MIAMI-DADE
TRANSPORTATION PLANNING ORGANIZATION
SMARTER Mobility Today & Tomorrow

SMART CONGESTION MANAGEMENT DASHBOARD

Final Report

July 30, 2021

RENAISSANCE PLANNING

HNTB

URBANSDK

SMART Plan Dashboard

Miami-Dade Transportation Planning Organization

July 2021

Executive Summary

The Miami-Dade Transportation Planning Organization (TPO) has developed a SMART Congestion Management Dashboard (CMD) to track and report historical and real-time mobility travel data in Miami-Dade County to accelerate and support the decision-making process for the Strategic Miami Area Rapid Transit (SMART) Plan. This is part of the ongoing Congestion Management Process (CMP) required by the Federal Highway Administration as part of the continuing metropolitan planning process. The dashboard is a web-based platform coordinating data efforts with the Florida Department of Transportation (FDOT), Miami-Dade County, Local governments, and stakeholder groups to provide user-friendly congestion management information access and easier reporting tools on the transportation network. The information from the dashboard will also be used to monitor SMART Plan benefits on the transportation network and will align strategies, objectives and investments within the region to ensure resources are dedicated to reducing congestion within the metropolitan area.

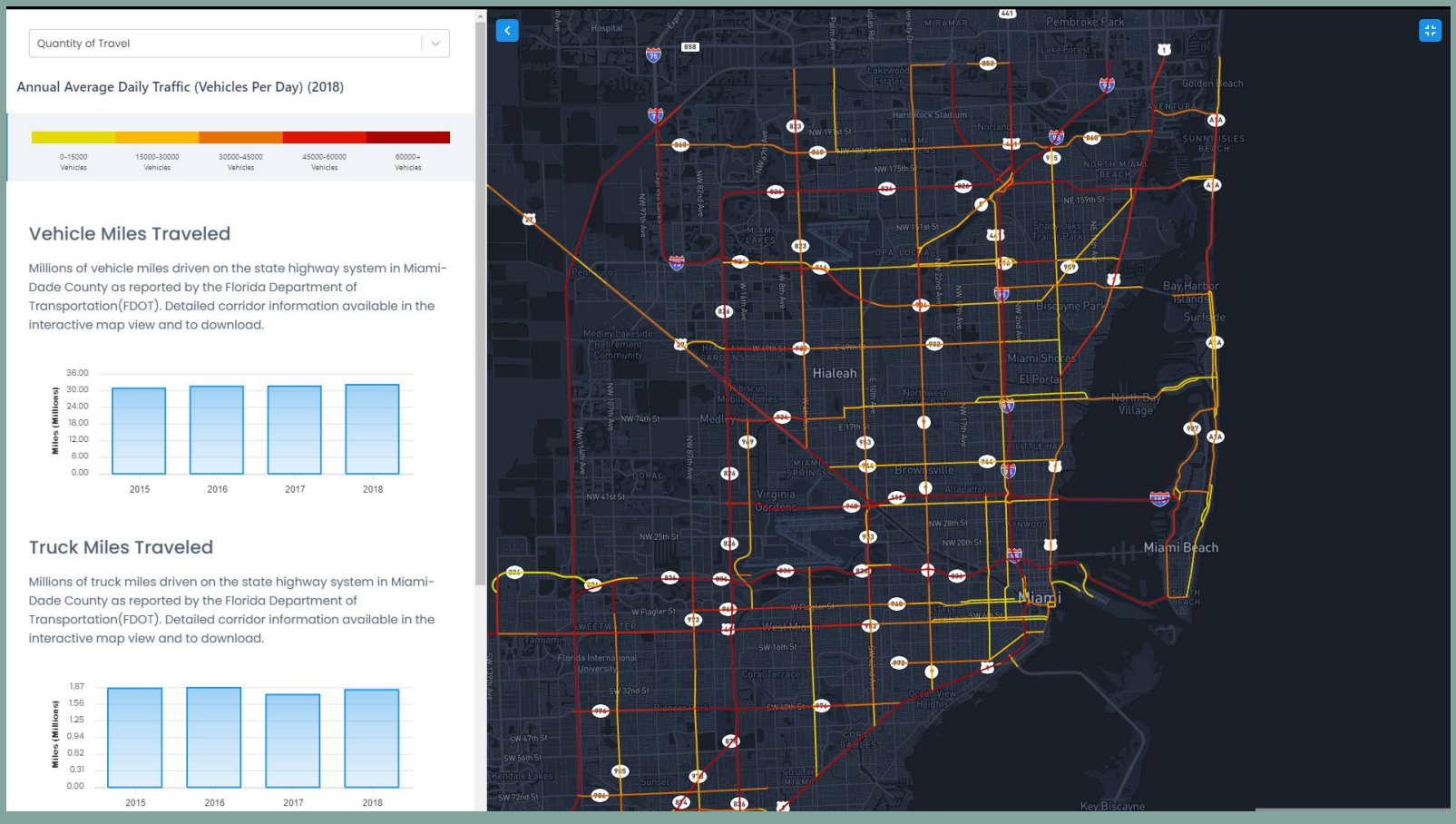
A review of peer agency dashboards was performed to help identify candidate measures for inclusion in the dashboard. Stakeholders were surveyed to rank the candidate measures in order of importance. A framework of the dashboard was developed and four Project Working Group meetings were conducted to help further refine development of the dashboard. The following sections provide an overview of measures reported on the dashboard, and how these are reported numerically and graphically.

SMART Congestion Management Dashboard

Miami-Dade Transportation Planning Organization

Quantity of Travel

The dashboard reports quantity of travel for Miami-Dade County on the State Highway System. Vehicle, person, and truck miles traveled are available as reported by the FDOT Forecasting and Trends Office. Examples of how the data is displayed on the dashboard are shown below.

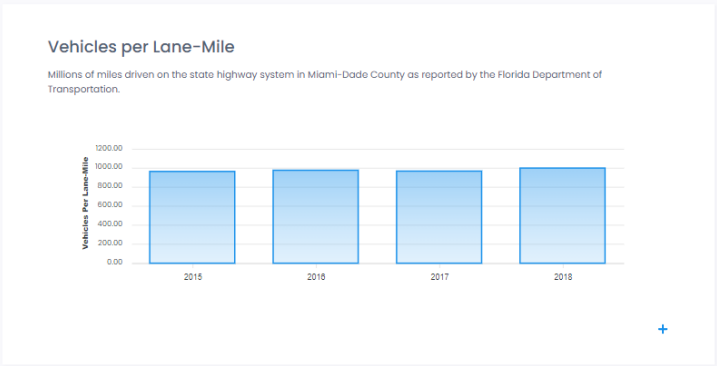


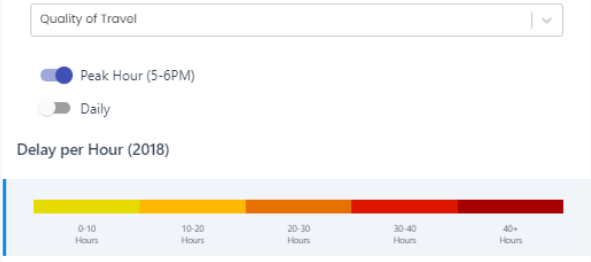
SMART Congestion Management Dashboard

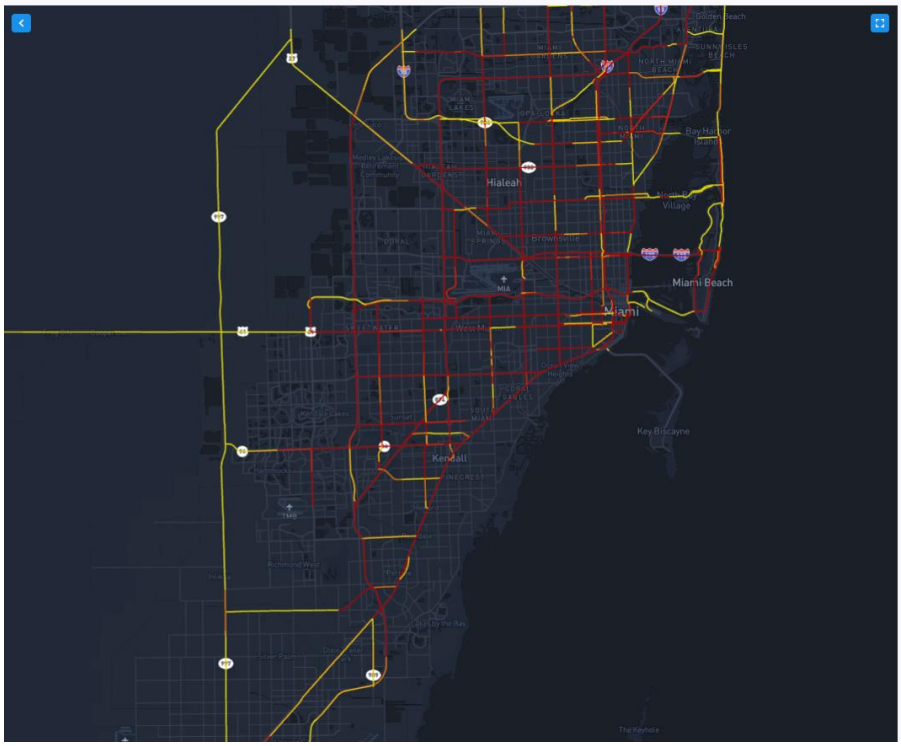
Miami-Dade Transportation Planning Organization

Quality of Travel

The dashboard reports on the quality of travel for Miami-Dade County on the State Highway System. These measures include the average speed, delay, hours congested, and reliability of the roadways. This data can be filtered by time of day and is shown graphically on a map view to help identify underperforming corridors.





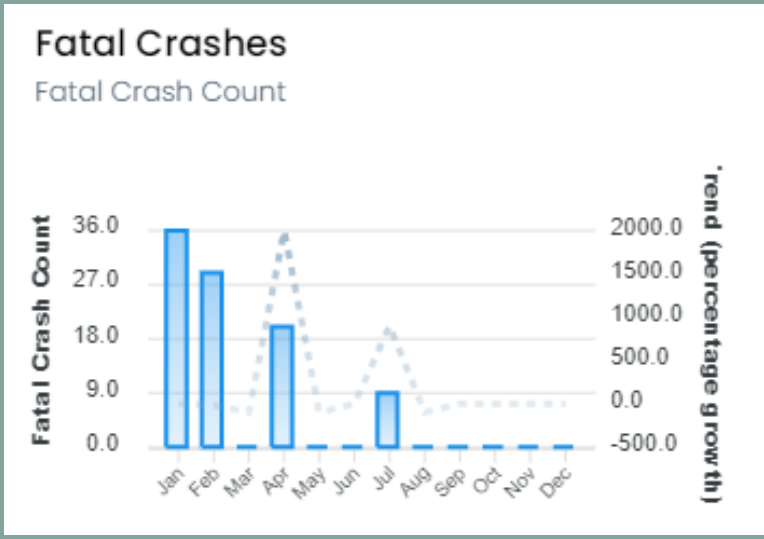


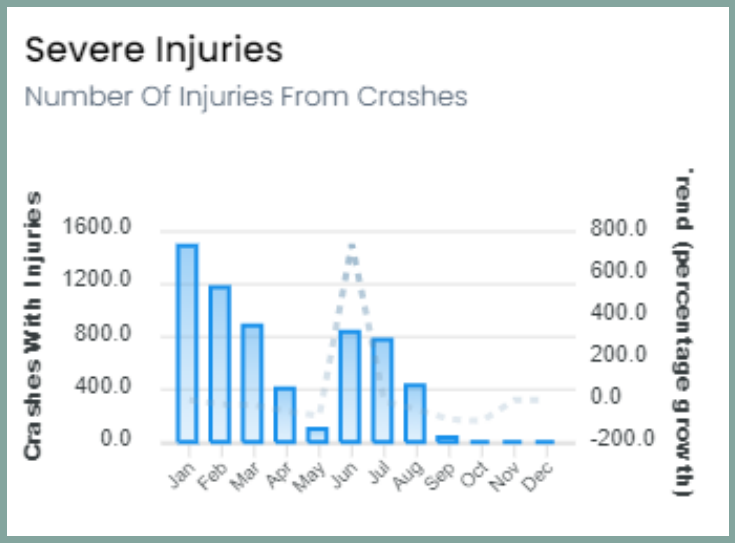
SMART Congestion Management Dashboard

Miami-Dade Transportation Planning Organization

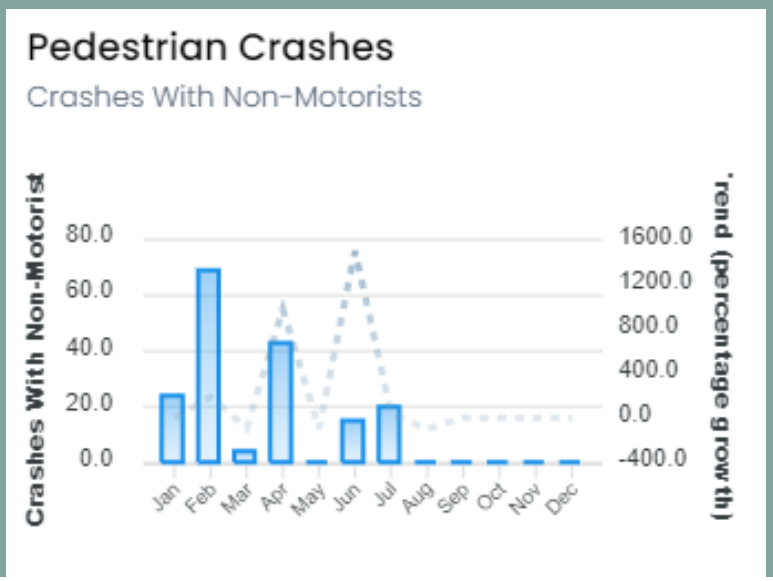
Safety

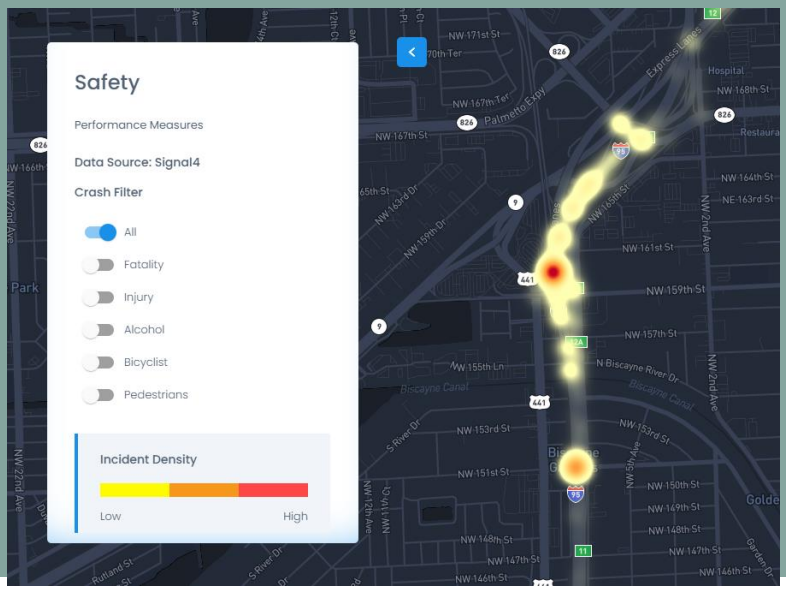
The safety performance measures help to assess fatalities and serious injuries on all public roads regardless of ownership or functional classification. The dashboard reports fatal and serious injury crashes for all modes of travel. The Signal4 database provides up-to-date data to analyze crashes by type on a monthly basis. A map view allows users to identify specific crashes by location and the ability to analyze hot spots and potential problem areas.





Performance Measure	2014	2015	2016	2017	2018
Total Crashes	60,165	63,451	64,070	65,986	64,627
Total Fatalities	280	339	294	285	293
Total Injuries	31,752	32,742	33,400	32,389	31,270





SMART Congestion Management Dashboard

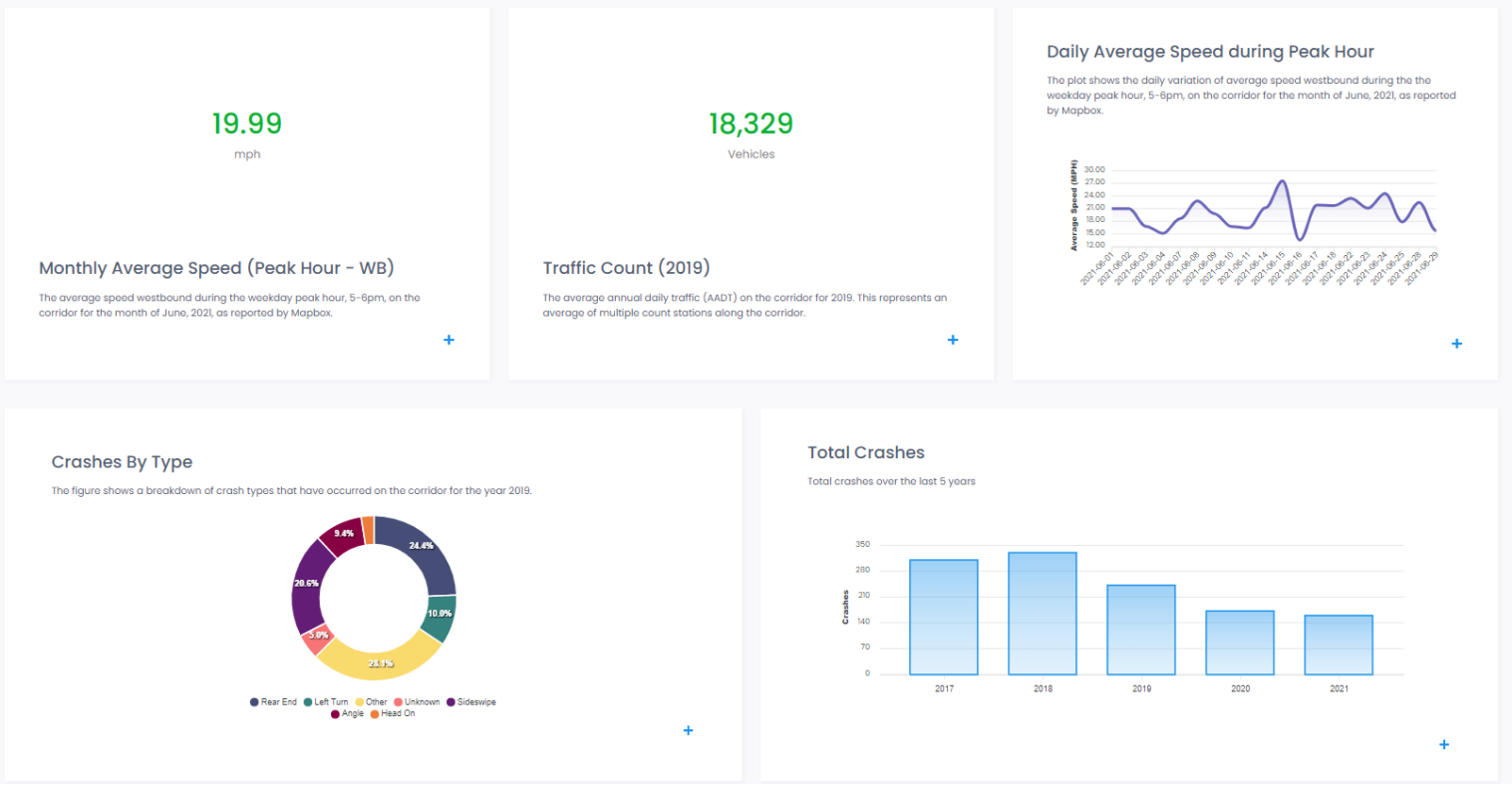
Miami-Dade Transportation Planning Organization

Smart Corridors

A connected and efficient multi-modal transportation system in Miami-Dade County is the backbone to a thriving economy. The Miami-Dade TPO has adopted a policy identifying the advancement of rapid transit projects, the Strategic Miami Area Rapid Transit (SMART) Plan, is its highest priority. The SMART Plan expands transit options in Miami-Dade County along six critical corridors:

- Beach Corridor: Highest tourist demand in region with major employment centers.
- East-West Corridor: Heaviest commuter travel for international, state and local businesses.
- Kendall Corridor: One of the most congested arterial roadways with the highest demand.
- North Corridor: Key regional mobility linkage for access to jobs, stadium and educational facilities.
- Northeast Corridor: High transit demand and part of a critical regional corridor stretching to Broward County.
- South Corridor: Experiencing the fastest population growth in Miami-Dade County.

The dashboard reports real-time performance measures for these six corridors with the ability to create dashboards for any user selected corridor. Reported performance measures include current and historical speeds, travel time reliability and incident information. An example along the Beach Corridor is shown below.



Contents

Figures

Tables

Disclaimer

The Miami-Dade TPO is not endorsing any manufacturers, products, or services cited herein and any trade name that may appear in the work has been included only because it is essential to the contents of the work.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the Miami-Dade TPO.

I. Introduction

Background

This project's purpose is to develop a SMART Congestion Management Dashboard (CMD) for the Miami-Dade Transportation Planning Organization (Miami-Dade TPO), which is the Metropolitan Planning Organization (MPO) for Miami-Dade County. The dashboard tracks and reports historical and real-time mobility travel data in Miami-Dade County to accelerate and support the decision-making process for the Strategic Miami Area Rapid Transit (SMART) Plan. This dashboard is part of the ongoing Congestion Management Process (CMP) required by the Federal Highway Administration as part of the continuing metropolitan planning process.

The dashboard is a web-based platform in coordination with the Florida Department of Transportation (FDOT), Miami-Dade County, Local governments, and stakeholder groups to provide user-friendly congestion management information access and easier reporting tools on the transportation network.

The information from the dashboard will also be used to monitor SMART Plan benefits on the transportation network and will align strategies, objectives and investments within the region to ensure resources are dedicated to reducing congestion within the metropolitan area.

Organization of this Report

This report provides the following

- Section II lays the policy and regulatory framework for the performance-based planning and the CMP
- Section III walks through the components of the dashboard
- Section IV provides conclusions and recommendations

II. Framework

FHWA Congestion Management Process

A Congestion Management Process, or CMP, involves routinely monitoring all modes of travel and activity on the transportation network and identifying effective solutions that mitigate the adverse impacts of congestion. The purpose of the CMP is to improve traffic operations and safety by aligning strategies, objectives, and investments to ensure resources are dedicated to reducing congestion within the Miami-Dade TPO planning boundary.

According to the Congestion Management Process: A Guidebook (FHWA, 2011), the Federal Highway Administration (FHWA) defines a CMP as "a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs." This guidebook includes an eight actions of a successful congestion management process. At a basic level, these actions must be implemented to comply with federal regulations. The federal eight-action congestion management process outlined in the FHWA CMP Guidebook is displayed on Figure 1.

Intentionally left blank.

Figure 1. FHWA Congestion Management Process

Maintenance of a CMP is a requirement for all Metropolitan Planning Organizations (MPO) under Florida law and for MPO's in Transportation Management Areas (TMAs) under Federal law. In accordance with state and Federal law, the Miami-Dade TPO has maintained a CMP since 1997 as part of routine planning efforts. The public benefits from having a functional CMP in place, since it can often improve travel conditions by suggesting low-cost improvements or strategies. These strategies can be implemented in a relatively short timeframe (within five to ten years) compared to more traditional capacity improvements such as adding additional travel lanes which can take over ten years to implement and cost significantly more. Projects identified through the CMP may also be added to future updates of the Long-Range Transportation Plan (LRTP), should they require a longer timeframe to implement.

Causes of Congestion

The process of congestion management begins by understanding the cause of the problem. In a national study presented by FHWA (Paniati, 2003), six major causes of congestion are identified. These occurrences can be recurring, such as bottlenecks and poor signal timing, or non-reoccurring, such as traffic incidents, work zones, bad weather, and special events. Figure 2 illustrates the six major causes of congestion.

Recurring Congestion

Bottlenecks – points where the roadway narrows or regular traffic demands (typically at traffic signals) cause traffic to back up. Bottlenecks cause 40 percent of traffic congestion, the largest source of congestion and typically cause a roadway to operate below its adopted level of service standards.

Poor Traffic Signal Timing – the faulty operation of traffic signals where the time allocation for a road does not match the volume on that road. Poor signal timings cause five percent of traffic congestion, typically on major and minor streets.

Non-recurring Congestion

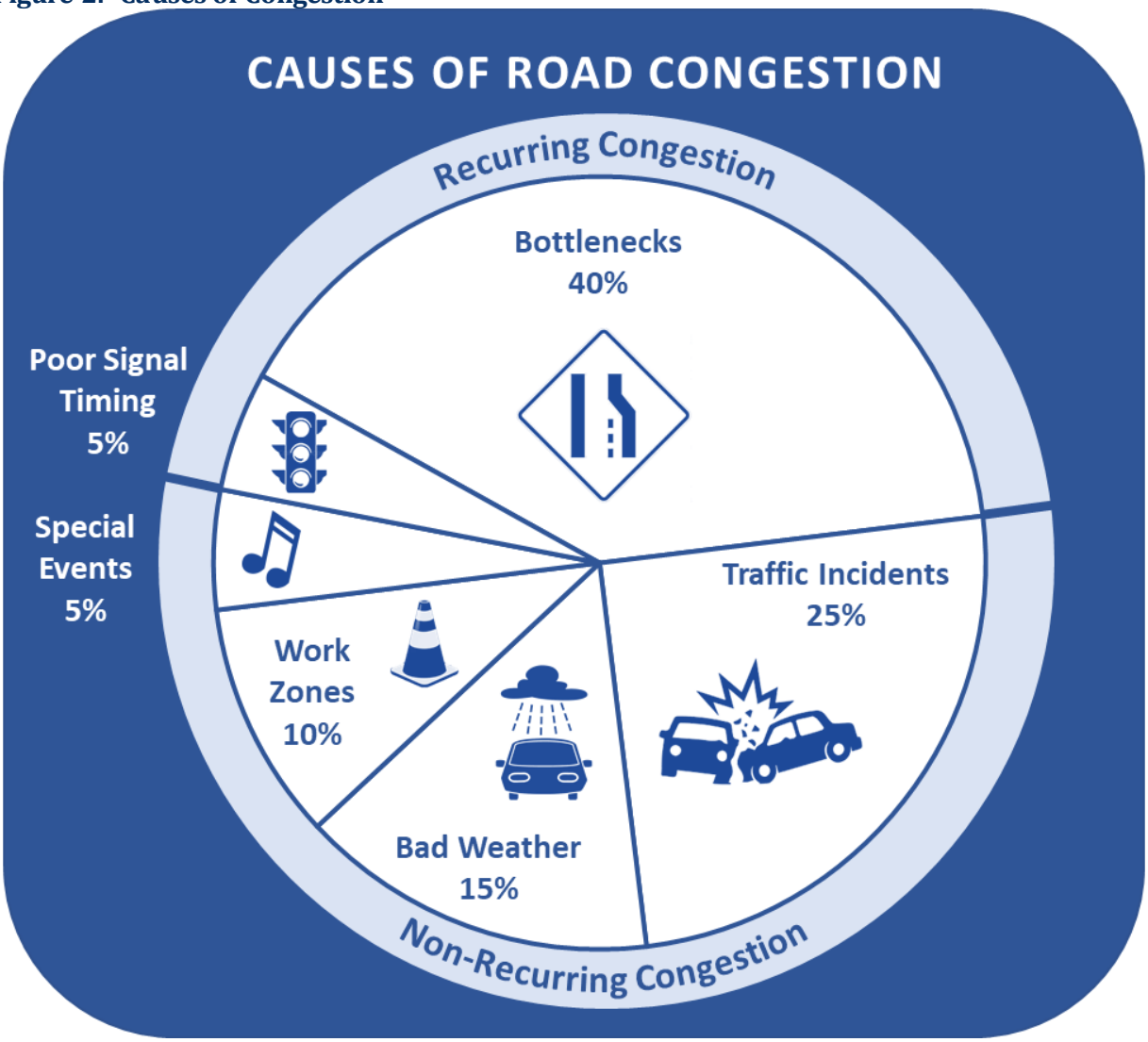
Traffic Incidents – could include crashes, stalled vehicles, and debris on the road. These incidents cause about one quarter of congestion problems.

Bad Weather – weather cannot be controlled but cause about 15 percent of traffic congestion. Travelers can be notified of the potential for increased congestion and signal systems can adapt to improve safety.

Work Zones – could include new road building and maintenance activities, such as filling potholes. These are necessary activities but cause about 10 percent of traffic congestion. The amount of congestion caused by these activities can be reduced through a variety of strategies.

Special Events – could include musical events, sports games, or other public festivals. These events cause spikes in traffic volumes and account for about 5 percent of traffic congestion.

Figure 2.- Causes of Congestion



Miami-Dade TPO CMP

The Miami-Dade TPO's CMP, adopted in 2014, follows the FHWA requirements. It was prepared using the Southeast Regional Planning (travel demand forecasting) Model (SERPM 7.0) and includes the network of facilities from the model that include 1,625 centerline miles and 6,500 lane miles of roadways as shown on Figure 3 on the next page.

The performance measures adopted as part of the plan were based on the dimensions of congestion (duration, extent, intensity and variability) and include:

- Average travel time: This measure assesses the quality of travel and can be applied at the level of facility, corridor, and systemwide.
- Hours of delay: This measure assesses the quality of travel and could be applied at the point, segment, facility, corridor, and systemwide level.
- Planning time index: This measure assesses the quality of travel and could be applied at the facility, corridor, and systemwide level.
- Percent sidewalk and bike lane coverage: These measures evaluate the accessibility of nonmotorized transportation options and could be applied at the facility, corridor, and systemwide level.
- Percent of population within 20 minutes of employment center: This measure evaluates accessibility to jobs and could be assessed at a system level.
- Connector level of service: This measure evaluates the accessibility to hubs and could be applied at the facility and system level.
- Truck hours of delay: This measure assesses the quality of truck travel and could be applied at the point, segment, facility, corridor, and systemwide level.
- Transit, sidewalk, and trail miles per highway centerline miles: These measures evaluate the accessibility of nonmotorized transportation options and could be applied at the facility, corridor, and systemwide level.
- Truck travel time: This measure assesses the quality of truck travel and could be applied at the facility, corridor, and systemwide level.
- Service volume ratio (SVR): AM-peak, PM-peak, and Off-Peak Volumes/LOS E capacity
- Travel time ratio (TTR): Congested travel time/free flow travel time (AM/Off-/PM peak periods)
- Segment daily throughput: The number of vehicles able to enter or exit the segment during an average day.

No specific visualization methods were identified in the plan. The plan does provide examples of other visualization tools available at the time of publishing.

Figure 3. Miami-Dade TPO CMP Network

The quality of this image is limited based on the original document.

Miami-Dade SMART Plan

The 2045 Long Range Transportation Plan (LRTP) is a strategic and comprehensive transportation plan that identifies highway, transit, freight, and non-motorized transportation improvements for the County. The LRTP has a planning horizon of at least twenty years and is required to address mobility, safety, security, resiliency, and sustainability. The LRTP also considers the impact of emerging technologies and innovation on the County's existing and future transportation infrastructure. The need to positively impact transportation mobility of people and goods by increasing travel options, is a clear priority and focus of the LRTP.

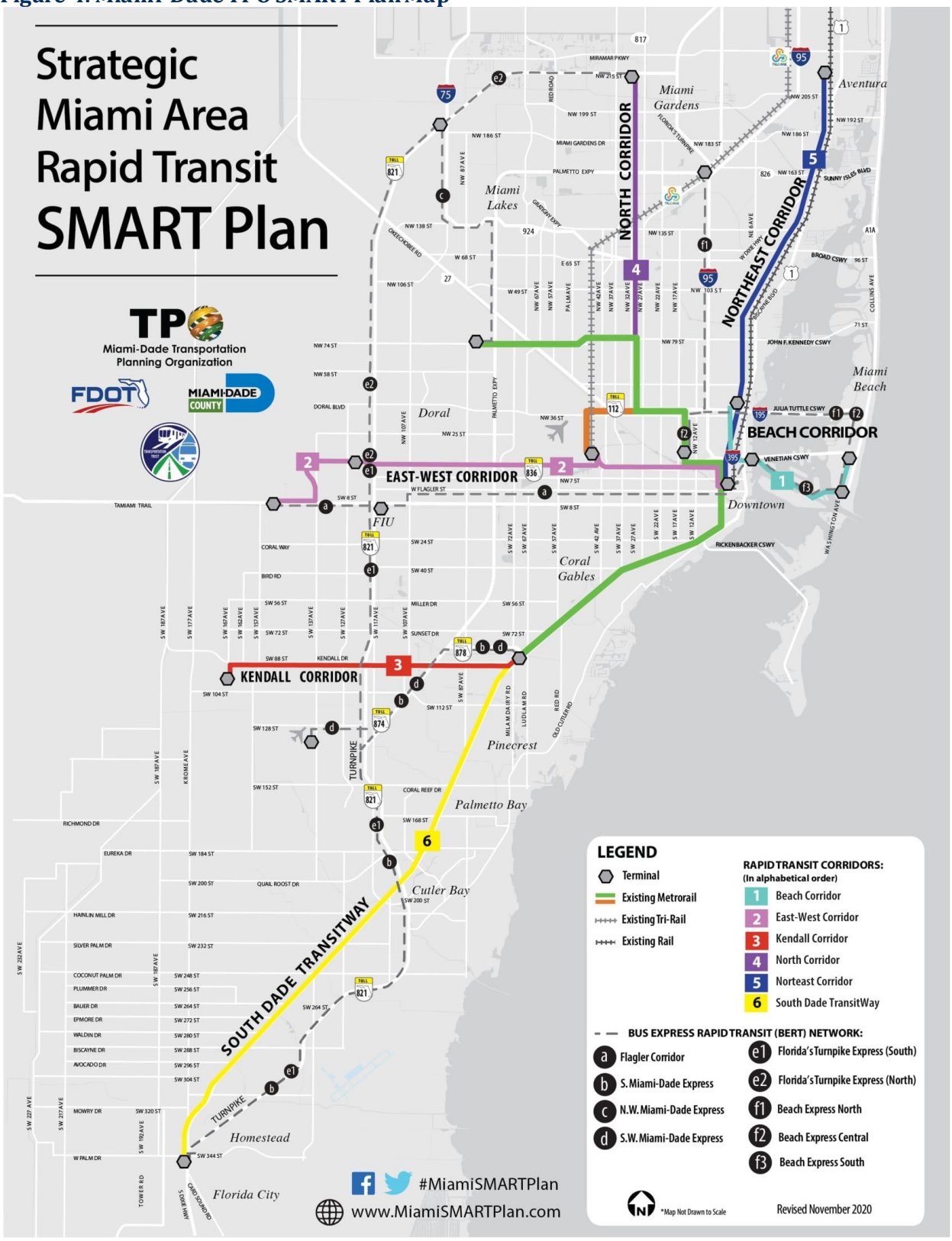
A connected and efficient multi-modal transportation system in Miami-Dade County is the backbone to a thriving economy. The Miami-Dade TPO has adopted a policy identifying the advancement of rapid transit projects, the Strategic Miami Area Rapid Transit (SMART) Plan, is its highest priority.

The SMART Plan will expand transit options in Miami-Dade County along six critical corridors that are linked to regional, state, national, and global economic markets, as highlighted below. Another critical component of the SMART Plan is a network of express buses, known as Bus Express Rapid Transit (BERT), which will connect the SMART rapid transit corridors on limited access facilities, promoting the active expansion of South Florida's Express Lanes network. This innovative approach effectively expands the reach of transit in Miami-Dade County and beyond.

- Beach Corridor: Highest tourist demand in region with major employment centers.
- East-West Corridor: Heaviest commuter travel for international, state and local businesses.
- Kendall Corridor: One of the most congested arterial roadways with the highest demand.
- North Corridor: Key regional mobility linkage for access to jobs, stadium and educational facilities.
- Northeast Corridor: High transit demand and part of a critical regional corridor stretching to Palm Beach County.
- South Corridor: Experiencing the fastest population growth in Miami-Dade County.

These corridors are shown on Figure 4.

Figure 4. Miami-Dade TPO SMART Plan Map



III. Final SMART Congestion Management Dashboard

Based on the review of the Miami-Dade TPO's CMP, the SMART Plan and the practices of other MPOs and related dashboards, candidate performance measures were identified and included in a survey. The results are summarized in Appendix A. The measures were prioritized as high, medium or low. A score was tabulated using a score of 3 for high, 2 for medium and 1 for low. The measures were then ranked from high score to low score and grouped into high, medium and low priority overall. A comprehensive list of desired performance measures was created. Through the different project working group meetings there were suggested revisions to the initial list of performance measures generated from the surveys performed as part of technical memorandum 1.

The working group identified the desire to analyze more real-time measures for the identified Smart Corridors. This inclusion of more real-time data forced some of the historical measures to be included in a potential Phase 2 enhancement. The availability of certain data sets also excluded some performance measures from inclusion in the first phase of the dashboard.

The SMART Congestion Management Dashboard (CMD) is preconfigured to list the Smart Corridor Dashboards at the top for ease of access. Additional preconfigured dashboards for the entire Miami-Dade area are available to view historical trends from year to year. The following sections walk through each portion of the dashboard to show how the performance measures are displayed and baseline performance for the county and on specific corridors. This effort produced two versions of the dashboard. A tool was developed for the Miami-Dade TPO to have access to create new dashboards for roadway segments and different performance measures. A public-facing dashboard was also developed to limit the user's ability to create new entries or filter by date or time. The following sections walk through the two versions of the dashboard.

Internal SMART CMD

The internal SMART CMD provides a tool that allows the user to create a dashboard for any roadway indexed in Miami-Dade County. The user can choose from preconfigured performance measure options relating to traffic, safety, quality of travel, etc. Once the dashboard is created the user can track the progress in these areas from year to year, or filter dates to analyze specific periods of time.

Creating a Dashboard

Figure 5 through Figure 10 show the creation of a new dashboard and the completed product at the end.

Figure 5. Dashboard Main Page

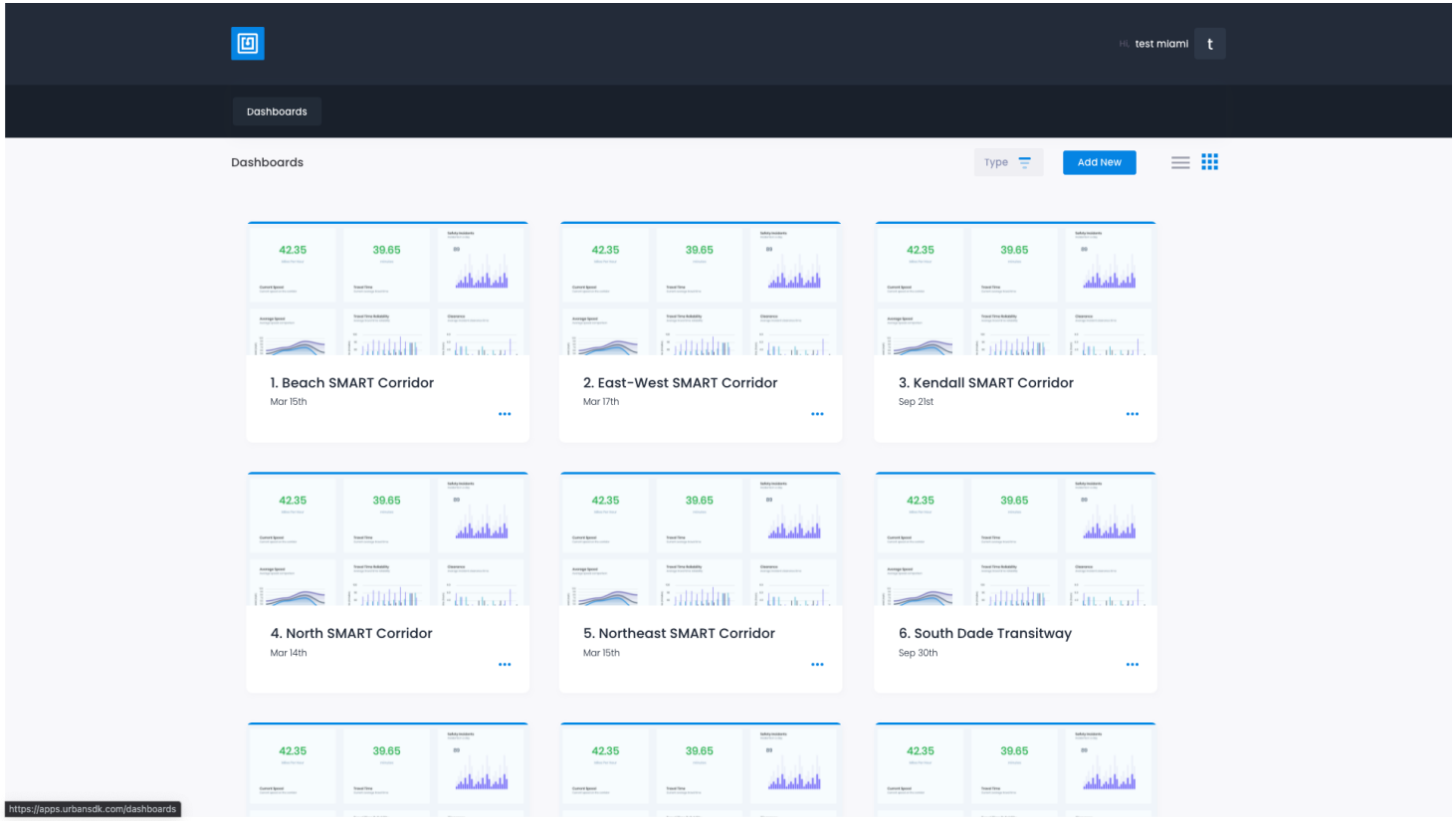


Figure 6. Selecting a Dashboard Type

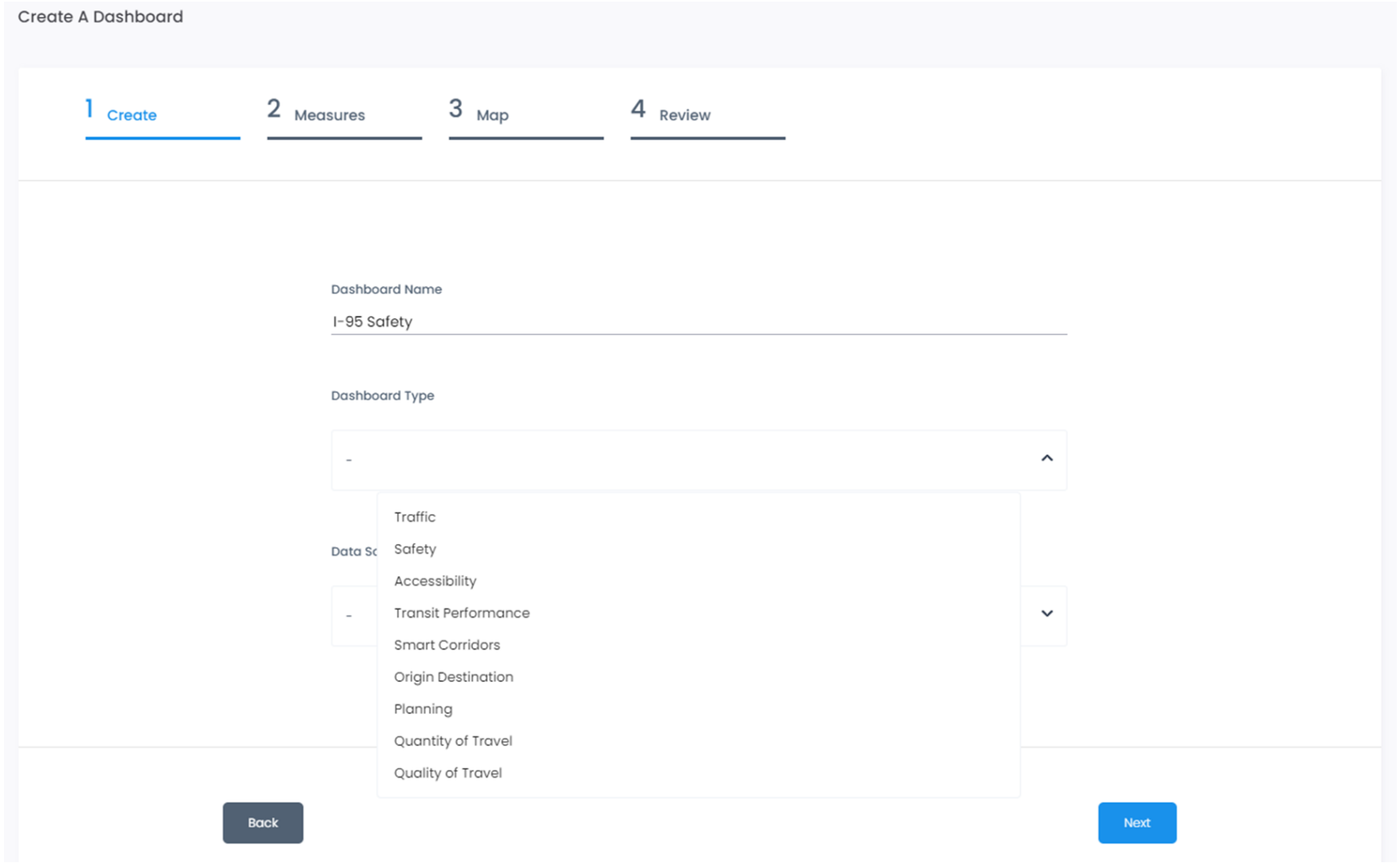


Figure 7. Custom Selection of Measures

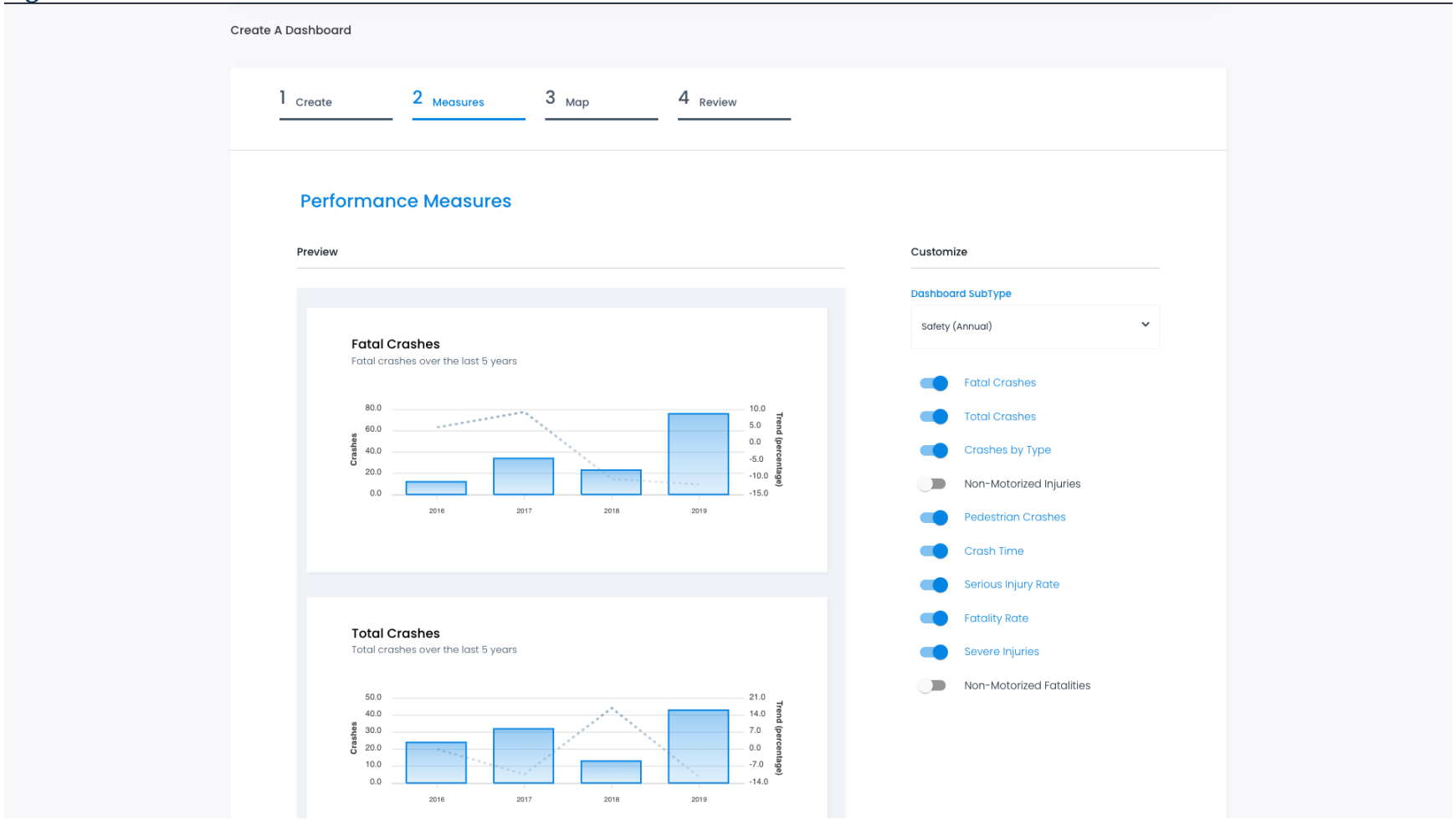
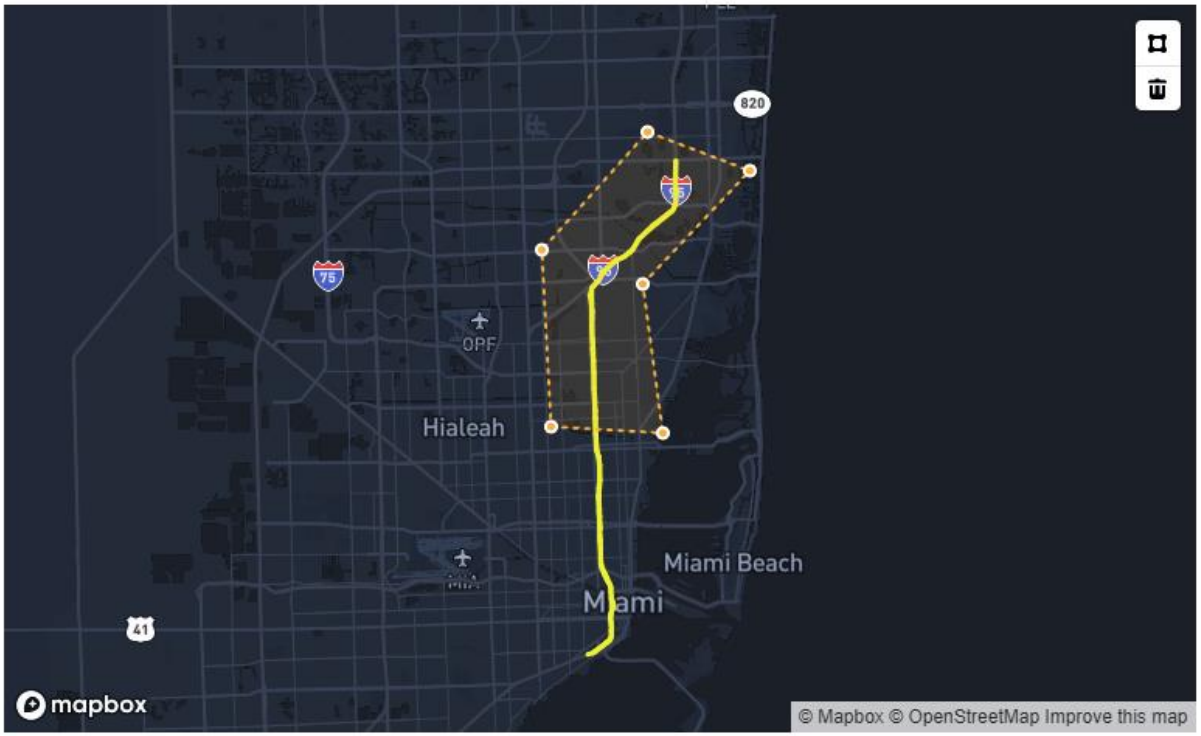


Figure 8. Selecting Extents of Roadway

Road View

Add Roadway

2. Use the polygon icon in the upper right **after selecting AND adding a road** to select regions of the roadway to monitor. To monitor the entire roadway, do not add any polygons that would intersect the road to the map.



View Selections

3. Review or remove roads or sections selected for monitoring. Polygons previously drawn and no longer on the map in "edit mode" will have to be deleted first before drawing another polygon to replace it.

Figure 9. Completed Safety Dashboard Map View

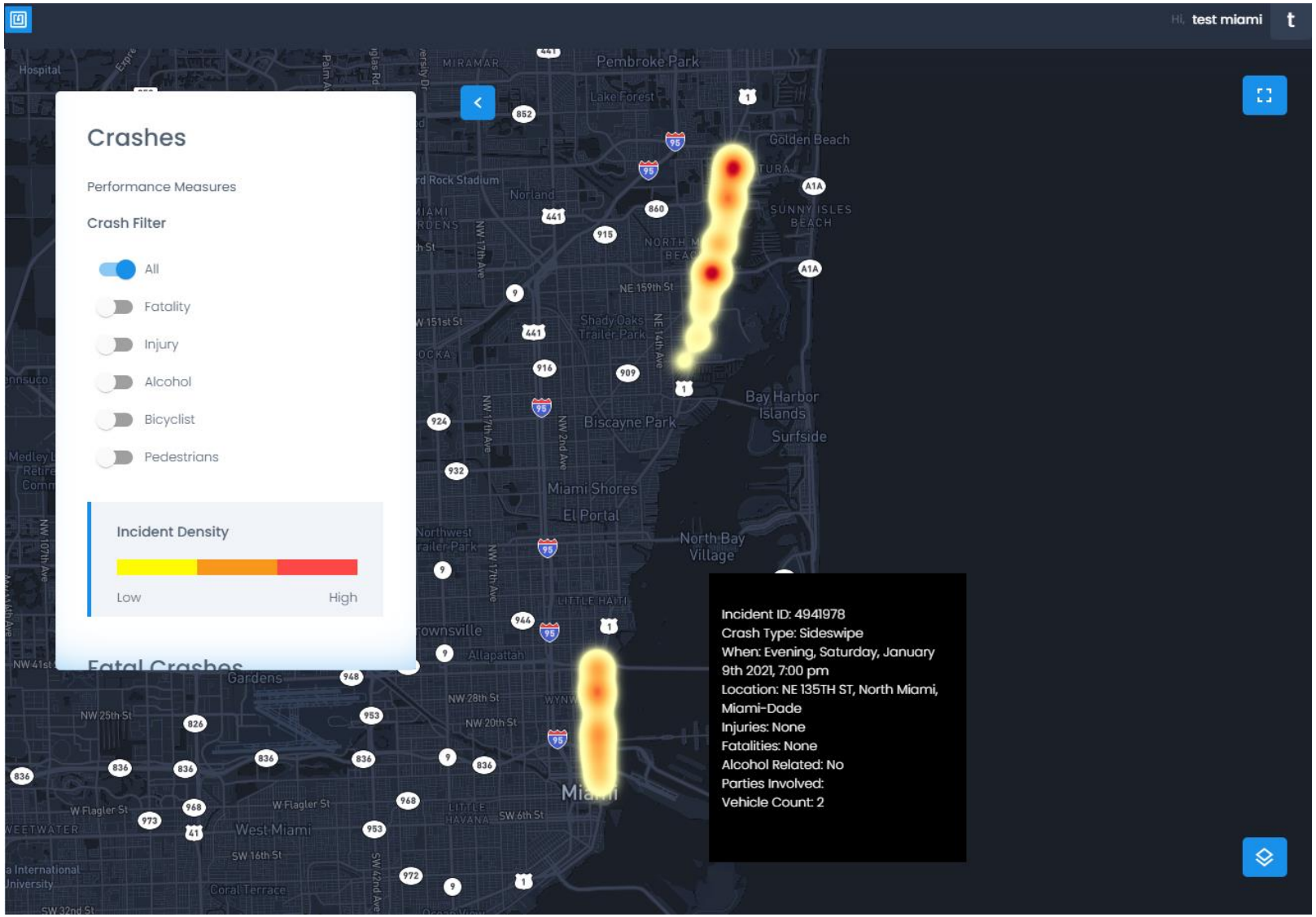
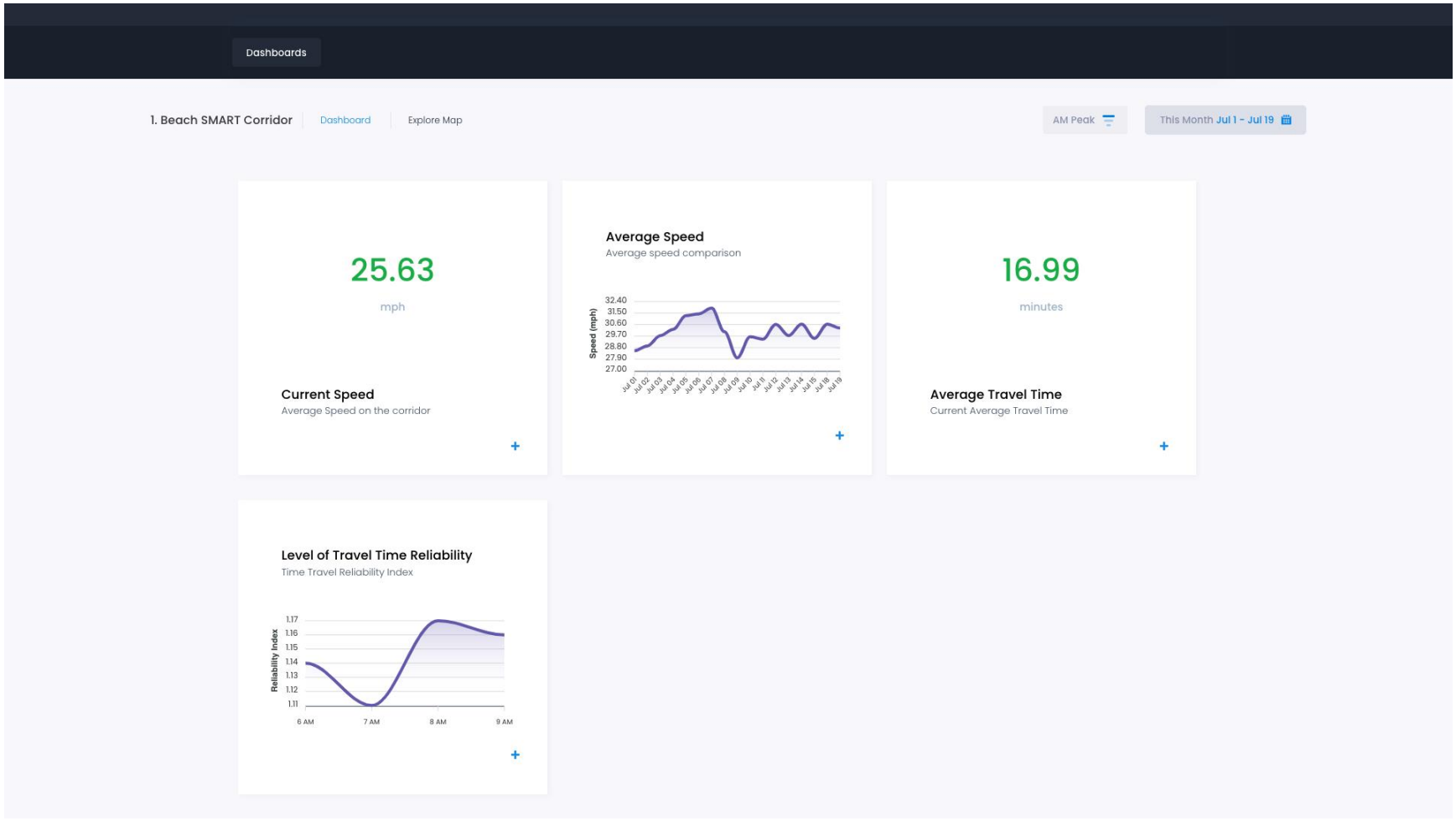


Figure 10. Completed SMART Plan Corridor Dashboard View

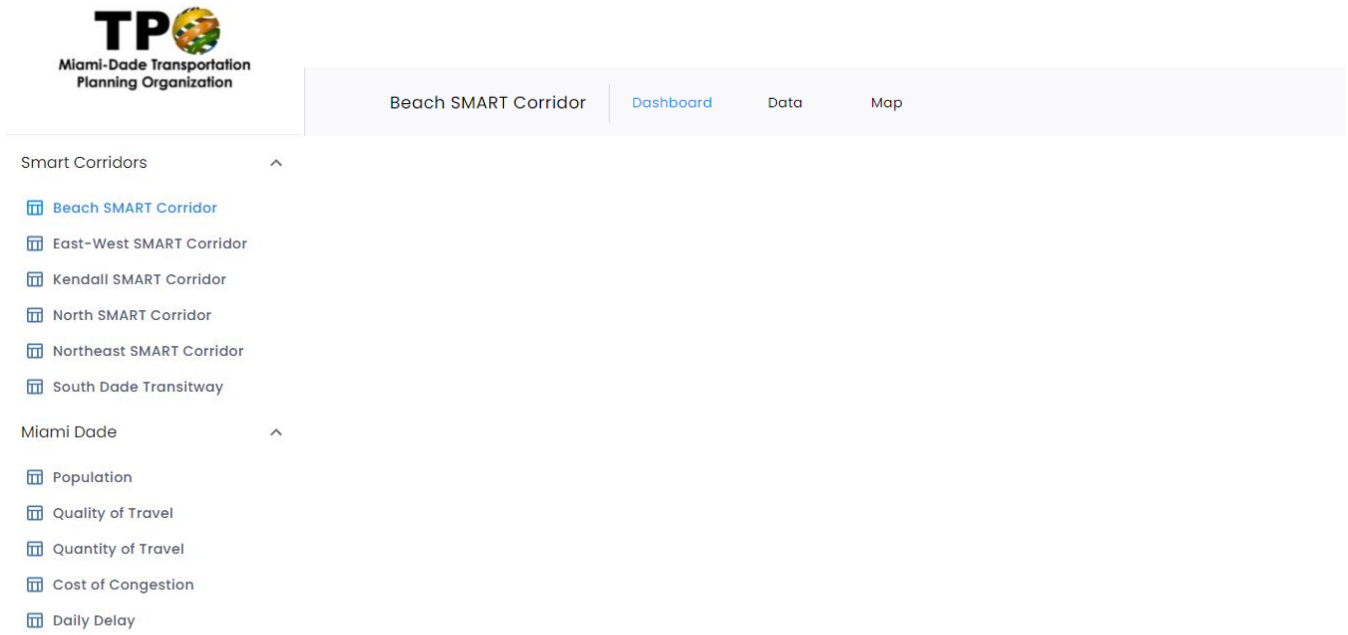


Public SMART CMD

The SMART CMD is housed on the Miami-Dade TPO website providing the public access to view and interact with mobility performance data. The public facing dashboard allows the user to browse current and historical performance data without the ability to create new dashboards as in the access-controlled version. Figure 11 shows the left navigation pane on the main screen of the dashboard with two dropdown options.

The measures are broken into SMART Corridor and overall Miami-Dade County measures. The SMART Corridor measures provide detailed information about the identified SMART Corridors consisting of the Beach SMART Corridor, East-West SMART Corridor, Kendall SMART Corridor, North SMART Corridor, Northeast SMART Corridor and the South Dade Transitway. The Miami-Dade County portion provides performance measures capturing the entire state highway system in Miami-Dade County. These two sections combine to provide a detailed representation of the SMART corridors and an overall performance measure view of Dade County. Across the top of the dashboard the name of the dashboard currently displayed is accompanied by three tabs: Dashboard, Data and Map. These three tabs allow the user to view the dashboard performance measures

Figure 11. SMART CMD Home Page



The following subsections provide an overview of the performance measures represented in the SMART Corridor and County portions of the public-facing dashboard.

SMART Corridors

The SMART Corridor measures provide detailed information about the identified SMART Corridors consisting of the Beach SMART Corridor, East-West SMART Corridor, Kendall SMART Corridor, North SMART Corridor, Northeast SMART Corridor and the South Dade Transitway. Figure 12 shows the Beach SMART Corridor dashboard displaying the monthly average speed in the westbound direction during the peak hour over the prior month. This data is updated monthly to reflect recent conditions. Traffic counts are also presented for the most recent year available. Crashes are broken down by type and are tracked along the corridor from year to year. Each SMART corridor entry shows the same performance measure information as the Beach SMART Corridor dashboard.

Figure 12. Beach SMART Corridor Dashboard

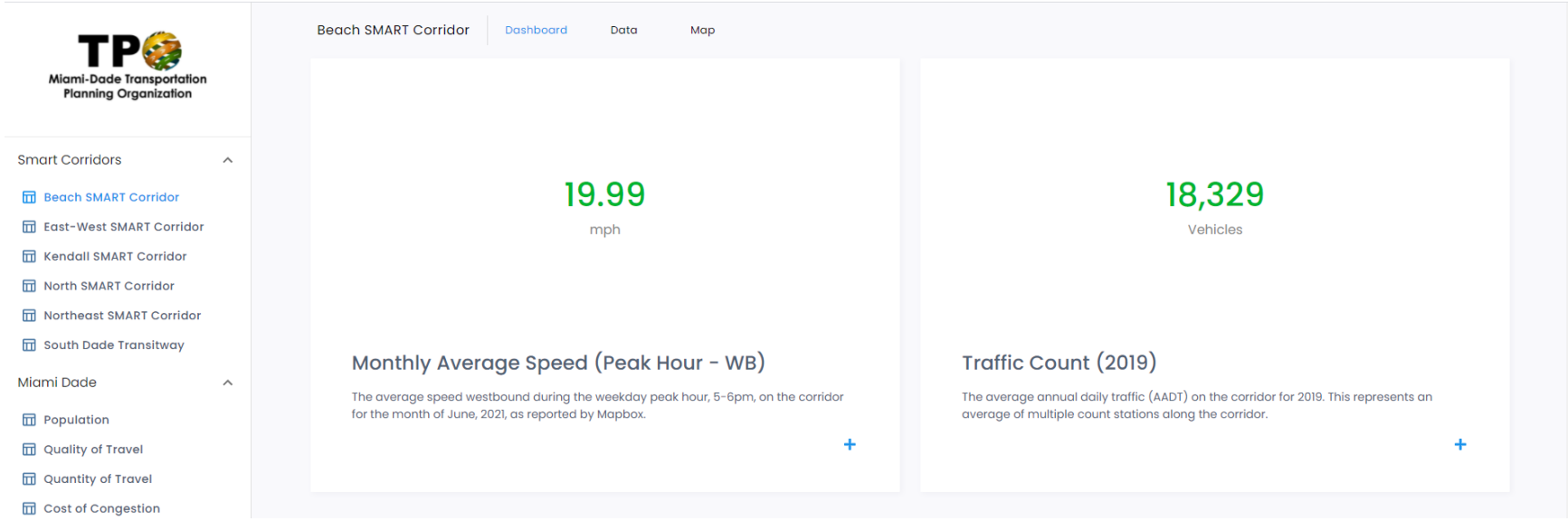
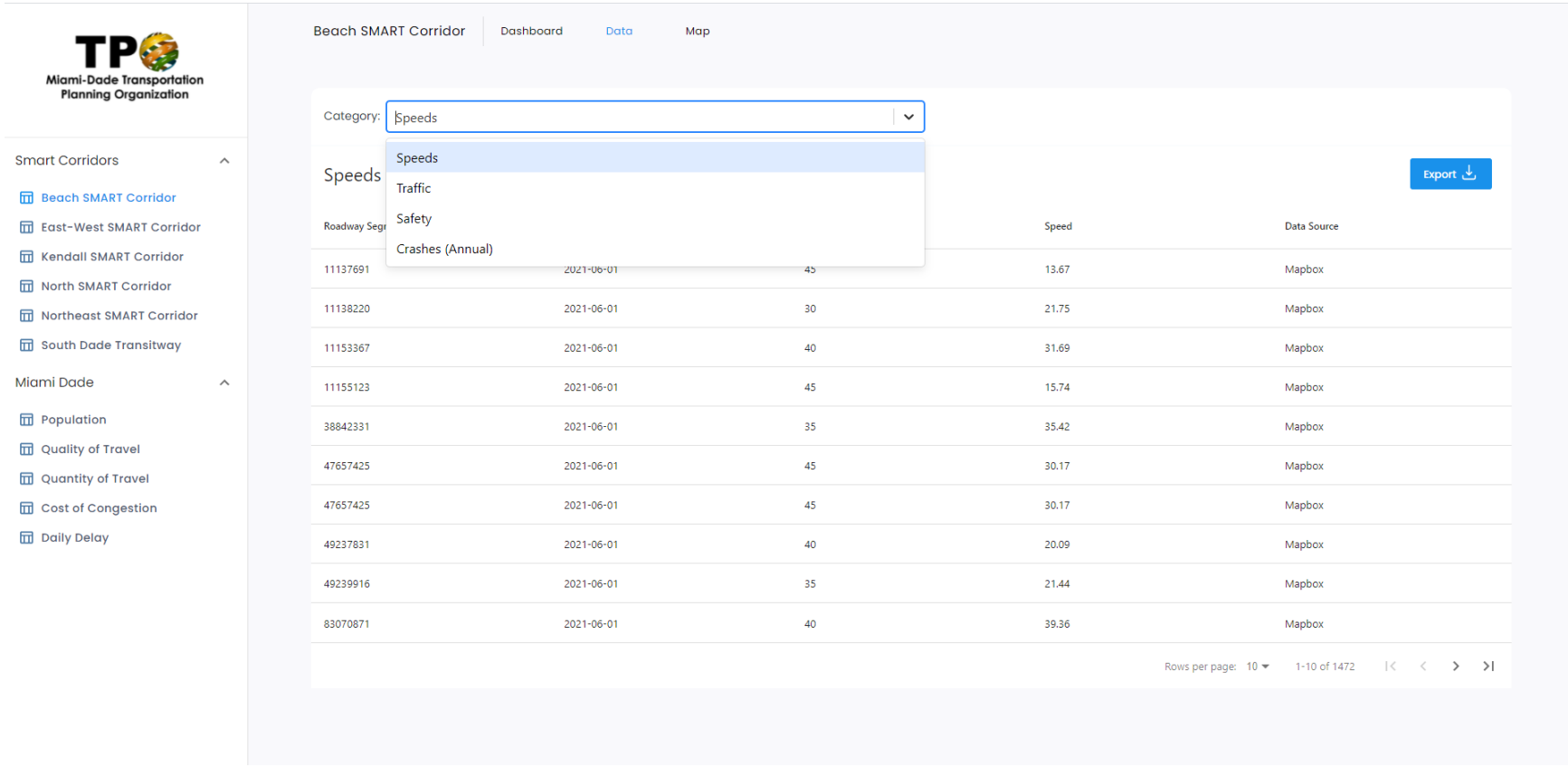


Figure 13. Beach SMART Corridor Dashboard – Average Speed and Crashes by Type

Figure 14. Beaches Smart Corridor - Total Crashes

The data that is displayed in the dashboard is available for download in the Data tab. A drop-down menu allows the user to select which data set do download. The export button allows the user to generate and download the data file as a comma separated value (CSV) file.

Figure 15. SMART Corridors - Data Tab



The Map tab allows the user to visualize the performance measure on an area wide map. Figure 16 shows the map view for speed the performance measure. The overall performance measure for the corridor is displayed in the left pane, while the user is able to hover over any road segment and obtain the average speed for that specific segment. The speed is displayed for the weekday peak hour (5-6) pm for the prior month.

Figure 16. SMART Corridors Map View - Average Travel Speed

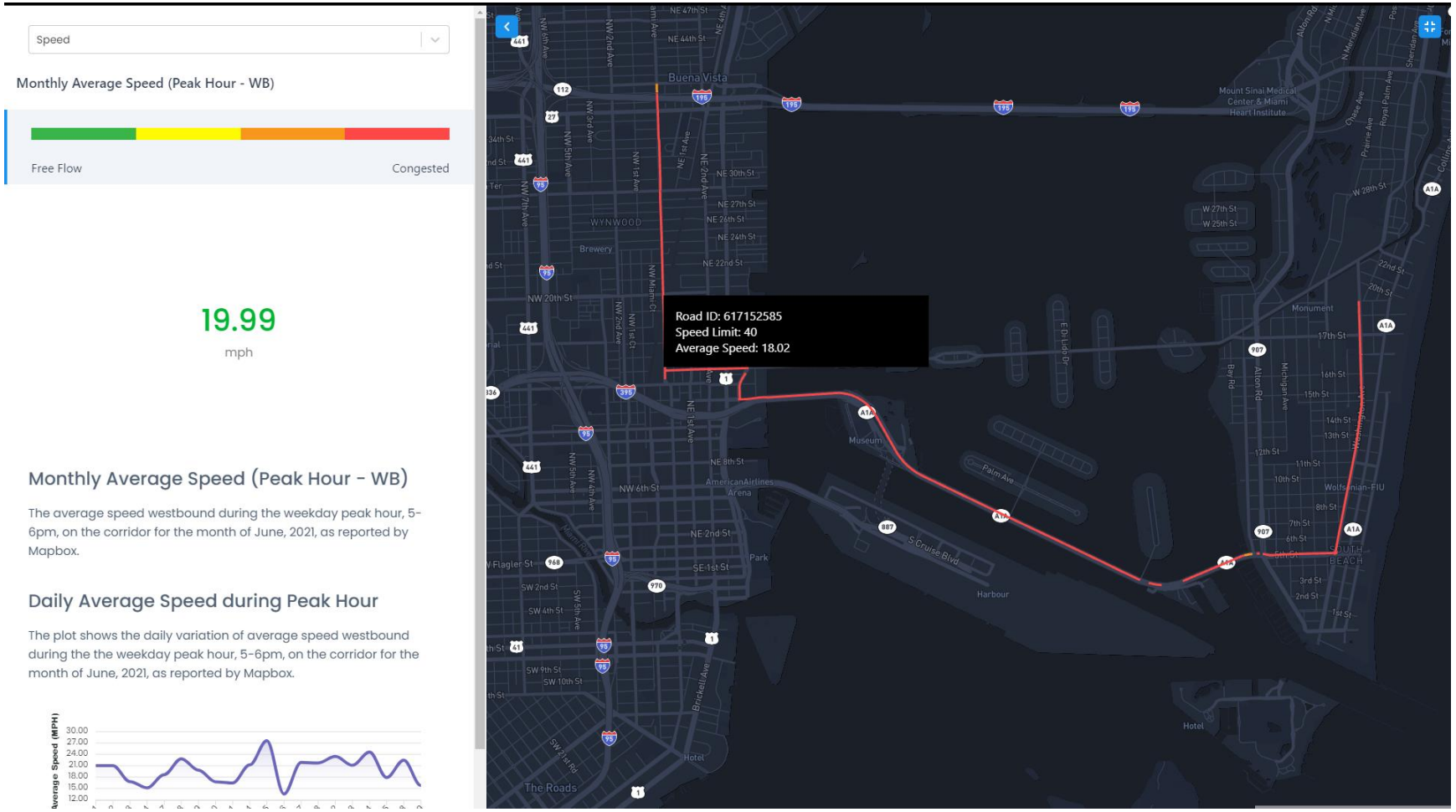
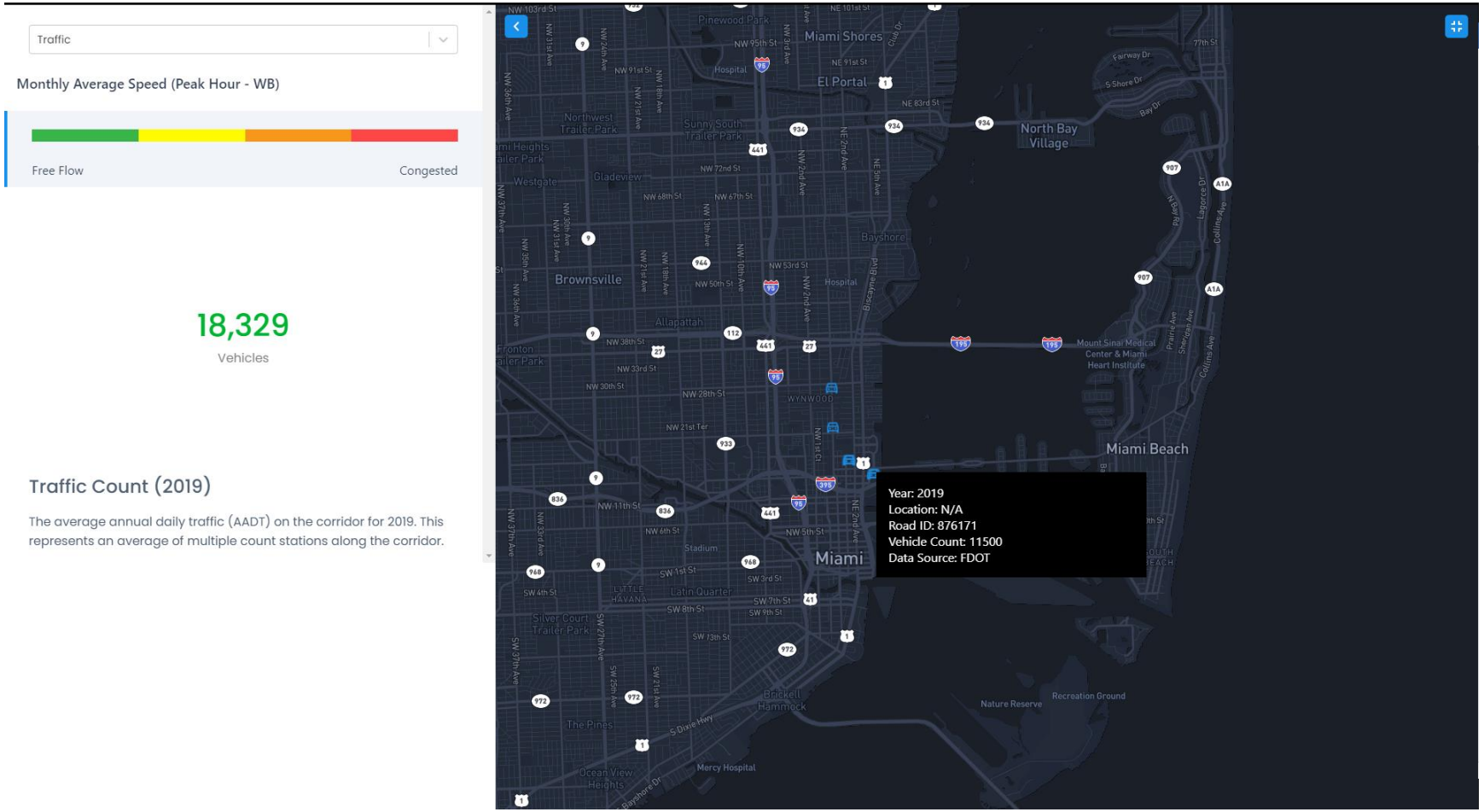


Figure 17 shows the traffic counts that are available along the Beach SMART corridor. Hovering over an icon allows the user to determine the traffic counts for the most recent year and the agency who performed the counts.

Figure 17. SMART Corridors Map View - Traffic Counts



Miami-Dade County Measures

The Miami-Dade County portion of the dashboard summarizes performance measures considering the entire county. Tabs included in this drop-down section include population, quality of travel, quantity of travel, cost of congestion and daily delay. The following sections summarize these available dashboards.

Population

Figure 18 shows the population dashboard presenting the most recent census population data from the U.S. Census Bureau.

Figure 18. Miami-Dade County Measures – Population Dashboard

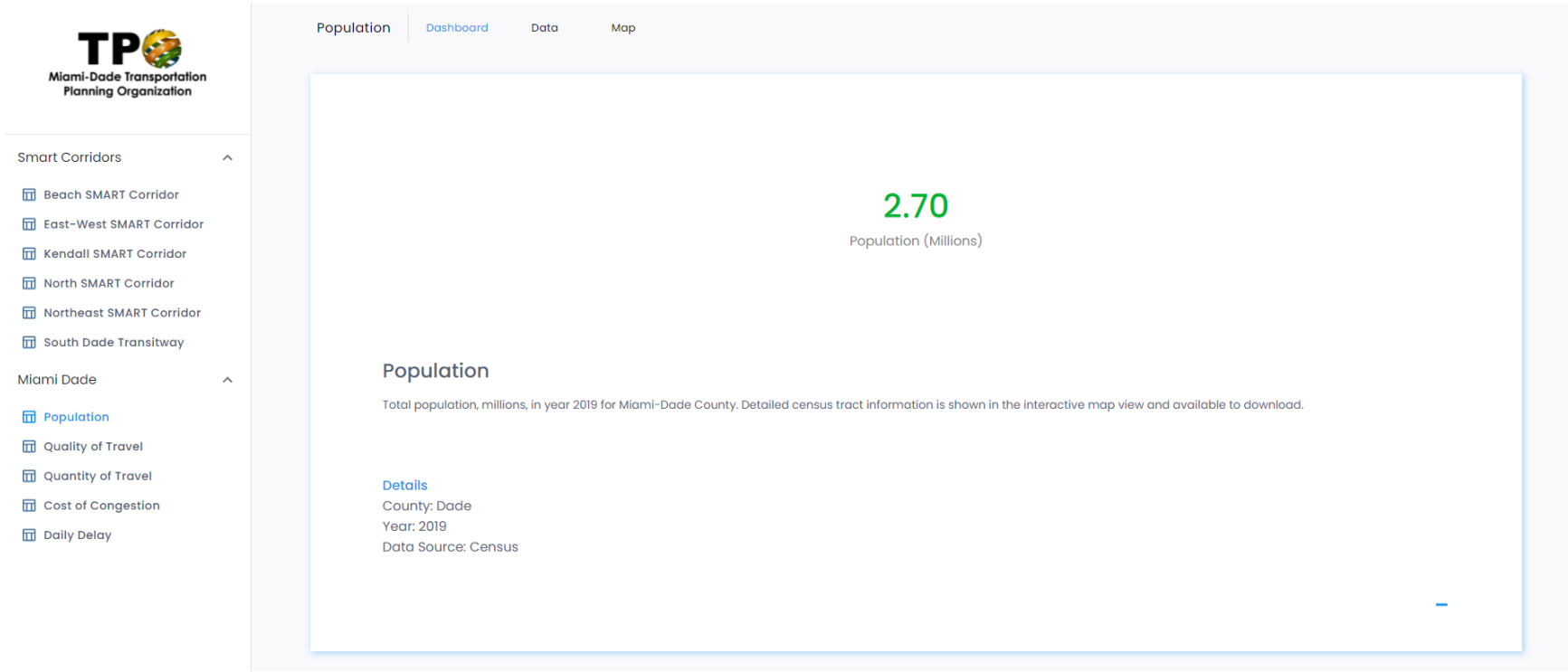


Figure 19 shows the population data available for download in the Data tab. The data is exported by clicking the export button which creates a csv file for download. The population data is viewable by census block group ID by clicking the Map tab at the top of the page as show in Figure 20.

Figure 19. Miami-Dade County Measures – Population Data Tab

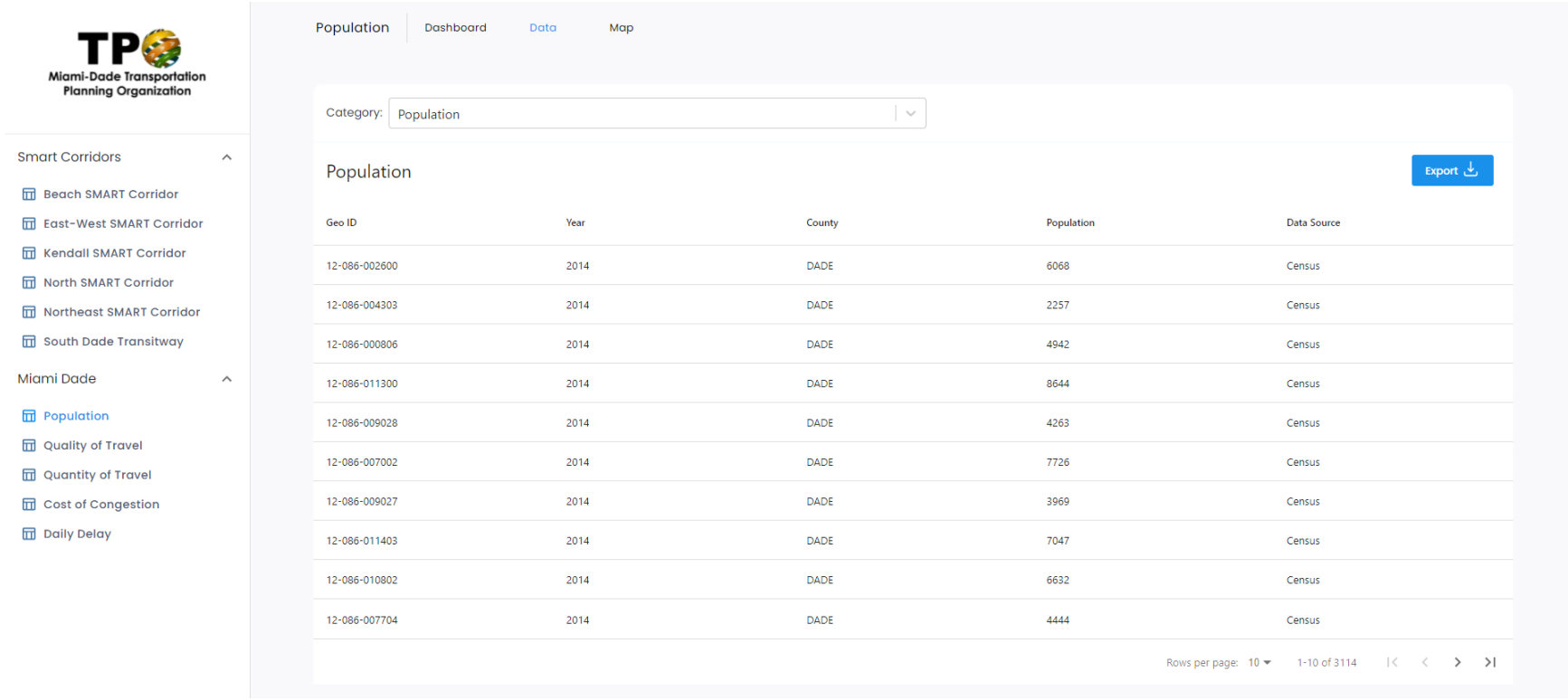
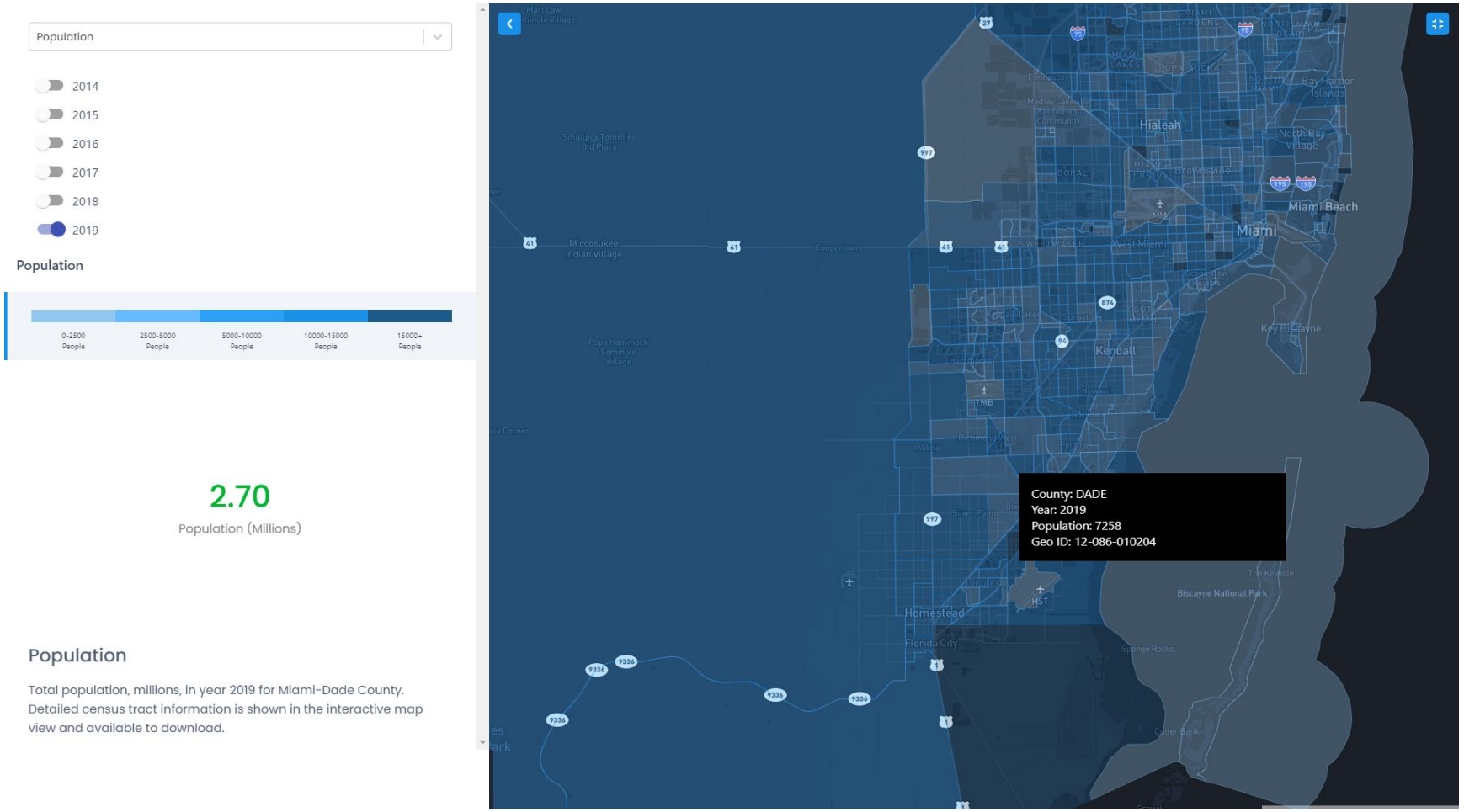


Figure 20. Miami-Dade County Measures – Map View



Quality of Travel

The quality of travel tab contains four performance measures quantifying the quality of travel in Miami-Dade County including percent travel severely congested, percent miles severely congested, hours severely congested and vehicles per lane mile. These measures are based on the Mobility Performance Measure data provided by the FDOT Office of Forecasting and Trends. These performance measures represent travel on the state highway system. Figure 21 shows the percent travel and miles severely congested from 2015 to 2018 in Miami-Dade County.

Figure 21. Quality of Travel Dashboard - Severely Congested

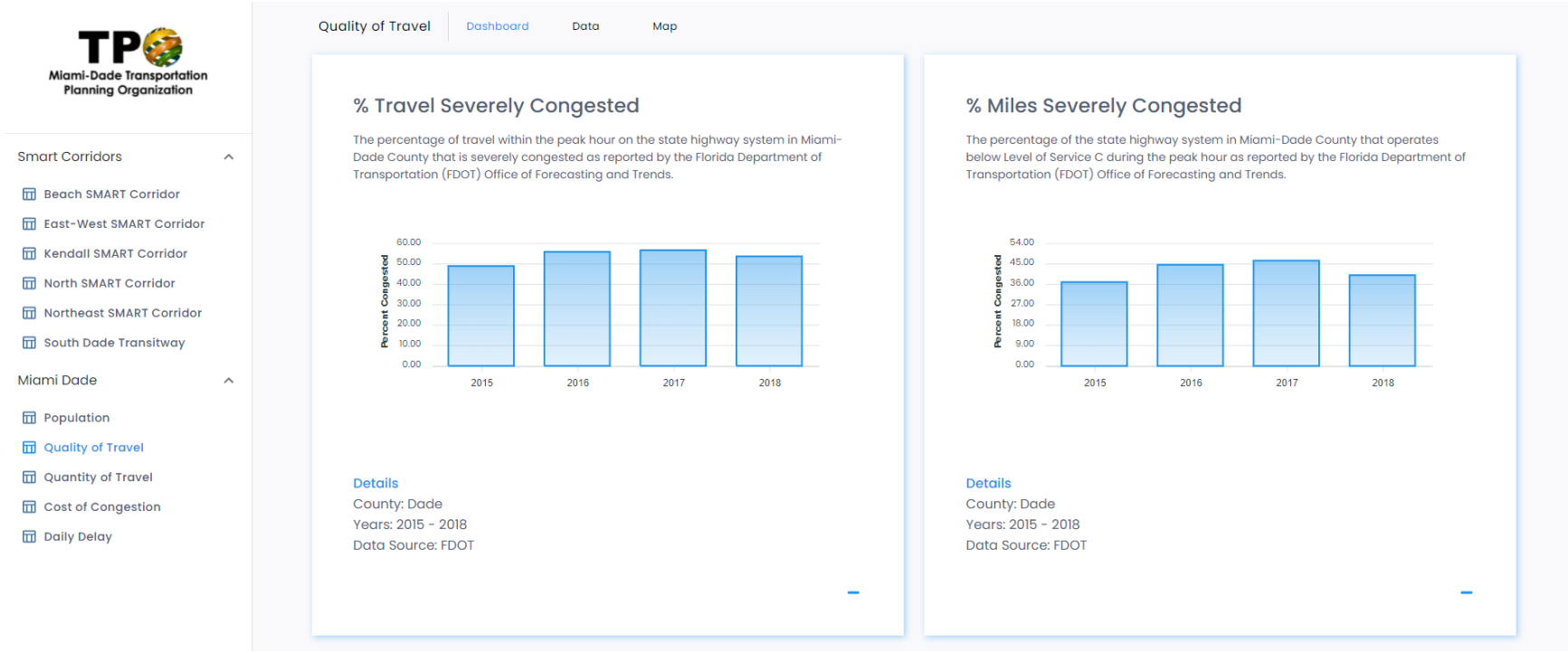


Figure 22. Quality of Travel Dashboard - Hours Severely Congested

Figure 23. Quality of Travel Dashboard - Vehicles Per Lane-Mile

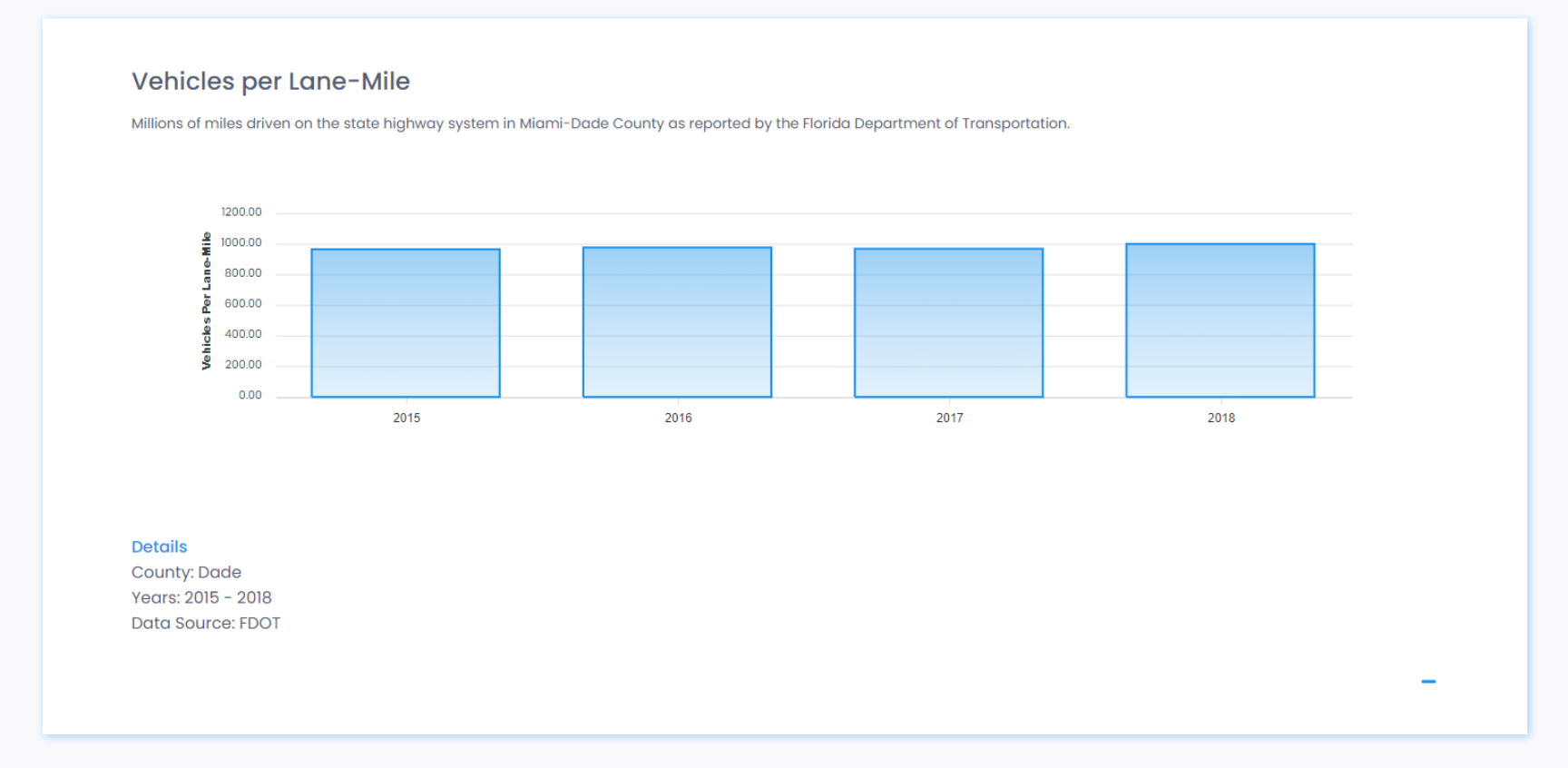
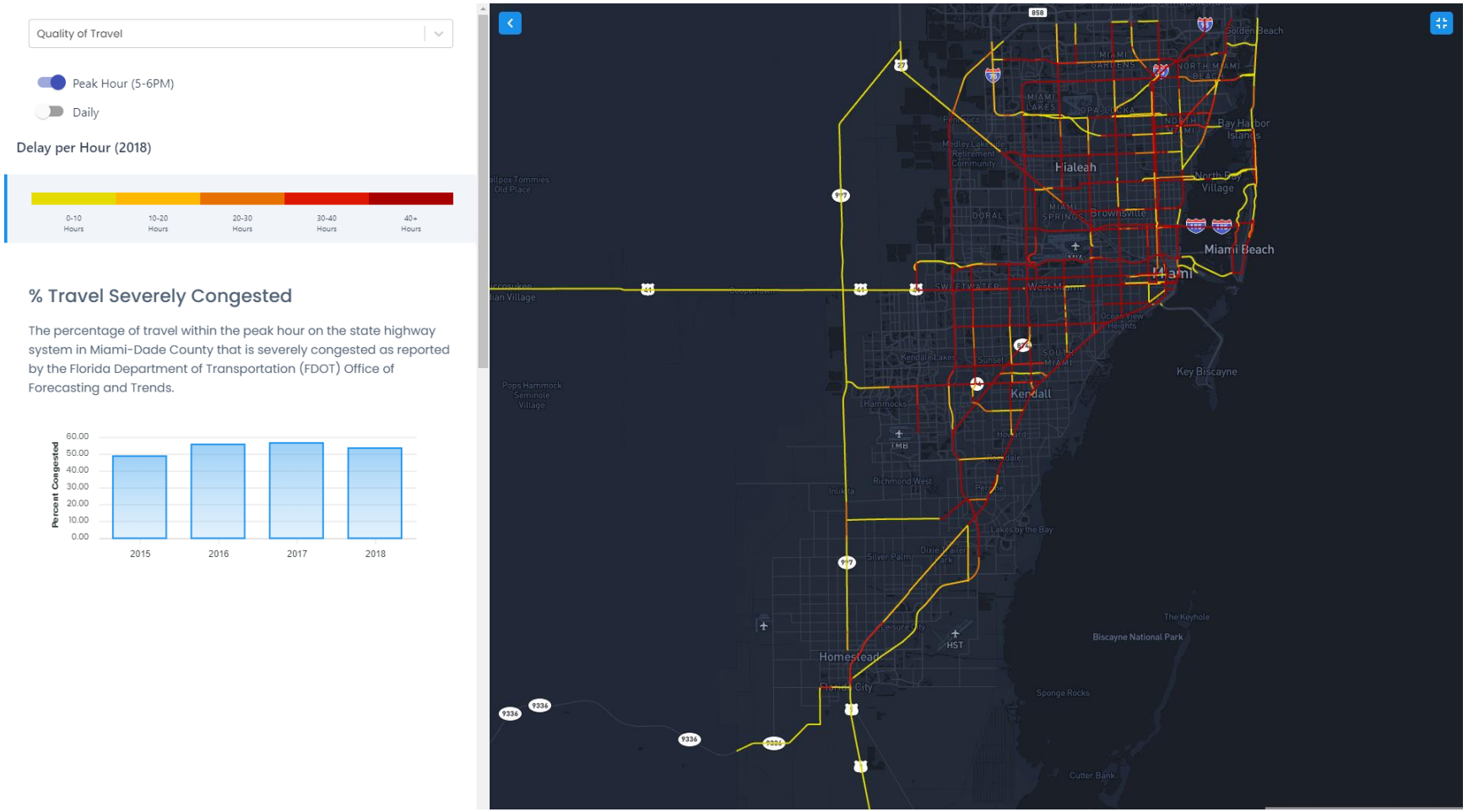


Figure 24. Quality of Travel Map View



Quantity of Travel

The quantity of travel section reports the vehicle miles traveled, truck miles and person miles traveled on the state highway system for Dade county. This data is provided by the FDOT Forecasting and Trends Office. The dashboard reports these measures from year to year and provides segment level detail on the map tab as shown in Figure 25.

Figure 25. Quantity of Travel Dashboard - VMT and TMT

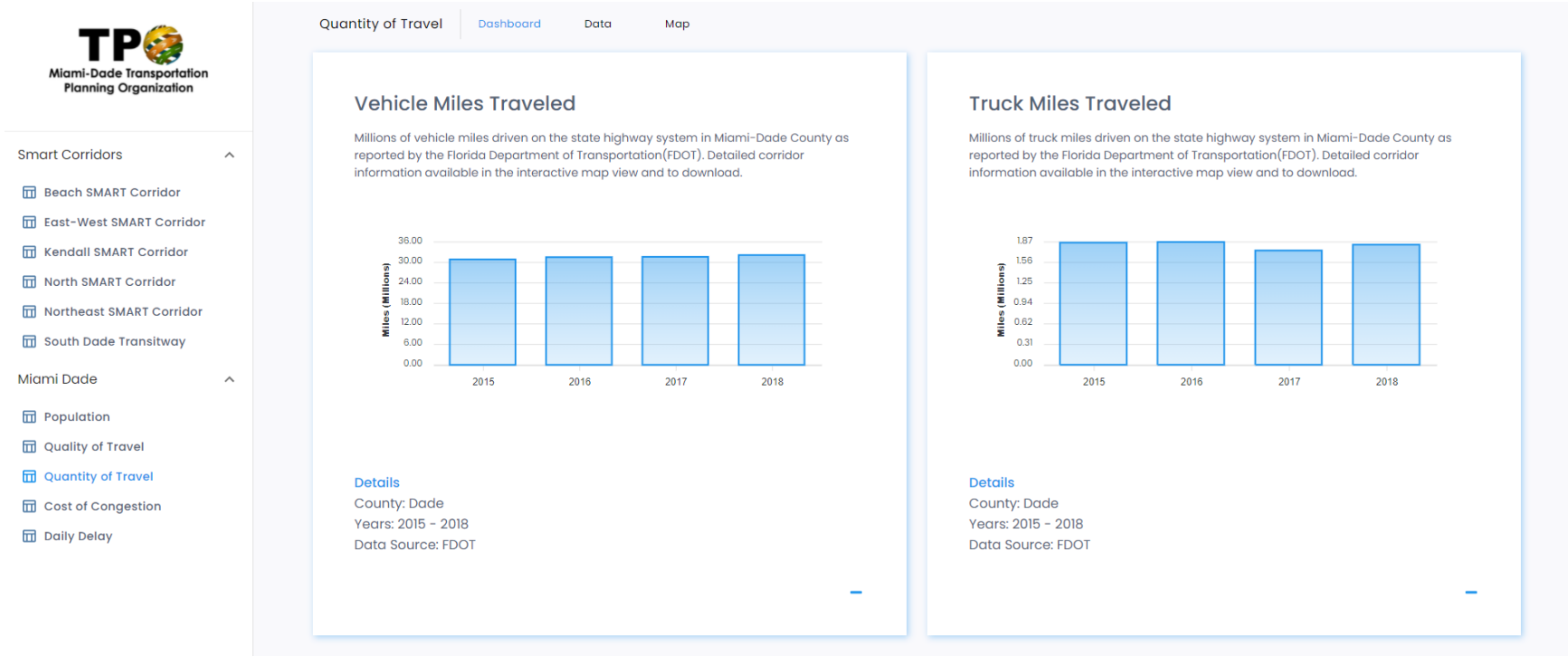


Figure 26. Quantity of Travel - Person Miles Traveled

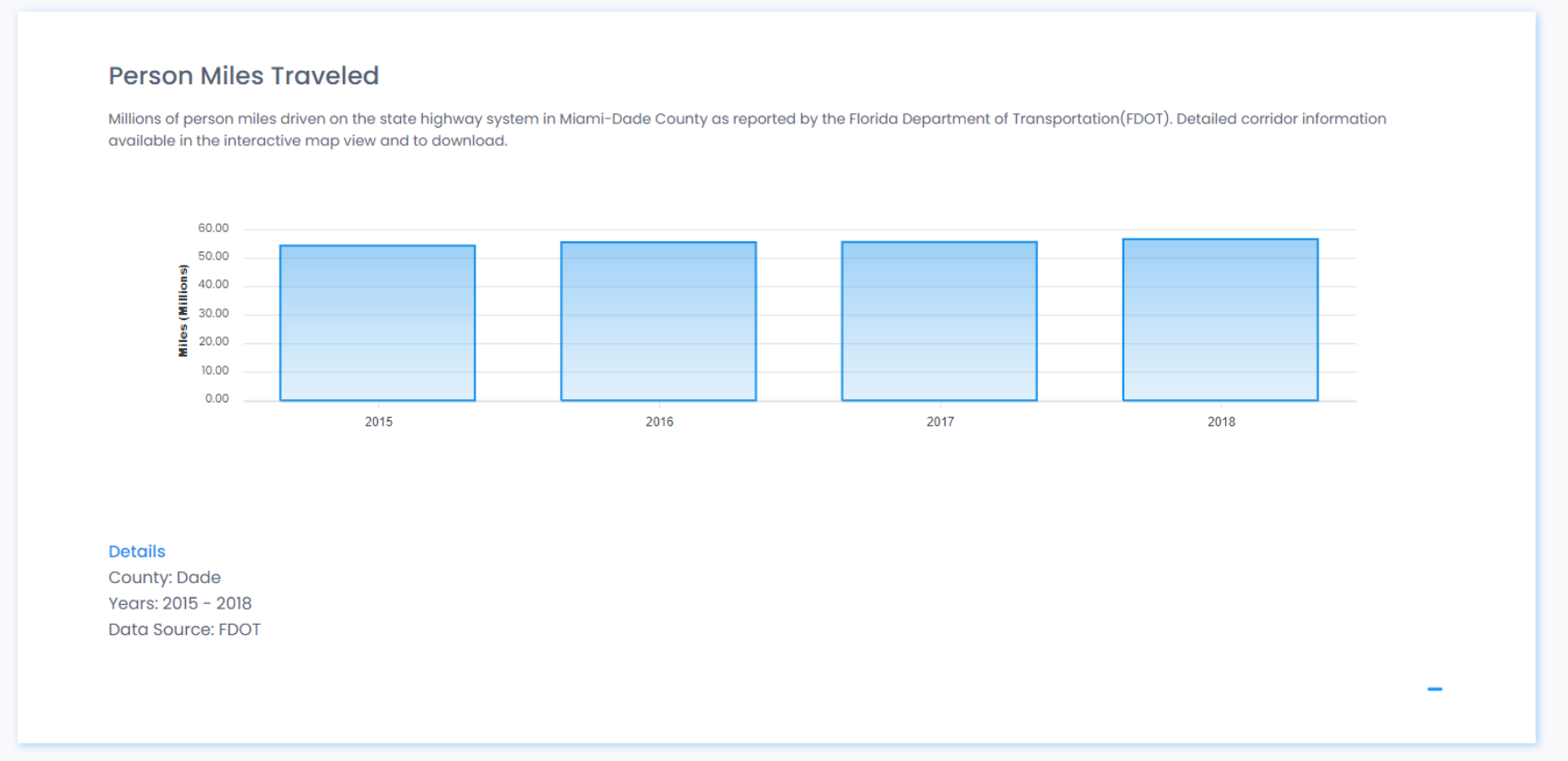
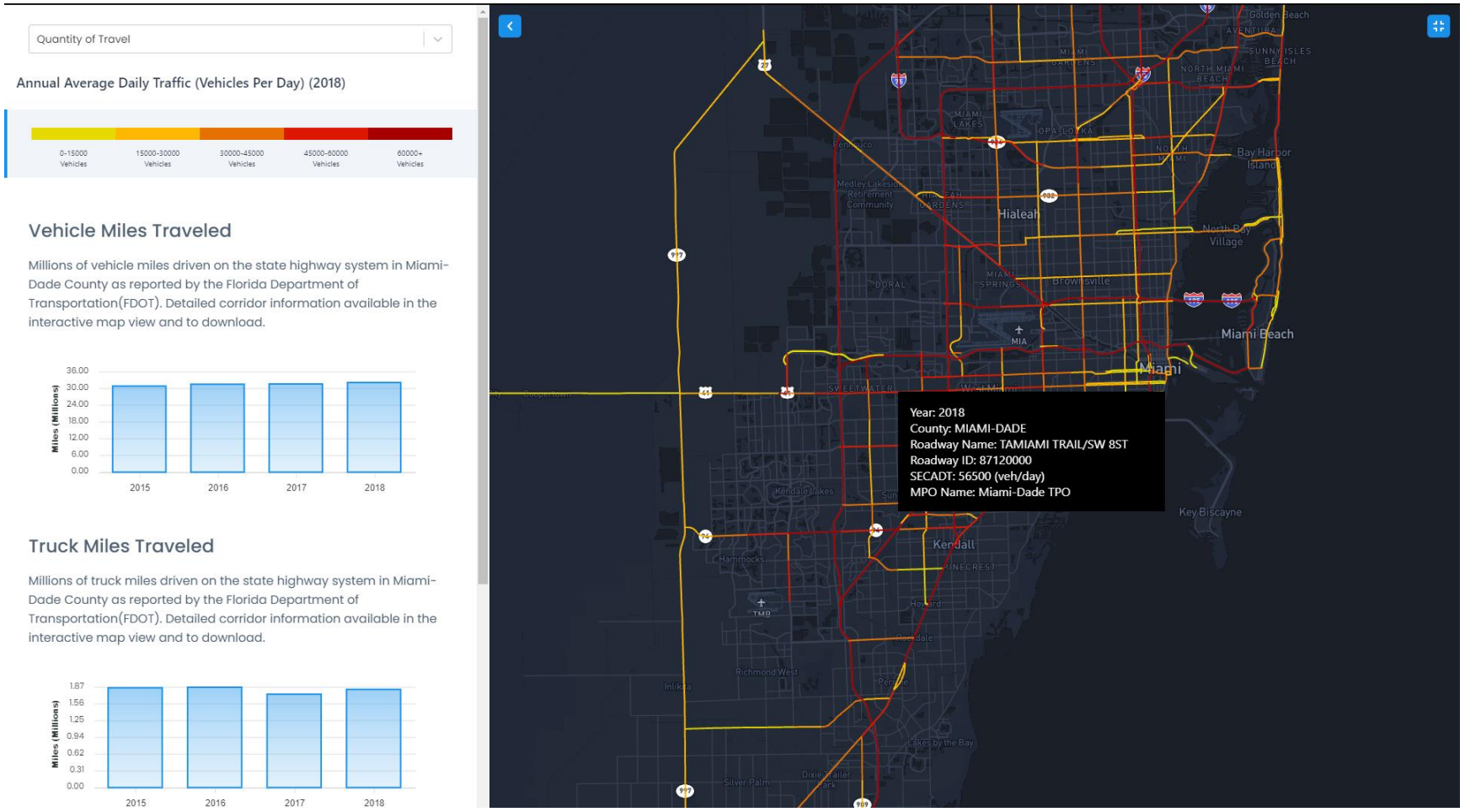


Figure 27. Quantity of Travel - Map View



Cost of Congestion

The cost of congestion section represents the cost of recurring congestion on the state highway system for the past four years. This cost is broken down into cost of time loss and cost of fuel consumption.

Figure 28. Cost of Congestion Dashboard – Time Loss

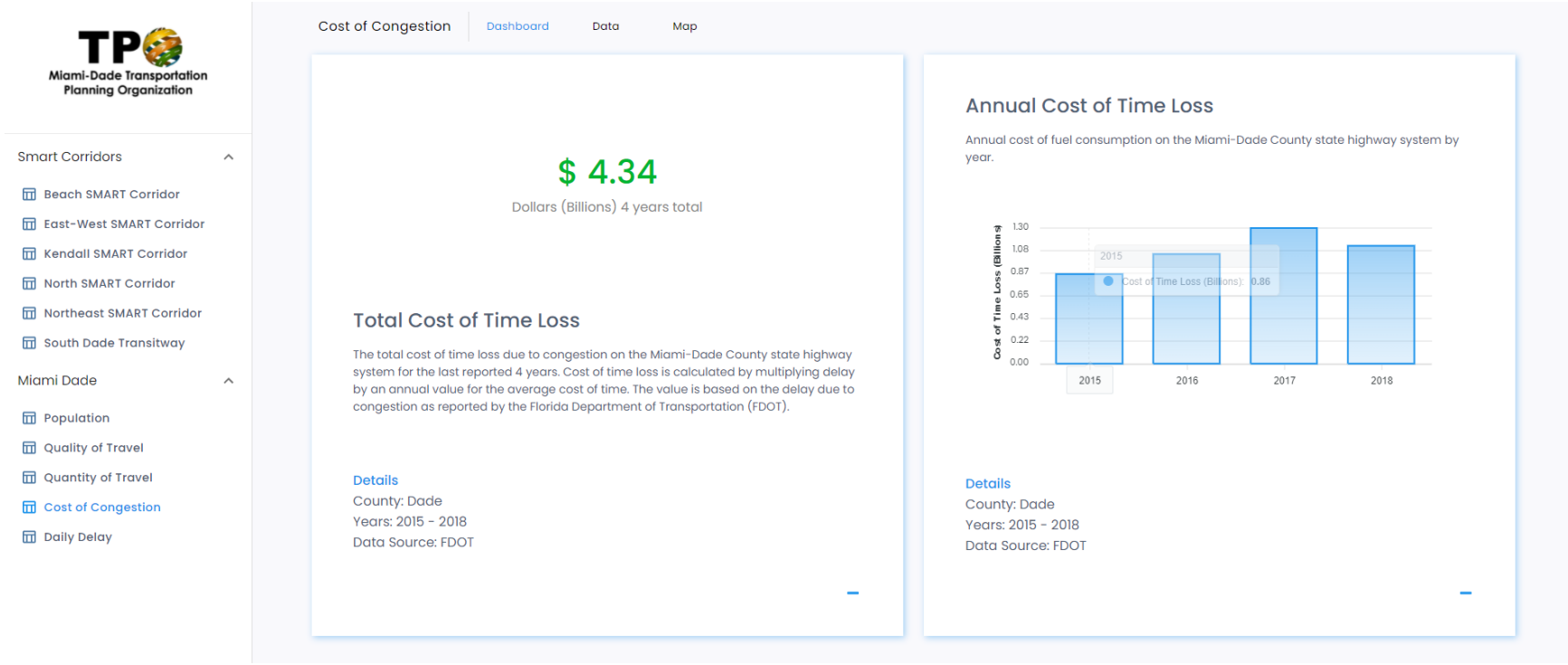


Figure 29. Cost of Congestion Dashboard –Fuel Consumption

Figure 30. Cost of Congestion Dashboard – Total Cost

Daily Delay

Figure 31. Daily Delay Dashboard

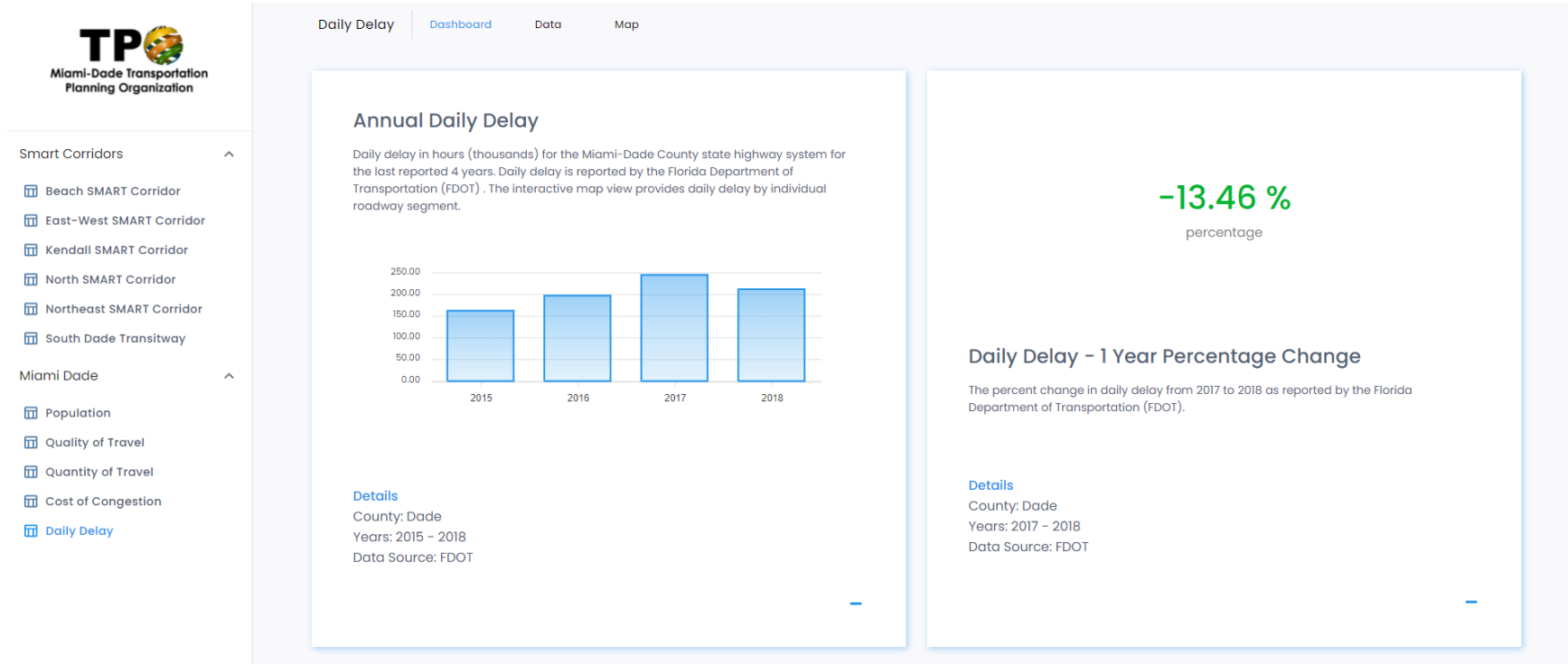
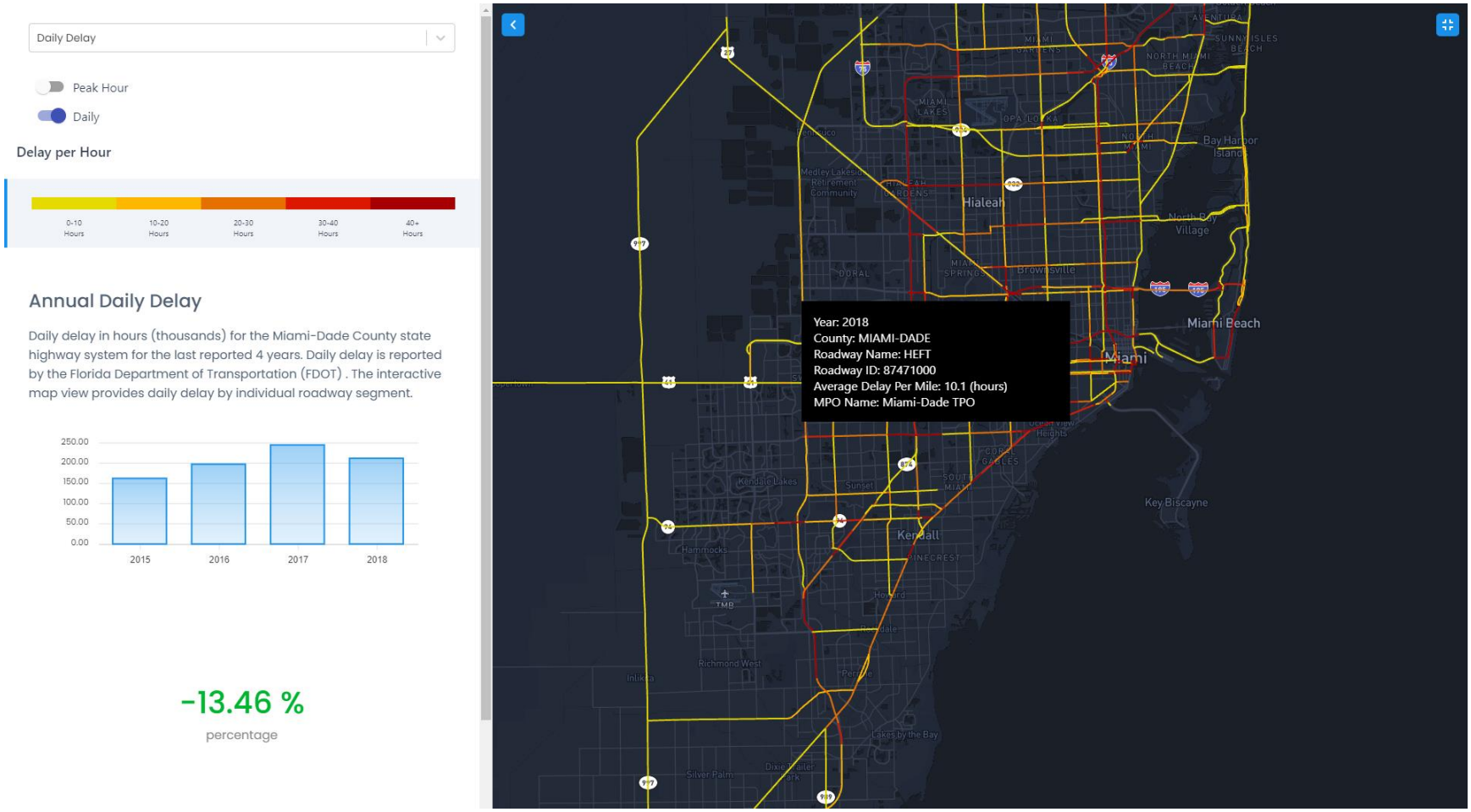


Figure 32. Daily Delay - Map View



IV. Conclusions and Recommendations

This report provided context for the development of the SMART CMD and presented a walkthrough of the dashboard features and functionality. The final product is a tool that will aid the Miami-Dade TPO and their partners in assessing the traffic and safety conditions of the Smart Plan Corridors and provide performance tracing for the Miami-Dude County from year to year.

Performance measures that were not included in the first phase of the dashboard are recommended for inclusion in a second phase of the SMART CMD. This second update would add the additional measures identified in Table 1. In addition to adding these identified performance measures, it is suggested to provide a federal reporting segment of the dashboard. This portion would annually update the federally mandated performance measures from Map-21, Fast Act and other federal guidance documents.

Table 1 – Recommended Phase 2 Performance Measures

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
Accessibility Measures				
	Jobs Near Highways	●	●	
	Population with Access to Bike Share	●	●	
	Population with Access to Transit (Transit Accessibility)	●	●	
	Population within 5 Miles of Park and Ride Lots	●	●	
	Retail Accessibility	●	●	
	Walkability Score	●	●	
	Work Accessibility	●	●	
Condition Measures				
	Pavement Condition	●		
Economic Measures				
	Gross Domestic Product	●		
	Transit-related Cost Efficiency Measures	●		

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
Environmental Measures				
	Vehicle emissions: CO2, VOC, NOx	●		
Operations Measures				
	Real-time Events Highways	●	●	●
	Real-time Events Transit	●	●	●
	Incident and Response Information	●		
Quality Measures				
	Average Transit Load	●		
	Daily Duration of Congestion	●		
	Transit On-Time Performance	●		
	Rideshare Reliability	●		
	Micromobility Service Reliability	●		
	Truck Travel Time Reliability	●		
	On Time Reliability	●		
	Average Commute Time	●		
Quantity Measures				
	Air Cargo	●		
	Aviation Enplanements	●		
	Port Traffic: Tons Moved	●		
	Port Traffic: Containers Moved	●		
	Port Traffic: Cruise Passengers	●		
	Transit Ridership	●		
	Vehicle Occupancy	●		
Safety Measures				
	Crashes by Severity	●	●	
	Crash Rate by Severity	●	●	
	Crashes by Mode	●	●	

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
	Public Safety Events	●	●	
	Transit-related Safety Events	●	●	
Utilization Measures				
	Passengers Per Revenue Hour	●		
	Passengers Per Revenue Mile	●		
	Percent of Miles Meeting LOS Criteria	●		

Appendix A.

Survey Responses and Identified Performance Measures

Table 2 - Summary of Candidate Performance Measures and Ranking

Question	Resp. #1	Resp. #2	Resp. #3	Resp. #4	Score	Rank	Priority
1. Total Crash Rate (crashes/million vehicle-miles)	High	High	High	High	12	1	High
2. Number of Fatalities	High	High	High	High	12	1	High
3. Number of Serious Injuries	High	High	High	High	12	1	High
4. Fatal Crash Rate (crashes/million vehicle-miles)	High	High	High	High	12	1	High
5. Serious Injury Rate (crashes/million vehicle-miles)	High	High	Medium	High	11	9	High
6. Total Number of Non-Motorized Fatalities and Serious Injuries	High	High	Medium	High	11	9	High
7. Transit-related Reportable Fatalities	High	High	Low	High	10	27	Medium
8. Transit-related Rate of Facilities per Vehicle Revenue Miles by Mode	High	High	Low	Low	8	52	Low
9. Transit-related Reportable Safety Events	High	Medium	Low	High	9	43	Medium
10. Transit-related Reportable Safety Events per Vehicle Revenue Mile	High	Medium	Low	Low	7	67	Low
11. Predicted Crash Hot Spots	High	High	Low	High	10	27	Medium
12. Vehicle-Miles Traveled (Daily)	High	High	Medium	Medium	10	27	Medium
13. Vehicle Occupancy (Persons/Vehicle)	High	High	High	Medium	11	9	High
14. Person-Miles Traveled (Daily)	High	High	Medium	Medium	10	27	Medium
15. Truck-Miles Traveled (Daily)	High	High	Low	Medium	9	43	Medium
16. Transit Ridership	High	High	High	Medium	11	9	High
17. Percent of Non-SOV Travel	High	High	Medium	Low	9	43	Medium
18. Aviation	High	High	Low	Low	8	52	Low

Question	Resp. #1	Resp. #2	Resp. #3	Resp. #4	Score	Rank	Priority
19. Enplanements	High	Medium	Low	Low	7	67	Low
20. Air Cargo (Tons)	High	Medium	Low	Low	7	67	Low
21. Ports (Tons Moved)	High	High	Low	Low	8	52	Low
22. Ports (Containers Moved)	High	Medium	Low	Low	7	67	Low
23. Cruise Passengers Served	High	High	Low	Low	8	52	Low
24. Average Travel Speed (Peak Hour)	High	High	High	High	12	1	High
25. Delay (Daily)	High	High	High	High	12	1	High
26. Percent of Person-miles Traveled on the Interstate that Are Reliable	High	High	High	Medium	11	9	High
27. Percent of Person-miles Traveled on The Non-interstate NHS that Are Reliable	High	High	Medium	Medium	10	27	Medium
28. Truck Travel Time Reliability Ratio (TTTR) on the Interstate	High	High	Low	Low	8	52	Low
29. Number of Jobs Near a State Highway	High	Medium	Low	Low	7	67	Low
30. Percent Miles Meeting LOS Criteria Rural Facilities	High	Low	Low	Medium	7	67	Low
31. Cost Per Trip	High	Medium	Medium	Medium	9	43	Medium
32. Travel Time Reliability for Ride Share	High	High	Medium	Medium	10	27	Medium
33. Percent Miles Severely Congested (Peak Hour)	High	Medium	High	High	11	9	High
34. Percent Travel Severely Congested (Daily)	High	Medium	Medium	High	10	27	Medium
35. Percent Travel Severely Congested (Peak Hour)	High	Medium	High	High	11	9	High
36. Hours Severely Congested (Daily)	High	Medium	High	High	11	9	High
37. Hours Severely Congested (Yearly)	High	Medium	High	High	11	9	High

Question	Resp. #1	Resp. #2	Resp. #3	Resp. #4	Score	Rank	Priority
38. Vehicles Per Lane Mile (Peak Hour)	High	High	High	High	12	1	High
39. Events (Lane Closures and Work Zones)	High	Medium	Medium	High	10	27	Medium
40. Identification and Verification (minutes)	High	Medium	Medium	Low	8	52	Low
41. Clearance Times (minutes)	High	Medium	Medium	Low	8	52	Low
42. Weather Condition	High	High	Low	Low	8	52	Low
43. Cost of Congestion ($)	High	Medium	Medium	Medium	9	43	Medium
44. Cost of Emissions ($)	High	Medium	Low	Medium	8	52	Low
44. Percent of Population within a Quarter-mile Walk of a Transit Stop	High	High	High	High	12	1	High
45. Population within 5 miles of Park-n-ride Lots	High	High	Medium	Medium	10	27	Medium
46. Passengers per Vehicle Revenue-mile	High	High	Medium	Medium	10	27	Medium
47. Passengers per Vehicle Revenue-hour	High	High	Medium	Low	9	43	Medium
48. Lane miles with Bicycle and Pedestrian Facilities	High	High	Medium	High	11	9	High
49. Walkability Score	High	High	High	Medium	11	9	High
50. Safety Score (crime and public transit)	High	Medium	Medium	Low	8	52	Low
51. Real-time data on all transit and mobility options	High	High	Low	Low	8	52	Low
52. Population within a 1/8 mile of a bike share	High	High	Medium	High	11	9	High
53. Parking Supply/Demand	Medium	High	High	Medium	10	27	Medium
54. Daily Population Density	Medium	High	Medium	Low	8	52	Low

Question	Resp. #1	Resp. #2	Resp. #3	Resp. #4	Score	Rank	Priority
55. Ride Share Reliability	Medium	Medium	Medium	Medium	8	52	Low
56. Bike Share Reliability	Medium	Medium	Medium	High	9	43	Medium
57. Scooter Share Reliability	High	Medium	Low	High	9	43	Medium
58. Transit Accessibility	High	High	Medium	High	11	9	High
59. Retail Accessibility	High	Medium	Medium	Low	8	52	Low
60. Education Accessibility	High	Medium	Low	Medium	8	52	Low
61. Work Accessibility	High	Medium	Medium	Medium	9	43	Medium
62. Co-work Locations	Medium	Medium	Medium	Low	7	67	Low
63. Percent of Interstate Pavement in Good Condition	Medium	High	High	Medium	10	27	Medium
64. Percent of Interstate Pavements in Poor Condition	Medium	High	High	Medium	10	27	Medium
65. Percent of Interstate Pavements in Poor Condition	Medium	High	High	Medium	10	27	Medium
66. Percent of Non-Interstate NHS Pavement in Good Condition	High	High	High	Medium	11	9	High
67. Percent of Non-Interstate NHS Pavement in Poor Condition	High	High	High	Medium	11	9	High
68. Percent of National Highway System Bridges in Good Condition	High	High	High	Medium	11	9	High
69. Percent of National Highway System Bridges in Poor Condition	High	High	High	Medium	11	9	High
70. Average Age of Transit Vehicles (years)	High	Medium	Low	Low	7	67	Low

Question	Resp. #1	Resp. #2	Resp. #3	Resp. #4	Score	Rank	Priority
71. Transit-related Percent of Non-revenue Support-service and Maintenance Vehicles	High	Medium	Low	Low	7	67	Low
72. Transit-related Revenue Vehicles by Mode	High	High	Medium	Medium	10	27	Medium
73. Transit-related Percentage of Track Segments with Performance Restrictions	High	Medium	Low	Low	7	67	Low
74. Percent of Facilities with Condition Rating Below 3.0 on Level of Service Scale	High	High	Medium	Medium	10	27	Medium
75. Transit-related Systems Reliability	High	High	Medium	High	11	9	High

Table 3 - Summary of High Priority Measures

Question	Score	Priority
1. Total Crash Rate (crashes/million vehicle-miles)	12	High
2. Number of Fatalities	12	High
3. Number of Serious Injuries	12	High
4. Fatal Crash Rate (crashes/million vehicle-miles)	12	High
24. Average Travel Speed (Peak Hour)	12	High
25. Delay (Daily)	12	High
38. Vehicles Per Lane Mile (Peak Hour)	12	High
44. Percent of Population within a Quarter-mile Walk of a Transit Stop	12	High
5. Serious Injury Rate (crashes/million vehicle-miles)	11	High
6. Total Number of Non-Motorized Fatalities and Serious Injuries	11	High
13. Vehicle Occupancy (Persons/Vehicle)	11	High
16. Transit Ridership	11	High
26. Percent of Person-miles Traveled on the Interstate that Are Reliable	11	High
33. Percent Miles Severely Congested (Peak Hour)	11	High
35. Percent Travel Severely Congested (Peak Hour)	11	High
36. Hours Severely Congested (Daily)	11	High
37. Hours Severely Congested (Yearly)	11	High
48. Lane miles with Bicycle and Pedestrian Facilities	11	High
49. Walkability Score	11	High
52. Population within a 1/8 mile of a bike share	11	High
58. Transit Accessibility	11	High
66. Percent of Non-Interstate NHS Pavement in Good Condition	11	High
67. Percent of Non-Interstate NHS Pavement in Poor Condition	11	High
68. Percent of National Highway System Bridges in Good Condition	11	High
69. Percent of National Highway System Bridges in Poor Condition	11	High
75. Transit-related Systems Reliability	11	High

Table 4 - Summary of Medium Priority Measures

Question	Score	Priority
7. Transit-related Reportable Fatalities	10	Medium
11. Predicted Crash Hot Spots	10	Medium
12. Vehicle-Miles Traveled (Daily)	10	Medium
14. Person-Miles Traveled (Daily)	10	Medium
27. Percent of Person-miles Traveled on The Non-interstate NHS that Are Reliable	10	Medium
32. Travel Time Reliability for Ride Share	10	Medium
34. Percent Travel Severely Congested (Daily)	10	Medium
39. Events (Lane Closures and Work Zones)	10	Medium
45. Population within 5 miles of Park-n-ride Lots	10	Medium
46. Passengers per Vehicle Revenue-mile	10	Medium
53. Parking Supply/Demand	10	Medium
63. Percent of Interstate Pavement in Good Condition	10	Medium
64. Percent of Interstate Pavements in Poor Condition	10	Medium
65. Percent of Interstate Pavements in Poor Condition	10	Medium
72. Transit-related Revenue Vehicles by Mode	10	Medium
74. Percent of Facilities with Condition Rating Below 3.0 on Level of Service Scale	10	Medium
9. Transit-related Reportable Safety Events	9	Medium
15. Truck-Miles Traveled (Daily)	9	Medium
17. Percent of Non-SOV Travel	9	Medium
31. Cost Per Trip	9	Medium
43. Cost of Congestion ($)	9	Medium
47. Passengers per Vehicle Revenue-hour	9	Medium
56. Bike Share Reliability	9	Medium
57. Scooter Share Reliability	9	Medium
61. Work Accessibility	9	Medium

Table 5 - Recommended Performance Measures and Visualization Method

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
Accessibility Measures				
	Bicycle Facilities	●	●	
	Education Accessibility	●	●	
	Jobs Near Highways	●	●	
	Pedestrian Facilities	●	●	
	Population with Access to Bike Share	●	●	
	Population with Access to Transit (Transit Accessibility)	●	●	
	Population within 5 Miles of Park and Ride Lots	●	●	
	Retail Accessibility	●	●	
	Walkability Score	●	●	
	Work Accessibility	●	●	
Condition Measures				
	Bridge Condition	●		
	Pavement Condition	●		
	Transit Vehicle Condition	●		
	Transit Infrastructure Condition	●		
Economic Measures				
	Cost of Congestion and Cost of Congestion Per Capita	●		
	Cost of Emissions	●		
	Gross Domestic Product	●		
	Transit-related Cost Efficiency Measures	●		
Environmental Measures				
	Vehicle emissions	●		
Operations Measures				
	Real-time Events Highways	●	●	●
	Real-time Events Transit	●	●	●
	Incident and Response Information	●		

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
Quality Measures				
	Average Commute Time	●	●	
	Average Load on Transit Vehicles	●		
	Average Speed	●		
	Average Vehicle Delay	●		
	Hours Severely Congested	●		
	Level of Travel Time Reliability	●		
	On-Time Reliability by Mode	●		
	Percent of Travel Severely Congested	●		
	Rideshare Reliability	●		
	Micromobility Service Reliability	●		
	Truck Travel Time Reliability	●		
Quantity Measures				
	Air Cargo	●		
	Aviation Enplanements	●		
	Person-miles Traveled	●		
	Port Traffic: Tons Moved	●		
	Port Traffic: Containers Moved	●		
	Port Traffic: Cruise Passengers	●		
	Transit Ridership	●		
	Truck-miles Traveled	●		
	Vehicle Occupancy	●		
	Vehicle-miles Traveled	●		
Safety Measures				
	Crashes by Severity	●	●	
	Crash Rate by Severity	●	●	
	Crashes by Mode	●	●	
	Public Safety Events	●	●	
	Transit-related Safety Events	●	●	

Dimension of Mobility	Performance Measure	Data with Trend Chart	Map	Real-time Information
Utilization Measures				
	Passengers Per Revenue Hour	●		
	Passengers Per Revenue Mile	●		
	Vehicles per Lane-mile	●		
	Percent of Miles Meeting LOS Criteria	●		
	Percent of Miles Severely Congested	●		