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**Methods and Assumptions for**

{Project Name}

{County, Iowa}

Project Number {IMN-XXX-X(XXX)XX—XX-XX}

Prepared for:





{Month Day, Year}

Instructions for Using Template

Use this template as a starting point for writing a Methods and Assumptions (M&A) document related to an access change request. This template provides materials to be supplied in all M&A documents and in the order in which the materials are to be presented. The user is encouraged to follow this template as strictly as possible to provide consistency for documentation. The Iowa Department of Transportation recognizes that every project is unique, and modifications to template materials and organization of materials may be necessary to meet the unique characteristics of a project. This template should be used in conjunction with the [Iowa DOT User Guide for New or Revised Interchange Access](https://www.iowadot.gov/ijr). Section 4.3 of the [Iowa DOT User Guide for New or Revised Interchange Access](https://www.iowadot.gov/ijr) provides guidance pertaining to the M&A document.

The page layout for this template is 8 ½” x 11” portrait, and this should be maintained by the user. It may be appropriate to provide figures or tables on pages that are 11” x 17” landscape.

Text in this template is color-coded to identify user inputs, instructions and standard text, as follows:

* Text highlighted yellow is a user input. This text should be replaced with the appropriate text or value, and the highlight should be removed.
* Text in {brackets} is also a user input. This text is part of a heading or title, and the formatting of this text should not be altered. The {brackets} surrounding the text should be deleted when inputting/updating this text.
* Text in **bold/orange** is instructional to help the user complete the document. This text should be deleted from the document once the user has followed the instructions provided by this text.
* Text that is **bold/red** is a reference to a table or figure. This format should be used for all references to tables and figures.
* Text that is black or a hyperlink is standard text that should generally not be edited.

Example tables and figures are provided in this template. These tables and figures should be populated, replaced or deleted as appropriate. Table and figure title numbers are set up to reference the appropriate section of the document and the appropriate table or figure number within each section. The reference to tables and figures within the body of the document is cross-referenced to the table or figure title. When adding tables or figures, the user should match the formatting of provided tables and figures (including table/figure titles and references within the body). When adding or removing tables or figures, the provided table and figure title numbers and references within the body should be updated.

Page breaks are inserted at locations throughout the template for readability of the template. The user should remove page breaks where appropriate.

Double-click in the header and Word will automatically update the project name and date after filling out the cover page.

The lists for Contents, Tables and Figures on the following page(s) should be updated after completing the document.

**This page is to be deleted prior to submittal.**

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# Introduction

This document outlines the methods and assumptions to be used for the access change request for new or revised access on Interstate facility at crossroad (mile marker) in County, Iowa. The proposed access change would describe the changes that would be made by the proposed access change. The access change request is being made to state the goals and objectives of the proposed access change.

This Methods and Assumptions (M&A) document is submitted to the project Advisory Group for review and comment before proceeding with the access change request evaluation and documentation.

# Area of Influence

The area of influence for operational and safety analyses is shown in **Figure 2‑1**. The area of influence includes freeway mainline, ramps, ramp terminal intersections and cross road intersections within the following boundaries:

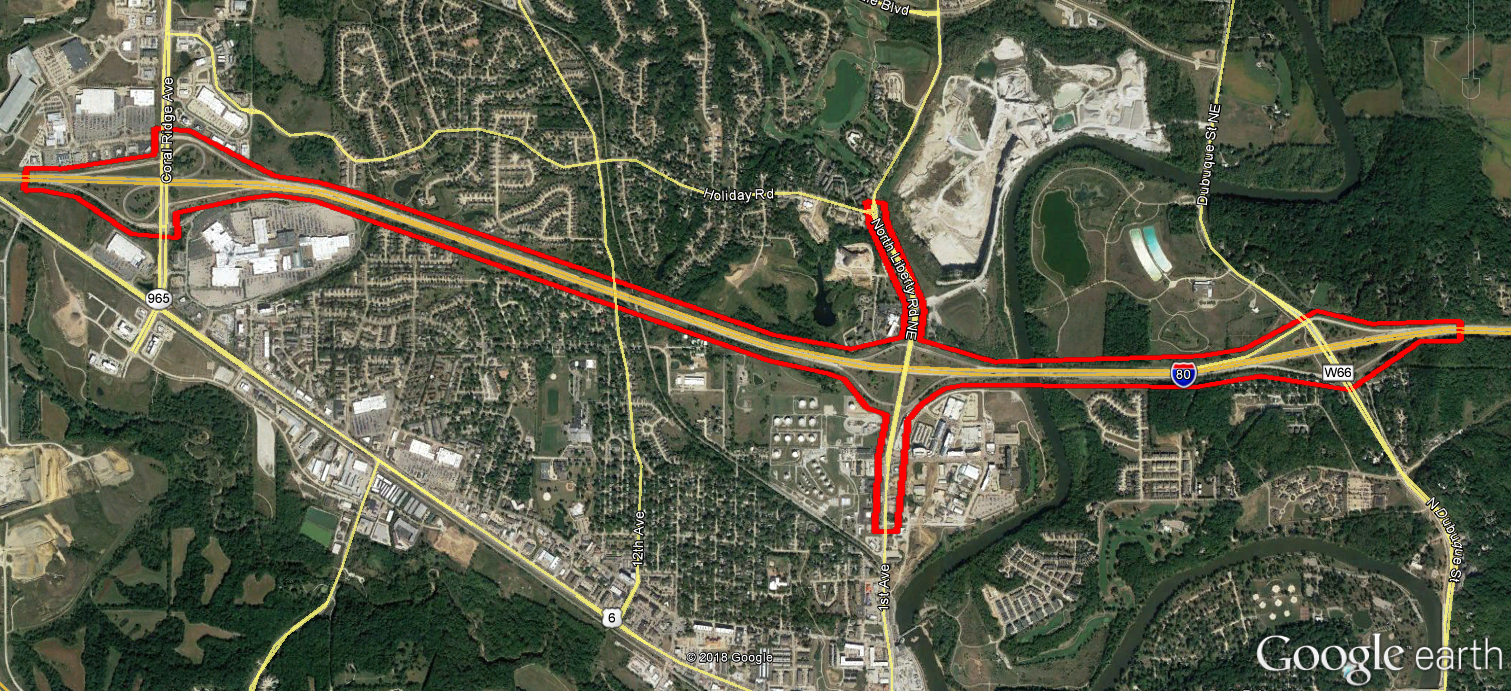
* West limits: XXXXX.
* East limits: XXXXX.
* South limits: XXXXX.
* North limits: XXXXX.

**Example of boundary summary for example graphic in Figure 2-1:**

* **West limits: West ramp junctions of the I-80 / Coral Ridge Avenue interchange (Exit 240).**
* **East limits: East ramp junctions of the I-80 / Dubuque Street interchange (Exit 244).**
* **South limits: 1st Avenue / E 7th Street intersection.**
* **North limits: 1st Avenue / Holiday Road intersection.**

**Provide additional details to clearly define the area of influence as appropriate.**

Figure ‑. Area of Influence



N

Area of Influence

**(Replace this example graphic with project area of influence graphic)**

# Analysis Years/Scenarios and Periods

## Operational Analysis Years/Scenarios and Periods

The following analysis years/scenarios will be evaluated for the traffic operational analysis:

* Existing (base) year 20XX.
* Design year 20XX No-Build.
* Design year 20XX Build Alternative Name. **Provide a separate bullet for each Alternative evaluated for the design year. Provide additional description for each Alternative as needed to differentiate between the Alternatives.**
* Opening year 20XX Build Alternative Name.
* Interim year 20XX Build Alternative Name. **Remove this bullet if not included for the traffic operational analysis. Provide a separate bullet for each interim year evaluated.**

Operational analysis will be evaluated for periods of each scenario. **(e.g., AM and PM peak hours). It may be necessary or beneficial to show existing data to support determination of the period durations, such as ATR or INRIX speed data.**

## Safety Analysis Scenarios

The following scenarios will be evaluated for the traffic safety analysis:

* Existing crash analysis for the most recent number of years years of crash data (years 20XX-20XX). **Number of years is typically a minimum of five years.**
* Predictive crash analysis for design year 20XX No-Build. **Remove this bullet if not included for the traffic safety analysis (No-Build predictive crash analysis may only be necessary when comparing predicted crashes to Build alternatives).**
* Predictive crash analysis for design year 20XX Build Alternative Name. **Provide a separate bullet for each Alternative evaluated for the design year.**

# Data Collection Sources and Methodologies

Data to be collected and sources are outlined in **Table 4‑1**. This data will be collected for all locations within the area of influence. Data to be requested from Iowa DOT will be consolidated into a single request for all traffic operational and safety evaluations.

**The highlighted sources in Table 4-1 are typical sources for data and should be replaced by the user as appropriate. Table rows for data elements that are not included on this project should be removed. Similarly, data elements that are not listed in Table 4-1 but will be collected, should be added into the table. Provide details on how the data will be collected in this section (i.e., Will recent count data and speeds be supplied by Iowa DOT Office of Systems Planning? Will count data be collected by a third party on specific days that coincide with field observations?).**

Table ‑. Traffic Data and Sources for IJR/IOR Operational and Safety Analysis

|  |  |
| --- | --- |
| **Data Element1** | **Source** |
| **Geometry** | |
| Basic lanes/layout | Publicly available online imagery; field observation |
| Lane and shoulder widths | As-built plans from constructing agency; field measurement |
| Acceleration/deceleration/ turn-lane storage lengths | Publicly available online imagery; as-built plans from constructing agency |
| Alternative geometry | Conceptual layouts |
| **Traffic Control** | |
| Control type | Publicly available online imagery; field observation |
| Signal phasing/timing | Local jurisdiction (City or County) |
| Signal detection | As-built plans from constructing agency; field observation |
| **Traffic Volumes** | |
| Intersection turn movement and pedestrian crossing counts | Iowa DOT Office of Systems Planning (<https://iowadot.gov/maps/digital-maps/traffic/turn>) / Office of Systems Planning Traffic Processing/Analyst Coordinator ; local jurisdiction (City or County); project-specific field counts |
| Automatic Traffic Recorder (ATR) counts | Iowa DOT Office of Systems Planning (<https://iowadot.gov/maps/data/automatic-traffic-recorder-reports>) / Forecasting and Modeling Team |
| Origin-destination data | Iowa DOT Office of Systems Planning (<https://iowadot.gov/systems_planning/modeling-forecasting-and-telemetrics>) / Forecasting and Modeling Team; local MPO/RPA; other third party (e.g., StreetLight Data) |
| Classification/fleet composition | ATR data (Iowa DOT Office of Systems Planning); project-specific field counts; Iowa Motor Vehicle Division (<https://iowadot.gov/mvd/factsandstats#vehiclestats>) |
| Future-year traffic forecasts | Iowa DOT Office of Systems Planning; local MPO/RPA |
| Transit data | Local transit agency |
| Railway crossing details | At-grade rail crossing owner (railroad); Federal Railroad Administration (FRA) (<https://safetydata.fra.dot.gov/officeofsafety/publicsite/crossing/crossing.aspx>) |
| **Travel Speeds** | |
| Freeway mainline speed | INRIX data (via access from Iowa DOT Office of Traffic Operations ITS Administrator); ATR speed data (via Iowa DOT Office of Systems Planning); field measured (spot speed data) |
| Ramp speed | Posted advisory speed; design speed from plans; field measured (spot speed data; pilot car) |
| Arterial | Posted speed |
| **Crash Data** | |
| Historical crash data | Iowa DOT web-SAVER (<https://saver.iowadot.gov/>) |
| Iowa comparable crash rates | Iowa DOT Office of Traffic and Safety – Crash analysis resources (<https://www.iowadot.gov/crashanalysis/comparablesprofilesmain.aspx>) |

1 Data element is for existing conditions unless otherwise noted.

# Traffic Forecasting Methodologies

* Existing conditions traffic volumes for study periods will be developed from traffic counts, vehicle classification data and origin-destination data obtained for this project. **Modify or add to the methodology for developing existing condition traffic volumes as appropriate.**
* Traffic forecasts for design year (year 20XX) No-Build and Build conditions will be provided by source. Forecasts will be based on state the Travel Demand Model(s) to be used and the horizon year for the Travel Demand Model(s), and will utilize existing conditions turning patterns, vehicle classification data and origin-destination data as appropriate. **Modify or add to the methodology for developing design year forecasts as appropriate.**
* Traffic forecasts for opening year Build conditions will be provided by source. State the methodology for developing opening year forecasts.
* Traffic forecasts for interim year Build conditions will be provided by source. State the methodology for developing interim year forecasts. **Remove this bullet if not included for the traffic operational analysis.**

# Operational Analysis Methodologies

Operational analysis of locations within the area of influence will be completed using list software and software version to be used for the operational analysis for the scenarios/periods outlined in [Section 3.1](#_Operational_Analysis_Years/Scenario). **Provide a description of the software as appropriate. (Examples: HCS 7 is a computerized analytical tool that replicates the operational analysis procedures of the Highway Capacity Manual, 6th Edition. Vissim is a microscopic simulation (microsimulation) software that models individual vehicles and their behavior based on algorithms for specific driving tasks such as car following and lane changing.)**

## Software Input Assumptions and Methodologies

Data, forecasts and conceptual layouts obtained will be used for inputs of geometry, traffic control, traffic volumes and travel speeds.

**Provide details on input assumptions specific to each software. These details typically answer the following questions as appropriate:**

* **How will unique geometric features be evaluated?**
* **What coding protocols or guidelines will be used to code geometry in microsimulation tools?**
* **How will terrain/grades be accounted for in the evaluation?**
* **Are there any planned improvements within the area of influence that will be accommodated in future year evaluations (No-Build and Build)?**
* **What will be used to update geometry for Build conditions (including any interim conditions)?**
* **How will peaking or variations of traffic demand during the analysis period be accommodated?**
* **How will fleet composition be developed?**
* **What type of vehicle routing (static vs. dynamic; all vehicles vs. by class) will be used for analysis completed with microsimulation?**
* **How will free-flow speeds or speed profiles vary throughout the area of influence or vary by vehicle class?**
* **What types of adjustments to traffic control will be made for future year evaluations?**
* **What types of driver behavior assumptions will be used?**
* **What range of distances will be used for driver reaction distances in microsimulation models?**

**Note: There are many other input assumptions not captured in the above list of questions that may be of importance to review with the Advisory Group. The user should include all relevant input details to review with the Advisory Group.**

**For projects including microsimulation analysis, state that the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document will be used for data collection methodologies and model development. Provide a hyperlink to the document located on Iowa DOT’s website (the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document is linked in the following section for reference).**

## Reporting of Operational Analysis Results

Detail the results that will be reported from each software.

**The user should provide an outline of all results that will be reported from the operational analysis. This may vary between different software, as may be the case between using deterministic tools versus microsimulation tools. For deterministic software such as Highway Capacity Software (HCS) and Synchro, density/delay, level of service (LOS) and queuing are appropriate performance measures to be reported. For microsimulation software, a number of other performance measures may be desired based on the goals and objectives of the project. Some common performance measures reported from microsimulation analysis include:**

* **Volume throughput and percentage of demand served**
* **Speed**
* **Travel time**
* **Queue length**
* **Duration of congestion**
* **Density/Level of Service (LOS)**
* **Delay/LOS**

**For projects using microsimulation analysis, the user should consult the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document for guidance on reporting results.**

## Microsimulation Model Calibration and Number of Runs

**This section is only applicable for projects that include microsimulation modeling. For projects that do not include microsimulation modeling, delete this section (including the section heading).**

Data and field observations will be used to calibrate the existing conditions microsimulation models. The procedures outlined in the [Iowa DOT Microsimulation Guidance](https://www.iowadot.gov/ijr) document will be used for model calibration and to determine the number of model runs to complete for each model. Models will be calibrated to match the targets listed in **Table 6‑1**. To achieve model calibration, parameters within the model will be adjusted based on the value ranges listed in **Table 6‑2**. Ten model runs are estimated to be completed for each model to produce a 95% confidence of achieving results within a maximum tolerable error of 10% of the average for a given performance measure. The number of model runs will be verified or updated using the procedures outlined in the [Iowa DOT Microsimulation Guidance](https://www.iowadot.gov/ijr) document.

* **The user should state any specific procedures for data collection and calibration that differ from those outlined in the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document.**
* **The calibration items and targets listed in Table 6-1 are from the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document. The user should update Table 6-1 to match the proposed calibration methods on their project as appropriate.**
* **The calibration parameters and ranges listed in Table 6-2 are from the** [**Iowa DOT Microsimulation Guidance**](https://www.iowadot.gov/ijr) **document, and are based on Vissim microsimulation software. The user should update Table 6-2 to match the proposed calibration methods on their project as appropriate.**
* **The user should provide any other model calibration processes or methodologies that will be used on their project.**

Table ‑. Calibration Items and Targets

| Calibration Item | Calibration Target |
| --- | --- |
| **Volume Throughput** | |
| Individual movement flows ≤ 700 veh/hr | Within 100 vehicles of field data for more than 85% of movements in model area |
| Individual movement flows between 700 and 2,700 veh/hr | Within 15% of field data for more than 85% of movements in model area |
| Individual movement flows > 2,700 veh/hr | Within 400 vehicles of field data for more than 85% of movements in model area |
| Capacity | Within 10% of field data at locations experiencing congestion |
| **Speed** | |
| Link speed | Within 10 mph of field data for more than 85% of network links |
| **Travel Time** | |
| Field travel times ≤ 7 minutes | Within 1 minute of field data for more than 85% of travel time segments |
| Field travel times > 7 minutes | Within 15% of field data for more than 85% of travel time segments |
| **Queues** | |
| Queues formed in free flow areas | All locations with formed queues are modeled |
| Queue length | Within 20% of field measured queue length |
| **Congestion** | |
| Duration of congestion | Within 15 minutes from the beginning and end of congestion |

Source: [Iowa DOT Microsimulation Guidance](https://www.iowadot.gov/ijr), October 2017.

Table ‑. Vissim Global Calibration Parameters and Value Ranges

| Calibration Parameter\* | Default | Value Range | |
| --- | --- | --- | --- |
| Basic Segment | Merge/Diverge/ Weave |
| **Freeway Car Following (Wiedemann 99)** | | | |
| CC0 Standstill Distance | 4.92 ft | >4.00 ft | >4.92 ft |
| CC1 Headway Time | 0.9 s | 0.7 to 3.0 s | 0.9 to 3.0 s |
| CC2 ‘Following’ Variation | 13.12 ft | 6.56 to 22.97 ft | 13.12 to 39.37 ft |
| **Arterial Car Following (Wiedemann 74)** | | | |
| Average Standstill Distance | 6.56 ft | >3.28 ft | |
| Additive Part of Safety Distance | 2.00 | 1 to 3.5 | |
| Multiplicative Part of Safety Distance | 3.00 | 2 to 4.5 | |
| **Lane Change** | | | |
| Maximum Deceleration | -13.12 ft/s2 (Own)  -9.84 ft/s2 (Trailing) | < -12 ft/s2 (Own)  < -8 ft/s2 (Trailing) | |
| -1 ft/s2 per Distance | 200 ft (Freeway)  100 ft (Urban) | >100 ft (Freeway)  >50 ft (Urban) | |
| Accepted Deceleration | -3.28 ft/s2 (Own)  -1.64 ft/s2 (Trailing) | < -2.5 ft/s2 (Own)  < -0.5 ft/s2 (Trailing) | |
| Min. Headway (Front/Rear) | 1.64 ft | 1.5 to 6 ft | |
| Safety Distance Reduction Factor | 0.6 | 0.1 to 0.9 | |
| Max. Deceleration for Cooperative Breaking | -9.84 ft/s2 | -32.2 to -3 ft/s2 | |
| Overtake Reduced Speed Areas | Not checked | Depends on field observations | |
| Cooperative Lane Change | Not checked | Depends on field observations (should be checked in most freeway merge/diverge/ weave areas) | |
| Maximum Speed Difference | 6.71 mph | <20 mph | |
| Maximum Collision Time | 10.00 s | <15 s | |
| **Link Connector** | | | |
| Emergency Stop | 16.4 ft | ≥16.4 ft (Depends on field observations) | |
| Lane Change | 656.2 ft | ≥656.2 ft (Depends on field observations) | |
| per lane | Not checked | Depends on field observations | |

Source: [Iowa DOT Microsimulation Guidance](https://www.iowadot.gov/ijr), October 2017.

# Safety Analysis Methodologies

Safety analysis of locations within the area of influence will be completed for the scenarios/periods outlined in [Section 3.2](#_Safety_Analysis_Scenarios). The methodologies and procedures outlined in the [Iowa DOT Data Driven Safety Guidance](https://www.iowadot.gov/ijr) document will be used to complete the safety analysis. A summary of safety analysis to be completed on this project are outlined below.

Existing crash analysis will be completed by summarizing the obtained historical crash data through the following:

* Calculate crash rates for each mainline segment and intersection, and compare to statewide averages.
* Identify crash trends by type/manner of crash and cause of crash.
* Detailed review of any crashes resulting in a fatality.

**Add to the above bullet list based on the project goals and objectives as appropriate. The** [**Iowa DOT Data Driven Safety Guidance**](https://www.iowadot.gov/ijr) **document should be used to identify other performance measures that may be appropriate.**

Predictive crash analysis will be completed using state the tool(s) or resource(s) that will be used. The predictive crash analysis will summarize:

* Performance measure.

**Provide a list of the performance measures that will be used to summarize the predictive crash analysis results. The** [**Iowa DOT Data Driven Safety Guidance**](https://www.iowadot.gov/ijr) **document should be used to identify performance measures that may be appropriate.**

# Geometric Design Criteria

Geometric design criteria will be documented using the electronic form from the [Iowa DOT Design Manual, Section 1C-1](https://iowadot.gov/design/dmanual/01c-01.pdf) for each roadway type within the area of influence.

**List additional resources that will be used in the development of design criteria, such as the Iowa DOT adopted versions of the American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets or AASHTO Policy on Design Standards Interstate System, Highway Capacity Manual, or local City/County design standards. Provide any guiding principles or key features that will support development of the design criteria.**

# Anticipated Design Exceptions

Description of anticipated design exceptions

**Provide descriptions of anticipated design exceptions. If no design exceptions are anticipated, provide a statement similar to, “No design exceptions are anticipated at this time based on current information.”**