EXISTING CONDITIONS

Physical Corridor

The physical corridor gives consideration to the existing “on the ground” elements of the highway within its right-of-way. This includes the highway’s typical section, the horizontal and vertical alignment, the condition of pavement and bridges, as well as mobility elements of transit, bicycle and pedestrian facilities, and access management on roadways that cross I-235.

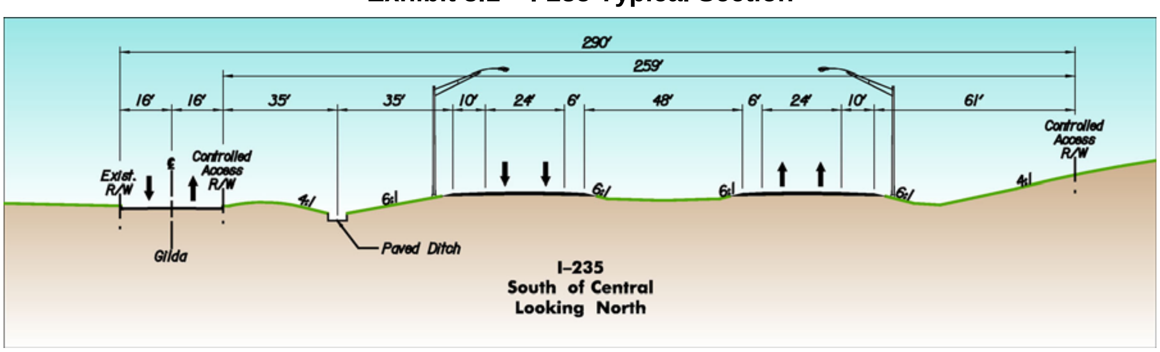
Interstate-235 is sixteen miles long beginning on the south side of Wichita at a junction with Interstate-135 and ending at Interstate-135 on the north side of Wichita near K-254. This study area specifically includes the US-54/400 (Kellogg Ave.) interchange (EXIT 7) and the Central Avenue interchange (EXIT 8) as well as the section of I-235 between the interchanges. Aerial based strip maps of I-235, US-54/400 (Kellogg Ave.), and Central Avenue within the study area can be found in the Appendix.

Typical Sections

A typical section includes the total right-of-way width, median width, number and width of travel lanes, as well as any utility corridors including continuous lighting.

Interstate-235 – This four-lane highway has a 60 foot wide grass median (including 6 foot paved shoulders) with 12 foot wide travel lanes. The right-of-way width varies but is typically about 200 feet. In some locations, access roads are included within the right-of-way and the right-of-way width increases to approximately 250 feet. In those locations an additional line of access control is provided between the highway and access road which often reduces the effective highway width down to the typical 200 feet. Throughout the entire study area continuous street lighting is provided, with poles at the outside edge of the shoulder. From south of US-54/400 (Kellogg Ave.) to north of Maple Street the Westar transmission line is located in close proximity parallel to the interstate and within KDOT right-of-way. The transmission line also includes a tower within the area of the I-235 interchange with US-54/400 (Kellogg Ave.), near the loop ramp in the southwest quadrant. Near Towne West Mall, I-235 right-of-way is adjacent to a gas easement for a short distance. Also in that same area, but not abutting the highway right-of-way are water, storm sewer, and other miscellaneous utility easements. See Exhibit 3.1 for the Interstate-235 typical section. In the southeast quadrant of the crossing of I-235 over Maple Street, a triangular shaped parcel (approximately 575 ft by 100 ft) is shown dedicated as a contingency road on County Assessor maps. This suggests that previous design concepts may have developed a potential northbound off-ramp and may be fueling the request to investigate a partial interchange at Maple Street. However, it has been determined through a previous study that an interchange at Maple is not feasible because of the inadequate spacing of ramps.

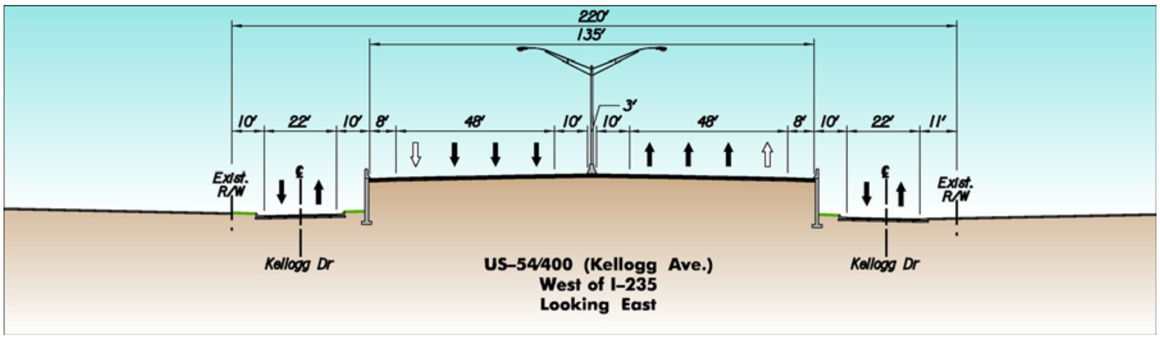
Exhibit 3.1 – I-235 Typical Section

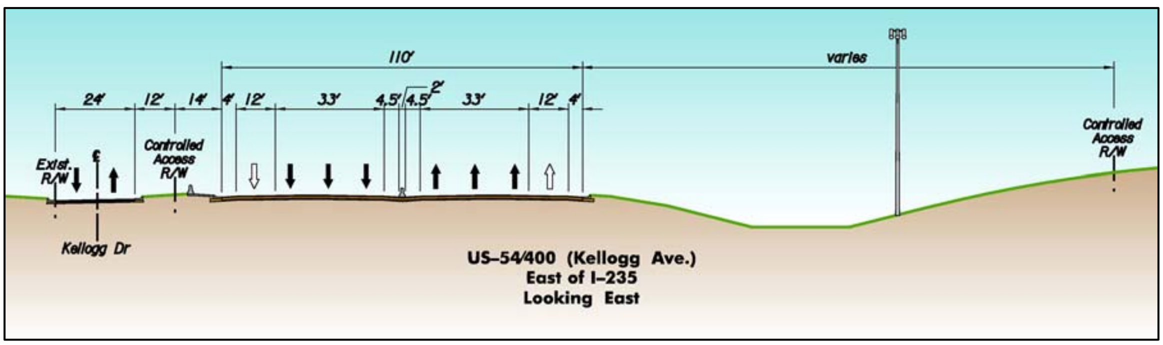


US-54/400 (Kellogg Ave.) – This six-lane highway has a variable median width, ranging from 11 feet to 23 feet wide. The median is raised and paved. The width of the travel lanes varies from 11 to 12 feet. The right-of-way width varies but is typically about 300 feet. Often a parallel access road (referred to as Kellogg Drive) is provided. In some locations the access road carries traffic in one direction, while in other locations the travel is two-way. Two typical sections for US-54/400 (Kellogg Ave.) are provided in

Exhibit 3.2, one west of Hoover Road and one east of I-235. Since the section of US-54/400 (Kellogg Ave.) west of the Big Ditch was recently reconstructed (in 1996), it is proposed to tie into the existing typical section where practical. This point is likely to occur at or near the bridge crossing of Hoover Road. To the east, in an effort to minimize cumulative effects, the location of the on- and off-ramps for West Street is proposed as the tie in point. As concepts are developed, the location of the West Street on- and off-ramps may actually shift from their current location.

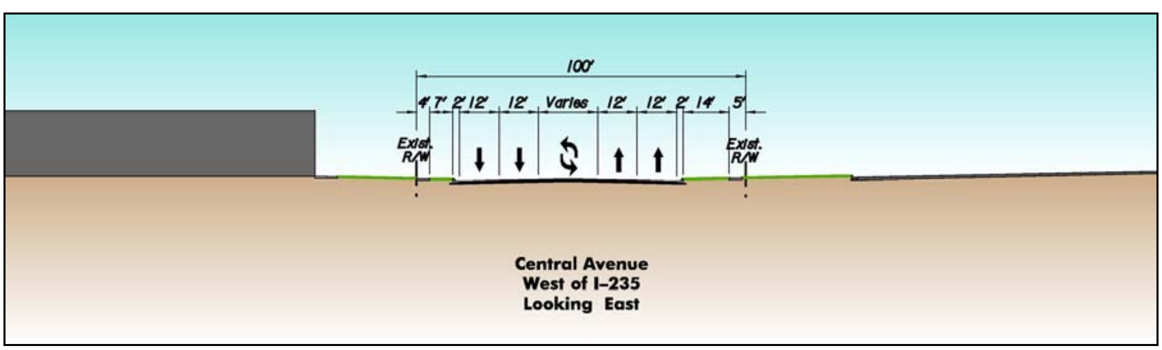
Exhibit 3.2 – US-54/400 (Kellogg Ave.) Typical Sections





Central Avenue – This five-lane arterial street has two 12-foot lanes in each direction as well as a center turn lane of variable width ranging from 20 feet just east of the bridge over the Wichita Valley Center Floodway to 12 feet just west of the intersection with Gilda Avenue. The right-of-way width varies but is typically approximately100 feet. See Exhibit 3.3 for a Central Avenue typical section.

Exhibit 3.3 – Central Avenue Typical Section



Maple Street – Maple Street varies from 5-lanes on both sides of I-235 to 4-lanes under the bridge. The right-of-way width varies but narrows to 80 feet as Maple Street crosses I-235.

Physical Parameters

The physical parameters assessment focuses upon the highway's horizontal and vertical curvature design elements, specifically along I-235 and US-54/400 (Kellogg Ave.) and the interchange between the two highways. In order to adequately assess the horizontal and vertical conditions of I-235 and US-54/400 (Kellogg Ave.) areas beyond the specified study area were included. This includes I-235 from the southern interchange with K-42 north to an interchange with Zoo Boulevard and US-54/400 (Kellogg Ave.) from Dugan Road east through the interchange with I-235 to West Street. In future tasks as various concepts are developed, additional review and development of horizontal and vertical elements for adjacent or crossing roads (such as Central Avenue) may be included. When I-235 was designed in the late 1950's (construction was completed for the section under study in 1961) the design speed used was 60 mph, which typically would be posted 5 mph less at 55 mph. The current posted speed limit is 65 mph on I-235 and 60 mph on US-54/400 (Kellogg Ave.). Because of the existing urban conditions of the corridor, it would be inappropriate to assess the highway for the more desirable 70 mph design speed. Consequently, this section assesses the highways for the posted 65 mph/60 mph speeds.

Exhibits 3.4 and 3.5 graphically represent the existing horizontal and vertical conditions of I-235 (Exhibit 3.4) and the I-235/US-54/400 (Kellogg Ave.) ramps (Exhibit 3.5). The vertical conditions are found on the left side of the graph, and the horizontal conditions on the right. The graphs are color coded green, yellow, and red to represent respectively meeting, being within range of, or not meeting the criteria outlined above. Curve design speeds are illustrated using bars whose width represents the actual length of curve. The vertical grades are represented based on a scale across the bottom with a line and noted grade. The horizontal and vertical conditions are explained in more detail in the following sections.

Horizontal Alignment

The existing alignment of I-235 between K-42 and Zoo Boulevard includes five curves, three of which include spiral transitions. Three curves between US-54/400 (Kellogg Ave.) and Central Avenue have design speeds, based on today's design policy (2004 AASHTO A Policy on Geometric Design of Highways and Streets), below 65 mph, one at 60 mph and two at 55 mph. All three of these curves have superelevation rates less than the maximum value of 8.0%, the 60 mph curve being at 7.0% and the other two at 5.0%. The design speed of these curves could be increased to 65 mph (and even 70 mph) by increasing the superelevation rates. However, in increasing superelevation rates other factors need to be addressed, particularly the drainage of the median. Other possible improvements could be to increase the horizontal radii, though this too may result in other impacts.

The horizontal alignment of US-54/400 (Kellogg Ave.) is essentially a straight line between Dugan Road and West Street. A reverse curve with normal crown cross slope is present just west of the interchange with I-235 with a design speed exceeding 80 mph.

The assessment of the horizontal design of the ramps requires a different approach to the design criteria due to the different types of ramps and recommended design ranges based on highway speeds. According to the 2004 AASHTO "Green Book" ramp design speeds are split into three ranges: upper, middle and lower. For a 65 mph highway design speed the ramp design speed upper range is 55 mph, the middle range is 45 mph, and the lower range is 30 mph, with a minimum loop ramp design speed of 25 mph. Such ramps also include deceleration requirements. However, where auxiliary lanes are present between on- and off-ramps there are no acceleration or deceleration lanes to assess. However weaving operations are considered. Elsewhere along I-235, the acceleration and deceleration lanes for on- and off-ramps are adequate.

In the northeast quadrant of the interchange the ramp from Westbound US-54/400 (Kellogg Ave.) to Northbound I-235 consists of 3 horizontal curves, two with design speeds of 40 mph and a 25 mph curve at the entrance of the ramp. The loop ramp from Northbound I-235 to Westbound US-54/400 (Kellogg Ave.) includes one curve with spiral transitions at the entrance and exit of the ramp. The design speed of this ramp is 25 mph.

Exhibit 3.4 – I-235 Horizontal and Vertical Conditions

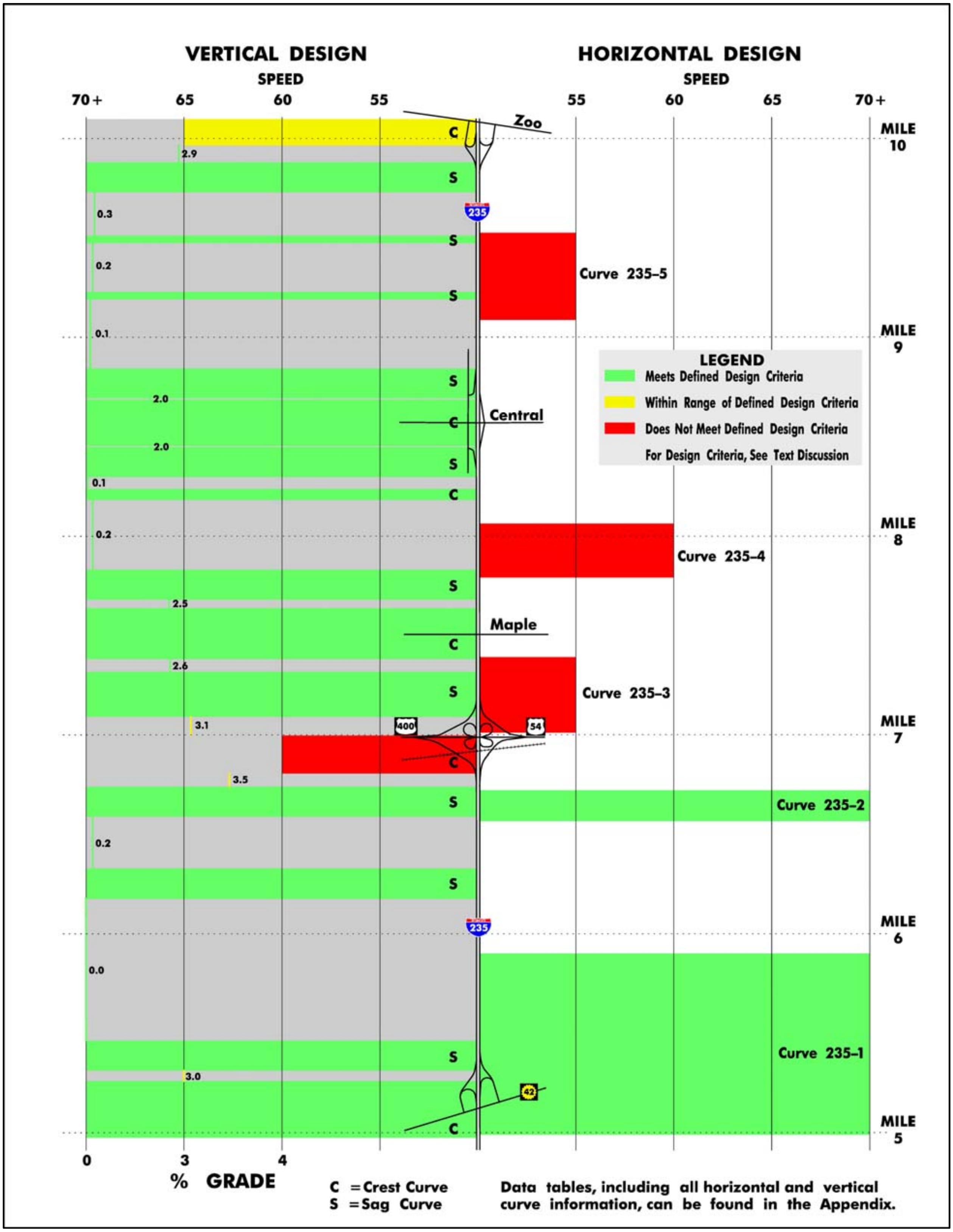
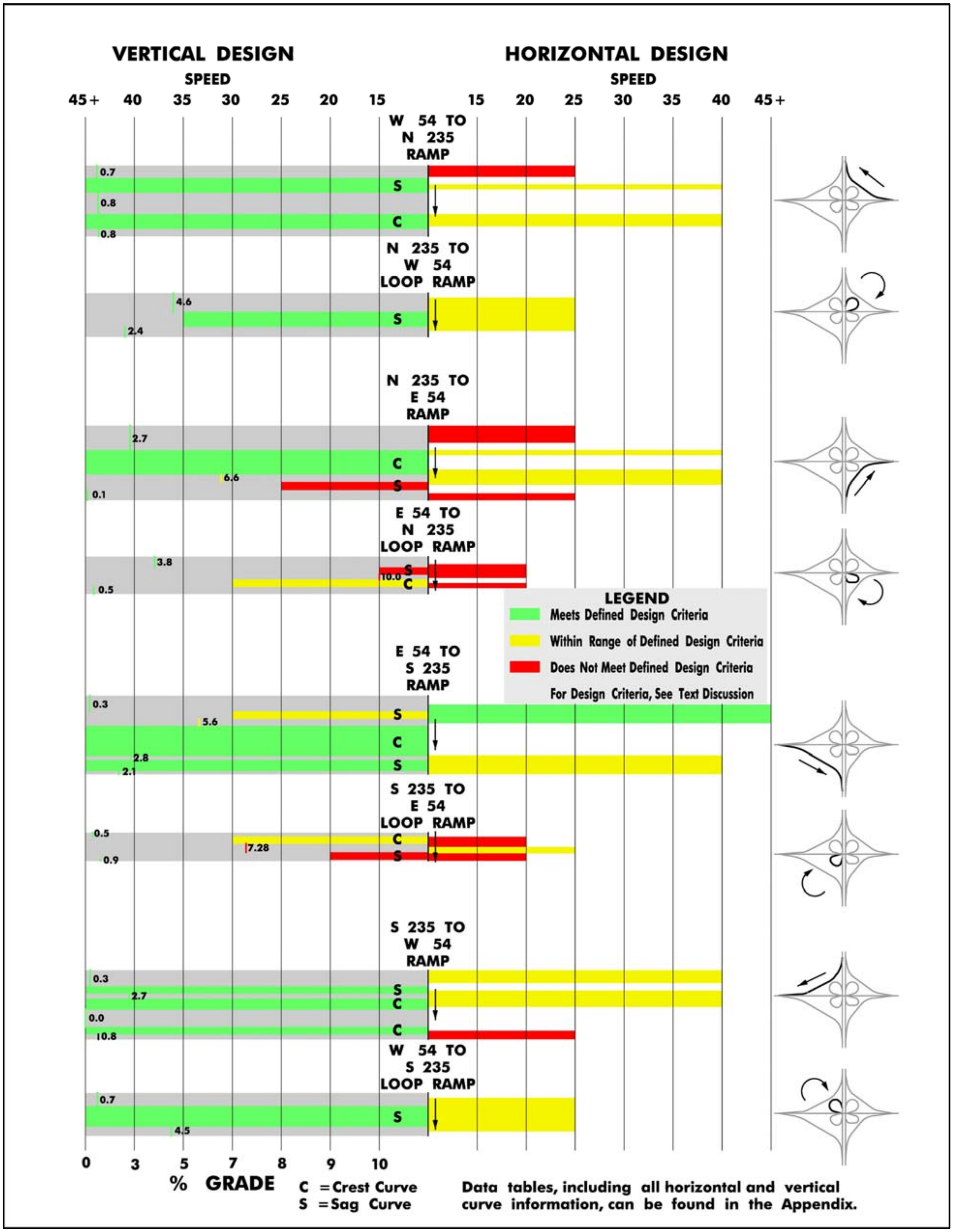


Exhibit 3.5 – I-235 and US-54/400 (Kellogg Ave.) Interchange Ramps Horizontal and Vertical Conditions



The southeast quadrant of the interchange is constrained, particularly the loop ramp, by the proximity of the old railroad alignment. The alignment of the Northbound I-235 to Eastbound US-54/400 (Kellogg Ave.) ramp includes 4 horizontal curves. The two curves immediately at the entrance and exit of this ramp have design speeds of 25 mph, with two 40 mph curves in between. The loop ramp from Eastbound US-54/400 (Kellogg Ave.) to Northbound I-235 has a design speed of 20 mph through two curves and includes a spiral transition at the entrance of the ramp.

In the southwest quadrant of the interchange the ramp from Eastbound US-54/400 (Kellogg Ave.) to Southbound I-235 consists of two curves with design speeds of 45 mph and 40 mph as you travel along the ramp. The loop ramp from Southbound I-235 to Eastbound US-54/400 (Kellogg Ave.) includes 3 horizontal curves and a spiral transition at the entrance of the ramp. The entrance and exit curves have a design speed of 20 mph with the curve in between having a design speed of 25 mph.

In the northwest quadrant of the interchange the ramp from Southbound I-235 to Westbound US-54/400 (Kellogg Ave.) includes three curves, two with a design speed of 40 mph and a 25 mph curve at the exit of the ramp. The loop ramp in this quadrant from Westbound US-54/400 (Kellogg Ave.) to Southbound I-235 consists of one 25 mph curve with spiral transitions and both the entrance and exit of the ramp.

Vertical Alignment

The vertical alignment is assessed based both on design speed and grade requirements for different types of facilities. The same design speed criteria discussed under horizontal alignment applies to the vertical alignment. Vertical curve design speeds are based on stopping sight distance. According to AASHTO *A Policy on Design Standards Interstate System,* January 2005, the maximum grade for a highway with a design speed of 65 mph (and 70 mph) is 3% (assuming level terrain), however grades may be up to 1% steeper in urban areas with crucial right-of-way constraints. For ramps, a grade of 5% is considered the maximum desirable while 7% is the absolute maximum grade.

The existing profile of I-235 between K-42 and Zoo Boulevard includes 16 vertical curves, six crest curves and ten sag curves. All but two of these curves meet or exceed a 70 mph design speed by today's design criteria. There is a 65 mph vertical crest curve through the interchange with Zoo Boulevard; this meets the posted speed limit. The other lower design speed curve is a 60 mph crest curve on the south side of US-54/400 (Kellogg Ave.) interchange over the old railroad alignment. The former railroad corridor has been purchased jointly by the State, City, and County so improvements to the profile are possible. The grades on I-235 are all below 4.0%; with all but three grades being below 3.0% (maximum grade is 3.46%).

US-54/400 (Kellogg Ave.) includes nine vertical curves, four crest curves and five sag curves. Four of these curves (three sags, one crest) have design speeds less than 70 mph, while only two are at or below the posted speed of 60 mph. Based upon stopping sight distance, the sag curves have design speeds of 60 mph, 65 mph, and 55 mph, while the crest curve is at 65 mph. All four of these curves are between the Dugan ramps and the western ramp termini to/from I-235. These four vertical curves were constructed from plans dated 1994. It should also be noted that the design speed indicated on the as-built plans for US-54/400 (Kellogg Ave.) is 60 mph. Because US-54/400 (Kellogg Ave.) is lighted, the sag curves were also reviewed for other criteria and do meet the desired 70 mph based on passenger comfort and general appearance. However, any new facility should be designed to accommodate stopping sight distance. The grades on US-54/400 (Kellogg Ave.) are less or equal to 3.0%, the exception being a grade of 3.16% at Dugan Road.

The following discussion on quadrants is associated with the I-235 and US-54/400 (Kellogg Ave.) interchange. In the northeast quadrant both ramps meet or exceed design speed and grade requirements. The design speeds on the ramp from Westbound US-54/400 (Kellogg Ave.) to Northbound I-235 are 80+ mph and 70 mph, while the design speed on the loop ramp is 35 mph. The grades on these two ramps are all below 5%.

The ramps in the southeast quadrant are constrained by the proximity of the old railroad alignment and the increased vertical clearance associated with the railroad. The ramp from Northbound I-235 to

Eastbound US-54/400 (Kellogg Ave.) includes 2 vertical curves. The first is a 45 mph crest curve over the old railroad alignment into a 6.55% downgrade to a 25 mph sag curve as the ramp approaches US-54/400 (Kellogg Ave.). The loop ramp from Eastbound US-54/400 (Kellogg Ave.) to Northbound I-235 begins with a 15 mph sag curve into a 10% upgrade to a 30 mph crest curve near I-235.

In the southwest quadrant the ramp from Eastbound US-54/400 (Kellogg Ave.) to Southbound I-235 is essentially a viaduct/bridge over the Wichita Valley Center Floodway and former railroad alignment. This ramp includes a 30 mph sag curve into a 5.64% upgrade to achieve the original necessary clearance over the railroad. The ramp also includes another 50 mph crest curve and 80+ mph sag curve as it continues on to Southbound I-235. The loop ramp from Southbound I-235 to Eastbound US-54/400 (Kellogg Ave.) is constrained by the railroad and its increased vertical clearance between the two highways. This ramp exits I-235 with a 30 mph crest curve into a 7.28% downgrade to a 20 mph sag curve as it merges with Eastbound US-54/400 (Kellogg Ave.).

In the northwest quadrant both ramps meet or exceed design speed and grade requirements. The design speeds on the ramp from Southbound I-235 to Westbound US-54/400 (Kellogg Ave.) are 70 mph, 50 mph, and 45 mph (sag curve), while the loop ramp has a design speed of 50 mph. Grades on both ramps are less than 5%.

Condition Assessment

The condition assessment gives consideration to the elements of the highway that are often assessed on an annual basis. This assessment typically includes pavement and bridges. Another element that can be considered is drainage structures. Drainage design is an important element, yet it is often not specifically addressed in planning studies. However, because I-235 runs parallel to and shares a common right-of-way with the Wichita Valley Center Floodway, drainage issues for this particular study may be important enough to warrant further review. At this time, no hydraulic data has been collected that would allow an assessment of the current drainage system, including the size of pipes, drainage areas, etc.

Pavement Condition

The pavement condition is summarized from data obtained from KDOT's Pavement Management Information System (PMIS). The highway segment reviewed is approximately a four-mile stretch of Portland Cement Concrete Pavement (PCCP) from one mile south of US-54/400 (Kellogg Ave.) to one mile north of Central Avenue. This stretch of pavement was built between 1985 and 1988. Portions within this stretch have already had some full depth patching.

The latest available data on pavement conditions was taken in the Spring of 2005. Various measures of pavement condition are reported including an International Roughness Index (IRI), a Distress State (DS) consisting of faulting, rutting and cracking, and a Performance Level. A brief description of each type of condition is provided below.

International Roughness Index (IRI) – Roughness in inches per mile is calculated from the left and right wheelpath profiles collected with a South Dakota profilometere. Roughness levels are based on the right wheelpath IRI values in determining distress states and performance levels. Three broad categories of roughness are defined:

- 1 indicates an IRI value of less than 105 inches per mile (Acceptable)
- 2 indicates an IRI value of 105 to 164 inches per mile (Tolerable)
- 3 indicates an IRI value of more than 164 inches per mile (Unacceptable)

The ratings for the right wheelpath for this stretch of pavement are 109 in the southbound direction and 107 in the northbound direction. This places the pavement just barely in category "2". For comparison, the statewide IRI average for (non-turnpike) concrete interstate pavement is 98 or in category "1".

Distress State – This is a three digit number, where each digit represents the level of a certain pavement condition parameter. The level ranges from 1-3 with 1 being the best condition, 3 being the worst. The three digits are defined as:

- First digit: An indicator of roughness on all pavement types based upon the IRI value calculated from the right wheelpath profile.
- Second digit: An indicator of joint distress on rigid pavements or transverse cracking on flexible pavements.
- Third digit: An indicator of faulting on rigid pavements or rutting on flexible pavements.

The Distress State of this stretch of pavement is rated a 211, meaning it has moderate roughness and no significant additional distress.

Performance Level – There are three performance levels; 1, 2 and 3.

- 1 denotes segments that are smooth and exhibit few if any surface defects. Pavement segments in this category do not require corrective action, however it may be appropriate to perform preventative maintenance actions to prolong this good condition
- 2 denotes segments that appear to require at least routine maintenance to address roughness or to correct moderate surface defects.
- 3 denotes segments that appeared to require a rehabilitative action beyond routine maintenance at the time of the survey.

This stretch of pavement is shown to be in performance level 1, along with 1,800 other miles in Sedgwick County. This means that more than 90% of all KDOT miles in Sedgwick County are in level 1.

No scheduled actions have been identified for the short or long term on this section of I-235. KDOT utilizes a pavement “remaining life” estimation tool, but it is important to understand the definition used at the agency for the term “remaining life”. To KDOT, the term means the time until a structural (typically 1½” asphalt) overlay or equivalent action is warranted. The remaining life is estimated using probabilistic methods (Monte Carlo), based on the time to reach threshold levels of the primary and secondary distresses. For concrete pavements, this is the minimum time to reach either “level 3” joint distress or “level 3” faulting. For I-235 from K-42 to Zoo Boulevard, the estimate of the “remaining life is consistently around 16 years. Overall, the pavement condition along I-235 is considered “good”.

Bridge Condition

Within the study boundary, there are numerous highway bridges including two along US-54/400 (Kellogg Ave.) and 4 sets of dual bridges (one northbound the other southbound) along I-235, as well as bridges along the interchange ramps. The bridges along I-235 were built in 1961. The features crossed include roads (US-54/400 (Kellogg Ave.), Maple Street and Central Avenue) as well as a former railroad and the Wichita Valley Center Floodway (often referred to as the ‘Big Ditch’).

The US-54/400 (Kellogg Ave.) bridge over the Wichita Valley Center Floodway was built in 1971 and has a span of nearly 465 feet. This bridge had a major deck resurfacing in 2004. The US-54/400 (Kellogg Ave.) bridge over Hoover Road is a box culvert bridge and is the youngest bridge having been built in 1996.

The majority of bridges have a sufficiency index rating in the high-80’s to low-90’s with the exceptions of the bridges over US-54/400 (Kellogg Ave.) and the two bridges on the ramps that cross the Big Ditch, all having a rating in the high-60’s. Other ratings are also available for these bridges including deck, superstructure, substructure, and approach ratings. The majority of these bridges have such deck, superstructure, substructure, and approach ratings of 7’s, with a few 8’s, and an occasional 5 or 6. The lower ratings are for the ramp bridges’ superstructure over the Big Ditch, the two longest bridges under review. With the aforementioned exceptions, these ratings are good. Another set of ratings includes the bridge condition index (BCI) and the bridge health index (BHI). The BCI ranges from 60 to 95 with the most prevalent rating being an 85. The BHI ranges from 82.9 to 100. Overall, these ratings systems indicate good conditions.

The vertical clearance of the bridges over roadways is often less than the required 16 feet (for Interstates and arterials) though many of these are over secondary arterials, including Maple Street and Hoover Road. Central Avenue is classified as a primary arterial. In some cases the listed vertical clearance is higher than the posted vertical clearance. For example, the listed vertical clearance for Maple Street is 14.8 feet, yet it is posted for 14.0 feet. The clearance over US-54/400 (Kellogg Ave.) is noted as 17.1 feet for the NB lanes and 15.8 feet for the southbound lanes. Review of accident data back to 1990 for vehicles striking the bridge decks showed only one occurrence; a dump truck with its load in an upright position when traveling along US-54/400 (Kellogg Ave.).

KDOT's bridge maintenance packets include various comments and recommendations. Some recommendations include repairing exposed piles, shot creting spalled columns, and sealing cracks. A rip rap void on the southbound I-235 bridge over US-54/400 (Kellogg Ave.) was cited to be monitored. The inspections also indicate that overloaded vehicles should not be allowed to cross the ramp bridges over the Big Ditch.

To summarize, in terms of condition the majority of bridges are in good shape overall. However, issues such as vertical clearance have been noted as well as restricted width, particularly where US-54/400 (Kellogg Ave.) was re-striped from a four-lane bridge with shoulders to a six-lane bridge without shoulders.

A summary of the bridges within the study area and their corresponding information and ratings is provided in Exhibit 3.6.

Exhibit 3.6 – Bridge Ratings

Roadway	Feature Crossed	Bridge Number	Date Built	Length (feet)	Ratings			Vertical Clearance
					Sufficiency	BCI	BHI	
I-235 RAMP	ATSF Railway	87-083	1961	189.5	87	90	99.1	23
I-235 RAMP	ATSF / WVFC	87-084	1961	709.7	66.7	60	83.9	23
I-235 SB	ATSF Railway	87-085	1961	128.5	87.8	90	99.1	18.7
I-235 NB	ATSF Railway	87-086	1961	128.5		85	95	19.2
I-235 SB	US-54/400	87-087	1961	214.5	66.8	80	83.1	15.8
I-235 NB	US-54/400	87-088	1961	214.5	66.8	80	82.9	17.1
I-235 RAMP	WVFC	87-089	1960	521.7	66.2	65	84.5	NA
I-235 SB	Maple	87-090	1961	153	92.7	85	95	14.8
I-235 NB	Maple	87-091	1961	153	92.7	85	95	14.8
I-235 SB	Central	87-092	1961	148.5	88.5	85	100	15
I-235 NB	Central	87-093	1961	148.05	88.5	85	100	15
US-54/400	WVFC	87-132	1971	464.7	81.4	75	89.1	NA
US-54/400	Hoover Road	87-441	1996	45.4	87.8	95	100	14.3

Mobility Elements

Within, along, and crossing the corridor, other transportation facilities are provided that serve different modes of transportation as well as attempt to manage vehicular flow. This section looks more specifically at the pedestrian, bicycle and transit facilities as well as current access management, particularly along Central Avenue. In many cases these facilities for other modes of transportation do not currently exist. Nonetheless, such facilities are worthy for consideration. Jurisdictional issues for these facilities regarding funding, construction and/or maintenance are not yet discussed. When and if such facilities are proposed, those issues will need to be addressed by the various responsible parties.

Public Transit

This section expands upon the information contained in the regional context chapter to include review of site specific elements within the study area. Wichita Transit (WT) currently operates several fixed routes along Central Avenue, Maple Street and other roadways that utilize the street network crossings of or are adjacent to I-235. Typically along these routes are transit facilities, such as bus stops, that include identifying signs and benches. When such facilities exist, it is important to identify their location and type so that the facility remains functional as conceptual designs for improvements are developed. Field review along the known transit routes of Central Avenue and Maple Street identified several such existing facilities. These facilities are located on the plan maps in the Appendix. The location and type of bus stops are somewhat inconsistent in regards to placement (on the leaving or approach side of an intersection) and type (a bench on the south side of Central Avenue at Gilda Street is not complimented by a bench on the north side). Exhibit 3.7 shows a photograph of a Wichita Transit bus along Central Avenue and a bench on the south side of Central Avenue just west of the Gilda Street intersection.

Exhibit 3.7 – Transit Vehicle and Bus Stop

Non-Motorized
Within the study area, there are only two crossings of I-235; Maple Street and Central Avenue, where pedestrians and bicyclists are permitted to cross. US-54/400 (Kellogg Ave.) is a freeway facility and by definition prohibits pedestrians and bicyclists. Similarly, no pedestrian or bicycle facilities are located along I-235 because it is a freeway.

Central Avenue – Sidewalks are present on both the north and south sides as Central Avenue passes beneath I-235, yet they are relatively narrow, measuring four feet, but often with an effective width less than that. Pedestrian actuated push buttons are provided at the traffic signals, as well as pedestrian heads and sloped ramps. Crosswalk markings do not exist. Central Avenue has not been identified as a bicycle compatible facility but field observations revealed adult cyclists riding on-road as well as child cyclists riding along the sidewalks. See Exhibit 3.8 for photographs.

Exhibit 3.8 – Cyclists and Pedestrians along Central Avenue

Maple Street – An approximately four foot wide sidewalk is present on the south side of Maple Street, but a sidewalk on the north side stops approximately 100 feet west of I-235. The sidewalk on the north side reappears east of Elder Street. A worn path is evident between the two sidewalks indicating pedestrian usage. Tire treads from bicycles are also evident along the worn path. See Exhibit 3.9 for photographs.

The bridge opening under I-235 is not wide enough to accommodate sidewalks on both sides of Maple Street. Maple Street is identified as a bicycle route, although no signs have been observed in the immediate area to identify it as a bicycle route. A Wichita Transit bus stop with a bench is located on the north side of Maple Street between Doris and Clara Streets.

Exhibit 3.9 – Sidewalk and Path on North Side of Maple Street

In the continued effort to provide transportation facilities for all modes, it is acknowledged that continuous sidewalks on both sides of the street will be provided along Central Avenue along with appropriate supporting pedestrian facilities at signalized intersections. If exclusive right-turn lanes are required at an intersection, it is suggested that a refuge island be provided for pedestrians. Along Maple Street, consideration could be given to a wider curb lane width (suggested 15 feet) to allow for a more bicycle friendly roadway in keeping with the bicycle route designation as well as a sidewalk on the north side, though this determination is under the City of Wichita's authority. This would require lengthening the existing bridge opening. Consequently additional consideration could be given to carrying the center turn lane through the bridge opening and eliminate the transitions from 5 to 4 to 5 lanes as one passes beneath I-235. Because these considerations would lengthen the bridge span, costs are expected to increase.

Access Management

Central Avenue – The section of Central Avenue under study extends from the eastern bridge abutments of the Big Ditch to Flora Avenue. The total length of this segment is 2,800 feet or slightly longer than a half-mile long. In this segment there are a total of 22 buildings with active businesses having 19 driveways that access Central Avenue. Only one driveway is considered a shared driveway, meaning that a property line bisects the driveway. That location is on the north side of Central with the drive between the Strip Mall and the Poorman's Auto Supply. Other apparent shared driveways exist, like the drive at Quik Trip between the business and the office space or the restaurant and business that share access with an alley on the north side between Hoover and Flora. For the majority of businesses, only one driveway is provided. There are only two properties having more than two driveways, Frank's Automotive and Bob Dulohery's Alignment, Service & Repair. Both are located east of the Northbound I-235 ramps, each have side street access, and face a raised median on Central Avenue. Six properties use only the side street to access their business.

There are 13 public road access points (including alleys) that occur along this stretch. It is important to note that a side street that crosses Central Avenue counts as two access points. In the half-mile stretch, there are a total of 32 access points (public and private). When translated to an access point per mile rate calculation (59.5), the density of driveways for a level of development can be rated border line between "medium" and "high" based upon the Institute of Transportation Engineer's (ITE's) *Traffic Engineering Handbook* scale of low being less than 30 driveways per mile, medium being between 30 and less than 60 driveways per mile and high being more than 60 driveways per mile. While this calculation would indicate a relatively high density of driveways, the size of the commercial properties, the current use of side street access points, and the number of public access points would indicate that even with consolidation or relocation of existing driveways that the density of driveways would not be significantly reduced. On the other hand, any reduction in the number of driveways could be considered beneficial.

Kellogg Drive – As noted in the discussion of typical sections, Kellogg Drive is typically a one-way paired frontage road (north and south of US-54/400 (Kellogg Ave.) utilized as a collector-distributor system that includes the on- and off-ramps to and from US-54/400 (Kellogg Ave.). In certain locations the one-way system reverts to two-way. East of the Big Ditch, Kellogg Drive is only present on the north side. Here Kellogg Drive is one-way westbound from West Street to Tracy Street where it picks up two-way traffic and eventually turns northward (and becomes Westdale Drive) towards the Towne West Mall. The south side of US-54/400 (Kellogg Ave.) is flanked by a former railroad with restricted access. Consequently, a frontage road system, to provide access to private property is unnecessary.

The Environment

The study area (the area immediately adjacent to I-235 between US-54/400 (Kellogg Ave.) and Central Avenue and around the interchanges of I-235 and US-54/400 (Kellogg Ave.), and I-235 and Central Avenue) is an approximately 0.76 square mile area which includes an environment that ranges between industrial to aquatic/drainage areas. The influence area (an area identified to assess potential transportation related impacts to the study area) is approximately 10 square miles and is not expected to experience any direct construction related impacts outside of the study area. However, review of the influence area helps to understand the systemic effects of potential transportation improvements along I-235 and at the US-54/400 (Kellogg Ave.) and Central Avenue interchanges. The environmental analysis evaluates the project in terms of the typical “avoid, minimize, mitigate” approach. No impacts were quantified during the existing conditions evaluation; however, probable impacts were evaluated during subsequent portions of the design concepts evaluation. Guidance pertaining to sensitive resources is included to identify potential next steps that may need to take place prior to construction. Specific action items identified in the following sections are underlined. The following natural and man-made physical features evaluated to determine existing conditions include:

- socioeconomic factors;
- land use;
- public lands;
- cultural resources;
- water quality;
- floodplain;
- wetlands;
- soil erosion and sedimentation;
- threatened and endangered species;
- geologic conditions;
- hazardous waste; and
- noise.

Data was compiled from a variety of sources to examine existing conditions. The data used includes GIS parcel, parks, neighborhood, and zoning data, U.S. Census 2000 block group data, Census 2000 TIGER/Line data, aerial photography, the Wichita Phone Directory, National Wetlands Inventory Hardcopy mapping, Natural Resources Conservation Service soil data, U.S. Geological Survey mapping, National Register of Historic Places data, Kansas State Historical Society data, Wichita Register of Historic Places data, the Wichita Flood Insurance Study and FEMA Q3 Digital Flood Data, Kansas Department of Wildlife and Parks threatened and endangered species data, Comprehensive Environmental Response, Compensation and Liability Information System data, National Priorities List data, and Kansas Department of Health and Environment Licensed Landfills data and Identified Sites data.

Socioeconomic Factors

Available databases were researched to determine the existing socioeconomic factors in the influence area, including environmental justice and demographics.

Environmental Justice

Title VI of the Civil Rights Act requires that actions be taken to address environmental justice in minority and low-income populations, by identifying and addressing disproportionately high and adverse human health or environmental effects from potential actions of the project. Minority and low-income populations were identified within and adjacent to the influence area. Of the 34 Census Block Groups within and adjacent to the influence area, four block groups contained minority populations above the Sedgwick County average; however, those four block group are not located within the study area. Eleven of the 34 block groups within and adjacent to the influence area contained higher than average percentages of people living below the poverty level compared to the whole of Sedgwick County; and only two of those 11 block groups are contained within the study area. Exhibit 3.10 identifies Sedgwick County averages for percent minority, percent below poverty, and the total population of Sedgwick County.

Exhibit 3.10 – Sedgwick County Population Averages

CENSUS DATA 2000 SEDGWICK COUNTY KANSAS AVERAGES	
Percent Minority	23.61%
Percent below Poverty	9.36%
Total Population	452,869

Exhibit 3.13 on the next page illustrates percent minority and percent below poverty for all block groups within and adjacent to the influence area with those block groups partially located within the study area noted on the right side of the table. Exhibits 3.11 and 3.12 illustrate minority and poverty population block groups within and adjacent to the influence area. <u>If impacts occur to low income or minority populations as a result of project actions, efforts to avoid, minimize, or mitigate should be taken</u>. Independent of who may be impacted, conformance with the Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (Uniform Act), which requires just compensation to be paid to the owner(s) of private property taken for public use, and providing offsetting benefits and opportunities to enhance communities, neighborhoods, and individuals affected by project actions.

Exhibit 3.11 – Minority Populations

Exhibit 3.12 – Poverty Level

Exhibit 3.13 – Influence Area Minority and Poverty Block Groups

Block Group Number	Percent Minority	Percent Below Poverty	
Block Group 6, Census Tract 54	12.77	5.74	
Block Group 1, Census Tract 86	13.39	0.79	
Block Group 2, Census Tract 86	13.04	**10.44**	
Block Group 3, Census Tract 86	10.74	4.50	
Block Group 2, Census Tract 87	17.36	4.97	
Block Group 3, Census Tract 87	19.77	7.08	
Block Group 4, Census Tract 87	**25.59**	**16.89**	
Block Group 1, Census Tract 88	19.32	3.25	
Block Group 2, Census Tract 88	14.64	7.78	
Block Group 3, Census Tract 88	17.88	1.82	Partially within study area
Block Group 4, Census Tract 88	15.38	4.09	Partially within study area
Block Group 5, Census Tract 88	22.18	**12.50**	
Block Group 1, Census Tract 89	19.90	**29.54**	
Block Group 2, Census Tract 89	9.67	5.97	
Block Group 3, Census Tract 89	14.87	**10.85**	
Block Group 4, Census Tract 89	18.43	8.66	Partially within study area
Block Group 5, Census Tract 89	14.48	**12.12**	Partially within study area
Block Group 1, Census Tract 90	17.17	**11.18**	
Block Group 2, Census Tract 90	19.49	**13.41**	
Block Group 3, Census Tract 90	17.05	**18.26**	
Block Group 1, Census Tract 91	**27.19**	**10.39**	
Block Group 2, Census Tract 91	**29.15**	2.51	
Block Group 5, Census Tract 91	18.55	4.53	Partially within study area
Block Group 1, Census Tract 92	17.86	6.76	Partially within study area
Block Group 4, Census Tract 92	10.06	7.20	Partially within study area
Block Group 1, Census Tract 93.01	11.19	1.08	
Block Group 2, Census Tract 93.01	11.57	5.87	
Block Group 3, Census Tract 93.01	16.50	**9.53**	Partially within study area
Block Group 1, Census Tract 93.02	**25.33**	7.76	
Block Group 3, Census Tract 93.02	11.97	6.61	
Block Group 1, Census Tract 95.03	6.53	2.57	
Block Group 1, Census Tract 95.13	13.93	0.91	
Block Group 2, Census Tract 95.13	8.66	2.76	
Block Group 1, Census Tract 96	11.82	2.86	

Demographics
Gender, age, income, employment, and vehicle availability data within the influence area was reviewed to compile a demographic profile of the area. Census block groups within and adjacent to the influence area were examined to extrapolate the desired statistical data. Of the 46,101 people living in the block groups within and adjacent to the influence area, 49.13% were male and 50.87% were female. The age of the population living in the block groups within and adjacent to the influence area was examined and five age groups were identified to provide a demographic profile of age. The highest populous age group has persons in the 18-39 year age group, while the lowest populous has persons in the age 80 and over group. Exhibit 3.14 illustrates the demographic profile of age for block groups within and adjacent to the influence area.

Exhibit 3.14 – Demographic Profile of Age for Influence Area

Age Group	Number of Persons	Percent of Total Block Group Population within and adjacent to the Influence Area
Total Block Group Population within and adjacent to the Influence Area	46,101	
Total Under 18	12,457	27.02%
Total 18 to 39	14,931	32.39%
Total 40 to 59	11,708	25.40%
Total 60 to 79	5,539	12.01%
Total 80 and Over	1,466	3.18%

Median income data was compiled for the block groups within and adjacent to the influence area. Of the 34 block groups, the average household median income was $42,200. The highest household median income was $97,500 and the lowest household median income was just under $21,000.

Unemployment data was compiled for the block groups within and adjacent to the influence area. For the 34 block groups included in the data compilation, the unemployment rate was 2.84%. Data was compiled to determine the percentage of people living in the block groups within and adjacent to the influence area that live and work within the Wichita Metro area. Of the 34 block groups evaluated, 81.55% of the people live and work within the Wichita Metro area, while 18.45% live within the Wichita Metro area, but work outside of the area.

Vehicle availability was identified for block groups within and adjacent to the influence area. For the 34 block groups included in the data compilation, the percentage of people with no vehicle available was 4.76%.

Land Use

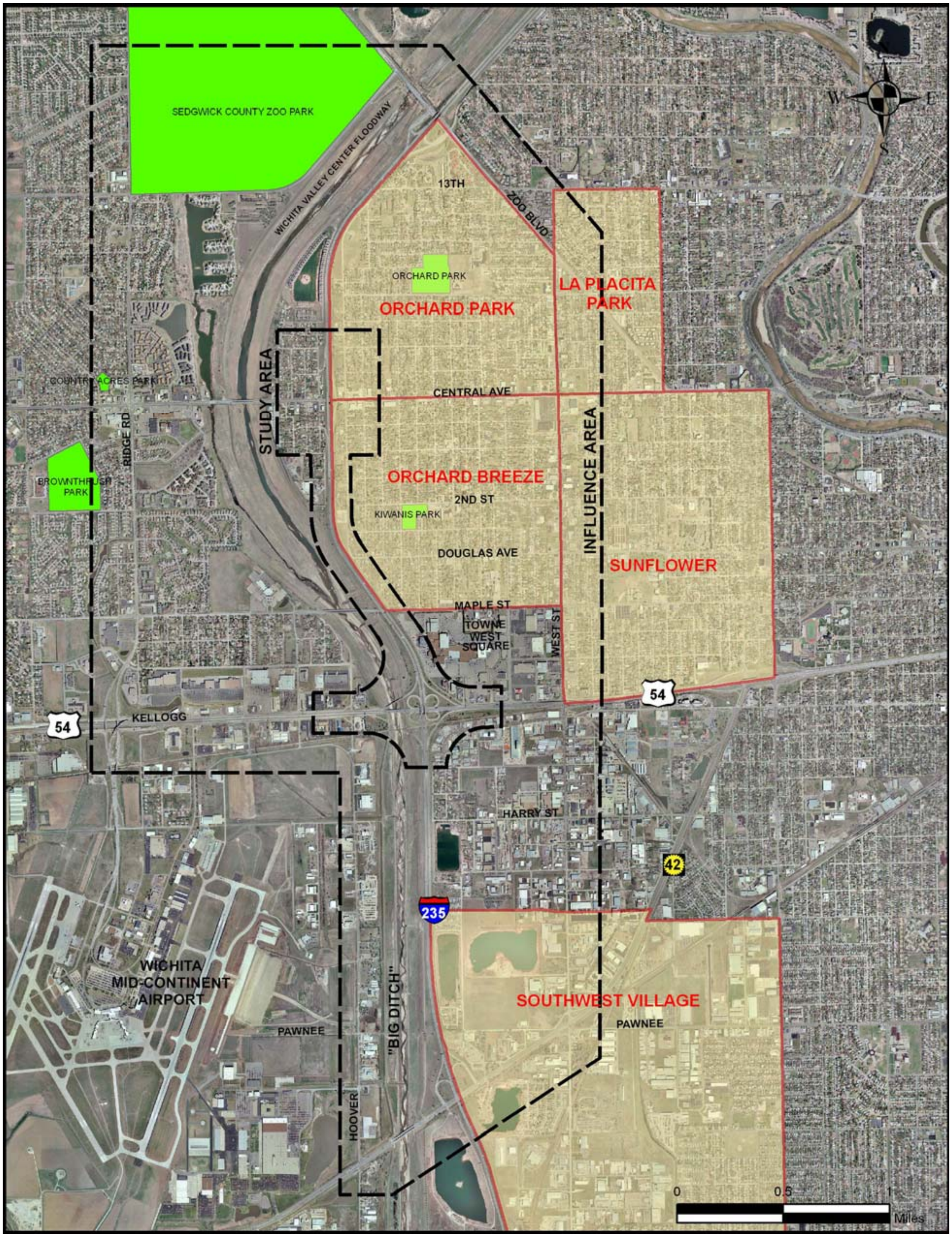
Available databases and records were researched to determine land use within the influence area. Land use categories that were examined include residential, commercial, industrial, institutional, and emergency services.

Residential

Unless otherwise noted, the following residential areas are located within the influence area and are shown in Exhibit 3.15.

- The Orchard Park neighborhood is located within and adjacent to the influence area and is bounded by West Street to the east, I-235 to the west, Central Avenue to the south, and the junction of I-235 and Zoo Boulevard to the north. It is primarily composed of single-family residences, with some two family and multi-family residences. The neighborhood can be accessed from Central Avenue, West Street, Zoo Boulevard, and Hoover Road.
- The Orchard Breeze neighborhood is located within and adjacent to the influence area and is bounded by West Street to the east, I-235 to the west, Maple Street to the south, and Central Avenue to the north. It is primarily composed of single-family residences, with some two family and multi-family residences. The neighborhood can be accessed from Central Avenue, West Street, and Maple Street.
- Although they are not identified by a specific neighborhood name, other residences are located west of I-235 and north of US-54/400 (Kellogg Ave.) within the influence area. These residential areas include mostly single family housing with some two-family and multi-family housing and can be accessed from Ridge Road, Central Avenue, and 13th Street North.
- The Southwest Village, Sunflower, and La Placita Park neighborhoods are located partially within the influence area.

Exhibit 3.15 – Neighborhoods and Parks



Commercial
Commercial land use is primarily concentrated along US-54/400 (Kellogg Ave.), West Street, Central Avenue, and Maple Street, and are predominantly composed of commercial and office activity. Types of commercial businesses located within the influence area include Towne West Mall, retail strip malls, bowling, rollerskating, auto parts, auto repair, auto dealerships, health and medical services, banks, thrift stores, florists, dine-in and drive-thru restaurants, building supplies, printing services, gas stations, and big boxes.

Industrial
A majority of the industrial activity within the influence area is located south of US-54/400 (Kellogg Ave.) with some industrial activity occurring on the north side of US-54/400 (Kellogg Ave.) east of Tracy Street. South of US-54/400 (Kellogg Ave.) industrial areas are located both east and west of I-235.

Institutional
The following institutions listed in Exhibit 3.16 are located within the influence area:

Exhibit 3.16 – Institutions Located within the Influence Area

NAME	ADDRESS	WITHIN STUDY AREA	ADJACENT TO STUDY AREA	WITHIN INFLUENCE AREA
Schools and Daycare				
Dodge Elementary School	4801 West 2nd St. North			**X**
Bryant Elementary	4702 West 9th St. North			**X**
Hadley Middle School	1101 North Dougherty St.			**X**
Kensler Elementary	1030 Wilbur Ln.			**X**
Christ the King School	4501 West Maple St.			**X**
Starkey Developmental Center	4500 West Maple St.			**X**
Junior Junction Professional Daycare	5226 West Central Ave.		**X**	
West Street Toybox Daycare	1312 North West St.			**X**
Noah's Ark Child Care Center and Preschool	6100 West Maple St.			**X**
Loving Arms Child Care Center	1241 North Ridge Rd.			**X**
Catholic Charities Adult Daycare	5920 West Central Ave.	**X**		
Homes for the Disabled				
Bethesda Faith Village (for developmental disabilities)	551 North McComas St.			**X**
Starkey Group Home	105 North Tracy St.			**X**
Kouri Place Apartments	140 South Anna St.			**X**
Senior Care Facilities				
Central Park Senior Residences	3850 West Newell St.			**X**
Carriage House Residential Care Facility	1325 North West St.			**X**
Lakepoint Retirement and Rehab	1315 North West St.			**X**
Mothers and Others Long Term Care	234 South Anna St.			**X**
Sandpiper Bay Health and Retirement	5808 West 8th St. North		**X**	
Presbyterian Manors	4700 West 13th St. North			**X**

Emergency Services
Police, fire, hospital, and other emergency services within the influence area were identified. No hospitals are located within the influence area. Wichita Fire Station Eight is located at Central Avenue and Elder Street within the influence area. Station Eight has a complement of one engine, and one squad. It responds to alarms from the Airport and protects the City's west side. Station Eight also houses a police substation. Built in 1965, it currently has 15 personnel assigned over three shifts.

Public Lands
Public lands include properties used or reserved for use as park, recreation, wildlife or waterfowl areas. Public park lands may be reserved for public recreational usage under a Section 4(f) or Section 6(f) designation. Section 4(f) is part of the Department of Transportation (DOT) Act of 1966 that was designed to preserve parks, recreation areas, wildlife and waterfowl refuges, and historic sites. Property eligible for Section 4(f) must be publicly owned, except for historic sites, which can be either public or privately owned. Section 4(f) eligible sites cannot be impacted by federally funded actions unless there is no feasible and prudent alternative. Section 6(f) is part of the Land and Water Conservation Fund (LWCF) Act, which was designed to provide restrictions for public recreation facilities funded with LWCF funds. The LWCF Act provides funds for the acquisition and development of public outdoor recreation facilities that could include community, county, and state parks, trails, fairgrounds, conservation areas, boat ramps, shooting ranges, etc. Facilities that are LWCF-assisted must be maintained for outdoor recreation in perpetuity and therefore require mitigation that includes replacement land of at least equal value and recreation utility. As referenced below, Brownthrush Park, Orchard Park, and Kiwanis Park have received LWCF funds.

The following parks were identified within the influence area and are illustrated on Exhibit 3.15:

- Country Acres Park is located at 754 North Country Acres and is owned by the City of Wichita. The 2.1 acre park contains a family swimming pool, wading pool, bathhouse/restrooms, a basketball court, and a drinking fountain.
- Brownthrush Park is located at 533 North Country Acres and is owned by the City of Wichita. The 44.62 acre park includes 2 softball diamonds, 1 football field, children's play area, and a parking area. LWCF funds, provided through the Kansas Department of Wildlife and Parks and the National Park Service, have been used to develop this park.
- Sedgwick County Zoo Park is located at 6501 West 21st Street North and is owned by Sedgwick County. The 617.07 acre park and zoo provides access to the zoo, shelters, baseball/softball fields, soccer fields, tennis courts, fitness and biking trails, horseshoe pits, fishing lakes, volleyball courts, basketball courts, a rollerhockey area, a bocce court, a sledding hill, parking areas, restrooms, tot lots, and stores.
- Orchard Park is located at 4808 West 9th Street North and is owned by the City of Wichita. The 19.82 acre park includes a recreation center, a swimming pool, wading pool, bathhouse/restrooms, a lighted softball diamond, 2 lighted tennis courts, a basketball court, 3 parking areas, a drinking fountain, and a children's play area. LWCF funds, provided through the Kansas Department of Wildlife and Parks and the National Park Service, have been used to develop this park.
- Kiwanis Park is located at 5101 West 2nd Street North and is owned by the City of Wichita. The 6.77 acre park provides an enclosed shelter with restrooms, a walking path, a softball diamond, a basketball court, a soccer field shared with a softball diamond, 3 parking areas, a drinking fountain, and a children's play area. LWCF funds, provided through the Kansas Department of Wildlife and Parks and the National Park Service, have been used to develop this park.

All parks are located outside the study area boundary and therefore are not anticipated to be affected by any potential improvements to the I-235 and US-54/400 (Kellogg Ave.) and Central Avenue interchanges.

Cultural Resources
A review of historic resources within the influence area was performed. Historic sites and historic districts as listed on the National Register of Historic Places (NRHP) and retrieved from the Kansas State

Historical Society (KSHS) archeological data server were searched. Search results of historic sites and historic districts indicated no sites or historic districts listed on the NRHP; however, a historic trail and road from the Salt Plain passes through the southeast portion of the influence area. The historic road and trail lies outside of the study area, and therefore, will not be impacted by any potential improvements to the I-235 and US-54/400 (Kellogg Ave.) and Central Avenue interchanges. The Register of Historic Kansas Places (RHKP) and Wichita Register of Historic Places (WRHP) were searched for historic places. Search results of the RHKP and WRHP did not indicate any historic places within the influence area. A field investigation was performed to determine the approximate age of all standing structures within the study area. Nearly all of the structures within the study area will require photographic review by KSHS personnel. KDOT Environmental Services Section personnel will conduct an Activity I field review when the study area is further refined in the design phase.

Water Quality

The Wichita Valley Center Floodway is the only stream or creek crossing identified within the study area.

Floodplain

The State of Kansas participates in the National Flood Insurance Program (NFIP). Any development associated with this project that is within a special flood hazard area as identified by FEMA must meet the requirements of the City of Wichita. A flood development permit must be obtained from the City of Wichita prior to the commencement of construction activity. All of the floodway within the study area is contained within the Wichita Valley Center Floodway. The 100-year floodplain coincides with floodway locations of the Wichita Valley Center Floodway within the study area. All of the study area is contained within the 500-year floodplain. The locations of potential floodway and floodplain are indicated on Exhibit 3.17.

If construction were to occur within the floodway (which coincides with the 100-year floodplain), the flood-carrying capacity of the floodplain might be reduced and the flood height would be increased as filling and encroachment takes place in the floodplain. To prevent this from occurring, FEMA defines the floodway as the stream channel plus any adjacent floodplain area that must be kept free of encroachment to allow conveyance of the 100-year flood without substantially increasing the base flood elevation.

Section 60.3(d)(3) of the NFIP regulations states that a community shall *"prohibit encroachments, including fill, new construction, substantial improvements, and other developments within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance the standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base (100-year) flood discharge."* A "no-rise" certification must be obtained from the U.S. Army Corps of Engineers before any development permits can be obtained if construction activities associated with this project occur within the regulatory floodway.

Wetlands

Wetlands are defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3 (b)). Wetlands are considered to be "waters of the U.S." and are regulated by the USACE under Section 404 of the Clean Water Act. Additionally, Executive Order 11990 requires all federal agencies to minimize impacts to wetlands when conducting specific activities.

Potential wetland areas and waters of the U.S., within and adjacent to the study area, were identified. National Wetlands Inventory (NWI) data was reviewed to locate potential wetlands. A wetland delineation will not be performed for this concept study phase; however, a wetland delineation will need to be performed prior to construction of improvements. Hardcopy NWI maps were digitized and georeferenced. The locations of potential wetlands in the study area are indicated on Exhibit 3.18.

Exhibit 3.17 – Floodplain

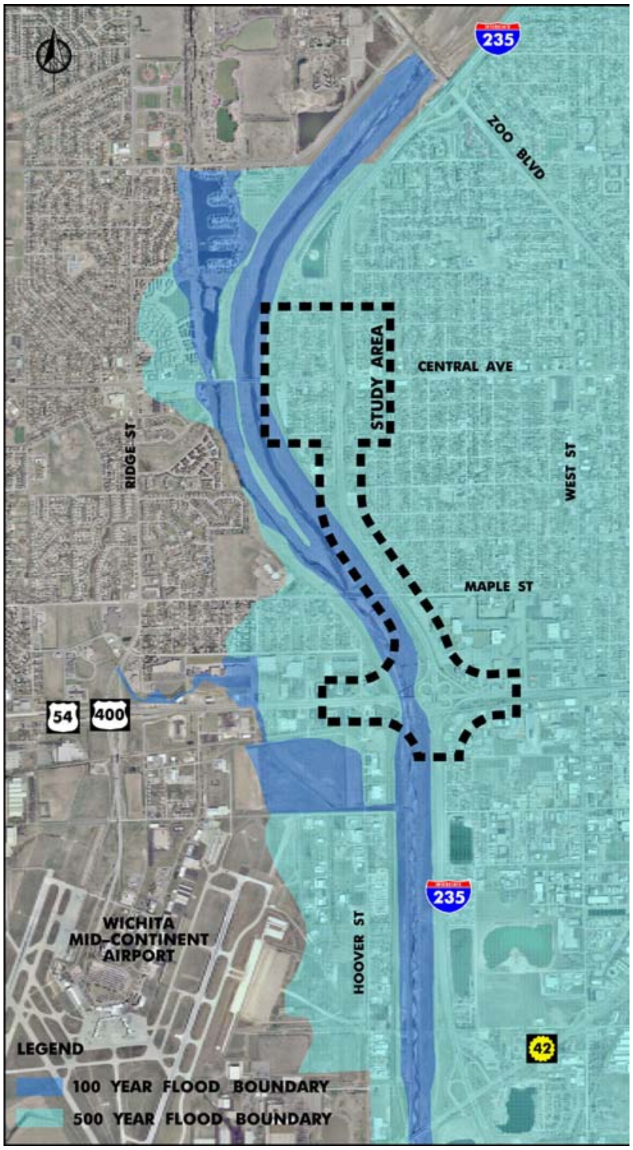


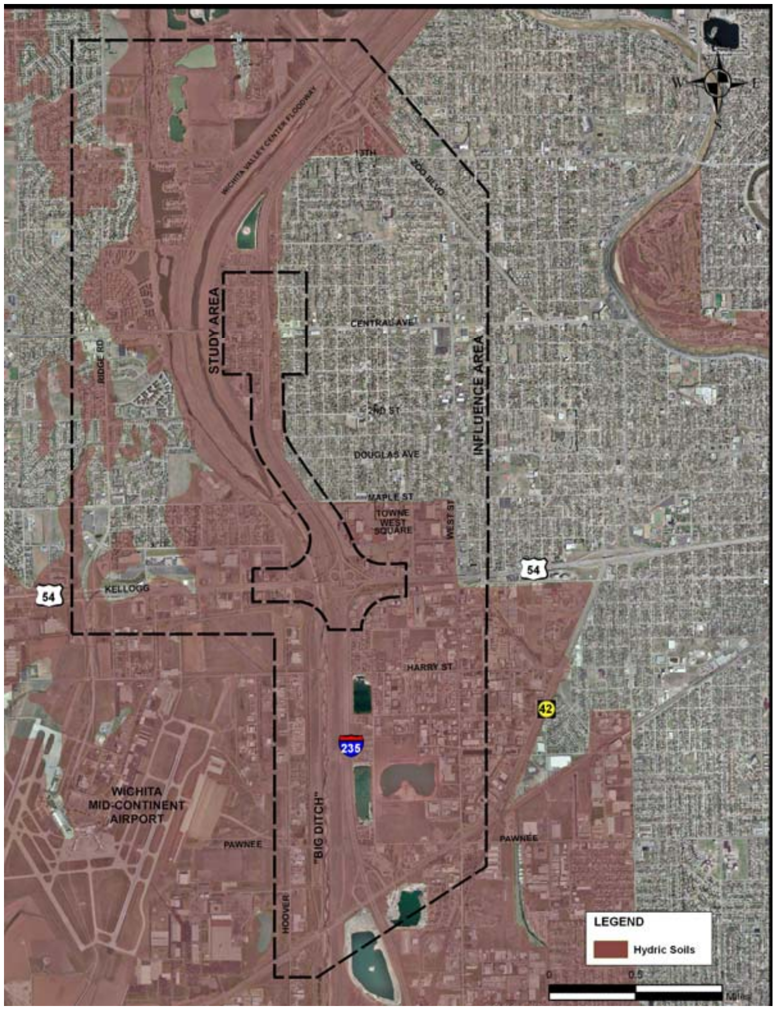
Exhibit 3.18 – NWI Wetland Areas

The most concentrated areas of wetland habitat lie along the Wichita Valley Center Floodway; these wetlands consist mainly of riverine wetland, emergent wetland, and scrub shrub wetland.

Hydric soil information was obtained from the NRCS. Nearly the entire study area consists of soil that may contain hydric inclusions, as illustrated on Exhibit 3.19.

Depending upon the extent of impacts that wetlands and waters of the U.S. are impacted by interchange improvements, wetland mitigation may need to be performed in accordance with Clean Water Act Section 404 Compensatory Mitigation Requirements, including creation, restoration, enhancement, or preservation of aquatic resources. This would likely involve crossings of the floodway at the I-235 and US-54/400 (Kellogg Ave.) interchange.

Exhibit 3.19 – Hydric Soils



Soil Erosion and Sedimentation

The Wichita Valley Center Floodway is located within the study area. Soil erosion and sedimentation are closely linked to Water Quality. Soil erosion and sedimentation would likely take place with any clearing for improvements. Storm water could then erode soil and convey sedimentation to the Wichita Valley Center Floodway. The potential improvements will require compliance with the provisions of the Kansas Department of Health and Environment (KDHE) storm water regulations found at K.A.R. 28-16-150. Construction activities would be permitted under KDHE National Pollutant Discharge Elimination System permit no. S-MCST-0110-1, which is a general permit issued for road construction projects statewide. KDOT addresses permit requirements through construction practices.

Threatened & Endangered Species

The Kansas Department of Wildlife and Parks (KDWP) lists twelve species as threatened or endangered in Sedgwick County. Of these twelve species, four are federally listed by the U.S. Fish and Wildlife Service. <u>Only one species, the state listed eastern spotted skunk, has state designated critical habitat, the Big Slough drainage basin, adjacent to the study area.</u> The study area is not located within the Big Slough drainage basin; however, it is located in close proximity. Locations of threatened and endangered species are evaluated by the U.S. Fish and Wildlife Service (USFWS) and KDWP on known and potential species populations and habitat locations on a case by case basis. The eastern spotted skunk has a black tail with a white tip, elongated white spots on its back and a white spot on its forehead. A description of the listed species and their designated critical habitat can be found in the Appendix.

A habitat assessment for the eastern spotted skunk may need to be completed prior to construction depending upon a more specific definition of the Big Slough drainage basin and the defined improvements. If habitat is identified within the construction limits, compensatory mitigation may be sought by the KDWP for the loss of habitat.

Geologic Resources

The project is located east of the Hutchinson Salt Member active dissolution front and is not known to contain sinkholes, caves, mines or outcroppings. The bedrock in the area is the Wellington Shale Formation, known for its gypsum beds and extremely variable compressive strengths. Therefore, no geologic constraints are anticipated with the interchange improvements.

Hazardous Waste Sites

A field investigation and database review identified sites known to have encountered or could potentially encounter hazardous waste releases into the environment. Databases reviewed include the CERCLIS (Superfund), the NPL (National Priorities List), KDHE Licensed Landfills, and KDHE Identified Sites. The database review found no known sites within the study area. A description of the field review is located in the Appendix. Sites examined during the field review are illustrated on Exhibit 20.

Exhibit 20 – Sites Examined during Hazardous Waste Field Reconnaissance

Some sites examined during the field review are located in close proximity to the existing I-235 right-of-way and may present constraints to interchange improvements. A Phase I Environmental Site Assessment (ESA) will need to be performed prior to acquiring any privately owned properties necessary for interchange improvement construction and will be necessary in order to determine the level of NEPA documentation required for the project. A Phase I ESA can provide a review of known and observable conditions that would allow for the evaluation of the environmental condition of a site or property.

Noise

Vehicle noise is a combination of noise produced by the engine, exhaust, and tires. Heavier traffic volumes, higher speeds, and greater numbers of trucks all increase the loudness of traffic noise. Traffic noise impacts can occur when the predicted noise levels approach or exceed the Noise Abatement Criteria (NAC) or when predicted traffic noise levels substantially (greater than a 10 dB increase) exceed the existing noise level. During this study phase, an existing noise analysis will not be conducted. Consequently, it is unknown what the existing noise levels are, or if those levels would increase in the future under potential improvements.

The determination to conduct a noise analysis would be made during the permitting phase of a funded project. If a noise analysis is conducted through the advancement of the study into a project or series of projects, then the KDOT "Policy Statement on Highway Noise Abatement" will be applied. This typically means that a preliminary traffic noise evaluation will be conducted utilizing design year traffic with the FHWA traffic noise prediction model, TNM. The TNM approximates the distance of the 66 dB contour line from the centerline of the highway. When the project is programmed for construction the final traffic noise study and abatement analysis will be conducted in accordance with 23 CFR 772 Procedures for Highway

Traffic Noise and Construction Noise. If traffic noise impacts occur, noise abatement options may need to be examined. A table on noise abatement criteria by land use is provided in the Appendix.

One of the first steps is to identify sensitive noise receptors within the study area, such as churches, schools, hospitals, residences, etc. typically located within 500 feet (although this distance may vary) of the I-235 centerline. Much of the study area is developed; yet no churches, schools, or hospitals are located within 500 feet of the existing I-235 centerline. However, nearly 190 residences are located within 500 feet of the existing I-235 centerline. It should be noted that an assisted care living facility, Sandpiper Bay Health and Retirement, is also located within 500 feet of the existing I-235 centerline, but just north of the study area boundary.

Transportation

The analysis of transportation conditions usually consists of a before-after scenario analysis. The performance of existing conditions is compared to that of future conditions. An operational analysis is performed to identify existing deficiencies for the freeway facilities as well as along the arterials. A transportation network consists of all the identified freeways or arterials, with interchanges and intersections for this project study area. Travel speeds, intersection control and turning movement traffic volumes are provided as inputs to the networks. Separate transportation networks are constructed for existing and projected conditions. They are analyzed for AM and PM peak hours of a typical weekday. The outputs of the operational analyses of these networks will determine future deficiencies for no-build conditions and later in the study assist in the development of various design concepts.

The safety analysis provides an overview of the type and location of crashes during a three year period within the study area, as well as a comparison of actual accident rates to critical statewide accident rates for similar facilities.

Transportation Network

The transportation network essentially includes the freeway system and the next adjacent and parallel arterial network. This includes:

- I-235 from K-42 to Zoo Boulevard
- US-54/400 (Kellogg Ave.) from Ridge Road to West Street
- Zoo Boulevard from Windmill to West Street
- Central Avenue from Ridge Road to West Street
- K-42 from Hoover Road to West Street
- West Street at Harry, Taft and Maple

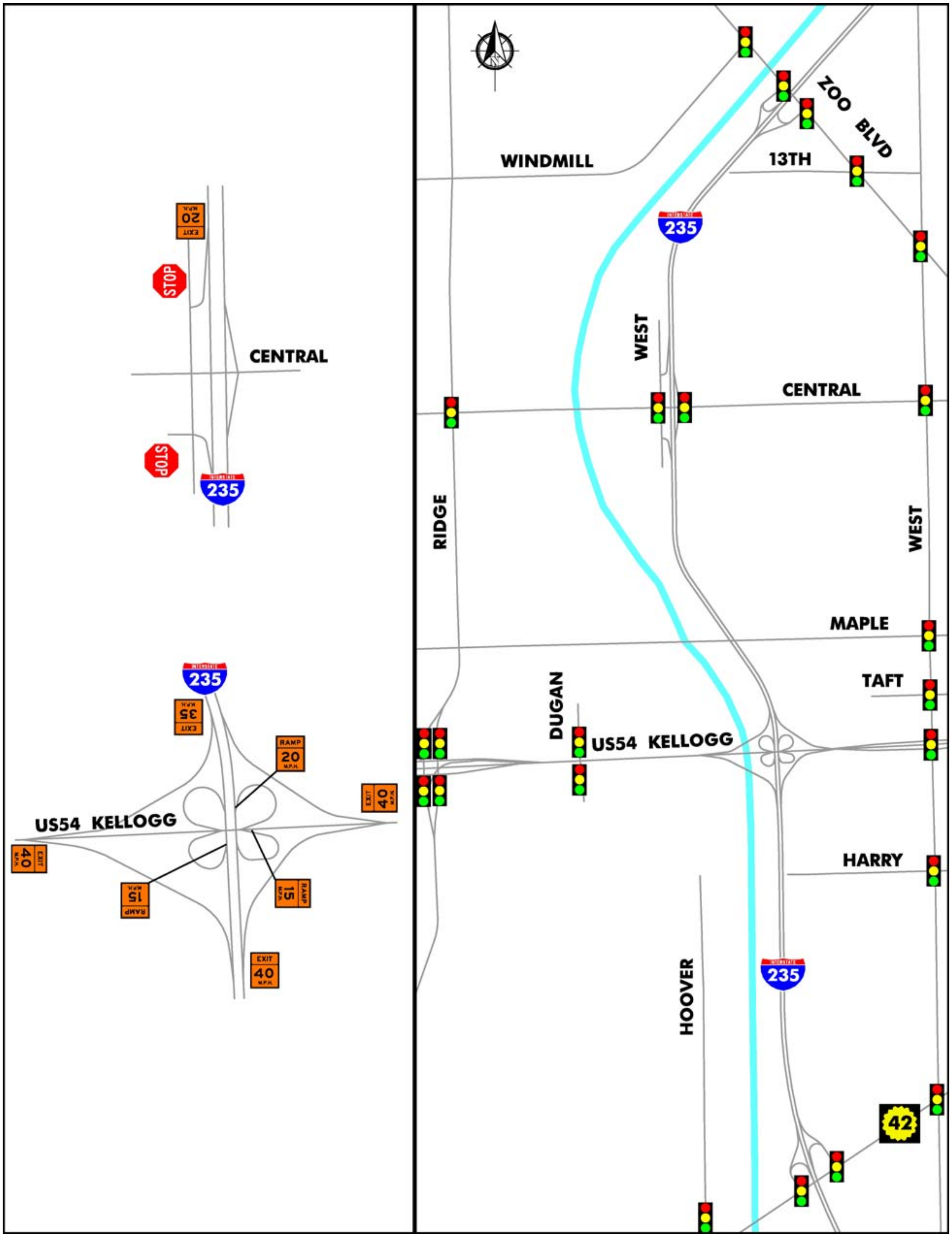
Traffic Control and Signing

Because much of the transportation network under investigation is the highway and its junctions with arterial streets, the predominant traffic exchanges are through interchanges. When an interchange is a “service” interchange, the junction of the highways’ ramps with the arterial street is often controlled by traffic signals. Similarly, the junction of an arterial with another arterial is often controlled by traffic signals. This is the case at the interchange ramps for Zoo Blvd., Central Ave. and K-42. When other side streets intersect the arterial, these junctions are often under stop control. Exhibit 3.21 shows the location of the type of traffic control at the highway’s ramps as well as traffic signals along the arterial street system in the influence area. It is at these junctions that peak hour capacity analysis has been conducted. Selected signing is also shown with a focus upon warning signs associated with speed advisories.

Traffic Volumes

Summary information on daily traffic volumes along I-235 and US-54/400 (Kellogg Ave.) from permanent count stations within the study area were provided in the previous chapter. Daily traffic volumes were recorded at various locations throughout the study and influence area, yet the key to conducting traffic operations is utilizing the peak hour volumes for both the AM and PM peak hours. Comparison of these peak hour traffic volumes to the 30th highest hour (typically the design hour for a highway) finds that the PM peak hour approximates the 30th highest hour. The analysis of design hour traffic volumes is necessary for review by the Federal Highway Administration (FHWA). Nonetheless because the traffic

Exhibit 3.21 – Existing Traffic Control and Signing



patterns differ substantially between the AM and PM peak hours, both sets of analyses were performed for existing and projected conditions.

The freeway and ramp traffic data was collected by KDOT in October 2005 and January 2006. Turning movement traffic counts during AM and PM peak hours were conducted in January 2006 by TranSystems and sub-consultants. The peak hour weaving traffic information on US-54/400 near from West Street I-235 interchange and from I-235 and Dugan Street were collected by TranSystems in January 2006.

Existing Peak Hour Traffic Volumes

24 hour volumes are applicable to mainline sections, yet the key to understanding patterns and evaluating capacity is with the AM and PM peak hour flows. These hourly patterns are discussed south to north along I-235, starting from the junction of K-42 moving through the study area and ending at Zoo Boulevard. Refer to Exhibit 3.22a and 3.22b for the Existing AM and PM Peak Hour Traffic Volume maps respectively in the study area. A discussion of capacity issues associated with the traffic volumes is discussed in the next section.

<u>AM Peak Hour</u>

I-235 at the junction of K-42 - South of this interchange, the predominant traffic flow is northbound on I-235 (1,750/1,350 – N/S) yet north of this interchange the pattern reverses and becomes predominantly southbound (1,900/2,150 – N/S). A sizable percentage (900/2135) of traffic exits southbound onto K-42. The heaviest traffic on K-42 in the AM peak period is west of I-235.

I-235 at the junction of US-54/400 (Kellogg Ave.) - Of the eight ramps at this interchange, the heaviest traveled ramp is the I-235 S to US-54 E loop ramp with nearly 1,200 vph. Two other ramps (US-54 E to I-235 S, and I-235 S to US-54 W) are greater than 500 vph. Traffic along I-235 has a higher southbound directional factor (3,500/1,750 – N/S). Traffic along US-54/400 (Kellogg Ave.) is slightly heavier west of I-235 (7,000/7,300 – W/E). A sizeable portion of eastbound traffic exits US-54 to West Street at 975 vph. The heaviest ramp traffic at the Dugan Road interchange is the westbound off-ramp at 500 vph.

I-235 at the junction of Central Avenue - At this interchange, the southbound and northbound on-ramps are nearly equal at 600 and 550 vph respectively. Traffic along I-235 north of this interchange is predominantly southbound (1,850/2,750 – N/S). The heaviest traffic on Central Avenue in the AM peak period is west of I-235.

I-235 at the junction of Zoo Boulevard - The southbound on-ramp is the most heavily traveled with nearly 1,000 vehicles in the peak hour and the predominant flow is from the west (3,500/2,000 – W/E). North of this interchange along I-235, southbound traffic is slightly heavier (1,900/2,100 – N/S).

<u>PM Peak Hour</u>

I-235 at the junction of K-42 - South of this interchange, the predominant traffic flow is southbound on I-235 yet north of this interchange the pattern reverses and becomes predominantly northbound (2,200/1,900 – N/S), in part due to heavy northbound left turns entering from K-42. The heaviest traffic on K-42 in the PM peak period is west of I-235.

I-235 at the junction of US-54/400 (Kellogg Ave.) - Of the eight ramps at this interchange, the heaviest traveled ramp is the US-54 W to I-235 N ramp with over 1,200 vph. This traffic added to I-235 NB makes the north bound directional factor significantly greater (3,000/1,950 – N/S). The next heaviest ramp for traffic volumes is US-54 E to I-235 S at 700 vph. Traffic along US-54/400 (Kellogg Ave.) is very balanced east and west of I-235. All of the ramps at the West Street and Dugan Road interchanges exceed 500 vehicles in the peak hour. The heaviest ramp is the West Street westbound on-ramp at 1,050 vph. The Dugan Road off-ramp at 880 vph only exceeds the on-ramp (850 vph) by a few vehicles.

Exhibit 3.22a – Existing 2006 Traffic Volume Map – AM Peak Hour

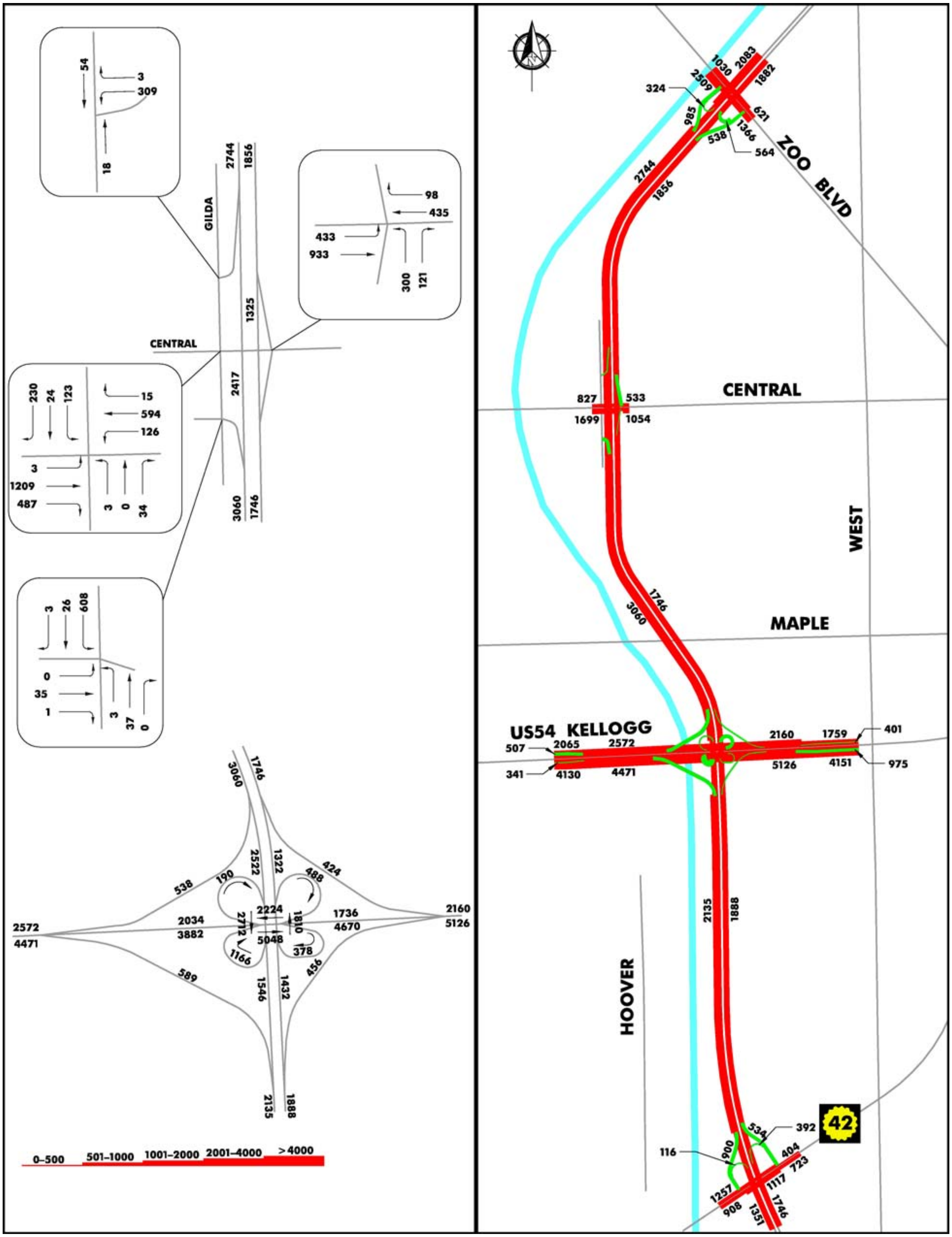
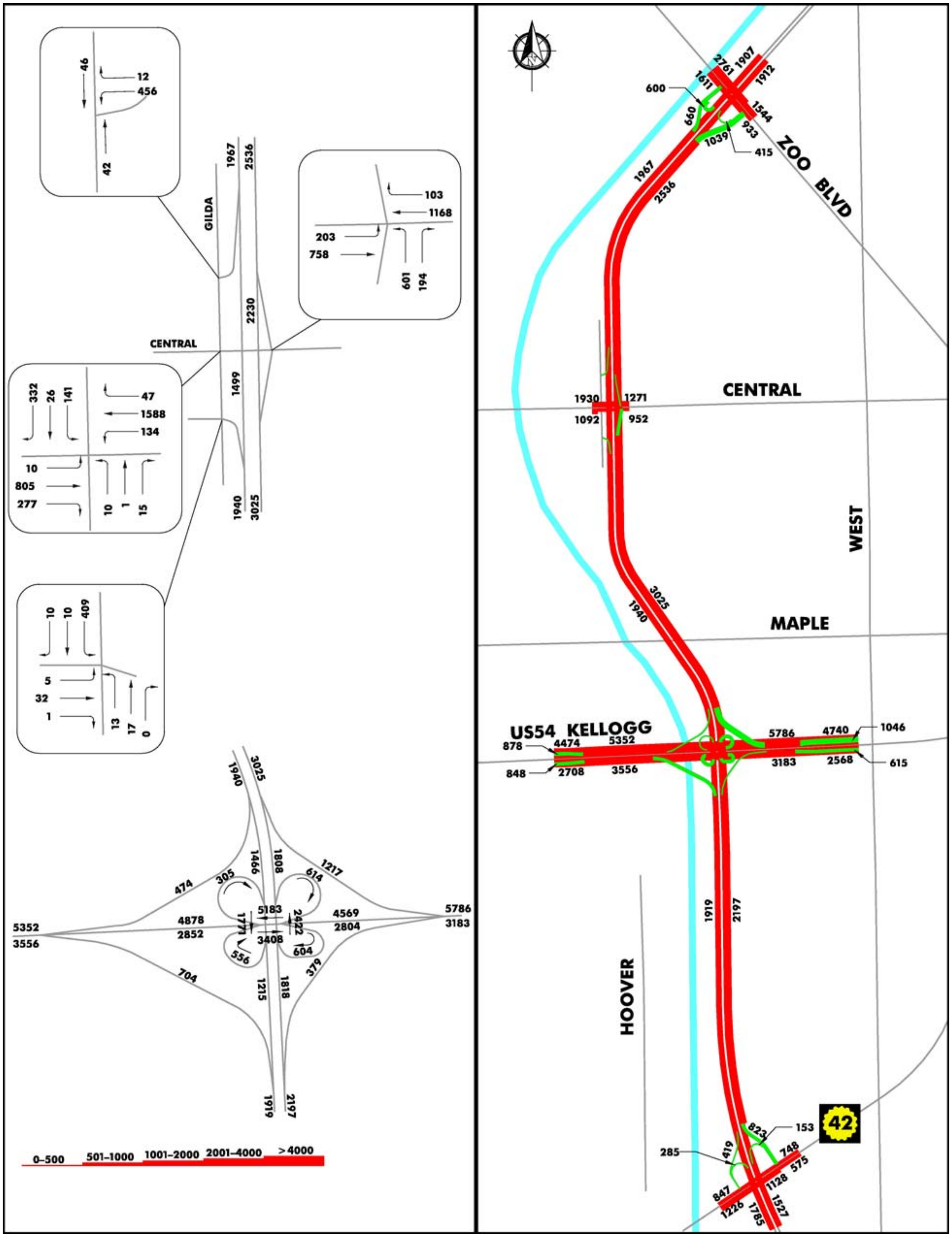


Exhibit 3.22b – Existing 2006 Traffic Volume Map – PM Peak Hour



I-235 at the junction of Central Avenue - At this interchange, the northbound off-ramp is the most heavily traveled with nearly 800 vehicles in the peak hour. The predominant turning movement is the northbound left heading westerly. Traffic along I-235 north of this interchange is predominantly northbound (2,500/2,1000 – N/S). The heaviest traffic on Central Avenue in the PM peak period is west of I-235.

I-235 at the junction of Zoo Boulevard - Here again, the northbound off-ramp is the most heavily traveled with nearly 1,000 vehicles in the peak hour and the predominant movement is to the west (4,300/2,500 – W/E). North of this interchange, traffic flows on I-235 are equally balanced.

Capacity Analysis

This section focuses on the transportation operations in terms of the existing network capacity. With a varied network, several different types of capacity analyses have been performed as well as using differing analysis methods and software programs to calculate the level of service results. In the following paragraphs, the results of the capacity analyses within the study area and then the surrounding influence area are summarized.

Level of Service Criteria

The operating conditions for freeways and roadway intersections are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. The measures of performance for LOS determination are different for freeways and intersections. For any analysis in general, LOS A represents the condition with free-flow movement of traffic with minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D and E reflect incremental changes in the performance measure. KDOT attempts to design projects in urban areas for LOS D.

The *Highway Capacity Manual* (HCM), *2000 Edition* published by the Transportation Research Board, assigns level of service for freeway segments based on the density of traffic in passenger cars per mile per lane (cars/mile/lane). Average delay per stopped vehicle (seconds/vehicle) is used as the performance measure to determines level of service for arterial intersections.

Highway Segments, Ramp and Weave sections

All ramp junctions on a freeway can be categorized as a merge area (on-ramp) or a diverge area (off-ramp). Weaving is defined as the crossing of two or more traffic streams traveling in the same general direction along a significant length of highway. Weaving segments are formed when a merge area (on-ramp) is closely followed by a diverge area (off-ramp) and the two are joined by an auxiliary lane. The freeway segment analysis considers that basic segment of freeway that is outside of the influence area of ramps or weaving areas on the freeway.

In order to evaluate the operation of freeway segments, freeway ramp merge areas and weave sections, two separate analyses were performed. One, using the Highway Capacity Manual methods and another from a simulation model using VISSIM software package. The LOS criteria assigned by the Highway Capacity Manual, as shown in Exhibit 3.23, were used for both analysis methods.

For the VISSIM analysis, the results are summarized in greater detail using graphs. Using VISSIM, density was measured in 100-foot segments along the freeways. Freeway density values obtained from the VISSIM model varied as compared to the analyses computed using HCM. HCM uses an empirical formula based on input data. Based on arrival rate, volume, truck percentage, interchange spacing and other parameters, HCM computes a density for the freeway segment. These HCM calculations are based on data collected in the field. VISSIM is a micro-simulation tool, rather than a capacity operations tool; thus, the density values are arrived at in a different manner. VISSIM measures the density experienced on the segments in the model over set periods of time. The VISSIM results include the impact of upstream and downstream roadway components in a more realistic fashion. If an upstream portion of the freeway constrains traffic, then the total volume destined for the freeway segment being measured will be less. Contrarily, if a freeway segment downstream restricts traffic to the point of slowing traffic in the freeway segment being measured, the density measured will be higher. Other differences between the two values can be attributed to arrival rates. HCM assumes a peak hour factor which fixes the peak entering flow; while VISSIM uses a random seed methodology which directs the rate at which traffic enters the network. Additionally, HCM's freeway segment module does not account for the impact of signalized ramp intersections. These ramp intersections can cause traffic to queue onto the freeway at exit ramp locations or enter the freeway in platoons at entrance ramp locations.

Exhibit 3.23 – HCM Level of Service Thresholds

Level of Service (LOS)	**Basic Freeway Segment**	**Freeway Merge and Diverge Areas**	**Freeway Weave Sections**	**Signalized Intersection**	**Unsignalized Intersection**
	Density (veh/mi/ln)	Density (veh/mi/ln)	Density (veh/mi/ln)	Control Delay (sec/veh)	Control Delay (sec/veh)
A	< 11	≤10	≤10	< 10	<10
B	11 – 18	10 – 20	10 – 20	10 – 20	<15
C	18 – 26	20 – 28	20 – 28	20 – 35	<25
D	26 – 35	28 – 35	28 – 35	35 – 55	<35
E	35 – 45	> 35	35 – 43	55 – 80	<50
F	> 45	Demand Exceeds Capacity	> 43	≥ 80	≥ 50

Ramp Terminals and Arterial Intersections

Intersections at the ramp terminals in the study area and arterial intersections in the influence area were evaluated based on the methodologies outlined in the HCM. The level of service at each intersection is based on average delay per stopped vehicle. The thresholds show the upper limit of delay associated with level of service for signalized and unsignalized intersections.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. At unsignalized intersections LOS E and F is often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location has been deemed undesirable for signalization for other reasons, e.g., the close proximity of an existing traffic signal or the presence of a convenient alternative path. For signalized intersections, level of service and average delay relate to all vehicles using the intersection. The arterial intersections were evaluated with Synchro simulation analysis package using the Highway Capacity Manual Outputs. The LOS rating deemed acceptable by KDOT for freeway analysis is C or higher.

WAMPO Travel Demand Model

For the purpose of forecasting future year (2030) traffic volumes in the study area, WAMPO’s Travel Demand Model (TDM) was used. A TDM is a tool used to estimate future growth of traffic in a study area. These growth estimates are later used to assess the impacts of future growth on the existing transportation systems and identify necessary future improvements.

The TDM includes projects currently included in WAMPO’s Long Range Transportation Plan (LRTP), including Big Ditch crossings at 13th Street and 25th/29th Street as well as the proposed Northwest Bypass. The model output overestimates existing east-west traffic in the study area, with overall traffic volumes approximately 10 percent higher than actual (2002 model vs. 2003 existing), while overestimating existing volumes on US-54/400 (Kellogg Ave.), K-42 and Zoo Boulevard by almost 20 percent. For north-south traffic, the existing conditions model closely reflects actual traffic volumes.

Simulation Models
The study area and influence area transportation network were built in VISSIM and Synchro software programs. VISSIM is a micro-simulation tool that simulates traffic flow through the network and collects and summarizes operational information. Synchro is an intersection based capacity analysis software tool. VISSIM was used to analyze highways and Synchro was used for arterial operations. Two separate simulation models were developed for existing and projected conditions using both the software programs for both peak hours.

The VISSIM model for existing and projected conditions includes the following interchanges:
- I-235 and W. Zoo Boulevard
- I-235 and W. Central Avenue
- I-235 and K-42
- I-235 and US-54/400 (Kellogg Ave.)
- US-54/400 and S. Ridge Road
- US-54/400 and S. Dugan Road
- US-54/400 and S. West Street

Additionally, numerous at-grade intersections were also included in the VISSIM model to realistically simulate flow entering and exiting the freeways, but were not used to analyze intersection operation. In all, over two dozen intersections were included in the model. The intersection of W. Zoo Boulevard and W. Windmill Road was included in the existing year model; however, it was removed from the future year models as the simulations implied that improvements unrelated to this project will need to be made at this location. Without the localized improvements, queuing was observed with spill back in to the study area.

Most of the default values for variables in the model were maintained; however, a couple of parameters were initially changed to better represent driver behavior. The default values for desired speed ranges and the accepted deceleration for the trailing vehicle with regards to lane change maneuvers were changed.

In order to add validity to the model, the existing year model was calibrated to match current operations. Video was recorded at several key locations throughout the study area. In addition, observers noted queue lengths along W. Central Avenue. This information was used to adjust signal timings, reduced speed zones, and "look ahead" distances in order to create similar results. These changes were maintained in all future models, thus providing for continuation of the calibration.

The Synchro model includes signalized and unsignalized intersections along the following arterials as well as their interchange junctions:
- W. Zoo Boulevard
- Central Avenue
- K-42
- S. Ridge Road
- S. Dugan Road
- S. West Street

Highway Segments, Ramp and Weave Sections

<u>US-54/400 (Kellogg Ave.) Eastbound</u>

The existing traffic volumes on US-54/400 Eastbound entering the study area (west of W Ridge Road exit ramp) and exiting the study area (east of West Street entrance ramp) are approximately 3,900 vph and 4,630 vph in the AM peak hour. In the PM peak hour, the volumes at the same locations are approximately 2,200 vph and 3,360 vph.

The AM peak hour analysis indicates LOS D through the weaving area near I-235 interchange. The density per mile is higher because the length of the weaving section (less than 500 feet) is insufficient to handle the weaving operation. All other segments perform acceptably at LOS C or B along the highway. The PM peak hour analysis indicates no problem areas along US-54/400 (Kellogg Ave.) eastbound. During PM peak hour, congestion occurs in the opposite direction of the highway.

US-54/400 (Kellogg Ave.) Westbound
The existing traffic volumes on US-54/400 Westbound entering the study area (east of West Street exit ramp) and exiting the study area (west of W Ridge Road entrance ramp) are approximately 2,380 vph and 1,590 vph in the AM peak hour. In the PM peak hour, the volumes at the same locations are approximately 5,550 vph and 4,270 vph.

The AM peak hour capacity analysis indicates that all the sections of the highway operate at acceptable LOS. During the PM peak hour, at several sections along the highway, the LOS jumps to. D. At the freeway section between West Street exit ramp and east of the Dugan Street entrance ramp, the traffic volumes are nearly 1,800 vehicles per hour per lane (vphpl) which implies that the section is operating over capacity.

I-235 Northbound
The existing traffic volumes on I-235 Northbound entering the study area (south of K-42 exit ramp) and exiting the study area (north of Zoo Boulevard entrance ramp) are approximately 1750 vph and 1,890 vph in the AM peak hour. In the PM peak hour, the volumes at the same locations are approximately 1,530 vph and 1,910 vph.

The AM peak hour capacity analysis indicates that all the sections of the highway operate predominantly at LOS B. The section near the US-54/400 interchange operates at LOS C. In general, during the PM peak hour, the northbound direction of I-235 freeway experiences queuing due to heavy traffic volumes and consequent spillbacks from the adjacent ramp intersections. The weaving section between the US-54/400 loops operates at LOS D. The freeway section between US-54/400 Westbound entrance ramp and Central Ave. Exit ramp fails with LOS F. The simulation indicates that the queuing is partly due to the ramp operations at Central Ave. This results in essentially only one operating through lane on I-235 posing capacity restraints to the northbound traffic on I-235.

I-235 Southbound
The existing traffic volumes on I-235 Southbound entering the study area (north of Zoo Boulevard exit ramp) and exiting the study area (south of K-42 entrance ramp) are approximately 2,080 vph and 1,350 vph in the AM peak hour. In the PM peak hour, the volumes at the same locations are approximately 1,910 vph and 1,790 vph.

During the AM peak hour, the analysis indicates LOS C predominantly at all sections except between Central Avenue entrance ramp and US-54/400 Westbound exit ramp, which operates at LOS D. The LOS D in this section is due to high traffic volumes in the range of 3000 vehicles per hour (vph) or 1500 vphpl which pushes the two-lane capacity on I-235 southbound. The weaving section at US-54/400 performs acceptably during AM peak hour in the southbound direction. The PM peak hour traffic experiences little congestion and operates acceptably on the freeway sections.

The LOS indicated by the VISSIM analyses for various segments are shown on Exhibits 3.24. The LOS calculated using the HCM methodology for basic freeway segments, merge and diverge areas and weaving sections is shown in Exhibits 3.25a and b. The freeway analysis results from the VISSIM model for existing conditions are provided in an Appendix.

Exhibit 3.24 – Existing 2006 AM and PM Segment Analysis – VISSIM LOS

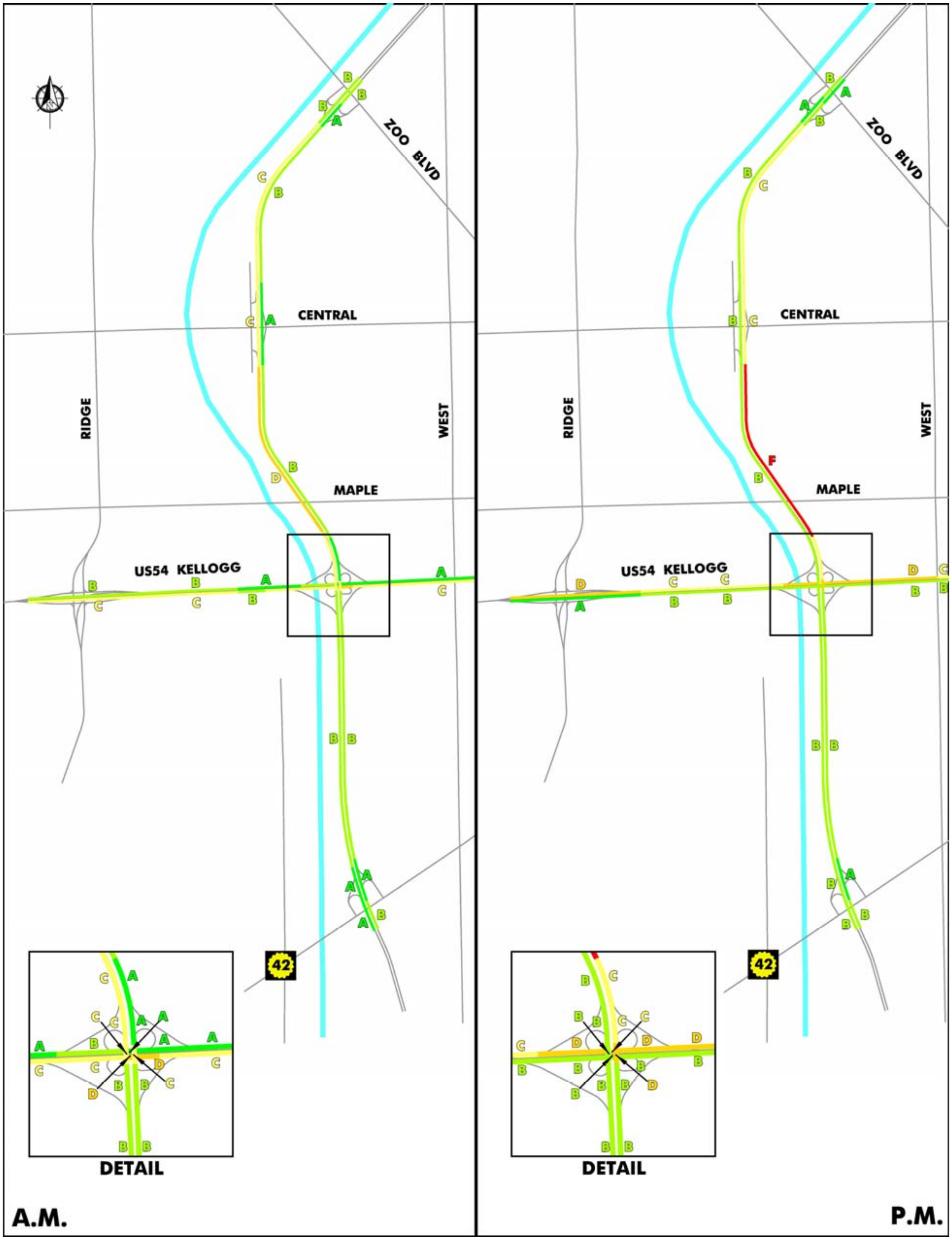


Exhibit 3.25 – Existing 2006 AM and PM Segment Analysis

Interstate 235

SEGMENT		AM DENSITY VISSIM	AM DENSITY HCM	AM LOS HCM	PM DENSITY VISSIM	PM DENSITY HCM	PM LOS HCM
I-235 Southbound		*Approx.*			*Approx.*		
Zoo Off Ramp	Diverge	*18*	19.7	B	*17*	15.3	B
Zoo On Ramp	Merge	*16*	25.7	C	*10*	19	B
Zoo to Central	Basic	*23*	22.5	C	*16*	16	B
Central Off Ramp	Diverge	*10*	25.2	C	*8*	16.2	B
Central On Ramp	Merge	*18*	28.3	D	*11*	18.5	B
Central to US-54	Basic	*29*	25.5	C	*17*	15.8	B
US-54 Off Ramp	Diverge	*32*	26.8	C	*19*	16.5	B
US-54 Loops	Weave	*23*	29.2	C	*13*	16	B
US-54 On Ramp	Merge	*13*	20.7	C	*13*	18.7	B
US-54 to K-42	Basic	*17*	17.4	B	*17*	15.6	B
K-42 Off Ramp	Diverge	*16*	14.8	B	*17*	17.3	B
K-42 On Ramp	Merge	*8*	18	B	*10*	19	B
I-235 Northbound							
K-42 Off Ramp	Diverge	*18*	16.1	B	*14*	16.3	B
K-42 On Ramp	Merge	*10*	18.6	B	*12*	21.1	C
K-42 to US-54	Basic	*15*	15.4	B	*18*	17.9	B
US-54 Off Ramp	Diverge	*16*	16.1	B	*16*	19.9	B
US-54 Loops	Weave	*19*	16.4	B	*29*	25	C
US-54 On Ramp	Merge	*9*	16.4	B	*30*	27.3	C
US-54 to Central	**Basic**	*14*	14.2	B	***37***	25.1	C
Central Off Ramp	**Diverge**	*9*	9.5	A	***>70***	18.3	B
Central On Ramp	Merge	*10*	18	B	*15*	24.2	C
Central to Zoo	Basic	*15*	15.1	B	*21*	20.7	C
Zoo Off Ramp	Diverge	*9*	15.2	B	*29*	17	B
Zoo On Ramp	Merge		16.7	B		17.1	B

US-54/400 (Kellogg Ave.)

SEGMENT		AM DENSITY VISSIM	AM DENSITY HCM	AM LOS HCM	PM DENSITY VISSIM	PM DENSITY HCM	PM LOS HCM
US-54/400 Eastbound		*Approx.*			*Approx.*		
Ridge to Dugan	Basic	*23*	23.7	C	*17*	15.5	B
Dugan to I-235	Weave	*18*	22.9	B	*17*	18.2	B
EB-SB Ramp to Loops	Basic	*21*	22.3	C	*17*	16.4	B
I-235 Loops	**Weave**	*30*	**41.6**	**F**	*22*	27.5	C
Loops to NB-EB Ramp	Basic	*27*	27.1	D	*17*	16.1	B
I-235 to West Street	Weave	*22*	34.5	D	*14*	18.8	B
Btw. West St. Ramps	Basic	*23*	23.8	C	*15*	14.7	B
West Street On Ramp	Merge		27.1	C		21.5	C
West Street to K-42	Basic						
US-54/400 Westbound							
K-42 to West Street	Basic						
West Street Off Ramp	Diverge	*10*	12.3	B	*24*	28.8	D
Btw. West St. Ramps	Basic	*10*	10.1	A	*28*	27.5	D
West Street to I-235	**Weave**	*9*	11.4	A	*27*	**41.6**	**F**
WB-NB Ramp to Loops	Basic	*10*	10	A	*27*	26.4	D
I-235 Loops	**Weave**	*10*	14.8	B	*24*	**38.0**	**E**
Loops to SB-WB Ramps	Basic	*11*	11.7	B	*28*	28.5	D
I-235 to Dugan	Weave	*11*	12.3	B	*22*	28.5	C
Dugan to Ridge	Basic	*11*	11.8	B	*24*	25.8	C

Ramp Terminals and Arterial Intersections

The ramp terminals mentioned previously were analyzed for capacity using HCM methodology during both AM and PM peak hours. The existing traffic volumes and existing lane configurations were used. Exhibit 3.26 shows the results of the capacity analysis for signalized ramp terminals as well as arterial signalized intersections.

The interchange at Central Avenue is referred to as a "3-point diamond" because of its basic diamond shape and the 3-points for the ramp junctions (in this case SB off-ramp with Gilda Street, and the SB on-ramp with Gilda Street). At the unsignalized intersection of Gilda and I-235 SB off-ramp, the ramp operates at LOS B during both the AM and PM peak hours. The unsignalized intersection of Newell Street and the SB on-ramp, Newell Street approach operates at LOS D and LOS F during AM and PM peak hours respectively. However, the traffic exiting Newell Street is less than 50 vehicles per hour. A fourth junction also plays an important role, that being the signalized intersection of Gilda and Central. During the AM and PM peak hours the two signalized intersections along Central Avenue operate at LOS C or better, although the queues are extensive. Long delays at the ramp terminals were observed and detailed traffic signal analysis indicates that the delays are caused due to long cycle lengths (approximately 200 seconds) and phasing issues.

The analyses of the existing traffic volumes indicate that all the ramp terminals on US-54 and K-42 operate acceptably with LOS C or better. On Zoo Boulevard, the intersection at I-235 Northbound ramps operates poorly with an LOS E during the PM peak hour. The heavy exiting traffic from the ramps causes the intersection to reach capacity.

Arterial Junctions

<u>Signalized Intersections</u>

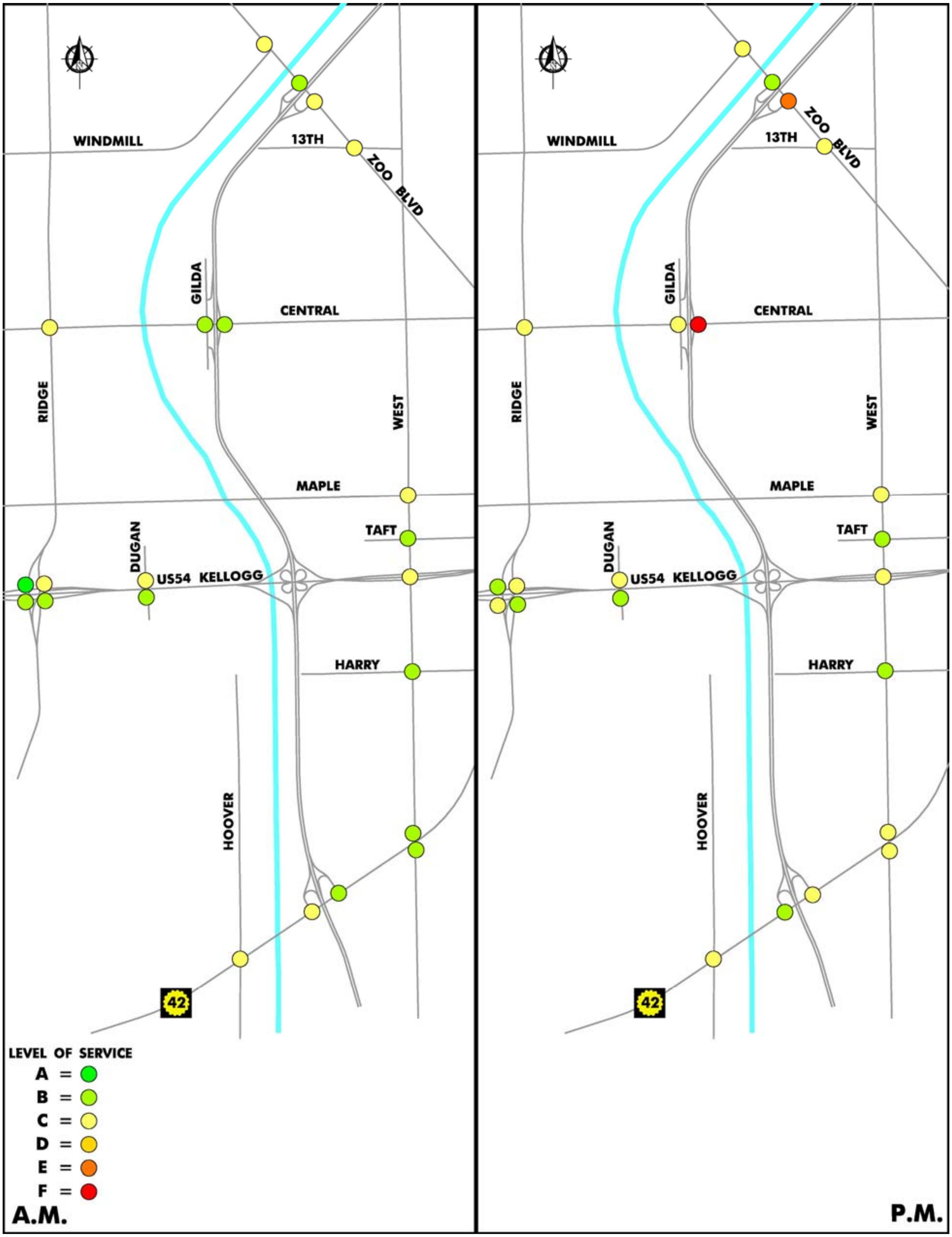
Approximately half of the signalized intersections studied are at the interchange ramps with an arterial and the other half are arterial to arterial junctions. During both the AM and PM peak periods the majority of operations are at a LOS C or better. During the PM peak hour, the worst level of service is LOS E at the intersection of Zoo Boulevard and I-235 Northbound ramps. As mentioned above, the intersection on Central Avenue at I-235 Northbound ramps operates poorly with LOS F in the PM peak hour. All other signalized intersections operate at acceptable levels of service.

<u>Unsignalized Intersections</u>

The primary set of unsignalized intersections considered critical enough to conduct capacity analysis is along Central Avenue. Four unsignalized intersections were evaluated, two west of I-235 at the intersections with Boyd Avenue and Eisenhower Street, and two east of I-235 at the intersections of Hoover Road and Flora Street.

During the AM peak hour, the worst operation occurs in the southbound direction at Eisenhower at LOS E. LOS D occurs for the southbound direction at Boyd Avenue and for the northbound direction at both Hoover Road and Flora Street. During the PM peak hour, the pattern essentially remains the same although conditions are worse. The worst operation, now a LOS F, occurs in the southbound direction at Boyd Avenue and in the northbound and southbound direction at Eisenhower Street. LOS F also occurs for the northbound direction at both Hoover Road and Flora Street. These operations are strongly influenced by the heavy traffic on Central Avenue. However, the traffic on these side streets and the number of vehicles making eastbound or westbound turns to these side streets is very low, approximately fifty or fewer vehicles. Low left-turn volumes were observed to be because of the majority in the traffic stream avoid left-turning movements and turn right or reroute through a signalized intersection.

Exhibit 3.26 – Existing 2006 AM and PM Signalized Intersection Analysis



Accident Data Review

Crash Data

A total of 545 accidents were reported over a three year period (2002 to 2004) within the study area. Three fatal accidents were recorded during this period. Injury accidents account for approximately 30% of all accidents, which is slightly higher than the 23.6% injury percentage for statewide 4 or 6 lane divided highways with full access control in urban areas for the same period. 67 of the accidents were recorded on Central Avenue. The injury percentage for Central Avenue is just under 27%.

The majority of accidents in the study area occurred at the junction of I-235 and US-54/400 (Kellogg Ave.). When combined, the interchange accidents at this location account for 88% of all highway accidents (excluding Central Avenue). When reviewed by highway (I-235 versus US-54/400 (Kellogg Ave.)) the percentages vary, yet only slightly as the interchange remains the location for the majority of accidents. Along I-235 the interchanges of Central and US-54/400 (Kellogg Ave.) account 59% of the total accidents. The US-54/400 (Kellogg Ave.) interchange accounts for the majority or 77% of the interchange accidents. Along US-54/400 (Kellogg Ave.), the I-235 interchange accounts for 72% of all accidents in the study area. Exhibit 3.27 shows a scatter plot of Property Damage Only (PDO) in blue and injury accidents in red at the I-235 interchanges with US-54/400 (Kellogg Ave.) and Central Avenue.

The purpose of reviewing three years of data is to account for fluctuations in data, many of which cannot be directly or reasonably explained. When reviewing the distribution of annual accidents on I-235, the pattern remains relatively consistent with a three year average of 92.3, a minimum of 81, and a maximum of 99 accidents in a year. The same consistency is true along Central Avenue with a three year average of 22.3, a minimum of 22, and a maximum of 23. Yet along US-54/400 (Kellogg Ave.), the year of 2004 saw a tremendous rise in the number of accidents with a three year average of 67.0, a minimum of 40, and a maximum of 107. When further breaking down the segments of the accidents, it is apparent that the weaving sections experienced a significant change in the reporting of accidents between West Street and I-235 and between Dugan Road and I-235.

A review of the type of accidents indicates that the majority of accidents are with other vehicles, ranging from 56% along I-235, to 78% along US-54/400 (Kellogg Ave.), and just over 95% on Central Avenue. The category “other vehicle” is further divided into angle, rear end, sideswipe, etc. On the highways, rear ends account for the majority of other vehicle accidents (63% on I-235 and 71% on US-54/400 (Kellogg Ave.)). This percentage is consistent with the statewide percentage of 67%. On Central Avenue, angle accidents occurred more frequently than rear end accidents (47% versus 42% respectively). Overall, the second most prevalent type of accident was with fixed objects. The “fixed object” category is further divided into bridge railings, ditch, guardrail, utility pole, etc. Along I-235, the most frequently struck object was utility pole at 35% followed closely by guardrail at 26%. Along US-54/400 (Kellogg Ave.), the most frequently struck object was median barrier at 46% followed by guardrail at 16%. Statewide percentages for similar facilities and fixed object accidents indicate median barrier at 34% and guardrail at 19% as the first and second most frequently struck objects.

Review of the contributing factors to the number of accidents indicates that overall improper attention (22.1%) is first, with Followed Too Closely (FTC) at 20.6% being second. The third most prevalent type was “none” at 13.3%, which means no cause was listed. The top five contributing factors account for over 76% of all accidents. Improper attention is listed as the number one contributing circumstance whether for similar statewide facilities (24%) or for all statewide facilities (37%).

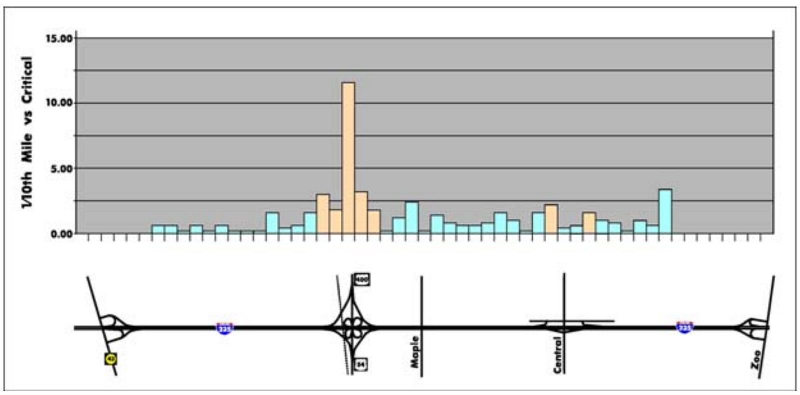
Further review of these contributing factors was conducted by location and by severity. Along I-235, improper attention was cited as the number one contributing factor for both PDO (Property Damage Only) and for injury accidents. The second most common contributing factor was follow too closely. Along US-54/400 (Kellogg Ave.), the order reverses. Along Central, FTY (Failure to Yield) was the most common contributing factor for PDO accidents followed closely by improper attention and follow too closely. Improper attention was the number one contributing factor for injury accidents. The ranking of these contributing circumstances are consistent with statewide percentages for similar facilities.

Exhibit 3.27 – Accident Scatter Plot Maps

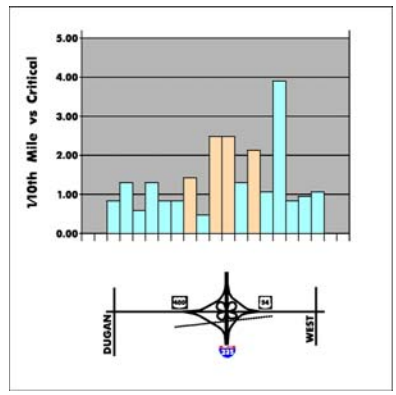
In review of the total length of the highway segments under study, I-235 (at a length of 4.4 miles) has a rate less than the critical statewide rate (1.20 versus 1.38 per million vehicle miles (MVM)). However, US-54/400 (at a length of 1.5 miles) has a higher rate than the critical statewide rate (1.70 vs 0.84 MVM). When the accidents were reviewed at a finer length of segment, specifically at every 1/10th mile, a pattern emerges identifying the I-235 and Kellogg interchange as a location that exceeds the critical statewide rate. Exhibit 3.28 illustrates the rates at the ramp junctions and how they vary by location. Note the weaving sections between the loop ramps along both I-235 and along US-54/400 (Kellogg Ave.).

Review of the increase in accidents in 2004 would indicate the segments with the most significant increase to be along US-54/400 (Kellogg Ave.) immediately east and west of the Kellogg interchange. These segments were further reviewed to test if changes in the type, severity or contributing factors of the accidents occurred. While accidents dropped from 38 accidents in 2002 to 24 accidents in 2003, accidents increased significantly in 2004 to a total of 81accidents. The majority of the accidents remain PDO, ranging between 71% and 85% as well as with other vehicles, ranging form 68% to 96%. The most common type of accident remains rear end, yet the percentage has steadily increased form 42% to 77% in the three year period. The most common contributing factor has changed over the years from a near 50% of improper attention to 43% following too closely. Improper attention is the second most prevalent at 26%.

Exhibit 3.28 – Accident Rates (at 1/10th mile increments)



Interstate 235



US-54/400 (Kellogg)

Review of a longer accident history period for ten years (from 1996 through 2005) indicates that accidents along US-54/400 (Kellogg Ave.) took a substantial jump in the year 2004 but have returned to a below average level for the year 2005. Along I-235, the review of the ten year period would indicate a downward trend in the overall number of accidents. Refer to Exhibit 3.29 for charts of the total accidents by facility by accident type over a ten year period

Exhibit 3.29 – Accidents 1996-2005