UPDATE

SEE BELOW FOR THE FOLLOWING ITEMS:

I. FACT SHEET
II. STUDY AREA MAP
III. TENTATIVE SCHEDULE
IV. DRAFT - CHAPTERS 1-3
V. TRANSPORTATION PLANNING STUDY - TEC Engineering, Inc.
WHAT: In September 2019 Boone County Judge/Executive Gary Moore requested that the Boone County Planning Commission initiate a special land use/zoning study for property around the planned I-275/Graves Road interchange. On November 12, 2019 the Boone County Fiscal Court passed a resolution formally asking for the study to commence (Resolution No. 2019-243).

WHY: The study will focus on land uses, infrastructure, compatibility with adjacent neighborhoods, property zoning districts, and other related factors and will guide development in the area in order to promote economic vitality and quality of life for residents and/or businesses in the community and to ensure the appropriate and coordinated use of undeveloped land in the area.

WHERE: The study will focus on an area comprised of approximately 2,500 acres emitting from the planned interchange and include the new Graves Road corridor northeast to the roundabout at KY 237 as well as to the south where it terminates at KY 20 (Petersburg Road). The study area also includes property on both sides of KY 20 south of I-275 as well as property along Williams Road on the north side of I-275. A study area map is located on the following page.

WHEN: The planning process will begin immediately with reconnaissance of existing conditions, followed by analysis of future conditions and is projected to conclude with recommendations to be adopted by the Boone County Fiscal Court in October 2020 in time for the estimated opening of the interchange slated for November 2020. See study schedule on following pages.

WHO: Staff at the Boone County Planning Commission will lead the planning study with assistance from a Stakeholders Group appointed by Judge/Executive Gary Moore as well as the public in general through a series of workshops and social media outreach efforts. Questions and/or comments can be directed to the project manager for the study, Robert A. Jonas, AICP at rjonas@boonecountyky.org or by phone at 859-334-2196.

For more information on the I-275/Graves Rd Interchange design, see the Transportation Cabinet page dedicated to the project here: http://www.drivingnkyprogress.org/gravesrd
I-275/GRAVES ROAD INTERCHANGE STUDY SCHEDULE

November-December 2019
- Form Stakeholder Group
- Staff begins data reconnaissance
- Hire consultant to perform Traffic Analysis

January-February 2020
- Stakeholder Group reviews ‘Existing Conditions’ data
- Kickoff Public Workshop

March-May 2020
- Stakeholder Group review ‘Future Conditions’ data (including Traffic and Utility study)
- Staff draft plan

June-July 2020
- Present draft to Stakeholder Group for comment
- Present to Long Range Planning Committee for comment
- Public Workshop to present draft plan for comment
- Staff revisions to draft plan

August-September 2020
- Present to Boone County Planning Commission (Public Hearing)
- Adoption by Planning Commission

October 2020
- Present to Boone County Fiscal Court
- Adoption by Boone County Fiscal Court

NOTE: Schedule is subject to change
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CHAPTER 1. INTRODUCTION AND PURPOSE

The Kentucky Transportation Cabinet (KYTC) in cooperation with the Federal Highway Administration (FHWA) are constructing a new interchange on Interstate (I)-275 in northern Boone County, KY. The interchange will be located between the existing Petersburg (Exit 11) and Hebron/KY-237 (Exit 8) interchanges, about 1 mile west of Exit 8. The project includes widening along Graves Road and auxiliary lanes on I-275 between the Exit 8 and the new interchange. Construction is occurring and not expected to be open until early 2021.

1.1 PURPOSE AND OPPORTUNITY

The purpose of this study is to “guide development in the area of the new I-275/Graves Road Interchange in order to promote economic vitality and quality of life for residents and/or businesses in the community.”

The anticipated function of the interchange with the local and regional transportation network provides an opportunity to develop recommendations for the area in order to ensure that the traffic functions in harmony with existing and future land uses.

1.2 PROJECT GOALS AND OBJECTIVES

1. Protect the function and operation of the interchange.
2. Protect the function and operation of the local street network within the study area.
3. Provide safe and efficient operations between the connecting roadways and adjoining local roadways as well as any multi-modal components.
4. Ensure that future land uses in the area are consistent with the long-term function of the interchange and supportive road network.
5. Recommendations consistent with Our Boone County - Plan 2040.

1.3 DEFINITION OF THE STUDY AREA

The study area is located in the Hebron vicinity of northern Boone County (Figure 1.1). The 2,499-acre (3.9 mi$^2$) study area encompasses the entire project footprint including: interchange and ramps, improvements along Graves (CR-1311) and Williams (CR-1312) roads, connections to Petersburg (KY-20) and Bullittsville roads (CR-1052), and all parcels which front on project area road segments.

The study area boundaries are based upon topography, land uses, developable properties, and major roadways affecting the interchange function over the long-term planning horizon (20 years). The study area contains the properties around the new interchange and extends west...
along both sides of I-275 and KY-20 to include undeveloped parcels up to about 140 acres in size. Much the area north and east of the new interchange has already been developed and is not included in the study area proper, although it is within the Project Area of Influence. The study area also includes all or part of several existing (primarily residential) developments including Treetops, Treetops Estates, Traditions, Park West International, Sunchase Meadows, Sutton’s Estates, Branham Farm, and others.
CHAPTER 2. EXISTING CONDITIONS

2.1 INTERCHANGE DESIGN DRAWINGS

As a 'Design Build' project, the interchange design drawings are continually changing and will do so throughout the construction process. The most recent drawings, as provided to the Boone County GIS by the contractor for the interchange project, can be accessed on the web GIS application at the link below by picking the “KYTC Designs” box under the Layer List dropdown tab: https://secure.boonecountygis.com/JavaScript/BooneCounty/

According to the Kentucky Transportation Cabinet - District 6 project website, the interchange will be a double crossover diamond (DCD) interchange that supports safer traffic movements by eliminating left turns made against oncoming traffic (Figure 2.1). In addition to the actual interchange, the following improvements will be included in the design and construction:

- Extend the third westbound lane on I-275 past Graves Rd.
- Build an additional travel lane on eastbound I-275 between Graves Rd. and KY 237
- Widen and realign Graves Rd. to avoid historic farmland and minimize the impact to local streams
- Shift the intersection of Williams Rd. and Graves Rd. away from the new ramps
- Improve the intersection at Graves Rd. and KY 20
- Make safety enhancements at the KY 237/Hebron interchange
- Provide sidewalks along Graves Rd. from KY 20 to KY 237

Figure 2.1 - KYTC Graves Rd Project Map
In addition, the Transportation Cabinet states that the purpose of the new interchange is "to improve mobility and safety in this rapidly-growing area in northern Boone County. The existing KY 237 interchange with I-275 (Exit #8) is experiencing substantial traffic congestion, including traffic backing-up onto mainline I-275 at the KY 237 westbound off-ramp. The surrounding area is expected to see continued traffic growth as a result of changes at the Cincinnati/Northern Kentucky International Airport and the associated business and industrial facilities. Additionally, residential developments north and south of I-275 continue to add to the demand on the surrounding roadway network."

2.2 ZONING

The primary zoning classification in the study area is Rural Suburban Estates (RSE) which is a residential designation permitting 1 dwelling unit per acre (Figure 2.2). There are 1,185 acres in the study area zoned RSE with the majority (943 acres) on the south side of I-275 and along the Petersburg Road/KY 20 corridor. This includes Sunchase Meadows subdivision as well as scattered homes fronting on KY 20. An additional 232 acres of mostly undeveloped RSE land lies north of I-275 along Graves Road from the KY 237 intersection and new Hebron Library southwest to the back portion of Park West.

There is also a considerable amount of Suburban Residential One (SR-1) zoning which allows for up to 4 units per acre. The majority of the SR-1 area is located north of I-275 and includes the Traditions subdivision (419 acres) which has approval to add residential to the existing golf course. Also in the north portion of the study area is 387 acres of SR-1 along the north side of Graves Road and includes undeveloped land as well as the parts of Tree Tops Estates and Tree Tops subdivisions that front on Graves Road. There is an area of 62 acres of SR-1 to the south of I-275, north of existing Liberty Crossing subdivision and west of the end of Litton Lane. Furthermore, there is 100 acres of Rural Suburban (RS) zoned land primarily located at the intersection of Graves Road and KY 20 (Petersburg Road) that is lightly developed with residential units. This particular zoning classification allows up to 3 dwelling units per acre.

In addition, there is a sizable amount (149 acres) of undeveloped Agriculture (A-1) zoned land along Williams Road just north of Traditions. This designation permits 1 dwelling unit per 5 acres. A small portion (26 acres) of undeveloped Agricultural Estate (A-2) land exists on the south side of Petersburg Road across from Sutton Lane. The A-2 Zone permits 2-acre residential lots.

There is nearly 110 acres of land zoned Industrial (I-1) in the study area but it is developed as part of Park West. A 1.3 acre parcel along Petersburg Road near the Bullittsville Road intersection is
zoned Commercial Two (C-2) and the building on site appears to be vacant at the time of the preparation of this study. Lastly, a couple of Public Facility (PF) districts exist in the study area. One, for the new Hebron Library, consists of 20 acres and the other, a 1 acre lot, is home to a cell tower. The Hebron Fire Station Two parcel at the intersection of Worldwide Boulevard and Graves Road is zoned I-1.
2.3 LAND USE

The 2017 Existing Land Use layer, prepared for the Our Boone County - Plan 2040 comprehensive plan, reveals that within the study area, the primary land use (778 acres) is designated Agricultural (A) which in addition to farming, includes vacant or overgrown fields and the occasional residential dwelling (Figure 2.3). Woodland (W) is the next highest land use at 600 acres. Next is the 462 acres of Rural Density Residential (RD) which consists of up to one dwelling
unit per acre. Nearly 85 acres of Suburban Density Residential (SD) exists in the study area and is comprised of portions of Treetops and Tree Tops Estates subdivisions as well as some residential development along Watts Road and Petersburg Road. There are nearly 400 acres of land at Traditions Golf Course designated as Recreational (R). In addition, there are 104 acres of Industrial (I) development in Park West, as well as 11 acres of Public/Institutional (P) which includes the Bullittsville Christian Church at Watts Lane and Petersburg Road, Hebron Fire Station Two and the Duke Energy Substation on Graves Road. There is a half-acre of Commercial (C) on Petersburg Road near the intersection with Bullittsville Road and nearly 70 acres of Transportation (T) which accounts for the I-275 interstate and the Park N Ride lot at KY 237 in front of the new Hebron Library.

2.4 DEMOGRAPHICS

Using ESRI’s Business Analyst software, it was determined that the U.S. Census Bureau's 2019 forecasts for 39 square miles in a 5 block group area around the new I-275/Graves Road Interchange shows that the population of nearly 18,000 is a bit younger and more affluent than the Boone County averages as a whole (Figure 2.4). The median age of residents in the area is 34.6 compared to 38 for the county as a whole. Furthermore, the county-wide average household size is approximately 2.63 people whereas for the area around the new interchange it is 3.11 indicating more of a traditional family demographic. The larger the household size, the more stable and less transient the population for a given area.

Figure 2.4 - Business Analyst 5-Block Group Area
Economically, the area is quite prosperous when compared to the county as a whole. The median household income for Boone County is currently around $74,000 whereas the area around the new interchange is estimated around $103,000 (Figure 2.5). This indicates the working population is more white collar in nature and able to afford higher valued housing. Most of the people working in this area of the county travel to areas such as downtown Cincinnati for more corporate, white-collar jobs versus the primarily heavy logistics jobs that have recently moved into the areas around the Cincinnati-Northern Kentucky International Airport (CVG) and I-75/71 corridor.

Figure 2.5 - Business Analyst Economic Summary
2.5 NATURAL AND CULTURAL RESOURCES

Water Resources
The Study Area includes portions of four watersheds: Woolper Creek, Garrison Creek, Sand Run, and Elijah’s Creek (Figure 2.6). The central part of the study area with most of the interchange footprint and improvements covers 985 acres of the north end of the 33-square mile Woolper Creek Watershed. Most of the western end of the study area (959 acres) falls within the Garrison Creek sub-watershed of the 31.8-square mile Ohio River North Watershed. The northwest tip and northeast portion of the study area along Graves Road up to North Bend Road (560 acres) lies within the 5-square mile watershed of Sand Run. Just 3 acres of the study area extends into the Elijah's Creek watershed.

Figure 2.6 - Watersheds
As part of the 2007 Sanitation District Number 1 (SD1) Consent Decree with the US Environmental Protection Agency (USEPA) and Kentucky Division of Water (KDOM), SD1 developed Watershed Characterization Reports for each of these watersheds. These reports include good reference information ranging from physical and natural features to infrastructure and potential sources of pollution. The Woolper Creek Watershed Initiative, completed in 2016, is a more in depth resource and includes inventories, analysis and recommended Best Management Practices for the 33-square mile watershed. Up to date, two projects following BMPs from the initiative have been completed, including a Bioretention Basin at the KY 18/237 Interchange in Burlington and retrofit of a water retention basin at the Toyota North American Parts Center of Kentucky.

Field surveys conducted in 2017 and 2018 to assess streams and wetlands in the project area showed that the Selected Alternative will have minimal stream impacts to Woolper Creek, Sand Run and tributaries. Minimal impacts to small wetlands may also occur, but neither stream nor wetland impacts were considered significant. Ashby’s Fork and its tributaries and also Garrison Creek’s tributaries may be impacted depending the final design. The Interchange Justification Study notes that through completion, the project will follow the design criteria and storm water regulations of KYTC’s existing MS4 permit.

**Threatened and Endangered Species**

This information is summarized from the Interchange Justification Study and Categorical Exclusion Environmental Determination Checklist. The data came from the US Fish and Wildlife Service, Kentucky Department of Fish and Wildlife, and Kentucky State Nature Preserves Commission supplemented by three field surveys. While no detailed “presence/absence” studies were conducted to identify individual species, habitats suitable for 11 threatened (1) or endangered (10) species were identified in the project area, including Running Buffalo Clover, 3 bat species and 7 mussel species. Given the ‘Design Build’ nature of construction, there may be additional environmental study conducted at some point during the project.

**Historic Structures**

Fifteen (15) properties recorded in the Kentucky Historic Inventory are located within this project’s Study Area (Table 2.1), mostly along Petersburg, Graves or Williams Roads. Two of these are listed in the National Register of Historic Places (NRHP): the Alli Corn House (Be-95) and the Watts House (Be-352). The Allie Corn House (Figure 2.7) is prominently sited at 2807 Graves Road and includes the large 1893 Queen Anne style farm house, three outbuildings adjacent to the house and a stock barn on the opposite side of Graves Road from the house. The Corn House is in excellent condition and has been well maintained for many years by the Graves family. The Boone County Historic Preservation Review Board recognized the owners and property with a bronze National Register plaque in 2011 for these ongoing efforts. The Watts House at 1829 Williams Road is a Federal style 5-bay hall-parlor house constructed of stone c. 1800. Although its early history has never been researched, the property has been in the Souther family since 1916 and is one of just a few stone houses of its type known to have been built in Boone County.
A cultural resources assessment of the Interchange project conducted for KYTC recommended that the Allie Corn NRHP boundary be expanded to include the Graves Tenant House (Be-871) located on the east side of Graves Road. The assessment also recommended NRHP edibility for the Lucretia Souther Gaines House (Be-96) at 2272 Williams Rd. The Kentucky Heritage Council (KHC) concurred with both recommendations and that design Alternative 2-A would have No...
Adverse Effect on either property. During the project design phase the historic significance of the Allie Corn House was one of the factors that led to a final design with the realigned Graves Road and new roundabout to the west.

The National Register eligibility of the c. 1878 Marietta Graves House (Be-108) at 2123 Graves Road was not evaluated by the KYTC-sponsored assessment. However, the house is considered one of the finest remaining Victorian era Stick style buildings in the county and certainly has potential for listing in the NRHP.

Archaeological Sites
Archaeological investigations sponsored by KYTC as part of the interchange planning process referred to four sites in the project footprint. Three (Sites 15Be472, 15Be472, and 15Be529) were previously recorded and Site 15Be720 was newly reported. None were expected to have NRHP eligibility and no further work was recommended.

Cemeteries
Two small family cemeteries are located within the project study area. The Watts Cemetery is located in the front of a 3.5-acre parcel at 3190 Petersburg Road. Grave marker dates of the 26 known burials range from 1813 to 1878. The well-kept cemetery sits next to a small pond and is visible from Petersburg Road. The Graves-Duncan Cemetery is located in the back yard of a residence on Sequoia Drive in the Treetops Subdivision and was preserved on site when the subdivision was created. Revolutionary War Captain John Graves is thought to be buried in the cemetery, which includes six other marked graves dating from 1836 to 1871. The cemetery was cleared and fenced as part of Eagle Scout project in 2017, which culminated in the Patriot Grave Marking ceremony for Captain Graves by the Daughters and Sons of the American Revolution.

In addition the two historic period family cemeteries, a prehistoric burial mound (Rheimer Mound, Site 15Be65) is located just outside the study area in the Liberty Crossing subdivision. First recorded in 1968, the site was later confirmed by archaeologists from the University of Kentucky as a burial mound, most likely from the Early Woodland period (c. 1000 BC to AD 200). The mound has been fenced and preserved within the subdivision under the Cemeteries Section of the Boone County Zoning Regulations. Quite a few such mounds have been recorded in Boone County. While these mounds are often isolated ceremonial sites found on ridges and hilltops, there can be associated features elsewhere nearby, including "twin" mounds. The mound's presence should be taken into consideration prior to development of any nearby property.
2.6 PREVIOUS PLANS AND STUDIES

Comprehensive Plans
The earliest mention of a Graves Road/I-275 interchange appears in the 1995 Boone County Comprehensive Plan. A “possible interchange” is referenced briefly in two places in the Hebron Area discussion of the Land Use Element, although no time frame is given. The 1996 Boone County Transportation Plan also references an I-275/Graves Road Interchange twice. Both instances are in “Future Highway System Capacity Expansion Projects Only” tables (Tables 2.3 and 4.5). The latter reference shows it as an Unfunded Project not expected to occur before 2020.

The Land Use Element of the 2000 Boone County Comprehensive Plan mentions the future need for an I-275 interchange at Graves Road in both Hebron and Idlewild area discussions. For the Hebron area, the plan noted that “the industrial/business park shown south of I-275 in the Bullittsville area is dependent upon a future interchange in the Graves Road area.” In the Idlewild Area, the plan further states that “the High Suburban Density residential development shown on the Future Land Use map along I-275 is dependent on a new interchange in the Graves Road area and must be accessed from the interchange and Industrial/Business Park development described in the Hebron Area.” Language in the 2005 Boone County Comprehensive Plan is similar and adds that a “future parallel road north of I-275 [and] possible interchange at Graves Road should preclude any need to directly connect the Idlewild Interchange with KY 8.”

Language about the 2010 Boone County Comprehensive Plan of the I-275/Graves Road interchange in the Hebron and Idlewild subareas is unchanged from 2005. Discussion in the North Hebron Area notes that a KY 8 connection to I-275 may be more appropriate to the east of the existing Idlewild Exit due to the future Graves Road interchange.

Boone County’s most recent comprehensive plan Our Boone County – Plan 2040 was adopted in June, 2019 and deals with the County as a whole in a more general sense than a specific area plan such as this Interchange Study. The plan specifically recommends a land use/zoning study for the Graves Road area. Discussion related to the I-275/Graves Road interchange is more specific than in preceding plans. The North Hebron area discussion notes that the interchange area should see expansion of existing industrial uses coming west from Park West International but that the west side of the new Graves Road alignment should be commercial. Additionally, property next to the interstate at Graves Road is appropriate for high-profile office uses, in part as a transition between residential to the west and industrial/business park to the east.
The Hebron area discussion in Plan 2040 recommends continued subdivision activity in the Bullittsville and Bullittsville Road areas with High Suburban Density Residential adjacent to the interchange, but that new residential must be accompanied by road improvements in the area. Business park development is specified from the new interchange east toward Litton Lane. The plan goes on to say that a collector road along the south side of I-275 should connect the interchange to the existing Litton Lane industrial and that the Industrial/Business Park shown on the future land use map is contingent on the interchange. Design control is recommended to ensure that this development is sensitive to nearby residential. It should also be accessed from the interchange rather than KY 20.

Transportation Plans
The Boone County Transportation Plan 2030 (November, 2005) discusses the interchange and Graves Road improvements separately among a list of 29 long-range highway improvement projects. The plan states that the new I-275/Graves Road interchange is warranted due to “increased residential and industrial development already...and need for improved mobility and accessibility to the interstate.” The project was considered a High Priority to be completed by 2015. Recommended improvements to Graves Road included widening from 2 to 4 lanes from KY 20 to KY 237 and realignment with Bullittsville Road. This was considered Medium Priority to be completed between 2015 - 2025.

The 2018 Boone County Transportation Plan lists the I-275/Graves Road interchange as a Tier 1 (Highest Priority) project (Figure 2.8) designed to “improve mobility and reduce congestion in the Hebron area” per the recommendations of the Interchange Justification Study.
CHAPTER 3. FUTURE CONDITIONS

3.1 POPULATION AND EMPLOYMENT GROWTH ASSUMPTIONS

Population in and around the Study Area is expected to grow as residential developments expand. Several “active” residential subdivisions continue to develop in the area with a current total of approved units at approximately 2,450. All but 500 of these units will be single family residences. The largest of these developments with lots yet to be built include Rivers Pointe Estates (488 single family (SF) lots plus 255 multi-family (MF) units), Traditions (515 SF lots), Northpointe (477 SF lots), Sawgrass (211 SF lots), and The Woodlands (31 SF lots plus 130 MF units). These developments are already approved. It is anticipated that additional acreages will develop in the years following the opening of the I-275/Graves Road Interchange as well as any improvements being made to North Bend Road (KY 237) and/or Petersburg Road (KY 20).

U.S. Census projections for the area foresee steady increases in population over the next 5 years as well as a rise in the median household income as additional affluent families move into the area. While the predominant professions of residents in the area are classified as “white collar,” the jobs in the immediate area currently do not support such a workforce. Most have to commute to their “professional” office jobs in adjoining counties/states. The logistics industry growth in and around the Cincinnati-Northern Kentucky International Airport (CVG) will continue as the economy shifts more towards on-line e-commerce and away from brick and mortar stores. As a result, the abundance of “blue-collar” jobs will remain in the region. However, in order to promote a more sustainable employment environment with current and future residents of the Hebron and north Hebron area, more office-related professional jobs must be made available to curb the impact that the commute has on the already congested roadways in and around the I-275 Interchanges at KY 237 as well as Graves Road.

3.2 FUTURE LAND USE ANALYSIS

The Future Land Use layer in the Our Boone County - Plan 2040 comprehensive plan indicates anticipated land uses over the next 20 years (Figure 3.1). These future uses could occur or develop prior to 2040 depending on changes to the area such as the availability of utilities, improvements to roads, and other factors. The general nature of the Future Land Use designations in the vicinity of the new interchange has not varied much since the 2000 Boone County Comprehensive Plan update when the possibility of a new interchange at Graves Road was discussed in the Land Use Element. However, the fact that the area was looked at in a
The most prevalent Future Land Use classification shown in the I-275/Graves Road Interchange study area is the 860 acres of Suburban Density Residential (SD) shown on both the north and south sides of the interstate. Approximately 484 acres of this SD Residential land is undeveloped. This classification reflects the typical subdivision development of single family homes up to 4 units per acre. The next largest Future Land Use in area is High Suburban Density Residential (HSD) at 406 acres, most of which (327 acres) remains undeveloped. This zone calls for up to 8 units per acre and is most typically seen in the form of town homes or condos. The majority of...
this HSD use is shown near the southern end of the new interchange as well as along the new Graves Road corridor north of I-275 to North Bend Road (KY 237). Rural Density Residential (RD) consists of larger lot homes, typically 1 acre lots or larger, and located in more rural areas of Boone County where roads and utilities are not as developed and available. There are 260 acres of RD shown on the Future Land Use Map in the study area, 145 of which is not yet developed. This use is primarily shown at the west end of the KY 20/Petersburg Road corridor as well as an area off Williams Road near Traditions Golf Course. There are 340 acres of Recreational (R) represented solely by the existing Traditions Golf Course.

Of the non-residential (or recreation) uses, there are 244 acres of Business Park (BP), 123 acres of Industrial (I), and 87 acres of Commercial (C) shown on the Future Land Use Map. The 244 acres of BP land, shown on the south side of I-275, is either undeveloped or currently being used as lower density residential and will likely redevelop in time. This use is mostly comprised of office, research, small warehousing, light industrial uses in a professional office park-like campus setting. This type of use is recommended for high visibility areas and can serve as a transition between residential developments and the more intense Industrial (I) uses such as large scale warehousing typical of the logistics industry. The 123 acres of Industrial (I) shown in the study area is mostly comprised of the already developed industrial uses on Worldwide Boulevard as well as a small (21 acre) “leftover” undeveloped section at the end of the newly created old Graves Road cul-de-sac. Lastly, 87 acres of Commercial (C) has been shown on the north side of the new Interchange along the new Graves Road alignment between the intersection with Worldwide and the interstate. These uses could include retail as well as corporate and professional office uses.

**3.3 UTILITIES ANALYSIS**

There are approximately 1,300 acres of undeveloped land in the I-275/Graves Road Interchange Study Area and a primary concern is whether the area can be adequately served by water and sanitary sewer once the I-275/Graves Road Interchange opens and land begins to be developed. To address this issue, staff met with representatives of both the Sanitation District No. 1 (SD1) and the Boone County Water District in February 2020 to gauge current and future service capacities and whether these agencies expect to be able to meet future service demands in the area. Fortunately, both agencies have relied heavily upon the Boone County Comprehensive Plan updates over the past 20 years to anticipate projected land uses in the area.
Sanitary Sewer

Within the I-275/Graves Road Interchange Study Area, both north and south of the interstate, the existing sanitary sewer system is adequately serving current needs and has room for growth depending on the connection point to the existing system and anticipated sanitary sewer usage of the new development. SD1 indicates that treatment capacity for the area north of I-275 will be more than adequate for many years to come. Existing needs presently only consume 40% of treatment capacity at the Dry Creek Plant. The question becomes, how much room for growth is there in areas where growth is predicted within the study area and, more specifically, what growth will be spurred by the development of the new interchange? Figure 3.2 shows sanitary sewer lines and possible tap locations that will allow for future development in the area. There are many options for future land use development in the project area to be served by sewage treatment facilities.

Figure 3.2 - Sanitary Sewer Lines
Based on the potential flows and diameter of the existing pipelines, undeveloped land within the project area, both north and south of I-275, can be adequately served in the future. As existing developments expand or new ones are built, the sanitary sewer system can be extended beyond the current pipeline network. There are no obvious restrictions or impediments to flow within the project area and treatment of sewage from the I-275/Graves Road Interchange area. Development in areas north of I-275 will need to be pumped generally to the north due to topography. The possible exception to this is that a pipeline could be installed under I-275 that would enable the area to flow by gravity to the Bullittsville Pump Station near the intersection of KY 20 and Bullittsville Road. The area south of I-275 generally flows to the existing Bullittsville Pump Station by gravity without pumping. Development west of the “high spot” on KY 20 will require pumping in order to get material to the Bullittsville Pump Station. Potential investment west along KY 20 towards the I-275/Petersburg Exit may result in the availability of sewerage along that road pending a cost-benefit analysis by SD1 but is unrelated to development in the I-275/Graves Road Interchange Study area.

Water
The Boone County Water District (BCWD) is the water service provider to the I-275/Graves Road Interchange Study area and, similar to SD1, also relied on the Boone County Comprehensive Plan and its Future Land Use map designations over the past couple of decades to prepare for future system needs. Currently, there is adequate capacity to meet future water demand in the project Study Area, assuming the 1,300 acres of undeveloped land develop in a pattern similar to that shown on the 2040 Future Land Use Map. **Figure 3.3** shows the existing water line coverage in the Study Area along with existing and proposed water tanks/towers.

Currently, water is distributed throughout the area via a storage tower located on old Graves Road near Worldwide Boulevard. In anticipation of the future growth expected in the area, the completion of a new ground storage tank is planned by the BCWD within the next 2-3 years on Williams Road. This new underground tank will provide an additional 2-3 million gallons of water service capacity for future development. In addition, as the new Graves Road is built, new water mains will be installed in the new right-of-way.
3.4 TRAFFIC ANALYSIS

The Planning Commission retained TEC Engineering to analyze the potential impact of the new I-275/Graves Road Interchange on the surrounding roadway network and recommend future improvements. TEC’s review focused on the project’s Area of Influence as established in the KYTC Interchange Justification Study with some adjustments from Planning Commission staff. The traffic study Area of Influence is based on traffic analysis standards and consultation between
KYTC and FHWA. It largely overlaps with the land use study project area, with the exception of extensions northwest on Williams road and southeast along Bullittsville Road toward Burlington.

TEC identified existing roads within the Area of Influence most likely to experience increased traffic volumes following completion of the new interchange and subsequent development of currently undeveloped land. The identified roads include 6 Residential streets, 3 Collectors and 1 Arterial:

- Residential: Treetop Lane, Thornwilde Drive, Southcross Drive, Sequoia Drive, Merrell Road, Watts Road
- Collector: Williams Road, Worldwide Boulevard, Bullittsville Road
- Arterial: Petersburg Road (KY 20)

TEC generated future traffic counts for undeveloped land in the Area of Influence based on the land uses on the Planning Commission's Plan 2040 Future Land Use Map. The analysis assumes that traffic will be generated at varying rates and times of day by land use, whether Business Park, Commercial or Residential, which is further broken down into Rural Density (2 homes/acre), Suburban Density (3 homes/acre) and High Suburban Density (8 homes/acre). The analysis determined that future Business Park land will generate the most traffic, followed by Commercial land uses and then Residential. The traffic analysis used the Institute of Traffic Engineers Trip Generation Manual (10th Edition) to generate total hourly trip counts for peak AM and PM times.

Further analysis of the raw trip numbers provided by TEC can be used to calculate other data relevant to future land use planning. Table 3.1 aggregates trip data by land use type and totals for future (Year 2040) land uses in the Area of Influence, both north and south of I-275. Assuming that land develops according to the Year 2040 Future Land Use Map, the 809 acres north of I-275 will generate 2606 and 4189 trips/hour during the AM and PM peaks. The 1214 acres south of the interstate will generate 6776 and 7435 trips/hour during the peaks. Residential land uses (Rural, Suburban and High Suburban Density in Areas A-K and L-AA on TEC’s map) generate between 1.5 and 3.5 trips/hour depending on density, significantly below the rates of either Commercial or Business Park. Residential uses are combined in Table 3.1. The 21.0 AM trips/hour generated by Commercial land uses during the AM peak doubles to 42.9 PM trips/hour in the afternoon. By comparison, Business Park generates consistent AM and PM rates of around 19.0 trips/hour. Although the evening Commercial trip peak is the highest of any land use, the nearly six times more acreage of future Business Park (243ac v. 42ac) in the Area of Influence make BP the greater traffic generator of the two.
Table 3.1 - AM & PM Trip Counts By Future Land Use

<table>
<thead>
<tr>
<th>AREA OF INFLUENCE NORTH OF I-275</th>
<th>FUTURE LAND USE</th>
<th>ACRES</th>
<th>AM</th>
<th>PM</th>
<th>TRIPS PER ACRE (AM vs PM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential (Areas I-AA)*</td>
<td>767</td>
<td>1724</td>
<td>2389</td>
<td></td>
<td>2.2 – 3.1</td>
</tr>
<tr>
<td>Commercial (Area AG)</td>
<td>42</td>
<td>882</td>
<td>1800</td>
<td></td>
<td>21.0 – 42.9</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>809</strong></td>
<td><strong>2606</strong></td>
<td><strong>4189</strong></td>
<td></td>
<td><strong>3.2 – 5.2</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA OF INFLUENCE SOUTH OF I-275</th>
<th>FUTURE LAND USE</th>
<th>ACRES</th>
<th>AM</th>
<th>PM</th>
<th>TRIPS PER ACRE (AM vs PM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential (Areas A-K)*</td>
<td>971</td>
<td>2166</td>
<td>2865</td>
<td></td>
<td>2.2 – 2.9</td>
</tr>
<tr>
<td>Business Park (Area AF)</td>
<td>243</td>
<td>4610</td>
<td>4570</td>
<td></td>
<td>19.0 – 18.9</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>1214</strong></td>
<td><strong>6776</strong></td>
<td><strong>7435</strong></td>
<td></td>
<td><strong>5.6 – 6.1</strong></td>
</tr>
</tbody>
</table>

* Combined RD, SD, and HSD Residential Trips

Analysis of the existing transportation network, coupled with trip data for future land uses, led TEC to make the below recommendations. The impacts of the high peak rates for Commercial and Business Park are reflected in these recommendations:

- **Treetop Lane** - careful consideration of this connection to Williams Road opposite Worldwide Blvd as such a connection could reroute significant traffic into the adjacent subdivisions.
- **Thornwilde Drive** and **Southcross Drive** - Intersection improvements including lighting, westbound right turn lanes at Williams Road, and consideration for future signalization or roundabouts as traffic volume grows.
- **Sequoia Drive** - Signalized new intersection at Graves Road needs to be carefully designed and coordinated with other intersections in the immediate area.
- **Merrell Road** - Improve Williams Road intersection and upgrade Merrell to a modern 2-lane roadway with curb & gutter.
- **Williams Road** - Upgrade to 4-lane roadway; improve intersections at Thornwilde, Southcross and Merrell; create “Stop Controlled” T intersection at Worldwide Blvd to allow continuous flow to/from Williams.
- **Worldwide Blvd** - Several recommendations to accommodate increased truck traffic including turn lanes to/from New Graves road; relocated, signalized and timed Old Graves intersection to allow for truck stacking; consideration for issues such as slower speeds, acceleration, turning radii and pavement design.
- **Bullittsville Road** - Improved Petersburg Road intersection with turn lanes and signals or a roundabout.
• **Petersburg Road** - Improve to 4 or 6-lanes between Graves Road and proposed new Development Roads to the west; new intersections should be designed to with truck traffic in mind.
• **Watts Road** - Realign southern end to cross New Graves Road to proposed Litton Lane extension with signalized or roundabout intersection.
• **New Development Roads** - Construct two new 4-lane curb & gutter roads off of Petersburg Road to access undeveloped Business Park land on the south side of I-275.
• **Litton Lane** - Extend west as a 4-lane road and connect with Graves Road opposite realigned Watts Road at new signalized or roundabout intersection.
• **General Site Development Recommendations:**
  o Careful consideration of access to future Business Park on the south side of I-275 west of Graves to spread out traffic volumes.
  o New connections to residential streets should be evaluated to minimize traffic diverting through subdivisions.
  o With the northwest area of influence expected to develop as residential, subdivision plans should be carefully evaluated relative to intersection spacing, capacity and sight distance for both existing and future traffic.
Qualifications


TEC has conducted a wide variety of Transportation Planning Studies throughout Ohio and Kentucky. The studies range in size from a single intersection to large corridors.

"I certify that this Transportation Planning Study has been prepared by me or under my immediate supervision and that I have the experience and pre-qualifications in the appropriate fields of traffic and transportation engineering to prepare such a study."

Edward R. Williams, PE, PTOE, RSP
Kentucky Registration #24973
TEC Engineering, Inc.
Transportation Planning Study
Graves Road Interchange
April 2020 – Final Version 1.0

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Executive Summary

i. Purpose
TEC was retained by the Boone County Planning Commission to review the potential impact of the Graves Road Interchange on the surrounding roadway network and provide recommendations for potential roadway improvements. The new interchange will greatly increase access to developable land as well as increase access to I-275 for several existing subdivisions. Based on a review of the existing road network, the current interchanges, and the proposed future land uses, the influence area of this interchange was determined. This Influence area was reviewed to determine existing roadway and intersection geometrics, existing traffic, and proposed future land uses for currently undeveloped land.

ii. Background
They Kentucky Transportation Cabinet (KYTC) recently awarded the design build contract for the construction of a new interchange at I-275 and Graves Road. This interchange will be constructed as a double diverging diamond (DDI), also known as a double crossover diamond (DCD). The construction of the interchange will significantly increase access to the existing properties in the vicinity of Graves Road, Williams Road, and Petersburg Road. An interchange justification study was performed by KYTC for the Federal Highway Association (FHWA) to allow interchange to be constructed. This study analyzed the impact of the interchange on I-275, determined the type of interchange to be constructed (DDI) and looked at the impacts to Graves Road in the immediate vicinity of the interchange. However, this study was not tasked with analyzing the road network outside the immediate vicinity, nor was it tasked with considering the development potential sparked by the increased access to and from the interstate.

This study was commissioned by the planning commission to attempt to quantify the impacts of future development and understand the future road network needs. Understanding these impacts and needs will allow the region to better plan improvements as development occurs to help mitigate traffic congestion and safety issues before they occur.

iii. Analysis
TEC Engineering started with a review of the existing road network to determine the likely area of influence the new interchange will have. As part of this review, the current topography, surface roads, interchanges, and the proposed future land uses were all considered. Upon collecting this information, the influence area of this interchange was determined. Once identified, the influence area was examined to determine existing roadway and intersection geometrics, existing traffic, and proposed future land uses for currently undeveloped land. These metrics provided the background, “existing” condition for the study area.

TEC extracted approximate sizes of currently undeveloped parcels for the land uses identified in the Boone County Planning Commission 2040 Land Use Plan by overlaying the previously developed influence area boundary. Using the preliminary interchange plan provided by the planning commission, the existing conditions data and engineering judgement, TEC determined the likely routes to and from each land use and the new interchange. The Institute of Transportation Engineers (ITE) Trip Generation Manual, Vol. 10
was utilized to calculate the anticipated number of peak hour trips from each of the proposed land uses. The total peak hour trips were separated into arriving and departing trips based on the ITE manual percentages and distributed throughout the existing road network.

Once anticipated future traffic volumes were distributed, the existing roadway and intersection geometrics were examined to determine broad recommendations for improvements. It should be noted that these improvements are based on what is anticipated to be needed once all the land which is currently deemed “developable” is built out. These recommendations should be used as guide for the region to consider as it makes its long-range plans and as new development proceeds. This study does not negate the requirement of individual traffic impact studies for each new development. Rather, it provides the region a document to assist with aligning individual development improvements with the broader regional surface roadway network.
1. Introduction

TEC was retained by the Boone County Planning Commission to review the potential impact of the Graves Road Interchange on the surrounding roadway network and provide recommendations for potential roadway improvements. The new interchange will greatly increase access to developable land as well as increase access to I-275 for several existing subdivisions. Based on a review of the existing road network, the current interchanges, and the proposed future land uses, the influence area of this interchange was determined to be as outlined in red in the figure below. This influence area (Figure 1) is defined as the land likely to be serviced and most impacted by the new interchange.
Figure 1: Graves Road Interchange Influence Area
2. Existing Conditions

Within the above influence area, TEC has identified existing roads which are likely to be affected by increased traffic volumes due to the new interchange. In general, roads affected will be those classified as arterials or collectors. Most of the residential streets are to and from individual subdivisions. These residential streets will likely have some re-routing of subdivision traffic but will not be majorly affected by the regional draw of the interchange. We have identified the following existing roads as those directly impacted by the new interchange (these are organized from North to South):

- Treetop Lane/Boxwood Way**
- Thornwilde Drive*
- Southcross Drive*
- Sequoia Drive*
- Merrell Road
- Williams Road
- Worldwide Boulevard
- Bullittsville Road
- Petersburg Road
- Watts Road
- KY237 (North Bend Road)***

*A residential street in a major subdivision which could experience a great shift in traffic flows. It is not anticipated to see a large increase in cut through traffic to/from the interstate.

**Treetop Lane is a residential street in a major subdivision which could experience a great shift in traffic flows if and/or when it is connected to Graves Road. It is possible that 30-50% of traffic exiting this subdivision could re-route to Treetop Lane due to its proximity to the new interchange once it is connected. It could also see a minor amount of cut through traffic to/from the interstate.

*** KY237 is likely to have noticeable impacts due to the new interchange. However, it is anticipated that these impacts will be a reduction in traffic volume (potentially as much as 10%-25%) traveling on KY237 and therefore this corridor was not considered for needed roadway improvements. Signal timing and coordination may need to be adjusted to better handle reduced traffic volumes, but roadway improvements are not anticipated.

The existing characteristics of these roads were collected in relation to existing and future capacities. The table below provides those roadway characteristics.
### Table 1: Existing Road Characteristics

<table>
<thead>
<tr>
<th>Road Names</th>
<th>Designation</th>
<th># Lanes</th>
<th>Lane Width</th>
<th>Cross Section</th>
<th>Speed Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treetop Lane</td>
<td>Residential</td>
<td>2</td>
<td>12</td>
<td>Curb / Gutter</td>
<td>25 mph</td>
</tr>
<tr>
<td>Thornwilde Drive</td>
<td>Residential</td>
<td>2</td>
<td>14</td>
<td>Curb / Gutter</td>
<td>25 mph</td>
</tr>
<tr>
<td>Southcross Drive</td>
<td>Residential</td>
<td>2</td>
<td>11</td>
<td>Curb / Gutter</td>
<td>25 mph</td>
</tr>
<tr>
<td>Sequoia Drive</td>
<td>Residential</td>
<td>2</td>
<td>14 ft</td>
<td>Curb / Gutter</td>
<td>20 mph</td>
</tr>
<tr>
<td>Merrell Road</td>
<td>Residential</td>
<td>1.5</td>
<td>12</td>
<td>Ditch</td>
<td>25 mph</td>
</tr>
<tr>
<td>Williams Road</td>
<td>Collector</td>
<td>2</td>
<td>11 ft</td>
<td>Ditch</td>
<td>35 mph</td>
</tr>
<tr>
<td>Worldwide Boulevard</td>
<td>Collector</td>
<td>3</td>
<td>13 ft</td>
<td>Curb / Gutter</td>
<td>25 mph</td>
</tr>
<tr>
<td>Bullittsville Road</td>
<td>Collector</td>
<td>2</td>
<td>10 ft</td>
<td>Ditch</td>
<td>35 mph</td>
</tr>
<tr>
<td>Petersburg Road</td>
<td>Arterial</td>
<td>2</td>
<td>10 ft</td>
<td>Ditch</td>
<td>35 mph</td>
</tr>
<tr>
<td>Watts Road</td>
<td>Residential</td>
<td>1.5</td>
<td>9</td>
<td>Ditch</td>
<td>25 mph</td>
</tr>
</tbody>
</table>

**Interchange Justification Study – Graves Road (KYTC)**

TEC reviewed the Interchange Justification Study performed by KYTC for the new interchange. This study took a broad look at the anticipated impact to existing traffic by the new interchange. The study area for the Graves Road Interchange Justification Study, as defined in the original study, was:

*The project study area is along I-275 in northern Boone County and encompasses Graves Road, KY 20 and KY 237, among others. The study area, also referred to as the area of influence, was defined based on safety and operational concerns. At a minimum, the study area should include the first interchange on either side of the proposed new access and local roadways extending to the first major intersection and/or signalized intersection. Based on consultation with FHWA and KYTC, the study area was extended to include Graves Road between KY 20 and KY 237, KY 20 between Graves Road and KY 237 and KY 237 between KY 20 and Graves Road. The study area is illustrated on Figure 2.*
While the new interchange will redistribute a significant portion of the existing traffic on KY 237, it will also provide more direct access from the freeway to currently undeveloped land. TEC utilized the 2040 future land use plan provided by the Boone County Planning Commission, coupled with the Institute of Traffic Engineers’ (ITE) trip generation manual (10th Edition) to determine the anticipated traffic volume generated by the development of currently vacant land. Engineering judgement and common industry practice were utilized to estimate the approximate building sizes and uses to calculate the anticipated increase in traffic due to new development.

3. Trip Generation

The new Graves Road interchange will provide access to a vast amount of currently un-developed or underdeveloped land. As this land develops it will be extremely important to update the existing and proposed road network to accommodate the new trips. The assumptions listed below were used when estimating the possible new traffic volumes based on the 2040 Future Land Use plan. These assumptions were based on engineering judgement as well as a survey of existing land uses along I-275 in the near vicinity. New trips generated by each potential land use are provided in Appendix A.
\textbf{Assumptions}

1) BP (Business Park)
   a. 2 story buildings,
   b. Building footprint = 20\% of available land in LU
   c. 75\% General Office, 25\% Medical Office
   d. General Distribution: 1/3 Graves east of new interchange, 1/3 Watts, 1/3 Sutton

2) RD/SD/HSD (Rural Density/Suburban Density/High Suburban Density)
   a. All residential is built out at maximum density by zoning code
      i. RD = 2 homes per acre
      ii. SD = 3 homes per acre
      iii. HSD = 8 homes per acre

3) C (Commercial)
   a. Building footprint = 20\% of available land in LU
   b. Shopping Center* land use

*A shopping center land use was utilized for the commercial area based on the Planning Commission’s envision for this area to be developed as a neighborhood friendly, planned development rather than as big box stores. The shopping center land use is defined by ITE as “an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center’s composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands.” Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels. These buildings are typically drive-in banks, retail stores, restaurants or small offices. TEC considered other land uses in preliminary analysis. However, the Boone County Planning Commission stated they intend to have this area develop as “smaller, neighborhood type” shops and uses. The “Shopping Center” land use best fits this plan.

The influence area outlined in Figure 1 was selected based on the assumption that traffic traveling to and from it would likely use new Graves Road interchange. The trips generated for the land uses within the influence area were therefore distributed along the local road network under the assumption that the majority would be traveling to and from the new interchange.

Traffic was generated based upon the 2040 Land Use plan, the assumptions listed above and the ITE Trip Generation Manual. TEC then used the ITE distribution plus the Area of Influence listed above to develop the trip distribution throughout the network. Once this was developed, it allowed TEC to determine the amount of traffic on each roadway within the project. As mentioned previously, Appendix A contains the generated trips as well as a map showing the breakdown of developable parcels.
4. Recommendations

The largest generators on the provided 2040 Land Use plan are the business park areas followed by the commercial area. The available business park area is anticipated to have substantial impact on the local road network, and consideration may be given to limiting the size and/or density of development allowed in these areas. Assuming the existing local road backbone is not drastically altered, the following roadway improvements (Figure 3) are recommended to be planned and implemented as development occurs.
Figure 3: Recommendations
1) Treetop Lane:
   a. Recommend caution if connection to Williams Road is planned. While more accesses to
      this large residential development is good, this connection will likely re-route a significant
      portion of neighborhood traffic onto Treetop Lane. Consideration should be given to the
      viability of completing this connection, or if completed, how to buffer or protect the
      residential feel of this portion of the neighborhood.

2) Thornwilde Drive:
   a. Improve the intersection at Williams Road
      i. Westbound right turn lane on Williams Road
      ii. Intersection lighting
      iii. Consideration for a traffic signal or roundabout as traffic volume grows on
           Williams

3) Southcross Drive:
   a. Improve the intersection at Williams Road
      i. Westbound right turn lane on Williams Road
      ii. Intersection lighting
      iii. Consideration for a traffic signal or roundabout as traffic volume grows on
           Williams Road

4) Sequoia Drive:
   a. Re-routed traffic should be considered at new intersection with Graves Road
      i. The new interchange is likely to pull existing subdivision traffic from Treetop Lane & KY 237 to Sequoia Drive & Old Graves Road
         1. Consider signalized intersection at Old Graves & Re-located Graves Road
            (it should be noted that the intersection is planned as an unsignalized intersection stop controlled on Sequoia

5) Merrell Road:
   a. Improve the existing cross section to a modern 2-3 lane section with curb and gutter
   b. Improve intersection with Williams Road
      i. Consider redesign as a true 3-way intersection with stop control on Merrell, or
         all-way stop control, and eliminate existing “y” design.
6) Williams Road:
   a. Improve existing cross section to a 4-5 lane cross section
      i. Improvements should be considered as development occurs. At a minimum it is recommended to improve Williams to a 4-5 lane section between Graves and Thornwilde Drive. Beyond Thornwilde could be considered for a 3-lane section with a two way left turn lane.
   b. Improve intersections with Merrell Road, Thornwilde Drive, Southcross Drive
   c. Construct proposed intersection with “Worldwide Blvd” extension as a stop controlled “T” intersection. Provide stop control for Treetop SB to provide continuous flow to and from Williams
The approved Traditions residential development are anticipated to impact the Merrell & Williams Road intersection as well as the Current course entrance. This development was included in the trip generation for this study.
7) Worldwide Boulevard:
Old Graves Road is likely to serve as a rearage road providing primary access to the proposed commercial land use therefore generating a fair amount of traffic. The intersection of Old Graves and Worldwide Boulevard is near the signalized intersection of New Graves and Worldwide Boulevard and therefore will likely need a creative solution. High truck volume must be considered as trucks have significantly slower acceleration from stop, require larger turning radii and thicker pavement design should be considered. In addition to the following recommendations, turn lanes to and from New Graves Road will likely be required. (It should be noted that the intersection of New Graves and Worldwide is designed as a signalized intersection in the interchange project. The intersection of Worldwide Blvd and Old Graves is designed as an unsignalized intersection with stop control on Old Graves)

The following options are included for consideration:

a. Option 1 - Consider the construction of a median on Worldwide Boulevard between New Graves and a proposed roundabout at the commercial driveways east of Old Graves. Construct Old Graves Road as a right-in/right-out with the roundabout serving as a turnaround for traffic headed to New Graves.

b. Option 2 - Consider construction of Old Graves & Worldwide Boulevard as a signalized intersection with hard wire communication to New Graves & Worldwide. Coordination between these signals will be a necessity.

c. Option 3 - Consider realigning Old Graves Road to south side of existing Water Tower to increase the distance between New Graves and Old Graves intersections with Worldwide.
8) Bullittsville Road:
   a. Improve intersection with Petersburg Road
      i. Consider turn lanes with signal or roundabout when re-aligning Graves Road to Bullittsville Road

9) Petersburg Road:
   a. Improve existing 2-lane cross section to a full 6-7 lane** cross section with curb and gutter between the Re-aligned Graves Road and the new eastern development access roadway
      i. Improve Petersburg Road to a full 4-5 lane section between development access roadways
   b. All existing intersections should be evaluated due to increasing mainline volumes – will most likely include turn lanes and larger turning radii for developmental truck traffic
   c. Intersections between and including the western access roadway and Bullittsville Road should be studied for improvements with turn lanes and traffic signals or modern roundabouts as development occurs.
   d. Improvements east of New Graves Road should be accommodated by the Petersburg Road improvement project currently in the OKI long range plan.

   **Majority of this major improvement is due to trips generated by business park land use along the southern edge of I-275. Extensive effort should be placed on preliminary development plans and planning level study to maximize this land use while minimizing/managing impact to surrounding road network.

10) Watts Road:
    Watts Road currently intersects Petersburg Road in close vicinity to the proposed re-aligned Graves Road (at Bullittsville Road) intersection. With increased traffic volume from the interchange and anticipated development, this intersection will likely pose a safety hazard if it is not realigned. (It should be noted, this intersection will not be re-aligned with the current interchange project)
    a. Consider re-aligning across from old Graves Road/Litton Lane Extension
    b. Provide traffic signal with turn lanes or roundabout at this intersection

11) New Development Roads (to be provided with development):
    a. Provide a modern 4-5 lane section with curb and gutter. May consider having road build in phases with development phases.
    b. Consider traffic signal warrants for the intersection with Petersburg Road

12) Litton Lane (to be provided with development):
    Intersecting Litton Lane with New Graves Road is recommended since an intersection at Litton and Petersburg Road would be very close to the intersection of New Graves and Petersburg Road. Additionally, most of the traffic from Litton Lane is anticipated to be traveling to and from I-275 and therefore intersecting with New Graves instead of Petersburg provides more efficient access.
Recommend this intersection be located halfway between Petersburg and the new ramp terminal on the south side of I-275. Based upon discussions with the County, Litton Lane is expected to extend to the west and connect to/become Old Graves Road.

a. Provide a modern 4-5 lane section with curb and gutter
b. Consider signal with turn lanes or roundabout at intersection with New Graves Road.

Table 2 provides a summary of existing and recommended roadway improvements. It should be noted that recommended intersection improvements are not listed in this table.

<table>
<thead>
<tr>
<th>Table 2: Roadway Recommendation Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Treetop Lane</td>
</tr>
<tr>
<td>Thornwilde Drive</td>
</tr>
<tr>
<td>Southcross Drive</td>
</tr>
<tr>
<td>Sequoia Drive</td>
</tr>
<tr>
<td>Merrell Road</td>
</tr>
<tr>
<td><strong>Williams Road</strong></td>
</tr>
<tr>
<td>i) Graves Road to Thornwilde Drive</td>
</tr>
<tr>
<td>ii) Thornwilde Drive to Merrell Road</td>
</tr>
<tr>
<td>Worldwide Boulevard</td>
</tr>
<tr>
<td>Bullittsville Road</td>
</tr>
<tr>
<td><strong>Petersburg Road</strong></td>
</tr>
<tr>
<td>i) New Graves Road to E. Development Drive</td>
</tr>
<tr>
<td>ii) E. Development Drive to W. Development Drive</td>
</tr>
<tr>
<td>iii) E. of New Graves Road</td>
</tr>
<tr>
<td>Watts Road</td>
</tr>
</tbody>
</table>
General Site Development Recommendations

1) Care should be taken to ensure the Business Park south of I-275 and west of New Graves is developed to encourage drivers to equally use the proposed new access roadways. Drivers natural tendency is to enter and exit a facility at the first access point they can. Trip distributions and recommendations provided in this study assume drivers are equally distributed between the two proposed accesses. *If efficient cross access is provided for the entire proposed business park, it is likely that most vehicles would attempt to use the eastern access rather than split equally.*

2) Care should be taken when considering future connections to residential streets, particularly those in and around the Treetop and Thornwilde subdivisions. *Connection to existing residential streets would likely cause diverted traffic within the subdivision, causing residential streets to act more like collector roads.*

3) Development in the NW of the influence area is anticipated to be residential. Approved Subdivision plans should consider intersections with Merrell/Williams. Intersection spacing, capacity and sight distance must be considered both for the roadway conditions at the time of construction as well as anticipated future improvements and developments.
Appendix A
<table>
<thead>
<tr>
<th>Area ID</th>
<th>Area Type</th>
<th>Acres</th>
<th># of Houses</th>
<th>AM Total</th>
<th>Enter</th>
<th>Exit</th>
<th>PM Total</th>
<th>Enter</th>
<th>Exit</th>
<th>AM</th>
<th>PM</th>
<th>Roads Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG</td>
<td>C</td>
<td>42</td>
<td>182920</td>
<td>365900</td>
<td>365904</td>
<td>365904</td>
<td>365900</td>
<td>365904</td>
<td>365904</td>
<td></td>
<td></td>
<td>Petersburg/Graves</td>
</tr>
<tr>
<td>B</td>
<td>SD</td>
<td>498.5</td>
<td>1495</td>
<td>1106</td>
<td>254</td>
<td>852</td>
<td>1480</td>
<td>932</td>
<td>548</td>
<td></td>
<td></td>
<td>Bullittsville/Petersburg/Graves</td>
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### Roads Impacted
- New Access
- Petersburg
- Litton/Graves
- Williams
- Worldwide