



User Guide: Interactive Online Map

Value of Dedicated Right-of-Way

June 2025

Report Number: 2025-01G



INTERACTIVE ONLINE MAP - USER GUIDE

Welcome!

This guide will help you explore and use the Interactive Online Map developed to assess transit service reliability in the Minneapolis–Saint Paul (Twin Cities) metropolitan area in Minnesota, U.S. The map also shows estimated improvements in travel time reliability that could result from implementing dedicated bus lanes and busways.

Whether you're a transit planner, researcher, or simply curious about how public transit performs in the Twin Cities, this guide will show you how to navigate the mapping application with ease.

Access the map here: [Interactive Map Link](#)

Getting Started

The online map is organized into four main sections, or “tabs”, each offering a different way to explore transit reliability and potential improvements:

1. Introduction

Learn about the purpose of the project and access the full research report. This tab provides context for how and why the tool was developed.

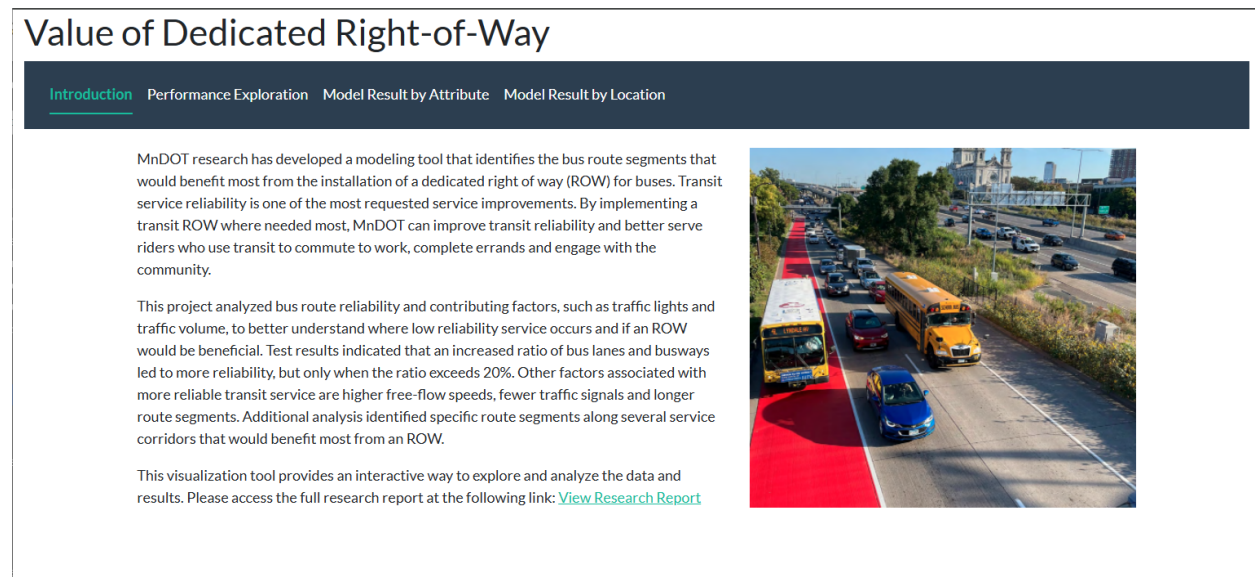


Figure 1 The Introduction tab with project summary and report link

2. Performance Exploration

Explore how different roadway segments perform by selecting them on the map. You'll be able to view key measures such as median bus speed and travel time variability, and explore attributes of segments such as road type, service frequency, and presence of transit right-of-way (ROW). The map can identify areas that could benefit from dedicated bus lanes or busways.

How to use it:

- Use the drop-down menus to choose different types of roads (such as state roads).
- Use the map on the left to select road segments.
- The chart, the result map, and the attribute table will update automatically with information about your selected segments.

You can see key performance measures:

- Bus median speed
- Reliability of bus travel times

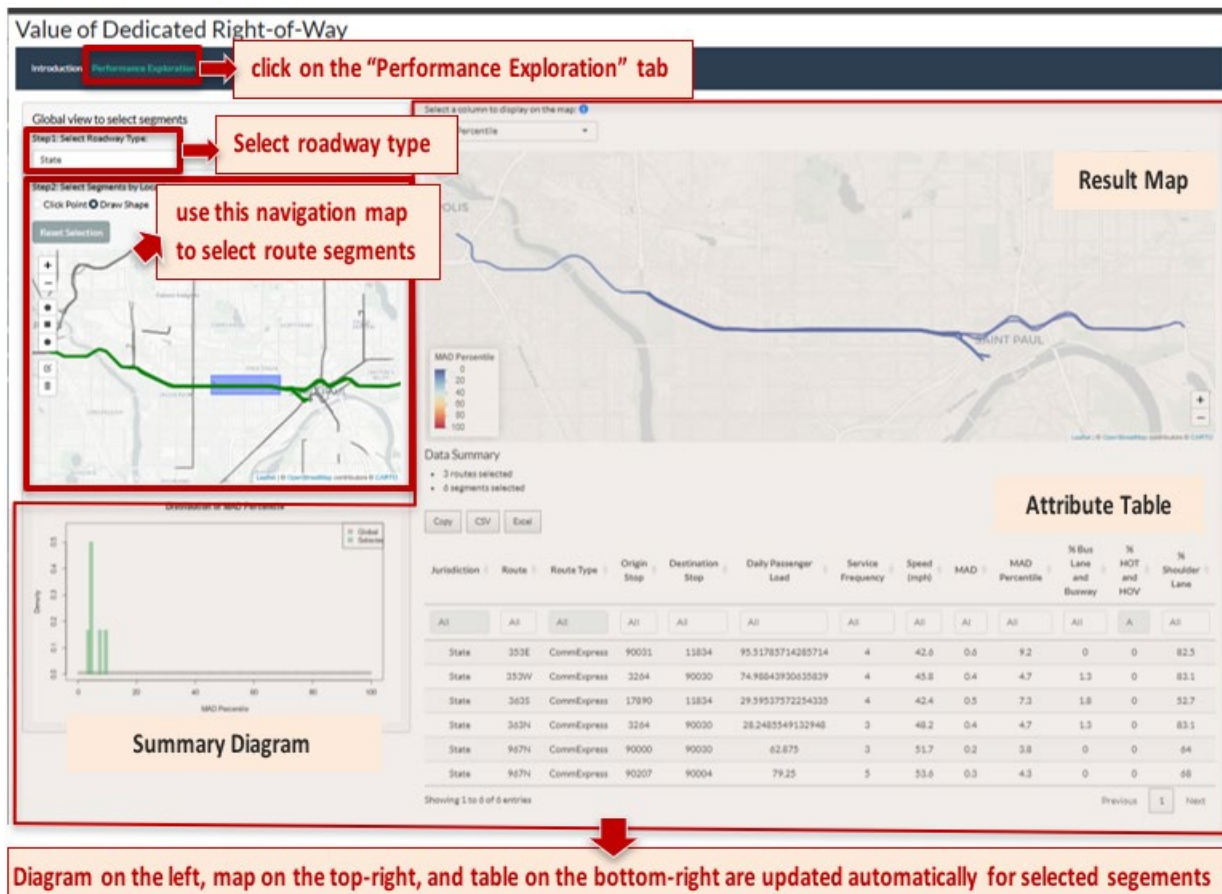


Figure 2 The Performance Exploration tab showing selected segments and metrics

3. Model Results by Attribute

Focus on individual bus routes. You can type in a route number or choose from the route list to see how performance varies along that route and which segments may benefit most from dedicated bus lanes or busways. You can also select multiple routes to compare their performance side by side.

How to use it:

- Type in bus route numbers or pick them one by one from the list.
- The summary list, the result map, and the charts will update with information about those routes.
- You can click on a specific segment on the result map to explore its properties.

You can see :

- Whether and how performance varies across segments along routes.
- How much more reliable the travel time could become with improvements.
- Which segments of the route would benefit the most.

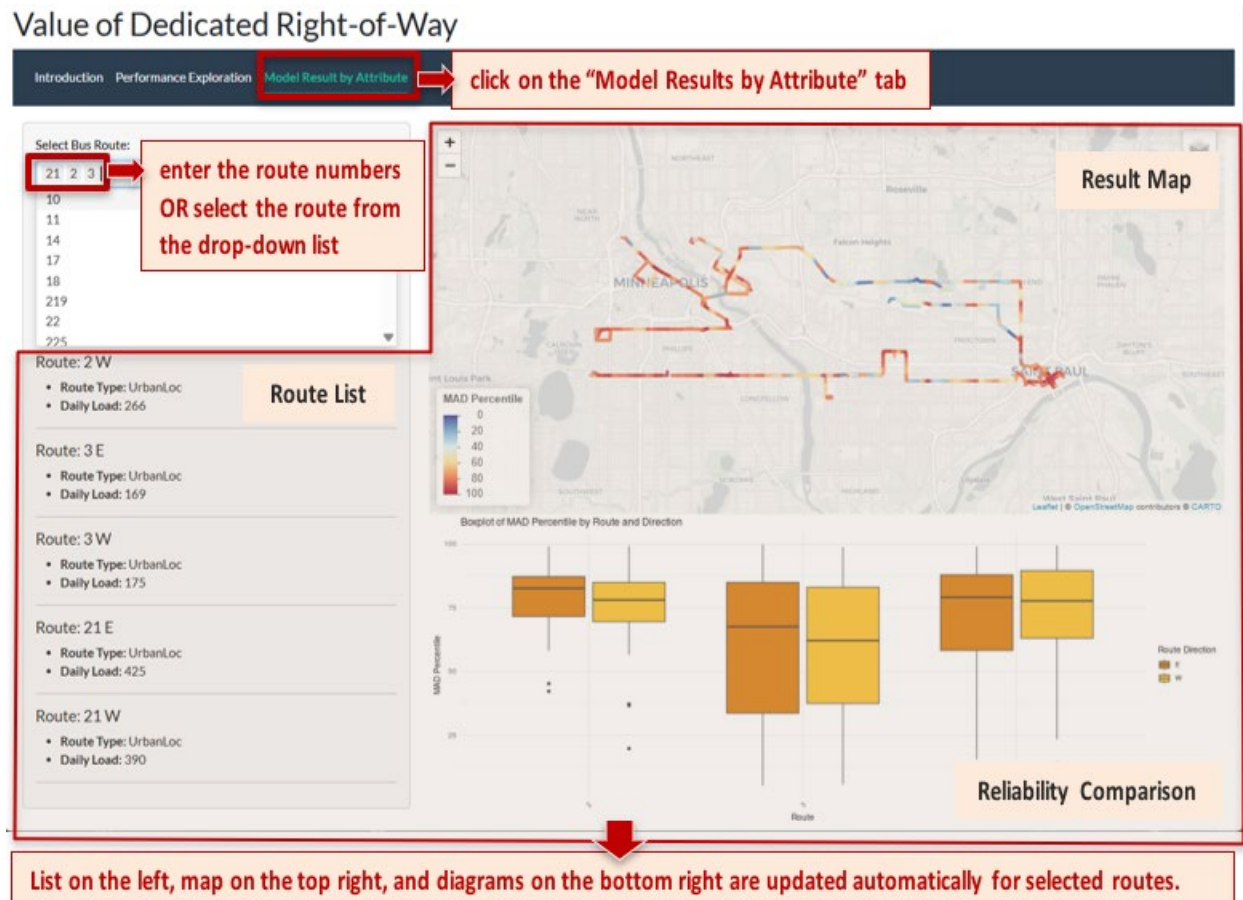


Figure 3 The Model Results by Attribute tab showing route-based reliability analysis

4. Model Results by Location

Select specific locations or areas on the map – by clicking points or drawing shapes – to examine current bus service reliability and potential improvements from dedicated bus lanes or busways.

How to use it:

- Click on the navigation map or draw a shape to select segments in an area.
- The charts, the result map, and the attribute tables will update to show information for segments in your selected area.
- You can click on a specific segment on the result map to explore its properties.
- You can filter results, compare values, and even export the data in the attribute table.

You can see :

- Whether and how performance varies across segments within the area of interest.
- How much more reliable the travel time could become with improvements.
- Which segments of the route would benefit the most and their specific locations and features.

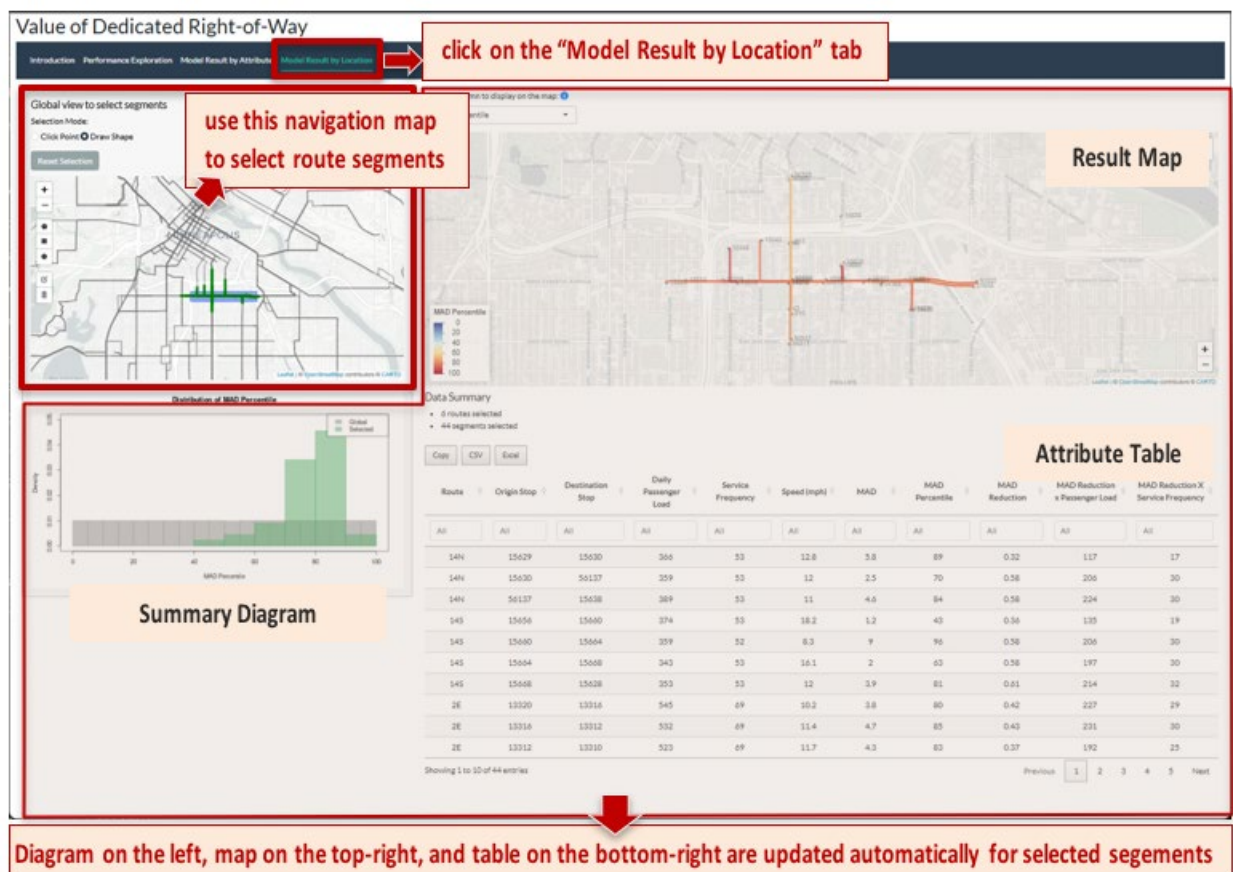


Figure 4 The Model Results by Location tab showing location-based reliability analysis

Understanding Contents on the Map

1. Road Type

In the Performance Exploration tab, you can filter roadway segments based on their ownership. Here's a brief guide to the road types you'll see:

- **State Roads:** Interstates, U.S. and Minnesota highways, and other roads maintained by the state.
- **County Roads:** County highways and roads maintained at the county level.
- **City Roads:** Municipal streets and local connectors managed by cities.
- **Other Roads:** Private roads with public access, airport roads, and non-trafficways.

These categories help you focus your exploration on specific road types and identify the most appropriate transit improvement strategies for each type.

2. Bus Service Type

The Twin Cities metro area offers a range of bus service types to meet the needs of communities and their various trip purposes. Here's a quick overview of the four main types included in the map:

- **Urban Local:** Frequent, all-day service with many stops along key corridors, primarily within the cities of Minneapolis and Saint Paul.
- **Bus Rapid Transit (BRT):** Enhanced service with faster boarding and transit priority features.
- **Commuter Express:** Typically peak-only service that connects suburbs to downtowns via highways with limited stops; with a few routes with all-day service connecting Minneapolis and Saint Paul.
- **Suburban Local:** Routes serving lower-density areas with less frequent service and more coverage-oriented design.

These service types support different rider needs, from quick urban trips to long-distance commuting, and are a key part of the region's transit network strategy.

3. Dedicated Transit Right-of-Way (ROW)

The Twin Cities metro areas use several types of dedicated lanes and transitways to improve bus and rail service. Here's a quick overview of the four types included in the map:

- **Bus Lanes:** Special lanes just for buses, usually next to the curb or between parked cars and traffic (e.g., peak-hour bus-only-lanes along Hennepin Avenue in downtown Minneapolis)
- **Busways:** Entire roadways used only by buses (e.g., Nicollet Mall in downtown Minneapolis).
- **Shoulder Lanes:** Allow buses to drive on highway shoulders when traffic is slow (typically below 35 mph) (e.g., bus-on-shoulder along I-35W and I-94).
- **HOT/HOV Lanes (High-Occupancy Toll/Vehicle):** Let buses and carpools travel for free while solo drivers pay a toll (e.g., MnPASS lanes on I-394 and I-35W).

These dedicated transitways play a key role in reducing travel delays and improving service reliability across the Twin Cities metro area. The remaining two tabs provide estimated improvements in travel time variability resulting from the implementation of bus lanes or busways.

4. Performance and Estimation Metrics

The map includes a set of key metrics used to assess transit reliability and estimated improvements from dedicated bus lanes or busways. Below is a summary of each metric in the map:

- **MAD (Median Absolute Deviation):** The primary service reliability metric used in this study. MAD is calculated as the median absolute deviation from the median of normalized bus travel times (in seconds per 100 meters) for each route segment.
- **Median Percentile** (default setting): Indicates how a segment's MAD compares to others in the network. For example, a value of 90% means the segment's MAD is higher than 90% of all other segments in the study area.
- **Speed:** The median operating speed (in miles per hour) of buses along each segment, based on observed travel times and segment lengths.
- **MAD Reduction:** The estimated decrease in MAD after implementing bus lanes or busways, based on a trained Gradient Boosted Tree (GBT) model. Higher values suggest greater reduction in travel time variability and improvement in service reliability.
- **MAD Reduction × Ridership:** Combines the estimated MAD reduction with the average passenger load to highlight segments where more riders would benefit from improved reliability.
- **MAD Reduction × Service Frequency:** Combines the estimated MAD reduction with the average number of daily trips, identifying segments with potentially greater overall system impact.

These metrics are summarized within the map interface while being explained in detail above to support interpretation and informed decision-making.

Understanding the Map Tools

1. Metric Selection and Visualization

In each of the three result map tabs, you can select a specific performance metric from a drop-down list to visualize on the map. Once selected, the map will display segment-level results based on the chosen metric, and the summary diagram on the left will update automatically to reflect the current selected metric. Please refer to Figures 2, 3, and 4 for the layout of each tab.

For your convenience, a small info icon is provided next to the drop-down menu, allowing you to view a concise definition of each metric. For more detailed descriptions, please refer to the [Error! Reference source not found.](#) section above.

The screenshot shows the 'Select Attribute to Display' dialog box with the following content:

Select Bus Route: 21 2 3

Select Attribute to Display: [Info icon]

Attributes list:

- MAD Percentile
- MAD
- MAD Percentile** (highlighted)
- Speed (mph)
- MAD Reduction
- MAD Reduction X Passenger Load
- MAD Reduction X Service Frequency

Route type: UrbanLoc

Daily Load: 266

Annotations:

- Click on the icon for the explanations of attribute in the list
- Choose one attribute from the list to be shown in the map and diagrams

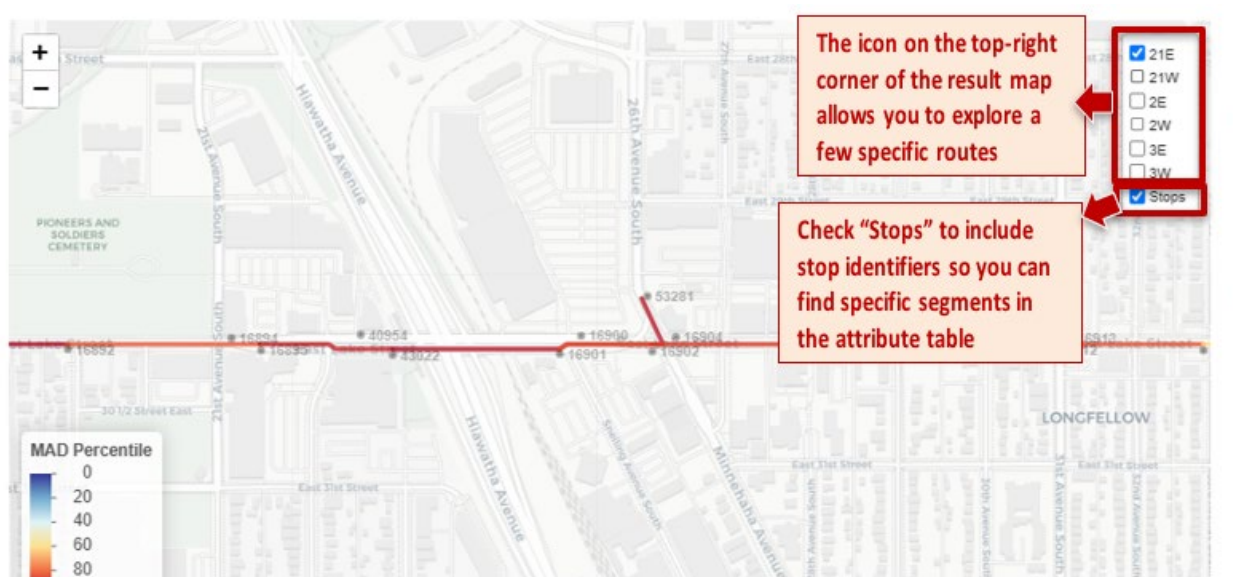
Explanation of Attributes:

- MAD:** Median Absolute Deviation of normalized bus travel time (in seconds per 100 meters). Lower values indicate more reliable service.
- MAD Percentile:** Percentile ranking of MAD relative to all segments.
- Speed:** Median bus speed in miles per hour.
- MAD Reduction:** Estimated Reduction in MAD with a dedicated ROW. Negative values indicate a reduction in MAD and an improvement in service reliability.
- MAD × Passenger Load:** Estimated MAD Reduction weighted by average passenger load along the segment.
- MAD × Service Frequency:** Estimated MAD Reduction weighted by service frequency.

2. Route and Stop Layer Controls

In each of the three result map tabs, you can control which routes are displayed by clicking the “layers” icon in the top-right corner of the map. Use the checkboxes to show or hide individual routes—only the selected layers will appear on the map.

An additional layer is included for stop identifiers (typically five-digit numbers), allowing you to identify specific segments between stop A and stop B, as referenced in the attribute table. This helps users match mapped segments with data records more easily.



3. Select Segments by Location – Click Point

This tool allows users to interactively select route segments by clicking directly on the map.

Steps:

- Activate the “Click Point” mode before beginning.
- Zoom in on the navigation map to your area of interest and locate the targeted segments.
- Click on any point along a route segment to select it. All segments passing through the clicked location will be included.
- Repeat as needed to add additional segments in the area.
- Use the “Layers” icon in the top-right corner of the map to show or hide segments by route for easier viewing and comparison.
- Click “Reset Selection” to clear all selected segments before starting a new selection.

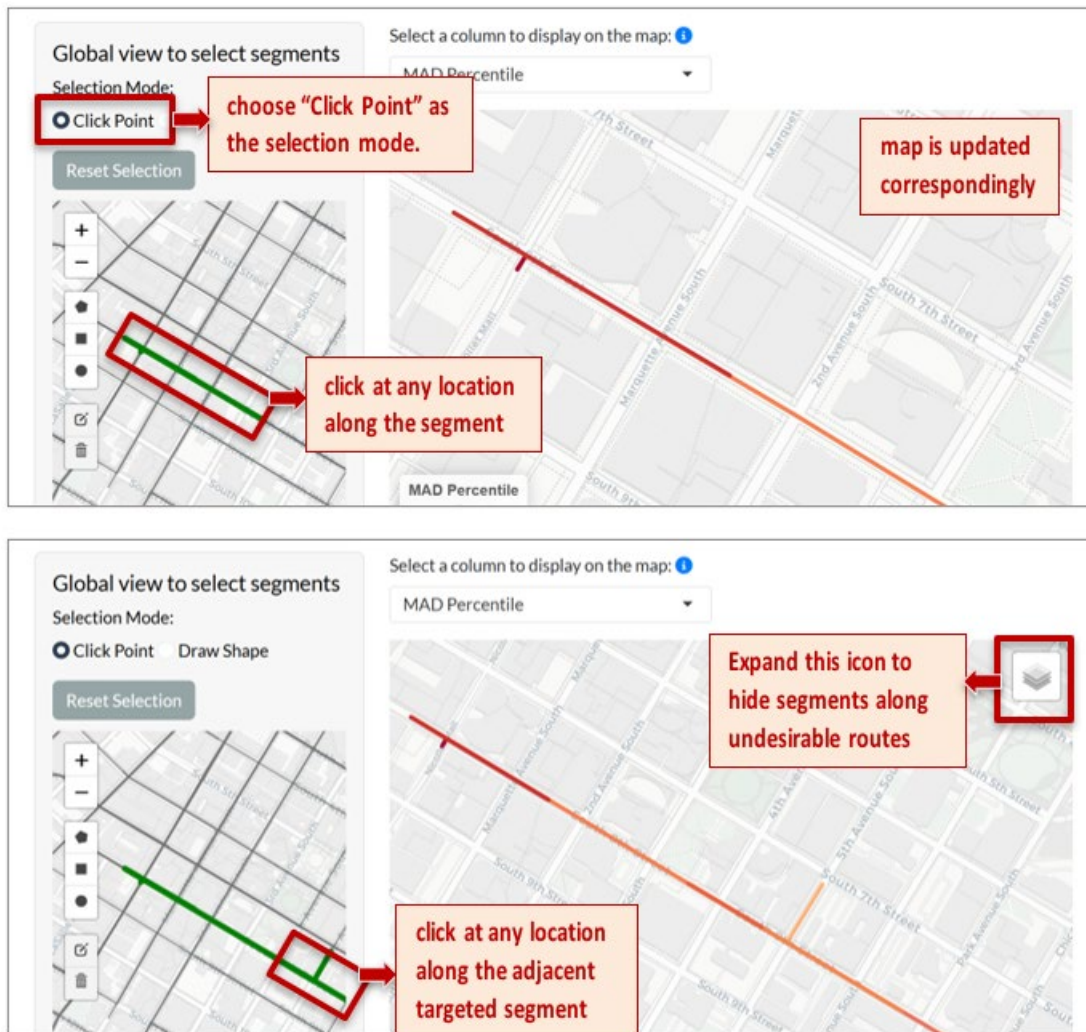


Figure 7 Selecting Segments by Location: Click-Based Method

4. Select Segments by Location – *Draw Shape*

This option allows users to select route segments by drawing a shape over the area of interest.

Steps:

- Activate the “Draw Shape” mode before starting.
- Zoom in on the navigation map to your area of interest, using the base map as a visual guide.
- Choose a shape type – freeform polygon, square, or circle.
- Draw the shape by clicking to create vertex points. Continue clicking, then click Finish to complete the shape. You can also delete the last point if needed during the process.
- Edit the shape (if needed) by clicking the Edit icon. Move or adjust vertex points, then click Save to apply the changes. The map on the right will update automatically to reflect the new selection.
- Use the “Layers” icon in the top-right corner of the map to show or hide segments for specific routes, as in the Select by Attribute tab.
- When done, click “Clear All” to remove drawn shapes and click “Reset Selection” to begin a new selection process.

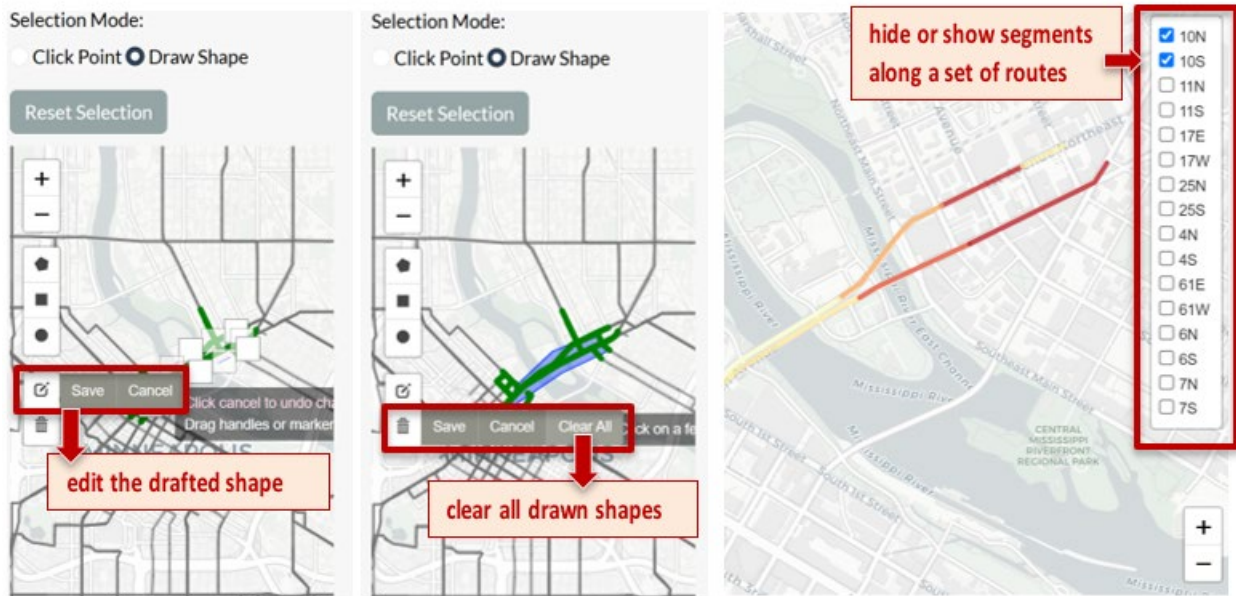
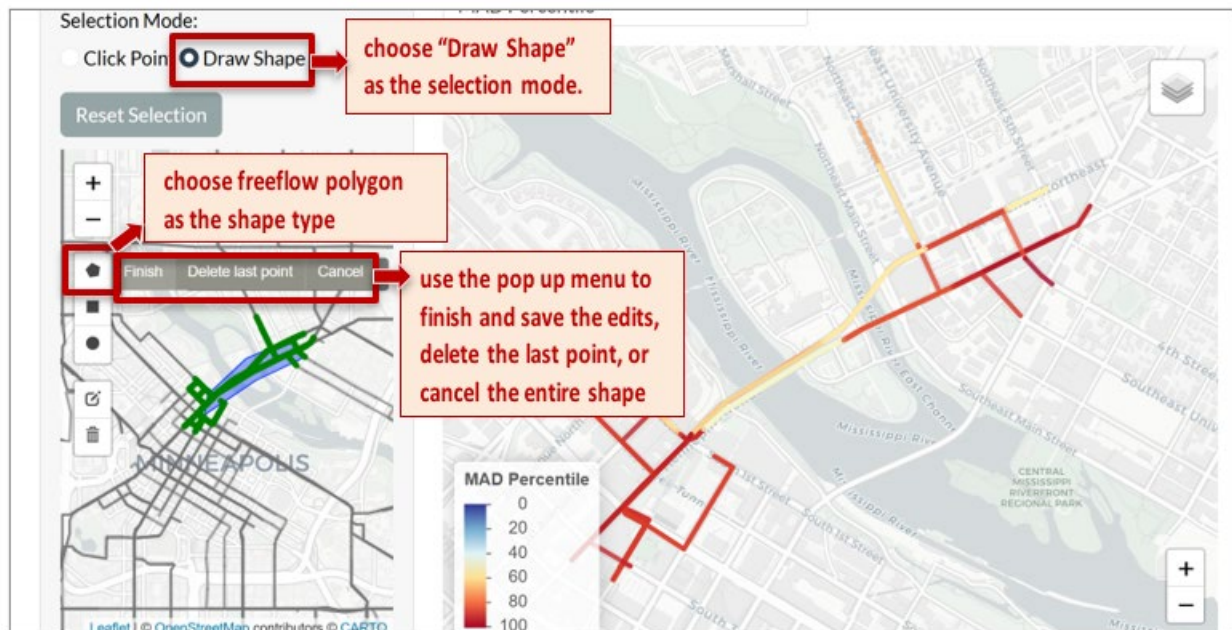


Figure 8 Selecting Segments by Location: Shape-Based Method

5. Table of Segment Attributes

The table on the bottom-left displays attribute values for all selected segments. Users can explore key performance and estimation metrics to identify segments with the greatest potential improvements from implementing dedicated bus lanes or busways.

We highlight several key features of the table with examples below.

Features and Steps:

- *Sort Values*

Click on a column header to sort records. For example, sorting MAD Change in ascending order reveals segments with the greatest potential reductions in travel time variability.

- *Highlight Records*

Click to select or deselect rows in the table. Selected rows are highlighted in blue. For example, segments between Stop #15559 and Stop #15562 across multiple routes show substantial MAD reductions after implementing dedicated bus lanes or busways.

- *Filter by Attributes*

Use the filter boxes below column headers to refine the displayed records.

✓ Enter “15559 ... 15559” in the Origin Stop column to view all segments from Stop #15559.

✓ Enter “10S” in the Route column to focus on segments along Route 10S.

This reveals that Route 10S includes four consecutive segments – from Stop #15559 through Stops #15563, #17916, #17917, to #17976 – with the highest combined benefit due to high ridership and frequency.

- *Export Table Records*

Click the export options to save selected records as CSV or Excel files for further analysis or reporting.



Figure 9 Identifying High-Impact Segments with Table Filters

Getting the Most Out of the Tool

You're almost ready to dive in—here are a few final tips to help you get the most out of the app:

- Start simple: Try selecting a few segments on a familiar route to see how reliability varies.
- Compare areas: Use the Shape-Based Method to compare different neighborhoods or corridors.
- Toggle layers: Use the layer icon to focus on just one or two routes and show stop IDs – this helps avoid missing information when layers overlap and trace exact route segments.
- Mix and match: Combine filters, maps, and tables to uncover patterns in transit performance.
- Export what matters: Save your filtered table as a CSV or Excel file and take screenshots of result maps to save or share your findings.

This tool is all about helping you discover where better bus infrastructure could make a real difference. Explore, experiment, and see what insights you can uncover!

Acknowledgments

The interactive online map is part of the research project funded by the Minnesota Department of Transportation (MnDOT) under Contract #1036342, Work Order #95.

You can learn more about the project online via the [Research Summary published by MnDOT](#).

Document Version and Updates

Version: 1.0

Date: May 2025

This user guide will be updated to reflect new features, data updates, and improvements to the transit reliability interactive map application. Please check the [GitHub repository](#) for this app to access the latest version or contact the research team at yingsong@umn.edu if you have any questions or feedback.

A Note on the Data

The estimated improvements shown in this tool are based on a Gradient Boosting Tree (GBT) model trained using transit data collected between January 2022 and April 2023. As a result, the results may not reflect more recent transitway developments or service schedule changes.

Please use this tool as a reference to help identify candidate locations for dedicated transit right-of-way (ROW) improvements. Final planning decisions should be based on more detailed, case-specific analysis and should also consider local policies, community input, and planning priorities.