I-380 Planning Study

INTERSTATE 380

PLANNING STUDY (PEL)

Existing Conditions and Operations

Office of Location and Environment | May 2018

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1. EXECUTIVE SUMMARY

The Iowa Department of Transportation (DOT) is preparing the planning study for Interstate 380 (I-380) which extends from U.S. 30 in Cedar Rapids to just north of I-80. Interstate 380 is vital to the Iowa economy – providing the infrastructure to move people and goods throughout the region. The department is conducting this study following the planning environmental linkages (PEL) model. The purpose of this planning study is to determine whether the current infrastructure will meet the transportation demands over the next 30 years and identify the potential infrastructure improvements necessary in the foreseeable future.

The assessments and recommendations associated with the planning study are documented in a series of technical memos. This technical memo investigates the existing conditions and operations within this portion of the I-380 corridor. The investigation of this segment of I-380 includes a review and assessment of the following:

- Existing Conditions, including;
  - Infrastructure – the current condition of the pavement and bridges;
  - Geometrics – does I-380 meet current design standards;
  - Environment – the setting (human and natural) in the immediate vicinity;
- Operations – the existing and forecasted traffic levels-of-service; and,
- Safety – the extent, type and causes of crashes.

The existing conditions assessment of operations identified current levels of service, as well as anticipated levels of service based on forecasted traffic volumes in the mid-term (2026), and longer-term (2040). The planning team identified areas of concern for crashes and the potential for infrastructure improvements to provide remedies to the causes. Additionally, the traffic operations review looked at the potential for improving traffic operations on I-380 by providing more modal choices for travelers and by managing traffic operations differently to gain efficiencies and longer life from the existing facility.

I-380 was designed and constructed in the 1970s to previous design standards. The pavement and bridges are beginning to show wear. The pavement was resurfaced in 2008 to improve its condition and bridges in the corridor, while still considered in good condition, are approaching their original design life of 50 years. There are some factors – shoulder width, cross-slope and other aspects of horizontal design – that do not meet current acceptable design criteria. It is reasonable to assume that each of these factors would be addressed as part of any strategy or concept for improving I-380.

A goal and guiding principle of this planning study is to find cost effective ways to increase mobility. Providing safe and efficient traffic flow through the corridor, both now and in the future, is a primary concern. To better understand the existing and future traffic conditions, the planning team conducted a forecast and operations analysis. The analysis included the existing and future year conditions to identify the traffic needs within the corridor. As with other aspects of the conditions assessment, the planning team built off of previous I-380 studies when conducting the operations review.

The department's stated goal for this section of I-380 is to be able to maintain the minimum level-of-service (LOS B), on this rural segment of freeway. Growth pressures in the corridor are such, that in the future this segment will likely change to an urban designation, with a minimum LOS C. The planning team's traffic operations analysis for this segment of I-380 indicates that this threshold is already being exceeded daily along the corridor. In an existing and future no-build condition (I-380 with two lanes in each direction), the traffic operations analysis for mainline I-380 shows that:

- Today, during the AM peak hours, 3 of 12 segments analyzed already operate at LOS C;
- In the PM peak hours, that increases to 8 of 12 segments operating at LOS C;
- In less than ten years, some segments will be at or exceed LOS D; and,
- By 2040, all but one segment is expected to operate at LOS D or worse in the PM peak hours.

Current and forecasted traffic operations for freeway merging and diverging segments are operating at LOS D. The most affected segments are near the Wright Brothers Boulevard interchange. The mainline segments at Penn are also experiencing decreasing service levels.

Crashes and incidents effect traffic operations in the corridor daily. The results of the planning team's safety analysis indicate that most segments along this stretch of I-380 have a crash rate that is lower than the statewide rate for rural freeways. An exception is on the mainline interstate at the rest area between 120th Street NE and Wright Brother's Boulevard. Like crashes, non-crash incidents such as debris in the roadway or stalled vehicles negatively affect traffic operations in the corridor. In 2016, the department's Highway Helper program recorded 3,758 incidents in its I-380 service area. Incidents – which include disruptions to traffic such as crashes, work zone delays, congestion and stalled vehicles – can further diminish level-of-service in the corridor.

Over the last five years the department has looked to expand modal options in the corridor. Concurrent to this study, the department is also assessing the potential for Transportation System Management and Operation-related strategies such as ramp metering to improve traffic operations such that the life of the existing system could be lengthened and the need for future widening delayed. These efforts have resulted in the decision to implement the Interregional Express Bus (IRXB), service between Iowa City and Cedar Rapids as well as rideshare programs in partnership with the East Central Iowa Council of Governments. As an alternate to I-380, multiple past studies have looked at the feasibility of using the CRANDIC railroad to provide commuter rail service between Iowa City and Cedar Rapids. Confirming the findings of past studies, ridership forecasts show that the use of the CRANDIC railroad as a commuter rail or bus rapid transit facility on its own does not provide a reasonable alternative to I-380.

Any future improvements to I-380 must account for any potential impacts to the natural and social environment. The area in and around the Iowa River crossing contains several constraints that must be accounted for with any planned improvement. In addition to the river, there are wetlands, floodplains and Section 4(f) considerations. Any planned improvement would ideally avoid, or minimize and mitigate impacts to these resources. The I-380 corridor is the commercial spine of the study area and major transportation facility in both the Cedar Rapids and Iowa City commuter sheds. As development in the corridor grows, I-380 will continue to be leveraged to serve industrial needs in the north portion of the corridor and residential and commercial growth in the south. As development occurs adjacent to the highway, the likelihood increases that right of way displacement costs will increase with any planned improvement.

2. INTRODUCTION

The Iowa DOT is studying Interstate 380 in Iowa from U.S. 30 in Cedar Rapids to north of I-80 as part of an effort to increase mobility across the interstate system. Hereafter referred to as the "I-380 planning study", the study follows the planning environmental linkages (PEL) model. The planning study evaluates the safety, capacity, infrastructure, and other topics regarding I-380. The department is working to identify, assess, recommend and document strategies that address current and future transportation issues in the corridor study area. The I-380 planning study team is evaluating strategies through a variety of lenses including roadway capacity, infrastructure, and safety.

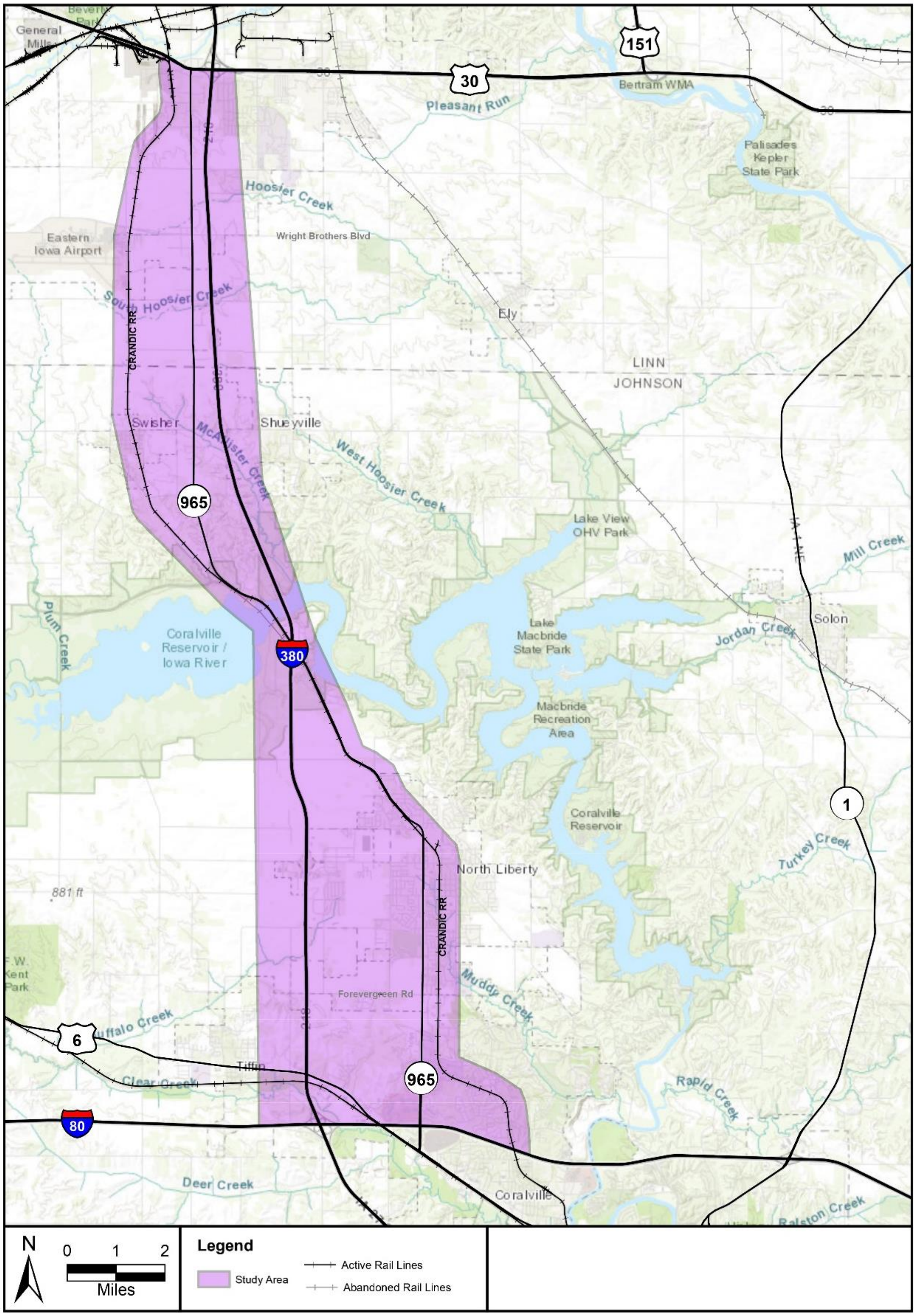
The assessments and recommendations associated with the planning study are documented in a series of technical memos. Each of these memos will be included in the overall planning study report. This technical memo presents the finding of the study team's investigation of the existing conditions and operations within this portion of the I-380 corridor. The investigation of existing conditions includes a review and assessment of the following:

- Infrastructure – the current condition of the pavement and bridges for this segment;
- Geometrics – how I-380 measures up to current design standards; and,
- Environment – the setting (human and natural) in the immediate vicinity of I-380.

The existing conditions assessment also includes an evaluation by the study team of traffic operations and safety. The traffic operations assessment examined current levels of service, as well as anticipated levels of service based on forecasted traffic volumes in the mid-term (2026), and longer-term (2040). The assessment includes an evaluation of general safety concerns and the potential for providing remedies to the causes by addressing potential geometric deficiencies or other conditions in the corridor. Lastly the operations review summarizes ongoing work in the corridor devoted to providing new modal options for travelers and managing traffic operations differently to gain efficiencies and longer life from the existing facility.

This memo concludes by documenting the current known and anticipated long-term needs in the corridor, to better identify, develop and recommend strategies to address these needs.

FIGURE 1. I-380 PLANNING AND ENVIRONMENTAL LINKAGE CORRIDOR STUDY AREA



3. EXISTING CONDITIONS

When planning for future improvements to an existing interstate, the physical, environmental and social context matters. For this study, the planning team reviewed existing conditions in the corridor that could influence the department's decision-making process on future improvements to I-380. The review focused on infrastructure, geometric conditions, as well as natural and environmental features that establish the context for assessing the benefit and impact of future improvements. The assessment built off a similar review performed several years ago as part of the I-380 Rural Feasibility Study. This previous assessment reviewed conditions of a 16-mile segment of I-380 from U.S. 6 in Coralville to 76th Avenue in Cedar Rapids. For this exercise, the planning team identified changes in the corridor that occurred since the previous review. They also reviewed as-built plans, Iowa DOT condition data and information, and aerial photography to assess the conditions and design of I-380. Where appropriate, conditions were compared to Iowa DOT design criteria for rural interstates.

Highway Infrastructure Conditions

To assess the current state of the infrastructure, the planning team utilized data and rating information provided by the Iowa DOT. This included the department's conditions index tied to geo-spatial data services for pavement and bridges. The data below is discussed in further detail and displayed in the infrastructure conditions assessment and straight-line diagrams included as **Appendix A**:

***ICE* –** The Infrastructure Condition Evaluation (ICE), tool is the department's annual evaluation on all interstate roadway segments in the State of Iowa. The ICE Rating considers factors such as pavement, bridges, traffic and safety to achieve a single condition rating for a segment of interstate. As displayed in the straight-line diagrams contained in Appendix A, the ICE rating for the I-380 segments within the planning study area are considered average for the condition of Interstates in Iowa.

***Pavement* –** Pavement conditions were evaluated utilizing the department's latest Pavement Condition Index (PCI). The PCI ranges in the corridor from 84 to 89 which is categorized as good by the Iowa DOT on a good/fair/poor rating system. The pavement through most of the corridor was originally constructed in 1973 and resurfaced in 2008. The northern end of the evaluation area near 76th Avenue was constructed in 1976 and resurfaced in 2009. It is noted the pavement base within the study limits is therefore greater than 40 years old.

***Bridges* –** Bridges on and over I-380 were evaluated utilizing the department's Bridge Condition Index. As displayed in Appendix A, conditions for each bridge in the corridor range from 63 to 82.3. The department categorizes these as good on a good/fair/poor rating system.

Geometric Assessment

For the assessment of existing geometrics, the planning team used 14 design parameters. As shown in **Table 1**, these parameters accounted for the horizontal, vertical, surface, shoulder and median conditions. Horizontal and vertical design parameters were obtained from the department's as-built plans for I-380 as well as available cross streets.

TABLE 1. ROADWAY GEOMETRY AND PAVEMENT ANALYSIS PARAMETERS

Horizontal Design Parameters	Vertical Design Parameters	Other Parameters
Radius, Super Elevation	K Values	Surface Width and Thickness
Acceleration/Deceleration Distance	Stopping Sight Distance	Surface Condition Rating
Interchange Spacing	Decision Sight Distance	Shoulder Type and Width
Ramp Terminal Spacing	Vertical Bridge Clearance	Median Type and Width
Decision Sight Distance		Posted Speed

Source: I-380 PEL Infrastructure Conditions Technical Memorandum, 2017

The team evaluated the roadway based on the department's preferred and acceptable design standards established by the department for the posted speed limits as follows:

- Meets Preferred Criteria – parameter meets or exceeds preferred criteria;
- Meets Acceptable Criteria – parameter fails to meet preferred criteria but does meet acceptable criteria and AASHTO 2011 Standards; and,
- Does Not Meet Criteria – the parameter fails to meet department or AASHTO standards.

Table 2 displays the current preferred and acceptable rural interstate design criteria for various design elements. Appendix A displays existing geometric conditions. A summary of instances where a section does not meet current design criteria follows the table.

TABLE 2. ROADWAY GEOMETRY AND PAVEMENT DESIGN CRITERIA 2016

Design Element	Preferred	Acceptable
Design Speed	75 mph	70 mph
Max Super Elevation	6%	8%
Lane Width	12 feet	12 feet
Outside Shoulder	12 feet	12 feet
Inside Shoulder	6 feet	4 feet
Median Width	82 feet	36 feet
X-Slope - min.	2%	1.50%
X-Slope - max.	3%	3%
Existing Bridge Shoulder Width – min.	3.5-foot shoulders	3.5-foot shoulders

***All information updated for 12-08-16 release of Rural Interstate Design Criteria

Existing I-380 Horizontal Design – There are four locations – near the Highway 965 crossing, near the Coralville Reservoir, north of 120th St. and near 76th Avenue – where horizontal curve radii do not meet acceptable or preferred criteria. In all four of these cases, the superelevation is set to reverse crown at a 1.5 percent cross-slope. These horizontal radii do not meet the 2011 AASHTO Greenbook guidance for 75 mph (preferred) or 70 mph (acceptable) and instead meet a 60-65 mph design speed.

Existing I-380 Vertical Design – Rate of grade change values (K) and the stopping sight distance of the vertical curves were reviewed to assess vertical conditions throughout the corridor study area. Vertical highway curvature on I-380 within the study limits meets acceptable criteria. Two mainline locations – at the bridges over U.S. 6 and Highway 965 – do not meet the current preferred K value criteria for speeds of 75 mph. It should be noted that the bridge over U.S. 6 is in design and scheduled for replacement as part of the I-80/I-380 system interchange reconstruction.

Existing I-380 Cross-Sectional Elements – Cross-sectional elements include travel lane width, shoulder width and type, median width and type, and cross-slope. Current standards have changed since the I-380 corridor was constructed in the early 1970s. In general, the previous design cross section does not meet current standards for the following:

- Median width (60’);
- Median ditch depth (3.5’);
- Outside shoulder width (10’); and,
- Cross-slope (1.5%).

These values, except for outside shoulder width, meet the Iowa DOT acceptable design criteria. Twelve-foot outside shoulders are required on all rural interstates to be considered acceptable. Also of note is that the inside shoulders (6’) along I-380 do meet preferred design for a four-lane rural interstate; however, if I-380 is to widen in the future to a six-lane facility, the preferred inside shoulder width will be 12’, which would require inside shoulder widening to meet preferred criteria.

Existing I-380 Roadside Elements – The roadside elements, foreslope and backslope, found in the as-built plans for I-380 were evaluated. The roadway was built with foreslopes and backslopes that meet acceptable, but not preferred, current design criteria. The standard foreslope was built at 6 to 1 and the standard backslope was built at 2.5 to 1. At various points along the corridor, the foreslope was made even steeper and fails to meet acceptable criteria.

Existing I-380 Decision Sight Distances and Interchange Ramps – Decision sight distance is the distance traveled while recognizing an object or hazard, formulating actions for avoidance, and making the maneuvers necessary to avoid the obstruction. Decision sight distances on I-380 within the study limits all meet preferred design criteria for rural corridors. The horizontal curves on the existing I-380 ramps within the study area were designed for entrance and exit speeds of 55-60 mph. This speed is sufficient for these ramps to meet preferred design criteria and would function well geometrically in the future.

Existing I-380 Vertical Clearance – Vertical design criteria are set to allow at least 1-foot of differential between the maximum legal vehicle height and the roadway. Each of the four underpasses and seven overpass bridges in the study corridor meet or exceed preferred design criteria for vertical clearance, including; overpass bridges for the 16.5-foot vertical clearance, the 23.5-foot clearance over the CRANDIC Railroad, and the 15-foot clearance over the Coralville Reservoir Access Road.

Environmental Setting

The planning team built on the previously conducted I-380 Rural Feasibility Studies' review of natural and social-environment conditions in the study area. This remains a high-level perspective activity. It focused on identifying any issues or constraints in the social and natural environment that would impede consideration of a given improvement strategy or concept in the study corridor. Previously obtained GIS data from the Iowa DOT, Iowa DNR, Johnson County, U.S. Fish and Wildlife Service, and Federal Emergency Management Agency (FEMA) was utilized. Environmental constraints the planning team identified and analyzed included Section 4(f)-protected properties (public parks, trails, other recreation areas, wildlife refuges, historic properties), public and community facilities (schools, city or county facilities, houses of worship, community centers), wetlands, streams and water crossings, and FEMA 100 and 500-year floodplains. Section 4(f) requirements stipulate that FHWA and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use; or, the FHWA determines that the use of the property will have a de minimis impact.

Natural Environment

Natural environmental constraints in the I-380 study corridor are primarily focused in the vicinity of the Iowa River Crossing. The area in and around this crossing includes the Iowa River (and its floodplain), the Coralville Reservoir, and to the west, the Hawkeye Wildlife Management Area. The Hawkeye Wildlife Management Area is a Section 4(f) property. Since the highway is already in this area, it does not preclude development of highway expansion, but it may require more detailed documentation, further evaluation and potentially mitigation alternatives. There are not any "red flag" constraints that would prohibit or preclude development of alternative transportation solutions in the study corridor. However, the Iowa River crossing is one area that will require extra consideration.

Following is a summary of environmental conditions in the study area and any consideration each could present when developing and assessing any future improvements to the I-380 Corridor.

Wetlands and Floodplains – There are multiple wetlands in the study area, especially in and around the Iowa River. The National Wetlands Inventory also identified a few wetlands associated with river/stream crossings to the north and south of the Iowa River crossing in the area between Penn Street and 120th Street. All existing floodplain regions were identified based on Digital Flood Insurance Rate Map (DFIRM) databases obtained from FEMA. FEMA mapping identified both 100-year and 500-year floodplains associated with these waterways throughout the corridor. Any capacity improvement, especially widening to the outside of existing, would have impacts to wetlands and the 100-year floodplain in the corridor. Widening could also potentially have a slight (an acre or less), impact on the 500-year floodplain.

Park Land – While there are parks near I-380, any future widening of I-380 should be able to avoid impacts to park land. An exception, depending on a given improvement concept's right of way needs, could be the Hawkeye Wildlife Management Area. It should be noted that should the department consider widening to the outside, efforts could be made to eliminate or minimize impacts to the wildlife management area and other potential 4(f) resources.

Hazardous Material Sites – As part of the previous feasibility study, existing hazardous materials databases maintained by the Iowa Department of Natural Resources were examined, and all known locations of hazardous materials were identified. Hazardous material datasets included in the analysis included: Title 5 Facilities, Tier 2 Chemical Storage Facilities, Contaminated Sites, Leaking Underground Storage Tank (LUST) Sites, Underground Storage Tank (UST) Sites, National Priority List (NPL) Sites, and Non-National Priority List Sites. Widening I-380 in the future should not impact known hazardous material sites. Potential specific impacts are not known due to the inexact precision of the location data within the hazardous materials database.

Social Environment

The I-380 Corridor continues to be an area of rapid growth. At the south end of the study area, the communities of Coralville, Tiffin and North Liberty continue to see expanded residential and commercial growth along and near I-380. To the north, Cedar Rapids continues to grow and expand to the south. This is especially the case at Wright Brothers Boulevard. The area west of I-380 includes the Eastern Iowa Airport and a variety of industrial and commercial development. It also includes thousands of acres of developable land in the area in and around the airport. This includes land owned by the airport and a separate 1,300-acre mega-site, Big Cedar, currently marketed by Alliant Energy.

Any future improvements to I-380 should not have a direct impact on existing or future land use plans. However, improvements to I-380, either to mainline or at interchanges such as Wright Brothers Boulevard, will likely be considered by communities and economic development officials to be vital to encouraging and supporting future development and access in the corridor. For existing and future land use along I-380, widening to six or more lanes would have right of way impacts, as well as commercial and residential displacements. Future improvements should not negatively affect the stability, quality of life, property values and age of structures, organizations and facilities of adjacent neighborhoods. Likewise, there are no anticipated negative impacts associated with I-380 improvements to any public facilities nor at-risk population groups living in or near I-380.

Existing Conditions Summary

I-380 was designed and constructed in the 1970s and to previous design standards. The age of the pavement and bridges are beginning to show wear. The pavement was recently resurfaced to improve its condition and bridges in the corridor, while still considered in good condition, are approaching their original design life of 50 years. Due to the design standards utilized when I-380 was originally constructed, several geometric design components fall into the current acceptable design criteria status instead of the current preferred design criteria. In a few instances, some factors do not meet either criterion. The major factors not meeting criteria include the shoulder width, which does not meet acceptable criteria, and the cross-slope, as this affects other aspects of the horizontal design. It is reasonable to assume that each of these factors would be addressed as part of any strategy or concept for improving I-380.

From the perspective of the natural environmental, the vicinity of the Iowa River crossing contains several constraints that must be accounted for with any planned improvement. In addition to the river, there are wetlands, floodplains and Section 4(f) considerations. Any planned improvement would ideally avoid, or minimize and mitigate impacts to these resources. I-380 is the commercial spine of the corridor and major facility in both the Cedar Rapids and Iowa City commuter sheds. As development in the corridor grows, I-380 will continue to be leveraged to serve industrial needs in the north portion of the corridor and residential and commercial growth in the south. As development occurs adjacent to the highway, the likelihood increases that right of way displacement costs will increase with any planned improvement.

4. OPERATIONS

Assessing the safety and system efficiency within this section of I-380 and to find cost effective ways to increase mobility is a goal and guiding principle for this planning study. Providing safe and efficient traffic flow through the corridor, both now and in the future, is a primary concern. To better understand the existing and future traffic conditions, the planning team conducted a forecast and operations analysis. The analysis included the existing and future year conditions to identify the traffic needs within the corridor. As with other aspects of the conditions assessment, the planning team built from previous I-380 studies when conducting the operations review.

I-380 Capacity Analysis

In 2012, the Iowa DOT completed a feasibility study for improvements on this section of I-380. In Phase 1 of that study, the planning team forecasted traffic volumes for 2020 and 2040. Forecasts from that study indicated that traffic volumes would require expansion to a six-lane freeway by 2020 to continue to operate at the desired LOS B during the AM and PM peak time periods. Maintaining this level of service as defined by the Iowa DOT Design Manual through

2040 may require expansion of the corridor to an eight-lane freeway from I-80 north to the Wright Brothers Boulevard interchange for most segments of the corridor. If LOS C is considered acceptable, the corridor would require expansion to a six-lane freeway by the 2040 design year.

For this planning study, the planning team developed new traffic volumes from the statewide i-Tram model by establishing growth rates for each mainline segment of the corridor between the years 2015, 2026 and 2040. The annual growth rate was then applied to Iowa DOT 2015 traffic volume counts recorded at Automatic Traffic Recorder (ATR) 125 in the I-380 corridor and ramp volumes were established from turning movement counts. The traffic volumes used in the analysis are shown in **Table 3** and **Table 4**.

TABLE 3. FREEWAY MAINLINE TRAFFIC VOLUMES

			No-Build								
			AM			PM			Daily		
Freeway	Segment	Direction	2015	2026	2040	2015	2026	2040	2015	2026	2040
I-380	Wright Bros. to 120th	SB	1792	2149	2599	2330	2794	3379	28320	34000	41080
	120th Interchange	SB	1632	1957	2367	1982	2377	2875	25030	30410	37080
	120th to Penn	SB	1871	2274	2804	2073	2519	3106	26630	32360	39900
	Penn Interchange	SB	1425	1732	2136	1453	1766	2178	21200	26230	32780
	Penn to Forevergreen	SB	2079	2565	3184	1778	2193	2722	25810	31810	39460
	Wright Bros. to 120th	NB	2304	2763	3342	2358	2828	3420	28910	34630	41920
	120th Interchange	NB	1692	2029	2454	2123	2546	3079	25040	30400	37100
	120th to Penn	NB	1753	2102	2592	2298	2756	3398	26630	32360	39900
	Penn Interchange	NB	1131	1356	1672	1844	2212	2727	21130	26180	32740
	Penn to Forevergreen	NB	1408	1688	2095	2293	2750	3413	25720	31760	39440

TABLE 4. FREEWAY MERGE AND DIVERGE SEGMENT VOLUMES

			No-Build								
			AM			PM			Daily		
Freeway	Segment	Direction	2015	2026	2040	2015	2026	2040	2015	2026	2040
I-380	Wright Bros. Diverge	SB	630	755	913	433	519	628	4950	6280	8130
	Wright Bros. Merge	SB	235	282	341	410	492	595	4230	5790	7870
	120th Diverge	SB	160	192	232	348	417	504	3290	3590	4000
	120th Merge	SB	239	287	347	91	109	132	1600	1950	2820
	Penn Diverge	SB	446	542	668	620	753	928	5430	6130	7120
	Penn Merge	SB	654	795	980	325	395	487	4610	5580	6680
	Wright Bros. Merge	NB	218	261	316	435	522	631	4270	5300	6940
	Wright Bros. Diverge	NB	440	528	639	230	276	334	3880	5420	7120
	120th Merge	NB	612	734	888	235	282	341	3870	4230	4820
	120th Diverge	NB	61	73	88	175	210	254	1590	1960	2800
	Penn Merge	NB	622	746	920	454	544	671	5500	6180	7160
	Penn Diverge	NB	277	332	409	449	538	663	4590	5580	6700

Once traffic volumes were established for all three model forecast years, other important geometric information was collected using aerial mapping and as-built plans. Traffic operations on I-380 were analyzed using the Highway Capacity Software 2010 release (HCS 2010). Information such as terrain type and merge lengths were also gathered from an aerial review and input into HCS 2010.

The I-380 mainline traffic operations results are displayed in **Tables 5 and 6**. The Highway Capacity Manual establishes LOS thresholds. **The minimum LOS accepted by the department for rural freeway segments is LOS B**, while the minimum LOS threshold for urban freeway sections is LOS C. Densities in yellow demonstrate where freeway mainline densities exceed LOS B and densities in red demonstrate where freeway mainline segments are exceeding LOS C. Additional detail is available in **Appendix B**.

Table 5 shows that three AM and eight PM mainline segments already operate at a LOS C during the peak hours. In forecast year 2026, many segments will be operating in the LOS C range for both AM and PM peaks, and a few segments will be operating in the LOS D range in the PM peak period. In forecast year 2040 all but one mainline freeway segment will be operating at LOS C or worse with three AM and nine total PM mainline segments operating at LOS E. This represents long segments of I-380 which operate at unacceptable LOS, potentially creating mobility issues in the I-380 corridor.

Table 6 shows that most merge and diverge segments at interchanges in the I-380 corridor operate at LOS C today during peak periods, with one AM diverge segment and five PM diverge segments operating at LOS D. By 2040 most merge and diverge segments will operate in the LOS D range in the AM peak and LOS E range in the PM peak periods. By 2040, all southbound ramp segments are projected to operate at LOS D or worse. The 120th Street diverge will be the worst from an operations perspective currently operating at LOS D. In the northbound direction during the PM Peak all merge or diverge areas currently operate at LOS C or worse. By 2040, all ramps except one northbound ramp segment are forecasted to operate at LOS E or worse.

Both directions of I-380 mainline outside of the ramp influence areas operate worse during the PM peak period timeframe. The PM southbound freeway currently operates at LOS C between Penn St. and Wright Brothers' Blvd. In 2026 all southbound freeway segments will operate at LOS C or worse except for the segment between the Penn St. ramps; this segment will not reach LOS C until approximately 2033. All northbound freeway segments currently operate at LOS C. Northbound I-380 LOS is expected to worsen with all but one segment operating at LOS D in 2026. By 2040 all northbound segments will operate at LOS D or worse.

TABLE 5. FREEWAY MAINLINE DENSITIES

Freeway	Segment	Direction	No-Build					
			AM			PM		
			2015	2026	2040	2015	2026	2040
I-380	Wright Bros. to 120th	SB	15.8	19.4	24.7	21.4	27.5	38.2
	120th Interchange	SB	14.4	17.4	21.8	17.7	22	28.7
	120th to Penn	SB	16.6	20.8	27.6	18.6	23.7	32.6
	Penn Interchange	SB	12.5	15.3	19.3	12.8	15.6	19.7
	Penn to Forevergreen	SB	18.7	24.3	34.1	15.7	19.9	26.4
	Wright Bros. to 120th	NB	21.1	27	37.4	21.7	28	39.2
	120th Interchange	NB	14.9	18.1	22.9	19.1	24	32.1
	120th to Penn	NB	15.5	18.9	24.6	21	26.9	38.7
	Penn Interchange	NB	9.9	11.9	14.7	16.3	20.1	26.5
	Penn to Forevergreen	NB	12.4	14.9	18.8	21	26.8	39
Thresholds	LOS B/C		18.0	18.0	18.0	18.0	18.0	18.0
	LOS C/D		26.0	26.0	26.0	26.0	26.0	26.0
	LOS D/E		35.0	35.0	35.0	35.0	35.0	35.0
	LOS E/F		45.0	45.0	45.0	45.0	45.0	45.0

TABLE 6. FREEWAY MERGE AND DIVERGE SEGMENT DENSITIES

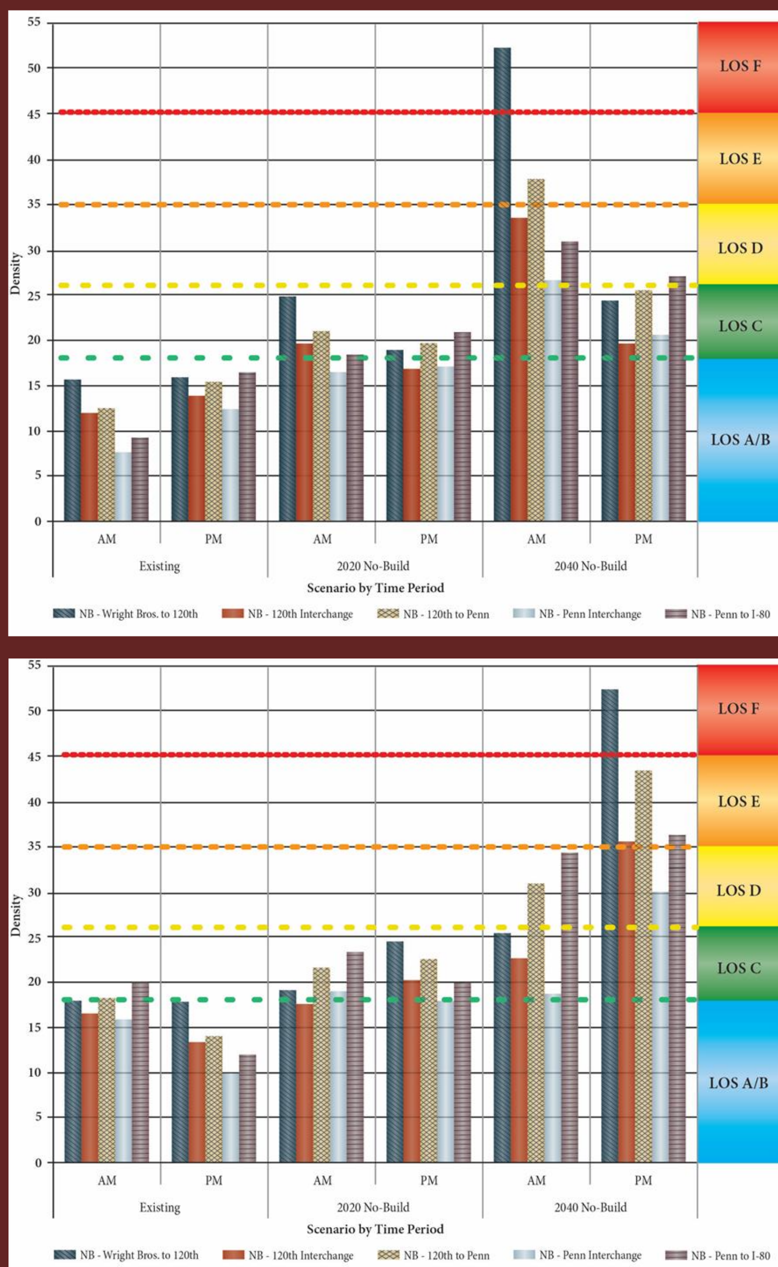
Freeway	Segment	Direction	No-Build					
			AM			PM		
			2015	2026	2040	2015	2026	2040
I-380	Wright Bros. Diverge	SB	26.8	31.8	38.0	28.7	34.0	40.7
	Wright Bros. Merge	SB	20.7	24.4	29.0	25.5	30.1	36.0
	120th Diverge	SB	22.3	26.4	31.5	28.4	33.7	40.3
	120th Merge	SB	19.6	23.3	28.0	21.9	26.1	31.5
	Penn Diverge	SB	23.2	27.8	33.8	25.5	30.6	37.2
	Penn Merge	SB	20.9	25.3	31.0	18.6	22.4	27.5
	Wright Bros. Merge	NB	23.4	27.6	33.0	27.6	32.7	39.2
	Wright Bros. Diverge	NB	28.1	33.3	39.9	28.8	34.1	40.8
	120th Merge	NB	23.1	27.6	33.2	24.6	29.3	35.3
	120th Diverge	NB	21.9	25.8	31.4	28.1	33.3	40.5
	Penn Merge	NB	17.5	20.8	25.5	23.7	28.3	34.7
	Penn Diverge	NB	18.0	21.2	25.8	28	33.2	40.7
Thresholds	LOS B/C		20.0	20.0	20.0	20.0	20.0	20.0
	LOS C/D		28.0	28.0	28.0	28.0	28.0	28.0
	LOS D/E		35.0	35.0	35.0	35.0	35.0	35.0

FIGURE 2. FORECASTED TRAFFIC ON MAINLINE I-380

Growth in I-380 Traffic Outpaces Previous Forecasts

The 2012 I-380 Rural Feasibility Study forecasted that several segments of I-380 would operate at LOS C or worse by 2020.

The I-380 PEL **operations analysis results show that LOS C is already exceeded on mainline segments in** the morning and afternoon peak hour



Safety

The planning team conducted a safety analysis for mainline I-380 and for ramp terminal intersections at each interchange. The team utilized Iowa DOT's SAVER database for years 2011-2015, the most recent 5-year period available, to conduct the analysis. The analysis identified general safety concerns and sought to determine if crashes were linked to any potential geometric deficiencies or other conditions in the corridor. Additional detail on the analysis is included in **Appendix C** with a summary below.

Mainline Crash Analysis

Interstate 380 was analyzed from I-80 in Coralville to U.S. 30 in Cedar Rapids, a segment of approximately 16 miles. The study area was divided into 11 segments for analysis, including mainline segments between interchanges that include the ramp influence areas north and south of each interchange. The crashes were investigated for crash type and contributing conditions to the crash in helping to determine what might be causing the crashes. **Figure 3** displays mainline I-380 crash densities and **Figure 4** displays crashes by severity type.

FIGURE3. MAINLINE I-380 EXISTING CRASH DENSITIES (2011-2015)

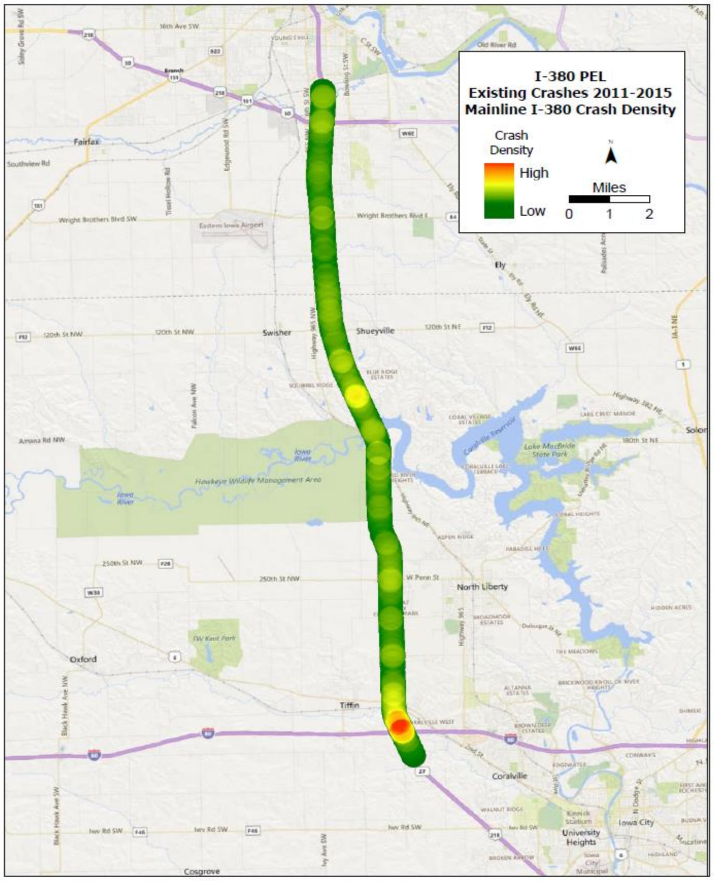
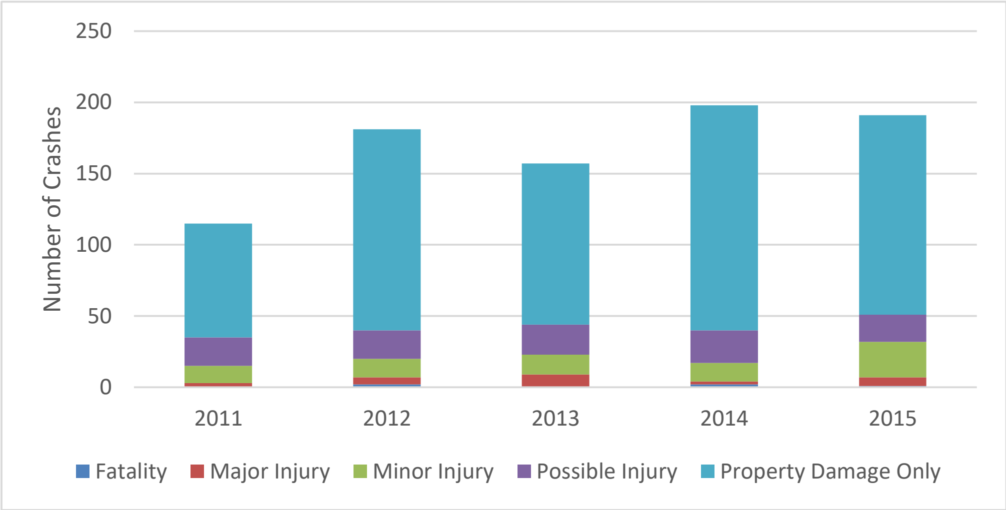


FIGURE4. I-380 CRASH SEVERITY (2011-2015)



Source: Iowa DOT SAVER Database

As displayed in **Table 7**, crash rates are provided for each mainline segment. It also notes those segments where fatal crashes occurred (in parenthesis). There were 836 crashes on the mainline during the five-year period; this equated to approximately one crash, every 2.5 days. There were five fatal crashes during this period. The segment of I-380 with the highest number of crashes over the five-year period was between Penn Street in North Liberty to 120th Street in Swisher.

TABLE 7. I-380 MAINLINE 5-YEAR CRASH RATES (2011-2015)

I-380 Segment	ADT 2015	Length (miles)	VMT	Total Crashes	Crash Rate	Fatal Crash Rate
I-80 Interchange	34,742	1.47	51,071	119 (2)	127.7	2.1
US-6 to Penn St	51,300	2.84	145,692	124 (1)	46.6	0.4
Penn St Interchange	45,966	1.19	54,700	59	59.1	0.0
Penn St to 120th St	53,600	5.35	286,760	263 (1)	50.3	0.2
120th St Interchange	50,400	1.46	73,584	59	43.9	0.0
120th to Rest Area	57,700	0.15	8,655	6	38.0	0.0
Rest Area	57,200	0.57	32,604	41	68.9	0.0
Rest Area to Wright Brothers	57,200	0.37	21,164	11 (1)	28.5	2.6
Wright Bro. Blvd. Interchange	46,573	1.22	56,819	46	44.4	0.0
Wright Brother Blvd to US-30	58,400	1.32	77,088	37	26.3	0.0
US-30 Interchange	51,833	1.42	73,603	71	52.9	0.0

* Note: Statewide five-year average crash rate is 67 for interstates in Iowa.

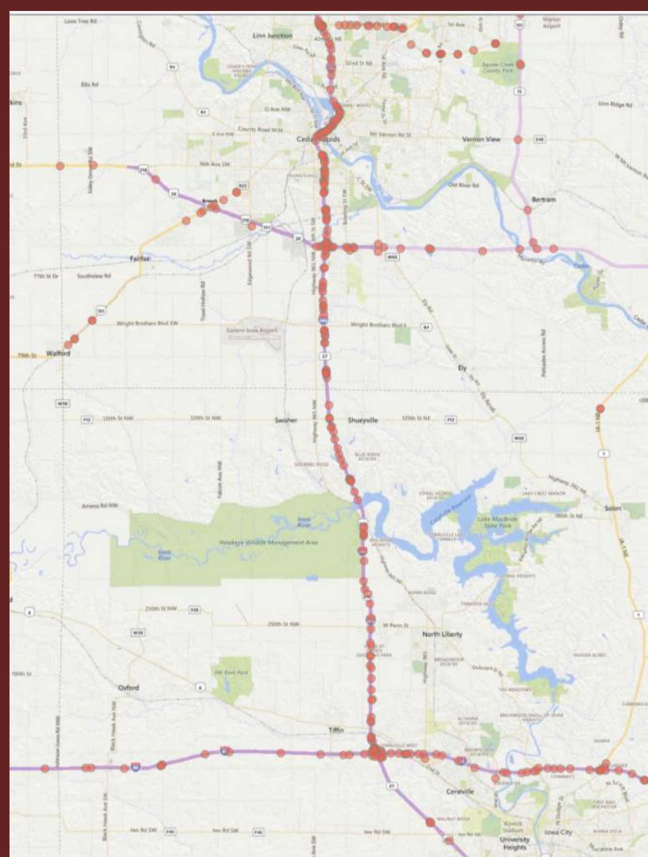
As shown in Table 7, the I-380 Rest Area between 120th Street and Wright Brothers interchange, including its ramp influence areas, has the highest crash rate in the corridor. Within this section, the rest area ramps have tapered entrances and exits. This can result in speed differentials between vehicles entering and exiting the freeway and mainline traffic, causing emergency braking and occasionally accidents. Future improvements in the corridor should consider creating more acceleration and deceleration distance at this location. All other roadway segments are currently below the statewide average.

For the five-year period analyzed, crashes along I-380 are characterized as follows:

- Approximately 41 percent were single-vehicle run off-road incidents;
- Approximately 35 percent involved rear-end collisions;
- Approximately 75 percent of incidents resulted in property damage only; and,
- Less than 1 percent of crashes were fatal.

The section of the highest crash concentration shown just north of the Iowa River crossing does not have a single obvious cause. There are a few contributing factors including heavy traffic, rolling hills and a visually narrowing affect. The most common contributing factor listed in the crash data base was unknown and there was only a normal level of weather related incidents. Based upon this information and the general nature of this roadway segment, more capacity and wider shoulders on both the left and right may help to reduce some crashes.

FIGURE 5. LANE BLOCKING INCIDENT LOCATIONS IN THE I-380 CORRIDOR



Source: 2016 TMC Performance Measure Annual Report, Iowa DOT

I-380 Ramp Terminal Crashes

The planning team also analyzed the ramp terminal intersections for the same period, at each of the three I-380 interchanges (Wright Brothers, Penn and 120th), within the study area. From 2011 to 2015, a total of 81 crashes occurred on NB and SB ramps at the six terminal intersections (see **Figure6**). Of these, 72 percent of incidents involved rear-end collisions.

The greatest number of crashes occurred at the Penn Street and NB I-380 ramps (34 percent of total rear end collisions at the three interchanges). Of ramp terminal crashes, 77 percent of incidents resulted in property damage only. There were no fatalities at ramp terminal intersections.

FIGURE 6. TOTAL RAMP TERMINAL CRASHES (2011-2015)

Source: Iowa DOT SAVER Database, 2017

Other Modes

Over the past ten years, interest has grown in providing new modal options for the I-380 Corridor. Following the completion of the I-380 Rural Corridor Feasibility Study in 2012, local supporters worked with their state elected officials to push for new options for commuters. As a result, in 2014 the Iowa Legislature created legislation directing the Iowa DOT "to conduct a study to identify administrative needs, projected demand, necessary capital and operating costs, and public transit service structures including park and ride lots, employer or public vanpool programs, and traditional fixed-route transit. The Iowa DOT shall submit a report with findings and recommendations to the general assembly on or before December 15, 2014." Through this legislation and other efforts, work on providing new modal options for commuters continues. A summary of these activities follows below.

Transit and Rideshare

Per the direction of the Iowa Legislature, the Iowa DOT commissioned the Iowa Commuter Transportation Study (ICTS) to identify the existing and future commuter needs in the I-380 corridor and determine the viability of various commuter transportation improvements to address those needs. The ICTS recommended a package of commuter improvements that could be implemented as a comprehensive program, or individually, reflecting the realities of funding and local priorities. This package of improvements included:

- Public Interregional Express Bus Service: A new interregional fixed route bus service connecting Cedar Rapids, North Liberty, Coralville and Iowa City.
- Subscription Bus Service: This service can be tailored to the commuter needs of a specific locale or even a single employer and would be ideal to serve large employers.
- Public Vanpool Program: Open to the public, uses passenger vans supplied by a public agency or agencies driven by one of the vanpool participants. Vanpools typically have ten to sixteen participants with similar origins and destinations.
- Public Carpool Program: A formal sharing of rides using one of the participant's private automobile. Carpooling typically has two to six participants with similar origins and destinations.

As summarized in the 2014 Iowa Commuter Transportation Study (ICTS), the study identified creating a new public express bus service – called Interregional Express Bus (IRXB) – as well as expanded rideshare opportunities through a new public vanpool program to meet existing and future commuter needs in the I-380 corridor and better connect Cedar Rapids, North Liberty, Coralville and Iowa City.

Through the I-380 Multi-Modal and Operations Study (referred to as Big Mo), the Iowa DOT worked in collaboration with an IRXB Subcommittee, created shortly after the finalization of the ICTS, to develop an implementation plan to launch IRXB as a pilot program ahead of I-80/I-380 construction. Additionally, Big Mo was leveraged to assist the East Central Iowa Council of Governments (ECICOG) in preparing an Iowa Clean Air Attainment Program grant application to fund a contracted public vanpool program to be administered by ECICOG.

Passenger Rail Service in the I-380 Corridor

Over the past 30 years, several studies have assessed the feasibility of commuter rail service on the CRANDIC line. The most recent study was the 2006 *Cedar-Rapids River Rail Transit Project Feasibility Study* prepared by R.L. Banks and HNTB. Information and conclusions developed in the 2006 study were updated and used for the evaluation by the ICTS planning team. The 2006 study was a follow-on study drawing from a 1995 study of passenger rail in the corridor. The evaluation for the ICTS did not include any new analysis of passenger rail; rather the planning team relied on the 2006 study's methodology, including:

- The 2006 study provided information on alignments, stops, operating plan, ridership, capital and operating costs;
- The 2006 cost estimates were extrapolated forward to 2014 dollars for purposes of assessing costs and cost effectiveness;
- Ridership estimates were taken from the 2006 study; and,
- The 2006 study identified three potential rail lines, the most relevant being: 1) Cedar Rapids (Eastern Iowa Airport) to Iowa City; and 2) North Liberty to Iowa City.

The ICTS evaluation considered only the Cedar Rapids – Iowa City line because of its potential relevancy to the purpose of the ICTS.

As with the 2006 study, the ICTS planning team determined that commuter rail service was not recommended to be pursued as part of the preferred package of service improvements in the short or mid-term. The conclusions from 2006 that the capital and operating costs, and the cost effectiveness measured by cost per passenger was found to be significantly greater than comparable bus options, continued to hold true. As shown in **Table 8**, the cost per rider of either rail service scenario is significantly greater than comparable bus options 1 and 2.

TABLE 8. ICTS – COMMUTER RAIL RIDERSHIP AND COST FORECASTS

Service Option	Daily Ridership Round-trip	Annual Operating Cost	Capital Cost	Cost Per Rider
Bus Option 1	901	$2,073,000	$10,768,000	$12.14
Bus Option 2	563	$1,037,000	$5,913,000	$9.84
*Commuter Rail Scenario 1	1,025	$6,352,000	$27,118,000	$27.12
*Commuter Rail Scenario 2	2,438	$15,151,000	$44,693,000	$26.50

*Note: The capital costs for the commuter rail options are based on the 2006 Cedar-Iowa River Rail Transit Project Feasibility Study and were grown to year 2014 dollars for comparison.

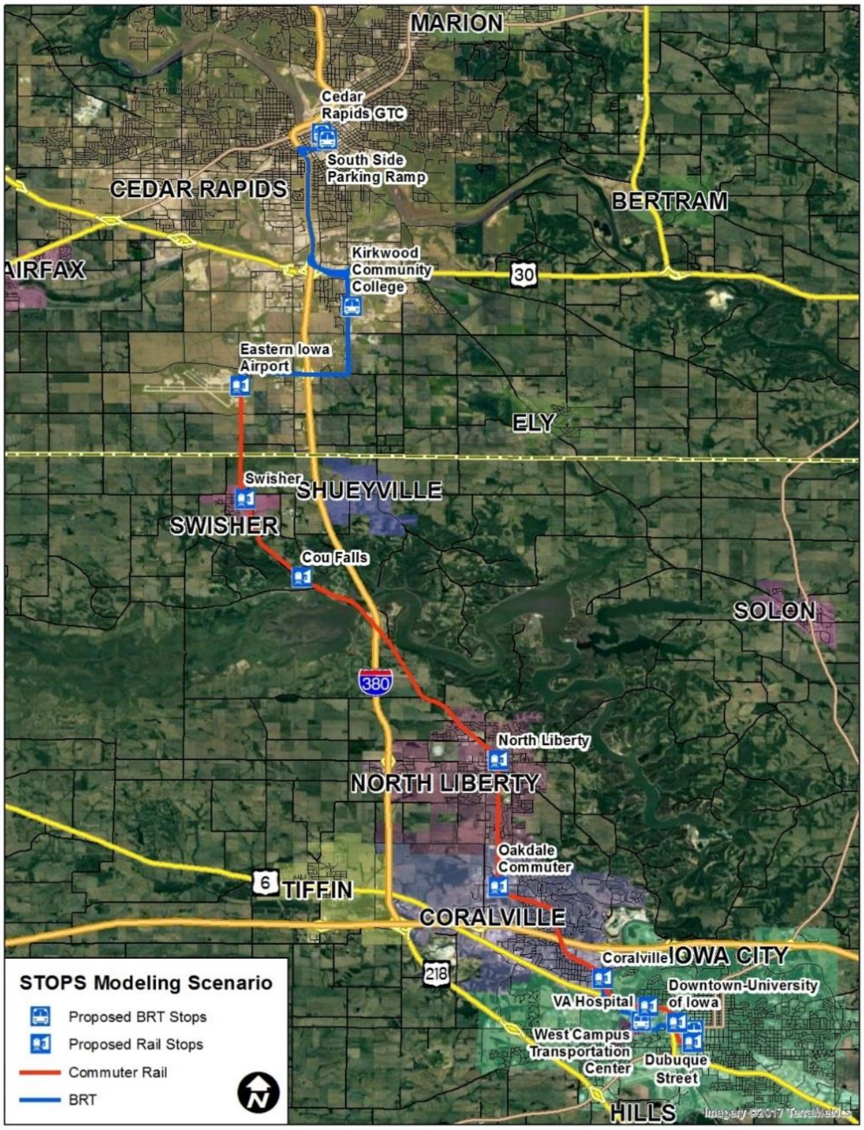
Despite these conclusions, interest in using the CRANDIC right of way for commuter rail or other modal options remains in the I-380 Corridor. In response, the Iowa DOT had the I-380 planning team develop and assess two transit use scenarios for the CRANDIC line between Cedar Rapids and Iowa City.

For this study, the planning team developed forecasts for the two transit scenarios within the CRANDIC Corridor. Forecasts were developed using the Federal Transit Administration (FTA) Simplified Trips-on-Project (STOPS) model. Stop locations were derived from a previous study on transit options utilizing the CRANDIC rail corridor prepared by HDR, Inc.

As discussed in **Appendix D**, the purpose of the STOPS model analysis was to estimate the ridership and auto diversion of transit scenarios that would utilize the existing CRANDIC Corridor. STOPS models are calibrated and validated using actual ridership experience on fixed-guideway transit including bus rapid transit (BRT), light rail (LRT), commuter rail and streetcar systems across the country.

The two model scenarios include a commuter rail line from downtown Iowa City to the Eastern Iowa Airport (Scenario 1) and BRT from downtown Iowa City to downtown Cedar Rapids. Modeled station locations are displayed in **Figure7**. Scenario 1A has 2-hour 10-minute commuter rail headways and 1B has 30-minute headways. Scenario 2 utilized 10-minute headways in the morning and afternoon peaks and 30-minute headways in the off-peak period. **Table 9** displays the operating assumptions of each scenario forecasted.

FIGURE7. CRANDIC RAIL CORRIDOR BRT AND COMMUTER RAIL MODELED STATION LOCATIONS



Through the review of the boardings at Scenario 1B stations, it appeared that the STOPs model was overstating the walk access. The STOPs model allows passengers to walk up to a mile to the nearest station, and is not configurable or adjustable by the model operator. The one mile walk distance expands the market and potentially leads to an overstatement of ridership. Also, the STOPs model treats fares equal across the system. This would also make the commuter rail appear to be more attractive to the market.

TABLE 9. STOPS MODELING RESULTS FOR CRANDIC TRANSIT SCENARIOS

	Scenario 1	Scenario 2
Mode	Commuter rail	Bus Rapid Transit
Route	Iowa City to Eastern Iowa Airport	downtown Iowa City to downtown Cedar Rapids
Operating Plan	6:00 a.m. to 7:00 p.m.	5:15 a.m. to 6:45 p.m.
Headways	1A) departs downtown every 2'10" 1B) 30 minutes	AM/PM Peak) 10 minutes Off-peak) 30 minutes
Forecast Ridership	**Year / Scenario 1A / Scenario 1B** 2015 / 433 / 2,953 2020 / 487 / 3,375 2025 / 554 / 3,924 2040 / 805 / 5,966	**Year / Scenario 2** 2015 / 2,660 2020 / 2,958 2025 / 3,388 2040 / 5,342

The commuter rail options were re-run to test the sensitivity of the options to additional fares that commuter rail would likely have. For the re- run of the model it was assumed that the commuter rail would have a fare that was approximately five dollars more than the existing transit system. To account for this, five-minutes of additional time was built into the model for each of the stations for walk, kiss and ride, and park and ride access mode. The added impedance had a small impact to Scenario 1A due to it already having a low level of service. Scenario 1B was reduced by about 1,500 riders in the current year. It also reduces the attractiveness of trips to and from Cedar Rapids. **Table 10** is a summary of forecasts for each model run.

TABLE 10. SUMMARY OF RIDERSHIP FORECASTS

Scenario	2015	2020	2025	2040
Scenario 1A – Rail: 130-minute Headway	433	487	554	805
Scenario 1A – Rail: 130-minute Headway with Impedance	357	400	452	633
Scenario 1B – Rail: 30-minute Headway	2,953	3,375	3,924	5,966
Scenario 1B – Rail: 30-minute Headway with Impedance	1,595	1,812	2,120	3,411
Scenario 2 – Bus Rapid Transit	2,660	2,958	3,388	5,342

The primary market identified by the model is trips that occur between the stations between North Liberty and Downtown Iowa City. As modeled, trips from Cedar Rapids would have to transfer to the commuter rail line, or drive and park and ride to the Eastern Iowa Airport station. The additional travel time makes the service unattractive to the Cedar Rapids market.

To further refine the model for the commuter rail service and bus rapid transit the operating plan and running time would need to be refined. Additional data about the market would also need to be obtained including ridership by stop for the existing transit network, effects on ridership due to fare increases, and potentially an origin destination survey of the existing transit system.

Transportation Systems Management and Operations

Transportation Systems Management and Operations (TSMO) is a cross-cutting approach meant to optimize existing infrastructure through better integration, coordination, and systematic implementation of key operational strategies. Transportation Systems Management and Operations provides a performance-based approach to delivering cost effective investment and services to realize Iowa DOT's vision of Smarter, Simpler, Customer-Driven. In recent years, the department has applied a new focus on TSMO in response to the challenges associated with the movement of people, goods and services that extend beyond traditional construction and maintenance functions. With projected traffic growth and system demand, advancements in technology, and limitations in funding, there is increasing recognition that Iowa's transportation system must be managed and operated in a manner responsive to constantly changing conditions.

As documented in the department's TSMO Strategic Plan, eight service layers have been identified – with plans in development for each layer. **Table 11** displays and defines each of the service layers.

TABLE 11. TSMO SERVICE LAYERS

Service Layer	Definition
Traffic Management Center	The around-the-clock hub of DOT traffic coordination activities throughout the state. The Traffic Management Center recently relocated from Ames to a newly remodeled facility in the Iowa Motor Vehicle Division Building in Ankeny.
ITS and Communications	Fixed and mobile traffic detectors, non-enforcement traffic cameras, dynamic message signs, highway advisory radio, and supporting communications infrastructure.
Traveler Information	Traveler Information tools that help publicly broadcast planned and prevailing traffic conditions, such as Iowa 511 and various social media.
Traffic Incident Management	The coordination of how Iowa DOT and its partners respond to routine highway traffic incidents.
Emergency Transportation Operations	The coordination of how Iowa DOT and its partners respond to large scale incidents (not necessarily highway related), such as flooding, tornado, epidemics, etc.
Work Zone Management	The planning and deployment of various strategies to maintain traffic flow and safety through highway work zones.
Active Transportation and Demand Management	Innovative strategies to maximize available capacity of roadways, such as ramp metering, variable speed limits, lane control signing, and time-of-day shoulder use.
Connected and Autonomous Vehicle	An emerging technology that considers the challenges and opportunities of vehicle-to-vehicle, vehicle-to infrastructure, and autonomous vehicles to improve vehicle safety and efficiency. Iowa DOT's primary role is an information service provider.

Source: Iowa DOT, TSMO Strategic Plan, 2016

Combined, TSMO plans and service layers are designed to help the department manage facilities such as I-380 differently as well as:

- Realize the full capacity of the existing transportation system;
- Increase reliability for freight and auto;
- Improve safety and reliability through traffic incident management, traveler information, and work zone management; and,
- Target safety and operational problem locations to deliver performance-driven improvements to the existing system.

In early 2018, the department will initiate the I-380 Corridor Feasibility Assessment of Integrated Corridor Management Strategies. This project will assess the applicability and feasibility of Integrated Corridor Management strategies on I-380 within the PEL study area. Additional strategies from the other service layers may also be considered during that study process. This assessment, which will be conducted by the same consultant assisting the Iowa DOT with the PEL, will build off work recently completed for three separate projects within the I-380 Corridor.

In 2015, the Iowa DOT initiated a comprehensive review of potential strategies to mitigate congestion along the I-380 Corridor, ahead of and in collaboration with reconstruction of the I-80/I-380 system interchange. The I-380 Coralville to Cedar Rapids Corridor, Multi-Modal and Operations Study, commonly referred to as Big Mo, explored corridor-wide strategies in both the short- and long-term. As the study progressed, the department chose to leverage this study instead to focus on nearer-term strategies having the ability to mitigate congestion during the I-80/I-380 system interchange reconstruction, scheduled to begin in the fall of 2018. Utilizing the same planning team that conducted Big Mo, the Iowa DOT coordinated study efforts with the I-80/I-380 Transportation Management Plan (TMP) and Iowa City Traffic Incident Management (TIM) Plan which were completed in 2017.

As part of assessing nearer-term strategies, the planning team assessed each strategy's benefit to the overall corridor and in the long-term post-construction. The study's Final Assessment Report and Master Plan documented the assessment of initial strategy packages, as well as the refinement and development of final strategies which were grouped into six categories. Each category is identified and defined in **Table 12**: These strategies were vetted in concert with the I-80/I-380 TMP and TIM.

TABLE 12. I-80/I-380 SYSTEM INTERCHANGE TMP MITIGATION STRATEGIES

Strategy	Definition
PI/Communications Strategies (Package 1)	The Engagement and Communication Plan was developed in the first half of 2017, to provide a plan for implementing the identified strategies at the appropriate time in preparation for and during construction.
Transit Service and Modal Enhancement Strategies (Package 2)	Interregional Express Bus (IRXB) – the culmination of work begun through the ICTS – will launch in the fall of 2018. Rideshare via ECICOG's RideConnect program launched in fall 2016.
Construction/Work Zone Strategies –	The majority of these strategies are currently under development as part of the I-80/I-380 system interchange design.
ITS/IWZ Strategies –	This category includes both temporary and permanent ITS to deploy to either replace existing permanent ITS impacted by construction or to supplement existing permanent ITS during construction.
TIM Strategies –	Incident Management strategies were coordinated with Johnson County, local municipalities, and emergency responders. They will be implemented by the start of major construction anticipated in the fall of 2020.
Corridor/Network Management Strategies –	This category of strategies focuses on enhancing mobility off the interstate system, whether it be for natural diversion, construction detours, or traffic incident management. The development and design of these strategies were scheduled to begin in the first quarter of 2017, with varying implementation timeframes.

Source: I-80/I-380 Transportation Management Plan

5. CONCLUSIONS

The I-380 Corridor is one of the fastest-growing transportation corridors in Iowa. Interstate 380 connects Cedar Rapids and Iowa City, the state's second- and fourth-largest metro areas, which continue to experience considerable growth. This growth has led to a similar increase in traffic on I-380. A primary goal of the I-380 planning study is to "*Investigate the existing conditions and operations within the corridor as well as the setting (human and natural) and the potential impacts of identified improvement needs. Determine cost effective ways to increase mobility, safety and system efficiency within the corridor.*" Following below is a summary of the existing conditions in the I-380 corridor and how those conditions might affect improvement strategies.

Operations

The department's stated goal for this section of I-380 is to be able to maintain the minimum level-of-service on the freeway mainline. For rural freeway segments, this is LOS B, for urban freeway segments LOS C is the minimum threshold. This segment is currently considered a rural freeway. Growth pressures in the corridor are such that the rural designation will likely change to an urban designation.

In 2012, future traffic forecasts prepared for the I-380 Rural Feasibility Study indicated that I-380 would need to be widened to six lanes by the year 2020 if the Iowa DOT were to maintain the desired LOS B. Operations analysis for this planning study indicate that this threshold is already being exceeded daily along the corridor. In an existing and future no-build condition

(I-380 with two lanes in each direction), the traffic operations analysis for mainline I-380 shows that:

- Today, during the AM peak hours, 3 of 12 segments analyzed already operate at LOS C;
- In the PM peak hours, that increases to 8 of 12 segments operating at LOS C;
- In less than ten years, some segments are at or exceed LOS D; and,
- By 2040, all but one segment is expected to operate at LOS D or worse in the PM.

Current and forecasted operations for freeway merge and diverge segments are even worse. Already, existing operations are such that multiple merge/diverge segments operate at LOS D. By far the most affected area is the segments involving the Wright Brothers Boulevard interchange. The mainline segments at Penn Avenue are also experiencing decreasing service levels.

Crashes and incidents affect operations in the corridor daily. The results of the planning team's safety analysis indicate that most segments along this stretch of I-380 have a crash rate that is lower than the statewide rate for rural freeways. An exception is at the rest area between 120th Street NE and Wright Brother's Boulevard. That segment of mainline surpasses the average statewide crash rate. Contributing factors include high daily traffic volumes, speed differentials between mainline and merging/diverging vehicles and geometric conditions. In addition, non-crash incidents such as debris in the roadway or stalled vehicles have a negative effect on operations in the corridor. In 2016, the department's Highway Helper program reported 3,758 incidents in the I-380 service area.

In addition to increasing capacity, the department has studied the feasibility of alternative modes in the corridor. Over the past five years the department has assessed and chose to help implement the IRXB, service between Iowa City and Cedar Rapids as well as rideshare programs in partnership with the East Central Iowa Council of Governments. As an alternate to I-380, multiple past studies have looked at the feasibility of using the CRANDIC railroad to provide commuter rail service between Iowa City and Cedar Rapids. For this study, the planning team's ridership forecasts indicate that the use of the CRANDIC railroad as a commuter rail or bus rapid transit facility would not affect the need for adding capacity to I-380. Concurrent to this study, the department is also assessing the potential for TSMO-related strategies to improve operations such that the life of the existing system could be lengthened and the need for future widening delayed.

Conditions

To meet the traveling needs today and in the future, the Iowa DOT will consider a strategy of a full replacement of the facility that meets current design standards and provides the potential to expand to 8 lanes. As displayed in **Figure 8**, the preferred cross section would provide the department with the capability to first add an outside third lane in each direction, and an 82-foot median with cable barrier in the center. If additional capacity or other use is required in the future, then capacity could be added to the inside, within the 82-foot median.

FIGURE8. PREFERRED CROSS SECTION FOR I-380

Source: I-80 Planning Study, Iowa DOT, 2017

The infrastructure for this segment of I-380 is approaching 50 years old. The underlying pavement and sub-base and subgrade will likely require replacement soon, with or without additional capacity improvements. With any widening scenario, reuse of the existing lanes in a six-lane section may be problematic due to impacting the existing sub-base of the adjacent lanes. Additionally, maintaining subsurface drainage could impact the ability to construct a quality long-life pavement structure.

As it relates to bridges in the corridor, all bridges meet current criteria for horizontal and vertical clearances. However, like the roadway, these bridges are approaching 50 years old and they were not designed to accommodate the Iowa DOT's preferred cross-section for any future widening. Therefore, any future improvements would require a full replacement of the existing overpasses at Swan Lake Road, Walford Road and 76th Avenue.

The needs at each interchange will vary based on forecasted traffic numbers and traffic operations. Currently, some segments near Wright Brothers and Penn Avenue exceed the Iowa DOT's level-of-service threshold. This is forecasted to worsen throughout the corridor over the next 25 years. Besides adding capacity to mainline I-380, the Iowa DOT should consider improving:

- Wright Brothers to an improved Diamond, Diverging Diamond, or Single Point Interchange
- 120th Street to an improved Diamond Interchange; and
- Penn Avenue to an improved Diamond or Diverging Diamond Interchange.

The I-380 crossings over the Iowa River and over Highway 965 and the CRANDIC railroad present the greatest challenge to adding capacity and rebuilding I-380. Any replacement of these structures would have to follow existing alignment and stay within right or a way to avoid or greatly minimize impacts to the Coralville reservoir and Section 4(f) resources. Additionally, there is constructability and temporary traffic control issues to consider – any replacement of these structures would have to maintain two lanes of traffic in each direction during each stage of construction.

6. REFERENCES

The following documents and studies were referenced in this report.

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