	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Free	pm+pt			Split		Free		
Protected Phases		2		1	6		4	4			
Permitted Phases			Free	6					Free		
Actuated Green, G (s)		110.0	150.0	125.1	125.1			12.9	150.0		
Effective Green, g (s)		110.0	150.0	125.1	125.1			12.9	150.0		
Actuated g/C Ratio		0.73	1.00	0.83	0.83			0.09	1.00		
Clearance Time (s)		6.0		6.0	6.0			6.0			
Vehicle Extension (s)		3.0		3.0	3.0			3.0			
Lane Grp Cap (vph)		2621	1599	610	2981			151	1599		
v/s Ratio Prot		0.20		0.02	0.33			0.05			
v/s Ratio Perm			c0.78	0.27					0.18		
v/c Ratio		0.27	0.78	0.35	0.39			0.58	0.18		
Uniform Delay, d1		6.7	0.0	2.9	3.1			66.0	0.0		
Progression Factor		0.50	1.00	0.11	0.14			1.00	1.00		
Incremental Delay, d2		0.2	2.6	0.2	0.3			5.6	0.2		
Delay (s)		3.5	2.6	0.6	0.7			71.6	0.2		
Level of Service		A	A	A	A			E	A		
Approach Delay (s)		2.9			0.7			16.9		0.0	
Approach LOS		A			A			B		A	

Intersection Summary			
HCM Average Control Delay	3.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	32	1456	271	1034	110	32	407	26	19
v/c Ratio	0.11	0.85	0.87	0.47	0.11	0.12	0.60	0.28	0.20
Control Delay	7.6	25.5	61.3	12.0	1.7	56.3	26.5	75.4	43.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	25.6	61.3	12.0	1.7	56.3	26.5	75.4	43.1
Queue Length 50th (ft)	11	577	198	286	6	27	195	25	7
Queue Length 95th (ft)	m13	640	#326	335	16	62	315	58	35
Internal Link Dist (ft)		697		795		460			536
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	296	1704	351	2192	1023	271	713	193	183
Starvation Cap Reductn	0	6	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.86	0.77	0.47	0.11	0.12	0.57	0.13	0.10

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	1325	15	249	951	101	14	16	374	24	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3566		1752	3574	1599		1527	1568	1805	1619	
Flt Permitted	0.27	1.00		0.05	1.00	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (perm)	518	3566		96	3574	1599		1527	1568	1805	1619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	1440	16	271	1034	110	15	17	407	26	7	12
RTOR Reduction (vph)	0	1	0	0	0	44	0	0	111	0	11	0
Lane Group Flow (vph)	32	1455	0	271	1034	66	0	32	296	26	8	0
Heavy Vehicles (%)	0%	1%	7%	3%	1%	1%	46%	0%	3%	0%	17%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	73.7	70.5		98.8	89.6	89.6		26.6	48.9	6.6	6.6	
Effective Green, g (s)	73.7	70.5		98.8	89.6	89.6		26.6	48.9	6.6	6.6	
Actuated g/C Ratio	0.49	0.47		0.66	0.60	0.60		0.18	0.33	0.04	0.04	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	282	1676		309	2135	955		271	574	79	71	
v/s Ratio Prot	0.00	0.41		c0.13	0.29			0.02	c0.08	c0.01	0.00	
v/s Ratio Perm	0.05			c0.44		0.04			0.11			
v/c Ratio	0.11	0.87		0.88	0.48	0.07		0.12	0.52	0.33	0.11	
Uniform Delay, d1	19.8	35.6		49.6	17.1	12.7		51.8	41.0	69.6	68.9	
Progression Factor	0.62	0.58		0.80	0.69	0.73		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	5.4		22.3	0.2	0.0		0.9	0.8	2.4	0.7	
Delay (s)	12.4	25.9		62.2	12.0	9.3		52.7	41.8	72.0	69.5	
Level of Service	B	C		E	B	A		D	D	E	E	
Approach Delay (s)		25.6			21.4			42.6			71.0	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1418	168	75	980	160	65
v/c Ratio	0.59	0.16	0.59	0.34	0.72	0.26
Control Delay	11.7	2.6	62.6	0.9	80.9	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.8	2.6	62.6	0.9	80.9	14.4
Queue Length 50th (ft)	372	5	69	15	153	0
Queue Length 95th (ft)	484	13	123	18	225	44
Internal Link Dist (ft)	1132			697	755	
Turn Bay Length (ft)		200	250			300
Base Capacity (vph)	2414	1080	152	2842	277	302
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	51	0	0	0	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.16	0.49	0.34	0.58	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1305	155	69	899	3	146	1	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1538	1752	3573			1775	1583			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1538	1752	3573			1775	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1418	168	75	977	3	159	1	65	0	0	0
RTOR Reduction (vph)	0	0	31	0	0	0	0	0	57	0	0	0
Lane Group Flow (vph)	0	1418	137	75	980	0	0	160	8	0	0	0
Heavy Vehicles (%)	0%	2%	5%	3%	1%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)		102.3	102.3	11.0	119.3			18.7	18.7			
Effective Green, g (s)		102.3	102.3	11.0	119.3			18.7	18.7			
Actuated g/C Ratio		0.68	0.68	0.07	0.80			0.12	0.12			
Clearance Time (s)		6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		2414	1049	128	2842			221	197			
v/s Ratio Prot		c0.40		c0.04	0.27			c0.09				
v/s Ratio Perm			0.09						0.01			
v/c Ratio		0.59	0.13	0.59	0.34			0.72	0.04			
Uniform Delay, d1		12.7	8.3	67.3	4.3			63.2	57.8			
Progression Factor		0.79	0.52	0.69	0.12			1.00	1.00			
Incremental Delay, d2		0.9	0.2	6.0	0.1			11.1	0.1			
Delay (s)		10.9	4.6	52.4	0.6			74.3	57.8			
Level of Service		B	A	D	A			E	E			
Approach Delay (s)		10.2			4.3			69.5			0.0	
Approach LOS		B			A			E			A	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	321	1272	886	176	258	137
v/c Ratio	0.74	0.57	0.82	0.29	0.35	0.30
Control Delay	38.6	9.4	21.9	2.8	26.6	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.6	9.4	21.9	2.8	26.6	7.0
Queue Length 50th (ft)	138	160	183	7	52	0
Queue Length 95th (ft)	#253	212	250	18	85	42
Internal Link Dist (ft)		164	153		311	
Turn Bay Length (ft)						100
Base Capacity (vph)	433	2218	1085	617	747	452
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.57	0.82	0.29	0.35	0.30

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	295	1170	815	162	237	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3539	3539	1615	3502	1615
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1805	3539	3539	1615	3502	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	1272	886	176	258	137
RTOR Reduction (vph)	0	0	0	122	0	108
Lane Group Flow (vph)	321	1272	886	54	258	29
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	18.0	47.0	23.0	23.0	16.0	16.0
Effective Green, g (s)	18.0	47.0	23.0	23.0	16.0	16.0
Actuated g/C Ratio	0.24	0.63	0.31	0.31	0.21	0.21
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	2218	1085	495	747	345
v/s Ratio Prot	c0.18	0.36	c0.25		c0.07	
v/s Ratio Perm				0.03		0.02
v/c Ratio	0.74	0.57	0.82	0.11	0.35	0.08
Uniform Delay, d1	26.3	8.2	24.0	18.7	25.1	23.6
Progression Factor	1.00	1.00	0.64	0.67	1.00	1.00
Incremental Delay, d2	6.7	1.1	6.5	0.4	1.3	0.5
Delay (s)	33.1	9.2	21.8	12.8	26.3	24.1
Level of Service	C	A	C	B	C	C
Approach Delay (s)		14.0	20.3		25.6	
Approach LOS		B	C		C	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues
2: Graves Mill Rd & East Ramp

11/22/2013

Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	358	262	748	105	537	540	173
v/c Ratio	0.83	0.14	0.67	0.19	0.89	0.89	0.25
Control Delay	31.5	9.8	41.0	15.7	53.8	53.9	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.5	9.8	41.0	15.7	53.8	53.9	4.5
Queue Length 50th (ft)	173	49	284	23	392	394	0
Queue Length 95th (ft)	#305	75	358	69	#591	#594	45
Internal Link Dist (ft)		689	908			895	
Turn Bay Length (ft)	125			125	300		300
Base Capacity (vph)	465	1840	1112	552	644	647	720
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.14	0.67	0.19	0.83	0.83	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	329	241	0	0	688	97	0	0	0	989	2	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0				6.0	6.0	6.0
Lane Util. Factor	1.00	0.95			0.95	1.00				0.95	0.95	1.00
Frt	1.00	1.00			1.00	0.85				1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00				0.95	0.95	1.00
Satd. Flow (prot)	1770	3406			3539	1615				1681	1686	1599
Flt Permitted	0.17	1.00			1.00	1.00				0.95	0.95	1.00
Satd. Flow (perm)	324	3406			3539	1615				1681	1686	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	262	0	0	748	105	0	0	0	1075	2	173
RTOR Reduction (vph)	0	0	0	0	0	45	0	0	0	0	0	111
Lane Group Flow (vph)	358	262	0	0	748	60	0	0	0	537	540	62
Heavy Vehicles (%)	2%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	1%
Turn Type	pm+pt					Perm				Split		Perm
Protected Phases	5	2			6					8	8	
Permitted Phases	2					6						8
Actuated Green, G (s)	64.8	64.8			37.7	37.7				43.2	43.2	43.2
Effective Green, g (s)	64.8	64.8			37.7	37.7				43.2	43.2	43.2
Actuated g/C Ratio	0.54	0.54			0.31	0.31				0.36	0.36	0.36
Clearance Time (s)	6.0	6.0			6.0	6.0				6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Lane Grp Cap (vph)	429	1839			1112	507				605	607	576
v/s Ratio Prot	c0.15	0.08			0.21					0.32	c0.32	
v/s Ratio Perm	c0.30					0.04						0.04
v/c Ratio	0.83	0.14			0.67	0.12				0.89	0.89	0.11
Uniform Delay, d1	22.9	13.8			35.8	29.3				36.1	36.2	25.6
Progression Factor	0.65	0.67			1.00	1.00				1.00	1.00	1.00
Incremental Delay, d2	13.0	0.2			3.3	0.5				14.7	14.9	0.1
Delay (s)	27.8	9.4			39.0	29.8				50.8	51.0	25.7
Level of Service	C	A			D	C				D	D	C
Approach Delay (s)		20.0			37.9			0.0			47.4	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM Average Control Delay	38.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	545	1354	274	1498	49	437
v/c Ratio	0.21	0.86	0.37	0.49	0.39	0.27
Control Delay	2.8	19.1	3.0	4.3	60.9	0.4
Queue Delay	0.0	0.0	0.0	0.4	0.0	0.0
Total Delay	2.8	19.1	3.0	4.7	60.9	0.4
Queue Length 50th (ft)	26	638	32	255	37	0
Queue Length 95th (ft)	m38	m593	m51	299	76	0
Internal Link Dist (ft)	795			689	514	
Turn Bay Length (ft)		200	200			150
Base Capacity (vph)	2571	1583	863	3060	292	1599
Starvation Cap Reductn	0	0	0	934	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.86	0.32	0.70	0.17	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR
Lane Configurations											
Volume (vph)	0	501	1246	252	1378	0	45	0	402	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0	6.0	6.0			6.0	4.0		
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00		
Frt		1.00	0.85	1.00	1.00			1.00	0.85		
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		
Satd. Flow (prot)		3574	1583	1770	3574			1752	1599		
Flt Permitted		1.00	1.00	0.42	1.00			0.95	1.00		
Satd. Flow (perm)		3574	1583	775	3574			1752	1599		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	545	1354	274	1498	0	49	0	437	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	545	1354	274	1498	0	0	49	437	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	3%	0%	1%	0%	0%
Turn Type			Free	pm+pt			Split		Free		
Protected Phases		2		1	6		4	4			
Permitted Phases			Free	6					Free		
Actuated Green, G (s)		85.2	120.0	100.4	100.4			7.6	120.0		
Effective Green, g (s)		85.2	120.0	100.4	100.4			7.6	120.0		
Actuated g/C Ratio		0.71	1.00	0.84	0.84			0.06	1.00		
Clearance Time (s)		6.0		6.0	6.0			6.0			
Vehicle Extension (s)		3.0		3.0	3.0			3.0			
Lane Grp Cap (vph)		2538	1583	725	2990			111	1599		
v/s Ratio Prot		0.15		0.03	0.42			0.03			
v/s Ratio Perm			c0.86	0.29					0.27		
v/c Ratio		0.21	0.86	0.38	0.50			0.44	0.27		
Uniform Delay, d1		6.0	0.0	2.2	2.8			54.2	0.0		
Progression Factor		0.41	1.00	0.94	1.31			1.00	1.00		
Incremental Delay, d2		0.1	3.7	0.2	0.4			2.8	0.4		
Delay (s)		2.5	3.7	2.2	4.0			56.9	0.4		
Level of Service		A	A	A	A			E	A		
Approach Delay (s)		3.4			3.7			6.1		0.0	
Approach LOS		A			A			A		A	

Intersection Summary			
HCM Average Control Delay	3.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	1316	272	1470	123	90	364	103	63
v/c Ratio	0.34	0.94	0.90	0.82	0.14	0.28	0.64	0.58	0.30
Control Delay	13.4	24.5	63.2	15.3	0.6	47.9	21.0	63.7	28.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	24.5	63.2	15.3	0.6	47.9	21.0	63.7	28.1
Queue Length 50th (ft)	4	407	167	311	2	62	115	77	19
Queue Length 95th (ft)	m6	#640	#315	450	0	118	189	132	61
Internal Link Dist (ft)		697		795		478			542
Turn Bay Length (ft)	225		400		300		125	125	
Base Capacity (vph)	141	1399	314	1824	876	316	579	238	263
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.94	0.87	0.81	0.14	0.28	0.63	0.43	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	1199	12	250	1352	113	64	18	335	95	24	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1805	3569		1770	3574	1615		1829	1599	1787	1733	
Flt Permitted	0.09	1.00		0.08	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (perm)	166	3569		144	3574	1615		1829	1599	1787	1733	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	1303	13	272	1470	123	70	20	364	103	26	37
RTOR Reduction (vph)	0	1	0	0	0	53	0	0	76	0	33	0
Lane Group Flow (vph)	48	1315	0	272	1470	70	0	90	288	103	30	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Split		pm+ov	Split		
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases	2			6		6			8			
Actuated Green, G (s)	49.9	45.9		69.3	59.3	59.3		20.7	38.1	12.0	12.0	
Effective Green, g (s)	49.9	45.9		69.3	59.3	59.3		20.7	38.1	12.0	12.0	
Actuated g/C Ratio	0.42	0.38		0.58	0.49	0.49		0.17	0.32	0.10	0.10	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	124	1365		319	1766	798		316	508	179	173	
v/s Ratio Prot	0.01	c0.37		c0.12	0.41			0.05	c0.08	c0.06	0.02	
v/s Ratio Perm	0.15			0.37		0.04			0.10			
v/c Ratio	0.39	0.96		0.85	0.83	0.09		0.28	0.57	0.58	0.17	
Uniform Delay, d1	52.3	36.2		43.3	26.1	16.0		43.2	34.1	51.6	49.4	
Progression Factor	0.42	0.38		0.76	0.44	0.08		1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	13.2		17.9	3.2	0.0		2.3	1.5	4.4	0.5	
Delay (s)	23.3	26.8		50.9	14.7	1.3		45.5	35.5	56.0	49.9	
Level of Service	C	C		D	B	A		D	D	E	D	
Approach Delay (s)		26.7			19.1			37.5			53.7	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1	1467	309	235	1210	193	38
v/c Ratio	0.01	0.73	0.32	1.00	0.47	0.69	0.13
Control Delay	62.0	15.4	3.3	76.6	1.9	60.2	13.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	15.4	3.3	76.6	1.9	60.2	13.4
Queue Length 50th (ft)	0	240	16	181	18	143	0
Queue Length 95th (ft)	m1	461	m48	m#280	52	212	30
Internal Link Dist (ft)		1099			697	750	
Turn Bay Length (ft)	200		200	250			300
Base Capacity (vph)	85	2001	966	236	2584	290	294
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.73	0.32	1.00	0.47	0.67	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1350	284	216	1113	0	178	0	35	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00			
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)	1805	3574	1583	1770	3574			1787	1615			
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)	1805	3574	1583	1770	3574			1787	1615			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1467	309	235	1210	0	193	0	38	0	0	0
RTOR Reduction (vph)	0	0	86	0	0	0	0	0	32	0	0	0
Lane Group Flow (vph)	1	1467	223	235	1210	0	0	193	6	0	0	0
Heavy Vehicles (%)	0%	1%	2%	2%	1%	0%	1%	0%	0%	0%	0%	0%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.2	62.4	62.4	20.8	82.0			18.8	18.8			
Effective Green, g (s)	1.2	62.4	62.4	20.8	82.0			18.8	18.8			
Actuated g/C Ratio	0.01	0.52	0.52	0.17	0.68			0.16	0.16			
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0			6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	18	1858	823	307	2442			280	253			
v/s Ratio Prot	0.00	c0.41		c0.13	0.34			c0.11				
v/s Ratio Perm			0.14						0.00			
v/c Ratio	0.06	0.79	0.27	0.77	0.50			0.69	0.02			
Uniform Delay, d1	58.8	23.5	16.1	47.3	9.1			47.8	42.8			
Progression Factor	1.14	0.64	0.41	0.54	0.18			1.00	1.00			
Incremental Delay, d2	1.1	3.0	0.7	6.9	0.1			6.9	0.0			
Delay (s)	68.2	18.0	7.3	32.3	1.7			54.7	42.9			
Level of Service	E	B	A	C	A			D	D			
Approach Delay (s)		16.2			6.7			52.8			0.0	
Approach LOS		B			A			D			A	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	441	1255	1063	263	472	275
v/c Ratio	0.88	0.48	0.73	0.33	0.81	0.55
Control Delay	60.1	7.3	20.3	1.8	60.0	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.1	7.3	20.3	1.8	60.0	9.7
Queue Length 50th (ft)	321	184	223	4	183	0
Queue Length 95th (ft)	436	223	381	7	#256	77
Internal Link Dist (ft)		191	182		311	
Turn Bay Length (ft)						
Base Capacity (vph)	572	2621	1447	800	584	498
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.48	0.73	0.33	0.81	0.55

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	406	1155	978	242	434	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3574	3574	1615	3502	1615
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1805	3574	3574	1615	3502	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	441	1255	1063	263	472	275
RTOR Reduction (vph)	0	0	0	146	0	229
Lane Group Flow (vph)	441	1255	1063	117	472	46
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	33.4	88.0	48.6	48.6	20.0	20.0
Effective Green, g (s)	33.4	88.0	48.6	48.6	20.0	20.0
Actuated g/C Ratio	0.28	0.73	0.41	0.41	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	502	2621	1447	654	584	269
v/s Ratio Prot	c0.24	0.35	c0.30		c0.13	
v/s Ratio Perm				0.07		0.03
v/c Ratio	0.88	0.48	0.73	0.18	0.81	0.17
Uniform Delay, d1	41.4	6.6	30.2	22.9	48.2	42.9
Progression Factor	1.00	1.00	0.55	0.20	1.00	1.00
Incremental Delay, d2	15.9	0.6	3.0	0.5	11.5	1.4
Delay (s)	42.7	7.2	19.6	5.2	59.6	44.3
Level of Service	D	A	B	A	E	D
Approach Delay (s)		20.2	16.7		54.0	
Approach LOS		C	B		D	

Intersection Summary			
HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	4526	4663	4616	4628	4604	4660	4605
Vehs Exited	4470	4611	4550	4568	4527	4592	4494
Starting Vehs	178	170	192	199	178	161	175
Ending Vehs	234	222	258	259	255	229	286
Denied Entry Before	2	6	16	11	14	6	4
Denied Entry After	35	29	30	33	34	7	42
Travel Distance (mi)	3267	3274	3263	3297	3237	3286	3217
Travel Time (hr)	220.4	222.1	204.4	229.0	235.2	203.9	226.5
Total Delay (hr)	126.9	127.6	110.4	134.0	141.9	109.5	133.7
Total Stops	8882	9119	7959	9084	10136	8173	9331
Fuel Used (gal)	150.1	151.6	146.9	152.9	152.7	148.2	150.7

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	4561	4620	4542	4598
Vehs Exited	4495	4569	4480	4534
Starting Vehs	171	165	156	171
Ending Vehs	237	216	218	239
Denied Entry Before	8	11	10	9
Denied Entry After	15	33	18	25
Travel Distance (mi)	3258	3300	3266	3266
Travel Time (hr)	200.9	227.4	203.3	217.3
Total Delay (hr)	107.1	132.6	109.5	123.3
Total Stops	7793	9289	7847	8761
Fuel Used (gal)	147.4	153.1	146.9	150.0

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	4526	4663	4616	4628	4604	4660	4605
Vehs Exited	4470	4611	4550	4568	4527	4592	4494
Starting Vehs	178	170	192	199	178	161	175
Ending Vehs	234	222	258	259	255	229	286
Denied Entry Before	2	6	16	11	14	6	4
Denied Entry After	35	29	30	33	34	7	42
Travel Distance (mi)	3267	3274	3263	3297	3237	3286	3217
Travel Time (hr)	220.4	222.1	204.4	229.0	235.2	203.9	226.5
Total Delay (hr)	126.9	127.6	110.4	134.0	141.9	109.5	133.7
Total Stops	8882	9119	7959	9084	10136	8173	9331
Fuel Used (gal)	150.1	151.6	146.9	152.9	152.7	148.2	150.7

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	4561	4620	4542	4598
Vehs Exited	4495	4569	4480	4534
Starting Vehs	171	165	156	171
Ending Vehs	237	216	218	239
Denied Entry Before	8	11	10	9
Denied Entry After	15	33	18	25
Travel Distance (mi)	3258	3300	3266	3266
Travel Time (hr)	200.9	227.4	203.3	217.3
Total Delay (hr)	107.1	132.6	109.5	123.3
Total Stops	7793	9289	7847	8761
Fuel Used (gal)	147.4	153.1	146.9	150.0

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWR	All
Total Delay (hr)	2.8	1.7	2.4	0.1	10.0	1.0	18.0
Delay / Veh (s)	32.4	13.9	23.7	8.2	36.8	22.1	28.3
Total Stops	346	214	245	17	692	93	1607
Travel Dist (mi)	43.6	63.9	64.6	4.4	174.4	28.9	379.8
Travel Time (hr)	4.1	3.3	4.0	0.2	15.7	2.0	29.3
Avg Speed (mph)	11	20	16	27	15	24	16
Fuel Used (gal)	1.7	2.3	2.8	0.2	6.4	1.0	14.5
HC Emissions (g)	12	31	36	2	51	6	138
CO Emissions (g)	553	1378	1858	116	1467	416	5788
NOx Emissions (g)	41	102	114	5	145	19	426
Vehicles Entered	310	450	362	24	981	163	2290
Vehicles Exited	308	450	362	25	982	164	2291
Hourly Exit Rate	308	450	362	25	982	164	2291
Input Volume	326	457	355	25	992	167	2322
% of Volume	94	98	102	100	99	98	99
Denied Entry Before	0	0	0	0	6	0	6
Denied Entry After	0	0	0	0	5	1	6

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBL	SBR	All
Total Delay (hr)	1.2	5.8	0.6	1.7	1.5	0.0	0.6	11.5
Delay / Veh (s)	6.7	19.1	11.5	5.4	71.1	99.7	8.1	12.1
Total Stops	60	147	116	95	68	1	6	493
Travel Dist (mi)	105.0	171.8	28.9	169.2	7.5	0.1	25.5	508.1
Travel Time (hr)	3.8	11.3	1.6	6.7	1.8	0.0	1.5	26.7
Avg Speed (mph)	29	16	18	25	4	4	22	20
Fuel Used (gal)	5.4	6.0	1.5	9.8	0.6	0.0	0.9	24.4
HC Emissions (g)	75	43	14	148	5	0	11	294
CO Emissions (g)	3798	1698	914	7522	179	2	551	14663
NOx Emissions (g)	274	166	52	512	14	0	34	1052
Vehicles Entered	647	1093	194	1150	74	1	271	3430
Vehicles Exited	647	1092	192	1149	75	1	270	3426
Hourly Exit Rate	647	1092	192	1149	75	1	270	3426
Input Volume	665	1154	198	1149	80	1	267	3514
% of Volume	97	95	97	100	94	100	101	97
Denied Entry Before	0	1	0	0	0	0	0	1
Denied Entry After	0	1	0	0	0	0	0	1

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.2	18.9	0.3	3.9	3.8	0.1	0.2	0.3	4.1	0.5	0.1	0.0
Delay / Veh (s)	26.6	54.1	64.9	55.0	13.7	4.2	64.2	62.7	39.6	73.9	71.4	11.0
Total Stops	25	1110	19	228	319	34	13	16	279	23	5	11
Travel Dist (mi)	3.7	177.6	2.2	41.0	158.1	17.1	1.3	1.7	35.2	2.6	0.6	1.3
Travel Time (hr)	0.3	23.0	0.4	5.1	7.6	0.6	0.3	0.4	5.5	0.6	0.1	0.1
Avg Speed (mph)	12	8	6	8	21	27	5	5	7	5	5	15
Fuel Used (gal)	0.2	11.0	0.1	2.0	7.3	0.8	0.1	0.1	2.0	0.2	0.0	0.0
HC Emissions (g)	1	76	1	19	75	12	8	0	20	0	1	0
CO Emissions (g)	86	2949	21	659	4216	675	130	29	640	22	21	10
NOx Emissions (g)	6	288	3	56	290	37	14	2	54	1	2	1
Vehicles Entered	26	1262	16	252	992	105	14	18	373	24	6	12
Vehicles Exited	26	1256	16	252	992	105	14	18	375	24	6	12
Hourly Exit Rate	26	1256	16	252	992	105	14	18	375	24	6	12
Input Volume	29	1338	15	249	999	101	14	16	374	24	6	11
% of Volume	90	94	107	101	99	104	100	112	100	100	100	109
Denied Entry Before	0	1	0	0	0	0	0	0	1	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	32.5
Delay / Veh (s)	37.7
Total Stops	2082
Travel Dist (mi)	442.5
Travel Time (hr)	44.0
Avg Speed (mph)	10
Fuel Used (gal)	23.8
HC Emissions (g)	214
CO Emissions (g)	9460
NOx Emissions (g)	755
Vehicles Entered	3100
Vehicles Exited	3096
Hourly Exit Rate	3096
Input Volume	3176
% of Volume	97
Denied Entry Before	2
Denied Entry After	0

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	All
Total Delay (hr)	30.7	2.2	1.1	1.0	0.0	2.6	0.0	0.8	38.5
Delay / Veh (s)	88.3	54.5	61.5	4.2	3.7	63.3	43.4	50.5	53.9
Total Stops	2041	164	62	56	0	133	1	50	2507
Travel Dist (mi)	281.9	33.1	9.6	132.3	0.3	22.0	0.1	8.8	488.2
Travel Time (hr)	37.1	3.2	1.4	4.0	0.0	3.4	0.0	1.1	50.3
Avg Speed (mph)	8	12	7	33	27	7	9	8	11
Fuel Used (gal)	14.6	1.6	0.6	5.7	0.0	1.4	0.0	0.5	24.4
HC Emissions (g)	112	32	6	73	0	13	0	6	242
CO Emissions (g)	4277	949	221	3375	6	508	2	249	9588
NOx Emissions (g)	357	77	19	295	0	38	0	16	802
Vehicles Entered	1272	149	66	901	2	148	1	58	2597
Vehicles Exited	1231	145	66	901	2	148	1	56	2550
Hourly Exit Rate	1231	145	66	901	2	148	1	56	2550
Input Volume	1305	155	69	904	3	146	1	60	2643
% of Volume	94	94	96	100	67	101	100	93	96
Denied Entry Before	0	0	0	0	0	0	0	0	0
Denied Entry After	16	2	0	0	0	0	0	0	18

6: Graves Mill Rd & Entrance Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Total Delay (hr)	2.5	3.3	4.5	0.3	1.7	0.4	12.7
Delay / Veh (s)	30.2	10.2	19.5	6.9	26.4	11.7	16.3
Total Stops	253	442	440	91	179	92	1497
Travel Dist (mi)	13.0	50.9	34.5	6.4	15.0	8.1	127.9
Travel Time (hr)	3.1	4.5	5.2	0.6	2.4	0.8	16.6
Avg Speed (mph)	4	11	7	10	6	12	8
Fuel Used (gal)	0.9	2.3	2.1	0.2	0.9	0.4	6.8
HC Emissions (g)	1	24	14	0	3	2	44
CO Emissions (g)	73	821	389	34	175	98	1590
NOx Emissions (g)	9	83	53	2	16	8	171
Vehicles Entered	299	1168	826	153	234	125	2805
Vehicles Exited	299	1166	825	153	233	125	2801
Hourly Exit Rate	299	1166	825	153	233	125	2801
Input Volume	295	1176	819	162	237	126	2815
% of Volume	101	99	101	94	98	99	100
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

17: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	WBR	All
Total Delay (hr)	2.1	1.3	0.0	3.4
Delay / Veh (s)	5.3	4.5	2.1	4.9
Total Stops	126	38	0	164
Travel Dist (mi)	68.0	228.5	8.1	304.7
Travel Time (hr)	3.9	6.6	0.2	10.7
Avg Speed (mph)	18	35	33	28
Fuel Used (gal)	4.1	6.3	0.2	10.6
HC Emissions (g)	46	85	5	136
CO Emissions (g)	2194	3334	196	5724
NOx Emissions (g)	182	301	16	499
Vehicles Entered	1397	1017	36	2450
Vehicles Exited	1394	1018	36	2448
Hourly Exit Rate	1394	1018	36	2448
Input Volume	1412	1019	35	2466
% of Volume	99	100	103	99
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

19: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	SBR	All
Total Delay (hr)	1.9	0.7	0.1	2.6
Delay / Veh (s)	4.6	2.8	6.7	3.9
Total Stops	131	0	31	162
Travel Dist (mi)	97.9	46.5	1.3	145.6
Travel Time (hr)	4.5	1.9	0.1	6.6
Avg Speed (mph)	22	24	10	22
Fuel Used (gal)	4.5	3.5	0.0	8.1
HC Emissions (g)	68	49	0	117
CO Emissions (g)	3649	2296	6	5950
NOx Emissions (g)	202	191	1	393
Vehicles Entered	1463	948	31	2442
Vehicles Exited	1460	948	31	2439
Hourly Exit Rate	1460	948	31	2439
Input Volume	1465	944	32	2441
% of Volume	100	100	97	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

Total Network Performance

Total Delay (hr)	123.3
Delay / Veh (s)	97.2
Total Stops	8761
Travel Dist (mi)	3266.5
Travel Time (hr)	217.3
Avg Speed (mph)	16
Fuel Used (gal)	150.0
HC Emissions (g)	1614
CO Emissions (g)	70642
NOx Emissions (g)	5621
Vehicles Entered	4598
Vehicles Exited	4534
Hourly Exit Rate	4534
Input Volume	27605
% of Volume	16
Denied Entry Before	9
Denied Entry After	25

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW	NW
Directions Served	L	T	T	T	T	R	L	LT	R
Maximum Queue (ft)	224	268	184	228	132	19	276	272	85
Average Queue (ft)	143	75	76	76	61	6	187	178	37
95th Queue (ft)	232	186	144	173	111	18	253	253	66
Link Distance (ft)		718	718	931	931			931	
Upstream Blk Time (%)				0					
Queuing Penalty (veh)				0					
Storage Bay Dist (ft)	125					125	300		300
Storage Blk Time (%)	14	0			0		0	0	
Queuing Penalty (veh)	32	1			0		1	0	

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	122	97	223	134	109	131	159	53
Average Queue (ft)	29	25	76	53	27	41	68	7
95th Queue (ft)	86	72	188	101	74	94	131	36
Link Distance (ft)	813	813			718	718	524	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			0	0			1	
Queuing Penalty (veh)			1	0			3	

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	172	775	742	309	252	275	43	434	175	71	63
Average Queue (ft)	22	597	689	173	113	135	13	162	156	23	13
95th Queue (ft)	91	996	810	284	200	225	34	402	202	57	41
Link Distance (ft)		698	698		813	813	813	488			559
Upstream Blk Time (%)		14	20					0			
Queuing Penalty (veh)		95	136					0			
Storage Bay Dist (ft)	225			400					125	125	
Storage Blk Time (%)		6		0	0			0	25		
Queuing Penalty (veh)		2		0	0			0	7		

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	1185	1167	500	154	91	106	267	114
Average Queue (ft)	577	657	165	61	20	30	129	36
95th Queue (ft)	1262	1308	536	122	62	76	224	86
Link Distance (ft)	1148	1148			698	698	778	
Upstream Blk Time (%)	5	8						
Queuing Penalty (veh)	35	56						
Storage Bay Dist (ft)			200	250				300
Storage Blk Time (%)	24	46					0	
Queuing Penalty (veh)	0	71					0	

Intersection: 6: Graves Mill Rd & Entrance

Movement	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	T	T	T	T	R	L	L	R
Maximum Queue (ft)	197	215	206	194	190	115	112	125	88
Average Queue (ft)	142	113	126	123	138	47	51	61	34
95th Queue (ft)	209	196	203	195	200	91	93	105	65
Link Distance (ft)	186	186	186	179	179	179	334	334	
Upstream Blk Time (%)	6	4	6	3	4				
Queuing Penalty (veh)	29	22	28	8	12				
Storage Bay Dist (ft)									100
Storage Blk Time (%)								1	0
Queuing Penalty (veh)								2	0

Intersection: 14: Bend

Movement	EB
Directions Served	T
Maximum Queue (ft)	435
Average Queue (ft)	31
95th Queue (ft)	251
Link Distance (ft)	562
Upstream Blk Time (%)	0
Queuing Penalty (veh)	1
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: Graves Mill Rd &

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	158	148	116	159
Average Queue (ft)	30	33	12	20
95th Queue (ft)	143	146	64	94
Link Distance (ft)	179	179	1148	1148
Upstream Blk Time (%)	4	5		
Queuing Penalty (veh)	25	33		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 19: Graves Mill Rd &

Movement	EB	EB	EB	B7	B7	SB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	168	152	156	61	60	58
Average Queue (ft)	28	26	27	7	8	21
95th Queue (ft)	149	158	158	84	88	48
Link Distance (ft)	297	297	297	422	422	214
Upstream Blk Time (%)	0	1	1	0	0	
Queuing Penalty (veh)	0	0	0	0	0	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 601

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1	1
Vehs Entered	5461	5332	5402	5324	5296	5200	5390
Vehs Exited	5305	5209	5260	5192	5189	5048	5303
Starting Vehs	240	270	256	265	268	212	283
Ending Vehs	396	393	398	397	375	364	370
Denied Entry Before	15	1	6	3	18	11	7
Denied Entry After	292	452	386	420	289	425	376
Travel Distance (mi)	3607	3532	3614	3541	3548	3465	3629
Travel Time (hr)	439.8	515.7	537.0	528.1	425.3	487.9	489.4
Total Delay (hr)	334.3	412.4	431.2	424.8	321.4	386.6	383.5
Total Stops	14782	15170	15910	14463	14063	13688	15025
Fuel Used (gal)	209.5	224.9	233.3	227.8	204.8	217.1	221.7

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intvls	1	1	1	1
Vehs Entered	5364	5304	5479	5352
Vehs Exited	5223	5215	5388	5234
Starting Vehs	258	262	269	258
Ending Vehs	399	351	360	381
Denied Entry Before	9	17	4	6
Denied Entry After	382	368	205	358
Travel Distance (mi)	3556	3499	3662	3565
Travel Time (hr)	484.8	499.3	410.1	481.7
Total Delay (hr)	380.6	396.3	303.2	377.4
Total Stops	14469	14649	14765	14697
Fuel Used (gal)	219.5	220.2	204.8	218.3

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	5461	5332	5402	5324	5296	5200	5390
Vehs Exited	5305	5209	5260	5192	5189	5048	5303
Starting Vehs	240	270	256	265	268	212	283
Ending Vehs	396	393	398	397	375	364	370
Denied Entry Before	15	1	6	3	18	11	7
Denied Entry After	292	452	386	420	289	425	376
Travel Distance (mi)	3607	3532	3614	3541	3548	3465	3629
Travel Time (hr)	439.8	515.7	537.0	528.1	425.3	487.9	489.4
Total Delay (hr)	334.3	412.4	431.2	424.8	321.4	386.6	383.5
Total Stops	14782	15170	15910	14463	14063	13688	15025
Fuel Used (gal)	209.5	224.9	233.3	227.8	204.8	217.1	221.7

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	5364	5304	5479	5352
Vehs Exited	5223	5215	5388	5234
Starting Vehs	258	262	269	258
Ending Vehs	399	351	360	381
Denied Entry Before	9	17	4	6
Denied Entry After	382	368	205	358
Travel Distance (mi)	3556	3499	3662	3565
Travel Time (hr)	484.8	499.3	410.1	481.7
Total Delay (hr)	380.6	396.3	303.2	377.4
Total Stops	14469	14649	14765	14697
Fuel Used (gal)	219.5	220.2	204.8	218.3

2: Graves Mill Rd & East Ramp Performance by movement

Movement	EBL	EBT	WBT	WBR	NWL	NWT	NWR	All
Total Delay (hr)	2.1	0.8	6.9	0.3	13.5	0.0	0.9	24.6
Delay / Veh (s)	26.8	13.5	36.6	12.1	50.2	54.5	20.0	36.7
Total Stops	233	95	483	68	734	1	92	1706
Travel Dist (mi)	40.6	31.2	121.2	17.8	169.8	0.4	27.8	408.6
Travel Time (hr)	3.4	1.6	9.9	0.9	19.0	0.0	1.8	36.6
Avg Speed (mph)	12	20	12	23	11	12	25	13
Fuel Used (gal)	1.5	1.2	5.4	0.7	7.2	0.0	1.0	16.9
HC Emissions (g)	12	23	67	6	50	0	11	170
CO Emissions (g)	518	835	3009	446	1499	2	528	6839
NOx Emissions (g)	37	67	200	21	144	0	31	501
Vehicles Entered	284	221	676	99	967	2	159	2408
Vehicles Exited	284	221	682	99	966	2	159	2413
Hourly Exit Rate	284	221	682	99	966	2	159	2413
Input Volume	329	241	688	97	989	2	159	2505
% of Volume	86	92	99	102	98	100	100	96
Denied Entry Before	0	0	0	0	3	0	1	4
Denied Entry After	0	0	0	0	2	0	0	2

3: Graves Mill Rd & West Ramp Performance by movement

Movement	EBT	EBR	WBL	WBT	SBL2	SBR	All
Total Delay (hr)	0.6	4.8	0.8	3.2	0.7	1.0	11.1
Delay / Veh (s)	5.2	16.3	11.2	8.3	61.9	8.9	11.2
Total Stops	37	128	145	197	41	18	566
Travel Dist (mi)	70.5	164.9	37.0	208.4	4.4	37.7	522.8
Travel Time (hr)	2.4	10.2	2.0	9.0	0.9	2.3	26.8
Avg Speed (mph)	30	17	18	23	5	22	20
Fuel Used (gal)	3.8	5.8	1.7	10.3	0.3	1.2	23.1
HC Emissions (g)	41	50	22	132	2	12	257
CO Emissions (g)	2723	2008	921	6108	76	604	12440
NOx Emissions (g)	159	184	78	496	5	35	957
Vehicles Entered	436	1060	247	1401	43	397	3584
Vehicles Exited	437	1060	247	1400	44	397	3585
Hourly Exit Rate	437	1060	247	1400	44	397	3585
Input Volume	501	1246	252	1425	45	402	3871
% of Volume	87	85	98	98	98	99	93
Denied Entry Before	0	0	0	0	0	1	1
Denied Entry After	0	1	0	0	0	1	2

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	0.6	18.7	0.2	3.7	8.3	0.2	0.8	0.3	2.5	1.5	0.4	0.2
Delay / Veh (s)	62.2	64.4	82.2	53.9	21.7	6.1	45.3	47.5	26.2	56.2	52.2	22.9
Total Stops	38	1161	16	263	605	47	52	16	255	86	23	31
Travel Dist (mi)	5.2	142.2	1.5	40.1	221.6	18.9	5.9	1.9	33.3	10.2	2.9	3.7
Travel Time (hr)	0.8	22.0	0.3	4.9	13.7	0.8	1.0	0.3	3.8	1.8	0.5	0.4
Avg Speed (mph)	7	6	5	8	16	24	6	6	10	6	6	10
Fuel Used (gal)	0.4	10.2	0.1	2.2	10.6	1.0	0.4	0.1	1.6	0.7	0.2	0.2
HC Emissions (g)	2	59	0	20	100	10	1	0	9	3	1	1
CO Emissions (g)	154	2670	10	786	5012	759	77	28	522	175	48	55
NOx Emissions (g)	9	239	1	66	385	33	5	2	33	11	3	3
Vehicles Entered	36	1047	11	247	1389	116	61	20	340	94	26	34
Vehicles Exited	36	1047	10	246	1386	116	61	20	342	95	26	34
Hourly Exit Rate	36	1047	10	246	1386	116	61	20	342	95	26	34
Input Volume	44	1329	12	250	1418	113	64	18	335	95	24	34
% of Volume	82	79	83	98	98	103	95	111	102	100	108	100
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	1	0	0	0

4: Graves Mill Rd & Creekside Dr Performance by movement

Movement	All
Total Delay (hr)	37.4
Delay / Veh (s)	39.4
Total Stops	2593
Travel Dist (mi)	487.4
Travel Time (hr)	50.2
Avg Speed (mph)	10
Fuel Used (gal)	27.5
HC Emissions (g)	207
CO Emissions (g)	10294
NOx Emissions (g)	791
Vehicles Entered	3421
Vehicles Exited	3419
Hourly Exit Rate	3419
Input Volume	3736
% of Volume	92
Denied Entry Before	0
Denied Entry After	1

5: Graves Mill Rd & Old Graves Mill Rd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	All
Total Delay (hr)	0.0	79.0	11.2	4.9	2.6	2.3	0.2	100.2
Delay / Veh (s)	62.7	260.7	182.4	82.5	7.6	48.2	30.0	123.0
Total Stops	1	3028	462	275	171	152	26	4115
Travel Dist (mi)	0.1	239.6	49.0	31.1	169.8	25.9	4.5	519.9
Travel Time (hr)	0.0	84.4	12.7	5.8	6.5	3.3	0.4	113.0
Avg Speed (mph)	6	4	6	5	26	8	12	6
Fuel Used (gal)	0.0	25.0	4.3	2.1	9.0	1.4	0.2	42.1
HC Emissions (g)	0	89	30	14	101	11	1	246
CO Emissions (g)	3	3000	1034	542	5722	525	98	10925
NOx Emissions (g)	0	314	91	48	409	35	5	902
Vehicles Entered	1	1107	224	212	1203	175	30	2952
Vehicles Exited	1	1074	217	212	1205	175	30	2914
Hourly Exit Rate	1	1074	217	212	1205	175	30	2914
Input Volume	1	1362	284	216	1235	178	35	3311
% of Volume	100	79	76	98	98	98	86	88
Denied Entry Before	0	1	0	0	0	0	0	1
Denied Entry After	0	39	8	0	0	0	0	47

6: Graves Mill Rd & Entrance Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Total Delay (hr)	3.9	13.7	5.1	0.4	67.4	26.7	117.3
Delay / Veh (s)	40.1	47.2	18.7	6.2	751.1	503.9	135.1
Total Stops	245	824	391	109	521	181	2271
Travel Dist (mi)	17.2	50.3	45.9	11.1	20.6	12.3	157.4
Travel Time (hr)	4.6	14.8	6.1	0.9	68.4	27.4	122.3
Avg Speed (mph)	4	4	8	12	1	8	3
Fuel Used (gal)	1.4	4.8	2.5	0.3	16.3	6.5	31.9
HC Emissions (g)	2	24	19	1	4	1	50
CO Emissions (g)	108	741	565	50	885	356	2705
NOx Emissions (g)	12	85	70	3	26	7	204
Vehicles Entered	354	1049	979	235	333	190	3140
Vehicles Exited	355	1039	980	235	313	191	3113
Hourly Exit Rate	355	1039	980	235	313	191	3113
Input Volume	406	1174	992	242	434	253	3501
% of Volume	87	89	99	97	72	75	89
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	3	0	0	111	67	181

17: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	WBR	All
Total Delay (hr)	12.7	1.6	0.0	14.3
Delay / Veh (s)	34.0	4.6	2.5	19.6
Total Stops	751	43	0	794
Travel Dist (mi)	71.4	272.9	6.5	350.8
Travel Time (hr)	14.7	8.0	0.2	22.8
Avg Speed (mph)	6	34	32	17
Fuel Used (gal)	5.2	8.4	0.2	13.8
HC Emissions (g)	82	106	4	192
CO Emissions (g)	1534	4709	154	6396
NOx Emissions (g)	141	390	12	543
Vehicles Entered	1350	1250	30	2630
Vehicles Exited	1340	1253	29	2622
Hourly Exit Rate	1340	1253	29	2622
Input Volume	1609	1275	28	2912
% of Volume	83	98	104	90
Denied Entry Before	0	0	0	0
Denied Entry After	3	0	0	3

19: Graves Mill Rd & Performance by movement

Movement	EBT	WBT	SBR	All
Total Delay (hr)	11.6	0.8	0.1	12.5
Delay / Veh (s)	30.0	2.3	10.9	17.3
Total Stops	817	0	36	853
Travel Dist (mi)	64.3	62.0	1.4	127.7
Travel Time (hr)	13.3	2.4	0.2	15.9
Avg Speed (mph)	5	26	7	8
Fuel Used (gal)	5.3	3.8	0.1	9.1
HC Emissions (g)	41	48	0	89
CO Emissions (g)	1391	2267	7	3664
NOx Emissions (g)	142	188	1	330
Vehicles Entered	1402	1172	36	2610
Vehicles Exited	1388	1173	36	2597
Hourly Exit Rate	1388	1173	36	2597
Input Volume	1561	1246	37	2844
% of Volume	89	94	97	91
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

Total Network Performance

Total Delay (hr)	377.4
Delay / Veh (s)	256.6
Total Stops	14697
Travel Dist (mi)	3565.4
Travel Time (hr)	481.7
Avg Speed (mph)	10
Fuel Used (gal)	218.3
HC Emissions (g)	1760
CO Emissions (g)	72878
NOx Emissions (g)	6043
Vehicles Entered	5352
Vehicles Exited	5234
Hourly Exit Rate	5234
Input Volume	32239
% of Volume	16
Denied Entry Before	6
Denied Entry After	358

Intersection: 2: Graves Mill Rd & East Ramp

Movement	EB	EB	EB	WB	WB	WB	NW	NW	NW
Directions Served	L	T	T	T	T	R	L	LT	R
Maximum Queue (ft)	224	303	106	327	320	224	406	411	104
Average Queue (ft)	134	50	44	203	189	45	278	268	33
95th Queue (ft)	227	171	87	295	282	160	379	375	78
Link Distance (ft)		717	717	934	934			921	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	125					125	300		300
Storage Blk Time (%)	9	0			20		4	4	
Queuing Penalty (veh)	11	0			19		29	24	

Intersection: 3: Graves Mill Rd & West Ramp

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	<L	R
Maximum Queue (ft)	96	54	221	151	245	210	112	62
Average Queue (ft)	20	11	65	62	38	62	40	18
95th Queue (ft)	64	38	166	122	146	146	88	59
Link Distance (ft)	813	813			717	717	529	
Upstream Blk Time (%)					0			
Queuing Penalty (veh)					0			
Storage Bay Dist (ft)			200	200				150
Storage Blk Time (%)			0	0	0		0	
Queuing Penalty (veh)			1	0	0		1	

Intersection: 4: Graves Mill Rd & Creekside Dr

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	TR
Maximum Queue (ft)	92	773	748	369	446	471	44	302	174	160	99
Average Queue (ft)	34	680	696	182	180	201	16	87	119	80	42
95th Queue (ft)	78	998	821	318	365	391	35	224	191	141	84
Link Distance (ft)		697	697		813	813	813	505			564
Upstream Blk Time (%)		14	18								
Queuing Penalty (veh)		100	123								
Storage Bay Dist (ft)	225			400					125	125	
Storage Blk Time (%)		0		0	0			1	9	2	0
Queuing Penalty (veh)		0		1	1			2	8	1	0

Intersection: 5: Graves Mill Rd & Old Graves Mill Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	T	TR	LT	R
Maximum Queue (ft)	104	1181	1161	500	359	280	291	247	55
Average Queue (ft)	4	1104	1100	386	208	86	93	135	14
95th Queue (ft)	71	1389	1326	706	382	310	289	217	39
Link Distance (ft)		1112	1112			697	697	773	
Upstream Blk Time (%)		35	46			0	0		
Queuing Penalty (veh)		281	362			0	0		
Storage Bay Dist (ft)	200			200	250				300
Storage Blk Time (%)		63	75	0	10			0	
Queuing Penalty (veh)		1	213	0	54			0	

Intersection: 6: Graves Mill Rd & Entrance

Movement	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	T	T	T	T	R	L	L	R
Maximum Queue (ft)	240	261	246	222	225	138	350	350	324
Average Queue (ft)	200	209	212	148	160	53	305	313	104
95th Queue (ft)	267	285	280	232	237	106	426	422	247
Link Distance (ft)	211	211	211	206	206	206	335	335	335
Upstream Blk Time (%)	18	44	48	4	5		52	66	3
Queuing Penalty (veh)	92	227	249	14	19		0	0	0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 14: Bend

Movement	EB
Directions Served	T
Maximum Queue (ft)	597
Average Queue (ft)	85
95th Queue (ft)	425
Link Distance (ft)	534
Upstream Blk Time (%)	1
Queuing Penalty (veh)	5
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: Graves Mill Rd &

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	272	248	165	204
Average Queue (ft)	201	199	14	23
95th Queue (ft)	311	297	85	120
Link Distance (ft)	206	206	1112	1112
Upstream Blk Time (%)	34	42		
Queuing Penalty (veh)	268	335		
Storage Bay Dist (ft)				
Storage Blk Time (%)				0
Queuing Penalty (veh)				0

Intersection: 19: Graves Mill Rd &

Movement	EB	EB	EB	B7	B7	WB	SB
Directions Served	T	T	T	T	T	T	R
Maximum Queue (ft)	282	267	259	671	674	25	64
Average Queue (ft)	207	191	186	396	423	1	25
95th Queue (ft)	365	347	343	867	903	25	54
Link Distance (ft)	204	204	204	642	642	211	196
Upstream Blk Time (%)	19	31	25	8	29	0	
Queuing Penalty (veh)	0	0	0	0	0	0	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Network Summary

Network wide Queuing Penalty: 2441

EPR - "ENGINEERING & PLANNING RESOURCES"
637 BERKMAR CIRCLE, CHARLOTTESVILLE, VA 22901

MEMORANDUM

TO: RON COX AND BILL BERKLEY	FROM: BILL WUENSCH, P.E., PTOE
ORGANIZATION: BERLEY HOWELL	DATE: 12-26-13
PHONE NUMBER:	SENDER'S REFERENCE NUMBER:
RE: ROSEDALE – INTERNAL INTERSECTION GEOMETRY REQUIREMENTS	YOUR REFERENCE NUMBER:

☐ URGENT X FOR YOUR USE ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

The following information has been prepared to respond to the City's question regarding internal ADTs, internal turning movement projections, and internal intersection laneage requirements. The attached **Figure 1** provides an illustration of the projected internal ADTs for the site. As shown, the first road link from Graves Mill Road has a projected ADT of approximately 19,000 vehicles per day. At the first intersection (intersection #4), we are projecting a heavy left turn volume to the uses along the west side of the site. The mainline (development spine road) volume is then reduced to approximately 7,300 vehicles per day.

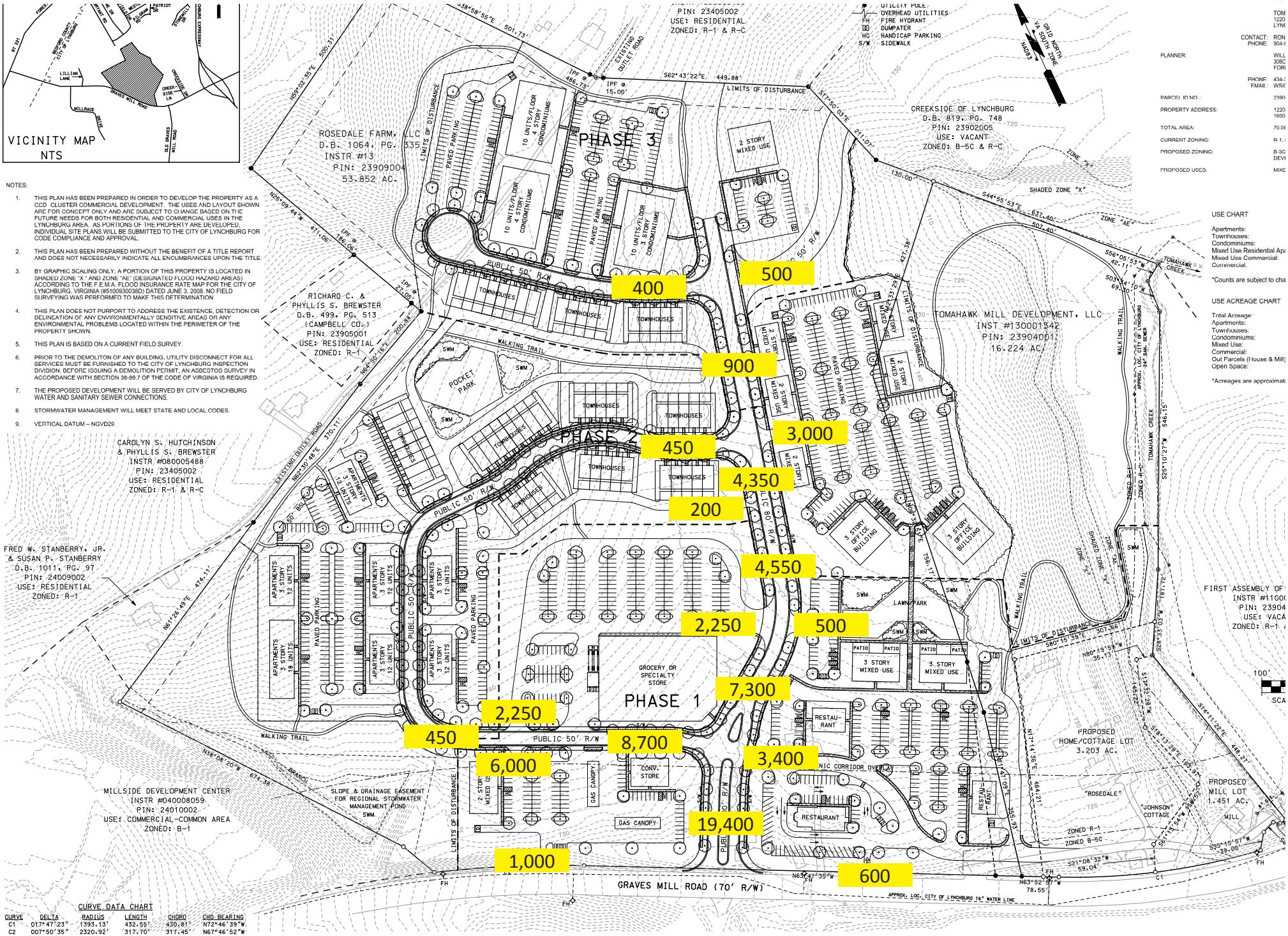
Figure 2 illustrates the projected peak hour turning movements, and **Figure 3** is a table with the findings of FHWA turn lane warrant analyses. The Synchro model was utilized to identify recommendations for intersection laneage and traffic control. **Figures 4 and 5** provides an illustrations of the recommended intersection geometry and resulting movement delay and volume to capacity ratios. The recommended traffic control at the first major internal intersection location is a four way STOP configuration. Without the four way STOP, the westbound left turn has an LOS F. With the four way STOP all movements function at LOS D or better. The figures show the 2nd internal intersection also. The recommended geometry provides for intuitive transitions while allowing for the required turn lanes.

The attached table summarizes the turn lane requirements at the internal intersections.

END OF MEMORANDUM

Attachments
Figures 1 through 5

Figure 1 Graves Mill Internal ADT Estimate



NOTES:

1. THIS PLAN HAS BEEN PREPARED IN ORDER TO DEVELOP THE PROPERTY AS A CCD CLUSTER COMMERCIAL DEVELOPMENT. THE USES AND LAYOUT SHOWN ARE FOR CONCEPT ONLY AND ARE SUBJECT TO CHANGE BASED ON THE FUTURE NEEDS FOR BOTH RESIDENTIAL AND COMMERCIAL USES IN THE LYNCHBURG AREA. AS PORTIONS OF THE PROPERTY ARE DEVELOPED, INDIVIDUAL SITE PLANS WILL BE SUBMITTED TO THE CITY OF LYNCHBURG FOR CODE COMPLIANCE AND APPROVAL.
2. THIS PLAN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND DOES NOT NECESSARILY INDICATE ALL ENCUMBRANCES UPON THE TITLE.
3. BY GRAPHIC SCALING ONLY, A PORTION OF THIS PROPERTY IS LOCATED IN SHADED ZONE "X" AND ZONE "AE" (DESIGNATED FLOOD HAZARD AREAS) ACCORDING TO THE F.E.M.A. FLOOD INSURANCE RATE MAP FOR THE CITY OF LYNCHBURG, VIRGINIA (#5100930038D) DATED JUNE 3, 2008. NO FIELD SURVEYING WAS PERFORMED TO MAKE THIS DETERMINATION.
4. THIS PLAN DOES NOT PURPORT TO ADDRESS THE EXISTENCE, DETECTION OR DELINEATION OF ANY ENVIRONMENTALLY SENSITIVE AREAS OR ANY ENVIRONMENTAL PROBLEMS LOCATED WITHIN THE PERIMETER OF THE PROPERTY SHOWN.
5. THIS PLAN IS BASED ON A CURRENT FIELD SURVEY.
6. PRIOR TO THE DEMOLITON OF ANY BUILDING, UTILITY DISCONNECT FOR ALL SERVICES MUST BE FURNISHED TO THE CITY OF LYNCHBURG INSPECTION DIVISION. BEFORE ISSUING A DEMOLITION PERMIT, AN ASBESTOS SURVEY IN ACCORDANCE WITH SECTION 36-99.7 OF THE CODE OF VIRGINIA IS REQUIRED.
7. THE PROPOSED DEVELOPMENT WILL BE SERVED BY CITY OF LYNCHBURG WATER AND SANITARY SEWER CONNECTIONS.
8. STORMWATER MANAGEMENT WILL MEET STATE AND LOCAL CODES.
9. VERTICAL DATUM – NGVD29

CURVE DATA CHART

CURVE	DELTA	RADIUS	LENGTH	CHORD	CHD BEARING
C1	017°47'23"	1393.13'	432.55'	430.81'	N72°46'39"W
C2	007°50'35"	2320.92'	317.70'	317.45'	N67°46'52"W

Figure 2 Graves Mill Internal Intersection Turning Movement Estimate

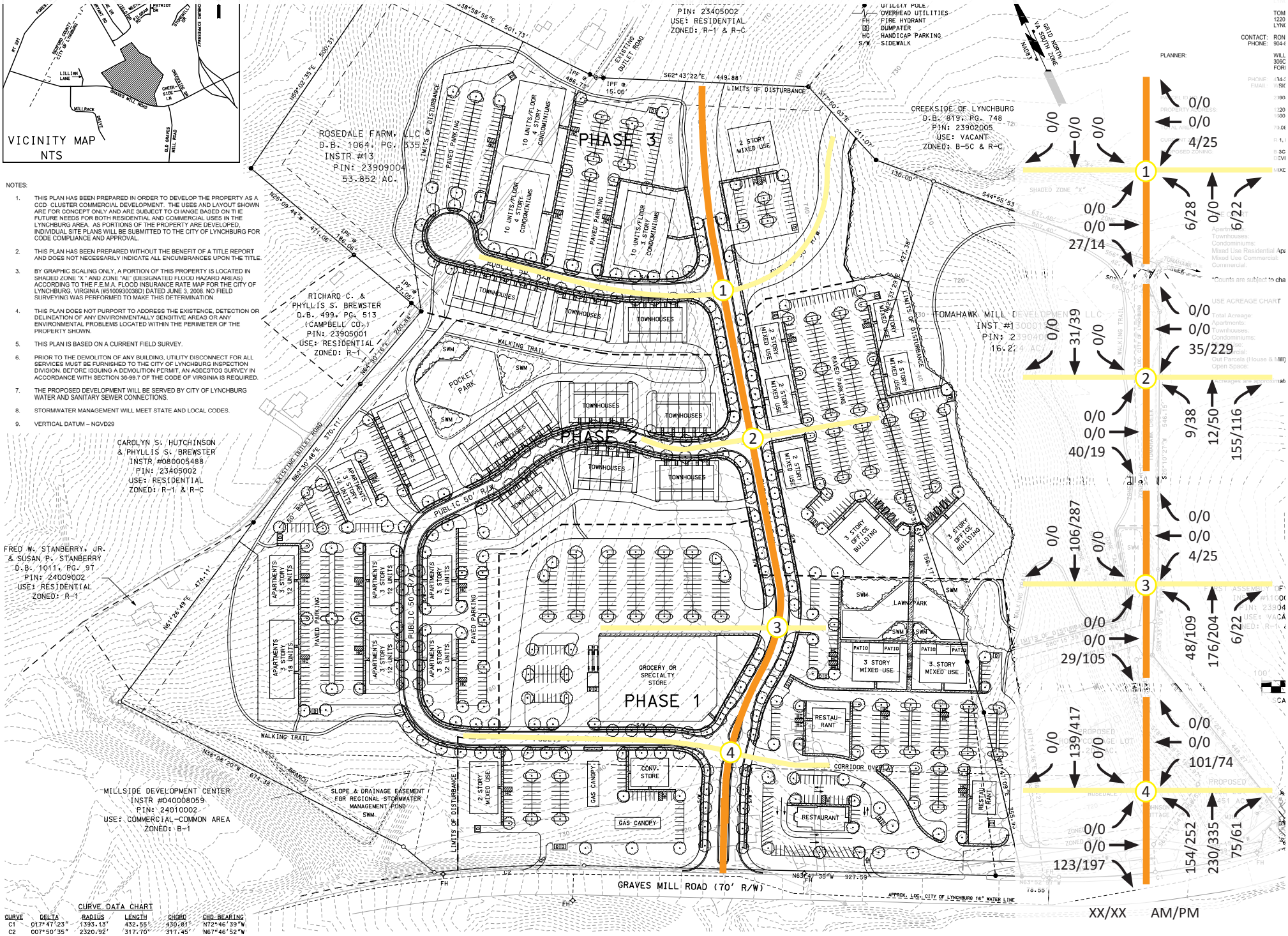
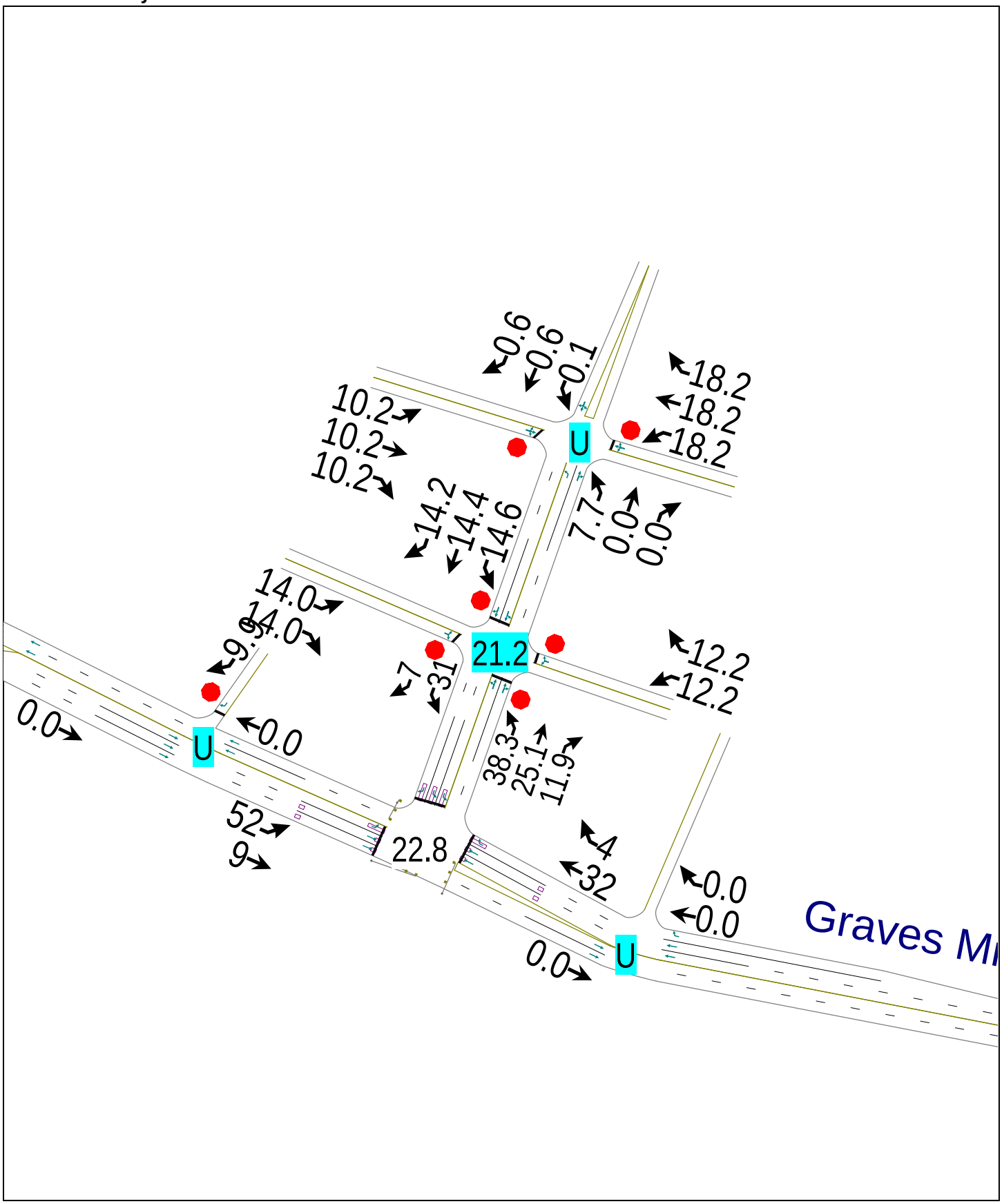


Figure 3 Graves Mill Internal Intersection Turning Lane Warrants

Intersection (As indicated in Figure 2)	Lane	Graves Mill Internal Roads	
		AM	PM
#1	NBL	No Left-Turn Lane Required	No Left-Turn Lane Required
#1	NBR	Right-Turn Radius Required	Right-Turn Radius Required
#2	NBL	No Left-Turn Lane Required	No Left-Turn Lane Required
#2	NBR	Full-Width Right-Turn Lane And Taper Required	Full-Width Right-Turn Lane And Taper Required
#3	NBL	No Left-Turn Lane Required	75' Left-Turn Storage Required
#3	NBR	Right-Turn Radius Required	Right-Turn Radius Required
#4	NBL	75' Left-Turn Storage Required	150' Left-Turn Storage Required
#4	NBR	Full-Width Right-Turn Lane And Taper Required	Full-Width Right-Turn Lane And Taper Required

first internal intersection
Movement Delay **12/25/2013**

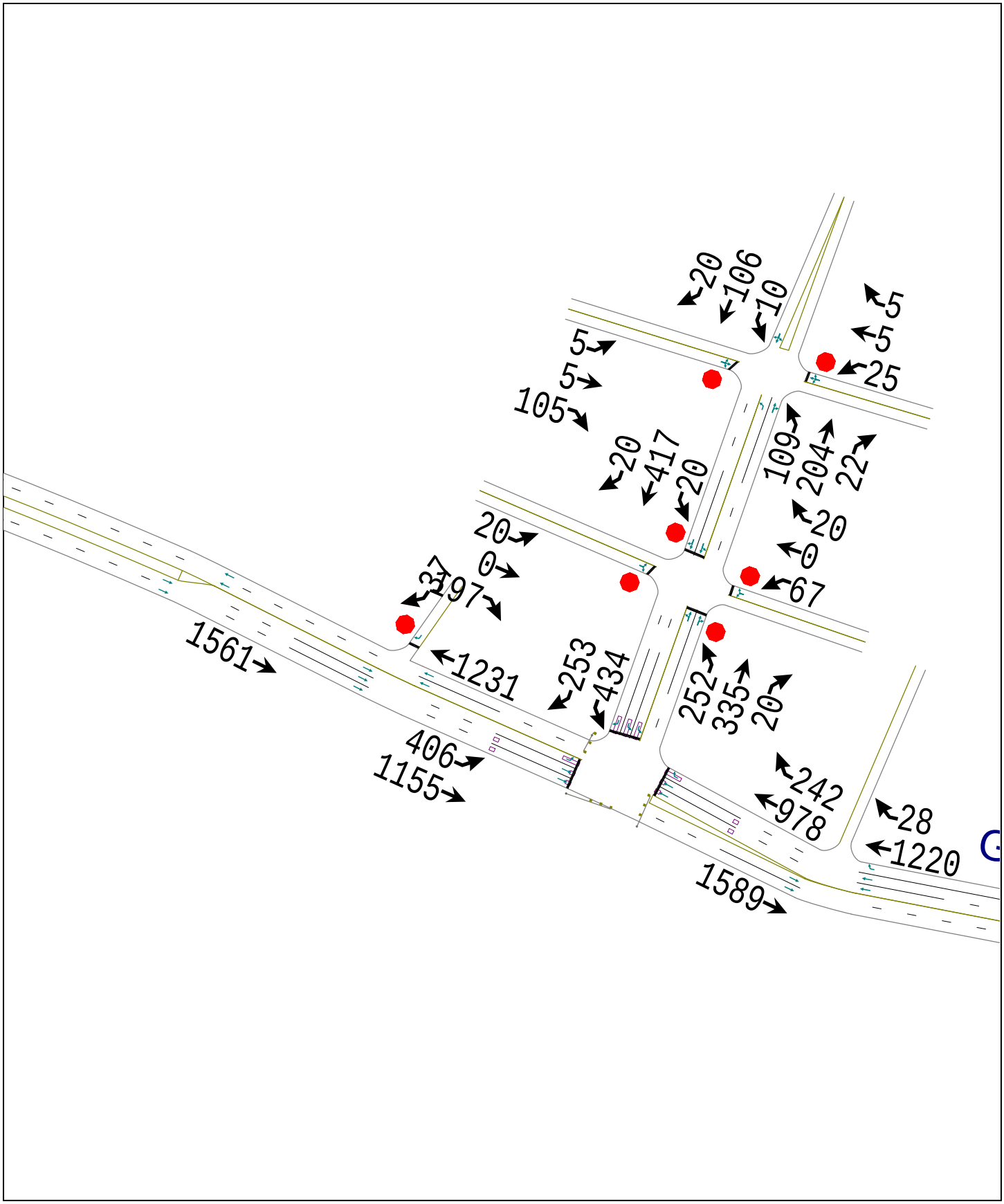


Graves Mill 2024 Build with Mitigation PM **C:\temp\Mitigation PM w internal.syn**
EPR

FIGURE 5 - GEOMETRY WITH VOLUMES

first internal intersection
Volumes

12/25/2013



Graves Mill 2024 Build with Mitigation PM
EPR

C:\temp\Mitigation PM w internal.syn

Technical Memorandum

Traffic Impact Analysis Update

Rosedale Farms
Lynchburg, Virginia

Prepared for:

Mr. Ron Cox
Rosedale Farm Development LLC
2217 Surrey Pl.
Lynchburg, VA 24503

By:

Bill Wuensch, P.E., PTOE; Wei He
EPR, P.C.
637 Berkmar Circle
Charlottesville, Virginia 22901

January, 2014

Rosedale Farms

Traffic Impact Analysis Update

The purpose of this memorandum is to provide an updated analysis per the latest site plan and proposed land uses for the Rosedale Farm development. This memorandum only addresses the intersection along the site frontage and internal to the site.

1. Site Trip Generation

The latest site plan illustrates generally the same land uses in the development, with some minor differences in intensity and location. **Table 1** shows the areas for each land use in the latest site plan with comparison to those from Rosedale Farm TIA (last version).

Table 1 Site Plan and Land Uses Comparison

Use Description	ITE	Qty from last version	Qty this time
Multi-Family Residential	220	102	100
Condo/Townhouse	230	175	169
Office	710	68,600	51,000
Retail (Shopping Center)	820	25,800	35,000
General Commercial (Use Unknown)	826	8,100	35,000
Grocery/Specialty Store	850	45,000	45,000
Convenience Store with Gas Pump	853	12 (Gas Pumps)	12 (Gas Pumps)
High-Turnover (Sit-Down) Restaurant	932	5,000	5,000
Fast Food Restaurant with Drive-Through	934	7,000	5,000

Table 2 indicates that, with the latest site plan, daily trips generated by Rosedale Farms development are about 500 more than the daily trips from Rosedale Farm TIA, in and out trips in AM peak hour are a little less (49 less, 627 vs. 676), and in

and out trips in PM peak hour are a little more (47 more, 1,120 vs. 1,073).

Table 2 Site Trip Generation

				AM		PM	
Use Description	**ITE**	**Qty**	**Daily**	**in**	**out**	**in**	**out**
Multi-Family Residential	220	100	730	11	42	47	25
Condo/Townhouse	230	169	1,015	13	65	62	31
Office	710	51,000	787	98	13	23	113
Retail (Shopping Center)	820	35,000	3,432	51	31	142	154
General Commercial (Use Unknown)	826	35,000	1,551	0	0	46	59
Grocery/Specialty Store	850	45,000	4,601	95	58	218	209
Convenience Store with Gas Pump	853	12	6,511	99	99	114	114
High-Turnover (Sit-Down) Restaurant	932	5,000	636	30	24	30	20
Fast Food Restaurant with Drive-Through	934	5,000	2,481	57	55	42	39
	total		21,744	455	389	725	764
internal capture			262	4	16	16	8
Peak Hour Trips After Reductions (driveway trips)			21,482	451	373	708	755
Pass-by			6,152	107	90	172	172
Primary Trips			15,330	344	283	537	584
	total peak		15,330	627		1,120	

A series of traffic volume figures are provided in **Appendix A**.

2. Turn Lane Needs

The analyses indicate the following needs of turn lanes:

(1) Full-Width Right-Turn Lane and Taper Required at:

- Right In/Out Entrance at Graves Mill, Westbound
- Right In/Out Entrance to Gas Station, Northbound spine road
- Full Entrance to Restaurant/Grocery, Northbound

(2) Right-Turn Radius Required at:

- Full Entrance to Restaurant/Grocery, Southbound

(3) 150' Left-Turn Storage Required at:

- Full Entrance to Restaurant/Grocery, Northbound

(4) No Left-Turn Lane Required at:

- Full Entrance to Restaurant/Grocery, Southbound

See **Table 3** for detail turn lane needs. The turn lane warrant sheets are provided in **Appendix B** to this memorandum.

Table 3 Turn Lane Needs

Intersection	Direction	AM	PM
Right In/Out Entrance at Graves Mill	WB Right Turn	Full-Width Right-Turn Lane and Taper Required	Full-Width Right-Turn Lane and Taper Required
Right In/Out Entrance to Gas Station	NB Right Turn	Right-Turn Taper Required	Full-Width Right-Turn Lane and Taper Required
Full Entrance to Restaurant/Grocery	NB Right Turn	Right-Turn Taper Required	Full-Width Right-Turn Lane and Taper Required
Full Entrance to Restaurant/Grocery	NB Left Turn	No Left-Turn Lane Required	150' Left-Turn Storage Required
Full Entrance to Restaurant/Grocery	SB Right Turn	Right-Turn Radius Required	Right-Turn Radius Required
Full Entrance to Restaurant/Grocery	SB Left Turn	No Left-Turn Lane Required	No Left-Turn Lane Required

3. Traffic Operations at Intersections

After adding turn lanes as indicated in the last section in the latest site plan, Synchro and SimTraffic models (ver 8) were utilized to evaluate the build traffic operations at the study intersections in the future (year 2024). The delay and level of service (LOS) from Synchro and queues from SimTraffic were summarized in **Table 4**. The analysis results from Synchro indicate that all movements and intersections will operate at LOS C or better, with the exception of WB movement (the road leading to restaurants) at the intersection of Rosedale Main Road and the roads leading to grocery and restaurants, which will operate at LOS F in PM peak hour, due to a large number of vehicles turning left from that STOP-Sign-Control minor road. The analysis results from SimTraffic show that queues at all movements of the study intersections will be well accommodated by the turn lanes proposed in the site plan and recommended in the last section of

this memo. The Synchro and SimTraffic outputs are provided in **Appendix C** and **Appendix D** to this memorandum.

Table 4 Rosedale LOS Summary

Rosedale LOS Summary		2024 Build AM			2024 Build PM		
		LOS	Delay	Queue	LOS	Delay	Queue
5. Rosedale Main/To Grocery and Restaurant							
From Grocery	EBL/EBT/EBR	A	9.1	60	C	16.9	123
From Restaurant	WBL/WBT/WBR	C	20.7	70	F	929.8	111
Rosedale Main	NBL	A	7.7	55	A	8.9	129
Rosedale Main	NBT	A	0.0	0	A	0.0	50
Rosedale Main	NBR	A	0.0	0	A	0.0	2
Rosedale Main	SBL/SBT/SBR	A	0.0	0	A	0.8	53
Intersection		A	6.6		F	117.1	
2. Rosedale Main/Graves Mill							
Graves Mill	EBL	B	18.6	159	C	27.9	181
Graves Mill	EBT	A	5.2	114	A	6.5	128
Graves Mill	WBT	B	13.3	180	C	20.8	251
Graves Mill	WBR	A	8.8	71	B	11.7	108
Rosedale Main	SBL	B	16.1	96	C	21.0	174
Rosedale Main	SBR	B	14.8	51	B	17.1	148
Intersection		B	10.4		B	16.2	

4. Conclusions and Recommendations

The analyses conducted in this memo lead to the following principal conclusions:

For the updated Rosedale Farms development, full-width right-turn lane and taper will be required at westbound movement at the intersection of right in/out entrance and Graves Mill Rd, northbound movement at the intersection of right in/out entrance and the road to gas station, and northbound movement at the intersection of Rosedale's main road and the roads to Grocery and restaurants; 150' left-turn storage will be required at northbound movement at the intersection

of Rosedale's main road and the roads to Grocery and restaurants; right-turn radius will be required at southbound movement at the intersection of Rosedale's main road and the roads to Grocery and restaurants.

All movements will function well (LOS C or better), except westbound movement at the intersection of Rosedale's main road and the roads to Grocery and restaurants, which will operate at LOS F.

A solution to mitigate this sidestreet left turn issue, and to provide a safe intersection configuration, is to build a roundabout at this location. Testing of a one lane roundabout indicates that all movements function at LOS B or better. The Sidra output is provided in ***Appendix E*** *to this memorandum.*

Queues at all movements of the study intersections will be accommodated well by the proposed turn lanes in the latest site plan and the recommended turn lanes in this memo.

Recommendations:

1. Construct turn lanes as summarized in the preceding summary table.
2. Eliminate the right out movement for the first connection along the development spine road. This location is shown to be less than 225' from the grocery store intersection, and causes concern relative to weaving and safety.
3. Construct a roundabout at the first major intersection (grocery store entrance) along the spine road.
4. For the development entrance along Graves Mill Road, construct the intersection as shown in the plan with the dual eastbound left turn lanes.

Appendices

Appendix A Traffic Volumes

Figure 01 2013 Existing Traffic Volumes

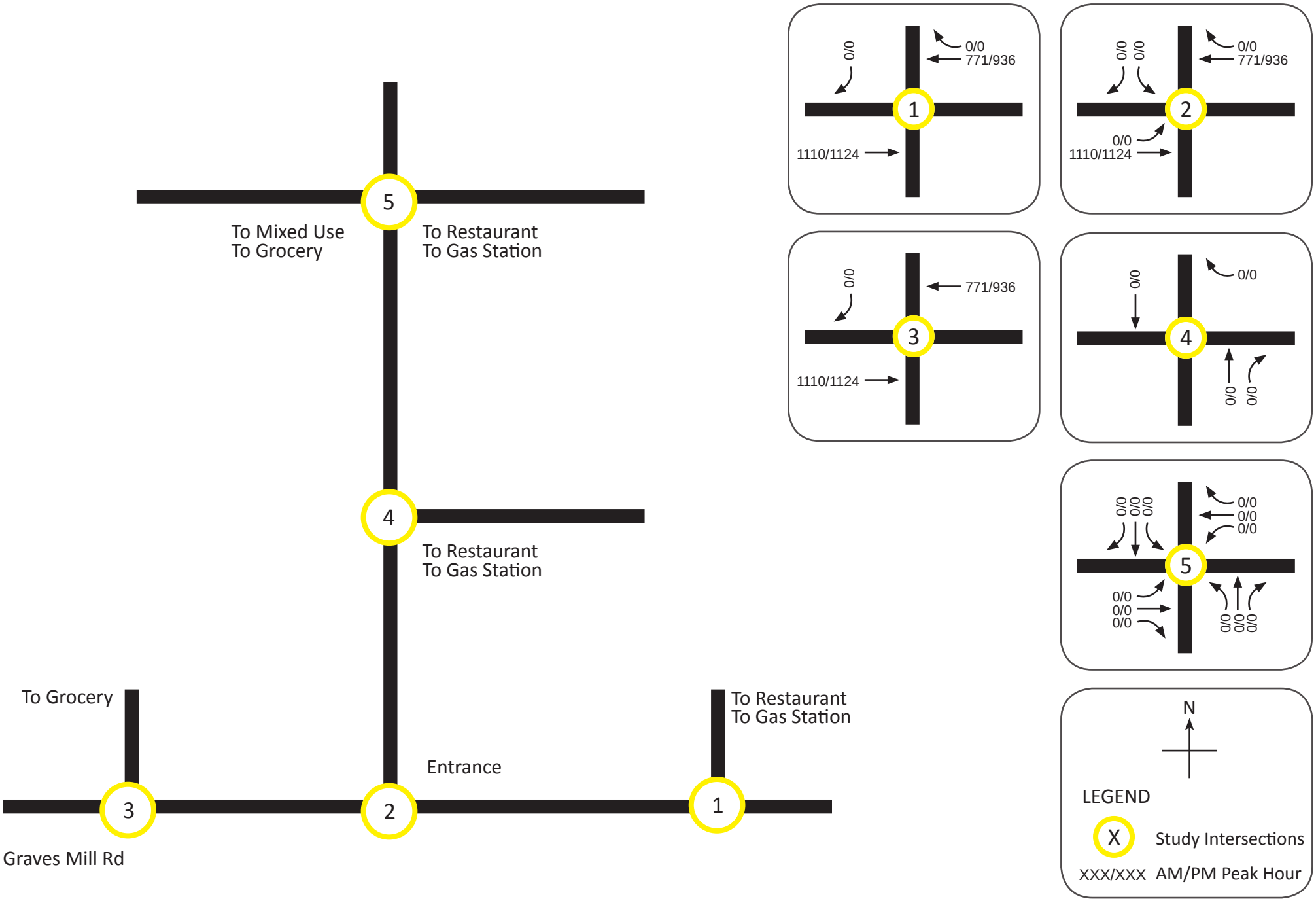


Figure 02 2024 No Build Traffic Volumes

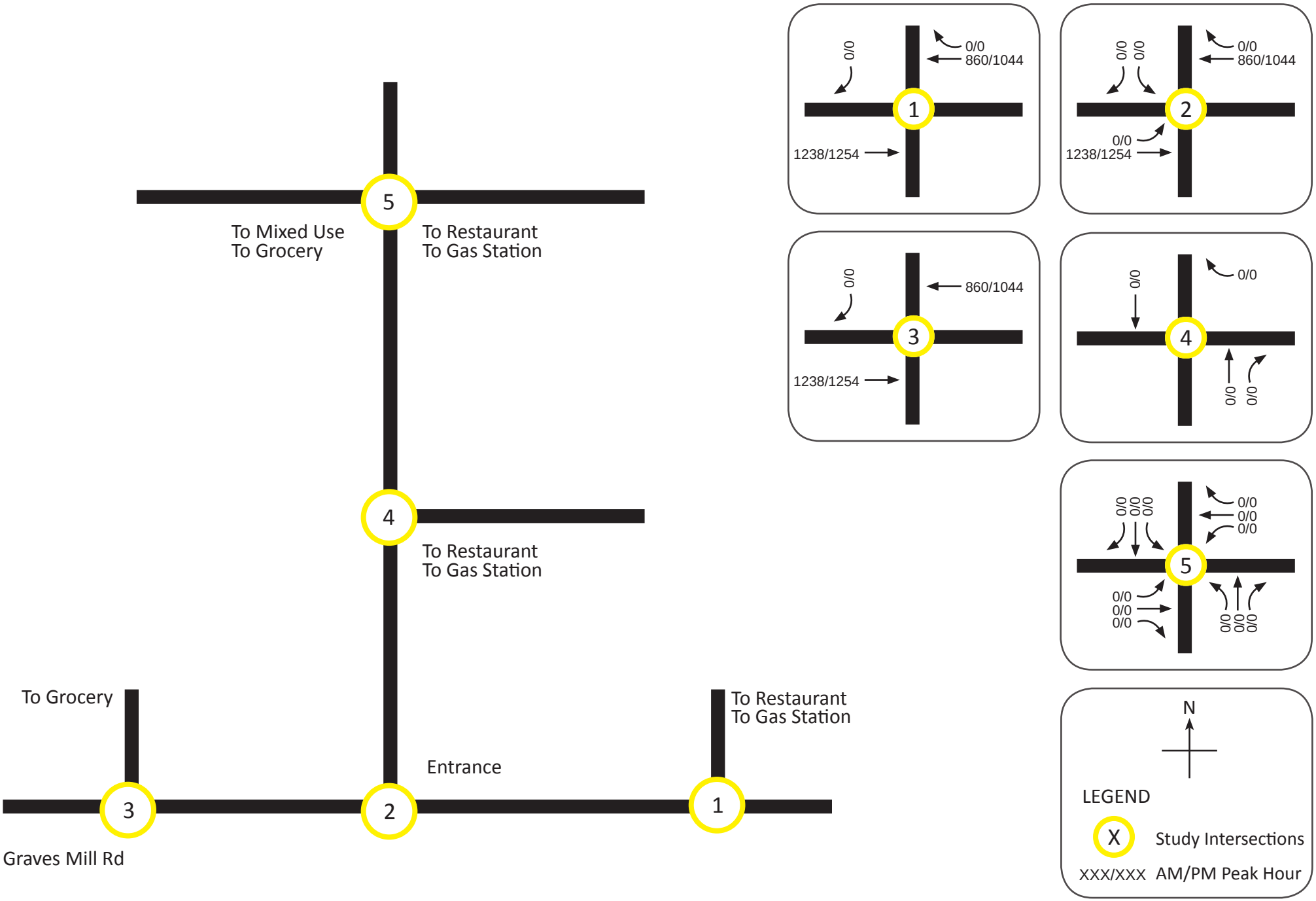


Figure 03 Distribution Percentage Key Map

Figure 04 Distribution Percentage - Zone 1

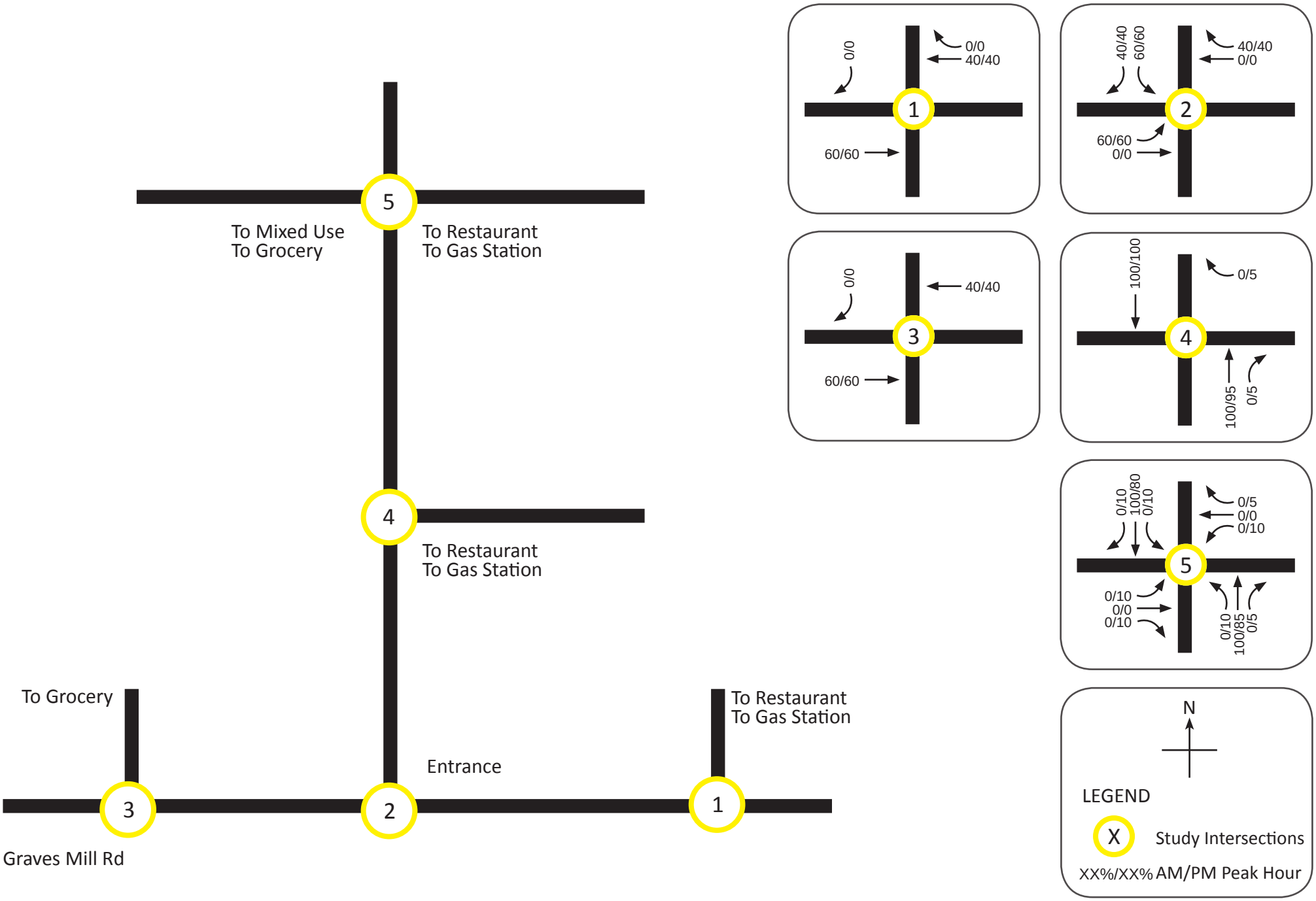


Figure 05 Site Trip - Zone 1

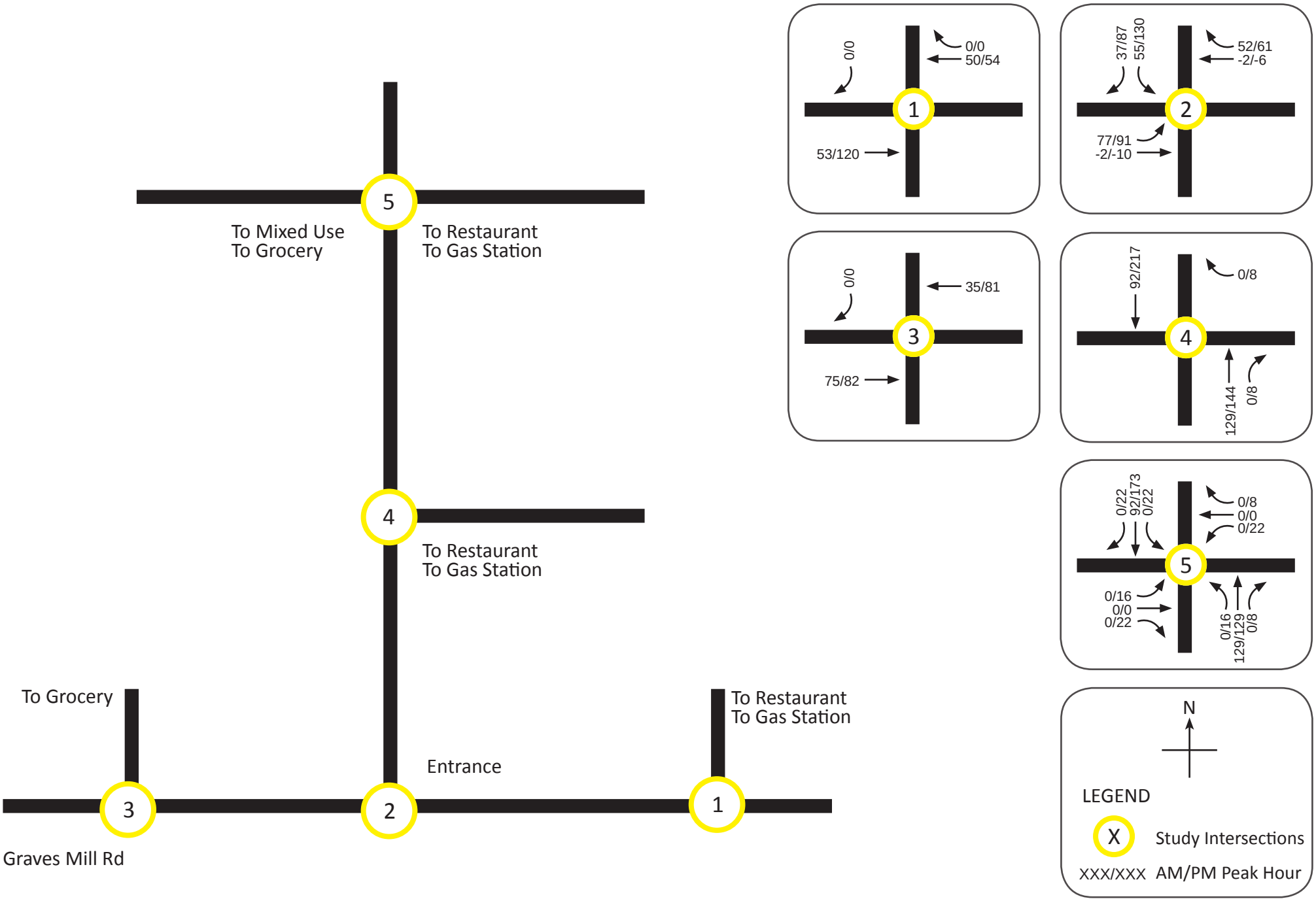


Figure 06 Distribution Percentage - Zone 2

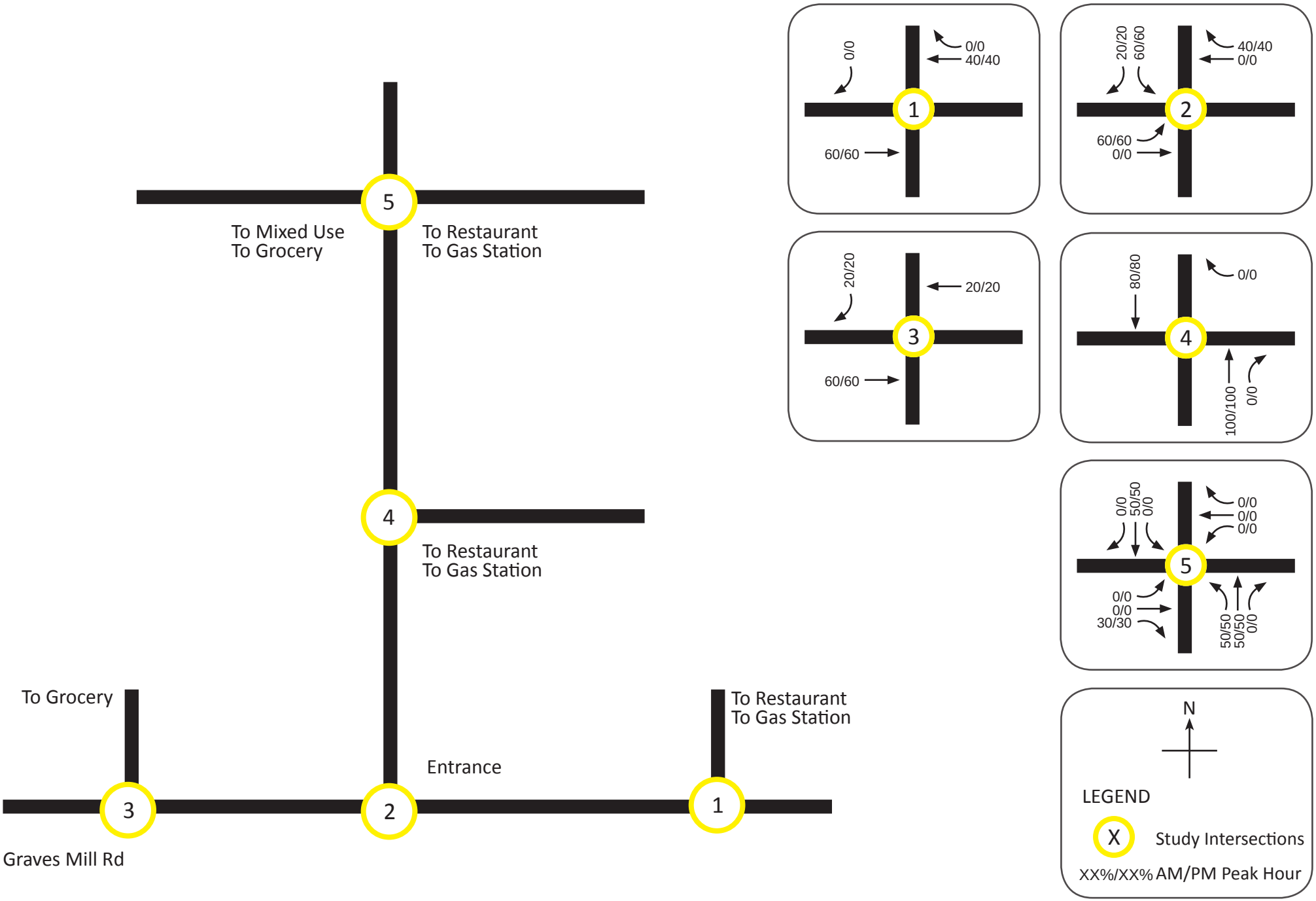


Figure 07 Site Trip - Zone 2

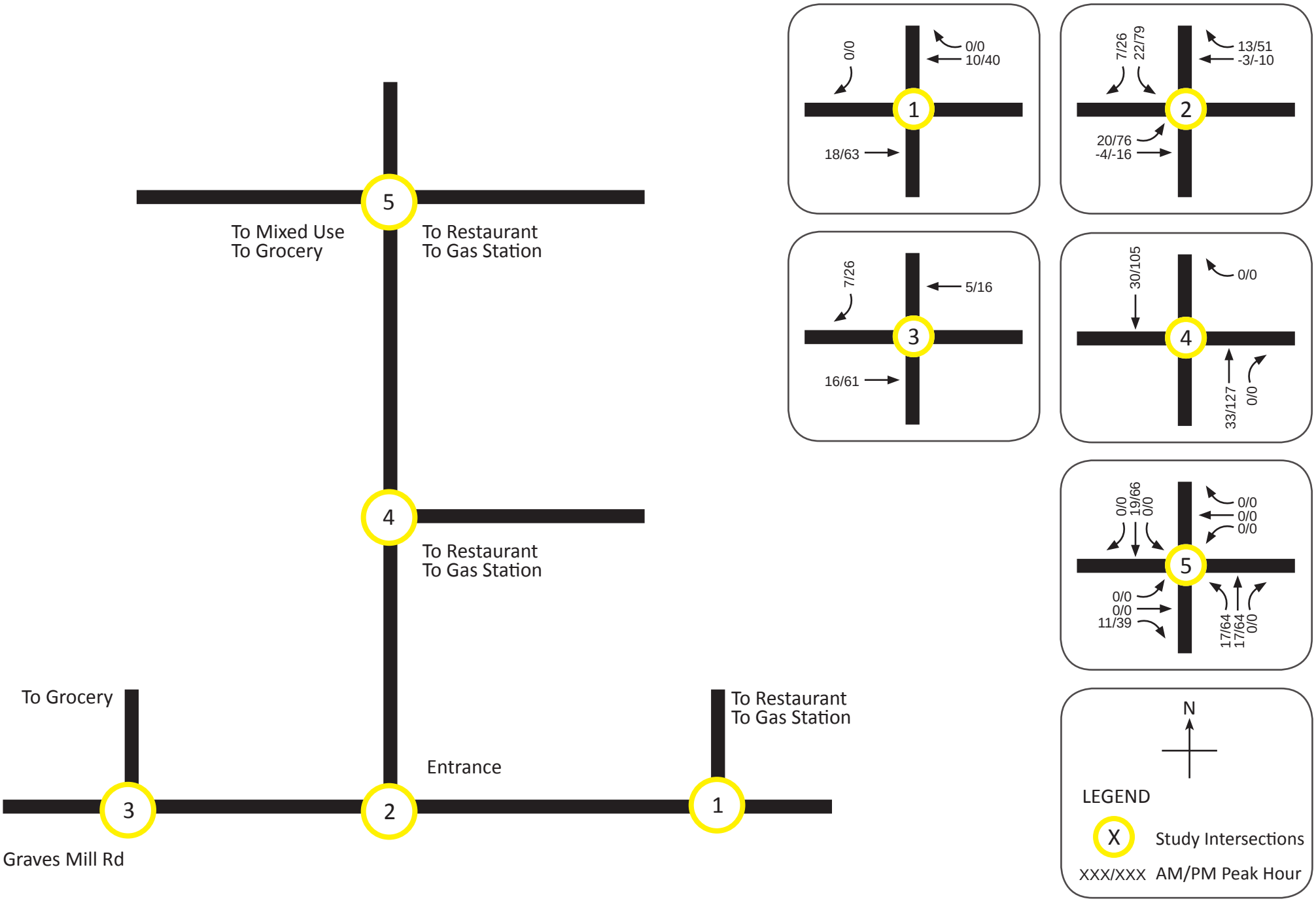


Figure 08 Distribution Percentage - Zone 3

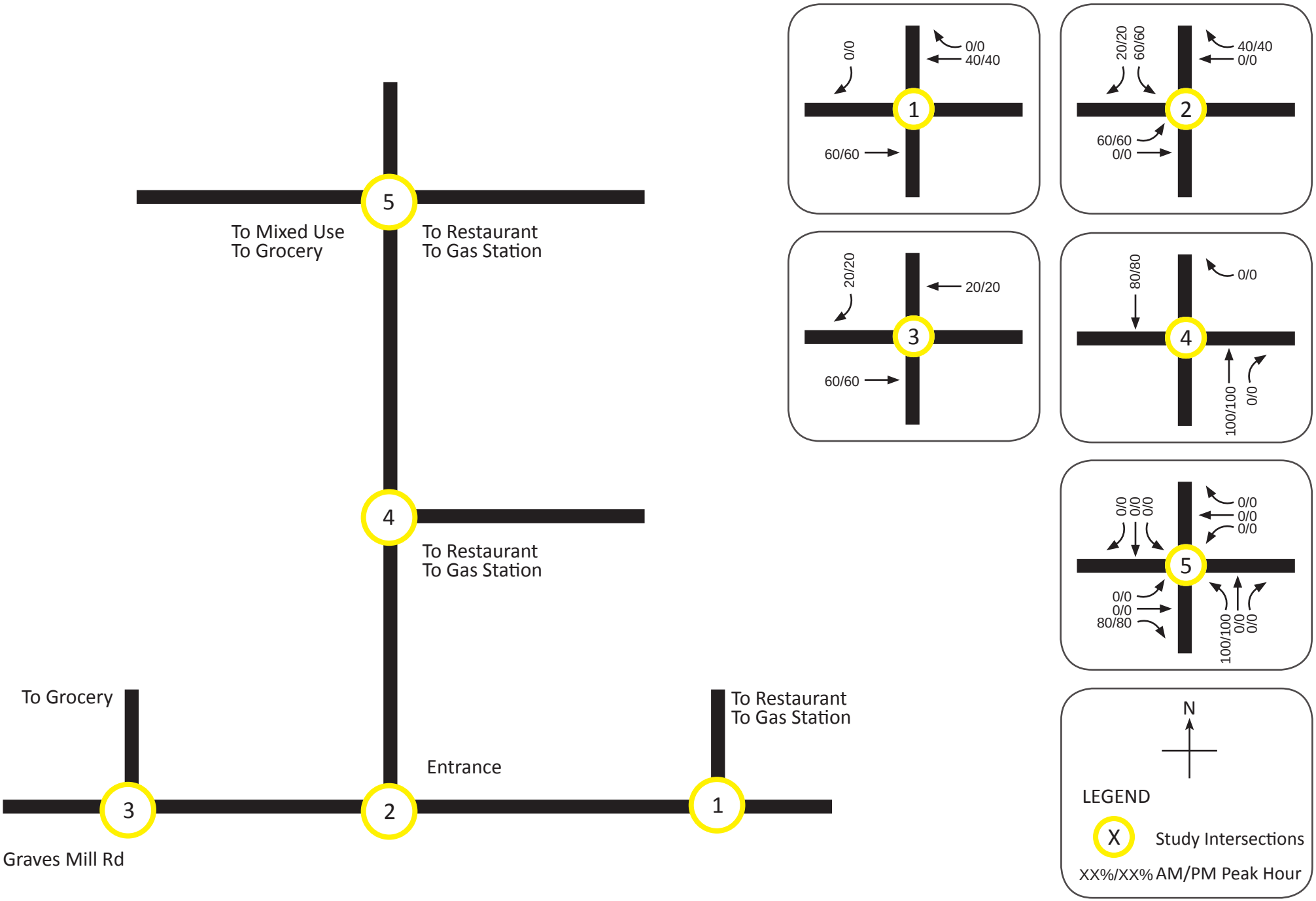


Figure 09 Site Trip - Zone 3

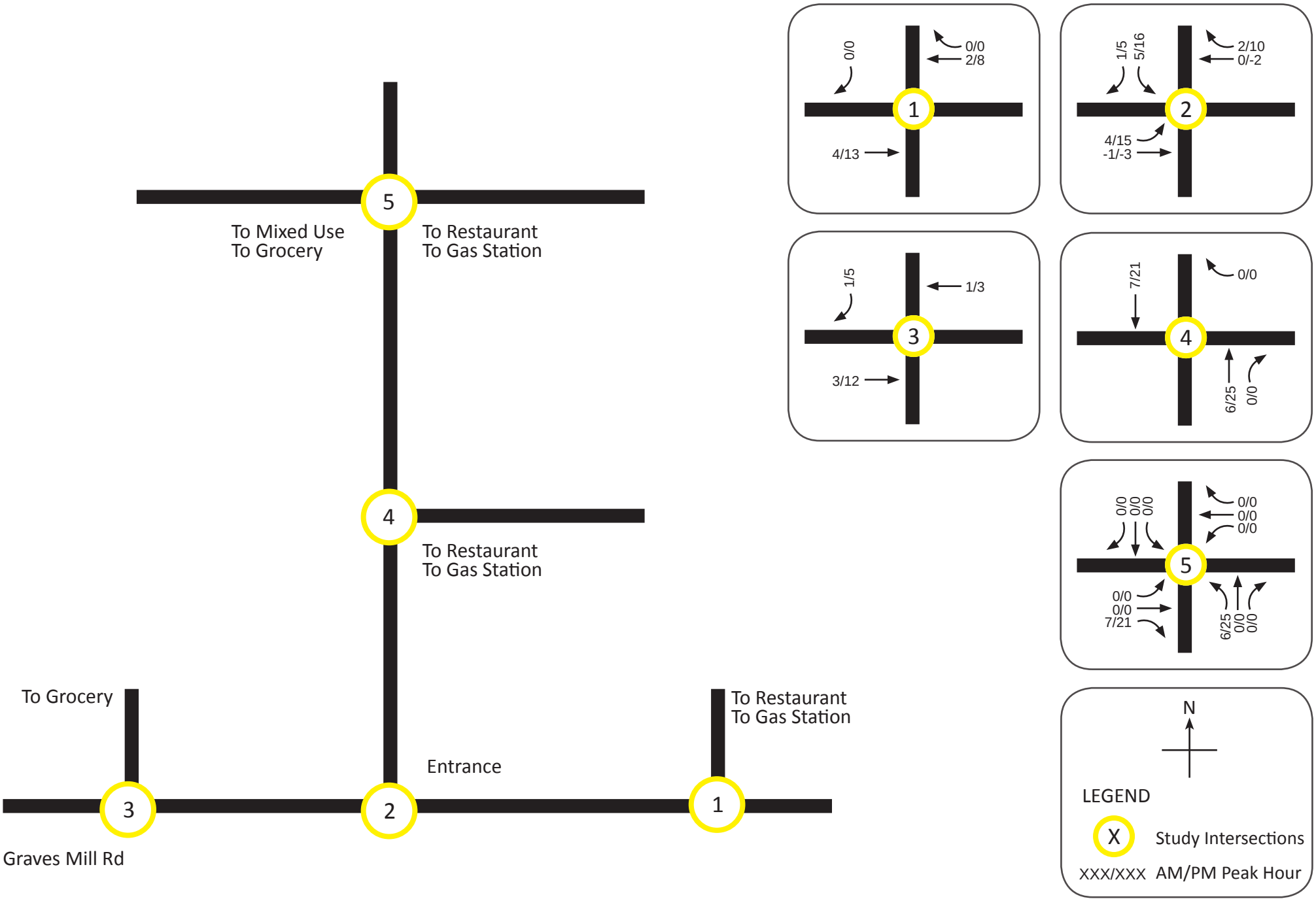


Figure 10 Distribution Percentage - Zone 4

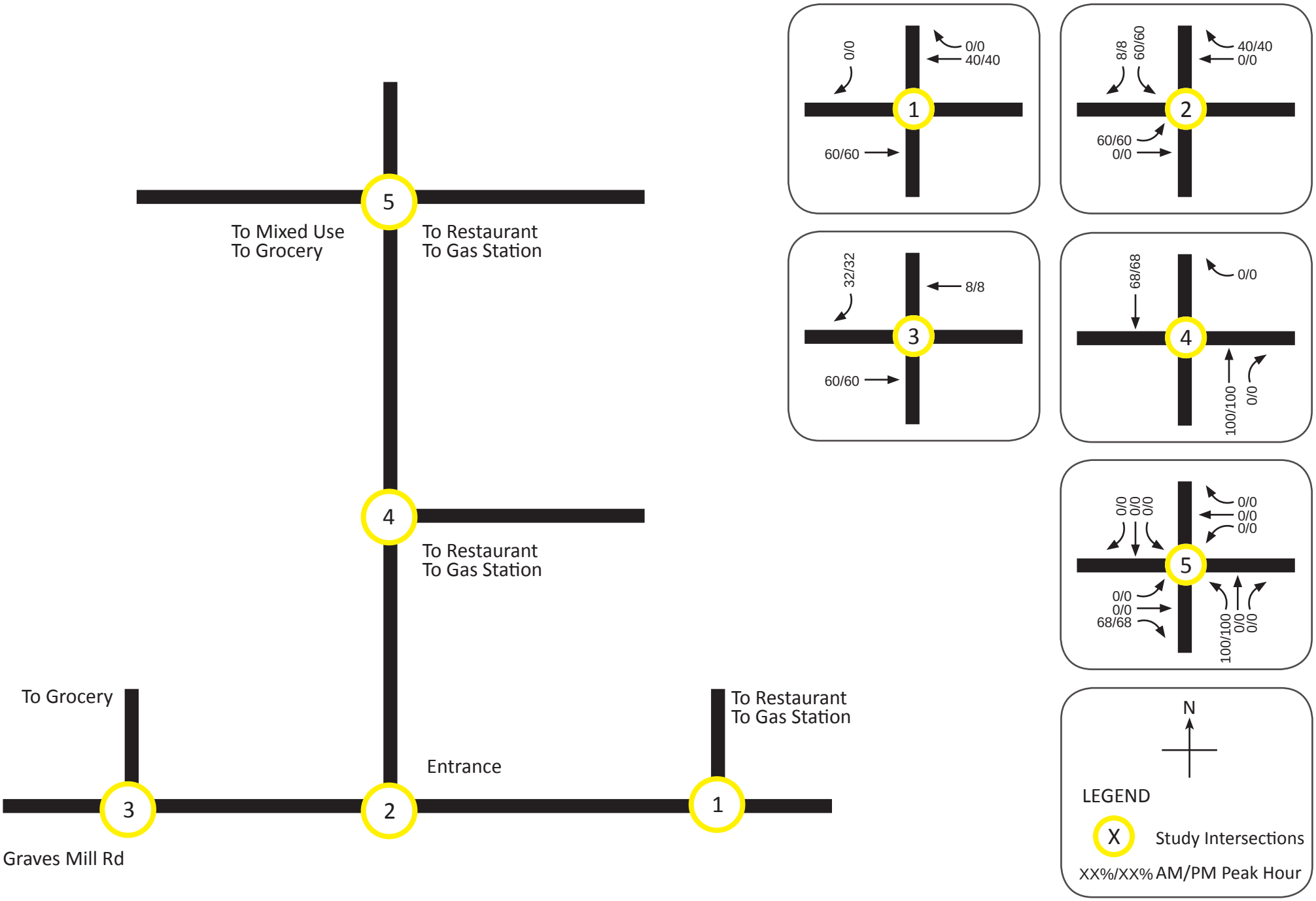


Figure 11 Site Trip - Zone 4

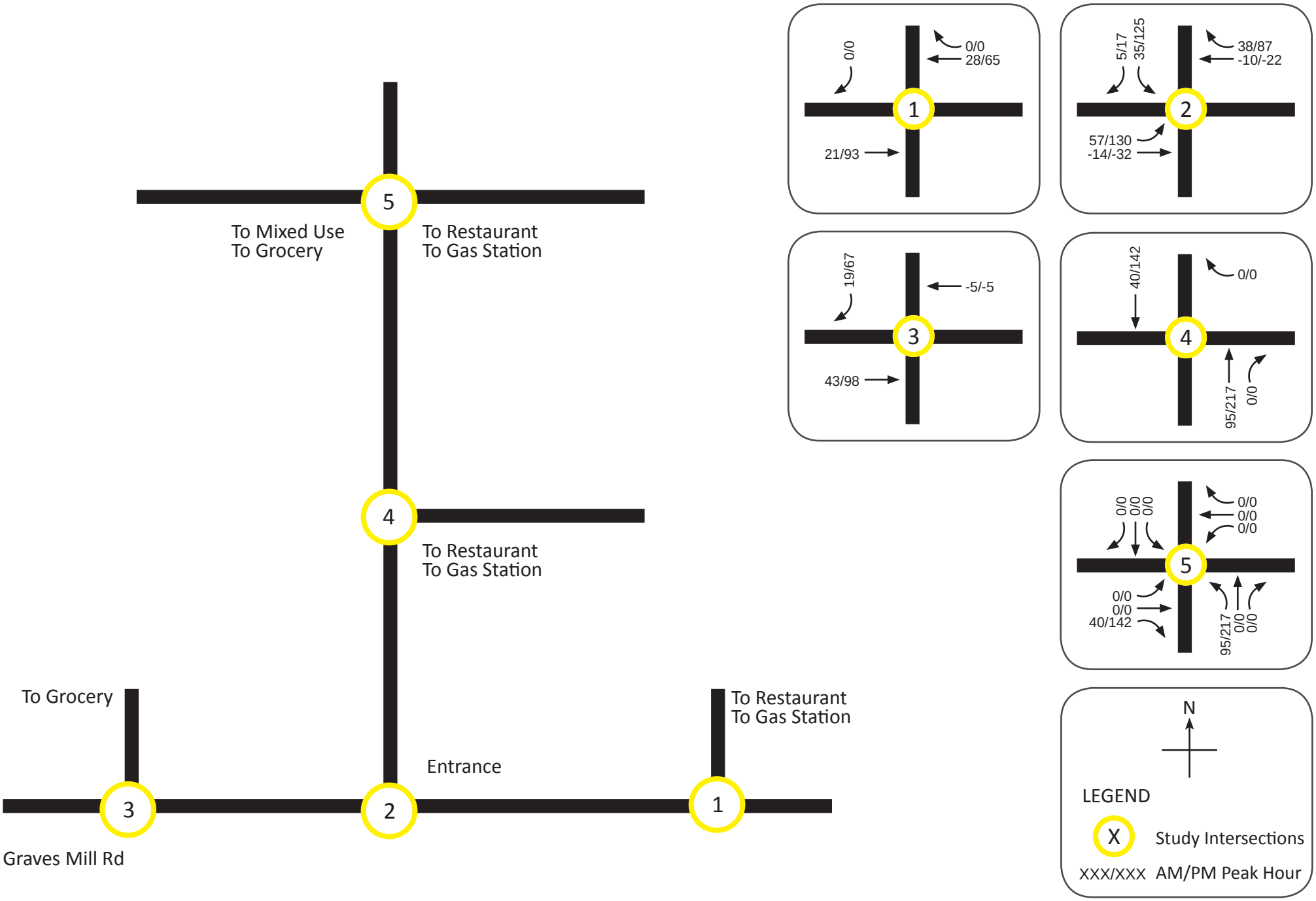


Figure 12 Distribution Percentage - Zone 5

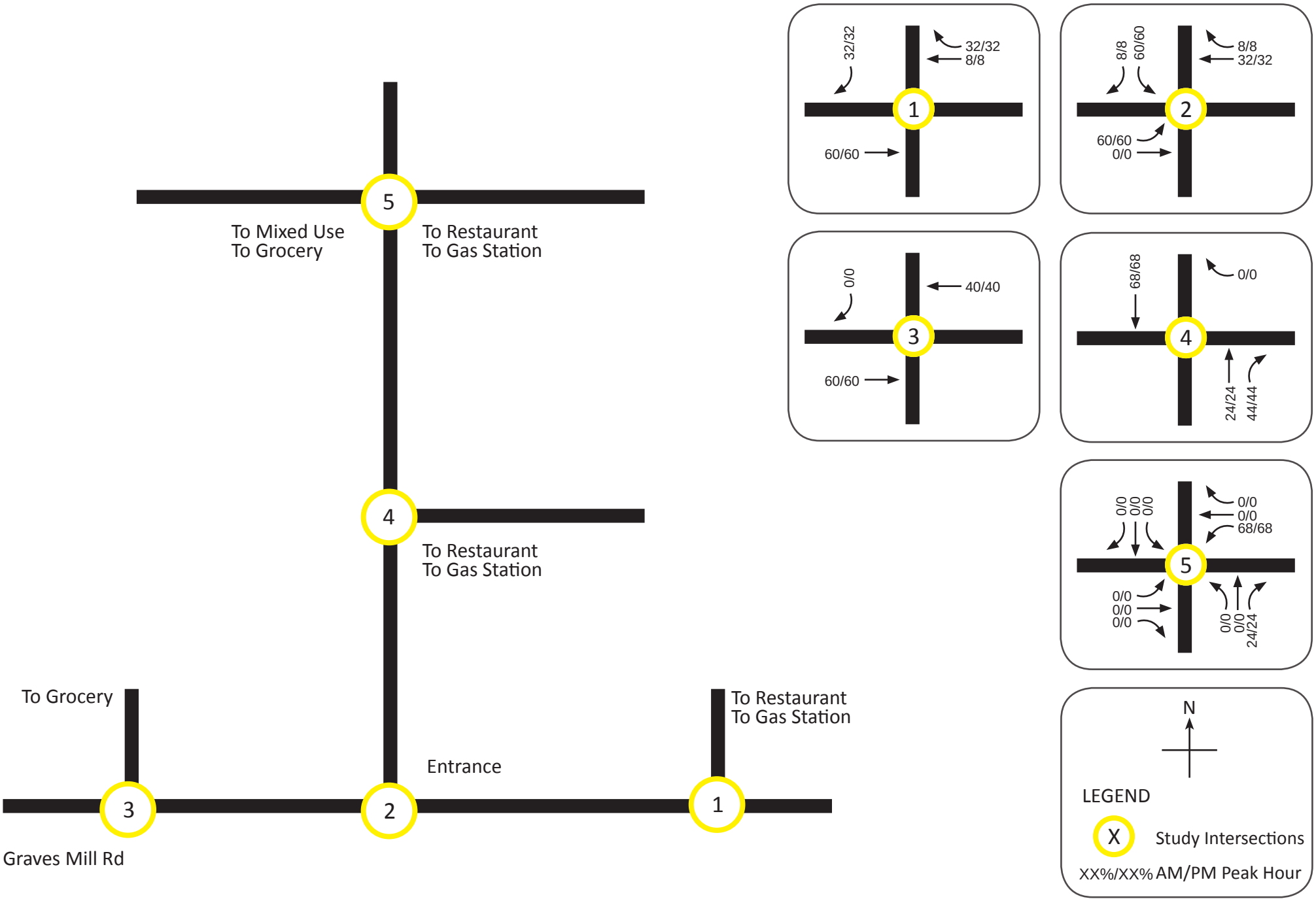


Figure 13 Site Trip - Zone 5

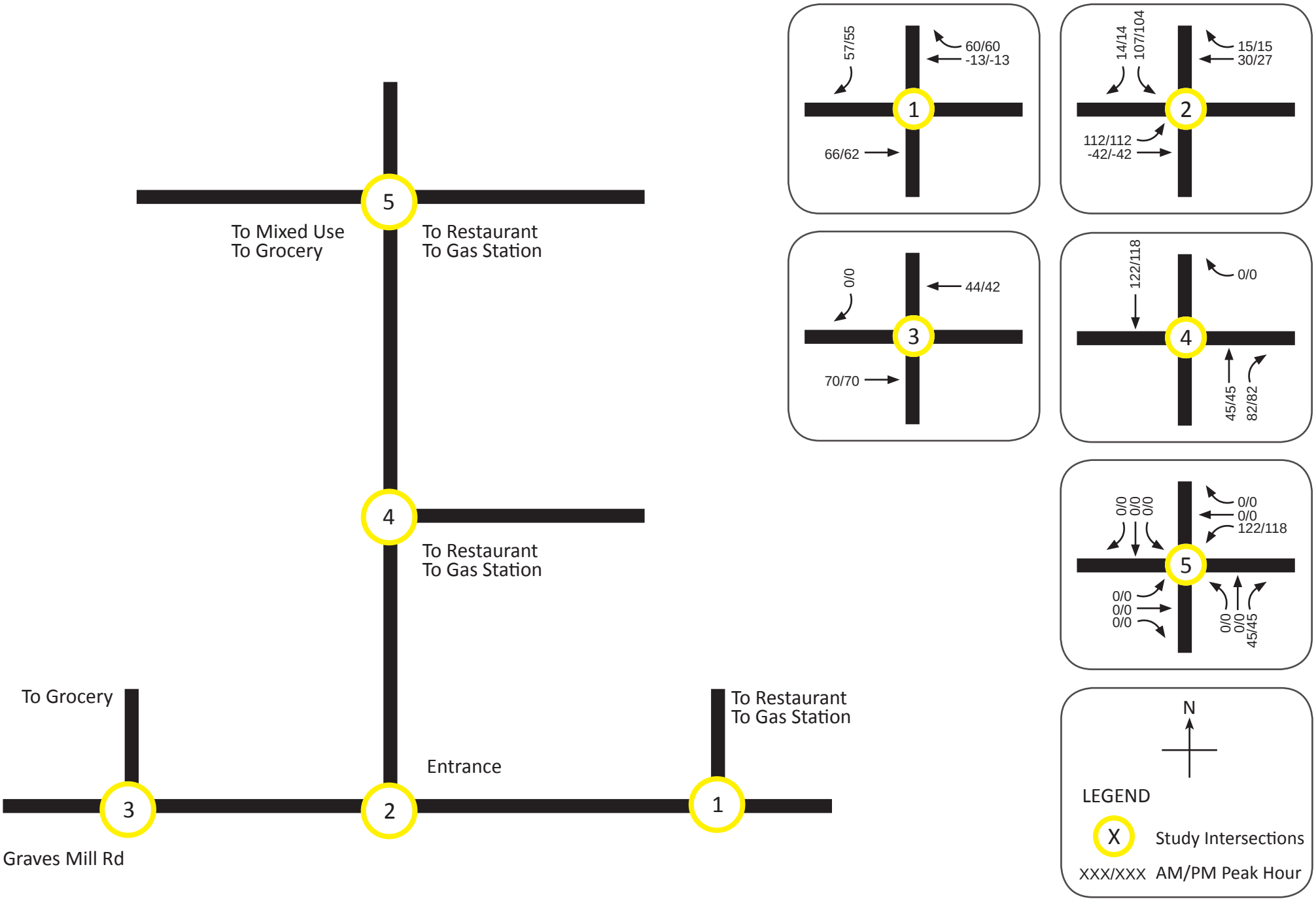


Figure 14 Site Trips

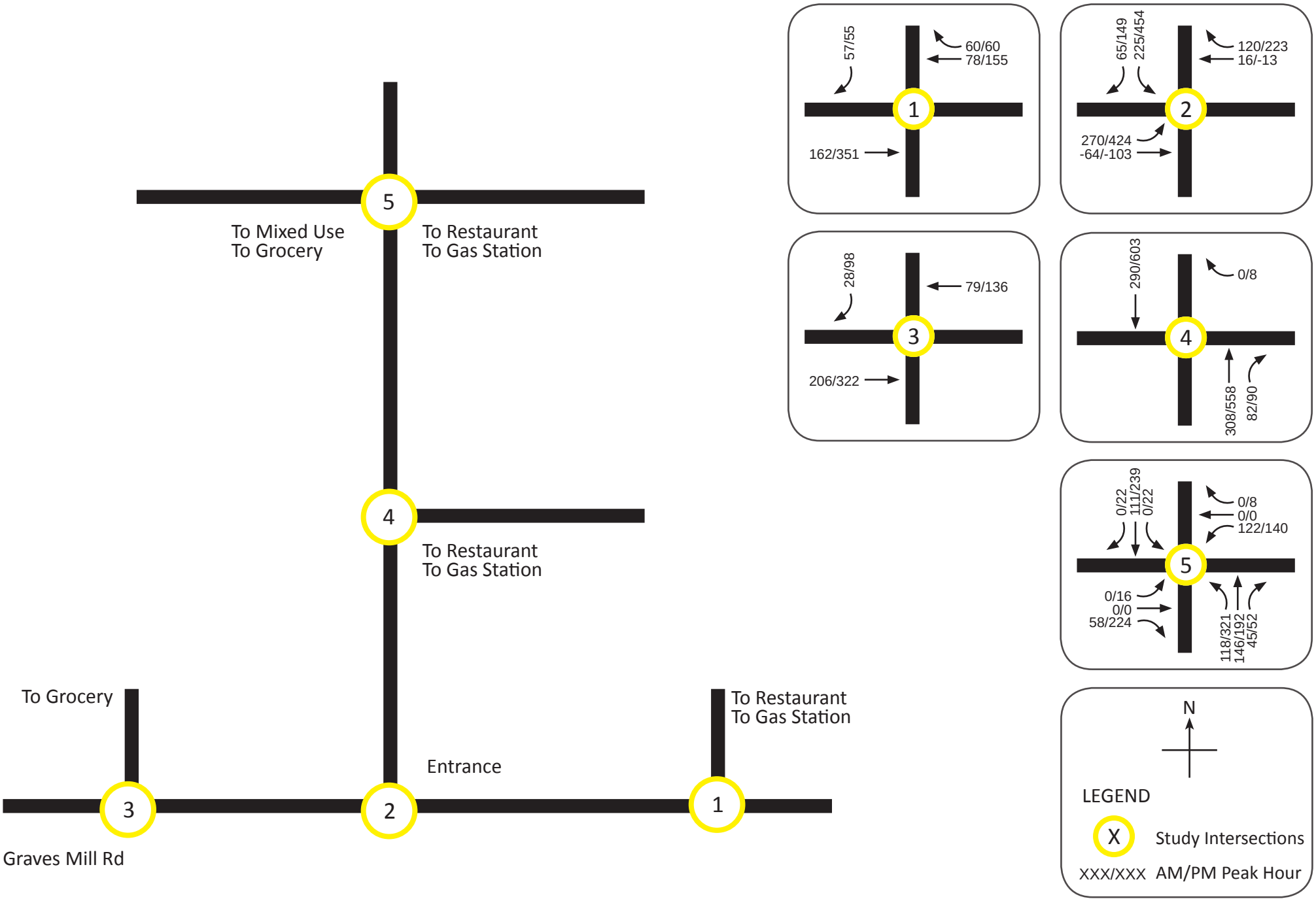
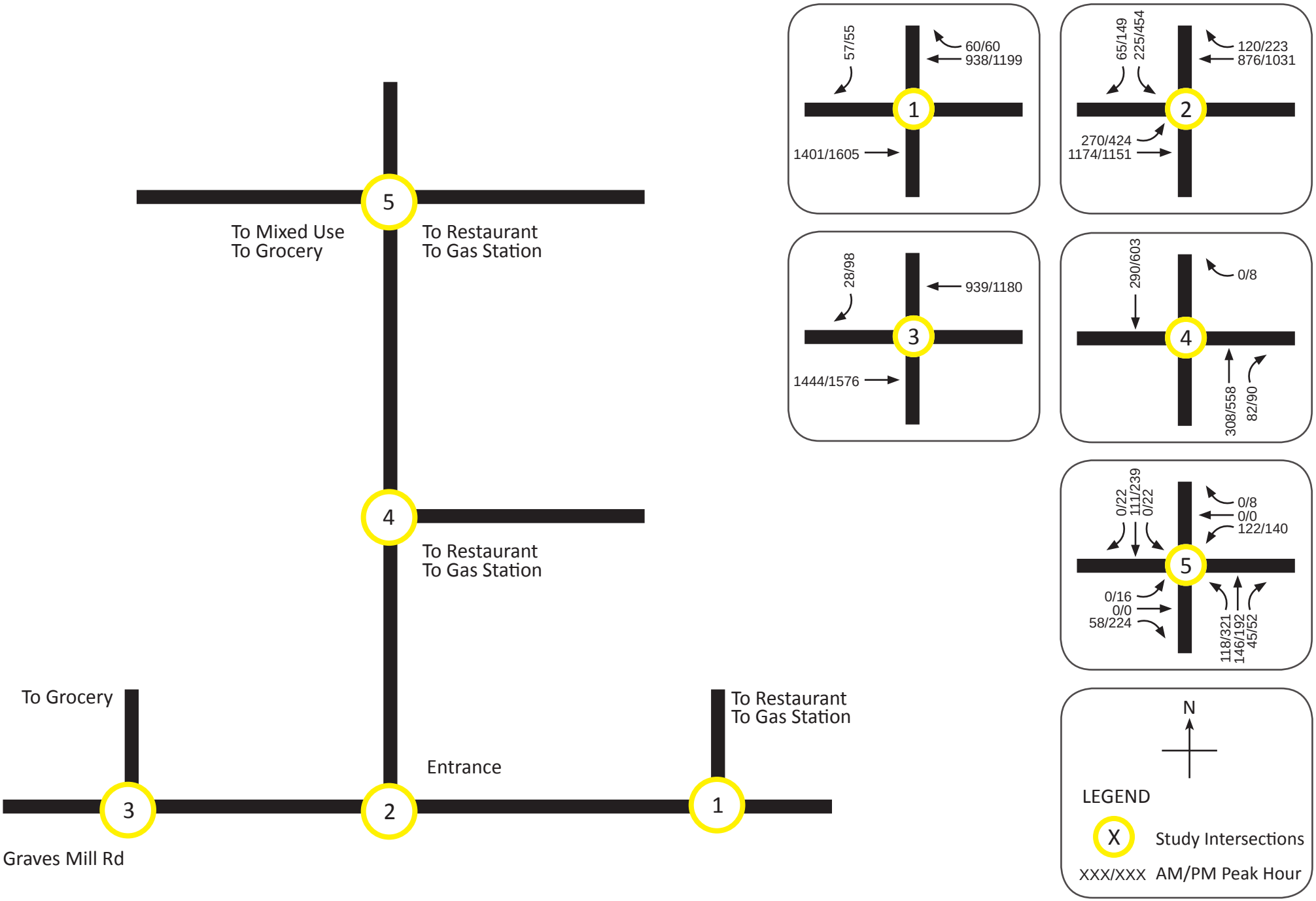


Figure 15 2024 Build Traffic Volumes

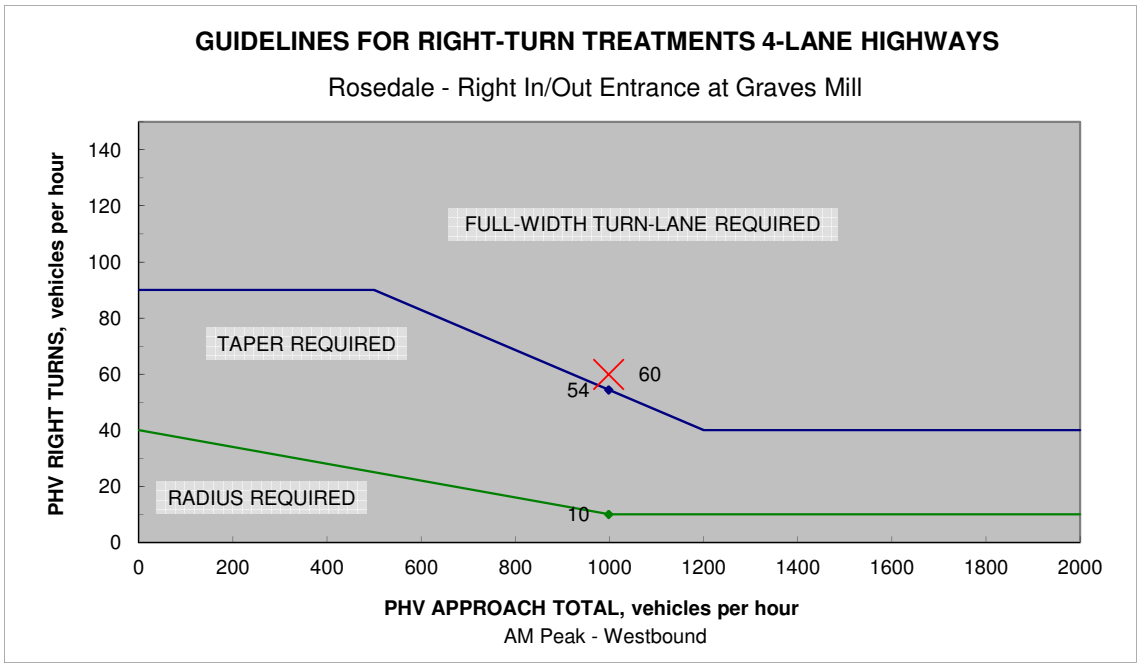


Appendix B Turn Lane Warrant Sheets

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Right In/Out Entrance at Graves Mill			
Approach Direction:	Westbound		Analysis Date:	2014'
Peak Hour:	AM Peak		Data Date:	2013'
PHV Right Turns:	60	vph	Projection Year:	2024
PHV Approach Total:	998	vph		

CONCLUSION: **FULL-WIDTH RIGHT-TURN LANE AND TAPER REQUIRED**

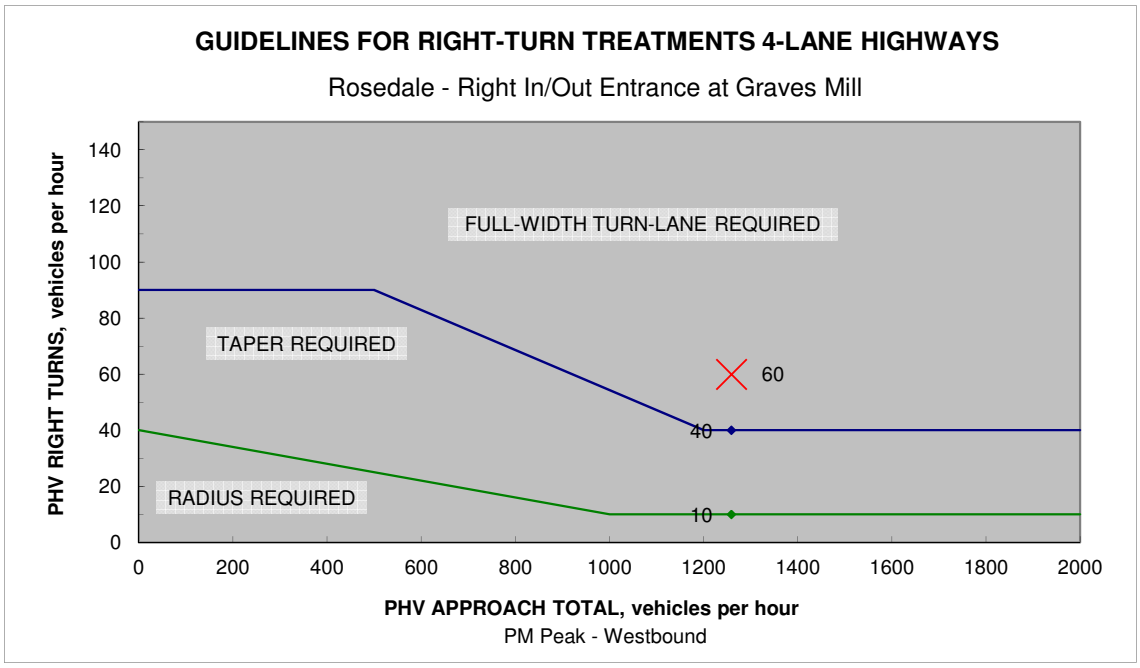


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Right In/Out Entrance at Graves Mill			
Approach Direction:	Westbound		Analysis Date:	2014'
Peak Hour:	PM Peak		Data Date:	2013'
PHV Right Turns:	60	vph	Projection Year:	2024
PHV Approach Total:	1,259	vph		

CONCLUSION: **FULL-WIDTH RIGHT-TURN LANE AND TAPER REQUIRED**

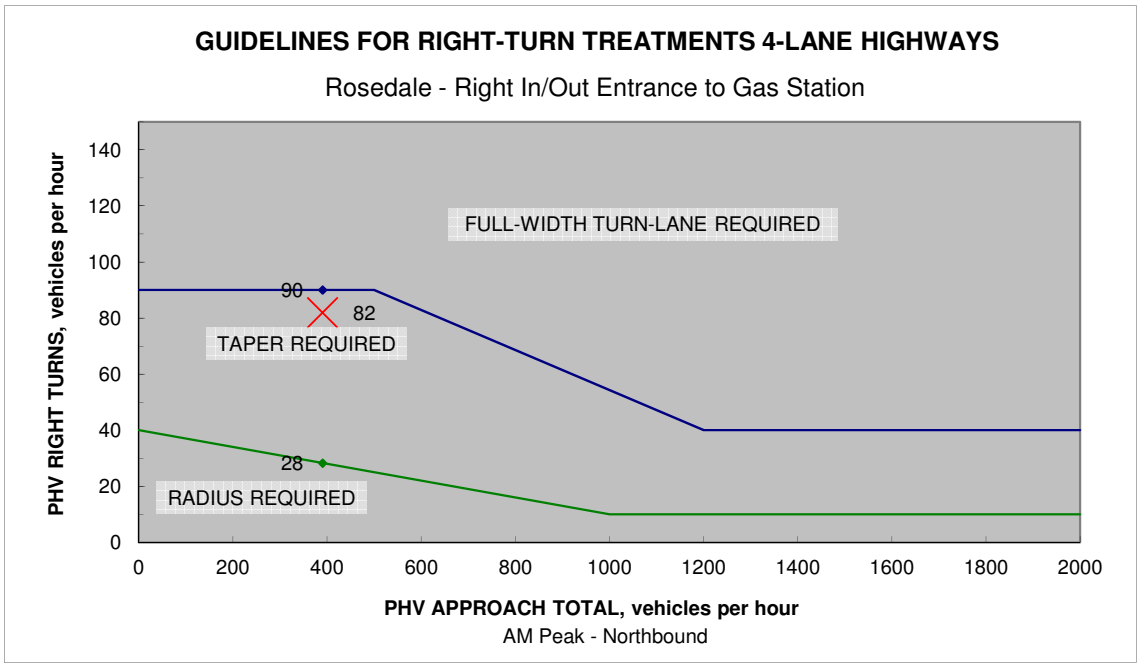


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Right In/Out Entrance to Gas Station			
Approach Direction:	Northbound		Analysis Date:	2014'
Peak Hour:	AM Peak		Data Date:	2013'
PHV Right Turns:	82	vph	Projection Year:	2024
PHV Approach Total:	390	vph		

CONCLUSION: **RIGHT-TURN TAPER REQUIRED**

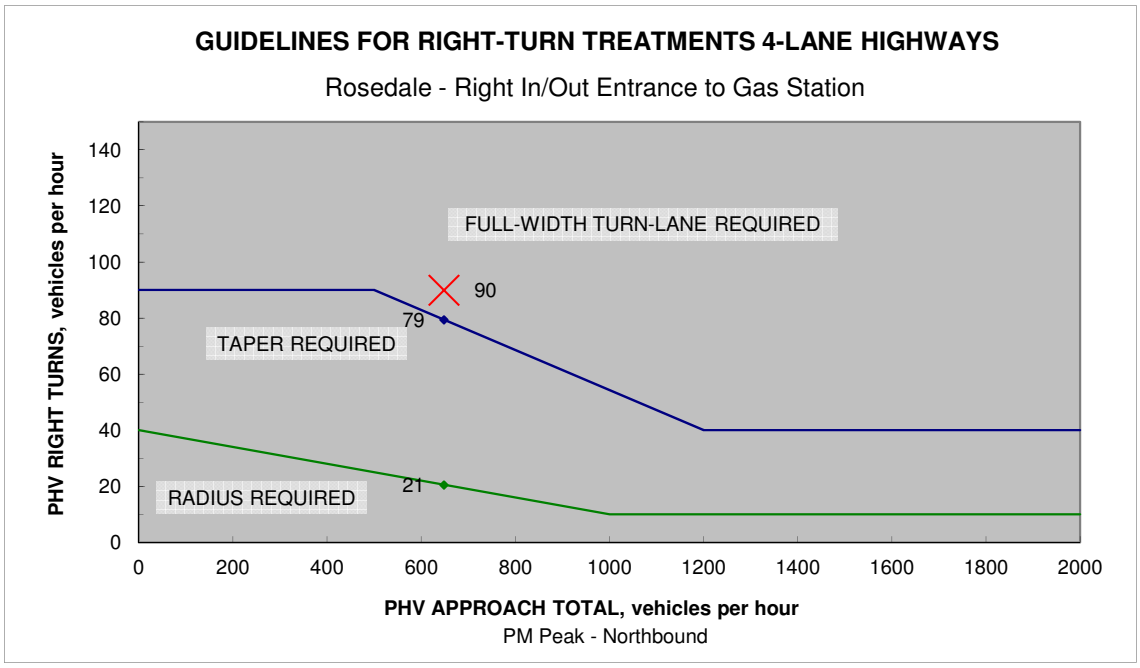


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 4-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Right In/Out Entrance to Gas Station			
Approach Direction:	Northbound		Analysis Date:	2014'
Peak Hour:	PM Peak		Data Date:	2013'
PHV Right Turns:	90	vph	Projection Year:	2024
PHV Approach Total:	648	vph		

CONCLUSION: **FULL-WIDTH RIGHT-TURN LANE AND TAPER REQUIRED**

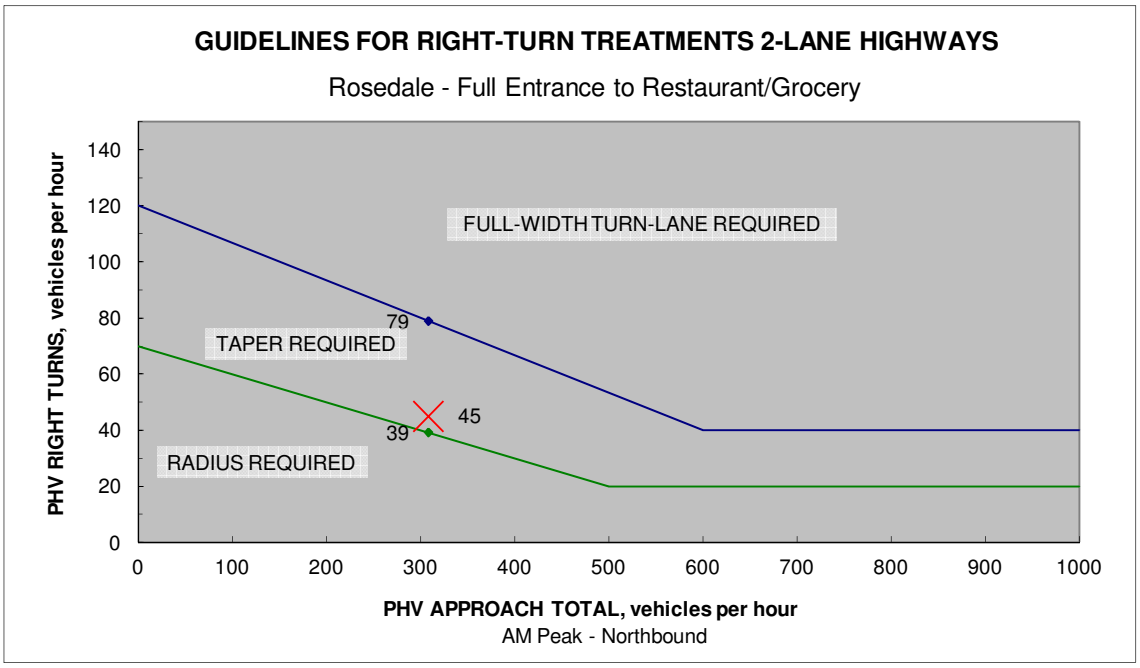


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 6

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 2-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Full Entrance to Restaurant/Grocery			
Approach Direction:	Northbound		Analysis Date:	2014
Peak Hour:	AM Peak		Data Date:	2013
PHV Right Turns:	45	vph	Projection Year:	2024
PHV Approach Total:	308	vph		

CONCLUSION: **RIGHT-TURN TAPER REQUIRED**

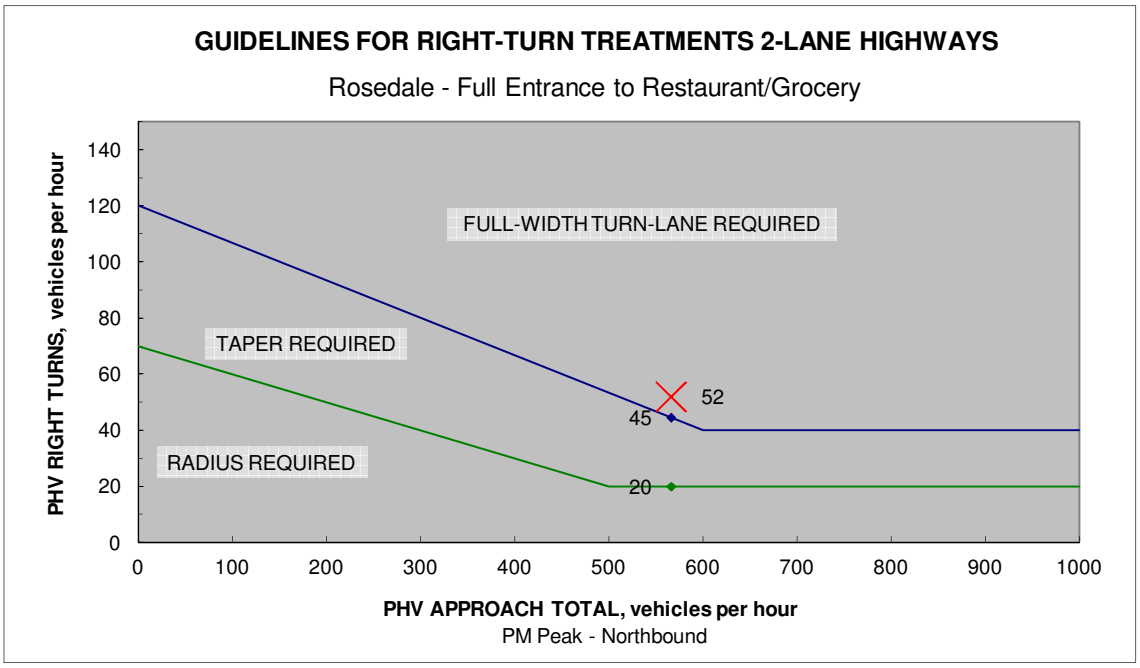


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 5

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 2-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Full Entrance to Restaurant/Grocery			
Approach Direction:	Northbound		Analysis Date:	2014
Peak Hour:	PM Peak		Data Date:	2013
PHV Right Turns:	52	vph	Projection Year:	2024
PHV Approach Total:	566	vph		

CONCLUSION: **FULL-WIDTH RIGHT-TURN LANE AND TAPER REQUIRED**



Source: VDOT Minimum Standards of Entrances to State Highways - Figure 5

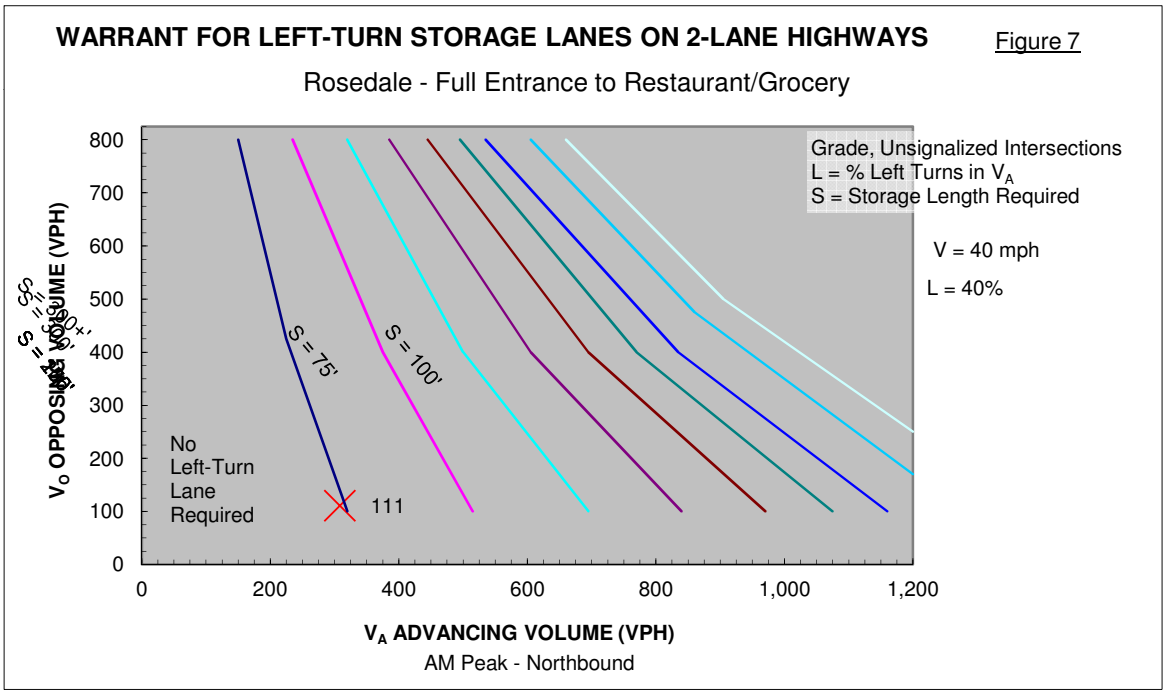
WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAYS

Project:	Rosedale	Analysis Date:	2014'
Intersection:	Full Entrance to Restaurant/Grocery	Data Date:	2013'
Approach Direction:	Northbound	Projection Year:	2024
Peak Hour:	AM Peak		

Peak Hour Left Turns (V_L):	118	vph
Advancing Volume (V_A):	308	vph (Northbound Approach)
Opposing Volume (V_O):	111	vph (Southbound Approach)
Operating/Design Speed (V):	**40**	mph

% Left Turns in V_A (L):	**40%**	(Calculated Value: 38.3%)
Optional % Left Turn Override:		
		(0' storage required based on chart)
% Trucks in V_L:	0%	(0' additional storage for trucks)

CONCLUSION: **No Left-Turn Lane Required**



Source: Highway Research Record Number 211 - Figure 7

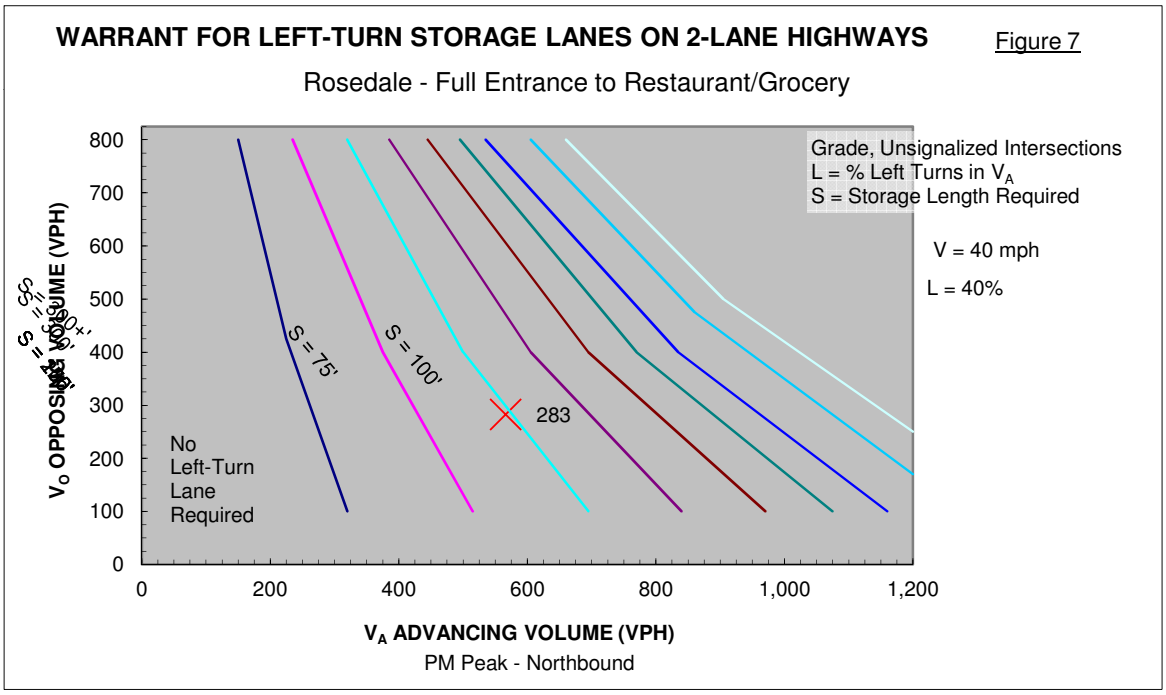
WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAYS

Project:	Rosedale	Analysis Date:	2014'
Intersection:	Full Entrance to Restaurant/Grocery	Data Date:	2013'
Approach Direction:	Northbound	Projection Year:	2024
Peak Hour:	PM Peak		

Peak Hour Left Turns (V_L):	321	vph
Advancing Volume (V_A):	566	vph (Northbound Approach)
Opposing Volume (V_O):	283	vph (Southbound Approach)
Operating/Design Speed (V):	**40**	mph

% Left Turns in V_A (L):	**40%**	(Calculated Value: 56.7%)
Optional % Left Turn Override:		
		(100' storage required based on chart)
% Trucks in V_L:	0%	(0' additional storage for trucks)

CONCLUSION: **100' LEFT-TURN STORAGE REQUIRED**

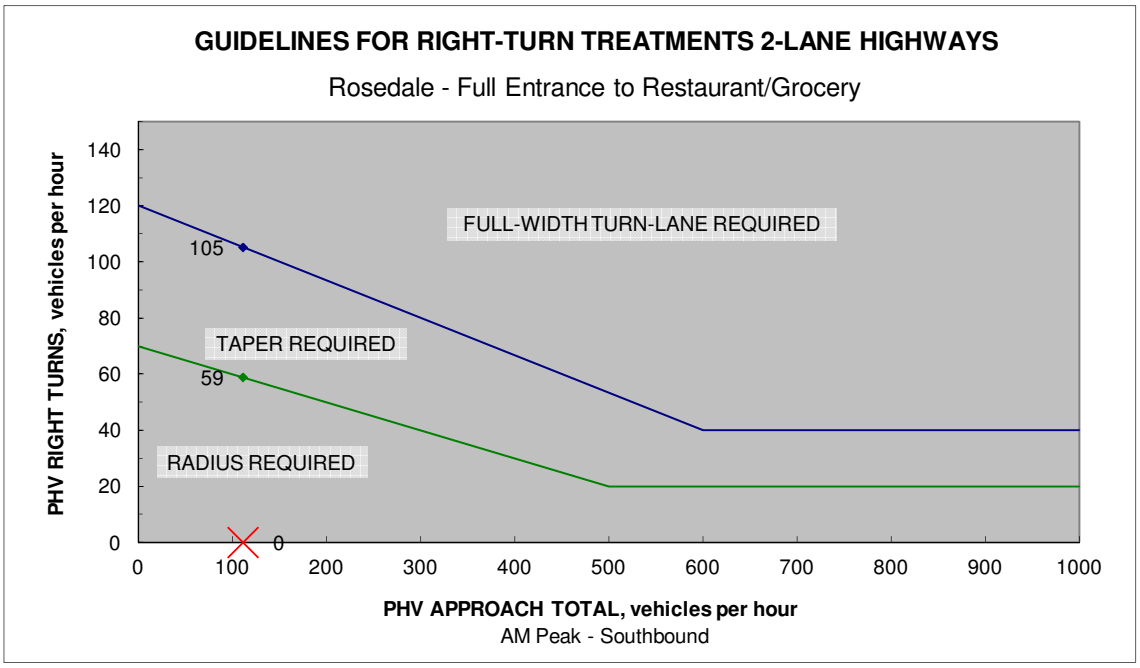


Source: Highway Research Record Number 211 - Figure 7

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 2-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Full Entrance to Restaurant/Grocery			
Approach Direction:	Southbound		Analysis Date:	2014
Peak Hour:	AM Peak		Data Date:	2013
PHV Right Turns:	0	vph	Projection Year:	2024
PHV Approach Total:	111	vph		

CONCLUSION: **RIGHT-TURN RADIUS REQUIRED**

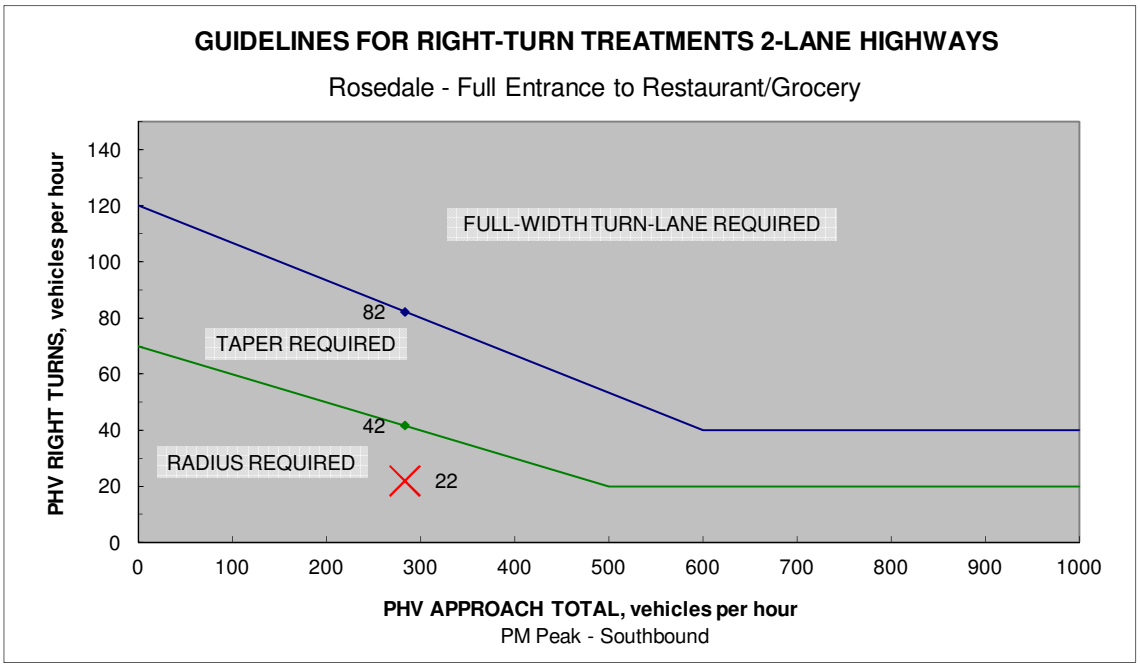


Source: VDOT Minimum Standards of Entrances to State Highways - Figure 5

GUIDELINES FOR RIGHT-TURN TREATMENTS ON 2-LANE HIGHWAYS

Project:	Rosedale			
Intersection:	Full Entrance to Restaurant/Grocery			
Approach Direction:	Southbound		Analysis Date:	2014
Peak Hour:	PM Peak		Data Date:	2013
PHV Right Turns:	22	vph	Projection Year:	2024
PHV Approach Total:	283	vph		

CONCLUSION: **RIGHT-TURN RADIUS REQUIRED**



Source: VDOT Minimum Standards of Entrances to State Highways - Figure 5

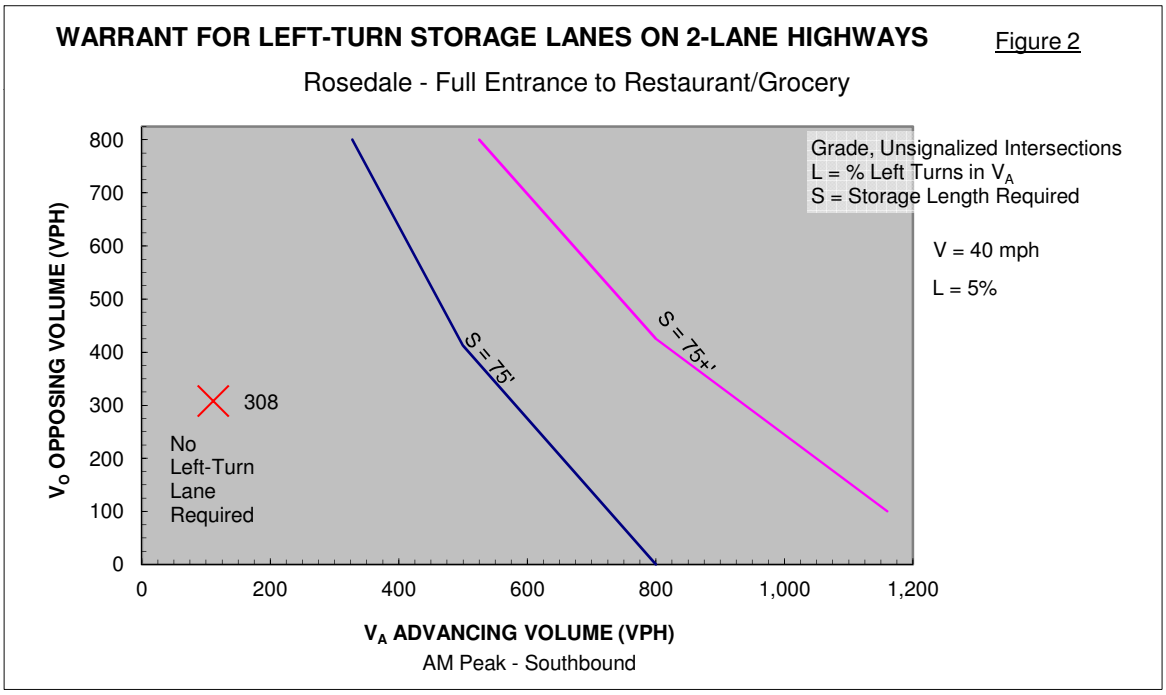
WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAYS

Project:	Rosedale	Analysis Date:	2014'
Intersection:	Full Entrance to Restaurant/Grocery	Data Date:	2013'
Approach Direction:	Southbound	Projection Year:	2024
Peak Hour:	AM Peak		

Peak Hour Left Turns (V_L):	0	vph
Advancing Volume (V_A):	111	vph (Southbound Approach)
Opposing Volume (V_O):	308	vph (Northbound Approach)
Operating/Design Speed (V):	**40**	mph

% Left Turns in V_A (L):	**5%**	(Calculated Value: 0%)
Optional % Left Turn Override:		
		(0' storage required based on chart)
% Trucks in V_L:	0%	(0' additional storage for trucks)

CONCLUSION: **No Left-Turn Lane Required**



Source: Highway Research Record Number 211 - Figure 2

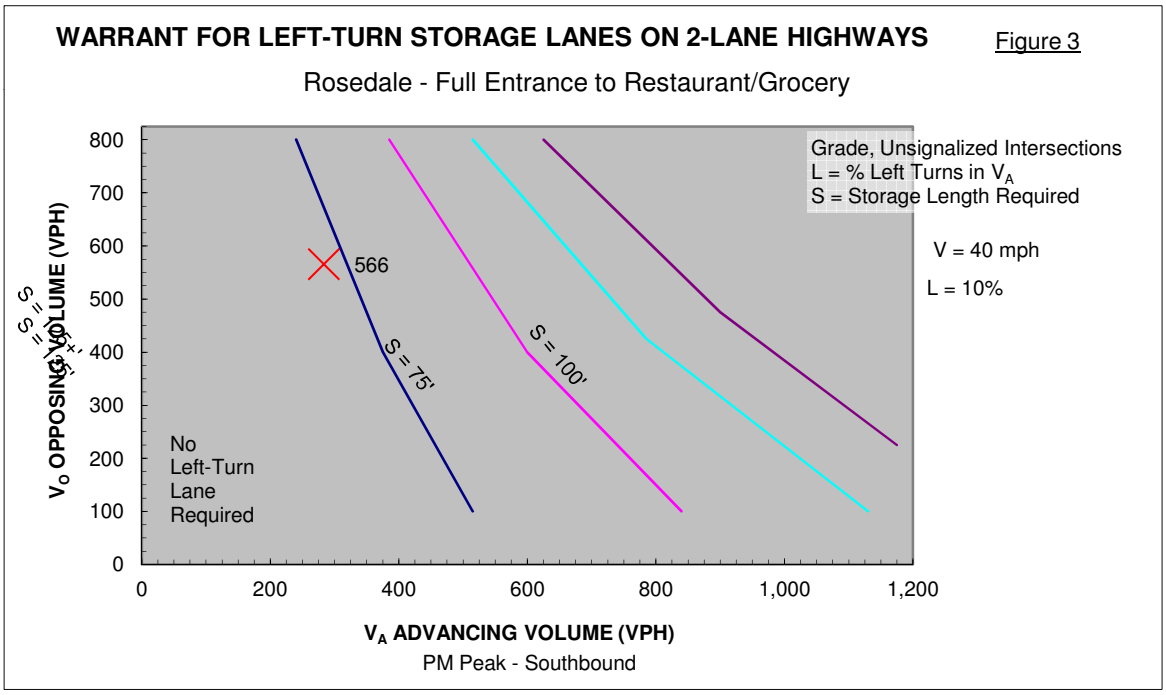
WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAYS

Project:	Rosedale	Analysis Date:	2014'
Intersection:	Full Entrance to Restaurant/Grocery	Data Date:	2013'
Approach Direction:	Southbound	Projection Year:	2024
Peak Hour:	PM Peak		

Peak Hour Left Turns (V_L):	22	vph
Advancing Volume (V_A):	283	vph (Southbound Approach)
Opposing Volume (V_O):	566	vph (Northbound Approach)
Operating/Design Speed (V):	**40**	mph

% Left Turns in V_A (L):	**10%**	(Calculated Value: 7.8%)
Optional % Left Turn Override:		
		(0' storage required based on chart)
% Trucks in V_L:	0%	(0' additional storage for trucks)

CONCLUSION: **No Left-Turn Lane Required**



Source: Highway Research Record Number 211 - Figure 3

Appendix C Synchro Output

HCM Unsignalized Intersection Capacity Analysis
4: Rosedale Main & To Grocery/To Restaurant

2/3/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	58	122	0	0	118	146	45	0	111	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	63	133	0	0	128	159	49	0	121	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								500				
pX, platoon unblocked												
vC, conflicting volume	536	585	121	599	536	159	121			208		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	536	585	121	599	536	159	121			208		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	93	63	100	100	91			100		
cM capacity (veh/h)	425	386	931	360	412	887	1467			1363		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	63	133	128	159	49	121
Volume Left	0	133	128	0	0	0
Volume Right	63	0	0	0	49	0
cSH	931	360	1467	1700	1700	1363
Volume to Capacity	0.07	0.37	0.09	0.09	0.03	0.00
Queue Length 95th (ft)	5	41	7	0	0	0
Control Delay (s)	9.1	20.7	7.7	0.0	0.0	0.0
Lane LOS	A	C	A			
Approach Delay (s)	9.1	20.7	2.9			0.0
Approach LOS	A	C				

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: Graves Mill & Rosedale Main

2/3/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	270	1174	876	120	225	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3539	3539	1583	3432	1441
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3539	1583	3432	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	1276	952	130	245	71
RTOR Reduction (vph)	0	0	0	80	4	52
Lane Group Flow (vph)	293	1276	952	50	248	12
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	7.0	28.2	17.2	17.2	8.6	8.6
Effective Green, g (s)	7.0	28.2	17.2	17.2	8.6	8.6
Actuated g/C Ratio	0.16	0.63	0.38	0.38	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	536	2227	1358	607	658	276
v/s Ratio Prot	0.09	c0.36	c0.27		c0.07	
v/s Ratio Perm				0.03		0.01
v/c Ratio	0.55	0.57	0.70	0.08	0.38	0.04
Uniform Delay, d1	17.4	4.8	11.6	8.8	15.8	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.4	1.7	0.1	0.4	0.1
Delay (s)	18.6	5.2	13.3	8.8	16.1	14.8
Level of Service	B	A	B	A	B	B
Approach Delay (s)		7.7	12.8		15.9	
Approach LOS		A	B		B	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	44.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Rosedale Main & To Grocery/To Restaurant

2/3/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	0	224	140	0	8	321	192	52	22	239	22
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	0	243	152	0	9	349	209	57	24	260	24
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								500				
pX, platoon unblocked												
vC, conflicting volume	1235	1283	272	1470	1238	209	284			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1235	1283	272	1470	1238	209	284			265		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	100	68	0	100	99	73			98		
cM capacity (veh/h)	118	118	767	56	125	832	1279			1299		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	261	161	349	209	57	308
Volume Left	17	152	349	0	0	24
Volume Right	243	9	0	0	57	24
cSH	561	59	1279	1700	1700	1299
Volume to Capacity	0.46	2.73	0.27	0.12	0.03	0.02
Queue Length 95th (ft)	61	410	28	0	0	1
Control Delay (s)	16.9	929.8	8.9	0.0	0.0	0.8
Lane LOS	C	F	A			A
Approach Delay (s)	16.9	929.8	5.0			0.8
Approach LOS	C	F				

Intersection Summary			
Average Delay	117.1		
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: Graves Mill & Rosedale Main

2/3/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	424	1151	1031	223	454	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3539	3539	1583	3431	1441
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3539	1583	3431	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	461	1251	1121	242	493	162
RTOR Reduction (vph)	0	0	0	151	4	112
Lane Group Flow (vph)	461	1251	1121	91	505	34
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	9.9	35.2	21.3	21.3	13.2	13.2
Effective Green, g (s)	9.9	35.2	21.3	21.3	13.2	13.2
Actuated g/C Ratio	0.18	0.62	0.38	0.38	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	602	2208	1336	597	803	337
v/s Ratio Prot	c0.13	0.35	c0.32		c0.15	
v/s Ratio Perm				0.06		0.02
v/c Ratio	0.77	0.57	0.84	0.15	0.63	0.10
Uniform Delay, d1	22.1	6.2	16.0	11.6	19.4	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.8	0.3	4.8	0.1	1.6	0.1
Delay (s)	27.9	6.5	20.8	11.7	21.0	17.1
Level of Service	C	A	C	B	C	B
Approach Delay (s)		12.3	19.2		20.1	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	56.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Appendix D SimTraffic Output

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded mScheduledIntervals	1	1	1	1	1	1	1
Vehs Entered	2772	2908	2770	2798	2746	2818	2730
Vehs Exited	2767	2917	2767	2783	2744	2796	2744
Starting Vehs	58	66	56	49	47	37	62
Ending Vehs	63	57	59	64	49	59	48
Travel Distance (mi)	1726	1801	1725	1732	1716	1739	1683
Travel Time (hr)	54.2	57.8	54.2	54.8	52.6	56.0	52.8
Total Delay (hr)	11.8	13.4	11.7	12.1	10.6	13.0	11.2
Total Stops	1342	1475	1289	1357	1202	1396	1308
Fuel Used (gal)	58.3	61.7	58.2	58.9	57.3	59.6	56.7

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded mScheduledIntervals	1	1	1	1
Vehs Entered	2881	2818	2768	2801
Vehs Exited	2859	2799	2785	2797
Starting Vehs	40	41	58	48
Ending Vehs	62	60	41	55
Travel Distance (mi)	1781	1732	1707	1734
Travel Time (hr)	57.0	54.8	54.5	54.9
Total Delay (hr)	13.2	12.2	12.1	12.1
Total Stops	1375	1392	1386	1352
Fuel Used (gal)	61.0	59.0	58.3	58.9

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2772	2908	2770	2798	2746	2818	2730
Vehs Exited	2767	2917	2767	2783	2744	2796	2744
Starting Vehs	58	66	56	49	47	37	62
Ending Vehs	63	57	59	64	49	59	48
Travel Distance (mi)	1726	1801	1725	1732	1716	1739	1683
Travel Time (hr)	54.2	57.8	54.2	54.8	52.6	56.0	52.8
Total Delay (hr)	11.8	13.4	11.7	12.1	10.6	13.0	11.2
Total Stops	1342	1475	1289	1357	1202	1396	1308
Fuel Used (gal)	58.3	61.7	58.2	58.9	57.3	59.6	56.7

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	2881	2818	2768	2801
Vehs Exited	2859	2799	2785	2797
Starting Vehs	40	41	58	48
Ending Vehs	62	60	41	55
Travel Distance (mi)	1781	1732	1707	1734
Travel Time (hr)	57.0	54.8	54.5	54.9
Total Delay (hr)	13.2	12.2	12.1	12.1
Total Stops	1375	1392	1386	1352
Fuel Used (gal)	61.0	59.0	58.3	58.9

3: Graves Mill & Rosedale Main Performance by movement

4: Rosedale Main & To Grocery/To Restaurant Performance by movement

7: Graves Mill & Right Out Entrance Performance by movement

9: Graves Mill & Right In/Out Entrance Performance by movement

12: Rosedale Main & To Gas Station Performance by movement

Total Network Performance

Intersection: 3: Graves Mill & Rosedale Main

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	LR	R
Maximum Queue (ft)	121	159	106	114	180	175	71	94	96	51
Average Queue (ft)	48	78	57	54	97	88	32	50	48	7
95th Queue (ft)	95	137	96	97	151	149	61	81	83	31
Link Distance (ft)	402	402	402	402	334	334	334	238	238	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)										100
Storage Blk Time (%)									0	0
Queuing Penalty (veh)									0	0

Intersection: 4: Rosedale Main & To Grocery/To Restaurant

Movement	EB	WB	NB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	60	70	55
Average Queue (ft)	27	32	12
95th Queue (ft)	50	58	41
Link Distance (ft)	384	371	125
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: Graves Mill & Right Out Entrance

Movement	B1	B1
Directions Served	T	T
Maximum Queue (ft)	66	133
Average Queue (ft)	2	7
95th Queue (ft)	64	115
Link Distance (ft)	648	648
Upstream Blk Time (%)	0	0
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Graves Mill & Right In/Out Entrance

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 12: Rosedale Main & To Gas Station

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded mScheduledIntervals	1	1	1	1	1	1	1
Vehs Entered	3627	3816	3673	3701	3603	3647	3636
Vehs Exited	3626	3810	3667	3712	3607	3647	3617
Starting Vehs	74	76	83	87	67	84	75
Ending Vehs	75	82	89	76	63	84	94
Travel Distance (mi)	2139	2252	2165	2187	2117	2156	2135
Travel Time (hr)	77.8	83.2	78.1	79.4	75.7	78.4	76.5
Total Delay (hr)	22.4	25.1	22.3	23.1	20.9	22.7	21.7
Total Stops	2473	2720	2476	2602	2392	2537	2458
Fuel Used (gal)	76.9	81.9	78.0	79.5	75.9	77.5	77.0

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded mScheduledIntervals	1	1	1	1
Vehs Entered	3712	3642	3584	3665
Vehs Exited	3706	3649	3581	3662
Starting Vehs	85	70	67	77
Ending Vehs	91	63	70	75
Travel Distance (mi)	2193	2147	2121	2161
Travel Time (hr)	80.1	77.7	75.3	78.2
Total Delay (hr)	23.6	22.0	20.7	22.5
Total Stops	2618	2522	2298	2508
Fuel Used (gal)	80.0	76.8	76.0	78.0

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3627	3816	3673	3701	3603	3647	3636
Vehs Exited	3626	3810	3667	3712	3607	3647	3617
Starting Vehs	74	76	83	87	67	84	75
Ending Vehs	75	82	89	76	63	84	94
Travel Distance (mi)	2139	2252	2165	2187	2117	2156	2135
Travel Time (hr)	77.8	83.2	78.1	79.4	75.7	78.4	76.5
Total Delay (hr)	22.4	25.1	22.3	23.1	20.9	22.7	21.7
Total Stops	2473	2720	2476	2602	2392	2537	2458
Fuel Used (gal)	76.9	81.9	78.0	79.5	75.9	77.5	77.0

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3712	3642	3584	3665
Vehs Exited	3706	3649	3581	3662
Starting Vehs	85	70	67	77
Ending Vehs	91	63	70	75
Travel Distance (mi)	2193	2147	2121	2161
Travel Time (hr)	80.1	77.7	75.3	78.2
Total Delay (hr)	23.6	22.0	20.7	22.5
Total Stops	2618	2522	2298	2508
Fuel Used (gal)	80.0	76.8	76.0	78.0

3: Graves Mill & Rosedale Main Performance by movement

4: Rosedale Main & To Grocery/To Restaurant Performance by movement

7: Graves Mill & Right Out Entrance Performance by movement

9: Graves Mill & Right In/Out Entrance Performance by movement

12: Rosedale Main & To Gas Station Performance by movement

Total Network Performance

Intersection: 3: Graves Mill & Rosedale Main

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	LR	R
Maximum Queue (ft)	176	181	125	128	250	251	108	159	174	148
Average Queue (ft)	93	101	75	76	150	147	50	92	105	45
95th Queue (ft)	151	160	115	116	223	223	87	141	155	111
Link Distance (ft)	402	402	402	402	334	334	334	238	238	
Upstream Blk Time (%)						0				
Queuing Penalty (veh)						0				
Storage Bay Dist (ft)										100
Storage Blk Time (%)									8	0
Queuing Penalty (veh)									6	1

Intersection: 4: Rosedale Main & To Grocery/To Restaurant

Movement	EB	WB	NB	NB	NB	SB
Directions Served	LTR	LTR	L	T	R	LTR
Maximum Queue (ft)	123	111	129	50	2	53
Average Queue (ft)	60	50	53	2	0	6
95th Queue (ft)	101	94	104	23	2	30
Link Distance (ft)	384	371	125	125	125	319
Upstream Blk Time (%)			0	0		
Queuing Penalty (veh)			0	0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 7: Graves Mill & Right Out Entrance

Movement	B1	B1	SB
Directions Served	T	T	R
Maximum Queue (ft)	131	269	23
Average Queue (ft)	4	13	1
95th Queue (ft)	93	168	16
Link Distance (ft)	648	648	228
Upstream Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 9: Graves Mill & Right In/Out Entrance

Movement	WB	SB
Directions Served	TR	R
Maximum Queue (ft)	3	6
Average Queue (ft)	0	0
95th Queue (ft)	4	6
Link Distance (ft)	1475	198
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 12: Rosedale Main & To Gas Station

Movement	NB
Directions Served	T
Maximum Queue (ft)	20
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	238
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 7

Appendix E Sidra Output

MOVEMENT SUMMARY

Site: Rou 4-way 1&2-Lane US

Rosedale
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Spine road											
3	L	349	1.0	0.531	10.1	LOS B	3.3	83.2	0.31	0.71	24.9
8	T	192	1.0	0.531	10.1	LOS B	3.3	83.2	0.31	0.46	27.1
18	R	61	1.0	0.060	4.1	LOS A	0.2	5.2	0.17	0.53	30.3
Approach		602	1.0	0.531	9.5	LOS A	3.3	83.2	0.29	0.61	26.0
East: Eastside											
1	L	161	1.0	0.325	10.1	LOS B	1.3	32.1	0.59	0.91	24.9
6	T	22	5.0	0.325	10.1	LOS B	1.3	32.1	0.59	0.77	26.8
16	R	22	1.0	0.325	10.1	LOS B	1.3	32.1	0.59	0.80	26.6
Approach		204	1.4	0.325	10.1	LOS B	1.3	32.1	0.59	0.88	25.3
North: Spineroad											
7	L	24	1.0	0.472	12.7	LOS B	2.3	58.9	0.65	1.02	24.2
4	T	260	1.0	0.472	12.7	LOS B	2.3	58.9	0.65	0.86	25.9
14	R	24	1.0	0.472	12.7	LOS B	2.3	58.9	0.65	0.89	25.7
Approach		308	1.0	0.472	12.7	LOS B	2.3	58.9	0.65	0.87	25.8
West: Grocery											
5	L	22	1.0	0.404	10.5	LOS B	1.8	46.1	0.59	0.96	25.0
2	T	22	5.0	0.404	10.5	LOS B	1.8	46.1	0.59	0.78	26.9
12	R	243	1.0	0.404	10.5	LOS B	1.8	46.1	0.59	0.82	26.7
Approach		287	1.3	0.404	10.5	LOS B	1.8	46.1	0.59	0.83	26.5
All Vehicles		1401	1.1	0.531	10.5	LOS B	3.3	83.2	0.48	0.75	26.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

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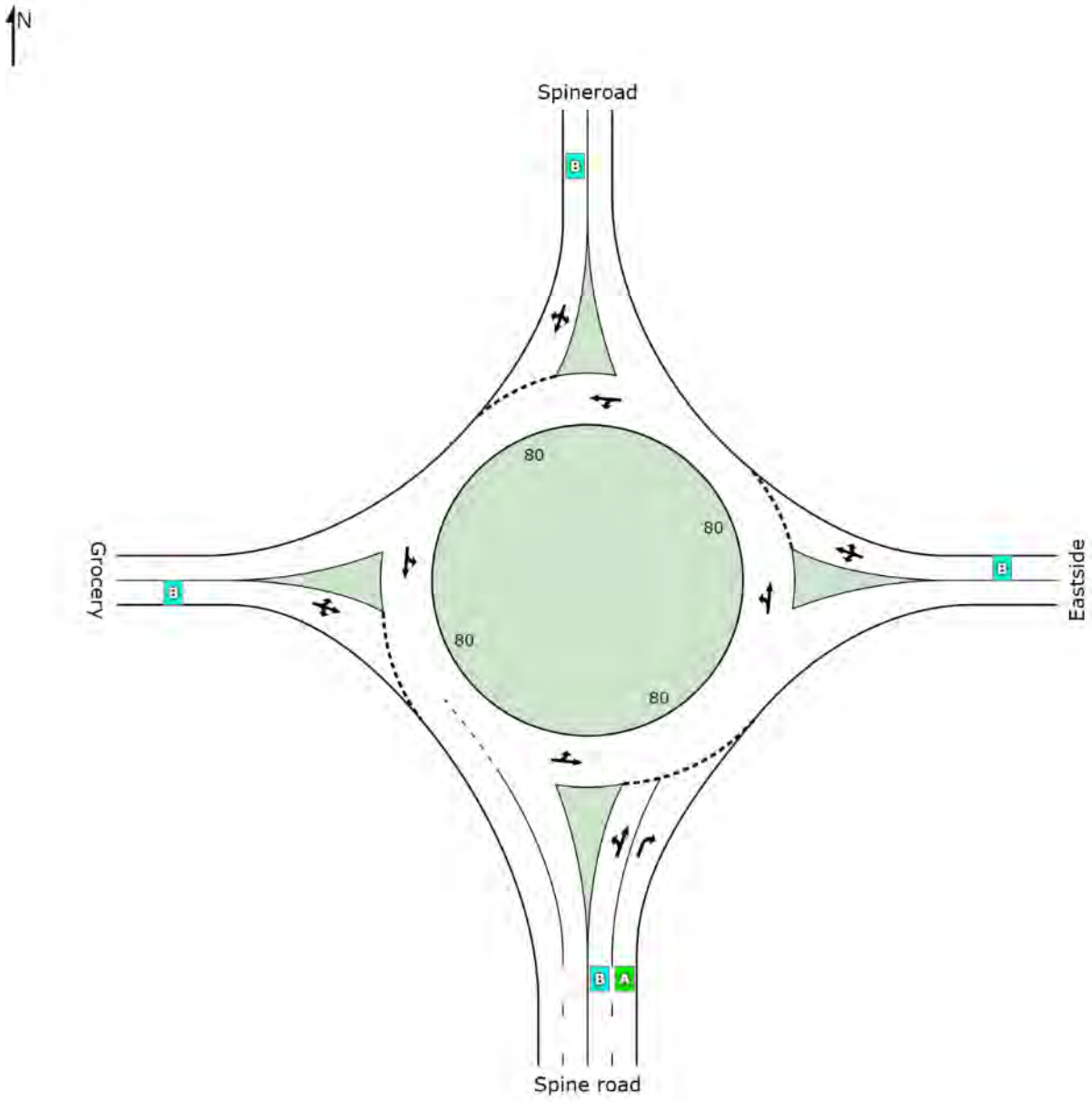
LEVEL OF SERVICE SUMMARY

Site: Rou 4-way 1&2-Lane US

Rosedale
Roundabout



	South	East	North	West	Intersection
LOS	A	B	B	B	B

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Model used. Geometric Delay not included.

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