IOWA DOT
I-380 Planning Study

INTERSTATE 380

PLANNING AND ENVIRONMENTAL LINKAGE (PEL) STUDY

Impact of Alternative Modes on Interstate 380 – Technical Memorandum

Office of Location and Environment | February 2018

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Executive Summary

The purpose of this Impact of Alternative Modes on Interstate 380 Technical Memorandum developed by the Iowa Department of Transportation (Iowa DOT) is to examine the long-term potential for commuter rail and automated bus transit as a component of an enhanced multimodal transportation network for growing communities in the Iowa City-Cedar Rapids Corridor. The Technical Memorandum was developed concurrently with the broader Iowa DOT Interstate 380 Corridor Planning and Environmental Linkage Study (I-380 PEL Study) that evaluated safety, capacity, and infrastructure deficiencies on the principal roadway between the two cities and made recommendations for improvements to increase regional mobility in the near-term horizon.

The Cedar Rapids & Iowa City Railway (CRANDIC) right-of-way, an active freight railroad corridor, parallels the Interstate 380 Corridor between Iowa City and Cedar Rapids, Iowa. The continuous 20.5-mile segment of the CRANDIC Corridor right-of-way between central Iowa City, Coralville, North Liberty, and the Eastern Iowa Airport at Cedar Rapids was considered for future alternative transportation use in the long-term horizon in this Technical Memorandum. (Note that an approximately 13-mile connecting segment of the Interstate 380 Corridor right-of-way between an intersection with the CRANDIC Corridor right-of-way near North Liberty and Downtown Cedar Rapids was also considered for its conceptual feasibility of future alternative transportation use shared with the interstate highway within the existing right-of-way in the long-term horizon.)

Iowa DOT selected HDR as its consultant team for the Technical Memorandum. The study and analysis conducted for this project also leveraged past and ongoing studies and stakeholder coordination in the Iowa City-Cedar Rapids Corridor, was divided into the tasks identified and described below, and culminated in this Technical Memorandum:

- **Background** – Describes the background of Iowa DOT's development of the I-380 PEL Study and the related Impact of Alternative Modes on Interstate 380 Technical Memorandum.
- **Summary of Recent Multimodal Study in the Iowa City-Cedar Rapids Corridor** – Summarizes recent multimodal, commuter transport, and passenger rail study between Iowa City and Cedar Rapids, inclusive of the CRANDIC Corridor right-of-way and Interstate 380.
- **Existing CRANDIC Corridor Right-of-Way General Description** – Describes the location, multimodal connectivity, existing conditions and infrastructure, and uses of the CRANDIC Corridor right-of-way.
- **Conceptual Short-Term and Long-Term Vision for CRANDIC Corridor Right-of-Way Alternative Use** – Identifies the conceptual short- and long-term vision for alternative use of the CRANDIC Corridor right-of-way and the process, inputs, criteria, and general considerations used to develop the vision.
- **Potential Alternative Use Modes and Scenarios for the CRANDIC Corridor Right-of-Way** – Describes typical characteristics and features of two potential alternative use modes (commuter rail transit and automated bus transit) considered for potential implementation in the CRANDIC Corridor right-of-way and presents a conceptual analysis of four potential alternative use scenarios that would include alternative transportation use of all or part of the CRANDIC Corridor right-of-way. The analysis identifies and summarizes for each scenario: alternative mode route and service characteristics; general applicability of alternative transportation mode for potential implementation within the CRANDIC Corridor right-of-way (or within the Interstate 380 Corridor right-of-way and on the connecting roadway network, as applicable); conceptual ridership

forecast; probable conceptual cost of implementation; general applicability with the CRANDIC Corridor right-of-way alternative use vision; and general findings and recommendations, including any potential impacts on Interstate 380.

- **Next Steps for Potential Study and Implementation in the CRANDIC Corridor Right-of-Way** – Presents potential next steps for future study and alternative transportation implementation in the CRANDIC Corridor right-of-way that are consistent with the vision, conceptual analysis of alternative use modes and scenarios in the context of the region's multimodal network as developed for this Technical Memorandum, and the recommendations for the Interstate 380 Corridor as identified by Iowa DOT during the I-380 PEL Study.

General Conclusions and Recommendations

Several conclusions emerged from assessment of the ridership potential, probable conceptual cost, and other considerations for implementation of four potential alternative use scenarios in the CRANDIC Corridor right-of-way and their likely impacts on parallel Interstate 380. These conclusions and related recommendations developed for the Technical Memorandum include:

- **Development of Interstate 380 Improvements are Necessary in the Short-Term Horizon and Future Alternative Transportation Implementation Will be Considered a Supplemental Long-Term Option** – Ridership potential for commuter rail and / or automated bus transit implementation in the CRANDIC Corridor right-of-way between Iowa City and Cedar Rapids in the long-term horizon is not so large to serve as a replacement for the additional roadway capacity that would be provided by the widening of Interstate 380 in the short-term horizon. As other elements of the Interstate 380 PEL Study have confirmed, in light of the need for additional freeway capacity and to address other documented existing system deficiencies on Interstate 380 in the short-term horizon, the implementation of a potential parallel transit line in the long-term horizon should be considered supplemental to freeway widening rather than a potential replacement to widening in the short-term horizon.
- **Preservation of the CRANDIC Corridor Right-of-Way as a Public Asset in the Short-Term Horizon Provides Future Opportunity** – The 20.5-mile CRANDIC Corridor right-of-way is the only existing, continuous, and direct linear railroad corridor between Iowa City and Cedar Rapids that can be preserved as a public asset and adapted for future alternative transportation use. Owing to its location within an area with high population concentration, the CRANDIC Corridor right-of-way has high potential for multimodal connectivity and for catalyzing future economic, community, and land use development. The cost to develop a new "greenfield" linear alternative transportation corridor between Iowa City and Cedar Rapids in the future – if the existing CRANDIC Corridor right-of-way is not preserved – would likely be cost prohibitive, suffer from feasibility challenges, disrupt existing and potential future land use, and face public opposition.
- **Phase CRANDIC Corridor Right-of-Way Alternative Use to Match Demand; Start with Additional Commuter Rail Study and Potential Implementation Between Central Iowa City and North Liberty** – Ridership forecasts indicate that the primary market for alternative transportation use in the CRANDIC Corridor right-of-way at present and in the future would be a daily commuter rail service between central Iowa City and North Liberty. This approximately 8-mile segment has a high population concentration and the most potential for attracting ridership. Ridership forecasts also suggest that a commuter rail service with greater frequencies and operating on 30-minute headways from terminal points – an operating plan that is more typical of

commuter rail service offered in the U.S. – would attract significantly more riders than would a commuter rail service with fewer frequencies and operations with headways of over two hours from terminal points. Implementation of commuter rail service on 30-minute headways would also require additional commuter rail equipment and infrastructure investment than had been identified in past studies for passenger rail implementation in the CRANDIC Corridor right-of-way involving fewer frequencies and longer service headways. After implementation of a first phase of commuter rail between central Iowa City and North Liberty, subsequent extension to the Eastern Iowa Airport at Cedar Rapids (or elsewhere on the CRANDIC Corridor) could be considered as demand requires.

- **Automated Vehicle Implementation Best Suited for First Mile / Last Mile Connections to Commuter Rail Service in the CRANDIC Corridor Right-of-Way** – Forecasts suggest that for alternative transportation use of the CRANDIC Corridor right-of-way between Iowa City and Cedar Rapids that commuter rail service can expect higher ridership than automated bus service and may be generally better suited for implementation owing to the corridor's current configuration for railroad operations. With commuter rail implementation in the CRANDIC Corridor right-of-way, the potential for inclusion of automated vehicles that provide first-mile / last-mile transportation from commuter rail stations to local destinations via the connecting roadway network could also be explored, as automated vehicle technology advances.
- **Commuter Rail Implementation within the Existing Interstate 380 Corridor Right-of-Way is Infeasible** – Commuter rail line development in the shoulders or median of the existing Interstate 380 Corridor right-of-way between North Liberty and Downtown Cedar Rapids in the long-term horizon is considered infeasible and it is recommended that it be removed from further consideration. The I-380 PEL Study determined that the existing freeway footprint is insufficient to accommodate recommended near-term system improvements and that it will be necessary to acquire additional parallel right-of-way. Efforts to improve Interstate 380 thus would pose significant challenges to the potential long-term implementation of commuter rail within or parallel to the Interstate 380 Corridor right-of-way, and would require additional parallel right-of-way to host commuter rail line development. Acquisition of this additional right-of-way to develop a commuter rail line alignment parallel to Interstate 380 or to realign Interstate 380 and modify freeway interchanges with the local roadway network and interfaces with roadway, railroad, and waterway crossings concurrent with commuter rail line development would present significant engineering, environmental, and constructability challenges; potentially provide negative impacts to Cedar Rapids and severe disruption to traffic on Interstate 380 during construction; and be cost prohibitive to develop.

Next Steps

Public and private stakeholders, including Iowa DOT, will develop consensus regarding conclusions and recommendations from recent multimodal study and stakeholder outreach in the Iowa City-Cedar Rapids Corridor (including exploring the potential for preservation of the 20.5-mile CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids in the short-term horizon); determine a lead agency for future study and potential implementation; and conduct additional study for a first phase of commuter rail implementation between central Iowa City and North Liberty, which could also consider the potential for operation of a pilot commuter rail service in advance to further gauge demand and public interest for alternative transportation in the CRANDIC Corridor right-of-way.

Section 1 Background

The Iowa Department of Transportation (Iowa DOT) studied the Interstate 380 Corridor between Iowa City and Cedar Rapids, Iowa, in 2017 to evaluate safety, capacity, and infrastructure deficiencies in an effort to increase mobility across the interstate system and the region. The Interstate 380 Corridor Planning and Environmental Linkage Study (PEL Study) followed the PEL model, which allowed Iowa DOT to:

- Foster engagement by stakeholders and consider recent past and ongoing multimodal transportation studies in the Iowa City-Cedar Rapids Corridor.
- Improve current mobility, safety, and system efficiency while planning for the future needs within the Iowa City-Cedar Rapids Corridor.
- Design for future needs in consideration of emerging technologies.
- Identify and recommend methods of utilizing capacity across other transportation modes within the Iowa City-Cedar Rapids Corridor to increase throughput on Interstate 380.
- Consider design, environmental, and social implications of potential improvement strategies.
- Develop an implementation plan for increased mobility in the Iowa City-Cedar Rapids Corridor.

As part of the broader PEL Study effort, Iowa DOT developed the Impact of Alternative Modes on Interstate 380 Technical Memorandum (this document) to:

- Generally identify and describe the long-term potential for a commuter rail or automated vehicle (AV) component as part of enhanced multimodal transportation in the Iowa City-Cedar Rapids Corridor of which Interstate 380 is a key component.
- Identify a potential long-range alternative passenger transportation use vision and conceptual plan for the Cedar Rapids & Iowa City Railway (CRANDIC) Corridor right-of-way between Iowa City and Cedar Rapids, presently an active freight rail line owned by short line CRANDIC.
- Identify potential impacts to parallel Interstate 380 between Iowa City and Cedar Rapids, in the context of broader long-range transportation for the region that includes alternative transportation.

Section 2 Summary of Recent Multimodal Study in the Iowa City-Cedar Rapids Corridor

This section summarizes recent multimodal study in the Iowa City-Cedar Rapids Corridor. For more information, see recent multimodal study executive summaries in Technical Memorandum Appendix A.

2.1 Iowa Commuter Transportation Study

The Iowa legislature mandated that an Iowa Commuter Transportation Study be conducted on needs for and cost to provide additional transportation options in Johnson and Linn Counties to the over 7,500 daily commuters between the Cedar Rapids and Iowa City metro areas. In 2014, the study conducted a survey of public perceptions and preferences for commuter transportation options that received nearly 1,000 responses, roughly 70 percent of whom were receptive to utilizing bus or other ridesharing services.

Leveraging the survey results, the study recommended a mixture of public transportation options that could be pursued independently or act as part of a larger regional program. Recommended options included: 1) public interregional express bus service, 2) subscription bus service, 3) a public vanpool program, and 4) a public carpool program. To support those public transportation options, the following infrastructure and policies were recommended: 1) park and ride facilities, 2) regional commuter travel information, 3) transit priority measures, and 4) a guaranteed ride home program. The study identified a preliminary alignment, service plan, and range of costs for the public interregional express bus service. Detailed information on subscription bus service, a vanpool program, and a carpool program were not developed for this study; with these public transportation and ridersharing services instead being evaluated at qualitative level for pros and cons of each offering.

The findings of the study concluded with the following recommended next steps: 1) Identify a lead agency for implementation of study recommendations, 2) Form a study implementation committee, 3) Identify and pursue preferred funding and financing options for implementation, 4) Create an implementation plan, and 5) Define project phasing based on available funding and priorities.

2.2 Interstate 380 Coralville to Cedar Rapids Corridor Multimodal and Operations Study

In 2015, the Interstate 380 Coralville to Cedar Rapids Corridor Multimodal and Operations Study, or "Big Mo," was initiated to identify strategies to mitigate congestion on Interstate 380. The study focused on nearer term strategies, especially in light of the planned 2018-2025 reconstruction program for the Interstate 80 / Interstate 380 system interchange. Early screening within the study led to a focus upon three strategy packages: 1) public interregional express bus and vanpool, 2) public information / communications, and 3) additional congestion mitigation and operational improvement strategies.

Under strategy package 1, the study documented Iowa DOT's plan to provide funding for a seven-year pilot of the public interregional express bus service during the reconstruction period of Interstate 80 / Interstate 380 with long-term funding to be provided by local municipalities through a yet unidentified mechanism. Express bus service would be contracted with the East Central Iowa Council of Governments (ECICOG) acting as lead agency. The assumed start date for the service is mid-2018. Strategy package 1 also investigated potential ridership of public vanpool service, ultimately estimating that 26 vans would be needed based on surveyed market preferences. ECICOG will also administer the public vanpool service, RideConnect; the program will leverage Iowa Clean Air Attainment Program funding.

Strategy package 2 focused on the development of an engagement and communications plan. The framework for the plan was completed as part of the Big Mo study and will be further refined and implemented by Iowa DOT in coordination with its General Engineering Consultant for the Interstate 80 / Interstate 380 reconstruction.

Strategy package 3 considered operational strategies and network improvements to improve corridor mobility. Strategy package 3 includes a number of strategies that fit into the following categories: 1) Construction / work zone strategies, 2) Corridor / network management strategies, 3) Intelligent Transportation Systems (ITS) / Intelligent Work Zone strategies, and 4) Traffic Incident Management (TIM) strategies. As part of the study, strategies in each category were reviewed for feasibility and assessed an order of magnitude cost estimate and implementation timeframe. The study also included addition conceptual engineering for three strategies: 1) Bus-on-shoulder, 2) Ramp metering, and 3) Intersection / local system improvements. Additional study concluded that bus-on-shoulder operations and ramp metering operations provide a limited benefit to congestion. Those strategies were subsequently dismissed from further consideration. The study did identify two intersection improvement projects that are recommended to be constructed to alleviate congestion in the area of the Interstate 80 / Interstate 380 system interchange reconstruction.

2.3 Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study

The purpose of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study developed by Iowa DOT, CRANDIC, Metropolitan Planning Organization of Johnson County (MPOJC), and other local stakeholders in 2015 was to examine the conceptual feasibility of a passenger rail service operating on a 20.5-mile segment of the Cedar Rapids & Iowa City Railway (CRANDIC) Corridor between central Iowa City and the Eastern Iowa Airport at Cedar Rapids.

In this high-level conceptual study, various passenger rail modes – including streetcar, light rail transit, and commuter rail transit – were examined for their typical service characteristics and potential applicability for implementation in the CRANDIC Corridor. A conceptual assessment of the existing conditions in the CRANDIC Corridor right-of-way was conducted and conceptual implementation costs were estimated by passenger rail mode. The study determined conceptually that the lowest cost option for passenger rail development in the CRANDIC Corridor right-of-way was the commuter rail mode and its probable capital cost for implementation in 2015 dollars was estimated at between $250 million and $520 million and annual operations and maintenance costs were expected to range between $5.6 million and $6.7 million. The study also provided a conceptual phased implementation plan that considered the need for the service and the potential availability of funding to design and construct it, and also identified potential next steps for study and implementation. The results of the study were presented for discussion to local stakeholder agencies and organizations.

2.4 Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study

The purpose of the Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study developed by Iowa DOT, CRANDIC, MPOJC, and other local stakeholders in 2016 was to examine the conceptual feasibility of an initial phase of commuter rail service implementation over a 7.1-mile segment of the CRANDIC Corridor between central Iowa City and North Liberty, as identified in potential next steps in the previous Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study in 2015.

In this conceptual study, the commuter rail transit mode using self-propelled Diesel Multiple Unit (DMU) railcar equipment was examined for its typical service characteristics and applicability for implementation in the CRANDIC Corridor right-of-way. This study assumed that the CRANDIC Corridor between central Iowa City and North Liberty would be passenger rail only. A more in-depth assessment of existing conditions in the CRANDIC Corridor between central Iowa City and North Liberty was also conducted and a conceptual equipment and service plan and conceptual infrastructure requirements were developed. The study determined conceptually that the probable capital cost for implementation in 2016 dollars was estimated at $40.06 million and annual operations and maintenance costs were expected to be $1.39 million. The study also provided alternative infrastructure and equipment requirements as a strategy to potentially reduce upfront implementation capital costs and to allow for a varied equipment procurement strategy and phased plan of infrastructure improvements, and also identified potential next steps for study and implementation. The results of the study were presented for discussion to local stakeholders.

Section 3 Existing CRANDIC Corridor Right-of-Way General Description

A general description of the existing CRANDIC Corridor right-of-way between Iowa City and Cedar Rapids is provided in this section. For more information about the history and existing physical characteristics of the CRANDIC Corridor right-of-way, see Appendix B of this Technical Memorandum.

3.1 Corridor Right-of-Way Location, Intersections, and Connectivity

The CRANDIC Corridor right-of-way connects Iowa City in Johnson County and Cedar Rapids in Linn County – two of the State of Iowa's fastest growing metropolitan areas. According to U.S. Census data, the Iowa City and Cedar Rapids Metropolitan Statistical Areas were estimated to have a combined population of 428,242 as of July 1, 2014[1]. The north-south CRANDIC Corridor, and parallel Interstate 380 Corridor, sit astride growing residential, commercial, and industrial development in the region. The CRANDIC Corridor right-of-way intersects with:

- **Universities and Colleges** – including University of Iowa in Iowa City and Oakdale and Kirkwood Community College in Cedar Rapids.
- **Employment** – including access to several major and small business employers.
- **Shopping Destinations** – including Downtown Iowa City, and Iowa River Landing, Coral Ridge Mall, and other shopping centers in Coralville.
- **Recreation** – including University of Iowa sporting and cultural events, and parks and trails.
- **Hospitals** – including University of Iowa Hospitals and Clinics, Iowa City Veterans Administration Hospital, and Mercy Hospital in the Iowa City area.

Implementation of an alternative transportation mode in the CRANDIC Corridor right-of-way could also provide intermodal connectivity with existing and future passenger rail, transit, bus, and air services in the region as described below.

- **Intercity Passenger Rail** – Implementation of a twice-daily intercity passenger rail service between Chicago and Moline, Illinois, and Iowa City is under study by Iowa DOT and Illinois DOT. The CRANDIC Corridor right-of-way is located one block south of a potential Iowa City station of the intercity passenger rail service, which could provide a transfer point between the those trains and alternative transportation on the CRANDIC Corridor.
- **Public Transit** – Alternative transportation on the CRANDIC could potentially provide access to and enhance existing and future connecting public transit systems in the Corridor. Potential connections could be made with Iowa City Transit buses and the University of Iowa CAMBUS network at Iowa City; Coralville Transit buses at Iowa City, Coralville, and North Liberty; and Cedar Rapids Transit buses at the Eastern Iowa Airport in Cedar Rapids.
- **Intercity Buses** – Burlington Trailways serves the Court Street Transportation Center on Court Street in Downtown Iowa City and Megabus serves the Coralville Intermodal Transit Facility, which are located in close proximity to the CRANDIC Corridor.
- **Airport** – CRANDIC Corridor is located in close proximity to the Eastern Iowa Airport terminal in Cedar Rapids. The Airport presently hosts several daily domestic fights for Allegiant Air, American Eagle, Delta Airlines, Frontier Airlines, and United Airlines.
- **Trails** – CRANDIC Corridor intersects with local multi-use trails used by pedestrians and bicycles.

The map in Figure 1 shows the CRANDIC Corridor right-of-way and its relationship to the region's multimodal transportation network, including existing transit services; its proximity to principal roadways

1 U.S. Census, Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014 – United States – Metropolitan Statistical Area; 2014 Population Estimates; U.S. Census website (http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk); July 31, 2015

(including Interstates 380 and 80), other rail lines, and intercity bus stations; and a proposed future intercity passenger rail line to the Quad Cities and Chicago, Illinois.

3.2 CRANDIC Corridor Right-of-Way Development and Use

The Cedar Rapids & Iowa City Railway (CRANDIC) Corridor was constructed as an electrified passenger and freight interurban providing service over 27 miles between Iowa City and Cedar Rapids starting on August 13, 1904.[2] Much of the CRANDIC Corridor was constructed within an exclusive right-of-way, and short segments of the line were situated in city streets shared with other modes of transport in order to access downtowns in Iowa City and Cedar Rapids. Owing to the growing popularity of the automobile and the dominance of hard-surfaced roadways in the post-World War II era, CRANDIC ridership declined sharply and passenger rail service was discontinued on May 30, 1953.[3] Full dieselization of the remaining freight railroad operation soon followed. Today, the CRANDIC Corridor between central Iowa City and the southwest side of Cedar Rapids remains an active freight rail corridor that serves local industries.

3.3 Present General CRANDIC Corridor Right-of-Way Characteristics

The segment of the CRANDIC Corridor right-of-way under consideration for potential alternative transportation use in this Technical Memorandum is the 20.5 miles between Gilbert Street in central Iowa City and Wright Brothers Boulevard near the Eastern Iowa Airport in southwest Cedar Rapids[4].

The CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport generally varies from 50 to 100 feet in width, with some narrower segments existing in the urban areas of central Iowa City. CRANDIC also owns additional property adjacent to the right-of-way at Iowa City, North Liberty, and at other locations. The right-of-way accommodates the active single main track, sidings, and other industrial trackage required for the Cedar Rapids & Iowa City Railway to provide freight rail transportation services, at-grade crossings where the railroad interfaces with roadways and trails, and the infrastructure for a fiber optic line and utilities. In Figure 2, a typical representation of the current uses of the CRANDIC Corridor right-of-way, are shown at Cherry Street in North Liberty.

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2 Cedar Rapids & Iowa City Railway (CRANDIC) website; www.crandic.com; May 2, 2017

3 *Ibid.*

4 Note that the 20.5-mile CRANDIC Corridor right-of-way identified above and under assessment and study in this Technical Memorandum is between Gilbert Street in central Iowa City and Wright Brothers Boulevard in southwest Cedar Rapids. However, throughout the balance of this Technical Memorandum, the limits of the Study Area are identified as between Dubuque Street in central Iowa City (which is within the corridor 0.1 mile west of Gilbert Street) and the Eastern Iowa Airport in Cedar Rapids (which is adjacent to and within the corridor at Wright Brothers Boulevard) in order to be consistent with likely transit terminal points that would be developed for potential alternative transportation implementation in the CRANDIC Corridor right-of-way that is under study in this Technical Memorandum.

Figure 1. CRANDIC Corridor Right-of-Way between Iowa City and the Eastern Iowa Airport

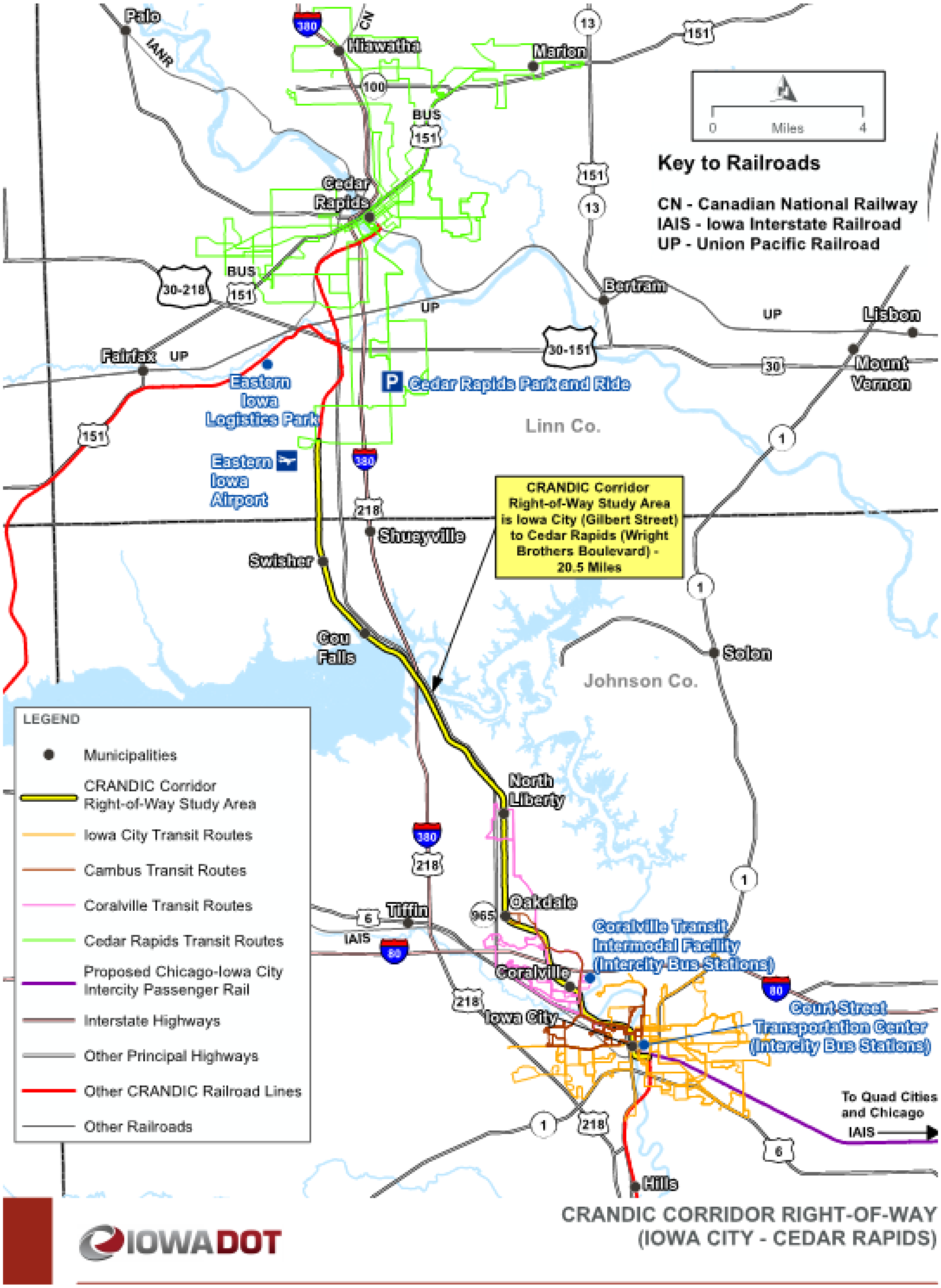

Figure 2. Typical CRANDIC Corridor Right-of-Way Usage

Source: HDR

Section 4 Conceptual Short-Term and Long-Term Vision for CRANDIC Corridor Right-of-Way Alternative Use

Iowa DOT developed a potential conceptual short-term and long-term vision for alternative use of the 20.5 miles of the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and Wright Brothers Boulevard at the Eastern Iowa Airport in Cedar Rapids, within the context of multimodal planning in the area, including the Interstate 380 PEL Study.

4.1 Conceptual Short-Term and Long-Term Vision Inputs

This vision for alternative use of the CRANDIC Corridor right-of-way was informed by:

- Previous recent studies of potential passenger rail implementation in the CRANDIC Corridor right-of-way, including the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study (2015) and the Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study (2016).
- Previous recent multimodal studies of the parallel Interstate 380 Corridor, including the Interstate 380 Coralville to Cedar Rapids Multimodal and Operations Study (2016) and the Iowa Commuter Transportation Study (2014).
- Stakeholder outreach conducted during development of the two passenger rail studies above (2015-2016) and during the development of this Technical Memorandum (2017).
- Stakeholder outreach and other public involvement activities conducted by Iowa DOT during development of the I-380 PEL Study, including I-380 PEL Study public comments (2017).
- The Iowa DOT Interstate 380 PEL Study Guiding Principles Technical Memorandum (2016).
- Internal discussions between Iowa DOT Office of Location and Environment, Office of Rail Transportation, Office of Systems Planning, and Iowa DOT District 6 (2016-2017).

4.2 Conceptual Short-Term and Long-Term Vision Criteria

The conceptual vision for alternative use of the CRANDIC Corridor right-of-way considered several criteria and related general considerations for a short-term planning horizon of 1-4 years (2017-2020) and a long-term planning horizon of 5-25 years (2021-2041). The criteria used to develop a corresponding short-term and long-term vision is identified below. (For more information about the criteria and general considerations used to develop the vision, see Appendix C of this Technical Memorandum.)

- Population growth trends
- Sustainability
- Mobility
- Accessibility
- Reliability
- Efficiency
- Capacity
- Safety
- Multimodal connectivity
- Near-term versus long-terms needs of the traveling public
- Capability for affordable and realizable implementation
- Economic development
- Community development
- General benefits of preserving the CRANDIC Corridor right-of-way

Based on discussions and consensus between Iowa DOT and various local public and private stakeholders, a conceptual short-term and long-term vision for alternative use of the CRANDIC Corridor right-of-way within the context of multimodal planning in the region, and especially as it relates to capacity improvements currently under study and development for Interstate 380, is as follows.

4.2.1 Conceptual Short-Term Vision for CRANDIC Corridor Right-of-Way Alternative Use

Pursue options in the short-term for promoting and preserving the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids as a valuable community asset for the future. Continue study of its potential development for alternative transportation use that promotes sustainability, enhances mobility, supports economic and community development, strengthens multimodal connections, and compliments multimodal capacity and the improvements currently under development on Interstate 380.

4.2.2 Conceptual Long-Term Vision for CRANDIC Corridor Right-of-Way Alternative Use

Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will:

- Preserve the CRANDIC Corridor right-of-way as a valuable regional asset for a variety of stakeholders.
- Promote sustainable, energy efficient, and cost-effective alternative transportation use that would match the needs of the region’s changing and growing population.
- Enhance mobility, accessibility, reliability, efficiency, capacity, safety, and connectivity of the region’s multimodal network, including Interstate 380.
- Embrace emerging technologies and best planning practices for alternative transportation implementation.
- Provide a catalyst for enhanced economic, community, and land use development adjacent to the CRANDIC Corridor right-of-way and Interstate 380.

This conceptual short-term and long-term vision was used to support analysis of potential alternative use modes and scenarios for the CRANDIC Corridor right-of-way for this Technical Memorandum.

Section 5 Potential Alternative Use Modes and Scenarios for the CRANDIC Corridor Right-of-Way

5.1 General Characteristics of Potential Alternative Transportation Modes

A general high-level description of the typical characteristics and features of the two potential alternative use modes under consideration for potential implementation in the existing CRANDIC Corridor right-of-way and the connecting multimodal network between Iowa City and Cedar Rapids – commuter rail and automated vehicle – is provided in this section.

5.1.1 Commuter Rail Mode

During previous development of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study, stakeholders identified Diesel Multiple Unit (DMU) commuter rail transit equipment as the modal choice likely most applicable to passenger rail implementation in the CRANDIC Corridor right-of-way and a potential option for a Phase 1 commuter rail service between Iowa City and North Liberty. This DMU equipment and an associated potential service plan for this first potential phase of operation were studied in the subsequent Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study, and was also selected for consideration in this Technical Memorandum.

Equipment for a potential commuter rail service implementation in the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids would include new self-propelled DMU railcars. This equipment operates in a push-pull configuration which allows the trainset to be operated from control cabs at either end, thus eliminating the need to turn trains at terminal points. As applied on several commuter rail systems in the U.S., modern DMU operations have demonstrated to be efficient, reliable, versatile, safe, accessible, and sustainable in all weather and operating environments. The general physical and operating characteristics of the typical DMU are identified in Table 1.

Table 1. Typical General Physical and Operating Characteristics of Commuter Rail DMUs

Characteristics	Description
Typical Average Trainset	Two cars coupled together to form one trainset; approximately 170 total feet in length
Typical Average Capacity per Trainset	150-170 seats on average, including accommodations for wheelchairs and a lavatory
Typical Trainset Accessibility	Meets full Americans with Disabilities Act (ADA) requirements for transit and provides maximum accessibility
Typical Average Service Frequency	Every 30 to 60 minutes
Typical Commuter Train Operating Speeds	Maximum speeds up to 79 mph Average speeds of 40 mph
Typical Technology Characteristics	Fuel-efficient diesel locomotive propulsion; reduced emissions. Energy efficient onboard lighting and climate control systems. Potential for onboard wi-fi service.
Typical Station Characteristics and Spacing in the Corridor	Elevated concrete level boarding platforms (meeting ADA compliance), canopy (over part or all of platform), lighting, signage, and ticketing machine. Stations may also have a small building / waiting room and parking. Typical station spacing: 1 to 4 miles

Characteristics	Description
Typical Corridor Infrastructure Requirements	Track and track structures to be of a standard that meets federal regulations for passenger rail operations; provides for adequate safety, reliability, and ride quality; accommodates the intended commuter train operating plan and maximum speeds; and reduces capital and operations and maintenance program costs. Sidings in the corridor for meet-pass events between trains. Wayside signal system to control train movements, enhance safety, and minimize the potential of a collision between trains. At-grade railroad / roadway crossing signal infrastructure with active warning devices (bells, flashing light signals, and gates) that is tied into roadway traffic signaling. Commuter rail stations / shelters, platforms, and ramps. Layover and maintenance facility where trainsets are staged between scheduled runs and are maintained during periods of non-operation.

The DMU cars would be designated as Federal Railroad Administration (FRA) Compliant, meaning that they would meet the current FRA safety regulations that are generally built around specifications providing the structural integrity to withstand a crash between passenger trains and freight trains on shared use corridors. While the study undertaken for this Technical Memorandum assumes that the CRANDIC Corridor right-of-way between Iowa City and the Eastern Iowa Airport would be designated passenger rail only, the acquisition of FRA Compliant passenger cars could potentially be required later by FRA, if CRANDIC decides to maintain its current common carrier obligation and host freight rail operations on this segment in the future.

As an example, a typical two-car trainset of new FRA Compliant DMU equipment recently constructed by Nippon Sharyo and the Sumitomo Corporation and operated in revenue commuter rail service by Sonoma-Marin Area Rail Transit (SMART) in the San Francisco Bay Area of California is shown in Figure 3.[5] Passenger rail equipment of this type and configuration is what has been explored in this Technical Memorandum for potential implementation in the CRANDIC Corridor right-of-way.

Figure 3. Typical Two-Car Trainset of New FRA Compliant DMU Equipment

Source: Sonoma-Marin Area Rail Transit

5 http://www.nipponsharyousa.com/tp101216.htm

5.1.2 Automated Vehicle Mode

Automated vehicles (AVs) as defined for this study are rubber-tired vehicles that operate on agency-operated roadways using a combination of autonomous and connected technologies. Autonomous technologies refer to the ability for computer processors within the vehicle to control tasks, such as: acceleration / deceleration and steering. Connected vehicle technologies refer to radio and cellular technologies that allow for rapid communication between vehicles and infrastructure. AVs are a rapidly-developing technology that are poised to impact travelers and transportation providers substantially. AVs were considered for this study due to their anticipated efficiency, scalability, and cost-effectiveness. AVs are still evolving, but the technology has been envisioned to work on a broad scale of vehicle types from passenger cars to semi-trucks to bus transit vehicles. With that flexibility, it could be envisioned that a dedicated alternative use corridor could potentially serve automated personal use vehicles and automated transit vehicles simultaneously. As further described in the scenario-specific sections that follow, the CRANDIC Corridor right-of-way combined with some agency policy considerations present significant challenges to mixed use that make auto use of the CRANDIC Corridor right-of-way unlikely. As such, the focus of this Technical Memorandum is to examine the potential characteristics of AVs operating solely as transit vehicles directly serving as bus or bus-rapid transit service.

As AVs enter move from test tracks to public roadways, these vehicles will operate in a safety-first manner, avoiding extreme speeds and leaving following distance behind a human driver well beyond what the computer-controlled system will need (while still requiring less safe following distance than a human operated vehicle). One crucial traffic benefit to existing roadways from these AVs will be reduced crashes; saving lives, preventing injuries and property damage, and alleviating traffic back-ups due to crashes on the roadway. The prospective safety benefits of AVs are predicted by U.S. Department of Transportation (USDOT) to be incredibly high, in large part to the 94 percent of existing crashes that are wholly or partially due to driver error.[6]

On top of safety benefits, AVs will improve travel times on congested roadways. Their efficiency in speeding up and slowing down and the vehicles' persistent attention to traffic conditions even in a chaotic situation will lead to less severe backups. Building on that improved efficiency; in cases where two or more AVs come in close proximity, the advanced technology will allow for the vehicles to match speeds and travel as a connected unit, using only a fraction of the space typically needed for a pair of vehicles.

Beyond benefits to safety and travel times on existing roadways, AVs are expected to enhance accessibility to the young, seniors, and disabled since these folks will not need to do the driving. AVs are also poised to change how transit riders deal with the first mile and last mile connectivity of trips since AVs, and particularly shared vehicles, can more easily serve individual homes and places of business. The concept is that a traveler buys their transit fare from home (likely on a computer or smart phone) and then a ride-matching program routes a vehicle to the traveler's front door. The traveler would then board the AV for a short trip over to the transit station (possibly with a few stops in their neighborhood to pick-up others). A similar short trip to their final destination might also be needed via AV. In that manner, a key limitation on existing transit, the problem of station access, can be addressed by this AV mode.

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[6] National Highway Traffic Safety Administration. Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey, 2015. Accessed November 22, 2016. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115.

Automated vehicles will also have flaws as a travel mode, but at this stage in their development there is less information available to assess whether the following are flaws, benefits, or of neutral impact.

- **Sustainability** – AVs are being built of newer generations of vehicles, which have been designed to higher fuel efficiencies and cleaner fuel exhaust standards. Newer vehicles are also more likely to be hybrid or fully electric vehicles that can utilize renewable sources, like solar power, to charge the vehicle's battery. Conversely, AVs could lead to greater use of vehicles, which, depending on how extensive the use is, could be adverse to the goal of sustainability.
- **Reliability** – Depending on the definition of reliability used, AVs likely fall in the range between improving reliability and essentially neutral on reliability. On the benefit side of the argument, travel times in the presence of AVs should experience much less variability and the overall occurrence of nonrecurring congestion, like traffic incidents, should be less frequent. However, should considerably more trips be taken, the on-time performance of the transportation system could be negatively impacted even if there is little variation in how travel varies day to day.
- **Other** – AVs may lead to challenges related to transportation equity, cybersecurity, and undesirable land development patterns. At this time, the transportation community has a general awareness of these potential issues and can make efforts to mitigate any adverse outcomes as the technology develops. Also, this list of potential impacts is not exhaustive, so other outcomes positive and negative may arise as automated vehicles are produced and gain popularity of use.

The focus of this Technical Memorandum is on developing a high-capacity transit corridor between Iowa City and Cedar Rapids, and the study focused on potential characteristics of public AVs operating solely as transit vehicles directly serving as a bus or bus-rapids transit type service. Table 2 identifies potential general physical and operating characteristics of an AV bus vehicle, as understood at this time.

Table 2. Potential General Physical and Operating Characteristics of AV Buses

Characteristics	Description
Typical Average Vehicle	Articulated vehicle, typically 60 feet
Typical Average Vehicle Capacity	Articulated vehicle, 65 seated and 50 standees
Typical Average Service Frequency	Highly variable - Between 10 and 60 minutes
Maximum and Running (includes dwell time) Vehicle Operating Speeds	Maximum speeds up to 60-65 mph Average running speeds (includes stopped time for passenger boarding) typically 2/3 of general traffic speeds on the same route
Typical Technology Characteristics	Diesel engine
Typical Station Characteristics and Spacing in the Corridor	Bus stops may be little more than a sign along the sidewalk, though bus rapid transit corridors tend to provide shelters accessible after a fare is purchased. Bus boarding heights were traditionally higher than curb level, requiring the bus to kneel to be accessible. Newer, high service buses have low-floor level boarding platforms. Typical stop spacing: 500-700 feet local buses, but bus rapid transit corridors often use 0.5-1.0 mile spacing to limit stops.
Typical Layover / Maintenance Requirements	Vehicles would layover at terminating stations between scheduled runs and would be maintained at a maintenance facility during non-operating periods.
Typical Corridor Infrastructure Requirements	Automated vehicles are rubber-tired, running on paved roadways. Auto manufacturers are developing automated vehicles with built-in sensing and mapping technology to allow their operation on today's roadways. However, automated vehicles can benefit from vehicle connectivity that would can be enhanced by communication and sensing equipment along the roadway, potentially including roadside equipment transmitting and processing dedicated short range communications (DSRC) messages.

As an example, a next generation articulated battery-electric bus recently developed by BYD is shown in Figure 4.[7] Bus equipment of this general type, but with consideration for AV features as they are currently understood, is what has been explored in this Technical Memorandum for potential implementation in the CRANDIC Corridor right-of-way and on the connecting roadway network.

Figure 4. Next Generation Articulated Bus

Source: BYD (Electric Vehicle manufacturer); photo location Seattle, Washington

5.2 Potential Alternative Use Scenarios

Iowa DOT developed a high-level assessment of potential alternative use scenarios for commuter rail and/or automated vehicle implementation between central Iowa City and Downtown Cedar Rapids, utilizing some or all of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids. The applicability of each mode for potential implementation in the CRANDIC Corridor right-of-way, and for connections to the multimodal transportation network outside of the CRANDIC Corridor right-of-way, including Interstate 380, is described. This section also defines how each alternative use scenario meets (or does not meet) the conceptual long-term vision developed for this Technical Memorandum. The four potential alternative use scenarios and the assumptions used in the conceptual assessment of each are described in this section.

5.3 Alternative Use Scenarios Assessment Assumptions

The following assumptions were made for development of the high-level assessment of potential alternative use scenarios for commuter rail and / or automated vehicle implementation in the CRANDIC Corridor right-of-way and within or parallel to the Interstate 380 Corridor right-of-way, as applicable:

- No freight rail service would be provided in the 20.5 miles of the CRANDIC Corridor right-of-way between Dubuque Street in Iowa City and Wright Brothers Boulevard (Eastern Iowa Airport) in Cedar Rapids in the future. Future study and implementation of alternative use on this segment of the right-of-way would require coordination with CRANDIC to determine the potential for the retention of freight rail service over any portion of this segment.
- The CRANDIC Corridor right-of-way segment from the Eastern Iowa Airport north to the CRANDIC Shops Area in southwest Cedar Rapids, approximately 5.5 miles, is a congested urban freight railroad terminal facility with potentially complex engineering and environmental constraints to accommodating alternative transportation use in the future, and is not considered in this study. The CRANDIC Corridor from the CRANDIC Shops Area northeast to Downtown Cedar

[7] https://chargedevs.com/newswire/byd-and-singapore-institute-collaborate-on-autonomous-vehicle-tech/

Rapids, approximately 1.5 miles, was a passenger rail only segment that operated largely within public city streets shared with other transportation modes. It was abandoned after discontinuance of passenger service in 1953, and is not considered in this study. Connections between the CRANDIC Corridor right-of-way at Wright Brothers Boulevard in Cedar Rapids and Downtown Cedar Rapids, when applicable, are assumed to be AV buses operating on existing roadways.

- One scenario includes an assessment of potential commuter rail implementation within or parallel to the Interstate 380 right-of-way and consists of a conceptual examination of the feasibility of the Interstate 380 Corridor right-of-way for rail use, including compatibility of gradients and curvature with typical commuter rail practices; compatibility of overhead highway structures and major drainage crossings for accommodation of a commuter rail line and feasibility of ingress and egress of the commuter rail line to and from the Interstate 380 right-of-way; and the available linear footprint in the Interstate 380 Corridor and its feasibility for construction, operating, and maintaining a commuter rail line. Further engineering of commuter rail implementation within or parallel to the existing Interstate 380 Corridor right-of-way was not considered for development, as conceptual analysis conducted for this study revealed significant feasibility challenges.
- The conceptual assessment resulted in a narrative with supporting Google Earth Pro imagery to detail key general conditions and bottlenecks. No engineering assessment was made for development of a commuter rail line within or parallel to the Interstate 380 Corridor right-of-way.
- Any assessment including AV implementation focused on AVs in place of fixed route transit service both in dedicated guideway and in mixed traffic. Station characteristics were not assessed for AVs. Operations of AVs in a fixed guideway within the CRANDIC Corridor right-of-way were assumed to be buses operating in two-way traffic flows.
- Conceptual level capital costs, where developed in past recent study for alternative use scenarios including commuter rail implementation in the CRANDIC Corridor right-of-way, were referenced, but not independently updated for this Technical Memorandum. Conceptual level capital cost estimates for AV mode development within and outside of the CRANDIC Corridor right-of-way were developed as a high-level representation for likely infrastructure and AV bus equipment required only, based on recent industry averages and projections for emerging technology.
- To show demand, traffic volumes, and public benefits for alternative use of the CRANDIC Corridor right-of-way (and the parallel Interstate 380 Corridor right-of-way, as applicable), conceptual ridership forecasts for each potential alternative use scenario were developed using the Federal Transit Administration (FTA) Simplified Trips on Project Software (STOPS) model. Forecasts were developed for a base year (defined as 2015) and two future years – 2025 and 2040. Additional detail about the methodology and assumptions underlying the STOPS modeling conducted for this Technical Memorandum can be found in Appendix D. A high-level presentation of STOPS modeling forecasts for each alternative use scenario appears later in this section; additional detail about the forecasts can be found in Appendix E.

5.4 Alternative Use Scenarios Assessment and Impacts on Interstate 380

Four CRANDIC Corridor right-of-way alternative use scenarios were considered for providing enhanced mobility and transit options between Iowa City and Cedar Rapids and are assessed in the following sections. Ultimately, alternative use of the CRANDIC Corridor right-of-way can be seen as part of an integrated multimodal transportation system that includes Interstate 380. Other Technical Memoranda developed for the Interstate 380 PEL Study address Interstate 380 as an individual asset, and this Technical Memorandum assesses how an adjacent potential transit service operating in the CRANDIC Corridor right-of-way may affect mobility needs along Interstate 380. Findings related to how current auto travelers might switch to transit and how that shift could affect Interstate 380 are also discussed. The following sections identify and generally summarize the following for each alternative use scenario:

- Alternative mode route and service characteristics
- General applicability of alternative transportation mode for potential implementation within the CRANDIC Corridor right-of-way (or within or parallel to the Interstate 380 Corridor right-of-way)
- Conceptual ridership forecast
- Conceptual cost of implementation
- General applicability with the vision for CRANDIC Corridor right-of-way alternative use
- General findings and recommendations

For more detail related to the alternative use scenarios assessment developed for the Technical Memorandum, see the complete assessment in Appendix E.

5.5 Alternative Scenario 1 (Commuter Rail – Central Iowa City-Downtown Cedar Rapids via CRANDIC Corridor and Interstate 380 Corridor Rights-of-Way)

Scenario 1 for alternative use includes the potential implementation of commuter rail in the CRANDIC Corridor right-of-way between central Iowa City and the location where the CRANDIC Corridor right-of-way and Interstate 380 intersect north of North Liberty, and in the Interstate 380 right-of-way from that intersection north to Downtown Cedar Rapids. Figure 5 shows the Scenario 1 route and its proximity to, and intersections with, the multimodal network in the region. Table 3 presents a high-level summary of the assessment of Scenario 1 undertaken for this Technical Memorandum.

Figure 5. Alternative Scenario 1 Route Map

Source: HDR

Table 3. Summary of Alternative Use Assessment for Scenario 1

Topic	Summary
Route and Service Characteristics	26-mile commuter rail route – approximately 13 miles within the CRANDIC Corridor right-of-way and 13 miles within or parallel to the Interstate 380 Corridor right-of-way. Daily commuter rail service operating on 130-minute headway (limited service option) and 30-minute headway (typical commuter rail service option) from Iowa City and Cedar Rapids were assessed. Run time between Dubuque Street (Iowa City) and Downtown Cedar Rapids endpoints assumed at 59 minutes. Considered potential stations at the following locations: Dubuque Street (Iowa City), Downtown Iowa City / University of Iowa, VA Hospital, Coralville, Oakdale, North Liberty, Wright Brothers Boulevard (Eastern Iowa Airport), and Downtown Cedar Rapids.* **Note – Specific potential station site unconfirmed for this phase of analysis.*
General Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way	The CRANDIC Corridor right-of-way connects Iowa City and Cedar Rapids – two of Iowa's fastest growing metropolitan areas, and it sits astride surging residential, commercial, and industrial development in the region. As an active freight railroad corridor that once hosted passenger rail service between Iowa City and Cedar Rapids, future commuter rail implementation in the CRANDIC Corridor right-of-way is considered feasible from an engineering, environmental, and constructability standpoint. The existing right-of-way footprint on much of the corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network.
General Applicability of Commuter Rail Mode for Potential Implementation in the Interstate 380 Corridor Right-of-Way	The Interstate 380 Corridor right-of-way connects Coralville (west of Iowa City) and Cedar Rapids; is used exclusively to accommodate a limited access freeway, local roadway network interchanges, and interfaces with intersecting railroad lines and waterways; and has never hosted a parallel railroad line within its alignment. The assessment considered that the Interstate 380 right-of-way between North Liberty and Cedar Rapids may be generally inadequate to construct, operate, and maintain a commuter rail line. According to the I-380 PEL Study, the existing Interstate 380 footprint between North Liberty and Cedar Rapids is considered insufficient to accommodate recommended system improvements in the short-term horizon (e.g. widening to include a third lane in each direction and new median and shoulders and interchanges that match current requirements and roadway design standards), necessitating the acquisition of additional parallel right-of-way in the near-term future. Any project to improve Interstate 380 in this manner would also pose significant challenges to the potential long-term implementation of a commuter rail line within the median or shoulders of the existing Interstate 380 Corridor right-of-way. It is therefore assumed that additional right-of-way beyond that described above for widening Interstate 380 would likely be required throughout most of the corridor between North Liberty and Cedar Rapids to accommodate a single track commuter rail line; any sidings at prescribed intervals for meet-pass events between commuter trains; and any potential commuter rail stations and related multimodal park and ride facilities in Cedar Rapids that may be developed within the corridor. Acquisition of additional right-of-way to accommodate a commuter rail line alignment parallel to Interstate 380 or to realign Interstate 380 and modify freeway interchanges with the local roadway network and interfaces with other roadway, railroad, and waterway crossings concurrent with the development of a commuter rail line, would present significant engineering, environmental, and constructability challenges; potentially provide negative impacts to Cedar Rapids and severe disruption to traffic on Interstate 380 during construction; and likely be cost prohibitive to develop.

<table>
<tr><th>Topic</th><th>Summary</th></tr>
<tr><td>Conceptual Ridership Forecast</td><td>
Average Weekday Ridership Estimates by Year and Route Segment (130 Minute Headway)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>888</td><td>118</td><td>134</td><td>1,140</td></tr>
<tr><td>2025</td><td>1,184</td><td>142</td><td>144</td><td>1,470</td></tr>
<tr><td>2040</td><td>1,698</td><td>226</td><td>203</td><td>2,127</td></tr>
</table>
Average Weekday Ridership Estimates by Year and Route Segment (30 Minute Headway)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>3,210</td><td>298</td><td>216</td><td>3,724</td></tr>
<tr><td>2025</td><td>4,266</td><td>238</td><td>363</td><td>4,867</td></tr>
<tr><td>2040</td><td>6,200</td><td>364</td><td>491</td><td>7,055</td></tr>
</table>
Note – Forecasts developed using FTA STOPS model.
</td></tr>
<tr><td>Conceptual Range of Costs for Implementation and Operations and Maintenance</td><td>

Capital Cost (2017 dollars) – $328 million - $683 million*
Annual Operations & Maintenance Cost (2017 dollars) – $7.4 million - $8.9 million*

*No new or refined costs were developed for this Technical Memorandum. Range of costs presented are conceptual only and were based on analysis of recent past studies and industry averages, adjusted to 2017 dollars. Conceptual cost does not include any costs for likely right-of-way acquisition and any modifications to Interstate 380, freeway interchanges, bridges, and other infrastructure that would likely be necessary to accommodate a commuter rail line within or parallel to the existing Interstate 380 Corridor right-of-way.
</td></tr>
<tr><td>General Applicability of Alternative Use Scenario with the Vision for CRANDIC Corridor Right-of-Way Alternative Use</td><td>

Scenario 1 does not preserve and repurpose for alternative transportation use the entire CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and the Eastern Iowa Airport (Cedar Rapids).
Development of the Scenario 1 commuter rail line segment within or parallel to the Interstate 380 Corridor between North Liberty and Downtown Cedar Rapids is not cost-effective to construct, operate, and maintain as a long-term alternative transportation option.

</td></tr>
</table>

Source: HDR / Iowa DOT

Alternative Use Scenario 1 General Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way and the potential for alternative use of part of the Interstate 380 Corridor right-of-way or additional right-of-way parallel to Interstate 380 has been developed based on the assessment of applicability of alternative use Scenario 1, the vision for alternative use of the CRANDIC Corridor right-of-way, the conceptual ridership forecasts for a continuous commuter rail service between Iowa City and Cedar Rapids (including cases for 130-minute headways and traditional commuter rail operations with 30-minute headways), a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service based on recent industry averages and past studies, and recommendations for improvements to Interstate 380 developed by Iowa DOT during the I-380 PEL Study.

Ridership forecasts developed using the FTA STOPS model suggest that the primary market for commuter rail service in the CRANDIC Corridor right-of-way exists between Dubuque Street in central Iowa City and North Liberty, as this segment has a high population concentration and has the most potential for attracting ridership. Commuter rail service in this scenario would serve Downtown Cedar

Rapids directly, but would not utilize the north of North Liberty-Eastern Iowa Airport segment of the CRANDIC Corridor right-of-way (approximately 7.3 miles long) or serve the Eastern Iowa Airport directly. Ridership forecasts do not show a high level of trips between the Iowa City and Cedar Rapids metropolitan areas based on STOPS results. The ridership forecasts also suggest that a commuter rail service with greater frequencies and operating on 30-minute headways from terminal points – an operating plan that is more typical of commuter rail service offered in the U.S. – would attract significantly more riders than would a commuter rail service with fewer frequencies and operations with headways of over two hours from terminal points. Implementation of a commuter rail service on 30-minute headways would also require additional commuter rail equipment and infrastructure investment.

Recommendations developed by Iowa DOT during the I-380 PEL Study include planning for the widening of Interstate 380 from four to six lanes between Coralville (west of Iowa City) and south Cedar Rapids in the short-term horizon to meet growing travel demand and new standards for interstate highway construction, which will consume much of the existing highway right-of-way and likely require the acquisition of additional adjacent right-of-way to accommodate the anticipated improvements to traffic lanes, medians, shoulders, on- and off-ramps, and other roadway components. The Interstate 380 Corridor right-of-way between south Cedar Rapids and Downtown Cedar Rapids already hosts six traffic lanes and is likely of insufficient width to also accommodate a single-track commuter rail line. Implementation of a single-track commuter rail line and any potential stations in the Interstate 380 segment of the corridor in the long-term horizon would likely require the acquisition of additional right-of-way and construction of various modifications to Interstate 380 and enhanced interface with other roadways and principal waterway crossings, which is anticipated to be costly to design, permit, and construct – particularly in the urban Cedar Rapids segment of the corridor. More in-depth study would be required by stakeholders in the future to determine the feasibility and actual conceptual cost of commuter rail implementation within or parallel to the Interstate 380 right-of-way between north of North Liberty and Downtown Cedar Rapids in the long-term horizon.

5.6 Alternative Scenario 2 (Commuter Rail – Central Iowa City-Eastern Iowa Airport in Cedar Rapids via CRANDIC Corridor Right-of-Way)

Scenario 2 for alternative use of the CRANDIC Corridor right-of-way includes the potential implementation of commuter rail service between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids. Figure 6 shows the Scenario 2 route and its proximity to, and intersections with, the regional multimodal network. Table 4 presents a high-level summary of the assessment of Scenario 2 undertaken for this Technical Memorandum.

Figure 6. Alternative Scenario 2 Route Map

Source: HDR

Table 4. Summary of Alternative Use Assessment for Scenario 2

Topic	Summary
Route and Service Characteristics	20.5-mile commuter rail route within the CRANDIC Corridor right-of-way Daily commuter rail service operating on 130-minute headway (limited service option) and 30-minute headway (typical commuter rail service option) from Iowa City and the Eastern Iowa Airport (Cedar Rapids) were assessed. Run time between Dubuque Street (Iowa City) and Eastern Iowa Airport endpoints assumed at 48 minutes. Considered potential stations at the following locations: Dubuque Street (Iowa City), Downtown Iowa City / University of Iowa, VA Hospital, Coralville, Oakdale, North Liberty, Cou Falls, Swisher, and Eastern Iowa Airport (Cedar Rapids).
General Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way	The CRANDIC Corridor right-of-way connects Iowa City and Cedar Rapids – two of Iowa's fastest growing metropolitan areas, and it sits astride surging residential, commercial, and industrial development in the region. As an active freight railroad corridor that once hosted passenger rail service between Iowa City and Cedar Rapids, future commuter rail implementation in the CRANDIC Corridor right-of-way is considered feasible from an engineering, environmental, and constructability standpoint. The existing right-of-way footprint on much of the corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network.

<table>
<tr><th>Topic</th><th>Summary</th></tr>
<tr><td>Conceptual Ridership Forecast</td><td>
Average Weekday Ridership Estimates by Year and Route Segment (130 Minute Headway)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>1,102</td><td>36</td><td>33</td><td>1,171</td></tr>
<tr><td>2025</td><td>1,462</td><td>46</td><td>40</td><td>1,548</td></tr>
<tr><td>2040</td><td>2,140</td><td>66</td><td>57</td><td>2,263</td></tr>
</table>
Average Weekday Ridership Estimates by Year and Route Segment (30 Minute Headway)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>3,030</td><td>86</td><td>74</td><td>3,190</td></tr>
<tr><td>2025</td><td>4,024</td><td>97</td><td>98</td><td>4,219</td></tr>
<tr><td>2040</td><td>6,000</td><td>152</td><td>120</td><td>6,272</td></tr>
</table>
Note – Forecasts developed using FTA STOPS model.
</td></tr>
<tr><td>Conceptual Range of Costs for Implementation and Operations and Maintenance</td><td>
• Capital Cost (2017 dollars) – $260 million - $541 million*
• Annual Operations & Maintenance Cost (2017 dollars) – $5.8 million - $7.0 million*
*No new or refined costs were developed for this Technical Memorandum. Range of costs presented are conceptual only and were based on analysis of recent past studies and industry averages, adjusted to 2017 dollars.
</td></tr>
<tr><td>General Applicability of Alternative Use Scenario with the Vision for CRANDIC Corridor Right-of-Way Alternative Use</td><td>
• Scenario 2 preserves and repurposes for alternative transportation use the entire CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and the Eastern Iowa Airport (Cedar Rapids).
• Implementation of the Scenario 2 commuter rail service in the long-term horizon would promote a sustainable and reliable alternative transportation service that is integrated with the multimodal network to enhance accessibility, connectivity, and mobility and would provide a catalyst for enhanced economic, community, and land use development.
</td></tr>
</table>

Source: HDR / HNTB / Iowa DOT

Alternative Use Scenario 2 General Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way has been developed based on an assessment of applicability of alternative use Scenario 2, vision for alternative use of the CRANDIC Corridor right-of-way, conceptual ridership forecasts for commuter rail between Iowa City and the Eastern Iowa Airport in Cedar Rapids (including cases for 130-minute headways and traditional commuter rail operations with 30-minute headways), and a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service based on recent industry averages and past studies.

Any development of a full commuter rail service between Iowa City and the Eastern Iowa Airport in Cedar Rapids would be considered for potential implementation in the long-term horizon, and would be considered supplementary to any capacity improvements made to parallel Interstate 380 in the short-term horizon. Ridership forecasts developed using the FTA STOPS model suggest that the primary market for commuter rail service in the CRANDIC Corridor right-of-way exists between Dubuque Street in central Iowa City and North Liberty, as this segment has the highest population concentration and has the most potential for attracting ridership, and could be considered as a first phase implementation phase of commuter rail. Trips to Downtown Cedar Rapids would have to transfer from the commuter rail service to another mode at the Eastern Iowa Airport, adding more travel time and making the service generally unattractive to the Cedar Rapids market based on STOPS results. The ridership forecasts also suggest that a commuter rail service with greater frequencies and operating on 30-minute headways from terminal points – an operating plan that is more typical of commuter rail service offered in the U.S. – would attract significantly more riders than would a commuter rail service with fewer frequencies and operations with headways of over two hours from terminal points. Implementation of a commuter rail service on 30-minute headways would also require additional commuter rail equipment and infrastructure investment.

5.7 Alternative Scenario 3 (Commuter Rail – Central Iowa City-Eastern Iowa Airport in Cedar Rapids via CRANDIC Corridor Right-of-Way and Automated Vehicle Service on Existing Roadway Network – Eastern Iowa Airport in Cedar Rapids-Downtown Cedar Rapids)

Scenario 3 for alternative use includes the potential implementation of commuter rail in the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids and automated bus service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids. Figure 7 shows the Scenario 3 route and its proximity to, and intersections with, the regional multimodal network. Table 5 presents a high-level summary of the assessment of Scenario 3 undertaken for this Technical Memorandum.

Figure 7. Alternative Scenario 3 Route Map

Source: HDR

Table 5. Summary of Alternative Use Assessment for Scenario 3

<table>
<tr><th>Topic</th><th>Summary</th></tr>
<tr><td>Route and Service Characteristics</td><td> 30-mile transit route – commuter rail line within CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and the Eastern Iowa Airport in Cedar Rapids (approximately 20.5 miles) and connecting automated vehicle (bus) service between the Eastern Iowa Airport and Downtown Cedar Rapids on existing roadway network (approximately 9.5 miles). Daily commuter rail service operating on 130-minute headway (limited service option) and 30-minute headway (typical commuter rail service option) from Iowa City to the Eastern Iowa Airport in Cedar Rapids were assessed. Connecting daily automated bus service between the Eastern Iowa Airport and Downtown Cedar Rapids operating on 10-minute headway was assessed. Run time between Dubuque Street (Iowa City) and Downtown Cedar Rapids endpoints with transfer of modes at the Eastern Iowa Airport was assumed at 75 minutes. Considered potential stations at the following locations: Dubuque Street (Iowa City) – commuter rail; Downtown Iowa City / University of Iowa – commuter rail; VA Hospital – commuter rail; Coralville – commuter rail; Oakdale – commuter rail; North Liberty – commuter rail; Cou Falls – commuter rail; Swisher – commuter rail; Eastern Iowa Airport – commuter rail / automated bus (transfer point); Kirkwood Community College – automated bus; and Downtown Cedar Rapids – automated bus. </td></tr>
<tr><td>Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way</td><td>The CRANDIC Corridor right-of-way connects Iowa City and Cedar Rapids – two of Iowa's fastest growing metropolitan areas, and it sits astride surging residential, commercial, and industrial development in the region. As an active freight railroad corridor that once hosted passenger rail service between Iowa City and Cedar Rapids, future commuter rail implementation in the CRANDIC Corridor right-of-way is considered feasible from an engineering, environmental, and constructability standpoint. The existing right-of-way footprint on much of the corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network.</td></tr>
<tr><td>Applicability of Automated Bus Mode for Potential Implementation on the Existing Roadway Network</td><td>The existing roadway network between the Eastern Iowa Airport in Cedar Rapids and Downtown Cedar Rapids is a paved network that already accommodates auto and transit bus traffic, and is therefore considered well-suited to the implementation of rubber-tired automated bus service, and any likely infrastructure upgrades required to accommodate this alternative transportation mode.</td></tr>
<tr><td>Conceptual Ridership Forecast</td><td> Average Weekday Ridership Estimates by Year and Route Segment
(130 Minute Headway for Commuter Rail and 10 Minute Headway for AV Bus)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>To / From Rural</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>988</td><td>78</td><td>730</td><td>37</td><td>1,833</td></tr>
<tr><td>2025</td><td>1,304</td><td>98</td><td>824</td><td>43</td><td>2,269</td></tr>
<tr><td>2040</td><td>1,924</td><td>118</td><td>1,073</td><td>63</td><td>3,178</td></tr>
</table>
Average Weekday Ridership Estimates by Year and Route Segment
(30 Minute Headway for Commuter Rail and 10 Minute Headway for AV Bus)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>To / From Rural</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>3,226</td><td>202</td><td>840</td><td>74</td><td>4,342</td></tr>
<tr><td>2025</td><td>4,278</td><td>244</td><td>956</td><td>94</td><td>5,572</td></tr>
<tr><td>2040</td><td>6,188</td><td>318</td><td>1,272</td><td>145</td><td>7,923</td></tr>
</table>
Note – Forecasts developed using FTA STOPS model. The To / From Rural category captures a small number of total trips from Iowa City and Cedar Rapids to proposed stations in rural areas only (e.g. Cou Falls and Swisher). </td></tr>
</table>

Topic	Summary
Conceptual Range of Costs for Implementation and Operations and Maintenance	• Capital Cost (2017 dollars) – $310 million - $661 million* • Annual Operations & Maintenance Cost (2017 dollars) – $7.2 million - $10.0 million* **No new or refined costs were developed for this Technical Memorandum. Range of costs presented are conceptual only and based on analysis of recent past studies, industry averages, and automated vehicle costs as presently understood, adjusted to 2017 dollars.*
General Applicability of Alternative Use Scenario with the Vision for CRANDIC Corridor Right-of-Way Alternative Use	• Scenario 3 preserves and repurposes for alternative transportation use the entire CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and the Eastern Iowa Airport (Cedar Rapids). • Implementation of the Scenario 3 combined commuter rail and AV bus service in the long-term horizon would promote a sustainable and reliable alternative transportation service that embraces technological advances; is integrated with the multimodal network to enhance accessibility, connectivity and mobility; and would provide a catalyst for enhanced economic, community, and land use development.

Source: HDR / HNTB / Iowa DOT

Alternative Use Scenario 3 General Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way has been developed based on the assessment of applicability of alternative use Scenario 3, the vision for alternative use of the CRANDIC Corridor right-of-way, the conceptual ridership forecasts for commuter rail service between Iowa City and the Eastern Iowa Airport in Cedar Rapids (including cases for traditional commuter rail operations with 30-minute headways) and implementation of automated vehicle (bus) service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids, and a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service and automated bus service based on recent industry averages and past studies.

Scenario 3 generally promotes passenger ridership better than the other scenarios, and particularly encourages high levels of commuter rail ridership between Iowa City and North Liberty. Scenario 3 appears to be conceptually feasible to construct and a good fit with the long-term vision for the CRANDIC Corridor right-of-way. Scenario 3 also has the benefit of providing connectivity between Downtown Iowa City and Downtown Cedar Rapids, via a transfer of modes at the Eastern Iowa Airport in Cedar Rapids.

Scenario 3 appears to have long-term value in providing multimodal connectivity, and based on stop-to-stop transit activity in the FTA STOPS model, a near-term approach to pursuing Scenario 3 could be the development of an initial commuter rail service between Dubuque Street (Iowa City) and North Liberty. This initial phase of implementation would benefit most from a shift of focus from longer headways (like the 130-minute headways explored in the STOPS modeling) to a more typical 30-minute headway service. STOPS ridership projections also support moderate use of automated bus or express bus service between the Eastern Iowa Airport and Downtown Cedar Rapids via Kirkwood Community College even in the near-term when a commuter rail link from the Eastern Iowa Airport to Iowa City would not yet exist.

A key challenge with the full implementation of Scenario 3 in the long-term horizon is the cost of buying, operating, and maintaining both commuter rail vehicles and automated buses. Conceptually, transit agencies can more efficiently operate and maintain one type of transit vehicle, as maintenance work for rail vehicles and the track they run on is very different than bus maintenance work. Also, the total number of vehicles needed in Scenario 3 would likely increase by not being able to continue a transit trip to a more logical terminal as it takes two vehicle purchases (one rail, one bus) to make an end-to-end trip.

5.8 Alternative Scenario 4 (Automated Vehicle Service – Central Iowa City on Existing Roadway Network; Iowa City-Eastern Iowa Airport in Cedar Rapids on CRANDIC Corridor Right-of-Way; and Eastern Iowa Airport in Cedar Rapids-Downtown Cedar Rapids on Existing Roadway Network)

Scenario 4 for alternative use includes the potential implementation of a continuous automated vehicle (bus) service using buses on the existing roadway network within Iowa City, in the CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport in Cedar Rapids, and on the existing roadway network within Cedar Rapids between the Eastern Iowa Airport and Downtown Cedar Rapids. Figure 8 shows the Scenario 4 route and its proximity to, and intersections with, the multimodal network in the region. Table 6 presents a high-level summary of the assessment of Scenario 4 undertaken for this Technical Memorandum.

Figure 8. Alternative Scenario 4 Route Map

Source: HDR

Table 6. Summary of Alternative Use Assessment for Scenario 4

<table>
<tr><th>Topic</th><th>Summary</th></tr>
<tr><td>Route and Service Characteristics</td><td> 30-mile transit route – automated vehicle (bus) service on existing roadway network between Court Street Transportation Center (Downtown Iowa City) and western Iowa City (approximately 2 miles), within the CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport in Cedar Rapids (approximately 18.5 miles), and on existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids (approximately 9.5 miles). Daily automated bus service operating on 10-minute headways between Iowa City and Cedar Rapids was assessed. Run time between Dubuque Street (Iowa City) and Downtown Cedar Rapids endpoints assumed at 63 minutes. Considered potential stations at the following locations: Court Street Transportation Center (Downtown Iowa City), West Campus Transportation Center (University of Iowa), Coralville, Oakdale, North Liberty, Cou Falls, Swisher, Eastern Iowa Airport (Cedar Rapids), Kirkwood Community College, and South Side Parking Ramp (Downtown Cedar Rapids). </td></tr>
<tr><td>General Applicability of Automated Bus Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way</td><td>The CRANDIC Corridor right-of-way connects Iowa City and Cedar Rapids – two of Iowa's fastest growing metropolitan areas, and it sits astride surging residential, commercial, and industrial development in the region. As an active railroad corridor with a profile suited for railroad operations, future automated bus implementation in the CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport in Cedar Rapids is considered likely feasible from an engineering, environmental, and constructability standpoint. The existing right-of-way footprint on much of the corridor is likely of sufficient width to accommodate a paved fixed guideway and interface with the local roadway network, although there could potentially be constraints in some urban segments of the corridor where additional right-of-way may be required. Future development of an AV bus route on the CRANDIC Corridor right-of-way would preclude the continuation of freight railroad operations or the implementation of any other alternative use mode.</td></tr>
<tr><td>General Applicability of Automated Bus Mode for Potential Implementation on the Existing Roadway Network</td><td>The existing roadway network between the Court Street Transportation Center (Downtown Iowa City) and western Iowa City and between the Eastern Iowa Airport in Cedar Rapids and Downtown Cedar Rapids is a paved network that already accommodates auto and transit bus traffic, and is therefore considered well-suited to the implementation of rubber-tired automated bus service, and any likely infrastructure upgrades required to accommodate this alternative transportation mode.</td></tr>
<tr><td>Conceptual Ridership Forecast</td><td> Average Weekday Ridership Estimates by Year and Route Segment
(10 Minute Headway for AV Bus)
<table>
<tr><th>Year</th><th>Within Iowa City / Coralville / North Liberty</th><th>Between Iowa City and Cedar Rapids Metropolitan Areas</th><th>Within Cedar Rapids / Eastern Iowa Airport</th><th>To / From Rural</th><th>Total Ridership</th></tr>
<tr><td>2015</td><td>1,646</td><td>242</td><td>581</td><td>91</td><td>2,560</td></tr>
<tr><td>2025</td><td>2,220</td><td>296</td><td>648</td><td>112</td><td>3,276</td></tr>
<tr><td>2040</td><td>3,830</td><td>394</td><td>857</td><td>149</td><td>5,230</td></tr>
</table>
Note – Forecasts developed using FTA STOPS model. The To / From Rural category captures a small number of total trips from Iowa City and Cedar Rapids to proposed stations in rural areas only (e.g. Cou Falls and Swisher). </td></tr>
<tr><td>Conceptual Range of Costs for Implementation and Operations and Maintenance</td><td>Capital Cost (2017 dollars) – $350 million - $625 million*
Annual Operations & Maintenance Cost (2017 dollars) – $2.9 million - $6.4 million*
*No new or refined costs were developed for this Technical Memorandum. Range of costs presented are conceptual only and were based on analysis of recent past studies, industry averages, and automated vehicle costs as they are presently understood, adjusted to 2017 dollars.</td></tr>
</table>

Topic	Summary
General Applicability of Alternative Use Scenario with the Vision for CRANDIC Corridor Right-of-Way Alternative Use	• Scenario 4 does not preserve and repurpose for alternative transportation use the entire CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and the Eastern Iowa Airport (Cedar Rapids). • Implementation of the Scenario 4 AV bus service in the long-term horizon would promote a sustainable, reliable, and cost-effective alternative transportation service that embraces technological advances; is integrated with the multimodal network to enhance accessibility, connectivity and mobility; and would provide a catalyst for enhanced economic, community, and land use development.

Source: HDR / HNTB / Iowa DOT

Alternative Use Scenario 4 General Findings and Recommendations

Alternative use Scenario 4 provides a cost-effective alternative public transportation strategy to the previously studied commuter rail concepts. The use of automated vehicles would have a major effect on potential development of a transit link between Iowa City and Cedar Rapids utilizing the CRANDIC Corridor right-of-way and leveraging the connecting existing roadway network. First, the choice to pursue AV technology along the corridor would require a thorough investigation into the market for automated buses and general readiness of the industry to supply automated vehicles in general. More than likely, the choice of pursuing AV technology would lead to a waiting period dependent on the speed with which the automated vehicle industry develops before a starter line using this technology could be implemented.

Schedule notwithstanding, if AVs are the preferred transit mode for implementation in the CRANDIC Corridor right-of-way in the long-term horizon, the CRANDIC railroad track would need to be removed in order to accommodate a new paved fixed guideway for automated bus use. The removal of the track would preclude any future development that jointly supports commuter rail and roadway traffic. Based on the mostly commonly employed transit market projection tool, FTA STOPS, a choice of bus transit over commuter rail transit is projected to lead to lower overall levels of ridership. The counterpoint to the reduced ridership is that AV transit costs are likely to be less than the commuter rail transit options.

Overall, Scenario 4 appears to be a viable option in the long-term horizon, although at the present, it is open to a great deal of uncertainty as AV technology continues to be developed and better understood. Should Scenario 4 be preferred by stakeholders for alternative transportation implementation in the Iowa City-Cedar Rapids Corridor, a contingency plan should also be developed that considers existing and bus-rapid transit (traditional, non-autonomous vehicles operated by drivers) as a potential replacement for automated bus transit.

5.9 Alternative Use Scenarios Assessment Summary and Recommendations

Several general conclusions emerged from the assessment of the ridership potential, conceptual cost considerations, and other general considerations for implementation of four potential alternative use scenarios of the CRANDIC Corridor right-of-way between Iowa City and Cedar Rapids and their impacts on parallel Interstate 380, as conducted during development of this Technical Memorandum.

The first conclusion is that the ridership potential for commuter rail and / or automated bus transit implementation in the CRANDIC Corridor right-of-way between Iowa City and Cedar Rapids in the long-term horizon is not so large to serve as a replacement for the additional roadway capacity that would be provided by the widening of Interstate 380 between Coralville (west of Iowa City) and Cedar Rapids in the short-term horizon. As other elements of the Interstate 380 PEL Study have confirmed, in light of the need for additional freeway capacity and to address other documented existing system deficiencies on

Interstate 380 in the short-term horizon, the implementation of a potential parallel transit line in the long-term horizon should be considered supplemental to freeway widening rather than a potential replacement to widening in the short-term horizon.

Of the four alternative use scenarios analyzed, a natural initial alternative transportation use of the CRANDIC Corridor right-of-way appears to be implementation of a first phase of commuter rail service between Dubuque Street in central Iowa City, Coralville, and North Liberty (approximately 8 miles). This segment of the CRANDIC Corridor right-of-way is well-suited for commuter rail operations, offers comprehensive multimodal connectivity and a viable public option to auto travel on Interstate 380 (and intersecting Interstate 80 in the Coralville / Iowa City area), and it provides the best current market for ridership and transit use based on the FTA STOPS ridership project models across alternative use Scenarios 1, 2, and 3 (with Scenario 4 having similar findings, but for automated bus technology).

Commuter rail implementation between Iowa City and North Liberty has also been considered for this segment in recent 2015 and 2016 studies by Iowa DOT, CRANDIC, MPOJC, and other stakeholders, and dovetails with the additional study conducted by Iowa DOT for this Technical Memorandum. In these past studies, it was determined conceptually that the probable capital cost for implementation of a starter daily commuter service operating with longer service headways between central Iowa City and North Liberty was $40.9 million (in 2017 dollars) and annual operations and maintenance costs was expected to be $1.42 million (in 2017 dollars). STOPS ridership projections developed for this Technical Memorandum suggest that commuter rail service with greater frequencies and operating on shorter 30-minute headways from terminal points – an operating plan that is more typical of U.S. commuter rail service – would attract significantly more riders than would a service with fewer frequencies and longer headways. Implementation of a commuter rail service on 30-minute headways between central Iowa City and North Liberty would likely require additional commuter rail equipment and infrastructure investment. The likely conceptual capital cost (above the $40.9 million presented in past study) to implement commuter rail service on 30-minute headways, and a related conceptual annual operations and maintenance cost, was not developed for this Technical Memorandum and would be developed in a future phase of study.

In addition to potential future study for commuter rail implementation between central Iowa City and North Liberty in the short-term horizon, stakeholders may also consider the potential for operating a trial or pilot commuter rail service to further gauge demand and public interest in commuter rail in the region. Potential conceptual operating, infrastructure, and equipment plans and related conceptual costs for this approach were not developed for this Technical Memorandum.

Beyond a potential first phase of commuter rail implementation between Iowa City and North Liberty, STOPS ridership projections also recommend the implementation of 30-minute commuter rail service headways for all other commuter rail implementation scenarios, rather than the originally considered 130-minute headways which are too infrequent to make transit an attractive option. Use of a 30-minute headway for any potential commuter rail implementation scenario would require some alterations of previous feasibility assessments, or development of new assessments, to account for the likely additional rail infrastructure and equipment required to accommodate more frequent service on a single-track commuter rail corridor. Construction of this first, starter commuter rail service in the CRANDIC Corridor right-of-way would likely eliminate the all autonomous bus Scenario 4 from any future consideration between central Iowa City and North Liberty, which is recommended based on a lower potential for long-term ridership for the automated bus mode than the commuter rail mode between these points (note that some past transit studies in the U.S. have suggested a perception that transit riders typically have a preference for riding the rail mode over the bus mode in many U.S. transit markets, and this preference may have impacted STOPS modeling developed for this Technical Memorandum).

The analysis conducted for this Technical Memorandum did not show extraordinary ridership growth related to Scenario 1 – implementation of commuter rail in the CRANDIC Corridor right-of-way and within or parallel to the Interstate 380 Corridor right-of-way – nor did Scenario 1 completely meet the long-term vision for alternative use of the CRANDIC Corridor right-of-way. Development of the Scenario 1 segment within or parallel to the Interstate 380 Corridor between North Liberty and Cedar Rapids in particular may not be feasible due to the likely high cost to design, permit, acquire land, and construct a commuter rail line within or adjacent to the Interstate 380 Corridor right-of-way and it may potentially exhibit significant negative impacts on Interstate 380 and the connecting roadway network during construction, operations, and maintenance. As such, it is recommended that Scenario 1 be eliminated from further consideration.

Consequently, Scenario 2 and Scenario 3 appear feasible from a general assessment of the ridership potential, conceptual cost considerations, and for minimal known impacts on Interstate 380 to construct, operate, and maintain alternative transportation services, and are therefore recommended to be retained for potential future study in the short-term horizon and potential implementation in the long-term horizon. To allow for future full development of either Scenario 2 or Scenario 3, which would include extension of the Iowa City-North Liberty phase one commuter rail service, identified above, north to the Eastern Iowa Airport in Cedar Rapids, it is recommended that stakeholders explore the potential for exclusive use of the CRANDIC Corridor right-of-way between central Iowa City, North Liberty, and the Eastern Iowa Airport by future passenger transportation, and also to consider the potential for public agency purchase and preservation of the entire CRANDIC Corridor right-of-way between those points. After development of the initial phase of commuter rail service implementation between central Iowa City and North Liberty, future study may uncover additional scenarios for alternative transportation use on other segments of the CRANDIC Corridor right-of-way, potentially including a commuter rail service extension or mixed-mode public transportation that could possibly involve automated vehicles. In any phase of commuter rail service implementation in the CRANDIC Corridor right-of-way, the potential for inclusion of automated vehicles that provide first-mile / last-mile transportation from commuter rail stations to local destinations via the connecting roadway network could also be explored.

Section 6 Next Steps for Potential Study and Implementation in the CRANDIC Corridor Right-of-Way

This section identifies potential next steps for future study and alternative transportation implementation in the CRANDIC Corridor right-of-way that are consistent with the conceptual short- and long-term vision and conceptual analysis of alternative use modes and scenarios for alternative transportation implementation in the CRANDIC Corridor right-of-way in the context of the region's multimodal network as developed for this Technical Memorandum, and the recommendations and vision for the Interstate 380 Corridor as identified by Iowa DOT during the I-380 PEL Study.

The next steps outlined below suggest a potential approach for advancing additional study and potential development of alternative transportation use in the CRANDIC Corridor right-of-way. Specific details about the process outlined below are subject to ongoing project stakeholder coordination and approval.

Step 1: Develop Consensus Regarding Conclusions and Recommendations from Recent Multimodal Study and Stakeholder Outreach in the CRANDIC Corridor Right-of-Way

Iowa DOT and other public and private stakeholders will come to a consensus that recommendations for the preservation and promotion of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport at Cedar Rapids as an asset for potential alternative transportation use, as informed by applicable recent multimodal study in the region and this Technical Memorandum, related stakeholder outreach, and a general understanding of the current and potential future transportation needs of Johnson and Linn Counties, provides a valuable long-range opportunity that should be considered in the context of future transportation planning and community and economic development for the region.

Step 2: Determine Lead Agency for Future Study and Potential Implementation of Alternative Transportation Use in the CRANDIC Corridor Right-of-Way

Future study for potential implementation of alternative transportation modes (commuter rail and / or automated vehicle) on the CRANDIC Corridor right-of-way between Dubuque Street in Iowa City and the Eastern Iowa Airport at Cedar Rapids based on the recommendations will be supported by a partnership of several local stakeholder agencies, companies, organizations, and jurisdictions in Johnson and Linn counties. These stakeholders would include metropolitan planning organizations, regional planning affiliations, current right-of-way owner and freight railroad operator Cedar Rapids & Iowa City Railway (CRANDIC) and its parent company Alliant Energy, municipalities, county agencies, universities and colleges, chambers of commerce, economic development agencies, major companies and employers, citizens' groups, and others. Participation by representatives of these entities would be subject to internal approval within each entity. A lead agency would be designated that spearheads preliminary coordination and communication between stakeholders. While future study and potential alternative use implementation would be led by stakeholders at the local level, it is anticipated that Iowa DOT would continue to support these efforts at the state and regional levels.

Step 3: Establish CRANDIC Corridor Right-of-Way Study and Implementation Committee

A CRANDIC Corridor Study and Implementation Committee would be organized by the lead agency to coordinate all future study (and potentially, future implementation, which could also include exploration of a trial commuter rail service between central Iowa City and North Liberty to further gauge public demand and interest) of alternative transportation use in the CRANDIC Corridor right-of-way. The committee would include members of local stakeholder agencies, companies, organizations, and jurisdictions in Johnson and Linn counties, as identified in Step 2 above. The committee would coordinate at established regular intervals to maintain momentum.

Step 4: Conduct Additional CRANDIC Corridor Right-of-Way Study

The CRANDIC Corridor Study and Implementation Committee, in partnership with a broad array of public and private stakeholders in the region, would conduct preliminary study necessary to design, permit, and construct commuter rail and / or automated vehicle implementation in the CRANDIC Corridor right-of-way. Depending upon what alternative use mode and scenario is studied, the scope of future preliminary study could include the development of ridership, revenue, and demand / traffic forecasts; conceptual engineering for infrastructure and facilities; comprehensive capital and operations and maintenance cost estimates; environmental review and related documentation; operating plan; equipment plan; maintenance plan; financial plan; benefit-cost analysis; and other efforts that would provide refined and more comprehensive conclusions and recommendations. These study components would likely be eligible as supporting documentation for any future federal or state grant applications to secure funding for implementation of alternative use in the CRANDIC Corridor right-of-way. Subsequent CRANDIC Corridor right-of-way study should inform, and be informed by, and be integrated with other local, county, regional, and state planning initiatives and programs.

Step 5: Identify and Pursue Preferred Funding and Financing Options for Implementation of Alternative Use of the CRANDIC Corridor Right-of-Way

The CRANDIC Corridor Study and Implementation Committee, in partnership with a broad array of public and private stakeholders in the region, would coordinate with federal, state, and local agencies and local private partners to determine the potential for public-private partnerships and funding availability to support development of alternative use of the CRANDIC Corridor right-of-way. In order for the project to be eligible to receive federal funding, a public agency (which could be the lead agency) may need to be identified or a new agency created to administer and manage the funding. It may be preferable to establish a Regional Transit District (RTD) or similar mechanism to manage funding, if awarded in the future, and to spearhead construction and operations and maintenance of alternative use of the CRANDIC Corridor right-of-way.

Step 6: Determine Potential Phased Implementation of Alternative Use in the CRANDIC Corridor Right-of-Way Based on Local Priorities and Funding Availability

Demand for alternative transportation service and the initial eligible federal, state, and local funding sources may or may not be sufficient to fully develop alternative transportation use within the entire CRANDIC Corridor right-of-way between Dubuque Street in Iowa City and the Eastern Iowa Airport at Cedar Rapids in a single project phase. Phased implementation of a commuter rail service or automated vehicle service could be employed to match demand for alternative transportation and available funding to design and construct it, and also to bolster local support for broader implementation in the CRANDIC Corridor. If the commuter rail alternative mode is ultimately selected by stakeholders, for example, it could potentially be phased geographically with a first phase between Dubuque Street in Iowa City and North Liberty and a second phase extension from North Liberty to the Eastern Iowa Airport at Cedar Rapids. Similarly, subsequent implementation phases could allow for additional commuter train frequencies and / or stations on the first phase territory, second phase territory, or both, as demand increases in the future. Automated vehicle service, if selected for implementation, could also be phased geographically.

Step 7: Develop Plan for Implementation of Alternative Use in the CRANDIC Corridor Right-of-Way

In consideration of the recommendations, established priorities, and the outcomes of ongoing study; preliminary information on funding needs, availability, and eligibility; and the potential for phased implementation, a comprehensive implementation plan should be developed that specifically lists the steps to implement preferred alternative use on the CRANDIC Corridor right-of-way. The plan will be developed by the CRANDIC Corridor Study and Implementation Committee and a broad array of public and private stakeholders through the analysis of potential strategies for implementation, operations, and maintenance of alternative use of the CRANDIC Corridor right-of-way. The implementation plan should be in concert with other local, county, regional, and state planning initiatives and programs.

I-380 Planning Study

INTERSTATE 380

PLANNING AND ENVIRONMENTAL LINKAGE (PEL) STUDY

Appendix A – Recent Multimodal Study in the Iowa City-Cedar Rapids Corridor

Office of Location and Environment | February 2018

1 Introduction

This appendix presents the executive summaries for recent multimodal study between Iowa City and Cedar Rapids, Iowa, as organized below:

- Iowa Commuter Transportation Study (2014)
- Interstate 380 Coralville to Cedar Rapids Corridor Multimodal and Operations Study (2015)
- Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study (2015)
- Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study (2016)

Executive Summary

The Iowa legislature directed the Iowa Department of Transportation (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." To meet this requirement, the Iowa DOT commissioned the Iowa Commuter Transportation Study (ICTS) to identify the existing and future commuter needs in the Interstate 380 (I-380) corridor and determine the viability of various commuter transportation improvements to address those needs.

The Office of Public Transit (OPT) was responsible for managing the study through a Project Management Team which included staff representatives of Iowa DOT's System Planning unit and the East Central Iowa Council of Governments (ECICOG). Iowa DOT retained HNTB, a transportation planning and engineering firm that has been assisting Iowa DOT with the assessment of I-380 improvements. A 15-person Advisory Group, comprised of transportation, planning and economic development stakeholders, was instrumental in providing valuable input throughout the study. The study relied heavily on input from major employers in the study area and the results of two public surveys that produced a combined total of nearly 1,000 responses from study area commuters.

Commuting between the Cedar Rapids and Iowa City metropolitan areas is significant. As shown in the table below, there are over 7,500 commuters travelling between the Cedar Rapids and Iowa City metropolitan areas and most of these commuters are traveling during the peak periods using I-380.

Table E-1: Cedar Rapids Metropolitan Area – Iowa City Metropolitan Area Commuter Patterns

Origin Area	Destination	Total Commuters
Cedar Rapids/Hiawatha/Marion	North Liberty/Coralville/Iowa City	4,159
North Liberty/Coralville/ Iowa City	Cedar Rapids/Hiawatha/Marion	3,371

Source: U.S. Census Bureau, American Community Survey 2006-2010 5-year samples

The public interest for improvements in the I-380 corridor is evident from the public surveys. Over 90 percent of respondents think transportation improvements are needed. Nearly 70 percent of respondents stated that they would use a public bus for their commute, indicating significant support for transit and other forms of ridesharing. For a detailed breakdown of survey results, see **Appendices A** and **B**.

I-380 Commuter Transportation Improvements

The study 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 includes:

- ***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.

Commuter rail service in the corridor was previously studied in the Cedar-Iowa River Rail Transit Project Feasibility Study in 2006; this mode was considered in the evaluation. However, the capital and operating costs, and the cost effectiveness measured by cost per passenger was found to be significantly greater than comparable bus options. Therefore, at this time, the commuter rail service is not recommended to be pursued as part of the preferred package of service improvements in the short or mid-term. However, as pointed out in the previous study, the communities may reevaluate in the future.

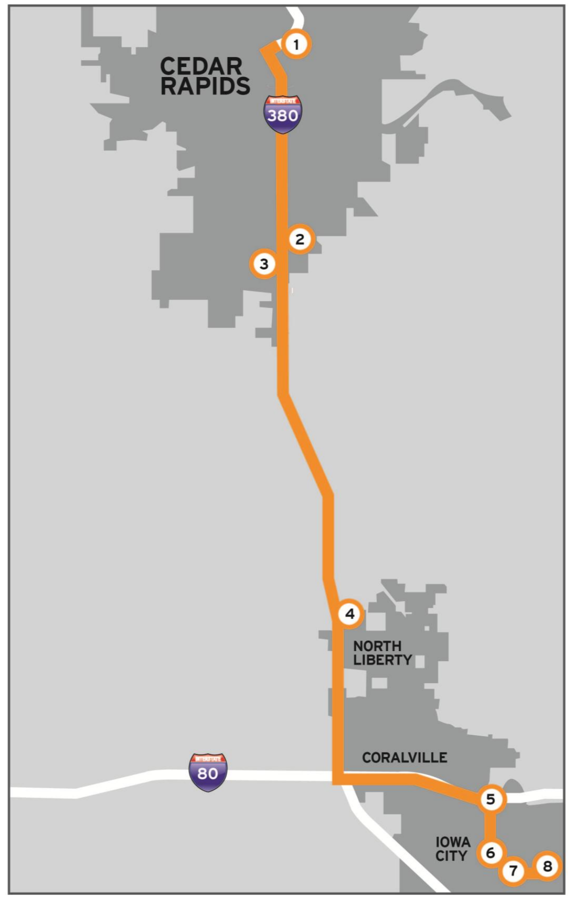
This package of improvements also includes recommended infrastructure and technology improvements that will augment the service alternatives and make them more effective:

- ***Park and ride facilities***: These are convenient locations along or near the primary commuting corridor to park private autos and connect to some form of public or private transportation which may include vanpools, carpools, and public bus service.
- ***Regional Commuter Travel Information***: This is a readily accessible and comprehensive source of information on all commuter transportation options in a defined area. Information includes routing, pick-up points, schedules, fares and fees, and other information necessary for commuters to make decisions regarding mode of travel.
- ***Transit Priority Measures***: These are transportation engineering tactics intended to make public transit and ridesharing more attractive to potential users by reducing travel time and improving reliability. Priority measures include strategies such as dedicated transit or high occupancy vehicle (HOV) lanes, bus-on-shoulder operation, traffic signal priority and queue jump lanes.
- ***Guaranteed Ride Home***: This service is used in conjunction with public transportation and rideshare options to provide a ride home in case of an emergency (illness, personal crisis), usually a cab ride that is reimbursed up to a certain amount.

Public Interregional Express Bus Service

This 2-way premium express service would operate with a minimum number of stops to minimize travel time in order to make the service as competitive as possible with auto commuting. In concept, the service would operate between downtown Cedar Rapids and downtown Iowa City using I-380 and I-80, with potential stops at the Cedar Rapids Ground Transportation Center, Kirkwood Community College, park and ride near the Eastern Iowa Airport, park and ride near North Liberty, the Coralville Intermodal Facility, University of Iowa, University of Iowa Hospitals and Clinics, and the Iowa City Court Street Transportation Center.

Figure E-1: Conceptual Public Interregional Express Bus Alignment and Stops



The service would rely on park and ride lots as collection points for the dispersed commuter origins and the current transit networks for distribution to destinations not within walking distance of stops. The graphic to the right shows this concept.

Four operating plans with varying service frequency were evaluated for the express service. The option with 30 minute service during the peak periods, assumed to be 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m., was judged to be the most effective in balancing costs and benefits such as ridership. Ridership was estimated at 563 daily trips for the 30 minute frequency option. For any of the alternatives, midday off peak service can be considered, however, this service may be eliminated if a guaranteed ride home program is in place.

The proposed service would use standard 40 passenger transit buses. Operating and capital costs were estimated for all of the bus options evaluated and are presented in the final report. For simplicity, only figures for the 30 minute frequency option are show in **Table E.2** below. The capital costs do not include the cost of vehicle storage and park and ride lots. Initial park and ride lots could include no cost lease options on shared use private lots. The table below shows the public transportation-related costs that require new funding.

Table E-2: Public Transportation Option Costs and Revenues – 2014 dollars

Service Option	High Estimate	Low Estimate
*Transit Only Capital Cost	$2,831,000	$990,000
Annual Operating Cost	$1,037,000	$676,000
Passenger Revenue	$502,000	$502,000
Annual Operating Funding Needed	$535,000	$174,000

**Note: Capital costs only include vehicles costs.*

The figures in **Table E.2** are shown as a range reflecting the uncertainty of estimating costs for a service that is defined only conceptually, and the fact that there are many different ways to deliver the service, all of which have different cost implications.

Subscription Public Bus Service

A subscription bus is tailored to the commuter needs of a specific locale or even a single employer. Large employers sometimes have a need to move a relatively large number of employees, 20 to 30 or more, from an origin area to the workplace. In concept the service works similar to a vanpool except the vehicle is larger, usually a small to medium size bus, and the driver is a professional rather that one of the commuters.

The design and operation of a subscription bus is very flexible; often the service consists of one trip to the workplace and a return trip after the workday. The route can be designed to access the largest number of employees; a park and ride lot is typically used as a collection point. The service can be limited to employees of a single company, or can be open to the public, serving multiple employers.

The Whirlpool manufacturing plant near the Amana Colonies is an example of a location that may be effectively served by a subscription bus. With a current workforce of 2,200 and growing, and a location remote from large numbers of employees, the plant would benefit from a more structured approach to commuter options. However, the low density area of the plant cannot support regular fixed route transit service.

Public Vanpool Program

To meet the needs of dispersed origins, particularly in the rural areas not directly served by the I-380 corridor, a public regional vanpool program was recommended. This program would complement the proposed interregional express bus service and address service gaps of existing private vanpools by providing a service that is open to the public and is an efficient and cost-effective employment transportation option for commuters with dispersed origins.

Two vanpool programs are currently provided in the study area. The University of Iowa provides a program that is limited to university employees with 80 vanpools including 15 in the I-380 corridor from the Cedar Rapids area. A private firm, vRide provides private vanpool service, however, it is up to individuals who live and work in the same areas to collectively organize.

An expanded public vanpool program can take different forms. The vanpool program could be operated by an existing transit service operator or other agency eligible to receive federal and state funding. The benefit of this is that the operator could use federal and state transit funding for vehicle acquisition thereby lowering the cost to the commuter. The program requires administrative and management support to handle responsibilities such as vehicle acquisition, defining program policies and procedures, training drivers, assisting in ridematching and program accounting. Alternatively, an agency could contract with a private firm such as vRide to handle all operational aspects of the program.

It is possible for user fees to cover all program costs. In practice user fees would be set to achieve program policies regarding cost recovery. Typically, agency operated programs cover some costs through grants or local transit funding. Operating costs typically are in the range of $10,000 to $12,000 per vanpool, although program costs vary widely. The capital cost of the vans is either realized as an outright purchase cost, or a lease cost. Vans typically cost in the range of $35,000 to $40,000 per vehicle.

There is no reliable means to estimate the demand for vanpooling, however the public surveys revealed a high level of interest among survey respondents in vanpooling (and carpooling). Moreover, much of the study area outside of the I-380 corridor does not currently have commuter transit service and likely will not be able to support transit in the foreseeable future.

Public Carpool Program

A carpool program can be implemented less expensively than other programs and is recommended because of its ease of implementation and cost effectiveness. A formal carpool program is a natural element of a commuter transportation program. Employers and stakeholders have noted their desire for a centralized ridematching system. This would need to be integrated into existing programs and would need to be actively promoted by sponsoring agencies.

Statewide Applicability

Iowa's socioeconomic and passenger travel trends suggest there will be a need to identify travel demand management strategies for increasing the safety and efficiency of Iowa's transportation system. Increased population in and around metropolitan areas will create congestion and capacity issues as long as single-occupant vehicle travel remains the primary mode of travel. As Iowans drive longer distances to work, it will be increasingly important to identify and maintain commuter routes with facilities and services that provide alternatives to the single-occupant vehicle.

When examining the applicability of this effort to other areas of the state, the advisory group and project management team looked to identify other commuter corridors that were comparable to the Cedar Rapids-Iowa City corridor. The general consensus was that there was only one truly comparable corridor in the state of Iowa, that being the Ames-Des Moines corridor. Here you also have two metropolitan areas (population greater than 50,000), separated by roughly the same distance, and connected by a similar interstate highway facility that carries comparable levels of passenger traffic.

Having identified Ames-Des Moines as a comparable corridor where this effort may have some direct applicability, it was noted that a feasibility study was already underway for this corridor, led by the Des Moines Area Metropolitan Planning Organization. The final Ames-Des Moines I-35 Commuter Corridor Feasibility Study was published on August 19, 2014 and contained conclusions similar to those identified in the ICTS. The Ames-Des Moines study found that sufficient demand exists to warrant investment in a commuter express bus service operating along the I-35 corridor during the weekday peak periods.

While these two corridors are somewhat unique in a statewide context, the methodology applied in the development of the ICTS could certainly be applied to other commuter corridors, although the recommendations would likely differ. In addition to the ICTS, the Iowa DOT has also recently engaged in other commuter transportation planning efforts, including the recent completion of the Iowa Park and Ride System Plan and ongoing efforts related to the development of a statewide ride-matching system.

The *Iowa Park and Ride System Plan* will be used by the Iowa DOT to plan, evaluate, and develop a formal statewide system of park and ride facilities. For the purposes of this plan, park and ride facilities are places to park a vehicle when carpooling, vanpooling, or taking public transit. The plan provides the framework for determining the current need for commuter park and ride services, evaluating the existing system, identifying gaps in service, and guiding potential system expansion. The primary objective of the plan was to develop a location-specific, priority-based park and ride system that allows for coordinated planning and implementation of park and ride facilities that maintain highway safety, encourage ridesharing, support commuter transportation, and promote energy conservation.

Related to this effort is the development of a statewide rideshare program that can be used to match potential carpool and vanpool participants using a single ride-matching system. Historically, rideshare services across Iowa have been administered in a decentralized model where the Iowa DOT has not been involved in the procurement, administration, or marketing of local rideshare programs. This model requires rideshare organizations to provide separate startup funding and yearly support fees, reduces the overall number of matches available for potential rideshare participants, and is not consistently administered across the state.

The result of this has been an inefficient and costly system that does not serve all of Iowa's communities and results in fewer ride matches created. The statewide rideshare project will provide a more efficient, affordable, and user-friendly service by eliminating the need for multiple global administrators, reducing capital and operating expenses, and consolidating services into a single software system. The goal of this program is to increase the number of people who wish to take part in car pools, van pools, and public transit services.

Next Steps

The following ICTS next steps are necessary for the implementation of the ICTS recommended package of service improvements.

1. ***Identify Lead Agency for Implementation:*** The implementation of the ICTS recommendations will involve an active partnership between multiple jurisdictions and agencies within the region. However, one agency should be identified to lead the effort. ECICOG was suggested as the agency that could lead the initial effort of coordinating initial discussion between the study partners. Although not identified as a lead agency, Iowa DOT would continue to have an important role in the initiative.
2. ***Form Study Implementation Committee***: The lead agency will organize a study implementation committee comprised of study area jurisdictions, public agencies and service providers. The function of the committee would coordinate implementation efforts.

3. ***Identify and Pursue Preferred Funding and Financing Options for Implementation:*** The implementation of the ICTS recommendations will likely require multiple funding sources, some existing such as state and federal funding programs, some new such as a regional transit district, a special assessment district or other sales or property tax.
4. ***Create an Implementation Plan:*** Given the recommendations and established priorities, and with more information on funding needs and availability, a detailed implementation plan should specifically list the steps to implement each of the projects and programs. There are multiple ways to operate and manage each of the service improvements. However, this will require more deliberation from the Study Implementation Committee, public agencies, transit service providers, local governments, and more detailed discussions with corridor stakeholders including major employers on how best to implement the improvements.
5. ***Define Project Phasing Based on Available Funding and Priorities:*** Initial funding through one-time state or federal grants or other mechanism may be able to fund initial improvements. Implementation can be phased based on available funding and financing, as well as the community's priorities. There are several initiatives already underway such as the Iowa DOT's park and ride program, the statewide ridematching system deployment and the statewide transportation website. Pilot programs can be an effective way to test the effectiveness of concepts and garner support for funding and broader implementation. For example, a pilot of the interregional bus transportation concept may be effective in helping to create the support for a long term investment in the corridor.

DATE:	**12/09/16**
PROJECT NUMBER:	**IM-380-6(315)0--13-52 (I-380 Coralville to Cedar Rapids Corridor, Multi-Modal and Operations Study) (Big Mo)**
SUBJECT:	**I-380 Corridor Strategies – Final Assessment Report (Big Mo Task 7)**

Overview

In 2015, the Iowa Department of Transportation (Iowa DOT) initiated a comprehensive review of potential strategies to mitigate congestion along the I-380 corridor between Iowa City/Coralville and Cedar Rapids ahead of and in collaboration with reconstruction of the I-80/I-380 system interchange as part of the I-380 Coralville to Cedar Rapids Corridor, Multi-Modal and Operations Study, commonly referred to as Big Mo. While the initial purpose of the study was to explore corridor-wide strategies in both the short- and long-term, the Iowa DOT leveraged 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. This was done in concert with the I-80/I-380 Transportation Management Plan (TMP) and Iowa City Traffic Incident Management (TIM) Plan also underway, and as part of assessing nearer-term strategies, their benefit to the overall corridor and in the long-term post-construction was considered. As part of this study, three strategy packages emerged (documented in a technical memorandum dated 02/17/2016):

- Package 1: Public Interregional Express Bus and Vanpool
- Package 2: Public Information/Communications
- Package 3: Additional Congestion Mitigation and Operational Improvement Strategies

These three strategy packages, which may be implemented independently but provide the greatest benefit to the corridor if implemented together, included several individual strategies to evaluate, at a planning-level, for implementation in the corridor. The purpose of this Final Assessment Report is to summarize strategy assessments conducted as part of this study and leveraged by the Iowa DOT to decide which strategies to carry forward for further development and design as part of the I-80/I-380 Transportation Management Plan (TMP) (underway via a separate contract) and ultimately, implement ahead of and/or during the I-80/I-380 interchange reconstruction project.

For Package 1, several technical memorandums were prepared summarizing the assessment of Interregional Express Bus (IRXB) and Vanpool; these are summarized in this report and attached in **Appendix A**. At the time of this report, this strategy package and its individual strategies are already moving forward into implementation. For Package 2, a Public Information (PI) Plan Framework was developed to provide the Iowa DOT with a framework for implementing a comprehensive public Engagement and Communication Plan ahead of and during construction of the I-80/I-380 system interchange; this PI Plan Framework is attached in **Appendix B** and the Plan itself is being developed as part of the I-80/I-380 TMP. For Package 3, individual engineering and operational assessments for specific individual strategies were identified in the February 17, 2016 technical memorandum referenced above, to determine their viability to the corridor ahead of, during, and post reconstruction of the I-80/I-380 system interchange. These strategies included the following:

- Bus on Shoulder (BOS)
- Ramp Metering
- Integrated Corridor Management (ICM)
- Traffic Signal Interconnect and Advanced Control/Timing
- Intersection/Local System Improvements

Through Big Mo, engineering and operational assessments were ultimately conducted for BOS, ramp metering, and intersection/ local system improvements. The other two strategies noted above, ICM and traffic signal interconnect and advanced control/timing, are still under consideration at the time of this report and are being evaluated as part of the development and design phase of the I-80/I-380 TMP. The engineering and operational assessments for the three individual strategies noted are summarized in this report and detailed in **Appendix C**.

On July 26, 2016, an Evaluation and Recommendation Workshop was conducted with Iowa DOT Management, in concert with the planning phase for the I-80/I-380 TMP, to decide which strategies to consider further as part of the development and design phase of the I-80/I-380 TMP – and ultimately implement ahead of and/or during construction of I-80/I-380. Through the course of Big Mo and in preparation for this workshop, the three strategy packages summarized in February 2016 morphed into the following six strategy categories, and the individual strategies were categorized accordingly:

1) Public Information/Communications Strategies
2) Construction/Work Zone Strategies
3) Corridor/Network Management Strategies
4) Intelligent Transportation System (ITS)/Intelligent Work Zone (IWZ) Strategies
5) Traffic Incident Management (TIM) Strategies
6) Transit Service and Modal Enhancement Strategies

As an outcome of the Evaluation and Recommendation Workshop, a comprehensive list of all strategies considered, which may not be predictive or exhaustive, are attached in a strategy matrix in **Appendix D**. This matrix summarizes which strategy assessments are complete as an outcome of Big Mo and are currently moving forward into implementation, which strategies will be developed and/or designed further as part of the I-80/I-380 TMP prior to implementation, and which strategies will not be pursued further at this time.

Package 1: Interregional Express Bus Service and Vanpool

As summarized in the February 17, 2016 technical memorandum, the 2014 *Iowa Commuter Transportation Study (ICTS)* 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 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 (ICAAP) Grant application to fund a contracted public vanpool program to be administered by ECICOG.

The following is a brief summary of the assessments and technical memorandums conducted for Package 1 as part of Big Mo; technical memorandums created for these strategies are attached in **Appendix A**.

PUBLIC VANPOOL

<u>Rideshare Estimation Methodology and Results</u>

The purpose of this memorandum, attached in **Appendix A1**, is to document the methodology used to estimate ridership for a new public vanpool service between Cedar Rapids and Coralville/Iowa City, as the potential demand for ridesharing is difficult to estimate for a number of reasons. For one, carpooling is very informal and reliable data is often unavailable. For example, public transit usage information is relatively precise as public transit agencies collect data as part of their business practices. However, carpooling among spouses, friends, neighbors and coworkers cannot be tracked except through commuter surveys, and vanpooling presents challenges as well to estimating potential usage.

The ridesharing and transit usage estimation methodology used for the I-380 corridor is therefore based on survey data from the 2014 ICTS that established current mode split and mode preferences for survey respondents; analogous data from Des Moines, a similar urban area with an established ridesharing program; the American

Community Survey; and analysis of commuter market segments. Travel demand model data from the Metropolitan Planning Organization of Johnson County (MPOJC) and Corridor MPO models was used to quantify several commuter market segments. As a result of this methodology, the estimated increase in vanpool trips suggested a need for 26 vans for a public vanpool program, named RideConnect, to be administered by the ECICOG. As part of Big Mo, this estimate was used to evaluate the effect on air quality in the Cedar Rapids/Iowa City area for ECICOG to include in an ICAAP Grant Application, which ultimately will provide funding for the program.

INTERREGIONAL EXPRESS BUS SERVICE

IRXB Ridership Estimation Methodology and Results

The purpose of this memorandum, attached in **Appendix A2**, is to document the methodology used to estimate ridership for the IRXB route and stop options developed as part of the congestion mitigation assessment of strategies for the I-80/I-380 interchange reconstruction project. Because there are currently no commuter public transportation options in the I-380 corridor, ridership estimates were based on commuter sensitivity to a hypothetical choice. This approach used stated preference data from public surveys to gain insight into how commuters would make decisions between single occupant vehicle commuting and public transportation. The methodology is based on survey data from the ICTS and commuter market segments from travel demand models used for the project. Travel demand model data was used to estimate trips from Cedar Rapids to destinations in Coralville and Iowa City, and Iowa City and Coralville to destinations in Cedar Rapids. The ridership estimates provide a reasonable idea of the potential for a public transportation service in the I-380 corridor, and the results indicate that a service with frequencies of 30 minutes could capture approximately three to four percent of the total Cedar Rapids to Iowa City commuter market.

IRXB Route and Stop Options

This document, attached in **Appendix A3**, summarizes an evaluation of a number of route and stop options for the IRXB service. The initial IRXB service concept outlined in the ICTS recommended eight stops. Given the number and location of stops, it was determined that the IRXB service could achieve a running time of approximately 66 minutes, which is approximately 12 to 13 minutes longer than a comparable auto trip. The refined IRXB route and stop options were identified through a multi-step process as part of Big Mo. For the initial review, 10 route and stop options with ridership estimates were provided the IRXB Subcommittee and included running times, local transit system connectivity, and capital and operating costs. The Iowa DOT and IRXB Subcommittee reviewed the initial options and selected the top six for further refinement. The selected six options were then refined based on input from the Iowa DOT, IRXB Subcommittee and the transit agencies and the IRXB Subcommittee selected their top three options. These options were presented to the public at two workshops on successive nights in Coralville on May 17th and Cedar Rapids on May 18th, 2016. As an outcome of the workshops, final route and stop options were developed and are summarized in the IRXB Recommendation (see below).

IRXB AVL/CAD System Integration

This document, attached in **Appendix A4**, evaluates steps to achieve Automatic Vehicle Location/Computer-Aided Dispatch (AVL/CAD) system integration between the new IRXB service and the existing fixed route services in the study area. AVL/CAD is a GIS-based automated dispatch and passenger information system. To provide a seamless means of travel for IRXB commuters within the Cedar Rapids, Coralville and Iowa City areas, a goal for ECICOG is to work with Cedar Rapids Transit, Coralville Transit, Cambus and Iowa City Transit to provide opportunities for AVL/CAD system integration or at a minimum, the ability to share route, schedule and real time information for trip planning. This would involve creating a methodology for sharing pertinent information among IRXB and other transit system operating personnel using current communication means, and will require equipping IRXB vehicles with GPS and communications hardware that is compatible with the technology systems used by the four existing transit systems. The interfaces between IRXB and the other systems will need to be developed by ECICOG and/or the IRXB vendor along with the detail of the system's design.

IRXB Fare Collection Integration

This document, attached in **Appendix A5**, summarizes the current fare policies of the existing fixed route transit providers in the study area and identifies approaches to integrate fares/transfers from IRXB to these systems. Although it is anticipated that most of the users will access the IRXB service by driving to a stop or park-and-ride identified in **Appendix A3**, the route is also designed to connect with existing transit services to extend the opportunities for both origins and destinations. The key objective of fare integration is to provide a seamless means of travel for interregional commuters within the Cedar Rapids/Iowa City region. This would require inter-agency agreements between ECICOG and the local transit providers. These agreements could include:

- Procedures for collecting fares and transfers, and a means to adjust for fare level differentials.
- Agreements on sharing passenger revenue including transfer fees, a means to collect and compile this data.

Similar to AVL/CAD system integration, the procedures and inter-agency agreements to implement regarding fare collection integration will need to be developed with the detail of the system's design.

Regional Transit District (RTD) Analysis

This document, attached in **Appendix A6**, evaluates the potential for a Regional Transit District (RTD) as a long-term funding and financing mechanism for the IRXB service. The Iowa DOT will fund the initial IRXB seven-year pilot for the I-80/I-380 interchange reconstruction. Long-term, post-construction, the ECICOG and the participating local public agencies, municipalities and service providers will need to identify local funding and financing after fiscal year 2025. The 2014 ICTS identified several funding and financing options including the potential for tax levy through the formation of an RTD. In 2005, the Iowa legislature authorized counties with populations exceeding 175,000 to form RTDs for support of area-wide public transit services. While both Linn and Polk counties have the population to form an RTD, only Polk County has chosen to form a district. Johnson County could join the RTD under an agreement with Linn County. An RTD provides the authority to issue bonds and to levy property taxes on both the incorporated and unincorporated portions of participating counties to support the public transit system. The property tax levy may not exceed $0.95 per thousand dollars of the assessed value of all taxable property in an RTD. The City of Iowa City, which operates a municipal bus system, has already reached the statutory maximum transit levy of $0.95 and would be unable to increase this levy to fund an RTD.

IRXB Recommendation

The purpose of this document, attached in **Appendix A7**, is to provide a final recommendation for the preferred IRXB route and stops based on an evaluation of the three route and stop options identified in **Appendix A3**. The final evaluation leveraged the assessments described above and considered density of employment and students, potential ridership, average running time between stops, ability to transfer to existing transit routes, capital and operating costs, and input from the Iowa DOT, IRXB Subcommittee and public input received at two public workshops. Based on the analysis and input, a final recommendation was developed based on the preferred elements of each option. In general, participants noted the need to stop at the University of Iowa Hospitals and Clinics as well as Downtown Iowa City. They also preferred to have a stop at Kirkwood Community College in both the southbound and northbound directions.

NEXT STEPS

The implementation of IRXB will involve an active partnership between the Iowa DOT and local agencies, municipalities and public transit service providers including ECICOG, Cedar Rapids Transit, Coralville Transit, Cambus and Iowa City Transit. ECICOG will be the lead agency responsible for implementation and managing the contracted service. The IRXB Recommendation memorandum in Appendix A-7 includes a project schedule for the development of the service assuming service will start in mid-2018. A summary of the schedule includes the following:

- **2017:**
  - Develop a Request for Proposals (RFP) for the operation of the contracted IRXB service
  - Select service contractor and begin mobilization.

  - Continue to work with local transit providers on both AVL/CAD integration and fare payment integration and procure the necessary systems for their implementation.
  - Develop agreements for use of the IRXB park-and-rides.

- **2017 – 2018:** Discuss long-term funding and financing strategies for continuation of the IRXB service after the initial pilot period including consideration of an RTD.

A more detailed cost estimate and implementation workflow will be included in a Master Plan as an outcome of Big Mo.

Package 2: Public Information/Communications

As described in the February 17, 2016 technical memorandum, an Engagement and Communication Plan was identified as a key strategy package to implement in the I-380 corridor and surrounding area ahead of and during reconstruction of the I-80/I-380 system interchange. The purpose of creating a plan will be to manage stakeholder and motorist (including trucking) expectations and provide a venue for users of the corridor to plan ahead and leverage congestion mitigation strategies (e.g. transit), facilitating mobility and a safer work zone. It will provide a foundation for the success of other strategies to be implemented.

Through Big Mo, a framework for this plan was developed in concert with District 6 and the Office of Strategic Communications following interviews with internal DOT staff, stakeholders including major employers, and peer agencies. This framework was finalized on March 8, 2016 (see **Appendix B**). It is intended for the plan to include, but not be limited to, all individual strategies outlined in Category 1: Public Information/Communications Strategies in **Appendix D**.

NEXT STEPS

At the time of this report, development of the Engagement and Communication Plan itself is being launched through the I-80/I-380 TMP process, building upon the Engagement and Communication Plan Framework developed under Big Mo. The Plan will ultimately be implemented by the Iowa DOT and their General Engineering Consultant (GEC) ahead of and during the I-80/I-380 system interchange reconstruction.

Package 3: Additional Congestion Mitigation and Operational Improvement Strategies for Consideration

Package 3 was identified in early 2016 to include additional strategies to consider beyond Transit and Multi-Modal Enhancement Strategies (Package 1) and Public Information/Communications Strategies (Package 2). As introduced in the Overview above, this package included strategies within the following categories and have been developed through the course of Big Mo and the I-80/I-380 TMP. It is noted additional individual strategies have been identified within each of these categories since the February 2016 technical memorandum, and this comprehensive list is included in **Appendix D**.

- Construction/Work Zone Strategies
- Corridor/Network Management Strategies
- Intelligent Transportation System (ITS)/Intelligent Work Zone (IWZ) Strategies
- Traffic Incident Management (TIM) Strategies

These strategies have the potential to facilitate mobility in the I-380 corridor and the I-80/I-380 system interchange not only during construction, but also post-construction for some strategies. As part of Big Mo, bus-on-shoulder, ramp metering, and intersection/local system improvements were individual strategies identified as warranting an engineering and operational assessment through this study to determine their viability for further consideration. These are summarized below.

BUS-ON-SHOULDER

As part of Big Mo and in conjunction with IRXB service as a strategy, the Iowa DOT considered BOS, for both during and post-construction of I-80/I-380, to improve mobility on I-380 between Iowa City/Coralville and Cedar Rapids. This assessment is summarized in **Appendix C1** and included evaluating traffic operations during construction (year 2020) and post-construction (year 2040) to determine where BOS may have viability in the corridor. In areas where congestion is anticipated to cause mainline traffic to fall below 35 mph, buses – in this case IRXB – would be permitted to operate on the shoulder up to speeds within 10 mph of mainline traffic. This strategy, used in other states and requiring legislative authority, could aid in mobility by providing greater reliability to bus service times and by attracting more passengers to use the service.

While BOS was evaluated for the entire 15-mile stretch between Iowa City/Coralville and Cedar Rapids in both directions, BOS was deemed most viable during reconstruction of I-80/I-380 between U.S. 6 (or the northern limit of the construction work zone) to three-miles north (near the Penn Street interchange) in the southbound direction where queues are anticipated in the AM peak hour. Speeds elsewhere in the corridor are not anticipated to drop below 35 mph on a recurring (daily) basis neither during construction nor by 2040, assuming I-380 is ultimately widened to six lanes. While BOS may provide benefit elsewhere for non-recurring congestion (e.g. due to weather or incidents), it was concluded for this three-mile segment during this timeframe that BOS would only provide a travel time savings of three minutes.

As an outcome of the engineering and operational assessment, the Iowa DOT conducted a field assessment of the existing shoulders along I-380 to confirm their width (a minimum 10’ is required for BOS) and condition. Due to shoulder overlays through the corridor, the existing shoulder width and condition has been compromised over time. It was therefore decided not to move forward with this strategy as the travel time savings do not justify the cost to replace the existing shoulders at this time.

RAMP METERING

While the Iowa DOT does not currently implement ramp metering, this was also considered as a congestion mitigation strategy along the I-80 and I-380 corridors, both short-term during I-80/I-380 construction (2020 analysis) and potentially long-term as a strategy post-construction (2040 analysis). The limits considered for this strategy as part of this assessment included U.S. 218/I-380 between Melrose Avenue and Penn Street as well as I-80 between Ireland Avenue and Highway 965. As part of the traffic analysis, ramp merge area levels of service (LOS) were analyzed and reviewed for feasibility; a LOS D or worse was the threshold to consider ramp metering.

The technical memorandum detailing this operational assessment may be found in **Appendix C2**. In summary, the only potential location where ramp metering was deemed potentially beneficial, in the short- or long-term, within these limits was the northbound (NB) Highway 965 (Coral Ridge Avenue) to westbound (WB) I-80 loop ramp. The operational assessment, however, did not show enough operational benefit at this location during construction; sight distance, acceleration lane length, and driver familiarity were other potential concerns. While other locations were deemed potentially feasible (LOS D or worse) in the short-term along I-380, congestion downstream was found to limit the benefit ramp metering would provide. It was therefore decided not to move forward with this strategy. Long-term, there may be benefit to ramp metering at I-380/Penn Street if I-380 is not widened to six lanes in the future. There may also be benefit if ramp metering is instead assessed as more of a global freeway management strategy.

INTERSECTION/LOCAL SYSTEM IMPROVEMENTS

As part of Big Mo, geometric improvements to the local system to facilitate improved mobility on the state system during detours, special events, or incidents were considered. These improvements were considered to provide benefit during the I-80/I-380 system interchange construction, as well as for lasting benefit post-construction. While several locations were vetted, including but not limited to Forevergreen Road between I-380 and Highway 965, Highway 965 between Oakdale Boulevard and Forevergreen Road, the ramp terminals of I-80/Highway 965 (Coral Ridge Avenue), and the intersection of U.S. 6/Highway 965, an engineering and operational assessment was ultimately conducted through Big Mo for two locations: the intersection of U.S. 6/Highway 965 and the ramp terminals of I-80/Highway 965. These locations were selected to assess by Iowa DOT given their planned use construction detours or incident management routes, respectively. It is noted Forevergreen Road (I-380 to Jones Boulevard) improvements are moving forward outside of this study, and Highway 965 (Oakdale to Forevergreen) improvements are being considered by the City of Coralville. See **Appendix C3** for the technical memorandum summarizing this assessment.

I-80/Highway 965 Ramp Terminals

During I-80/I-380 construction, as well as post-construction, Forevergreen Road (I-380 to Highway 965) and Highway 965 (Forevergreen Road to I-80) are planned to serve as an incident management route to I-80 and I-380. Specifically, the westbound ramp terminal at I-80/Highway 965 was identified through this study in concert with the I-80/I-380 TMP as needing improvements to better facilitate overall mobility and traffic operations in the project area. Several combinations of improvement alternatives were therefore considered at the I-80/Highway 965 ramp terminals (see **Appendix C3**). "Option 2" was determined to best balance operational benefits with geometrics impacts. Option 2 includes the following improvements:

- **Signal Timings:** Optimize signal timings based on current traffic.
- **WB I-80 Off-Ramp to Highway 965:** Widen the north edge of the WB I-80 off-ramp terminal at Highway 965 to provide a dedicated right-turn lane to northbound Highway 965. Revise pavement markings on the off-ramp to provide two dedicated left-turn movements to southbound Highway 965, one dedicated through lane to westbound Commerce Drive, a shared through/right-turn lane, and a new dedicated right-turn lane to northbound Highway 965. Provide advanced overhead signing and/or ground mounted signs to facilitate better lane utilization.
- **SB Highway 965/WB I-80 Ramp Terminal:** Widen the west edge of Highway 965 between Corridor Way and the WB I-80 on-ramp terminal to provide an additional southbound (SB) lane, used as a shared through/right for traffic destined for Commerce Dr. and WB I-80. This additional lane drops at the WB I-80 on-ramp. Install advanced overhead signing north of Commerce Dr. to provide advanced lane assignments for the WB I-80 and eastbound (EB) I-80 ramp movements resulting in better lane utilization.
- **Commerce Drive**: Provide advanced signing and pavement marking on eastbound Commerce Dr. to notify drivers of lane configurations on Highway 965 and guide dual right-turning traffic.
- **NB Highway 965/EB I-80 Ramp Terminal:** Install advanced overhead signing on northbound Highway 965 south of the Coral Ridge Mall entrance, to provide advanced lane assignments for the WB I-80 and EB I-80 ramp movements resulting in better lane utilization.

At the time of this report, the Iowa DOT is currently preparing an Interchange Operations Report (IOR) documenting the impacts of the proposed improvements and is moving forward with design in coordination with the City of Coralville. The plan is for this project to be constructed ahead of major construction commencing on the I-80/I-380 system interchange.

U.S. 6/Highway 965

For a portion of one of the I-80/I-380 construction years (anticipated in 2021), the eastbound (EB) Ireland Avenue on-ramp to I-80 will be closed and traffic from Ireland to EB I-80 will be detoured northbound (NB) on Ireland to travel EB on U.S. 6 and NB on Highway 965 before taking the on-ramp to EB or westbound (WB) I-80. Due to this ramp closure and detour, the Iowa DOT considered geometric improvements to improve operations at the intersection of U.S. 6/Highway 965.

Several improvement alternatives were considered at U.S. 6/Highway 965, primarily including improvements to the eastbound and westbound approaches. "Modified Network 1" was selected as the preferred option. This option will temporarily convert one EB through lane to additional left-turn lane storage during the closure and detour of the EB Ireland on-ramp. Traffic sensors are recommended to monitor conditions throughout construction, and if desired, adjustments could be considered with the City of Coralville to either the lane configuration or the signal timing to address unacceptable congestion. The westbound right-turn movement in particular was identified as a critical movement, but because the construction detour does not directly impact the westbound right turn, and given the short duration of this detour, no permanent geometric modifications to the westbound right turn or elsewhere at this intersection are proposed at this time. **Appendix C3** contains more details of this analysis.

Evaluation and Recommendation Workshop

In addition to the strategies and their assessments noted above, several additional congestion mitigation and operational improvements strategies were considered in concert with the I-80/I-380 TMP and TIM Plan and are attached in **Appendix D**. These are summarized within the six strategy categories noted previously. In order to decide which strategies to carry forward for potential implementation ahead of I-80/I-380 construction, an Evaluation and Recommendation Workshop was held with Iowa DOT Management on July 26, 2016. As part of this workshop, each individual strategy was reviewed, including a description, rough order of magnitude cost estimate, and implementation timeframe. **Appendix D** summarizes the following:

- Strategy assessments completed under Big Mo and already moving forward into implementation, either ahead of I-80/I-380 construction or as part of procuring a General Engineering Consultant (GEC) to support the Iowa DOT during construction;
- Strategies to carry forward into the development and design phase of the I-80/I-380 TMP ("Phase 2"), where a final implementation decision will be made; and
- Strategies not deemed viable for this project and corridor at this time.

The rough order of magnitude cost estimates and implementation timeframes for each strategy planned to move forward at this time will be summarized in a Master Plan as an outcome of this Big Mo study. The cost estimates and implementation schedules will then be developed further through the I-80/I-380 TMP Phase 2.

Conclusion

This Final Assessment Report summarizes the initial three packages of strategies developed for the I-380 Corridor, Coralville to Cedar Rapids, Multi-Modal and Operations Study (Big Mo) and the corresponding engineering and operational assessments conducted as part of this study. These assessments and next steps include the following:

- Package 1: Public Interregional Express Bus and Vanpool *(IRXB Recommendation completed as part of Big Mo; implementation underway)*
- Package 2: Public Information/Communications *(Engagement and Communication Framework completed as part of Big Mo; Plan development underway as part of the I-80/I-380 TMP Phase 2)*
- Package 3: Additional Congestion Mitigation and Operational Improvement Strategies
    - Bus on Shoulder *(assessment completed as part of Big Mo and deemed not viable for this corridor at this time)*
    - Ramp Metering *(assessment completed as part of Big Mo and deemed not viable for this corridor at this time)*
    - Intersection/Local System Improvements *(improvements at I-80/Highway 965 deemed viable as part of Big Mo and design is underway by Iowa DOT; temporary improvements at U.S. 6/Highway 965 deemed viable as well and will be implemented during construction as part of a construction detour)*

These strategies as well as the remaining congestion mitigation and operational improvements strategies within Big Mo "Package 3") were vetted in concert with the I-80/I-380 Transportation Management Plan (TMP) and Iowa City Traffic Incident Management (TIM) Plan by Iowa DOT Management at an Evaluation and Recommendation Workshop held in July 2016. This included individual strategies within six strategy categories; the number of individual strategies within each category to be carried forward for additional development and/or design are noted below:

1) Public Information/Communications Strategies (12 individual strategies)
2) Construction/Work Zone Strategies (14 individual strategies)
3) Corridor/Network Management Strategies (9 individual strategies)
4) Intelligent Transportation System (ITS)/Intelligent Work Zone (IWZ) Strategies (5 individual strategies)

5) Traffic Incident Management (TIM) Strategies (17 individual strategies)
6) Transit Service and Modal Enhancement Strategies (5 individual strategies)

As an outcome of the pending I-80/I-380 TMP Phase 2, final strategies will be selected and implemented ahead of or during construction of I-80/I-380. The conceptual cost estimates and implementation workflow for each of these strategies will be documented in a Master Plan for this study.

Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study Final Study

HDR

October
2015

Executive Summary

The purpose of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study is to examine the conceptual feasibility of a passenger rail service operating between Iowa City, Iowa, and Cedar Rapids, Iowa. The corridor under consideration in this study is the Cedar Rapids & Iowa City Railway (CRANDIC), an active freight railroad over which no passenger rail services are offered at present. The 20.5-mile CRANDIC Corridor Study Area (the Corridor) is between Gilbert Street in central Iowa City, Iowa, and the Eastern Iowa Airport in Cedar Rapids, Iowa.

CRANDIC and the Iowa Department of Transportation (Iowa DOT) selected HDR as its consultant team for the study. The railroad, Iowa DOT, and other project stakeholders participated in the study through coordination with HDR.

The study was divided into the following tasks, which culminated in this study report:

- **Background** – Describe the background of the passenger rail study.
- **Prior Studies** – Provide a high-level assessment of prior studies of the Corridor's passenger rail feasibility, service territory, and transit and ridership potential.
- **Existing Corridor Conditions** – Describe the existing conditions and infrastructure on the Corridor.
- **Potential Corridor Passenger Rail Service Characteristics** – Describe the general characteristics of the modes of passenger rail service available and their applicability to the Corridor.
- **Conceptual Cost Estimate** – Develop representative conceptual capital and operations and maintenance costs for each mode of passenger rail service assessed for potential implementation on the Corridor.
- **Environmental Review** – Describe the general Environmental Review process for constructing and implementing passenger rail service.
- **Federal Safety and Governance Regulatory Requirements** – Describe the basic federal regulatory requirements for the implementation of passenger rail service.
- **Funding Availability Assessment** – Describe the general federal funding streams and availability for each mode of passenger rail service.

Applicability of Modes to the Corridor

Three passenger rail modes in use on other passenger rail corridors across the U.S. were studied and analyzed for potential applicability to the CRANDIC Corridor and are described in detail later in this study. These modes are:

- Streetcar
- Light Rail Transit
- Commuter Rail Transit

The applicability of each mode to the Corridor took into account the following considerations:

- Typical service range
- Typical average capacity per vehicle
- Typical station spacing
- Maximum and average operating speeds
- Typical service frequency
- Typical technology characteristics
- Typical corridor and infrastructure requirements
- Typical capital costs for service implementation
- Typical annual operations and maintenance costs

The streetcar mode typically uses a variety of small vehicles and tends to operate like a downtown people mover linking downtown visitors, employees, and residents to jobs, shopping, and entertainment. Electrified streetcar networks characteristically operate over short distances (typically 4 miles or less), provide service every 5-15 minutes, and operate within city streets in urban areas. The typical average capacity per vehicle is 60 passengers. Maximum speeds are typically up to 35 mph.

The Light Rail Transit (LRT) mode is typically a single vehicle type operating over an electrified network in a traffic lane or exclusive right-of-way. The typical operating range for an LRT is up to 20 miles and service is typically provided every 5-15 minutes. In some cases, LRT operations can share track with an active freight railroad, but only if the two modes are temporally separated (e.g., LRT operates during daylight, freight at night). The typical average capacity per vehicle is 225 passengers. The power supply that allows the rapid accelerating and longer distance operating performance typical of the LRT requires overhead catenary and traction power substations, which have a significant cost to build, operate, and maintain. Maximum speeds are typically 45-65 mph.

Commuter Rail Transit (CRT) typically employs either push-pull diesel locomotive powered commuter trains or self-propelled Diesel Multiple Unit (DMU) trains. The typical operating range for CRT is up to 50 miles and service is typically provided every 30 or more minutes. The typical average capacity per vehicle or train is between 250 and 1,000 passengers. The type and intensity of land uses in the Corridor suggest a passenger rail service with fairly long station spacing and peak period focused service, a service pattern that is characteristic of CRT. DMU trains are versatile and typically offer performance characteristics suitable to likely station spacing in the Corridor and they provide a suitable capacity, flexibility to expand train length as necessary, and potential for use on city streets in downtown areas, if required. Maximum speeds are typically up to 79 mph.

Potential Implementation and Operating and Maintenance Costs

A detailed cost estimate was not performed due to the limited nature of the study. Instead, costs were obtained by extracting costs from other streetcar, LRT, and CRT corridors recently implemented in the U.S. These costs were adjusted for the length of corridor, potential number of stations, frequency of service, and other attributes specific to the Corridor. The findings of the technical work described above and the development of the conceptual cost estimate by mode undertaken for this study are summarized in Figure ES-1 below. The study determined that the lowest cost option for implementation of passenger rail service on the CRANDIC Corridor between Iowa City and the Eastern Iowa Airport at Cedar Rapids is the Commuter Rail Transit (CRT) mode. Probable corridor implementation costs would vary depending on the number of stations, the length of the corridor, and the frequency of service. Savings could potentially be realized by reducing the number of stations, frequency of service, passenger capacity, and maximum speeds.

The probable capital cost for implementation based on other recently implemented corridors would be expected to range from $250 million to $520 million, and annual operations and maintenance costs would be expected to range between $5.6 million and $6.7 million, in 2015 dollars, as shown in Figure ES-1 below.

Figure ES-1. Conceptual Cost Summary for Passenger Rail Implementation on CRANDIC Corridor

ATTRIBUTES AND MODE	STREETCAR	LIGHT RAIL TRANSIT	COMMUTER RAIL TRANSIT
Potential Capital Cost to Implement Passenger Rail Service on the CRANDIC Corridor	$1.07 - $1.64 billion	$860 million - $1.33 billion	$250 million - $520 million
Potential Annual Operations and Maintenance Cost on the CRANDIC Corridor	$5.6 million - $6.7 million	$5.6 million - $6.7 million	$5.6 million - $6.7 million

Phased implementation of passenger rail service in the CRANDIC Corridor could be considered by stakeholders based upon need for the service and the availability of funding. Passenger rail service could be phased geographically to reduce the initial cost of service implementation. The cost to implement a Commuter Rail Transit (CRT) mode of passenger rail operation over the 9.5-mile Iowa City-North Liberty segment of the Corridor in a potential first phase, for example, are anticipated to range from $114 million to $238 million in capital costs and between $2.6 million and $3.1 million annually in operations and maintenance costs. The acquisition of reconditioned secondhand CRT equipment, if available, could also potentially lower the capital cost for procurement of equipment. Capital costs could potentially be reduced further by decreasing the number of stations or by phasing the implementation of stations and station amenities and the construction of a new layover and maintenance facility where trains would be stored and maintained between scheduled operations.

Next Steps

Project stakeholders will determine the feasibility of further study of the potential for implementation of passenger rail service on the Corridor. More detailed future analysis and study could include ridership and revenue forecasts, more detailed cost estimates, financial plan, conceptual operating and phasing plans, conceptual station designs and infrastructure engineering, environmental fatal-flaws analysis and screening, and the potential for phased implementation of passenger rail service.

HDR

Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study Final Study

October
2016

Executive Summary

The purpose of the *Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study* (the Study) is to examine the conceptual feasibility of a passenger rail service operating between Iowa City, Iowa, and North Liberty, Iowa. The corridor under consideration in this study is the Cedar Rapids & Iowa City Railway (CRANDIC), an active freight railroad over which no passenger rail services are offered at present. The 7.1-mile CRANDIC Corridor Study Area (the Corridor) is between Gilbert Street in central Iowa City, Iowa, and Forever Green Road in North Liberty, Iowa.

CRANDIC, the Iowa Department of Transportation (Iowa DOT), and the Metropolitan Planning Organization of Johnson County, Iowa (MPOJC) selected HDR as its consultant team for the Study. The railroad, Iowa DOT, MPOJC, and other local project stakeholders participated in, contributed to, and informed the development of the Study through coordination with HDR during the life of the project.

The Study was divided into the following tasks, which culminated in this report:

- **Background** – Describe the background of recently completed and ongoing passenger rail feasibility study of the Corridor.
- **Existing Corridor Conditions** – Describe the existing conditions and infrastructure on the CRANDIC Corridor.
- **Conceptual Equipment and Service Plan** – Describe the general characteristics of the mode of passenger rail service and equipment selected by stakeholders and its applicability to service in the Corridor.
- **Conceptual Cost Estimate** – Develop the probable conceptual capital and operations and maintenance costs for the selected mode of passenger rail service assessed for potential implementation on the Corridor, and identify potential alternatives that could reduce the capital cost to implement the service.
- **Federal Safety and Governance Regulatory Requirements** – Describe the basic federal regulatory requirements for the implementation of passenger rail service selected for potential implementation on the Corridor.

Applicability of the Passenger Rail Mode and Equipment to the Corridor

One passenger rail mode in use on other passenger rail corridors across the U.S. was studied and analyzed for potential applicability to the CRANDIC Corridor between Iowa City and North Liberty and is described in detail later in this Study. This mode is commuter rail transit using self-propelled Diesel Multiple Unit (DMU) railcar equipment.

The applicability of this passenger rail mode and equipment type to the Corridor took into account the following considerations:

- Typical service range
- Typical station spacing
- Maximum and average operating speeds
- Typical service frequency
- Typical average capacity per vehicle
- Typical technology characteristics
- Typical corridor and infrastructure requirements
- Typical capital costs for service implementation, which were determined in prior study of the Corridor to be the likely lowest cost option when compared to other passenger rail modes
- Typical annual operations and maintenance costs, which were determined in prior study of the Corridor to be the likely lowest cost option when compared to other passenger rail modes

The typical operating range for commuter rail transit using self-propelled DMU trains is up to 50 miles and service is typically provided every 30 or more minutes. The typical average capacity per vehicle is between 75 and 90 passengers, or between 150 and 180 passengers for a two-car trainset, which is being studied for implementation on the Corridor. The type and intensity of land uses in the Corridor suggest a passenger rail service with fairly long station spacing and peak period focused service, a service pattern that is characteristic of commuter rail transit. DMU trains are versatile and typically offer performance characteristics suitable to likely station spacing in the Corridor and they provide a suitable capacity and flexibility to expand train length as necessary. Maximum speeds are typically up to 79 mph, and DMUs can also operate efficiently at lower maximum and average operating speeds that would be more likely suited to the Corridor.

Implementation and Operating and Maintenance Costs
A conceptual capital cost estimate to implement passenger rail service between Iowa City and North Liberty, and an associated conceptual annual Operations & Maintenance (O&M) cost was developed for the Study.

The conceptual capital cost for implementation of a passenger rail service between Iowa City and North Liberty based on other recently implemented commuter rail corridors and rail industry projects in the U.S. and a conceptual level analysis of the attributes of the CRANDIC Corridor is $40.06 million, in 2016 dollars. Conceptual annual operations and maintenance costs for the first year of passenger rail operations are expected to be $1.39 million, in 2016 dollars. Both are shown in Figure ES-1 below.

Figure ES-1: Conceptual Cost Summary for Passenger Rail Implementation on the CRANDIC Corridor (Iowa City-North Liberty) in 2016 Dollars

COST COMPONENT	TOTAL (IN 2016 DOLLARS)
Conceptual Capital Cost to Implement Passenger Rail Service on the CRANDIC Corridor	$40,060,558
Conceptual Annual Operations and Maintenance Cost on the CRANDIC Corridor	$1,392,650

Passenger rail service in the CRANDIC Corridor between Iowa City and North Liberty could be considered for implementation in the future by stakeholders, based upon need for the service and the availability of funding for construction and implementation. Alternatives to the conceptual capital cost estimate were developed during the Study, which may potentially reduce the upfront capital cost experience for passenger rail implementation. The acquisition of reconditioned secondhand DMU equipment, if available, could potentially lower the capital cost for procurement of equipment. Conceptual capital costs could potentially be reduced further by phasing some improvements to track and bridge infrastructure.

Next Steps
Project stakeholders will determine the feasibility of further study of the potential for implementation of passenger rail service on the Iowa City-North Liberty Corridor. More detailed future analysis and study could include ridership and revenue forecasts, more detailed or modified cost estimates, benefit cost analysis and financial plan, strategies for determining the availability of and methods for securing public and private project funding, comprehensive operating plan, conceptual station designs and infrastructure engineering, environmental fatal-flaws analysis and screening, and the potential for phased implementation of passenger rail service including additional frequencies in the Iowa City-North Liberty Corridor and the potential extension of services north to the Eastern Iowa Airport in Cedar Rapids, and downtown Cedar Rapids.

HDR

INTERSTATE 380
PLANNING AND ENVIRONMENTAL LINKAGE (PEL) STUDY

Appendix B – CRANDIC Corridor Right-of-Way Existing Conditions

Office of Location and Environment | February 2018

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Figures

Tables

1 Introduction

This appendix describes existing conditions of the 20.5 miles of the Cedar Rapids & Iowa City Railway (CRANDIC) Corridor right-of-way between central Iowa City (Gilbert Street) and the Eastern Iowa Airport (Wright Brothers Boulevard) at Cedar Rapids, Iowa (the Impact of Alternative Modes on Interstate 380 Project Study Area) including:

- The condition and current uses of the corridor right-of-way and railroad infrastructure.
- General demographics and geographic characteristics of the surrounding area.
- Intersections with other transportation infrastructure, modes, and services.
- A brief history of passenger and freight rail transportation services.

1.1 CRANDIC Corridor Location, Intersections, and Connectivity

The CRANDIC Corridor right-of-way connects Iowa City in Johnson County and Cedar Rapids in Linn County – two of the State of Iowa's fastest growing metropolitan areas. According to U.S. Census data, the Iowa City and Cedar Rapids Metropolitan Statistical Areas were estimated to have a combined population of 428,242 as of July 1, 2014.[1] The north-south CRANDIC Corridor, and the parallel Interstate 380 Corridor, sit astride growing residential, commercial, and industrial development in the region. The CRANDIC Corridor right-of-way intersects with:

- **Universities and Colleges -** including University of Iowa in Iowa City and Oakdale and Kirkwood Community College in Cedar Rapids.
- **Employment -** including access to several major and small business employers.
- **Shopping Destinations -** including Downtown Iowa City and the Iowa River Landing, Coral Ridge Mall, and other shopping centers in Coralville.
- **Recreation -** including University of Iowa sporting and cultural events, and parks and trails.
- **Hospitals -** including University of Iowa Hospitals and Clinics, Iowa City Veterans Administration Hospital, and Mercy Hospital in the Iowa City area.

The CRANDIC Corridor right-of-way also interfaces with and provides connectivity to existing and future passenger rail, transit, bus, and air services and recreational trails in the region, as described below.

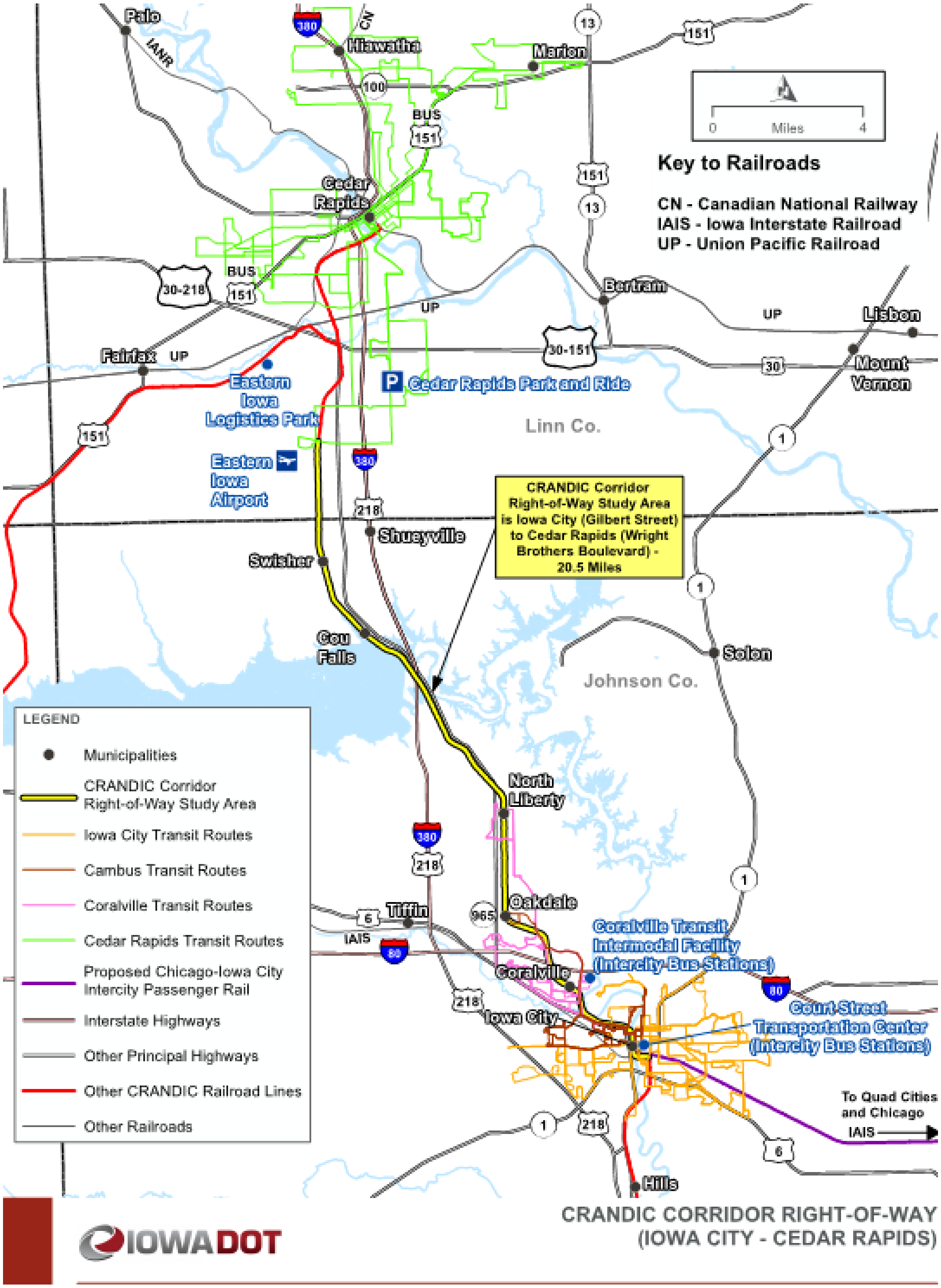
- **Intercity Passenger Rail -** Implementation of a twice-daily intercity passenger rail service between Chicago and Moline, Illinois, and Iowa City is under study by Iowa DOT and Illinois DOT. The CRANDIC Corridor right-of-way is located one block south of a potential Iowa City station of the intercity passenger rail service.
- **Public Transit -** The CRANDIC Corridor intersects with existing and potential future connecting public transit systems in the region. Some intersections are with Iowa City Transit buses and the University of Iowa CAMBUS network at Iowa City; Coralville Transit buses at Iowa City, Coralville, and North Liberty; and Cedar Rapids Transit buses at the Eastern Iowa Airport in Cedar Rapids.

[1] U.S. Census, Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014 – United States – Metropolitan Statistical Area; 2014 Population Estimates; U.S. Census website (http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk); July 31, 2015

- **Intercity Buses -** Burlington Trailways serves the Court Street Transportation Center on Court Street in Downtown Iowa City and Megabus serves the Coralville Intermodal Transit Facility, which are located in close proximity to the CRANDIC Corridor.
- **Airport -** The CRANDIC Corridor is located in close proximity to the Eastern Iowa Airport terminal in Cedar Rapids. The Airport presently hosts several daily domestic fights for Allegiant Air, American Eagle, Delta Airlines, Frontier Airlines, and United Airlines.
- **Trails -** The CRANDIC Corridor intersects with a comprehensive local network of recreational multi-use trails used by pedestrians and bicycles, including the Iowa River Trail, North Ridge Trail, North Liberty Trail, and other trails.

The map in Figure 1 below shows the CRANDIC Corridor right-of-way and its relationship to the region's multimodal transportation network, including existing transit services; its proximity to principal roadways (including Interstates 80 and 380), other rail lines, and intercity bus stations; and a proposed future intercity passenger rail line.

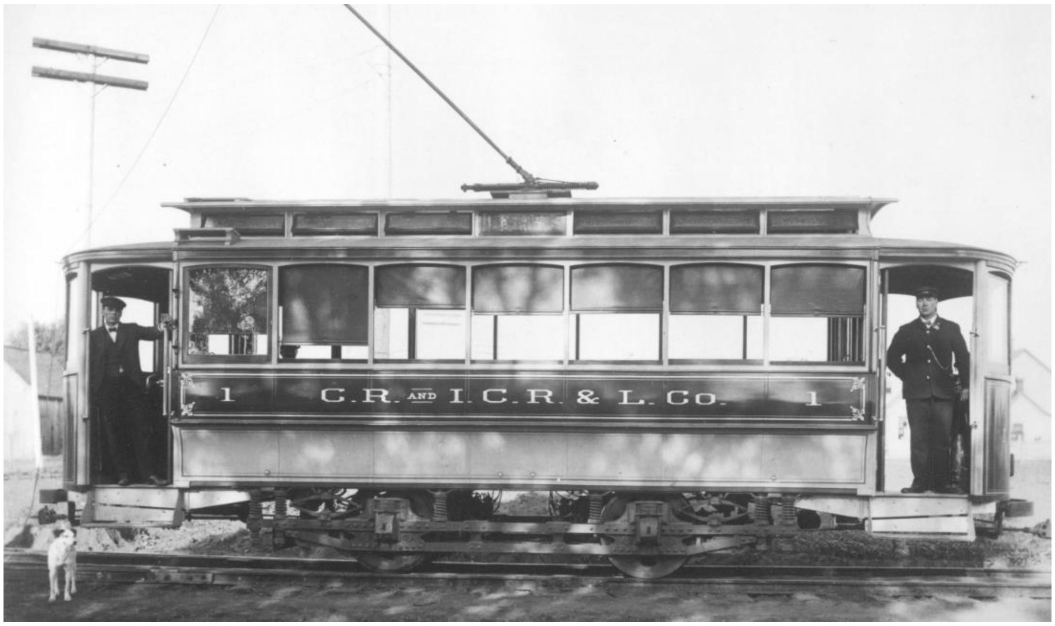
Figure 1 – CRANDIC Corridor Right-of-Way between Iowa City and the Eastern Iowa Airport



1.2 CRANDIC Corridor History

The Cedar Rapids & Iowa City Railway (CRANDIC) Corridor was constructed as a high-speed interurban between its namesake cities by the Iowa Railway & Light Company during 1903 and 1904. The railroad provided electrified passenger and freight service over the 27 miles between Cedar Rapids and Iowa City starting on August 13, 1904.[2] Figure 2 below shows the standard of track construction and style of passenger equipment employed when the railroad began operations.

Figure 2 – Early Interurban Car on the CRANDIC



Source: CRANDIC

The map in Figure 3 below shows the route of the CRANDIC Corridor and its proximity to municipalities and other railroad lines in the region today. The bold red line identifies the CRANDIC Corridor Project Study Area between Iowa City and the Eastern Iowa Airport in Cedar Rapids.

[2] Cedar Rapids & Iowa City Railway (CRANDIC) website; www.crandic.com; July 27, 2015

Figure 3 – CRANDIC Corridor between Iowa City and Cedar Rapids

Source: HDR

The height of CRANDIC interurban operations began when the railroad upgraded its passenger car feet in 1939, via the acquisition of second-hand high-speed electric interurban cars. These cars proved capable of providing faster and more efficient interurban service over the Corridor, and attracted record ridership.[3] Figure 4 below shows a high-speed interurban car at Swisher that supported the enhanced passenger rail operation.

3 *Ibid.*

Figure 4 – High-Speed Interurban Car on the CRANDIC at Swisher

Source: CRANDIC (William D. Middleton Photo)

By 1944, CRANDIC operated 17 interurbans each way daily, which provided almost hourly commuter service between Cedar Rapids and Iowa City, from approximately 5 a.m. until 12 midnight. In 1945, CRANDIC reached the zenith of ridership carrying a record 573,307 patrons.[4] Figure 5 below shows CRANDIC's station locations and frequent passenger service offerings in the Corridor, as they existed in October 1946.

[4] *Ibid.*

Figure 5 – CRANDIC Passenger Service Timetable, October 1946

CEDAR RAPIDS TO IOWA CITY

SOUTHBOUND—READ DOWN

	2 Dly AM	4 ExS AM	6 Dly AM	8 Dly AM	10 Dly AM	12 Dly AM	14 Dly PM	16 Dly PM	18 Dly PM	20 Dly PM	22 Dly PM	24 Dly PM	26 Dly PM	28 Dly PM	30 Dly PM	32 Dly PM	34 Dly AM
Cedar Rapids Lv	4 40	5 50	6 45	7 50	10 00	11 00	12 01	1 00	2 00	3 00	4 00	5 15	6 15	7 45	9 00	10 05	12 01
Crandic	4 46	5 56	6 51	7 56	10 05	11 06	12 07	1 06	2 06	3 06	4 06	5 21	6 21	7 51	9 06	10 10	12 05
Hawkeye Downs	4 50	6 00	6 57	8 02	10 10	11 11	12 12	1 11	2 11	3 11	4 11	5 26	6 26	7 56	9 11	10 15	12 10
Waconia	4 51	6 01	6 58	8 04	10 11	11 12	12 13	1 12	2 12	3 12	4 12	5 27	6 27	7 57	9 12	10 16	12 11
Konigsmark	4 56	6 06	7 02	8 08	10 15	11 17	12 18	1 17	2 17	3 17	4 17	5 32	6 32	8 01	9 16	10 20	12 15
Swisher	5 00	6 10	7 07	8 12	10 19	11 22	12 23	1 22	2 22	3 22	4 22	5 37	6 37	8 05	9 20	10 24	12 19
Cou Falls	5 03	6 13	7 10	8 16	10 22	11 25	12 26	1 25	2 25	3 25	4 25	5 40	6 40	8 08	9 23	10 27	12 22
North Liberty	5 13	6 23	7 22	8 27	10 32	11 35	12 35	1 35	2 35	3 35	4 35	5 50	6 50	8 18	9 33	10 37	12 32
Oakdale	5 16	6 26	7 26	8 31	10 36	11 39	12 39	1 39	2 39	3 39	4 39	5 54	6 54	8 22	9 37	10 41	12 36
Coralville	5 21	6 31	7 31	8 36	10 41	11 44	12 44	1 44	2 44	3 44	4 44	5 59	6 59	8 27	9 42	10 46	12 41
Iowa City—*Yards*	5 25	6 35	7 35	8 40	10 45	11 48	12 48	1 48	2 48	3 48	4 48	6 03	7 03	8 31	9 46	10 50	12 45
Iowa City—*Passenger Station* Ar	5 30	6 40	7 40	8 45	10 50	11 52	12 52	1 52	2 52	3 52	4 52	6 07	7 07	8 35	9 50	10 55	12 50

Ship via the ***CRANDIC ROUTE . . .***

Through freight service in connection with ALL railroads.

TO PASSENGERS: In the interest of safety please do not ride in the front vestibule of car or converse with the engineer.

IOWA CITY TO CEDAR RAPIDS

NORTHBOUND—READ DOWN

	1 Dly AM	3 ExS AM	5 Dly AM	7 Dly AM	9 Dly AM	11 Dly PM	13 Dly PM	15 Dly PM	17 Dly PM	19 Dly PM	21 Dly PM	23 Dly PM	25 Dly PM	27 Dly PM	29 Dly PM	31 Dly PM	33 Dly AM
Iowa City—*Passenger Station* Lv	5 35	6 45	7 50	9 30	11 00	12 01	1 00	2 00	3 00	4 00	5 15	6 15	7 15	9 05	10 00	11 00	12 55
Iowa City—*Yards*	5 40	6 49	7 55	9 35	11 05	12 06	1 05	2 05	3 05	4 05	5 20	6 20	7 21	9 10	10 06	11 05	1 00
Coralville	5 44	6 53	7 59	9 39	11 09	12 10	1 09	2 09	3 09	4 09	5 24	6 24	7 26	9 14	10 10	11 09	1 04
Oakdale	5 50	6 58	8 05	9 44	11 14	12 15	1 14	2 14	3 14	4 14	5 29	6 29	7 31	9 19	10 15	11 14	1 09
North Liberty	5 56	7 02	8 09	9 48	11 18	12 19	1 18	2 18	3 18	4 18	5 33	6 33	7 35	9 23	10 19	11 18	1 13
Cou Falls	6 06	7 10	8 16	9 56	11 25	12 26	1 25	2 25	3 25	4 25	5 40	6 40	7 42	9 30	10 27	11 25	1 20
Swisher	6 10	7 14	8 21	10 00	11 29	12 30	1 29	2 29	3 29	4 29	5 44	6 44	7 46	9 34	10 31	11 29	1 24
Konigsmark	6 14	7 18	8 25	10 04	11 33	12 34	1 33	2 33	3 33	4 33	5 48	6 48	7 50	9 38	10 35	11 33	1 28
Waconia	6 18	7 22	8 29	10 09	11 38	12 38	1 38	2 38	3 38	4 38	5 53	6 53	7 55	9 43	10 40	11 37	1 32
Hawkeye Downs	6 19	7 23	8 30	10 10	11 39	12 39	1 39	2 39	3 39	4 39	5 54	6 54	7 56	9 44	10 41	11 41	1 36
Crandic	6 24	7 28	8 34	10 14	11 43	12 43	1 43	2 43	3 43	4 43	5 58	6 58	8 00	9 48	10 45	11 45	1 40
Cedar Rapids Ar	6 30	7 35	8 40	10 20	11 50	12 50	1 50	2 50	3 50	4 50	6 05	7 05	8 05	9 55	10 50	11 50	1 45

A.M. TIME (12 00 night to 11 59 noon) is shown in light face type.
P.M TIME (**12 00** noon to **11 59** night) is shown in **bold face type.**

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Source: HDR

Owing to the surging popularity of the automobile and the dominance of hard-surfaced roadways in the immediate post World War II era, CRANDIC ridership declined sharply to just 188,317 patrons in 1952. Passenger rail service was discontinued altogether on May 30, 1953, and abandonment of remaining interurban trackage in city streets and full dieselization of freight railroad operations soon followed.[5]

The CRANDIC's freight service and network grew considerably in the ensuing years, largely through the acquisition of two other railroad lines between Cedar Rapids and South Amana, Iowa, and between Iowa City and Hills, Iowa, in the 1980s. CRANDIC and its parent company Alliant Energy currently have offices in and manage the CRANDIC network from Cedar Rapids.

In 2014, the short line railroad had 54 route miles and continued to provide direct access to several large industries and multiple connections with other railroads in the Cedar Rapids area. CRANDIC carried 99,334 carloads during 2014.

The CRANDIC's former Iowa City-Cedar Rapids interurban line – today known as CRANDIC Division 2 – once served as a primary artery for considerable volumes of freight rail track originating in Cedar Rapids

5 *Ibid.*

that was interchanged to the Iowa Interstate Railroad (IAIS) at Iowa City for furtherance to the Quad Cities of Iowa and Illinois; Chicago and Peoria, Illinois; and Council Bluffs, Iowa. The interchange of freight rail traffic between the carriers was shifted from Division 2 and Iowa City, west to South Amana, Iowa, and over another CRANDIC line in 2001.

Today, the CRANDIC's former interurban line is still used by CRANDIC to serve rail shippers in Iowa City and North Liberty and a considerable industrial base in Cedar Rapids. Present freight operations in the CRANDIC Corridor are described later in this section. The CRANDIC Corridor right-of-way also has a non-transportation purpose, as it also hosts infrastructure for a fiber optic line and various utilities.

1.3 Present General CRANDIC Corridor Right-of-Way Characteristics

This section contains a conceptual assessment of the present general characteristics and conditions of the 20.5-mile segment of the CRANDIC Corridor right-of-way between central Iowa City (Gilbert Street) and the Eastern Iowa Airport (Wright Brothers Boulevard) in Cedar Rapids, Iowa, as noted from desktop analysis and a field observation conducted during development of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study and the Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study undertaken by the Iowa Department of Transportation (Iowa DOT), Cedar Rapids & Iowa City Railway (CRANDIC), Metropolitan Planning Organization of Johnson County (MPOJC), and other local stakeholders during 2015-2016. No additional field observation was conducted for the development of the Impact of Alternative Modes on Interstate 380 Project Technical Memorandum in 2017.

The primary purpose of this 20.5-mile segment of the CRANDIC Corridor right-of-way is to accommodate freight railroad activities of the Cedar Rapids & Iowa City Railway and to host a fiber optic line and other utilities infrastructure, as detailed below.

1.3.1 Railroad Line, Timetable Station, and Milepost Designation

The CRANDIC identifies unique locations along the corridor right-of-way in terms of railroad line, railroad timetable station, and railroad milepost designations. The CRANDIC Corridor Project Study Area is part of the Cedar Rapids & Iowa City Railway's Division 2 railroad line between Iowa City and Cedar Rapids. Railroad timetable stations on CRANDIC Division 2 and their railroad milepost location (note that mileposts are numbered from Cedar Rapids and increase to Iowa City) within the CRANDIC Corridor are listed in Table 1 below.

Table 1 – CRANDIC Division 2 Timetable Stations between Iowa City and the Eastern Iowa Airport in Cedar Rapids

CRANDIC Railroad Timetable Station	CRANDIC Railroad Milepost
Iowa City *(Note: Gilbert Street in Iowa City is the south end of the Study Project Area, but is not a railroad timetable designated station. Gilbert Street intersects with the CRANDIC Corridor right-of-way at CRANDIC Milepost 25.8)*	25.1
Coralville	22.9
Great Lakes	22.3
Oakdale	19.8
North Liberty	16.7
Mid-River	13.3
Cou Falls	10.6
Swisher	8.3

CRANDIC Railroad Timetable Station	CRANDIC Railroad Milepost
Airport Siding	6.1
Konigsmark *(Note: Eastern Iowa Airport / Wright Brothers Boulevard in Cedar Rapids is the north end of the Study Project Area, and is not a railroad timetable designated station; Konigsmark station is where Wright Brothers Boulevard intersects with the CRANDIC Corridor right-of-way)*	5.3

Source: CRANDIC

1.3.2 Railroad Track Configuration

The CRANDIC Corridor right-of-way accommodates a single main track with sidings for meet-pass events between trains, switching of online freight customers, and to stage and store rail cars. Short sidings exist on the Corridor within the Project Study Area at Iowa City, Coralville, North Liberty, Mid-River, and Airport Siding.

CRANDIC maintains yards for classifying, staging, and meeting trains on the Corridor within the Project Study Area at Iowa City and just outside the Project Study Area at Cedar Rapids.

The profile of the Iowa City-Cedar Rapids Corridor is characteristic of the standard of construction employed to develop electrified interurban railroads in Iowa in the early 20th century. Main track grades up to 2.06 percent and curve sharpness (curvature) up to 14 degrees exist on the CRANDIC Corridor. Segments of the Corridor in Iowa City and Coralville closely parallel public roadways and waterways.

Figure 6 below demonstrates a typical interurban railroad profile on the CRANDIC Corridor, with a 6.5 degree curve and 1 percent grade over the Iowa Avenue overpass in Iowa City (Milepost 24.7).

Figure 6 – Railroad Curvature and Grade in the CRANDIC Corridor Right-of-Way at Iowa Avenue in Iowa City

Source: HDR

Figure 7 below demonstrates the proximity of the CRANDIC Corridor right-of-way to public roadways, as seen at First Avenue in Coralville (Milepost 23.06).

Figure 7 – Proximity of the CRANDIC Corridor Right-of-Way to Public Roadways at First Avenue in Coralville

Source: HDR

Figure 8 below demonstrates the proximity of the CRANDIC Corridor right-of-way to waterways, as seen along the east bank of the Iowa River in central Iowa City (Milepost 25.4). Note that the Iowa Interstate Railroad also crosses over the CRANDIC Corridor right-of-way and the adjacent Iowa River at this location.

Figure 8 – Proximity of the CRANDIC Corridor Right-of-Way to Waterways in Iowa City

Source: HDR

1.3.3 Existing Railroad Track Characteristics

The CRANDIC main track in the CRANDIC Corridor consists predominantly of 80 to 112 lb./yd. jointed rail, with most of the Corridor having 90 to 100 lb./yd. jointed rail. Rail in sidings is 100 lb./yd. rail or smaller. Timber ties and crushed rock ballast are used on main tracks and sidings.[6] Track curves are constructed with superelevation, which is the difference between the heights of track. Superelevation is typically employed on railroad curves to allow trains to operate at higher speeds than would otherwise be attainable if the railroad profile was fat or level. The minimum track superelevation in the CRANDIC Corridor Project Study Area is 0.25 inch. Track unbalance refers to the amount of superelevation that would be necessary for a train to reach a balanced condition through a curve. CRANDIC operates with no track unbalance, as operating speeds are low enough in the Corridor at present that current track curvature and elevations meet Federal Railroad Administration (FRA) approved superelevation requirements. Main track switches to sidings and industrial trackage are mostly No. 9 or smaller hand-throw turnouts.

Figure 9 below shows a recently rehabilitated segment of the CRANDIC main track, west of Rocky Shore Drive in Iowa City (Milepost 23.8).

[6] Cedar Rapids & Iowa City Railway Track Chart

Figure 9 – CRANDIC Corridor Main Track Structure in Iowa City

Source: HDR

1.3.4 Railroad Bridges and Drainage Structures

There are approximately 49 bridges and drainage structures that have been identified on the CRANDIC Corridor Project Study Area between central Iowa City and the Eastern Iowa Airport in Cedar Rapids, including nine bridges and approximately 40 culverts, as estimated by CRANDIC.[7] Bridge superstructure types vary and include through-plate girders, deck-plate girders, beam spans, and timber spans. The majority of bridges have open decks. Track culverts vary in size and condition, but mostly act to convey local drainage through the railroad embankment. Track ditches are also present along the majority of the Corridor. A typical track ditch consists of a swale located near the ballast shoulder that matches the grade changes of the rails, effectively allowing ballast and subgrade drainage to occur. There are no rail tunnels on the CRANDIC Corridor.

Figure 10 below shows the most prominent bridge on the CRANDIC Corridor – the four-span deck-plate girder Iowa River Bridge in Iowa City (Milepost 24.7).

7 Cedar Rapids & Iowa City Railway Bridge and Structures Inventory

Figure 10 – Iowa River Bridge in Iowa City

Source: HDR

1.3.5 At-Grade Roadway/Railroad Crossings

At-grade roadway crossings with the CRANDIC include public roadways which are protected by active warning devices and private crossings which are protected by passive warning devices. A total of 55 at-grade crossings have been identified in the CRANDIC Corridor between Gilbert Street (Milepost 25.8) in central Iowa City and the Eastern Iowa Airport at Cedar Rapids (Milepost 5.3), as estimated by CRANDIC. Legacy public crossings are typically protected by active warning devices, including crossbucks, flashing light signals, and bells. Newly established or upgraded public grade crossings are protected by active warning devices including crossbucks, flashing light signals, gates, and bells.

Private crossings are protected by passive warning devices, including crossbucks only.

Grade crossing surfaces are concrete pads or hot-mix asphalt on public crossings and hot-mix asphalt or gravel on private crossings.

Figure 11 below shows the typical active warning devices and concrete grade crossing surface used on the CRANDIC Corridor. Pictured is Forever Green Road grade crossing in North Liberty (Milepost 18.8).

Figure 11 – Typical CRANDIC Corridor Active Grade Crossing at Forever Green Road in North Liberty

Source: HDR

Figure 12 below shows the typical passive warning devices and timber/hot-mix asphalt grade crossing surface used on the CRANDIC Corridor. Pictured is the Postal Road grade crossing in Oakdale (Milepost 19.8).

Figure 12 – Typical CRANDIC Corridor Passive Grade Crossing at Postal Road in Oakdale

Source: HDR

1.3.6 Wayside Railroad Signaling and Asset Protection Devices

The CRANDIC Corridor is not equipped with a wayside railroad signal system or asset protection devices.

1.3.7 Fiber and Utilities

A fiber optic line exists in the CRANDIC right-of-way for the length of the Corridor. Several other utilities exist within, parallel to, or cross the right-of-way. The proximity of the fiber and electric utility infrastructure to the railroad is shown in the view of the CRANDIC Corridor near Mid-River in Figure 13 below.

Figure 13 – Fiber Optic and Electric Utility Infrastructure in the CRANDIC Corridor Right-of-Way near Mid-River

Source: HDR

1.3.8 Right-of-Way and Fencing

The CRANDIC right-of-way generally varies from 50 to 100 feet in width, and can be narrower in the urban areas of central Iowa City. CRANDIC owns additional adjacent property Iowa City, North Liberty, Cedar Rapids, and other locations. The right-of-way accommodates the active single main track, sidings, and other industrial trackage required for the Cedar Rapids & Iowa City Railway to provide freight rail transportation services, at-grade crossings where the railroad interfaces with roadways and trails, and the infrastructure for a fiber optic line and various utilities.

Corridor right-of-way fencing through urban sections of the CRANDIC Corridor is not complete.

1.3.9 Railroad Method of Operation

Cedar Rapids & Iowa City Railway freight railroad operations in the CRANDIC Corridor are made at slow speeds. Maximum authorized speed for trains over the Corridor's main tracks owned and operated by CRANDIC is 10 mph for freight trains, except where operating conditions and track geometry require lower speeds. CRANDIC yard managers in Cedar Rapids authorize main track authority over CRANDIC Division 2 between Iowa City and Cedar Rapids via track permit.

No locomotive number-of-axle restriction is in place on the CRANDIC Corridor's main track between Iowa City and Cedar Rapids. Tonnage restrictions include a maximum gross weight of 286,000 lbs. per railcar between Iowa City and Cedar Rapids and 263,000 lbs. per railcar within Iowa City and beyond on the connecting CRANDIC Hills Branch to Hills, Iowa (which is outside of the CRANDIC Corridor Project Study Area). No vertical clearance restrictions were identified on the CRANDIC Corridor by CRANDIC.

1.3.10 Railroad Operations

The volume and average frequency of typical Cedar Rapids & Iowa City Railway freight train operations in the CRANDIC Corridor between Iowa City and the Eastern Iowa Airport at Cedar Rapids – from south to north – is described in this section.

The portion of the CRANDIC Corridor in Iowa City (as well as the connecting CRANDIC Hills Branch between Iowa City and Hills, Iowa, located outside of the CRANDIC Corridor Project Study Area to the south) is served twice weekly on average by a local train based in Iowa City.

CRANDIC serves the line's sole customer between Iowa City and the Eastern Iowa Airport in southwestern Cedar Rapids – located in North Liberty – with a Cedar Rapids-based local train once weekly on average. CRANDIC stores rail cars at Coralville and on other sidings in the Corridor, as required.

Just outside of the Project Study Area near the Eastern Iowa Airport, CRANDIC serves a large Archer Daniels-Midland (ADM) corn processing and ethanol production plant and other rail shippers in Cedar Rapids three times daily with a local train based at Cedar Rapids. CRANDIC has occasionally stored railcars for ADM within the CRANDIC Corridor, at the Airport Siding (Milepost 6.1) and on the main track between Swisher (Milepost 8.3) and Konigsmark (Milepost 5.3), as needed.

In 2016, CRANDIC did not identify any likely future freight services or activities that would be performed on the CRANDIC Corridor between Iowa City (Milepost 25.8) and Swisher (Milepost 8.3).

Passenger trains do not presently operate over any segment of the CRANDIC Corridor.

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Appendix C – Conceptual Vision Criteria and Considerations for Alternative Use of the CRANDIC Corridor Right-of-Way

Office of Location and Environment | February 2018

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Tables

1 Introduction

A conceptual short-term and long-term vision for alternative use of the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport at Cedar Rapids (20.5 miles) was developed for this Technical Memorandum. This vision was informed by previous recent multimodal studies of the Iowa City-Cedar Rapids Corridor and potential passenger rail implementation in the CRANDIC Corridor right-of-way; stakeholder outreach and other public involvement activities conducted during the development of these recent studies and the I-380 PEL Study; findings and recommendations from the I-380 PEL Study; and internal Iowa DOT discussions during development of the I-380 PEL Study.

This appendix presents the conceptual vision for alternative use of the CRANDIC Corridor right-of-way and the general criteria and considerations identified and described in the table below, and as identified as some short and long-term considerations. From a planning standpoint, the short-term horizon is defined as 1-4 years (or years 2017-2020, inclusive) and the long-term horizon is defined as 5-25 years (or years 2021-2041, inclusive).

Table 1. CRANDIC Corridor Right-of-Way Vision General Criteria and Considerations

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
Population Growth Trends	According to U.S. Census data, the population of the combined Iowa City and Cedar Rapids Metropolitan Statistical Areas (MSAs) increased from 404,270 in 2008 to 428,242 in 2014.[1] This recent growth – 10.04% for the Iowa City MSA and 3.52% for the Cedar Rapids MSA – was significant, and larger than the 3% overall growth for the state of Iowa for that period.[2] Long-term population growth for Iowa's 10 largest counties are projected to increase 12% by 2045. Des Moines, Cedar Rapids, and Iowa City are expected to see the largest population changes.	Currently, Iowa's largest population group is the Millennial Generation. The second largest is the Baby Boomer Generation. Millennials are attracted to communities that have a multitude of transportation choices and are more likely to live in in cities where automobiles are not needed. Baby Boomers will become more reliant on alternative transportation modes to meet their needs in coming years; however, this is the timeframe to start planning and implementing alternative transportation along the Interstate 380 Corridor. The CRANDIC Corridor right-of-way offers a cohesive link to two large metropolitan communities in Iowa.	Iowa's metropolitan population is expected to account for 60% of the state's total population by 2045. This shift from rural to urban communities will require a planning effort to account for increased congestion and capacity issues within the urban corridor. Additionally, more Iowans are traveling farther for work. There is a need to identify and maintain commuter routes. The corridor between Iowa City and Cedar Rapids will require careful planning to accommodate the demographic changes to the metropolitan area over the long-term.
Sustainability	Alternative use that would generally promote sustainable and energy efficient transportation; reduce traffic congestion, travel times and costs for commuters, single-occupancy vehicle commuting, and greenhouse gas emissions on Interstate 380 and other principal roadways in the area; consider the benefits of emerging transportation technologies (i.e. automated vehicle mode); minimize constraints to area parking lot capacity; and provide an alternative use that is consistent with the best practices and recent experiences with adaptation of alternative use in other metropolitan areas with similar populations and population density.	The CRANDIC Corridor right-of-way originally connected communities from Iowa City to Cedar Rapids through passenger rail service. Its existing footprint will provide an opportunity to avoid greenfield construction and is independent of adjacent roadways and Interstate 380. Freight rail operations are currently performed on the CRANDIC rail line. In the short-term, planning in the corridor can examine environmental inventories and compare the transportation planning inputs and outputs to any environmentally sensitive resources identified in the environmental inventory. Next, long-term planning could examine the transportation mode that would result in acceptable levels of environmental mitigation and other social, environmental, and business factors, such as travel times, greenhouse gas emissions, capital costs, etc.	From a sustainability perspective, the CRANDIC Corridor right-of-way has high potential, as there are many social, environmental, and business savings available through a smart design of the existing corridor for alternative transportation use. Coordinating land-use and transportation planning is key to creating more sustainable, vibrant, and well-connected communities. Transit-oriented development will also be important to the success of this corridor and its transportation alternatives. Additionally, transit-oriented development will help to improve the livability and quality of life of Iowa's public adjacent to the CRANDIC Corridor right-of-way.
Mobility	Alternative transportation use that would enhance mobility within the region's multimodal network.	The CRANDIC Corridor right-of-way passes through several downtown and commercial districts	Long-term considerations for mobility include actual implementation to community planning and

1 Demographics and Economy Report (2015); Cedar Rapids Metro Economic Alliance
2 *Ibid.*

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
		of towns and cities along the Interstate 380 Corridor. Owing to this fact, it would be an important for communities to start considering development of transportation plans that better connect the CRANDIC Corridor right-of-way to the rest of the community and to enhance mobility. The success of alternative transportation use in the corridor relies on people using the transportation system – both the younger generation that prefers alternative transportation options and the older generation that will need alternative transportation options, as they continue aging and become less dependent on automobiles.	integration with the CRANDIC Corridor right-of-way. This would include making changes that would ease the movement of users dependent on the regions' multimodal system, including alternative transportation use of the CRANDIC Corridor right-of-way.
Accessibility	Alternative transportation use that would include provision for maximum opportunity for access to the CRANDIC Corridor right-of-way and local destinations and opportunities for students, workers, business and leisure travelers, retail shoppers, elderly, hospital patients, and others. Stations developed for a commuter rail service would be compliant with the Americans with Disabilities Act (ADA). Younger generations are consistently seeking access to transportation alternatives.	Title II of the Americans with Disabilities Act (ADA) emphasizes the accessibility of infrastructure within the public right-of-way. Iowa DOT and communities will need to develop a transition plan to bring current and future pedestrian facilities into compliance with ADA. Respective transition plans will need to include pedestrian facilities that will intersect and connect with the existing CRANDIC Corridor right-of-way in order to improve physical accessibility for the general public.	Long-term accessibility will need to consider the overall transportation network's user mobility and land-use patterns in order to connect to alternative transportation use in the CRANDIC Corridor right-of-way. This requires looking at the target user, their employment location, retail preferences, and the quality of connecting transportation modes.
Reliability	Alternative transportation use that would deliver reliable, timely, and safe, all-weather transportation capability.	Short-term considerations for reliability would require identifying areas that would impede expected travel time distributions (e.g. bottlenecks, special events, weather impacts, poor traffic light timing, etc.). Potential areas causing travel time variability, within the CRANDIC Corridor right-of-way, need to be identified and resolutions need to be planned for in order to properly mitigate for potential travel time variability. Transportation modeling or simulations (for each transportation mode) could verify performance and help to identify areas with reliability conflicts for incorporation in project planning. This can be done for a base case, no-build (future years), and build scenarios (future years). Minimizing conflicts and delays to travelers	As also mentioned in the short-term considerations, transportation modeling or simulations should help to identify and provide solutions to potential travel time variability problems along the CRANDIC Corridor right-of-way and at other modal connections in order to minimize conflicts and delays to travelers. These prioritized solutions can be implemented over the long term, with adjustments if problems arise. Additionally, future modal service on the CRANDIC corridor must be scheduled and all for some variances to travel time for various common scenarios that cannot be eliminated through modeling exercises.

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
		on existing modal services is essential before introducing a new transportation mode. Alternative transportation use that would operate on schedule.	
Efficiency	Alternative transportation use that would enhance system efficiency of the region's multimodal network.	As the Iowa City-Cedar Rapids multimodal transportation network expands and becomes more complex, there is the possibility that the transportation network becomes harder to for the public to use and access, which has the potential to limit the transportation network's efficiency. In this case, the CRANDIC Corridor right-of-way will be added to the area's multimodal network and will offer the potential for future alternative transportation use. A short-term consideration would require stakeholders to focus on current and long-term programmatic needs, such as enhancing traffic signalization and coordination; improving roadway and intersection geometrics; and other infrastructure improvement projects that will more efficiently move freight and passengers through the area's major corridors.	Long-term considerations should focus on implementing solutions identified in the short-term consideration phase, as well as providing improvements that help to optimize the current transportation network. Alternative transportation use of the CRANDIC Corridor right-of-way would provide a transit alternative that would improve congestion on parallel Interstate 380 and its connecting roadways, and allow for appropriate levels of expansion and renewal of those roadway systems. Additionally, the CRANDIC Corridor right-of-way would be another efficient path connecting the commercial areas of the municipalities offering system redundancy and resiliency, in the event of a disaster or a catastrophic failure of the primary route, and is needed for a regional transportation network.
Capacity	Alternative transportation use that would supplement and enhance existing capacity of the region's multimodal network and mitigate congestion.	Iowa's is shifting from rural to urban areas. This increase in population has the potential to create urban congestion and capacity issues. Additionally, during the public comment period for the Iowa in Motion 2045: State Transportation Plan (STP), "support was expressed for alternative modes of transportation as a way to reduce the need to increase capacity and ensure everyone has the ability to travel within the state." The CRANDIC Corridor right-of-way provides the opportunity to use alternative transportation modes and to help alleviate congestion and increase capacity on one of Iowa's busiest corridors – Interstate 380. By 2040, Interstate 380 from Iowa City to Cedar Rapids is forecasted to be at or over the capacity threshold. Planning to relieve urban congestion and improve intercity capacity should be a short-term consideration.	Future capacity expansion along the CRANDIC Corridor right-of-way should be limited, strategic, and prioritized, as the adjacent Interstate 380 Corridor between Iowa City and Cedar Rapids is forecasted to be approaching or over capacity by 2040. Use of the CRANDIC Corridor right-of-way for alternative transportation use is anticipated to alleviate some congestion along the Interstate 380 Corridor and improve regional transportation capacity. However, the potential for Interstate 380 congestion relief does not mean that capacity improvement projects on Interstate 380 should be delayed, as doing so will further intensify overall condition deficiencies on this interstate system.

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
Safety	Alternative transportation use that would provide a safe method of transportation to the traveling public and a safe interface with the intersecting multimodal transportation network.	The overriding goal for all aspects of transportation safety is to reduce injuries and fatalities, thereby reducing personal and economic losses experienced by families, employers, and communities, and improving Iowa's quality of life. Consideration for development of alternative transportation use in the CRANDIC Corridor right-of-way presents an opportunity to design a new, integrated modal system that has the ability to reduce severe automobile crashes, as well as cyclist or pedestrian injuries. Corridor improvements would require safety to be integrated throughout all aspects of public transit, including planning, design, operations, maintenance, employee training, technology development, and implementation of the Federal Transit Administration's (FTA) drug and alcohol testing programs. Intelligent technology systems, such as in-vehicle cameras and radio communications, may also be considered. Additionally, all short-term considerations and projects will need to be aligned with Iowa's Highway Safety Improvement Program, as well as the Iowa Strategic Highway Safety Plan (SHSP).	Continual safety improvements to the CRANDIC Corridor right-of-way will need to be made after any alternative transportation is implemented. Additionally, all long-term considerations and projects will need to be updated and aligned with Iowa's Highway Safety Improvement Program, as well as the Iowa Strategic Highway Safety Plan (SHSP) as they adapt to changes in regulation, as well as the needs of Iowans.
Multimodal Connectivity	Alternative transportation use that would enhance or create new connections with the region's multimodal transportation network, including existing and potential future transit routes (i.e. transit and interregional buses, vanpools), intercity passenger rail, intercity buses, regional airport, multi-use recreational trails, park and ride facilities, carsharing (i.e. Zipcar), and hired vehicles (i.e. taxis and Uber).	Iowa's extensive multimodal and multijurisdictional transportation system is a critical component of economic development and job creation throughout the state, and the system is also a major contributor to Iowans' quality of life. Multimodal transportation focuses on the different modal options that could be utilized to move people and goods from one place to another. Effectively it links the transportation system together. The CRANDIC Corridor right-of-way is an avenue that will provide another transportation mode to this fast-growing area. It is critical that any consideration of alternative transportation use of the CRANDIC Corridor right-of-way and its multimodal connections be planned to meet the	To help plan for the future, it is important to understand the current structure and usage of the multimodal transportation system. The bulk of the existing multimodal transportation system will likely need to be managed and maintained similarly to how it is today, though the addition of alternative transportation use in the CRANDIC Corridor right-of-way may require frequent changes to the management and maintenance plans because of the anticipated social, economic, and technological benefits that will likely be generated by the new transportation mode.

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
		needs of the 21st century, taking into account Iowa's population and development patterns, as well as having a diverse menu of travel choices that enable mobility across different demographics and land uses.	
Near-Term Versus Long-Term Needs of the Traveling Public	Alternative transportation use that would generally consider existing and anticipated future traffic demand and volumes, existing traffic patterns and adaptability to potential future traffic patterns, potential shifts in transportation mode choices, and the development of emerging transportation technologies (i.e. automated vehicles).	Though population growth is slow in Iowa, but there is presently a population shift from rural to urban communities. This will require a planning effort to account for increased congestion and capacity issues within the urban corridor, including the urbanized area along the CRANDIC Corridor right-of-way. Any consideration for the development of alternative transportation use in the CRANDIC Corridor right-of-way will need to account for expected changes to population, demographics, land use, and development patterns in the near-term.	Iowa's metropolitan population is expected to account for 60% of the state's total population by 2045. This will require a multi-jurisdictional planning effort to account for or alleviate congestion and capacity issues within the urban corridor, including the urbanized area along the CRANDIC Corridor right-of-way. Over the long-term, there will be changes to population, demographics, land use, and development patterns that will require changes to alternative transportation use on the CRANDIC Corridor right-of-way and adjoining areas.
Capability for Affordable and Realizable Implementation	Alternative transportation use that is technically and environmentally feasible to construct, most cost-effective to implement given the potential availability of public and private funding sources, and that would provide the maximum benefit to the most users.	There is federal, state, and local funding sources available to develop and support the implementation and operation of public transit; however, these resources are often not enough. Iowa DOT provides public transit agencies with tools and support to better coordinate affordable passenger transportation services order to increase the efficiency and effectiveness of the passenger transportation system. Securing new funding streams will be critical to supporting alternative transportation use of the CRANDIC Corridor right-of-way. Iowa DOT and key stakeholders could potentially apply for federal discretionary funding as it becomes available to improve existing or to develop new public transit systems, corridors, and facilities.	The existing CRANDIC Corridor right-of-way is a valuable regional resource for alternative transportation use, whether it is for commuter rail or AV. Implementation of these modes would be less costly than the potential assembly of a similar greenfield corridor within or parallel to the right-of-way of Interstate 380. Additionally, there are many grant opportunities to help offset the initial capital investment. The Federal Transit Administration (FTA) serves as a host to many programs and grants that aim to improve mobility, streamline capital project construction and acquisition, and increase the safety of public transportation systems across the nation.[3] These opportunities are in the form of Capital Investment Grants – 5309,[4] Transportation Investment Generating

3 https://www.transit.dot.gov/grants
4 https://www.transit.dot.gov/funding/grants/capital-investment-grants-5309

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
			Economic Recovery (TIGER) grants,[5] and Urbanized Area Formula Grants - 5307[6] to name a few.
Economic Development	Alternative transportation use that supports economic development, transit-oriented development near potential commuter rail stations and linkages with automated vehicle lanes, and job retention and creation at area employers.	The U.S. Midwest tends to have low population densities with high amounts of urban sprawl. This condition generally increases capital and operating and maintenance costs for public infrastructure, but perpetuate many social and environmental costs onto the public (e.g., higher travel times, added air emissions, more exposure to vehicular accidents, etc.). With urban population expected to increase throughout Iowa by 2045, it is important to introduce a new model for city planning that looks at transit-oriented development and new urbanism. These ideologies support sustainability and mobility, and lead to increased levels of economic development. Alternative transportation use of the CRANDIC Corridor right-of-way presents an opportunity to introduce transit-oriented development that promotes mixed land use. This would enhance economic activity by diversifying the types of goods and services readily accessible within the area, as well as providing accessible housing for residents requiring goods and services located along the corridor.	Long-term city planning along the CRANDIC Corridor right-of-way would need to facilitate smart growth of businesses, population, and recreation along the line and balance that with the demand of regional transit services, including potential alternative transportation use of the CRANDIC Corridor right-of-way. This synergy will boost the economic vitality of the corridor and foster economic development. Continual updates to city planning will remain critical to balancing the needs of the residents, and related commerce, along the corridor during future years.
Community Development	Alternative transportation use that supports and enhances multi-faceted community development in the municipalities along the CRANDIC Corridor right-of-way.	As livability is enhanced, so is its community. A livable community also has a high quality of life, since it was developed to have a well-connected transportation network with many modal choices. In turn, this provides enhanced access to quality jobs, housing, schools, and other amenities. The CRANDIC Corridor right-of-way played an integral role in developing and linking communities between Iowa City and Cedar Rapids during its earlier use as a passenger rail line in the 20th	Long-term considerations of community development need to consider land use and its impact on environment, modal connectivity, and connectivity to community services (as well as providing access to work, school, medical, retail, etc.). Transit-oriented development, as well as station accessibility and connectivity, will play an important role with long-term development of the CRANDIC Corridor right-of-way. Development of alternative transportation use in the CRANDIC

5 https://www.transit.dot.gov/funding/grants/transportation-investment-generating-economic-recovery-tiger-program
6 https://www.transit.dot.gov/funding/grants/urbanized-area-formula-grants-5307

General Criteria	General Considerations	Some Short-Term Considerations (Years 2017-2020)	Some Long-Term Considerations (Years 2021-2041)
		century. Alternative transportation use of the CRANDIC Corridor right-of-way presents an opportunity to continue to smartly develop growing communities along the corridor in a way that is functional and benefits the public and stakeholders. There is potential for additional residential and commercial development during this initial phase.	Corridor right-of-way would likely be a catalyst for attracting residents to growing communities in Johnson and Linn counties, and could be a factor in increasing home values in the region.
General Benefits of Preserving the CRANDIC Corridor Right-of-Way	The CRANDIC Corridor right-of-way is the only remaining direct rail corridor between Iowa City and Cedar Rapids that can be adapted for future alternative use; the cost to develop a new linear corridor for alternative transportation use between the cities would likely be cost prohibitive. The population concentration between Iowa City and Cedar Rapids is generally situated along the CRANDIC Corridor right-of-way. High multimodal connectivity potential of the CRANDIC Corridor right-of-way.	Currently, the CRANDIC Corridor right-of-way offers a direct connection to two fast-growing metropolitan areas in Iowa, and parallels Interstate 380. Uniquely, several municipalities' population centers are also adjacent to the CRANDIC Corridor right-of-way. The CRANDIC Corridor right-of-way is the only remaining direct and complete rail corridor between Iowa City and Cedar Rapids, and it is the only rail corridor in the region that also links the growing intermediate cities of Coralville and North Liberty. Owing to its location, the CRANDIC Corridor right-of-way has high potential for multimodal connectivity, as well as high potential for transit-oriented and other related economic development in Johnson and Linn counties, if it is adapted for alternative transportation use. Preservation and further study of the natural existing CRANDIC railroad corridor right-of-way as a valuable regional resource for alternative transportation use is feasible and would be less costly than the potential assembly of a new linear greenfield corridor within or parallel to the right-of-way of Interstate 380 and other roadways in the area for hosting alternative transportation use between Iowa City and Cedar Rapids in the future.	Public and private stakeholders to complete study for preservation and alternative transportation use of the CRANDIC Corridor right-of-way; select an alternative transportation mode and implementation plan; establish agency jurisdiction for the construction, operation, and maintenance of the alternative use mode and service; pursue public and private funding for the development of alternative use, and implement selected alternative mode and service.

IOWA DOT
I-380 Planning Study

INTERSTATE 380

PLANNING AND ENVIRONMENTAL LINKAGE (PEL) STUDY

Appendix D – STOPS Modeling Methodology and Assumptions

Office of Location and Environment | February 2018

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1 Introduction

To show demand, traffic volumes, and public benefits for alternative use of the CRANDIC Corridor right-of-way (and the Interstate 380 Corridor right-of-way, as applicable), conceptual ridership forecasts for each potential alternative use scenario were developed using the Federal Transit Administration (FTA) Simplified Trips on Project Software (STOPS) model. Forecasts were developed for a base year (defined as 2015) and two future years – 2025 and 2040.

This appendix provides detail about the methodology and assumptions underlying the STOPS modeling undertaken to support this Technical Memorandum. The detailed STOPS modeling forecasts for each alternative use scenario are presented within the context of the conceptual alternative use scenarios assessment presented in Appendix E of this Technical Memorandum.

2 STOPS Modeling Methodology and Assumptions

In order to make a high-level assessment of potential alternative use scenarios, each was modeled to project the number of riders attracted to alternative mode. The modeling was conducted using the Federal Transit Administration's Simplified Trips-on-Project (STOPS) model, version 2.0. The STOPS model was built on the relationship between socioeconomic traits (i.e. income level, age, race, etc.) and a multimodal network from experience generated in areas with existing transit service using a variety of rapid transit modes. The project STOPS model looked at proposed station / stop locations and frequency of service between the Iowa City and Cedar Rapids metropolitan areas. The primary output of the model was projected number of riders by mode of access (e.g. walk access, park and ride access, etc.) with details on where projected trips began and ended. Additional details on the model framework and details on model adjustments to local and project conditions can be found in the two documents at the end of Appendix D, which capture related work developed during the broader I-380 PEL Study.

In validating the models for use in this study, key input variables and generic output were reviewed. One of the key generic output findings is that FTA STOPS does not generate many trips from Downtown Iowa City to Downtown Cedar Rapids or vice versa. The inputs driving this low rate of end-to-end trips appear to be two-fold:

- The number of potential transit riders between the two downtown areas is estimated from U.S. Census Journey to Work survey data. STOPS estimates the potential transit trips generated from home locations to work locations. The data shows that the number of individuals that live reasonably close to the downtown station locations and work in the opposite metropolitan area are quite low in number. It should be noted that special travel markets, like the university student population and trips made occasionally, like for business air travel are not included in the base STOPS forecast estimates.
- The travel time for auto trips is much faster than commuter rail trips. Auto travel times from Downtown Iowa City to Downtown Cedar Rapids are approximately 40 minutes based on the Iowa Travel Analysis Model (iTRAM). Scenario run times range between 59 and 75 minutes based on general average speeds for the commuter rail and automated bus technology, respectively. Even if the average speeds along the transit modes could be increased to match the auto travel times, the average station access time for the beginning and end of a commuter rail trip would still tip the scales toward auto travel for this commute trip.

The STOPS model identifies potential ridership for those who access the commuter rail system stations by walking, being dropped off by a private vehicle (kiss and ride), driving and parking (park and ride), and transfers from other transit modes (modal transfers). During Iowa DOT review of the station boardings for the preliminary modeling results, it was noted that the STOPS model may portray optimistic ridership numbers due to ease of access. For this analysis, the model estimated ridership numbers are compared without modification, understanding that any future analyses will lead to the refinement of these ridership models. Still, details of a proposed modification to add an additional cost to the transit service are included in two documents at the end of Appendix D, which capture related work developed during the broader I-380 PEL Study.

Future study of alternative use of the CRANDIC Corridor right-of-way may consider refinements to the transit operating plan, trip generation, forecast land use characteristics, and or special generators that impact future ridership.

3 STOPS Modeling Developed for I-380 PEL Study

This section presents documents related to STOPS Modeling undertaken for the I-380 PEL Study and used to support this Technical Memorandum, as organized below:

- I-380 PEL Stops Scenarios Technical Memorandum
- Draft I-380 STOPS Modeling Technical Memorandum

To

Brad Hofer, Iowa DOT

Gary Harris, Iowa DOT

Phil Mescher, Iowa DOT

From

Robert Hosack, HNTB Corporation

Date

March 24, 2017

Subject

I-380 PEL STOPS Scenarios

HNTB Job Number

61933

Technical Memorandum

INTRODUCTION

Iowa Department of Transportation (IowaDOT) is conducting a Planning and Environmental Linkages study on the I-380 corridor in Linn and Johnson counties (I-380 PEL). This technical memorandum outlines the two scenarios HNTB intends to model in the STOPS model. The purpose of the STOPS model analysis is to estimate the ridership and auto diversion of transit scenarios which utilize the existing CRANDIC Corridor.

STOPS is a stand-alone ridership model specifically created by FTA for evaluating new transit networks. STOPS is similar to a conventional 4-step model that evaluates zone-to-zone travel markets based on socio-economic characteristics and the existing transit network. STOPS produces base year average weekday ridership forecasts for mobility and cost effectiveness measures and quantifies the projected change in daily automobile person miles travelled (PMT) resulting from implementation of the proposed project. STOPS has been 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.

Scenario 1

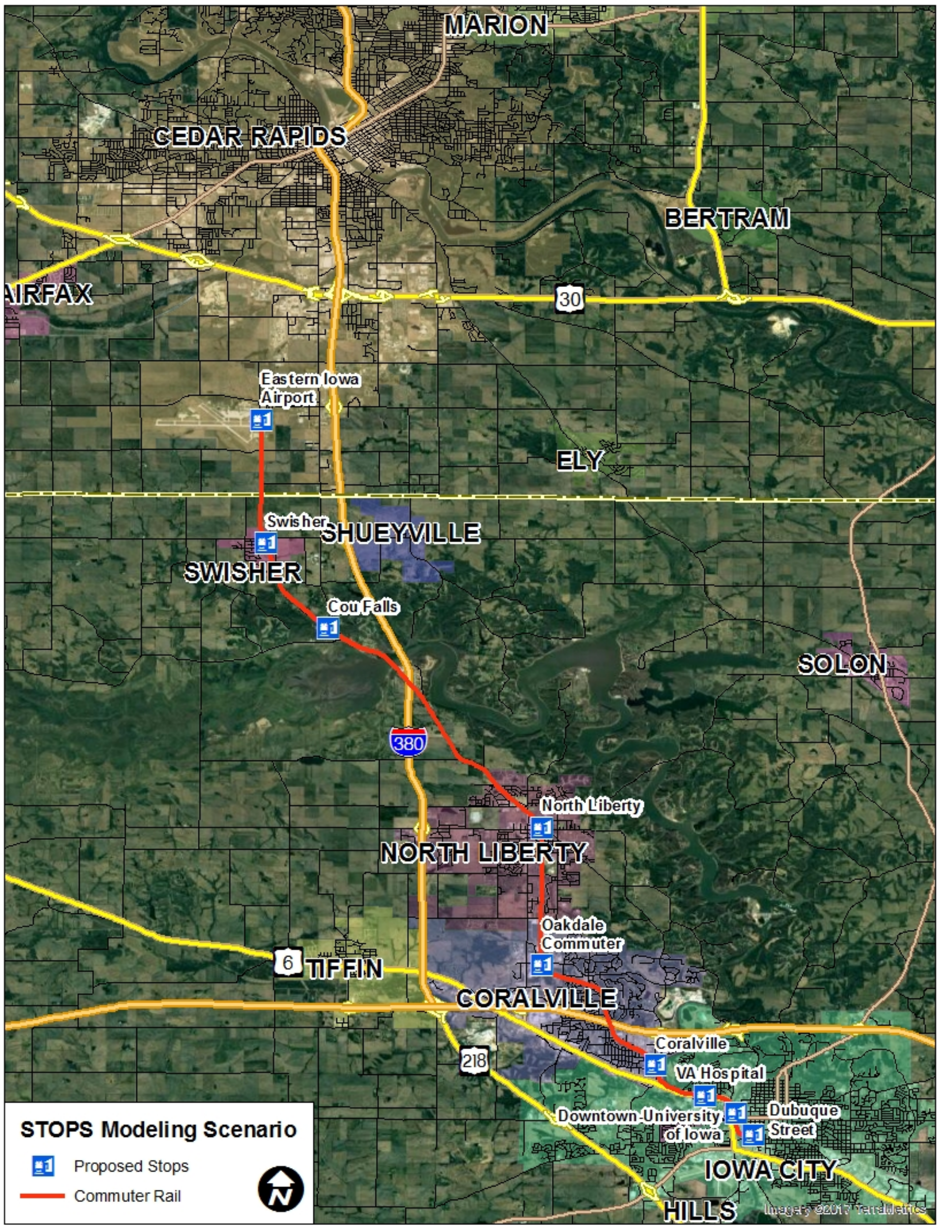
Scenario 1 will model a commuter rail line from downtown Iowa City to the Eastern Iowa Airport. For this scenario, the stop locations Identified in the *Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study* and the *Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study Final Study*. The station locations are as follows:

- Dubuque Street (Iowa City)
- Library/Burlington Street (Downtown Iowa City/University of Iowa)
- Veterans Affairs Hospital
- Coralville
- Oakdale Commuter
- Forever Green Road (North Liberty)

- Cou Falls
- Swisher
- Eastern Iowa Airport/Cedar Rapids Terminal

The alignment and stop locations are shown in **Figure 1**.

Figure 1: Commuter Rail Scenario



The scenario will use the *Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study* and *Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study Final Study* as the basis for the service span and headways. The scenario will assume a service span of 6:00 AM to 7:00 PM. Based on the assumed speeds identified in the studies the scenario will have a trip leaving downtown Iowa City approximately every one hour and 45 minutes.

Scenario 2

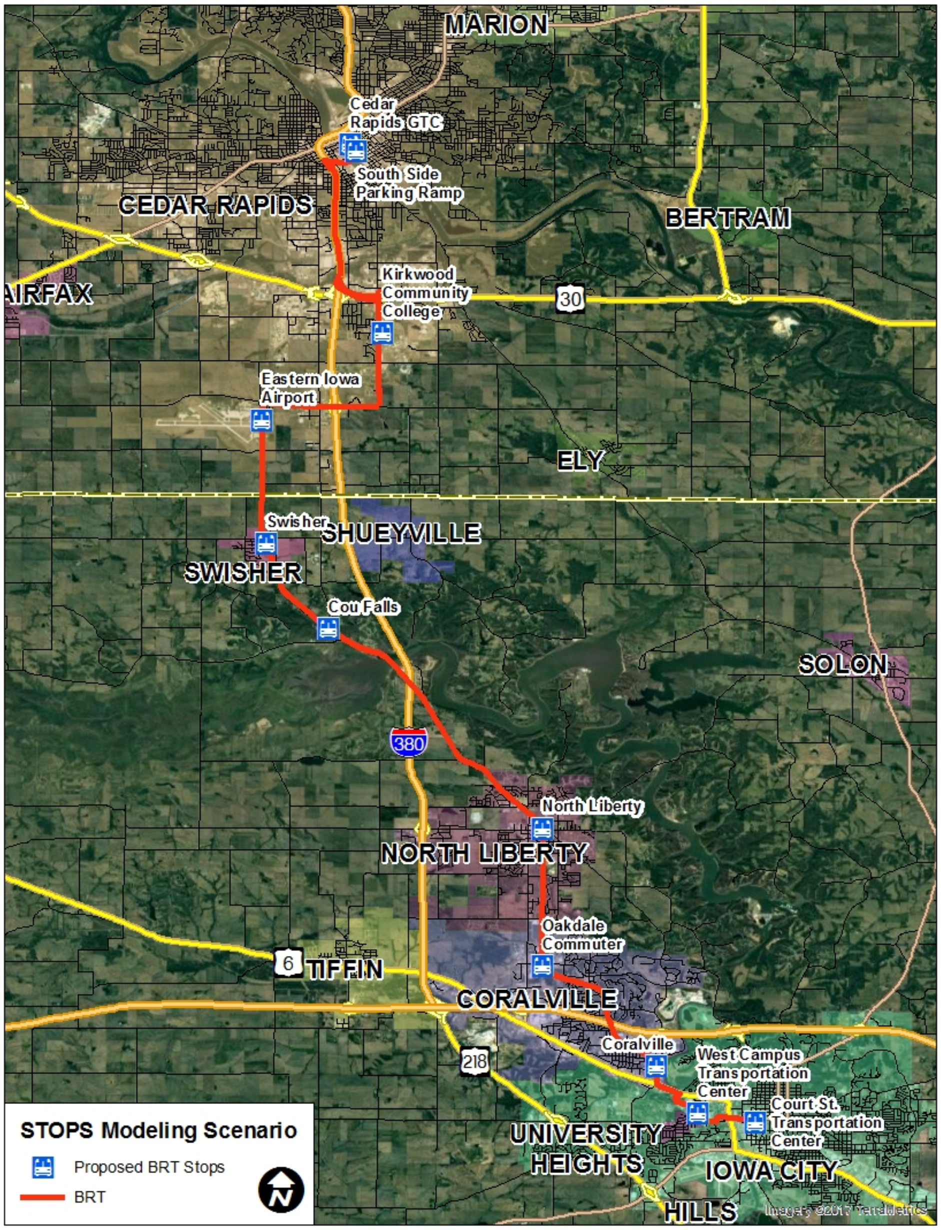
Scenario 2 will model bus rapid transit (BRT) from downtown Iowa City to the Eastern Iowa Airport utilizing the CRANDIC Corridor as an exclusive right-of-way for fixed guideway. The Scenario will have a service span of 5:15 AM to 6:45 PM. Morning peak period service will have 10 minute headways from 5:15 AM to 8:45 AM. Afternoon peak period service will have 10 minute headways from 3:15 PM to 6:45 PM. The off-peak service will have 30 minute headways.

For this scenario, the stop locations identified for the Iowa Regional Express Bus Service will be used and modified to account for the use of the CRANDIC Corridor. The stops are as follows:

- Court Street Transportation Center
- West Campus Transportation Center
- Coralville (Iowa River)
- Oakdale Commuter
- Forever Green Road (North Liberty)
- Cou Falls
- Swisher
- Eastern Iowa Airport
- Kirkwood Community College
- Cedar Rapids South Side Ramp

The BRT will be modeled as running on a fixed guideway on the CRANDIC Corridor from the Eastern Iowa Airport to 6th Street and 1st Avenue in Coralville. The portion of the route that is not on the fixed guideway will follow a similar routing that was identified in the Interregional *Express Bus (IRXB) Cedar Rapids to Iowa City Recommendation*. The alignment and stops are shown in **Figure 2.**

Figure 2: BRT Scenario



DATE: **6/5/2017**

PROJECT NUMBER: **IM-380-6(263)0--13-52 (I-380 Corridor Planning and Environmental Linkages Study)**

SUBJECT: **DRAFT I-380 STOPS Modeling Technical Memorandum**

As part of the I-380 Planning and Environmental Linkages Study, ridership forecasts were developed for the two transit scenarios identified by the Iowa Department of Transportation (Iowa DOT) for the CRANDIC Corridor. Forecasts were developed using the Federal Transit Administration (FTA) Simplified Trips-on-Project (STOPS) model. This technical memorandum summarizes the results of two forecast scenarios modeled utilizing the FTA STOPS model. The purpose of the STOPS model analysis is to estimate the ridership and auto diversion of transit scenarios which utilize the existing CRANDIC Corridor.

STOPS is a stand-alone ridership model specifically created by FTA for evaluating new transit networks and is similar to a conventional 4-step model that evaluates zone-to-zone travel markets based on socio-economic characteristics and the existing transit network. STOPS produces base year average weekday ridership forecasts for mobility and cost effectiveness measures and quantifies the projected change in daily automobile person miles travelled (PMT) resulting from implementation of the proposed project. STOPS has been 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.

Background

The two model scenarios include a commuter rail line from downtown Iowa City to the Eastern Iowa Airport (Scenario 1) and bus rapid transit (BRT) from downtown Iowa City to downtown Cedar Rapids. The stop locations for each of the scenarios is listed below and are shown in **Figures 1** and **2**. Stop locations were derived from a previous study on transit options utilizing the CRANDIC rail corridor prepared by HDR, Inc.

Scenario 1: Commuter Rail

- Dubuque Street (Iowa City)
- Library/Burlington Street (Downtown Iowa City/University of Iowa)
- Veterans Affairs Hospital
- Coralville
- Oakdale Commuter
- Forever Green Road (North Liberty)
- Cou Falls
- Swisher
- Eastern Iowa Airport

Scenario 2: BRT

- Court Street Transportation Center
- West Campus Transportation Center
- Coralville (Iowa River)
- Oakdale Commuter
- Forever Green Road (North Liberty)
- Cou Falls
- Swisher
- Eastern Iowa Airport
- Kirkwood Community College
- Cedar Rapids South Side Ramp (GTC)

Figure 1: Scenario 1 Commuter Rail

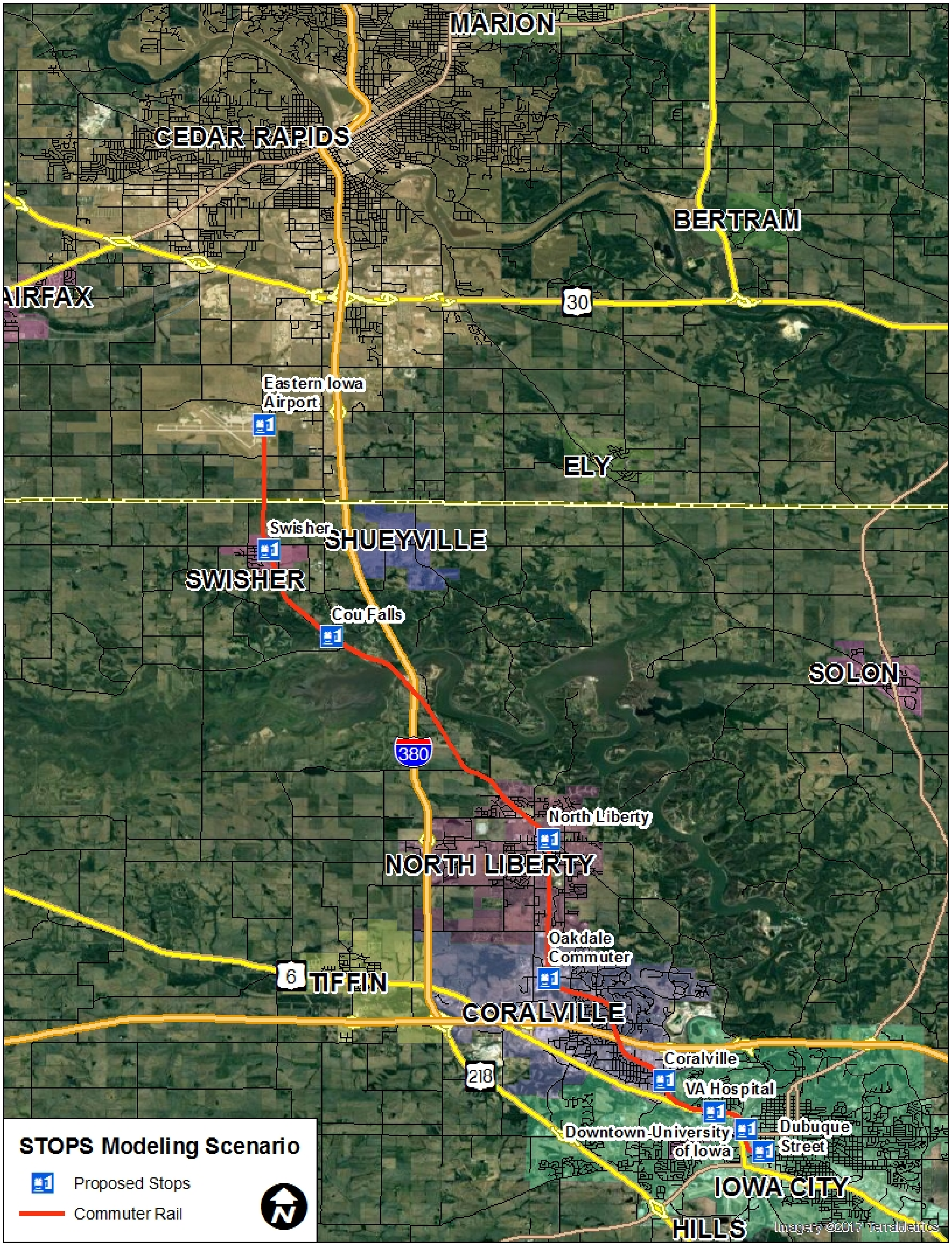
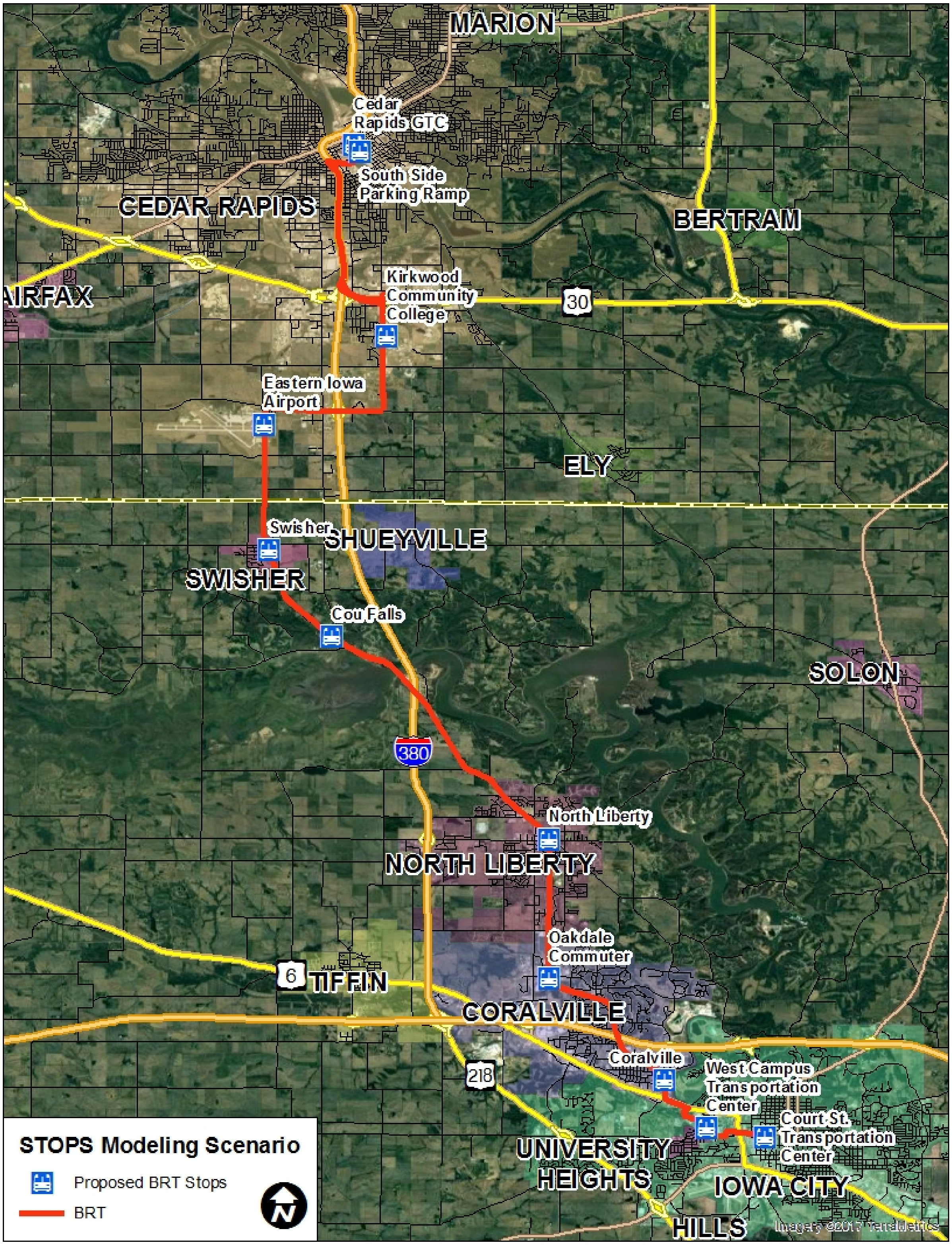


Figure 2: Scenario 2 Bus Rapid Transit



Operating Plan

Scenario 1 assumed a service span of 6:00 AM to 7:00 PM. Based on the assumed headways and speeds identified in the *Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study* and *Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study Final Study* the scenario assumed a single-track option and will have a trip leaving downtown Iowa City approximately every two hours and 10 minutes (Scenario 1A), this includes a 15-minute layover. The model was also run for a commuter rail line that was assumed to operate with headways of 30 minutes (Scenario 1B).

Scenario 2 utilized the CRANDIC Corridor as an exclusive right-of-way for fixed guideway bus rapid transit from downtown Iowa City to the Eastern Iowa Airport. The Scenario will have a service span of 5:15 AM to 6:45 PM. Morning peak period service will have 10 minute headways from 5:15 AM to 8:45 AM. Afternoon peak period service will have 10 minute headways from 3:15 PM to 6:45 PM. The off-peak service will have 30 minute headways.

Running Times

To determine the length of time it takes to complete a trip, a running time model was created and calibrated for input into the STOPS model. This was completed by first analyzing the route and the stops along route. The data gathered included the speed limit on different segments, traffic signal locations, turning locations, and stop locations. Each route was broken into segments with generally the same characteristics. For each route three such segments were identified. The travel speed, signal data and stops were input into the directionally based running time model to determine the theoretical travel time. Running times were then input into the STOPS model. The running times developed for the model are summarized in the following table.

Table 1: Running Times

	Running Time (Minutes)				
	Inbound AM	Outbound AM	Inbound PM	Outbound PM	Average Running Time
Scenario 1	51.9	51.9	51.9	51.9	51.9
Scenario 2	66.5	56.3	68.4	60.3	62.9

Scenario 1 Results

The following tables summarize the ridership estimates based on the STOPS model for the current year (2015) and forecast years (2020,2025, and 2040). The following table summarizes the daily ridership of the two commuter rail scenarios. The results in Table 2 are the base results for commuter rail. Within these results commuter rail is treated equally to the other transit options in regards to fares.

Table 2: Total Daily Ridership

	2015	**2020**	**2025**	**2040**
Scenario 1A	433	487	554	805
Scenario 1B	2,953	3,375	3,924	5,966

Through the review of the Scenario 1B station boardings, it appears that the STOPs model is over stating 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 2: Scenario 1B Average Weekday Station Boarding (2015)

	Walk	***Kiss and Ride***	***Park and Ride***	***Transfers***	***Total***
Dubuque St	479	25	86	29	619
Downtown Iowa City	668	4	0	74	746
VA Hospital	711	3	0	79	792
Coralville	156	29	169	8	363
Oakdale	151	24	13	0	188
North Liberty	154	36	23	2	215
Cou Falls	0	0	0	0	0
Swisher	3	1	4	0	9
E Iowa Airport	22	0	0	0	22
Total	2,343	123	296	192	2,953

The commuter rail options were re-run to test the sensitivity of the options to additional fare 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 a five-minute impedance was added to each of the stations for walk, kiss and ride, and park and ride access mode. **Tables 3, 4,** and **5** shows the results of the additional impedance.

Table 3: Total Daily Ridership with 5 Minute Impedance

	2015	**2020**	**2025**	**2040**
Scenario 1A - With 5 Minute Impedance	357	400	452	633
Scenario 1B - With 5 Minute Impedance	1,595	1,812	2,120	3,411

Table 4: Scenario 1A with 5 Minute Impedance

	Walk	*Kiss and Ride*	*Park and Ride*	*Transfers*	*Total*
Dubuque St	34	3	3	1	41
Downtown Iowa City	54	0	0	10	64
VA Hospital	84	1	0	6	91
Coralville	24	5	15	3	47
Oakdale	25	5	2	0	32
North Liberty	62	7	3	0	72
Cou Falls	0	0	0	0	0
Swisher	1	0	1	0	3
E Iowa Airport	6	0	0	0	6
Total	291	22	25	19	357

Table 5: Scenario 1B with 5 Minute Impedance

	Walk	*Kiss and Ride*	*Park and Ride*	*Transfers*	*Total*
Dubuque St	197	19	31	10	257
Downtown Iowa City	253	3	0	68	324
VA Hospital	392	2	0	88	482
Coralville	100	22	52	8	181
Oakdale	131	18	5	0	155
North Liberty	127	29	16	1	172
Cou Falls	0	0	0	0	0
Swisher	3	1	3	0	7
E Iowa Airport	16	0	0	0	16
Total	1,220	94	107	175	1,595

The added impedance had a small impact to Scenario 1B 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.

The primary market identified by the model are 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 the operating plan and running time could be adjusted. 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 potential an origin destination survey of the existing transit system.

Scenario 2 Results

The following tables summarize the ridership estimates based on the STOPS model for the current year (2015) and forecast years (2020,2025, and 2040). **Table 6** summarizes the daily ridership of the bus rapid transit scenario. Within these results bus rapid transit is treated equally to the other transit options in regards to fares. It is anticipated that the route would have a similar fare to that of the existing transit system.

Table 6: Scenario 2 Average Weekday Station Boarding

	2015	***2020***	***2025***	***2040***
Court Street	459	522	612	920
West Campus	596	677	823	1,510
Coralville	318	361	414	634
Oakdale	207	235	280	606
North Liberty	200	224	255	384
Cou Falls	21	23	26	33
Swisher	27	29	32	45
E Iowa Airport	109	114	121	167
Kirkwood	268	287	308	390
Southside Parking	307	326	347	427
Cedar Rapids GTC	148	158	170	227
Total	2,660	2,958	3,388	5,342

The primary market identified by the model are trips that occur between the stations between North Liberty and Downtown Iowa City. The model also identifies that a large number a short distance trips occur between downtown Iowa City and the West Campus Transportation Center, and between Downtown Cedar Rapids and Kirkwood. With the high level of service that the route would provide short trips would be expected to occur. The model does identify that trips would occur between Cedar Rapids and Iowa City. The more travel time that could be decreased on the route the service becomes more attractive for interregional trips.

Conclusion

Table 8 is a summary of forecasts for each model run.

Table 8: 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 results are generally consistent with expected market reaction to transit service types and service levels. A commuter service with over two hours between trips (Scenario 1A) is not likely to attract many passengers. This is reflected in the results.

The primary market identified by the model are trips that occur between the stations between North Liberty and Downtown Iowa City in Scenarios 1A, 1B, and 2. The STOPs model assumes passengers will walk up to a mile to the nearest station. This assumption may overestimate the walk distance in this market. But the walk distance input is not a variable in the model; it cannot be changed. The walk distance likely causes the model to overstate the walk access at stations. The model appears to have over assigned short trips between adjacent stations, in part due to the walk access assumption.

The addition of the impedance factor to the commuter rail forecasts is an adjustment to simulate the effect of a higher fare and also reduce the number of short trips assigned between adjacent stations.

For all scenarios, the model assigns fewer longer distance trips than expected, trips between Cedar Rapids and Iowa City. The additional travel time resulting from auto access makes the service unattractive to the interregional commuter market. This is particularly the case for commuter rail with the northern most station at the Airport, remote from most of the Cedar Rapids market. This could be offset by speeding up the service or providing service into downtown Cedar Rapids. 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.

I-380 Planning Study

INTERSTATE 380

PLANNING AND ENVIRONMENTAL LINKAGE (PEL) STUDY

Appendix E – Alternative Use Scenarios Assessment for the CRANDIC Corridor Right-of-Way and Impacts on Interstate 380

Office of Location and Environment | February 2018

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Tables

Figures

1 Introduction

An assessment of potential alternative use scenarios for the CRANDIC Corridor right-of-way between Gilbert Street in central Iowa City and the Eastern Iowa Airport at Cedar Rapids (approximately 20.5 miles) and potential related impacts on parallel Interstate 380 was developed for this Technical Memorandum.

This appendix presents the assumptions that support this general assessment of four potential alternative use scenarios in the Iowa City-Cedar Rapids Corridor, including the implementation of commuter rail and / or automated vehicle service within some or all of the CRANDIC Corridor right-of-way and / or the parallel Interstate 380 Corridor right-of-way, and presents the assessment outcomes.

The assessment presents the following outcomes for each of the alternative use scenarios:

- Alternative scenario description and route map
- Applicability of the assumed alternative transportation mode for potential implementation in the CRANDIC Corridor Right-of-Way (and the parallel Interstate 380 Corridor right-of-way, as applicable by scenario)
- Potential conceptual cost of implementation
- Applicability of alternative use with the vision for CRANDIC Corridor right-of-way alternative use
- Alternative use general findings and recommendations

A summary of the alternative use scenarios, recommendations, and other related information is presented in the Technical Memorandum.

2 Alternative Use Scenarios Assessment for the CRANDIC Corridor Right-of-Way and Impacts on Interstate 380

2.1 Potential Alternative Use Scenarios

Iowa DOT developed a high-level assessment of potential alternative use scenarios for commuter rail and / or automated vehicle implementation between central Iowa City and Downtown Cedar Rapids, utilizing some or all of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids. The applicability of each mode for potential implementation in the CRANDIC Corridor right-of-way, and for connections to the multimodal transportation network outside of the CRANDIC Corridor right-of-way, including Interstate 380, is described. This section also defines how each alternative use scenario meets (or does not meet) the conceptual long-term vision developed in Section 4 of this Technical Memorandum. The four potential alternative use scenarios and the assumptions used in the conceptual assessment of each are described in this section.

2.2 Alternative Use Scenarios Assessment Assumptions

- No freight rail service would be provided in the 20.5 miles of the CRANDIC Corridor right-of-way between Gilbert Street in Iowa City and Wright Brothers Boulevard (Eastern Iowa Airport) in Cedar Rapids in the future. Future study and implementation of alternative use on this segment of the right-of-way would require coordination with CRANDIC to determine the potential for the retention of freight rail service over any portion of this segment.

- The CRANDIC Corridor right-of-way segment from the Eastern Iowa Airport north to the CRANDIC Shops Area in southwest Cedar Rapids, approximately 5.5 miles, is a congested urban freight railroad terminal facility with potentially complex engineering and environmental constraints to accommodating alternative transportation use in the future, and is not considered in this study. The CRANDIC Corridor from the CRANDIC Shops Area northeast to Downtown Cedar Rapids, approximately 1.5 miles, was a passenger rail only segment that operated largely within public city streets shared with other transportation modes. It was abandoned after discontinuance of passenger service in 1953, and is not considered in this study. Connections between the CRANDIC Corridor right-of-way at Wright Brothers Boulevard in Cedar Rapids and Downtown Cedar Rapids, when applicable, are assumed to be AV buses operating on existing roadways.
- One scenario that includes an assessment of the potential for commuter rail implementation within or parallel to the Interstate 380 right-of-way consists of a conceptual examination of the feasibility of the Interstate 380 Corridor right-of-way for rail use, including:
    - Compatibility of gradients and curvature with typical commuter rail practices.
    - Compatibility of overhead highway structures and major drainage crossings for accommodation of a commuter rail line and feasibility of ingress and egress of the commuter rail line to and from the Interstate 380 right-of-way.
    - The available linear footprint in the Interstate 380 Corridor and its feasibility for construction, operating, and maintaining a commuter rail line.

  Further engineering of commuter rail implementation within or parallel to the existing Interstate 380 Corridor right-of-way was not considered for development, as conceptual analysis conducted for this study revealed significant feasibility challenges.
- The conceptual assessment resulted in a narrative with supporting Google Earth Pro imagery to detail key general conditions and bottlenecks. No engineering assessment was made for development of a commuter rail line within or parallel to the Interstate 380 Corridor right-of-way.
- Any assessment including AV implementation focused on AVs in place of fixed route transit service both in dedicated guideway and in mixed traffic. Station characteristics were not assessed for AVs. Operations of AVs in a fixed guideway within the CRANDIC Corridor right-of-way were assumed to be buses operating in two-way traffic flows.
- Conceptual level capital costs, where developed in past recent study for alternative use scenarios including commuter rail implementation in the CRANDIC Corridor right-of-way, were referenced, but not independently updated for this Technical Memorandum. Conceptual level capital cost estimates for AV mode development within and outside of the CRANDIC Corridor right-of-way were developed as a high-level representation for likely infrastructure and AV bus equipment required only, based on recent industry averages and projections for emerging technology.
- To show demand, traffic volumes, and public benefits for alternative use of the CRANDIC Corridor right-of-way (and the parallel Interstate 380 Corridor right-of-way, as applicable), conceptual ridership forecasts for each potential alternative use scenario were developed using the Federal Transit Administration (FTA) Simplified Trips on Project Software (STOPS) model. Forecasts were developed for the year 2015 and two future years - 2025 and 2040. Additional detail about the methodology and assumptions underlying the STOPS modeling conducted for this Technical Memorandum can be found in Appendix D. Additional detail for the STOPS modeling forecasts for each alternative use scenario appears later in this appendix.

2.3 Alternative Use Scenarios Assessment and Impacts on Interstate 380

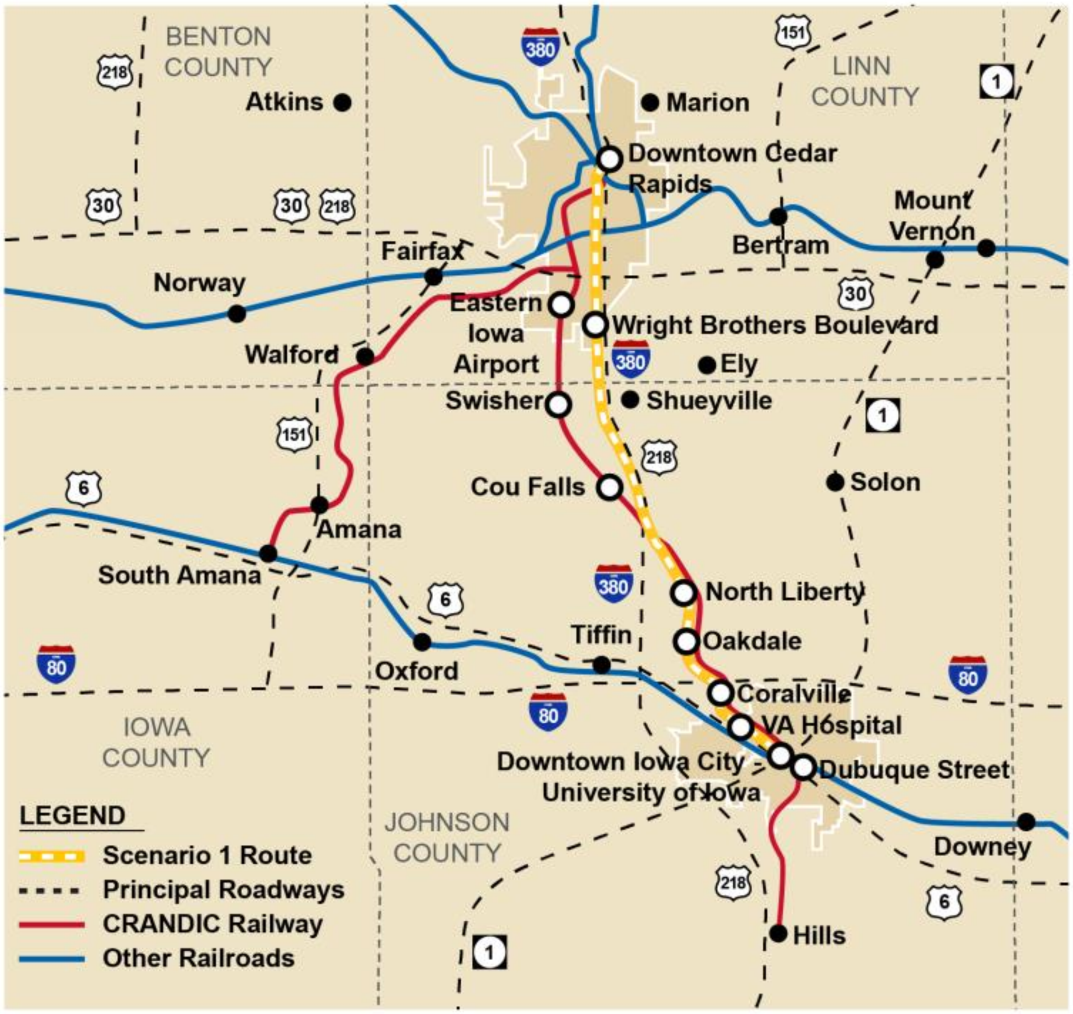
Four alternative use scenarios of the CRANDIC Corridor right-of-way were considered for providing enhanced mobility and transit options between Iowa City and Cedar Rapids. The following sections describe the two alternative transit modes and compares four transit operations scenarios against one another. Ultimately, the alternative use of the CRANDIC Corridor right-of-way can be seen as part of an integrated multimodal transportation system that includes Interstate 380. Other Technical Memoranda developed as part of the Interstate 380 PEL Study address Interstate 380 as an individual asset, and this Technical Memorandum assesses how an adjacent potential transit service operating in the CRANDIC Corridor right-of-way may affect mobility needs along Interstate 380. Findings related to how current auto travelers might switch to transit and how that shift could affect Interstate 380 are discussed in Section 5.9.

2.4 Alternative Scenario 1 (Commuter Rail – Central Iowa City-Downtown Cedar Rapids via CRANDIC Corridor and Interstate 380 Corridor Rights-of-Way)

2.4.1 Description

Scenario 1 for alternative use includes the potential implementation of commuter rail in the CRANDIC Corridor right-of-way between central Iowa City and the location where the CRANDIC Corridor right-of-way and Interstate 380 intersect north of North Liberty, and in the Interstate 380 right-of-way from that intersection north to Downtown Cedar Rapids – approximately 26 miles in length. The map in Figure 1 shows the Scenario 1 route and its proximity to, and intersections with, the multimodal network in the region.

Figure 1. Alternative Scenario 1 Route Map



Source: HDR

2.4.2 Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor and Interstate 380 Corridor Rights-of-Way

This section assesses and describes at a high-level the likely conceptual applicability of the commuter rail mode for potential implementation for Scenario 1 in the CRANDIC Corridor and Interstate 380 Corridor rights-of-way between Dubuque Street in central Iowa City and Downtown Cedar Rapids and the feasibility of these corridor rights-of-way for constructing, operating, and maintaining a commuter rail line, based on the analysis of available Google Earth Pro imagery, past passenger rail studies in the CRANDIC Corridor, and general representative recent industry standards and costs for construction of a commuter rail line. No engineering of the corridor for commuter rail implementation was conducted for this Technical Memorandum.

The CRANDIC Corridor right-of-way segment of Scenario 1 between Dubuque Street in Iowa City and the intersection with the Interstate 380 Corridor right-of-way north of North Liberty – approximately 13.2 miles – is an active freight railroad corridor of the Cedar Rapids & Iowa City Railway (CRANDIC) and is generally well-suited to the implementation of commuter rail operations. The line was engineered and constructed in the early 20th century as an interurban railroad between Iowa City and Cedar Rapids, and frequent daily passenger rail service was provided by CRANDIC from 1904 until 1953. At present, the approximately 13.2 miles of corridor right-of-way between Dubuque Street in Iowa City and the intersection with the Interstate 380 Corridor right-of-way north of North Liberty accommodates CRANDIC's single main track, sidings for meet-pass events between trains and to switch out and store freight rail cars, and industrial lead tracks for serving freight rail customers. The CRANDIC Corridor also hosts electric and fiber optic utility infrastructure within, parallel to, and across the right-of-way. The CRANDIC right-of-way generally varies in width from 50 to 100 feet, and is often narrower in urban sections of the corridor, which are typical conditions for railroad corridors in the U.S. A section of the CRANDIC Corridor with typical right-of-way width, and showing its purpose as an active freight railroad corridor, are presented at Rocky Shore Drive in Iowa City in Figure 2.

Figure 2. Typical Section of CRANDIC Corridor Right-of-Way at Rocky Shore Drive in Iowa City

Source: HDR

A typical section of narrow CRANDIC Corridor right-of-way accommodating the railroad line in urban areas, as shown at Front Street in Iowa City, is presented in Figure 3.

Figure 3. Typical Section of Narrow CRANDIC Corridor Right-of-Way in Urban Areas as Shown at Front Street in Iowa City

Source: HDR

The alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the intersection with the Interstate 380 Corridor right-of-way north of North Liberty for implementation of commuter rail operations is likely feasible from an engineering, environmental, and cost-effectiveness standpoint. The existing right-of-way footprint over much of the CRANDIC Corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network. Additional land adjacent to the CRANDIC Corridor right-of-way may potentially be required at locations in Iowa City, Coralville, Oakdale, and North Liberty for station development. More details about the general existing conditions of the CRANDIC Corridor right-of-way can be found in Appendix B of this Technical Memorandum.

Figure 4 shows the grade separated intersection of the CRANDIC Corridor's at-grade right-of-way with elevated Interstate 380 (co-located with US Highway 218) within the highway corridor right-of-way north of North Liberty. The Interstate 380 overpass provides 23 feet, 6 inches of vertical clearance for CRANDIC freight railroad operations below. Parallel to the CRANDIC Corridor right-of-way is a high-tension electric transmission line (at left) and Johnson County Highway W60 – formerly US Highway 218 and later State Highway 965 (at center). There would likely be significant engineering challenges to the development of a new commuter rail line connection that would diverge from the CRANDIC Corridor right-of-way (at left), turn right to intersect with County Highway W60 (at center), and enter the median or one of the shoulders in the existing Interstate 380 Corridor right-of-way (at center and right) or additional right-of-way parallel to the Interstate 380 right-of-way in this vicinity. Acquisition of additional land, which could be costly – and the shifting of Interstate 380, County Highway W60, or both – would likely be required to accommodate the rail line connection. Depending upon general site conditions and the alignment selected, the construction of the connection may also require a new at-grade crossing or a grade separation with County Highway W60 (at center).

Figure 4. Intersection of the CRANDIC Corridor and Interstate 380 Corridor Rights-of-Way North of North Liberty

Source: Google Earth Pro imagery; accessed June 23, 2017

The existing Interstate 380 Corridor right-of-way segment of Scenario 1 between the intersection with the CRANDIC Corridor right-of-way north of North Liberty and Downtown Cedar Rapids – approximately 13 miles – is an active interstate highway corridor that has never hosted a railroad line and is not generally well-suited in its current configuration to the accommodation of construction, operations, and maintenance of a commuter rail line. The existing conditions of the Interstate 380 Corridor right-of-way and the challenges to future alternative transportation implementation in this segment are generally described in the following discussion.

The existing corridor right-of-way currently hosts a four-or six-lane interstate highway with median and shoulders; interstate highway on- and off-ramps at several interchanges; a rest area; and grade-separated crossings of the intersecting local roadway network, railroad lines, waterways, and utilities. In terms of the general profile of the Interstate 380 Corridor right-of-way, gentle to moderate vertical grades and minimal horizontal curvature do not conceptually appear to provide conditions that would render rail line development infeasible, although it is likely that earthwork and other site improvements would be required to construct a single track commuter rail line with optimal vertical grades (no more than 1 percent – or about 53 feet of rise or fall in elevation, per mile – is typically preferable to ensure a safe and efficient commuter rail operation) and site drainage. The potential for development of a commuter rail line on right-of-way parallel to Interstate 380 could also be considered, particularly in areas where the existing Interstate 380 right-of-way may not be sufficient for incorporating alternative transportation. There are several examples in the U.S. in which a commuter or other rail transit line has been designed and implemented within the median or shoulder of an existing interstate highway corridor right-of-way or in a parallel right-of-way in this manner, including for transit systems in Chicago, Illinois; Los Angeles, California; and Albuquerque / Santa Fe, New Mexico. Through analysis of available Google Earth Pro imagery, the stem of the Interstate 380 Corridor right-of-way in rural areas generally varies in width from approximately 300 to 425 feet, and is significantly wider at locations where additional right-of-way exists to accommodate interchanges and rest areas. The stem of the Interstate 380 Corridor right-of-way in more constrained urban areas is typically narrower and generally varies in width from approximately 200 to 400 feet, and is moderately wider at the locations where additional right-of-way exists to accommodate interchanges.

A typical section of the rural Interstate 380 Corridor right-of-way as a highway corridor with four lanes, median, and shoulders is presented at Johnson County Highway F12 near Swisher in Figure 5.

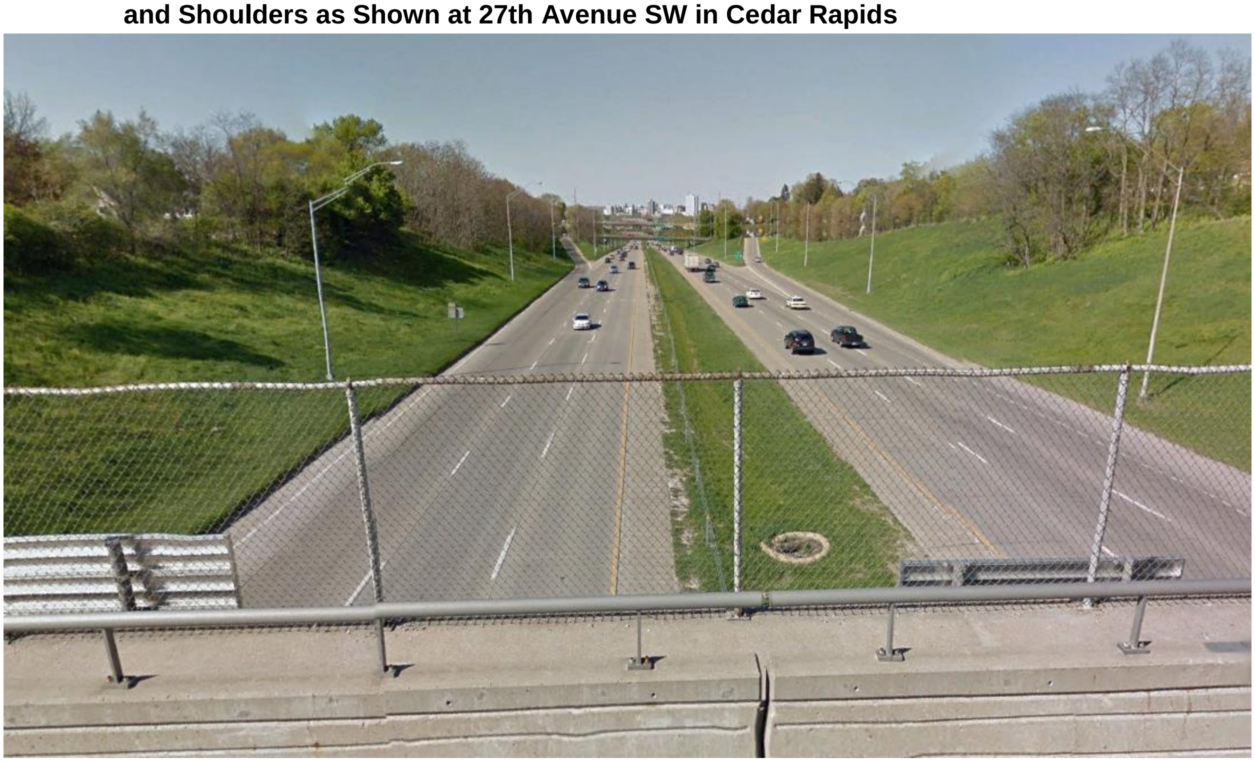
Figure 5. Typical Rural Section of Interstate 380 Corridor Right-of-Way with Four Lanes, Median, and Shoulders at Johnson County Highway F12 near Swisher

Source: Google Earth Pro imagery; accessed June 23, 2017

During development of the I-380 PEL Study in 2017, Iowa DOT studied the Interstate 380 Corridor between Iowa City and Cedar Rapids to evaluate safety, capacity, and infrastructure deficiencies in an effort to increase mobility and efficiency in the Johnson and Linn counties region through planning and various improvements. A key improvement identified during the I-380 PEL was planning for widening four-lane sections of Interstate 380 (as pictured above) to six lanes between Interstate 80 in Coralville (west of Iowa City) and US Highway 30 in south Cedar Rapids in the short-term horizon to improve capacity, safety, and efficiency. Interstate 380 between Coralville and Downtown Cedar Rapids was designed and constructed in the early and mid-1970s and to previous roadway design standards for a rural and urban interstate. The I-380 PEL Study identified that the existing Interstate 380 Corridor right-of-way is likely insufficient to accommodate widening to include the addition of a third lane in each direction and new median and shoulders and interchanges that match current requirements and roadway design standards, necessitating the acquisition of additional parallel right-of-way to make many of these improvements. Any project to improve Interstate 380 in this manner would also pose significant challenges to the implementation of a commuter rail line within the median or shoulders of the existing Interstate 380 Corridor right-of-way. It is therefore assumed that additional right-of-way beyond that described above for widening Interstate 380 would likely be required throughout most of the corridor between North Liberty and Cedar Rapids to accommodate a single track commuter rail line; sidings at prescribed intervals for meet-pass events between commuter trains, if required; and any potential commuter rail stations and related multimodal park and ride facilities in Cedar Rapids that may be developed within the corridor.

A typical section of the urban Interstate 380 Corridor right-of-way as a highway corridor with six lanes, median, and shoulders is presented at 27th Avenue SW in Cedar Rapids in Figure 6.

Figure 6. Typical Urban Section of Interstate 380 Corridor Right-of-Way with Six Lanes, Median, and Shoulders as Shown at 27th Avenue SW in Cedar Rapids

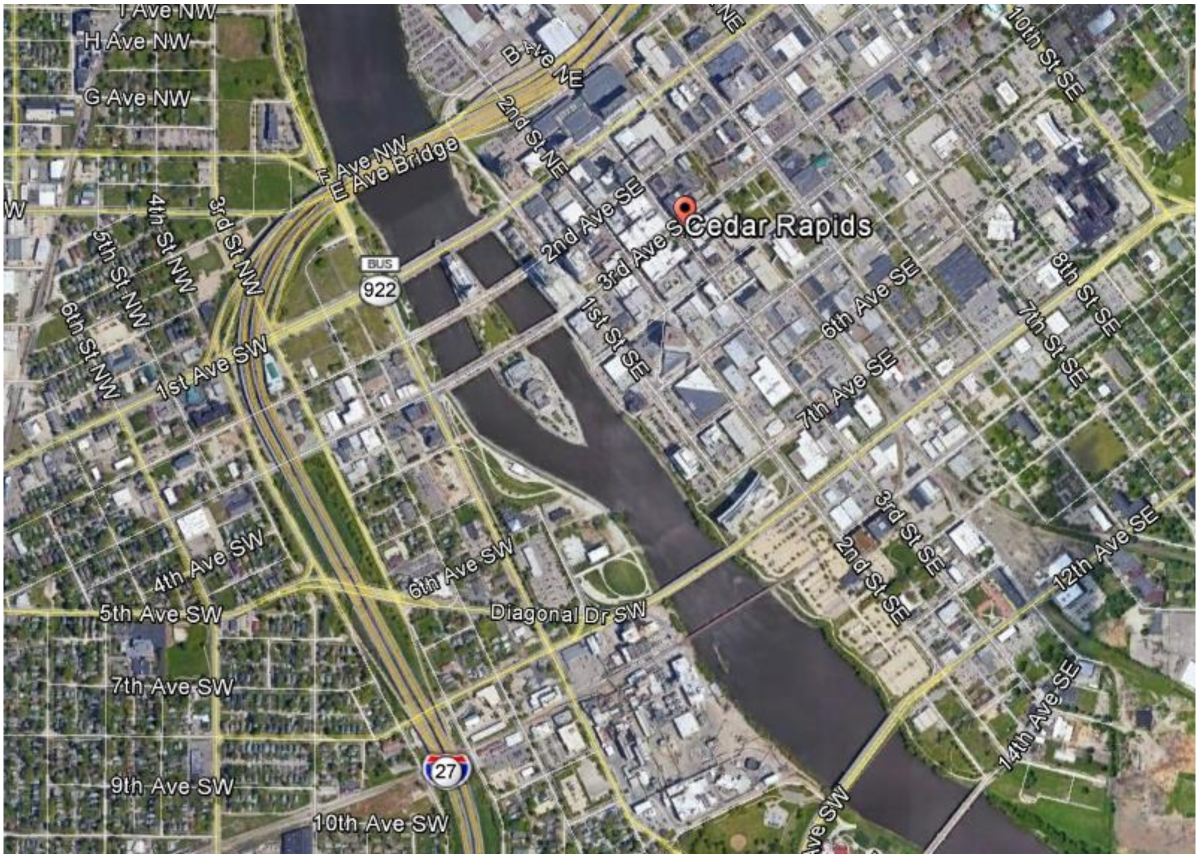


Source: Google Earth Pro imagery; accessed June 23, 2017

The urban sections of Interstate 380 between US Highway 30 in south Cedar Rapids and Downtown Cedar Rapids present a bottleneck to the implementation of a commuter rail line within or parallel to the existing highway right-of-way. As shown in Figure 6, the existing Interstate 380 Corridor right-of-way is narrow, constrained within a densely populated residential area, and likely insufficient to accommodate a single track commuter rail line; sidings at prescribed intervals for meet-pass events between commuter trains, if necessary; and potential commuter rail stations in the median or shoulders of the existing roadway. Acquisition of additional right-of-way to accommodate a commuter rail line alignment parallel to Interstate 380 or to realign Interstate 380 and several interchange on- and off-ramps with the local roadway network concurrent with the development of a commuter rail line would present significant engineering and environmental challenges, potentially provide negative impacts to neighborhoods in south Cedar Rapids and severe disruption to traffic on Interstate 380 during construction, and likely be cost prohibitive.

Figure 7 shows the Interstate 380 Corridor right-of-way (at left and top center) within urban Cedar Rapids and its geographical context relative to the Cedar River (center) and Downtown Cedar Rapids (at top center and right). All intersections between Interstate 380 and the local roadway and railroad network are grade separated. There would be significant engineering, environmental, and constructability challenges and cost-effectiveness considerations to either the development of a commuter rail station terminal for Downtown Cedar Rapids within or parallel to the existing Interstate 380 Corridor right-of-way or the development of a commuter rail line that would diverge from the Interstate 380 Corridor right-of-way or parallel right-of-way in this vicinity and continue to the terminal outside of these rights-of-way. The development of any rail line connection from the rail line alignment within or parallel to the Interstate 380 Corridor right-of-way on the west to a potential station within or adjacent to Downtown Cedar Rapids on the east would need to traverse the existing built residential, commercial, and industrial environment within or parallel to the right-of-way of existing freight railroad lines or city streets.

Figure 7. Interstate 380 Corridor Right-of-Way in the Vicinity of Downtown Cedar Rapids



Source: Google Earth Pro imagery; accessed June 23, 2017

Existing active railroad rights-of-way within and adjacent to Downtown Cedar Rapids that intersect with the Interstate 380 Corridor right-of-way are components of a congested railroad terminal area that are occupied by a complex network of railroad lines required for through and local freight train operations, interchange of railcars between freight railroads, and serving local industries. These rights-of-way are further constrained in several locations by the built residential, commercial, and industrial environment. As an example, Figure 8 shows a typical section of constrained urban active railroad right-of-way near Downtown Cedar Rapids on a CRANDIC line at 1st Street SW. There are potentially complex engineering and environmental challenges and significant cost considerations to accommodating alternative transportation use within or parallel to these freight railroad corridors – including the likely acquisition of land and the construction of a new bridge over the Cedar River – and therefore they are not considered feasible for the development of a commuter rail line connection from the egress from the Interstate 380 Corridor or parallel right-of-way to a potential station within or adjacent to Downtown Cedar Rapids.

Figure 8. Typical Section of Constrained Active Freight Railroad Corridor as Shown on CRANDIC Line at 1st Street SW in Cedar Rapids

Source: Google Earth Pro imagery; accessed June 23, 2017

Existing city streets within and adjacent to Downtown Cedar Rapids that intersect with the Interstate 380 Corridor right-of-way are components of a complex local roadway network that serves the built residential, commercial, and industrial environment. The right-of-way on many of these multimodal thoroughfares includes traffic lanes and parking for vehicles and transit services, sidewalks for pedestrians, and bicycle lanes for bicyclists. Utility infrastructure may also existing within, parallel to, or across city streets. Some city streets cross the Cedar River on historic bridges. For example, Figure 9 shows a typical section of a city street in the Downtown Cedar Rapids area, on 3rd Avenue SW looking east at the intersection with 1st Street SW. Development of an at-grade commuter rail line in a dedicated lane within or parallel to existing city streets ("street running") between an egress from the Interstate 380 Corridor or parallel right-of-way on the west and a potential station within or adjacent to Downtown Cedar Rapids on the east may not be feasible from an engineering, environmental, safety, and cost-effectiveness standpoint. Existing roadway bridges over the Cedar River may also need to be modified or replaced to withstand the operation of commuter rail trains.

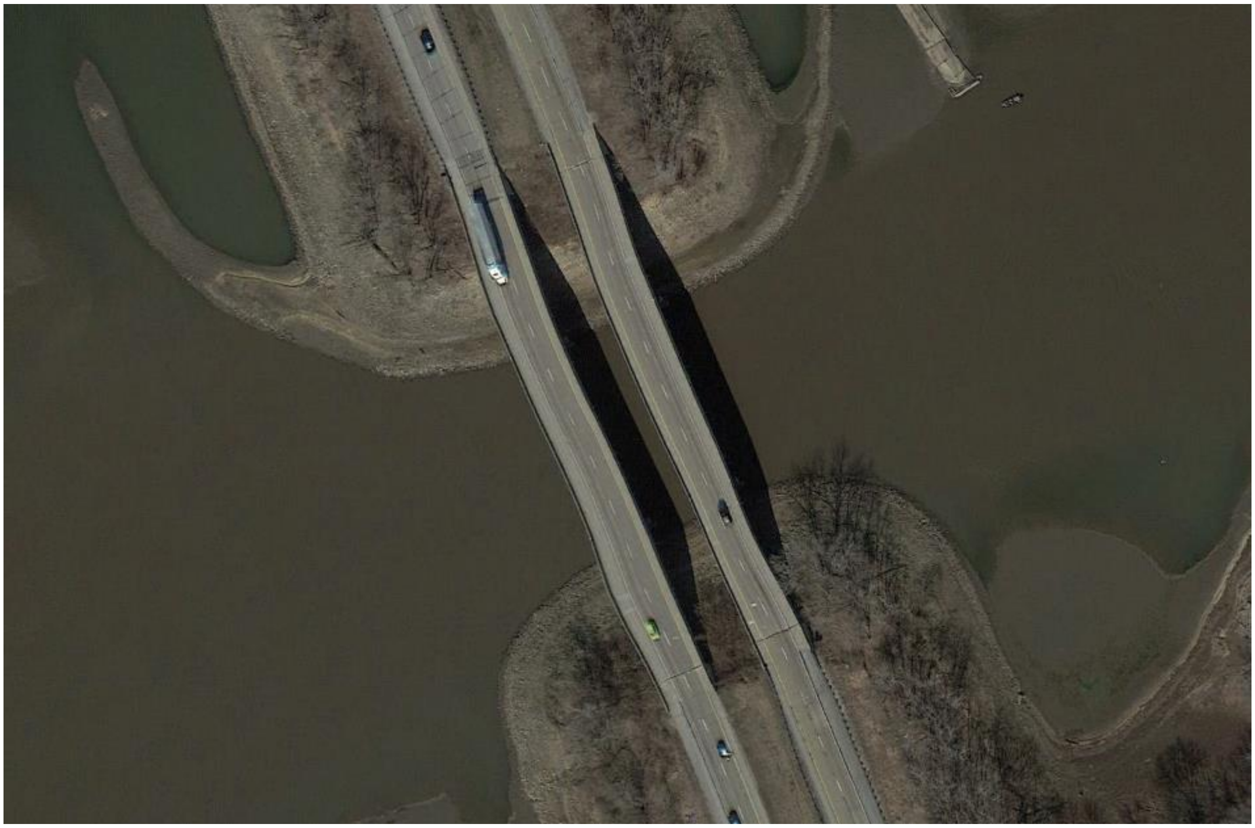
Figure 9. Typical Section of City Street in the Downtown Cedar Rapids Area as Shown on 3rd Avenue SW

Source: Google Earth Pro imagery; accessed June 23, 2017

One potential solution to a commuter rail terminal in Cedar Rapids could involve the development of a station opposite Downtown Cedar Rapids, on the west side of the Cedar River in the area bound roughly by Interstate 380 on the west and north, the Cedar River on the east, and 8th Avenue SW on the south, and the construction of a short connection from the commuter rail line alignment within or parallel to the Interstate 380 Corridor right-of-way east to the station.

The Interstate 380 Corridor right-of-way also crosses over three major waterways between the intersection with the CRANDIC Corridor right-of-way north of North Liberty and Downtown Cedar Rapids. One crossing occurs with Coralville Lake / Iowa River near Cou Falls, as shown in Figure 10. A second crossing occurs with the Cedar River in Downtown Cedar Rapids, as shown at top center in Figure 9 above. A third crossing, not pictured, occurs with Prairie Creek in south Cedar Rapids. The construction of a new bridge to span any of these waterways – either within the existing Interstate 380 Corridor right-of-way, if that is feasible, or on another alignment parallel to and outside of the Interstate 380 Corridor right-of-way – would be required to accommodate a new single track commuter rail line. Similarly, all other existing drainage structures within the Interstate 380 Corridor right-of-way – including culverts and pipes – would likely need to be modified, extended, or replaced to accommodate a new single track commuter rail line and meet drainage requirements. Site conditions at these crossings and the approaches to these crossings may also require significant earthwork and grading to achieve optimal grade and drainage. Construction of new bridges and culverts and earthwork would significantly increase the cost and would present a considerable engineering and environmental challenge to implementation of commuter rail service.

Figure 10. Interstate 380 Corridor Right-of-Way Crossing of Coralville Lake / Iowa River near Cou Falls



Source: Google Earth Pro imagery; accessed June 23, 2017

Several local roadways cross over Interstate 380 between North Liberty and south Cedar Rapids. Vertical clearances for vehicles passing under these overpasses in the lanes of Interstate 380 generally meets the preferred 16 feet 6 inches criteria for vehicle clearance, although the vertical clearances for overpasses in the south Cedar Rapids-Downtown Cedar Rapids segment of the Interstate 380 Corridor were not confirmed during development of this Technical Memorandum. Figure 11 shows a typical overpass in the Interstate 380 Corridor, at the grade separated intersection with Johnson County Highway F12 near Swisher.

Figure 11. Typical Overpass in the Interstate 380 Corridor at Johnson County Highway F12 near Swisher

Source: Google Earth Pro imagery; accessed June 23, 2017

A single track commuter rail line within or parallel to the existing Interstate 380 Corridor right-of-way using Diesel Multiple Unit (DMU) commuter rail equipment would need to travel beneath several roadway overpasses in the Interstate 380 Corridor. The maximum height of a typical DMU trainset with all roof-mounted equipment, including for the Sonoma Marin Area Rail Transit (SMART) DMUs used as the basis for the commuter rail equipment considered in this Technical Memorandum, is 14 feet, 8 inches.[1] Minimum vertical clearance, including a clearance envelope between the maximum height of the DMU and the underside of an overpass could increase this factor to approximately 16 feet, depending upon DMU operating factors, the commuter rail line's engineered profile and track geometry, site specific conditions, and other considerations. If equipment other than single-level DMUs was selected for commuter rail service in the future, it is possible that minimum vertical clearance under overpasses would need to be increased to more than 16 feet. In terms of conceptual compatibility of overhead roadway bridges for accommodation of a commuter rail line, there is the potential that some existing bridges would need to be modified or replaced in their existing location or shifted to a new location to accommodate the alignment of a commuter rail line within or parallel to the Interstate 380 Corridor right-of-way and related vertical clearance requirements for DMU equipment.

During previous development of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study, stakeholders identified DMU commuter rail transit equipment as the modal choice likely most applicable to passenger rail implementation in the CRANDIC Corridor right-of-way. This DMU equipment and an associated potential service plan for this first potential phase of operation were studied in the

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1 SMART Technical Specification for Diesel Multiple Units (DMUs), Sonoma-Marin Area Rail Transit; January 20, 2010

subsequent Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study, and was also selected for consideration in this Technical Memorandum.

The typical operating range for commuter rail transit in the U.S. using self-propelled DMU trainsets is up to 50 miles and service is typically provided every 30 or more minutes. The typical average capacity per vehicle is between 75 and 90 passengers, or between 150 and 180 passengers per two-car trainset, which is being studied on the Corridor. The type and intensity of current and potential future land uses in the CRANDIC Corridor and Interstate 380 Corridor suggest a passenger rail service with fairly long station spacing and peak-period focused service, a service pattern that is characteristic of commuter rail transit services in the U.S. DMU trainsets are versatile and typically offer performance characteristics suitable to likely station spacing the CRANDIC Corridor between central Iowa City and North Liberty and the Interstate 380 Corridor between North Liberty and Downtown Cedar Rapids and they provide a suitable capacity and flexibility to expand train length as necessary. Maximum operating speeds are typically up to 79 mph, and DMUs can also operate efficiently at lower maximum and average speeds that would be more likely suited to the profile of the CRANDIC and Interstate 380 corridors. More details about the general characteristics of the DMU can be found in Section 5.1.1 of this Technical Memorandum.

2.4.3 Conceptual Ridership Forecast

A conceptual ridership forecast was developed for the potential implementation of Scenario 1 – commuter rail service in the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the intersection with Interstate 380 north of North Liberty and in the Interstate 380 Corridor right-of-way from that intersection point north to Downtown Cedar Rapids – using the FTA STOPS model. The ridership model looked at the route serving eight stations and 59 minutes of run time between Dubuque Street (Iowa City) and Downtown Cedar Rapids. Stations selected for the ridership forecasts are consistent with potential station locations identified during previous recent study of passenger rail implementation in the CRANDIC Corridor right-of-way by Iowa DOT, CRANDIC, and other local stakeholders, and through additional coordination and outreach conducted by Iowa DOT during development of this Technical Memorandum. The potential commuter rail stations – from south to north – included:

- Dubuque Street (Iowa City)
- Downtown Iowa City / University of Iowa
- VA Hospital
- Coralville
- Oakdale
- North Liberty
- Wright Brothers Boulevard (Eastern Iowa Airport)
- Downtown Cedar Rapids (Note: The specific potential station location unconfirmed for this study)

Tables 1 and 2 summarize the base STOPS model average weekday ridership estimates of commuter rail for the current year (defined as 2015 for the terms of this study) and two future years (2025 and 2040) for two cases – 1A, with a limited daily commuter rail service operating on 2 hour and 10 minute headways from terminal points in Iowa City and the Eastern Iowa Airport at Cedar Rapids; and 1B, with a more typical daily commuter rail service that assumes an operation with 30-minute headways from terminal points in Iowa City and Cedar Rapids.

Table 1. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Year and Route Segment – Scenario 1A (130 Minute Headway)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	Total Ridership
2015	888	118	134	1,140
2025	1,184	142	144	1,470
2040	1,698	226	203	2,127

Source: HDR / Iowa DOT

Table 2. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Year and Route Segment – Scenario 1B (30 Minute Headway)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	Total Ridership
2015	3,210	298	216	3,724
2025	4,266	238	363	4,867
2040	6,200	364	491	7,055

Source: HDR / Iowa DOT

Detailed review of the ridership forecasts for scenarios 1A and 1B show that the introduction of commuter rail between Iowa City and Cedar Rapids does not generate a high level of end-to-end trips. For the preferred transit headway time scenario (1B), the STOPS model estimated 3,724 daily boardings for year 2015 with 298 (8 percent) of those boardings representing trips between the two metropolitan areas.

Conversely, estimated transit ridership along the CRANDIC Corridor right-of-way between North Liberty and central Iowa City is considerably stronger at 3,210 daily boardings for year 2015. A number of these trips cover only a distance of one to two stations, but are seen as likely transit trips due to comparable travel times with auto trips and the linkage between home and work locations. Notice that over time the growth of these two communities drives total boardings up to nearly double the 2015 number, but the number of trips between the metros show very little growth under current assumptions.

Tables 3 and 4 represent mode of access between those that walk to stations, those being dropped off by car at the station (Kiss and Ride), and those driving a car to the station and then parking to ride transit (Park and Ride). In general, though park and ride locations were considered available for many stops, most projected riders use the walk mode.

Table 3. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Mode of Access – Scenario 1A (130 Minute Headway)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
2015	851	93	196	1,140
2025	1,100	117	252	1,470
2040	1,546	183	398	2,127

Source: HDR / Iowa DOT

Table 4. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Mode of Access – Scenario 1B (30 Minute Headway)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
2015	2,652	314	757	3,724
2025	3,461	400	1,006	4,867
2040	4,696	638	1,720	7,055

Source: HDR / Iowa DOT

Further, STOPS models estimated station to station activity. Combining the results from the access mode and station boarding breakdown, it is clear that the location of the existing CRANDIC Corridor right-of-way in central Iowa City has potential to generate a significant number of short “walk + rail” trips between proposed stations at Dubuque Street, Downtown Iowa City, and the VA Hospital. Beyond that portion of the CRANDIC Corridor, there is also about 800 combined daily trips connecting North Liberty, Oakdale, and Coralville to central Iowa City.

Tables 5 and 6 show commuter rail average weekday ridership estimates by station and year for scenarios 1A and 1B.

Table 5. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Station and Year – Scenario 1A (130 Minute Headway)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	45	5	19	44	113
Wright Brothers Boulevard-Eastern Iowa Airport	64	6	8	0	78
North Liberty	65	13	8	1	87
Oakdale	44	7	5	0	56
Coralville	62	8	29	4	103
VA Hospital	262	1	0	7	270
Downtown Iowa City-University of Iowa	190	0	0	25	215
Dubuque Street (Iowa City)	180	5	29	3	218

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	51	6	21	50	128
Wright Brothers Boulevard-Eastern Iowa Airport	69	7	10	0	86
North Liberty	83	17	10	1	111
Oakdale	58	9	7	0	74
Coralville	85	8	38	5	136
VA Hospital	363	1	0	9	373
Downtown Iowa City-University of Iowa	244	2	0	33	279
Dubuque Street (Iowa City)	230	8	40	5	283

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	97	7	26	64	194
Wright Brothers Boulevard-Eastern Iowa Airport	108	10	15	0	133
North Liberty	125	28	11	1	165
Oakdale	106	18	10	0	134
Coralville	139	15	65	5	224
VA Hospital	569	1	0	11	581
Downtown Iowa City-University of Iowa	290	2	0	34	326
Dubuque Street (Iowa City)	281	9	72	9	370

Source: HDR / Iowa DOT

Table 6. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Station and Year – Scenario 1B (30 Minute Headway)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	All
Downtown Cedar Rapids	69	13	50	90	222
Wright Brothers Boulevard-Eastern Iowa Airport	104	16	26	0	146
North Liberty	184	43	26	2	255
Oakdale	159	26	11	0	196
Coralville	168	24	147	16	355
VA Hospital	856	3	0	26	885
Downtown Iowa City-University of Iowa	681	4	0	155	840
Dubuque Street (Iowa City)	652	26	119	28	825

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	All
Downtown Cedar Rapids	79	15	56	106	256
Wright Brothers Boulevard-Eastern Iowa Airport	112	20	32	0	164
North Liberty	231	57	34	2	324
Oakdale	214	35	14	0	263
Coralville	219	31	198	20	468
VA Hospital	1,180	3	0	32	1,215
Downtown Iowa City-University of Iowa	882	4	0	201	1,087
Dubuque Street (Iowa City)	852	33	169	36	1,090

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	All
Downtown Cedar Rapids	151	18	69	129	367
Wright Brothers Boulevard-Eastern Iowa Airport	171	26	45	0	242
North Liberty	339	94	39	3	475

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	All
Oakdale	380	72	21	0	473
Coralville	352	47	361	25	785
VA Hospital	1,889	4	0	53	1,946
Downtown Iowa City-University of Iowa	1,046	5	0	239	1,290
Dubuque Street (Iowa City)	1,058	50	325	43	1,477

Source: HDR / Iowa DOT

2.4.4 Conceptual Cost of Implementation

No new or refined conceptual capital cost estimates for the implementation of Scenario 1 – commuter rail service in CRANDIC Corridor right-of-way between central Iowa City and the location where the CRANDIC Corridor right-of-way and Interstate 380 intersect north of North Liberty, and in the Interstate 380 right-of-way from that intersection north to Downtown Cedar Rapids – were developed for this Technical Memorandum.

In the previous Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study undertaken by Iowa DOT, CRANDIC, and other stakeholders, it was reported that the probable conceptual capital cost to implement commuter rail service on the 20.5-mile segment of the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids could range between $250 million and $520 million or between $12 million and $25 million per mile (in 2015 dollars), based on industry averages for recent commuter rail implementation in the U.S. Specific potential passenger rail equipment and infrastructure requirements developed for this service were only high-level and conceptual. An operating plan for commuter rail was not developed, and the study only conceptually assumed a daily service with six stations suggested as potential sites by stakeholders. Operations and Maintenance (O&M) costs for commuter rail service presented in this previous study were based on industry averages and were estimated to range between $5.6 million and $6.7 million annually or between approximately $273,000 and $327,000 per mile annually (in 2015 dollars).

The CRANDIC Corridor right-of-way segment of Scenario 1 between Dubuque Street central in Iowa City and the intersection with the Interstate 380 Corridor right-of-way north of North Liberty is approximately 13.2 miles long, and the Interstate 380 right-of-way from that intersection north to Downtown Cedar Rapids is approximately 13 miles long. Based on the cost assumptions from the previous study cited above, the conceptual capital cost to implement commuter rail service on this approximately 26.2-mile corridor could potentially range between $315 million and $656 million (in 2015 dollars). The cost of any land acquisition that would be required to assemble a linear corridor for the segment of the Scenario 1 route parallel to the Interstate 380 Corridor and within Downtown Cedar Rapids and any costs for potential modifications to Interstate 380 and interchanges, adjacent and parallel roadways, highway and waterway bridges, and utilities to accommodate construction of the commuter rail line and potential commuter rail stations were not confirmed during development of this Technical Memorandum. Based on the cost assumptions from the previous study cited above, the annual Operations & Maintenance (O&M) cost for commuter rail service on this approximately 26.2-mile corridor could potentially range between $7.1 million and $8.6 million annually (in 2015 dollars).

The potential conceptual cost summary for implementation of commuter rail in Scenario 1 between Dubuque Street in central Iowa City and Downtown Cedar Rapids based on the assumptions above and adjusted to 2017 dollars is presented in Table 7 below.

Table 7. Conceptual Cost Summary for Commuter Rail Implementation in Scenario 1

Scenario 1 Cost Component	Scenario 1 Total (in 2017 Dollars)
Conceptual Capital Cost for Implementation	$328 million - $683 million
Conceptual Annual Operations & Maintenance Cost	$7.4 million - $8.9 million

2.4.5 Applicability of Alternative Use Scenario 1 with the Vision for CRANDIC Corridor Right-of-Way Alternative Use

Table 8 identifies each component of the short- and long-term vision for alternative use of the CRANDIC Corridor right-of-way, as identified in Section 4 of this Technical Memorandum and its applicability to alternative use Scenario 1 (which also includes additional use of the Interstate 380 Corridor right-of-way), based on the analysis above.

Table 8. Applicability of Alternative Use Scenario 1 to the Vision for the CRANDIC Corridor

Components	Applicability to Alternative Use Scenario 1
Components of the Short-Term Vision	
Pursue options for promoting and preserving the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids as a valuable community asset for the future. Continue study of its potential development for alternative transportation use that promotes sustainability, enhances mobility, supports economic and community development, strengthens multimodal connections, and compliments multimodal capacity and the improvements currently under development on parallel Interstate 380.	Future study for the development of a commuter rail service in the CRANDIC Corridor right-of-way under this scenario preserves only the Iowa City-north of North Liberty segment (approximately 13.2 miles) where the CRANDIC and Interstate 380 intersect. The segment of the CRANDIC Corridor right-of-way between north of North Liberty and the Eastern Iowa Airport in Cedar Rapids (approximately 7.3 miles) would not be studied for preservation and repurposing for commuter rail implementation in this scenario. This scenario does not fully satisfy the vision for CRANDIC Corridor right-of-way preservation and alternative use.
Components of the Long-Term Vision	
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will preserve the CRANDIC Corridor right-of-way as a valuable regional asset for a variety of stakeholders.	This alternative use scenario preserves only the Iowa City-north of North Liberty segment of the CRANDIC Corridor right-of-way (approximately 13.2 miles) for commuter rail implementation. The segment of the CRANDIC Corridor right-of-way between north of North Liberty and the Eastern Iowa Airport in Cedar Rapids (approximately 7.3 miles) would not be repurposed for commuter rail implementation in this scenario. Commuter rail implementation in the Interstate 380 Corridor right-of-way would not directly serve the Eastern Iowa Airport (a connecting bus or shuttle service would be required). This scenario does not fully satisfy the vision.

Components	Applicability to Alternative Use Scenario 1
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will promote sustainable, energy efficient, and cost-effective alternative transportation use that would match the needs of the region's changing and growing population.	Development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City and north of North Liberty meets the vision. Development of a commuter rail service within the Interstate 380 Corridor right-of-way from north of North Liberty to Downtown Cedar Rapids would be sustainable and energy efficient, but it presents several engineering and environmental feasibility challenges; would likely require the acquisition of land outside of the existing Interstate 380 right-of-way (particularly in urban sections of the highway between the US Highway 30 interchange in south Cedar Rapids and Downtown Cedar Rapids, and for a connection to a potential station in Downtown Cedar Rapids outside of the Interstate 380 Corridor right-of-way); would likely be cost prohibitive to permit and construct given the current and likely future availability of project funding; and would severely disrupt vehicular traffic on Interstate 380, US Highway 30, and the intersecting local roadway network between North Liberty and Cedar Rapids during construction and maintenance. This scenario does not fully satisfy the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will enhance mobility, accessibility, reliability, efficiency, capacity, safety, and connectivity of the region's multimodal network, including Interstate 380.	Future study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City and north of North Liberty and in the Interstate 380 Corridor right-of-way between the intersection near North Liberty and Downtown Cedar Rapids meets the vision. Connections on the commuter rail line would be developed with local transit services and the proposed Chicago-Iowa City intercity passenger rail service.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will embrace emerging technologies and best planning practices for alternative transportation implementation.	Future study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City and north of North Liberty and in the Interstate 380 Corridor right-of-way between the intersection near North Liberty and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will provide a catalyst for enhanced economic, community, and land use development adjacent to the CRANDIC Corridor right-of-way and Interstate 380.	Future study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City and north of North Liberty and in the Interstate 380 Corridor right-of-way between the intersection near North Liberty and Downtown Cedar Rapids meets the vision.

2.4.6 Alternative Use Scenario 1 Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way and the potential for alternative use of part of the Interstate 380 Corridor right-of-way or additional right-of-way parallel to Interstate 380 has been developed based on the assessment of applicability of alternative use Scenario 1, the vision for alternative use of the CRANDIC Corridor right-of-way, the conceptual ridership forecasts for a continuous commuter rail service between Iowa City and Cedar Rapids (including cases for 130-minute headways and traditional commuter rail operations with 30-minute headways), a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service based on recent industry averages and past studies, and recommendations for improvements to Interstate 380 developed by Iowa DOT during the I-380 PEL Study.

Ridership forecasts developed using the FTA STOPS model suggest that the primary market for commuter rail service in the CRANDIC Corridor right-of-way exists between Dubuque Street in central Iowa City and North Liberty, as this segment has a high population concentration and has the most potential for attracting ridership. Commuter rail service in this scenario would serve Downtown Cedar Rapids directly, but would not utilize the north of North Liberty-Eastern Iowa Airport segment of the CRANDIC Corridor right-of-way (approximately 7.3 miles long) or serve the Eastern Iowa Airport directly. Ridership forecasts do not show a high level of trips between the Iowa City and Cedar Rapids metropolitan areas based on STOPS results. The ridership forecasts also suggest that a commuter rail service with greater frequencies and operating on 30-minute headways from terminal points – an operating plan that is more typical of commuter rail service offered in the U.S. – would attract significantly more riders than would a commuter rail service with fewer frequencies and operations with headways of over two hours from terminal points. Implementation of a commuter rail service on 30-minute headways would also require additional commuter rail equipment and infrastructure investment.

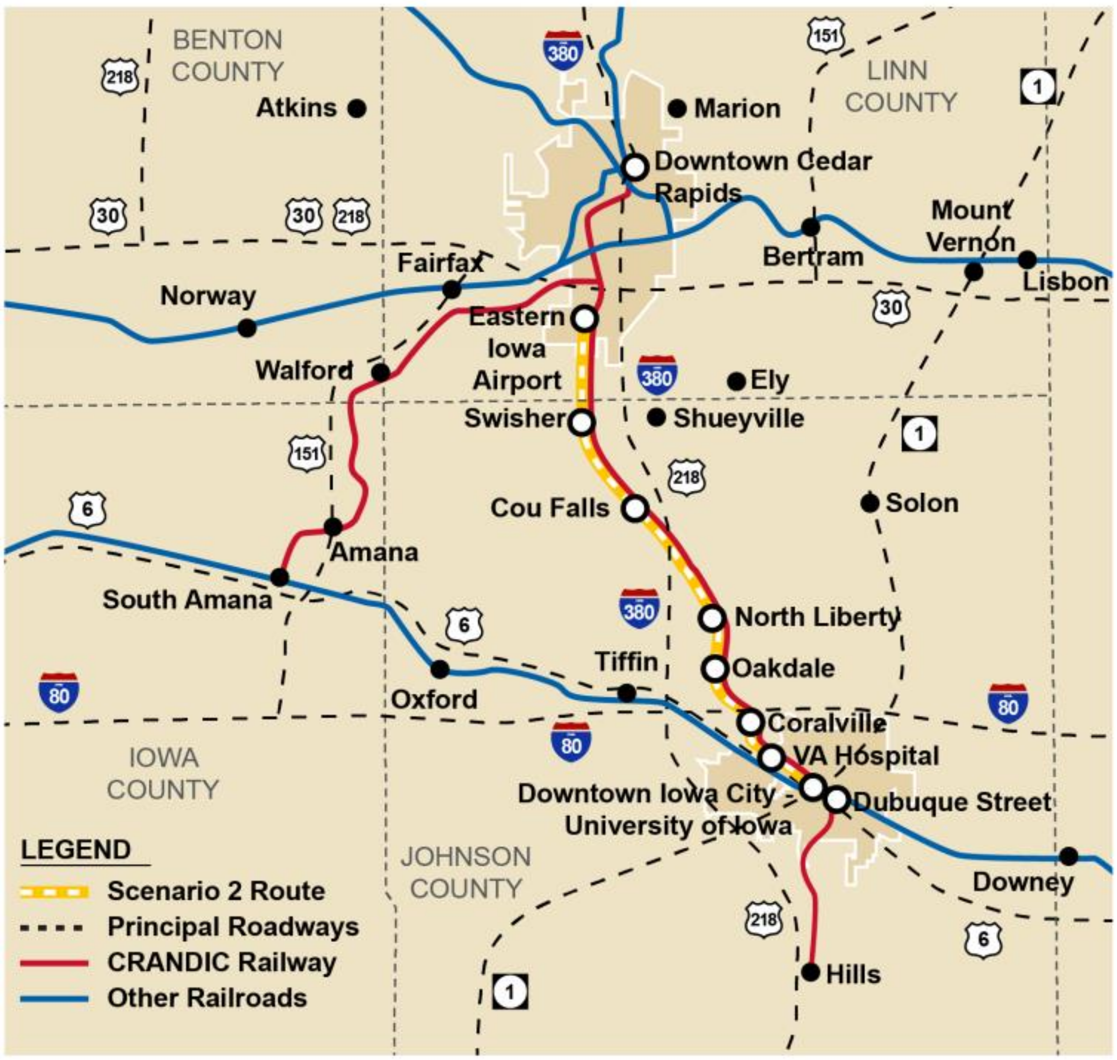
Recommendations developed by Iowa DOT during the I-380 PEL Study include planning for the widening of Interstate 380 from four to six lanes between Coralville (west of Iowa City) and south Cedar Rapids in the short-term horizon to meet growing travel demand and new standards for interstate highway construction, which will consume much of the existing highway right-of-way and likely require the acquisition of additional adjacent right-of-way to accommodate the anticipated improvements to traffic lanes, medians, shoulders, on- and off-ramps, and other roadway components. The Interstate 380 Corridor right-of-way between south Cedar Rapids and Downtown Cedar Rapids already hosts six traffic lanes and is likely of insufficient width to also accommodate a single-track commuter rail line. Implementation of a single-track commuter rail line and any potential stations in the Interstate 380 segment of the corridor in the long-term horizon would likely require the acquisition of additional right-of-way and construction of various modifications to Interstate 380 and enhanced interface with other roadways and principal waterway crossings, which is anticipated to be costly to design, permit, and construct – particularly in the urban Cedar Rapids segment of the corridor. More in-depth study would be required by stakeholders in the future to determine the feasibility and actual conceptual cost of commuter rail implementation within or parallel to the Interstate 380 right-of-way between north of North Liberty and Downtown Cedar Rapids in the long-term horizon.

2.5 Alternative Scenario 2 – (Commuter Rail – Central Iowa City-Eastern Iowa Airport in Cedar Rapids via CRANDIC Corridor Right-of-Way)

2.5.1 Description

Scenario 2 for alternative use of the CRANDIC Corridor right-of-way includes the potential implementation of commuter rail service between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids – approximately 20.5 miles in length.[2] The map in Figure 12 shows the Scenario 2 route and its proximity to, and intersections with, the multimodal network in the region.

Figure 12. Alternative Scenario 2 Route Map



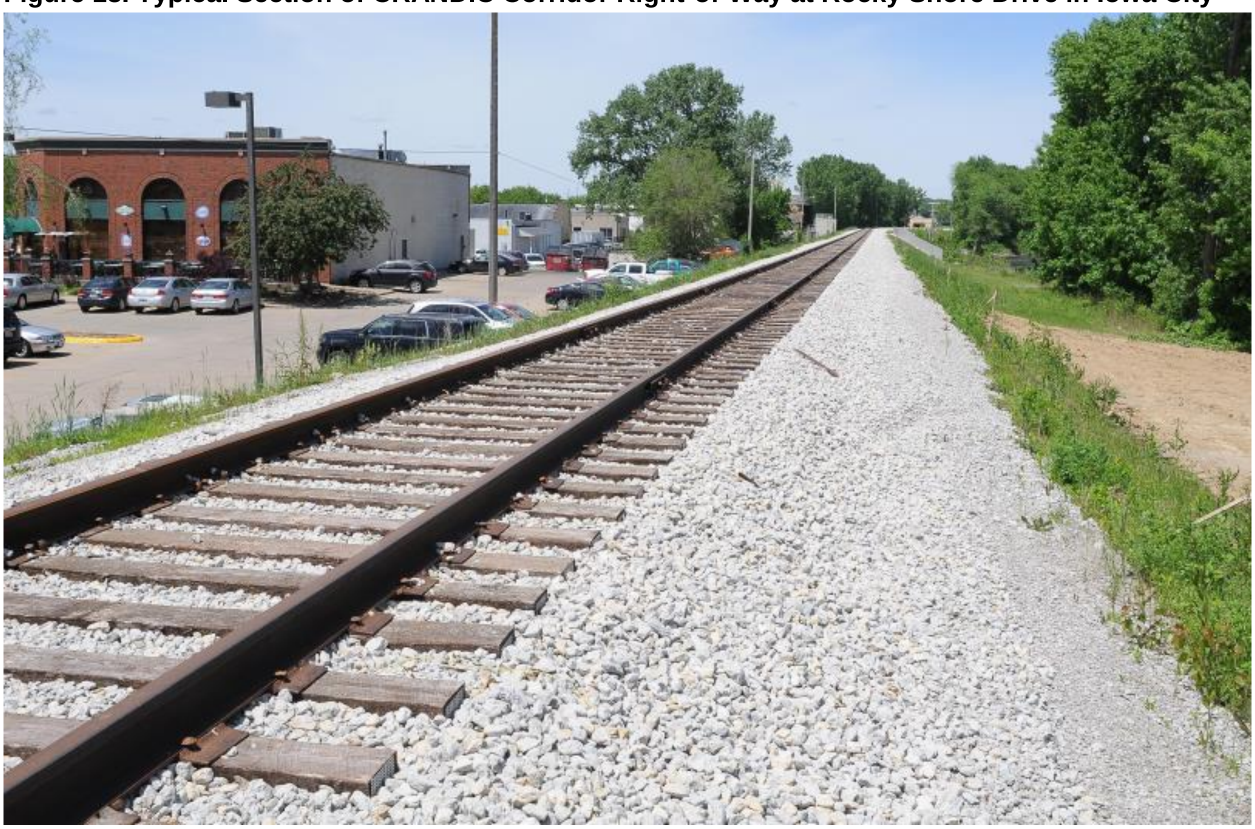
Source: HDR

[2] Note that the 20.5-miles of this CRANDIC Corridor segment includes approximately 0.1 mile between Dubuque Street and Gilbert Street to the south, which may potentially be upgraded during implementation of commuter rail service.

2.5.2 Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way

The CRANDIC Corridor right-of-way is well-suited to railroad operations and currently hosts the freight railroad operations of the Cedar Rapids & Iowa City Railway (CRANDIC). The line was engineered and constructed in the early 20th century as an interurban railroad with the purpose of providing frequent daily passenger and freight rail service between Iowa City and Cedar Rapids. Frequent passenger rail service was provided between Iowa City and Cedar Rapids until 1953. At present, the 20.5 miles of corridor right-of-way between Dubuque Street in Iowa City and the Eastern Iowa Airport at Cedar Rapids accommodates CRANDIC's single main track, sidings for meet-pass events between trains and to switch out and store freight rail cars, and industrial lead tracks for serving freight rail customers. The CRANDIC Corridor also hosts electric and fiber optic utility infrastructure within, parallel to, or across the right-of-way. The right-of-way generally varies in width from 50 to 100 feet, and is often narrower in urban sections of the corridor, which are typical conditions for railroad corridors in the U.S. A section of the CRANDIC Corridor with typical right-of-way width and showing its purpose as a railroad corridor are presented at Rocky Shore Drive in Iowa City in Figure 13. A typical section of narrow CRANDIC Corridor right-of-way accommodating the railroad line in urban areas, as shown at Front Street in Iowa City, is presented in Figure 14.

Figure 13. Typical Section of CRANDIC Corridor Right-of-Way at Rocky Shore Drive in Iowa City



Source: HDR

Figure 14. Typical Section of Narrow CRANDIC Corridor Right-of-Way in Urban Areas as Shown at Front Street in Iowa City

Source: HDR

The alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for implementation of commuter rail operations is likely feasible from an engineering, environmental, and cost-effectiveness standpoint. The existing right-of-way footprint over much of the CRANDIC Corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network. Additional land adjacent to the CRANDIC Corridor right-of-way may potentially be required at locations in Iowa City, Coralville, Oakdale, North Liberty, Swisher, and the Eastern Iowa Airport for station development.

During previous development of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study, stakeholders identified Diesel Multiple Unit (DMU) commuter rail transit equipment as the modal choice likely most applicable to passenger rail implementation in the CRANDIC Corridor. This DMU equipment and an associated potential service plan for this first potential phase of operation were studied in the subsequent Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study, and was also selected for consideration in this Technical Memorandum.

The typical operating range for commuter rail transit in the U.S. using self-propelled DMU trainsets is up to 50 miles and service is typically provided every 30 or more minutes. The typical average capacity per vehicle is between 75 and 90 passengers, or between 150 and 180 passengers per two-car trainset, which is being studied on the Corridor. The type and intensity of current and potential future land uses in the CRANDIC Corridor suggest a passenger rail service with fairly long station spacing and peak-period focused service, a service pattern that is characteristic of commuter rail transit services in the U.S. DMU trainsets are versatile and typically offer performance characteristics suitable to likely station spacing in the CRANDIC Corridor right-of-way and they provide a suitable capacity and flexibility to expand train length as necessary. Maximum operating speeds are typically up to 79 mph, and DMUs can also operate efficiently at lower maximum and average speeds that would be more likely suited to the profile of the CRANDIC Corridor. More details about the general characteristics of the DMU can be found in Section 5.1.1 of this Technical Memorandum.

2.5.3 Conceptual Ridership Forecast

A conceptual ridership forecast was developed for the potential implementation of Scenario 2 – commuter rail service in the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids – using the FTA STOPS model. The ridership model looked at the route serving nine stations and 48 minutes of run time between Dubuque Street (Iowa City) and the Eastern Iowa Airport. Stations selected for the ridership forecasts are consistent with potential station locations identified during previous recent study of passenger rail implementation in the CRANDIC Corridor right-of-way by Iowa DOT, CRANDIC, and other local stakeholders. The potential commuter rail stations – from south to north – included:

- Dubuque Street (Iowa City)
- Downtown Iowa City / University of Iowa
- VA Hospital
- Coralville
- Oakdale
- North Liberty
- Cou Falls
- Swisher
- Eastern Iowa Airport (Cedar Rapids)

Table 9 summarizes the base STOPS model ridership estimates of commuter rail for the current year (defined as 2015 for the terms of this study) and two future years (2025 and 2040) for two cases – 2A, with a limited daily commuter rail service operating on 2 hour and 10 minute headways from terminal points in Iowa City and Cedar Rapids; and 2B, with a more typical daily commuter rail service that assumes an operation with 30-minute headways from terminal points in Iowa City and the Eastern Iowa Airport at Cedar Rapids.

Table 9. STOPS Forecast of Total Daily Commuter Rail Ridership by Year – Scenario 2A (130 Minute Headway)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	Total Ridership
2015	1,102	36	33	1,171
2025	1,462	46	40	1,548
2040	2,140	66	57	2,263

Source: HDR / HNTB / Iowa DOT

Table 10. STOPS Forecast of Total Daily Commuter Rail Ridership by Year – Scenario 2B (30 Minute Headway)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	Total Ridership
2015	3,030	86	74	3,190
2025	4,024	97	98	4,219
2040	6,000	152	120	6,272

Source: HDR / HNTB / Iowa DOT

Detailed review of the ridership forecasts for scenarios 2A and 2B show that the introduction of commuter rail between Iowa City and the Eastern Iowa Airport at Cedar Rapids does not generate a high level of end-to-end trips. For the preferred transit headway time scenario (2B) the STOPS model estimated 3,190 daily boardings for year 2015 with 86 (or 3 percent) of those boardings representing trips between the two metropolitan areas. This meager number of trips between Iowa City and the Eastern Iowa Airport compared to more direct service to Downtown Cedar Rapids as presented for alternative use Scenario 1, shows that service terminating at the Eastern Iowa Airport is not likely to capture an existing travel market.

Conversely, transit ridership along the existing CRANDIC Corridor right-of-way between North Liberty and Downtown Iowa City is much stronger at 3,030 boardings in year 2015. A number of these trips cover only a distance of one to two stations, but are seen as likely transit trips due to comparable travel times with auto trips and the linkage between home and work locations. Notice that over time the growth of predominantly the Iowa City community drives total boardings up to nearly double the 2015 number, but the number of trips between the metros show very little growth under current assumptions.

Tables 11 and 12 represent mode of access between those that walk to stations, those being dropped off by car at the station (Kiss and Ride), and those driving a car to the station and then parking to ride transit (Park and Ride). In general, though park and ride locations were considered available for many stops, most projected riders use the walk mode.

Table 11. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Mode of Access – Scenario 2A (130 Minute Headway)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
2015	855	90	226	1,171
2025	1,127	115	306	1,548
2040	1,528	185	550	2,263

Source: HDR / HNTB / Iowa DOT

Table 12. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Mode of Access – Scenario 2B (30 Minute Headway)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
2015	2,244	275	671	3,190
2025	2,963	352	905	4,219
2040	4,104	568	1,600	6,272

Source: HDR / HNTB / Iowa DOT

Combining the results from the access mode and station boarding breakdown, it is clear that the placement of the existing CRANDIC Corridor right-of-way in central Iowa City has potential to generate a significant number of short “walk + rail” trips between Dubuque Street, Downtown Iowa City-University of Iowa, and the VA Hospital. Beyond that portion of the corridor, there is also about 1,000 combined daily trips connecting North Liberty, Oakdale, and Coralville to central Iowa City.

Tables 13 and 14 show commuter rail average weekday ridership estimates by potential station and year for scenarios 2A and 2B.

Table 13. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Station and Year – Scenario 2A (130 Minute Headway)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport (Cedar Rapids)	14	4	10	0	28
Swisher	4	0	2	0	7
Cou Falls	0	2	9	0	11
North Liberty	61	15	2	1	79
Oakdale	60	8	3	0	71
Coralville	47	6	49	2	104
VA Hospital	231	1	0	6	238
Downtown Iowa City-University of Iowa	295	1	0	10	306
Dubuque Street (Iowa City)	262	8	38	20	327

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport (Cedar Rapids)	16	5	11	0	32
Swisher	6	1	3	0	8
Cou Falls	0	2	12	0	14
North Liberty	77	19	2	1	99
Oakdale	82	11	4	0	97
Coralville	58	8	67	3	136
VA Hospital	316	1	0	8	325
Downtown Iowa City-University of Iowa	389	1	0	13	403
Dubuque Street (Iowa City)	343	9	54	26	434

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport (Cedar Rapids)	17	6	14	0	37
Swisher	7	1	3	0	11
Cou Falls	0	5	18	0	23

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
North Liberty	106	32	2	1	141
Oakdale	150	18	6	0	174
Coralville	97	12	126	7	242
VA Hospital	559	1	0	11	571
Downtown Iowa City-University of Iowa	455	2	0	32	489
Dubuque Street (Iowa City)	422	15	106	32	575

Source: HDR / HNTB / Iowa DOT

Table 14. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Station and Year – Scenario 2B (30 Minute Headway)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport (Cedar Rapids)	21	10	25	0	56
Swisher	11	1	4	0	15
Cou Falls	0	5	21	0	26
North Liberty	174	38	15	2	229
Oakdale	136	22	10	0	168
Coralville	189	18	139	10	356
VA Hospital	757	3	0	34	794
Downtown Iowa City-University of Iowa	650	3	0	99	752
Dubuque Street (Iowa City)	587	36	122	49	794

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport (Cedar Rapids)	25	12	29	0	66
Swisher	12	2	4	0	18
Cou Falls	0	7	26	0	33
North Liberty	218	50	21	2	291
Oakdale	182	30	13	0	225
Coralville	244	23	189	13	469
VA Hospital	1,046	4	0	41	1,091
Downtown Iowa City-University of Iowa	844	4	0	126	974
Dubuque Street (Iowa City)	774	41	171	66	1,052

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Eastern Iowa Airport	28	13	35	0	76

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
(Cedar Rapids)					
Swisher	15	3	6	0	24
Cou Falls	0	12	42	0	55
North Liberty	316	82	26	3	427
Oakdale	324	63	20	0	407
Coralville	390	34	358	18	800
VA Hospital	1,770	4	0	58	1,832
Downtown Iowa City-University of Iowa	997	6	0	200	1,203
Dubuque Street (Iowa City)	983	63	313	90	1,448

Source: HNTB / Iowa DOT

2.5.4 Conceptual Cost of Implementation

No new or refined capital cost estimates for the implementation of Scenario 2 – commuter rail service in the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids – were not developed for this Technical Memorandum.

In the previous Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study undertaken by Iowa DOT, CRANDIC, and other stakeholders, it was reported that the probable conceptual capital cost to implement commuter rail service on this 20.5-mile segment of the CRANDIC Corridor right-of-way could range between $250 million and $520 million in 2015 dollars, based on industry averages for recent commuter rail implementation in the U.S. Specific potential passenger rail equipment and infrastructure requirements developed for this service were only high-level and conceptual. An operating plan for commuter rail was not developed, and the study only conceptually assumed a daily service with six stations. Operations and Maintenance (O&M) costs for commuter rail service presented in this previous study were based on industry averages and were estimated to range between $5.6 million and $6.7 million per year in 2015 dollars.

In the subsequent Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study also undertaken by Iowa DOT, CRANDIC, and other stakeholders, it was reported that the conceptual capital cost to implement a limited daily starter commuter rail service with six stations in the 7.1 miles of the CRANDIC Corridor right-of-way between Dubuque Street (Iowa City) and Forever Green Road (North Liberty) in a first phase of implementation could cost approximately $40 million in 2016 dollars. This concept assumed minimally required DMU passenger rail equipment procurement and infrastructure enhancements and construction and 90-minute operating headways from terminal points at Dubuque Street (Iowa City) and Forever Green Road (North Liberty). The study also assumed that the CRANDIC Corridor between Iowa City and North Liberty would be passenger rail only and that commuter trains would be operated as a push-pull turnaround service with no meet-pass events occurring for passenger trains between Iowa City and North Liberty and that only one commuter train would operate on the Corridor at a time. The capital cost estimate developed for this study did not include the additional passenger rail equipment and track, track structures, and wayside signal infrastructure that would be necessary to support a greater number of frequencies operating on 30-minute headways from terminal points in Iowa City and North Liberty.

Operations and Maintenance (O&M) costs for commuter rail service on 90-minute headways between Iowa City and North Liberty presented in this previous study were based on industry averages and were estimated at $1.39 million per year (in 2016 dollars).

The potential conceptual cost summary for implementation of commuter rail in Scenario 2 between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids based on the assumptions from the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study above and adjusted to 2017 dollars is presented in Table 15.

Table 15. Conceptual Cost Summary for Commuter Rail Implementation in Scenario 2

Scenario 2 Cost Component	Scenario 2 Total (in 2017 Dollars)
Conceptual Capital Cost for Implementation	$260 million - $541 million
Conceptual Annual Operations & Maintenance Cost	$5.8 million - $7.0 million

2.5.5 Applicability of Alternative Use Scenario 2 with the Vision for CRANDIC Corridor Alternative Use

Table 16 identifies each component of the short- and long-term vision for alternative use of the CRANDIC Corridor right-of-way identified in Section 4 of this Technical Memorandum and its applicability to alternative use Scenario 2, based on the analysis above.

Table 16. Applicability of Alternative Use Scenario 2 to the Vision for the CRANDIC Corridor

Components	Applicability to Alternative Use Scenario 2
Components of the Short-Term Vision	
Pursue options for promoting and preserving the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids as a valuable community asset for the future. Continue study of its potential development for alternative transportation use that promotes sustainability, enhances mobility, supports economic and community development, strengthens multimodal connections, and compliments multimodal capacity and the improvements currently under development on parallel Interstate 380.	Further efforts to promote the preservation of the CRANDIC Corridor right-of-way for alternative transportation use and additional future study for the development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport in Cedar Rapids meets the vision.
Components of the Long-Term Vision	
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will preserve the CRANDIC Corridor right-of-way as a valuable regional asset for a variety of stakeholders.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will promote sustainable, energy efficient, and cost-effective alternative transportation use that would match the needs of the region’s changing and growing population.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport meets the vision.

Components	Applicability to Alternative Use Scenario 2
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will enhance mobility, accessibility, reliability, efficiency, capacity, safety, and connectivity of the region's multimodal network, including Interstate 380.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport meets the vision. Connections on the commuter rail line would be developed with local transit services and the proposed Chicago-Iowa City intercity passenger rail service.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will embrace emerging technologies and best planning practices for alternative transportation implementation.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will provide a catalyst for enhanced economic, community, and land use development adjacent to the CRANDIC Corridor right-of-way and Interstate 380.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport meets the vision.

2.5.6 Alternative Use Scenario 2 Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way has been developed based on the assessment of applicability of alternative use Scenario 2, the vision for alternative use of the CRANDIC Corridor right-of-way, the conceptual ridership forecasts for commuter rail service between Iowa City and the Eastern Iowa Airport in Cedar Rapids (including cases for 130-minute headways and traditional commuter rail operations with 30-minute headways), and a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service based on recent industry averages and past studies.

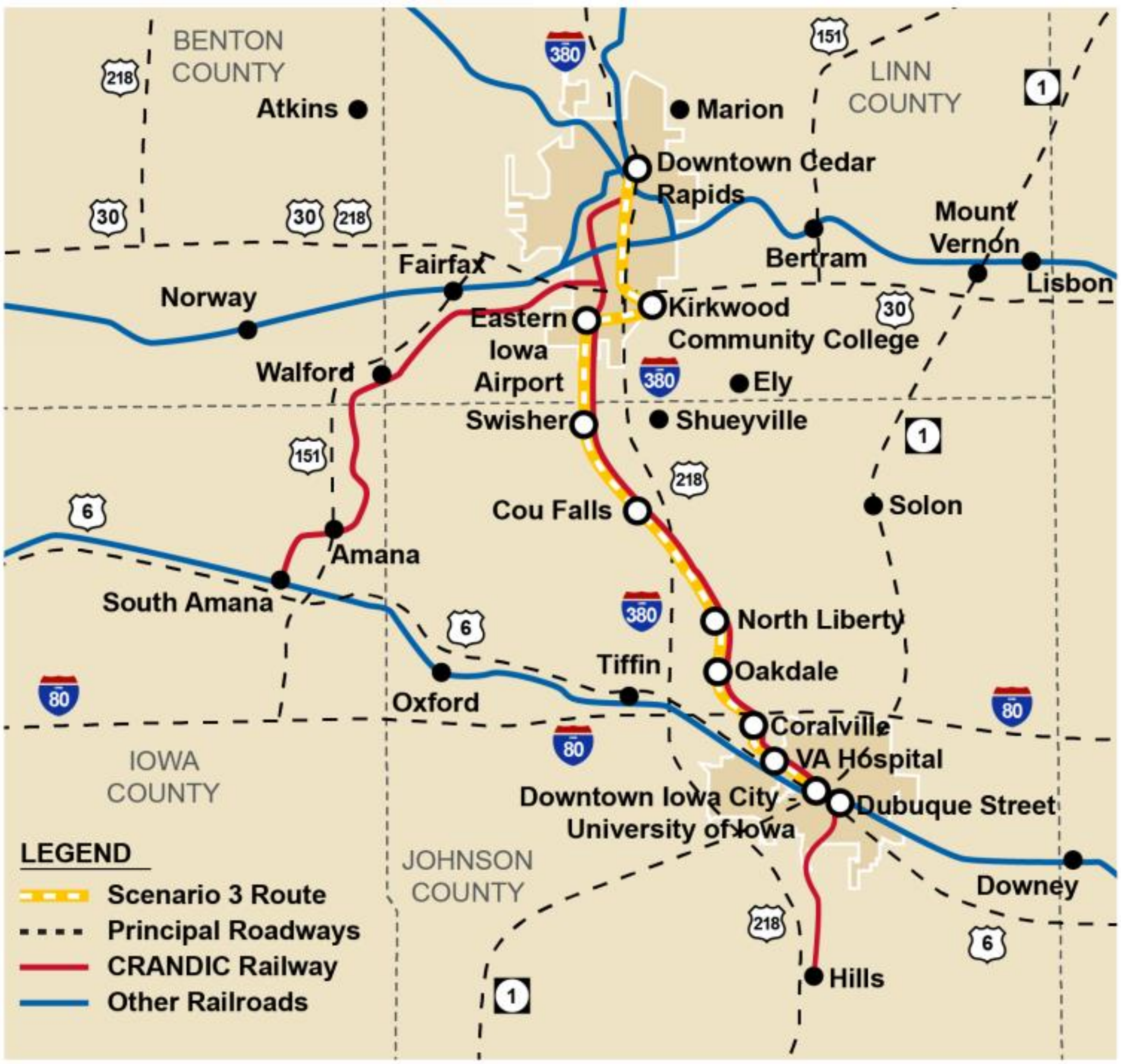
Ridership forecasts developed using the FTA STOPS model suggest that the primary market for commuter rail service in the CRANDIC Corridor right-of-way exists between Dubuque Street in central Iowa City and North Liberty, as this segment has the highest population concentration and has the most potential for attracting ridership. Trips to Downtown Cedar Rapids would have to transfer from the commuter rail service to another mode at the Eastern Iowa Airport, adding more travel time and making the service generally unattractive to the Cedar Rapids market based on STOPS results. The ridership forecasts also suggest that a commuter rail service with greater frequencies and operating on 30-minute headways from terminal points – an operating plan that is more typical of commuter rail service offered in the U.S. – would attract significantly more riders than would a commuter rail service with fewer frequencies and operations with headways of over two hours from terminal points. Implementation of a commuter rail service on 30-minute headways would also require additional commuter rail equipment and infrastructure investment.

2.6 Alternative Scenario 3 – (Commuter Rail – Central Iowa City-Eastern Iowa Airport in Cedar Rapids via CRANDIC Corridor Right-of-Way and Automated Vehicle Service on Existing Roadway Network – Eastern Iowa Airport in Cedar Rapids-Downtown Cedar Rapids)

2.6.1 Description

Scenario 3 for alternative use includes the potential implementation of commuter rail in the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids and automated bus service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids – approximately 30 miles in length. The map in Figure 15 shows the Scenario 3 route and its proximity to, and intersections with, the multimodal network in the region.

Figure 15. Alternative Scenario 3 Route Map

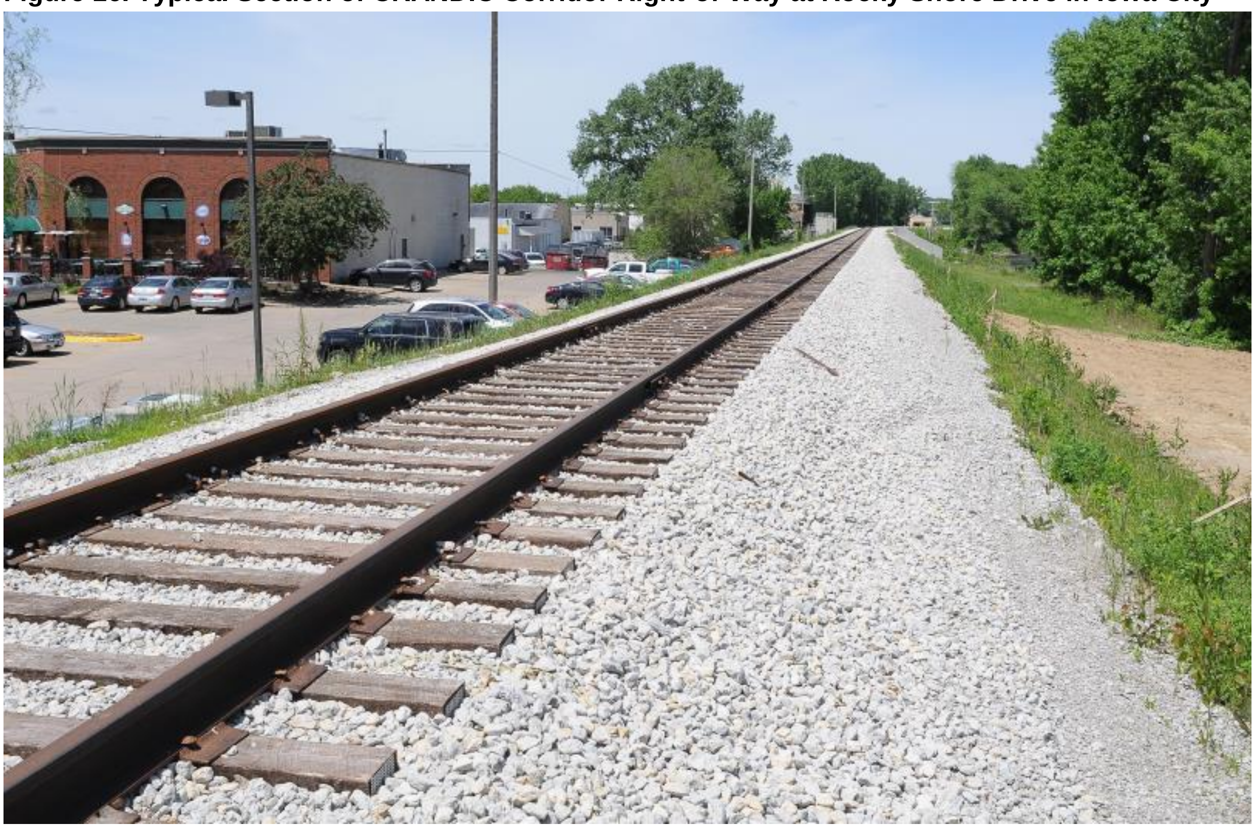


Source: HDR

2.6.2 Applicability of Commuter Rail Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way

The CRANDIC Corridor right-of-way is well-suited to railroad operations and currently hosts the freight railroad operations of the Cedar Rapids & Iowa City Railway (CRANDIC). The line was engineered and constructed in the early 20th century as an interurban railroad with the purpose of providing frequent daily passenger and freight rail service between Iowa City and Cedar Rapids. Frequent passenger rail service was provided between Iowa City and Cedar Rapids until 1953. At present, the 20.5 miles of corridor right-of-way between Dubuque Street in Iowa City and the Eastern Iowa Airport at Cedar Rapids accommodates CRANDIC's single main track, sidings for meet-pass events between trains and to switch out and store freight rail cars, and industrial lead tracks for serving freight rail customers. The CRANDIC Corridor also hosts electric and fiber optic utility infrastructure within, parallel to, or across the right-of-way. The right-of-way generally varies in width from 50 to 100 feet, and is often narrower in urban sections of the corridor, which are typical conditions for railroad corridors in the U.S. A section of the CRANDIC Corridor with typical right-of-way width and showing its purpose as a railroad corridor are presented at Rocky Shore Drive in Iowa City in Figure 16. A typical section of narrow CRANDIC Corridor right-of-way accommodating the railroad line in urban areas, as shown at Front Street in Iowa City, is presented in Figure 17.

Figure 16. Typical Section of CRANDIC Corridor Right-of-Way at Rocky Shore Drive in Iowa City



Source: HDR

Figure 17. Typical Section of Narrow CRANDIC Corridor Right-of-Way in Urban Areas as Shown at Front Street in Iowa City

Source: HDR

The alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for implementation of commuter rail operations is likely feasible from an engineering, environmental, and cost-effectiveness standpoint. The existing right-of-way footprint over much of the CRANDIC Corridor is likely of sufficient width to accommodate a single main track, sidings at prescribed intervals for meet-pass events between commuter trains, and interface with the local multimodal network. Additional land adjacent to the CRANDIC Corridor right-of-way may potentially be required at locations in Iowa City, Coralville, Oakdale, North Liberty, Swisher, and the Eastern Iowa Airport for station development.

During previous development of the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study, stakeholders identified Diesel Multiple Unit (DMU) commuter rail transit equipment as the modal choice likely most applicable to passenger rail implementation in the CRANDIC Corridor. This DMU equipment and an associated potential service plan for this first potential phase of operation were studied in the subsequent Iowa City-North Liberty Passenger Rail Conceptual Feasibility Study, and was also selected for consideration in this Technical Memorandum.

The typical operating range for commuter rail transit in the U.S. using self-propelled DMU trainsets is up to 50 miles and service is typically provided every 30 or more minutes. The typical average capacity per vehicle is between 75 and 90 passengers, or between 150 and 180 passengers per two-car trainset, which is being studied on the Corridor. The type and intensity of current and potential future land uses in the CRANDIC Corridor suggest a passenger rail service with fairly long station spacing and peak-period focused service, a service pattern that is characteristic of commuter rail transit services in the U.S. DMU trainsets are versatile and typically offer performance characteristics suitable to likely station spacing in the CRANDIC Corridor right-of-way and they provide a suitable capacity and flexibility to expand train length as necessary. Maximum operating speeds are typically up to 79 mph, and DMUs can also operate efficiently at lower maximum and average speeds that would be more likely suited to the profile of the CRANDIC Corridor. More details about the general characteristics of the DMU can be found in Section 5.1.1 of this Technical Memorandum.

2.6.3 Applicability of Automated Vehicle Mode for Potential Implementation on the Existing Roadway Network

Scenario 3 utilizes commuter rail service operations between Downtown Iowa City and the Eastern Iowa Airport, with extended service to Downtown Cedar Rapids via automated vehicles. To ensure the automated vehicle connection is available on a regularly scheduled service frequency, the automated vehicles would be provided by a public agency serving as public transportation. Also, the number of passengers riding the commuter rail vehicle would suggest either a large number of low-occupancy automated vehicles or a smaller number of high-occupancy vehicles, like buses. Thus, the primary automated vehicle considered for regular alternative mode service along this route between the Eastern Iowa Airport and Downtown Cedar Rapids are automated buses. Even considering that bus style vehicles are the most realistic mode for an agency to provide for public transportation in this instance, it is possible a significant number of private automated vehicles, either operating as taxis or a personally-owned chauffeurs could also pick-up and drop off passengers at the Eastern Iowa Airport. Those non-publicly provided vehicles are considered generally in the assumed street-running travel times of the automated buses, but are not explicitly considered in assessing this alternative mode scenario.

The assumed automated bus service would operate in tandem with the assumed commuter rail service, as follows for a trip from Downtown Iowa City to Downtown Cedar Rapids:

1. Riders would walk / bike / drive to one of the Iowa City area stations to board the commuter rail train.
2. The commuter rail train would serve other stations along the line.
3. Upon reaching the Eastern Iowa Airport station in Cedar Rapids, all travelers would disembark the train and transfer to automated buses.
4. The automated buses would then travel the existing roadway network within Cedar Rapids, between the Eastern Iowa Airport and Downtown. Potential routes the bus service could utilize have not been confirmed; however, for the terms of study in this Technical Memorandum the following route was assumed: east on Wright Brothers Boulevard from the Eastern Iowa Airport, north on Kirkwood Boulevard to Kirkwood Community College, west on U.S. Highway 30, and north on Interstate 380 to travel into Downtown Cedar Rapids (approximately 9.5 miles).
5. Reverse service from Downtown Cedar Rapids to Downtown Iowa City would operate in the reverse order, going from Steps 4 to 1.

The proposed combination of multiple transit modes has both obvious benefits and challenges. The primary benefit / utility of this option being that automated buses can travel on existing roadways, where a suitable rail connection to Downtown Cedar Rapids would require a major new construction investment. The conditions on the Iowa City-Eastern Iowa Airport segment of the CRANDIC Corridor right-of-way are generally well-suited to the operation of passenger trains, but north of the Eastern Iowa Airport, the existing CRANDIC rail corridor is part of the complex Cedar Rapids freight railroad terminal area and is not considered available for the implementation of commuter rail service. Yet, a transit connection between the Eastern Iowa Airport and Downtown Cedar Rapids can be made using the existing roadway system. And since automated buses run on the existing roadway system, the use of busing to make the connection is a reasonable and fiscally-conservative choice of mode.

Also, direct transit service between the two downtown core areas provides a much more attractive alignment for surrounding land uses than transit service that ends at the Eastern Iowa Airport. This connectivity can have both short- and long-term benefits that may go unrealized in the high-level ridership modeling conducted as part of this study. In the short-term, communities like North Liberty and Coralville can help off-load the congestion on Iowa City roadways and downtown parking facilities with park and ride facilities coupled with high capacity transit. For Cedar Rapids, the Eastern Iowa Airport may be able to serve a similar complimentary role. Longer term, downtown areas have generally been growing in popularity for new housing, which may allow a transit link between the Iowa City and Cedar Rapids downtown areas to better serve changing travel patterns.

On the other hand, one key challenge of this combined service is the lost time while travelers have to transfer between the commuter rail trains and automated buses, as end-to-end travel between Iowa City and Cedar Rapids utilizing the two modes is projected to take 75 minutes. Time transferring between transit modes is often viewed by travelers as less desirable than the time spent traveling in transit vehicles, especially in cold and wet conditions that are seasonally common to Iowa.

Another challenge is the cost of buying and maintaining both commuter rail vehicles and automated buses. Conceptually, transit agencies can more efficiently operate and maintain one type of transit vehicle as maintenance work for rail vehicles and the track they run on is very different than bus maintenance work. Also, the total number of vehicles needed increases by not being able to continue a transit trip to a more logical terminal as it takes two vehicle purchases (one rail, one bus) to make an end-to-end trip.

2.6.4 Conceptual Ridership Forecast

A conceptual ridership forecast was developed for the potential implementation of Scenario 3 – commuter rail service in the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids and connecting automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids – using the FTA STOPS model. The ridership model looked at the route serving 11 stations and 75 minutes of run time between Dubuque Street (Iowa City) and Downtown Cedar Rapids; note that a change of modes from commuter rail to automated bus service (or vice versa) is required at the Eastern Iowa Airport (Cedar Rapids) station in this scenario. Stations selected for the ridership forecasts are consistent with potential commuter rail station locations identified during previous recent study of passenger rail implementation in the CRANDIC Corridor right-of-way by Iowa DOT, CRANDIC, and other local stakeholders, and potential stop locations on the existing roadway network for the automated vehicle service segment of this scenario were determined through additional coordination and outreach conducted by Iowa DOT during development of this Technical Memorandum. The potential commuter rail stations and automated vehicle stops – from south to north – included:

- Dubuque Street (Iowa City) - commuter rail
- Downtown Iowa City / University of Iowa - commuter rail
- VA Hospital - commuter rail
- Coralville - commuter rail
- Oakdale - commuter rail

- North Liberty - commuter rail
- Cou Falls - commuter rail
- Swisher - commuter rail
- Eastern Iowa Airport (Cedar Rapids) - commuter rail / automated bus (transfer point)
- Kirkwood Community College - automated bus
- Downtown Cedar Rapids - automated bus

Tables 17 and 18 summarizes the base STOPS model ridership estimates of commuter rail for the current year (defined as 2015 for the terms of this study) and two future years (2025 and 2040) for two cases – 3A, with a limited daily commuter rail service operating on 2 hour and 10 minute headways from terminal points in Iowa City and the Eastern Iowa Airport at Cedar Rapids with 10-minute headway automated bus service connecting at the Eastern Iowa Airport to Downtown Cedar Rapids; and 3B, with a more typical daily commuter rail service that assumes an operation with 30-minute headways from terminal points in Iowa City and the Eastern Iowa Airport at Cedar Rapids with 10-minute headway automated bus service connecting at the Eastern Iowa Airport to Downtown Cedar Rapids.

Table 17. STOPS Forecast of Total Daily Commuter Rail Ridership by Year – Scenario 3A (130 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	To / From Rural	Total Ridership
2015	988	78	730	37	1,833
2025	1,304	98	824	43	2,269
2040	1,924	118	1,073	63	3,178

Source: HDR / HNTB / Iowa DOT
Note: The To / From Rural category above captures a small number of total trips from Iowa City and Cedar Rapids to proposed stations in rural areas of the corridor only (e.g. Cou Falls and Swisher).

Table 18. STOPS Forecast of Total Daily Commuter Rail Ridership by Year – Scenario 3B (30 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	To / From Rural	Total Ridership
2015	3,226	202	840	74	4,342
2025	4,278	244	956	94	5,572
2040	6,188	318	1,272	145	7,923

Source: HDR / HNTB / Iowa DOT
Note: The To / From Rural category above captures a small number of total trips from Iowa City and Cedar Rapids to proposed stations in rural areas of the corridor only (e.g. Cou Falls and Swisher).

Detailed review of the ridership forecasts for scenarios 3A and 3B show that the introduction of commuter rail and automated bus modes between Iowa City and Cedar Rapids does not generate a high level of end-to-end trips. For the preferred transit headway time scenario (3B) the STOPS model estimated 4,342 daily boardings for year 2015 with 202 (or 5 percent) of those boardings representing trips between the two metropolitan areas. This reduced number of trips between Iowa City and Cedar Rapids via a transfer at the Eastern Iowa Airport compared to more direct service to downtown Cedar Rapids (Scenario 1), shows that transferring transit modes at the Eastern Iowa Airport is likely to reduce the amount of existing travelers between the two downtown areas that can be enticed to switch travel mode by high capacity transit.

Conversely, transit ridership along the existing CRANDIC Corridor right-of-way between North Liberty and Downtown Iowa City is much stronger at 3,226 daily boardings in year 2015. A number of these trips cover only a distance of one to two stations, but are seen as likely transit trips due to comparable travel times with auto trips and the linkage between home and work locations. A similar but, much less pronounced travel market for automated bus was also identified within the Cedar Rapids metropolitan area. According to the STOPS modeling results, over time the growth of the Iowa City and Cedar Rapids communities drives total boardings up to nearly double the 2015 number, but the number of trips between the metropolitan areas show very little growth under current assumptions.

The following tables represent mode of access between those that walk to stations, those being dropped off by car at the station (Kiss and Ride), and those driving a car to the station and then parking to ride transit (Park and Ride). In general, though park and ride locations were considered available for many stops, most projected riders use the walk mode.

Table 19. STOPS Model Average Weekday Ridership Estimates by Mode of Access – Scenario 3A (130 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
Commuter Rail (Central Iowa City-Eastern Iowa Airport)				
2015	772	93	238	1,104
2025	1008	119	318	1,445
2040	1360	188	558	2,106
Automated Bus (Eastern Iowa Airport-Downtown Cedar Rapids)				
2015	390	97	242	729
2025	440	109	275	824
2040	591	134	346	1,071

Source: HDR / HNTB / Iowa DOT

Table 20. STOPS Model Average Weekday Ridership Estimates by Mode of Access – Scenario 3B (30 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
Commuter Rail (Central Iowa City-Eastern Iowa Airport)				
2015	2559	262	680	3,502
2025	3363	335	914	4,612
2040	4524	524	1,605	6,653
Automated Bus (Eastern Iowa Airport-Downtown Cedar Rapids)				
2015	432	125	283	840
2025	490	144	325	959
2040	665	183	422	1,270

Source: HDR / HNTB / Iowa DOT

Combining the results from the access mode and station boarding breakdown, it is clear that the placement of the existing CRANDIC Corridor right-of-way in central Iowa City has potential to generate a significant number of short “walk + rail” trips between Dubuque Street, Downtown Iowa City-University of Iowa, and the VA Hospital. Beyond that portion of the corridor, there is also about 1,700 combined daily trips connecting North Liberty, Oakdale, and Coralville to central Iowa City.

Tables 21 and 22 show commuter rail average weekday ridership estimates by potential station and year for scenarios 3A and 3B.

Table 21. STOPS Model Average Weekday Ridership Estimates by Station and Year – Scenario 3A (130 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	102	34	99	110	344
Kirkwood Community College	258	5	10	4	278
Eastern Iowa Airport (Cedar Rapids)	78	8	19	51	156
Swisher	8	1	3	0	11
Cou Falls	0	1	6	0	7
North Liberty	67	14	8	1	90
Oakdale	37	7	4	0	49
Coralville	64	7	57	8	136
VA Hospital	285	1	0	8	294
Downtown Iowa City-University of Iowa	209	2	0	25	235
Dubuque Street (Iowa City)	196	8	27	2	233

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	115	37	111	123	388
Kirkwood Community College	294	5	11	6	317
Eastern Iowa Airport (Cedar Rapids)	85	10	23	63	180
Swisher	8	2	3	0	13
Cou Falls	0	1	7	0	9
North Liberty	85	19	11	1	116
Oakdale	48	11	6	0	65
Coralville	83	10	76	10	180
VA Hospital	393	1	0	11	405
Downtown Iowa City-University of Iowa	265	2	0	33	300
Dubuque Street (Iowa City)	252	8	40	1	296

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	201	47	137	120	505

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Kirkwood Community College	365	6	17	5	394
Eastern Iowa Airport (Cedar Rapids)	122	11	27	86	245
Swisher	11	2	3	0	17
Cou Falls	0	3	12	0	15
North Liberty	124	29	14	1	168
Oakdale	83	23	9	0	115
Coralville	138	15	150	11	314
VA Hospital	643	2	0	15	659
Downtown Iowa City-University of Iowa	320	2	0	35	358
Dubuque Street (Iowa City)	304	10	72	2	388

Source: HDR / HNTB / Iowa DOT

Table 22. STOPS Model Commuter Rail Average Weekday Ridership Estimates by Station and Year – Scenario 3B (30 Minute Headway for Commuter Rail and 10 Minute Headway for Automated Bus)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	118	35	100	130	384
Kirkwood Community College	255	8	12	13	288
Eastern Iowa Airport (Cedar Rapids)	92	15	36	141	285
Swisher	15	2	4	0	21
Cou Falls	0	2	16	0	18
North Liberty	183	37	18	2	241
Oakdale	138	21	9	0	168
Coralville	199	24	148	16	387
VA Hospital	850	3	0	34	888
Downtown Iowa City-University of Iowa	692	4	0	136	832
Dubuque Street (Iowa City)	671	26	118	19	830

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	134	39	113	149	435
Kirkwood Community College	291	9	13	16	329
Eastern Iowa Airport (Cedar Rapids)	100	18	43	175	336
Swisher	17	3	5	0	24
Cou Falls	0	3	21	0	25
North Liberty	230	50	26	2	307

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Oakdale	183	28	11	0	222
Coralville	264	29	197	20	510
VA Hospital	1,171	3	0	42	1,217
Downtown Iowa City-University of Iowa	893	5	0	176	1,075
Dubuque Street (Iowa City)	874	32	165	22	1,092

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
Downtown Cedar Rapids	225	50	143	163	581
Kirkwood Community College	369	11	19	19	419
Eastern Iowa Airport (Cedar Rapids)	144	20	53	237	452
Swisher	22	5	7	0	33
Cou Falls	0	6	36	0	43
North Liberty	337	79	33	4	453
Oakdale	312	52	15	0	379
Coralville	441	45	360	25	870
VA Hospital	1,863	5	0	57	1,924
Downtown Iowa City-University of Iowa	1,067	6	0	211	1,283
Dubuque Street (Iowa City)	1,097	47	312	27	1,486

Source: HDR / HNTB / Iowa DOT

All told, early consideration of transit stations between Dubuque Street in central Iowa City and North Liberty appear to have the strongest existing market for transit and have great growth potential for future improvements to expand commuter rail service to more outlying communities and potentially bridge the gap between Iowa City and Cedar Rapids. The case for near-term rapid transit within Cedar Rapids via automated bus to the Eastern Iowa Airport is less convincing. Longer term, both commuter rail extensions and development of connecting automated bus service may become feasible with shifting travel behavior toward living near activity centers.

2.6.5 Conceptual Cost of Implementation

No new or refined capital cost estimates for the commuter rail portion of Scenario 3 – commuter rail service in the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids and implementation of automated vehicle (bus) service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids – were developed for this Technical Memorandum.

In the previous Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study undertaken by Iowa DOT, CRANDIC, and other stakeholders, it was reported that the probable conceptual capital cost to implement commuter rail service on this 20.5-mile segment of the CRANDIC Corridor right-of-way could range between $250 million and $520 million in 2015 dollars, based on industry averages for recent commuter rail implementation in the U.S. Specific potential passenger rail equipment and infrastructure requirements developed for this service were only high-level and conceptual. An operating plan for commuter rail was not developed, and the study only conceptually assumed a daily service with six stations. Operations and Maintenance (O&M) costs for commuter rail service presented in this previous study were based on industry averages and were estimated to range between $5.6 million and $6.7 million per year in 2015 dollars.

A conceptual cost estimate for the implementation of the automated vehicle mode on the existing roadway network between the Eastern Iowa Airport in Cedar Rapids and Downtown Cedar Rapids was considered as part of this study. The primary cost elements of automated bus service considered include: initial bus purchase, maintenance of buses, bus station development, and likely enhancements to existing roadways along the route.

Automated vehicles are a technology undergoing rapid research and development activity. At present and for the near term, the cost of creating an automated transit vehicle is still very much uncertain. Such a vehicle would be essentially a one-time only, prototype development that can lead to excessive costs. Yet, because of the number of worldwide private developers investing in the research and development to go from prototype to standard model, a long-term vision of automated bus transit cost can be estimated from today's standard transit costs plus the new physical equipment that will be needed to enable automated function. And like existing transit vehicles, the true cost of transit also includes operating and maintenance expenditures. There has also been no previous study or development of related costs for the potential for either bus-rapid transit or automated vehicle implementation in the CRANDIC Corridor right-of-way or the connecting roadway network in Iowa City and Cedar Rapids from which to source.

A potential conceptual cost estimate range for implementation of the 9.5-mile automated bus segment of Scenario 3 was developed using recent industry averages for recent bus-rapid transit implementation in the U.S., which was modified to account for potential automated vehicle technology costs as they are presently understood. These conceptual figures are presented by cost component and category in 2017 dollars in Table 23.

Table 23. Conceptual Cost Summary for Segment of Automated Bus Implementation in Scenario 3

Cost Component	Total (in 2017 Dollars)
Conceptual Capital Cost	$50 million - $120 million Total includes the following categories: Roadway Infrastructure – $38 million - $95 million Vehicles – $5 million - $8 million Stations / Facilities – $7 million - $16 million
Conceptual Annual Operations & Maintenance Cost	$1.4 million - $3.0 million

The potential conceptual cost summary for implementation of the 20.5-mile commuter rail service in Scenario 3 between Dubuque Street in central Iowa City and the Eastern Iowa Airport in Cedar Rapids based on the assumptions from the Iowa City-Cedar Rapids Passenger Rail Conceptual Feasibility Study above and adjusted to 2017 dollars, and the potential conceptual cost for implementation of automated bus service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar

Rapids as based on recent transit industry averages for the implementation of bus-rapid transit service and potential automated vehicle costs as they are currently understood in 2017, is presented in Table 24.

Table 24. Conceptual Cost Summary for Combined Commuter Rail and Automated Bus Implementation in Scenario 3

Scenario 3 Cost Component	Scenario 3 Total (in 2017 Dollars)
Conceptual Capital Cost for Implementation	$310 million - $661 million
Conceptual Annual Operations & Maintenance Cost	$7.2 million - $10.0 million

2.6.6 Applicability of Alternative Use Scenario 3 with the Vision for CRANDIC Corridor Alternative Use

Table 25 identifies each component of the short- and long-term vision for alternative use of the CRANDIC Corridor right-of-way identified in Section 4 of this Technical Memorandum and its applicability to alternative use Scenario 3, based on the analysis above.

Table 25. Applicability of Alternative Use Scenario 3 to the Vision for the CRANDIC Corridor

Components	Applicability to Alternative Use Scenario 3
Components of the Short-Term Vision	
Pursue options for promoting and preserving the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids as a valuable community asset for the future. Continue study of its potential development for alternative transportation use that promotes sustainability, enhances mobility, supports economic and community development, strengthens multimodal connections, and compliments multimodal capacity and the improvements currently under development on parallel Interstate 380.	Further efforts to promote the preservation of the CRANDIC Corridor right-of-way for alternative transportation use and additional future study for the development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport in Cedar Rapids meets the vision. Study for implementation of connecting automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Components of the Long-Term Vision	
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will preserve the CRANDIC Corridor right-of-way as a valuable regional asset for a variety of stakeholders.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will promote sustainable, energy efficient, and cost-effective alternative transportation use that would match the needs of the region's changing and growing population.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.

Components	Applicability to Alternative Use Scenario 3
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will enhance mobility, accessibility, reliability, efficiency, capacity, safety, and connectivity of the region's multimodal network, including Interstate 380.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will embrace emerging technologies and best planning practices for alternative transportation implementation.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will provide a catalyst for enhanced economic, community, and land use development adjacent to the CRANDIC Corridor right-of-way and Interstate 380.	Study and development of a commuter rail service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.

2.6.7 Alternative Use Scenario 3 Findings and Recommendations

A recommendation for alternative use of the CRANDIC Corridor right-of-way has been developed based on the assessment of applicability of alternative use Scenario 3, the vision for alternative use of the CRANDIC Corridor right-of-way, the conceptual ridership forecasts for commuter rail service between Iowa City and the Eastern Iowa Airport in Cedar Rapids (including cases for traditional commuter rail operations with 30-minute headways) and implementation of automated vehicle (bus) service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids, and a general understanding of likely potential conceptual capital costs for implementation of a commuter rail service and automated bus service based on recent industry averages and past studies.

Scenario 3 generally promotes passenger ridership better than the other scenarios, and particularly encourages high levels of commuter rail ridership between central Iowa City and North Liberty. Scenario 3 appears to be conceptually feasible to construct and a good fit with the long-term vision for the CRANDIC Corridor right-of-way. Scenario 3 has also has the benefit of providing connectivity between Downtown Iowa City and Downtown Cedar Rapids, via a transfer of modes at the Eastern Iowa Airport in Cedar Rapids.

Scenario 3 appears to have long-term value in providing multimodal connectivity, and based on stop-to-stop transit activity from the FTA STOPS model, a near-term approach to pursuing Scenario 3 could be the development of an initial commuter rail service between Dubuque Street (Iowa City) and North Liberty. This initial phase of implementation would benefit most from a shift of focus from longer headways (like the 130-minute headways explored in the STOPS modeling) to a more typical 30-minute headway service. STOPS ridership projections also support moderate use of automated bus or express bus service between the Eastern Iowa Airport and Downtown Cedar Rapids via Kirkwood Community College even in the near-term when a commuter rail link from the Eastern Iowa Airport to Iowa City would not yet exist.

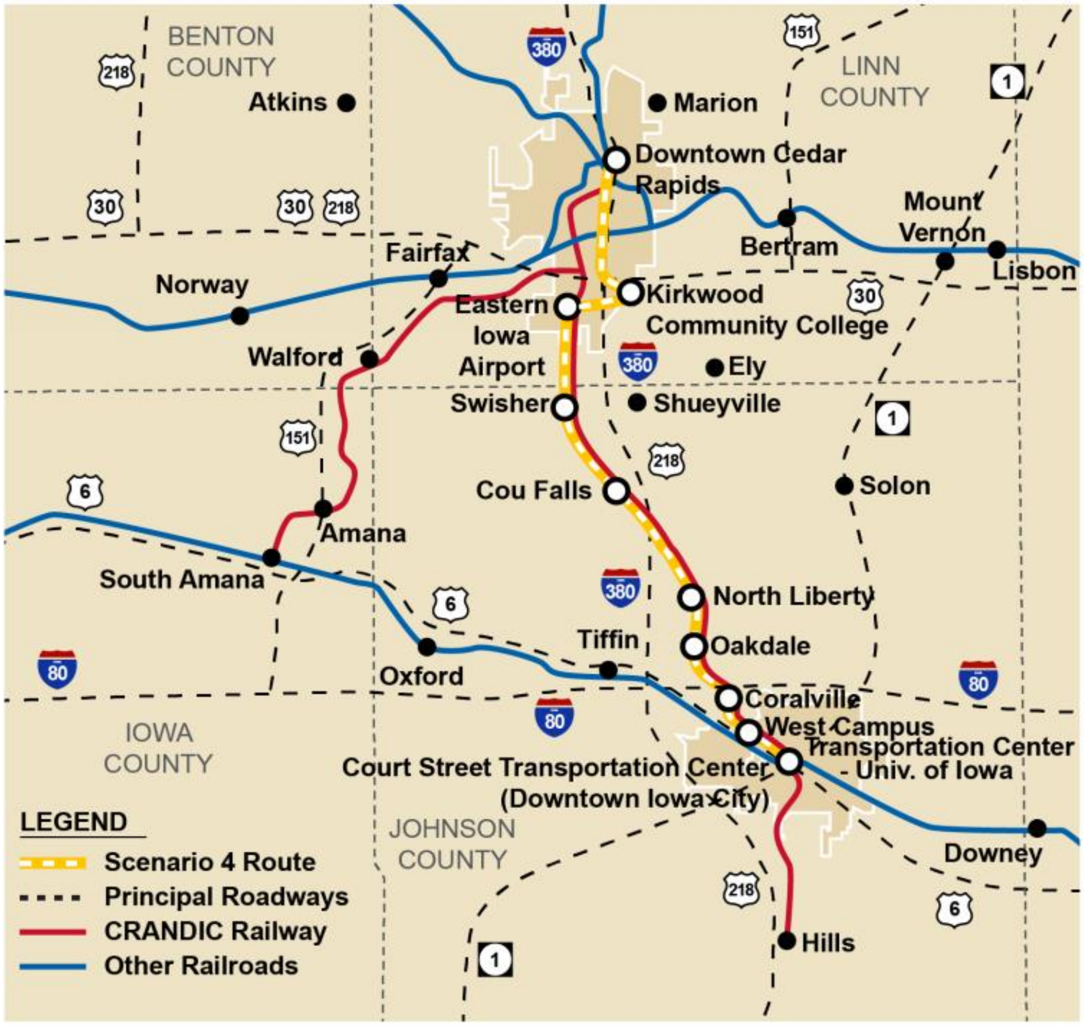
A key challenge with Scenario 3 is the cost of buying, operating, and maintaining both commuter rail vehicles and automated buses. Conceptually, transit agencies can more efficiently operate and maintain one type of transit vehicle, as maintenance work for rail vehicles and the track they run on is very different than bus maintenance work. Also, the total number of vehicles needed in Scenario 3 would likely increase by not being able to continue a transit trip to a more logical terminal as it takes two vehicle purchases (one rail, one bus) to make an end-to-end trip.

2.7 Alternative Scenario 4 – (Automated Vehicle Service – Central Iowa City on Existing Roadway Network; Iowa City-Eastern Iowa Airport in Cedar Rapids on CRANDIC Corridor Right-of-Way; and Eastern Iowa Airport in Cedar Rapids-Downtown Cedar Rapids on Existing Roadway Network)

2.7.1 Description

Scenario 4 for alternative use includes the potential implementation of a continuous automated vehicle (bus) service using buses on the existing roadway network within Iowa City, in the CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport in Cedar Rapids, and on the existing roadway network within Cedar Rapids between the Eastern Iowa Airport and Downtown Cedar Rapids – approximately 30 miles in length. The map in Figure 18 shows the Scenario 4 route and its proximity to, and intersections with, the multimodal network in the region.

Figure 18. Alternative Scenario 4 Route Map



Source: HDR

2.7.2 Applicability of Automated Vehicle Mode for Potential Implementation in the CRANDIC Corridor Right-of-Way and Existing Roadway Network

Automated vehicles provide a flexible future technology that can operate on dedicated transit lanes and roadways and in mixed traffic with other cars and trucks. The proposed scenario considered the best alternative automated vehicle mode to move traffic between Downtown Iowa City and Downtown Cedar Rapids via the CRANDIC Corridor right-of-way. As in Scenario 3, the opportunity to use automated bus vehicles requires a reduced number of vehicles to be purchased while carrying many travelers per vehicle. Purely considering agency use of automated vehicles, deployment, ownership, operation, and maintenance of a fleet of less than 20 buses is preferable to a fleet of 125 micro-transit type vehicles or 300 automated passenger car size vehicles. As such, automated bus vehicles are considered as the primary alternative mode between Downtown Iowa City and Downtown Cedar Rapids. However, potential use of the CRANDIC Corridor right-of-way by automated passenger vehicles is also discussed as a supplemental alternative travel mode that would likely be supplied by private households and / or taxi-type service companies.

Focusing on the southern portion of the automated bus alignment, the bus would begin operation between the Court Street Transportation Center in Downtown Iowa City, the West Campus Transportation Center in western Iowa City, and entrance to the CRANDIC Corridor right-of-way near U.S. Highway 6 and Rocky Shore Road in western Iowa City. In this portion of the alignment, the vehicle would use the existing roadway network shared with other cars, buses, and trucks, potentially both human operated and automated. This flexibility in the technology allows for stops off the existing CRANDIC Corridor right-of-way before leaving general roadways and entering the CRANDIC Corridor right-of-way. Potential routes within the existing Iowa City roadway network that the automated bus service could utilize have not been confirmed for study undertaken during development of this Technical Memorandum; however, the following route was assumed: west on Court Street from the Court Street Transportation Center in Downtown Iowa City, north on Clinton Street, west on Burlington Street, west and south on Grand Avenue, west on Melrose Avenue, north and west on Hawkins Drive, and north on Rocky Shore Drive until connecting with the CRANDIC Corridor right-of-way near the intersection of Rocky Shore Drive and U.S. Highway 6 (approximately 2 miles).

The segment of the Scenario 4 route in the CRANDIC Corridor right-of-way between Rocky Shore Drive in western Iowa City and the Eastern Iowa Airport in Cedar Rapids (approximately 18.5 miles) would be adapted to implement a fixed guideway used by buses only. To make the CRANDIC Corridor right-of-way suitable to the operation of automated vehicles, the existing railroad track and some other railroad infrastructure components would need to be removed and the corridor paved as a two-lane roadway. Much of the existing CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport at Cedar Rapids conceptually appears to be suitably wide for two lanes of traffic and roadside slopes for drainage (assuming 2-12' wide lanes, 2-2' shoulders, 3:1 slopes; roughly 40 feet minimum right-of-way), based on conceptual analysis of available Google Earth Pro imagery undertaken for development of this Technical Memorandum. Given the limited use of this corridor to only automated buses, the roadside slopes may not meet typical slope design recommendations that address human-driven vehicle safety. The roadway construction would also include a continuous run of buried fiber optic and power to allow for detection and communication of the transit corridor with agency managers. At points along the fixed guideway corridor, the power and communications infrastructure will support roadside equipment (RSEs), which are connected infrastructure elements that allow agencies to send and receive automated vehicle data, like providing transit vehicles a roadway conditions update in inclement weather situations.

The use of automated vehicles within the CRANDIC Corridor right-of-way would also require the replacement of railroad / roadway grade crossing infrastructure with signage and / or roadway traffic signals to manage locations where the automated bus service and the roadway network intersect. Automated vehicles have braking capabilities similar to or superior to human-operated automobiles, so in theory, the automated bus vehicle has greater flexibility to stop for cross-street traffic. Automated bus operations are assumed to have priority over roadway traffic at crossings, and would typically stop only for stations.

Another consideration for applicability of the automated vehicle mode is that the automated bus is extremely flexible with regard to changing corridor speeds. Depending on the design of roadbed within the CRANDIC Corridor right-of-way, an automated bus could take advantage of large station spacing in rural areas to travel at higher speeds. Given the existing grade profile of the CRANDIC Corridor right-of-way, the automated bus is expected to travel at average speeds in the range of 40 mph, though flatter elevations – if possible to achieve when adapting the CRANDIC Corridor right-of-way for an automated bus service in a fixed guideway – could result in faster average speeds.

In this portion of the alignment, the automated buses would be separated from on-street congestion, which is a major benefit to the transit service. However, the guideway in the CRANDIC Corridor right-of-way, now paved, could be opened up to allow automated vehicle use along with automated buses. Mixing automated vehicles of private use with automated buses could have some potential benefits and challenges, as noted below:

- Safety - The automated bus guideway in the CRANDIC Corridor right-of-way would be narrow by most human driver standards for intercity highways. This narrow footprint allows the guideway to fit in an existing railroad right-of-way, but is only safe for vehicles operating in autonomous mode.
- Congestion - The CRANDIC Corridor right-of-way provides a parallel route and alternative transportation option to Interstate 380. If converted to a roadway, the railroad corridor right-of-way may be able to handle some of the traffic off of Interstate 380, which would benefit many Interstate 380 travelers. However, travelers tend to choose the route offering the lowest travel time, even if that route has more than desirable levels of crowding. The CRANDIC Corridor right-of-way transit guideway would operate at design speeds below 50 mph, whereas Interstate 380 operates at design speeds of 70 mph. Thus, the a fixed guideway in the CRANDIC Corridor right-of-way does not provide an attractive alternative for diverting Interstate 380 traffic, except for those that would experience much shorter trips when traveling along the CRANDIC Corridor. If the guideway were to be open to private vehicle use, another negative outcome could be the congestion of the guideway to the detriment of the proposed transit service. To protect good quality service for the rapid transit line, constraints would need to be placed on the use of the transit guideway.
- Policy - Related to the constraints discussed under congestion, agency stipulations on the appropriate use of the CRANDIC Corridor right-of-way guideway could include measures not typically advocated by local agencies or familiar to the traveling public. Two of those policy choices could be traffic signal metered entry and high occupancy toll (HOT) lane treatment of the guideway. Both treatments have been used by other agencies outside of Iowa to limit the use of facilities by private vehicles to a level that serves to maintain high speeds along the facility. Both policies could be considered, but would add to agency cost, may encounter political opposition, and provide benefits to just a limited number of travelers.
- Equity - Operating a guideway within the CRANDIC Corridor right-of-way for public transportation only provides equitable benefits because even those who are economically disadvantaged can afford to benefit from the automated buses at just the cost of a fare. Yet, if private automated vehicles were allowed on the guideway, those able to afford an automated vehicle or pay for taxi-type automated vehicle services would obtain benefits not eligible to those without the means to use an automated vehicle. If tolling were instituted to limit access to the facility, as mentioned above, that particular policy could create a greater boundary to use of the facility by the economically disadvantaged.

Considering all of these potential benefits and challenges, the primary benefit of automated buses as public transportation became the preferred alternative autonomous vehicle mode within the CRANDIC right-of-way segment of the Iowa City-Cedar Rapids Corridor, as it is likely that a limited number of automated vehicle users would choose to access the CRANDIC Corridor, and providing access to that limited user set may not be a benefit to the transit operating agencies.

The flexibility of automated buses is also valuable in the portion of the proposed route between Eastern Iowa Airport, Kirkwood Community College, and Downtown Cedar Rapids where the automated bus can drive on a combination of existing roadways within Cedar Rapids. Potential routes within the existing Cedar Rapids roadway network that the automated bus service could utilize have not been confirmed for study undertaken during development of this Technical Memorandum; however, the following route was assumed: east on Wright Brothers Boulevard from the Eastern Iowa Airport, north on Kirkwood Boulevard to Kirkwood Community College, west on U.S. Highway 30, and north on Interstate 380 to travel into Downtown Cedar Rapids (approximately 9.5 miles).

2.7.3 Conceptual Ridership Forecast

A conceptual ridership forecast was developed for the potential implementation of Scenario 4 – automated vehicle (bus) service using buses on the existing roadway network within Iowa City, in the CRANDIC Corridor right-of-way between western Iowa City and the Eastern Iowa Airport in Cedar Rapids, and on the existing roadway network within Cedar Rapids between the Eastern Iowa Airport and Downtown Cedar Rapids in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport at Cedar Rapids and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids – using the FTA STOPS model. The ridership model looked at the route traversing 10 stations in 63 minutes run time.

The ridership model looked at the route serving 10 stations and 63 minutes of run time between the Court Street Transportation Center (Downtown Iowa City) and the South Side Parking Ramp (Downtown Cedar Rapids). Note that the urban segment of the CRANDIC Corridor right-of-way between Dubuque Street in central Iowa City and Rocky Shore Drive in western Iowa City (approximately 2 miles) was not considered for potential implementation of an automated bus route in this scenario owing to challenges identified later in this section; rather, implementation in the existing roadway network between these points was assumed. Bus stations selected for the ridership forecasts are consistent with potential commuter rail station locations identified during previous recent study of passenger rail implementation in the CRANDIC Corridor right-of-way by Iowa DOT, CRANDIC, and other local stakeholders, and potential stop locations on the existing roadway network for the automated vehicle service segment of this scenario in Iowa City and Cedar Rapids were determined through additional coordination and outreach conducted by Iowa DOT during development of the I-380 PEL Study and this Technical Memorandum. The potential automated vehicle (bus) stops – from south to north – included:

- Court Street Transportation Center (Downtown Iowa City)
- West Campus Transportation Center (University of Iowa)
- Coralville
- Oakdale
- North Liberty
- Cou Falls
- Swisher
- Eastern Iowa Airport (Cedar Rapids)
- Kirkwood Community College
- South Side Parking Ramp (Downtown Cedar Rapids)

Table 26 summarizes the base STOPS model ridership estimates of automated bus for the current year (defined as 2015) and two future years (2025 and 2040).

Table 26. STOPS Forecast of Total Daily Automated Vehicle (Bus) Ridership by Year – Scenario 4 (10 Minute Headway for Automated Bus)

Year	Within Iowa City / Coralville / North Liberty	Between Iowa City and Cedar Rapids Metropolitan Areas	Within Cedar Rapids / Eastern Iowa Airport	To / From Rural	Total Ridership
2015	1,646	242	581	91	2,560
2025	2,220	296	648	112	3,276
2040	3,830	394	857	149	5,230

Source: HNTB / Iowa DOT
Note: The To / From Rural category above captures a small number of total trips from Iowa City and Cedar Rapids to proposed stations in rural areas of the corridor only (e.g. Cou Falls and Swisher).

Detailed review of the ridership forecasts for Scenario 4 shows that the introduction of automated buses between Iowa City and Cedar Rapids does not generate a high level of end-to-end trips. The STOPS model estimated 2,560 daily boardings for year 2015 with 242 (or 9 percent) of those boardings representing trips between the two metropolitan areas. This number of trips between Iowa City and Cedar Rapids is fairly consistent with the ridership projected for direct service to Downtown Cedar Rapids via an all commuter rail service (Scenario 1). The similarly low values for either the commuter rail or the automated bus mode show a combination of a limited market for downtown to downtown commute trips and that high-capacity transit would need to produce a much greater time savings compared to the auto mode in order to attract higher levels of downtown to downtown ridership.

Conversely, transit ridership along the proposed automated bus route between North Liberty and Downtown Iowa City is stronger at 1,646 daily boardings in year 2015. A number of these trips cover only a distance of one to two stations, but are seen as likely transit trips due to comparable travel times with auto trips and the linkage between home and work locations. A similar but, much less pronounced travel market for automated bus was also identified within the Cedar Rapids metropolitan area, with 581 daily boardings in year 2015. Both of these ridership numbers for within metropolitan areas are lower for this scenario due to traveler preference for commuter rail vehicles, even though the automated bus mode studied provides extremely convenient, “no wait” headways of 10 minutes. Notice that over time the growth of the Iowa City and Cedar Rapids communities drives total boardings up to nearly double the 2015 number, but the number of trips between the metropolitan areas show limited growth under current assumptions.

The following tables represent mode of access between those that walk to stations, those being dropped off by car at the station (Kiss and Ride), and those driving a car to the station and then parking to ride transit (Park and Ride). Scenario 4 provides a contrast to the other three scenarios because this scenario shows a greater use of park and ride access and kiss and ride access. Since automated bus headways in this scenario are very frequent, there are a number of potential riders that would travel from beyond walking distance to get the transit benefits of avoiding highway congestion and / or avoiding downtown parking. Still, many riders (51 percent) are projected to use the walk mode.

Table 27. STOPS Model Average Weekday Ridership Estimates by Mode of Access – Scenario 4 (10 Minute Headway for Automated Bus)

Year	Walk	Kiss and Ride	Park and Ride	Total All Modes
2015	1,349	411	899	2,660
2025	1,695	512	1,182	3,388
2040	2,474	763	2,105	5,342

Source: HNTB / Iowa DOT

Even though the automated bus mode will be used in place of the commuter rail mode in Scenario 4, bus stations selected for the ridership forecasts are similar to potential station locations identified during previous recent study of passenger rail implementation in the CRANDIC Corridor right-of-way by Iowa DOT, CRANDIC, and other local stakeholders. The primary differences are within Iowa City where Scenario 4 includes automated bus stops at the Court Street Transportation Center (Downtown Iowa City) and the West Campus Transportation Center (University of Iowa). The potential average weekday boarding in by year and station for Scenario 4 is shown in Table 28.

Table 28. STOPS Model Average Weekday Ridership Estimates by Station and Year – Scenario 4 (10 Minute Headway for Automated Bus)

2015	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
South Side Parking Ramp (Downtown Cedar Rapids)	97	34	94	130	355
Kirkwood Community College	225	9	12	22	268
Eastern Iowa Airport (Cedar Rapids)	81	8	20	0	109
Swisher	15	2	9	0	27
Cou Falls	0	5	16	0	21
North Liberty	139	30	25	7	200
Oakdale	115	22	69	0	207
Coralville	122	55	105	37	318
West Campus Transportation Center (University of Iowa)	550	5	0	42	596
Court Street Transportation Center (Downtown Iowa City)	308	32	100	18	459

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
South Side Parking Ramp (Downtown Cedar Rapids)	111	38	106	149	405
Kirkwood Community College	257	11	13	27	308
Eastern Iowa Airport (Cedar Rapids)	88	9	24	0	121
Swisher	17	3	12	0	32
Cou Falls	0	6	20	0	26
North Liberty	174	39	34	8	255
Oakdale	155	29	96	0	280
Coralville	156	69	143	46	414

2025	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
West Campus Transportation Center (University of Iowa)	766	6	0	51	823
Court Street Transportation Center (Downtown Iowa City)	407	42	143	21	612

2040	Walk	Kiss and Ride	Park and Ride	Modal Transfer	Total
South Side Parking Ramp (Downtown Cedar Rapids)	202	47	129	163	542
Kirkwood Community College	326	13	19	33	390
Eastern Iowa Airport (Cedar Rapids)	125	10	32	0	167
Swisher	23	4	19	0	45
Cou Falls	0	8	25	0	33
North Liberty	257	65	53	9	384
Oakdale	276	64	266	0	606
Coralville	232	97	244	61	634
West Campus Transportation Center (University of Iowa)	1,443	6	0	61	1,510
Court Street Transportation Center (Downtown Iowa City)	560	62	265	30	919

Source: HNTB / Iowa DOT

Combining the STOPS modeling results from the access mode and station boarding breakdowns above, it is clear that the placement of the existing roadway network in central Iowa City has potential to generate a significant number of short bus trips between Court Street Transportation Center (Downtown Iowa City) and the West Campus Transportation Center (University of Iowa). Beyond the roadway segment of the route in Iowa City, there is also about 800 combined daily trips in year 2015 connecting North Liberty, Oakdale, and Coralville along the CRANDIC Corridor right-of-way to central Iowa City.

2.7.4 Conceptual Cost of Implementation

As described previously for Scenario 3, there is a great deal of uncertainty in what automated bus transit may cost in the future, and there has also been no previous study or development of related costs for the potential for either bus-rapid transit or automated vehicle implementation in the CRANDIC Corridor right-of-way or the connecting roadway network in Iowa City and Cedar Rapids from which to source. This Technical Memorandum considered automated bus transit cost in a future, more stable development environment. Under these assumptions, the cost of automated bus vehicles can be estimated from today's standard bus-rapid transit costs plus the new physical equipment that will likely be needed to enable automated function. And like existing transit vehicles, the true cost of transit includes operating and maintenance expenditures.

In Scenario 4, costs needed outside the vehicle related costs are mainly costs to modify the existing CRANDIC Corridor right-of-way to suit automated transit. The existing railroad tracks would need to be removed and replaced with pavement for a fixed transit guideway. The pavement would need to be designed for frequent bus use and would cross other city streets at grade and would require traffic control, potentially including traffic signals. The new roadway would also be outfitted with Intelligent Transportation System (ITS) equipment, such as continuous fiber optic for communication and power service. The corridor may also utilize features like roadside equipment (RSE) and reference markers.

Based on new construction, sources like the *Bus Rapid Transit Practioner's Guide* estimate between $15 million and $25 million per mile related to typical bus transit guideway construction. Without a conceptual cost estimate specific to a scenario whereby a railroad corridor right-of-way is repurposed for bus-rapid transit, it is unknown if there is a possibility that retrofitting the CRANDIC Corridor right-of-way could be achieved at a lower than typical price. Still, based on this range, the use of automated vehicles could provide service between the downtown areas of Iowa City and Cedar Rapids at a potential cost savings in comparison to the Scenario 1 commuter rail alternative. While many more automated vehicles are required to maintain peak headways given the journey time and desirable headways, the cost per vehicle is projected to be lower with buses than typical commuter rail equipment. On top of lower capital costs for vehicle and equipment procurement, the automated vehicle provides an even greater benefit because it has no operator cost and no restrictions to driver scheduling. Automated buses can operate long hours continuously with only the vehicle wear to consider. The estimated Operations & Maintenance (O&M) costs for Scenario 4, including reduced salary costs resulting from a marked reduction in driver cost.

A potential conceptual cost estimate range for implementation of the 30-mile automated bus service in Scenario 4 was developed using recent industry averages for recent bus-rapid transit implementation in the U.S., which was modified to account for potential automated vehicle technology costs as they are presently understood. These conceptual figures are presented by cost component and category in 2017 dollars in summary Table 29.

Table 29. Conceptual Cost Summary for Full Automated Bus Implementation in Scenario 4

Cost Component	Total (in 2017 Dollars)
Conceptual Capital Cost	$350 million - $625 million Total includes the following categories: Roadway Infrastructure – $309 million - $554 million Vehicles – $20 million - $24 million Stations / Facilities – $21 million - $47 million
Conceptual Annual Operations & Maintenance Cost	$2.9 million - $6.4 million

2.7.5 Applicability of Alternative Use Scenario 4 with the Vision for CRANDIC Corridor Alternative Use

Table 30 identifies each component of the short- and long-term vision for alternative use of the CRANDIC Corridor right-of-way identified in Section 4 of this Technical Memorandum and its applicability to alternative use Scenario 4, based on the analysis above.

Table 30. Applicability of Alternative Use Scenario 4 to the Vision for the CRANDIC Corridor

Components	Applicability to Alternative Use Scenario 4
Components of the Short-Term Vision	
Pursue options for promoting and preserving the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids as a valuable community asset for the future. Continue study of its potential development for alternative transportation use that promotes sustainability, enhances mobility, supports economic and community development, strengthens multimodal connections, and compliments multimodal capacity and the improvements currently under development on parallel Interstate 380.	Further efforts to promote the preservation of the CRANDIC Corridor right-of-way for alternative transportation use and additional future study for the development of a dedicated automated vehicle transit service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport in Cedar Rapids meets the vision. Study for implementation of connecting automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Components of the Long-Term Vision	
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will preserve the CRANDIC Corridor right-of-way as a valuable regional asset for a variety of stakeholders.	Study and development of automated vehicle service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will promote sustainable, energy efficient, and cost-effective alternative transportation use that would match the needs of the region's changing and growing population.	Study and development of automated vehicle service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will enhance mobility, accessibility, reliability, efficiency, capacity, safety, and connectivity of the region's multimodal network, including Interstate 380.	Study and development of automated vehicle service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will embrace emerging technologies and best planning practices for alternative transportation implementation.	Study and development of automated vehicle service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.

Components	Applicability to Alternative Use Scenario 4
Alternative use of the CRANDIC Corridor right-of-way between central Iowa City and the Eastern Iowa Airport in Cedar Rapids for the long-term horizon will provide a catalyst for enhanced economic, community, and land use development adjacent to the CRANDIC Corridor right-of-way and Interstate 380.	Study and development of automated vehicle service in the CRANDIC Corridor right-of-way between Iowa City, North Liberty, and the Eastern Iowa Airport and implementation of automated vehicle service on the existing roadway network between the Eastern Iowa Airport and Downtown Cedar Rapids meets the vision.

2.7.6 Alternative Use Scenario 4 Findings and Recommendations

Alternative use Scenario 4 provides a cost-effective alternative public transportation strategy to the previously studied commuter rail concepts. The use of automated vehicles would have a major effect on potential development of a transit link between Iowa City and Cedar Rapids utilizing the CRANDIC Corridor right-of-way and leveraging the connecting existing roadway network. First, the choice to pursue automated vehicle technology along the corridor would require a thorough investigation into the market for automated buses and general readiness of the industry to supply automated vehicles in general. More than likely, the choice of pursuing automated vehicle technology would lead to a waiting period dependent on the speed with which the automated vehicle industry develops before a starter line using this technology could be implemented.

Schedule notwithstanding, if automated vehicles are the preferred transit mode for implementation in the CRANDIC Corridor right-of-way, the CRANDIC railroad track would need to be removed in order to accommodate a new paved fixed guideway for automated bus use. The removal of the track would preclude any future development that jointly supports commuter rail and roadway traffic. Based on the mostly commonly employed transit market projection tool, FTA STOPS, a choice of bus transit over commuter rail transit is projected to lead to lower overall levels of ridership. The counterpoint to the reduced ridership is that automated vehicle transit costs are likely to be less than the commuter rail transit options.

Overall, Scenario 4 appears to be a viable long-term option, although at the present time, it is open to a great deal of uncertainty as automated vehicle technology continues to be developed and better understood. Should Scenario 4 be preferred by stakeholders for alternative transportation implementation in the Iowa City-Cedar Rapids corridor, a contingency plan should also be developed that considers existing and bus-rapid transit (traditional, non-autonomous vehicles operated by drivers) as a potential replacement for automated bus transit.