MAY 2012

PHASE I ARCHEOLOGICAL INVENTORY OF THE FACTORY LANE SITE DUE DILIGENCE PROJECT IN LOUISVILLE, JEFFERSON COUNTY, KENTUCKY

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Abstract

This document presents the results of a Phase I archeological inventory of the approximately 41.3 ha (102 ac) Factory Lane Due Diligence Project located in Louisville, Jefferson County, Kentucky. The cultural resources investigation described herein was conducted at the request of Carpenter/Robbins Commercial Real Estate, Inc., and on behalf of the Department of Veterans Affairs (VA). Electronic polygons of previously recorded archeological sites were received from the University of Kentucky Office of State Archaeology (OSA) on June 14, 2011; an in person review of these data was completed on March 8, 2012. Fieldwork for the project was conducted from February 23 and February 29, 2012 by R. Christopher Goodwin & Associates, Inc.

This study incorporated a comprehensive records review and the completion of a Phase I archeological inventory of each project item. The cultural resources investigation was designed to identify and to evaluate all cultural resources (archeological sites, isolated finds, standing structures, and cemeteries) situated within the proposed project area that might be impacted adversely as a result of this undertaking. The field investigation involved pedestrian reconnaissance and shovel testing along survey transects spaced 20 m (65.6 ft) apart. During the cultural resources investigation, a total of 1058 shovel tests were excavated.

The Phase I archeological inventory of the Factory Lane Due Diligence Project identified a single archeological site, newly recorded Site 15JF810, and two non-site cultural resources loci. Site 15JF810 was a low density scatter of historic (i.e., nineteenth and twentieth century) artifacts. The two non-site cultural resources loci each consisted of a single lithic flake. The three resources do not possess those qualities of significance as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). No additional investigation of these cultural resources or the Factory Lane Project parcel is recommended.

Table of Contents

List of Figures

List of Tables

Chapter I

Introduction

This document contains the results of a Phase I archeological inventory of the Factory Lane Site Due Diligence Project located in Louisville, Jefferson County, Kentucky. The approximately 41.3 ha (102 ac) project area is located on the eastern side of Louisville and south of the Pewee Valley community (Figures 1.1 and 1.2). This cultural resources investigation was conducted at the request of Carpenter/Robbins Commercial Real Estate, Inc., and on behalf of the Department of Veterans Affairs (VA) under Contract # VA101-10-RP-0084(E); Task Order #3; Modification #1. Electronic polygons of previously recorded archeological sites were received from the University of Kentucky Office of State Archaeology (OSA) on June 14, 2011; an in person review of these data was completed on March 8, 2012. Fieldwork for the project was conducted between February 23 and February 29, 2012 by R. Christopher Goodwin & Associates, Inc.

A multi-staged approach was used to complete this archeological inventory. It consisted of cartographic, archival, and archeological review of data relevant to the area under investigation; pedestrian survey and systematic shovel testing throughout the project area; and the recordation and preliminary assessment of all cultural resources identified during survey.

All work associated with this investigation was performed in accordance with the procedures outlined in the National Historic Preservation Act of 1966, as amended; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979, as amended; and Title 36 of the Code of Federal Regulations, Parts 60-66 and 800, as appropriate. Additionally, this survey effort abided by the standards set forth in *Archeology and Historic Preservation: The Secretary of the Interior's Guidelines*; the Advisory Council on Historic Preservation's handbook entitled *Treatment of Archaeological Properties*; and with Kentucky's *Specifications For Conducting Fieldwork And Preparing Cultural Resource Assessment Reports* (Sanders 2006).

Project Description

The VA seeks to construct a new medical center that measures approximately 1,100,000 gross square feet in size and includes at least 2400 parking spaces, in the Louisville, KY area. The new medical center will service 166,000 veterans from the 35 county western Kentucky and southern Indiana area. The Factory Lane Parcel is located east of I-265 and south of Factory Lane. The parcel includes approximately 41.3 ha (102 ac) of mostly unimproved, agricultural land and is located approximately 17.4 km (10.8 mi) east of the existing Louisville VAMC.

In order to fulfill their obligations under Section 106 of the National Historic Preservation Act, VA requested a Phase I cultural resources survey of the Factory Lane Parcel. This archeological inventory was designed to identify, record, and assess the distribution of all cultural resources situated within or immediately adjacent to the currently proposed project area.

Project Results

Intensive pedestrian survey augmented by the excavation of 1058 shovel tests resulted in the identification of three cultural resources, i.e., Archeological Site 15JF810 and Non-Site Loci FLS-B-01 and FLS-B-02. Site 15JF810 produced 39 nineteenth and twentieth century artifacts and a single faunal specimen. Only a single lithic flake each was recovered from the two non-site loci. All three cultural resources lack research potential. No intact cultural deposits were identified during the investigation of the three resources, demonstrating that neither of these cultural resources possesses integrity. Site 15JF810, Locus FLS-

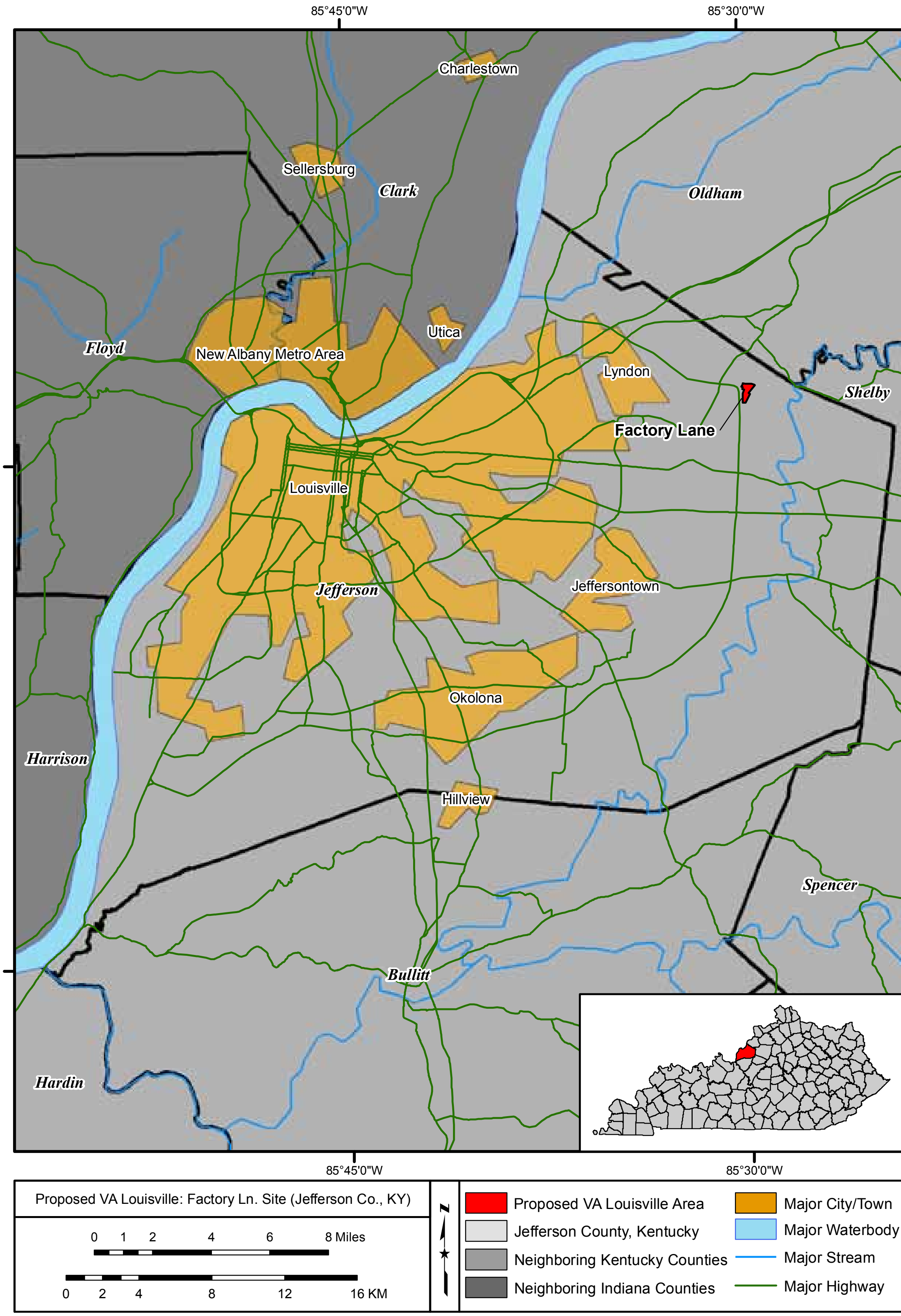

Figure 1.1 **Map excerpt showing the location of the Factory Lane Due Diligence Project Area.**

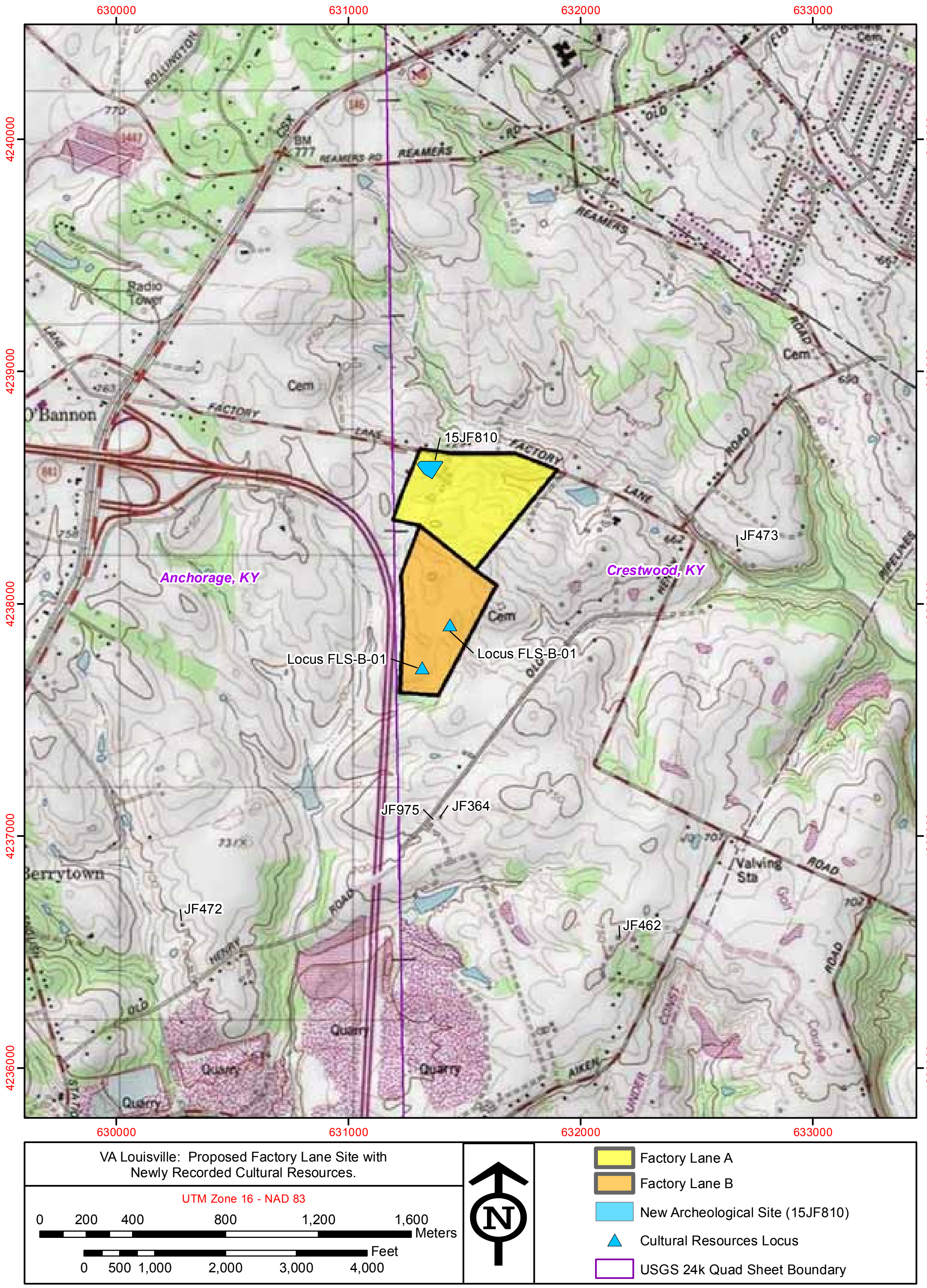

Figure 1.2 **USGS Quadrangle excerpt showing the location of the Factory Lane Due Diligence Project Area.**

B-01, and Locus FLS-B-02 do not possess those qualities of significance and integrity as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). No further investigation of these resources is recommended.

Project Personnel

Mr. William Athens, M.A., R.P.A., and Mr. James Eberwine, M.S., R.P.A. served as co-Principal Investigators for this project. Mr. Eberwine also served as Project Manager. The fieldwork component of the project was supervised by Ms. Carrie Humphrey, M.A. She was assisted by Ms. Merritt Eller, M.A., Ms. Elicia Kimble, M.A., Ms. Stacy Scott, M.A., Mr. Gareth Foster, B.A., Ms Genevieve Jones, B.A., Ms. Sabreina Slaughter, B.A., Ms. Kelin Verrette, B.A., and Ms. Laura Welles, B.A. The laboratory analysis of the recovered material was performed by Dr. Charlotte Pevny, Ph.D. and Mr. Nathanael Heller, M.A.; Mr. Travis Shaw, M.A., served as Project Historian. Finally, Mr. David Stitcher, B.A., produced the graphics contained within this report while Ms. Heidi Post, B.A., produced the document.

Curation

Following the completion and acceptance of the final report all artifacts, records, photographs, and field notes will be curated with the Program of Archaeology at the University of Louisville, at the facility located at:

Archaeology MS 04-14
University Of Louisville
Louisville, Kentucky 40292-0414

Organization of the Report

An overview of the natural setting of the project region is presented in Chapter II and it includes a brief description of the regional geology and geomorphology, the floral and faunal communities characteristic of the area, and a short description of the climate of the region. The prehistoric cultural development of the area is explored in Chapter III, while the history of the region is chronicled in Chapter IV. A review of all previous archeological research completed in the immediate vicinity of the project area is presented in Chapter V. The research design and field methodologies used to complete this investigation are discussed in Chapter VI. That chapter also includes a discussion of the laboratory methods and procedures used to process and analyze the cultural material recovered during survey. The results of this investigation including a detailed description of the cultural resource identified during survey appears in Chapter VII. An inventory of all artifacts recovered as a result of this investigation is included as Appendix I, while a copy of the *curriculum vitae* for Mr. Athens and Mr. Eberwine is included as Appendix II.

Chapter II

Natural Settings

This chapter provides a general description of the natural environment found in the vicinity of the currently proposed Factory Lane Due Diligence Project located in Louisville, Jefferson County, Kentucky. This chapter discusses the physiography, geology, geomorphology, soils, hydrology, paleo-environments, modern ecology, and modern climate common to the project region.

Physiography

The currently proposed project area is situated within the Outer Bluegrass physiographic region, a sub-division of the approximately 20,718 km^2 (8000 m^2) Bluegrass Province. The Outer Bluegrass region is separated from the Inner Bluegrass physiographic region by the Eden Shale, a belt of sedimentary rock. In total, the Outer Bluegrass encompasses approximately one-third of the overall Bluegrass Province, and is bordered to the north and west by the Ohio River, to the east by the Cumberland Plateau, and to the south by the Mississippian Plateau/Pennyroyal (Spetz 1992; Newell 2001).

The Outer Bluegrass is characterized by, "broad, gently sloping ridgetops, moderately sloping to steep side slopes, and moderately wide to narrow flood plains" (Blanford et al. 2007:2). The landscape of the region is dominated by limestone bedrock and well exposed dolomites dating from the Silurian Period (Spetz 1992; Newell 2001). Elevations within the Outer Bluegrass range from approximately 305 m (1000 ft) in nearby Garrard and Madison Counties, to approximately 152.4 m (500 ft) southeast of the project area. Shelby County, which is located immediately east of Jefferson County, contains Jeptha Knob, the highest elevation in the Outer Bluegrass at an elevation of 358 m (1176 ft) (Parola et al. 2007).

Geology

The Factory Lane project area is underlain by the Louisville Limestone (Middle Silurian) formation (Kentucky Geological Survey 2012). Louisville Limestone is light olive gray to olive gray in color, and weathers to a yellowish gray color. The formation consists of dolomitic limestone and dolomite with a fine to coarse grained matrix; fossils are abundant. The formation is bedded thinly in the upper part and bedded thickly near the base. In addition, small sinkholes are common within the formation. (Kentucky Geological Survey 2012).

Geomorphology

The project area is situated on a level upland within the rolling hills of Jefferson County. Hillslopes consist of geologically dynamic landscapes that form through and are modified by erosion and deposition. A number of components are common to most hillslopes. At the head of a drainageway, a headslope has a concave form with the slope lengths converging downward to the drainage. Side slopes bound the drainageway in a linear pattern, and opposing sideslopes descend to valley bottoms. Adjacent drainageways are separated by interfluves, which form the summit, or top, of a hillslope profile. Below the summit, the convex portions of the hillslope are known as the shoulder and backslope. Due to their slope, these areas are most susceptible to erosion, chemical and mechanical weathering, and mass movement. The footslope is located below the backslope and it forms a concave structure. The footslope is subject to mass movement, but it also receives erosional sediments from above, and a colluvial fan may form at this location. The toeslope occurs beneath the footslope with a flattening gradient, and it descends gently to the drainageway. The toeslope may receive both erosional sediments from the hillslope and alluvial sediments from the drainage channel (Ruhe 1975; Gerrard 1981).

Soils

Eight individual soil units fall within the limits of the proposed project item, Beasley silt loam, 6 to 12 percent slopes; Caneyville silt loam, 12 to 25 percent slopes, eroded, very rocky; Crider silt loam, 0 to 2 percent slopes; Crider silt loam, 2 to 6 percent slopes; Crider silt loam, 6 to 12 percent slopes; Lindside silt loam, occasionally flooded; Nicholson silt loam, 2 to 6 percent slopes; and, Nicholson silt loam, 6 to 12 percent slopes. The majority of the soils within the project area (i.e., 63.8 per cent) are classified as Crider Silt Loam 2 to 6 per cent slopes. This soil unit is found along ridge summits, and consists of silty loess over clays that weathered from limestone and dolomite. The soil is deep and well drained; it has a low potential for surface runoff. The surface layer for the Crider Silt Loam 2 to 6 per cent slopes soil unit is silt loam that stretches down from the surface to a depth of 17.8 cm (7 in). Below this surficial layer is a silt loam that continues to a depth of 61 cm (24 in). The basal stratum is made up of silty clay loam. This stratum extends to a depth of 254 cm (100 in). This soil unit is well suited to cropland, pasture, and small areas of woodland. The soil unit does have the potential for developing sinkholes (Blanford et al. 2007).

The Nicholson Silt Loam, 2 to 6 per cent slopes soil unit accounts for approximately 11.1 per cent of the project area. This soil unit typically is encountered along upland ridge summits, where it is made up of thin, fine silty loess over clays. It also is very deep and moderately well drained; it neither floods nor ponds. The top three layers of this soil type are classified as silt loams, and they extend to 17.8 cm (7 in), from 17.8 cm (7 in) to 68.6 cm (27 in), and from 68.6 cm (27 in) to 149.9 cm (59 in) respectively. Below these silt loam deposits is a deposit of silty clay loam, which extends to a depth of 188 cm (74 in) and terminates on a silty clay substratum. As was the case with the Crider Silt Loam, this soil is well suited to crops, pasture, and woodlands (Blanford et al. 2007).

The Crider Silt Loam, 6 to 12 per cent slopes soil unit makes up 9.9 per cent of the project area. The soil is found on ridge shoulders and is well drained and very deep. Parent material for this unit is described as thin, fine silty loess over clays, which weathered from limestone and dolomite. The soil profile of this unit is identical to that of the Crider Silt Loam 2 to 6 per cent slopes described above, i.e., two strata of silt loam that extend to a combined depth of 61 cm (24 in), underlain by silty clay loam to a depth of 254 cm (100 in). This soil unit also is well suited to crops, pasture, and small wooded areas, but has a higher rate of surface runoff due to its position on ridge shoulders. This soil unit also has the potential for sinkholes to develop (Blanford et al. 2007).

The Lindside silt loam, occasionally flooded soil unit is found typically within river valley flood plains. Within the project area, this soil unit makes up 6.9 per cent of the encountered soils. Lindsdide silt loam is made up of mixed to fine silty alluvium which dates from the Quaternary System. The soil is very deep and moderately well drained, with a low potential for surface runoff. The surface layer is made up of silt loam that terminates 40.6 cm (16 in) below the ground surface. This layer is underlain by a silt loam subsoil that continues down to a depth of 132.1 cm (52 in). The substratum extends to a depth of 228.6 cm (90 in) and is made up of gravelly silt loam. Although the soil unit is well suited to pasture and cropland, the propensity of the unit for flooding may cause damage to both crops and pasture (Blanford et al. 2007).

The Canyeville silt loam, 12 to 25 per cent slopes, eroded, very rocky soil unit comprises approximately 4.5 per cent of the project area. This soil unit is characterized by a thin (i.e., 5 cm [2 in]) silt loam surface deposit underlain by a silty clay subsoil which extends to a depth of 76.2 cm (30 in). Below the subsoil is a 10 cm (4 in) deposit of unweathered limestone bedrock. The soil unit is found along the backslopes of hills; it is moderately deep and well drained. Although not considered to be prime farmland, since the depth to bedrock inhibits root growth, the soil is well suited for pasture and woods. The soil has a medium potential for surface runoff, and, due to its position on the landform, possesses higher erosion hazards (Blanford et al. 2007).

The Nicholson Silt Loam, 6 to 12 per cent slopes soil unit is found on ridge shoulders, and makes up 1.8 per cent of the soils within the project area. The soil unit is made up of silty loess over clays that weathered from limestone and dolomite. This soil type is not prone to flooding or ponding, and is moderately well drained; it possesses a medium potential for surface runoff. A typical soil profile for the Nicholson Silt Loam 6 to 12 per cent slopes soil unit is comprised of five strata. The surface deposit extends to a depth of 17.8 cm (7 in) and is made up of silt loam. Below this stratum is the first of three subsoil deposits. The first subsoil deposit also is a silt loam; it extends from 17.8 to 68.6 cm (7 to 27 in). The second subsoil deposit continues to a depth of 150 cm (49 in) and also consists of silt loam. The final subsoil deposit is a silty clay loam. At a depth of 188 cm (74 in), this subsoil deposit terminates on the substratum, a deposit of silty clay that extends to a depth of 221 cm (87 in). The soil unit is moderately suited for crops, but well suited for pasture and small woodland areas (Blanford et al. 2007).

The Beasley Silt Loam, 6 to 12 per cent slopes soil unit makes up 1.1 per cent of the project area and is situated along ridge shoulders. The parent material for this unit is clays weathered from shale siltstone, and limestone of the Silurian and Ordovician Systems. A silt loam surface stratum makes up the top 15 cm (6 in) of the soil column. This deposit is underlain by a silty clay subsoil that continues to a depth of 121.9 cm (48 in). Weathered shale bedrock is encountered below the subsoil. This bedrock continues to a depth of 147.3 cm (58 in). The soil unit is deep and well drained, and is not prone to flooding or ponding. It is moderately suited to cropland, and well suited for pasture and woods. The unit does have a high erosion hazard because of its location on the landscape, i.e., ridge shoulders (Blanford et al. 2007).

Crider Silt Loam, 0 to 2 per cent slopes is located only within 0.9 per cent of the project parcel, and is commonly identified on ridge summits along karst uplands. The soils are comprised of thin, fine, silty loess over clays that weathered from the limestone and dolomite deposits of the Sellersburg and Jefferson Limestone Formations. The soils are very deep and well drained; they are not prone to flooding. A typical soil profile exhibits a silt loam from the ground surface to a depth of 17.8 cm (7 in), underlain by a 43.2 cm (17 in) deposit of silt loam. The basal stratum stretches from 61 to 254 cm (24 to 100 in) and is comprised of silty clay loam. The soil is well suited to crops, woodland, and pasture (Blanford et al. 2007).

Hydrology

The proposed project item is situated within the Ohio River Basin, which drains an approximately 528,163.8 km^2 (203,940 mi^2) area that includes portions of Illinois, Indiana, Kentucky, Maryland, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (Save Local Waters 2011). Specifically, the project area is situated within Silver-Little Kentucky Watershed cataloguing unit, which forms part of the Lower Ohio-Salt accounting unit. The Lower Ohio-Salt Unit, in turn forms part of the Lower Ohio hydrologic subregion (Environmental Protection Agency 2012). While the project area does not cross any named streams, the western and central portions of Jefferson County are drained by the Harrods, Goose, Beargrass, Fern, Mill, and Pond Creeks. These waterways in turn drain into the Ohio River (Blanford et al. 2007).

Paleo-environment

Environmental conditions in the currently proposed project areas have changed significantly in the last 10 to 20 millennia. From 16,000 to 8000 B.C., i.e., during the terminal years of the Late Pleistocene Epoch, temperatures in Kentucky were much colder than they are today. As a result, the vegetation in this area was dominated by cold tolerant species such as spruce and jack pine. Increasing temperatures and decreasing precipitation during the first millennium of the Holocene, however, led to gradual changes in vegetation regimes. By 8,000 B.C., the spruce and jack pine forests in Kentucky were replaced by mixed hardwoods forests. By 6500 B.C. with the onset of the middle Holocene, the area experienced another vegetational change. As a result of hotter temperatures and drier conditions, wild fires largely destroyed the hardwoods and oaks of the Middle South, and these were replaced by more fire-tolerant pine species. The climate became slightly cooler ca. 2000 B.C. and modern climatic conditions developed between ca. 2000 and 1000 B.C. These changes led to the modern species distributions observed today with pine and oak-hickory forests dominating the southeastern United States (Bense 1994:18-24).

Modern Ecology

A variety of plant and animal species thrive in north-central Kentucky. The biological diversity in this area is due in part to the presence of numerous microhabitats created by variations in relief, landform, soils, hydrologic systems, and geology throughout these areas. Since many plant and animal species are common to the currently proposed project area, the flora and fauna of the overall region is reviewed below.

<u>Flora</u>

While the current project region is named for the Kentucky Bluegrass (*Poa pratensis*), where trees are present, they are dominated by a mixture of short leaf pine (i.e., Virginia Pine), oak, hickory, sassafras, and sweet gum as well as a number of other minor species. Trees common to upland areas are ash, beech, blackgum, black cherry, cucumber tree, dogwood, hawthorn, hickory, hophornbeam, maple, oak, persimmon, pine, redbud, serviceberry, and yellowwood. Wildflowers throughout the project area vicinity include wild ginseng, wild ginger, swamp milkweed, tickseed, aster, and trumpetweed. In addition to bluegrass, other encountered grasses include bluestem, Indian wood-oats, and nodding wild-rye (Petrides 1988; Enature.com 2007; University of Kentucky College of Agriculture 2012).

<u>Fauna</u>

A variety of animal species also are found throughout the project region. Recent repopulation programs have increased the numbers of black bear, elk, and red wolf in the state; white-tail deer also are widespread. Smaller mammals, such as bats, beaver, rabbit, opossum, skunks, and squirrels also are present (Murray State University 2012a). Common bird species include ducks, grouse, wild turkey, loons, cormorant, blue heron, and the turkey vulture (Kentucky Ornithological Society 2009). Fish species include a variety of bass species, catfish, crappie, freshwater drum, gar, shad, shiner, sucker, trout, and walleye (Murray State University 2012b). The principal amphibians and reptiles include frogs, toads, mudpuppys, newts, salamanders, skinks, snakes, including venomous species such as copperheads, and a variety of turtle species. (Murray State University 2012c; Murray State University 2012d).

Climate

The climate of Jefferson County, Kentucky is temperate, with average winter temperatures measuring 1.4^{o} C (34.8 ^{o} F). Average winter daily minimum temperatures measure -3.3 ^{o} C (26.1 ^{o} F), and the coldest day on record was recorded on January 19, 1994, in Louisville. On that day, the temperature dropped to -30 ^{o} C (-22^{o} F). Snowfall during the winter months averages 44.2 cm (17.4 in), with 15 days per year having at least 2.5 cm (1 in) of snow on the ground. The record one-day snow event for the area was recorded on January 17, 1994, when 39.4 cm (15.5 in) of snow fell within the county (Blanford et al. 2007).

Summers (June, July, and August) in the project area are marked by high temperatures and moderate relative humidity. Average summer temperatures approximate 24.4^{o} C (75.9^{o} F), with average daily maximum temperatures measuring 29.9^{o} C (85.9^{o} F). The record high for the county was recorded on July 20, 1999, in Louisville, and measured 41.1 ^{o} C (106^{o} F). Average humidity measures approximately 56 per cent in the afternoon. It rises at night, with the average humidity at dawn totaling 82 per cent (Blanford et al. 2007).

A typical growing season for the project area lasts from April to October, which also coincides with the wet season. A total of 59 per cent (i.e., 66.5 cm [26.2 in])of the rainfall for the year occurs within these seven months. Thunderstorms are common from April to August, and occur on an average of 45 days a year. The heaviest rain total on record occurred on March 1, 1997, when 18.3 cm (7.2 in) of rain were recorded at Louisville (Blanford et al. 2007).

CHAPTER III

PREHISTORIC SETTING

Typically prehistoric archeological research in Kentucky has focused on particular geographical regions, e.g., the Bluegrass, the Eastern Mountains, the Pennyroyal, the Western Coal Fields, and the Jackson Purchase. Prehistoric development within these five regions shows considerable variation, particularly during the later periods of prehistory. Since the currently proposed project lies within the Bluegrass region of Kentucky, this discussion will focus on the prehistoric cultural developments of this region.

Prehistoric Cultural Sequence

The prehistoric culture history of North America typically is divided into a series of developmental stages. Willey and Phillips (1958), for example, define the Lithic, Archaic, and Formative stages to describe the prehistoric cultural developments of native North American groups, while Griffin (1978) and Bense (1994) divide the prehistory of the southeastern United States into a series of temporal stages, i.e., the Paleo-Indian, Archaic, Woodland, and Mississippian stages.

Lewis (1996a) divides the prehistory of Kentucky into five stages: the Paleo-Indian, Archaic, Woodland, Mississippian, and Fort Ancient stages, with Mississippian and Fort Ancient being roughly contemporaneous; he further subdivides each stage into temporal periods, e.g., the Early, Middle, and Late Paleo-Indian periods. These periods can be divided further into horizons, cultures, and phases. Horizons represent widely distributed artifactual and cultural traits that occur over multiple physiographic regions within a given time period, however they typically are not long lasting (Sharp 1996). Cultures and phases are marked by combinations of distinctive artifactual, cultural, mortuary, settlement, and subsistence traits that occur throughout a given period; cultures, however, are associated with larger regions whereas phases are limited to smaller areas or localities (Lewis 1996a; Fagan 2000).

Lewis' (1996a) classificatory scheme, which combines chronological, developmental, and cultural historical frameworks into a syncretic Stage-Period-Horizon/Culture/Phase sequence, is used in this chapter. The following pages provide a discussion of the prehistoric cultural development of Kentucky with emphasis placed on the region encompassing the currently proposed project area.

Paleo-Indian Stage (pre ca. 10,000 - 8000 B.C.)

Current data suggest that the first Native Americans to reach the project region arrived in Kentucky sometime before ca. 10,000 B.C. These immigrants are characterized as migratory hunter/gatherers who most likely specialized in hunting large mammals. Distinctive traits associated with the Paleo-Indian stage include the manufacture of finely made, lanceolate, fluted projectile points; a lithic tool kit designed for hunting animals and processing their remains; and a highly mobile hunting and foraging economy. Current models suggest that the Paleo-Indians were organized at the band level and that social organization within each band was egalitarian. A seasonal subsistence cycle is inferred, however, the details remain to be confirmed through stratigraphic excavation. Since relatively few stratified sites containing Paleo-Indian components have been identified, only limited data currently is available for this stage (Lewis 1996a; Fagan 2000; Bense 1994).

Walthall (1980:35) suggests that the Paleo-Indians were organized at the band level, the least complex of all human socio-political systems. Bands are defined as "groups of loosely related kinsmen who function as an economic and social unit" (Walthall 1980:35). The groups are characterized as mobile hunter/gatherers who move within a given geographic range to exploit available natural resources on a seasonal basis. These Paleo-Indian bands probably contained an average of 25 people. Related bands shared geographic ranges and probably gathered seasonally to exchange goods and to facilitate inter-band marriage (Walthall 1980:35). These settlement systems maintained a fairly low population density, a hypothesis that is consistent with the sparse distribution of Paleo-Indian sites in Kentucky and the southeastern United States (Tankersly 1996).

The Paleo-Indian stage in Kentucky is divided into three temporal periods: the Early (9500-9000 B.C.), Middle (9000-8500 B.C.), and Late (8500-8000 B.C.) periods (Tankersly 1996). This division is based principally on changes in projectile point/knife morphology through time. For example, to the northeast of the project area lies an Early Paleo-Indian kill site at Big Bone Lick in Boone County, which is part of the Big Bone Lick National Register of Historic Places Archaeological District. A number of fluted points have been recovered from the site, which also possess a great number of Pleistocene megafauna remains. In contrast to the large projectile points found at these and other Early Paleo-Indian sites across North America, Middle Paleo-Indian toolkits seem to focus on the production of end and side scrapers. By the Late Paleo-Indian period, a variety of tool types were produced, including a number of differing bifacial and unifacial tools (Tankersly 1996).

The changing toolkit produced by Paleo-Indian peoples likely reflects a changing resource procurement strategy. As Tankersly (1996) points out, the Middle Paleo-Indian period was marked by a change in vegetation. This change may have forced individuals to adopt a broader based diet that included the exploitation of small game, fish, plant foods and large game (Walthall 1980:37). Environmental changes were even more pronounced during the Late Paleo-Indian period, as the end of Ice Age ca. 8500 B.C. marked the end of the megafauna. Diets likely expanded further, as game animals of the Kentucky forests took on a greater role in subsistence (Tankersly 1996).

Archaic Stage (8000 - 1000 B.C.)

The Archaic stage in Kentucky dates from ca. 8000 to 1000 B.C. and it incorporates those prehistoric cultures that developed after the initial peopling of the region and before the rise of the ceramic producing cultures associated with the later Woodland stage. First coined by Ritchie (1932), the Archaic is marked by a number of distinctive cultural and artifactual traits. Archaic stage peoples are characterized generally as migratory hunter/gatherers who exploited a wider range of natural resources, e.g., small game, vegetable foods, and shellfish, when compared with the preceding Paleo-Indian populations (Jefferies 1996; Walthall 1980:38-76; Bense 1994:62-105; Fagan 2000).

Jefferies (1996) divides the Archaic stage into Early (8000-6000 B.C.), Middle (6000-3000 B.C.), and Late (3000 to 1000 B.C.) periods. Within Kentucky, the Archaic can be described as a process from which foraging hunter-gatherers gradually developed into incipient farmers. Likewise, over the course of these seven thousand years, increases in population, social complexity, and technological complexity occur and (Jefferies 1996).

<u>Early Archaic Period (8000 - 6000 B.C.)</u>

The peoples of the Early Archaic are believed to have been hunter/gatherers who focused their subsistence strategy on small game, shellfish, fish, and plant resources. Throughout the eastern United States, including Kentucky, the transition from Late Paleo-Indian to Early Archaic times is hypothesized to have been a gradual process that involved local peoples. This is inferred from similarities observed in Late Paleo-Indian and Early Archaic artifact assemblages, projectile points/knives excluded. The biggest change in tool inventories is associated with projectile point morphology. A variety of new projectile point types (i.e., Kirk and LeCroy), including notched and stemmed varieties, appeared during the Early Archaic and they replaced the earlier lanceolate, fluted point types (Walthall 1980:44-45, 48; Jefferies 1996).

Current models suggest that Early Archaic subsistence was based on hunting, gathering, trapping, and fishing. Collins' (1979) excavations of the Longworth-Gick Site near Louisville indicated that the site was occupied intermittently and its inhabitants augmented their diets with hickory nut, acorn, butternut, black walnut, and persimmon. Data recovered from the various Early Archaic zones represented at the site suggest that in addition to increased artifact diversity towards the end of the Early Archaic period, the use of plant resources also increased with time (Collins 1979; Jefferies 1996).

Additional Early Archaic site data has been recovered at rock shelter sites such as Cloudsplitter. Much like the Longworth-Gick Site, the Early Archaic components identified at the Cloudsplitter Site indicate that the rock shelter was occupied seasonally by small groups of individuals. In contrast to Longworth-Gick, where only one faunal element was recovered, bones from a variety of animals, including deer, elk, beavers, birds, and turtles, were identified (Jefferies 1996).

Very few Early Archaic burials have been identified within Kentucky, which Jefferies (1996) argues is a function of the highly mobile nature of Early Archaic groups. DiBlasi's (1981) investigations at the Ashworth Site, a rockshelter lying south of Louisville, identified a single burial along the rear wall of the shelter. The individual was buried in a flexed position and a projectile point was found within its spine (DiBlasi 1981; Jefferies 1996). At the Lawrence site, two additional individuals were identified. While both individuals were buried with necklaces comprised of domesticated dog and beaver teeth, one of the two individuals was interred with a cache of tools, including points, drills, and scrapers (Jefferies 1996). Jefferies (1996) suggests that the cache may have been intended for use in the afterlife.

<u>Middle Archaic Period (6000 - 4000 B.C.)</u>

The beginning of the Middle Archaic period in Kentucky coincides generally with the Hypsithermal (Altithermal) climatic interval (Walthall 1980). This shift produced a warm, dry climate which enabled the bottomlands of river valleys, such as the Tennessee River Valley, to become dryer and more habitable. In addition, drier conditions facilitated the development of shoal waters which became breeding grounds for freshwater shellfish (Walthall 1980). As Jefferies (1996) points out however, Middle Archaic sites in Kentucky are rare. Most of the knowledge of this period is generated from sites in Tennessee and Illinois (Jefferies 1996).

The environmental changes brought on by the Hypsithermal likely led to a reduction in forests and increase in grasslands (Walthall 1980). Whereas these changes allowed for an increase in sedentism and long-term occupation of sites such as the Reid and Miller Sites, other areas of central Kentucky, such as the Pennyroyal, appear to have been abandoned (Jefferies 1996). In Jefferson County however, access to two diverse ecozones, the Ohio Valley and the Bluegrass, likely allowed for nearly year round habitation by Middle Archaic groups (Jefferies 1996).

Technologically, a number of different types of projectile points, including Morrow Mountain, Matanzas, and Big Sandy II, first appeared during the Middle Archaic (Jefferies 1996). Furthermore, new groundstone tools appeared during this period, indicating an increased reliance on plant foods. Finally, it is likely that the atlatl first appeared during the Middle Archaic, which increased the hunting efficiency of these groups (Fagan 2000).

Many of the data for Middle Archaic burial traditions within the vicinity of the project area comes from the Kyang Site in Jefferson County. A total of 32 individuals were identified at the site and all were interred in a flexed position in bowl shaped burial pits. Grave goods, including bone pins, animal tooth necklaces, and groundstone tools, were found to be distributed equally among all of the interments, which included males, females, adults, and children. These data suggest that little social differentiation existed within the Middle Archaic (Jefferies 1996).

<u>Late Archaic Period (4000 - 1000 B.C.)</u>

Whereas Middle Archaic sites in Jefferson County indicate almost year round occupation, Late Archaic sites in the Bluegrass generally represent short-term occupations restricted to floodplains, uplands, and rockshelters. Fagan (2000) suggests that many of the changes from Middle

Archaic to Late Archaic lifeways are rooted in environmental changes. As sea levels and global temperatures rose during the Late Archaic, humans adapted to these new environments. Likewise, with the rise in population growth during the Middle Archaic, kinship ties between groups allowed for larger settlements and more sedentary lifestyles (Fagan 2000).

As mentioned previously however, the use of intensively occupied village sites in the Bluegrass does not appear to be common. It has been suggested (Jefferies 1996) that the wide scale distribution of both animal and plant resources in this region may have provided so many suitable habitation areas that there was little need to reuse a site, i.e., resources were so abundant that people had more exploitable areas. This is not to say that no sites were reused within the Bluegrass region. At the Zilpo Site in Bath County, Rolingson and Rodeffer (1968) identified a limited range of tool types suggesting that the camp had been used intermittently for a much longer period of time. It is possible however, that the Zilpo Site, found along the eastern margin of the Bluegrass, may have been influenced by the Eastern Mountain groups, who seem to have preferred more long-term site occupations (Jefferies 1996).

The Late Archaic toolkit is impressive for its breadth (Jefferies 1996). A larger range of specialized tools, constructed from stone, bone, and wood appeared during the Late Archaic. Projectile point morphologies evolved to include straight and expanded stems, although corner notched points, such as the Brewerton points recovered by Collins (1979) at the Villier Site. In addition to projectile points, Collins (1979) identified a large percentage of pitted stones and pestles in the lithic artifact sub-assemblage recovered from the Villier Site, which infers an increased reliance on food preparation.

In contrast to the Early and Middle Archaic periods, a significant number of Late Archaic burials have been excavated in Kentucky. Although many of these burials were excavated at the Green River shell mounds located to the southwest of the current project area, they nonetheless shed important light on Late Archaic social complexity. For example, whereas Early and Middle Archaic burials suggest egalitarian societies, burials excavated within the Green River mounds indicate at least incipient social ranking. While the interments of some men and children are buried with a variety of artifacts, other adult burials are interred with a single kind of artifact. In addition, some of the grave goods are of nonlocal materials, such as copper (Jefferies 1996). Not only do these data indicate at least some social stratification, they also reinforce Fagan's (2000) claim of expanded trade and kin networks.

Woodland Stage (1000 B.C. - A.D. 900/1000)

The Woodland stage in Kentucky is marked primarily by the widespread production of pottery, the development of agriculture, a change in subsistence and settlement patterning, the adoption of new technologies, and a change in mortuary ceremonialism. In Kentucky, the Woodland stage is divided into three temporal periods, i.e., Early (1000-200 B.C.), Middle (200 B.C.-A.D. 500), and Late (A.D. 500-1000). Whereas the Early Woodland period spans the time between the introduction and acceptance of pottery to the beginning of the Hopewell culture, the Middle Woodland period equates to Hopewell culture. The Late Woodland marks the transition from the end of Hopewell to the beginning of the Mississippian/Fort Ancient cultures (Railey 1996).

<u>Early Woodland Period (1000-200 B.C.)</u>

The Early Woodland in Kentucky is distinguished primarily by the presence of ceramics (Railey 1996). These early vessels possessed narrow, flat bases typically and exhibited cordmarking and fabric impressions. Vessel shapes were limited generally to conoidal or flowerpot shapes. The oldest identified vessels in Kentucky are classified as Fayette Thick; they are thickwalled and decorations, when present, include cordmarking and fabric impressions. In addition to ceramics, new projectile point types, such as Kramer, Wade, Savannah River, and Adena, appeared (Railey 1996; Collins 1979).

Fagan (2000) notes that population densities increased during the Early Woodland Period. With this increase in population came increased resource pressures. No longer could the Archaic hunter-gatherers exploit large territories, since there was less land to be occupied. As a result, Early Woodland peoples adapted to these changing resource patterns through the cultivation of starchy plants and nuts. Furthermore, evidence from the Salts Cave Site indicated that squash and other gourds also were under cultivation (Railey 1996; Fagan 2000).

Another shift away from Late Archaic lifeways occurred in the treatment of the dead. In contrast to the Green River mounds burials, Early Woodland interments were located away from settlements. These areas likely were assembly areas were different groups would come together to exchange goods, conduct ceremonies, and bury their dead. While non-mound burials are present at the beginning of the Early Woodland Period, by 500 B.C., large burial mounds with earthen and palisaded enclosures appear on the landscape. It is possible that these large ceremonial centers represented territorial boundaries, as different groups competed for resources across the landscape (Railey 1996).

Within the Bluegrass, Early Woodland peoples settled along ridgetops and the Ohio River floodplain. Although exploiting different ecological niches, the settlements and cultural expressions were similar. What does appear to be different is the amount of people living in both types of locales. Whereas Early Woodland peoples at the Falls of the Ohio occupied a substantial base camp/village, sites identified away from the Ohio River indicate that population densities were much lower (Railey 1996).

<u>Middle Woodland Period (200 B.C.-A.D. 500)</u>

As mentioned above, the Middle Woodland Period is synonymous with the Hopewell culture. Contemporaneous with Hopewell, particularly in Central Kentucky, was the Adena culture. Although viewed originally as a predecessor to Hopewell, recent research has shown that Adena likely was a regional expression of Hopewell (Railey 1996).

Middle Woodland ceramics included both conoidal and barrel-shaped jars. In the Bluegrass these vessels generally were undecorated and possessed outflaring, thick rims. As the Middle Woodland progressed, ceramics shift primarily to cordmarked jars with occasional decorations, such as simple stamping, rocker stamping, and complicated stamping. Similarly, Adena projectile points, which persisted from the Early to the Middle Woodland, were phased out in favor of notched and expanded stem points, such as Jacks Reef and Steuben (Railey 1996; Collins 1979).

Middle Woodland subsistence appears to be similar to its Early Woodland predecessor. Collins (1979) identified hickory, walnut, and acorn remains, in addition to fish, including freshwater drum, terrapin, opossum, deer, and turkey remains during the excavations of the Spadie Site in Jefferson County. Railey (1996) adds gourds, sunflowers, maygrass, erect knotweed, little barley, goosefoot, and sumpweed to the Middle Archaic diet, and points out that although maize has not been recovered from Middle Woodland sites in Kentucky, it is presumed to have been under cultivation at this time. He further contends that if maize was present in the diet of Middle Archaic Kentucky individuals, bone chemistry analysis has demonstrated that it was a minor part of the prehistoric diet (Railey 1996).

Although Middle Woodland individuals continued the tradition of burying the dead in ceremonial centers away from villages, they interred their dead exclusively within burial mounds. Adena burial mounds, in particular, display a succession of building episodes. Often circular structures are found beneath the mounds, indicating a progression of burials covered by earthen caps. In addition, log tombs often have been discovered below Adena mounds. A variety of interments, including cremations, bundle burials, and extended inhumations also have been identified within these mounds (Railey 1996).

Adena earthworks are not limited to burial mounds however. Ditched earthworks, enclosing areas both large and small, have been identified at Adena sites. These stockaded enclosures resemble the earthworks found within burial mounds, and Railey (1996) suggests that they served similar functions, i.e., preparation of the dead for burial (Railey 1996).

As the Middle Woodland comes to a close, the construction of large burial mounds declined in frequency, while at the same time, those that were constructed were built on a much smaller scale and included stone within the burial mounds, particularly in the Bluegrass. Additionally, mound centers were constructed closer to habitation sites than in the preceding Early Woodland Period, particularly in the vicinity of the project area. The rise of large, nucleated village sites built closer to mound centers along the middle Ohio Valley and possibly in the Bluegrass likely signaled a change towards increasing ritualization within the village setting (Railey 1996).

Late Woodland Period (A.D. 500-1000)

The Late Woodland can be viewed as the interstitial between the decline of Hopewell/Adena and the rise of Mississippian/Fort Ancient. Fagan (2000) argues that this period is characterized by fixed territories dominated by larger settlements that were densely settled. In Kentucky, earthwork construction and long-distance trade both decline; they are not seen on such a scale again until the beginning of the Mississippian/Fort Ancient Period (Railey 1996). Railey (1996) divides the Late Woodland period in Kentucky into two subunits. The early Late Woodland lasted from approximately A.D. 500 and ended ca. A.D. 800. The terminal Late Woodland began at this point and ended ca. A.D. 1000 in central Kentucky.

Late Woodland peoples continued the Woodland tradition of augmenting a protein based diet with small-scale gardening. It was not until the terminal Late Woodland that maize agriculture became the primary food resource in the region. Tool types remained similar to Middle Archaic toolkits; however decorated Hopewellian ceramics disappear from Late Woodland sites. Ceramic vessel shapes also remained similar, with cooking pots and cordmarked jars being the dominant shape. Beginning in the terminal Late Woodland, regional differences in ceramic styles emerged across the state. Further, the bow and arrow was adopted ca. A.D. 700, and became the primary weapon for hunting. Archeological evidence of the bow is inferred from the recovery of small triangular arrow points, which were markedly different from their predecessors (Railey 1996).

Within the Bluegrass, the Newtown complex forms the basis of Late Woodland Period social organization. Located in the middle Ohio Valley, Newtown sites are recognized by the presence of jars that possessed thick, angular shoulders. Excavated Newtown sites, such as Bentley and Hansen, both located to the east of the current project area, show evidence for multiple oval-shaped houses with exterior rock ovens. In the Bluegrass, Newtown complex sites incorporate both open-air and rockshelter habitations, and demonstrate substantial local variation. Again, by the terminal Late Woodland, the Newtown villages of central Kentucky appear to have been abandoned in favor of a more dispersed settlement pattern. In contrast to the Adena and Hopewell dispersed settlement pattern, terminal Late Woodland peoples did not construct burial mounds or earthworks (Railey 1996).

Mississippian/Fort Ancient Stage (A.D. 1000-1700)

Fagan (2000) indicates that the term "Mississippian" is somewhat difficult to define. It generally refers to a variety of groups throughout southeastern North America that shared complex social and ceremonial customs. These shared customs are expressed in decorative styles and motifs that have been identified on artifacts recovered from sites dating from this stage. Further, the Mississippian peoples show the first clear evidence of ranked societies. Whereas their Archaic and Woodland forbearers likely were egalitarian bands or tribes, chiefdom level societies, with individuals possessed of both achieved and ascribed status, emerged during this time (Fagan 2000). While earlier theories on the development of Mississippian culture focused on interlopers from other regions of North America, current theories indicate that the change from the Late Woodland to the Mississippian was the result of the exchange of people, ideas, and technology by indigenous groups over time (Lewis 1996b).

In Kentucky, Mississippian sites generally are found in the southern and western portion of the state. In these areas, Lewis (1996b) defined two Mississippian sub-units, early Mississippi (A.D. 900-1300) and late Mississippi (A.D. 1300-1700). Although many early Mississippi lifeways likely were present during the Late Woodland, subsistence certainly was different. Mississippi groups practiced large-scale cultivation of maize, and early Mississippi sites show evidence for granaries and associated storage buildings. Likewise, the stone tool assemblage found at these sites consists primarily of chert hoes; when projectile points are recovered, they are rare (Lewis 1996b).

In addition to relying on cultivated crops for food, Mississippian peoples constructed mounds. Typical Mississippian village centers included mound complexes surrounded by a central plaza. Mounds included both platform and burial mounds; the former likely were reserved for high status individuals. Around the plazas, smaller mounds often were present, which in turn were surrounded by other structures, such as houses and storage buildings. These villages typically occupied areas of higher elevation on the landscape; Mississippian sites in Kentucky often can be found along bluffs, terraces, and natural levees. Villages typically were fortified with stockade walls that ringed the town (Lewis 1996b).

The late Mississippi period spans both the greatest fluoresce of Mississippian culture and also its decline. Although late Mississippian lifeways and village organization remained largely unchanged from the early Mississippi, around ca. 1500, many Mississippian sites within Kentucky were abandoned. The reasons behind these large scale site abandonments are unclear at this time. Lewis (1996b) suggests that Native American depopulation in Kentucky likely was the result of introduced European diseases rather than developmental cycles (i.e., tribal cycling [see Parkinson 2002]).

Mississippian sites in the Bluegrass, however, are not as well known. Griffin (1978) indicates that although the Louisville area appears to have been the eastern margin of Mississippian culture in Kentucky, very little data on these sites have been analyzed and/or published. Instead, the dominant cultural group within north-central Kentucky was the contemporaneous Fort Ancient culture, which was spread throughout portions of Kentucky, Indiana, Ohio, and West Virginia (Sharp 1996).

Fort Ancient culture was similar to Mississippian. Villages possessed a central plaza surrounded by houses, and many villages were palisaded. In contrast to Mississippian villages, platform mounds did not occur at Fort Ancient sites. Likewise, there were differences in the styles and decorative techniques used on both ceramics and tools (Sharp 1996). These differences are more prominent early in the Fort Ancient stage, leading Sharp (1996) to suggest that Mississippian and Fort Ancient traditions likely developed from different Late Woodland patterns.

Like their Mississippian contemporaries, Fort Ancient people also relied on a diet based primarily on maize. At some sites though, such as Muir in Jessamine County, evidence of dietary dependence on large game is present in the archeological record. Unlike older cultures, these people did not rely heavily on nuts or aquatic food resources. As the Fort Ancient stage progressed, these individuals became farmers primarily. Large game animals are still present in later Fort Ancient sites, however, suggesting that these resources played an important part in the prehistoric diet (Sharp 1996).

In addition to increased reliance on agriculture over time, mortuary practices also change throughout the Fort Ancient stage. Whereas early Fort Ancient individuals separated their mortuary facilities from the village, as the stage progressed, burials were placed near houses in possible family plots. Furthermore, later burials often are found covered with stone slabs or rock concentrations. Excavated Fort Ancient burials also suggest a less rigid social hierarchy than at Mississippian sites. While Fort Ancient peoples certainly possessed some social differentiation, the distribution of grave goods has not been found to be limited to any particular type of individual (i.e., gender or age based) (Sharp 1996).

The Fort Ancient peoples do appear to have had more interaction with European colonizers, however. Artifacts of European manufacture, such as rifle parts and scissor fragments, have been recovered at the Bentley or Lower Shawneetown Site in Greenup County; European goods are absent from Kentucky Mississippian sites. Although these artifacts have been recovered, a direct connection between Fort Ancient groups and historically documented Native American groups has not yet been completed (Sharp 1996).

As was the case with Mississippian peoples, the arrival of Europeans to North America also led to the downfall of the Fort Ancient culture. Very few Late Fort Ancient/Protohistoric sites have been identified within Kentucky (Henderson 2008). The archeological data suggest that by the seventeenth century, Fort Ancient peoples adjusted their trade networks to focus on Europeans goods. This change led to fierce battles between Native groups, that, when coupled with the introduction of European diseases, opened up the Ohio Valley for European colonization (Sharp 1996). It is likely that the Fort Ancient peoples developed into a number of different historically recognized tribes. Henderson (2008) suggests that the Shawnee and, "Yuchi or Eastern Siouan speakers like the Tutelo," may trace their ancestry to Fort Ancient peoples (Henderson 2008:751).

Chapter IV

History

European Exploration and Colonization 1669-1792

The first Europeans to arrive in what would become Kentucky were French explorers and traders traveling south out of Canada. René-Robert Cavalier, sieur de la Salle explored the Ohio River in 1669, possibly travelling as far as the falls of the Ohio, near the current site of Louisville. Over the following decades the French established numerous military and trading posts in an attempt to secure a claim over the Ohio Valley; at these posts furs were exchanged for European tools, knives, textiles, and firearms (Rice 1993:2-3). None of these posts were established within the boundaries of Kentucky, but the French were nonetheless able to draw Native Americans from throughout the region into political and trade alliances for much of the early eighteenth century.

By the middle of the eighteenth century, however, French control over the Ohio country was being increasingly challenged by English traders moving westward from Pennsylvania and Virginia. Throughout the 1740s Irishman George Croghan dispatched traders throughout the Ohio River valley and southward along the Kentucky River, establishing posts within France's sphere of influence (Rice 1993:4). Other English traders soon followed, and many Native groups were drawn away from the French by the lower cost of the English trade goods. During this period a number of land companies were formed, with the intention of laying claim to Kentucky and the rest of the Ohio River valley. The Ohio Company and Loyal Company – both based in Virginia – sent out expeditions to explore the region in the 1740s and 1750s (Harrison and Klotter 1997:16-17).

The conflict over trade in the Ohio country would directly lead to the outbreak of the French and Indian War (1754-1760), which resulted in the French being expelled from their North American colonies. With the French no longer a threat to English expansion the exploration and settlement of the Ohio country by Anglo-Americans began in earnest. Numerous hunters set out from the Virginia frontier in search of profitable furs, establishing the first English posts within Kentucky (Rice 1993:23-25). Large scale settlement of the area was delayed by the passage of the Proclamation of 1763, which made settlement beyond the Appalachians illegal in an attempt to avoid further conflict with Native Americans.

Within a decade of the Proclamation, however, surveyors traveled to Kentucky with the intention of establishing settlements. The Proclamation had done little to stop the flow of westward settlement, and Lord Dunmore, the governor of Virginia, sought to legitimize the western settlements as well as benefit personally through his association with land speculators (Rice 1993:47-48). One of these surveyors, Thomas Bullitt, led a party of over 30 men to Kentucky in 1773, where he surveyed the area around the Falls of the Ohio that would become Louisville (Harrison and Klotter 1997:18-19). Fincastle County - which included modern Kentucky as well as portions of West Virginia and Virginia – was established at that time. The Shawnee who inhabited the Ohio Valley were increasingly alarmed at the growing number of Euro-Americans moving westward, and tensions soon flared into a conflict known as Lord Dunmore's War. Through much of 1774 the Shawnee fought against forces led by the Virginia governor before finally agreeing to abandon their hunting grounds south of the Ohio River (Rice 1993:68-69). The tentative peace opened the way for Euro-American settlement south of the Ohio, and the first permanent white settlements appeared in 1775; among these early settlements were Harrodsburgh and Boonesborough (Harrison and Klotter 1997:24-28).

Conflict on the Kentucky frontier would reignite with the start of the American Revolutionary War. Many Native American tribes saw the British crown as an important bulwark against encroachment on their lands and chose to support them in their fight against the American rebels. British posts throughout the Great Lakes and Ohio Valley served as bases for Indian and Loyalist raids in Pennsylvania, Virginia, and Kentucky (Rice 1993:86-89). In an effort to defend the Kentucky settlements from such raids the Virginia government dispatched Colonel George Rogers Clark and his "Illinois Regiment" to wrest the region north of the Ohio River from British control. Clark's forces set out early in 1778 and by May they reached the Falls of the Ohio, where Colonel Clark was determined to create a base for his expedition (Yater 1987:3-4). This settlement, located on Corn Island, consisted of a small blockhouse and several cabins; these structures marked the beginnings of Louisville (Yater 1987:4-7). The town was given its name the following year, when it was named after King Louis XVI in honor of the Franco-American alliance.

Colonel Clark was successful in his campaign to capture the British forts north of the Ohio, but British, Indian, and Loyalist raids continued to plague Kentucky for the remainder of the Revolutionary War. Despite the fighting, settlers continued to arrive at Louisville; in 1780 "near 300 large boats . . . arrived this spring at the Falls with families" (Harrison and Klotter 1997:48). In the years that followed the end of the Revolution the population of Kentucky continued to expand rapidly, in a large part spurred on by land warrants given to veterans by the state of Virginia. By 1788 the population totaled approximately 62,000 people, and just two years later it had increased to over 73,000 (Harrison and Klotter 1997:48). Many of the settlers coming to the Louisville area travelled down the Ohio River on large flatboats, and the town soon became a major port for river traffic.

Statehood to the Civil War: 1792-1861

As the population increased so too did the desire for self government, and between the years of 1784 and 1790 nine statehood conventions met in Danville in the hopes of breaking away from Virginia (Coward 1979:6-7). The Virginia Compact, adopted at the ninth convention, helped to enumerate the conditions for Kentucky statehood and the date for its admission into the union was set at June 1, 1792 (Harrison and Klotter 1997:60-61). A tenth and final statehood convention was convened to establish a state constitution and the Commonwealth of Kentucky was admitted to the union as the fifteenth state. Following statehood the population continued to grow rapidly, increasing to over 220,000 by 1800 and 406,000 by 1810 (Harrison and Klotter 1997:48). During the first decades of the nineteenth century Louisville expanded rapidly, growing from 359 residents to over 1,300 between 1800 and 1810 (Yater 1987:33).

In 1828 Louisville became the first city in the commonwealth, with a population of nearly 7,000 residents; this included over 1,000 enslaved African-Americans (Yater 1987:47, 42). Slaves had been present in Kentucky from the beginning of permanent settlement, and the rich agricultural lands in many parts of the state were ideal for plantation agriculture. Most of the slaves in Louisville, however, were engaged in urban work – as domestic servants, drivers, artisans, and boatmen (Kleber 2001:825-826). Louisville also was well known for its numerous slave markets; by the mid-1840s there were 84 slave traders registered in the city (Kleber 2001:826). These markets took advantage of Louisville's position on the Ohio River to ship slaves to the Deep South.

Much of Kentucky's growth was spurred by the opening of the Mississippi and Ohio Rivers to international trade. Kentucky produce was sent down river to New Orleans and beyond, while in Louisville burgeoning shipbuilding and marine insurance industries developed (Yater 1987:32-33). Louisville's preeminence as a port along the Ohio increased in later decades with the introduction of steam ships and the completion of the Portland Canal, which bypassed the Falls in 1830 (Yater 1987:38-39). The city benefited further with the 1850 chartering of the Louisville and Nashville Railroad. In an effort to compete with Cincinnati for southern trade, the city subscribed to over $3 million in stock to fund the railroad's construction. The line reached Nashville in 1859 and cut travel time for freight dramatically reducing the trip from five days by river to approximately twelve hours by rail (Kleber 2001:528-

529). Within a few years the line was extended to connect to Atlanta, Memphis, and New Orleans, making the L&N one of the south's first major rail companies.

Louisville's population grew rapidly in the decades leading up to the American Civil War, and much of that growth was due to immigration. By 1855 nearly half of the city's 60,000 residents were foreign born, mostly German and Irish Catholics (Ramage and Watkins 2011:160). These immigrants often clashed with their largely Protestant neighbors, who feared foreign and Papal influence. This lead to an outburst of nativist violence on August 6, 1855 known as "Bloody Monday," in which Louisville citizens killed over twenty immigrants and burned several Irish homes (Ramage and Watkins 2011:160). Following Bloody Monday much of the anti-immigrant sentiment in Louisville faded as the conflict between the slave and free states heightened.

The Civil War: 1861-1865

In the election of 1860 the citizens of Louisville – and Kentuckians in general - voted overwhelmingly for John Bell and the Constitutional Union party (Ramage and Watkins 2011:57; Kleber 2001:194). As a slave state there was little support for the Republican Party, but most in Louisville disliked the idea of secession and when the Confederate States were formed Kentucky's governor, Beriah Magoffin, sought to remain neutral in the conflict. Southern forces invaded the state in the summer of 1861, causing the legislature to demand that the rebels withdraw; when the rebels failed to do so Kentucky found itself pushed out of neutrality and to the side of the Union (Harrison 1975:12-13). Even before the ultimatum, however, the citizens of Louisville had declared their sentiment for the Union. Although the city had been a major slave trading center during the antebellum years trade had declined in the 1850s, giving way to rapid industrialization and greater ties to the north bank of the Ohio River. By the start of the Civil War slaves made up less than ten percent of the total population in Louisville (Kleber 2001:194). Some of the wealthier citizens identified with the southern cause and several companies of men were raised for Confederate service, but the majority of citizens – especially blue collar workers and immigrants - supported the United States during the conflict (Kleber 2001:194-195). By the end of 1861 over 29,000 Kentuckians were in Union service, over 2,000 from Louisville alone (Harrison 1975:15; Kleber 2001:195). That number that would grow to over 90,000 by war's end, while between 25,000 and 40,000 soldiers served in Confederate armies (Harrison 1975:94-95).

Because of its position on several important river and rail networks, Louisville quickly became the main supply center for Union forces operating in the west. Soldiers and war materiel from the Midwestern states crossed the Ohio River into Louisville and onto the L&N; the railroad made over $6 million during the war in support of Union forces (Kleber 2001:194). General Sherman went as far as to say that "The Atlanta Campaign would simply have been impossible without the use of the railroads from Louisville . . ." (Yater 1987: 94). Camps and hospitals were established throughout the old part of the city, as well as in the suburbs that surrounded the city. Eleven earthen forts ringed the city in an effort to deter any Confederate incursions (Kleber 2001:195-197). The expected Confederate attacks never came, although the surrounding countryside often was targeted by small raids (Harrison and Klotter 1997:202-203).

Post War Recovery: 1865-1900

Although Louisville was spared direct damage during the Civil War it was profoundly affected by the conflict. The war cost nearly 30,000 Kentuckians their lives and millions of dollars were lost in damaged industrial and agricultural products (Harrison and Klotter 1997:215). Because the state remained with the Union it was exempt from the Emancipation Proclamation, and slavery was not outlawed in Kentucky until the passage of the 13th Amendment. Thousands of newly freed African-Americans moved to Louisville in search of economic opportunity (Harrison and Klotter 1997:236). Sectional differences continued as ex-Confederates seeking to escape the reconstruction governments also arrived in the city.

The decades following the Civil War saw an increased dependence on industrial manufacturing in Louisville. Numerous new railroads were built, and in 1870 a bridge spanning the Ohio connected the L&N Railroad with the north (Yater 1987:99-100). Street railroads were built throughout the city to move local produce and serve industrial workers commuting to the numerous new mills and factories; Louisville was a major manufacturing center for steam engines and furniture, as well as "tobacco processing, distilling, leather working, and manufacture of clothing" (Yater 1987:96-98, 102). Economic growth was reflected in the new banks, offices, and municipal buildings that sprang up during the latter decades of the nineteenth century. Louisville showcased its economic growth to the world in 1883 with the opening of the Southern Exposition, attracting millions of visitors through 1887 (Yater 1987:121-122). By 1890 the population of the city had grown to over 161,000 residents (Yater 1987:122).

The city boundaries also expanded during this period, largely to the south and west of the old city. The eastern suburbs were favored by more affluent residents and the areas around St. Matthews, Crescent Hill, and Anchorage developed along the rail line to Lexington, becoming "Louisville's equivalent of Philadelphia's Main Line" (Yater 1987:106-107). The current Factory Lane project area is located between two of these suburbs – Anchorage and Pewee Valley. Initially composed of several scattered farms, by the late nineteenth century Anchorage was home to several prominent Louisville families. Train service to the area was established in 1849 with the construction of the Louisville and Frankfort Railroad and by 1878 the community was incorporated (Kleber 2001:33). Pewee Valley developed much as Anchorage did. For most of the nineteenth century it served as a rural retreat for wealthy citizens, but upon the completion of the L&F Railroad the population expanded to include commuters who worked in the city. In 1870 the town was incorporated and by 1874 the community featured "250 people, three churches, two hotels, four stores, and one doctor" (Kleber 2001:699). Pewee Valley also featured a hotel converted for use by Confederate veterans. Both communities would continue to be popular vacation destinations for wealthy and middleclass residents of Louisville for the remainder of the nineteenth and early twentieth centuries.

Early Twentieth Century Expansion: 1900-1945

In the waning years of the nineteenth century the city of Louisville expanded rapidly, annexing many of the suburban communities that had grown following the war including the eastern suburbs of Clifton, Crescent Hill, and Cherokee Park (Yater 1987:143). In doing so the population of the city surpassed 200,000 residents at the turn of the century. Outside of the city the population also expanded. Electric railroad systems made it easier for workers to live in the suburbs and areas outside the city slowly gained in population (Yater 1987: 146). The electric railroad reached Pewee Valley in 1901, serving the area at half hour intervals (Kleber 2001:699). Author Annie Fellows Johnston and Photographer Kate Matthews lived in Pewee Valley during this period, and both drew inspiration for their work from their quiet suburban surroundings (Kleber 2001: 699). Anchorage continued to grow during this time. Zoning restrictions on commercial development were introduced in 1901 in an effort to preserve the rural character of the town (Kleber 2001:33). In 1914 the Frederick Law Olmsted firm was contracted to provide a plan for community growth, and many stylistic elements were borrowed from the Louisville Park system – also designed by Olmsted (Kleber 2001: 33).

When the United States entered the First World War in 1917 the citizens of Louisville were quick to respond, and over 10,000 local men and women participated in the war effort (Kleber 2001:954). A training facility known as Camp Taylor was formed south of the city and over 150,000 soldiers received training there during the course of the war (Kleber 2001:159). While the war effort claimed 350 soldiers from Louisville and the surrounding communities (Kleber 2001:954), Camp Taylor was hit particularly hard by the Spanish Influenza Pandemic in 1918, and approximately 1,500 soldiers and 500 civilians died of the disease (Kleber 2001:159, 273).

The Great Depression brought unprecedented hardship to Louisville and the surrounding area. Many local banks were closed and major investors such as the L&N Railroad withdrew their funds. Unemployment rose rapidly and in 1932 had reached 23.5 per cent for white residents and 37.2 per cent among African-Americans (Kleber 2001:354). The Great Depression also hampered the outlying suburbs of Louisville, as the number of vacationers dropped dramatically, leading to a decline in passenger rail traffic (Kleber 2001: 699). One Louisville industry that was not affected by the depression was tobacco processing; by 1932 cigarette production was three times greater than pre-depression levels (Yater 1987: 194-195). New Deal programs, as well as the repeal of Prohibition, helped to raise employment through the mid-1930s, but recovery was checked in 1937 by the worst flood in the city's history. In January 1937 extraordinary rainfall caused the Ohio River to rise over forty feet, causing over $50 million in damage and killing ninety residents (Yater 1987:200).

Louisville's recovery was aided greatly by the outbreak of the Second World War. Defense industries sprang up in the area surrounding the city, manufacturing everything from smokeless gunpowder and aircraft to jeeps and ships; The DuPont Corporation also built a number of plants, making the Louisville area the world's largest supplier of synthetic rubber (Kleber 2001:955). Defense industries brought in over 80,000 workers from rural Kentucky and Indiana as well as African-Americans from the rural south, which resulted in severe housing shortages (Kleber 2001:955-956, Yater 1987:210). Thousands of local men enlisted to serve in World War II and many were trained at nearby Fort Knox; unfortunately approximately 1,450 local men lost their lives (Kleber 2001:954).

Post-War to the Modern Day: 1945-Present

The industrial growth spurred on by the war continued to benefit Louisville after the conflict ended. Synthetic rubber was joined by plastics and aluminum manufacturing, and many wartime plants were converted to producing civilian goods (Yater 1987:214-215). Louisville continued to serve as a major transportation hub. By 1950 over 125,000 passengers came through Louisville's airport (Yater 1987:215). Passenger rail service, meanwhile, continued to decline as automobiles became the preferred mode of transportation among Louisville residents. Lloydsboro, a large subdivision in Pewee Valley, was constructed in 1962 to house the increasing number of commuters who sought a suburban lifestyle, and by 1970 the population of the town had reached nearly 1,000 (Kleber 2001:699). Anchorage also grew rapidly due to its suburban location. Between 1977 and 1997 the number of houses in Anchorage doubled, while the population increased to over 2,000 by 1996 (Kleber 2001:33). The increasing number of motorists commuting from the suburbs necessitated the construction of vast new road networks. The Gene Snyder Freeway, located immediately to the west of the current project area, was one of two interstate highways built around the city of Louisville in the late twentieth century. Named after one local congressman, the Snyder Freeway was intended to relieve traffic congestion on Interstate 264 and was completed in 1986 (Kleber 2001:831).

Louisville faced large scale civil unrest during the 1950s and 1960s as the city's African-American citizens struggled for equality. Successful boycotts had desegregated the city streetcars in the 1870s, but African-Americans still faced discrimination in housing, education, and employment. To combat discrimination, a number of organizations were formed in the post-war decades that successfully picketed and boycotted several local businesses and government institutions; School integration began in 1956, and in 1966 Kentucky passed a civil rights law – the first such law in a southern state (Kleber 2001:191).

In recent decades manufacturing has become less important to the growth of the Louisville economy. Between 1963 and 1982 the percentage of workers employed in manufacturing dropped from 42 percent to 26.5 percent (Yater 1987:246). While manufacturing decreased, sectors such as health care, food and beverage services, freight service, and financial services have grown increasingly important to the Louisville region (Kleber 2001:262-264). In 2003 the city merged with Jefferson County, giving the metropolitan area a population of approximately 741,000 inhabitants at the time of the 2010 census (United States Census Bureau 2011).

Chapter V

Previous Investigations

Background Research

A records search was performed to locate data on all archeological sites, cultural resources surveys, and historic standing structures currently on file with the Kentucky Heritage Council in Frankfort, Kentucky and the University of Kentucky, Office of State Archaeology in Lexington. This research also included a review of the online National Register of Historic Places (NRHP) database for listed properties and districts located within the vicinity of the Factory Lane Due Diligence Project. The purpose of this research was to: 1) determine the locations of previously recorded archeological sites and/or standing structures situated within 2.0 km (1.2 mi) of the current project area; 2) to identify and evaluate those portions of the project area that have been the subject of previous archeological or historical survey; 3) to gather information that can be used to develop the archeological context for assessing those cultural resources identified as a result of the subsequent Phase I cultural resources investigation.

Previously Completed Cultural Resources Surveys Situated within 2.0 km (1.2 mi) of the Current Project Area

A total of four previously completed cultural resources investigations were identified within 2.0 km (1.2 mi) of the current project item (Table 5.1). Martin C. Evans of Archaeology Resources Consultant Services, Inc. completed an investigation in 1992. A combination of shovel testing and intensive pedestrian reconnaissance of a proposed Texas Gas Transmission Corporation natural gas mainline expansion failed to identify any cultural resources or evidence of intact cultural deposits. Since no cultural material was identified within the proposed project right-of-way, no additional testing or evaluation of the project areas was recommended (Evans 1992).

A Phase I cultural resources investigation of a proposed mono-pole cell tower site was conducted by Kurt Fiegel in 2000 on behalf of Terracon. The archeological inventory included the examination of a 20 by 20 m (65.6 by 65.6 ft) tower pad and a 400 m (1312.3 ft) long access road. Pedestrian survey and shovel testing failed to identify any cultural material and no archeological sites were identified. No additional archeological investigation of the project items was recommended (Fiegel 2000).

Between September of 2001 and January of 2002, Cultural Resource Analysts, Inc. conducted a Phase I cultural resources survey of proposed new highway right-of-way. The survey, conducted at the request of American Consulting Engineers, and on behalf of the Kentucky Transportation Cabinet, included shovel testing and bucket auguring. A total of eight new archeological sites were identified; these included 15OL122, 15JF689, 15JF690, 15JF691, 15OL123, 15OL124, 15OL125, and 15OL126. Additional testing and evaluation was recommended at only two sites, Site 15JF691, the structural remains of the nineteenth century Woolen Manufactory, and Site 15OL126, a late nineteenth/early twentieth century cemetery. Neither of the two sites fell within the bounds of the examined right-of-way. The remaining six sites were assessed as not eligible for listing on the National Register (Allgood et al. 2002).

Cultural Resource Analysts, Inc. completed a Phase I archeological investigation of a proposed highway alternative in 2004. Field methods included both pedestrian survey and shovel testing. Fieldwork resulted in the recordation of two archeological sites, Sites 15OL129 and 15JF710. Only Site 15OL129, a mid-nineteenth century residence, was recommended for additional testing and evaluation, however. Deep testing of the northern end and southern half of the project area

Table 5.1 Previously completed cultural resources investigations identified within 2.0 km (1.2 mi) of the Project Area.

Report #	Title (Author/Date)	Sponsoring Agency	Contractor	Study Type	Methods	Site(s) / Loci / Structures Identified	Recommendations
014-054	*Phase I Archaeological Reconnaissance on Miscellaneous Tracts on Sections in Jefferson, Oldham, and Breckinridge Counties Kentucky of the Transco/Texas Gas/ CNG Northeastern Project Mainline System Expansion* (Evans 1992)	Texas Gas Transmission Corporation	Archaeology Resources Consultant Services, Inc.	Phase I	Shovel testing and pedestrian survey	N/A	No further investigations recommended
056-200	*An Archaeological Evaluation of the Proposed Heib Concrete Mono-pole Tower Site in Eastern Jefferson County, Kentucky* (Fiegel 2000)	Terracon	Kurt H. Fiegel	Phase I	Shovel testing and pedestrian survey	N/A	No further investigations recommended
056-210	*An Archaeological Reconnaissance Survey of the Proposed Old Henry Road-Crestwood Connector in Jefferson, Oldham, and Shelby Counties, Kentucky (Item No. 5-367.00)* (Allgood et al. 2002)	American Consulting Engineers, PLC	Cultural Resource Analysts, Inc.	Phase I	Shovel testing, pedestrian survey, and bucket augering	Recorded eight sites: 15OL122, 15JF689, 15JF690, 15JF691, 15OL123, 15OL124, 15OL125, and 15OL126	Two sites were recommended for addittional investigations: 15JF691 and 15OL126
056-230	*An Archaeological Survey of the Recommended Alternate of the Proposed Crestwood Connector in Jefferson, Oldham,* and Shel*by Counties, Kentucky (Item No. 5-367.00)* (Cooper and Barber 2005)	American Consulting Engineers, PLC	Cultural Resource Analysts, Inc.	Phase I	Shovel testing and pedestrian survey	Recorded two sites: 15OL129 and 15JF710	A Phase II investigation was recommended for 15OL129. Deep testing was recommneded for the north end and the south half of the project area.

was recommended, since alluvial sediments in those areas were too deep to be sampled through shovel testing (Cooper and Barber 2005).

<u>Previously Recorded Archeological Sites Identified within 2.0 km (1.6 mi) of the Current Project Area</u>

A total of twelve previously recorded archeological sites were identified within 2.0 km (1.2 mi) of the current project area (Table 5.2). The first of these, Site 15JF107, also known as Evans Mound, was located on the floodplain of the Ohio River and was listed as destroyed on the examined site form. Amateur collections likely were made during the late 1800s, and it was reported at that time that human remains, ceramics, projectile points, and other artifacts were present at the site. The cultural affiliation of the once present site is not known, however, since no evidence of the site remains (Office of State Archaeology).

Sites 15JF178 through 15JF181, Factory Lane Sites 1 through 4, were recorded by Granger and DiBlasi in 1975. The four sites were identified on separate hilltops, and were under cultivation at the time of their recordation. While prehistoric artifacts recovered at each site, temporally diagnostic cultural material only originated from Site 15JF178, which was assigned a Middle to Late Archaic period of occupation based on the recovery of a St. Charles projectile point. The data on the examined site forms suggests that additional testing at each site may reveal cultural features. The National Register eligibility of these four sites was not assessed (Granger and DiBlasi 1975).

Site 15JF272 was identified by Granger, McGraw, and Janzen in 1973. Pedestrian survey identified, "several" projectile points dating from the Archaic period (Granger et al. 1973). No subsurface testing was conducted, and the site form indicates that further investigation of the site should be conducted prior to assessing the National Register eligibility of the site (Granger et al. 1973).

Site 15JF689 was recorded by Cultural Resource Analysts, Inc. in 2000 on dissected uplands. The site was classified as a Middle to Late Woodland/Mississippian open habitation site without mounds. The temporal assignation of the site was based upon the recovery of a Lowe Clus-

Table 5.2 Previously recorded archeological sites identified within 2.0 km (1.2 mi) of the Project Area.

Site #	Site Name	Site Type	Affiliation	Topography	NRHP Assessment
Jefferson County					
15JF107	Evans Mound	Mound (destroyed)	Unknown Prehistoric	Floodplain	Not eligible
15JF178	Factory Lane #1	Open habitation w/o mounds	Middle to Late Archaic	Hilltop	Not assessed
15JF179	Factory Lane #2	Open habitation w/o mounds	Unknown Prehistoric	Hilltop	Not assessed
15JF180	Factory Lane #3	Open habitation w/o mounds	Unknown Prehistoric	Hilltop	Not assessed
15JF181	Factory Lane #4	Open habitation w/o mounds	Unknown Prehistoric	Hilltop	Not assessed
15JF272		Open habitation w/o mounds	Archaic	Undissected uplands	Not assessed
15JF689		Open habitation w/o mounds	Middle Woodland; Late Woodland/Mississippian	Dissected uplands	Not eligible
15JF690		Historic farm / residence	Historic Euro-American (1801-1900)	Dissected uplands	Not assessed
15JF691		Historic farm / residence; Industrial	Historic Euro-American (1801-1950)	Dissected uplands	Not assessed
15JF710		Prehistoric Isolated Find; Historic farm / residence	Unknown Prehistoric and Historic Euro-American (1801-2000)	Dissected uplands	Not eligible
Oldham County					
15OL8		Open habitation w/o mounds	Late Woodland/ Mississippian	Undissected uplands	Not assessed
15OL129		Historic farm / residence	Historic Euro-American (1801-1950)	Dissected uplands	Not assessed

ter Hafted Biface. Additionally, lithic debitage and a core also were collected. All of the artifacts recovered from Site 15JF689 originated from the surface of the site. Subsurface testing throughout the site area failed to produce any additional cultural material. Site 15JF689 was assessed as not eligible for inclusion on the National Register of Historic Places due to an absence of intact cultural deposits (Cultural Resource Analysts, Inc. 2000).

Site 15JF690 also was identified by Cultural Resource Analysts, Inc. in 2000. The site consists of structural remains associated with Woolen Manufactory (ca. 1840-1880). The authors derive this conclusion from background research and from the temporally diagnostic stoneware, window glass, black transfer print whiteware, cut nails, and ironstone collected from the site. A probable stone-lined root cellar also was identified along with the remains of a stone foundation. Shovel testing and pedestrian survey identified extensive disturbance (i.e., looting and plowing) throughout the site. The site was assessed as not significant based on an absence of archeological integrity; no further testing or recordation of the site was recommended (Cultural Resource Analysts, Inc. 2000).

In 2001, Cultural Resource Analysts, Inc. identified site 16JF691. The site occupied a side slope within a dissected upland. The site consisted of a partially collapsed springhouse and a stone foundation. Subsurface testing of the site produced no cultural material. Historic map research indicated that the site likely was associated with the Woolen Manufactory (Site 16JF691). The National Register of Historic Places eligibility of the site was not assessed, since the site fell outside of the limits of the proposed highway right-of-way (see above; Cultural Resource Analysts, Inc. 2001).

Site 15JF710 was described as a small scatter of nineteenth and twentieth century historic artifacts; a single prehistoric flake also was recovered from the site. The site was recorded on the ridge of a dissected upland during a 2004 cultural resources survey conducted by Cultural Resource Analysts, Inc. (see above). Shovel testing resulted in the recovery of seven historic artifacts including window glass fragments, blue transfer printed whiteware sherds, and a molded ironstone sherd. A concrete wellhead also was present. The historic scatter likely is associated with a structure that was depicted at this location on historic maps dating from 1858, 1879, and 1931. The structure must have been removed or taken down between 1931 and 1961, since it does not appear on the 1969 USGS map. An absence of artifacts led the site form recorder to assess the site as not eligible for inclusion on the National Register (Cultural Resource Analysts, Inc. 2004).

Site 15OL08 was recorded by Diblasi and Braunbeck in 1977. The site form indicates that the site was identified on a hillside and dates from Late Woodland/Mississippian. The site measured approximately 125 by 75 m (410 by 246 ft), and was covered by woods at the time of its identification. The National Register status of Site 15OL08 was not assessed (Office of State Archaeology).

The final site identified within 2.0 km (1.2 mi) of the project parcel was Site 15OL129. The large nineteenth century site was recorded by Cultural Resource Analysts, Inc. in 2004. Shovel testing across the site area produced 752 historic artifacts, most associated with domestic use. In addition, two features were identified; a possible root cellar or privy and an oxidized area suggesting the remains of a burned structure. Archival data indicated that the property first was owned by James Ward in 1850; however, no structure was present on the 1925 map of Oldham County (Cooper and Barber 2005). Although the National Register status of the site was not assessed, further investigation of the site was recommended to better determine if the site retained integrity (Cultural Resource Analysts, Inc. 2004).

<u>Standing Structures Greater than 50 Years in Age Identified within 2.0 km (1.6 mi) of the Project Area</u>

A total of 19 previously recorded structures greater than 50 years in age were identified during the background research portion of this investigation (Figure 1.2; Table 5.3). Fourteen of the structures were identified within Jefferson County, while the remaining five buildings fell within Oldham County. These resources included 15 residential structures, a barn, a church, a commercial building, and a farm complex. The residential

Table 5.3 Previously recorded structures greater than 50 years in age identified within 2.0 km (1.2 mi) of the Project Area.

Structure #	USGS 7.5' Quadrangle	Address	Type	Style	Construction Date	NHRP Eligibility
Jefferson County						
JF364	Crestwood	Old Henry Road	Residential	No data	No data	Undetermined
JF462	Crestwood	Aiken Rd	Barn	Log pen	No data	Undetermined
JF472	Anchorage	13105 Old Henry Rd	Residential	No data	pre-1879	Undetermined
JF473	Crestwood	14405 Old Henry Rd	Residential	No data	pre-1879	Undetermined
JF475	Anchorage	Old Lagrange Rd At Collins Lane	Commercial	Classical Revival	ca. 1906	Undetermined
JF477	Anchorage	12405 Old Lagrange Rd	Residential	No data	No data	Undetermined
JF478	Anchorage	13204 Factory Lane	Residential	No data	c. 1801-1825	Removed from Natl Reg (NR 1991)
JF479	Anchorage	East Side of Factory Lane	Residential	No data	c. 1810	Undetermined
JF480	Anchorage	12412 Lagrange Rd	Residential	No data	c. 1873	Undetermined
JF481	Anchorage	12518 Lagrange Rd	Residential	No data	ca. 1855	Undetermined
JF482	Anchorage	11210 Lagrange Rd	Residential	No data	pre-1951	Undetermined
JF483	Anchorage	3920 Altawood Rd	Residential	Colonial Revival	c. 1878	Undetermined
JF975	Crestwood	13715 Old Henry Trail	Farm Complex	No data	1900-1924	Undetermined
JF976	Anchorage	13508 Factory Lane	Residential	Craftsman	1900-1924	Undetermined
Oldham County						
OL336	Crestwood	100 Mt Mercy Drive Pewee Valley	Residential	Vernacular	c. 1856	Undetermined
OL341	Crestwood	310 Ash Ave Pewee Valley	Residential	Eclectic	1876-1900	Undetermined
OL342	Crestwood	8712 Ash Ave Pewee Valley	Residential	Eclectic	c. 1900	Undetermined
OL343	Crestwood	Old Floydburg Rd Peewee Valley	Church	Vernacular	1869	Undetermined
OL344	Crestwood	316 Ash Ave Pewee Valley	Residential	Vernacular	1876-1900	Undetermined

structures were classified further as vernacular (n=2; 14.3 per cent), eclectic (n=2; 14.3 per cent), Craftsman (n=1; 7.1 per cent), and Colonial Revival (n=1; 7.1 per cent). No academic style was recorded for the remaining nine residential structures. Two of the residential structures were constructed during the early nineteenth century, one during the middle nineteenth century, four during the late nineteenth century, and one during the early twentieth century; construction dates for the other six structures were not present on the examined structure forms. The non-residential buildings included a vernacular church building constructed in 1869, a Classical Revival style grocery store constructed ca. 1906, a log pen barn with an unknown construction date, and a farm complex of no academic style built between 1900 and 1924. The National Register of Historic Places eligibility was assessed for only one of the identified buildings, i.e., the early nineteenth century residence, the Dorsey-O'Bannon House, was listed on the National Register of Historic Places. It subsequently was removed from the National Register in 1991, as a result of it being moved to a different location.

Properties Listed on the National Register of Historic Places Located Within 2.0 km (1.2 mi) of the Project Area

A total of seven properties listed on the National Register of Historic Places were identified within 2.0 km (1.2 mi) of the project area (Table 5.4). These properties included five individually nominated properties and two National Register districts (Table 5.4). The first of the two districts, the Altawood Historic District, was listed on the National Register on March 13, 2001. The development encompasses 80 buildings, of which 61 are considered contributing elements, and initially developed as a suburb around an interurban

Table 5.4 Properties listed on the National Register of Historic Places identified within 2.0 km (1.2 mi) of the Project Area.

Historic Name	Address	Date Listed on Register	Level of Significance	Area of Significance	Architectural Style
Altawood Historic District	Altawood Ct.	3/13/2001	Local	Community Planning and Development; Transportation	Early 20th century; Bungalow/Craftsman
Ashwood Avenue Historic District	Roughly Ash Ave. from La Grange Rd. to Elm Ave.	8/7/1989	Local	Suburban Development; Architecture	Early 20th century; Colonial Revival-Bungalow/Craftsman-Queen Anne
Bondurant-Hustin House	Mt Mercy Drive Pewee Valley	11/27/1989	Local	Suburban Development; Architecture	Late 19th century; Queen Anne
Forrester-Duvall House	115 Old Forest Rd	11/27/1989	Local	Suburban Development; Architecture	Early 20th century; Bungalow/Craftsman
Tuliphurst	Dogwood Lane Pewee Valley	11/27/1989	Local	Suburban Development, Architecture; Education; Buisness	Mid 19th century; Gothic Revival
Wm A Smith House	Mt Mercy Drive Pewee Valley	11/27/1989	Local	Suburban Development; Architecture	Mid 19th century; Italianate
Otto F Eitel House	1200 Lagrange Rd	11/9/1998	Local	Community Planning and Development Transportation	Early 20th century; Bungalow/Craftsman

railroad line. The period of significance for the district stretches from 1910, when the development was platted, to 1935, when the interurban rail line ceased operations. The district, significant at the local level under Criterion A, was important within the contexts of Community Planning and Development, and Transportation.

The Ashwood Avenue Historic District was listed on the National Register on August 7, 1989. Much like the Altawood District, the Ashwood Avenue District was nominated for its local significance under Criterion A, within the historic context of Suburban Development. The district remains the only area within Pewee Valley that was laid out systematically all at once. The Ashwood Avenue District is small and encompasses only nine buildings, of which seven are considered to be contributing elements. In addition to the district's nomination under Criterion A, it also was nominated under Criterion C for its architectural significance. The seven contributing elements to the district represent important examples of Queen Anne, Colonial Revival, and Bungalow/Craftsman style residences.

The five individual properties listed on the National Register are residences. The Bondurant-Hustin House, is a two-story, wood-framed house built ca. 1885. The residence was built in the Queen Anne style, and is considered to be one of the best examples of Queen Anne-influenced construction in Pewee Valley. The house was listed on the National Register on November 27, 1989, and was found to be locally significant under Criteria A and C. The house was considered significant under Criterion A due to its association with late nineteenth century suburban development. It was considered significant under Criterion C due to its architectural significance as one of the finest examples of a Queen Anne style residence in the area.

The Forrester-Duval House also was listed on the National Register on November 27, 1989. The home was constructed ca. 1908 and is one of the few larger houses that reflects Craftsman-style in Pewee Valley. As was the case with the Bondurant-Hustin House, this dwelling also was found to be locally significant under Criteria A and C. The house was considered significant under Criterion A due to its association with early twentieth century suburban development. It was considered significant under Criterion C due to its architectural significance as one of the few intact Craftsman style residences in the area.

Tuliphurst, a Gothic Revival style dwelling, also was listed on the National Register on November 27, 1989. The residence was built in two different phases, i.e., ca. 1854 and ca. 1865, and has a period of significance that stretches from

1854 to 1904. The house was found to be locally significant under National Register Criteria A, B, and C. Its area of significance under Criteria A is associated with suburban development of Pewee Valley before and after the Civil War. Further, the name "Pewee Valley" to describe the community may have been determined at Tuliphurst by its then owner, Noble Butler. The house also is significant under Criterion B due to its association with the context of education. Not only did Noble Butler name the community, he also was a professor at Louisville College (now the University of Louisville) and authored a number of textbooks that were distributed widely throughout Kentucky. The house also is significant under Criterion B in the area of education. William Hector Dulaney, who purchased the property from Noble Butler, was the president of the Elizabethtown and Paducah Railroad and the Cumberland and Ohio Railroad Company, the director of the Bank of Kentucky, and the president of the Kentucky Board of Managers for the Chicago World's Fair. Finally, the home is significant under Criterion C since it represents the best extant Gothic Revival residence within Oldham County.

The William Alexander Smith House is a single dwelling constructed in the Italianate style ca. 1860. Much like the other residences, this house also was listed on the National Register on November 27, 1989. The period of significance associated with the house spans the period 1860 to 1917, and it was found to be significant under Criteria A, B, and C. It was nominated under Criterion A for its association with suburban development that occurred prior to the Civil War; it is one of only three remaining houses from the period. The property was nominated under Criterion B for its association with Henry S. Smith, who not only built the house, but also was one of the largest landowners in the area. Finally, the house was nominated under Criterion C due to its importance as one of a group of Italianate style homes within Pewee Valley. Italianate style buildings are found infrequently in other parts of Oldham County.

The Otto F. Eitel House, a Bungalow/Craftsman-style home, was built in 1907. The house was listed on the National Register on November 9, 1998, and nominated under Criterion A for its local significance in the areas of community planning and development, and transportation. Unlike the similar nomination for the Altawood Historic District described above, the nomination of the Otto F. Eitel House is specific to this particular rail-related property type. Since Otto Eitel constructed this dwelling as a response to the establishment of the interurban railroad line that was installed through this portion of the county, and the house maintains much of its original integrity, it met the requirements set forth by the Kentucky Heritage Commission for eligible residential rail-related properties.

Chapter VI

Methodology

This chapter describes the field methodologies used to complete the archeological inventory of the proposed 41.3 ha (102 ac) Factory Lane Project Area in Jefferson County, Kentucky (Figure 1.2). It also includes information pertaining to the analysis of the recovered artifacts and the curation of the cultural material, and the maps, photos, and records generated by this investigation.

Field Methodology

This archeological survey was designed to identify and to evaluate all cultural resources, i.e., archeological sites, cultural resources loci, and cemeteries, situated within and immediately adjacent to the study area for the Factory Lane Area Project. Prior to initiating fieldwork for the project, cartographic, archival, and archeological review of data pertaining to the cultural resources recorded previously within or immediately adjacent to the proposed project area was undertaken (see Chapter V). Both pedestrian survey and systematic subsurface testing was undertaken throughout all portions of the project area to identify any cultural resources lying within the limits of the area under investigation. This cultural resources survey also included procedures designed to evaluate on a preliminarily level, all standing structures 50 years in age or older that fell within or immediately adjacent to the proposed Factory Lane Area Project area. No such structures were located.

Before survey was initiated, the project parcel was identified, assigned an area designation, and assessed in terms of its likelihood to contain intact cultural deposits. Survey crews were equipped with sub-meter accurate Trimble GPS units to record precisely the beginning and ending point of each survey transect extending through the project parcel. Fieldwork included a visual assessment of all ground surfaces and shovel testing to assess the distribution of cultural material and intact cultural deposits throughout the project area. Locations of survey transects and shovel tests, changes in vegetation and topography, as well as the presence of natural or artificial features were recorded on shovel test and area record forms.

This Phase I cultural resources investigation conformed to guidelines promulgated by the Kentucky Heritage Council (Sanders 2006). This archeological inventory was based on methodologies that provided consistency, quality control, and the precise recordation of all cultural resources located during survey.

<u>Pedestrian Survey and Shovel Testing</u>

This included pedestrian reconnaissance augmented with a stratified, systematic, subsurface testing regime. Transect survey was utilized to assure adequate coverage throughout the proposed project area. Shovel tests were excavated at 20 m (65.6 ft) intervals along survey transects spaced 20 m (65.6 ft) apart (See Figures 7.1 and 7.2). All shovel tests measured approximately 30 cm (11.8 in) in diameter and each was excavated to culturally sterile subsoil or bedrock. All shovel test fill was screened through 0.64 cm (0.25 in) hardware cloth, and each shovel test was excavated in 10 cm (3.9 in) artificial levels within natural strata, and the fill from each level was screened separately. Munsell Soil Color Charts were used to record soil color, soil texture, and other identifiable characteristics were recorded using standard soils nomenclature. All shovel tests were backfilled immediately upon completion of the archeological recordation process.

Site Recordation and Delineation

All cultural resources identified during survey were examined to ascertain the nature, size, depth, integrity, age, and affiliation of the cultural deposits. Delineation was used to assess the stratigraphic placement, density, and research potential of each identified site. This information was used to assist in the subsequent assessment of whether or not a site was considered not significant, potentially significant or significant by applying the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). Archeological site recordation included a combination of the following: (1) establishment of a site datum; (2) intensive surface reconnaissance of the site area; and (3) excavation of tightly spaced shovel tests along rays emanating from datum to delineate both the horizontal and vertical extent of the site and its configuration. Delineation shovel tests were excavated at 10 m (32.8 ft) intervals across the site area.

Laboratory Analysis

Laboratory analysis of all recovered cultural material followed established archeological protocols. All field specimen bag proveniences first were crosschecked against the field notes and the specimens inventoried for accuracy and completeness. Following this quality-control process, all recovered material was washed by hand, air-dried, sorted into basic material categories, and then encoded into computerized site catalogs which allowed for further manipulation of the data. The nature and structure of the analyses were guided by the goals of the project. The first requirement of the research was to determine whether or not a cultural resources locus had the potential to meet the legal definition of an historic property. Therefore, particular care was taken to observe and record any chronologically sensitive attributes associated with the historic artifacts, and to evaluate, for example, whether or not the material was more than 50 years in age.

Beyond the determination of minimum age, the artifact analysis consisted of making and recording a series of observations for each specimen. The observations were chosen to provide the most significant and diagnostic information available about each specimen. Three separate relational databases were used to store, organize, and manipulate the data generated by the analytical process. Separate databases were used for analyzing the prehistoric lithics, prehistoric ceramics, and historic artifacts recovered as a result of this investigation. The use of the various databases reflected the differences in the analytical protocols required to study thoroughly the different types of material.

<u>Historic/Modern Cultural Material Analysis</u>

The analysis of the historic/modern cultural material was organized by class, functional group, type, and subtype. The first level, class, represented the material category, e.g., ceramic, glass, or metal. The second level, functional group (e.g., architecture, kitchen, or personal) was based on generally accepted classifications. The third and fourth levels, type and subtype, were constructed to describe more precisely the temporally and/or functionally diagnostic attributes. The identification of artifacts was aided by consulting a number of standard reference works, e.g. Coates and Thomas (1990), Fike (1987), Florence (1990), Jones and Sullivan (1985), Kovel and Kovel (1986), Miller (1980, 1991), Miller et al. (2000), Nelson (1968), South (1977), Speer (1979), Switzer (1974), Toulouse (1971, 1977), and Wilson (1981), associated with a particular artifact.

<u>Prehistoric Lithic Analysis</u>

The lithic analysis protocol was a “technological” or “functional” one designed to identify prehistoric reduction trajectories, lithic industries, and tool functions. The protocol therefore focused on recording technological characteristics associated with the recovered lithic artifacts. The lithic artifact database was organized by lithic material group, type, and subtype. The first level was used to record the raw material type of the artifact being examined. Lithic materials were classified utilizing recognized geological descriptions and terminologies, and with the use of type specimens of a known source. The lithic raw material was divided into distinct categories based on three factors: texture, color, and translucence. The second analysis level, type, was used to define the general class, e.g., unmodified flake, core, or preform, of lithic artifact, while the last level, subtype, was employed to specify morphological attributes, e.g., primary cortex, extensively reduced, or corner-notched. Typological identifications for temporally and regionally diagnostic tools also was included in the analysis; such identifications were made by referencing established local and regional lithic artifact typologies.

Curation

After the final report has been accepted, all cultural material, drawings, maps, photographs, and field notes will be curated with the Program of Archaeology at the University of Louisville in the curation facility located at:

Archaeology MS 04-14
University Of Louisville
Louisville, Kentucky 40292-0414

Chapter VII

Results of the Field Investigations

Introduction

The Phase I archeological inventory of the Factory Lane Due Diligence project items was designed to investigate two parcels that totaled 41.3 ha (102 ac) in area; both are located in Jefferson County, Kentucky (Figures 1.2, 7.1, and 7.2). The current investigation resulted in the identification of three cultural resources, Site 15JF810 and two non site archeological loci (FLS-B-01 and FLS-B-02), within the limits of the two project parcels. A description of the project items and the identified cultural resources is below.

Factory Lane Area A

The Factory Lane Area A (FLS-A) Project Parcel was irregular in shape and measured approximately 600 m (1968.5 ft) in width by 600 m (1968.5 ft) in length. While the northern, western, and eastern boundaries of the parcel were demarcated by fences, the southern boundary was an arbitrary division within the larger parcel. The parcel consisted primarily of fallow corn field, although hardwoods and grasses were scattered throughout the northwestern quadrant of the area (Figure 7.3). The parcel was located in an area characterized by dissected uplands and project elevations ranged from 222 to 229 m (730 to 750 ft) NGVD.

A total of 545 shovel tests were excavated at 20 m (65.6 ft) intervals along 32 survey transects spaced 20 m (65.6 ft) apart (Figure 7.1). A typical shovel test excavated within the project parcel measured 30 cm (11.8 in) in diameter and it exhibited two strata in profile (Figure 7.4). Stratum I, a dark yellowish brown (10YR 4/4) silty clay loam, extended from the surface to a depth of 15 cm (5.9 in) below surface (bs). Stratum II, a strong brown (7.5YR 5/6) silty clay, extended from the base of Stratum I to the base of excavations at 50 cmbs (19.7 inbs).

During this investigation, Site 15JF810, a low-density scatter of late nineteenth to early twentieth century artifacts was identified within the northwestern quarter of the project parcel (Figures 1.2, 7.1, and 7.5).The site measured approximately 80 m (262.5 ft) in width by 90 m (295.3 ft) in length. The site was identified in an upland area covered by grasses and hardwood trees and at an elevation of 226 m (740 ft) NGVD (Figure 7.6). The site was bounded to the north by Factory Lane Road, and observed slopes were characterized as less than five per cent.

A total of 111 shovel tests were excavated within the general vicinity of the site, and 12 of these produced cultural material. A typical shovel test excavated within the boundaries of the site measured 30 cm (11.8 in) in diameter and exhibited three strata in profile (Figure 7.7). Stratum I, a brown (10YR 4/3) silt loam, extended from the surface to a depth of 15 cmbs (5.9 inbs). Stratum II was characterized as a strong brown (7.5YR 5/3) silty clay that extended from the base of Stratum II to a depth of 35 cmbs (13.8 inbs). Stratum III, the basal stratum, continued to the base of excavations, i.e., to 50 cmbs (19.7 inbs) and was described as a deposit of very dark brown (10YR 2/2) silty clay loam.

The examination of Site 15JF810 resulted in the recovery of 39 historic artifacts (Table 7.1) and a single faunal element from a domestic cat (Table 7.2). Historic artifacts were recovered from the ground surface (n=1), Stratum I (n=25), Stratum II (n=10), and Stratum III (n=3). Artifacts originating from Stratum I included 14 historic ceramic sherds, 8 glass shards, and 3 metal artifacts. The eight historic ceramic sherds were characterized as three undecorated soft-paste porcelain ceramic sherds (ca. 1850-present, Markell et al. 1999), two undecorated whiteware ceramic sherds (ca. 1820-present, Miller et al. 2000), two undecorated yelloware ceramic sherds (ca. 1830-

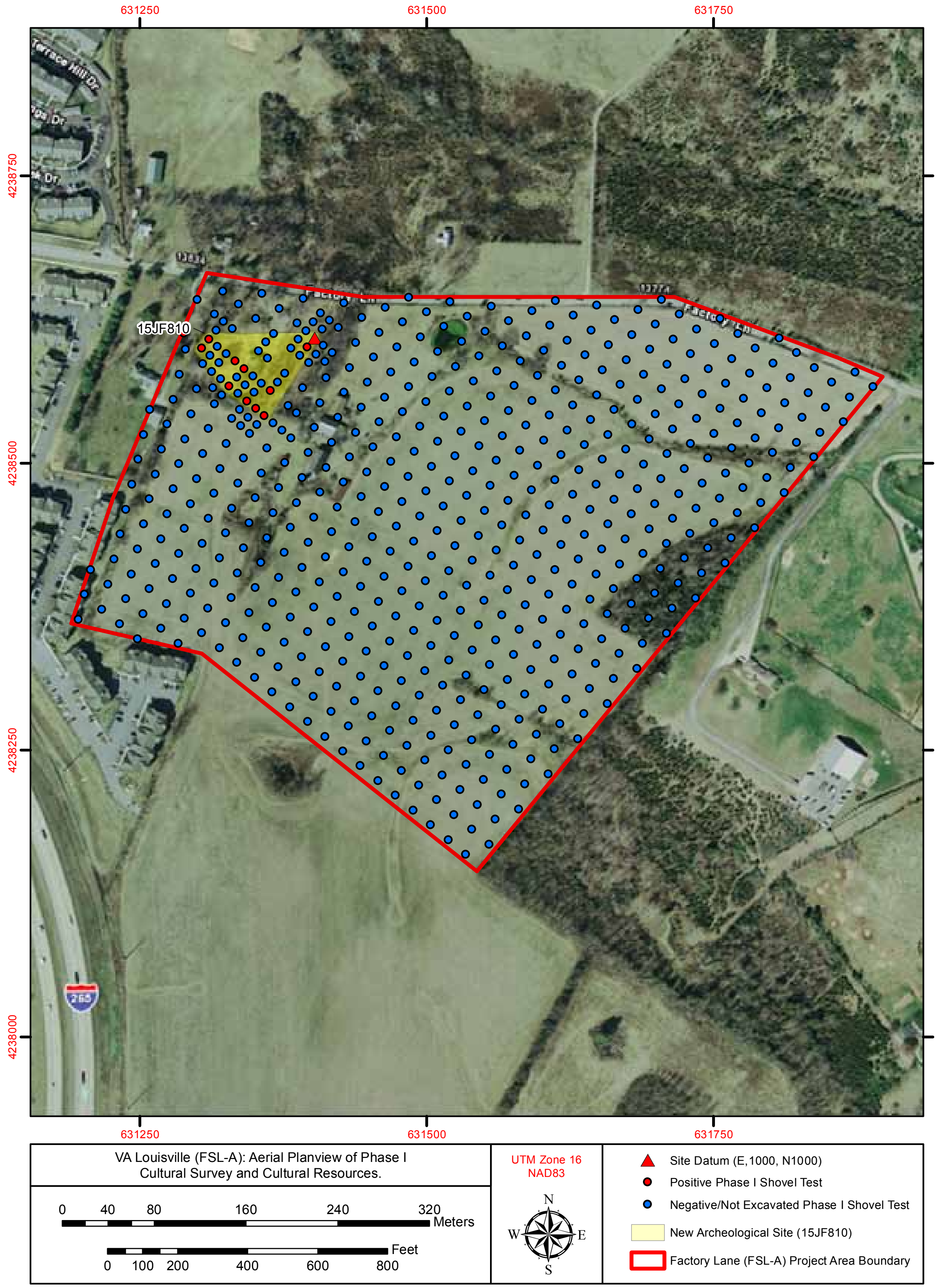

Figure 7.1 **Aerial photograph depicting the locations of survey transects and shovel tests within FSL-A.**

Figure 7.2 **Aerial photograph depicting the locations of survey transects and shovel tests within FSL-B.**

Figure 7.3 Overview photograph of the FSL-A Project Area facing north.

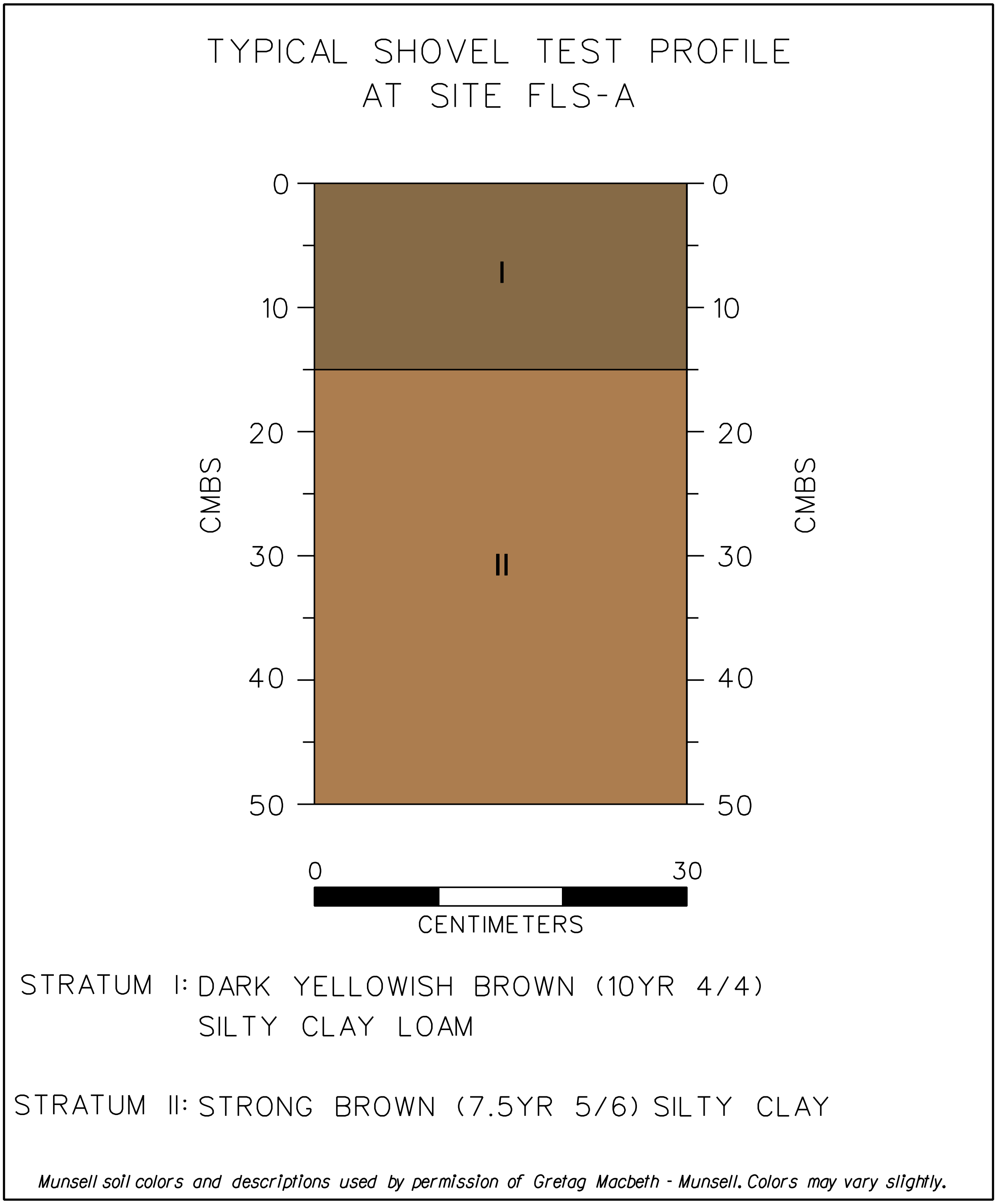

Figure 7.4 Typical shovel test profile identified within the FLS-A Project Area.

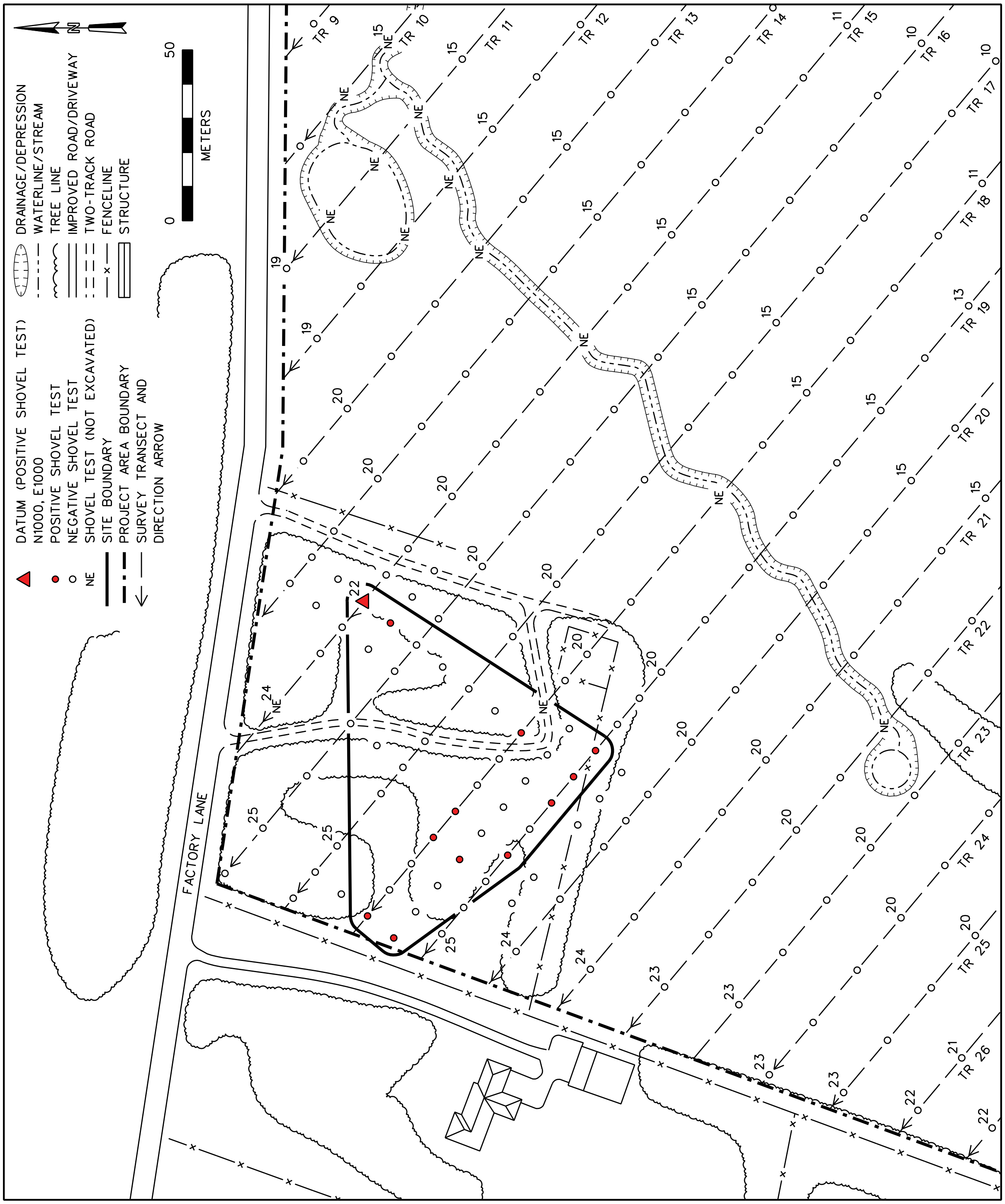

Figure 7.5 **Planview drawing of Site 15JF810.**

Figure 7.6 Overview photograph of Site 15JF810 facing southeast.

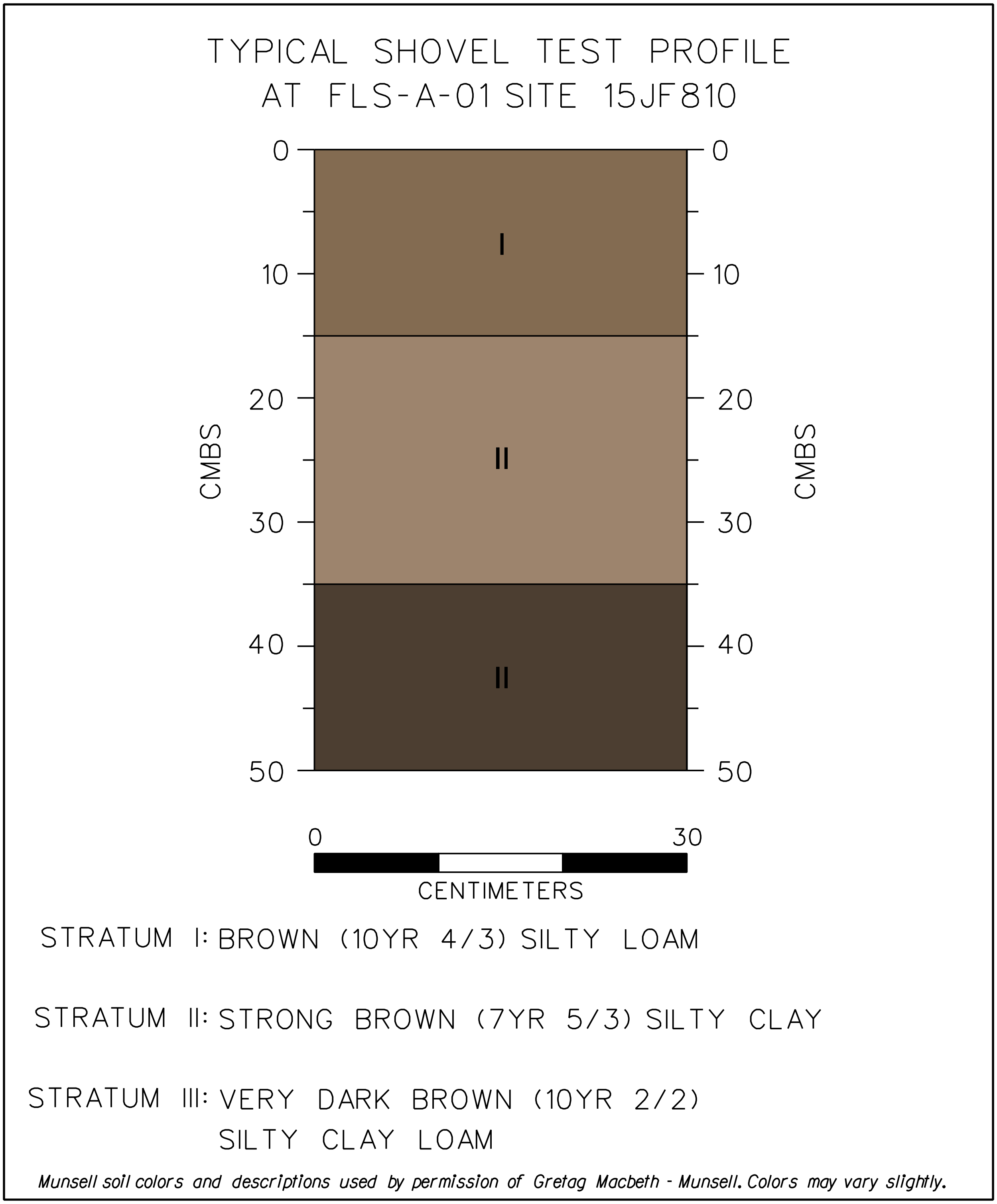

Figure 7.7 **Typical shovel test profile identified at Site 15JF810.**

Table 7.1 Historic artifacts recovered from Site 15JF810.

Stratum	Material Class	Material Category	Form	Type	Subtype	Decorative Class	Additional Diagnostic Trait(s)	Count
Surface Collection	Ceramic	Refined Earthenware	Holloware	Whiteware	n/a	Plain/Undecorated	n/a	1
I	Ceramic	Porcelaneous Ware	Container	Soft-paste	n/a	Plain/Undecorated	n/a	2
			Flat	Soft-paste	n/a	Plain/Undecorated	n/a	1
		Refined Earthenware	Container	Whiteware	n/a	Plain/Undecorated	n/a	1
			Holloware	Whiteware	n/a	Plain/Undecorated	n/a	1
				Yelloware	n/a	Plain/Undecorated	n/a	2
		Stoneware	Holloware	Gray-Bodied	Unidentified Glaze	Stamped	n/a	1
				Light-Bodied	Unidentified Glaze	Indeterminate	n/a	1
		Unrefined Earthenware	Container	Terracota	Unglazed	Plain/Undecorated	n/a	5
	Glass	Aqua (Light Blue/Light Green)	Bottle	Indeterminate	Indeterminate	Plain/Undecorated	n/a	1
			Container	Indeterminate	Indeterminate	Plain/Undecorated	n/a	1
			Indeterminate	Indeterminate	Indeterminate	Plain/Undecorated	n/a	1
			Window	Indeterminate	n/a	n/a	n/a	4
		Colorless	Container	Indeterminate	Indeterminate	Plain/Undecorated	Continuous Threaded Finish	1
	Metal	Ferrous	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	1
			Nail	Cut	Not Clinched	n/a	n/a	1
				Indeterminate	Clinched	n/a	n/a	1
II	Glass	Aqua (Light Blue/Light Green)	Indeterminate	Indeterminate	Indeterminate	Plain/Undecorated	n/a	1
			Window	Indeterminate	n/a	n/a	n/a	2
		Colorless	Bottle	Indeterminate	Indeterminate	Plain/Undecorated	n/a	1
			Container	Indeterminate	Indeterminate	Layered Glass	Red/Maroon Decoration	1
						Plain/Undecorated	n/a	1
	Metal	Cupreous	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	1
		Ferrous	Nail	Cut	Not Clinched	n/a	n/a	1
				Indeterminate	Clinched	n/a	n/a	1
					Indeterminate	n/a	n/a	1
III	Ceramic	Unrefined Earthenware	Holloware	Terracota	n/a	Plain/Undecorated	n/a	1
	Glass	Aqua (Light Blue/Light Green)	Window	Indeterminate	n/a	n/a	n/a	2
Grand Total								**39**

Table 7.2 Faunal element recovered from Site 15JF810.

Stratum	Common Name	Element	Count
I	Domestic cat	Mandible	1
Grand Total			**1**

1940, Miller et al. 2000), two untyped stoneware ceramic sherds including one stamped rim (Figure 7.8), and five terracotta ceramic sherds. The eight glass artifacts included four pieces of aqua window glass, two pieces of aqua bottle/container glass, one unidentified piece of aqua glass and one colorless continuous threaded bottle finish (ca. 1919-present, Miller et al. 2000). Metal artifacts from Stratum I consisted of an unidentified ferrous object, a single cut nail (ca. 1790-1890, Miller et al. 2000; Markell et al. 1999), and one untyped nail fragment.

Historic material recovered from Stratum II consisted of six glass artifacts, and four metal artifacts. The six glass artifacts consisted of two pieces of aqua window glass, one unidentified piece of aqua glass, two pieces of colorless bottle/container glass, and one piece of layered glass with a red decoration. Metal artifacts recovered from Stratum II consisted of one unidentified cupreous object, one cut nail (ca. 1790-1890, Miller et al. 2000; Markell et al. 1999), and two untyped nail fragments. Artifacts originating from Stratum III consisted of a single terracotta ceramic sherd and of two shards of aqua window glass.

Site 15JF810 consists of a low density scatter of late nineteenth to early twentieth century artifacts. Aerial photography and informant interviews indicated that a residence stood at this location as recently as 2010. Mr. Jones suggested that the house may have dated from the early 1900s and belonged to the Clemmons family. Historic United States Geological Survey Quadrangles from 1932 and 1951 depict a structure at this location, and remnants of the gravel driveway and power pole that once provided electricity to the house remain extant (Figures 7.9 and 7.10). Mr. Jones indicated that the house was destroyed recently, and the area bulldozed, grubbed, and graded. The paucity of artifacts recovered from depth demonstrates that the site lacks stratigraphic integrity. Further, the limited amount of

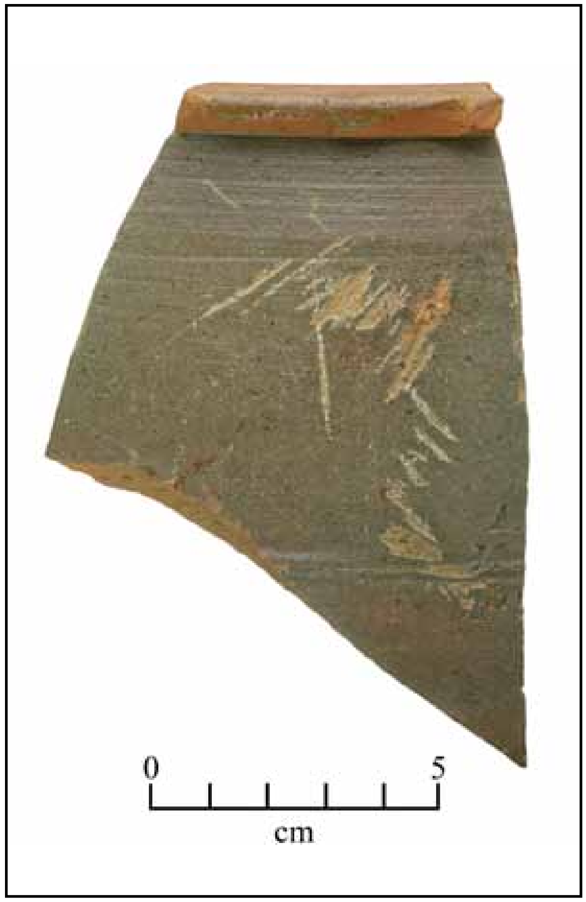

Figure 7.8 Stamped stoneware ceramic sherd recovered from Site 15JF810, FS# FLS-07.

material recovered during survey coupled with an absence of cultural features demonstrates that the site does not possess research potential. Site 15JF810 does not possess those qualities of significance and integrity as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). No further investigation of Site 15JF810 is recommended.

Factory Lane Area B

The Factory Lane Area B (FLS-B) Project Parcel was irregular in shape and measured approximately 417 m (1368.1 ft) in width by 900 m (2952.8 ft) in length. While the southern, western, and eastern boundaries of the parcel were demarcated by fences, the northern boundary was an arbitrary division within the larger parcel. The parcel consisted of fallow corn field (Figure 7.11) characterized by dissected uplands; elevations

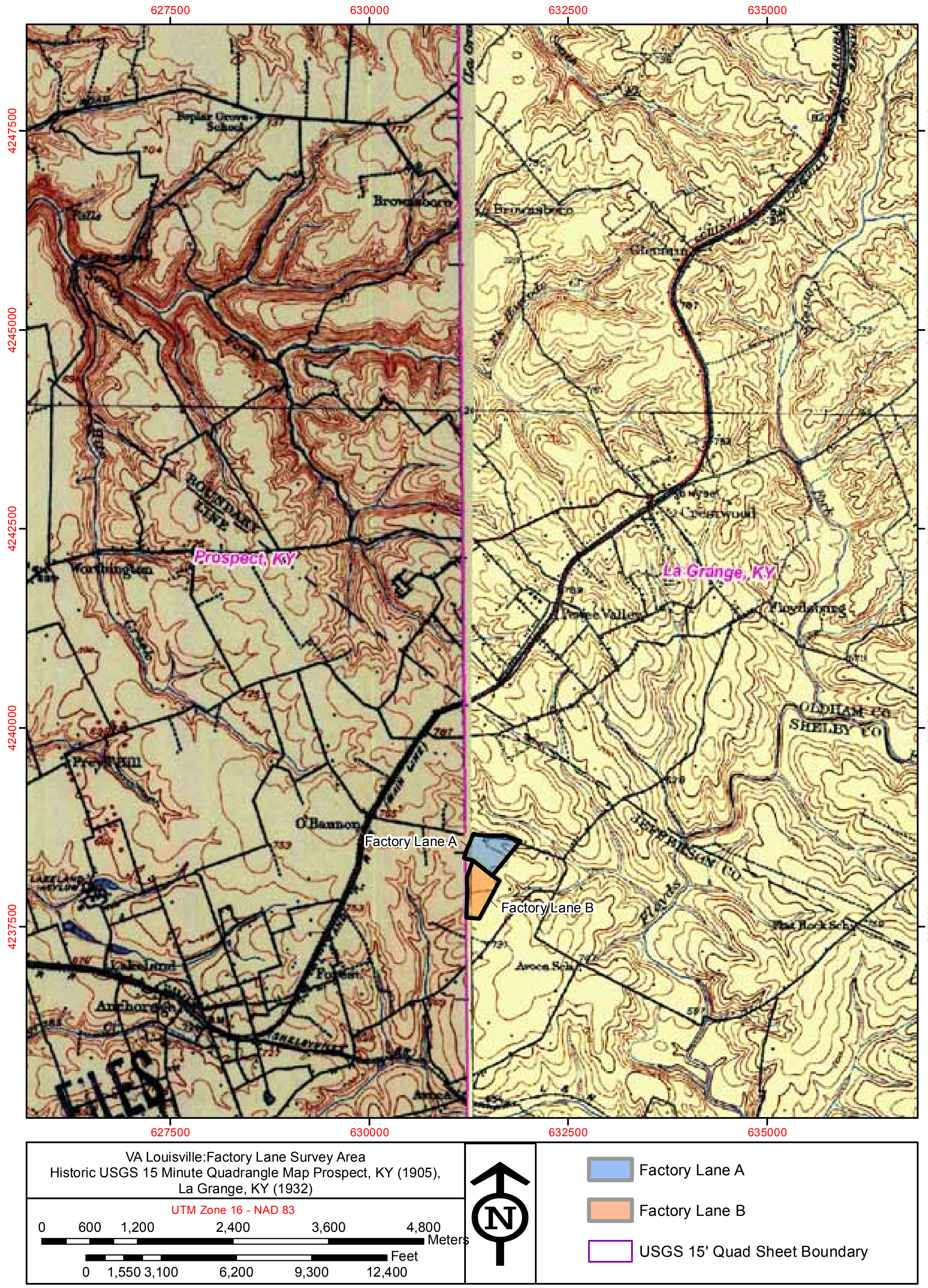

Figure 7.9 Excerpt from the 1932 LaGrange, KY USGS 15' quadrangle depicting the project area.

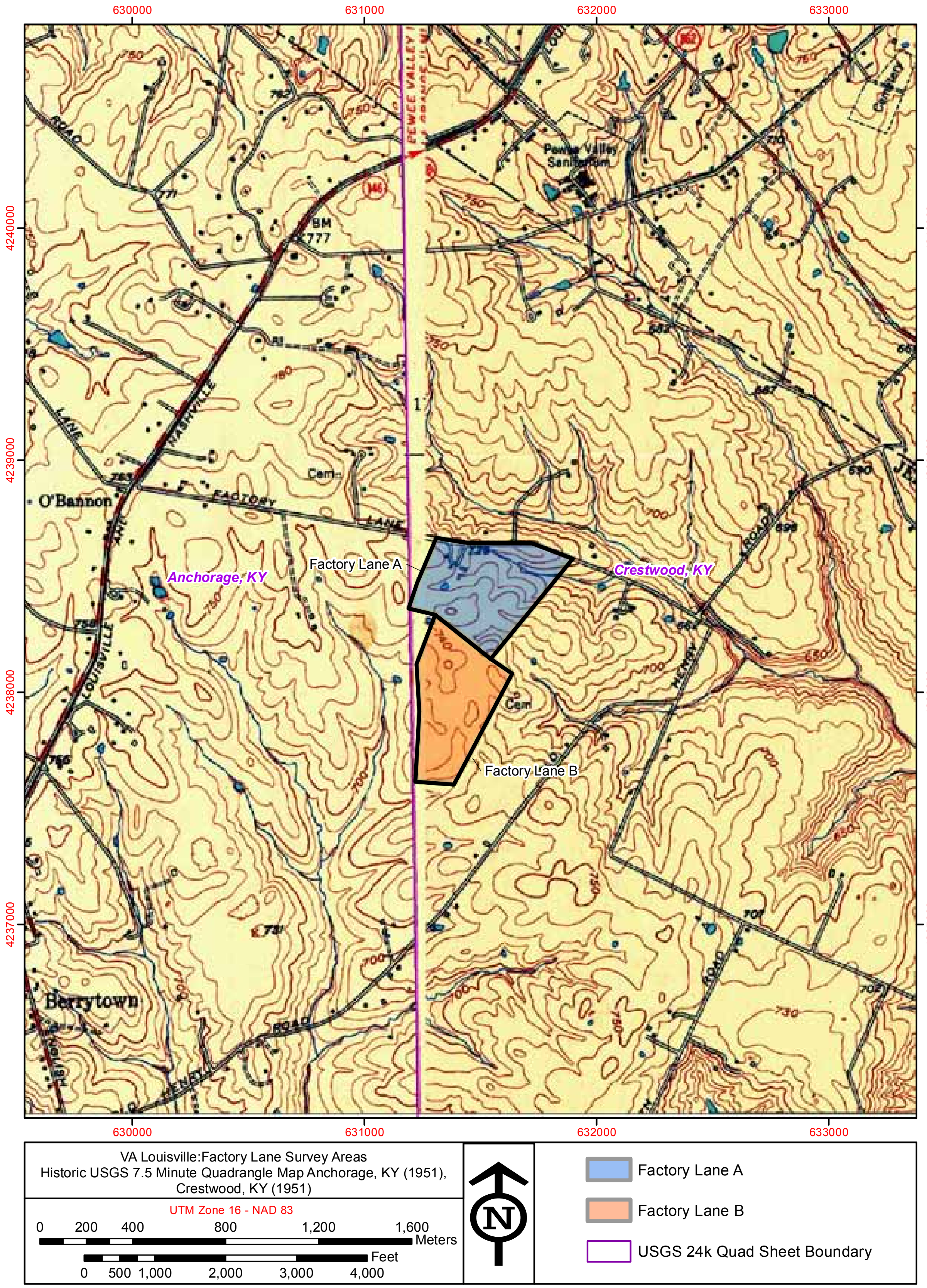

Figure 7.10 Excerpt from the 1951 Crestwood, KY USGS 7.5' quadrangle depicting the project area.

Figure 7.11 Overview photograph of the FSL-B Project Area facing southwest.

throughout the area ranged from 222 to 229 m (730 to 750 ft) NGVD. A total of two non site cultural resources (FLS-B-01 and FLS-B-02) were identified during survey of the Factory Lane Area B project item.

A total of 513 shovel tests were excavated within this parcel. Shovel testing was conducted at 20 m (65.6 ft) intervals along 37 survey transects spaced 20 m (65.6 ft) apart (Figure 7.2). A typical shovel test excavated within the project parcel measured 30 cm (11.8 in) in diameter and it exhibited two strata in profile (Figure 7.12). Stratum I, a brown (10YR 4/3) silty clay loam, extended from the surface to a depth of 20 cm (7.9 in) below surface (bs). Stratum II was characterized i as a strong brown (7.5YR 5/6) silty clay that extended from the base of Stratum I to the base of excavations at 50 cmbs (19.7 inbs).

Locus FLS-B-01

Locus FLS-B-01 was identified at Shovel Test 5, Survey Transect 16 (Figures 7.13 and 7.14). A single lithic flake was recovered from this shovel test. A total of 32 additional shovel tests were excavated to delineate the boundaries of Locus FLS-B-01, however no additional cultural material was identified.

The paucity of cultural material and an absence of intact cultural deposits/features demonstrates that Locus FLS-B-01 does not warrant archeological site status and has no research potential. Locus FLS-B-01 does not possess those qualities of significance and integrity as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). No additional investigation of this non-site cultural resource is recommended.

Locus FLS-B-02

Locus FLS-B-02 was identified at Shovel Test 6 Survey Transect 27 (Figures 7.15 and 7.16). A single edge-modified flake was recovered from Stratum II of this shovel test. A total of 32 additional shovel tests were excavated to delineate the

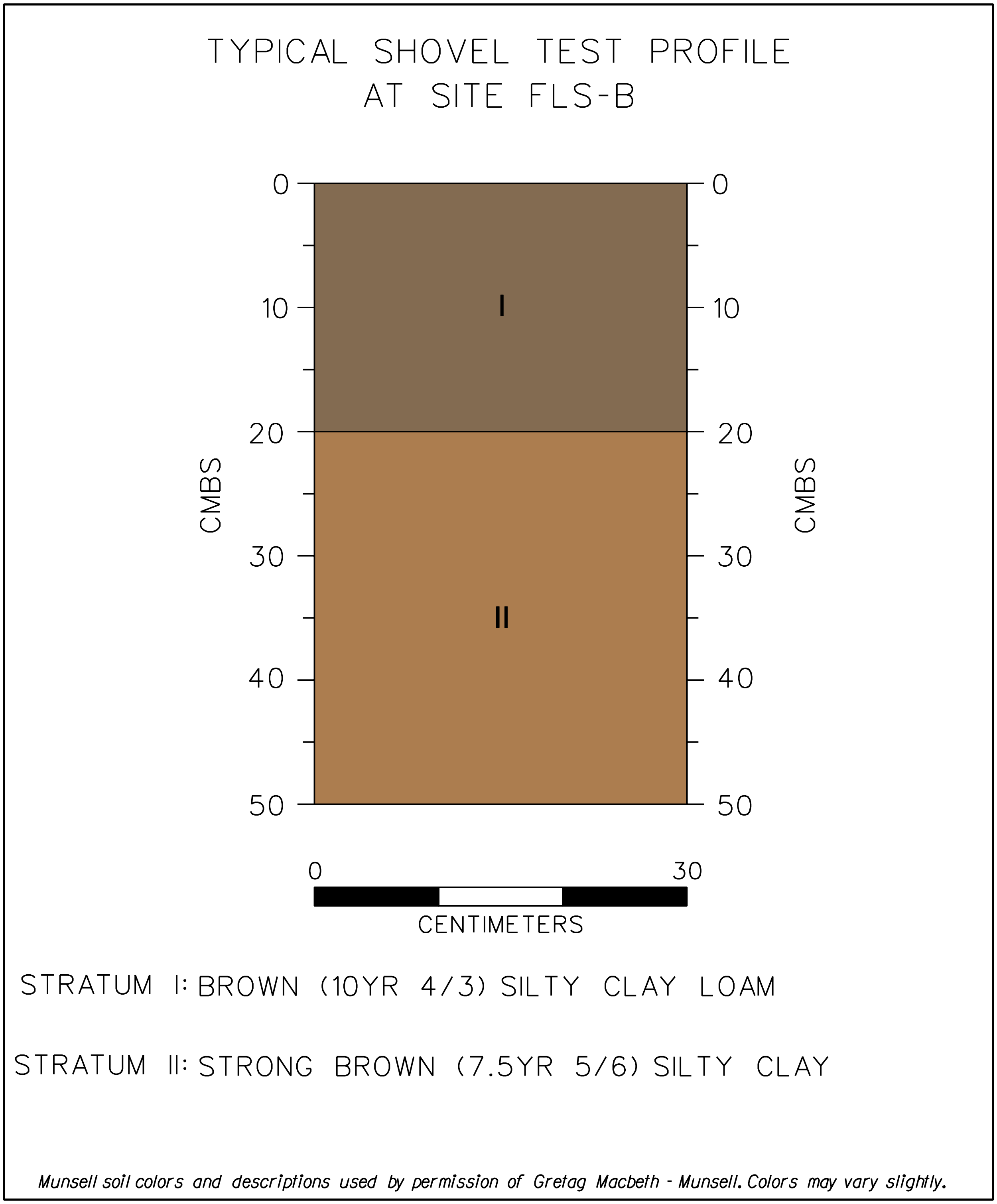

Figure 7.12 Typical shovel test profile identified within the FLS-B Project Area.

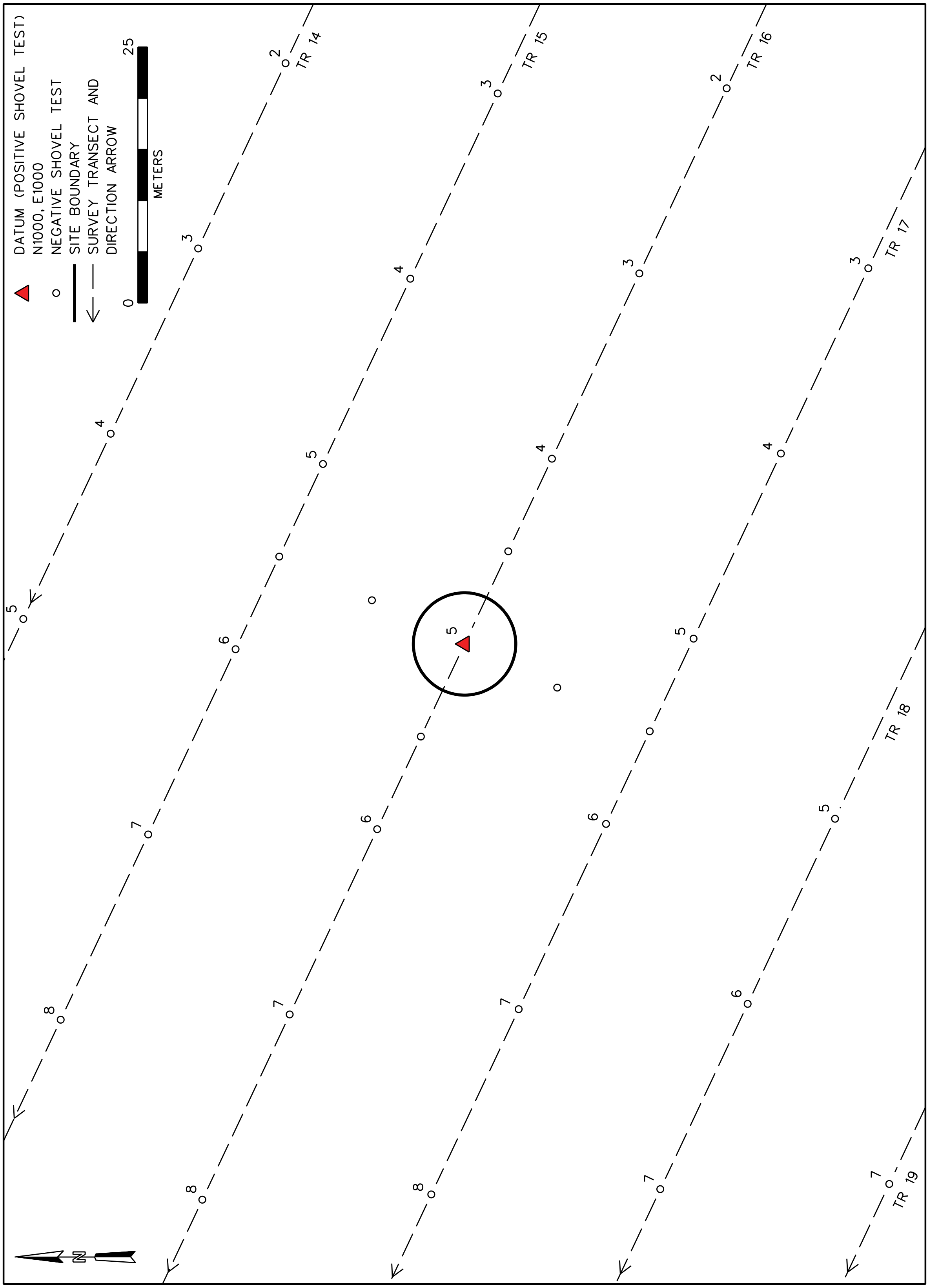

Figure 7.13 Planview of Locus FSL-B-01.

Figure 7.14 Overview photograph of Locus FSL-B-01 facing west.

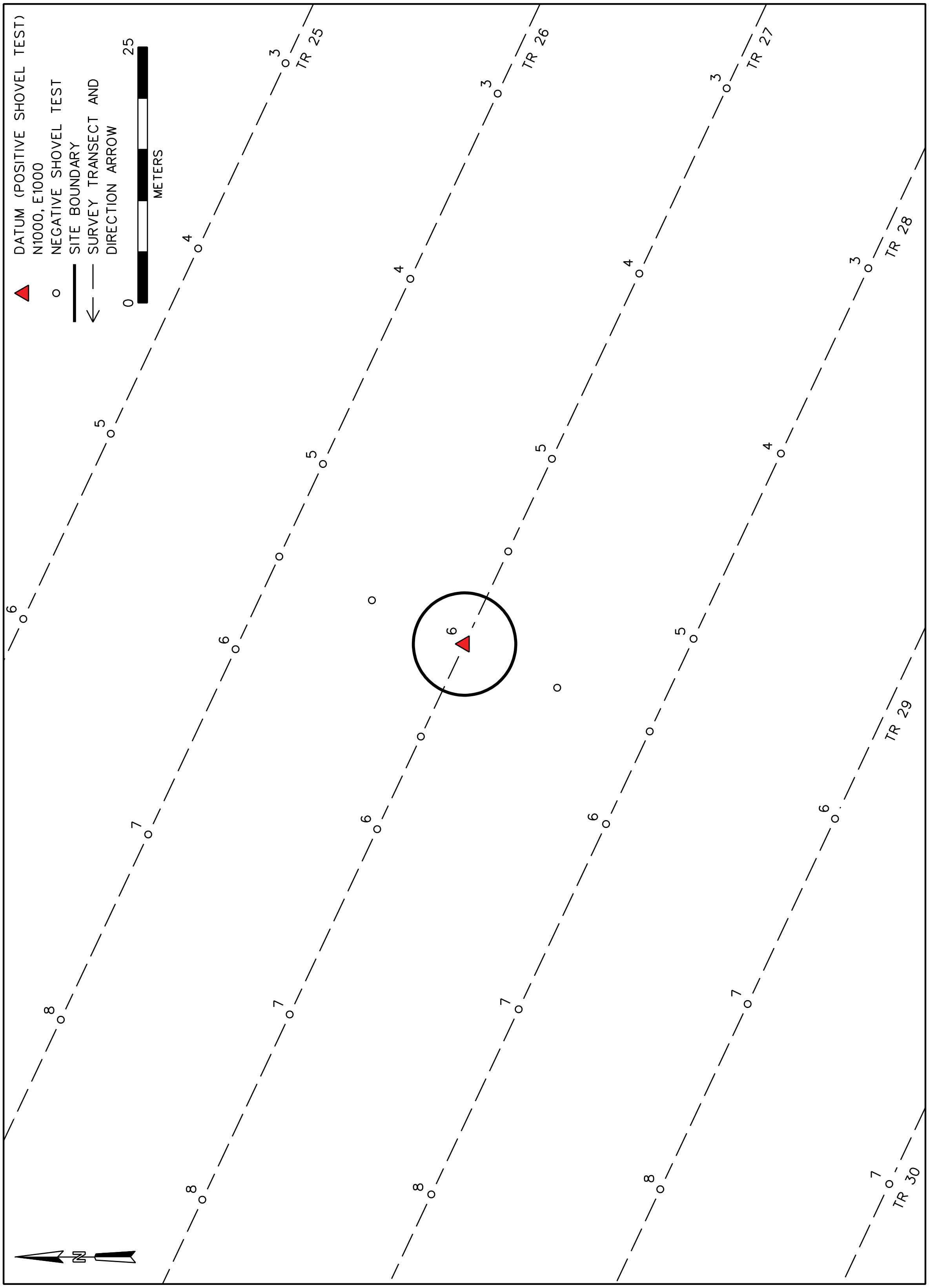

Figure 7.15 Planview of Locus FSL-B-02.

Figure 7.16 Overview photograph of Locus FSL-B-02 facing southwest.

boundaries of Locus FLS-B-01. No evidence of intact cultural deposits or features was identified.

The paucity of cultural material and an absence of intact cultural deposits demonstrates that Locus FLS-B-02 does not warrant archeological site status and does not have research potential. Locus FLS-B-02 does not possess those qualities of significance and integrity as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4[a-d]). No additional investigation of this non-site cultural resource is recommended.

Summary and Recommendations

The Phase I cultural resources survey of the Factory Lane Site Project resulted in the examination of two project parcels that totaled 41.3 ha (102 ac) in area. During survey, 1058 shovel tests were excavated successfully throughout the area under examination.

A single archeological site and two non site cultural resources were identified as a result of this investigation. Site 15JF810 and non-site loci FLS-B-01 and FLS-B-02 lack integrity and research potential and therefore do not possess those qualities of significance as defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4 [a-d]). No additional investigation of any of the single cultural resource and the two non-site loci, or the Factory Lane Site Project parcel is recommended.

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Site Card 15JF179. On file at the Office of State Archaeology, University of Kentucky, Lexington, Kentucky.

Site Card 15JF180. On file at the Office of State Archaeology, University of Kentucky, Lexington, Kentucky.

*Site Card 15JF181.*On file at the Office of State Archaeology, University of Kentucky, Lexington, Kentucky.

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APPENDIX I

ARTIFACT INVENTORY

Lithic Material Recovered during Survey.

FS	CM	Locus	Site	Area	Transect	Shovel Test	Meter	North	East	Stratum	Zone	Level	Top Elevation	Bottom Elevation	Additional Provenience	Tool #	Count	Wt (g)	Lithic Class	Morphological Class	Size Grade	Raw Material Type	Cortex	Technological Class	Portion	Length (cm)	Width (cm)	Blade Thickness (cm)	Additional Description	Recovery Date
FLS-23	Shovel Test	FLS B-01		FLS B	16	5	90			I		3	20	30			1	3.84	Debitage	Flake	5 - 5/8 in, 1.49 cm	Haney Chert	1-49% Dorsal Cortex	Hard Hammer	Complete					2/28/2012
FLS-24	Shovel Test	FLS B-02		FLS B	27	6	100			II		4	30	40		1	1	2.58	Flake Tool	Edge Modified Flake		Haney Chert	Cortical Platform	Retouch	Complete	28.6	18.46	4.42	straight edge, 21.2mm	2/28/2012

Lithic Material Recovered during Survey.

FS	CM	Locus	Site	Area	Transect	Shovel Test	Meter	North	East	Stratum	Level	Top Elevation	Bottom Elevation	Count	Material Class	Material Category	Functional Category	Form	Type	Subtype	Decorative Class	Additional Diagnostic Trait(s)	Portion	Additional Description	Recovery Date
FLS-01	Shovel Test	FLS A-01		FLS A	18	25	490			I	3	20	30	1	Glass	Aqua (Light Blue/Light Green)	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Fragment	partially melted; possible window glass	2/25/2012
FLS-02	Shovel Test	FLS A-01		FLS A	18	23	450			II	3	20	30	2	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/25/2012
FLS-02	Shovel Test	FLS A-01		FLS A	18	23	450			II	3	20	30	1	Glass	Colorless	Indeterminate	Container	Indeterminate	Indeterminate	Layered Glass	Red/Maroon Decoration	Fragment	layered transparent colorless and red glass	2/25/2012
FLS-03	Shovel Test	FLS A-01		FLS A	19	22	420			I	3	20	30	1	Glass	Colorless	Indeterminate	Container	Indeterminate	Indeterminate	Plain/Undecorated	Continuous Threaded Finish	Finish		2/25/2012
FLS-03	Shovel Test	FLS A-01		FLS A	19	22	420			I	3	20	30	1	Glass	Aqua (Light Blue/Light Green)	Indeterminate	Container	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Body		2/25/2012
FLS-03	Shovel Test	FLS A-01		FLS A	19	22	420			I	3	20	30	1	Ceramic	Porcelaneous Ware	Indeterminate	Container	Soft-paste	n/a	Plain/Undecorated	n/a	Fragment		2/25/2012
FLS-03	Shovel Test	FLS A-01		FLS A	19	22	420			I	3	20	30	1	Ceramic	Refined Earthenware	Indeterminate	Container	Whiteware	n/a	Plain/Undecorated	n/a	Body		2/25/2012
FLS-03	Shovel Test	FLS A-01		FLS A	19	22	420			I	3	20	30	1	Metal	Ferrous	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Complete	flattened funnel type shape with out hole in center portion; possible cap	2/25/2012
FLS-04	Shovel Test	FLS A-01		FLS A	19	25	480			II	2	10	20	1	Glass	Colorless	Indeterminate	Container	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Body		2/25/2012
FLS-05	Shovel Test	FLS A-01		FLS A	15	22	420			II	3	20	30	1	Metal	Ferrous	Architectural	Nail	Indeterminate	Clinched	n/a	n/a	Complete		2/25/2012
FLS-05	Shovel Test	FLS A-01		FLS A	15	22	420			II	3	20	30	1	Glass	Aqua (Light Blue/Light Green)	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Fragment	partially melted	2/25/2012
FLS-06	Delineation Shovel Test	FLS A-01		FLS A				920	990	I	2	10	20	1	Ceramic	Porcelaneous Ware	Indeterminate	Container	Soft-paste	n/a	Plain/Undecorated	n/a	Lower Body/Base		2/29/2012
FLS-07	Delineation Shovel Test	FLS A-01		FLS A				920	990	I	3	10	20	1	Ceramic	Stoneware	Indeterminate	Holloware	Gray-Bodied	Unidentified Glaze	Stamped	n/a	Rim	stamped on body "A.[...]/M[...]/L[...]"	2/29/2012
FLS-08	Delineation Shovel Test	FLS A-01		FLS A				920	1010	II	4	30	40	1	Metal	Ferrous	Architectural	Nail	Indeterminate	Indeterminate	n/a	n/a	Fragment		2/29/2012
FLS-08	Delineation Shovel Test	FLS A-01		FLS A				920	1010	II	4	30	40	1	Glass	Colorless	Indeterminate	Bottle	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Base		2/29/2012
FLS-09	Delineation Shovel Test	FLS A-01		FLS A				920	1010	II	5	40	50	1	Metal	Ferrous	Architectural	Nail	Cut	Not Clinched	n/a	n/a	Fragment		2/29/2012
FLS-09	Delineation Shovel Test	FLS A-01		FLS A				920	1010	II	5	40	50	1	Metal	Cupreous	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	folded over strip of cupreous metal	2/29/2012
FLS-10	Delineation Shovel Test	FLS A-01		FLS A				920	970	I	4	30	40	2	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/29/2012
FLS-11	Delineation Shovel Test	FLS A-01		FLS A				930	930	I	1	0	10	1	Ceramic	Unrefined Earthenware	Indeterminate	Container	Terracota	Unglazed	Plain/Undecorated	n/a	Body		2/29/2012
FLS-12	Delineation Shovel Test	FLS A-01		FLS A				930	930	I	2	10	20	4	Ceramic	Unrefined Earthenware	Indeterminate	Container	Terracota	Unglazed	Plain/Undecorated	n/a	Body		2/29/2012

Lithic Material Recovered during Survey.

FS	CM	Locus	Site	Area	Transect	Shovel Test	Meter	North	East	Stratum	Level	Top Elevation	Bottom Elevation	Count	Material Class	Material Category	Functional Category	Form	Type	Subtype	Decorative Class	Additional Diagnostic Trait(s)	Portion	Additional Description	Recovery Date
FLS-12	Delineation Shovel Test	FLS A-01		FLS A				930	930	I	2	10	20	1	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/29/2012
FLS-12	Delineation Shovel Test	FLS A-01		FLS A				930	930	I	2	10	20	1	Metal	Ferrous	Architectural	Nail	Cut	Not Clinched	n/a	n/a	Complete		2/29/2012
FLS-13	Delineation Shovel Test	FLS A-01		FLS A				930	930	III	5	40	50	1	Ceramic	Unrefined Earthenware	Indeterminate	Holloware	Terracota	n/a	Plain/Undecorated	n/a	Body		2/29/2012
FLS-13	Delineation Shovel Test	FLS A-01		FLS A				930	930	III	5	40	50	1	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/29/2012
FLS-14	Delineation Shovel Test	FLS A-01		FLS A				930	930	III	5	40	50	1	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/29/2012
FLS-15	Delineation Shovel Test	FLS A-01		FLS A				950	970	I	1	0	10	1	Ceramic	Refined Earthenware	Indeterminate	Holloware	Yelloware	n/a	Plain/Undecorated	n/a	Indeterminate	handle or spout	2/29/2012
FLS-15	Delineation Shovel Test	FLS A-01		FLS A				950	970	I	1	0	10	1	Metal	Ferrous	Architectural	Nail	Indeterminate	Clinched	n/a	n/a	Complete		2/29/2012
FLS-17	Delineation Shovel Test	FLS A-01		FLS A				950	970	I	3	20	30	1	Ceramic	Refined Earthenware	Indeterminate	Holloware	Yelloware	n/a	Plain/Undecorated	n/a	Indeterminate	possible handle or spout	2/29/2012
FLS-18	Delineation Shovel Test	FLS A-01		FLS A				940	1000	I	3	20	30	1	Glass	Aqua (Light Blue/Light Green)	Indeterminate	Bottle	Indeterminate	Indeterminate	Plain/Undecorated	n/a	Lower Body/Base		2/29/2012
FLS-18	Delineation Shovel Test	FLS A-01		FLS A				940	1000	I	3	20	30	1	Metal	Ferrous	Indeterminate	Indeterminate	n/a	n/a	Plain/Undecorated	n/a	Indeterminate	metal tube	2/29/2012
FLS-19	Delineation Shovel Test	FLS A-01		FLS A				930	960	I	2	10	20	1	Ceramic	Refined Earthenware	Indeterminate	Holloware	Whiteware	n/a	Plain/Undecorated	n/a	Rim		2/29/2012
FLS-20	Delineation Shovel Test	FLS A-01		FLS A				940	960	I	3	20	30	1	Ceramic	Stoneware	Indeterminate	Holloware	Light-Bodied	Unidentified Glaze	Indeterminate	n/a	Rim		2/29/2012
FLS-20	Delineation Shovel Test	FLS A-01		FLS A				940	960	I	3	20	30	1	Glass	Aqua (Light Blue/Light Green)	Architectural	Window	Indeterminate	n/a	n/a	n/a	Fragment		2/29/2012
FLS-21	Delineation Shovel Test	FLS A-01		FLS A				990	1000	I	2	10	20	1	Ceramic	Porcelaneous Ware	Indeterminate	Flat	Soft-paste	n/a	Plain/Undecorated	n/a	Body		2/29/2012
FLS-22	Surface Collection	FLS A-01		FLS A						Surface Collection				1	Ceramic	Refined Earthenware	Indeterminate	Holloware	Whiteware	n/a	Plain/Undecorated	n/a	Base		2/29/2012

Lithic Material Recovered during Survey.

FS	CM	Locus	Site	Area	Transect	Shovel Test	Meter	North	East	Stratum	Zone	Level	Top Elevation	Bottom Elevation	Additional Provenience	Count	Wt (g)	Common Name	Element	Symmetry	Portion	Proximal Fusion	Distal Fusion	Thermal Alteration	Additional Description	Recovery Date
FLS-16	Delineation Shovel Test	FLS A-01		FLS A				950	970	I		2	10	20		1	2.83	Domestic cat	Mandible	Left	Complete	n/a	n/a	Unburned	possibly modern	2/29/2012

Appendix II

Curriculum Vitae

WILLIAM P. ATHENS, M.A., R.P.A.

SENIOR VICE-PRESIDENT/
CHIEF MARKETING OFFICER
PRINCIPAL INVESTIGATOR

EDUCATION

Associate in Arts, Dekalb Community College, 1975.
Bachelor of Arts with Honors in Anthropology and Geography, University of Tennessee, 1979.
Master of Arts in Anthropology/Historic Archeology, Florida State University, Tallahassee, 1983.
Ph.D. Candidate, Department of Anthropology, University of Pittsburgh.
Introduction to Federal Projects and Historic Preservation Law, Section 106 Compliance Course, 1989, 1997, 2000.
Florida Department of Transportation, Cultural Resources Management Course, 1999.
Southern Gas Association, Environmental Inspection Construction Compliance Workshop, 1999, 2000.

ACADEMIC HONORS

Recipient of scholarships for supervised summer research in archeology, awarded through the Lowell Thomas Fund, the Explorers Club, 1975, 1978.
Rea Pre-doctoral Fellowship, awarded by the Carnegie Museum of Natural History, Pittsburgh, January – April, 1988.

PROFESSIONAL EXPERIENCE

Senior Vice-President, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, 1991 – present.
Project Manager, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, 1988 – 1991.
Instructor, Graduate Research Assistantship, Teaching Assistantship, University of Pittsburgh, Department of Anthropology, 1984 – 1988.
Archeological Remote Sensing and Computer Graphics Technician, Southeast Archeological Center, National Park Service, Tallahassee, Florida, 1982 – 1984.
Project Archeologist, R. Christopher Goodwin & Associates, Inc., 1980. Excavation of palisaded Monogahela village, Keyser, West Virginia.
Project Archeologist, St. Augustine Historic Preservation Board, 1980.
Archeology Lab Technician, Arkansas Archeological Survey, Fayetteville, Arkansas, 1979.
Assistant Director, Arizona State University Archeological Field School, St. Kitts, West Indies, 1979.
Crew chief and staff member, Arizona State University Archeological Field School in Caribbean Archeology, St. Kitts, West Indies, 1975, 1976, 1978.
Excavator, Georgia State University Archeological Field School, 1975.
Excavator, Shorter College Archeological Field School, Rome, Georgia, 1974.

CIVIC AND COMMUNITY ACTIVITIES

Eagle Scout, Atlanta Area Council, 1974
Florida Archeological Council
Society for American Archeology
Society for Historical Archaeology
Southeastern Archeological Conference
Sigma Xi, The Scientific Research Society
Louisiana Environmental Professionals Association

AREAS OF INTEREST

Prehistoric archeology, remote sensing, computer graphics, settlement pattern analysis, southeastern U.S. prehistory, and forensic archeology.

SPECIAL SKILLS

Educated in basic statistical and exploratory data analysis methods, with emphasis placed on all aspects of sampling (simple random, stratified, cluster, and ratio sampling) and multi-dimensional scaling. Human skeletal analysis. Experienced in computer graphics and analysis, including Autocad, Golden Graphics (Surfer, Topo, Grapher, and Grafit), Microstation PC, Systat, Dbase III+, MSWord, WordPerfect, Excel and Lotus 123 software programs.

SELECTED MANUSCRIPTS, PUBLICATIONS, AND PAPERS PRESENTED

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Belle Isle Restoration Project, St. Mary Parish, Louisia*na (with James Eberwine). Submitted by R. Christopher Goodwin & Associates, Inc. to Belle Isle, LLC.

2011 *Phase I Cultural Resources Investigation of the Elysian, LLC Project, East Baton Rouge Parish, Louisiana* (with James Eberwine, Ashley Hale, Susan Barrett Smith, Emily Meaden, and Nathanael Heller). Submitted by R. Christopher Goodwin & Associates, Inc. to Gulf Coast Housing Partnership.

2011 *Phase I Cultural Resources Survey and Archeological Inventory of a Well Pad and Access Road Associated with the Petro-Hunt Cypress Creek Prospect Well Location, Natchitoches Parish, Louisiana* (with Emily Crowe and James Eberwine). Submitted by R. Christopher Goodwin & Associates, Inc. to T. Baker Smith, Inc.

2011 Recordation of Buildings at the Francis W. Gregory Junior High School Campus, New Orleans, Orleans Parish, Louisiana (with Kelly Sellers Wittie, Susan Barrett Smith, and Katy Coyle)

2011 *Phase I Cultural Resources Investigations of the McCaleb Supportive Housing Project in New Orleans, Louisiana* (with James Eberwine, Kelly Wittie, and Sue Sanders.) Submitted by R. Christopher Goodwin & Associates to Gulf Coast Housing Partnership.

2011 *Phase II National Register Testing and Evaluation of Sites 1EE71/72 and 1EE384* (with James Eberwine, Ashley Sanders Hale, Bill Barse, R. Christopher Goodwin, and Nathanael Heller) Submitted by R. Christopher Goodwin & Associates to Southern Natural Gas Company

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Proposed 4.0 ha (9.9 ac) Wardview Wetland Restoration Project, Bossier Parish, Louisiana* (with Dr. Charlotte D. Pevny, and Tyler Leben). Submitted by R. Christopher Goodwin & Associates, Inc. to Tom Bourland & Associates, LLC.

2011 *Phase I/Phase II Cultural Resources Investigations of the Colton Junior High School Test Piling Project, Orleans Parish, Louisiana* (with Nathanael Heller, Kelly Wittie, Sean Coughlin, and James Eberwine) Submitted by R. Christopher Goodwin & Associates to Federal Emergency Management Agency

2011 *Phase I Cultural Resources Survey of the Proposed Pecan Island Bypass Line Project, Vermilion Parish, Louisiana* (with James Eberwine, Susan Barrett Smith, Nathanael Heller, and Merritt Smith) for Tennessee Gas Pipeline

2011 *Phase IA Cultural Resources Literature and Records Review and Associated GIS Archeological Predictive Modeling Project for the Proposed Alexandria to the Gulf of Mexico Feasibility Study, Rapides Parish, Louisiana* (with Martin Handly, Lindsay Hannah, Ginny Jones, Susan Barrett Smith, Nathanael Heller, Peter Cropley, and Katy Coyle)

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Once Proposed LaCrosse Pipeline Project, DeSoto, Natchitoches, Rapides, Avoyelles, St. Landry, Pointe Coupee, West Feliciana, East Feliciana, St. Helena, Tangipahoa, Washington and Iberville Parishes, Louisiana* (with Ashley S. Hale, Charlotte Pevny, Nathanael Heller, Lindsay Hannah, and James Eberwine.)

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Once Proposed LaCrosse Pipeline Project, DeSoto, Natchitoches, Rapides, Avoyelles, St. Landry, Pointe Coupee, West Feliciana, East Feliciana, St. Helena, Tangipahoa, Washington and Iberville Parishes, Louisiana* (with Ashley S. Hale, Charlotte Pevny, Nathanael Heller, Lindsay Hannah, and William P. Athens.)

JAMES EBERWINE, M.S., R.P.A. PROJECT MANAGER

EDUCATION

Bachelor of Arts in History, St. Mary's College of Maryland, St. Mary's City, Maryland, 1999
Master of Science in Anthropology, Florida State University, Tallahassee, Florida, 2005

PROFESSIONAL EXPERIENCE

Project Manager, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, October 2006 -present
Assistant Project Manager, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, October 2005-October 2006
Field Technician, Archaeological Consultants, Inc., Tallahassee, Florida 2004-2005
Assistant Project Manager, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, October 2002-July 2003
Archeologist I/Historical Research, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, December 2000–October 2002
Archeologist II, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, May–September 2000
Archeologist III, R. Christopher Goodwin & Associates, Inc., New Orleans, Louisiana, November 1999–May 2000
Field Technician, John Milner and Associates, Alexandria, Virginia, Summer 1998–Fall 1998
Field Technician, Epochs Past, Prince Frederick, Maryland, Fall 1997, Fall 1998
Volunteer Field Technician, Historic St. Mary's City, St. Mary's City, Maryland, Fall 1997–Spring 1999

SELECTED MANUSCRIPTS AND PUBLICATIONS

2010 *Addendum Report Additional Phase I Cultural Resources Survey and Archeological Inventory Related to the Proposed Southern Natural Gas Company South System Expansion III Project in Hale, Sumter, and Elmore Counties, Alabama, AHC 08-0680* (with William P. Athens). Submitted by R. Christopher Goodwin & Associates, Inc. to El Paso Corporation.

2010 *Phase I Cultural Resources Survey of the 2010 Department of Veterans Affairs Hospital Biloxi Expansion Project in the City of Biloxi, Harrison County, Mississippi* (with William P. Athens, Meredith Moreno, Ashley Hale, Kelly Wittie, and Nathanael Heller). Submitted by R. Christopher Goodwin & Associates, Inc. to PSI, Inc.

2010 *Phase I Cultural Resources Investigations of the McCaleb Supportive Housing Project in New Orleans, Louisiana* (with William P. Athens, Kelly Wittie, and Sue Sanders). Submitted by R. Christopher Goodwin & Associates, Inc. to Gulf Coast Housing Partnership.

2011 *Phase II National Register Testing and Evaluations of Sites 1EE71/72 and 1EE384* (with William P. Athens, Ashley Sanders, Nathanael Heller, Susan Barrett Smith, Bill Barse, and R. Christopher Goodwin). Submitted by R. Christopher Goodwin & Associates, Inc. to Southern Natural Gas Company.

2011 *Addendum #2: Additional Phase I Cultural Resources Survey and Archeological Inventory Related to the Proposed Southern Natural Gas Company South System Expansion III Project in Hale, Sumter, and Elmore Counties, Alabama, AHC 08-0680* (with William P. Athens). Submitted by R. Christopher Goodwin & Associates, Inc, to El Paso Corporation.

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Belle Isle Restoration Project, St. Mary Parish, Louisia*na (with William P. Athens). Submitted by R. Christopher Goodwin & Associates, Inc. to Belle Isle, LLC.

2011 *Addendum No. 1: Phase I Cultural Resources Survey and Archeological Inventory of the Louisiana Portion of the Proposed Tri-States Pipeline Replacement Project, St. Tammany Parish, Louisiana* (with William P. Athens, and Ashley Hale). Submitted by R. Christopher Goodwin & Associates, Inc. to Edge Engineering and Science, LLC.

2011 *Addendum No. 1: Phase I Cultural Resources Survey and Archeological Inventory of the Mississippi Portion of the Proposed Tri-States Pipeline Replacement Project, Hancock and Harrison Counties, Mississippi* (with William P. Athens). Submitted by R. Christopher Goodwin & Associates, Inc. to Edge Engineering and Science, LLC.

2011 *Phase I Cultural Resources Investigation of the Elysian, LLC Project, East Baton Rouge Parish, Louisiana* (with William P. Athens, Ashley Hale, Susan Barrett Smith, Emily Meaden, and Nathanael Heller). Submitted by R. Christopher Goodwin & Associates, Inc. to Gulf Coast Housing Partnership.

2011 *Phase I Cultural Resources Survey and Archeological Inventory of a Well Pad and Access Road Associated with the Petro-Hunt Cypress Creek Prospect Well Location, Natchitoches Parish, Louisiana* (with Emily Crowe and William P. Athens). Submitted by R. Christopher Goodwin & Associates, Inc. to T. Baker Smith, Inc.

2011 *Phase I Cultural Resources Investigations of the McCaleb Supportive Housing Project in New Orleans, Louisiana* (with Kelly Wittie, Sue Sanders, and William P. Athens). Submitted by R. Christopher Goodwin & Associates to Gulf Coast Housing Partnership.

2011 *Phase II National Register Testing and Evaluation of Sites 1EE71/72 and 1EE384* (with Ashley Sanders Hale, Nathanael Heller, Susan Barrett-Smith, Bill Barse, R. Christopher Goodwin, and William P. Athens) Submitted by R. Christopher Goodwin & Associates to Southern Natural Gas Company

2011 *Phase I/Phase II Cultural Resources Investigations of the Colton Junior High School Test Piling Project, Orleans Parish, Louisiana* (with Nathanael Heller, Kelly Wittie, Sean Coughlin, and William P. Athens) Submitted by R. Christopher Goodwin & Associates to Federal Emergency Management Agency

2011 *Management Summary: Phase I Cultural Resources Investigations of Block 551 (I.E., Site 16OR478) Within the Proposed VA Medical Center- New Orleans Replacement Project Area, New Orleans, Louisiana* (with Sue Sanders, and Merritt Smith) for AECOM Environment

2011 *Phase I Cultural Resources Survey of the Proposed Pecan Island Bypass Line Project, Vermilion Parish, Louisiana* (with Merritt Smith, Susan Barrett Smith, Nathanael Heller, and William P. Athens) for Tennessee Gas Pipeline

2011 *Phase I Cultural Resources Survey and Archeological Inventory of the Once Proposed LaCrosse Pipeline Project, DeSoto, Natchitoches, Rapides, Avoyelles, St. Landry, Pointe Coupee, West Feliciana, East Feliciana, St. Helena, Tangipahoa, Washington and Iberville Parishes, Louisiana* (with Ashley S. Hale, Charlotte Pevny, Nathanael Heller, Lindsay Hannah, and William P. Athens.)

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May 31, 2012 TTL Project No. 6960.06

U.S. Department of Veterans Affairs
c/o Ms. Evelyn Johnson
Carpenter/Robbins Commercial Real Estate, Inc.
3160 Crow Canyon Road, Suite 200
San Ramon, California 94583

Running Buffalo Clover Survey
Proposed Louisville VA Medical Center
St. Joseph Site
Factory Lane
Louisville, Kentucky

Dear Ms. Johnson:

This letter report summarizes the results of the Running Buffalo Clover Survey conducted at the above-referenced site by TTL Associates, Inc. (TTL) for Carpenter/Robbins Commercial Real Estate, Inc. (CRCRE) on behalf of the U.S. Department of Veterans Affairs (VA).

Background

The St. Joseph Site (site) is approximately 99 acres is located south of Factory Lane and east of Interstate 265 in Louisville, Jefferson County, Kentucky. Based on historic topographic maps and aerial photographs, the site has been farmland since at least 1937. The majority of the site is cultivated agricultural land. Dilapidated structures associated with the former farmstead in the northwestern portion of the site were removed in 2011.

As part of a National Environmental Policy Act (NEPA) Environmental Assessment (EA) that is being conducted for the VA for the proposed replacement Louisville VA Medical Center (VAMC), the U.S. Fish and Wildlife Service (USFWS), Kentucky Department of Natural Resources (KDNR), Kentucky Fish and Wildlife Resources (KFWR), Jefferson County, and the City of Louisville were contacted to identify any potential for presence of State or Federally listed threatened or endangered species on or in the vicinity of five candidate sites being considered for the proposed VAMC.

The USFWS indicated that the St. Joseph Site is located within potential Indiana Bat habitat range. The Indiana Bat is a Federally-listed endangered species. The USFWS also stated that the St. Joseph Site includes habitat that supports the presence of Running Buffalo Clover, a Federally-listed endangered species. The USFWS stated that alteration of habitat at the St. Joseph Site would require an on-site inspection for the presence of Running Buffalo Clover.

In January and February 2012, TTL completed a Threatened and Endangered Species Habitat Survey of the St. Joseph Site for Indiana Bat and Running Buffalo Clover. The results of the habitat survey are included in the Threatened and Endangered Species Habitat Survey Documentation report dated February 17, 2012.

Running Buffalo Clover requires periodic disturbance and a somewhat open habitat to successfully flourish, but it cannot tolerate full-sun, full-shade, or severe disturbance. Historically, Running Buffalo Clover was found in rich soils in the transition zone between open forest and prairie. Those areas were probably maintained by the disturbance caused by bison. Today, the species is found in partially shaded woodlots, mowed areas (lawns, parks, cemeteries), and along streams and trails.

The majority of the St. Joseph Site is cultivated agricultural land that is exposed to full-sun. These conditions are not suitable Running Buffalo Clover habitat. However, the Habitat Survey identified several smaller areas at the St. Joseph Site that could potentially support the presence of Running Buffalo Clover, including the edges of the tree lines primarily along the eastern boundary of the site, the edges of Floyds Fork Creek Tributary which crosses the northern portion of the site, the edges of three small wetlands in the northern and central portions of the site, the edges of Factory Lane, and the edges of the wooded area along the southern boundary of the site.

As a result of the Threatened and Endangered Species Habitat Survey, TTL concluded that Running Buffalo Clover was unlikely to be present at the St. Joseph Site. However, TTL further stated that the most effective method to identify Running Buffalo Clover is to observe areas with potential conditions to support the species while it is in flower (late spring to early summer) and recommended conducting an additional survey for Running Buffalo Clover during its flowering season. TTL contacted the USFWS Kentucky Ecological Services Field Office regarding the optimum time for conducting the Running Buffalo Clover survey. The USFWS indicated that the peak flowering period for Running Buffalo Clover is typically mid-May to mid-June, but that the early spring in 2012 pushed this timeframe forward about two weeks.

Running Buffalo Clover (*Trifolium stoloniferum*) is a perennial species with leaves divided into three leaflets. It is called Running Buffalo Clover because it produces runners (i.e., stolons) that extend from the base of erect stems and run along the surface of the ground. These runners are capable of rooting at nodes and expanding the size of small clumps of clover into larger ones. The flower heads are about one inch wide, white, and grow on stems that are two to eight inches long. Each flower head has two large opposite leaves below it on the flowering stem.

Field Activities

On May 15, 2012, a TTL environmental scientist/biologist performed a reconnaissance of the St. Joseph Site to evaluate for the presence of Running Buffalo Clover. On the day of the field activities, the weather was partly cloudy with high temperatures in the low 80s.

At the time of the field activities, the majority of the site (approximately 80 percent) had been planted with corn. Only limited non-agricultural areas were present at the site along the site boundaries, intermittent swales, Floyds Fork Creek Tributary, small wetlands, limited wooded areas in the northeastern and southern portions, and around the former farmstead in the northwestern portion.

Within the limited non-agricultural areas, significant populations of White Clover (*Trifolium repens*) and Red Clover (*Trifolium pratense*) were observed. While similar in structure and appearance to Running Buffalo Clover, White Clover is easily distinguished from Running Buffalo Clover by the absence of two, large, opposite leaves below the flower head on the flowering stem. Red Clover is distinguished from Running Buffalo Clover by the distinct purple to red flower head of the Red Clover.

No Running Buffalo Clover populations were identified on the site. However, Running Buffalo Clover was identified in three separate locations off-site along the eastern boundary of the southern portion of the site (see Figure 1). Two of the locations included one individual each and the third location included two individuals. Photographs are included in Attachment A.

Conclusions and Recommendations

Running Buffalo Clover's status as a Federally-listed endangered species is a result of its specific habitat requirements, as detailed above. Based on the May 15, 2012 site survey, Running Buffalo Clover is not present at the St. Joseph Site. However, Running Buffalo Clover was identified in three separate locations along the eastern boundary of the southern portion of the site.

Based on the absence of Running Buffalo Clover on the site and its limited off-site occurrence, it is anticipated that through environmentally sensitive site design and following good engineering practices, potential impacts to Running Buffalo Clover by VA would be avoided if the St. Joseph Site is selected for the proposed VAMC. If VA selects the St. Joseph Site for proposed the VAMC, TTL recommends submitting the Threatened and Endangered Species Habitat Survey Documentation report and this Running Buffalo Clover Survey Addendum to the USFWS for review and comment.

TTL appreciates the opportunity to provide CRCRE and the VA with our engineering, consulting, and testing services. If you have any questions or require additional information, please contact us.

Respectfully submitted,

TTL Associates, Inc.

Paul J. Jackson
Environmental Scientist

Robin J. Clark
Senior Scientist

Attachments

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FIGURE

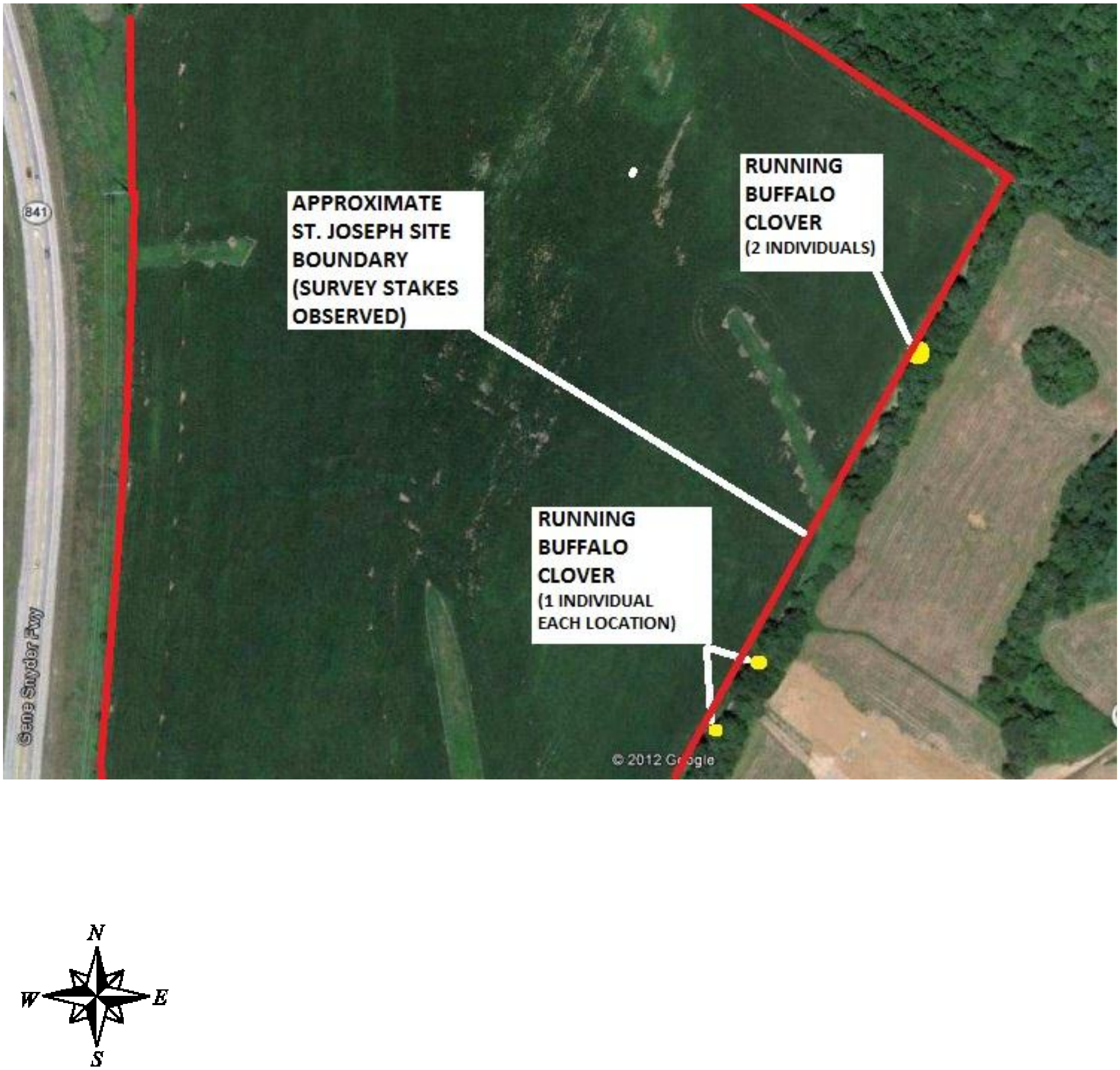

FIGURE 1
RUNNING BUFFALO CLOVER LOCATION MAP
RUNNING BUFFALO CLOVER SURVEY
PROPOSED LOUISVILLE VAMC
ST. JOSEPH SITE
FACTORY LANE
LOUISVILLE, KENTUCKY

PREPARED FOR
U.S. DEPARTMENT OF VETERANS AFFAIRS
WASHINGTON, D.C.

TTL PROJECT NO.
6960.06

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ATTACHMENT A

SITE PHOTOGRAPHS

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Photo #1:	Running Buffalo Clover location with two individuals

Photo #2:	View of Running Buffalo Clover taxonomy

Photo #3:	View of Running Buffalo Clover individual

Photo #4:	Reference photo for location of Running Buffalo Clover looking south

Photo #5:	Reference photo for location of Running Buffalo Clover looking west

Photo #6:	Reference photo for location of Running Buffalo Clover looking north

Photo #7:	View of Running Buffalo Clover individual

Photo #8:	View of Running Buffalo Clover individual

Photo #9:	View of White Clover population

Photo #10:	View of White Clover population

Photo #11:	View of Red Clover population

Photo #12:	View of White Clover taxonomy

Traffic Impact Study

Brownsboro Road (Us-42) and Henry Watterson Expressway (I-264)

Robley Rex VA Medical Center
Master Facility Plan
Louisville, Kentucky

Submission Date: May 29, 2012

Oculus Inc.
ARCHITECTURE | STRATEGIC PLANNING |
INTERIORS | MOVE MANAGEMENT

OLSSON ASSOCIATES

DEPARTMENT OF VETERANS AFFAIRS
UNITED STATES OF AMERICA

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 EXECUTIVE SUMMARY

Project Overview

This report studies traffic impacts for the Department of Veterans Affairs Medical Center, located near Brownsboro Road (US-42) and Henry Watterson Expressway (I-264). The site is bound by KY-22 to the north, residential development to the east and south, and I-264 to the west of the site. This traffic impact study evaluated existing, future 2018 conditions without the Medical Center, and a future 2018 conditions with full build out of the VA Medical Center site to determine the impact of the site on surrounding roadways.

Traffic volumes from The Midlands study were utilized for analysis of study area intersections where appropriate. Traffic counts at US-42 and the I-264 interchange, US-42 and Northfield Drive, and US-42 and Warrington Way were collected in February 2011, and found acceptable for use in this study. New count data was collected for US-42 and Rudy Lane, US-42 and Lime Kiln Lane, and KY-22 and Lime Kiln Lane in May 2012. All data utilized in this study was collected after the completion of the new I-264 Interchange at Westport Road just south of the study area.

The proposed 1,000,000 square foot VA Medical Center is expected to generate approximately 12,322 daily, 1,002 AM, and 967 PM peak hour trips. These trips will access the site via an access drive at KY-22 and the I-264 Slip Ramp intersection which will be completed December 2012 as a part of the KYTC 3-804.10 Project. **Figure 2** displays the preliminary site plan of the proposed VA Hospital.

Once trip generation and distribution was determined for the site, the development volumes were added to the 2018 scenario volumes to identify appropriate roadway improvement recommendations. Based on future growth and site generated trips, the following intersection improvements are necessary for study area intersections to operate at acceptable levels of service:

I-264 & US-42 PLANNED INTERCHANGE IMPROVEMENTS

Interchange Improvements were identified as part of the 5-390.00 I-264/US-42 Interchange Scoping Study completed by Palmer Engineering for the Kentucky Transportation Cabinet. The Interchange Scoping Study recommends the ultimate configuration of the I-264 and US-42 Interchange to be a Single Point Urban Interchange (SPUI). Based on future growth and site generated trips, this interchange configuration is expected to improve overall operations to acceptable levels.

Northfield Drive and I-264 Slip Ramp Improvements

Plans for the widening of Northfield Drive to accommodate an additional southbound thru lane and dedicated two-way-left-turn lane between US-42 and KY-22 are being completed as part of the KYTC 3-804.10 project. This project also adds a slip ramp off of I-264 EB connecting to the Northfield Drive and KY-22 Intersection.

US-42 & Northfield Drive

- Widen US-42 to a 6 lane divided roadway from the I-264 Interchange to approximately 600' east of Northfield Drive. Coordinate widening with planned Interchange Improvements. Continue to restrict left-turn movements on US-42 in the eastbound direction at a minimum during the peak hour periods. Due to low volume of left-turn vehicles and available alternate access we recommend restricting the westbound left-turn movement at a minimum during the peak hour periods.
- Add a third northbound lane, providing a triple left turn, extending to the intersection of KY-22 and the I-264 Slip Ramp.

KY-22 & I-264 Slip Ramp

- Modify the intersection to signalize the westbound right-turn movements and to add dual westbound right-turn lanes on KY-22 with approximately 200' of storage.
- Modify the northbound right-turn lane to a thru/right lane to provide two through lanes in the northbound direction.

2.0 INTRODUCTION & OBJECTIVE

This report studies traffic impacts for the Department of Veterans Affairs Medical Center, located at Brownsboro Road (US-42) and Old Brownsboro Road (KY-22). The medical center would be located in the Midland Development. Louisville Metropolitan staff and the Kentucky Transportation Cabinet staff were contacted for a detailed scope. This study reflects the scope of work presented the above agencies.

The objective of this study is to evaluate the existing traffic, roadway conditions and traffic impacts expected from the proposed development. The appropriate intersection geometrics and traffic control improvements necessary to accommodate the increased traffic on the study area roadways were identified. For the purposes of this study the following scenarios will be analyzed for the AM and PM peak hour period for vehicular traffic operations:

- Existing conditions
- 2018 Background conditions
- 2018 plus Development conditions

Specifics regarding each scenario will be discussed in further detail later in the report. The existing study area intersections include the following:

- Brownsboro Road (US-42) and Rudy Lane
- Brownsboro Road (US-42) and Westbound Watterson Expressway (I-264)
- Brownsboro Road (US-42) and Eastbound Watterson Expressway (I-264)
- Brownsboro Road (US-42) and Northfield Drive
- Brownsboro Road (US-42) and Holiday Manor Center
- Brownsboro Road (US-42) and Lime Kiln Lane
- Old Brownsboro Road (KY-22) and Warrington Way
- Old Brownsboro Road (KY-22) and Herr Lane/Lime Kiln Lane
- Old Brownsboro Road (KY-22)/Slip Ramp and Northfield Drive

US-42 is maintained by Kentucky Transportation Cabinet (KYTC) and borders the proposed project. Thus, the report has been completed consistent with the policies and procedures as discussed with the KYTC where applicable on US-42. Remaining study intersections will be consistent with standard guidelines and engineering judgment. The approximate location of the development area is shown on the vicinity map, **Figure 1. Figure 2** illustrates the site plan for the VA Medical Center development.

Figure 1: Vicinity Map

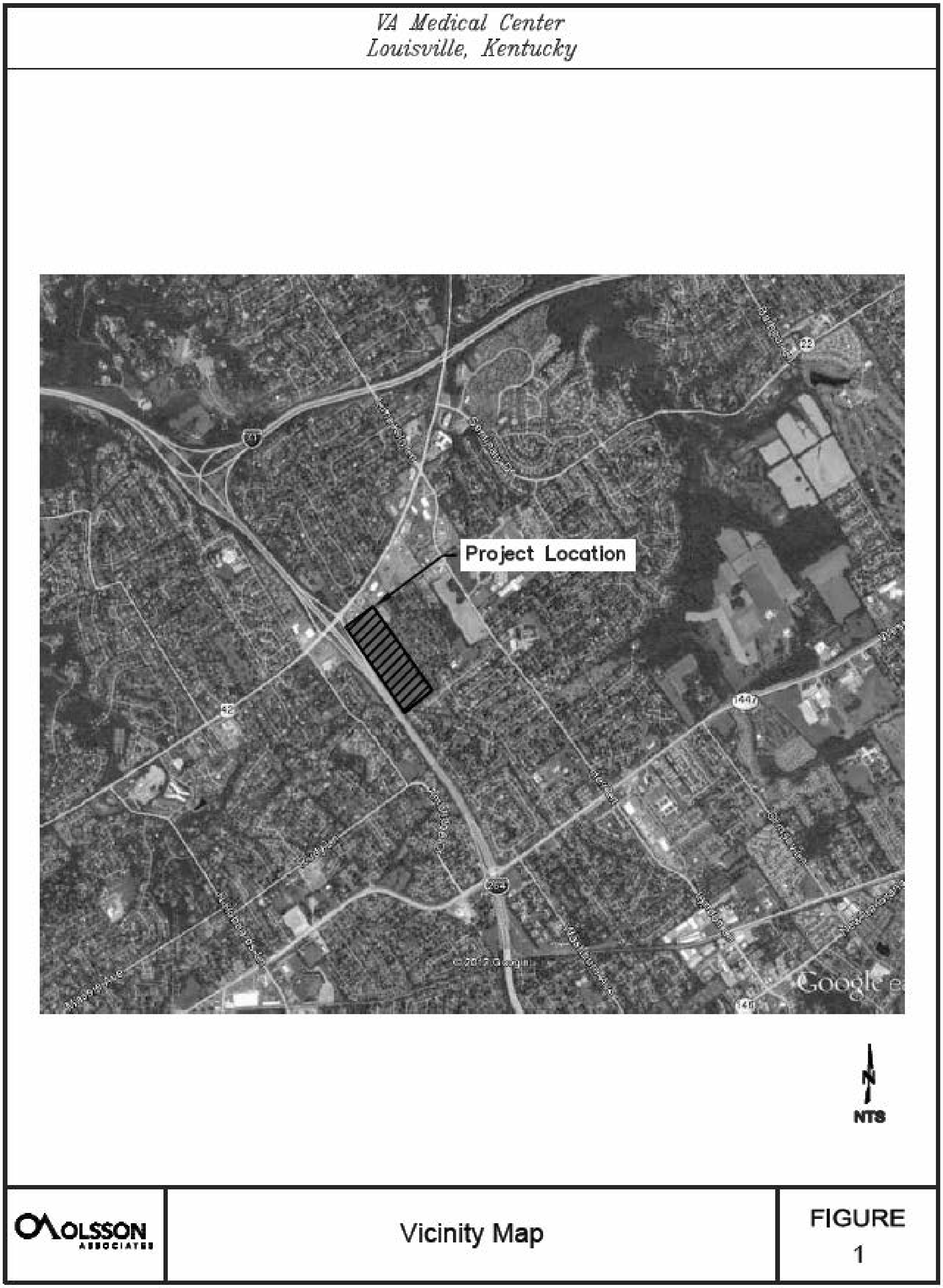
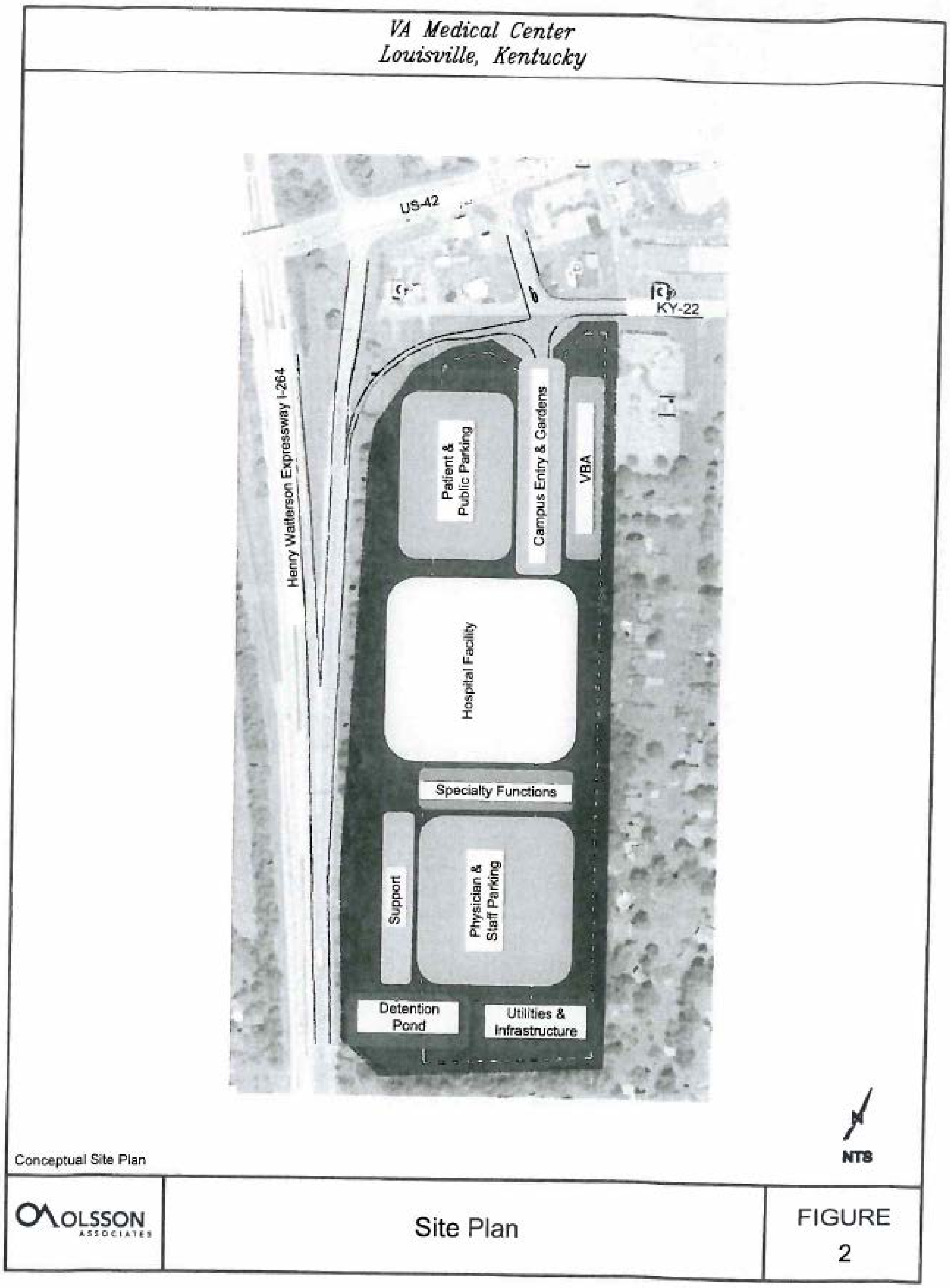


Figure 2: Site Plan



3.0 DESCRIPTION OF STUDY AREA

3.1 Proposed Development

The proposed development consists of a 1,000,000 square foot medical center. The development is bound by KY-22 on the north, the Henry Watterson Expressway (I-264) to the west and residential developments to the south and east.

Access to the development is proposed from a full access drive on KY-22/Northfield approximately 350 feet south of US-42. Spacing for the proposed drive was measured center to center. The proposed drive will be aligned at the existing KY-22 T-intersection where the eastbound I-264 slip ramp exit will be located. Plans for the I-264 slip ramp will be discussed in further detail in **Section 3.2**.

3.2 Roadway Classification and Characteristics

The Watterson Expressway (I-264) is a four-lane divided highway and is classified as an urban interstate. The interstate provides a functional connection around downtown Louisville from I-64 in the northwest to I-71 in the northeast. To be consistent with existing I-264 signing, the report will reference eastbound I-264 in the vicinity of the site as the northbound direction and westbound I-264 in the vicinity of the site as the southbound direction. Technical data provided in the appendix for analysis will classify I-264 eastbound movements as northbound and I-264 westbound movements as southbound. The existing I-264 and US-42 Brownsboro Road interchange is a classified as a Compressed Diamond Interchange. The entrance ramps at the interchange are both single-lane entrances to I-264. The eastbound ramp was recently improved to a two-lane exit and the westbound ramp is a single-lane exit. Additional improvements to the eastbound I-264 interchange are anticipated to be completed December, 2012 as part of the KYTC 5-804 project. These improvements will add an additional left-turn lane at US-42 and direct access from I-264 to KY-22 via a slip ramp off of the existing I-264 eastbound exit ramp at US-42.

Brownsboro Road (US-42) is classified as a principal urban arterial as a four lane undivided section to the west and a five lane section to the east of the I-264 interchange with a speed limit of 35 mph. Between the interchange ramps US-42 widens to a six lane section to accommodate back to back single/dual turn lanes at the I-264 ramps.

Old Brownsboro Road (KY-22) is classified as an urban minor arterial with a speed limit of 35 mph. Old Brownsboro Road was converted from KYTC control to the Louisville Metro with the realignment of KY-22. However, as part of the KYTC 5-804 project, Old Brownsboro Road will be taken back from the city into the State Highway System as KY-22 and will be referred to in this study as such. KY-22 is a three lane section in the study area with a two-way left-turn lane for access to surrounding commercial and residential development.

Lime Kiln Lane/Herr Lane is classified as an urban collector street to the north of US-42 and an urban minor arterial street to the south of US-42. Lime Kiln Lane/Herr Lane is a three-lane section with a two-way left-turn lane between US-42 and Old Brownsboro Road. To the north of US-42 and south of KY-22 Lime Kiln Lane/Herr Lane is a two lane roadway.

Holiday Manor Center is a two lane roadway classified as a rural and urban road between US-42 and KY-22 and serves as access to parking for commercial development to the east and west. Rudy Lane is a two lane roadway classified as a rural and urban local roadway to the north of US-42 and an urban collector street to the south with a speed limit of 35 mph. Warrington Way is a two lane rural and urban road to the south of KY-22 with a speed limit of 25 mph.

3.3 Study Intersection Characteristics

The intersection of US-42 and Rudy Lane is a signalized four-legged intersection with a fifth-leg acting as a dedicated entrance into a commercial development. Dedicated left-turn lanes are provided for the southbound, eastbound and westbound movements at the intersection and dedicated right-turn lanes are provided for all movements. Pedestrian accommodations are provided for the southbound, eastbound and westbound movement at the intersection, including marked crosswalks, pedestrian indications, and push buttons.

The US-42 and westbound I-264 Interchange (southbound direction) ramp is a signalized four-legged intersection. The westbound I-264 exit ramp widens from a single lane to accommodate dual left-turn lanes and a single right-turn lane at the intersection. The westbound movement on US-42 contains dual left-turn lanes at the intersection and two thru lanes while the eastbound movement contains a single right-turn lane and two thru lanes. At the signalized intersection of US-42 and eastbound I-264 ramp (northbound direction) the eastbound I-264 exit ramp widens from a two lane exit ramp to include dual right-turn lanes and a single left-turn lane. The westbound approach at the intersection has a right-turn lane and three thru lanes, one of which drops into the left-turn lane for entering onto westbound I-264.The eastbound direction has a left-turn lane for vehicles entering onto eastbound I-264 and two thru lanes.

The intersection of US-42 and Northfield Drive is a signalized four-legged intersection. Dedicated left-turn lanes are provided for the northbound, southbound, and westbound directions at the intersection. A dedicated right-turn lane is provided for the eastbound movement. During the peak hour periods, the eastbound left-turn movement is prohibited. Pedestrian accommodations are provided along the south, east, and west legs of the intersection and include marked crosswalks, pedestrian indications, and push buttons.

The intersection of US-42 and Holiday Manor Center is a signalized three-legged intersection with dedicated left-turn lanes for the westbound and northbound movements. Pedestrian accommodations are provided along the west leg of the intersection and include a marked crosswalk, pedestrian indications, and push buttons.

The intersection of US-42 and Lime Kiln Lane is a signalized skewed four-legged intersection. Dedicated left-turn lanes are provided for all movements at the intersection and right-turn lanes are provided for the northbound and southbound directions. The eastbound and westbound right-turn movements are channelized. Pedestrian accommodations are provided along the south and east legs of the intersection and include marked crosswalks, pedestrian indications, and push buttons.

The unsignalized t-intersection of KY-22 and the I-264 slip ramp located approximately 350' south of US-42 and Northfield Drive is anticipated to be completed December 2012 as part of the 5-804 project. Dedicated left-turn lanes will be provided for the southbound and westbound movements (into proposed development drive). Dedicated right-turn lanes will be provided for the northbound, eastbound and westbound movements with the eastbound and westbound right-turn lanes channelized. Analysis of existing conditions will account for these improvements.

The KY-22 and Warrington Way T-intersection is unsignalized with dedicated left-turn lanes provided for the northbound and westbound movements. Warrington Way is stop controlled.

The intersection of KY-22 and Lime Kiln/Herr Lane is a signalized four-legged intersection. Dedicated left-turn lanes are provided for all movements at the intersection. Dedicated right-turn lanes are provided for the southbound and eastbound movements.

4.0 DATA COLLECTION

Based on conversations with KYTC staff, new traffic counts were collected at the study intersections of US-42 and Rudy Lane, US-42 and Holiday Manor Center, and US-42 and Lime Kiln Lane as a part of this study. AM and PM peak hour turning movement counts for study area intersections were collected from 7:00 to 9:00 AM and 4:00 to 6:00 PM respectively. Counts were taken on Tuesday May 8th, 2012. Traffic counts for remaining study area intersections were taken from the Midlands Traffic Impact Study dated July 2011. The traffic counts from the Midlands Study were conducted in February 2011. Volumes were balanced between study area intersections where applicable.

The peak hour of traffic fluctuated between study intersections. To provide a baseline of traffic volumes, a consistent peak hour period was chosen for the study intersections. Based on the traffic count data collected the AM and PM peak hour period are 7:15-8:15 AM and 5:00 to 6:00 PM, respectively.

Data sheets for the traffic counts are provided in the **Appendix.**

5.0 EXISTING TRAFFIC CONDITIONS

The analysis of existing conditions is based on the traffic counts collected for the study intersections. **Section 3.2** and **3.3** details roadway classification and intersection characteristics for the existing network. Existing traffic volumes used for analysis are illustrated in **Figure 3.** The study area existing intersection geometrics and traffic control with the KYTC 5-804 project improvements are illustrated in **Figure 4.**

5.1 Capacity Analysis

Signalized intersection capacity analyses were performed using SYNCHRO, version 7.0, based on the Highway Capacity Manual (HCM) delay methodology. Unsignalized capacity analyses were performed in accordance with chapter 17 of the HCM using the Highway Capacity Software (HCS2010), version 6.1. For simplicity, the amount of delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. A letter grade between A and F is assigned, where LOS A represents the best operation. **Table 1** represents the LOS associated with intersection control delay, in seconds per vehicle (sec/veh), for signalized and unsignalized intersections.

Table 1: Intersection Level Of Service Summary

Level-of-Service Criteria		
Level of Service (LOS)	**Stop Control** Approach Delay sec/veh	**Signal Control** Control Delay sec/veh
A	≤ 10	≤ 10
B	>10 and ≤ 15	>10 and ≤ 20
C	>15 and ≤ 25	>20 and ≤ 35
D	>25 and ≤ 35	>35and ≤ 55
E	>35 and ≤ 50	>55 and ≤ 80
F	>50	>80

Typically the LOS for traffic signal controlled intersections should be LOS D or better as discussed with the KYTC. A LOS D or better at traffic signal controlled intersections is in regards to the overall intersection LOS; some individual movements may operate at a lower LOS. If an individual movement LOS is D or worse, queuing results will be reviewed to determine if queuing for the movement is accommodated. LOS D is desirable for stop controlled intersections; however, LOS E and F are often accepted during peak periods due low side street volumes waiting for gaps in the heavy mainline volume stream.

Capacity analysis was completed as discussed above for the signalized study area intersections. For the coordinated signalized intersections of US-42 and; Rudy Lane, I-264 Interchange Ramps and Northfield Drive existing signal timings and phasing were acquired from the KYTC. All other uncoordinated signalized study area intersections were modeled with reasonable cycle lengths and splits. **Table 2** details level of service for each signalized study intersection.

Table 2: Existing Signalized Intersection Capacity Analysis

Intersection	AM Peak Hour*	PM Peak Hour*
US-42 and Rudy Lane	C (30.6)	D (40.3)
US-42 and I-264 WB	C (30.7)	D (40.7)
US-42 and I-264 EB	C (32.8)	D (40.3)
US-42 and Northfield Drive	E (63.5)	C (31.6)
US-42 and Holiday Manor Center	A (7.8)	B (13.7)
US-42 and Lime Kiln Lane	C (26.1)	C (20.6)
KY-22 and I-264 EB Slip Ramp	B (12.7)	B (17.9)
KY-22 and Lime Kiln/Herr Lane	C (27.9)	C (31.8)

*LOS (Delay, in seconds)

The overall LOS for study intersections is a D or better with the exception of US-42 and Northfield Drive in the AM. Some individual movements at signalized intersections are operating at LOS D or worse.

During the AM and PM peak hour periods at Rudy Lane and US-42 the eastbound left-turn, northbound, and southbound movements are expected to operate at LOS E. During the AM peak hour period the eastbound left-turn movement is expected to operate at LOS E. During the PM peak hour period the westbound left-turn movement is expected to operate at LOS F. The eastbound, westbound, and southbound left-turn movements 95th-percentile queue length is expected to exceed the storage length during the PM peak hour period. The 95th-percentile queue represents the queue length that has a 5 percent probability of being exceeded during the peak hour period.

During the AM peak hour period at US-42 and the I-264 WB the southbound movement is expected to operate at LOS F. During the PM peak hour period the westbound left-turn movement is expected to operate at LOS F and the eastbound right-turn movement is expected to operate at LOS E. The westbound left-turn movement is expected to queue to the adjacent I-264 EB Interchange.

At the intersection of US-42 and I-264 EB the eastbound left-turn movement is expected to operate at LOS E during the AM peak hour period and the northbound right-turn movements is expected to operate at LOS E during the PM peak hour period. The eastbound left-turn movements 95th-percentile queue length is expected to exceed the available storage length during the AM and PM peak hour period.

During the AM and PM peak hour periods at US-42 and Northfield Drive the southbound thru movement and northbound movements are expected to operate at LOS E. During the AM peak hour period the westbound thru movement is expected to operate at LOS E and the eastbound right-turn movement is expected to operate at LOS F. Queues currently back south of US-42 on Northfield Drive to the adjacent intersection of KY-22 and the I-264 Slip Ramp during the AM peak hour period.

During the AM and PM peak hour period at US-42 and Holiday Manor Center the northbound left-turn lane is expected to operate at LOS E. Queuing at the intersection is minimal and likely caused by low split time for this movement due to the volume in comparison with the mainline traffic volumes.

At the intersection of US-42 and Lime Kiln Lane the westbound thru and, northbound thru, and southbound thru and left-turn movements are operating at LOS E during the AM peak hour period. During the PM peak hour period the southbound left-turn movement is operating at LOS F.All left-turn movements queue lengths are contained in the available storage bays, however, the westbound movement thru movement experiences a heavy queuing.

During the AM and PM peak hour period at the intersection of KY-22 and Lime Kiln Lane the northbound left-turn lane is operating at LOS E during the PM peak hour period. Additionally, queues at the intersection are contained in available storage bays.

The northbound movement at the unsignalized intersection of KY-22 and Warrington Way is expected to operate at LOS F during the AM and PM peak hour periods. The 95th-percentile queue length is expected to exceed the available storage length by less than one car during the peak hour periods.

Capacity analysis sheets are included in the **Appendix. Figure 5** illustrates the existing level of service for study intersections.

5.2 Existing Recommendations

Study intersections are currently operating at or slightly above the threshold of acceptable levels of service with the exception of US-42 and Northfield Drive during the AM peak hour. Improvements associated with the US-42 and I-264 Interchange ramp intersections are discussed in **Section 6.1**. Additional improvements based on existing conditions are not recommended.

Figure 3: Existing Peak Hour Volumes

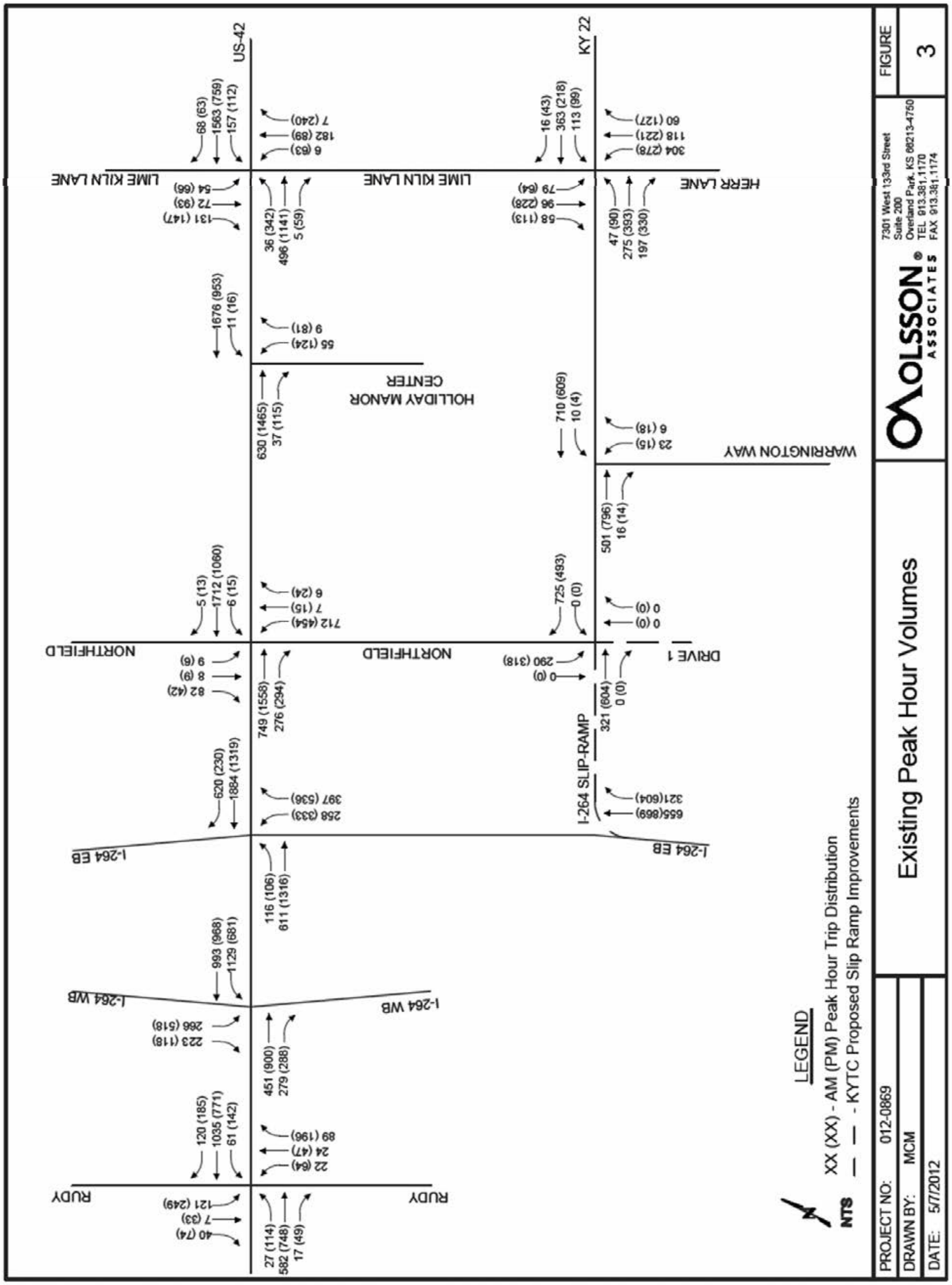


Figure 4: Existing Lane Configurations And Traffic Control With I-264 Slip Ramp Installed

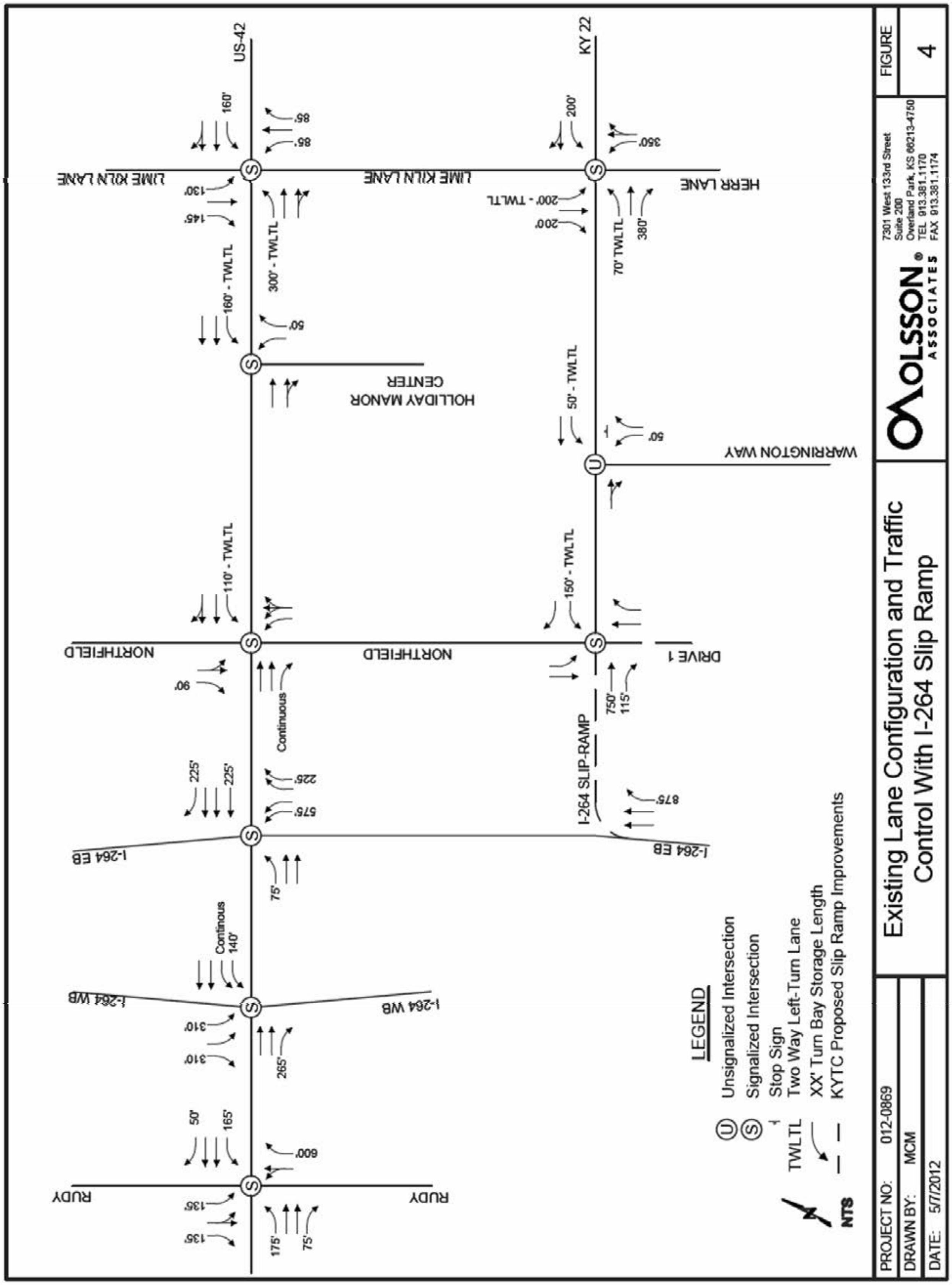
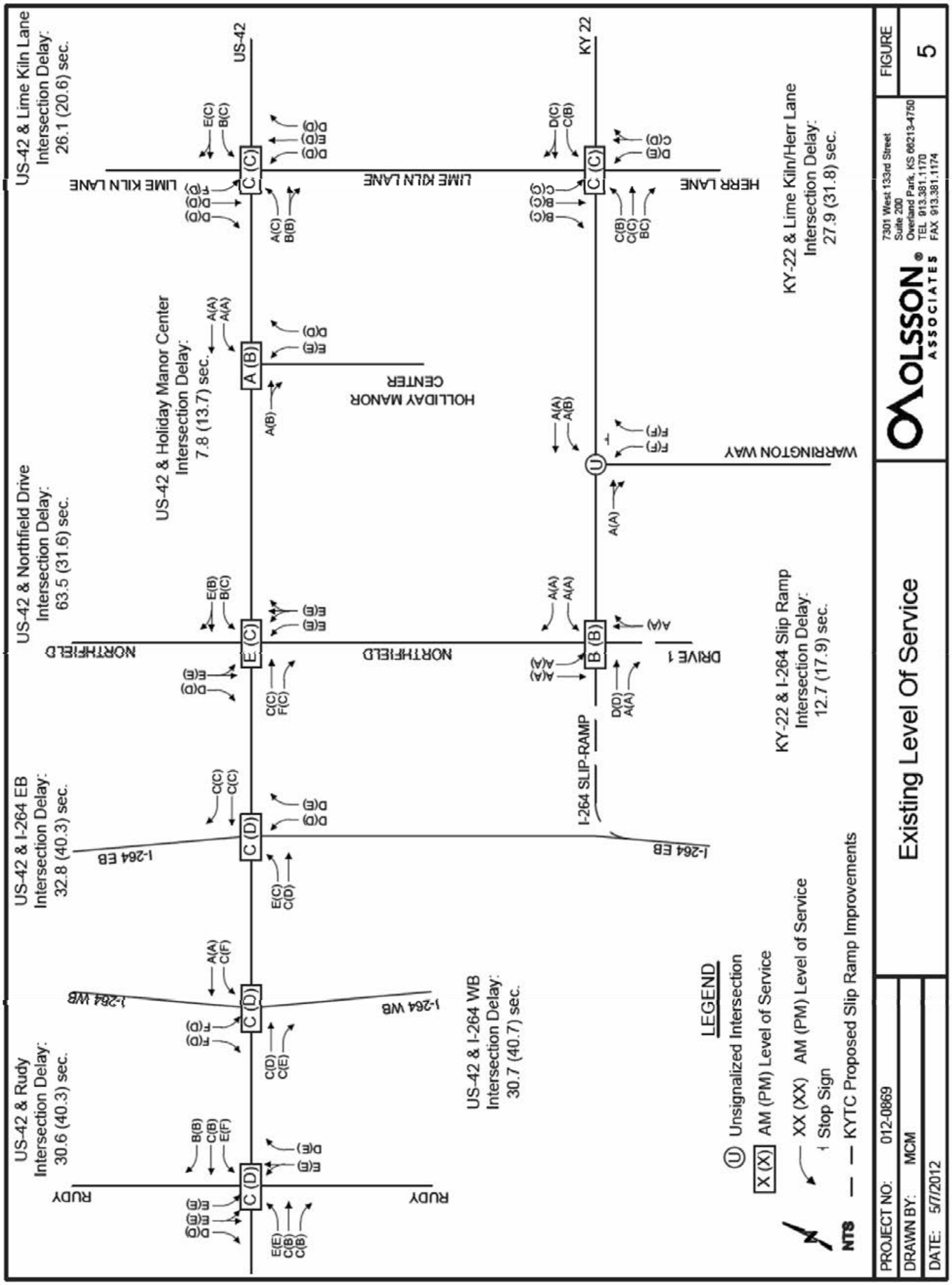


Figure 5: Existing Peak Hour Level Of Service Summary



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6.0 2018 BACKGROUND

The future year 2018 conditions consider the growth of background traffic volumes. The KYTC was consulted to help establish a growth rate in the vicinity of the study area. The advent of the Westport Road and I-264 Interchange is likely to slow growth in the study area as this interchange has resulted in as much as 50% volume reductions to movements at study area intersections. To remain conservative and account for any potential growth in the study area, a growth rate of 2% annually will be used on US-42 and 1% annually will be used on KY-22. These growth factors are consistent with previous studies and were discussed with the KYTC. The growth rate was applied to the existing volumes at study intersections to obtain future year background volumes.

The background additional volumes were added to the existing resulting in future year 2018 traffic volumes, illustrated in **Figure 6.** Future year 2018 intersection geometrics and traffic control for the study area intersections are illustrated in **Figure 7.**

6.1 Potential Area Improvements

As discussed in **Section 3.2** the I-264 Slip Ramp project is planned for completion December 2012. This interim solution was proposed through the KYTC Item Number 5-390.00 I-264/US 42 Interchange Scoping Study. This interchange scoping study outlines several potential area improvements near the proposed VA Hospital site. Alternative designs for the I-264/US-42 interchange and its surrounding intersections were analyzed. Ultimately, several recommendations were developed to handle future traffic volumes along US-42 and KY-22, most specifically recommended was the installation of a Single Point Urban Interchange (SPUI) in place of the current Compressed Diamond Interchange (CDI). Other improvements evaluated include making Northfield Road Right-In/Right-Out on the north and south side of US-42 and extending Glenview Avenue from US-42 to KY-22. A more in depth analysis of the preferred solutions is scheduled to begin in 2013 with the potential for improvements to be completed in 2020. The existing roadway network with I-264 slip ramp improvements in place will be used for the analysis of the 2018 background scenario.

6.2 Capacity Analysis

Section 5.1 details the methods used for capacity analysis. **Table 8** represents the LOS and delay associated with the signalized study intersections. To complete signalized capacity analysis, signal timings were reviewed and updated as necessary to account for changes in traffic volumes at study intersections for the future year 2018. Study area signalized intersections were analyzed as a coordinated system to maximize efficiency of the signals through US-42 and KY-22.

Capacity analysis sheets for signalized intersections are included in the **Appendix.**

Table 3: 2018 Background Signalized Intersection Capacity Analysis

Intersection	AM Peak Hour*	PM Peak Hour*
US-42 and Rudy Lane	C (30.6)	D (41.1)
US-42 and I-264 WB	D (50.7)	D (47.1)
US-42 and I-264 EB	C (29.2)	D (46.8)
US-42 and Northfield Drive	E (76.5)	C (31.0)
US-42 and Holiday Manor Center	A (4.0)	B (11.2)
US-42 and Lime Kiln Lane	C (33.5)	C (22.6)
KY-22 and I-264 EB Slip Ramp	B (19.4)	C (22.7)
KY-22 and Lime Kiln/Herr Lane	D (35.7)	C (33.9)

*LOS (Delay, in seconds)

The overall LOS for study intersections is a D or better with the exception of US-42 and Northfield Drive in the AM. Some individual movements at signalized intersections are operating at LOS D or worse. Intersection delay and queuing are expected to experience minimal increases over the existing scenario.

During the AM and PM peak hour periods at Rudy Lane and US-42 the eastbound left-turn, westbound left-turn, northbound, and southbound movements are expected to operate at LOS E. The eastbound, westbound, and southbound left-turn movements 95th-percentile queue length is expected to exceed the storage length during the PM peak hour period. The 95th-percentile queue represents the queue length that has a 5 percent probability of being exceeded during the peak hour period. Thus the queuing, if it were to occur, would be expected to be a limited occurrence.

During the AM peak hour period at US-42 and the I-264 WB the southbound movement is expected to operate at LOS F. During the PM peak hour period the westbound left-turn movement is expected to operate at LOS F and the southbound left-turn movement is expected to operate at LOS E. The westbound left-turn movement is expected to queue to the adjacent I-264 EB Interchange.

At the intersection of US-42 and I-264 EB the eastbound left-turn movement is expected to operate at LOS F during the AM peak hour period and the northbound movements are expected to operate at LOS E and at LOS F during the PM peak hour period. The eastbound left-turn movements 95th-percentile queue length is expected to exceed the available storage length during the AM and PM peak hour period.

During the AM and PM peak hour periods at US-42 and Northfield Drive the southbound thru movement is expected to operate at LOS E. During the PM peak hour period the northbound movements are expected to operate at LOS E. During the AM peak hour period the westbound thru movement is expected to operate at LOS F and the northbound movements are expected to operate at LOS F. Queues currently back south of US-42 on Northfield Drive to the adjacent intersection of KY-22 and the I-264 Slip Ramp during the AM peak hour period.

During the AM and PM peak hour period at US-42 and Holiday Manor Center the northbound left-turn lane is expected to operate at LOS E. During the AM peak hour period the northbound right-turn movement is expected to operate at LOS E. Queuing at the intersection is approximately 200' and likely caused by low split time for the northbound movement due to the side street volumes in comparison with the mainline traffic volumes.

At the intersection of US-42 and Lime Kiln Lane the eastbound and southbound left-turn movements are expected to operate at LOS F and the northbound thru movement is expected to operate at LOS E. During the PM peak hour period the northbound left-turn and southbound movement is expected to operate at LOS E. All left-turn movements queue lengths are contained in the available storage bays.

During the AM and PM peak hour period at the intersection of KY-22 and Lime Kiln Lane the northbound left-turn lane is operating at LOS E during the PM peak hour period.

The northbound movement at the unsignalized intersection of KY-22 and Warrington Way is expected to operate at LOS F during the AM and PM peak hour periods. The 95th-percentile queue length is expected to by approximately 100' during the peak hour periods.

Capacity analysis sheets are included in the Appendix. Figure 8 illustrates the future year 2018 level of service for study intersections.

6.3 Future Year 2018 Recommendations

Study intersections are currently operating at or slightly above the threshold of acceptable levels of service with the exception of US-42 and Northfield Drive during the AM peak hour. Delay at study area intersections slightly increases with the additional volumes. The KYTC currently has planned an Interchange justification study to develop mitigation strategies based on expected future volumes. Interchange improvements are evaluated in more detail in **Section 7.0**

Figure 6: Future Year 2018 Background Peak Hour Volumes

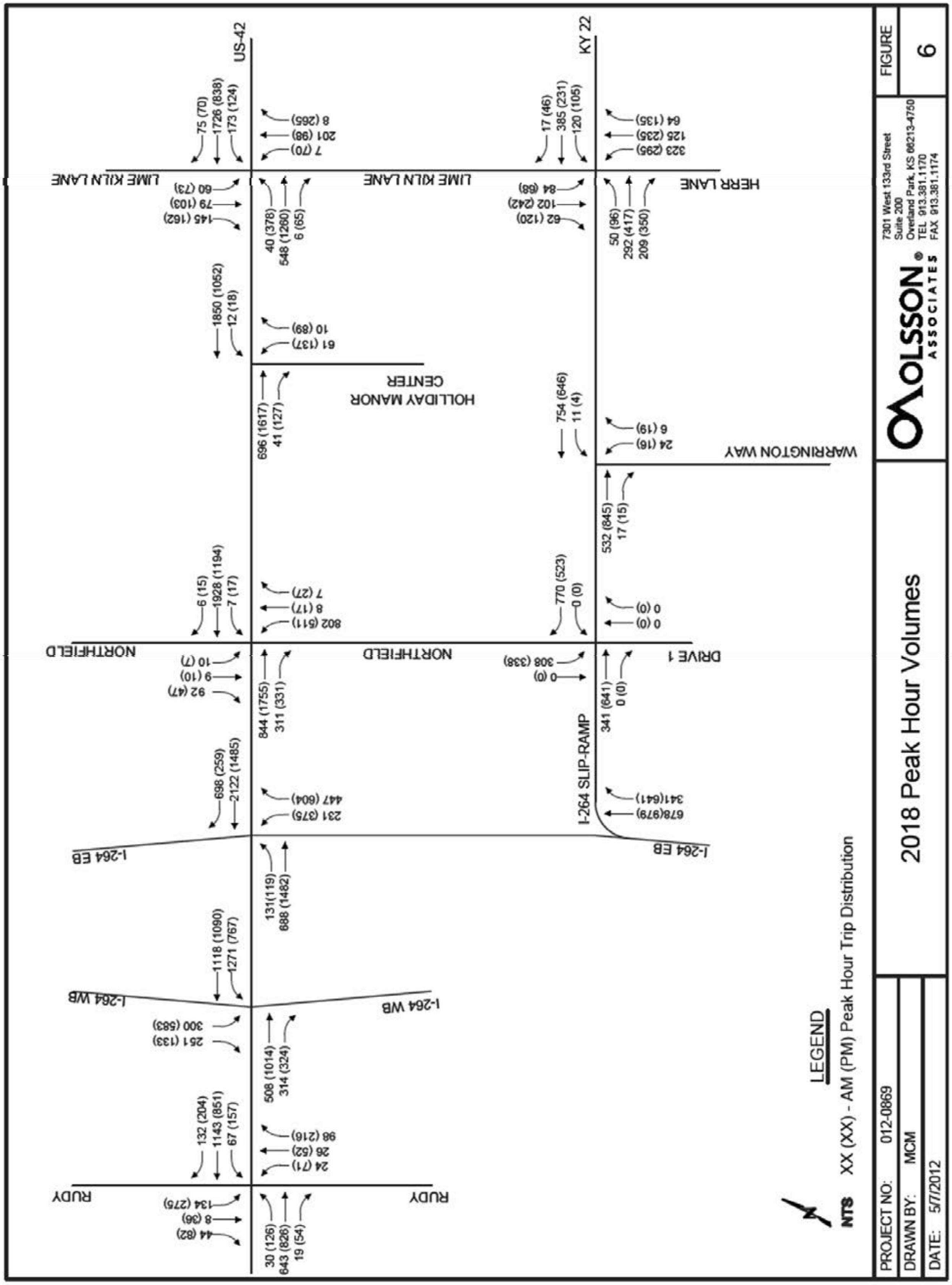

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Figure 7: Future Year 2018 Lane Configurations And Traffic Control

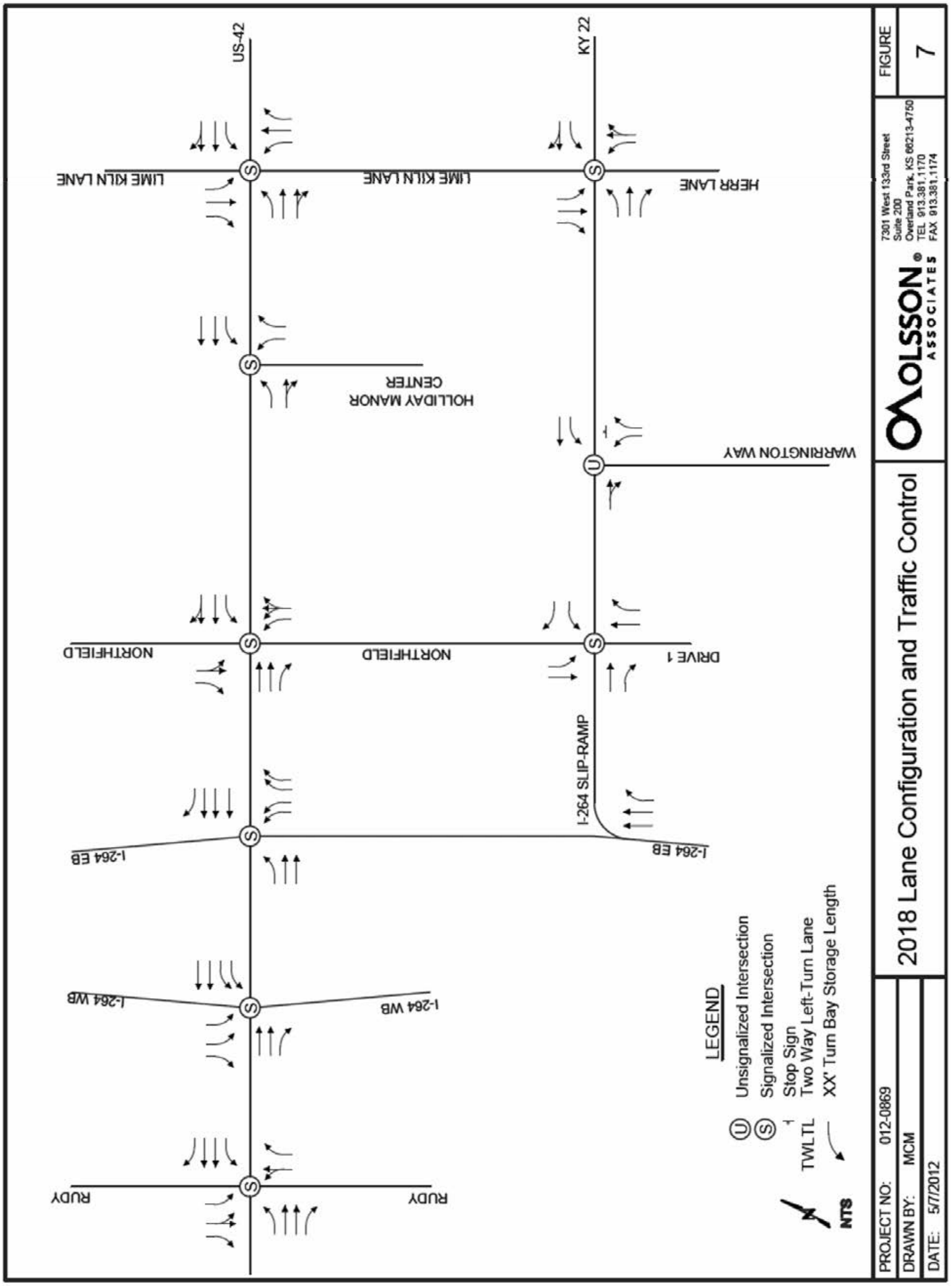
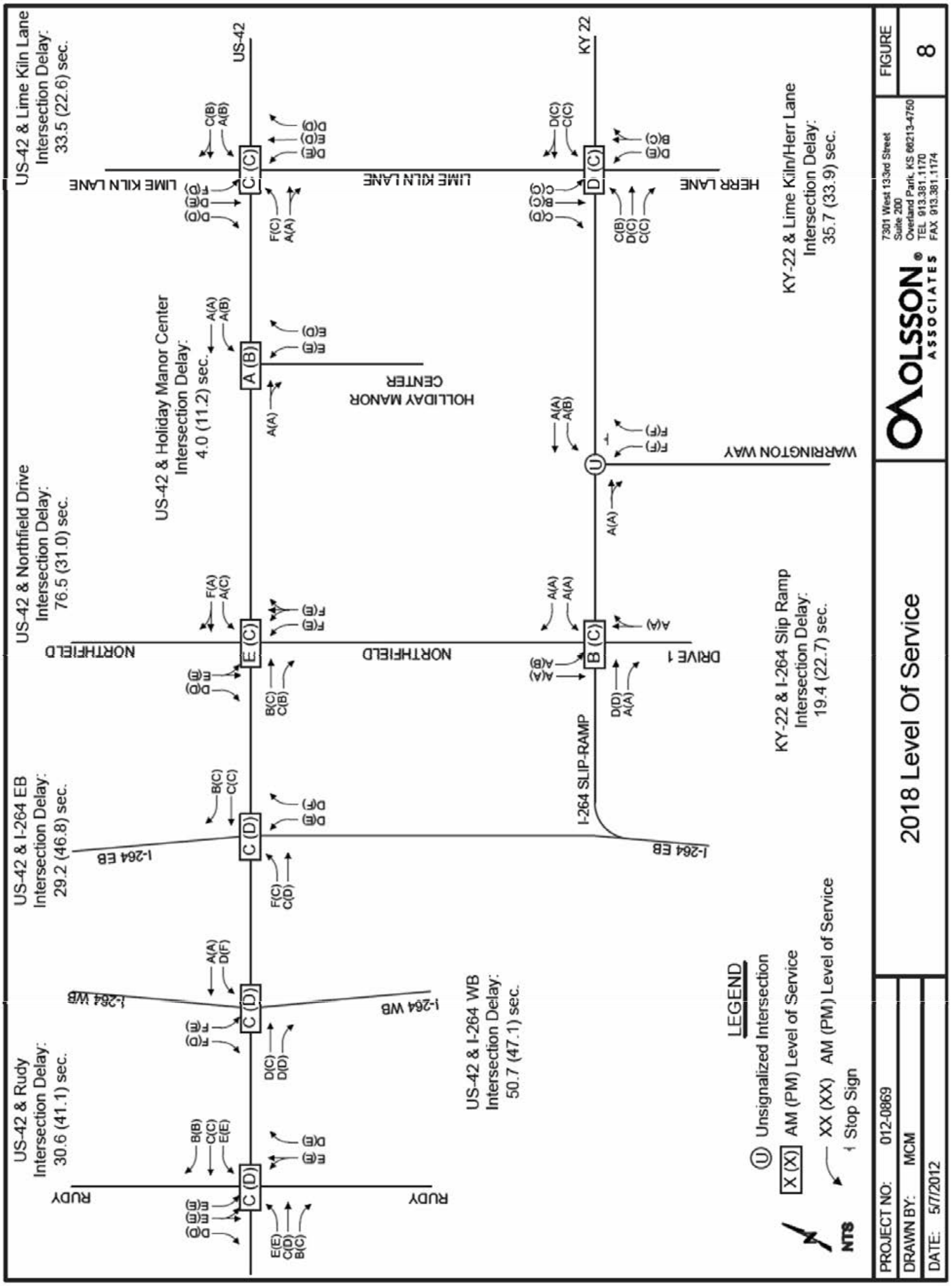


Figure 8: Future Year 2018 Level Of Service



7.0 2018 PLUS DEVELOPMENT

The proposed development consists of a 1,000,000 square foot medical center. The development is bound by KY-22 on the north, the Henry Watterson Expressway (I-264) to the west and residential developments to the south and east.

Access to the development is described in **Section 3.1**. Access spacing, throat length, and geometrics will be reviewed considering the policies and procedures described in **Section 2.0**. **Figure 2** illustrates the proposed site plan.

7.1 Trip Generation and Distribution

Trip generation characteristics expected for the development are shown in **Table 4**. These characteristics are based on trip generation data included in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (8th Edition). For trip generation determination the site was classified as a Hospital. Trip generation was based on the square footage of the medical center development.

The proposed development is expected to generate 12,322 daily trips on an average weekday. The site is expected to generate 1,002 trips during the AM peak hour period, and 967 trips during the PM peak hour period.

Table 4: Proposed Development Trip Generation

Trip Generation - VA Medical Center

Daily Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Daily Trips	Trip Distribution Enter	Trip Distribution Exit	Daily Trips Enter	Daily Trips Exit
610/1143	Hospital	1,000,000	SF	Equation	12,322	50%	50%	6,161	6,161
Total					**12,322**			**6,161**	**6,161**

AM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	AM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	AM Peak Hour Trips Enter	AM Peak Hour Trips Exit
610/1144	Hospital	1,000,000	SF	Equation	1,002	59%	41%	591	411
Total					**1,002**			**591**	**411**

PM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	PM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hour Trips Enter	PM Peak Hour Trips Exit
610/1145	Hospital	1,000,000	SF	Equation	967	42%	58%	406	561
Total					**967**			**406**	**561**

A traffic distribution was developed for the proposed site considering the usage of the site and access to the adjacent roadway network. Trip generation and distribution was provided to the KYTC and approved prior to use in this study. The distribution for trips generated from the site is illustrated in **Table 5** and **Figure 9**.

Table 5: Traffic Distribution

Trip Distribution				
	AM		PM	
Roadway To/From	To Site	From Site	To Site	From Site
North (Rudy Lane)	1%	1%	1%	1%
North (I-264 EB)	20%	20%	26%	18%
North (Northfield Drive)	1%	1%	1%	1%
North (Lime Kiln Lane)	6%	6%	5%	5%
South (Rudy Lane)	1%	1%	1%	1%
South (I-264 WB)	35%	30%	35%	40%
South (Herr/Lime Kiln Lane)	4%	10%	6%	10%
West (Brownsboro Road)	15%	15%	13%	13%
East (Brownsboro Road)	10%	10%	6%	6%
East (Old Brownsboro Road)	7%	6%	6%	5%
Total	100%	100%	100%	100%

The AM and PM peak hour period trips for the development, following distribution and assignment to the roadway network, are illustrated in **Figure 10**. Trips associated with the proposed development were added to the 2018 background traffic volumes. The resulting 2018 plus development traffic volumes are illustrated in **Figure 11**. The 2018 plus development intersection geometrics and traffic control for the study area intersections are illustrated in **Figure 12** and **Figure 13** illustrates the 2018 plus development intersection geometrics and traffic control with the SPUI improvements implemented.

7.2 Potential Area Improvements

Section 6.1 details potential improvements as outlined in the KYTC I-264/US-42 Interchange Scoping Study. The I-264/US-42 Interchange Scoping Study proposes several improvements to the study area based on expected future volumes. The installation of a Single Point Urban Interchange in place of the existing Compressed Diamond Interchange being the most significant improvement recommended. The increase in traffic generated by the site may increase the significance of this future improvement, therefore, capacity analysis was completed under two scenarios: 2018 plus development with I-263 & US-42 under existing conditions and 2018 plus development with I-264 & US-42 as a Single Point Urban Interchange for comparative purposes.

7.3 Capacity Analysis

Section 5.1 details the methods used for capacity analysis. **Table 6** represents the LOS and delay associated with the signalized study intersections. To complete signalized capacity analysis, signal timings were reviewed and intersection splits were updated as necessary to account for changes in traffic volumes at study intersections for the 2018 plus development scenario.

The impact of 2018 volumes with development volumes on the existing roadway network causes deficiencies at intersections adjacent to US-42 and Northfield Drive. During the AM and PM peak hour period the intersection of US-42 and Northfield Drive is expected to operate at LOS F with 2018 plus development volumes on the existing roadway network. Study area intersections are expected to operate at acceptable levels of service with the recommended improvements listed in **Section 7.5**.

Capacity analysis sheets for signalized intersections are included in the **Appendix.**

Table 6: 2018 plus Development Signalized Intersection Capacity Analysis

	I-264 & US-42 as Compressed Diamond Interchange w/ Improvements		I-264 & US-42 as Single Point Urban Interchange	
Intersection	AM Peak Hour*	PM Peak Hour*	AM Peak Hour*	PM Peak Hour
US-42 and Rudy Lane	C (28.0)	D (41.6)	C (29.6)	D (44.8)
US-42 and I-264 WB	E (75.2)	E (69.5)	C (34.5)	D (45.8)
US-42 and I-264 EB	D (37.9)	D (54.2)		
US-42 and Northfield Drive	D (42.4)	C (27.1)	C (24.7)	C (20.3)
US-42 and Holiday Manor Center	A (4.3)	B (14.0)	B (5.2)	B (13.3)
US-42 and Lime Kiln Lane	D (40.9)	C (25.2)	D (39.5)	C (24.5)
KY-22 and I-264 Slip Ramp	C (32.2)	D (37.0)	C (25.6)	D (38.7)
KY-22 and Lime Kiln/Herr Lane	D (41.3)	C (31.8)	D (39.0)	C (31.9)

*LOS (Delay, in seconds)

The overall LOS for study intersections is a D or better with the exception of US-42 and the I-264 WB Ramp during the AM and PM peak hour period. Some individual movements at signalized intersections are operating at LOS D or worse. Intersection delay and queuing are expected to experience minimal increases over the 2018 scenario with the recommended improvements.

During the AM and PM peak hour periods at Rudy Lane and US-42 the eastbound left-turn, westbound left-turn, northbound, and southbound movements are expected to operate at LOS E. The eastbound, westbound, and southbound left-turn movements 95th-percentile queue length is expected to exceed the storage length during the PM peak hour period. The 95th-percentile queue represents the queue length that has a 5 percent probability of being exceeded during the peak hour period. Thus the queuing, if it were to occur, would be expected to be a limited occurrence.

During the AM peak hour period at US-42 and the I-264 WB the westbound left-turn movement is expected to operate at LOS E and the southbound movements are expected to operate at LOS F. During the PM peak hour period the westbound and southbound left-turn movements are expected to operate at LOS F. The westbound left-turn movement is expected to queue to the adjacent I-264 EB Interchange.

At the intersection of US-42 and I-264 EB the eastbound left-turn movement is expected to operate at LOS F during the AM peak hour period and the northbound movements are expected to operate at LOS E and F during the PM peak hour period. The eastbound left-turn movements 95th-percentile queue length is expected to exceed the available storage length during the AM and PM peak hour period.

During the AM peak hour periods at US-42 and Northfield Drive the southbound thru movement is expected to operate at LOS E and the northbound movements are expected to operate at LOS F. Queues are expected to extend south to the adjacent intersection of KY-22 and the I-264 Slip Ramp during the AM peak hour period.

During the AM and PM peak hour periods at KY-22 and the I-264 Slip Ramp the westbound left-turn lane is expected to operate at LOS E. The northbound movement is expected to operate at LOS E during the PM peak hour period. Queue lengths from US-42 and Northfield Drive are expected to approach the intersection during the AM peak hour period. The estimated 95th-percentile queue length for the I-264 slip ramp is expected to approach 600' during the PM peak hour period. The slip ramp itself is approximately 700' plus additional storage on the main off ramp, so queuing is not expected to back on the freeway.

During the AM and PM peak hour period at US-42 and Holiday Manor Center the northbound movement is expected to operate at LOS E. Queuing at the intersection is approximately 200' and likely caused by low split time for the northbound movement due to the side street volumes in comparison with the mainline traffic volumes.

At the intersection of US-42 and Lime Kiln Lane the eastbound and southbound left-turn movements are expected to operate at LOS F and the northbound thru movement is expected to operate at LOS E. During the PM peak hour period the northbound left-turn, northbound right-turn and southbound thru movements are expected to operate at LOS E.

All left-turn movements queue lengths are contained in the available storage bays, however, the westbound movement thru movement experiences a heavy queuing during the AM peak hour period.

During the PM peak hour period at the intersection of KY-22 and Lime Kiln Lane the northbound left-turn and westbound right-turn lanes are expected to operate at LOS E.

The northbound movement at the unsignalized intersection of KY-22 and Warrington Way is expected to operate at LOS F during the AM and PM peak hour periods. The 95th-percentile queue length is expected to by approximately 100' during the peak hour periods.

Capacity analysis sheets are included in the **Appendix. Figure 15** illustrates the future year 2018 plus development level of service for study intersections with the recommended improvements. **Figure 16** illustrates the 2018 plus development level of service for study intersections if the I-264 SPUI were installed.

7.4 Intersection/Driveway Throat Length

Recommended driveway throat lengths are illustrated in **Table 7.**

Table 7: Recommended Driveway Throat Lengths

Intersection/Drive	Throat Length
KY-22/I-264 Slip Ramp & Northfield Drive	300'

7.5 2018 plus Development Recommendations

Study intersections are expected to operate at acceptable levels of service for the 2018 plus proposed development scenario considering the following recommended improvements:

I-264 & US-42 Planned Interchange Improvements

Interchange Improvements were identified as part of the 5-390.00 I-264/US-42 Interchange Scoping Study completed by Palmer Engineering for the Kentucky Transportation Cabinet. The Interchange Scoping Study recommends the ultimate configuration of the I-264 and US-42 Interchange to be a Single Point Urban Interchange (SPUI). Based on future growth and site generated trips, this interchange configuration is expected to improve overall operations to acceptable levels.

Northfield Drive and I-264 Slip Ramp Improvements

Plans for the widening of Northfield Drive to accommodate an additional southbound thru lane and dedicated two-way-left-turn lane between US-42 and KY-22 are being completed as part of the KYTC 3-804.10 project. This project also adds a slip ramp off of I-264 EB connecting to the Northfield Drive and KY-22 Intersection.

US-42 & Northfield Drive

- Widen US-42 to a 6 lane divided roadway from the I-264 Interchange to approximately 600' east of Northfield Drive. Coordinate widening with planned Interchange Improvements. Continue to restrict left-turn movements on US-42 in the eastbound direction at a minimum during the peak hour periods. Due to low volume of left-turn vehicles and available alternate access we recommend restricting the westbound left-turn movement at a minimum during the peak hour periods.
- Add a third northbound lane, providing a triple left turn, extending to the intersection of KY-22 and the I-264 Slip Ramp.

KY-22 & I-264 Slip Ramp

- Modify the intersection to signalize the westbound right-turn movements and to add dual westbound right-turn lanes on KY-22 with approximately 200' of storage.
- Modify the northbound right-turn lane to a thru/right lane to provide two through lanes in the northbound direction.

Figure 9: Proposed Development Trip Distribution

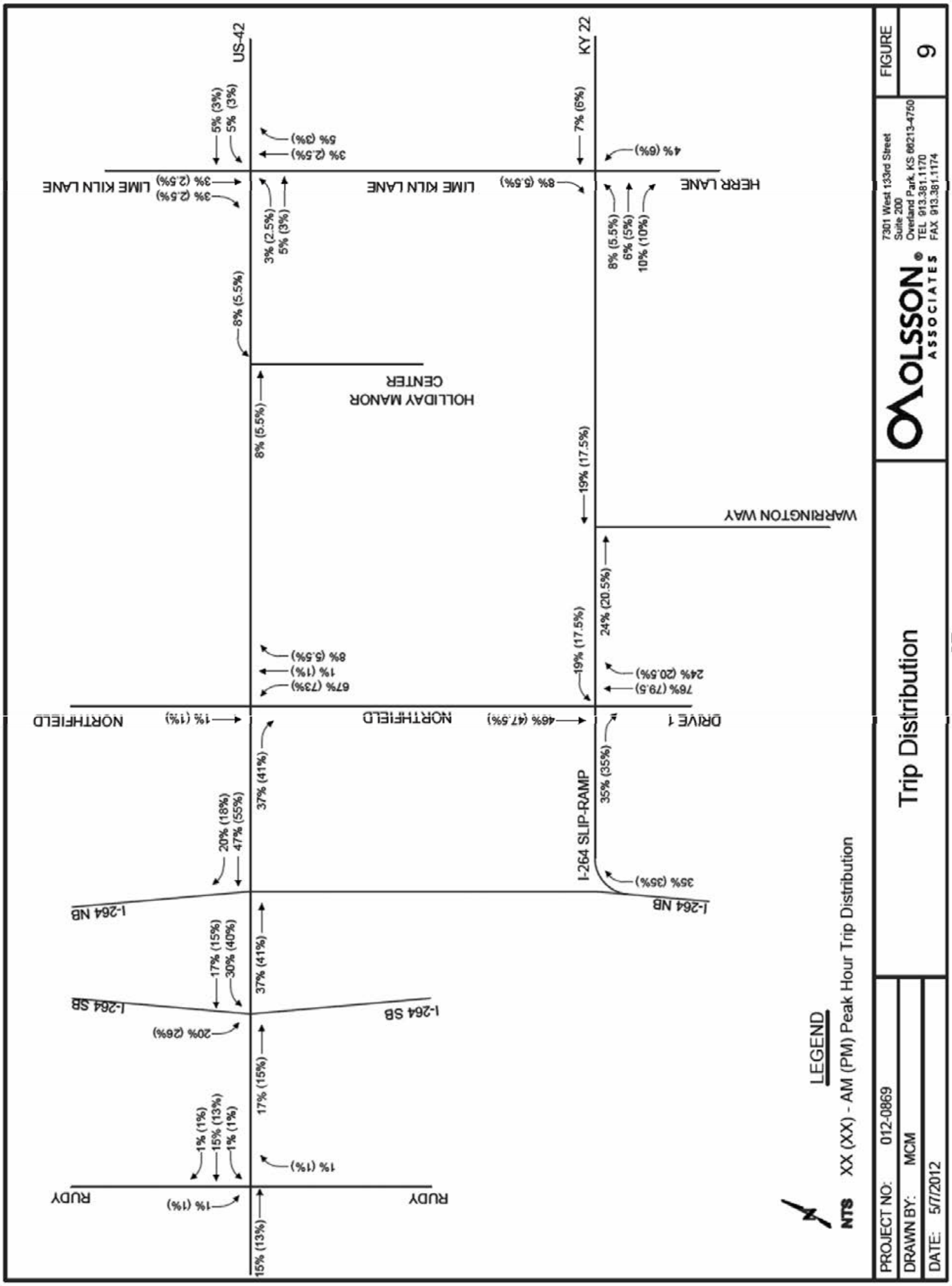


Figure 10: Proposed Development Trips

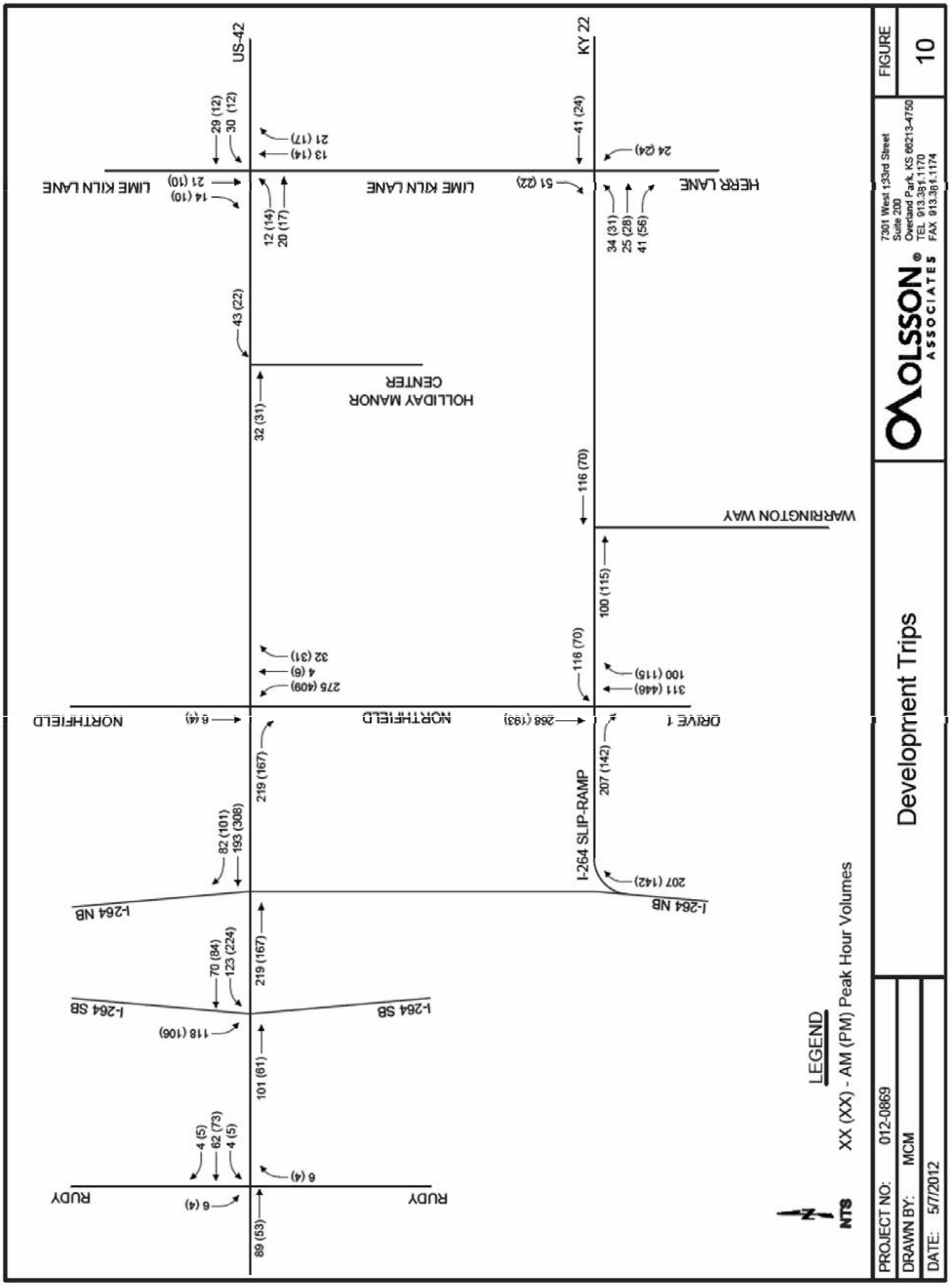


Figure 11: Future Year 2018 + Development Peak Hour Volumes

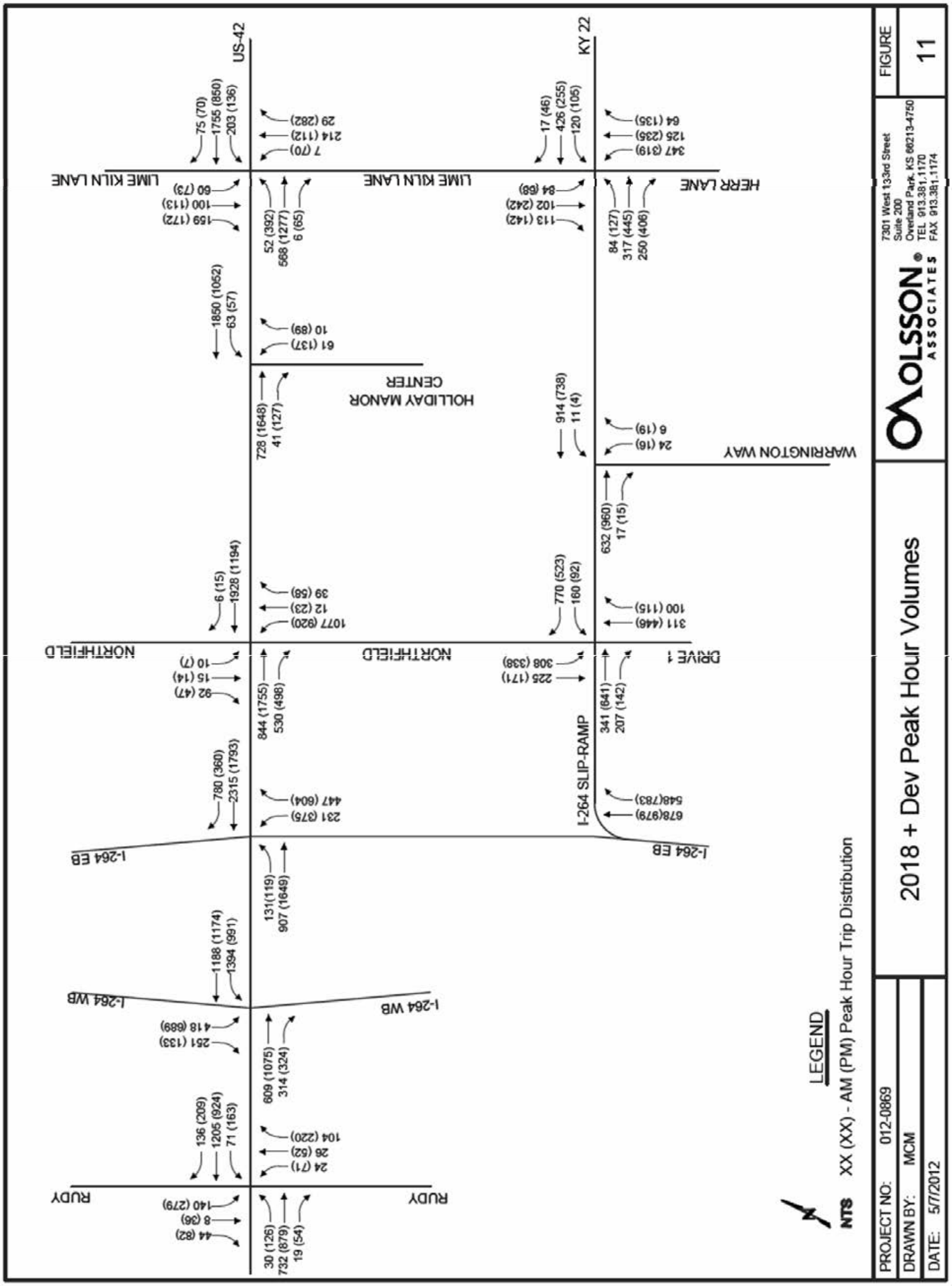


Figure 12: Future Year 2018 + Development Lane Configurations And Traffic Control

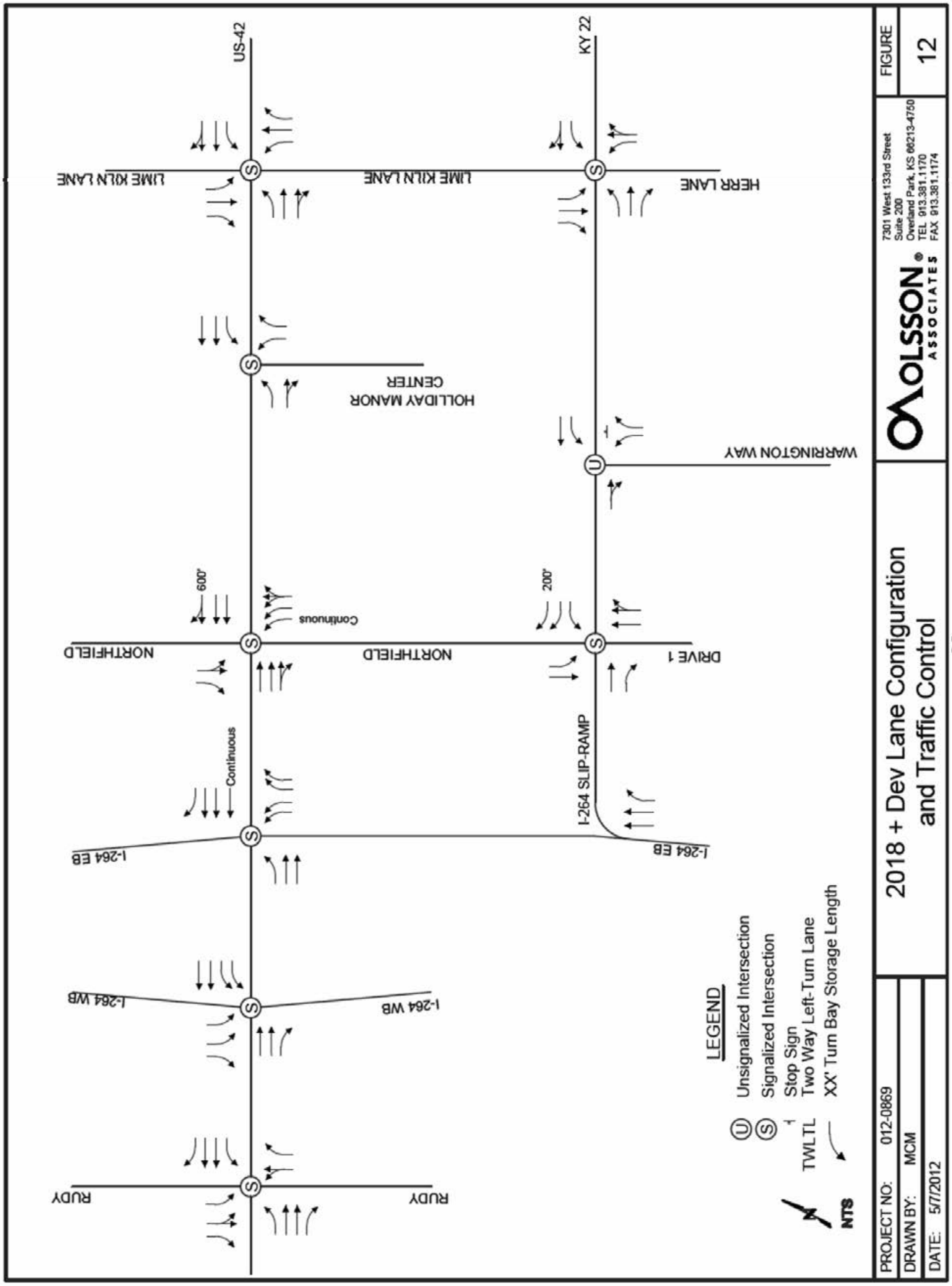


Figure 13: Future Year 2018 + Development Lane Configurations And Traffic Control With SPUI

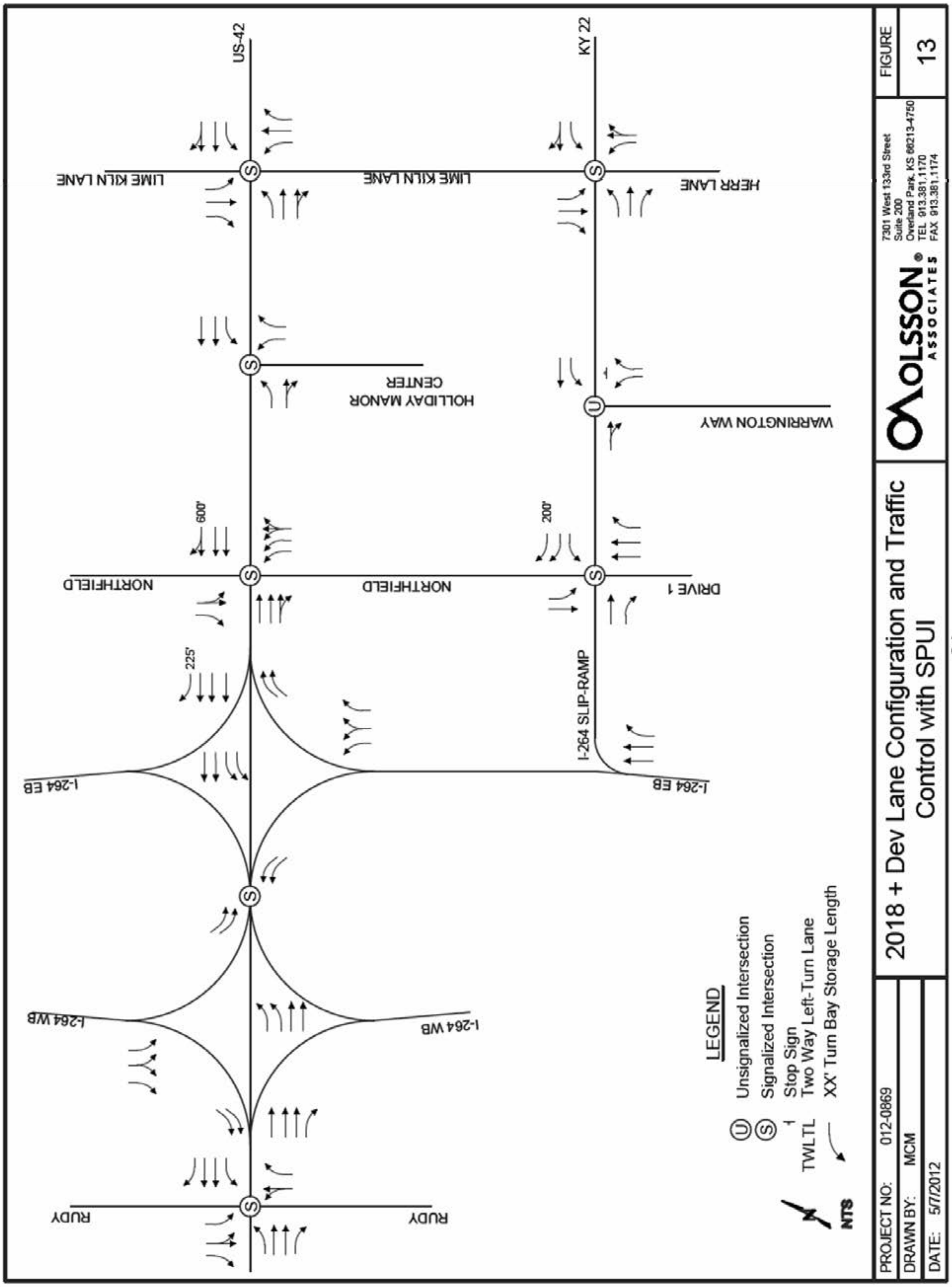


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Figure 14: Future Year 2018 + Development Peak Hour Level Of Service Summary

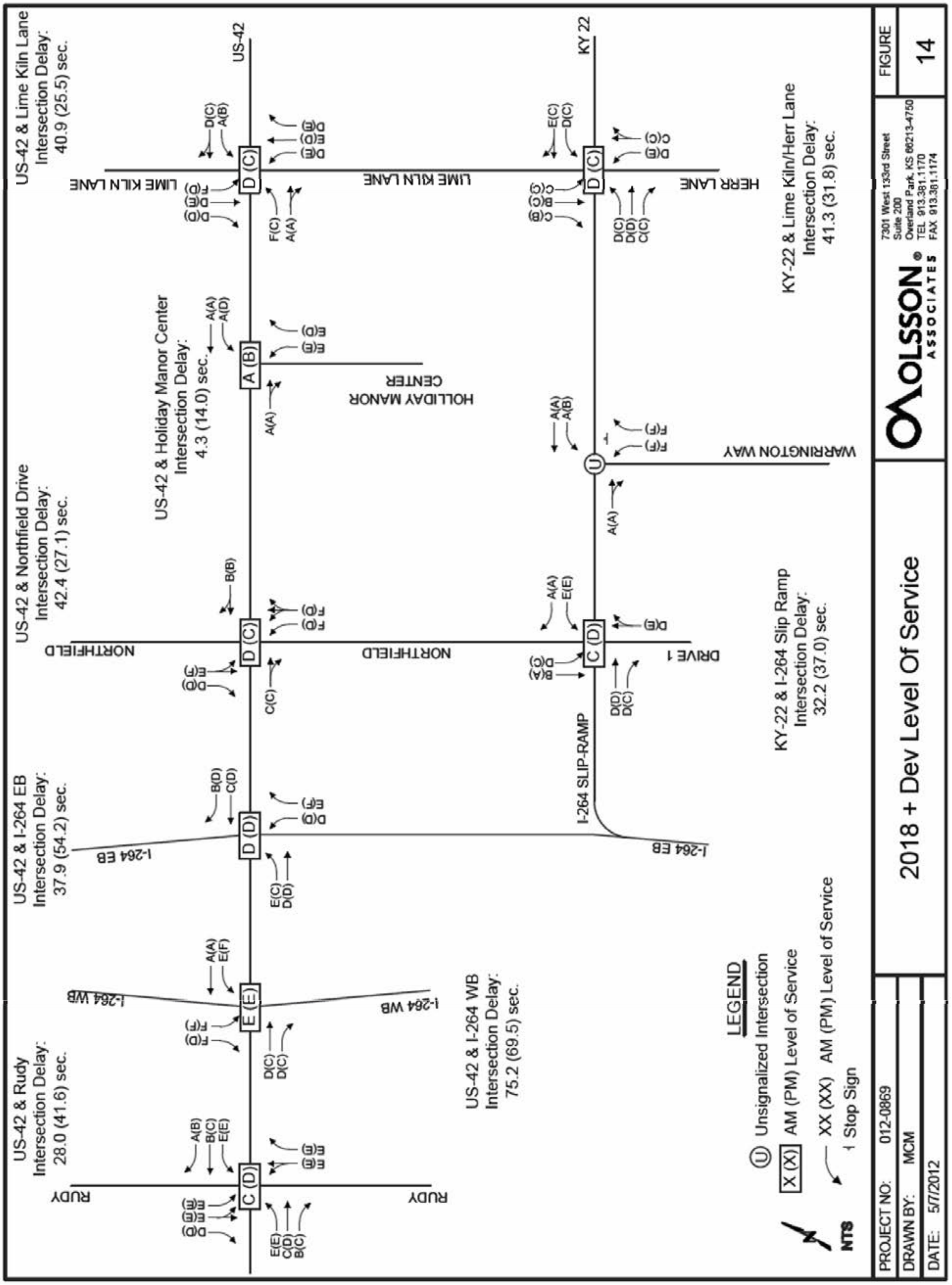

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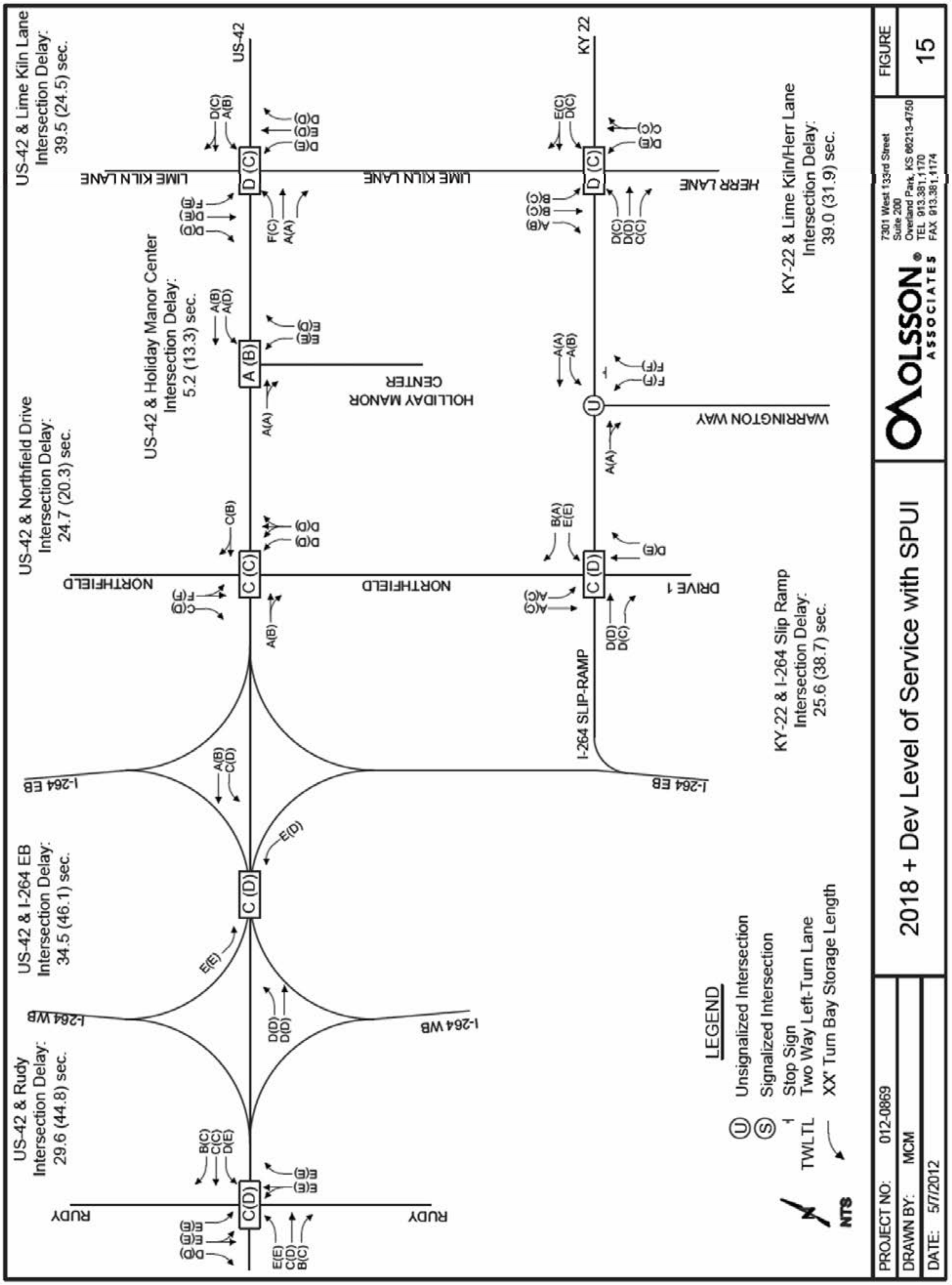
Figure 15: Future Year 2018 + Development Peak Hour Level Of Service Summary With SPUI



8.0 RECOMMENDATIONS & CONCLUSIONS

Based on completion of capacity analysis and review of the proposed project plan, the following improvements are recommended for the project study area for each scenario:

Existing Recommendations

Study intersections are currently operating at or slightly above the threshold of acceptable levels of service with the exception of US-42 and Northfield Drive during the AM peak hour. Improvements associated with the US-42 and I-264 Interchange ramp intersections are discussed in **Section 6.1**. Additional improvements based on existing conditions are not recommended.

Future Year 2018 Recommendations

Study intersections are currently operating at or slightly above the threshold of acceptable levels of service with the exception of US-42 and Northfield Drive during the AM peak hour. Delay at study area intersections slightly increases with the additional volumes. The KYTC currently has planned an Interchange justification study to develop mitigation strategies based on expected future volumes. Interchange improvements are evaluated in more detail in **Section 7.0**

2018 plus Development Recommendations

Study intersections are expected to operate at acceptable levels of service for the 2018 plus proposed development scenario considering the following recommended improvements:

I-264 & US-42 Planned Interchange Improvements

Interchange Improvements were identified as part of the 5-390.00 I-264/US-42 Interchange Scoping Study completed by Palmer Engineering for the Kentucky Transportation Cabinet. The Interchange Scoping Study recommends the ultimate configuration of the I-264 and US-42 Interchange to be a Single Point Urban Interchange (SPUI). Based on future growth and site generated trips, this interchange configuration is expected to improve overall operations to acceptable levels.

Northfield Drive and I-264 Slip Ramp Improvements

Plans for the widening of Northfield Drive to accommodate an additional southbound thru lane and dedicated two-way-left-turn lane between US-42 and KY-22 are being completed as part of the KYTC 3-804.10 project. This project also adds a slip ramp off of I-264 EB connecting to the Northfield Drive and KY-22 Intersection.

US-42 & Northfield Drive

- Widen US-42 to a 6 lane divided roadway from the I-264 Interchange to approximately 600’ east of Northfield Drive. Coordinate widening with planned Interchange Improvements. Continue to restrict left-turn movements on US-42 in the eastbound direction at a minimum during the peak hour periods. Due to low volume of left-turn vehicles and available alternate access we recommend restricting the westbound left-turn movement at a minimum during the peak hour periods.

- Add a third northbound lane, providing a triple left turn, extending to the intersection of KY-22 and the I-264 Slip Ramp.

KY-22 & I-264 Slip Ramp

- Modify the intersection to signalize the westbound right-turn movements and to add dual westbound right-turn lanes on KY-22 with approximately 200' of storage.
- Modify the northbound right-turn lane to a thru/right lane to provide two through lanes in the northbound direction.

APPENDIX

- **EXISTING CONDITIONS**

- **TRAFFIC VOLUMES**

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Turn Count Summary

Location: Brownsboro Rd @ Rudy Ln, Louisville, Ky

Date: 2012 -05 -08
Day of week: Tuesday
Weather: rain earlier in AM; sunny in PM
Analyst: Jones & Chambers

AM COUNT

Total vehicle traffic

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00	34	3	4	5	99	21	3	5	21	0	121	0	316
07:15	27	1	9	12	227	15	4	2	18	6	122	1	444
07:30	47	1	7	14	310	32	5	5	24	5	122	8	580
07:45	21	4	14	18	276	37	9	14	24	11	179	4	611
08:00	26	1	10	17	222	36	4	3	23	5	159	4	510
08:15	29	3	8	28	236	65	11	9	22	14	132	6	563
08:30	28	6	11	18	220	60	11	15	28	11	152	7	567
08:45	79	6	19	34	245	106	12	34	18	23	147	13	736
09:00	64	12	16	16	140	46	1	5	16	4	21	1	342

4669

PM COUNT

Total vehicle traffic

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
16:00	98	14	17	36	163	61	14	13	62	24	156	10	668
16:15	57	16	14	32	186	60	12	10	48	13	175	7	630
16:30	43	5	10	34	143	48	11	10	44	33	156	6	543
16:45	44	10	11	34	177	44	21	21	57	36	158	17	630
17:00	51	8	23	31	163	50	17	14	60	34	209	8	668
17:15	66	9	18	31	221	49	16	10	44	30	189	14	697
17:30	90	9	20	46	198	38	14	15	52	36	166	13	697
17:45	42	7	13	34	189	48	17	8	40	14	184	14	610
18:00	23	10	12	16	102	17	2	2	9	9	22	2	226

5369

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Truck Volume AM=2%

Interval starts	SouthBound Left	SouthBound Thru	SouthBound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Eastbound Left	Eastbound Thru	Eastbound Right	Total
7:00	3				2	1					6	0	12
07:15	0		1		4	2					2	0	9
07:30	0			2	2	1					1	1	7
07:45	0	1			1	0					0	0	2
08:00	0				6	1					2	0	9
08:15	1				5	2					1	1	10
08:30	1	1	1		8	5					2		18
08:45	9			1	3	7				1	8		29
09:00	4				2						0		6
													102

Intersection Peak Hour

08:00-9:00

	SouthBound Left	SouthBound Thru	SouthBound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Eastbound Left	Eastbound Thru	Eastbound Right	Total
Vehicle Total	162	16	48	97	923	267	38	61	91	53	590	30	2376
7:15-8:15	121	7	40	61	1035	120	22	24	89	27	582	17	2145
PHF	0.644	0.438	0.714	0.847	0.835	0.81	0.611	0.429	0.927	0.614	0.813	0.531	

Truck Volume PM=1.4%

Interval starts	SouthBound Left	SouthBound Thru	SouthBound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Eastbound Left	Eastbound Thru	Eastbound Right	Total
16:00	6	0	0	1	3	8	0	0	1		1		20
16:15	2	1	0		3	2	2	0	0		4		14
16:30	0	1	1		4	0	1	0	0		4		11
16:45	0	0			1	0		1	1		3		6
17:00	2	0			1	1			0		4		8
17:15	1	0			1				0		1		3
17:30		1		1	4				0		2		8
17:45					2				1		2	1	6
18:00													0
													76

Intersection Peak Hour

17:00 - 18:00

	SouthBound Left	SouthBound Thru	SouthBound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Eastbound Left	Eastbound Thru	Eastbound Right	Total
Vehicle Total	249	33	74	142	771	185	64	47	196	114	748	49	2672
5:00-6:00	249	33	74	142	771	185	64	47	196	114	748	49	2672
PHF	0.692	0.917	0.804	0.772	0.872	0.93	0.941	0.783	0.817	0.792	0.895	0.875	

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Turn Count Summary

Location: Brownsboro Rd @ Holiday Manor, Louisville, Ky

Date: 2012 -05 -08
Day of week: Tuesday
Weather: rain earlier in AM; sunny in PM
Analyst: Fugate & Deprosky

AM COUNT

Total vehicle traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	1	398	0	7	0	2	0	86	10	504
07:15	0	0	0	3	472	0	12	0	5	0	123	12	627
07:30	0	0	0	3	419	0	16	0	0	0	144	9	591
07:45	0	0	0	0	415	0	14	0	3	0	177	8	617
08:00	0	0	0	5	370	0	13	0	1	0	186	8	583
08:15	0	0	0	3	399	0	18	0	2	0	178	15	615
08:30	0	0	0	6	388	0	9	0	2	0	153	20	578
08:45	0	0	0	7	430	0	19	0	2	0	188	22	668
09:00	0	0	0	1	40	0	5	0	0	0	37	8	91
													4874

PM COUNT

Total vehicle traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	1	250	0	26	0	12	0	290	33	612
16:15	0	0	0	3	208	0	33	0	12	0	345	42	643
16:30	0	0	0	6	234	0	32	0	22	0	270	38	602
16:45	0	0	0	4	234	0	33	0	12	0	345	50	678
17:00	0	0	0	2	244	0	29	0	20	0	376	23	694
17:15	0	0	0	8	243	0	30	0	19	0	384	35	719
17:30	0	0	0	1	235	0	26	0	29	0	331	23	645
17:45	0	0	0	5	231	0	39	0	13	0	374	34	696
18:00	0	0	0	2	45	0	10	0	4	0	49	5	115
													5404

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Truck Volume AM=1.5%

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00					2						3		5
07:15					5	1					5		11
07:30					2						3		5
07:45					6						4		10
08:00					5	1					8		14
08:15					5	1					4		10
08:30				1	3						8		12
08:45					3						3		6
09:00					2						1		3
													76

Intersection Peak Hour

07:45-8:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	21	1587	0	59	0	7	0	705	65	2444
7:15-8:15	0	0	0	11	1676	0	55	0	9	0	630	37	2418
PHF	-	-	-	0.55	0.888	-	0.859	-	0.45	-	0.847	0.771	

Truck Volume PM=less than 1%

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0			0		0		0	9		9
16:15	0	0	0			0		0		0	6		6
16:30	0	0	0			0		0		0	3		3
16:45	0	0	0			0	1	0		0	1		2
17:00	0	0	0			0		0		0	6		6
17:15	0	0	0			0		0		0	4		4
17:30	0	0	0			0		0		0	3		3
17:45	0	0	0			0		0		0	4		4
18:00	0	0	0			0		0		0	0		0
													37

Intersection Peak Hour

17:00 - 18:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	16	953	0	124	0	81	0	1465	115	2754
5:00-6:00	0	0	0	16	953	0	124	0	81	0	1465	115	2754
PHF	-	-	-	0.5	0.976	-	0.795	-	0.698	-	0.954	0.821	

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Turn Count Summary

Location: Brownsboro Rd @ Lime Kiln, Louisville, Ky

Date: 2012 -05 -08
Day of week: Tuesday
Weather: rain earlier in AM; sunny in PM
Analyst: Jones & Matlack

AM COUNT

Total vehicle traffic

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00	7	14	24	26	366	5		15			58		515
07:15	13	22	37	55	475	11		33			116		762
07:30	17	21	42	46	395	24		51		4	119		719
07:45	14	21	25	34	326	21		63		9	130		643
08:00	10	8	27	22	367	12	6	35	7	23	131	5	653
08:15	12	24	64	40	314	21	16	11	23	29	115	10	679
08:30	9	19	82	30	344	17	7	16	22	25	87	3	661
08:45	22	30	73	25	333	36	8	14	29	50	101	7	728
09:00	3	3	4	2	30	5	1	0	2	6	13	0	69
													5429

PM COUNT

Total vehicle traffic

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
16:00	10	17	32	31	211	10	15	17	46	32	244	6	671
16:15	13	20	32	31	174	14	22	21	44	60	262	14	707
16:30	14	21	25	27	157	15	35	22	63	47	236	17	679
16:45	16	18	29	21	221	15	11	20	45	67	289	9	761
17:00	19	24	40	23	170	17	21	22	55	77	280	17	765
17:15	18	21	32	30	187	18	22	18	64	94	311	13	828
17:30	10	14	33	29	200	11	8	23	55	78	293	21	775
17:45	19	34	42	30	202	17	12	26	66	93	257	8	806
18:00	3	5	9	2	37	0	6	3	14	14	68	7	168
													6160

Abbie Jones Consulting
1022 Fontaine Rd
Lexington, KY, 40502
859.559.3443

Truck Volume AM=2%

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00	0	1		3	3	1	0	2	1	2	6	2	21
07:15	0	1	1	2	4	1	0	1	1	1	8	3	23
07:30	2	0	0	0	3	2	1	1	0	1	8	2	20
07:45	0	0	1	0	1		0		0	0	2	1	5
08:00	0	0	0	1	2		1		1	2	5		12
08:15	1	0	1	0	3				1	0	3		9
08:30		1	1	2	8					0	2		14
08:45				1	8					1	2		12
09:00				0	0						1		1
													117

Intersection Peak Hour

08:00-9:00

	SouthBound			Westbound			Northbound			Eastbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
Vehicle Total	53	81	246	117	1358	86	37	76	81	127	434	25	2721
7:15-8:15	54	72	131	157	1563	68	6	182	7	36	496	5	2777
PHF	0.79	0.818	0.78	0.714	0.823	0.71	0.25	0.722	0.25	0.391	0.947	0.25	

Truck Volume PM=1.3%

	SouthBound			Westbound			Northbound			Eastbound			
Interval starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
16:00	0	0	0	2	4		0	2	1	2	6		17
16:15	1	1	3	2	5		0	1	1	1	4		19
16:30		1	0	1	2	1	1		0	1	1		8
16:45			2	1	2		0		0	0	2		7
17:00					1		1		1	2	5		10
17:15					1				1	0	5		7
17:30					1					0	4		5
17:45		1								1	5		7
18:00											1		1
													81

Intersection Peak Hour

17:00 - 18:00

	SouthBound			Westbound			Northbound			Eastbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
Vehicle Total	66	93	147	112	759	63	63	89	240	342	1141	59	3174
5:00-6:00	66	93	147	112	759	63	63	89	240	342	1141	59	3174
PHF	0.87	0.684	0.875	0.933	0.939	0.88	0.716	0.856	0.909	0.91	0.917	0.702	

CUMMINS CONSULTING SERVICES, PLLC
4661 Marlberry Place
Lexington, KY 40509

File Name : KY22-LimeKiln
Site Code : 00000000
Start Date : 2/16/2011
Page No : 1

Groups Printed- Unshifted - Bank 1 - Bank 2

	Lime Kiln Drive From North					KY22 Old Brownsboro From East					Herr Lane From South					KY22 Old Brownsboro 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	9	14	5	2	30	20	55	5	0	80	49	15	8	6	78	8	67	40	4	119	307
07:15 AM	40	28	11	0	79	27	73	3	5	108	92	27	19	14	152	3	113	64	6	186	525
07:30 AM	30	22	12	1	65	30	76	7	2	115	115	43	19	3	180	13	91	53	23	180	540
07:45 AM	5	24	21	0	50	26	111	2	0	139	63	25	11	0	99	19	41	43	4	107	395
Total	84	88	49	3	224	103	315	17	7	442	319	110	57	23	509	43	312	200	37	592	1767
08:00 AM	4	22	14	0	40	30	103	4	0	137	34	23	11	0	68	12	30	37	0	79	324
08:15 AM	6	22	27	4	59	31	88	6	0	125	39	31	16	1	87	24	22	37	0	83	354
08:30 AM	4	35	18	0	57	29	89	9	0	127	43	30	14	0	87	17	36	40	0	93	364
08:45 AM	5	37	23	0	65	51	77	6	0	134	66	25	17	2	110	17	36	65	0	118	427
Total	19	116	82	4	221	141	357	25	0	523	182	109	58	3	352	70	124	179	0	373	1469
04:00 PM	8	48	28	2	86	20	43	4	0	67	72	58	32	7	169	27	84	69	0	180	502
04:15 PM	14	42	26	0	82	19	35	7	0	61	55	55	27	4	141	25	90	84	2	201	485
04:30 PM	12	34	34	1	81	18	55	9	0	82	69	31	28	3	131	32	97	61	2	192	486
04:45 PM	11	49	25	0	85	18	34	8	0	60	45	38	20	3	106	24	105	77	2	208	459
Total	45	173	113	3	334	75	167	28	0	270	241	182	107	17	547	108	376	291	6	781	1932
05:00 PM	21	52	36	1	110	23	47	11	2	83	72	57	31	6	166	20	92	86	0	198	557
05:15 PM	17	52	19	0	88	21	61	10	0	92	65	45	32	1	143	25	116	65	1	207	530
05:30 PM	13	60	23	1	97	25	50	10	0	85	69	54	31	2	156	23	103	87	2	215	553
05:45 PM	13	64	35	0	112	30	60	12	0	102	72	65	33	5	175	22	82	92	0	196	585
Total	64	228	113	2	407	99	218	43	2	362	278	221	127	14	640	90	393	330	3	816	2225
Grand Total	212	605	357	12	1186	418	1057	113	9	1597	1020	622	349	57	2048	311	1205	1000	46	2562	7393
Apprch %	17.9	51	30.1	1		26.2	66.2	7.1	0.6		49.8	30.4	17	2.8		12.1	47	39	1.8		
Total %	2.9	8.2	4.8	0.2	16	5.7	14.3	1.5	0.1	21.6	13.8	8.4	4.7	0.8	27.7	4.2	16.3	13.5	0.6	34.7	
Unshifted	206	592	351	12	1161	408	1052	112	9	1581	993	614	339	53	1999	302	1194	952	45	2493	7234
% Unshifted	97.2	97.9	98.3	100	97.9	97.6	99.5	99.1	100	99	97.4	98.7	97.1	93	97.6	97.1	99.1	95.2	97.8	97.3	97.8
Bank 1	6	13	6	0	25	10	5	1	0	16	27	6	9	2	44	9	11	48	1	69	154
% Bank 1	2.8	2.1	1.7	0	2.1	2.4	0.5	0.9	0	1	2.6	1	2.6	3.5	2.1	2.9	0.9	4.8	2.2	2.7	2.1
Bank 2	0	0	0	0	0	0	0	0	0	0	0	2	1	2	5	0	0	0	0	0	5
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	3.5	0.2	0	0	0	0	0	0.1

	Lime Kiln Drive From North					KY22 Old Brownsboro From East					Herr Lane From South					KY22 Old Brownsboro 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	**40**	**28**	11	0	**79**	27	73	3	**5**	108	92	27	**19**	**14**	152	3	**113**	**64**	6	**186**	525
07:30 AM	30	22	12	**1**	65	**30**	76	**7**	2	115	**115**	**43**	19	3	**180**	13	91	53	**23**	180	**540**
07:45 AM	5	24	**21**	0	50	26	**111**	2	0	**139**	63	25	11	0	99	**19**	41	43	4	107	395
08:00 AM	4	22	14	0	40	30	103	4	0	137	34	23	11	0	68	12	30	37	0	79	324
Total Volume	79	96	58	1	234	113	363	16	7	499	304	118	60	17	499	47	275	197	33	552	1784
% App. Total	33.8	41	24.8	0.4		22.6	72.7	3.2	1.4		60.9	23.6	12	3.4		8.5	49.8	35.7	6		
PHF	.494	.857	.690	.250	.741	.942	.818	.571	.350	.897	.661	.686	.789	.304	.693	.618	.608	.770	.359	.742	.826
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	**21**		**36**	**1**					**2**		**72**			**6**							
05:15 PM	17	52	19	0	88	21	**61**	10	0	92	65	45	32	1	143	**25**	**116**	65	1	207	530
05:30 PM	13	60	23	1	97	25	50	10	0	85	69	54	31	2	156	23	103	87	**2**	**215**	553
05:45 PM	13	**64**	35	0	**112**	**30**	60	**12**	0	**102**	72	**65**	**33**	5	**175**	22	82	**92**	0	196	**585**
Total Volume	64	228	113	2	407	99	218	43	2	362	278	221	127	14	640	90	393	330	3	816	2225
% App. Total	15.7	56	27.8	0.5		27.3	60.2	11.9	0.6		43.4	34.5	19.8	2.2		11	48.2	40.4	0.4		
PHF	.762	.891	.785	.500	.908	.825	.893	.896	.250	.887	.965	.850	.962	.583	.914	.900	.847	.897	.375	.949	.951

CUMMINS CONSULTING SERVICES, PLLC
4661 Marlberry Place
Lexington, KY 40509

File Name : US42-KY22
Site Code : 00000000
Start Date : 2/17/2011
Page No : 1

Groups Printed- Unshifted - Bank 1 - Bank 2

	Northfield Drive From North					US42 From East					KY22 Old Brownsboro From South					US42 From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Rt from US42	Rt from I264 Ramp	App. Total	Int. Total
07:00 AM	3	4	25	0	32	1	400	5	1	407	139	3	0	0	142	5	99	79	78	261	842
07:15 AM	2	4	18	0	24	0	490	2	0	492	159	2	1	0	162	10	131	90	110	341	1019
07:30 AM	2	1	26	0	29	3	502	0	0	505	199	2	1	0	202	8	152	75	61	296	1032
07:45 AM	4	3	19	0	26	1	383	2	0	386	185	2	2	0	189	7	208	90	77	382	983
Total	11	12	88	0	111	5	1775	9	1	1790	682	9	4	0	695	30	590	334	326	1280	3876
08:00 AM	1	0	19	0	20	2	337	1	0	340	169	1	2	0	172	21	212	21	73	327	859
08:15 AM	2	2	28	0	32	5	368	1	0	374	173	3	4	0	180	24	191	32	75	322	908
08:30 AM	2	0	19	1	22	2	332	2	0	336	172	4	6	0	182	5	202	53	83	343	883
08:45 AM	0	3	20	0	23	6	390	1	0	397	200	1	1	0	202	11	219	71	86	387	1009
Total	5	5	86	1	97	15	1427	5	0	1447	714	9	13	0	736	61	824	177	317	1379	3659
04:00 PM	0	2	10	0	12	9	239	8	0	256	134	2	8	0	144	2	312	84	75	473	885
04:15 PM	3	2	20	0	25	2	244	10	0	256	108	2	7	0	117	0	375	62	147	584	982
04:30 PM	1	2	12	0	15	3	213	11	0	227	103	2	8	0	113	3	364	66	132	565	920
04:45 PM	2	2	14	0	18	4	212	3	0	219	107	2	9	0	118	1	413	62	155	631	986
Total	6	8	56	0	70	18	908	32	0	958	452	8	32	0	492	6	1464	274	509	2253	3773
05:00 PM	3	3	5	0	11	5	223	3	0	231	128	2	1	0	131	1	420	80	149	650	1023
05:15 PM	0	3	12	0	15	3	242	3	0	248	99	3	6	0	108	3	432	84	161	680	1051
05:30 PM	3	1	8	0	12	3	217	5	0	225	118	5	10	0	133	3	469	77	151	700	1070
05:45 PM	0	2	17	0	19	4	192	2	0	198	109	5	7	0	121	0	473	53	143	669	1007
Total	6	9	42	0	57	15	874	13	0	902	454	15	24	0	493	7	1794	294	604	2699	4151
Grand Total	28	34	272	1	335	53	4984	59	1	5097	2302	41	73	0	2416	104	4672	1079	1756	7611	15459
Apprch %	8.4	10.1	81.2	0.3		1	97.8	1.2	0		95.3	1.7	3	0		1.4	61.4	14.2	23.1		
Total %	0.2	0.2	1.8	0	2.2	0.3	32.2	0.4	0	33	14.9	0.3	0.5	0	15.6	0.7	30.2	7	11.4	49.2	
Unshifted	26	33	266	1	326	51	4924	55	1	5031	2247	36	69	0	2352	102	4608	1010	1745	7465	15174
% Unshifted	92.9	97.1	97.8	100	97.3	96.2	98.8	93.2	100	98.7	97.6	87.8	94.5	0	97.4	98.1	98.6	93.6	99.4	98.1	98.2
Bank 1	2	1	6	0	9	2	60	4	0	66	55	5	4	0	64	2	64	69	11	146	285
% Bank 1	7.1	2.9	2.2	0	2.7	3.8	1.2	6.8	0	1.3	2.4	12.2	5.5	0	2.6	1.9	1.4	6.4	0.6	1.9	1.8
Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Northfield Drive From North					US42 From East					KY22 Old Brownsboro From South					US42 From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Rt from US42	Rt from I264 Ramp	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	2	**4**	18	0	24	0	490	**2**	0	492	159	**2**	1	0	162	10	131	**90**	**110**	341	1019
07:30 AM	2	1	**26**	0	**29**	**3**	**502**	0	0	**505**	**199**	2	1	0	**202**	8	152	75	61	296	**1032**
07:45 AM	**4**	3	19	0	26	1	383	2	0	386	185	2	**2**	0	189	7	208	90	77	**382**	983
08:00 AM	1	0	19	0	20	2	337	1	0	340	169	1	2	0	172	**21**	**212**	21	73	327	859
Total Volume	9	8	82	0	99	6	1712	5	0	1723	712	7	6	0	725	46	703	276	321	1346	3893
% App. Total	9.1	8.1	82.8	0		0.3	99.4	0.3	0		98.2	1	0.8	0		3.4	52.2	20.5	23.8		
PHF	.563	.500	.788	.000	.853	.500	.853	.625	.000	.853	.894	.875	.750	.000	.897	.548	.829	.767	.730	.881	.943
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	**3**	**3**				**5**					**128**										
05:15 PM	0	3	12	0	15	3	**242**	3	0	**248**	99	3	6	0	108	**3**	432	**84**	**161**	680	1051
05:30 PM	3	1	8	0	12	3	217	**5**	0	225	118	**5**	**10**	0	**133**	3	469	77	151	**700**	**1070**
05:45 PM	0	2	**17**	0	**19**	4	192	2	0	198	109	5	7	0	121	0	**473**	53	143	669	1007
Total Volume	6	9	42	0	57	15	874	13	0	902	454	15	24	0	493	7	1794	294	604	2699	4151
% App. Total	10.5	15.8	73.7	0		1.7	96.9	1.4	0		92.1	3	4.9	0		0.3	66.5	10.9	22.4		
PHF	.500	.750	.618	.000	.750	.750	.903	.650	.000	.909	.887	.750	.600	.000	.927	.583	.948	.875	.938	.964	.970

CUMMINS CONSULTING SERVICES, PLLC
4661 Marlberry Place
Lexington, KY 40509

File Name : US42-264SBRamp
Site Code : 00000000
Start Date : 2/17/2011
Page No : 1

Groups Printed- Unshifted - Bank 1 - Bank 2

	I264 SB Ramp From North					US42 From East					From South					US42 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	62	0	16	0	78	215	189	0	0	404	0	0	0	0	0	0	94	52	0	146	628
07:15 AM	67	0	34	0	101	288	242	0	0	530	0	0	0	0	0	0	98	55	0	153	784
07:30 AM	73	0	44	0	117	311	267	0	0	578	0	0	0	0	0	0	106	67	0	173	868
07:45 AM	74	0	36	0	110	298	209	0	0	507	0	0	0	0	0	0	145	81	0	226	843
Total	276	0	130	0	406	1112	907	0	0	2019	0	0	0	0	0	0	443	255	0	698	3123
08:00 AM	52	0	56	0	108	232	222	0	0	454	0	0	0	0	0	0	102	76	0	178	740
08:15 AM	63	0	37	0	100	259	245	0	0	504	0	0	0	0	0	0	104	65	0	169	773
08:30 AM	61	0	48	0	109	232	267	0	0	499	0	0	0	0	0	0	103	92	0	195	803
08:45 AM	57	0	50	0	107	252	310	0	0	562	0	0	0	0	0	0	154	108	0	262	931
Total	233	0	191	0	424	975	1044	0	0	2019	0	0	0	0	0	0	463	341	0	804	3247
04:00 PM	108	0	18	0	126	146	205	0	0	351	0	0	0	0	0	0	223	85	1	309	786
04:15 PM	114	0	60	0	174	154	211	0	0	365	0	0	0	0	0	0	188	73	1	262	801
04:30 PM	109	0	43	0	152	141	180	0	0	321	0	0	0	0	0	0	163	51	0	214	687
04:45 PM	128	0	32	0	160	143	193	0	0	336	0	0	0	0	0	0	196	73	0	269	765
Total	459	0	153	0	612	584	789	0	0	1373	0	0	0	0	0	0	770	282	2	1054	3039
05:00 PM	137	0	33	0	170	169	201	0	0	370	0	0	0	0	0	0	208	100	0	308	848
05:15 PM	148	0	37	0	185	178	183	0	0	361	0	0	0	0	0	0	213	79	0	292	838
05:30 PM	153	0	15	0	168	172	208	0	0	380	0	0	0	0	0	0	249	46	0	295	843
05:45 PM	153	0	33	0	186	162	190	0	0	352	0	0	0	0	0	0	230	63	0	293	831
Total	591	0	118	0	709	681	782	0	0	1463	0	0	0	0	0	0	900	288	0	1188	3360
Grand Total	1559	0	592	0	2151	3352	3522	0	0	6874	0	0	0	0	0	0	2576	1166	2	3744	12769
Apprch %	72.5	0	27.5	0		48.8	51.2	0	0		0	0	0	0		0	68.8	31.1	0.1		
Total %	12.2	0	4.6	0	16.8	26.3	27.6	0	0	53.8	0	0	0	0	0	0	20.2	9.1	0	29.3	
Unshifted	1522	0	585	0	2107	3347	3497	0	0	6844	0	0	0	0	0	0	2543	1150	2	3695	12646
% Unshifted	97.6	0	98.8	0	98	99.9	99.3	0	0	99.6	0	0	0	0	0	0	98.7	98.6	100	98.7	99
Bank 1	37	0	7	0	44	5	23	0	0	28	0	0	0	0	0	0	32	16	0	48	120
% Bank 1	2.4	0	1.2	0	2	0.1	0.7	0	0	0.4	0	0	0	0	0	0	1.2	1.4	0	1.3	0.9
Bank 2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	3
% Bank 2	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	I264 SB Ramp From North					US42 From East					From South					US42 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 08:00 AM																					
08:00 AM	52	0	**56**	0	108	232	222	0	0	454	0	0	0	0	0	0	102	76	0	178	740
08:15 AM	**63**	0	37	0	100	**259**	245	0	0	504	0	0	0	0	0	0	104	65	0	169	773
08:30 AM	61	0	48	0	**109**	232	267	0	0	499	0	0	0	0	0	0	103	92	0	195	803
08:45 AM	57	0	50	0	107	252	**310**	0	0	**562**	0	0	0	0	0	0	**154**	**108**	0	**262**	**931**
Total Volume	233	0	191	0	424	975	1044	0	0	2019	0	0	0	0	0	0	463	341	0	804	3247
% App. Total	55	0	45	0		48.3	51.7	0	0		0	0	0	0		0	57.6	42.4	0		
PHF	.925	.000	.853	.000	.972	.941	.842	.000	.000	.898	.000	.000	.000	.000	.000	.000	.752	.789	.000	.767	.872
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	137	0	33	0	170	169	201	0	0	370	0	0	0	0	0	0	208	**100**		**308**	**848**
05:15 PM	148	0	**37**	0	185	**178**	183	0	0	361	0	0	0	0	0	0	213	79	0	292	838
05:30 PM	**153**	0	15	0	168	172	**208**	0	0	**380**	0	0	0	0	0	0	**249**	46	0	295	843
05:45 PM	153	0	33	0	**186**	162	190	0	0	352	0	0	0	0	0	0	230	63	0	293	831
Total Volume	591	0	118	0	709	681	782	0	0	1463	0	0	0	0	0	0	900	288	0	1188	3360
% App. Total	83.4	0	16.6	0		46.5	53.5	0	0		0	0	0	0		0	75.8	24.2	0		
PHF	.966	.000	.797	.000	.953	.956	.940	.000	.000	.963	.000	.000	.000	.000	.000	.000	.904	.720	.000	.964	.991

CUMMINS CONSULTING SERVICES, PLLC
4661 Marlberry Place
Lexington, KY 40509

File Name : US42-264NBRamp
Site Code : 00000000
Start Date : 2/17/2011
Page No : 1

Groups Printed- Unshifted - Bank 1 - Bank 2

	From North					US42 From East					I264 NB Ramp From South					US42 From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Rt onto US42	Rt onto KY22	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	370	194	0	564	36	0	49	78	163	25	132	0	0	157	884
07:15 AM	0	0	0	0	0	0	494	177	0	671	45	0	86	110	241	28	140	0	0	168	1080
07:30 AM	0	0	0	0	0	0	545	178	0	723	39	0	83	61	183	35	145	0	0	180	1086
07:45 AM	0	0	0	0	0	0	449	138	0	587	59	0	109	77	245	28	195	0	0	223	1055
Total	0	0	0	0	0	0	1858	687	0	2545	179	0	327	326	832	116	612	0	0	728	4105
08:00 AM	0	0	0	0	0	0	396	127	0	523	62	0	119	73	254	25	131	0	0	156	933
08:15 AM	0	0	0	0	0	0	429	140	0	569	85	0	98	75	258	18	145	0	0	163	990
08:30 AM	0	0	0	0	0	0	419	108	0	527	90	0	116	83	289	21	142	0	0	163	979
08:45 AM	0	0	0	0	0	0	487	119	0	606	83	0	99	86	268	27	190	0	0	217	1091
Total	0	0	0	0	0	0	1731	494	0	2225	320	0	432	317	1069	91	608	0	0	699	3993
04:00 PM	0	0	0	0	0	0	308	73	1	382	46	0	92	75	213	30	307	0	0	337	932
04:15 PM	0	0	0	0	0	0	306	64	0	370	61	0	153	147	361	25	281	0	0	306	1037
04:30 PM	0	0	0	0	0	0	255	74	0	329	68	0	184	132	384	21	248	0	0	269	982
04:45 PM	0	0	0	0	0	0	280	51	0	331	61	0	177	155	393	27	299	0	0	326	1050
Total	0	0	0	0	0	0	1149	262	1	1412	236	0	606	509	1351	103	1135	0	0	1238	4001
05:00 PM	0	0	0	0	0	0	293	60	0	353	78	0	182	149	409	27	318	0	0	345	1107
05:15 PM	0	0	0	0	0	0	290	62	0	352	73	0	181	161	415	25	338	0	0	363	1130
05:30 PM	0	0	0	0	0	0	286	56	0	342	94	0	176	151	421	29	373	0	0	402	1165
05:45 PM	0	0	0	0	0	0	264	52	0	316	88	0	167	143	398	25	360	0	0	385	1099
Total	0	0	0	0	0	0	1133	230	0	1363	333	0	706	604	1643	106	1389	0	0	1495	4501
Grand Total	0	0	0	0	0	0	5871	1673	1	7545	1068	0	2071	1756	4895	416	3744	0	0	4160	16600
Apprch %	0	0	0	0		0	77.8	22.2	0		21.8	0	42.3	35.9		10	90	0	0		
Total %	0	0	0	0	0	0	35.4	10.1	0	45.5	6.4	0	12.5	10.6	29.5	2.5	22.6	0	0	25.1	
Unshifted	0	0	0	0	0	0	5794	1643	1	7438	1050	0	2060	1745	4855	405	3660	0	0	4065	16358
% Unshifted	0	0	0	0	0	0	98.7	98.2	100	98.6	98.3	0	99.5	99.4	99.2	97.4	97.8	0	0	97.7	98.5
Bank 1	0	0	0	0	0	0	72	29	0	101	18	0	11	11	40	11	83	0	0	94	235
% Bank 1	0	0	0	0	0	0	1.2	1.7	0	1.3	1.7	0	0.5	0.6	0.8	2.6	2.2	0	0	2.3	1.4
Bank 2	0	0	0	0	0	0	5	1	0	6	0	0	0	0	0	0	1	0	0	1	7
% Bank 2	0	0	0	0	0	0	0.1	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0

	From North					US42 From East					I264 NB Ramp From South					US42 From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Rt onto US42	Rt onto KY22	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	0	0	0	0	0	0	494	177	0	671	45	0	86	**110**	241	28	140	0	0	168	1080
07:30 AM	0	0	0	0	0	0	**545**	**178**	0	**723**	39	0	83	61	183	**35**	145	0	0	180	**1086**
07:45 AM	0	0	0	0	0	0	449	138	0	587	59	0	109	77	245	28	**195**	0	0	**223**	1055
08:00 AM	0	0	0	0	0	0	396	127	0	523	**62**	0	**119**	73	**254**	25	131	0	0	156	933
Total Volume	0	0	0	0	0	0	1884	620	0	2504	205	0	397	321	923	116	611	0	0	727	4154
% App. Total	0	0	0	0		0	75.2	24.8	0		22.2	0	43	34.8		16	84	0	0		
PHF	.000	.000	.000	.000	.000	.000	.864	.871	.000	.866	.827	.000	.834	.730	.908	.829	.783	.000	.000	.815	.956
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	**293**			**353**			**182**								
05:15 PM	0	0	0	0	0	0	290	**62**	0	352	73	0	181	**161**	415	25	338	0	0	363	1130
05:30 PM	0	0	0	0	0	0	286	56	0	342	**94**	0	176	151	**421**	**29**	**373**	0	0	**402**	**1165**
05:45 PM	0	0	0	0	0	0	264	52	0	316	88	0	167	143	398	25	360	0	0	385	1099
Total Volume	0	0	0	0	0	0	1133	230	0	1363	333	0	706	604	1643	106	1389	0	0	1495	4501
% App. Total	0	0	0	0		0	83.1	16.9	0		20.3	0	43	36.8		7.1	92.9	0	0		
PHF	.000	.000	.000	.000	.000	.000	.967	.927	.000	.965	.886	.000	.970	.938	.976	.914	.931	.000	.000	.930	.966

CUMMINS CONSULTING SERVICES, PLLC
4661 Marlberry Place
Lexington, KY 40509

File Name : KY22-Warrington
Site Code : 00000000
Start Date : 2/16/2011
Page No : 1

Groups Printed- Unshifted - Bank 1 - Bank 2

	From North					KY22 Old Brownsboro From East					Warrington From South					KY22 Old Brownsboro 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	1	108	0	0	109	2	0	1	0	3	0	119	1	0	120	232
07:15 AM	0	0	0	0	0	3	173	0	0	176	6	0	1	0	7	0	171	0	0	171	354
07:30 AM	0	0	0	0	0	2	201	0	0	203	5	0	2	0	7	0	154	5	0	159	369
07:45 AM	0	0	0	0	0	1	193	0	0	194	3	0	2	0	5	0	101	7	0	108	307
Total	0	0	0	0	0	7	675	0	0	682	16	0	6	0	22	0	545	13	0	558	1262
08:00 AM	0	0	0	0	0	4	147	0	0	151	9	0	1	0	10	0	75	4	0	79	240
08:15 AM	0	0	0	0	0	4	149	0	0	153	1	0	2	0	3	0	81	3	0	84	240
08:30 AM	0	0	0	0	0	5	147	0	0	152	0	0	2	0	2	0	92	5	0	97	251
08:45 AM	0	0	0	0	0	1	162	0	0	163	1	0	0	0	1	0	118	2	0	120	284
Total	0	0	0	0	0	14	605	0	0	619	11	0	5	0	16	0	366	14	0	380	1015
04:00 PM	0	0	0	0	0	2	138	0	0	140	3	0	2	0	5	0	174	4	0	178	323
04:15 PM	0	0	0	0	0	2	114	0	0	116	3	0	3	0	6	0	197	6	0	203	325
04:30 PM	0	0	0	0	0	1	157	0	0	158	4	0	5	0	9	0	183	4	0	187	354
04:45 PM	0	0	0	0	0	1	104	0	0	105	4	0	1	0	5	0	205	2	0	207	317
Total	0	0	0	0	0	6	513	0	0	519	14	0	11	0	25	0	759	16	0	775	1319
05:00 PM	0	0	0	0	0	0	155	0	1	156	7	0	6	0	13	0	192	2	3	197	366
05:15 PM	0	0	0	0	0	0	146	0	0	146	3	0	3	0	6	0	203	5	0	208	360
05:30 PM	0	0	0	0	0	1	143	0	0	144	2	0	6	1	9	0	208	1	1	210	363
05:45 PM	0	0	0	0	0	3	165	0	0	168	3	0	3	0	6	0	193	6	0	199	373
Total	0	0	0	0	0	4	609	0	1	614	15	0	18	1	34	0	796	14	4	814	1462
Grand Total	0	0	0	0	0	31	2402	0	1	2434	56	0	40	1	97	0	2466	57	4	2527	5058
Apprch %	0	0	0	0		1.3	98.7	0	0		57.7	0	41.2	1		0	97.6	2.3	0.2		
Total %	0	0	0	0	0	0.6	47.5	0	0	48.1	1.1	0	0.8	0	1.9	0	48.8	1.1	0.1	50	
Unshifted	0	0	0	0	0	31	2365	0	0	2396	54	0	39	0	93	0	2409	54	0	2463	4952
% Unshifted	0	0	0	0	0	100	98.5	0	0	98.4	96.4	0	97.5	0	95.9	0	97.7	94.7	0	97.5	97.9
Bank 1	0	0	0	0	0	0	33	0	0	33	2	0	1	0	3	0	55	3	0	58	94
% Bank 1	0	0	0	0	0	0	1.4	0	0	1.4	3.6	0	2.5	0	3.1	0	2.2	5.3	0	2.3	1.9
Bank 2	0	0	0	0	0	0	4	0	1	5	0	0	0	1	1	0	2	0	4	6	12
% Bank 2	0	0	0	0	0	0	0.2	0	100	0.2	0	0	0	100	1	0	0.1	0	100	0.2	0.2

	From North					KY22 Old Brownsboro From East					Warrington From South					KY22 Old Brownsboro 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	0	0	0	0	0	3	173	0	0	176	6	0	1	0	7	0	**171**	0	0	**171**	354
07:30 AM	0	0	0	0	0	2	**201**	0	0	**203**	5	0	**2**	0	7	0	154	5	0	159	**369**
07:45 AM	0	0	0	0	0	1	193	0	0	194	3	0	2	0	5	0	101	**7**	0	108	307
08:00 AM	0	0	0	0	0	**4**	147	0	0	151	**9**	0	1	0	**10**	0	75	4	0	79	240
Total Volume	0	0	0	0	0	10	714	0	0	724	23	0	6	0	29	0	501	16	0	517	1270
% App. Total	0	0	0	0		1.4	98.6	0	0		79.3	0	20.7	0		0	96.9	3.1	0		
PHF	.000	.000	.000	.000	.000	.625	.888	.000	.000	.892	.639	.000	.750	.000	.725	.000	.732	.571	.000	.756	.860
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	155	0	**1**		**7**		**6**		**13**				**3**		
05:15 PM	0	0	0	0	0	0	146	0	0	146	3	0	3	0	6	0	203	5	0	208	360
05:30 PM	0	0	0	0	0	1	143	0	0	144	2	0	6	**1**	9	0	**208**	1	1	**210**	363
05:45 PM	0	0	0	0	0	**3**	**165**	0	0	**168**	3	0	3	0	6	0	193	**6**	0	199	**373**
Total Volume	0	0	0	0	0	4	609	0	1	614	15	0	18	1	34	0	796	14	4	814	1462
% App. Total	0	0	0	0		0.7	99.2	0	0.2		44.1	0	52.9	2.9		0	97.8	1.7	0.5		
PHF	.000	.000	.000	.000	.000	.333	.923	.000	.250	.914	.536	.000	.750	.250	.654	.000	.957	.583	.333	.969	.980

- **AM CAPACITY REPORT**

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	789	20	1883	64	20
v/c Ratio	0.28	0.04	0.66	0.45	0.13
Control Delay	3.7	2.3	7.4	62.3	22.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	3.7	2.3	7.4	62.3	22.2
Queue Length 50th (ft)	52	2	218	45	0
Queue Length 95th (ft)	116	4	487	92	5
Internal Link Dist (ft)	1052		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2815	556	2839	319	312
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.28	0.04	0.66	0.20	0.06

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	630	37	11	1676	55	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3390		1711	3421	1711	1583
Flt Permitted	1.00		0.34	1.00	0.95	1.00
Satd. Flow (perm)	3390		621	3421	1711	1583
Peak-hour factor, PHF	0.85	0.77	0.55	0.89	0.86	0.45
Adj. Flow (vph)	741	48	20	1883	64	20
RTOR Reduction (vph)	2	0	0	0	0	19
Lane Group Flow (vph)	787	0	20	1883	64	1
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	97.1		98.6	97.1	8.6	8.6
Effective Green, g (s)	97.1		98.6	97.1	8.6	8.6
Actuated g/C Ratio	0.79		0.80	0.79	0.07	0.07
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2687		513	2712	120	111
v/s Ratio Prot	0.23		c0.00	c0.55	c0.04	
v/s Ratio Perm			0.03			0.00
v/c Ratio	0.29		0.04	0.69	0.53	0.01
Uniform Delay, d1	3.4		2.4	5.9	55.0	53.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3		0.0	1.5	4.5	0.0
Delay (s)	3.7		2.4	7.3	59.5	53.0
Level of Service	A		A	A	E	D
Approach Delay (s)	3.7			7.3	58.0	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	122.5	Sum of lost time (s)	15.3
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBR	SBL
Lane Group Flow (vph)	440	815	377
v/c Ratio	0.72	0.51	0.19
Control Delay	48.7	1.0	0.2
Queue Delay	0.0	0.2	0.0
Total Delay	48.7	1.2	0.2
Queue Length 50th (ft)	343	0	0
Queue Length 95th (ft)	317	0	0
Internal Link Dist (ft)	627		
Turn Bay Length (ft)			
Base Capacity (vph)	759	1583	2006
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	181	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.58	0.58	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰		↱		↑	↱	↰	↑	
Volume (vph)	0	321	0	0	0	725	0	0	0	290	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0				4.0				4.0		
Lane Util. Factor		1.00				1.00				1.00		
Frt		1.00				0.85				1.00		
Flt Protected		1.00				1.00				0.95		
Satd. Flow (prot)		2049				1583				2006		
Flt Permitted		1.00				1.00				0.95		
Satd. Flow (perm)		2049				1583				2006		
Peak-hour factor, PHF	0.92	0.73	0.92	0.92	0.92	0.89	0.92	0.92	0.92	0.77	0.92	0.92
Adj. Flow (vph)	0	440	0	0	0	815	0	0	0	377	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	440	0	0	0	815	0	0	0	377	0	0
Turn Type		NA	Perm	Prot		custom			Perm	pm+pt		
Protected Phases		4		3				6		5	2	
Permitted Phases			4			2 3 4 5			6	2		
Actuated Green, G (s)		40.2				135.0				135.0		
Effective Green, g (s)		40.2				135.0				135.0		
Actuated g/C Ratio		0.30				1.00				1.00		
Clearance Time (s)		4.0								4.0		
Vehicle Extension (s)		3.0								3.0		
Lane Grp Cap (vph)		610				1583				2006		
v/s Ratio Prot		0.21								0.19		
v/s Ratio Perm						c0.51						
v/c Ratio		0.72				0.51				0.19		
Uniform Delay, d1		42.4				0.0				0.0		
Progression Factor		1.00				1.00				1.00		
Incremental Delay, d2		4.2				0.2				0.2		
Delay (s)		46.6				0.2				0.2		
Level of Service		D				A				A		
Approach Delay (s)		46.6			0.2			0.0			0.2	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	76	451	256	120	471	461	247	161	112	84
v/c Ratio	0.34	0.70	0.36	0.50	0.68	0.77	0.29	0.31	0.12	0.10
Control Delay	19.9	28.1	2.6	31.1	40.4	38.0	18.6	21.9	18.2	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.9	28.1	2.6	31.1	40.4	38.0	18.6	21.9	18.2	3.8
Queue Length 50th (ft)	21	157	3	63	344	320	110	81	50	0
Queue Length 95th (ft)	32	163	19	105	414	280	119	64	81	12
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	223	640	709	241	697	595	848	512	938	839
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.70	0.36	0.50	0.68	0.77	0.29	0.31	0.12	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	275	197	113	363	16	304	118	60	79	96	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1785		1652	1658		1770	1863	1583
Flt Permitted	0.27	1.00	1.00	0.22	1.00		0.68	1.00		0.55	1.00	1.00
Satd. Flow (perm)	487	1801	1531	400	1785		1183	1658		1018	1863	1583
Peak-hour factor, PHF	0.62	0.61	0.77	0.94	0.82	0.57	0.66	0.69	0.79	0.49	0.86	0.69
Adj. Flow (vph)	76	451	256	120	443	28	461	171	76	161	112	84
RTOR Reduction (vph)	0	0	165	0	2	0	0	12	0	0	0	42
Lane Group Flow (vph)	76	451	91	120	469	0	461	235	0	161	112	42
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	51.2	48.0	48.0	58.8	51.8		68.0	68.0		68.0	68.0	68.0
Effective Green, g (s)	51.2	48.0	48.0	58.8	51.8		68.0	68.0		68.0	68.0	68.0
Actuated g/C Ratio	0.38	0.36	0.36	0.44	0.38		0.50	0.50		0.50	0.50	0.50
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	214	640	544	242	685		596	835		513	938	797
v/s Ratio Prot	0.01	0.25		c0.03	c0.26			0.14			0.06	
v/s Ratio Perm	0.13		0.06	0.19			c0.39			0.16		0.03
v/c Ratio	0.36	0.70	0.17	0.50	0.68		0.77	0.28		0.31	0.12	0.05
Uniform Delay, d1	31.8	37.4	29.8	26.7	34.8		27.2	19.4		19.7	17.7	17.1
Progression Factor	0.66	0.57	0.34	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	6.2	0.6	1.6	5.5		9.4	0.8		1.6	0.3	0.1
Delay (s)	21.9	27.7	10.7	28.3	40.3		36.7	20.2		21.3	17.9	17.2
Level of Service	C	C	B	C	D		D	C		C	B	B
Approach Delay (s)		21.6			37.8			30.9			19.3	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	27.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	92	542	221	2003	24	253	28	68	88	168
v/c Ratio	0.60	0.25	0.34	0.86	0.11	0.81	0.10	0.86	0.28	0.48
Control Delay	37.6	10.7	6.4	22.5	46.8	72.3	27.0	122.1	49.6	24.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.6	10.7	6.4	22.5	46.8	72.3	27.0	122.1	49.6	24.4
Queue Length 50th (ft)	24	101	49	678	18	210	9	57	66	49
Queue Length 95th (ft)	15	138	60	672	12	235	1	#118	107	90
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	157	2190	663	2342	252	371	328	93	371	397
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.25	0.33	0.86	0.10	0.68	0.09	0.73	0.24	0.42

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)	36	496	5	157	1563	68	6	182	7	54	72	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3402		1770	3514		1770	1863	1583	1770	1863	1583
Flt Permitted	0.05	1.00		0.42	1.00		0.68	1.00	1.00	0.25	1.00	1.00
Satd. Flow (perm)	91	3402		774	3514		1269	1863	1583	470	1863	1583
Peak-hour factor, PHF	0.39	0.95	0.25	0.71	0.82	0.70	0.25	0.72	0.25	0.80	0.82	0.78
Adj. Flow (vph)	92	522	20	221	1906	97	24	253	28	68	88	168
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	13	0	0	86
Lane Group Flow (vph)	92	540	0	221	2000	0	24	253	15	68	88	82
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	90.9	84.2		96.7	87.1		22.0	22.0	22.0	22.0	22.0	22.0
Effective Green, g (s)	90.9	84.2		96.7	87.1		22.0	22.0	22.0	22.0	22.0	22.0
Actuated g/C Ratio	0.69	0.64		0.74	0.67		0.17	0.17	0.17	0.17	0.17	0.17
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	152	2190		645	2340		213	313	266	79	313	266
v/s Ratio Prot	c0.03	0.16		0.03	c0.57			0.14			0.05	
v/s Ratio Perm	0.39			0.23			0.02		0.01	c0.14		0.05
v/c Ratio	0.61	0.25		0.34	0.85		0.11	0.81	0.06	0.86	0.28	0.31
Uniform Delay, d1	24.0	9.9		5.3	16.9		46.1	52.4	45.7	52.9	47.5	47.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	0.3		0.3	4.3		0.2	14.2	0.1	57.2	0.5	0.7
Delay (s)	30.6	10.1		5.6	21.2		46.4	66.5	45.8	110.1	48.0	48.4
Level of Service	C	B		A	C		D	E	D	F	D	D
Approach Delay (s)		13.1			19.7			63.0			61.2	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	130.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	140	783	2191	713	311	478
v/c Ratio	0.80	0.30	0.72	0.60	0.55	0.56
Control Delay	77.6	18.7	19.1	5.5	56.2	6.9
Queue Delay	0.0	2.3	61.6	2.3	0.0	0.4
Total Delay	77.6	21.0	80.7	7.8	56.2	7.2
Queue Length 50th (ft)	126	258	389	106	130	0
Queue Length 95th (ft)	m#182	263	m394	m93	164	31
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	176	2632	3028	1179	562	856
Starvation Cap Reductn	0	1669	1094	321	0	0
Spillback Cap Reductn	0	647	145	0	0	87
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.81	1.13	0.83	0.55	0.62

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)	116	611	0	0	1884	620	258	0	397	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.83	0.78	0.92	0.92	0.86	0.87	0.83	0.92	0.83	0.92	0.92	0.92
Adj. Flow (vph)	140	783	0	0	2191	713	311	0	478	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	265	0	0	400	0	0	0
Lane Group Flow (vph)	140	783	0	0	2191	448	311	0	78	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2 8		1					
Permitted Phases						2 8			1			
Actuated Green, G (s)	13.4	100.4			80.4	80.4	22.1		22.1			
Effective Green, g (s)	13.4	88.8			73.8	73.8	22.1		22.1			
Actuated g/C Ratio	0.10	0.66			0.55	0.55	0.16		0.16			
Clearance Time (s)	6.6						6.6		6.6			
Vehicle Extension (s)	6.0						4.0		4.0			
Lane Grp Cap (vph)	176	2328			2780	865	562		456			
v/s Ratio Prot	c0.08	0.22			c0.43		c0.09					
v/s Ratio Perm						0.28			0.03			
v/c Ratio	0.80	0.34			0.79	0.52	0.55		0.17			
Uniform Delay, d1	59.5	10.2			24.4	19.3	51.9		48.6			
Progression Factor	0.88	3.21			0.95	1.71	1.00		1.00			
Incremental Delay, d2	20.6	0.1			0.5	0.2	1.5		0.2			
Delay (s)	73.2	32.7			23.6	33.2	53.4		48.8			
Level of Service	E	C			C	C	D		D			
Approach Delay (s)		38.9			26.0			50.6			0.0	
Approach LOS		D			C			D			A	

Intersection Summary			
HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	44	719	32	72	1247	150	92	96	102	103	56
v/c Ratio	0.35	0.37	0.04	0.47	0.62	0.17	0.54	0.41	0.56	0.56	0.25
Control Delay	66.1	20.7	13.6	62.3	28.7	16.5	69.4	15.6	68.2	68.0	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.1	20.7	13.6	62.3	29.4	16.5	69.4	15.6	68.2	68.0	15.4
Queue Length 50th (ft)	37	191	7	61	491	55	78	0	90	91	0
Queue Length 95th (ft)	51	260	14	m94	583	m108	60	53	102	69	22
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	133	1934	871	216	2001	909	333	367	254	256	287
Starvation Cap Reductn	0	0	0	0	402	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.37	0.04	0.33	0.78	0.17	0.28	0.26	0.40	0.40	0.20

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)	27	582	17	61	1035	120	22	24	89	121	7	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Peak-hour factor, PHF	0.61	0.81	0.53	0.85	0.83	0.80	0.61	0.43	0.93	0.64	0.44	0.71
Adj. Flow (vph)	44	719	32	72	1247	150	36	56	96	189	16	56
RTOR Reduction (vph)	0	0	6	0	0	14	0	0	87	0	0	50
Lane Group Flow (vph)	44	719	26	72	1247	136	0	92	9	102	103	6
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	8.4	72.4	72.4	10.3	75.2	75.2		12.6	12.6	14.6	14.6	14.6
Effective Green, g (s)	8.4	72.4	72.4	10.3	75.2	75.2		12.6	12.6	14.6	14.6	14.6
Actuated g/C Ratio	0.06	0.54	0.54	0.08	0.56	0.56		0.09	0.09	0.11	0.11	0.11
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	110	1898	849	135	1971	882		171	148	182	184	171
v/s Ratio Prot	0.02	0.20		c0.04	c0.35			c0.05		c0.06	0.06	
v/s Ratio Perm			0.02			0.09			0.01			0.00
v/c Ratio	0.40	0.38	0.03	0.53	0.63	0.15		0.54	0.06	0.56	0.56	0.04
Uniform Delay, d1	60.9	18.2	14.8	60.0	20.5	14.5		58.4	55.8	57.2	57.1	53.9
Progression Factor	1.00	1.00	1.00	0.93	1.21	1.16		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.6	0.1	4.5	1.4	0.3		3.6	0.2	4.7	4.5	0.1
Delay (s)	64.1	18.8	14.8	60.2	26.2	17.2		62.1	56.0	61.9	61.6	54.0
Level of Service	E	B	B	E	C	B		E	E	E	E	D
Approach Delay (s)		21.1			26.9			59.0			60.1	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.1
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	902	358	12	2022	408	408	32	104
v/c Ratio	0.46	0.35	0.04	1.03	0.88	0.88	0.29	0.22
Control Delay	30.7	13.6	18.3	57.6	67.7	67.3	65.7	7.6
Queue Delay	0.5	0.3	0.0	0.0	104.1	104.2	0.0	0.4
Total Delay	31.2	14.0	18.3	57.6	171.8	171.5	65.7	8.0
Queue Length 50th (ft)	390	169	5	~1085	363	362	27	0
Queue Length 95th (ft)	433	180	10	#1136	#625	#610	33	30
Internal Link Dist (ft)	328			1052		293	358	
Turn Bay Length (ft)			110					90
Base Capacity (vph)	1973	1012	288	1971	486	487	143	501
Starvation Cap Reductn	579	247	0	0	99	99	0	0
Spillback Cap Reductn	0	0	0	0	153	154	0	147
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.47	0.04	1.03	1.23	1.23	0.22	0.29

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	749	276	6	1712	5	712	7	6	9	8	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.95	1.00	1.00	0.95		0.95	0.95			1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00	1.00			1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95			0.98	1.00
Satd. Flow (prot)		3539	1531	2006	3537		1681	1684			1696	1478
Flt Permitted		1.00	1.00	0.24	1.00		0.95	0.95			0.98	1.00
Satd. Flow (perm)		3539	1531	517	3537		1681	1684			1696	1478
Peak-hour factor, PHF	0.55	0.83	0.77	0.50	0.85	0.62	0.89	0.88	0.75	0.56	0.50	0.79
Adj. Flow (vph)	0	902	358	12	2014	8	800	8	8	16	16	104
RTOR Reduction (vph)	0	0	165	0	0	0	0	1	0	0	0	75
Lane Group Flow (vph)	0	902	193	12	2022	0	408	407	0	0	32	29
Turn Type		NA	Perm	Perm	NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases			2	6								4
Actuated Green, G (s)		72.6	72.6	72.6	72.6		37.1	37.1			6.1	37.1
Effective Green, g (s)		72.6	72.6	72.6	72.6		37.1	37.1			6.1	37.1
Actuated g/C Ratio		0.54	0.54	0.54	0.54		0.27	0.27			0.05	0.27
Clearance Time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		1903	823	278	1902		462	463			77	406
v/s Ratio Prot		0.25			c0.57		c0.24	0.24			c0.02	
v/s Ratio Perm			0.13	0.02								0.02
v/c Ratio		0.47	0.23	0.04	1.06		0.88	0.88			0.42	0.07
Uniform Delay, d1		19.4	16.5	14.8	31.2		46.9	46.8			62.7	36.2
Progression Factor		1.53	6.64	1.00	1.00		1.04	1.04			1.00	1.00
Incremental Delay, d2		0.8	0.6	0.3	39.8		16.3	15.7			4.9	0.1
Delay (s)		30.4	110.2	15.1	71.0		65.2	64.6			67.6	36.3
Level of Service		C	F	B	E		E	E			E	D
Approach Delay (s)		53.1			70.6			64.9			43.7	
Approach LOS		D			E			E			D	

Intersection Summary			
HCM Average Control Delay	63.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	618	324	1241	1128	296	293
v/c Ratio	0.51	0.53	0.88	0.41	0.89	0.95
Control Delay	26.2	13.6	32.1	0.3	88.9	63.3
Queue Delay	0.3	0.4	2.8	0.2	0.3	29.9
Total Delay	26.5	14.0	34.9	0.6	89.1	93.2
Queue Length 50th (ft)	221	38	475	0	134	109
Queue Length 95th (ft)	116	86	562	0	#218	#178
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1213	609	1436	2757	331	310
Starvation Cap Reductn	183	64	110	807	0	0
Spillback Cap Reductn	0	0	0	669	1	34
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.59	0.94	0.58	0.90	1.06

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)	0	451	279	1129	993	0	0	0	0	266	0	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.73	0.86	0.91	0.88	0.92	0.92	0.92	0.92	0.90	0.92	0.76
Adj. Flow (vph)	0	618	324	1241	1128	0	0	0	0	296	0	293
RTOR Reduction (vph)	0	0	90	0	0	0	0	0	0	0	0	157
Lane Group Flow (vph)	0	618	234	1241	1128	0	0	0	0	296	0	136
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		46.3	46.3	57.5	110.4					13.0		13.0
Effective Green, g (s)		39.7	39.7	57.5	104.5					13.0		13.0
Actuated g/C Ratio		0.29	0.29	0.43	0.77					0.10		0.10
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1041	450	1414	2648					331		152
v/s Ratio Prot		c0.17		c0.37	c0.33							
v/s Ratio Perm			0.15							c0.09		0.09
v/c Ratio		0.59	0.52	0.88	0.43					0.89		0.89
Uniform Delay, d1		40.8	39.7	35.5	5.1					60.3		60.3
Progression Factor		0.69	0.49	0.73	0.01					1.00		1.00
Incremental Delay, d2		1.0	1.3	5.3	0.1					25.4		43.8
Delay (s)		29.1	20.6	31.4	0.1					85.7		104.1
Level of Service		C	C	C	A					F		F
Approach Delay (s)		26.2			16.5			0.0			94.9	
Approach LOS		C			B			A			F	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	18.2
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JSS*	Intersection	*Warrington Way & KY-22*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Louisville, KY*
Date Performed	*04/23/2012*	Analysis Year	*Existing*
Analysis Time Period	*7:15 am*		
Project Description *VA Hospital*			
East/West Street: *KY-22*		North/South Street: *Warrington Way*	
Intersection Orientation: *East-West*		Study Period (hrs): *0.25*	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*501*	*16*	*10*	*710*	
Peak-Hour Factor, PHF	*1.00*	*0.73*	*0.57*	*0.62*	*0.89*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*686*	*28*	*16*	*797*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*1*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*23*		*6*			
Peak-Hour Factor, PHF	*0.64*	*1.00*	*0.75*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*0*	*8*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*2*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*16*		*43*				
C (m) (veh/h)		*826*		*101*				
v/c		*0.02*		*0.43*				
95% queue length		*0.06*		*1.78*				
Control Delay (s/veh)		*9.4*		*66.0*				
LOS		*A*		*F*				
Approach Delay (s/veh)	--	--	*66.0*					
Approach LOS	--	--	*F*					

 HCS+™ Version 5.6 Generated: 5/23/2012 9:14 AM

- **PM CAPACITY REPORT**

Queues
15: Holiday Manor Center & US-42

Existing w/Slip Ramp PM
5/23/2012

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1682	32	972	157	116
v/c Ratio	0.67	0.17	0.38	0.69	0.43
Control Delay	11.0	5.6	7.1	68.9	26.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.0	5.6	7.1	68.9	26.8
Queue Length 50th (ft)	366	5	150	127	34
Queue Length 95th (ft)	522	8	218	174	57
Internal Link Dist (ft)	1052		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2520	188	2547	316	350
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.67	0.17	0.38	0.50	0.33

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1465	115	16	953	124	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3379		1711	3421	1711	1583
Flt Permitted	1.00		0.10	1.00	0.95	1.00
Satd. Flow (perm)	3379		182	3421	1711	1583
Peak-hour factor, PHF	0.95	0.82	0.50	0.98	0.79	0.70
Adj. Flow (vph)	1542	140	32	972	157	116
RTOR Reduction (vph)	4	0	0	0	0	62
Lane Group Flow (vph)	1678	0	32	972	157	54
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	93.2		95.5	93.2	16.5	16.5
Effective Green, g (s)	93.2		95.5	93.2	16.5	16.5
Actuated g/C Ratio	0.73		0.75	0.73	0.13	0.13
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2474		164	2505	222	205
v/s Ratio Prot	c0.50		c0.00	0.28	c0.09	
v/s Ratio Perm			0.14			0.03
v/c Ratio	0.68		0.20	0.39	0.71	0.26
Uniform Delay, d1	9.1		7.5	6.4	53.1	49.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5		0.6	0.5	9.8	0.7
Delay (s)	10.6		8.1	6.8	62.9	50.6
Level of Service	B		A	A	E	D
Approach Delay (s)	10.6			6.9	57.7	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	127.3	Sum of lost time (s)	15.3
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBR	SBL
Lane Group Flow (vph)	643	554	361
v/c Ratio	0.81	0.35	0.18
Control Delay	45.0	0.6	0.2
Queue Delay	0.0	0.0	0.0
Total Delay	45.0	0.6	0.2
Queue Length 50th (ft)	490	0	0
Queue Length 95th (ft)	585	0	0
Internal Link Dist (ft)	627		
Turn Bay Length (ft)			
Base Capacity (vph)	926	1583	2006
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	35	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.69	0.36	0.18

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰		↱		↑	↱	↰	↑	
Volume (vph)	0	604	0	0	0	493	0	0	0	318	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0				4.0				4.0		
Lane Util. Factor		1.00				1.00				1.00		
Frt		1.00				0.85				1.00		
Flt Protected		1.00				1.00				0.95		
Satd. Flow (prot)		2049				1583				2006		
Flt Permitted		1.00				1.00				0.95		
Satd. Flow (perm)		2049				1583				2006		
Peak-hour factor, PHF	0.92	0.94	0.92	0.92	0.92	0.89	0.92	0.92	0.92	0.88	0.92	0.92
Adj. Flow (vph)	0	643	0	0	0	554	0	0	0	361	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	643	0	0	0	554	0	0	0	361	0	0
Turn Type		NA	Perm	Prot		custom			Perm	pm+pt		
Protected Phases		4		3				6		5	2	
Permitted Phases			4			2 3 4 5			6	2		
Actuated Green, G (s)		52.3				135.0				135.0		
Effective Green, g (s)		52.3				135.0				135.0		
Actuated g/C Ratio		0.39				1.00				1.00		
Clearance Time (s)		4.0								4.0		
Vehicle Extension (s)		3.0								3.0		
Lane Grp Cap (vph)		794				1583				2006		
v/s Ratio Prot		c0.31								0.18		
v/s Ratio Perm						c0.35						
v/c Ratio		0.81				0.35				0.18		
Uniform Delay, d1		36.9				0.0				0.0		
Progression Factor		1.00				1.00				1.00		
Incremental Delay, d2		6.1				0.1				0.2		
Delay (s)		43.0				0.1				0.2		
Level of Service		D				A				A		
Approach Delay (s)		43.0			0.1			0.0			0.2	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	100	462	367	121	293	290	392	84	256	143
v/c Ratio	0.19	0.56	0.41	0.31	0.35	0.90	0.61	0.36	0.36	0.21
Control Delay	18.2	32.6	4.2	19.0	25.8	69.0	34.1	31.5	29.8	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.2	32.6	4.2	19.0	25.8	69.0	34.1	31.5	29.8	3.8
Queue Length 50th (ft)	41	300	0	50	162	232	251	51	156	0
Queue Length 95th (ft)	85	432	65	89	258	331	284	69	194	24
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	517	831	904	398	835	400	796	293	883	826
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.56	0.41	0.30	0.35	0.72	0.49	0.29	0.29	0.17

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	393	330	99	218	43	278	221	127	64	228	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1756		1652	1651		1770	1863	1583
Flt Permitted	0.50	1.00	1.00	0.32	1.00		0.49	1.00		0.33	1.00	1.00
Satd. Flow (perm)	906	1801	1531	578	1756		844	1651		617	1863	1583
Peak-hour factor, PHF	0.90	0.85	0.90	0.82	0.89	0.90	0.96	0.85	0.96	0.76	0.89	0.79
Adj. Flow (vph)	100	462	367	121	245	48	290	260	132	84	256	143
RTOR Reduction (vph)	0	0	198	0	5	0	0	16	0	0	0	89
Lane Group Flow (vph)	100	462	169	121	288	0	290	376	0	84	256	54
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	70.1	62.3	62.3	73.1	63.8		51.4	51.4		51.4	51.4	51.4
Effective Green, g (s)	70.1	62.3	62.3	73.1	63.8		51.4	51.4		51.4	51.4	51.4
Actuated g/C Ratio	0.52	0.46	0.46	0.54	0.47		0.38	0.38		0.38	0.38	0.38
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	517	831	707	391	830		321	629		235	709	603
v/s Ratio Prot	0.01	c0.26		c0.02	0.16			0.23			0.14	
v/s Ratio Perm	0.09		0.11	0.15			c0.34			0.14		0.03
v/c Ratio	0.19	0.56	0.24	0.31	0.35		0.90	0.60		0.36	0.36	0.09
Uniform Delay, d1	16.9	26.3	22.0	17.5	22.5		39.5	33.5		30.0	30.0	26.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	2.7	0.8	0.5	1.1		27.1	1.5		0.9	0.3	0.1
Delay (s)	17.0	29.0	22.8	17.9	23.6		66.6	35.0		30.9	30.3	26.9
Level of Service	B	C	C	B	C		E	D		C	C	C
Approach Delay (s)		25.3			21.9			48.5			29.4	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	376	1324	120	877	88	103	264	73	137	167
v/c Ratio	0.67	0.59	0.39	0.43	0.60	0.38	0.62	0.42	0.51	0.45
Control Delay	11.6	13.5	11.0	17.0	64.3	49.2	15.7	52.8	52.8	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.6	13.5	11.0	17.0	64.3	49.2	15.7	52.8	52.8	10.3
Queue Length 50th (ft)	68	261	19	176	63	72	24	51	97	0
Queue Length 95th (ft)	153	446	48	347	94	120	107	100	120	55
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	828	2246	399	2043	239	443	550	286	443	504
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.59	0.30	0.43	0.37	0.23	0.48	0.26	0.31	0.33

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	342	1141	59	112	759	63	63	89	240	66	93	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3389		1770	3497		1770	1863	1583	1770	1863	1583
Flt Permitted	0.25	1.00		0.17	1.00		0.54	1.00	1.00	0.64	1.00	1.00
Satd. Flow (perm)	481	3389		325	3497		1006	1863	1583	1201	1863	1583
Peak-hour factor, PHF	0.91	0.92	0.70	0.93	0.94	0.90	0.72	0.86	0.91	0.90	0.68	0.88
Adj. Flow (vph)	376	1240	84	120	807	70	88	103	264	73	137	167
RTOR Reduction (vph)	0	3	0	0	3	0	0	0	195	0	0	143
Lane Group Flow (vph)	376	1321	0	120	874	0	88	103	69	73	137	24
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	91.1	78.4		76.8	69.1		17.2	17.2	17.2	17.2	17.2	17.2
Effective Green, g (s)	91.1	78.4		76.8	69.1		17.2	17.2	17.2	17.2	17.2	17.2
Actuated g/C Ratio	0.77	0.66		0.65	0.58		0.15	0.15	0.15	0.15	0.15	0.15
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	564	2246		305	2043		146	271	230	175	271	230
v/s Ratio Prot	c0.10	0.39		0.03	0.25			0.06			0.07	
v/s Ratio Perm	c0.42			0.23			c0.09		0.04	0.06		0.02
v/c Ratio	0.67	0.59		0.39	0.43		0.60	0.38	0.30	0.42	0.51	0.11
Uniform Delay, d1	7.0	11.0		8.5	13.6		47.3	45.7	45.2	46.0	46.6	43.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	1.1		0.8	0.7		6.8	0.9	0.7	1.6	1.5	0.2
Delay (s)	10.0	12.2		9.4	14.3		54.2	46.6	45.9	47.6	48.1	44.1
Level of Service	A	B		A	B		D	D	D	D	D	D
Approach Delay (s)		11.7			13.7			47.7			46.2	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	118.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	116	1415	1360	247	374	553
v/c Ratio	0.23	0.55	0.68	0.33	0.61	0.90
Control Delay	24.3	21.3	33.4	6.1	56.0	58.1
Queue Delay	0.0	10.6	1.8	0.5	0.0	4.4
Total Delay	24.3	31.8	35.2	6.7	56.0	62.5
Queue Length 50th (ft)	73	585	357	26	157	206
Queue Length 95th (ft)	m116	678	267	52	208	#819
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	503	2580	2011	759	613	617
Starvation Cap Reductn	0	1150	456	225	0	0
Spillback Cap Reductn	0	784	0	0	0	32
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.99	0.87	0.46	0.61	0.95

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)	106	1316	0	0	1319	230	333	0	536	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.91	0.93	0.92	0.92	0.97	0.93	0.89	0.97	0.97	0.92	0.92	0.92
Adj. Flow (vph)	116	1415	0	0	1360	247	374	0	553	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	132	0	0	119	0	0	0
Lane Group Flow (vph)	116	1415	0	0	1360	115	374	0	434	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2		1					
Permitted Phases						2			1			
Actuated Green, G (s)	38.4	98.4			53.4	53.4	24.1		24.1			
Effective Green, g (s)	38.4	86.8			53.4	53.4	24.1		24.1			
Actuated g/C Ratio	0.28	0.64			0.40	0.40	0.18		0.18			
Clearance Time (s)	6.6				5.9	5.9	6.6		6.6			
Vehicle Extension (s)	6.0				4.0	4.0	4.0		4.0			
Lane Grp Cap (vph)	503	2275			2011	626	613		498			
v/s Ratio Prot	0.07	c0.40			c0.27		0.11					
v/s Ratio Perm						0.07			c0.16			
v/c Ratio	0.23	0.62			0.68	0.18	0.61		0.87			
Uniform Delay, d1	37.0	14.3			33.7	26.6	51.1		53.9			
Progression Factor	0.63	2.46			0.94	1.04	1.00		1.00			
Incremental Delay, d2	0.5	0.4			1.6	0.5	2.1		15.7			
Delay (s)	23.7	35.8			33.2	28.2	53.2		69.7			
Level of Service	C	D			C	C	D		E			
Approach Delay (s)		34.8			32.4			63.0			0.0	
Approach LOS		C			C			E			A	

Intersection Summary			
HCM Average Control Delay	40.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	24.3
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	144	840	56	184	866	206	128	239	199	198	92
v/c Ratio	0.71	0.61	0.09	0.69	0.57	0.29	0.61	0.61	0.75	0.74	0.28
Control Delay	77.0	37.6	23.4	89.2	19.1	10.5	68.4	13.0	71.9	70.7	11.4
Queue Delay	0.0	1.3	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	77.0	38.9	23.4	89.2	19.6	10.5	68.4	13.2	71.9	70.7	11.4
Queue Length 50th (ft)	125	313	21	169	128	31	109	0	174	173	0
Queue Length 95th (ft)	#252	437	58	202	169	54	145	50	196	#272	35
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	204	1385	630	413	1530	721	290	454	289	292	348
Starvation Cap Reductn	0	0	0	0	272	0	0	0	0	0	0
Spillback Cap Reductn	0	325	0	0	0	0	0	22	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.79	0.09	0.45	0.69	0.29	0.44	0.55	0.69	0.68	0.26

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)	114	748	49	142	771	185	64	47	196	249	33	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Peak-hour factor, PHF	0.79	0.89	0.88	0.77	0.89	0.90	0.94	0.78	0.82	0.69	0.92	0.80
Adj. Flow (vph)	144	840	56	184	866	206	68	60	239	361	36	92
RTOR Reduction (vph)	0	0	11	0	0	36	0	0	211	0	0	77
Lane Group Flow (vph)	144	840	45	184	866	170	0	128	28	199	198	15
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	15.5	52.8	52.8	20.2	58.4	58.4		15.6	15.6	21.3	21.3	21.3
Effective Green, g (s)	15.5	52.8	52.8	20.2	58.4	58.4		15.6	15.6	21.3	21.3	21.3
Actuated g/C Ratio	0.11	0.39	0.39	0.15	0.43	0.43		0.12	0.12	0.16	0.16	0.16
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	203	1384	619	265	1531	685		210	183	265	268	250
v/s Ratio Prot	0.08	c0.24		c0.10	c0.24			c0.07		c0.12	0.12	
v/s Ratio Perm			0.03			0.11			0.02			0.01
v/c Ratio	0.71	0.61	0.07	0.69	0.57	0.25		0.61	0.15	0.75	0.74	0.06
Uniform Delay, d1	57.6	32.8	25.8	54.5	28.8	24.3		56.8	53.7	54.3	54.2	48.3
Progression Factor	1.00	1.00	1.00	1.42	0.61	0.56		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.5	2.0	0.2	7.7	1.4	0.8		5.2	0.5	12.0	10.8	0.1
Delay (s)	69.1	34.8	26.0	84.9	18.9	14.5		62.0	54.2	66.3	65.0	48.5
Level of Service	E	C	C	F	B	B		E	D	E	E	D
Approach Delay (s)		39.1			27.9			56.9			62.4	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM Average Control Delay	40.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1640	334	20	1198	286	284	24	68
v/c Ratio	0.76	0.33	0.24	0.56	0.75	0.74	0.23	0.17
Control Delay	34.2	12.4	28.7	19.7	59.4	57.8	64.8	8.9
Queue Delay	1.3	0.4	0.0	0.1	1.2	1.2	0.0	0.0
Total Delay	35.5	12.8	28.7	19.8	60.7	59.0	64.8	8.9
Queue Length 50th (ft)	715	130	9	346	247	240	20	0
Queue Length 95th (ft)	#925	m239	29	511	318	249	42	11
Internal Link Dist (ft)	328			1052		293	358	
Turn Bay Length (ft)			110					90
Base Capacity (vph)	2152	1016	83	2147	511	510	131	496
Starvation Cap Reductn	295	311	0	0	86	83	0	0
Spillback Cap Reductn	0	0	0	125	0	0	0	2
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.47	0.24	0.59	0.67	0.67	0.18	0.14

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)	0	1558	294	15	1060	13	454	15	24	6	9	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.95	1.00	1.00	0.95		0.95	0.95			1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00	0.98			1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.96			0.98	1.00
Satd. Flow (prot)		3539	1531	2006	3530		1681	1667			1696	1478
Flt Permitted		1.00	1.00	0.06	1.00		0.95	0.96			0.98	1.00
Satd. Flow (perm)		3539	1531	137	3530		1681	1667			1696	1478
Peak-hour factor, PHF	0.58	0.95	0.88	0.75	0.90	0.65	0.89	0.75	0.60	0.50	0.75	0.62
Adj. Flow (vph)	0	1640	334	20	1178	20	510	20	40	12	12	68
RTOR Reduction (vph)	0	0	89	0	1	0	0	5	0	0	0	53
Lane Group Flow (vph)	0	1640	245	20	1197	0	286	279	0	0	24	15
Turn Type		NA	Perm	Perm	NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases			2	6								4
Actuated Green, G (s)		79.5	79.5	79.5	79.5		30.7	30.7			5.6	30.7
Effective Green, g (s)		79.5	79.5	79.5	79.5		30.7	30.7			5.6	30.7
Actuated g/C Ratio		0.59	0.59	0.59	0.59		0.23	0.23			0.04	0.23
Clearance Time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2084	902	81	2079		382	379			70	336
v/s Ratio Prot		c0.46			0.34		c0.17	0.17			c0.01	
v/s Ratio Perm			0.16	0.15								0.01
v/c Ratio		0.79	0.27	0.25	0.58		0.75	0.74			0.34	0.05
Uniform Delay, d1		21.3	13.6	13.3	17.3		48.6	48.4			62.9	40.7
Progression Factor		1.44	1.91	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		2.4	0.6	7.1	1.2		8.0	7.5			4.0	0.1
Delay (s)		33.0	26.5	20.5	18.4		56.5	55.9			66.9	40.8
Level of Service		C	C	C	B		E	E			E	D
Approach Delay (s)		31.9			18.5			56.2			47.6	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	73.9%	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)	1000	400	709	1030	534	148
v/c Ratio	0.65	0.45	1.02	0.44	0.70	0.32
Control Delay	30.5	5.7	88.3	0.6	54.0	8.4
Queue Delay	3.2	1.1	0.0	0.2	38.8	0.0
Total Delay	33.7	6.8	88.3	0.8	92.8	8.4
Queue Length 50th (ft)	445	49	~246	2	224	0
Queue Length 95th (ft)	324	37	#445	2	288	38
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1531	889	698	2326	763	467
Starvation Cap Reductn	415	272	0	461	0	0
Spillback Cap Reductn	0	0	0	0	260	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.65	1.02	0.55	1.06	0.32

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰↰		↱
Volume (vph)	0	900	288	681	968	0	0	0	0	518	0	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.90	0.72	0.96	0.94	0.92	0.92	0.92	0.92	0.97	0.92	0.80
Adj. Flow (vph)	0	1000	400	709	1030	0	0	0	0	534	0	148
RTOR Reduction (vph)	0	0	247	0	0	0	0	0	0	0	0	115
Lane Group Flow (vph)	0	1000	153	709	1030	0	0	0	0	534	0	33
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		58.4	58.4	28.4	93.4					30.0		30.0
Effective Green, g (s)		51.8	51.8	28.4	87.5					30.0		30.0
Actuated g/C Ratio		0.38	0.38	0.21	0.65					0.22		0.22
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1358	587	698	2217					763		352
v/s Ratio Prot		c0.28		c0.21	c0.30							
v/s Ratio Perm			0.10							c0.16		0.02
v/c Ratio		0.74	0.26	1.02	0.46					0.70		0.09
Uniform Delay, d1		35.7	28.5	53.3	12.0					48.4		41.7
Progression Factor		0.94	1.98	1.05	0.02					1.00		1.00
Incremental Delay, d2		1.8	0.3	33.4	0.2					3.0		0.2
Delay (s)		35.4	56.6	89.6	0.3					51.4		41.9
Level of Service		D	E	F	A					D		D
Approach Delay (s)		41.4			36.7			0.0			49.3	
Approach LOS		D			D			A			D	

Intersection Summary			
HCM Average Control Delay	40.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	18.2
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JSS*	Intersection	*Warrington Way & KY-22*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Louisville, KY*
Date Performed	*04/23/2012*	Analysis Year	*Existing*
Analysis Time Period	*5:00 pm*		
Project Description *VA Hospital*			
East/West Street: *KY-22*		North/South Street: *Warrington Way*	
Intersection Orientation: *East-West*		Study Period (hrs): *0.25*	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*796*	*14*	*4*	*609*	
Peak-Hour Factor, PHF	*1.00*	*0.73*	*0.57*	*0.62*	*0.89*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*1090*	*24*	*6*	*684*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*1*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*18*			
Peak-Hour Factor, PHF	*0.64*	*1.00*	*0.75*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*23*	*0*	*24*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*Y*			*N*	
Storage		*2*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

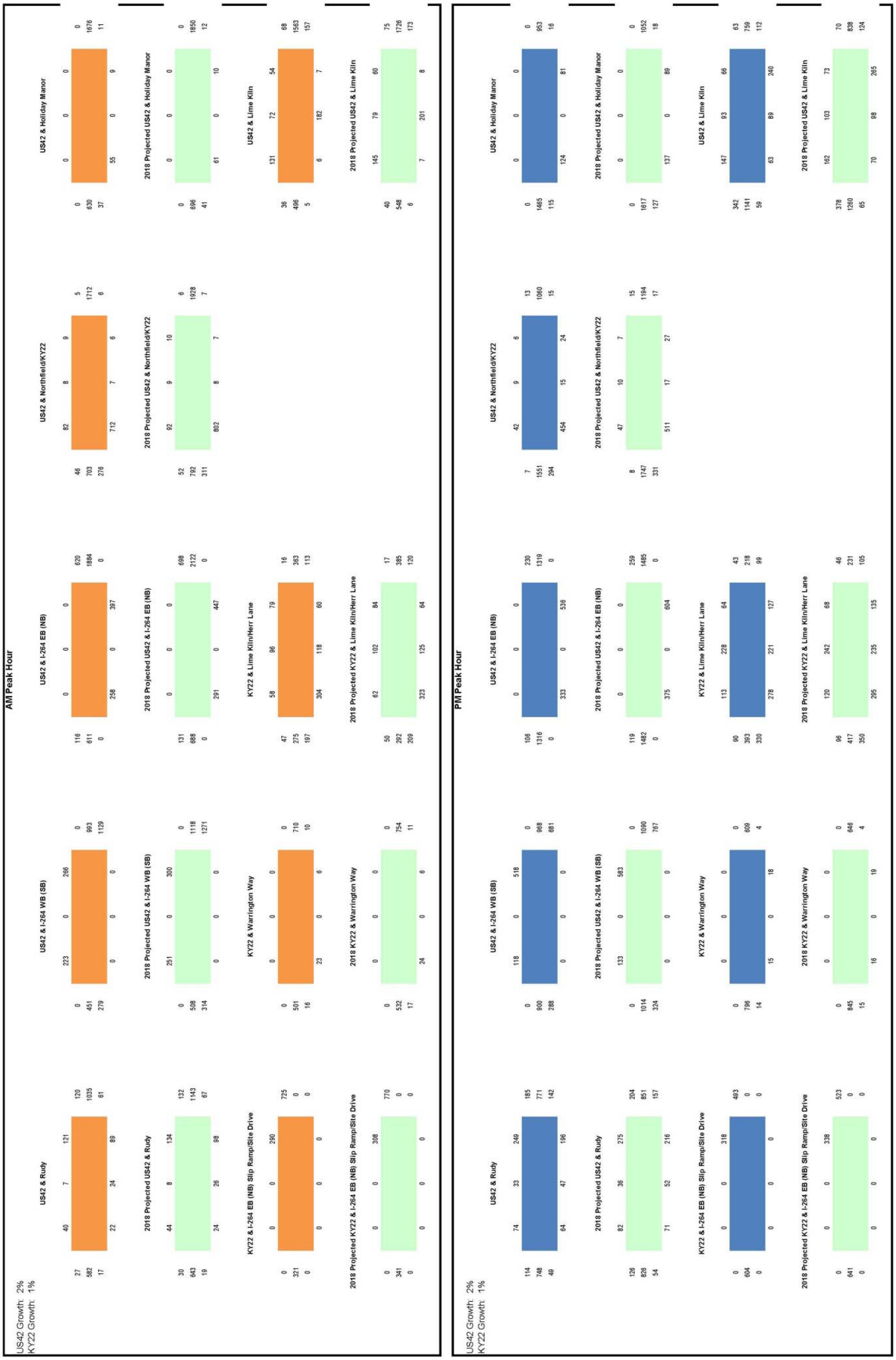
Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*6*		*47*				
C (m) (veh/h)		*460*		*74*				
v/c		*0.01*		*0.64*				
95% queue length		*0.04*		*2.84*				
Control Delay (s/veh)		*12.9*		*115.6*				
LOS		*B*		*F*				
Approach Delay (s/veh)	--	--	*115.6*					
Approach LOS	--	--	*F*					

 HCS+™ Version 5.6 Generated: 5/23/2012 9:15 AM

2008 BACKGROUND CONDITIONS

- **BACKGROUND VOLUMES**


AM Peak Hour
US42 Growth: 2%
KY22 Growth: 1%
US42 & Rudy
US42 & I-264 WB (SB)
US42 & I-264 EB (NB)
US42 & Northfield/KY22
US42 & Holiday Manor
2018 Projected US42 & Rudy
2018 Projected US42 & I-264 WB (SB)
2018 Projected US42 & I-264 EB (NB)
2018 Projected US42 & Northfield/KY22
2018 Projected US42 & Holiday Manor
KY22 & I-264 EB (NB) Slip Ramp/Site Drive
KY22 & Warrington Way
KY22 & Lime Kiln/Herr Lane
US42 & Lime Kiln
2018 Projected KY22 & I-264 EB (NB) Slip Ramp/Site Drive
2018 KY22 & Warrington Way
2018 Projected KY22 & Lime Kiln/Herr Lane
2018 Projected US42 & Lime Kiln
PM Peak Hour
US42 Growth: 2%
KY22 Growth: 1%
US42 & Rudy
US42 & I-264 WB (SB)
US42 & I-264 EB (NB)
US42 & Northfield/KY22
US42 & Holiday Manor
2018 Projected US42 & Rudy
2018 Projected US42 & I-264 WB (SB)
2018 Projected US42 & I-264 EB (NB)
2018 Projected US42 & Northfield/KY22
2018 Projected US42 & Holiday Manor
KY22 & I-264 EB (NB) Slip Ramp/Site Drive
KY22 & Warrington Way
KY22 & Lime Kiln/Herr Lane
US42 & Lime Kiln
2018 Projected KY22 & I-264 EB (NB) Slip Ramp/Site Drive
2018 KY22 & Warrington Way
2018 Projected KY22 & Lime Kiln/Herr Lane
2018 Projected US42 & Lime Kiln

- **AM CAPACITY REPORT**

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	872	22	2079	71	22
v/c Ratio	0.31	0.04	0.74	0.51	0.15
Control Delay	1.0	0.6	2.7	71.5	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	1.0	0.6	2.7	71.5	22.3
Queue Length 50th (ft)	14	0	22	61	0
Queue Length 95th (ft)	12	m1	133	105	5
Internal Link Dist (ft)	1052		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2778	521	2802	279	276
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.04	0.74	0.25	0.08

Intersection Summary

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

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	696	41	12	1850	61	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3390		1711	3421	1711	1583
Flt Permitted	1.00		0.31	1.00	0.95	1.00
Satd. Flow (perm)	3390		561	3421	1711	1583
Peak-hour factor, PHF	0.85	0.77	0.55	0.89	0.86	0.45
Adj. Flow (vph)	819	53	22	2079	71	22
RTOR Reduction (vph)	2	0	0	0	0	20
Lane Group Flow (vph)	870	0	22	2079	71	2
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	106.5		110.1	106.5	9.6	9.6
Effective Green, g (s)	106.5		110.1	106.5	9.6	9.6
Actuated g/C Ratio	0.79		0.82	0.79	0.07	0.07
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2674		488	2699	122	113
v/s Ratio Prot	0.26		c0.00	c0.61	c0.04	
v/s Ratio Perm			0.04			0.00
v/c Ratio	0.33		0.05	0.77	0.58	0.01
Uniform Delay, d1	4.0		2.4	7.7	60.8	58.3
Progression Factor	0.16		0.25	0.22	1.00	1.00
Incremental Delay, d2	0.3		0.0	0.9	6.9	0.0
Delay (s)	1.0		0.6	2.6	67.7	58.3
Level of Service	A		A	A	E	E
Approach Delay (s)	1.0			2.6	65.5	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBR	SBL
Lane Group Flow (vph)	371	837	335
v/c Ratio	0.70	0.59	0.37
Control Delay	51.5	1.8	6.3
Queue Delay	0.0	0.7	0.5
Total Delay	51.5	2.5	6.8
Queue Length 50th (ft)	294	0	43
Queue Length 95th (ft)	368	0	67
Internal Link Dist (ft)	627		
Turn Bay Length (ft)			
Base Capacity (vph)	683	1423	900
Starvation Cap Reductn	0	0	256
Spillback Cap Reductn	0	274	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.54	0.73	0.52

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰		↱		↑	↱	↰	↑	
Volume (vph)	0	341	0	0	0	770	0	0	0	308	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0				4.0				4.0		
Lane Util. Factor		1.00				1.00				1.00		
Frt		1.00				0.85				1.00		
Flt Protected		1.00				1.00				0.95		
Satd. Flow (prot)		2049				1583				2006		
Flt Permitted		1.00				1.00				0.68		
Satd. Flow (perm)		2049				1583				1439		
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	371	0	0	0	837	0	0	0	335	0	0
RTOR Reduction (vph)	0	0	0	0	0	273	0	0	0	0	0	0
Lane Group Flow (vph)	0	371	0	0	0	564	0	0	0	335	0	0
Turn Type		NA	Perm	Prot		custom			Perm	pm+pt		
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4						6	2		
Actuated Green, G (s)		35.1				91.0				71.9		
Effective Green, g (s)		35.1				91.0				71.9		
Actuated g/C Ratio		0.26				0.67				0.53		
Clearance Time (s)		4.0								4.0		
Vehicle Extension (s)		3.0								3.0		
Lane Grp Cap (vph)		533				1067				900		
v/s Ratio Prot		c0.18				c0.36				0.09		
v/s Ratio Perm										c0.11		
v/c Ratio		0.70				0.53				0.37		
Uniform Delay, d1		45.1				11.1				17.8		
Progression Factor		1.00				1.00				0.27		
Incremental Delay, d2		3.9				0.5				1.1		
Delay (s)		49.1				11.6				5.8		
Level of Service		D				B				A		
Approach Delay (s)		49.1			11.6			0.0			5.8	
Approach LOS		D			B			A			A	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues 2018 Base AM

22: Lime Kiln Lane & KY-22 5/24/2012

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	81	479	271	128	500	489	262	171	119	90
v/c Ratio	0.43	0.75	0.38	0.61	0.75	0.82	0.30	0.34	0.12	0.11
Control Delay	32.5	46.8	4.9	38.9	45.5	40.7	18.4	23.1	18.0	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.5	46.8	4.9	38.9	45.5	40.7	18.4	23.1	18.0	5.0
Queue Length 50th (ft)	42	367	0	68	379	350	117	102	63	0
Queue Length 95th (ft)	51	295	26	113	452	301	124	81	100	9
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	187	640	719	209	663	599	860	510	952	853
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.75	0.38	0.61	0.75	0.82	0.30	0.34	0.13	0.11

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	292	209	120	385	17	323	125	64	84	102	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1784		1652	1658		1770	1863	1583
Flt Permitted	0.21	1.00	1.00	0.20	1.00		0.67	1.00		0.53	1.00	1.00
Satd. Flow (perm)	384	1801	1531	361	1784		1172	1658		996	1863	1583
Peak-hour factor, PHF	0.62	0.61	0.77	0.94	0.82	0.57	0.66	0.69	0.79	0.49	0.86	0.69
Adj. Flow (vph)	81	479	271	128	470	30	489	181	81	171	119	90
RTOR Reduction (vph)	0	0	175	0	2	0	0	12	0	0	0	44
Lane Group Flow (vph)	81	479	96	128	498	0	489	250	0	171	119	46
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	52.0	48.0	48.0	56.0	50.0		69.0	69.0		69.0	69.0	69.0
Effective Green, g (s)	52.0	48.0	48.0	56.0	50.0		69.0	69.0		69.0	69.0	69.0
Actuated g/C Ratio	0.39	0.36	0.36	0.41	0.37		0.51	0.51		0.51	0.51	0.51
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	187	640	544	210	661		599	847		509	952	809
v/s Ratio Prot	0.01	0.27		c0.03	c0.28			0.15			0.06	
v/s Ratio Perm	0.15		0.06	0.23			c0.42			0.17		0.03
v/c Ratio	0.43	0.75	0.18	0.61	0.75		0.82	0.30		0.34	0.12	0.06
Uniform Delay, d1	30.2	38.2	29.9	30.0	37.1		27.7	19.0		19.5	17.2	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.07	1.02	1.43
Incremental Delay, d2	1.6	7.8	0.7	4.9	7.8		11.7	0.9		1.7	0.3	0.1
Delay (s)	31.9	46.0	30.6	35.0	44.9		39.4	19.9		22.5	17.8	23.9
Level of Service	C	D	C	C	D		D	B		C	B	C
Approach Delay (s)		39.6			42.9			32.6			21.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	35.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	103	601	244	2212	28	279	32	75	96	186
v/c Ratio	0.79	0.28	0.41	0.94	0.13	0.83	0.11	1.01	0.28	0.54
Control Delay	92.2	7.3	7.4	30.1	43.9	71.0	25.1	161.7	49.5	35.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	92.2	7.3	7.4	30.1	43.9	71.0	25.1	161.7	49.5	35.4
Queue Length 50th (ft)	62	167	59	870	22	244	13	66	72	87
Queue Length 95th (ft)	41	143	66	798	14	268	4	#145	114	133
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	131	2135	622	2349	237	359	319	79	359	365
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.28	0.39	0.94	0.12	0.78	0.10	0.95	0.27	0.51

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)	40	548	6	173	1726	75	7	201	8	60	79	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3401		1770	3514		1770	1863	1583	1770	1863	1583
Flt Permitted	0.05	1.00		0.37	1.00		0.66	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)	91	3401		697	3514		1229	1863	1583	409	1863	1583
Peak-hour factor, PHF	0.39	0.95	0.25	0.71	0.82	0.70	0.25	0.72	0.25	0.80	0.82	0.78
Adj. Flow (vph)	103	577	24	244	2105	107	28	279	32	75	96	186
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	14	0	0	61
Lane Group Flow (vph)	103	599	0	244	2209	0	28	279	18	75	96	125
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	90.2	84.7		100.6	90.1		24.4	24.4	24.4	24.4	24.4	24.4
Effective Green, g (s)	90.2	84.7		100.6	90.1		24.4	24.4	24.4	24.4	24.4	24.4
Actuated g/C Ratio	0.67	0.63		0.75	0.67		0.18	0.18	0.18	0.18	0.18	0.18
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	132	2134		606	2345		222	337	286	74	337	286
v/s Ratio Prot	c0.03	0.18		0.03	c0.63			0.15			0.05	
v/s Ratio Perm	0.49			0.27			0.02		0.01	c0.18		0.08
v/c Ratio	0.78	0.28		0.40	0.94		0.13	0.83	0.06	1.01	0.28	0.44
Uniform Delay, d1	34.4	11.4		5.7	20.1		46.4	53.3	45.8	55.3	47.8	49.2
Progression Factor	2.50	0.59		1.00	1.00		0.94	0.96	0.92	1.00	1.00	1.00
Incremental Delay, d2	24.5	0.3		0.4	9.2		0.2	14.7	0.1	108.4	0.5	1.1
Delay (s)	110.6	7.0		6.1	29.3		43.6	66.1	42.3	163.7	48.2	50.3
Level of Service	F	A		A	C		D	E	D	F	D	D
Approach Delay (s)		22.2			27.0			62.0			73.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	158	882	2467	802	278	539
v/c Ratio	0.90	0.34	0.81	0.68	0.49	0.68
Control Delay	88.2	19.4	16.4	3.7	54.8	17.6
Queue Delay	0.0	5.2	82.3	10.4	0.0	0.3
Total Delay	88.2	24.6	98.7	14.1	54.8	17.8
Queue Length 50th (ft)	143	293	409	85	115	57
Queue Length 95th (ft)	m#204	m293	m272	m69	148	97
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	176	2632	3028	1179	562	797
Starvation Cap Reductn	0	1668	939	352	0	0
Spillback Cap Reductn	0	272	157	0	0	31
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.91	1.18	0.97	0.49	0.70

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)	131	688	0	0	2122	698	231	0	447	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.83	0.78	0.92	0.92	0.86	0.87	0.83	0.92	0.83	0.92	0.92	0.92
Adj. Flow (vph)	158	882	0	0	2467	802	278	0	539	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	265	0	0	341	0	0	0
Lane Group Flow (vph)	158	882	0	0	2467	537	278	0	198	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2 8		1					
Permitted Phases						2 8			1			
Actuated Green, G (s)	13.4	100.4			80.4	80.4	22.1		22.1			
Effective Green, g (s)	13.4	88.8			73.8	73.8	22.1		22.1			
Actuated g/C Ratio	0.10	0.66			0.55	0.55	0.16		0.16			
Clearance Time (s)	6.6						6.6		6.6			
Vehicle Extension (s)	6.0						4.0		4.0			
Lane Grp Cap (vph)	176	2328			2780	865	562		456			
v/s Ratio Prot	c0.09	0.25			c0.49		c0.08					
v/s Ratio Perm						0.34			0.07			
v/c Ratio	0.90	0.38			0.89	0.62	0.49		0.43			
Uniform Delay, d1	60.1	10.5			26.9	21.0	51.4		50.8			
Progression Factor	0.88	3.22			0.74	0.79	1.00		1.00			
Incremental Delay, d2	33.2	0.1			0.4	0.1	0.9		0.9			
Delay (s)	85.8	34.0			20.3	16.7	52.3		51.7			
Level of Service	F	C			C	B	D		D			
Approach Delay (s)		41.9			19.4			51.9			0.0	
Approach LOS		D			B			D			A	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	49	794	36	79	1377	165	99	105	113	114	62
v/c Ratio	0.34	0.44	0.04	0.47	0.74	0.19	0.55	0.42	0.56	0.56	0.25
Control Delay	59.8	23.3	15.4	62.0	28.9	16.3	64.6	14.5	61.5	61.3	13.6
Queue Delay	0.0	0.0	0.0	0.0	11.6	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.8	23.3	15.4	62.0	40.5	16.3	64.6	14.5	61.5	61.3	13.6
Queue Length 50th (ft)	38	217	9	61	460	57	77	0	92	93	0
Queue Length 95th (ft)	52	292	17	103	587	104	60	53	103	69	22
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	145	1798	811	187	1861	847	234	294	444	449	464
Starvation Cap Reductn	0	0	0	0	479	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.44	0.04	0.42	1.00	0.19	0.42	0.36	0.25	0.25	0.13

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	643	19	67	1143	132	24	26	98	134	8	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Peak-hour factor, PHF	0.61	0.81	0.53	0.85	0.83	0.80	0.61	0.43	0.93	0.64	0.44	0.71
Adj. Flow (vph)	49	794	36	79	1377	165	39	60	105	209	18	62
RTOR Reduction (vph)	0	0	7	0	0	15	0	0	95	0	0	55
Lane Group Flow (vph)	49	794	29	79	1377	150	0	99	10	113	114	7
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	8.8	62.2	62.2	10.3	64.6	64.6		12.3	12.3	15.1	15.1	15.1
Effective Green, g (s)	8.8	62.2	62.2	10.3	64.6	64.6		12.3	12.3	15.1	15.1	15.1
Actuated g/C Ratio	0.07	0.50	0.50	0.08	0.52	0.52		0.10	0.10	0.12	0.12	0.12
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	125	1761	788	146	1829	818		180	156	203	205	191
v/s Ratio Prot	0.03	0.22		c0.04	c0.39			c0.05		c0.07	0.07	
v/s Ratio Perm			0.02			0.09			0.01			0.00
v/c Ratio	0.39	0.45	0.04	0.54	0.75	0.18		0.55	0.07	0.56	0.56	0.04
Uniform Delay, d1	55.5	20.3	16.1	55.1	23.9	16.1		53.7	51.1	51.8	51.8	48.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.8	0.1	5.1	2.9	0.5		4.0	0.2	4.0	4.0	0.1
Delay (s)	58.3	21.2	16.2	60.1	26.8	16.6		57.7	51.4	55.8	55.8	48.7
Level of Service	E	C	B	E	C	B		E	D	E	E	D
Approach Delay (s)		23.0			27.4			54.4			54.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	19.7
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1017	404	14	2278	460	459	36	116
v/c Ratio	0.50	0.39	0.05	1.12	1.18	1.17	0.31	0.27
Control Delay	17.8	4.9	10.4	79.0	145.2	143.0	65.7	8.7
Queue Delay	0.5	0.4	0.0	68.9	70.0	71.0	0.0	0.0
Total Delay	18.3	5.3	10.4	147.9	215.1	214.1	65.7	8.7
Queue Length 50th (ft)	451	45	2	~1231	~507	~505	31	0
Queue Length 95th (ft)	491	82	m4	#1275	#720	#709	37	34
Internal Link Dist (ft)	328			1052		293	358	
Turn Bay Length (ft)			110					90
Base Capacity (vph)	2037	1038	258	2035	391	392	382	433
Starvation Cap Reductn	552	255	0	0	47	48	0	0
Spillback Cap Reductn	0	0	0	248	0	0	0	8
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.52	0.05	1.27	1.34	1.33	0.09	0.27

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	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↱		↰	✥			↰↑	↱
Volume (vph)	0	844	311	7	1928	6	802	8	7	10	9	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.95	1.00	1.00	0.95		0.95	0.95			1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00	1.00			1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.95			0.98	1.00
Satd. Flow (prot)		3539	1531	2006	3537		1681	1684			1696	1478
Flt Permitted		1.00	1.00	0.21	1.00		0.95	0.95			0.98	1.00
Satd. Flow (perm)		3539	1531	449	3537		1681	1684			1696	1478
Peak-hour factor, PHF	0.55	0.83	0.77	0.50	0.85	0.62	0.89	0.88	0.75	0.56	0.50	0.79
Adj. Flow (vph)	0	1017	404	14	2268	10	901	9	9	18	18	116
RTOR Reduction (vph)	0	0	160	0	0	0	0	1	0	0	0	89
Lane Group Flow (vph)	0	1017	244	14	2278	0	460	458	0	0	36	27
Turn Type		NA	Perm	Perm	NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases			2	6								4
Actuated Green, G (s)		76.4	76.4	76.4	76.4		31.4	31.4			8.0	31.4
Effective Green, g (s)		76.4	76.4	76.4	76.4		31.4	31.4			8.0	31.4
Actuated g/C Ratio		0.57	0.57	0.57	0.57		0.23	0.23			0.06	0.23
Clearance Time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2003	866	254	2002		391	392			101	344
v/s Ratio Prot		0.29			c0.64		c0.27	0.27			c0.02	
v/s Ratio Perm			0.16	0.03								0.02
v/c Ratio		0.51	0.28	0.06	1.14		1.18	1.17			0.36	0.08
Uniform Delay, d1		17.8	15.1	13.1	29.3		51.8	51.8			61.0	40.5
Progression Factor		0.94	1.67	0.67	0.58		1.00	1.00			1.00	1.00
Incremental Delay, d2		0.8	0.7	0.3	67.0		100.2	97.2			2.9	0.1
Delay (s)		17.6	25.9	9.1	84.0		152.0	149.0			64.0	40.6
Level of Service		B	C	A	F		F	F			E	D
Approach Delay (s)		20.0			83.5			150.5			46.2	
Approach LOS		B			F			F			D	

Intersection Summary			
HCM Average Control Delay	76.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
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)	696	365	1397	1270	333	330
v/c Ratio	0.58	0.61	0.97	0.46	1.01	1.20
Control Delay	39.4	29.6	38.4	0.4	111.1	147.4
Queue Delay	1.6	1.2	19.4	0.3	41.0	0.0
Total Delay	41.0	30.7	57.8	0.7	152.1	147.4
Queue Length 50th (ft)	264	180	591	0	~154	~235
Queue Length 95th (ft)	253	267	#762	0	#256	#305
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1190	595	1436	2757	331	276
Starvation Cap Reductn	307	84	100	786	0	0
Spillback Cap Reductn	0	0	0	0	35	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.71	1.05	0.64	1.13	1.20

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	508	314	1271	1118	0	0	0	0	300	0	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.73	0.86	0.91	0.88	0.92	0.92	0.92	0.92	0.90	0.92	0.76
Adj. Flow (vph)	0	696	365	1397	1270	0	0	0	0	333	0	330
RTOR Reduction (vph)	0	0	86	0	0	0	0	0	0	0	0	124
Lane Group Flow (vph)	0	696	279	1397	1270	0	0	0	0	333	0	206
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		45.4	45.4	58.4	110.4					13.0		13.0
Effective Green, g (s)		38.8	38.8	58.4	104.5					13.0		13.0
Actuated g/C Ratio		0.29	0.29	0.43	0.77					0.10		0.10
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1017	440	1436	2648					331		152
v/s Ratio Prot		c0.20		c0.42	c0.37							
v/s Ratio Perm			0.18							0.10		c0.13
v/c Ratio		0.68	0.64	0.97	0.48					1.01		1.36
Uniform Delay, d1		42.7	41.9	37.5	5.5					61.0		61.0
Progression Factor		1.00	1.00	0.65	0.00					1.00		1.00
Incremental Delay, d2		2.1	3.4	12.8	0.1					51.0		197.1
Delay (s)		44.8	45.3	37.4	0.1					112.0		258.1
Level of Service		D	D	D	A					F		F
Approach Delay (s)		44.9			19.6			0.0			184.7	
Approach LOS		D			B			A			F	

Intersection Summary			
HCM Average Control Delay	50.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	18.2
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JSS*	Intersection	*Warrington Way & KY-22*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Louivile, KY*
Date Performed	*04/23/2012*	Analysis Year	*2018 Base*
Analysis Time Period	*7:15 am*		

Project Description *VA Hospital*

East/West Street: *KY-22* | North/South Street: *Warrington Way*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		532	17	11	754	
Peak-Hour Factor, PHF	1.00	0.73	0.57	0.62	0.89	1.00
Hourly Flow Rate, HFR (veh/h)	0	728	29	17	847	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		1			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	24		6			
Peak-Hour Factor, PHF	0.64	1.00	0.75	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	37	0	8	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (veh/h)		17		45				
C (m) (veh/h)		789		91				
v/c		0.02		0.49				
95% queue length		0.07		2.14				
Control Delay (s/veh)		9.7		78.7				
LOS		A		F				
Approach Delay (s/veh)	--	--	78.7					
Approach LOS	--	--	F					

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- **PM CAPACITY REPORT**

	→	↙	←	↖	↗
Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1857	36	1073	173	127
v/c Ratio	0.76	0.22	0.43	0.75	0.47
Control Delay	4.6	8.7	8.8	76.1	30.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	4.6	8.7	8.8	76.1	30.2
Queue Length 50th (ft)	31	3	338	147	45
Queue Length 95th (ft)	69	1	18	193	68
Internal Link Dist (ft)	1052		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2459	163	2486	279	317
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.76	0.22	0.43	0.62	0.40

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1617	127	18	1052	137	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3378		1711	3421	1711	1583
Flt Permitted	1.00		0.07	1.00	0.95	1.00
Satd. Flow (perm)	3378		128	3421	1711	1583
Peak-hour factor, PHF	0.95	0.82	0.50	0.98	0.79	0.70
Adj. Flow (vph)	1702	155	36	1073	173	127
RTOR Reduction (vph)	4	0	0	0	0	61
Lane Group Flow (vph)	1853	0	36	1073	173	66
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	97.1		101.6	97.1	18.1	18.1
Effective Green, g (s)	97.1		101.6	97.1	18.1	18.1
Actuated g/C Ratio	0.72		0.75	0.72	0.13	0.13
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2430		149	2461	229	212
v/s Ratio Prot	c0.55		c0.01	0.31	c0.10	
v/s Ratio Perm			0.17			0.04
v/c Ratio	0.76		0.24	0.44	0.76	0.31
Uniform Delay, d1	11.8		11.2	7.8	56.3	52.8
Progression Factor	0.27		1.56	1.01	1.00	1.00
Incremental Delay, d2	1.2		0.8	0.5	13.2	0.8
Delay (s)	4.4		18.3	8.3	69.5	53.7
Level of Service	A		B	A	E	D
Approach Delay (s)	4.4			8.7	62.8	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBR	SBL
Lane Group Flow (vph)	697	568	367
v/c Ratio	0.83	0.38	0.56
Control Delay	44.3	0.7	15.9
Queue Delay	0.0	0.0	0.5
Total Delay	44.3	0.8	16.4
Queue Length 50th (ft)	526	0	106
Queue Length 95th (ft)	649	0	124
Internal Link Dist (ft)	627		
Turn Bay Length (ft)			
Base Capacity (vph)	941	1485	652
Starvation Cap Reductn	0	0	69
Spillback Cap Reductn	0	98	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.74	0.41	0.63

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰		↱		↑	↱	↰	↑	
Volume (vph)	0	641	0	0	0	523	0	0	0	338	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0				4.0				4.0		
Lane Util. Factor		1.00				1.00				1.00		
Frt		1.00				0.85				1.00		
Flt Protected		1.00				1.00				0.95		
Satd. Flow (prot)		2049				1583				2006		
Flt Permitted		1.00				1.00				0.62		
Satd. Flow (perm)		2049				1583				1308		
Peak-hour factor, PHF	0.92	0.92	0.94	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	697	0	0	0	568	0	0	0	367	0	0
RTOR Reduction (vph)	0	0	0	0	0	109	0	0	0	0	0	0
Lane Group Flow (vph)	0	697	0	0	0	459	0	0	0	367	0	0
Turn Type		NA	Perm	Prot		custom			Perm	pm+pt		
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4						6	2		
Actuated Green, G (s)		55.5				109.0				51.5		
Effective Green, g (s)		55.5				109.0				51.5		
Actuated g/C Ratio		0.41				0.81				0.38		
Clearance Time (s)		4.0								4.0		
Vehicle Extension (s)		3.0								3.0		
Lane Grp Cap (vph)		842				1278				652		
v/s Ratio Prot		c0.34				c0.29				c0.12		
v/s Ratio Perm										c0.09		
v/c Ratio		0.83				0.36				0.56		
Uniform Delay, d1		35.5				3.5				31.7		
Progression Factor		1.00				1.00				0.37		
Incremental Delay, d2		6.7				0.2				3.3		
Delay (s)		42.2				3.7				15.1		
Level of Service		D				A				B		
Approach Delay (s)		42.2			3.7			0.0			15.1	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	107	491	389	128	311	307	417	89	272	152
v/c Ratio	0.23	0.61	0.43	0.38	0.39	0.91	0.61	0.36	0.36	0.21
Control Delay	19.9	35.3	4.3	22.2	28.1	66.8	32.4	30.8	28.3	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.9	35.3	4.3	22.2	28.1	66.8	32.4	30.8	28.3	6.9
Queue Length 50th (ft)	47	348	0	57	186	241	258	56	170	17
Queue Length 95th (ft)	91	460	66	96	279	#380	303	86	245	34
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	471	800	897	337	796	403	808	293	897	841
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.61	0.43	0.38	0.39	0.76	0.52	0.30	0.30	0.18

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)	96	417	350	105	231	46	295	235	135	68	242	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1756		1652	1650		1770	1863	1583
Flt Permitted	0.47	1.00	1.00	0.29	1.00		0.48	1.00		0.33	1.00	1.00
Satd. Flow (perm)	845	1801	1531	514	1756		836	1650		609	1863	1583
Peak-hour factor, PHF	0.90	0.85	0.90	0.82	0.89	0.90	0.96	0.85	0.96	0.76	0.89	0.79
Adj. Flow (vph)	107	491	389	128	260	51	307	276	141	89	272	152
RTOR Reduction (vph)	0	0	216	0	5	0	0	15	0	0	0	90
Lane Group Flow (vph)	107	491	173	128	306	0	307	402	0	89	272	62
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	67.5	60.0	60.0	69.1	60.8		54.7	54.7		54.7	54.7	54.7
Effective Green, g (s)	67.5	60.0	60.0	69.1	60.8		54.7	54.7		54.7	54.7	54.7
Actuated g/C Ratio	0.50	0.44	0.44	0.51	0.45		0.41	0.41		0.41	0.41	0.41
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	471	800	680	337	791		339	669		247	755	641
v/s Ratio Prot	0.01	c0.27		c0.02	0.17			0.24			0.15	
v/s Ratio Perm	0.10		0.11	0.17			c0.37			0.15		0.04
v/c Ratio	0.23	0.61	0.25	0.38	0.39		0.91	0.60		0.36	0.36	0.10
Uniform Delay, d1	18.5	28.6	23.5	20.1	24.7		37.7	31.6		28.0	28.0	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.04	1.02	2.17
Incremental Delay, d2	0.2	3.5	0.9	0.7	1.4		26.4	1.5		0.9	0.3	0.1
Delay (s)	18.7	32.2	24.4	20.8	26.1		64.1	33.1		30.0	28.7	53.9
Level of Service	B	C	C	C	C		E	C		C	C	D
Approach Delay (s)		27.6			24.6			46.2			36.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	33.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	415	1463	133	969	97	114	291	81	151	184
v/c Ratio	0.73	0.64	0.49	0.50	0.72	0.41	0.71	0.49	0.54	0.47
Control Delay	23.7	6.8	17.7	22.4	74.5	48.5	23.2	60.7	58.8	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	6.8	17.7	22.4	74.5	48.5	23.2	60.7	58.8	10.2
Queue Length 50th (ft)	117	38	25	265	85	96	91	66	124	0
Queue Length 95th (ft)	171	506	66	436	112	143	185	113	134	58
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	734	2284	326	1944	186	386	489	228	386	474
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.64	0.41	0.50	0.52	0.30	0.60	0.36	0.39	0.39

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↑	↱	↰	↑	↱
Volume (vph)	378	1260	65	124	838	70	70	98	265	73	103	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3389		1770	3496		1770	1863	1583	1770	1863	1583
Flt Permitted	0.21	1.00		0.15	1.00		0.48	1.00	1.00	0.59	1.00	1.00
Satd. Flow (perm)	400	3389		282	3496		897	1863	1583	1101	1863	1583
Peak-hour factor, PHF	0.91	0.92	0.70	0.93	0.94	0.90	0.72	0.86	0.91	0.90	0.68	0.88
Adj. Flow (vph)	415	1370	93	133	891	78	97	114	291	81	151	184
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	172	0	0	156
Lane Group Flow (vph)	415	1460	0	133	965	0	97	114	119	81	151	28
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	104.7	90.9		83.7	74.9		20.3	20.3	20.3	20.3	20.3	20.3
Effective Green, g (s)	104.7	90.9		83.7	74.9		20.3	20.3	20.3	20.3	20.3	20.3
Actuated g/C Ratio	0.78	0.67		0.62	0.55		0.15	0.15	0.15	0.15	0.15	0.15
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	573	2282		272	1940		135	280	238	166	280	238
v/s Ratio Prot	c0.13	0.43		0.03	0.28			0.06			0.08	
v/s Ratio Perm	c0.43			0.27			c0.11		0.07	0.07		0.02
v/c Ratio	0.72	0.64		0.49	0.50		0.72	0.41	0.50	0.49	0.54	0.12
Uniform Delay, d1	12.9	12.7		11.4	18.5		54.6	51.9	52.7	52.6	53.0	49.6
Progression Factor	1.86	0.41		1.00	1.00		0.90	0.89	0.86	1.00	1.00	1.00
Incremental Delay, d2	3.1	1.0		1.4	0.9		15.8	0.9	1.5	2.3	2.0	0.2
Delay (s)	27.1	6.1		12.8	19.4		64.9	46.9	46.9	54.8	55.0	49.8
Level of Service	C	A		B	B		E	D	D	D	E	D
Approach Delay (s)		10.8			18.6			50.4			52.7	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	131	1594	1531	278	421	623
v/c Ratio	0.26	0.62	0.76	0.37	0.69	1.07
Control Delay	23.7	21.8	31.9	6.6	58.5	100.9
Queue Delay	0.0	54.4	8.6	0.7	0.0	14.1
Total Delay	23.7	76.2	40.5	7.3	58.5	115.0
Queue Length 50th (ft)	73	687	320	32	180	~298
Queue Length 95th (ft)	m108	771	392	m59	235	#434
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	503	2580	2011	759	613	582
Starvation Cap Reductn	0	1149	456	232	0	0
Spillback Cap Reductn	0	664	0	0	0	19
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	1.11	0.98	0.53	0.69	1.11

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	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	1482	0	0	1485	259	375	0	604	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.91	0.93	0.92	0.92	0.97	0.93	0.89	0.97	0.97	0.92	0.92	0.92
Adj. Flow (vph)	131	1594	0	0	1531	278	421	0	623	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	132	0	0	85	0	0	0
Lane Group Flow (vph)	131	1594	0	0	1531	146	421	0	538	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2		1					
Permitted Phases						2			1			
Actuated Green, G (s)	38.4	98.4			53.4	53.4	24.1		24.1			
Effective Green, g (s)	38.4	86.8			53.4	53.4	24.1		24.1			
Actuated g/C Ratio	0.28	0.64			0.40	0.40	0.18		0.18			
Clearance Time (s)	6.6				5.9	5.9	6.6		6.6			
Vehicle Extension (s)	6.0				4.0	4.0	4.0		4.0			
Lane Grp Cap (vph)	503	2275			2011	626	613		498			
v/s Ratio Prot	0.07	c0.45			c0.30		0.12					
v/s Ratio Perm						0.09			c0.19			
v/c Ratio	0.26	0.70			0.76	0.23	0.69		1.08			
Uniform Delay, d1	37.3	15.7			35.3	27.2	51.9		55.4			
Progression Factor	0.61	2.30			0.84	0.83	1.00		1.00			
Incremental Delay, d2	0.5	0.7			2.0	0.6	3.5		64.0			
Delay (s)	23.1	36.7			31.7	23.1	55.4		119.4			
Level of Service	C	D			C	C	E		F			
Approach Delay (s)		35.6			30.4			93.6			0.0	
Approach LOS		D			C			F			A	

Intersection Summary			
HCM Average Control Delay	46.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	24.3
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	159	928	61	204	956	227	143	263	219	219	102
v/c Ratio	0.73	0.71	0.10	0.77	0.67	0.34	0.74	0.68	0.70	0.69	0.27
Control Delay	76.1	41.7	24.0	76.8	22.7	11.1	81.5	18.6	62.6	62.0	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.1	41.7	24.0	76.8	23.1	11.1	81.5	18.6	62.6	62.0	9.2
Queue Length 50th (ft)	133	377	25	136	369	84	122	16	190	190	0
Queue Length 95th (ft)	#200	486	61	200	460	185	168	73	193	266	33
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	225	1314	600	283	1435	674	207	396	417	422	470
Starvation Cap Reductn	0	0	0	0	151	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.71	0.10	0.72	0.74	0.34	0.69	0.66	0.53	0.52	0.22

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)	126	826	54	157	851	204	71	52	216	275	36	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Peak-hour factor, PHF	0.79	0.89	0.88	0.77	0.89	0.90	0.94	0.78	0.82	0.69	0.92	0.80
Adj. Flow (vph)	159	928	61	204	956	227	76	67	263	399	39	102
RTOR Reduction (vph)	0	0	12	0	0	33	0	0	217	0	0	83
Lane Group Flow (vph)	159	928	49	204	956	194	0	143	46	219	219	19
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	16.6	50.1	50.1	20.3	54.7	54.7		14.3	14.3	25.2	25.2	25.2
Effective Green, g (s)	16.6	50.1	50.1	20.3	54.7	54.7		14.3	14.3	25.2	25.2	25.2
Actuated g/C Ratio	0.12	0.37	0.37	0.15	0.41	0.41		0.11	0.11	0.19	0.19	0.19
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	218	1313	587	266	1434	641		192	168	314	317	295
v/s Ratio Prot	0.09	c0.26		c0.12	c0.27			c0.08		c0.13	0.13	
v/s Ratio Perm			0.03			0.12			0.03			0.01
v/c Ratio	0.73	0.71	0.08	0.77	0.67	0.30		0.74	0.27	0.70	0.69	0.06
Uniform Delay, d1	57.0	36.2	27.6	55.1	32.7	27.2		58.6	55.6	51.3	51.3	45.2
Progression Factor	1.00	1.00	1.00	1.09	0.59	0.43		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	3.2	0.3	12.0	2.2	1.1		14.9	1.0	7.1	6.8	0.1
Delay (s)	69.3	39.4	27.8	72.0	21.4	12.9		73.5	56.6	58.4	58.1	45.3
Level of Service	E	D	C	E	C	B		E	E	E	E	D
Approach Delay (s)		42.9			27.5			62.5			55.8	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM Average Control Delay	41.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1847	376	23	1350	321	321	27	76
v/c Ratio	0.84	0.37	0.36	0.61	0.90	0.90	0.25	0.20
Control Delay	32.3	9.3	24.1	8.9	79.5	77.7	64.9	10.5
Queue Delay	1.6	0.6	0.0	0.2	16.9	15.2	0.0	0.0
Total Delay	33.9	9.8	24.1	9.1	96.4	92.8	64.9	10.5
Queue Length 50th (ft)	834	128	6	192	289	284	23	0
Queue Length 95th (ft)	m878	m168	m14	236	#455	322	45	12
Internal Link Dist (ft)	328			1052		293	358	
Turn Bay Length (ft)			110					90
Base Capacity (vph)	2202	1026	64	2197	366	368	382	381
Starvation Cap Reductn	194	320	0	0	43	42	0	0
Spillback Cap Reductn	0	1	0	215	0	0	0	4
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.53	0.36	0.68	0.99	0.98	0.07	0.20

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)	0	1755	331	17	1194	15	511	17	27	7	10	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.95	1.00	1.00	0.95		0.95	0.95			1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00	0.98			1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95	0.96			0.97	1.00
Satd. Flow (prot)		3539	1531	2006	3530		1681	1667			1695	1478
Flt Permitted		1.00	1.00	0.05	1.00		0.95	0.96			0.97	1.00
Satd. Flow (perm)		3539	1531	104	3530		1681	1667			1695	1478
Peak-hour factor, PHF	0.58	0.95	0.88	0.75	0.90	0.65	0.89	0.75	0.60	0.50	0.75	0.62
Adj. Flow (vph)	0	1847	376	23	1327	23	574	23	45	14	13	76
RTOR Reduction (vph)	0	0	77	0	1	0	0	5	0	0	0	60
Lane Group Flow (vph)	0	1847	299	23	1349	0	321	316	0	0	27	16
Turn Type		NA	Perm	Perm	NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases			2	6								4
Actuated Green, G (s)		81.3	81.3	81.3	81.3		28.6	28.6			5.9	28.6
Effective Green, g (s)		81.3	81.3	81.3	81.3		28.6	28.6			5.9	28.6
Actuated g/C Ratio		0.60	0.60	0.60	0.60		0.21	0.21			0.04	0.21
Clearance Time (s)		6.0	6.0	6.0	6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2131	922	63	2126		356	353			74	313
v/s Ratio Prot		c0.52			0.38		c0.19	0.19			c0.02	
v/s Ratio Perm			0.20	0.22								0.01
v/c Ratio		0.87	0.32	0.37	0.63		0.90	0.90			0.36	0.05
Uniform Delay, d1		22.3	13.3	13.7	17.3		51.8	51.8			62.7	42.4
Progression Factor		1.34	1.28	0.47	0.45		1.00	1.00			1.00	1.00
Incremental Delay, d2		3.4	0.6	14.5	1.4		24.6	23.6			4.1	0.1
Delay (s)		33.2	17.6	20.9	9.0		76.4	75.4			66.9	42.5
Level of Service		C	B	C	A		E	E			E	D
Approach Delay (s)		30.6			9.2			75.9			48.9	
Approach LOS		C			A			E			D	

Intersection Summary			
HCM Average Control Delay	31.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	81.1%	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)	1127	450	799	1160	601	166
v/c Ratio	0.74	0.50	1.14	0.50	0.79	0.38
Control Delay	26.0	6.0	128.7	0.7	58.0	17.9
Queue Delay	1.0	0.4	0.0	0.2	241.3	0.0
Total Delay	27.0	6.4	128.7	0.9	299.2	18.0
Queue Length 50th (ft)	226	59	~405	2	258	37
Queue Length 95th (ft)	333	35	#636	2	327	79
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1531	897	698	2326	763	440
Starvation Cap Reductn	181	133	0	460	0	0
Spillback Cap Reductn	29	0	0	189	371	6
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.59	1.14	0.62	1.53	0.38

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1014	324	767	1090	0	0	0	0	583	0	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.90	0.72	0.96	0.94	0.92	0.92	0.92	0.92	0.97	0.92	0.80
Adj. Flow (vph)	0	1127	450	799	1160	0	0	0	0	601	0	166
RTOR Reduction (vph)	0	0	255	0	0	0	0	0	0	0	0	89
Lane Group Flow (vph)	0	1127	195	799	1160	0	0	0	0	601	0	77
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		58.4	58.4	28.4	93.4					30.0		30.0
Effective Green, g (s)		51.8	51.8	28.4	87.5					30.0		30.0
Actuated g/C Ratio		0.38	0.38	0.21	0.65					0.22		0.22
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1358	587	698	2217					763		352
v/s Ratio Prot		c0.32		c0.24	c0.34							
v/s Ratio Perm			0.13							c0.18		0.05
v/c Ratio		0.83	0.33	1.14	0.52					0.79		0.22
Uniform Delay, d1		37.6	29.4	53.3	12.6					49.5		42.9
Progression Factor		0.73	1.34	1.13	0.02					1.00		1.00
Incremental Delay, d2		3.5	0.3	76.4	0.2					5.7		0.4
Delay (s)		31.0	39.6	136.7	0.4					55.2		43.4
Level of Service		C	D	F	A					E		D
Approach Delay (s)		33.4			56.0			0.0			52.6	
Approach LOS		C			E			A			D	

Intersection Summary			
HCM Average Control Delay	47.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	18.2
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JSS	Intersection	Warrington Way & KY-22
Agency/Co.	Olsson Associates	Jurisdiction	Louiville, KY
Date Performed	04/23/2012	Analysis Year	2018 Base
Analysis Time Period	5:00 pm		

Project Description VA Hospital

East/West Street: KY-22 — North/South Street: Warrington Way

Intersection Orientation: East-West — Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		845	15	4	646	
Peak-Hour Factor, PHF	1.00	0.73	0.57	0.62	0.89	1.00
Hourly Flow Rate, HFR (veh/h)	0	1157	26	6	725	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		1			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	16		19			
Peak-Hour Factor, PHF	0.64	1.00	0.75	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	25	0	25	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (veh/h)		6		50				
C (m) (veh/h)		400		45				
v/c		0.01		1.11				
95% queue length		0.05		4.65				
Control Delay (s/veh)		14.1		311.6				
LOS		B		F				
Approach Delay (s/veh)	--	--	311.6					
Approach LOS	--	--	F					

 HCS+TM Version 5.6 Generated: 5/23/2012 6:22 PM

2008 + DEVELOPMENT CONDITIONS

Trip Generation - VA Medical Center

Daily Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Daily Trips	Trip Distribution Enter	Trip Distribution Exit	Daily Trips Enter	Daily Trips Exit
610/1143	Hospital	1,000,000	SF	Equation	12,322	50%	50%	6,161	6,161
Total					**12,322**			**6,161**	**6,161**

AM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	AM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	AM Peak Hour Trips Enter	AM Peak Hour Trips Exit
610/1144	Hospital	1,000,000	SF	Equation	1,002	59%	41%	591	411
Total					**1,002**			**591**	**411**

PM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	PM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hour Trips Enter	PM Peak Hour Trips Exit
610/1145	Hospital	1,000,000	SF	Equation	967	42%	58%	406	561
Total					**967**			**406**	**561**

AM		
Trip Distribution		
Roadway To/From	To Site	From Site
North (Rudy Lane)	1%	1%
North (I-264 EB)	20%	20%
North (Northfield Drive)	1%	1%
North (Lime Kiln Lane)	6%	6%
South (Rudy Lane)	1%	1%
South (I-264 WB)	35%	30%
South (Herr/Lime Kiln Lane)	4%	10%
West (Brownsboro Road)	15%	15%
East (Brownsboro Road)	10%	10%
East (Old Brownsboro Road)	7%	6%
Total	100%	100%

PM		
Trip Distribution		
Roadway To/From	To Site	From Site
North (Rudy Lane)	1%	1%
North (I-264 EB)	26%	18%
North (Northfield Drive)	1%	1%
North (Lime Kiln Lane)	5%	5%
South (Rudy Lane)	1%	1%
South (I-264 WB)	35%	40%
South (Herr/Lime Kiln Lane)	6%	10%
West (Brownsboro Road)	13%	13%
East (Brownsboro Road)	6%	6%
East (Old Brownsboro Road)	6%	5%
Total	100%	100%

- **AM CAPACITY REPORT**

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	909	115	2079	71	22
v/c Ratio	0.35	0.23	0.79	0.51	0.15
Control Delay	1.5	0.9	3.2	71.5	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	0.9	3.2	71.5	22.3
Queue Length 50th (ft)	12	2	23	61	0
Queue Length 95th (ft)	m51	4	m140	105	5
Internal Link Dist (ft)	441		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2615	500	2637	279	276
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.23	0.79	0.25	0.08

Intersection Summary

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

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	728	41	63	1850	61	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3391		1711	3421	1711	1583
Flt Permitted	1.00		0.29	1.00	0.95	1.00
Satd. Flow (perm)	3391		531	3421	1711	1583
Peak-hour factor, PHF	0.85	0.77	0.55	0.89	0.86	0.45
Adj. Flow (vph)	856	53	115	2079	71	22
RTOR Reduction (vph)	3	0	0	0	0	20
Lane Group Flow (vph)	906	0	115	2079	71	2
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	103.1		110.1	103.1	9.6	9.6
Effective Green, g (s)	103.1		110.1	103.1	9.6	9.6
Actuated g/C Ratio	0.76		0.82	0.76	0.07	0.07
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2590		494	2613	122	113
v/s Ratio Prot	0.27		c0.01	c0.61	c0.04	
v/s Ratio Perm			0.18			0.00
v/c Ratio	0.35		0.23	0.80	0.58	0.01
Uniform Delay, d1	5.1		2.6	9.6	60.8	58.3
Progression Factor	0.22		0.23	0.21	1.00	1.00
Incremental Delay, d2	0.3		0.1	0.9	6.9	0.0
Delay (s)	1.4		0.7	3.0	67.7	58.3
Level of Service	A		A	A	E	E
Approach Delay (s)	1.4			2.8	65.5	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	4.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	371	225	174	837	447	335	245
v/c Ratio	0.71	0.45	0.55	0.40	0.59	0.56	0.28
Control Delay	53.2	20.2	58.1	5.4	48.2	44.2	19.0
Queue Delay	0.0	0.0	0.0	0.3	0.0	1.4	0.7
Total Delay	53.2	20.2	58.1	5.7	48.2	45.6	19.8
Queue Length 50th (ft)	286	67	141	96	175	168	61
Queue Length 95th (ft)	399	144	219	129	233	289	135
Internal Link Dist (ft)	627				171		293
Turn Bay Length (ft)		115	150	200			
Base Capacity (vph)	577	536	315	2089	755	599	890
Starvation Cap Reductn	0	0	0	0	0	117	375
Spillback Cap Reductn	0	0	0	622	6	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.42	0.55	0.57	0.60	0.70	0.48

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰		↱↱		↑↱		↰	↑	
Volume (vph)	0	341	207	160	0	770	0	311	100	308	225	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00	1.00		0.88		0.95		1.00	1.00	
Frt		1.00	0.85	1.00		0.85		0.96		1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		2049	1583	1770		2787		3410		2006	1863	
Flt Permitted		1.00	1.00	0.95		1.00		1.00		0.26	1.00	
Satd. Flow (perm)		2049	1583	1770		2787		3410		539	1863	
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	371	225	174	0	837	0	338	109	335	245	0
RTOR Reduction (vph)	0	0	94	0	0	66	0	23	0	0	0	0
Lane Group Flow (vph)	0	371	131	174	0	771	0	424	0	335	245	0
Turn Type		NA	Perm	Prot		custom		NA		pm+pt	NA	
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4							2		
Actuated Green, G (s)		34.5	34.5	24.0		98.0		29.0		64.5	64.5	
Effective Green, g (s)		34.5	34.5	24.0		98.0		29.0		64.5	64.5	
Actuated g/C Ratio		0.26	0.26	0.18		0.73		0.21		0.48	0.48	
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)		524	405	315		2023		733		600	890	
v/s Ratio Prot		c0.18		c0.10		0.28		0.12		c0.13	0.13	
v/s Ratio Perm			0.08							c0.14		
v/c Ratio		0.71	0.32	0.55		0.38		0.58		0.56	0.28	
Uniform Delay, d1		45.7	40.8	50.6		7.0		47.5		23.5	21.2	
Progression Factor		1.00	1.00	1.00		1.00		1.00		1.77	0.82	
Incremental Delay, d2		4.4	0.5	6.8		0.1		1.1		3.0	0.6	
Delay (s)		50.0	41.3	57.4		7.1		48.6		44.6	18.0	
Level of Service		D	D	E		A		D		D	B	
Approach Delay (s)		46.7			15.8			48.6			33.4	
Approach LOS		D			B			D			C	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	135	520	325	128	550	526	262	171	119	164
v/c Ratio	0.78	0.80	0.43	0.68	0.86	0.89	0.31	0.34	0.13	0.19
Control Delay	56.2	49.0	4.8	44.6	55.6	49.8	19.0	23.7	18.4	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.2	49.0	4.8	44.6	55.6	49.8	19.0	23.7	18.4	5.2
Queue Length 50th (ft)	71	406	0	67	445	405	119	106	62	9
Queue Length 95th (ft)	77	320	25	#124	525	340	126	83	98	19
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	172	654	763	189	636	589	848	499	938	879
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.80	0.43	0.68	0.86	0.89	0.31	0.34	0.13	0.19

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)	84	317	250	120	426	17	347	125	64	84	102	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1786		1652	1658		1770	1863	1583
Flt Permitted	0.13	1.00	1.00	0.18	1.00		0.67	1.00		0.53	1.00	1.00
Satd. Flow (perm)	231	1801	1531	319	1786		1170	1658		992	1863	1583
Peak-hour factor, PHF	0.62	0.61	0.77	0.94	0.82	0.57	0.66	0.69	0.79	0.49	0.86	0.69
Adj. Flow (vph)	135	520	325	128	520	30	526	181	81	171	119	164
RTOR Reduction (vph)	0	0	207	0	1	0	0	12	0	0	0	81
Lane Group Flow (vph)	135	520	118	128	549	0	526	250	0	171	119	83
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	56.0	49.0	49.0	54.0	48.0		68.0	68.0		68.0	68.0	68.0
Effective Green, g (s)	56.0	49.0	49.0	54.0	48.0		68.0	68.0		68.0	68.0	68.0
Actuated g/C Ratio	0.41	0.36	0.36	0.40	0.36		0.50	0.50		0.50	0.50	0.50
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	173	654	556	189	635		589	835		500	938	797
v/s Ratio Prot	c0.04	0.29		0.03	c0.31			0.15			0.06	
v/s Ratio Perm	0.28		0.08	0.24			c0.45			0.17		0.05
v/c Ratio	0.78	0.80	0.21	0.68	0.86		0.89	0.30		0.34	0.13	0.10
Uniform Delay, d1	30.6	38.5	29.7	32.0	40.5		30.2	19.6		20.1	17.8	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.06	1.01	1.86
Incremental Delay, d2	20.0	9.7	0.9	9.2	14.6		18.4	0.9		1.7	0.3	0.2
Delay (s)	50.6	48.2	30.5	41.2	55.0		48.7	20.5		23.1	18.2	32.8
Level of Service	D	D	C	D	E		D	C		C	B	C
Approach Delay (s)		42.7			52.4			39.3			25.3	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	133	622	286	2247	28	297	116	75	122	204
v/c Ratio	0.88	0.30	0.49	0.99	0.13	0.83	0.33	0.99	0.34	0.53
Control Delay	99.5	8.9	8.7	40.7	47.4	72.5	28.6	154.3	50.2	31.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	99.5	8.9	8.7	40.7	47.4	72.5	28.6	154.3	50.2	31.2
Queue Length 50th (ft)	78	125	71	954	23	263	52	66	93	84
Queue Length 95th (ft)	43	156	77	872	14	286	4	#148	140	130
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	152	2055	621	2267	216	359	351	76	359	382
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.30	0.46	0.99	0.13	0.83	0.33	0.99	0.34	0.53

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)	52	568	6	203	1755	75	7	214	29	60	100	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3401		1770	3514		1770	1863	1583	1770	1863	1583
Flt Permitted	0.05	1.00		0.36	1.00		0.60	1.00	1.00	0.21	1.00	1.00
Satd. Flow (perm)	94	3401		668	3514		1122	1863	1583	392	1863	1583
Peak-hour factor, PHF	0.39	0.95	0.25	0.71	0.82	0.70	0.25	0.72	0.25	0.80	0.82	0.78
Adj. Flow (vph)	133	598	24	286	2140	107	28	297	116	75	122	204
RTOR Reduction (vph)	0	2	0	0	2	0	0	0	46	0	0	78
Lane Group Flow (vph)	133	620	0	286	2245	0	28	297	70	75	122	126
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	88.5	81.5		99.0	87.0		26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	88.5	81.5		99.0	87.0		26.0	26.0	26.0	26.0	26.0	26.0
Actuated g/C Ratio	0.66	0.60		0.73	0.64		0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	152	2053		592	2265		216	359	305	75	359	305
v/s Ratio Prot	c0.05	0.18		0.04	c0.64			0.16			0.07	
v/s Ratio Perm	0.53			0.31			0.02		0.04	c0.19		0.08
v/c Ratio	0.88	0.30		0.48	0.99		0.13	0.83	0.23	1.00	0.34	0.41
Uniform Delay, d1	41.3	13.0		6.6	23.6		45.1	52.3	46.0	54.5	47.1	47.8
Progression Factor	1.95	0.64		1.00	1.00		1.01	1.03	1.06	1.00	1.00	1.00
Incremental Delay, d2	37.6	0.4		0.6	16.9		0.3	13.4	0.4	103.9	0.6	0.9
Delay (s)	118.3	8.7		7.2	40.5		45.7	67.5	49.0	158.4	47.7	48.7
Level of Service	F	A		A	D		D	E	D	F	D	D
Approach Delay (s)		28.0			36.7			61.3			68.9	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	40.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	158	1163	2692	897	278	539
v/c Ratio	0.90	0.44	0.89	0.76	0.49	0.82
Control Delay	76.2	22.1	24.3	8.5	54.8	40.4
Queue Delay	0.0	93.2	29.9	3.4	0.0	1.3
Total Delay	76.2	115.2	54.2	11.9	54.8	41.8
Queue Length 50th (ft)	147	568	746	155	115	147
Queue Length 95th (ft)	m#177	m501	m506	m176	148	190
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	176	2632	3028	1185	562	660
Starvation Cap Reductn	0	1663	494	196	0	0
Spillback Cap Reductn	0	472	0	0	0	32
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	1.20	1.06	0.91	0.49	0.86

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)	131	907	0	0	2315	780	231	0	447	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.83	0.78	0.92	0.92	0.86	0.87	0.83	0.92	0.83	0.92	0.92	0.92
Adj. Flow (vph)	158	1163	0	0	2692	897	278	0	539	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	272	0	0	204	0	0	0
Lane Group Flow (vph)	158	1163	0	0	2692	625	278	0	335	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2 8		1					
Permitted Phases						2 8			1			
Actuated Green, G (s)	13.4	100.4			80.4	80.4	22.1		22.1			
Effective Green, g (s)	13.4	88.8			73.8	73.8	22.1		22.1			
Actuated g/C Ratio	0.10	0.66			0.55	0.55	0.16		0.16			
Clearance Time (s)	6.6						6.6		6.6			
Vehicle Extension (s)	6.0						4.0		4.0			
Lane Grp Cap (vph)	176	2328			2780	865	562		456			
v/s Ratio Prot	c0.09	c0.33			c0.53		0.08					
v/s Ratio Perm						0.39			c0.12			
v/c Ratio	0.90	0.50			0.97	0.72	0.49		0.73			
Uniform Delay, d1	60.1	11.8			29.5	22.9	51.4		53.7			
Progression Factor	0.90	3.27			0.93	1.08	1.00		1.00			
Incremental Delay, d2	20.3	0.1			5.9	1.4	0.9		6.4			
Delay (s)	74.5	38.6			33.3	26.3	52.3		60.1			
Level of Service	E	D			C	C	D		E			
Approach Delay (s)		42.9			31.6			57.5			0.0	
Approach LOS		D			C			E			A	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.1
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	49	904	36	84	1452	170	99	112	118	119	62
v/c Ratio	0.36	0.50	0.04	0.51	0.75	0.19	0.58	0.45	0.59	0.59	0.25
Control Delay	65.3	25.0	15.5	75.1	20.5	8.8	72.0	15.5	67.3	67.2	14.1
Queue Delay	0.0	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.3	25.1	15.5	75.1	21.0	8.8	72.0	15.6	67.3	67.2	14.1
Queue Length 50th (ft)	41	269	10	71	499	30	84	0	105	106	0
Queue Length 95th (ft)	55	345	17	m100	m561	m71	65	58	113	76	23
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	138	1797	810	181	1944	883	208	280	417	421	439
Starvation Cap Reductn	0	0	0	0	155	0	0	0	0	0	0
Spillback Cap Reductn	0	148	0	0	0	0	0	4	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.55	0.04	0.46	0.81	0.19	0.48	0.41	0.28	0.28	0.14

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)	30	732	19	71	1205	136	24	26	104	140	8	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Peak-hour factor, PHF	0.61	0.81	0.53	0.85	0.83	0.80	0.61	0.43	0.93	0.64	0.44	0.71
Adj. Flow (vph)	49	904	36	84	1452	170	39	60	112	219	18	62
RTOR Reduction (vph)	0	0	6	0	0	14	0	0	102	0	0	55
Lane Group Flow (vph)	49	904	30	84	1452	156	0	99	10	118	119	7
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	9.1	68.5	68.5	12.7	73.0	73.0		12.6	12.6	16.1	16.1	16.1
Effective Green, g (s)	9.1	68.5	68.5	12.7	73.0	73.0		12.6	12.6	16.1	16.1	16.1
Actuated g/C Ratio	0.07	0.51	0.51	0.09	0.54	0.54		0.09	0.09	0.12	0.12	0.12
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	119	1796	803	167	1914	856		171	148	200	203	189
v/s Ratio Prot	0.03	0.26		c0.05	c0.41			c0.05		c0.07	0.07	
v/s Ratio Perm			0.02			0.10			0.01			0.00
v/c Ratio	0.41	0.50	0.04	0.50	0.76	0.18		0.58	0.07	0.59	0.59	0.04
Uniform Delay, d1	60.4	22.0	16.7	58.1	24.1	15.8		58.7	55.9	56.3	56.3	52.6
Progression Factor	1.00	1.00	1.00	1.16	0.68	0.55		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	1.0	0.1	2.5	2.2	0.4		5.0	0.2	5.2	5.0	0.1
Delay (s)	63.5	23.0	16.8	70.2	18.8	9.0		63.7	56.1	61.5	61.3	52.7
Level of Service	E	C	B	E	B	A		E	E	E	E	D
Approach Delay (s)		24.8			20.3			59.7			59.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.1
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1705	2278	859	417	48	116
v/c Ratio	0.62	0.80	1.11	1.08	0.38	0.26
Control Delay	18.8	16.0	113.7	114.3	66.7	8.5
Queue Delay	0.4	14.7	66.7	58.0	0.0	0.1
Total Delay	19.2	30.6	180.4	172.3	66.8	8.5
Queue Length 50th (ft)	538	390	~476	~447	41	0
Queue Length 95th (ft)	543	473	#606	#652	45	33
Internal Link Dist (ft)	328	530		293	358	
Turn Bay Length (ft)						90
Base Capacity (vph)	2750	2856	773	387	372	443
Starvation Cap Reductn	453	0	94	45	0	0
Spillback Cap Reductn	66	619	12	7	19	27
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	1.02	1.27	1.22	0.14	0.28

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	844	530	0	1928	6	1077	12	39	10	15	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.91			0.91		0.91	0.91			1.00	1.00
Frt		0.94			1.00		1.00	0.98			1.00	0.85
Flt Protected		1.00			1.00		0.95	0.96			0.98	1.00
Satd. Flow (prot)		4777			5082		3221	1596			1707	1478
Flt Permitted		1.00			1.00		0.95	0.96			0.98	1.00
Satd. Flow (perm)		4777			5082		3221	1596			1707	1478
Peak-hour factor, PHF	0.55	0.83	0.77	0.50	0.85	0.62	0.89	0.88	0.75	0.56	0.50	0.79
Adj. Flow (vph)	0	1017	688	0	2268	10	1210	14	52	18	30	116
RTOR Reduction (vph)	0	68	0	0	0	0	0	4	0	0	0	88
Lane Group Flow (vph)	0	1637	0	0	2278	0	859	413	0	0	48	28
Turn Type		NA			NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases												4
Actuated Green, G (s)		74.6			74.6		32.4	32.4			8.8	32.4
Effective Green, g (s)		74.6			74.6		32.4	32.4			8.8	32.4
Actuated g/C Ratio		0.55			0.55		0.24	0.24			0.07	0.24
Clearance Time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0			3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2640			2808		773	383			111	355
v/s Ratio Prot		0.34			c0.45		c0.27	0.26			c0.03	
v/s Ratio Perm												0.02
v/c Ratio		0.62			0.81		1.11	1.08			0.43	0.08
Uniform Delay, d1		20.6			24.5		51.3	51.3			60.7	39.7
Progression Factor		0.95			0.58		1.01	1.01			1.00	1.00
Incremental Delay, d2		0.9			1.8		66.3	67.0			3.7	0.1
Delay (s)		20.5			15.9		118.4	118.9			64.4	39.9
Level of Service		C			B		F	F			E	D
Approach Delay (s)		20.5			15.9			118.6			47.0	
Approach LOS		C			B			F			D	

Intersection Summary			
HCM Average Control Delay	42.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	80.0%	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)	834	365	1532	1350	464	330
v/c Ratio	0.70	0.62	1.07	0.49	1.40	1.27
Control Delay	37.8	26.7	63.0	0.3	241.4	178.3
Queue Delay	2.9	2.0	32.0	0.4	488.7	34.0
Total Delay	40.7	28.6	94.9	0.8	730.1	212.3
Queue Length 50th (ft)	372	234	~750	0	~280	~265
Queue Length 95th (ft)	343	314	#891	0	#890	#835
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1190	591	1436	2757	331	260
Starvation Cap Reductn	244	110	95	804	0	0
Spillback Cap Reductn	0	0	0	427	196	15
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.76	1.14	0.69	3.44	1.35

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	609	314	1394	1188	0	0	0	0	418	0	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.73	0.86	0.91	0.88	0.92	0.92	0.92	0.92	0.90	0.92	0.76
Adj. Flow (vph)	0	834	365	1532	1350	0	0	0	0	464	0	330
RTOR Reduction (vph)	0	0	82	0	0	0	0	0	0	0	0	108
Lane Group Flow (vph)	0	834	283	1532	1350	0	0	0	0	464	0	222
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		45.4	45.4	58.4	110.4					13.0		13.0
Effective Green, g (s)		38.8	38.8	58.4	104.5					13.0		13.0
Actuated g/C Ratio		0.29	0.29	0.43	0.77					0.10		0.10
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1017	440	1436	2648					331		152
v/s Ratio Prot		c0.24		c0.46	0.39							
v/s Ratio Perm			0.18							0.14		c0.14
v/c Ratio		0.82	0.64	1.07	0.51					1.40		1.46
Uniform Delay, d1		44.8	42.1	38.3	5.7					61.0		61.0
Progression Factor		0.88	0.88	0.63	0.00					1.00		1.00
Incremental Delay, d2		5.1	3.2	37.9	0.1					198.1		241.0
Delay (s)		44.7	40.1	61.9	0.1					259.1		302.0
Level of Service		D	D	E	A					F		F
Approach Delay (s)		43.3			33.0			0.0			276.9	
Approach LOS		D			C			A			F	

Intersection Summary			
HCM Average Control Delay	75.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	23.2
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues
2018+Dev AM (SPUI)
6: I-264 WB & I-264 EB & US-42
5/24/2012

Lane Group	EBL	EBT	WBL	WBT	NBL	SBL
Lane Group Flow (vph)	158	652	1483	1100	278	464
v/c Ratio	0.50	0.79	0.89	0.49	0.57	0.88
Control Delay	50.2	55.0	29.2	8.4	59.2	74.8
Queue Delay	0.0	0.0	16.9	0.6	1.0	0.0
Total Delay	50.2	55.0	46.1	9.0	60.3	74.8
Queue Length 50th (ft)	70	317	509	180	118	207
Queue Length 95th (ft)	97	306	688	265	152	#295
Internal Link Dist (ft)		175		179		
Turn Bay Length (ft)						
Base Capacity (vph)	407	823	1663	2234	493	534
Starvation Cap Reductn	0	0	214	672	0	0
Spillback Cap Reductn	0	0	0	0	71	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.79	1.02	0.70	0.66	0.87

Intersection Summary

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

Movement	EBL	EBT	WBL	WBT	NBL	SBL
Lane Configurations						
Volume (vph)	131	489	1394	957	231	418
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.9	6.6	6.6	6.6	5.0
Lane Util. Factor	0.97	0.95	0.97	0.95	0.97	0.97
Frt	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.95	0.95
Satd. Flow (prot)	3433	3539	3433	3539	3433	3433
Flt Permitted	0.95	1.00	0.95	1.00	0.95	0.95
Satd. Flow (perm)	3433	3539	3433	3539	3433	3433
Peak-hour factor, PHF	0.83	0.75	0.94	0.87	0.83	0.90
Adj. Flow (vph)	158	652	1483	1100	278	464
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	158	652	1483	1100	278	464
Turn Type	Prot	NA	Prot	NA	Prot	Prot
Protected Phases	5	2	1	6	8	4
Permitted Phases						
Actuated Green, G (s)	12.5	31.4	65.4	85.2	19.1	20.7
Effective Green, g (s)	12.5	31.4	65.4	85.2	19.1	20.7
Actuated g/C Ratio	0.09	0.23	0.48	0.63	0.14	0.15
Clearance Time (s)	5.0	5.9	6.6	6.6	6.6	5.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	318	823	1663	2234	486	526
v/s Ratio Prot	0.05	c0.18	c0.43	0.31	0.08	c0.14
v/s Ratio Perm						
v/c Ratio	0.50	0.79	0.89	0.49	0.57	0.88
Uniform Delay, d1	58.3	48.7	31.6	13.3	54.1	56.0
Progression Factor	0.78	0.98	0.78	0.58	1.00	1.00
Incremental Delay, d2	1.5	7.0	3.6	0.4	2.0	16.3
Delay (s)	47.1	54.6	28.1	8.1	56.1	72.3
Level of Service	D	D	C	A	E	E
Approach Delay (s)		53.1		19.6		
Approach LOS		D		B		

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	909	115	2079	71	22
v/c Ratio	0.35	0.23	0.79	0.51	0.15
Control Delay	6.5	1.2	2.5	71.5	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	1.2	2.5	71.5	22.3
Queue Length 50th (ft)	98	6	69	61	0
Queue Length 95th (ft)	133	7	m82	105	5
Internal Link Dist (ft)	452		1977	675	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2615	500	2637	279	276
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.23	0.79	0.25	0.08

Intersection Summary

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

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	728	41	63	1850	61	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3391		1711	3421	1711	1583
Flt Permitted	1.00		0.29	1.00	0.95	1.00
Satd. Flow (perm)	3391		531	3421	1711	1583
Peak-hour factor, PHF	0.85	0.77	0.55	0.89	0.86	0.45
Adj. Flow (vph)	856	53	115	2079	71	22
RTOR Reduction (vph)	3	0	0	0	0	20
Lane Group Flow (vph)	906	0	115	2079	71	2
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	103.1		110.1	103.1	9.6	9.6
Effective Green, g (s)	103.1		110.1	103.1	9.6	9.6
Actuated g/C Ratio	0.76		0.82	0.76	0.07	0.07
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2590		494	2613	122	113
v/s Ratio Prot	0.27		c0.01	c0.61	c0.04	
v/s Ratio Perm			0.18			0.00
v/c Ratio	0.35		0.23	0.80	0.58	0.01
Uniform Delay, d1	5.1		2.6	9.6	60.8	58.3
Progression Factor	1.12		0.41	0.15	1.00	1.00
Incremental Delay, d2	0.3		0.1	0.9	6.9	0.0
Delay (s)	6.0		1.2	2.4	67.7	58.3
Level of Service	A		A	A	E	E
Approach Delay (s)	6.0			2.3	65.5	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	371	225	174	837	447	335	245
v/c Ratio	0.70	0.45	0.60	0.45	0.43	0.61	0.27
Control Delay	52.6	20.0	61.2	8.3	39.5	8.7	3.5
Queue Delay	0.0	0.0	0.0	0.1	0.2	0.3	0.6
Total Delay	52.6	20.0	61.2	8.4	39.7	9.0	4.1
Queue Length 50th (ft)	285	67	144	125	160	31	23
Queue Length 95th (ft)	399	144	219	129	233	58	30
Internal Link Dist (ft)	641				171		267
Turn Bay Length (ft)		115	150	200			
Base Capacity (vph)	581	539	315	1969	1038	614	909
Starvation Cap Reductn	0	0	0	0	0	45	370
Spillback Cap Reductn	0	0	0	228	141	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.42	0.55	0.48	0.50	0.59	0.45

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	341	207	160	0	770	0	311	100	308	225	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00	1.00		0.88		0.95		1.00	1.00	
Frt		1.00	0.85	1.00		0.85		0.96		1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		2049	1583	1770		2787		3410		2006	1863	
Flt Permitted		1.00	1.00	0.95		1.00		1.00		0.33	1.00	
Satd. Flow (perm)		2049	1583	1770		2787		3410		707	1863	
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	371	225	174	0	837	0	338	109	335	245	0
RTOR Reduction (vph)	0	0	94	0	0	86	0	20	0	0	0	0
Lane Group Flow (vph)	0	371	131	174	0	751	0	427	0	335	245	0
Turn Type		NA	Perm	Prot		custom		NA		pm+pt	NA	
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4							2		
Actuated Green, G (s)		34.8	34.8	22.3		86.7		40.3		65.9	65.9	
Effective Green, g (s)		34.8	34.8	22.3		86.7		40.3		65.9	65.9	
Actuated g/C Ratio		0.26	0.26	0.17		0.64		0.30		0.49	0.49	
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)		528	408	292		1790		1018		553	909	
v/s Ratio Prot		c0.18		c0.10		0.27		0.13		c0.10	0.13	
v/s Ratio Perm			0.08							c0.20		
v/c Ratio		0.70	0.32	0.60		0.42		0.42		0.61	0.27	
Uniform Delay, d1		45.4	40.6	52.2		11.8		38.0		22.3	20.4	
Progression Factor		1.00	1.00	1.00		1.00		1.00		0.22	0.14	
Incremental Delay, d2		4.2	0.5	3.3		0.2		0.3		1.4	0.5	
Delay (s)		49.6	41.0	55.4		12.0		38.2		6.4	3.3	
Level of Service		D	D	E		B		D		A	A	
Approach Delay (s)		46.4			19.5			38.2			5.1	
Approach LOS		D			B			D			A	

Intersection Summary			
HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	135	520	325	128	550	526	262	171	119	164
v/c Ratio	0.78	0.80	0.43	0.68	0.86	0.89	0.31	0.34	0.13	0.19
Control Delay	56.2	49.0	4.8	44.6	55.6	49.8	19.0	17.3	13.1	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.2	49.0	4.8	44.6	55.6	49.8	19.0	17.3	13.1	0.8
Queue Length 50th (ft)	71	406	0	67	445	405	119	90	36	0
Queue Length 95th (ft)	77	320	25	#124	525	340	126	51	57	0
Internal Link Dist (ft)		789			548		495		1968	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	172	654	763	189	636	589	848	499	938	879
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.80	0.43	0.68	0.86	0.89	0.31	0.34	0.13	0.19

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)	84	317	250	120	426	17	347	125	64	84	102	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1786		1652	1658		1770	1863	1583
Flt Permitted	0.13	1.00	1.00	0.18	1.00		0.67	1.00		0.53	1.00	1.00
Satd. Flow (perm)	231	1801	1531	319	1786		1170	1658		992	1863	1583
Peak-hour factor, PHF	0.62	0.61	0.77	0.94	0.82	0.57	0.66	0.69	0.79	0.49	0.86	0.69
Adj. Flow (vph)	135	520	325	128	520	30	526	181	81	171	119	164
RTOR Reduction (vph)	0	0	207	0	1	0	0	12	0	0	0	81
Lane Group Flow (vph)	135	520	118	128	549	0	526	250	0	171	119	83
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	56.0	49.0	49.0	54.0	48.0		68.0	68.0		68.0	68.0	68.0
Effective Green, g (s)	56.0	49.0	49.0	54.0	48.0		68.0	68.0		68.0	68.0	68.0
Actuated g/C Ratio	0.41	0.36	0.36	0.40	0.36		0.50	0.50		0.50	0.50	0.50
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	173	654	556	189	635		589	835		500	938	797
v/s Ratio Prot	c0.04	0.29		0.03	c0.31			0.15			0.06	
v/s Ratio Perm	0.28		0.08	0.24			c0.45			0.17		0.05
v/c Ratio	0.78	0.80	0.21	0.68	0.86		0.89	0.30		0.34	0.13	0.10
Uniform Delay, d1	30.6	38.5	29.7	32.0	40.5		30.2	19.6		20.1	17.8	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.75	0.72	0.14
Incremental Delay, d2	20.0	9.7	0.9	9.2	14.6		18.4	0.9		1.7	0.3	0.2
Delay (s)	50.6	48.2	30.5	41.2	55.0		48.7	20.5		16.8	13.0	2.7
Level of Service	D	D	C	D	E		D	C		B	B	A
Approach Delay (s)		42.7			52.4			39.3			10.7	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	39.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	133	622	286	2247	28	297	116	75	122	204
v/c Ratio	0.88	0.30	0.49	0.99	0.13	0.83	0.33	0.99	0.34	0.53
Control Delay	93.4	7.1	8.7	40.7	43.0	65.4	23.9	154.3	50.2	31.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	93.4	7.1	8.7	40.7	43.0	65.4	23.9	154.3	50.2	31.2
Queue Length 50th (ft)	64	115	71	954	18	215	36	66	93	84
Queue Length 95th (ft)	29	170	77	872	12	244	4	#148	140	130
Internal Link Dist (ft)		1977		810		1968			719	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	152	2055	621	2267	216	359	351	76	359	382
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.30	0.46	0.99	0.13	0.83	0.33	0.99	0.34	0.53

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)	52	568	6	203	1755	75	7	214	29	60	100	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3401		1770	3514		1770	1863	1583	1770	1863	1583
Flt Permitted	0.05	1.00		0.36	1.00		0.60	1.00	1.00	0.21	1.00	1.00
Satd. Flow (perm)	94	3401		668	3514		1122	1863	1583	392	1863	1583
Peak-hour factor, PHF	0.39	0.95	0.25	0.71	0.82	0.70	0.25	0.72	0.25	0.80	0.82	0.78
Adj. Flow (vph)	133	598	24	286	2140	107	28	297	116	75	122	204
RTOR Reduction (vph)	0	2	0	0	2	0	0	0	46	0	0	78
Lane Group Flow (vph)	133	620	0	286	2245	0	28	297	70	75	122	126
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	88.5	81.5		99.0	87.0		26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	88.5	81.5		99.0	87.0		26.0	26.0	26.0	26.0	26.0	26.0
Actuated g/C Ratio	0.66	0.60		0.73	0.64		0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	152	2053		592	2265		216	359	305	75	359	305
v/s Ratio Prot	c0.05	0.18		0.04	c0.64			0.16			0.07	
v/s Ratio Perm	0.53			0.31			0.02		0.04	c0.19		0.08
v/c Ratio	0.88	0.30		0.48	0.99		0.13	0.83	0.23	1.00	0.34	0.41
Uniform Delay, d1	41.3	13.0		6.6	23.6		45.1	52.3	46.0	54.5	47.1	47.8
Progression Factor	1.70	0.51		1.00	1.00		0.91	0.89	0.87	1.00	1.00	1.00
Incremental Delay, d2	37.6	0.4		0.6	16.9		0.3	13.4	0.4	103.9	0.6	0.9
Delay (s)	108.0	7.0		7.2	40.5		41.5	60.2	40.4	158.4	47.7	48.7
Level of Service	F	A		A	D		D	E	D	F	D	D
Approach Delay (s)		24.8			36.7			53.8			68.9	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	39.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	49	904	36	84	1452	170	99	112	118	119	62
v/c Ratio	0.36	0.50	0.04	0.51	0.75	0.19	0.58	0.45	0.59	0.59	0.25
Control Delay	65.3	25.0	15.5	59.0	24.8	12.1	72.0	15.5	67.3	67.2	14.1
Queue Delay	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.3	25.0	15.5	59.0	24.9	12.1	72.0	15.5	67.3	67.2	14.1
Queue Length 50th (ft)	41	269	10	71	481	64	84	0	105	106	0
Queue Length 95th (ft)	55	345	17	114	592	107	65	58	113	76	23
Internal Link Dist (ft)		411			438		786			578	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	138	1797	810	181	1944	883	208	280	417	421	439
Starvation Cap Reductn	0	0	0	0	57	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.50	0.04	0.46	0.77	0.19	0.48	0.40	0.28	0.28	0.14

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	732	19	71	1205	136	24	26	104	140	8	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1827	1583	1681	1698	1583
Peak-hour factor, PHF	0.61	0.81	0.53	0.85	0.83	0.80	0.61	0.43	0.93	0.64	0.44	0.71
Adj. Flow (vph)	49	904	36	84	1452	170	39	60	112	219	18	62
RTOR Reduction (vph)	0	0	6	0	0	14	0	0	102	0	0	55
Lane Group Flow (vph)	49	904	30	84	1452	156	0	99	10	118	119	7
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	9.1	68.5	68.5	12.7	73.0	73.0		12.6	12.6	16.1	16.1	16.1
Effective Green, g (s)	9.1	68.5	68.5	12.7	73.0	73.0		12.6	12.6	16.1	16.1	16.1
Actuated g/C Ratio	0.07	0.51	0.51	0.09	0.54	0.54		0.09	0.09	0.12	0.12	0.12
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	119	1796	803	167	1914	856		171	148	200	203	189
v/s Ratio Prot	0.03	0.26		c0.05	c0.41			c0.05		c0.07	0.07	
v/s Ratio Perm			0.02			0.10			0.01			0.00
v/c Ratio	0.41	0.50	0.04	0.50	0.76	0.18		0.58	0.07	0.59	0.59	0.04
Uniform Delay, d1	60.4	22.0	16.7	58.1	24.1	15.8		58.7	55.9	56.3	56.3	52.6
Progression Factor	1.00	1.00	1.00	0.86	0.84	0.76		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	1.0	0.1	3.0	2.7	0.4		5.0	0.2	5.2	5.0	0.1
Delay (s)	63.5	23.0	16.8	52.8	22.9	12.4		63.7	56.1	61.5	61.3	52.7
Level of Service	E	C	B	D	C	B		E	E	E	E	D
Approach Delay (s)		24.8			23.3			59.7			59.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.1
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1705	2278	859	417	48	116
v/c Ratio	0.67	0.87	0.86	0.84	0.52	0.22
Control Delay	6.6	23.1	48.0	52.7	82.5	7.5
Queue Delay	0.3	0.2	47.6	37.1	0.0	0.0
Total Delay	6.9	23.4	95.5	89.7	82.5	7.6
Queue Length 50th (ft)	72	542	403	385	42	3
Queue Length 95th (ft)	72	550	481	#530	47	33
Internal Link Dist (ft)	288	535		267	358	
Turn Bay Length (ft)						90
Base Capacity (vph)	2544	2615	1012	505	94	540
Starvation Cap Reductn	296	0	229	111	0	0
Spillback Cap Reductn	0	49	78	38	0	37
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.89	1.10	1.06	0.51	0.23

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)	0	844	530	0	1928	6	1077	12	39	10	15	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.91			0.91		0.91	0.91			1.00	1.00
Frt		0.94			1.00		1.00	0.98			1.00	0.85
Flt Protected		1.00			1.00		0.95	0.96			0.98	1.00
Satd. Flow (prot)		4777			5082		3221	1596			1707	1478
Flt Permitted		1.00			1.00		0.95	0.96			0.98	1.00
Satd. Flow (perm)		4777			5082		3221	1596			1707	1478
Peak-hour factor, PHF	0.55	0.83	0.77	0.50	0.85	0.62	0.89	0.88	0.75	0.56	0.50	0.79
Adj. Flow (vph)	0	1017	688	0	2268	10	1210	14	52	18	30	116
RTOR Reduction (vph)	0	88	0	0	0	0	0	4	0	0	0	77
Lane Group Flow (vph)	0	1617	0	0	2278	0	859	413	0	0	48	39
Turn Type		NA			NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases												4
Actuated Green, G (s)		68.2			68.2		41.7	41.7			5.9	41.7
Effective Green, g (s)		68.2			68.2		41.7	41.7			5.9	41.7
Actuated g/C Ratio		0.51			0.51		0.31	0.31			0.04	0.31
Clearance Time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0			3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2413			2567		995	493			75	457
v/s Ratio Prot		0.34			c0.45		c0.27	0.26			c0.03	
v/s Ratio Perm												0.03
v/c Ratio		0.67			0.89		0.86	0.84			0.64	0.09
Uniform Delay, d1		25.0			30.0		44.0	43.5			63.5	33.1
Progression Factor		0.24			0.66		0.87	0.87			1.00	1.00
Incremental Delay, d2		1.3			3.5		7.7	11.6			18.9	0.1
Delay (s)		7.3			23.3		46.1	49.5			82.5	33.2
Level of Service		A			C		D	D			F	C
Approach Delay (s)		7.3			23.3			47.2			47.6	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JSS	Intersection	Warrington Way & KY-22
Agency/Co.	OA	Jurisdiction	Louisville, KY
Date Performed	04/23/2012	Analysis Year	2018+Dev
Analysis Time Period	7:15		

Project Description VA Hospital	
East/West Street: KY-22	North/South Street: Warrington
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		632	17	11	914	
Peak-Hour Factor, PHF	1.00	0.73	0.57	0.62	0.89	1.00
Hourly Flow Rate, HFR (veh/h)	0	865	29	17	1026	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		1			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	24		6			
Peak-Hour Factor, PHF	0.64	1.00	0.75	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	37	0	8	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (veh/h)		17		45				
C (m) (veh/h)		668		46				
v/c		0.03		0.98				
95% queue length		0.08		4.05				
Control Delay (s/veh)		10.5		264.0				
LOS		B		F				
Approach Delay (s/veh)	--	--	264.0					
Approach LOS	--	--	F					

 HCS+TM Version 5.6 Generated: 5/29/2012 9:54 AM

- **PM CAPACITY REPORT**

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1890	114	1073	173	127
v/c Ratio	0.81	0.61	0.45	0.78	0.48
Control Delay	6.7	49.3	10.0	80.2	31.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	6.7	49.3	10.0	80.2	31.6
Queue Length 50th (ft)	62	22	354	147	46
Queue Length 95th (ft)	70	40	21	196	70
Internal Link Dist (ft)	445		1966	660	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2337	212	2361	253	293
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.81	0.54	0.45	0.68	0.43

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1648	127	57	1052	137	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3379		1711	3421	1711	1583
Flt Permitted	1.00		0.06	1.00	0.95	1.00
Satd. Flow (perm)	3379		105	3421	1711	1583
Peak-hour factor, PHF	0.95	0.82	0.50	0.98	0.79	0.70
Adj. Flow (vph)	1735	155	114	1073	173	127
RTOR Reduction (vph)	4	0	0	0	0	60
Lane Group Flow (vph)	1886	0	114	1073	173	67
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	93.1		102.2	93.1	17.5	17.5
Effective Green, g (s)	93.1		102.2	93.1	17.5	17.5
Actuated g/C Ratio	0.69		0.76	0.69	0.13	0.13
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2330		188	2359	222	205
v/s Ratio Prot	c0.56		c0.04	0.31	c0.10	
v/s Ratio Perm			0.42			0.04
v/c Ratio	0.81		0.61	0.45	0.78	0.33
Uniform Delay, d1	14.7		23.5	9.5	56.9	53.4
Progression Factor	0.32		1.94	0.94	1.00	1.00
Incremental Delay, d2	1.6		4.8	0.6	15.8	0.9
Delay (s)	6.3		50.3	9.4	72.6	54.3
Level of Service	A		D	A	E	D
Approach Delay (s)	6.3			13.4	64.9	
Approach LOS	A			B	E	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	697	151	76	568	610	367	210
v/c Ratio	0.85	0.23	0.48	0.27	0.90	0.79	0.27
Control Delay	47.3	16.2	69.6	5.0	68.9	35.6	6.6
Queue Delay	0.0	0.0	0.0	0.0	9.7	2.5	0.8
Total Delay	47.3	16.2	69.6	5.1	78.6	38.1	7.4
Queue Length 50th (ft)	526	50	65	68	268	214	38
Queue Length 95th (ft)	687	97	119	90	#875	m#851	m64
Internal Link Dist (ft)	627				171		293
Turn Bay Length (ft)		115	150	200			
Base Capacity (vph)	880	713	157	2088	677	462	785
Starvation Cap Reductn	0	0	0	0	0	34	336
Spillback Cap Reductn	0	0	0	226	56	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.21	0.48	0.31	0.98	0.86	0.47

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)	0	641	142	70	0	523	0	446	115	338	193	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00	1.00		0.88		0.95		1.00	1.00	
Frt		1.00	0.85	1.00		0.85		0.97		1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		2049	1583	1770		2787		3430		2006	1863	
Flt Permitted		1.00	1.00	0.95		1.00		1.00		0.13	1.00	
Satd. Flow (perm)		2049	1583	1770		2787		3430		281	1863	
Peak-hour factor, PHF	0.92	0.92	0.94	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	697	151	76	0	568	0	485	125	367	210	0
RTOR Reduction (vph)	0	0	34	0	0	16	0	17	0	0	0	0
Lane Group Flow (vph)	0	697	117	76	0	552	0	593	0	367	210	0
Turn Type		NA	Perm	Prot		custom		NA		pm+pt	NA	
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4							2		
Actuated Green, G (s)		54.1	54.1	12.0		101.0		26.0		56.9	56.9	
Effective Green, g (s)		54.1	54.1	12.0		101.0		26.0		56.9	56.9	
Actuated g/C Ratio		0.40	0.40	0.09		0.75		0.19		0.42	0.42	
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)		821	634	157		2085		661		462	785	
v/s Ratio Prot		c0.34		c0.04		0.20		c0.17		c0.16	0.11	
v/s Ratio Perm			0.07							0.18		
v/c Ratio		0.85	0.18	0.48		0.26		0.90		0.79	0.27	
Uniform Delay, d1		36.7	26.2	58.6		5.3		53.2		35.4	25.5	
Progression Factor		1.00	1.00	1.00		1.00		1.00		0.78	0.23	
Incremental Delay, d2		8.2	0.1	10.3		0.1		14.8		7.1	0.4	
Delay (s)		44.9	26.3	68.9		5.4		68.0		34.9	6.3	
Level of Service		D	C	E		A		E		C	A	
Approach Delay (s)		41.6			12.9			68.0			24.5	
Approach LOS		D			B			E			C	

Intersection Summary			
HCM Average Control Delay	37.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	141	524	451	128	338	332	417	89	272	180
v/c Ratio	0.33	0.68	0.50	0.44	0.46	0.92	0.58	0.33	0.34	0.23
Control Delay	21.7	39.1	4.5	25.4	32.4	66.4	30.2	23.8	22.4	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.7	39.1	4.5	25.4	32.4	66.4	30.2	23.8	22.4	1.9
Queue Length 50th (ft)	68	400	0	61	225	255	244	38	116	2
Queue Length 95th (ft)	116	500	71	96	321	#424	303	52	147	8
Internal Link Dist (ft)		728			537		489		1869	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	436	767	911	290	738	410	808	308	897	856
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.68	0.50	0.44	0.46	0.81	0.52	0.29	0.30	0.21

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)	127	445	406	105	255	46	319	235	135	68	242	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1760		1652	1650		1770	1863	1583
Flt Permitted	0.41	1.00	1.00	0.25	1.00		0.49	1.00		0.34	1.00	1.00
Satd. Flow (perm)	736	1801	1531	447	1760		853	1650		638	1863	1583
Peak-hour factor, PHF	0.90	0.85	0.90	0.82	0.89	0.90	0.96	0.85	0.96	0.76	0.89	0.79
Adj. Flow (vph)	141	524	451	128	287	51	332	276	141	89	272	180
RTOR Reduction (vph)	0	0	259	0	4	0	0	15	0	0	0	104
Lane Group Flow (vph)	141	524	192	128	334	0	332	402	0	89	272	76
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	66.9	57.6	57.6	64.5	56.4		57.3	57.3		57.3	57.3	57.3
Effective Green, g (s)	66.9	57.6	57.6	64.5	56.4		57.3	57.3		57.3	57.3	57.3
Actuated g/C Ratio	0.50	0.43	0.43	0.48	0.42		0.42	0.42		0.42	0.42	0.42
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	432	768	653	289	735		362	700		271	791	672
v/s Ratio Prot	0.02	c0.29		c0.03	0.19			0.24			0.15	
v/s Ratio Perm	0.14		0.13	0.18			c0.39			0.14		0.05
v/c Ratio	0.33	0.68	0.29	0.44	0.45		0.92	0.57		0.33	0.34	0.11
Uniform Delay, d1	19.7	31.3	25.4	23.0	28.2		36.6	29.6		26.0	26.2	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.85	0.85	0.47
Incremental Delay, d2	0.4	4.9	1.1	1.1	2.0		27.2	1.1		0.7	0.2	0.1
Delay (s)	20.2	36.2	26.5	24.1	30.3		63.8	30.7		22.8	22.5	11.2
Level of Service	C	D	C	C	C		E	C		C	C	B
Approach Delay (s)		30.3			28.6			45.4			18.8	
Approach LOS		C			C			D			B	

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	431	1481	146	982	97	130	310	81	166	195
v/c Ratio	0.74	0.66	0.53	0.53	0.74	0.45	0.71	0.51	0.57	0.47
Control Delay	25.0	8.7	21.0	24.7	78.9	50.4	24.6	61.4	59.2	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	8.7	21.0	24.7	78.9	50.4	24.6	61.4	59.2	9.9
Queue Length 50th (ft)	134	117	29	292	85	95	74	65	135	0
Queue Length 95th (ft)	m183	611	85	457	108	139	142	115	146	60
Internal Link Dist (ft)		1966		764		1869			702	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	730	2236	340	1860	173	386	504	213	386	483
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.66	0.43	0.53	0.56	0.34	0.62	0.38	0.43	0.40

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)	392	1277	65	136	850	70	70	112	282	73	113	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3389		1770	3497		1770	1863	1583	1770	1863	1583
Flt Permitted	0.19	1.00		0.14	1.00		0.45	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)	375	3389		270	3497		836	1863	1583	1025	1863	1583
Peak-hour factor, PHF	0.91	0.92	0.70	0.93	0.94	0.90	0.72	0.86	0.91	0.90	0.68	0.88
Adj. Flow (vph)	431	1388	93	146	904	78	97	130	310	81	166	195
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	187	0	0	165
Lane Group Flow (vph)	431	1478	0	146	978	0	97	130	123	81	166	30
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		4
Actuated Green, G (s)	103.9	88.9		81.7	71.7		21.1	21.1	21.1	21.1	21.1	21.1
Effective Green, g (s)	103.9	88.9		81.7	71.7		21.1	21.1	21.1	21.1	21.1	21.1
Actuated g/C Ratio	0.77	0.66		0.61	0.53		0.16	0.16	0.16	0.16	0.16	0.16
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	582	2232		275	1857		131	291	247	160	291	247
v/s Ratio Prot	c0.15	0.44		0.04	0.28			0.07			0.09	
v/s Ratio Perm	c0.42			0.28			c0.12		0.08	0.08		0.02
v/c Ratio	0.74	0.66		0.53	0.53		0.74	0.45	0.50	0.51	0.57	0.12
Uniform Delay, d1	16.9	14.0		12.6	20.6		54.3	51.7	52.1	52.2	52.8	49.0
Progression Factor	1.61	0.49		1.00	1.00		0.93	0.92	1.04	1.00	1.00	1.00
Incremental Delay, d2	3.2	1.0		2.0	1.1		18.8	1.0	1.5	2.5	2.7	0.2
Delay (s)	30.5	7.8		14.6	21.7		69.1	48.3	55.4	54.7	55.4	49.2
Level of Service	C	A		B	C		E	D	E	D	E	D
Approach Delay (s)		12.9			20.8			56.2			52.6	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	131	1773	1848	387	421	623
v/c Ratio	0.28	0.70	0.92	0.50	0.63	1.04
Control Delay	28.1	28.2	49.1	17.2	54.6	94.2
Queue Delay	0.0	171.9	24.7	0.9	0.0	8.1
Total Delay	28.1	200.1	73.8	18.1	54.6	102.3
Queue Length 50th (ft)	81	826	565	102	176	~306
Queue Length 95th (ft)	m91	m860	608	m166	230	#441
Internal Link Dist (ft)		454	328			
Turn Bay Length (ft)	75			225	575	225
Base Capacity (vph)	473	2519	2011	778	671	599
Starvation Cap Reductn	0	1234	250	177	0	0
Spillback Cap Reductn	0	730	0	0	0	13
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	1.38	1.05	0.64	0.63	1.06

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	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	1649	0	0	1793	360	375	0	604	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9			5.9	5.9	6.6		6.6			
Lane Util. Factor	1.00	0.95			0.91	1.00	0.97		0.88			
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)	1770	3539			5085	1583	3433		2787			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1583	3433		2787			
Peak-hour factor, PHF	0.91	0.93	0.92	0.92	0.97	0.93	0.89	0.97	0.97	0.92	0.92	0.92
Adj. Flow (vph)	131	1773	0	0	1848	387	421	0	623	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	152	0	0	54	0	0	0
Lane Group Flow (vph)	131	1773	0	0	1848	235	421	0	569	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot		custom			
Protected Phases	7	2 3 4			2		1					
Permitted Phases						2			1			
Actuated Green, G (s)	36.1	96.1			53.4	53.4	26.4		26.4			
Effective Green, g (s)	36.1	84.5			53.4	53.4	26.4		26.4			
Actuated g/C Ratio	0.27	0.63			0.40	0.40	0.20		0.20			
Clearance Time (s)	6.6				5.9	5.9	6.6		6.6			
Vehicle Extension (s)	6.0				4.0	4.0	4.0		4.0			
Lane Grp Cap (vph)	473	2215			2011	626	671		545			
v/s Ratio Prot	0.07	c0.50			c0.36		0.12					
v/s Ratio Perm						0.15			c0.20			
v/c Ratio	0.28	0.80			0.92	0.37	0.63		1.04			
Uniform Delay, d1	39.1	18.9			38.7	29.0	49.8		54.3			
Progression Factor	0.69	2.39			1.09	1.53	1.00		1.00			
Incremental Delay, d2	0.4	1.0			6.8	1.4	2.1		50.6			
Delay (s)	27.5	46.3			48.9	45.6	51.9		104.9			
Level of Service	C	D			D	D	D		F			
Approach Delay (s)		45.0			48.4			83.5			0.0	
Approach LOS		D			D			F			A	

Intersection Summary			
HCM Average Control Delay	54.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	24.3
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	159	988	61	212	1038	227	143	268	222	221	102
v/c Ratio	0.73	0.76	0.10	0.79	0.73	0.34	0.74	0.72	0.70	0.69	0.27
Control Delay	76.3	43.6	24.2	82.1	22.5	9.8	81.5	23.2	62.8	62.0	9.2
Queue Delay	0.0	0.1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.3	43.7	24.2	82.1	23.2	9.8	81.5	23.2	62.8	62.0	9.2
Queue Length 50th (ft)	133	418	26	147	427	71	122	32	193	191	0
Queue Length 95th (ft)	#212	#647	61	#224	513	157	168	94	196	267	33
Internal Link Dist (ft)		399			392		786			549	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	220	1303	594	278	1431	671	207	383	417	422	470
Starvation Cap Reductn	0	0	0	0	140	0	0	0	0	0	0
Spillback Cap Reductn	0	15	0	0	0	0	0	1	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.77	0.10	0.76	0.80	0.34	0.69	0.70	0.53	0.52	0.22

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)	126	879	54	163	924	204	71	52	220	279	36	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Peak-hour factor, PHF	0.79	0.89	0.88	0.77	0.89	0.90	0.94	0.78	0.82	0.69	0.92	0.80
Adj. Flow (vph)	159	988	61	212	1038	227	76	67	268	404	39	102
RTOR Reduction (vph)	0	0	11	0	0	30	0	0	204	0	0	83
Lane Group Flow (vph)	159	988	50	212	1038	197	0	143	64	222	221	19
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	16.6	49.7	49.7	20.6	54.6	54.6		14.3	14.3	25.3	25.3	25.3
Effective Green, g (s)	16.6	49.7	49.7	20.6	54.6	54.6		14.3	14.3	25.3	25.3	25.3
Actuated g/C Ratio	0.12	0.37	0.37	0.15	0.40	0.40		0.11	0.11	0.19	0.19	0.19
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	218	1303	583	270	1431	640		192	168	315	319	297
v/s Ratio Prot	0.09	0.28		c0.12	c0.29			c0.08		c0.13	0.13	
v/s Ratio Perm			0.03			0.12			0.04			0.01
v/c Ratio	0.73	0.76	0.09	0.79	0.73	0.31		0.74	0.38	0.70	0.69	0.06
Uniform Delay, d1	57.0	37.4	27.8	55.1	33.9	27.3		58.6	56.2	51.4	51.2	45.1
Progression Factor	1.00	1.00	1.00	1.17	0.55	0.37		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	4.2	0.3	13.2	2.9	1.1		14.9	1.7	7.5	6.9	0.1
Delay (s)	69.3	41.6	28.1	77.8	21.4	11.1		73.5	57.9	58.8	58.1	45.2
Level of Service	E	D	C	E	C	B		E	E	E	E	D
Approach Delay (s)		44.5			27.9			63.4			56.0	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.1
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	2413	1350	786	376	33	76
v/c Ratio	0.85	0.47	0.86	0.82	0.46	0.16
Control Delay	24.7	10.1	44.6	47.2	84.5	8.3
Queue Delay	8.7	2.4	53.5	33.9	0.0	0.0
Total Delay	33.4	12.4	98.2	81.1	84.5	8.3
Queue Length 50th (ft)	812	146	378	349	29	0
Queue Length 95th (ft)	m832	171	m441	382	55	11
Internal Link Dist (ft)	328	526		293	358	
Turn Bay Length (ft)						90
Base Capacity (vph)	2826	2883	940	469	71	485
Starvation Cap Reductn	411	0	232	109	0	0
Spillback Cap Reductn	0	1354	0	3	0	20
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.88	1.11	1.04	0.46	0.16

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)	0	1755	498	0	1194	15	920	23	58	7	14	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.91			0.91		0.91	0.91			1.00	1.00
Frt		0.96			1.00		1.00	0.96			1.00	0.85
Flt Protected		1.00			1.00		0.95	0.97			0.98	1.00
Satd. Flow (prot)		4906			5072		3221	1577			1702	1478
Flt Permitted		1.00			1.00		0.95	0.97			0.98	1.00
Satd. Flow (perm)		4906			5072		3221	1577			1702	1478
Peak-hour factor, PHF	0.58	0.95	0.88	0.75	0.90	0.65	0.89	0.75	0.60	0.50	0.75	0.62
Adj. Flow (vph)	0	1847	566	0	1327	23	1034	31	97	14	19	76
RTOR Reduction (vph)	0	39	0	0	1	0	0	9	0	0	0	54
Lane Group Flow (vph)	0	2374	0	0	1349	0	786	367	0	0	33	22
Turn Type		NA			NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases												4
Actuated Green, G (s)		74.1			74.1		38.5	38.5			3.2	38.5
Effective Green, g (s)		74.1			74.1		38.5	38.5			3.2	38.5
Actuated g/C Ratio		0.55			0.55		0.29	0.29			0.02	0.29
Clearance Time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0			3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2693			2784		919	450			40	422
v/s Ratio Prot		c0.48			0.27		c0.24	0.23			c0.02	
v/s Ratio Perm												0.01
v/c Ratio		0.88			0.48		0.86	0.81			0.82	0.05
Uniform Delay, d1		26.6			18.7		45.6	44.9			65.6	35.0
Progression Factor		0.90			0.53		0.78	0.76			1.00	1.00
Incremental Delay, d2		2.8			0.6		7.2	10.1			79.1	0.1
Delay (s)		26.8			10.5		42.6	44.4			144.8	35.1
Level of Service		C			B		D	D			F	D
Approach Delay (s)		26.8			10.5			43.2			68.3	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	80.8%	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)	1194	450	1032	1249	710	166
v/c Ratio	0.79	0.51	1.29	0.52	1.06	0.42
Control Delay	25.0	5.2	182.4	0.5	102.5	21.9
Queue Delay	2.7	0.5	0.0	0.4	638.4	0.1
Total Delay	27.8	5.8	182.4	0.8	740.9	22.0
Queue Length 50th (ft)	224	56	~579	1	~351	45
Queue Length 95th (ft)	301	36	m#677	m1	#475	90
Internal Link Dist (ft)	392			454		
Turn Bay Length (ft)		265	140		310	310
Base Capacity (vph)	1520	880	797	2418	671	394
Starvation Cap Reductn	173	148	0	569	0	0
Spillback Cap Reductn	215	0	0	347	420	11
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.61	1.29	0.68	2.83	0.43

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	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1075	324	991	1174	0	0	0	0	689	0	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	12	12	12	12	12	12	12
Total Lost time (s)		5.0	5.0	6.6	6.6					6.6		6.6
Lane Util. Factor		0.95	1.00	0.97	0.95					0.97		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	1531	3319	3421					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1531	3319	3421					3433		1583
Peak-hour factor, PHF	0.92	0.90	0.72	0.96	0.94	0.92	0.92	0.92	0.92	0.97	0.92	0.80
Adj. Flow (vph)	0	1194	450	1032	1249	0	0	0	0	710	0	166
RTOR Reduction (vph)	0	0	241	0	0	0	0	0	0	0	0	84
Lane Group Flow (vph)	0	1194	209	1032	1249	0	0	0	0	710	0	82
Turn Type		NA	Perm	Prot	NA					custom		custom
Protected Phases		4 6		5	1 2 4							
Permitted Phases			4 6							3		3
Actuated Green, G (s)		58.0	58.0	32.4	97.0					26.4		26.4
Effective Green, g (s)		51.4	51.4	32.4	91.1					26.4		26.4
Actuated g/C Ratio		0.38	0.38	0.24	0.67					0.20		0.20
Clearance Time (s)				6.6						6.6		6.6
Vehicle Extension (s)				6.0						4.0		4.0
Lane Grp Cap (vph)		1347	583	797	2309					671		310
v/s Ratio Prot		c0.34		c0.31	0.37							
v/s Ratio Perm			0.14							c0.21		0.05
v/c Ratio		0.89	0.36	1.29	0.54					1.06		0.26
Uniform Delay, d1		39.1	30.0	51.3	11.2					54.3		46.0
Progression Factor		0.66	0.86	1.13	0.01					1.00		1.00
Incremental Delay, d2		5.6	0.4	137.3	0.2					51.1		0.6
Delay (s)		31.2	26.3	195.2	0.2					105.4		46.7
Level of Service		C	C	F	A					F		D
Approach Delay (s)		29.9			88.5			0.0			94.3	
Approach LOS		C			F			A			F	

Intersection Summary			
HCM Average Control Delay	69.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	23.2
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	SBL
Lane Group Flow (vph)	131	1028	1032	853	421	710
v/c Ratio	0.45	0.88	0.94	0.43	0.59	0.94
Control Delay	50.9	50.1	51.3	14.6	52.0	72.5
Queue Delay	0.0	1.9	0.0	0.0	0.0	0.0
Total Delay	50.9	51.9	51.3	14.6	52.0	72.5
Queue Length 50th (ft)	48	500	377	136	172	317
Queue Length 95th (ft)	m68	#674	#677	217	225	#431
Internal Link Dist (ft)		172		183		
Turn Bay Length (ft)						
Base Capacity (vph)	407	1173	1104	1981	722	763
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	57	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.92	0.93	0.43	0.58	0.93

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	WBL	WBT	NBL	SBL
Lane Configurations						
Volume (vph)	119	956	991	802	375	689
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	5.9	6.6	6.6	6.6	5.0
Lane Util. Factor	0.97	0.95	0.97	0.95	0.97	0.97
Frt	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.95	0.95
Satd. Flow (prot)	3433	3539	3433	3539	3433	3433
Flt Permitted	0.95	1.00	0.95	1.00	0.95	0.95
Satd. Flow (perm)	3433	3539	3433	3539	3433	3433
Peak-hour factor, PHF	0.91	0.93	0.96	0.94	0.89	0.97
Adj. Flow (vph)	131	1028	1032	853	421	710
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	131	1028	1032	853	421	710
Turn Type	Prot	NA	Prot	NA	Prot	Prot
Protected Phases	5	2	1	6	8	4
Permitted Phases						
Actuated Green, G (s)	11.5	44.7	43.1	75.6	28.1	29.7
Effective Green, g (s)	11.5	44.7	43.1	75.6	28.1	29.7
Actuated g/C Ratio	0.09	0.33	0.32	0.56	0.21	0.22
Clearance Time (s)	6.6	5.9	6.6	6.6	6.6	5.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	292	1172	1096	1982	715	755
v/s Ratio Prot	0.04	c0.29	c0.30	0.24	0.12	c0.21
v/s Ratio Perm						
v/c Ratio	0.45	0.88	0.94	0.43	0.59	0.94
Uniform Delay, d1	58.7	42.6	44.7	17.2	48.2	51.8
Progression Factor	0.81	1.00	0.82	0.79	1.00	1.00
Incremental Delay, d2	1.1	6.9	13.0	0.5	1.5	19.8
Delay (s)	48.7	49.6	49.7	14.2	49.7	71.6
Level of Service	D	D	D	B	D	E
Approach Delay (s)		49.5		33.6		
Approach LOS		D		C		

Intersection Summary			
HCM Average Control Delay	46.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1890	114	1096	173	127
v/c Ratio	0.81	0.61	0.46	0.78	0.48
Control Delay	5.3	47.4	10.7	80.2	31.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	5.3	47.4	10.7	80.2	31.6
Queue Length 50th (ft)	51	18	363	147	46
Queue Length 95th (ft)	58	39	24	196	70
Internal Link Dist (ft)	456		1977	675	
Turn Bay Length (ft)		160			50
Base Capacity (vph)	2337	212	2361	253	293
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.81	0.54	0.46	0.68	0.43

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1648	127	57	1074	137	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	11	11	12
Total Lost time (s)	5.3		5.0	5.3	5.0	5.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3379		1711	3421	1711	1583
Flt Permitted	1.00		0.06	1.00	0.95	1.00
Satd. Flow (perm)	3379		105	3421	1711	1583
Peak-hour factor, PHF	0.95	0.82	0.50	0.98	0.79	0.70
Adj. Flow (vph)	1735	155	114	1096	173	127
RTOR Reduction (vph)	4	0	0	0	0	60
Lane Group Flow (vph)	1886	0	114	1096	173	67
Turn Type	NA		pm+pt	NA	NA	Perm
Protected Phases	2		1	2	4	
Permitted Phases			2			4
Actuated Green, G (s)	93.1		102.2	93.1	17.5	17.5
Effective Green, g (s)	93.1		102.2	93.1	17.5	17.5
Actuated g/C Ratio	0.69		0.76	0.69	0.13	0.13
Clearance Time (s)	5.3		5.0	5.3	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2330		188	2359	222	205
v/s Ratio Prot	c0.56		c0.04	0.32	c0.10	
v/s Ratio Perm			0.42			0.04
v/c Ratio	0.81		0.61	0.46	0.78	0.33
Uniform Delay, d1	14.7		23.5	9.6	56.9	53.4
Progression Factor	0.23		1.83	0.99	1.00	1.00
Incremental Delay, d2	1.6		4.8	0.6	15.8	0.9
Delay (s)	5.0		47.9	10.1	72.6	54.3
Level of Service	A		D	B	E	D
Approach Delay (s)	5.0			13.6	64.9	
Approach LOS	A			B	E	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	697	151	76	568	610	367	210
v/c Ratio	0.85	0.23	0.50	0.27	0.90	0.79	0.27
Control Delay	47.3	16.2	70.5	5.0	68.9	37.6	25.5
Queue Delay	0.0	0.0	0.0	0.0	18.5	42.3	2.7
Total Delay	47.3	16.2	70.5	5.0	87.4	79.9	28.2
Queue Length 50th (ft)	526	50	65	68	268	323	157
Queue Length 95th (ft)	687	97	119	90	#675	m#428	m194
Internal Link Dist (ft)	617				143		267
Turn Bay Length (ft)		115	150	200			
Base Capacity (vph)	880	713	157	2078	677	467	789
Starvation Cap Reductn	0	0	0	0	0	123	463
Spillback Cap Reductn	0	0	0	21	78	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.21	0.48	0.28	1.02	1.07	0.64

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)	0	641	142	70	0	523	0	446	115	338	193	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)		4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00	1.00		0.88		0.95		1.00	1.00	
Frt		1.00	0.85	1.00		0.85		0.97		1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		2049	1583	1770		2787		3430		2006	1863	
Flt Permitted		1.00	1.00	0.95		1.00		1.00		0.13	1.00	
Satd. Flow (perm)		2049	1583	1770		2787		3430		281	1863	
Peak-hour factor, PHF	0.92	0.92	0.94	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	697	151	76	0	568	0	485	125	367	210	0
RTOR Reduction (vph)	0	0	34	0	0	16	0	17	0	0	0	0
Lane Group Flow (vph)	0	697	117	76	0	552	0	593	0	367	210	0
Turn Type		NA	Perm	Prot		custom		NA		pm+pt	NA	
Protected Phases		4		3		3 4 5		6		5	2	
Permitted Phases			4							2		
Actuated Green, G (s)		54.1	54.1	11.7		101.0		26.0		57.2	57.2	
Effective Green, g (s)		54.1	54.1	11.7		101.0		26.0		57.2	57.2	
Actuated g/C Ratio		0.40	0.40	0.09		0.75		0.19		0.42	0.42	
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)		821	634	153		2085		661		467	789	
v/s Ratio Prot		c0.34		c0.04		0.20		c0.17		c0.16	0.11	
v/s Ratio Perm			0.07							0.17		
v/c Ratio		0.85	0.18	0.50		0.26		0.90		0.79	0.27	
Uniform Delay, d1		36.7	26.2	58.8		5.3		53.2		35.2	25.3	
Progression Factor		1.00	1.00	1.00		1.00		1.00		0.86	0.93	
Incremental Delay, d2		8.2	0.1	2.5		0.1		17.3		4.5	0.1	
Delay (s)		44.9	26.3	61.4		5.4		70.5		34.9	23.7	
Level of Service		D	C	E		A		E		C	C	
Approach Delay (s)		41.6			12.0			70.5			30.8	
Approach LOS		D			B			E			C	

Intersection Summary			
HCM Average Control Delay	38.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	141	524	451	128	338	332	417	89	272	180
v/c Ratio	0.33	0.68	0.50	0.44	0.46	0.92	0.58	0.33	0.34	0.23
Control Delay	21.7	39.1	4.5	25.4	32.4	66.4	30.2	24.2	22.7	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.7	39.1	4.5	25.4	32.4	66.4	30.2	24.2	22.7	2.1
Queue Length 50th (ft)	68	400	0	61	225	255	244	38	124	3
Queue Length 95th (ft)	116	500	71	96	321	#424	303	63	179	8
Internal Link Dist (ft)		789			548		495		1968	
Turn Bay Length (ft)	70		380	200		350		200		200
Base Capacity (vph)	436	767	911	290	738	410	808	308	897	856
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.68	0.50	0.44	0.46	0.81	0.52	0.29	0.30	0.21

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)	127	445	406	105	255	46	319	235	135	68	242	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	12	10	10	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1760		1652	1650		1770	1863	1583
Flt Permitted	0.41	1.00	1.00	0.25	1.00		0.49	1.00		0.34	1.00	1.00
Satd. Flow (perm)	736	1801	1531	447	1760		853	1650		638	1863	1583
Peak-hour factor, PHF	0.90	0.85	0.90	0.82	0.89	0.90	0.96	0.85	0.96	0.76	0.89	0.79
Adj. Flow (vph)	141	524	451	128	287	51	332	276	141	89	272	180
RTOR Reduction (vph)	0	0	259	0	4	0	0	15	0	0	0	104
Lane Group Flow (vph)	141	524	192	128	334	0	332	402	0	89	272	76
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2		2	6			4			4		4
Actuated Green, G (s)	66.9	57.6	57.6	64.5	56.4		57.3	57.3		57.3	57.3	57.3
Effective Green, g (s)	66.9	57.6	57.6	64.5	56.4		57.3	57.3		57.3	57.3	57.3
Actuated g/C Ratio	0.50	0.43	0.43	0.48	0.42		0.42	0.42		0.42	0.42	0.42
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	432	768	653	289	735		362	700		271	791	672
v/s Ratio Prot	0.02	c0.29		c0.03	0.19			0.24			0.15	
v/s Ratio Perm	0.14		0.13	0.18			c0.39			0.14		0.05
v/c Ratio	0.33	0.68	0.29	0.44	0.45		0.92	0.57		0.33	0.34	0.11
Uniform Delay, d1	19.7	31.3	25.4	23.0	28.2		36.6	29.6		26.0	26.2	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.87	0.86	0.53
Incremental Delay, d2	0.4	4.9	1.1	1.1	2.0		27.2	1.1		0.7	0.2	0.1
Delay (s)	20.2	36.2	26.5	24.1	30.3		63.8	30.7		23.3	22.8	12.5
Level of Service	C	D	C	C	C		E	C		C	C	B
Approach Delay (s)		30.3			28.6			45.4			19.4	
Approach LOS		C			C			D			B	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	431	1481	146	982	97	130	310	81	166	195
v/c Ratio	0.74	0.66	0.53	0.52	0.80	0.47	0.73	0.54	0.59	0.47
Control Delay	21.9	8.6	20.1	24.0	86.8	50.8	24.1	64.3	61.2	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	8.6	20.1	24.0	86.8	50.8	24.1	64.3	61.2	9.8
Queue Length 50th (ft)	124	192	27	281	75	98	74	66	137	0
Queue Length 95th (ft)	m179	610	83	457	98	144	144	115	146	59
Internal Link Dist (ft)		1977		810		1968			719	
Turn Bay Length (ft)	300		160		85		85	130		145
Base Capacity (vph)	735	2258	344	1886	169	386	504	209	386	493
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.66	0.42	0.52	0.57	0.34	0.62	0.39	0.43	0.40

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)	392	1277	65	136	850	70	70	112	282	73	113	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	11	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1829	3389		1770	3497		1770	1863	1583	1770	1863	1583
Flt Permitted	0.20	1.00		0.15	1.00		0.44	1.00	1.00	0.54	1.00	1.00
Satd. Flow (perm)	380	3389		274	3497		814	1863	1583	1010	1863	1583
Peak-hour factor, PHF	0.91	0.92	0.70	0.93	0.94	0.90	0.72	0.86	0.91	0.90	0.68	0.88
Adj. Flow (vph)	431	1388	93	146	904	78	97	130	310	81	166	195
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	189	0	0	164
Lane Group Flow (vph)	431	1478	0	146	978	0	97	130	121	81	166	31
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	custom
Protected Phases	5	2		1	6			4			4	
Permitted Phases	2			6			4		4	4		8
Actuated Green, G (s)	104.8	89.9		82.6	72.7		20.2	20.2	20.2	20.2	20.2	21.2
Effective Green, g (s)	104.8	89.9		82.6	72.7		20.2	20.2	20.2	20.2	20.2	21.2
Actuated g/C Ratio	0.78	0.67		0.61	0.54		0.15	0.15	0.15	0.15	0.15	0.16
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	586	2257		277	1883		122	279	237	151	279	249
v/s Ratio Prot	c0.15	0.44		0.04	0.28			0.07			0.09	
v/s Ratio Perm	c0.42			0.28			c0.12		0.08	0.08		0.02
v/c Ratio	0.74	0.65		0.53	0.52		0.80	0.47	0.51	0.54	0.59	0.12
Uniform Delay, d1	16.2	13.4		12.1	20.0		55.4	52.5	52.9	53.1	53.6	48.9
Progression Factor	1.45	0.50		1.00	1.00		0.90	0.90	0.94	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.9		1.8	1.0		27.5	1.2	1.7	3.6	3.4	0.2
Delay (s)	26.5	7.6		13.9	21.0		77.5	48.2	51.4	56.7	57.0	49.1
Level of Service	C	A		B	C		E	D	D	E	E	D
Approach Delay (s)		11.9			20.1			55.3			53.5	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	159	988	61	212	1038	227	143	268	222	221	102
v/c Ratio	0.73	0.76	0.10	0.79	0.73	0.34	0.74	0.72	0.70	0.69	0.27
Control Delay	76.3	43.6	24.2	76.6	32.8	20.1	81.5	23.2	62.8	62.0	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.3	43.6	24.2	76.6	32.8	20.1	81.5	23.2	62.8	62.0	9.2
Queue Length 50th (ft)	133	418	26	185	352	95	122	32	193	191	0
Queue Length 95th (ft)	#212	#647	61	#240	505	164	168	94	196	267	33
Internal Link Dist (ft)		411			438		786			578	
Turn Bay Length (ft)	175		75	165		50		600	135		135
Base Capacity (vph)	220	1303	594	278	1431	671	207	383	417	422	470
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.76	0.10	0.76	0.73	0.34	0.69	0.70	0.53	0.52	0.22

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)	126	879	54	163	924	204	71	52	220	279	36	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1815	1583	1681	1700	1583
Peak-hour factor, PHF	0.79	0.89	0.88	0.77	0.89	0.90	0.94	0.78	0.82	0.69	0.92	0.80
Adj. Flow (vph)	159	988	61	212	1038	227	76	67	268	404	39	102
RTOR Reduction (vph)	0	0	11	0	0	30	0	0	204	0	0	83
Lane Group Flow (vph)	159	988	50	212	1038	197	0	143	64	222	221	19
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	16.6	49.7	49.7	20.6	54.6	54.6		14.3	14.3	25.3	25.3	25.3
Effective Green, g (s)	16.6	49.7	49.7	20.6	54.6	54.6		14.3	14.3	25.3	25.3	25.3
Actuated g/C Ratio	0.12	0.37	0.37	0.15	0.40	0.40		0.11	0.11	0.19	0.19	0.19
Clearance Time (s)	5.7	5.4	5.4	6.6	5.4	5.4		6.6	6.6	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0		3.5	3.5	4.0	4.0	4.0
Lane Grp Cap (vph)	218	1303	583	270	1431	640		192	168	315	319	297
v/s Ratio Prot	0.09	0.28		c0.12	c0.29			c0.08		c0.13	0.13	
v/s Ratio Perm			0.03			0.12			0.04			0.01
v/c Ratio	0.73	0.76	0.09	0.79	0.73	0.31		0.74	0.38	0.70	0.69	0.06
Uniform Delay, d1	57.0	37.4	27.8	55.1	33.9	27.3		58.6	56.2	51.4	51.2	45.1
Progression Factor	1.00	1.00	1.00	1.05	0.83	0.80		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	4.2	0.3	13.7	3.0	1.2		14.9	1.7	7.5	6.9	0.1
Delay (s)	69.3	41.6	28.1	71.7	31.1	23.1		73.5	57.9	58.8	58.1	45.2
Level of Service	E	D	C	E	C	C		E	E	E	E	D
Approach Delay (s)		44.5			35.7			63.4			56.0	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	44.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	25.1
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	2413	1350	786	376	33	76
v/c Ratio	0.85	0.47	0.86	0.82	0.46	0.16
Control Delay	11.0	11.3	44.2	47.1	84.5	8.3
Queue Delay	2.0	0.0	17.4	12.4	0.0	0.0
Total Delay	13.0	11.3	61.6	59.5	84.5	8.3
Queue Length 50th (ft)	378	147	229	208	29	0
Queue Length 95th (ft)	460	197	m297	228	55	11
Internal Link Dist (ft)	288	531		267	358	
Turn Bay Length (ft)						90
Base Capacity (vph)	2826	2883	940	469	71	485
Starvation Cap Reductn	122	0	162	77	0	0
Spillback Cap Reductn	266	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.47	1.01	0.96	0.46	0.16

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)	0	1755	498	0	1194	15	920	23	58	7	14	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	16	12	12	12	12	12	12	10	10
Total Lost time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Lane Util. Factor		0.91			0.91		0.91	0.91			1.00	1.00
Frt		0.96			1.00		1.00	0.96			1.00	0.85
Flt Protected		1.00			1.00		0.95	0.97			0.98	1.00
Satd. Flow (prot)		4906			5072		3221	1577			1702	1478
Flt Permitted		1.00			1.00		0.95	0.97			0.98	1.00
Satd. Flow (perm)		4906			5072		3221	1577			1702	1478
Peak-hour factor, PHF	0.58	0.95	0.88	0.75	0.90	0.65	0.89	0.75	0.60	0.50	0.75	0.62
Adj. Flow (vph)	0	1847	566	0	1327	23	1034	31	97	14	19	76
RTOR Reduction (vph)	0	39	0	0	1	0	0	9	0	0	0	54
Lane Group Flow (vph)	0	2374	0	0	1349	0	786	367	0	0	33	22
Turn Type		NA			NA		Split	NA		Split	NA	custom
Protected Phases		2			6		4	4		8	8	
Permitted Phases												4
Actuated Green, G (s)		74.1			74.1		38.5	38.5			3.2	38.5
Effective Green, g (s)		74.1			74.1		38.5	38.5			3.2	38.5
Actuated g/C Ratio		0.55			0.55		0.29	0.29			0.02	0.29
Clearance Time (s)		6.0			6.0		6.6	6.6			6.6	6.6
Vehicle Extension (s)		3.0			3.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)		2693			2784		919	450			40	422
v/s Ratio Prot		c0.48			0.27		c0.24	0.23			c0.02	
v/s Ratio Perm												0.01
v/c Ratio		0.88			0.48		0.86	0.81			0.82	0.05
Uniform Delay, d1		26.6			18.7		45.6	44.9			65.6	35.0
Progression Factor		0.32			0.60		0.77	0.76			1.00	1.00
Incremental Delay, d2		3.5			0.5		7.2	10.1			79.1	0.1
Delay (s)		12.0			11.8		42.1	44.3			144.8	35.1
Level of Service		B			B		D	D			F	D
Approach Delay (s)		12.0			11.8			42.8			68.3	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JSS	Intersection	Warrington Way & KY-22
Agency/Co.	OA	Jurisdiction	Louisville, KY
Date Performed	04/23/2012	Analysis Year	2018+Dev
Analysis Time Period	5:00 pm		

Project Description VA Hospital

East/West Street: KY-22 | North/South Street: Warrington Way

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		960	15	4	738	
Peak-Hour Factor, PHF	1.00	0.73	0.57	0.62	0.89	1.00
Hourly Flow Rate, HFR (veh/h)	0	1315	26	6	829	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		1			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	16		19			
Peak-Hour Factor, PHF	0.64	1.00	0.75	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	25	0	25	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (veh/h)		6		50				
C (m) (veh/h)		309		22				
v/c		0.02		2.27				
95% queue length		0.06		6.42				
Control Delay (s/veh)		16.9		954.4				
LOS		C		F				
Approach Delay (s/veh)	--	--	954.4					
Approach LOS	--	--	F					

 HCS+™ Version 5.6 Generated: 5/29/2012 9:55 AM

EXHIBIT 1

VA Medical Center
Louisville, Kentucky

OLSSON ASSOCIATES	VA Medical Center Transportation Improvements	EXHIBIT 1