
TECHNICAL MEMORANDUM FOR

TIP PROJECTS
R-2559 & R-3329

US74 UPGRADE SCENARIO
UNION AND MECKLENBURG COUNTIES
NORTH CAROLINA

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Prepared for



Prepared by



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PROJECT DESCRIPTION

Project Description

Wilbur Smith Associates (WSA) has been contracted by the North Carolina Turnpike Authority (NCTA) to develop traffic forecasts for the Monroe Connector/Bypass, a candidate Toll project in Union and Mecklenburg Counties. The projects are also known as North Carolina Department of Transportation (NCDOT) State Transportation Improvement Program (TIP) Projects R-3329 and R-2559. The study area is shown in Exhibit 1. As a part of the traffic forecasting scope, a Technical Memorandum detailing findings and impacts that would be expected with the widening and upgrade of existing US 74 and the addition of a pair of one-way, two-lane parallel frontage roads adjacent to US 74 was requested. This document serves as the subject Technical Memorandum.

The R-3329/R-2559 Project is proposed to provide a vital east-west freeway facility relieving congestion on a key transportation facility and strategic highway (US 74) between Marshville and east Charlotte. As its name suggests, the Monroe Connector/Bypass is a combination of two projects previously studied by NCDOT; the Monroe Bypass (R-3329) and the Monroe Connector (R-2559). The Monroe Bypass was originally proposed to provide a freeway bypassing the City of Monroe and US 74 between US 601 north of Monroe to just east of the Town of Marshville. The Monroe Connector was originally proposed to "connect" the Monroe Bypass at US 601 to I-485 just east of the Town of Matthews. The Monroe Connector/Bypass would provide a facility that serves high-speed regional travel while maintaining access to properties along existing US 74. Several alternatives are currently under consideration for the Monroe Connector/Bypass. This Technical Memorandum summarizes one such scenario, the US 74 Upgrade scenario in lieu of construction of the Monroe Connector/Bypass. Exhibit 2 shows typical roadway sections for the US 74 upgrade scenario as well as the proposed Monroe Connector/Bypass.

Data recently released by the US Census Bureau indicates that Union County had the fastest growth in population in North Carolina over the period 2000-2007, with a population change of 49.2%, compared to the entire statewide population growth average of 12.6% over the same time period. Much of the growth in Union County occurred in the City of Monroe, where the population currently nears 30,000 residents. Based on these figures, travel demand is expected to increase at an aggressive rate. The R-3329 and R-2559 projects are proposed to relieve pressure and improve flow along US 74 between east Charlotte and the Marshville/Wingate area.

EXHIBIT 1: US 74 UPGRADE SCENARIO STUDY AREA

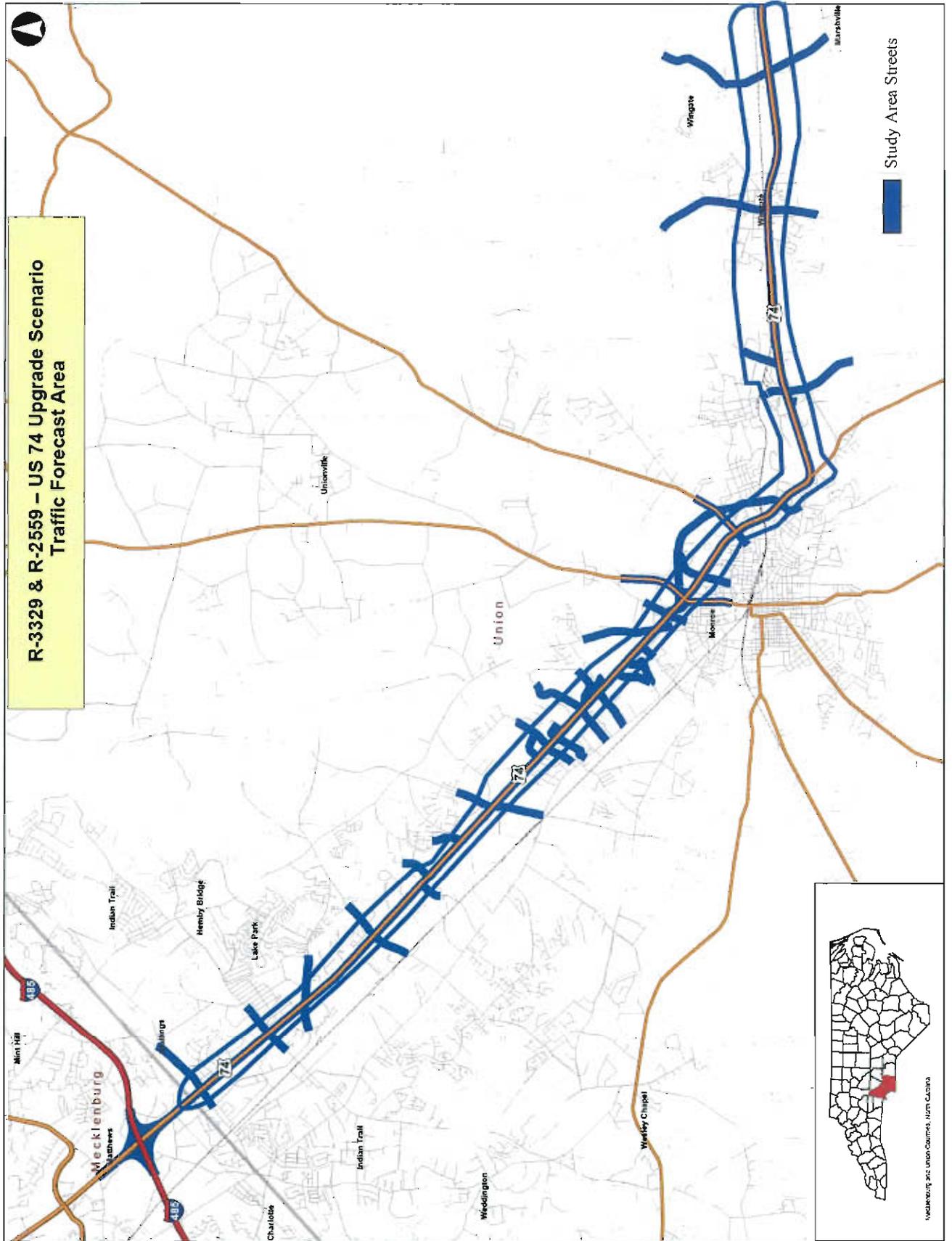
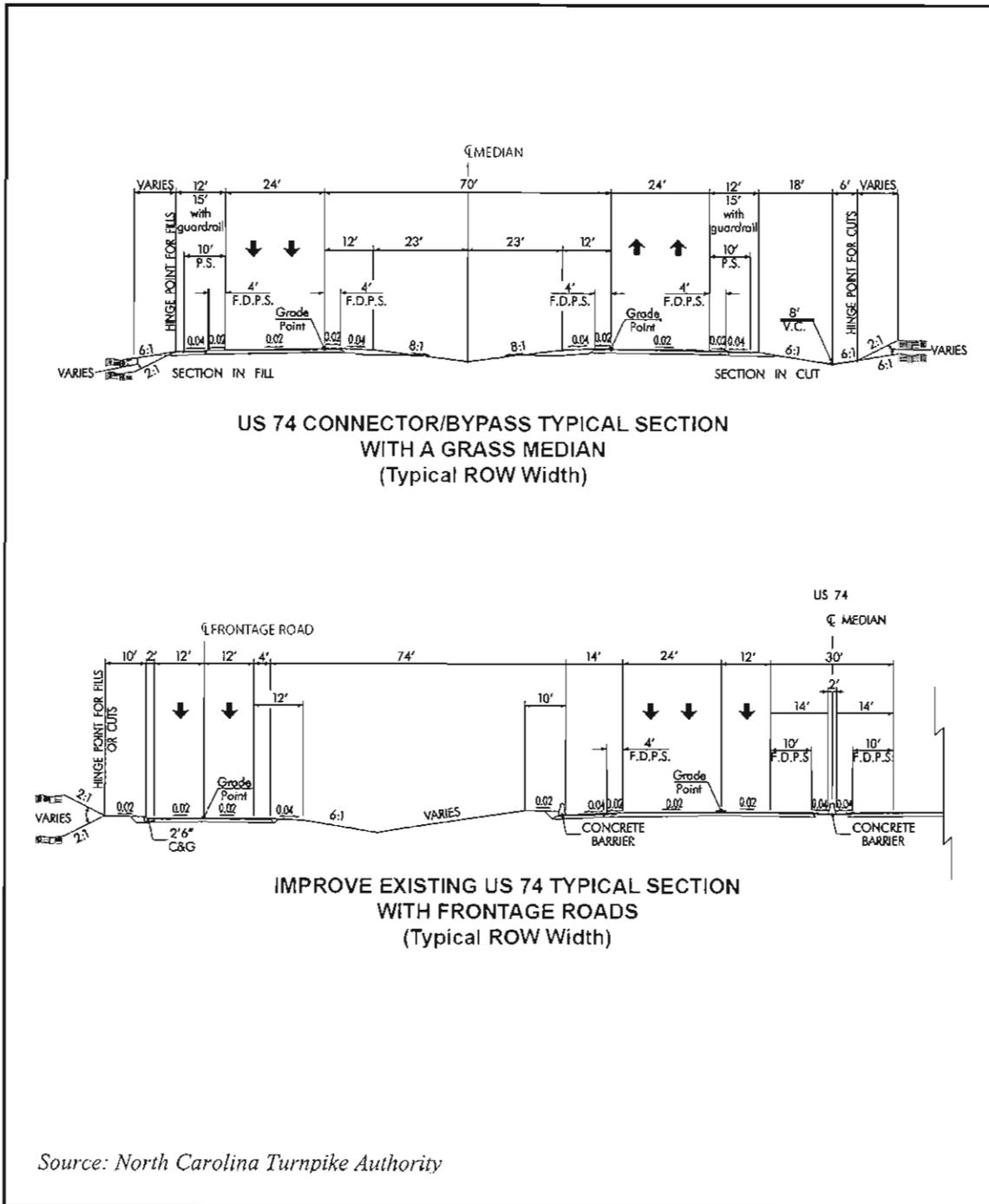


EXHIBIT 2: US 74 TYPICAL ROADWAY CROSS-SECTIONS



As shown in Exhibit 2, the US 74 Connector/Bypass would be constructed on an approximate right of way width of 200 feet while the US 74 Upgrade with frontage roads scenario would encompass an approximate right of way width of 400 feet.

SOURCES OF INFORMATION AND DATA

Sources of Information and Data

HISTORICAL AADT COUNT REVIEW

Historical Average Annual Daily Traffic (AADT) volumes from 1987 to 2006 were gathered from the *NCDOT Traffic Survey Unit* and reviewed. This data is summarized in Exhibit 3.

Previous Traffic Forecasts

Traffic forecasts for four (4) Transportation Improvement Program (TIP) projects within the study area were obtained from NCDOT and evaluated and included in this report. The traffic forecast for R-2559 (US 74 Monroe Bypass) prepared by NCDOT and dated November 2004 provided valuable data for this project. The traffic forecast for R-3329 (US 74 from Matthews Mint Hill Road to Rocky River Road) prepared by NCDOT in 1997 and updated in September 2005 is also referenced in this Technical Memorandum. The forecasts for U-3825 (Stallings Road from Old Monroe Road to US 74) prepared by NCDOT in March 2005 and R-2616 (US 601 from the South Carolina State Line to US 74) prepared by NCDOT in October 2004 were both consulted and utilized for reference.

Discussions with Municipal Officers

Telephone interviews were conducted with Ms. Katie Reeves, Town of Indian Trail Planning Department and Mr. Wayne Herron, City of Monroe Planning Director to ascertain information about planned or approved development sites in the Monroe Connector/Bypass corridor, possible land uses for large undeveloped tracts of land, and any road improvement projects planned to be implemented by the jurisdiction. Ms. Reeves provided a listing of approved subdivisions within the Town of Indian Trail and just outside the Town in Union County. She stated that the majority of planned development in and around the proposed corridor is low density residential. Mr. Herron echoed Ms. Reeves' statements in indicating that the majority of vacant land in Monroe in and around the proposed corridor is currently zoned low density residential (one house per acre) with no immediate plans or requests to rezone. Neither official stated that their municipalities would be undertaking any road improvement or construction projects in the foreseeable future.

EXHIBIT 3: HISTORICAL NCDOT AADT COUNT SUMMARY

ID	Route	Location	Year																			
			1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	I-485	North of US 74	-	-	-	-	-	-	-	-	-	-	-	-	13000	21,000	-	23,000	49,000	54,000	56,000	
2	I-485	South of US 74	-	-	-	-	-	-	-	-	-	25,300	-	33,000	37000	42,000	39,000	45,000	63,000	68,000	68,000	
3	US 74	West of I-485	-	32,000	-	31,700	-	34,000	-	39,900	-	-	-	53,000	53000	-	55,000	-	53,000	-	-	
4	US 74	East of I-485	-	32,000	-	31,700	-	34,000	-	39,900	-	-	-	50,000	52000	-	52,000	-	54,000	-	-	
5	US 74	West of Stallings Rd	28,000	28,700	33,000	32,300	32,300	34,000	36,300	37,200	-	42,800	46,000	50,000	-	-	-	57,000	56,000	54,000	58,000	58,000
6	Stallings Rd	North of US 74	2,200	-	2,500	-	3,100	-	3,400	-	3,000	-	5,500	-	5,400	-	3,800	-	4,300	-	4,500	-
7	Stallings Rd	South of US 74	6,700	-	7,000	-	8,000	-	9,200	-	8,600	-	10,600	-	10,000	-	8,700	9,500	-	8,900	-	10,000
8	US 74	East of Stallings Rd	25,000	27,800	28,400	28,000	28,600	33,100	35,200	36,600	-	37,200	42,000	45,000	-	-	-	53,000	52,000	54,000	52,000	53,000
9	Indian Trail Fairview Rd	North of US 74	-	-	-	-	-	-	-	-	-	-	-	-	6,200	-	-	5,900	-	5,500	-	-
10	Indian Trail Fairview Rd	South of US 74	4,800	-	5,500	-	6,900	-	8,300	-	8,300	-	9,800	-	10,000	-	9,000	9,800	-	13,000	-	12,000
11	US 74	East of Indian Trail Fairview Rd	23,400	24,800	-	27,000	28,400	31,200	32,800	35,000	-	38,200	42,000	45,000	-	-	-	50,000	48,000	46,000	49,000	51000
12	Unionville Indian Trail Rd	North of US 74	1,800	-	-	-	2,500	-	2,800	-	6,100	-	8,100	-	9,900	-	1,000	12,000	4,800	11,000	-	6,800
13	Unionville Indian Trail Rd	South of US 74	1,500	-	1,200	-	1,600	-	1,700	-	-	-	8,600	-	-	-	-	4,800	-	5,500	-	-
14	US 74	East of Unionville Indian Trail Rd	21,100	23,300	25,200	25,700	27,100	28,600	32,300	30,900	-	35,300	38,000	40,000	-	-	-	48,000	47,000	45,000	47,000	42,000
15	US 74	East of Wesley Chapel Stouts Rd	22,200	22,200	23,500	22,700	25,500	25,800	28,900	30,300	-	33,500	37,000	41,000	-	-	-	44,000	41,000	44,000	-	-
16	Wesley Chapel Stouts Rd	South of US 74	1,700	-	2,000	-	2,400	-	3,100	-	-	-	5,400	-	-	-	-	-	8,500	-	11,000	-
17	Chambers Dr	North of US 74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200	-	3,600	-
18	US 74	East of Chambers Dr	20,300	20,100	-	22,600	23,700	26,000	28,000	29,000	-	31,700	33,700	35,000	-	-	-	41,000	37,000	36,000	37,000	38,000
19	N Rocky River Rd	North of US 74	2,800	-	3,100	-	-	-	-	-	-	-	3,500	-	4,300	-	4,700	5,000	6,400	4,700	8,300	5,800
20	N Rocky River Rd	South of US 74	-	-	-	-	5,700	-	6,200	-	7,600	-	8,800	-	9,800	-	9,100	11,000	-	8,700	-	9,800
21	US 74	East of N Rocky River Rd	18,600	19,700	23,500	23,600	24,500	26,900	26,900	28,100	-	30,300	-	36,000	-	-	-	38,000	36,000	35,000	36,000	36,000
22	US 74	East of Rolling Hills Dr	-	-	-	-	-	26,900	28,800	29,700	-	32,000	-	40,000	-	-	-	40,000	37,000	35,000	46,000	-
23	Dickerson Blvd	South of US 74	-	-	-	-	-	-	-	-	-	-	-	13,000	-	15,000	17,000	-	14,000	-	16,000	
24	US 74	East of Dickerson Blvd	-	-	30,700	-	30,700	31,300	32,900	33,100	-	38,700	37,300	41,000	-	-	-	51,000	46,000	45,000	48,000	-
25	Secrest Shortcut Rd	North of US 74	4,900	-	4,000	-	4,900	-	6,100	-	7,500	-	6,900	-	6,900	-	7,500	-	8,400	-	8,900	-
26	US 74	East of Concord Ave	29,900	-	30,500	35,700	35,100	37,700	44,000	41,400	-	46,800	-	49,000	-	-	-	60,000	56,000	57,000	56,000	-
27	US 601	North of US 74	7,500	8,500	9,700	9,100	9,100	9,300	10,200	10,600	11,400	12,000	12,800	13,000	14,000	14000	14,000	13,000	13,000	12,000	13,000	13,000
28	NC 200	South of US 74	8,300	9,500	9,900	10,800	11,000	11,800	12,000	11,900	-	13,000	14,500	14,000	-	-	-	14,000	13,000	-	15,000	14,000
29	Stafford St	North of US 74	1,400	-	1,600	-	1,300	-	1,500	-	2,000	-	2,400	-	2,900	-	3,000	3,100	-	3,800	-	3,800
30	US 74	West of Morgan Mill Rd	32,000	29,400	-	32,900	36,300	37,000	39,000	39,100	-	44,300	46,000	50,000	-	-	-	55,000	51,000	52,000	54,000	55,000
31	Morgan Mill Rd	North of US 74	5,500	6,000	10,300	7,100	7,500	8,300	8,200	8,700	8,500	8,700	8,900	10,000	9,100	9700	9,500	9,700	9,300	9,800	11,000	9,700
32	Morgan Mill Rd	South of US 74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,000	-	10,000	-	10,000
33	US 74	East of Morgan Mill Rd	28,300	28,000	28,000	31,000	31,600	34,900	36,600	36,800	-	41,800	40,600	45,000	-	-	-	51,000	46,000	47,000	51,000	48,000
34	Walkup Ave	North of US 74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,000	-	11,000	-
35	US 601	South of US 74	10,800	11,000	11,000	10,200	10,000	10,900	11,500	-	12,900	13,100	13,400	15,000	18,000	18000	17,000	17,000	16,000	17,000	19,000	18,000
36	US 74	East of US 601	20,700	22,100	22,100	19,700	21,300	21,300	23,100	23,400	-	27,300	27,100	28,000	-	-	-	29,000	30,000	26,000	29,000	27,000
37	US 74	East of Old Pageland Monroe Rd	17,000	19,600	19,600	20,800	20,800	22,500	23,000	22,000	-	26,000	24,000	25,000	-	-	-	27,000	27,000	25,000	27,000	25,000
38	Old Pageland Monroe Rd	South of US 74	1,100	-	1,400	-	1,300	-	1,500	-	1,600	-	2,300	-	1,900	-	1,800	1,700	-	1,500	-	1,500
39	South Bivens Rd	North of US 74	1,700	-	2,000	-	1,400	-	1,700	-	1,900	-	1,900	-	2,200	-	2,000	-	1,900	-	1,900	-
40	US 74	East of South Bivens Rd	15,000	18,600	18,600	20,600	20,900	19,800	22,800	22,700	-	24,400	24,000	25,000	-	-	-	28,000	26,000	24,000	27,000	24,000
41	Bivens St	North of US 74	1,100	-	1,200	-	1,200	-	1,700	-	1,500	-	1,500	-	1,400	-	1,800	1,800	-	1,300	-	1,400
42	US 74	East of Bivens St	-	23,300	23,400	19,300	23,000	23,900	25,700	25,100	-	26,600	25,900	25,000	-	-	-	29,000	26,000	24,000	28,000	24,000
43	South Main St	North of US 74	4,200	-	4,800	-	4,800	-	5,100	-	5,200	-	6,300	-	5,000	-	5,000	6,500	-	4,200	-	4,200
44	South Main St	South of US 74	1,400	-	1,900	-	2,100	-	2,300	-	-	-	2,600	-	-	-	-	-	2,700	-	2,900	-
45	US 74	East of South Main St	14,200	14,700	14,700	14,600	16,400	16,700	19,100	18,000	-	19,500	20,000	20,000	-	-	-	22,000	21,000	19,000	21,000	19,000

Supplemental Traffic Data

Turning movement counts, as well as tube classification counts for specific intersections and sections of US 74 were collected in March and April 2007 for the previous No-Build Traffic Forecasts (prepared by others). This count data was used as reference data to provide the basis for establishing quadrant and turning movement flows for the study area intersections for these forecasts, along with establishing design data such as directional splits and design hourly volumes. Manual 16-hour turning movement counts were taken on average weekdays between the hours of 6:00 A.M. and 10:00 P.M. at selected locations, while morning (7:00-9:00 AM) and afternoon (4:00-6:00 PM) Peak Hour count data was collected at other intersections. Vehicle classification data was collected in 48-hour increments at various spots along US 74.

Exhibit 4 illustrates the locations where supplemental traffic data was collected.

Exhibit 4: Supplemental Traffic Count Locations

Location of Count	Type of Count	Count Date
US 74 at Stallings Road	Manual 16-Hour Count	March 15, 2007
US 74 at Indian Trail Fairview Road	Manual 16-Hour Count	March 21, 2007
US 74 at Unionville-Indian Trail Road	Manual 16-Hour Count	March 28, 2007
US 74 at Faith Church Road/Harris Teeter	Peak Hour Counts	March 14, 2007
US 74 at Sardis Church/Wesley Chapel Stout	Peak Hour Counts	March 21, 2007
US 74 at Chambers Drive	Peak Hour Counts	March 26, 2007
US 74 at North Rocky River Road	Manual 16-Hour Count	March 13, 2007
US 74 at Fowler Secrest/John Moore Road	Peak Hour Counts	March 29, 2007
US 74 at Carroll Street/Rolling Hills Drive	Peak Hour Counts	April 2, 2007
US 74 at Roland Drive/Round Table Road	Peak Hour Counts	April 25, 2007
US 74 at Williams Road	Peak Hour Counts	April 18, 2007
US 74 at Wal-Mart/Hanover entrances	Peak Hour Counts	April 24, 2007
US 74 at K-Mart/Dickerson Boulevard	Peak Hour Counts	April 20, 2007
US 74 at Secrest Shortcut/Mall Entrance	Manual 16-Hour Count	March 28, 2007
US 74 at Concord Avenue	Peak Hour Counts (both ramps)	April 17, 2007
US 74 at Skyway Drive (US 601-NC 200)	Peak Hour Counts (3 ramps)	April 26 and April 20, 2007
US 74 at Stafford Street/Stafford Street Extension	Manual 16-Hour Count	April 18, 2007
US 74 at Boyte Street/Retail Entrance	Peak Hour Counts	April 18, 2007
US 74 at Morgan Mill Road	Manual 16-Hour Count	April 17, 2007
US 74 at Walkup Avenue	Manual 16-Hour Count	April 5, 2007
US 74 at South Southerland Avenue	Peak Hour Counts	March 14, 2007
US 74 at Venus Street/Dove Street	Peak Hour Counts	March 19, 2007
US 74 at East Franklin Street/Retail Entrance	Manual 16-Hour Count	April 3, 2007
US 74 at Metro Medical Center/Pageland Highway	Manual 16-Hour Count	April 3, 2007
US 74 at South Secrest Avenue/Old Pageland-Monroe Road	Peak Hour Counts	March 21, 2007
US 74 at South Bivens Road	Peak Hour Counts	April 2, 2007
US 74 at Bivens Street/Food Lion Entrance	Peak Hour Counts	April 4, 2007
US 74 at North Main Street/South Main Street	Peak Hour Counts	April 3, 2007
US 74 at Forest Hills School Road	Manual 16-Hour Count	March 27, 2007

METHODOLOGY AND FORECAST DEVELOPMENT

Methodology and Forecast Development

The methodology for developing forecasts for the US 74 Upgrade Scenario with and without Toll consisted of several techniques including interpretation of model outputs, regression analysis of historical AADT data, and review of previous traffic forecasts. **Model outputs generated from the Monroe Connector/Bypass Build Toll and Non-Toll "A" Scenarios were used to estimate the AADT data for the Upgraded US 74 and Frontage Roads Toll and Non-Toll Scenarios for this Technical Memorandum.**

The modeling process discussed below outlines the process followed to predict AADT's reported in the May 2008 *Traffic Forecast Report* for projects R-2559 and R-3329. The discussion below references the Monroe Connector/Bypass as modeling was prepared for that project and used by reference for this Technical Memorandum.

Traffic Model Development and Refinement

The Charlotte Department of Transportation maintains the Metrolina Regional Travel Demand Model (MRTDM) that was used for the preliminary traffic and revenue analysis and the NEPA-level traffic forecasts. The Metropolitan Planning Organization (MPO) used this model to develop the region's 2030 Transportation Improvement Program (TIP) which contains the highway projects identified for construction. Certain refinements and adjustments were made to the original MRTDM in order to conduct this analysis. The model and underlying socioeconomic data used by the model were provided by the Charlotte Department of Transportation in February 2006. This section describes the model refinement process.

Data obtained for the MRTDM included highway networks and trip tables for 2000, 2006, 2008, 2015, 2020, and 2030 as well as socioeconomic forecasts for each year by traffic analysis zone. The base-year model was calibrated in the immediate project area to achieve the best traffic volume assignments compared to observed traffic counts and observed speeds from speed-delay runs conducted for the traffic and revenue analysis. The model also was updated to reflect the proposed Monroe Connector/Bypass as well as the other committed highway improvements. Variations of the Monroe Connector/Bypass alignment were also modeled by adding and deleting links to represent the alignment under consideration.

Highways proposed for future improvement in the model were compared with proposed roadway improvements in the TIP and Long Range Transportation Plan (LRTP) developed by the MPO. Special attention was given to proposed roadway improvements within the study area for the Monroe Connector/Bypass. Detailed

coding was added to represent the interchanges and Toll plaza locations for all alignments of the Connector/Bypass.

The base year 2008 model was run using inputs supplied by the MPO. A series of traffic assignments were compared with ground counts supplied by the NCDOT and those collected specifically for the traffic and revenue study. Adjustments were made to input network speeds and trip tables in the study area in order to improve the calibration of the model in comparison with ground counts for the specific corridor area.

After calibration was obtained, a series of traffic assignments to the highway network were made for years of 2008, 2010, 2015, 2020, and 2030 under No Build, Non-Toll, and Toll conditions.

Traffic assignments to the proposed Toll facility were made using a diversion assignment technique added to the MRTDM. This process involved a comparison of travel time and distance for trips that might use the Monroe Connector/Bypass with the best Non-Toll alternative routes. The estimated share of total traffic that would be expected to use the facilities was a function of travel time and distance savings, a monetary value placed on these savings, and the Toll charges being tested in any given assignment. In general, as the total costs to use the proposed Monroe Connector/Bypass increased, in comparison to the best alternative Non-Toll routes, the share of traffic on the Monroe Connector/Bypass would decrease. At lower Toll rates, a higher share would be estimated. Assignments under Non-Toll conditions on the Monroe Connector/Bypass were made using standard highway assignment techniques without the special Toll diversion component of the model.

The MRTDM also recognized capacity constraints on roadways in the study area. Speeds were adjusted in future conditions to reflect increasing congestion on the Toll facility and competing roads. The proposed Monroe Connector/Bypass was assumed to be four lanes at all locations for purposes of this analysis.

Basic Assumptions

The preliminary traffic and revenue estimates for the US 74 Upgrade Scenario were predicated on the following basic assumptions, which were considered reasonable for purposes of this analysis:

1. The US 74 Upgrade Scenario is expected to have the following interchange locations:
 - Stallings Road
 - Indian Trail Road /Fairview Road
 - Unionville Indian Trail Road West

- North Rocky River Road
- US 601/NC 200
- NC 200/Morgan Mill Road
- Metro Medical Center Campus/ US 601
- Austin Chaney Street/South Main Street
- Forest Hills School Road

All other Y-lines will be connected by the eastbound and westbound frontage roads.

2. The frontage roads will have right in / right out access only.
3. All vehicles that were previously turning left onto US 74 from intersecting streets or driveways will now turn right onto a frontage road, then left onto a Y-line that has access to US 74, and then left onto the upgraded US 74.
4. All vehicles that previously made through movements from intersecting streets or driveways will now to turn right onto a frontage road, then left onto a Y-line that crosses US 74, then left onto the opposite frontage road, then right onto the original intersecting street or driveway to complete the crossing maneuver. This does not apply to streets that form interchanges with US 74.
5. For the US 74 upgraded scenario with Toll, it is assumed that all left and through movements from the intersecting streets or driveways will use a frontage road to arrive at their destination rather than pay a toll to use US 74.
6. For the Non-Toll scenario, it is assumed that the upgraded US 74 will carry the same volume that was projected to use the Monroe Connector/Bypass Non-Toll scenario 'A' facilities except where interchanges are proposed on the upgraded US 74 as additional volume from the frontage roads generated by intended left turns from side streets would add volume to upgraded US 74 at these locations.
7. For the Toll scenario, it is assumed that the upgraded US 74 will carry the same volume that was projected to use the Monroe Connector/Bypass Toll scenario 'A' facilities except where interchanges are proposed on the upgraded US 74 as additional volume from the frontage roads generated by intended left turns from side streets would add volume to upgraded US 74 at these locations.

8. It is assumed that all of the forecasted volume using existing US 74 in the Monroe Connector/Bypass forecasts (Toll and Non-Toll) would be reassigned to the frontage roads at a 50/50 split percentage for the Toll and Non-Toll US 74 Upgrade forecasts respectively.
9. Roadway improvements included in the TIP current at the time of the preliminary traffic and revenue study were assumed to be implemented including the programmed widenings of competing routes.
10. No other competing facilities or additional capacity would be constructed during the project period, other than those in the Transportation Improvement Plan in effect at the time of the preliminary traffic and revenue study.
11. Economic growth in the project study area and associated travel demand will occur as represented in the Metrolina Regional Travel Demand Model used in this analysis.
12. The Toll road alternative will be signed and promoted effectively to encourage maximum usage.
13. Motor fuel will remain in adequate supply and no national or regional emergency would arise that would abnormally restrict the use of motor vehicles.

Any significant departure from these basic assumptions could materially affect traffic volumes on the proposed upgrade of existing US 74.

Roadway Improvements

Motorist's travel behavior and number of vehicles that would use the proposed upgraded US 74 in the future would be heavily influenced by the operating conditions of other area roadways. The process of transportation project development and funding makes it impossible to know with certainty which proposed transportation improvements will be implemented and when. However, it is important that reasonable assumptions are made regarding future improvements, since such improvements could have a considerable effect on the number of vehicles using upgraded US 74.

The MRTDM contains all future highway improvements listed in the MPO's fiscally constrained 2030 transportation improvement program in effect at the time of the preliminary study. A list of the planned road improvements that could affect traffic volumes on upgraded US 74 is provided in Exhibit 5. The improvements

that would have the most impact on operations and the year that they are programmed in the MRTDM include:

- **Model Year 2013**
 - Monroe Connector/Bypass;
 - Widening of US 601 north and south of US 74;
- **Model Year 2020**
 - Widening of US 74 from I-485 towards Charlotte, I-485 from US 74 to Albemarle Road;
- **Model Year 2030**
 - New Road – Monroe Northern Loop from Dickerson Road to US 601, Eastern Circumferential from Lawyers Road to NC 24/27; and
 - Widening of US 601 north of Monroe, I-485 from I-77 to NC 16.

Several of these highway improvement projects would either compete directly with or complement the proposed Monroe Connector/Bypass and/or US 74 Upgrade with Frontage Roads project. The widening of I-485 and US 601 would provide improved access to the Monroe Connector/Bypass and the upgraded US 74 corridor with frontage roads.

Exhibit 5: Major Highway Improvements Contained in Metrolina Regional Travel Demand Model

Name and Location	Project Description	Model Year
Monroe Connector/Bypass	US 74 in Marshville to I-485, New Freeway (4)	2014
US 601 (Pageland Highway)	US 74 (Roosevelt Boulevard) to South Carolina Line, Widening (4)	2014
Martin Luther King Jr. Boulevard	NC 200 (Lancaster Highway) to Charlotte Avenue, New Road (2)	2014
Starlings Road	Old Monroe Road to US 74	2014
NC 51 (Rock Hill Pineville Road)	Downs Circle To South Carolina State Line, Widening (4)	2014
US 601	US 74 (Roosevelt Boulevard) to Monroe Bypass, Widening (4), Median	2014
US 74 Expressway (Independence Boulevard)	Sharon Amity Road to I-485 (6 Lanes plus HOV or Busway)	2020
NC 51 (Matthews-Mint Hill Road)	Matthews township Parkway to Lawyers Road, Widening (4), Median, Bike Lanes	2020

Name and Location	Project Description	Model Year
Independence Point Pkwy	Matthews-Mint Hill Road To Campus Ridge Road, New Road (2), Median, Bike Lanes	2020
Idlewild Road	Mecklenburg/Union County line to Stevens Mill Road, Widening (4), Median, Bike Lanes	2020
John Street/Old Monroe Road	I-485 to Indian Trail Road, Widening (4), Median, Bike Lanes	2020
Old Monroe Road	Indian Trail Road to Wesley Chapel-Stouts Road, Widening (4), Median, Bike Lanes	2020
Independence Point Parkway	Windsor Square Drive to NC 51, New Road (2)	2020
Chestnut Lane/US 74 Connector	Old Monroe Road to US 74, New Road (4), Median	2020
Indian Trail Road	Old Monroe Road to US 74 (Independence Boulevard), Widening (3), Bike Lanes	2020
I-485	US 74 to Albemarle Road, Widening (6)	2020
Monroe Northern Loop	Dickerson Boulevard to US 601 N, New Road (4)	2030
Eastern Circumferential	Idlewild Road to US 74, Widening (4)/New (4), Median, Bike Lanes	2030
NC 84	NC 84 Relocation to Waxhaw-Indian Trail Road, Widening (4), Median, Bike Lanes	2030
Wesley Chapel-Stouts Road/Potter Road	Old Charlotte Hwy. to NC 84, Widening (4), Median, Bike Lanes	2030
Wesley Chapel-Stouts Road	US 74 to Old Charlotte Highway, Widening (4), Median, Bike Lanes	2030
US 601 (Concord Highway)	Ridge Road to Lawyers Road, Widening (4), Median, Bike Lanes	2030
Monroe Connector/Bypass	US 74 in Marshville to I-485, New Freeway (4)	2030
NC 218 (Fairview Road)	Brief Road to US 601, Widening (4), Median, Bike Lanes	2030
Chestnut Lane	Matthews-Weddington Road to Old Monroe Road, New Road (4), Widening (4), Bike Lanes	2030
I-485	NC 16 (Providence Road) to US 74, Widening (6)	2030
Bryant Farms Road	Johnson Road to Community House Road, New Road (4), Median, Bike Lanes	2030
Secrest Avenue Extension	Secrest Avenue to Olive Branch Road, New Road (5), Median, Bike Lanes	2030
Eastern Circumferential	Lawyers Road to NC 24/27 New Road (4), Median, Bike Lanes	2030
US 601 (Concord Highway)	Lawyers Road to Cabarrus County Line, Widening (4), Median, Bike Lanes	2030
Rocky River Road (Monroe)	Old Charlotte Highway to US 74, Widening (4), Median	2030
Rocky River Road (Monroe)	US 74 to Monroe Connector/Bypass, Widening (4), Median	2030

Name and Location	Project Description	Model Year
McKee Road	NC 16 to Tilley Morris Road, Widening (4), Median, Bike Lanes	2030
Charlotte Avenue	Dickerson Boulevard to Rocky River Road, Widening, Median, Bike Lanes	2030
NC 84 Relocation	NC 16 to NC 84, New Road (2) on 4 Lane ROW, Wide Outside Lanes	2030
Lawyers Road	NC 51 to I-485, Widening (4), Median, Bike Lanes	2030
Lawyers Road	McAlpine Creek to NC 51, Widening (4), Median, Bike Lanes	2030
McKee Road	Tilley Morris Road to Pleasant Plain Road, Widening (4), Median, Bike Lanes	2030
Faith Church Road Extension	US 74 to Monroe Road, New Road (2)	2030
Ardrey Kell Road Extension	NC 16 (Providence Road) to Tilley Morris Road, New Road (2), Median, Bike Lanes	2030
I-485	I-77 to NC 16 (Providence Road), Widening (6/8)	2030
Source: 2030 Long Range Transportation Plan Amendment, NCDOT, September, 2005		

The development of forecasted AADT volumes for upgraded US 74 and the “Y-lines” that intersect US 74 relied somewhat on linear regression applied to historical AADT data provided by NCDOT and collected from 1987-2006.

The trend analysis projects AADT volumes based on historical data along a linear trend (also known as the least squares method). Linear regression techniques provided data that was compared to model outputs to arrive at selected AADT volumes for sections of US 74 and all roads and streets that intersect US 74.

Design Data

The methodology used for estimating Truck, DHV and Directional Percentages relied on data previously collected, as well as data derived and compared to previous traffic forecast values found in forecast reports for TIP Projects R-2559, R-3329, and U-3825. The previous forecast for R-3329 prepared by NCDOT in March 2002 was particularly useful in that it examined the same cross-section (a six-lane US 74 with two-lane, one-way frontage roads) that this Technical Memorandum examines. However, the March 2002 forecast provides only a partial data source as the limits of study included the section of US 74 from just east of I-485 to just east of SR 2356 (Chambers Road). These values are shown in Exhibit 6.

Design Hourly Volume Factors

The design hourly volume factors (K-factors) were derived primarily from turning movement count data collected in the spring of 2007. These factors were calculated from data collected at the major intersections in the study area. K-factors were also taken from the previous traffic forecasts mentioned above. Upon comparing the factors from all data sources available, final K-factors were selected.

The DHV on upgraded US 74 was estimated to be in the 10% range, while the DHV on each frontage road was estimated to be slightly lower, in the 8% range since the traffic stream estimated for the Upgraded US 74 is assumed to consist primarily of long distance traffic, possibly traveling between the mountains and coastal areas of the state. DHV for the facilities that intersect upgraded US 74 vary in the 8% to 11% range.

Directional Distribution Factors

Directional distribution factors (D-factors) were derived primarily from turning movement count data collected in the spring of 2007. Directional splits along upgraded US 74 were estimated in the 55% range in the direction of peak flow. Directional splits along each frontage road are 100% since these are one-way streets. D-factors for the facilities that intersect US 74 and the frontage roads vary in the 55% to 60% range.

Heavy Vehicle Percentages

The turning movement count data collected in spring 2007 did not classify the vehicles. The data did, however, provide a total truck percentage (Duals plus TTST's). The R-3329 previous forecast mentioned above only provided design data for the upgraded US 74 but did not include data for the frontage roads. AADT's predicted for US 74 and the frontage roads vary between Toll and Non-Toll alternatives. It follows that truck percentages would be expected to increase along upgraded US 74 in the Toll scenario as the total volumes decrease as compared to the Non-Toll scenario. Conversely, under the Non-Toll scenario, the total forecasted AADT's are higher on US 74; therefore, the total volume of trucks would be expected to be slightly higher, while trucks as a percentage of the total traffic stream would be expected to be slightly lower than in the Toll scenario. In the Toll Scenario, 5% Duals and 8% TTST were selected for the upgraded US 74, while 2% Duals and 1% TTST were selected for the frontage roads since trucks would only be expected to utilize short sections of the frontage roads for deliveries before accessing US 74 to continue the trip. In the Non-Toll scenario, 4% Duals and 6% TTST were selected for the upgraded US

74 as these values are consistent with values found in the R-3329 previous forecast. For the frontage roads in the Non-Toll scenario, since the total predicted AADT's on the westbound frontage road are consistent with the AADT's in the Toll scenario, consistent 2% Duals and 1% TTST were selected west of NC 200. East of NC 200, total predicted AADT's diverge from those predicted in the Toll scenario; therefore, 3% Duals and 2% TTST values were selected. For the eastbound frontage road, total predicted AADT's in the Non-Toll scenario are lower than those predicted for this frontage road in the Toll scenario. Therefore, higher heavy vehicle percentages 3-4% Duals and 1-2% TTST values were selected for the forecast. Heavy vehicle percentages along the intersecting streets and roads varied, with higher percentages estimated along major roads such as US 601 and NC 200.

EXHIBIT 6: DIRECTIONAL DISTRIBUTION (D), DESIGN HOURLY VOLUME (K), and HEAVY VEHICLE PERCENTAGES (Dual and TTST) FACTORS (Build Scenarios)

Location	D - Directional Distribution							K- Design Hour Factor							Truck Percentages - Duals/TTST					
	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Historic Trend	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Historic Trend	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	E 2007 TMC*	Selected Value
US 74 west of I-485		55%					55%		10%					8%		4% / 6%				6% / 7%
US 74 east of I-485		55%					55%		10%					8%		4% / 6%				6% / 7%
US 74 west of Stallings Rd		55%		55%		52%	55%		10%		10%			10%		4% / 6%		5% / 6%	7%	4% / 6%
US 74 east of Stallings Rd		55%		55%		52%	55%		10%		10%			10%		4% / 6%		5% / 6%	7%	4% / 6%
US 74 east of Indian Trail Rd North		55%				55%	55%		10%					10%		4% / 6%			8%	4% / 6%
US 74 east of Unionville Indian Trail Rd		55%				56%	55%		10%					10%		4% / 6%			7%	4% / 6%
US 74 east of North Rocky River Rd	55%	55%				53%	55%	9%	10%					10%	3% / 4%	4% / 6%			9%	4% / 6%
US 74 east of US 601	60%						55%	9%						10%	2% / 3%					4% / 6%
US 74 east of Morgan Mill Rd	60%						55%	9%						10%	3% / 4%				9%	4% / 6%
US 74 east of US 601/Metro Medical Center Campus	55%					55%	55%	10%						10%	2% / 4%				9%	4% / 6%
US 74 east of South Main St						56%	55%							10%						4% / 6%
US 74 east of Forest Hills School Rd	60%					55%	55%	10%						10%	3% / 5%				10%	4% / 6%
US 74 east end of Project	60%					55%	55%	10%						8%	3% / 5%				10%	6% / 7%
I-485 north of US 74			58%				55%			10%				10%			7% / 3%			7% / 3%
I-485 south of US 74			59%				55%			8%				10%			8% / 3%			10%/5%
Stallings Rd north of US 74			61%	60%		58%	60%			10%	10%			11%			12% / 1%	3% / 3%	1%	3% / 1%
Stallings Rd south of US 74				60%		52%	55%				10%			9%				3% / 3%	5%	3% / 1%
Indian Trail Rd North north of US 74						53%	65%							9%					2%	8% / 1%
Indian Trail Rd North south of US 74						51%	55%							8%					2%	8% / 1%
Unionville Indian Trail Rd north of US 74						55%	65%							8%					2%	5% / 1%
Unionville Indian Trail Rd south of US 74						64%	65%							8%					2%	5% / 1%
Faith Church Rd north of US 74						58%	60%			10%				10%						3% / 1%
Harris Teeter Distribution Center south of US 74			59%			74%	60%			8%				8%			16% / 0%			16%/1%
Wesley Chapel Stouts Rd north of US 74						58%	60%							9%						3% / 1%
Wesley Chapel Stouts Rd south of US 74						54%	55%							9%						3% / 1%
Chambers Dr north of US 74						77%	75%							9%						3% / 1%
North Rocky River Rd north of US 74	60%					60%	60%	11%						9%	2% / 1%				4%	3% / 1%

Location	D - Directional Distribution							K- Design Hour Factor							Truck Percentages - Duals/TTST					
	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Historic Trend	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Historic Trend	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	E 2007 TMC**	Selected Value
North Rocky River Rd south of US 74	55%					66%	65%	11%						9%	2% / 1%				6%	3% / 1%
Fowler Secrest Rd north of US 74						58%	60%			9%				9%						3% / 1%
John Moore Rd South of US 74						63%	60%							9%						3% / 1%
Rolling Hills Dr north of US 74						61%	60%			9%				8%						3% / 1%
Carroll St south of US 74						52%	55%							8%						3% / 1%
Round Table Rd north of US 74						51%	55%			11%				11%						3% / 1%
Roland Rd south of US 74						53%	55%							9%						2% / 1%
Walmart/Lowes western entrance north of US 74						58%	60%							9%						2% / 1%
Concord Ave north of US 74							55%							8%						6% / 1%
Concord Ave south of US 74							55%							8%						6% / 1%
US 601 north of US 74	55%						55%	10%						8%	6% / 8%					8% / 7%
NC 200 south of US 74	65%						55%	10%						8%	3% / 3%					8% / 7%
Stafford St north of US 74						53%	55%							9%					2%	2% / 1%
Stafford St Ext south of US 74						60%	60%							9%					1%	2% / 1%
Shopping Center Access north of US 74						68%	70%							14%						2% / 1%
Boyte St south of US 74						59%	60%							14%						2% / 1%
NC 200 north of US 74	60%						60%	11%						8%	6% / 2%				5%	10% / 3%
Morgan Mill Rd south of US 74	55%		58%				55%	9%		8%				8%	3% / 1%		10%/3%		1%	10% / 3%
Walkup Ave north of US 74						57%	55%							8%					3%	3% / 1%
Walkup Ave south of US 74						52%	55%							8%					2%	3% / 1%
South Sutherland Ave north of US 74						51%	55%							10%						5% / 1%
South Sutherland Ave south of US 74						54%	55%							10%						5% / 1%
Venus St north of US 74							55%			9%				8%						3% / 1%
Dove St south of US 74							65%							7%						3% / 1%
Shopping Center Access north of US 74						57%	55%							10%					0%	4% / 1%
East Franklin St south of US 74			55%			51%	55%			8%				9%			4% / 1%		1%	4% / 1%
Metro Medical Center Campus north of US 74						100%	65%							8%					0%	3% / 1%
US 601 south of US 74	65%					66%	65%	10%						8%	2% / 4%				13%	14%/13%
South Secrest Ave north of US 74						71%	70%							10%						2% / 1%

Location	D - Directional Distribution							K- Design Hour Factor							Truck Percentages - Duals/TTST					
	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Trend Historic	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	NCDOT Trend Historic	E 2007 TMC	Selected Value	A Past Forecast (R-2559)	B Past Forecast (R-3329)	C Vehicle Class Counts	D Past Forecast (U-3825)	E 2007 TMC**	Selected Value
South Bivens Rd north of US 74						57%	55%						9%							2% / 1%
Bivens St north of US 74						60%	60%			9%			9%							2% / 1%
Food Lion Access south of US 74						60%	60%						9%							3% / 1%
South Main St north of US 74						55%	55%						9%							3% / 1%
South Main St south of US 74						52%	55%						9%							3% / 1%
Forest Hills School Rd north of US 74	75%					63%	55%	25%					9%	2% / 1%					0%	3% / 1%
Forest Hills School Rd south of US 74	75%					73%	50%	17%					6%	1% / 1%					0%	12% / 1%
A - Data taken from NCDOT Forecast previously prepared for this project dated November 2004																				
B - Data taken from NCDOT Forecast for R-3329 dated September 2005																				
C - Data taken from Vehicle Classification Counts dated April 2007																				
D - Data taken from NCDOT Forecast for U-3825 dated March 2005																				
E - Data derived from turning movement count field data taken for project in March/April 2007																				
** - TTST and Duals were not counted separately																				

Exhibits 8-9: Traffic Flow Maps

The quadrant movements, AADT volumes and design data for the two scenarios (2035 Build Toll and 2035 Build Non-Toll) are shown concurrently in Exhibits 8 and 9 at the end of this Technical Memorandum.

RESULTS OF ANALYSES

Results Of Analyses

Impacts to Adjoining Properties

The land uses in the study area may be categorized as mixed use, including retail and commercial, single family dwellings, day care facilities, hospitals, churches, industrial facilities and government properties. The proposed US 74 Upgrade scenario cross-section will encompass approximately 400 feet of right-of-way. Based on a GIS analysis using 2008 parcel data, approximately 1,052 parcels are expected to be affected by the additional right-of-way required for the proposed project. An affected parcel, as defined herein, is a parcel that has more than half of its total acreage affected by the construction of this alternative. A summary of the affected parcels and its land use is shown in Exhibit 7.

Exhibit 7: Parcel Types Impacted by Construction of the US 74 Upgrade Scenario

Land Use	Affected Parcels
Commercial/Retail	773
Hospital/Medical Offices	17
Offices	75
Single Family Dwellings	125
Multifamily Dwellings	18
Church	4
Daycare/Schools	24
Industrial	8
Government Buildings	8
Total	1,052

Levels of Service Analysis

The study area frontage roads, mainline sections, and intersections were analyzed using the methods outlined in the ***Highway Capacity Manual***. The Highway Capacity Manual defines capacity as "the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per hour or persons per hour."

Level of service (LOS) is a term used to represent differing traffic conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists or passengers”. Level of Service varies from Level A, representing free flow, to Level F where traffic breakdown conditions are evident. Level B represents good progression with minimal congestion or delay. At Level C, the number of vehicles slowing is significant, although many still average good progression. Level D represents more congestion, but the overall operations are adequate. At Level E, severe congestion is occurring as the road reaches its capacity. At Level F, freedom to maneuver within the traffic stream is extremely difficult with driver frustration being generally high.

For upgraded US 74, “Multilane Highway” methodology was used to determine levels of service in various sections along the studied route. LOS are based on typical speed-flow and density-flow relationships. Criteria used to determine LOS includes free flow speed (mph), maximum density (pc/mi/ln), average speed (mph), maximum volume to capacity ratio (v/c), and maximum service flow rate (pc/h/ln). For purposes of this analysis, WSA assumed a free flow speed of 55 mph for the upgraded US 74. AADT’s were converted to passenger car equivalents by subtracting trucks from the traffic volumes, then multiplied by the selected directional distribution (D) factor for the peak direction of flow to arrive at passenger cars per lane in the peak direction of flow. Ten (10) percent of the total passenger cars, representing the design hour factor, was then calculated to arrive at peak hour totals. Since it is assumed that the upgraded US 74 will provide three lanes of travel in each direction, the peak passenger car equivalents were then divided by 3 to arrive at passenger cars per hour per lane, representing the maximum service flow rates. A resulting level of service for each section was then yielded.

For the frontage roads, “Urban Street” methodology was used to determine levels of service for various sections along each frontage road. This methodology uses traffic signal density (signals per mile), free flow speed, cycle length, effective green ratio and other criteria to express levels of service based on the number of lanes provided. For the purposes of our evaluations, free flow speed of 40 mph and three (3) traffic signals per mile (Class II) was assumed for the frontage roads.

Non-Toll Scenario

In 2035, the upgraded US 74 (Non-Toll scenario) is expected to operate at adequate levels of service from US 601 to the eastern project terminus. From US 601 westward, levels of service in the D and E range (LOS D and LOS E) are expected, and the section between North Rocky River Road and NC 200 is predicted to yield a failing level of service (LOS F).

US 74					
Road 1	Road 2	AADT b/w Road 1 & Road 2 (vpd in 100's)	K-Factor	Peak Hour Volume (pc/h/ln)	LOS
Stallings Road	Indian Trail Road North	717	10%	1607	D
Indian Trail Road North	Wesley Chapel Stouts Road	864	10%	1936	E
Wesley Chapel Stouts Road	North Rocky River Road	878	10%	1968	E
North Rocky River Road	NC 200	1,125	10%	2521	F
NC 200	Morgan Mill Road	755	10%	1692	D
Morgan Mill Road	US 601	688	10%	1542	D
US 601	South Main Street	565	10%	1266	C
South Main Street	Forest Hills School Road	366	10%	820	B
Forest Hills School Road	East end of project	343	10%	769	B

Source: Exhibit 21-2 LOS Criteria for Multilane Highways, Highway Capacity Manual 2000, TRB

In 2035, the westbound frontage road is expected to operate at failing levels of service (LOS F) for the majority of its length. The sections between Unionville Indian Trail Road West and North Rocky River Road, in addition to the section between Metro Medical Center Campus and the end of the project provide the only exceptions, operating at more favorable levels of service (LOS D or better).

WESTBOUND FRONTAGE ROAD

Road 1	Road 2	AADT b/w Road 1 & Road 2 (vpd in 100's)	K-Factor	Peak Hour Volume (vph)	LOS
Stallings Road	Union West Blvd	297	8%	2,376	F
Union West Blvd.	Indian Trail Road	297	8%	2,376	F
Indian Trail Road	Unionville Indian Trail Road	339	8%	2,712	F
Unionville Indian Trail Road	Faith Church Road	338	8%	2,704	F
Faith Church Road	Unionville Indian Trail Road West	338	8%	2,704	F
Unionville Indian Trail Road West	Chambers Drive	185	8%	1,480	D
Chambers Drive	North Rocky River Road	186	8%	1,488	D
North Rocky River Road	Fowler Secrest Road	527	8%	4,216	F
Fowler Secrest Road	Rolling Hills Drive	528 / 565	8% / 8%	4,224 / 4,520	F / F
Rolling Hills Drive	Round Table Road	565	8%	4,520	F
Round Table Road	Wal-Mart/Lowe's Entrance (west)	565	8%	4,520	F
Wal-Mart/Lowe's Entrance (west)	Wal-Mart/Lowe's Entrance (east)	564	8%	4,512	F
Wal-Mart/Lowe's Entrance (east)	(Proposed) Northern Loop	564	8%	4,512	F
(Proposed) Northern Loop	Secrest Shortcut Road	563	8%	4,504	F
Secrest Shortcut Road	Concord Avenue	563	8%	4,504	F
Concord Avenue	US 601	563	8%	4,504	F
US 601	Stafford Street	358	8%	2,864	F
Stafford Street	Shopping Center Access	358	8%	2,864	F
Shopping Center Access	NC 200	359	8%	2,872	F
NC 200	Walkup Avenue	392	8%	3,136	F
Walkup Avenue	S. Sutherland Avenue	393	8%	3,144	F
S. Sutherland Avenue	Venus Street	393	8%	3,144	F
Venus Street	Shopping Center Access	392	8%	3,136	F
Shopping Center Access	Metro Medical Center Campus	392	8%	3,136	F
Metro Medical Center Campus	South Secrest Avenue	187	8%	1,496	D
South Secrest Avenue	South Bivens Road	187	8%	1,496	D
South Bivens Road	Bivens Street	187	8%	1,496	D
Bivens Street	Austin Chaney Street	188	8%	1,504	D
Austin Chaney St	Forest Hills School Rd	75 / 60	8% / 8%	600 / 480	B / B
Forest Hills School Road	US 74 merge	49	8%	392	B

Source: Exhibit 10-7 Service Volumes for Urban Streets, Highway Capacity Manual 2000, TRB

In 2035, the eastbound frontage road is expected to operate at poor levels of service (LOS D and/or F) for the majority of its length. Exceptions include a short section between Wesley Chapel Stouts Road and North Rocky River Road (LOS B), the section between NC 200 and Morgan Mill Road (LOS C), and the section between US 601 and the east end of the project (LOS B and C).

EASTBOUND FRONTAGE ROAD					
Road 1	Road 2	AADT b/w Road 1 & Road 2 (vpd in 100's)	K- Factor	Peak Hour Volume (vph)	LOS
Stallings Road	Indian Trail Road North	202	8%	1,616	D
Indian Trail Road North	Unionville Indian Trail Road	187	8%	1,496	D
Unionville Indian Trail Road	Harris Teeter Distribution Center	187	8%	1,496	D
Harris Teeter Distribution Center	Wesley Chapel Stouts Road	187	8%	1,496	D
Wesley Chapel Stouts Road	North Rocky River Road	102	8%	816	B
North Rocky River Road	John Moore Road	350	8%	2,800	F
John Moore Road	Carroll Street	347 / 371	8% / 8%	2,776 / 2,968	F / F
Carroll Street	Roland Drive	369	8%	2,952	F
Roland Drive	Williams Road Extension	369	8%	2,952	F
Williams Road Extension	Hanover Street	367	8%	2,936	F
Hanover Street	Dickerson Boulevard	366	8%	2,928	F
Dickerson Boulevard	Mall Entrance	365	8%	2,920	F
Mall Entrance	Secret Shortcut Road	363	8%	2,904	F
Secret Shortcut Road	Concord Avenue	363	8%	2,904	F
Concord Avenue	NC 200	362	8%	2,896	F
NC 200	Stafford Street Extension	199	8%	1,592	C
Stafford Street Extension	Boyte Street	199	8%	1,592	C
Boyte Street	Morgan Mill Road	199	8%	1,592	C
Morgan Mill Road	Walkup Avenue	361	8%	2,888	F
Walkup Avenue	S. Sutherland Avenue	362	8%	2,896	F
S. Sutherland Avenue	Dove Street	363	8%	2,904	F
Dove Street	East Franklin Street	362	8%	2,896	F
East Franklin Street	US 601	362	8%	2,896	F
US 601	Old Pageland Monroe Road	147	8%	1,176	C
Old Pageland Monroe Road	Food Lion Access	146	8%	1,168	C
Food Lion Access	South Main Street	147	8%	1,176	C
South Main Street	Forest Hills School Road	75 / 60	8%	600 / 480	B / B
Forest Hills School Road	US 74 merge	50	8%	400	B

Source: Exhibit 10-7 Service Volumes for Urban Streets, Highway Capacity Manual 2000, TRB

Toll Scenario

In 2035, the upgraded US 74 with Toll is expected to operate at LOS A, B, or C throughout the study area during the peak hours.

US 74					
Road 1	Road 2	AADT b/w Road 1 & Road 2 (vpd in 100's)	K- Factor	Peak Hour Volume (pc/h/ln)	LOS
Stallings Road	Indian Trail Road North	1130	10%	783	C
Indian Trail Road North	Wesley Chapel Stouts Road	1167	10%	809	C
Wesley Chapel Stouts Road	North Rocky River Road	1185	10%	821	C
North Rocky River Road	NC 200	1063	10%	737	C
NC 200	Morgan Mill Road	806	10%	558	B
Morgan Mill Road	US 601	562	10%	389	A
US 601	South Main Street	562	10%	389	A
South Main Street	Forest Hills School Road	444	10%	308	A
Forest Hills School Road	East end of project	354	10%	246	A

Source: Exhibit 21-2 LOS Criteria for Multilane Highways, Highway Capacity Manual 2000, TRB

In 2035, the eastbound and westbound frontage roads are expected to operate at failing levels of service (LOS F) for the majority of their lengths. For the westbound frontage road, the sections between Unionville Indian Trail Road West and North Rocky River Road and between Austin Chaney Street and Forest Hills School Road provide the only exceptions, operating at LOS C. For the eastbound frontage road, the section between Wesley Chapel Stouts Road and North Rocky River Road is predicted to operate at LOS C, as is the section between South Main Street and Forest Hills School Road. With US 74 operating as a Toll facility, the eastbound and westbound frontage roads are expected to carry higher volumes of traffic.

WESTBOUND FRONTAGE ROAD

Road 1	Road 2	AADT b/w Road 1 & Road 2 (in 100's)	K- Factor	Peak Hour Volume (vph)	LOS
Stallings Road	Union West Blvd	308	8%	2,464	F
Union West Blvd	Indian Trail Road	308	8%	2,464	F
Indian Trail Road	Unionville Indian Trail Road	347	8%	2,776	F
Unionville Indian Trail Road	Faith Church Road	346	8%	2,768	F
Faith Church Road	Unionville Indian Trail Road West	346	8%	2,768	F
Unionville Indian Trail Road West	Chambers Drive	153	8%	1,224	C
Chambers Drive	North Rocky River Road	154	8%	1,232	C
North Rocky River Road	Fowler Secrest Road	610	8%	4,880	F
Fowler Secrest Road	Rolling Hills Drive	611 / 642	8% / 8%	4,888 / 5,136	F / F
Rolling Hills Drive	Round Table Road	642	8%	5,136	F
Round Table Road	Wal-Mart/Lowe's Entrance (west)	642	8%	5,136	F
Wal-Mart/Lowe's Entrance (west)	Wal-Mart/Lowe's Entrance (east)	641	8%	5,128	F
Wal-Mart/Lowe's Entrance (east)	(Proposed) Northern Loop	641	8%	5,128	F
(Proposed) Northern Loop	Secrest Shortcut Road	640	8%	5,120	F
Secrest Shortcut Road	Concord Avenue	640	8%	5,120	F
Concord Avenue	US 601	640	8%	5,120	F
US 601	Stafford Street	343	8%	2,744	F
Stafford Street	Shopping Center Access	343	8%	2,744	F
Shopping Center Access	NC 200	344	8%	2,752	F
NC 200	Walkup Avenue	501	8%	4,008	F
Walkup Avenue	S. Sutherland Avenue	502	8%	4,016	F
S. Sutherland Avenue	Venus Street	502	8%	4,016	F
Venus Street	Shopping Center Access	501	8%	4,008	F
Shopping Center Access	Metro Medical Center Campus	501	8%	4,008	F
Metro Medical Center Campus	South Secrest Avenue	236	8%	1,888	F
South Secrest Avenue	South Bivens Road	236	8%	1,888	F
South Bivens Road	Bivens Street	236	8%	1,888	F
Bivens Street	Austin Chaney Street	237	8%	1,896	F
Austin Chaney St	Forest Hills School Rd	127 / 134	8% / 8%	1,016 / 1,072	C / C
Forest Hills School Road	US 74 merge	109	8%	872	B

Source: Exhibit 10-7 Service Volumes for Urban Streets, Highway Capacity Manual 2000, TRB

EASTBOUND FRONTAGE ROAD

Road 1	Road 2	AADT b/w Road 1 & Road 2	K -Factor	Peak Hour Volume (vph)	LOS
Stallings Road	Indian Trail Road North	317	8%	2,536	F
Indian Trail Road North	Unionville Indian Trail Road	366	8%	2,928	F
Unionville Indian Trail Road	Harris Teeter Distribution Center	366	8%	2,928	F
Harris Teeter Distribution Center	Wesley Chapel Stouts Road	366	8%	2,928	F
Wesley Chapel Stouts Road	North Rocky River Road	171	8%	1,368	C
North Rocky River Road	John Moore Road	628	8%	5,024	F
John Moore Road	Carroll Street	625 / 657	8% / 8%	5,000 / 5,256	F / F
Carroll Street	Roland Drive	655	8%	5,240	F
Roland Drive	Williams Road Extension	655	8%	5,240	F
Williams Road Extension	Hanover Street	653	8%	5,224	F
Hanover Street	Dickerson Boulevard	652	8%	5,216	F
Dickerson Boulevard	Mall Entrance	651	8%	5,208	F
Mall Entrance	Secret Shortcut Road	649	8%	5,192	F
Secret Shortcut Road	Concord Avenue	649	8%	5,192	F
Concord Avenue	NC 200	648	8%	5,184	F
NC 200	Stafford Street Extension	352	8%	2,816	F
Stafford Street Extension	Boyte Street	352	8%	2,816	F
Boyte Street	Morgan Mill Road	352	8%	2,816	F
Morgan Mill Road	Walkup Avenue	512	8%	4,096	F
Walkup Avenue	S. Sutherland Avenue	513	8%	4,104	F
S. Sutherland Avenue	Dove Street	514	8%	4,112	F
Dove Street	East Franklin Street	513	8%	4,104	F
East Franklin Street	US 601	513	8%	4,104	F
US 601	Old Pageland Monroe Road	235	8%	1,880	F
Old Pageland Monroe Road	Food Lion Access	234	8%	1,872	F
Food Lion Access	South Main Street	235	8%	1,880	F
South Main Street	Forest Hills School Road	125 / 132	8% / 8%	1,000 / 1,056	C / C
Forest Hills School Road	US 74 merge	108	8%	864	B

Source: Exhibit 10-7 Service Volumes for Urban Streets, Highway Capacity Manual 2000, TRB

Note: The values represented in all tables are approximate and for illustration purposes only.

As expected, traffic volumes along the frontage roads will vary greatly, with the highest volumes found at and near intersections with side streets providing access onto or crossing US 74. More local trips will be served along the frontage roads in the Toll scenario, as is expected. Also, volumes are higher along the frontage roads in areas of dense commercial or retail development. One would expect even higher frontage road volumes as vacant parcels continue to develop. Under the Toll Scenario, estimated AADT's along US 74 reach a maximum of 52,000 vpd (+/-) while maximum estimated AADT's along a Non-Toll Upgraded US 74 would be expected in the 113,000 vpd range in 2035.

According to *Highway Capacity Manual* guidelines, each frontage road would be expected to operate at "fair" Levels of Service "D" with the addition of a third through lane in each direction. Note: The values represented in all tables are approximate and for illustration purposes only.

Source: *Highway Capacity Manual*, Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 1998

CONCLUSIONS

CONCLUSIONS

The human and socio-economic impacts of constructing the US 74 Upgrade with frontage roads scenario are considerable. A minimum of 1,052 structure relocations and/or parcel takings would yield considerable costs to property owners and the project's owners alike. Relocation and proximity damage costs alone would be estimated to be in the billions of dollars.

Traffic volumes would be expected to increase to unmanageable levels in the design year, and likely years sooner, with the construction of the US 74 Upgrade alternative. Entrance and exit ramps onto and off of the upgraded US 74 would be estimated to carry heavy volumes of traffic, as much as 35,000 vpd on one ramp at the US 601 interchange. Turning movements at many of the right-in, right-out driveways and intersections with the frontage roads would be estimated to reach failing conditions quickly, reaching maximums nearing 50,000 vpd at US 601 and 20,000-30,000 vpd at several other intersections in the study area. Since many of the side streets crossing US 74 exist as minor two-lane secondary roads, these would surely require upgrading and widening to provide sufficient widths to accommodate such heavy volumes. To control right of way at heavy volume intersections along the frontage roads, traffic control signals would be required, possibly introducing further degradations of levels of service and possible increases in the frequency of "rear end" type collisions. The addition of a third travel lane along each frontage road would only slightly improve projected service levels, while resulting in many more parcel impacts and right-of-way relocations.

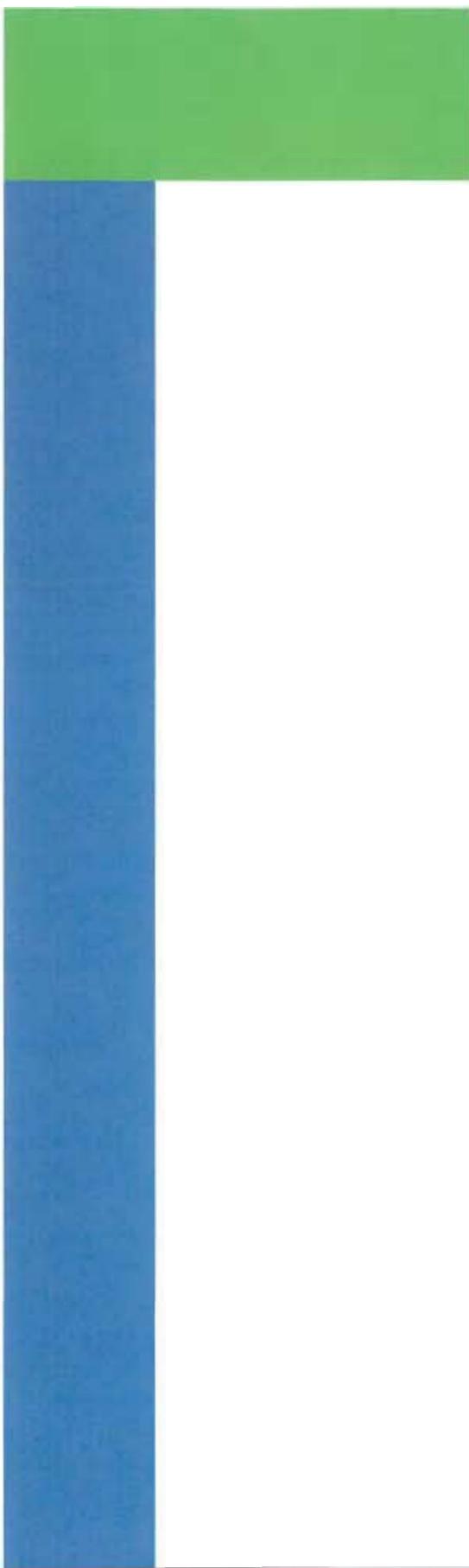
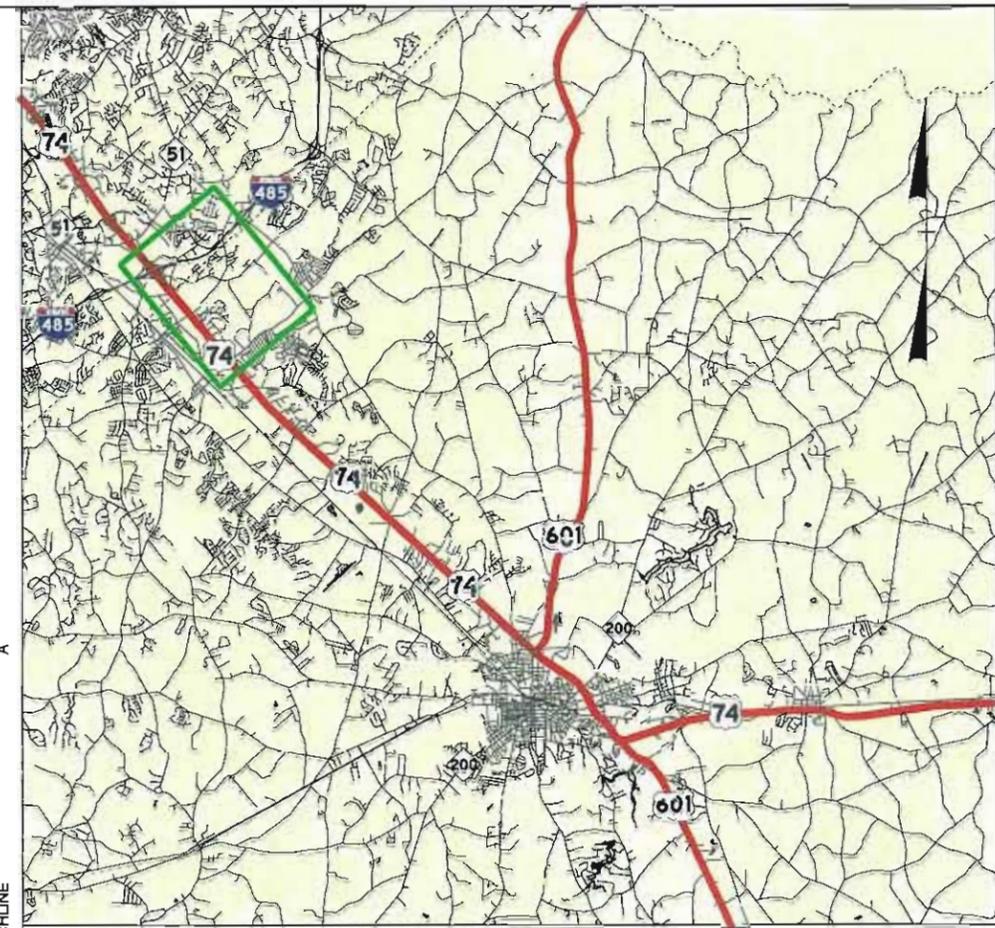
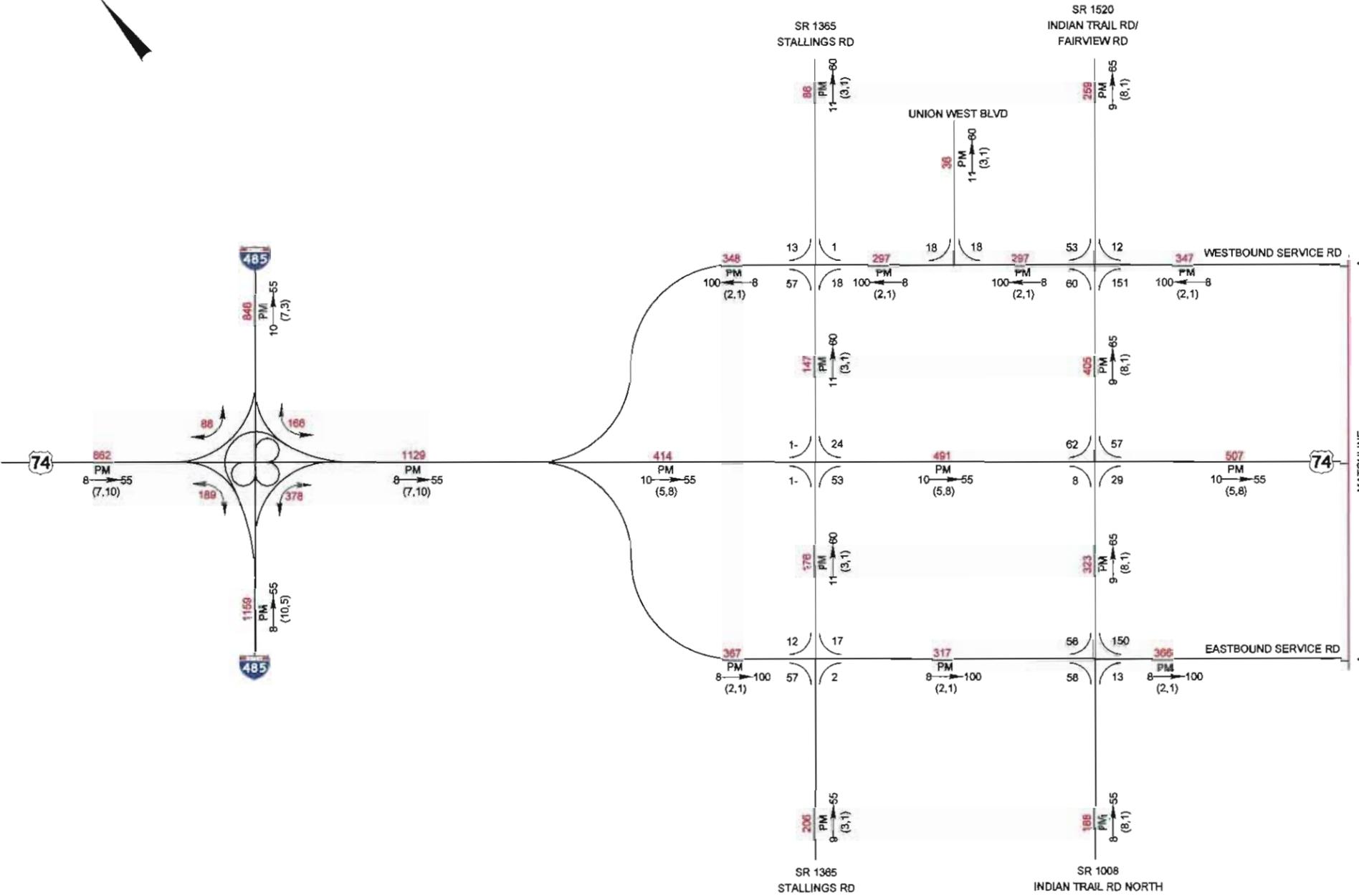


Exhibit 8
**US 74 Upgrade with
Frontage Roads Alternative**
2035 TOLL Scenario



2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

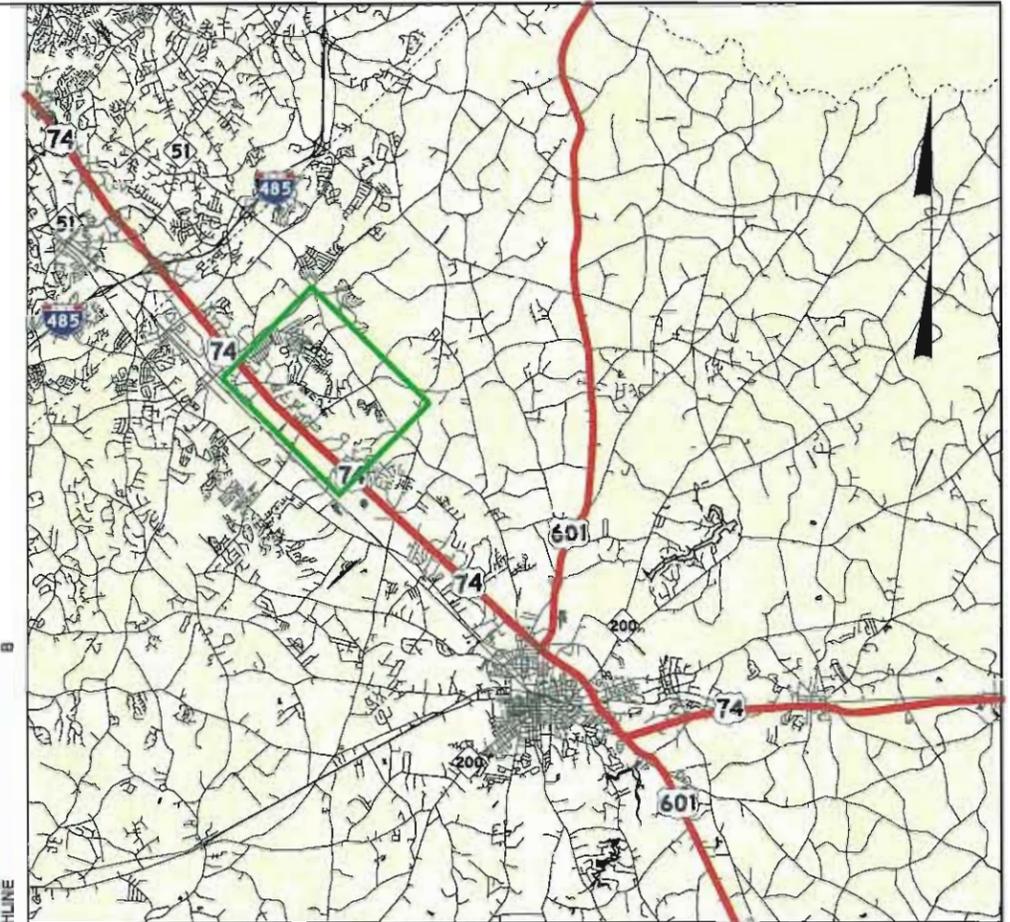
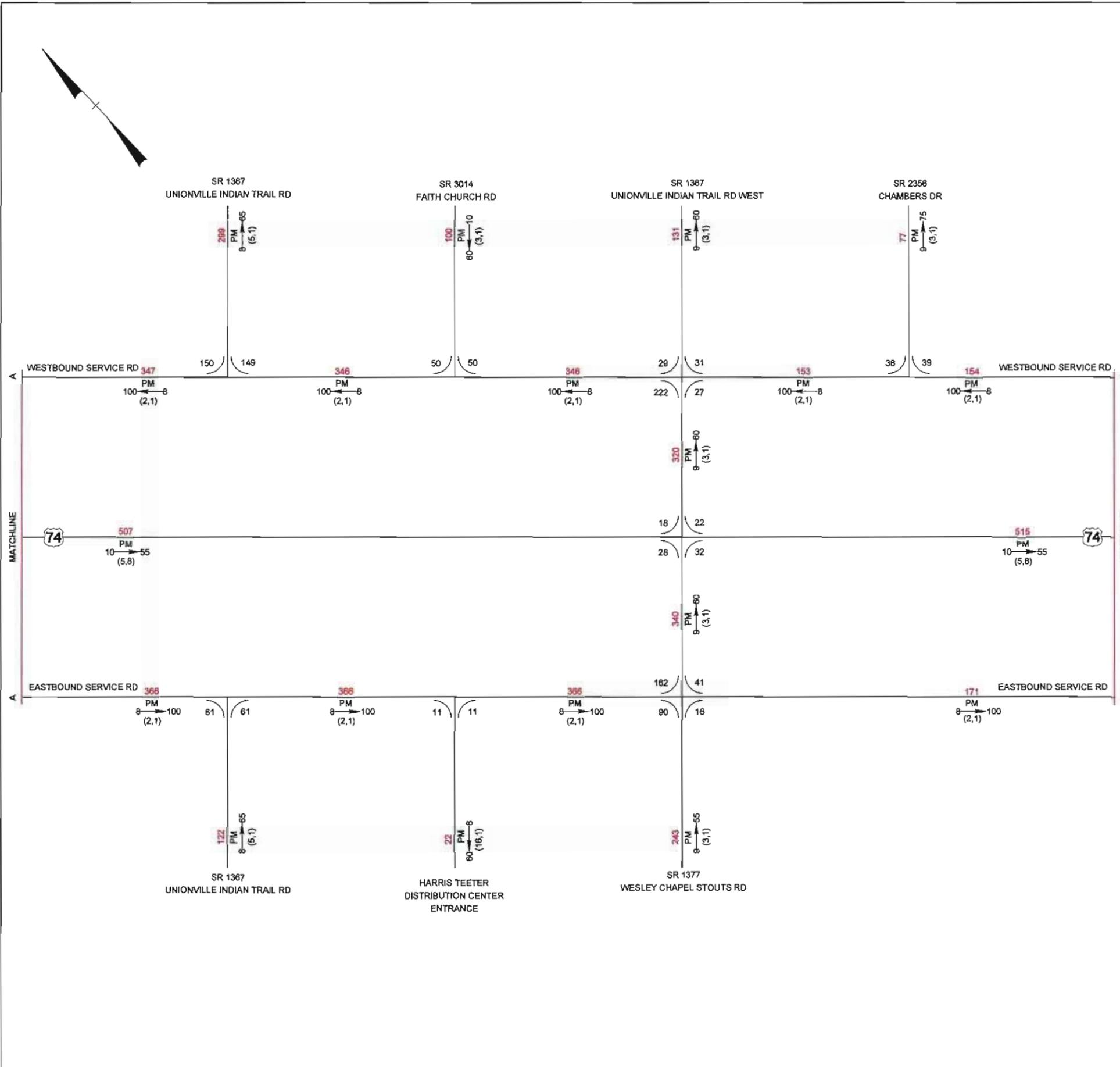
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 1

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV $\xrightarrow{\text{PM}} \text{D}$ (d, t) DHV Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- \rightarrow Indicates Direction of D (d, t) Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 2

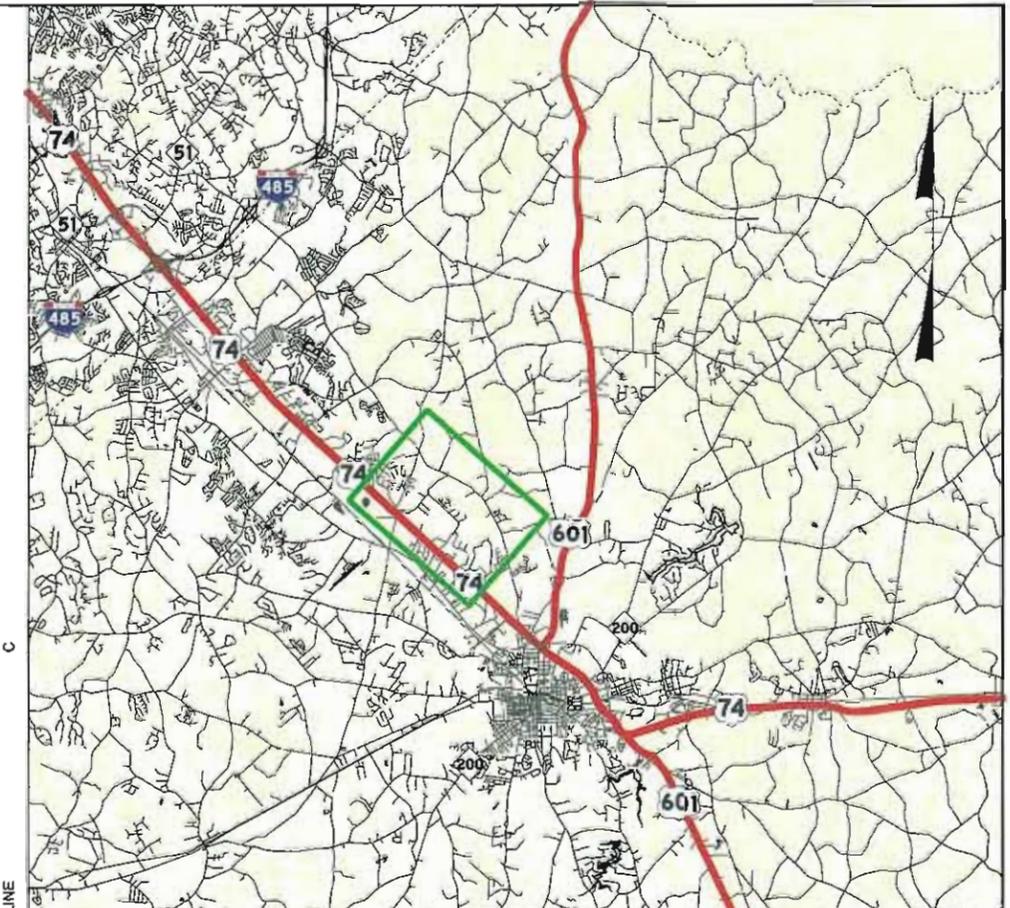
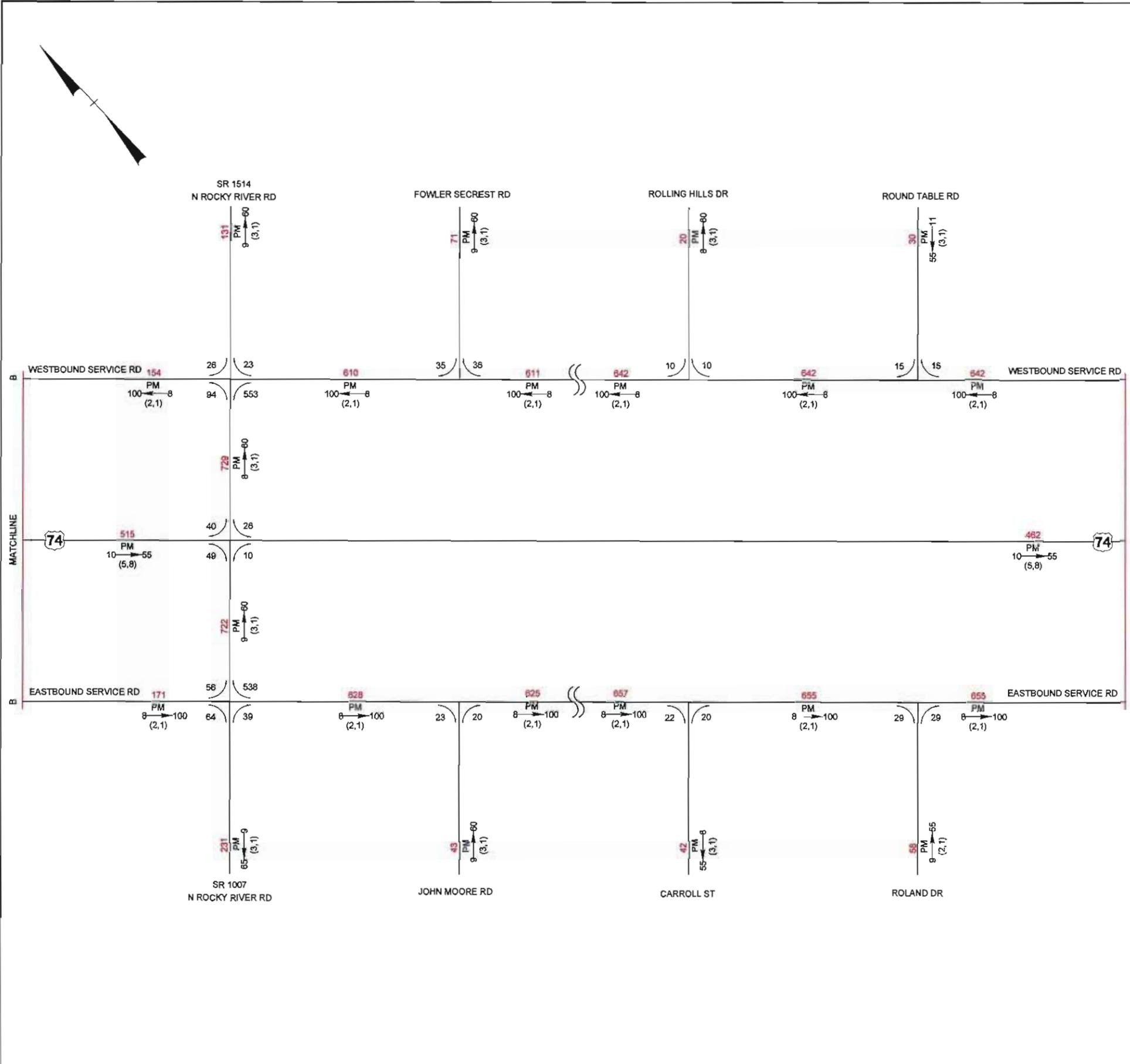
DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

DHV	PM	D	###	No. of Vehicles Per Day (VPD) in 100s
(d, t)	→	(d, t)	1-	Less than 50 VPD
			###	Turning volume (VPD)

DHV Design Hourly Volume (%) = K_{30}
 PM Peak Period
 D Peak Hour Directional Split (%)
 → Indicates Direction of D
 (d, t) Duals, TTST (%)





2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

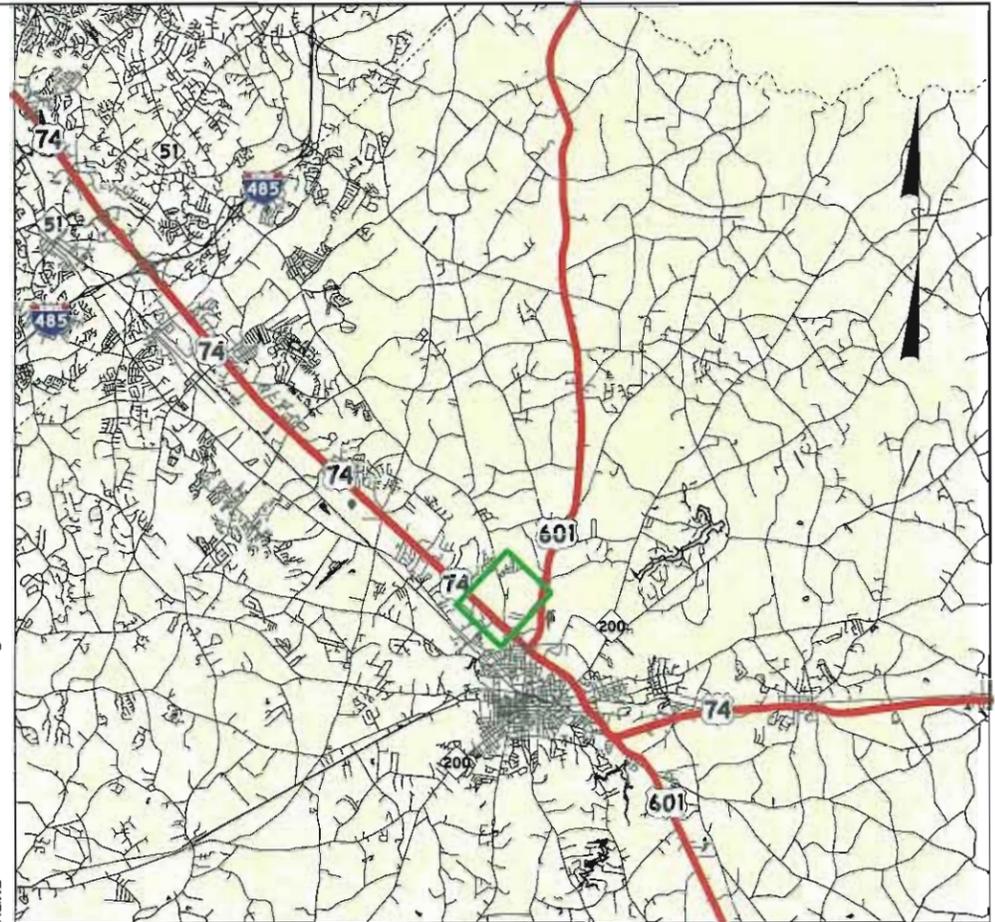
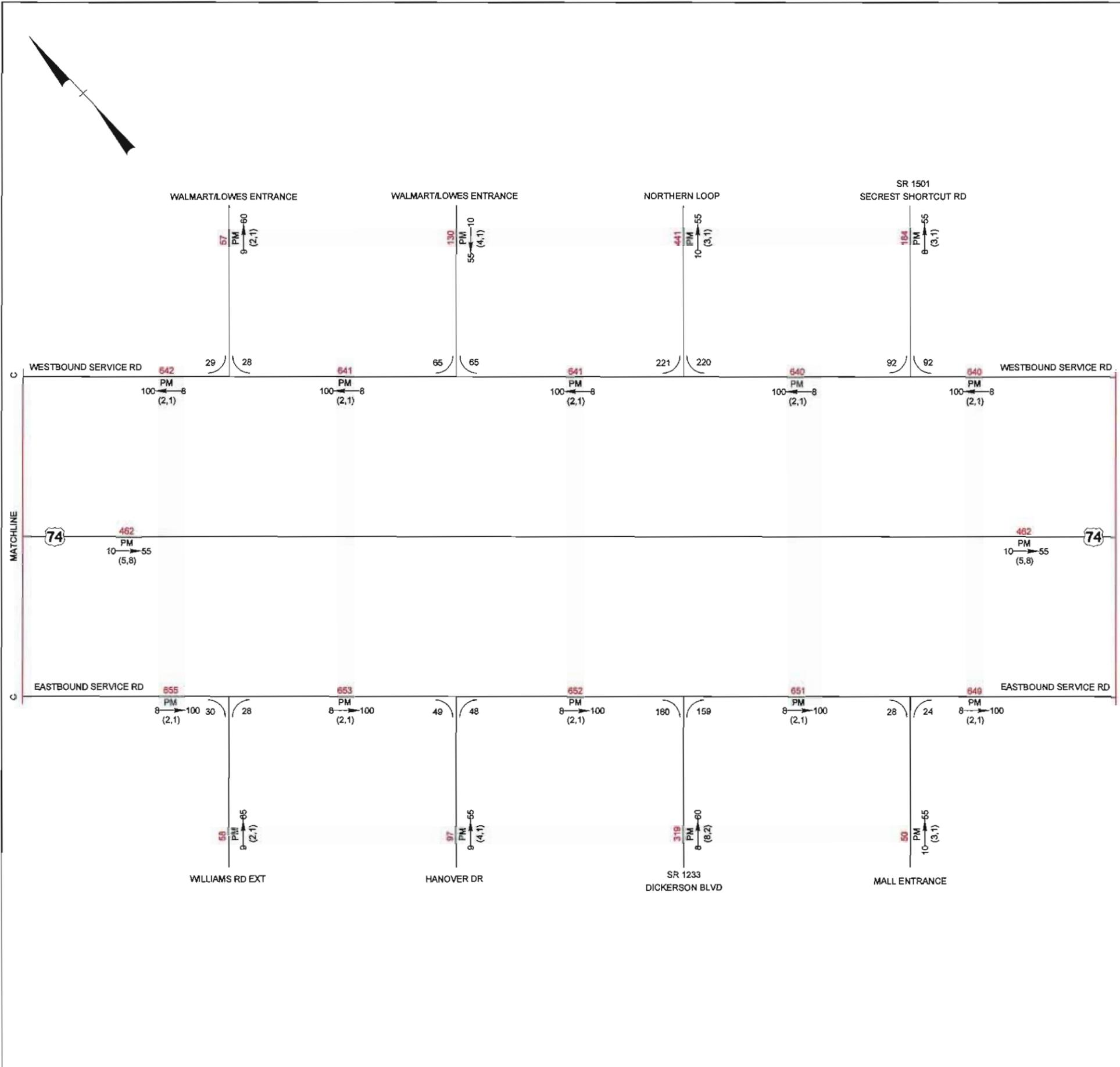
AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559	LOCATION: US 74 in Mecklenburg and Union Counties
PROJECT: US 74 Upgrade with Frontage Roads	SHEET NUMBER: 3
DIVISION: 10	DATE: June 2008
PREPARED BY: Wilbur Smith Associates	

LEGEND

<p>DHV $\xrightarrow{PM} D$ (d, t)</p> <p>DHV Design Hourly Volume (%) = K_{30}</p> <p>PM Peak Period</p> <p>D Peak Hour Directional Split (%)</p> <p>→ Indicates Direction of D</p> <p>(d, t) Duals, TTST (%)</p>	<p>### No. of Vehicles Per Day (VPD) in 100s</p> <p>1- Less than 50 VPD</p> <p>### Turning volume (VPD)</p>
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2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

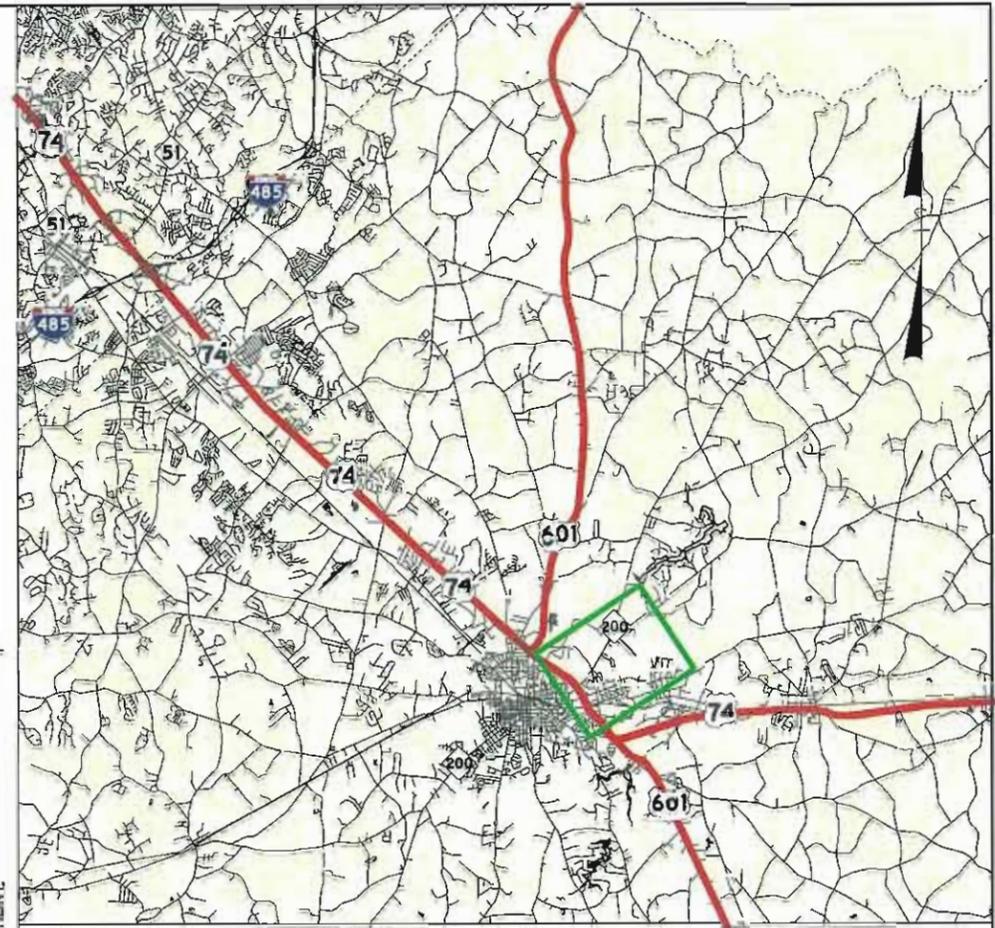
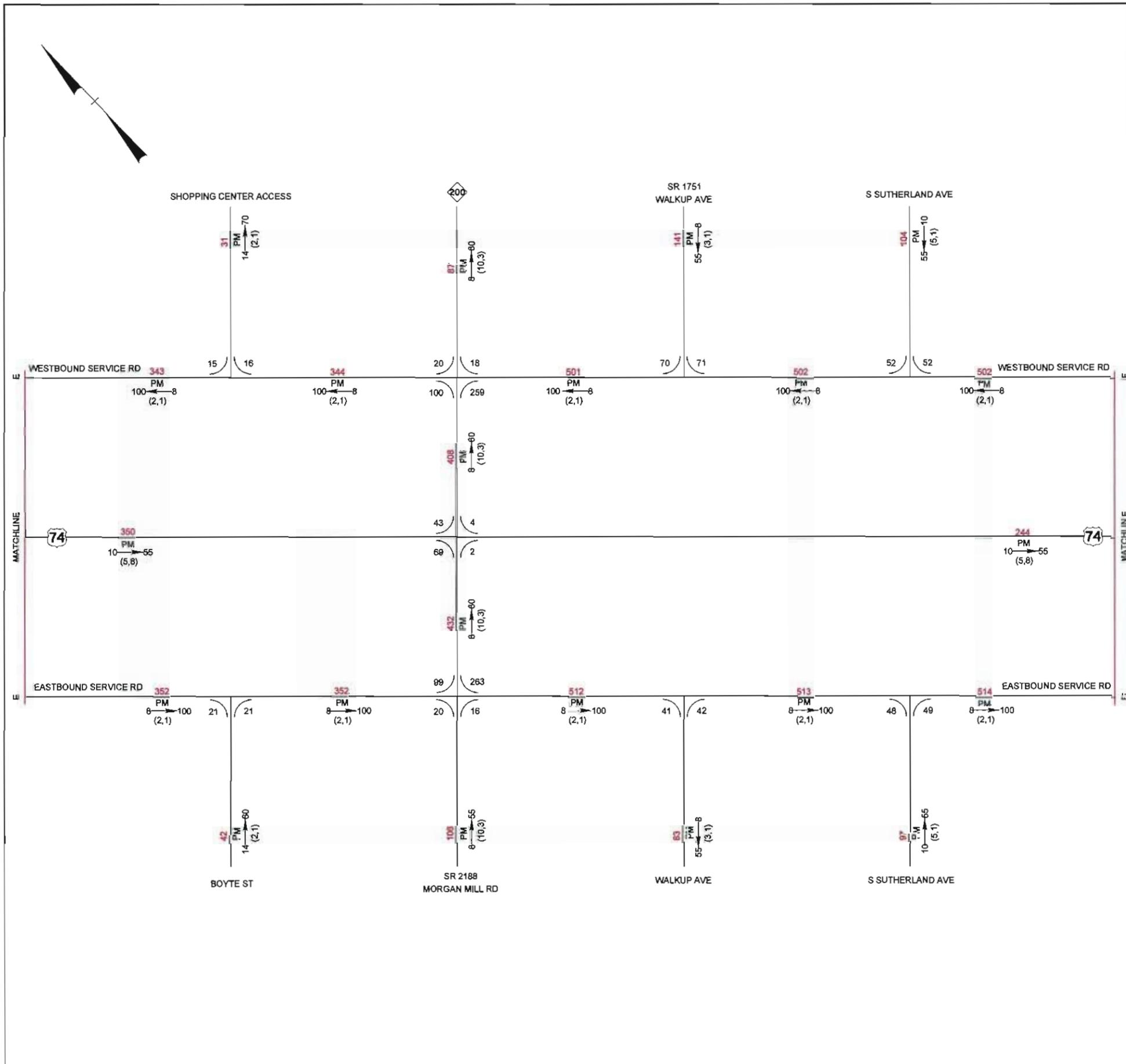
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 4

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

DHV	Design Hourly Volume (%) = K_{30}	###	No. of Vehicles Per Day (VPD) in 100s
PM	Peak Period	1-	Less than 50 VPD
D	Peak Hour Directional Split (%)	###	Turning volume (VPD)
→	Indicates Direction of D		
(d, t)	Duals, TTST (%)		





2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

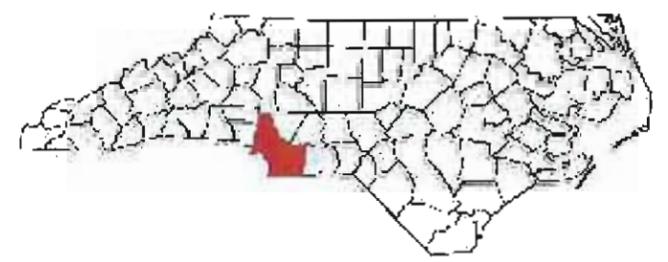
TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

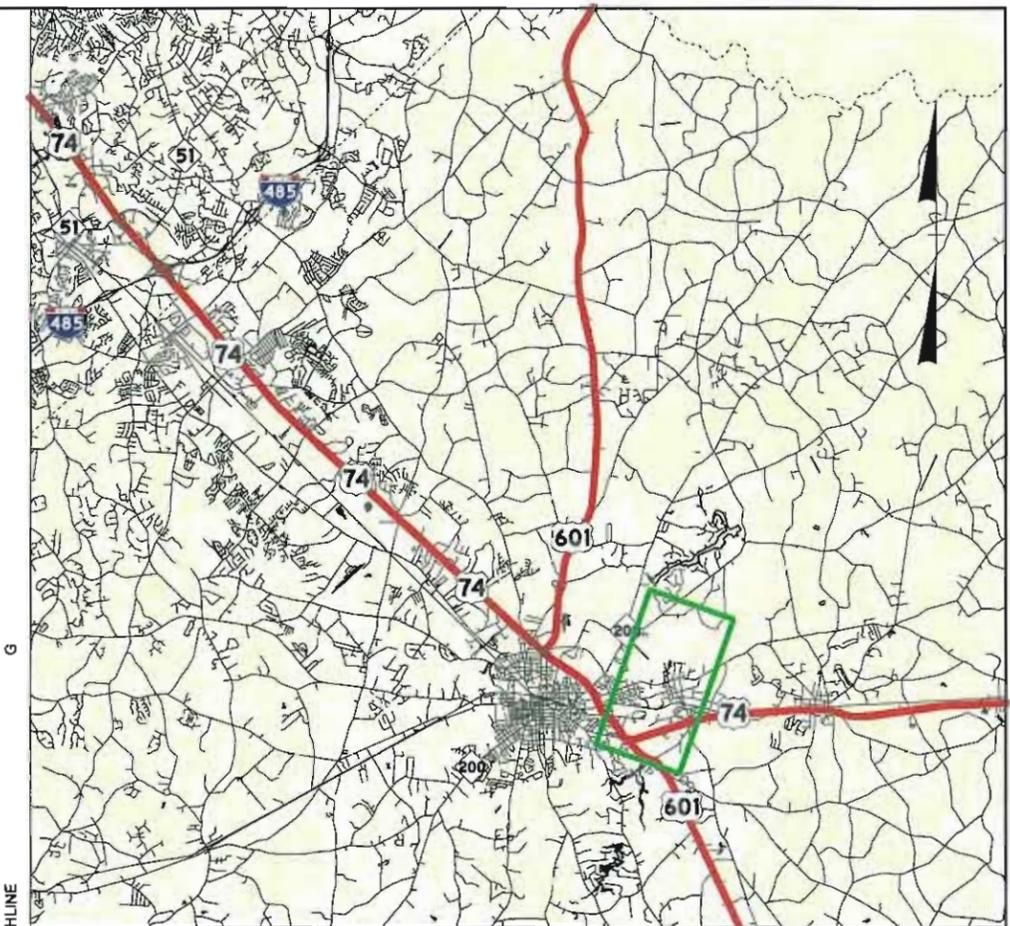
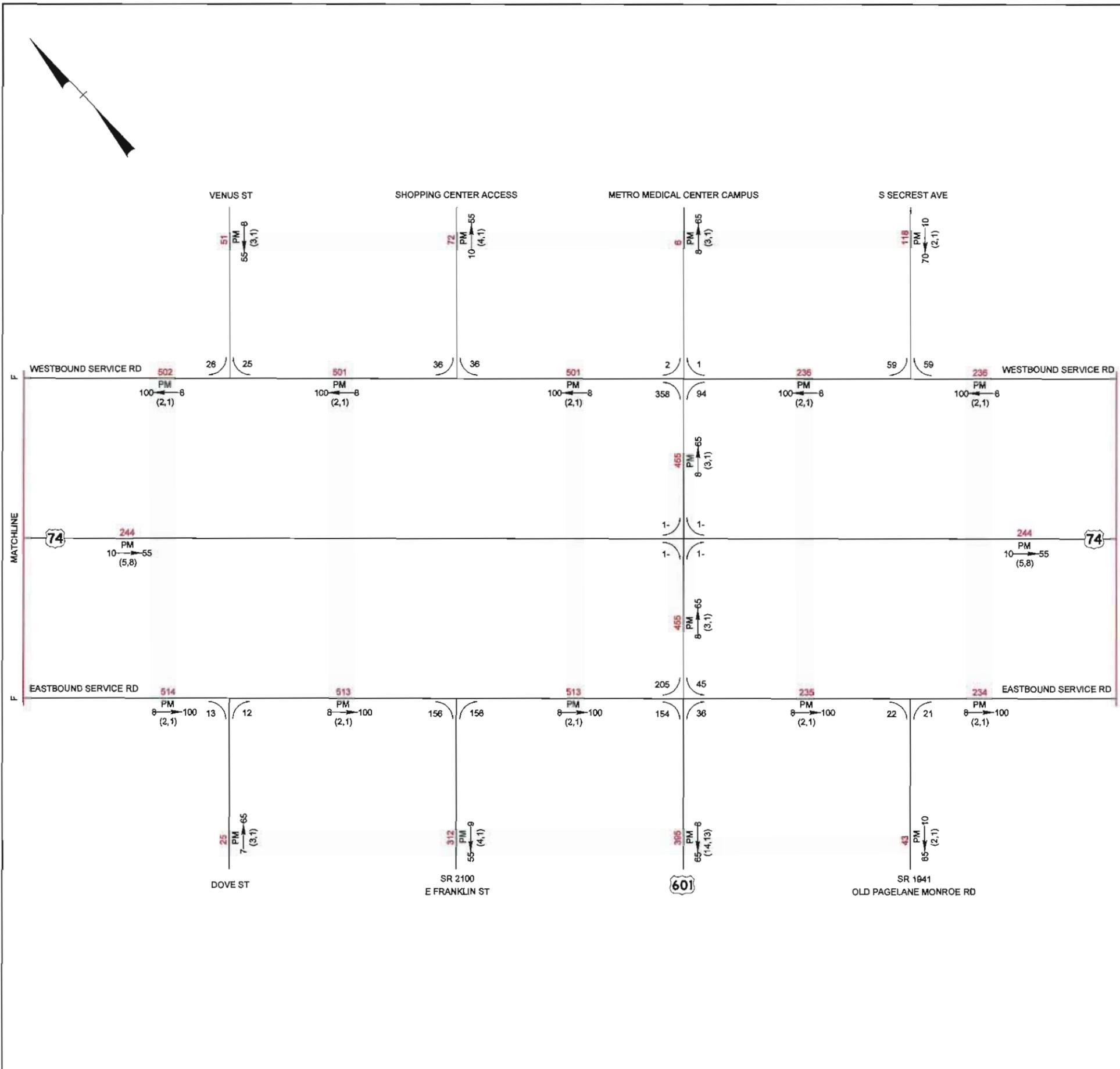
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 6

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- Indicates Direction of D (d, t) Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

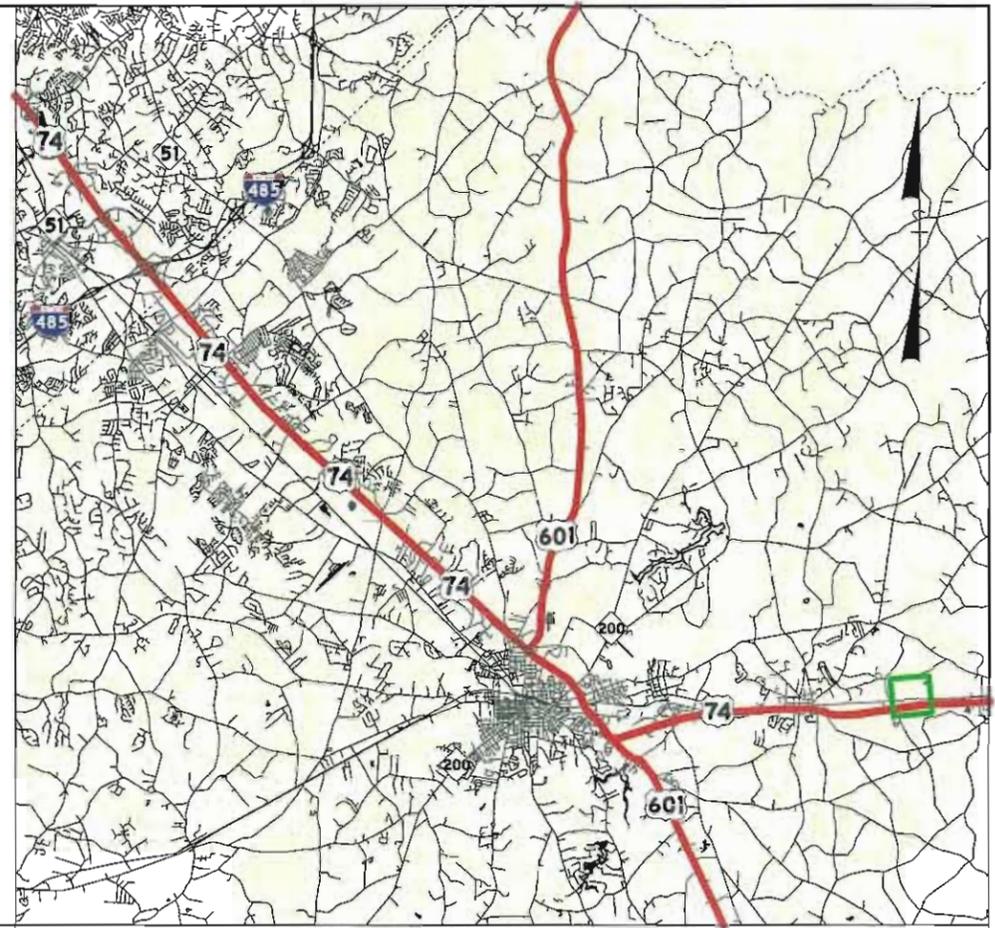
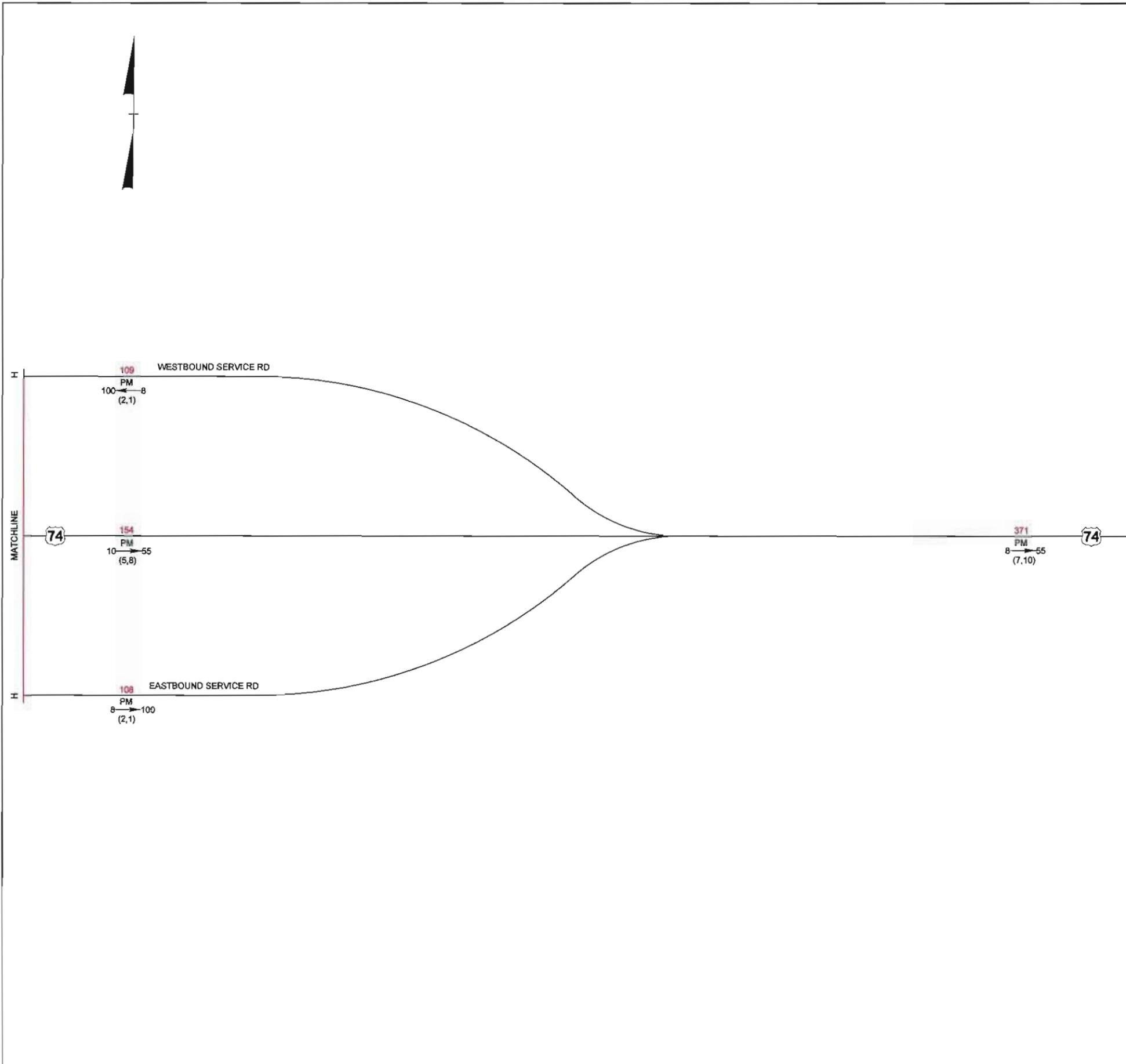
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 7

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV $\xrightarrow{\text{PM}} \text{D}$ (d, t) DHV Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- \rightarrow Indicates Direction of D
- (d, t) Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 9

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

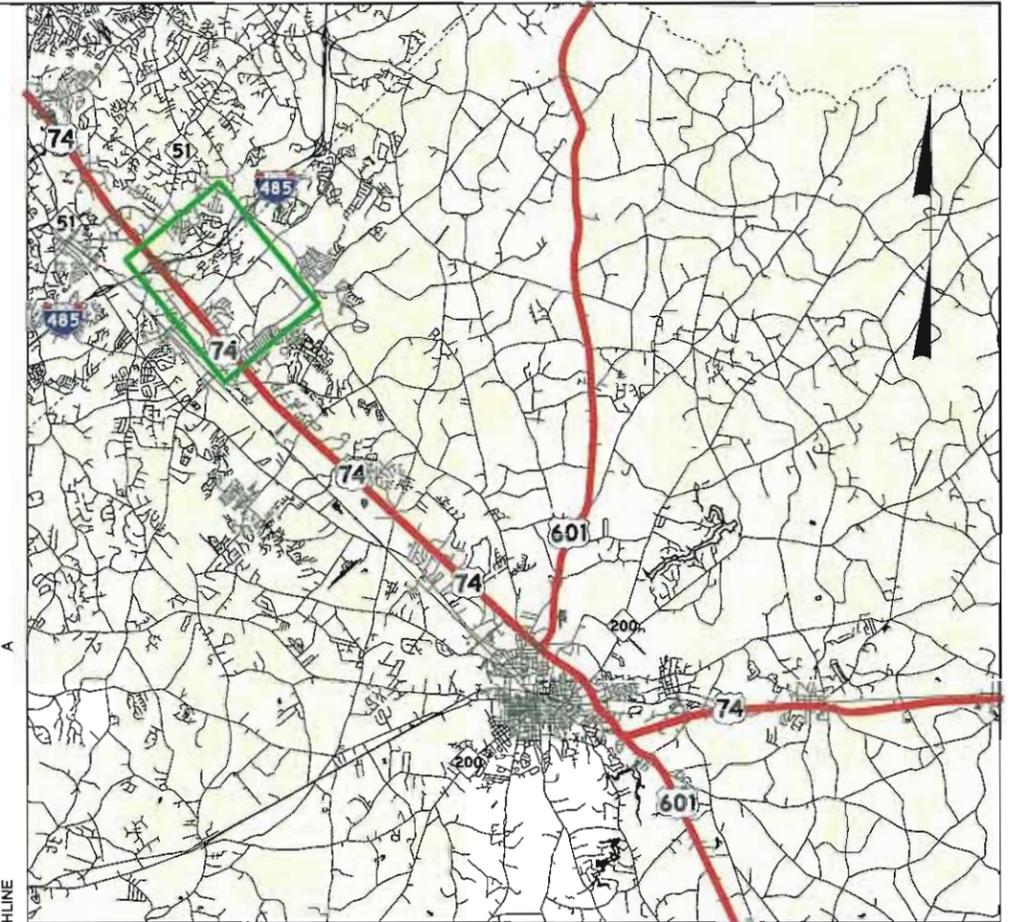
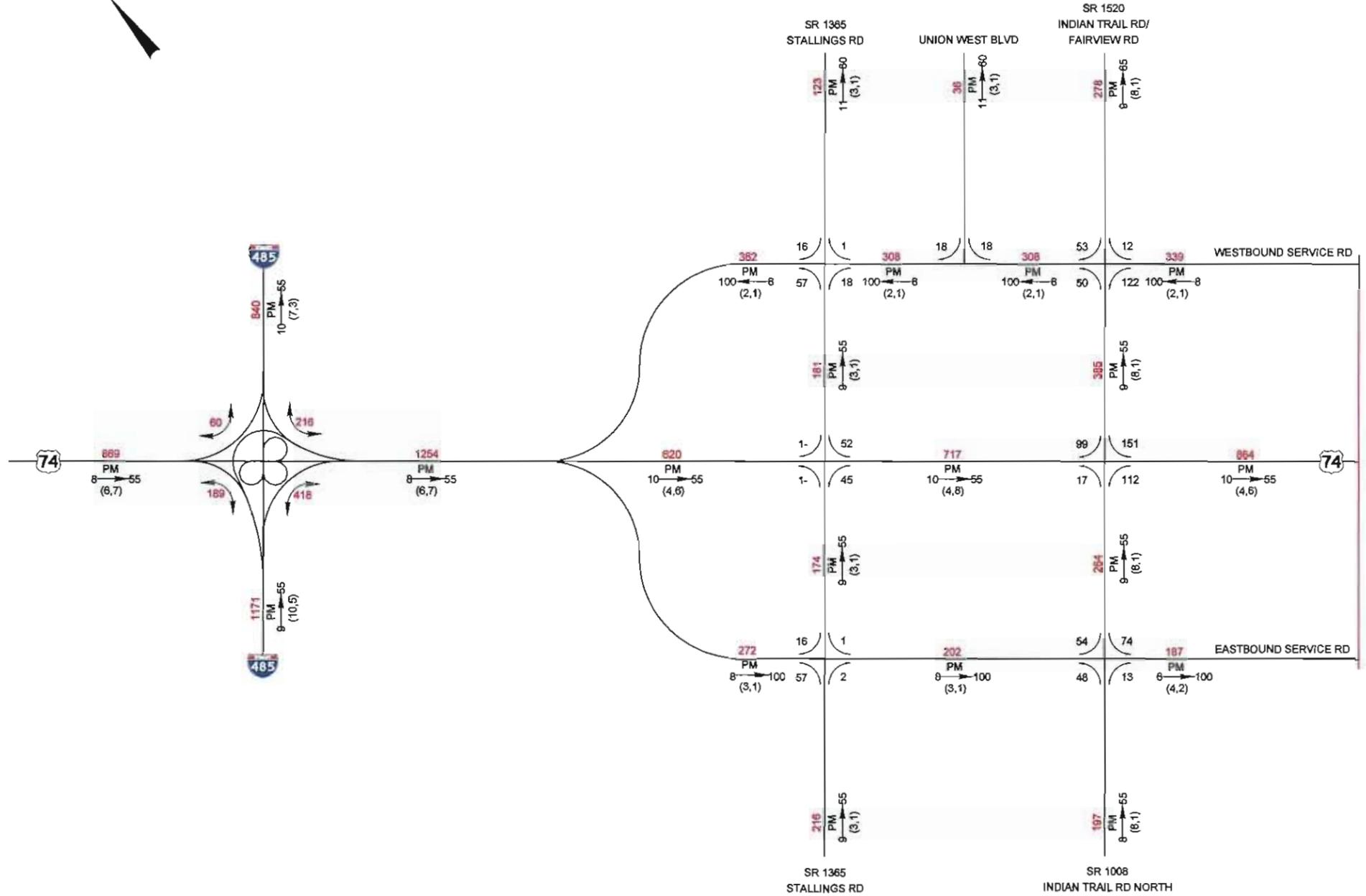
<p>DHV $\xrightarrow{\text{PM}} \text{D}$ (d, t)</p>	<p>DHV Design Hourly Volume (%) = K_{30} PM Peak Period D Peak Hour Directional Split (%) \rightarrow Indicates Direction of D (d, t) Duals, TTST (%)</p>	<p>### No. of Vehicles Per Day (VPD) in 100s 1- Less than 50 VPD ### Turning volume (VPD)</p>
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Exhibit 9
US 74 Upgrade with
Frontage Roads Alternative

2035 NON-TOLL Scenario



2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

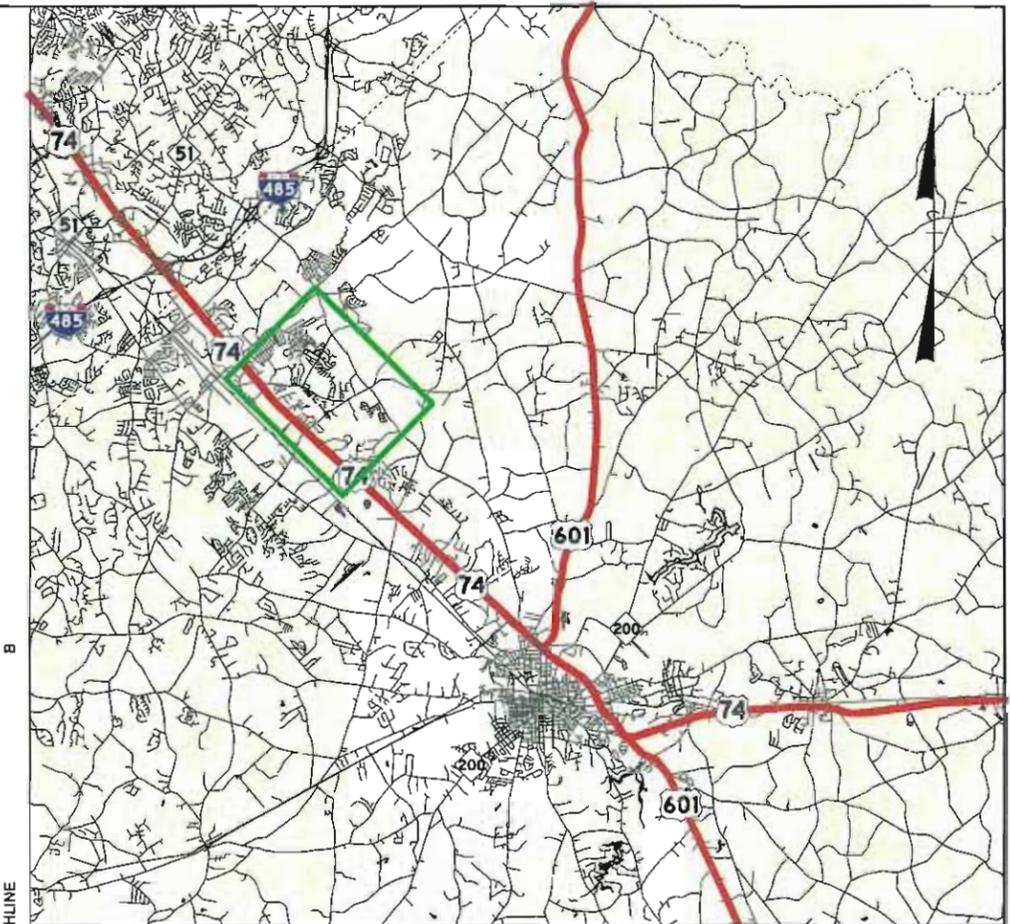
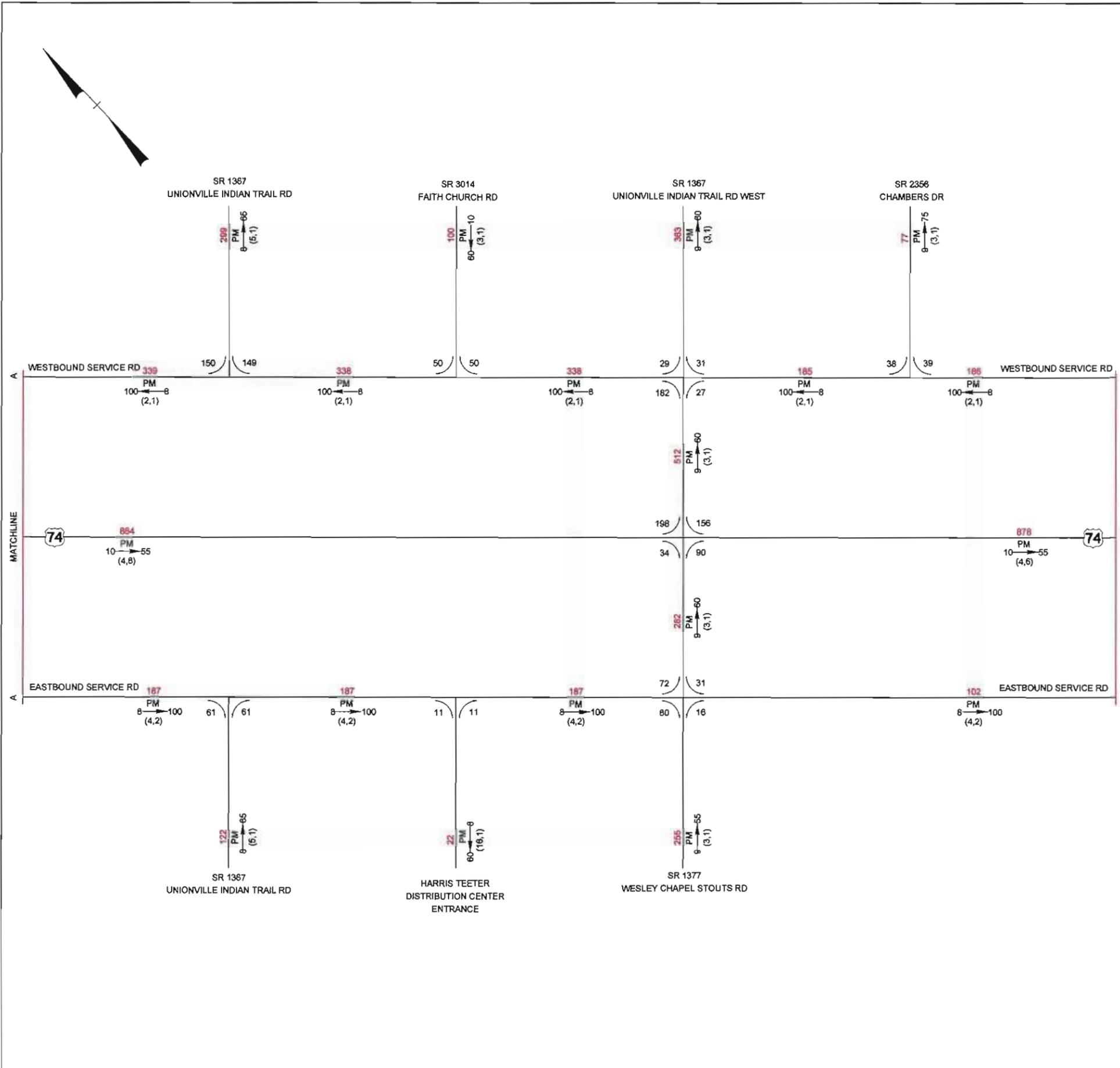
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 1

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV $\frac{PM}{(d, t)}$ Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- Indicates Direction of D
- $\frac{(d, t)}{(d, t)}$ Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

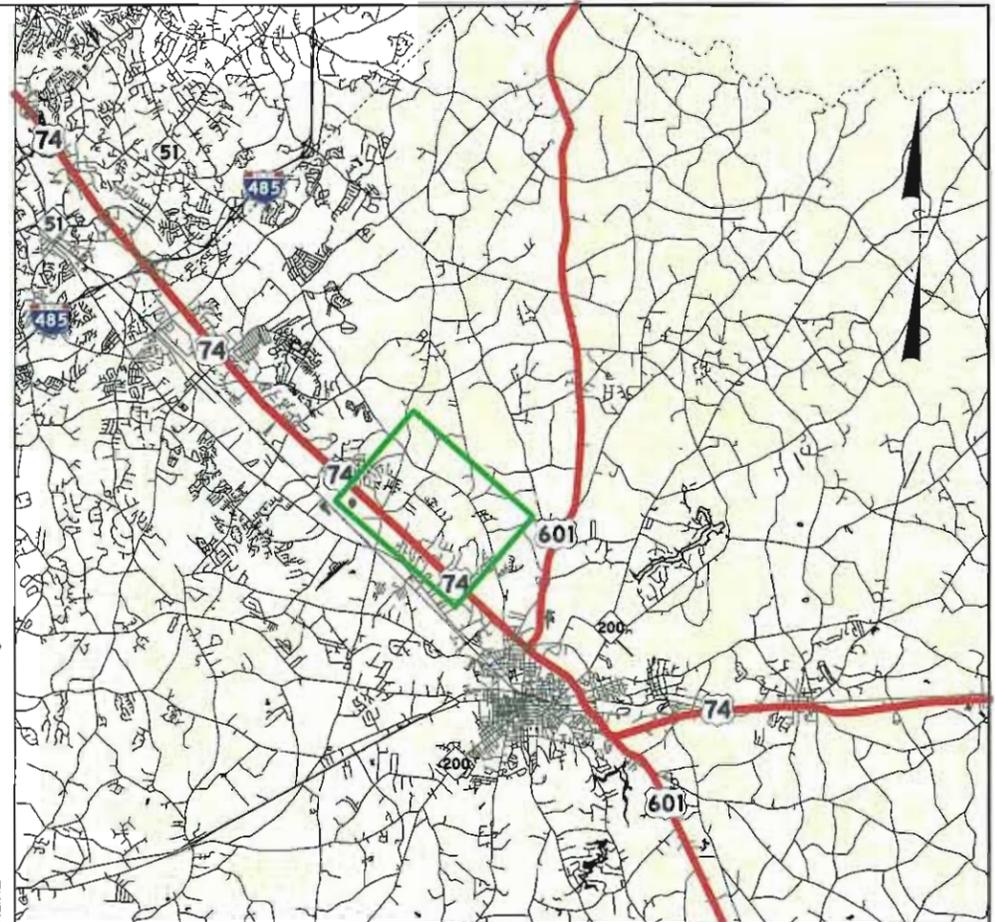
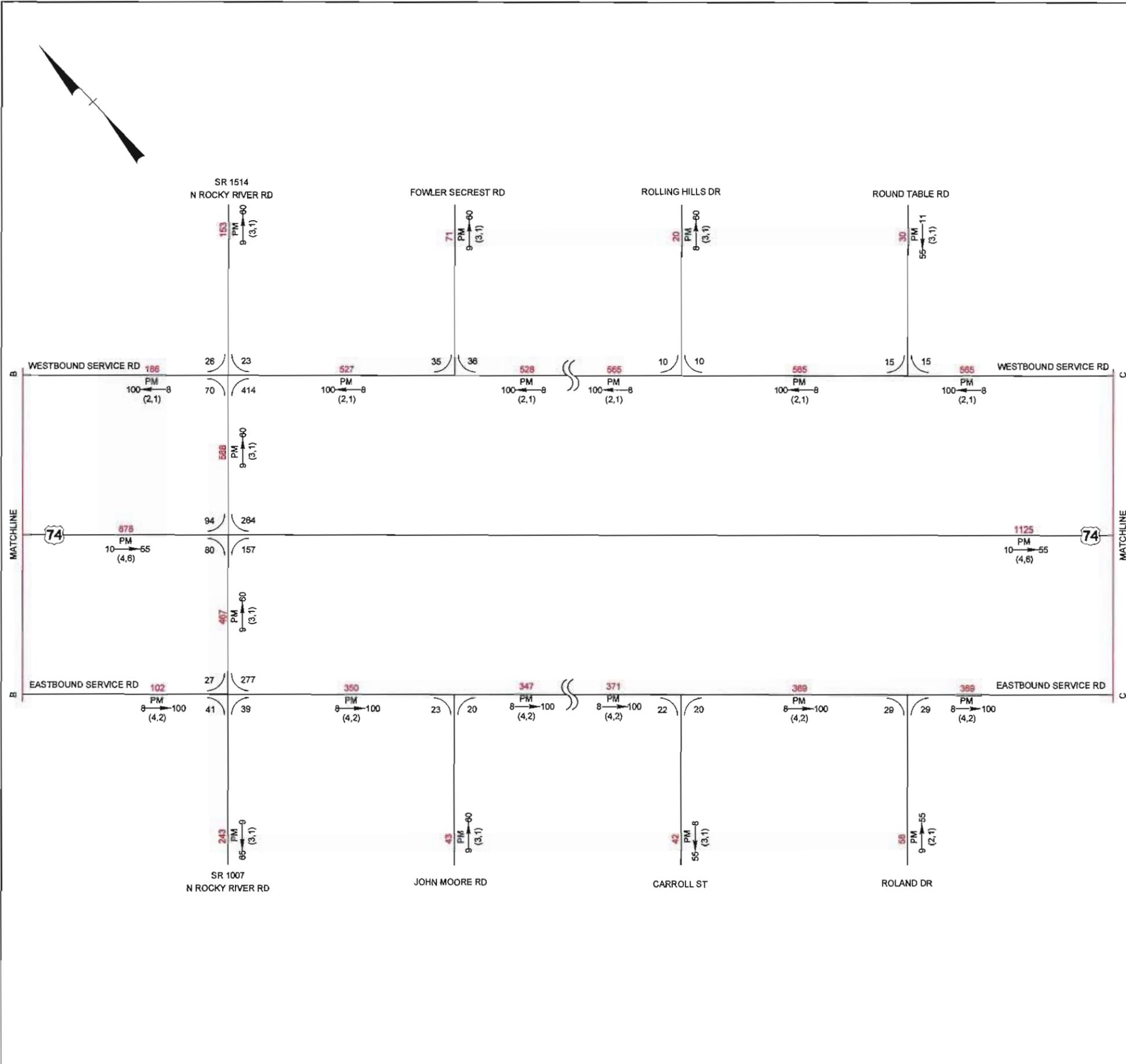
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 2

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

DHV	PM	D	DHV Design Hourly Volume (%) = K_{30}	###	No. of Vehicles Per Day (VPD) in 100s
(d, t)			PM Peak Period	1-	Less than 50 VPD
			D Peak Hour Directional Split (%)	###	Turning volume (VPD)
			→ Indicates Direction of D		
			(d, t) Duals, TTST (%)		





2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

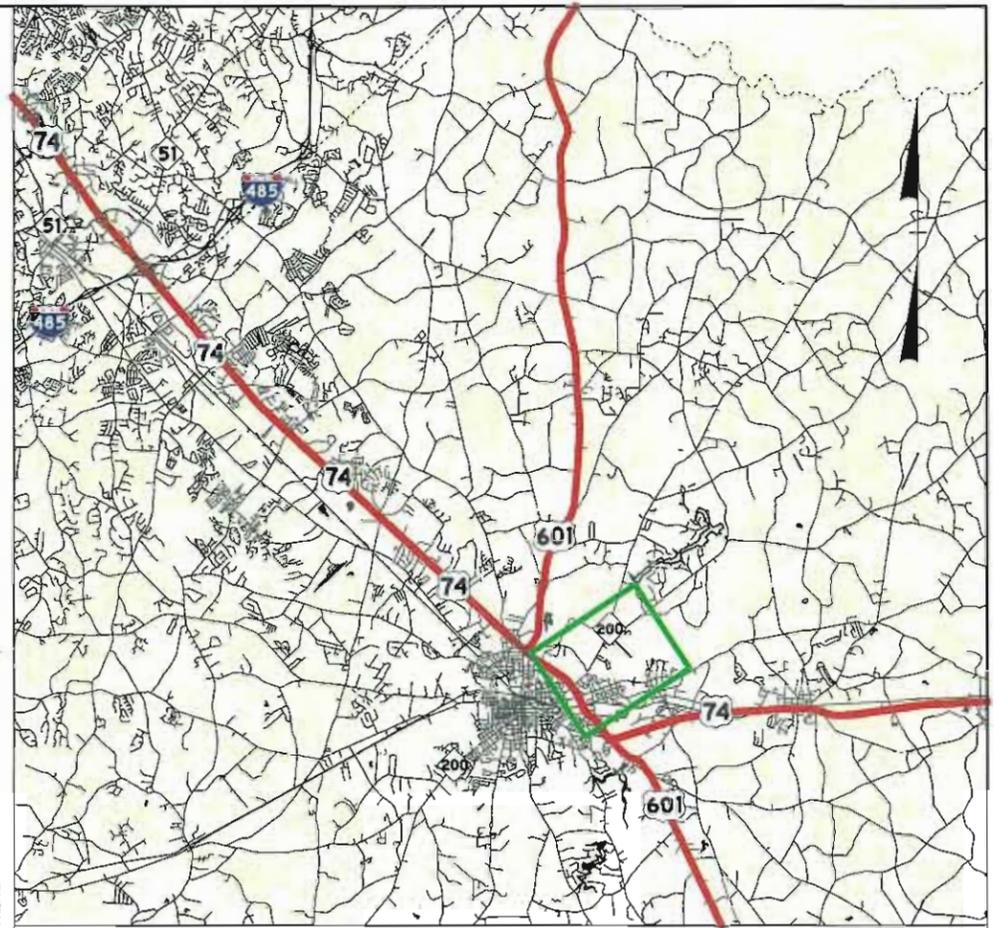
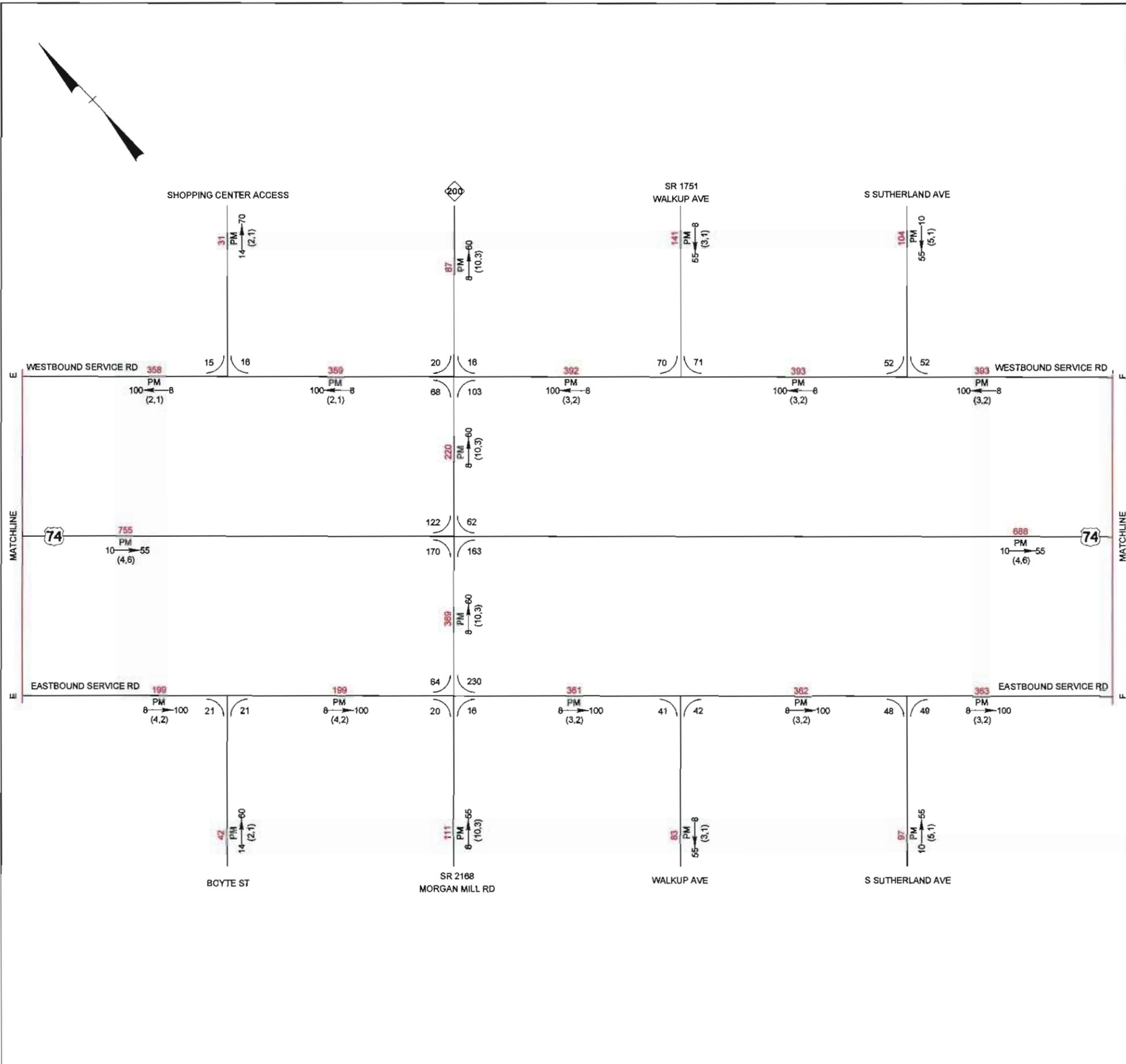
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: **3**

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

<p>DHV $\xrightarrow{\text{PM}} \text{D}$ (d, t)</p> <p>DHV Design Hourly Volume (%) = K_{30}</p> <p>PM Peak Period</p> <p>D Peak Hour Directional Split (%)</p> <p>Indicates Direction of D</p> <p>(d, t) Duals, TTST (%)</p>	<p>### No. of Vehicles Per Day (VPD) in 100s</p> <p>1- Less than 50 VPD</p> <p>### Turning volume (VPD)</p>
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2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

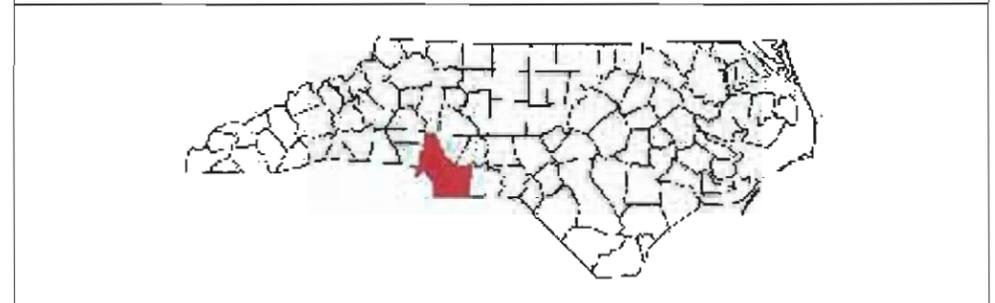
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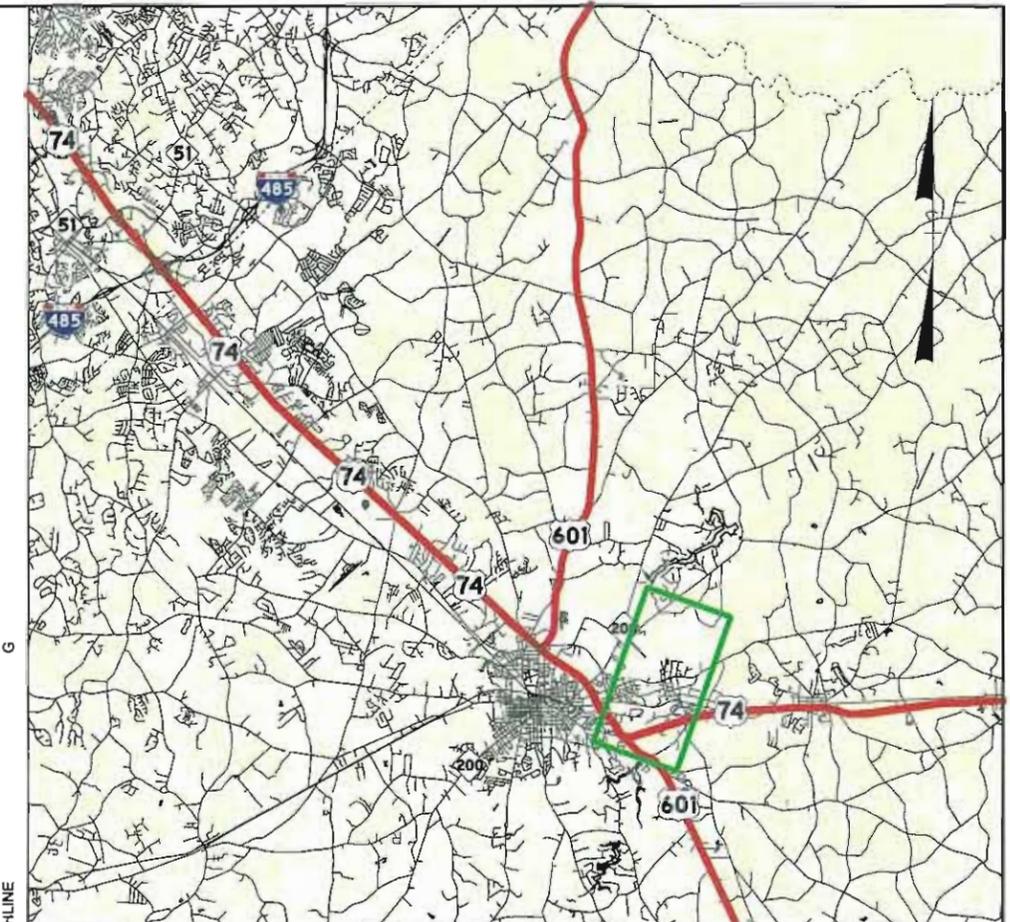
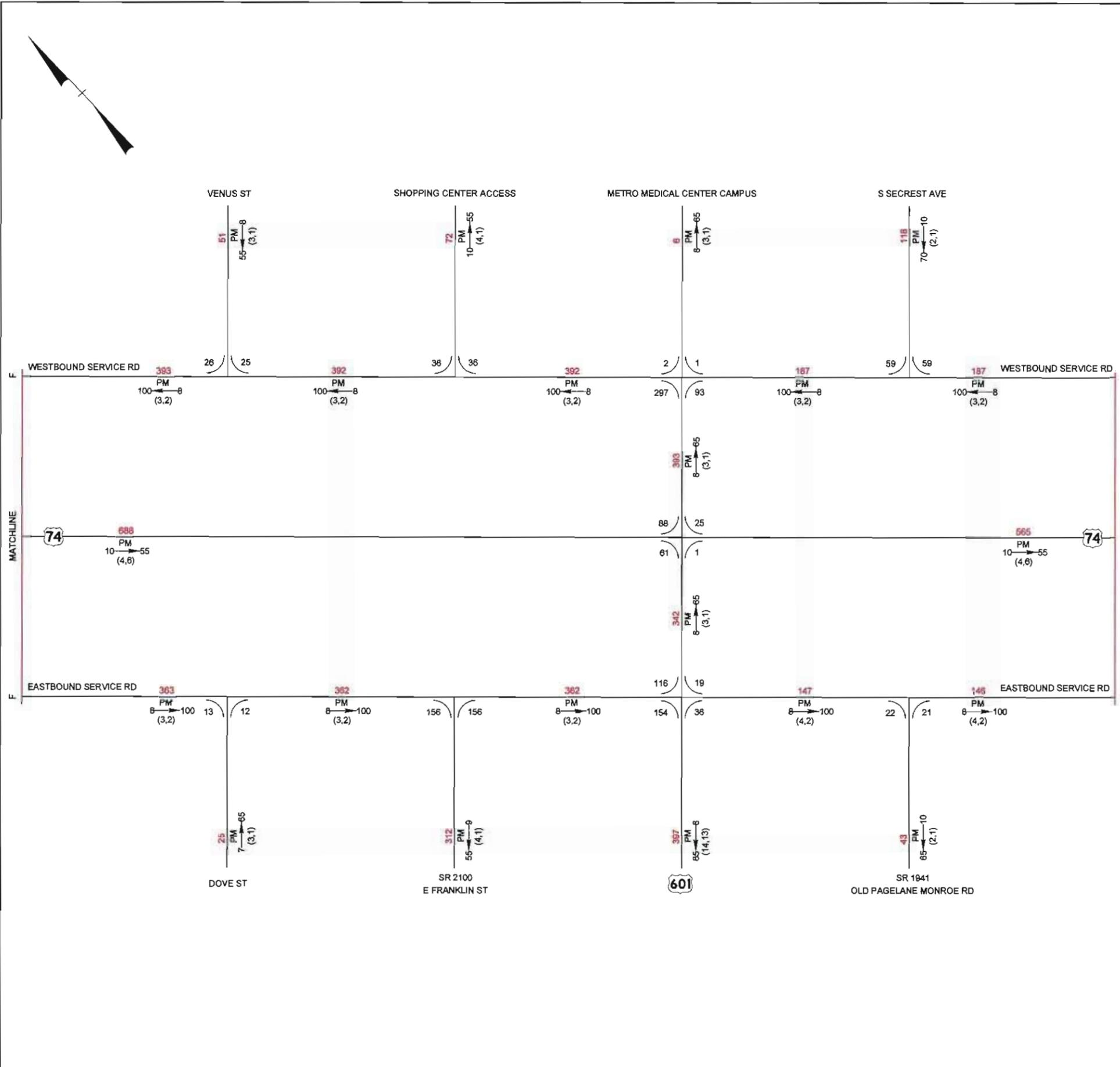
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 6

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

<p>DHV $\frac{PM}{(d, t)}$ D</p> <p>PM Peak Period</p> <p>D Peak Hour Directional Split (%)</p> <p>→ Indicates Direction of D</p> <p>(d, t) Duals, TTST (%)</p>	<p>### No. of Vehicles Per Day (VPD) in 100s</p> <p>1- Less than 50 VPD</p> <p>### Turning volume (VPD)</p>
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2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

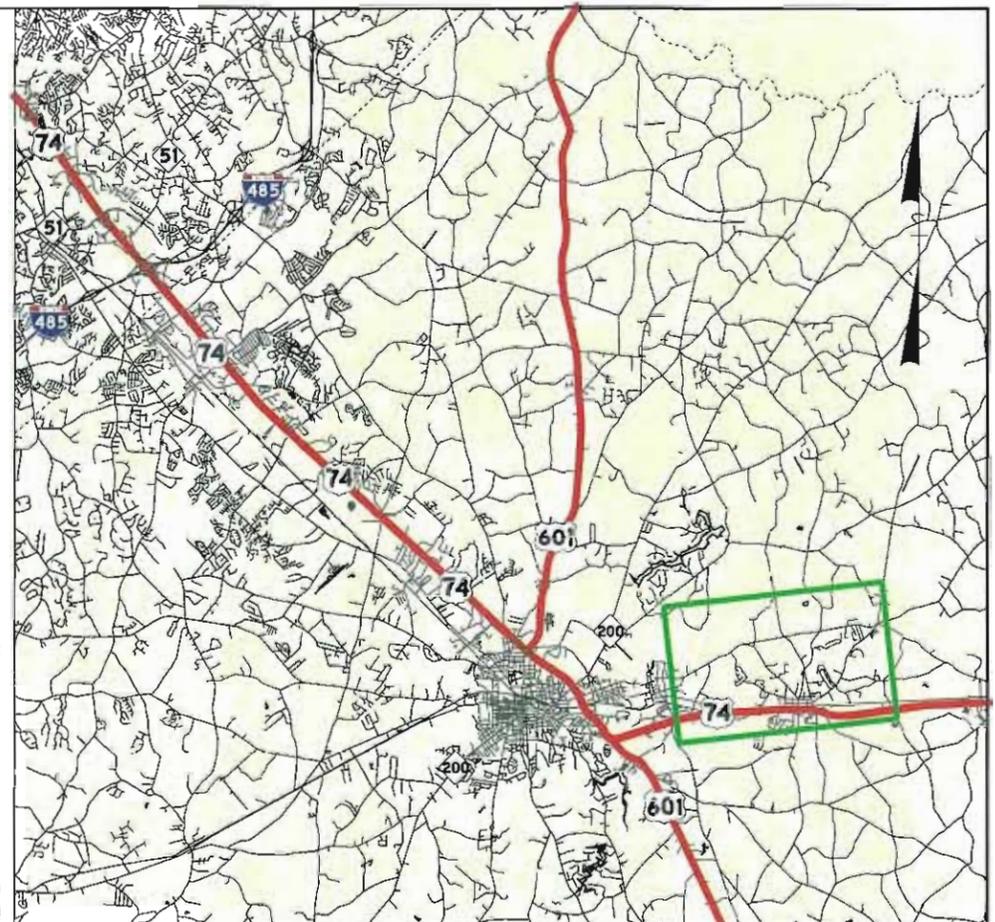
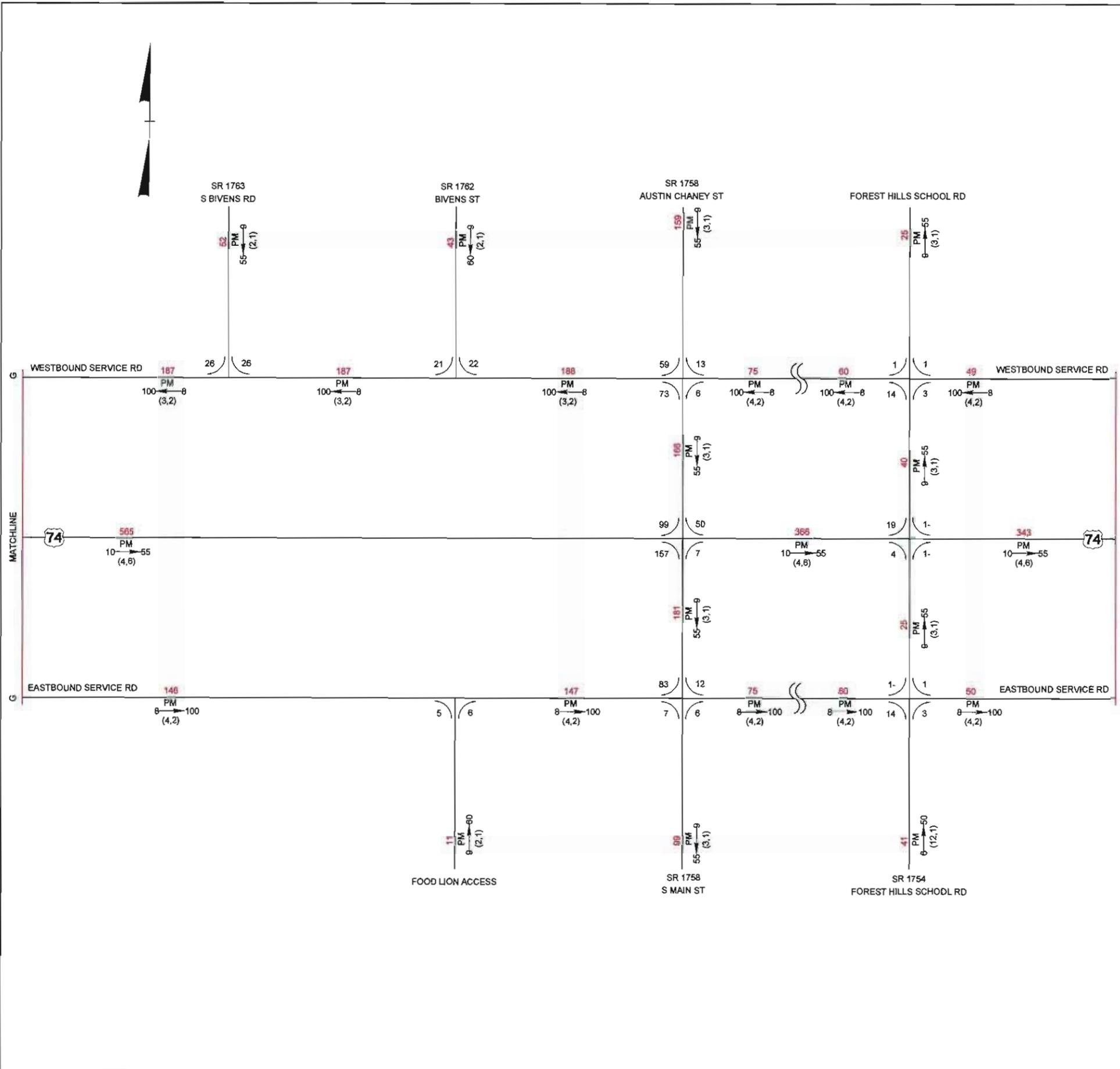
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 7

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- Indicates Direction of D
- (d, t) Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

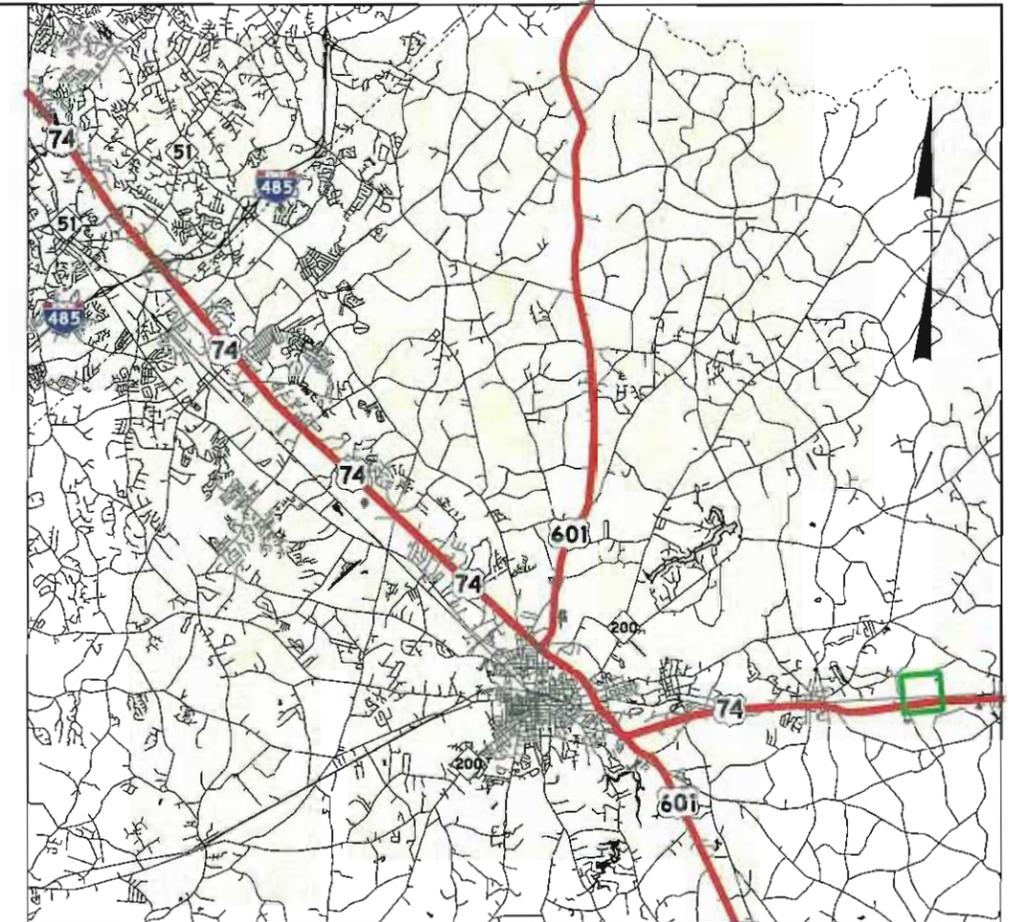
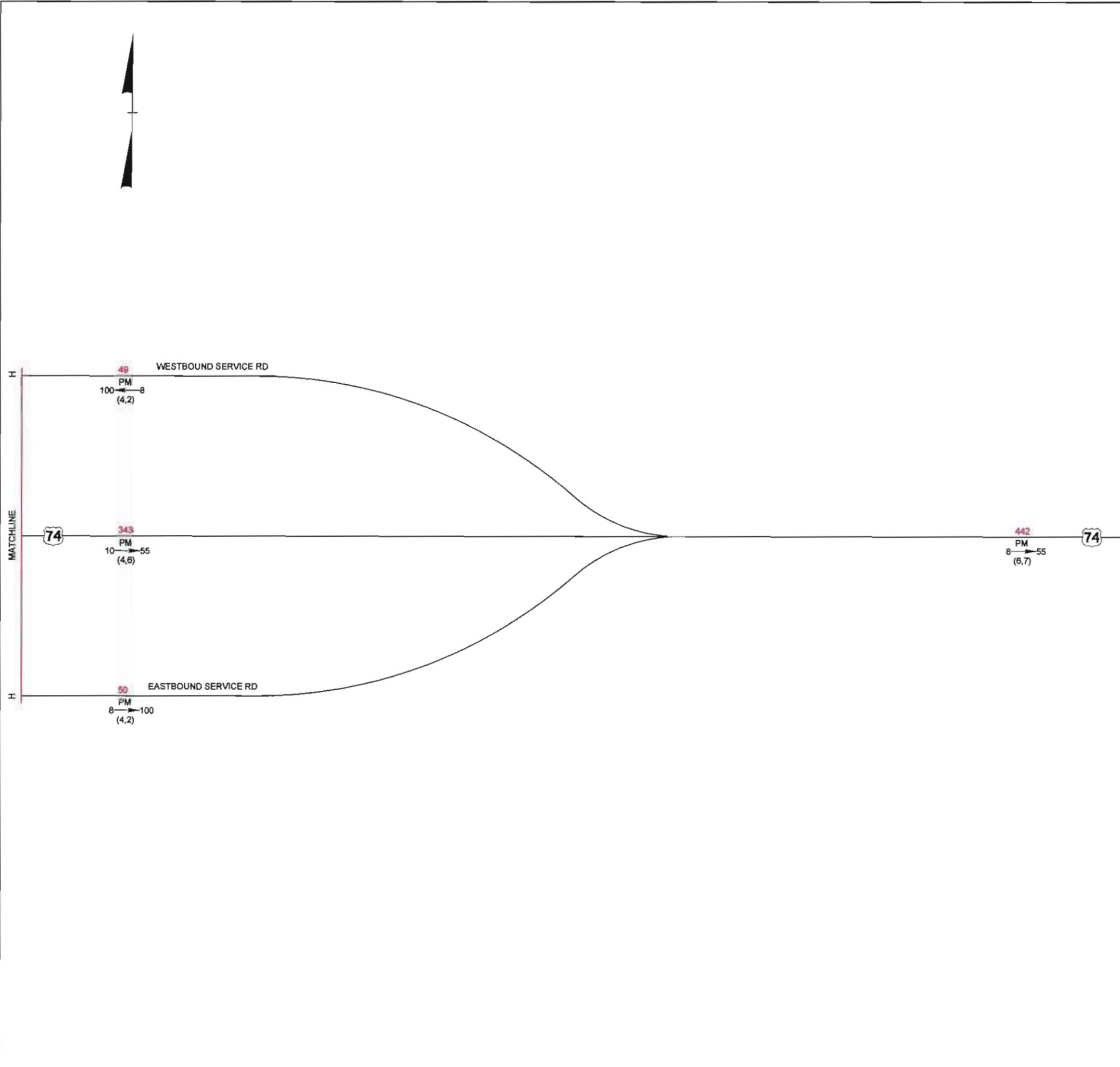
PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 8

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

- DHV $\xrightarrow{PM} D$ (d, t) DHV Design Hourly Volume (%) = K_{30}
- PM Peak Period
- D Peak Hour Directional Split (%)
- \rightarrow Indicates Direction of D
- (d, t) Duals, TTST (%)
- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- ### Turning volume (VPD)





2035 BUILD "NON-TOLL" US 74 UPGRADE SCENARIO

AVERAGE ANNUAL DAILY TRAFFIC WITH TRUCK, DHV AND DIRECTIONAL FACTORS

TIP: R-3329/R-2559 LOCATION: US 74 in Mecklenburg and Union Counties

PROJECT: US 74 Upgrade with Frontage Roads SHEET NUMBER: 9

DIVISION: 10 DATE: June 2008 PREPARED BY: Wilbur Smith Associates

LEGEND

DHV	Design Hourly Volume (%) = K_{30}	###	No. of Vehicles Per Day (VPD) in 100s
PM	Peak Period	1-	Less than 50 VPD
D	Peak Hour Directional Split (%)	###	Turning volume (VPD)
→	Indicates Direction of D		
(d, t)	Duals, TTST (%)		

