



# National Highway System (NHS) Travel Reliability and Freight Movement Performance Targets

January 5, 2023

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Boston Region Metropolitan Planning Organization

# Key Takeaways

- 1) United States Department of Transportation (US DOT) requires performance monitoring related to the **reliability of passenger and freight movement** on the National Highway System (NHS)
- 2) States and MPOs must set targets for two types of reliability performance measures:
  - For **all roadway users**: percent of person-miles that are reliable for the Interstate and non-Interstate NHS
  - For **freight**: Truck Travel Time Reliability Index for Interstates

# Requested MPO Actions

- Vote to support the Massachusetts Department of Transportation's (MassDOT) travel time reliability targets
  - Report MassDOT targets in MPO planning documents
  - Work collaboratively to plan and program projects to achieve targets

# Federal Performance Measures and Targets

## Two-Year and Four-Year Targets



**Bridge and  
Pavement  
Condition**



**Travel Time  
Reliability**



**CMAQ  
Congestion**



**CMAQ  
Mobile-Source  
Emissions**



**Roadway  
Safety**



**Transit  
Safety**



**Transit  
Asset  
Condition**

Set by the end  
of current TIP  
development  
cycle

Set by the end  
of current TIP  
development  
cycle



Set by the end  
of February  
2023

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# Federal Performance Measures and Targets

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January 5, 2023

## AGENDA

# Travel Time Reliability



Travel time reliability:  
consistency or dependability  
of travel times from day to  
day or across different times  
of day



How much do travel times  
vary from what is  
considered to be normal?




Technical difficulties? Call Stella  
Jordan at 857.702.3675 or email  
rfoley@ctps.org.

Photo sources: Commonwealth Magazine (top), CBS Boston (bottom).

January 5, 2023

## AGENDA

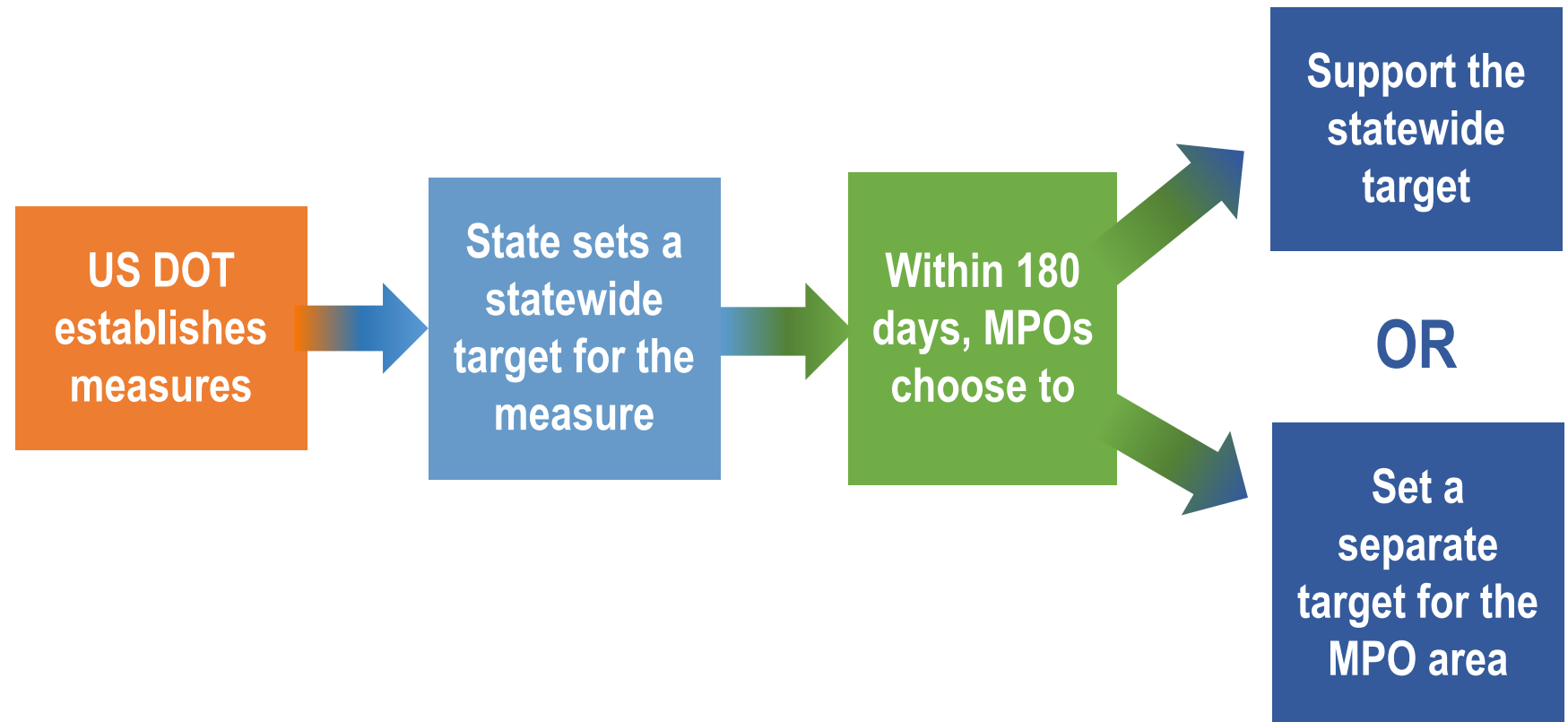
# Travel Time Reliability Measures

Category	Measure	Relevant Vehicle Types	Desired Direction
Travel Time Reliability	Percent of the person-miles traveled on the Interstate System that are reliable	All vehicles	
Travel Time Reliability	Percent of the person-miles traveled on the non-Interstate NHS that are reliable	All vehicles	
Freight reliability	Truck Travel Time Reliability Index	Trucks	

Technical difficulties? Call Stella Jordan at 857.702.3675 or email [rfoley@ctps.org](mailto:rfoley@ctps.org).

NHS = National Highway System.

# Target-Setting Approaches

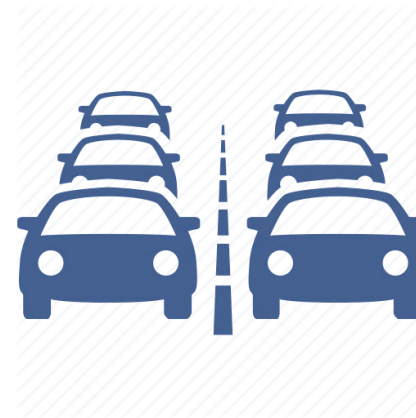
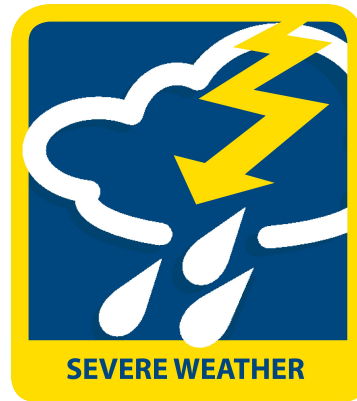




# Factors Affecting Reliability

Reliability = variability of travel times

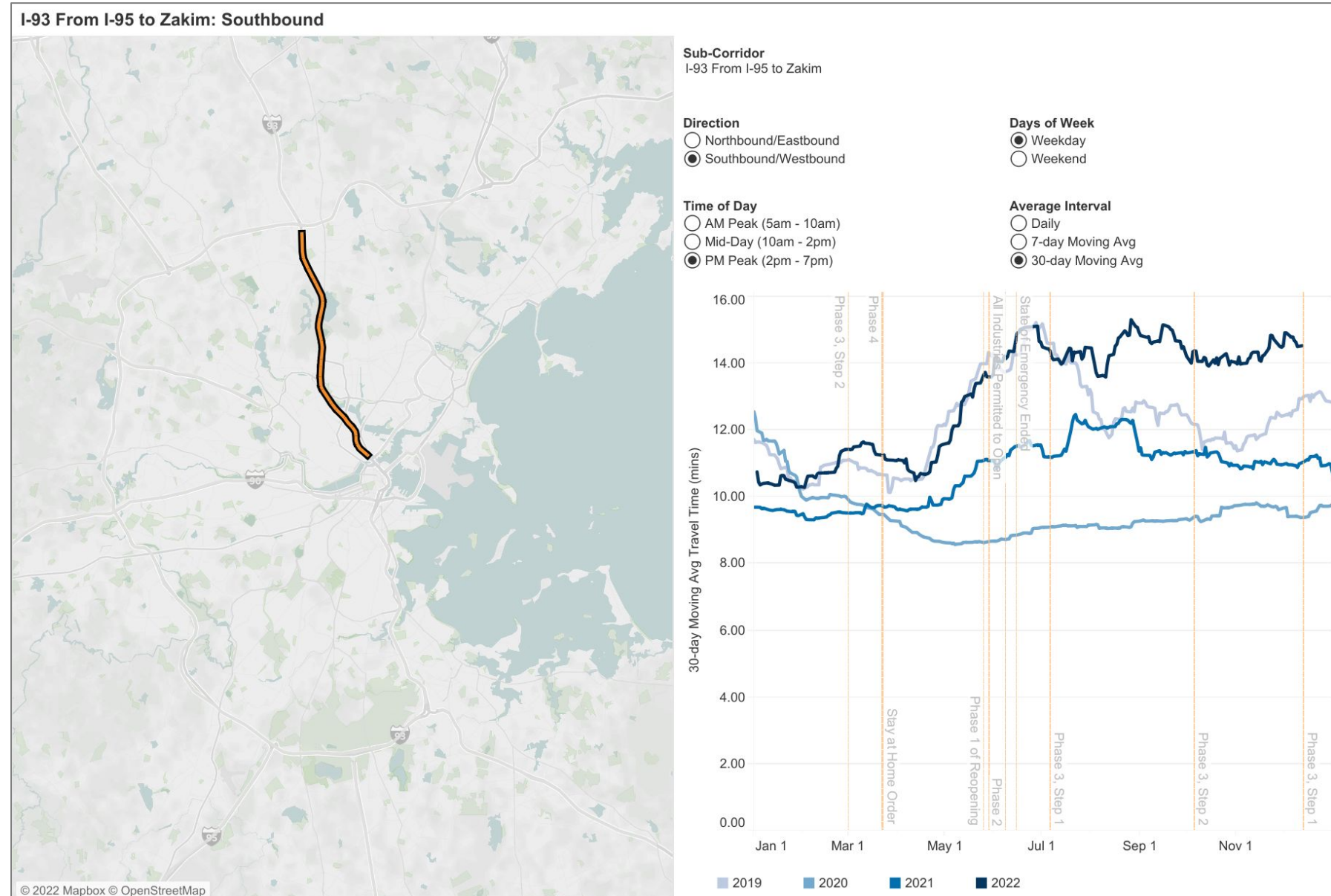
Affected by



# Mobility Following COVID-19

Changes in Travel  
Time on Regional  
Roadways

Source: MassDOT  
Mobility Dashboard



# National Highway System (NHS) in Massachusetts



- 3,340 total centerline miles
- 10,463 total lane miles
- 9% of lane miles in Massachusetts
- 16% of lane miles in Boston region

- Interstates
  - 567 centerline miles
  - 2,919 lane miles
  - Boston Region: 40% of Massachusetts Interstate lane miles

## Non-Interstate NHS

- 2,773 centerline miles
- 7,544 lane miles
  - Boston Region: 34% of Non-Interstate NHS lane miles

# Data Source for Reliability Measures

- Measured using National Performance Management Research Data Set (NPMRDS)
  - Travel time data for NHS segments
  - Travel times provided for trucks and passenger vehicles
  - Also used for CMAQ traffic congestion measures
- Vehicle volumes, vehicle occupancy factors, and other necessary data come from NPMRDS or related data sets

# Travel Time Reliability Measures

Level of  
Travel Time  
Ratio  
(LOTTR)

=

Longer Travel Time  
(80<sup>th</sup> Percentile)

Normal Travel Time  
(50<sup>th</sup> Percentile)



1

Reliability decreases as number increases →

∞

# Reliable Person-Miles

- NHS segments are considered reliable if they stay below the 1.5 LOTTR index threshold for all relevant time periods.
- Person-miles are calculated using NHS network mileage, traffic volumes, and vehicle occupancy factors.

$$\frac{\text{Reliable Person-Miles}}{\text{Total Person-Miles}}$$

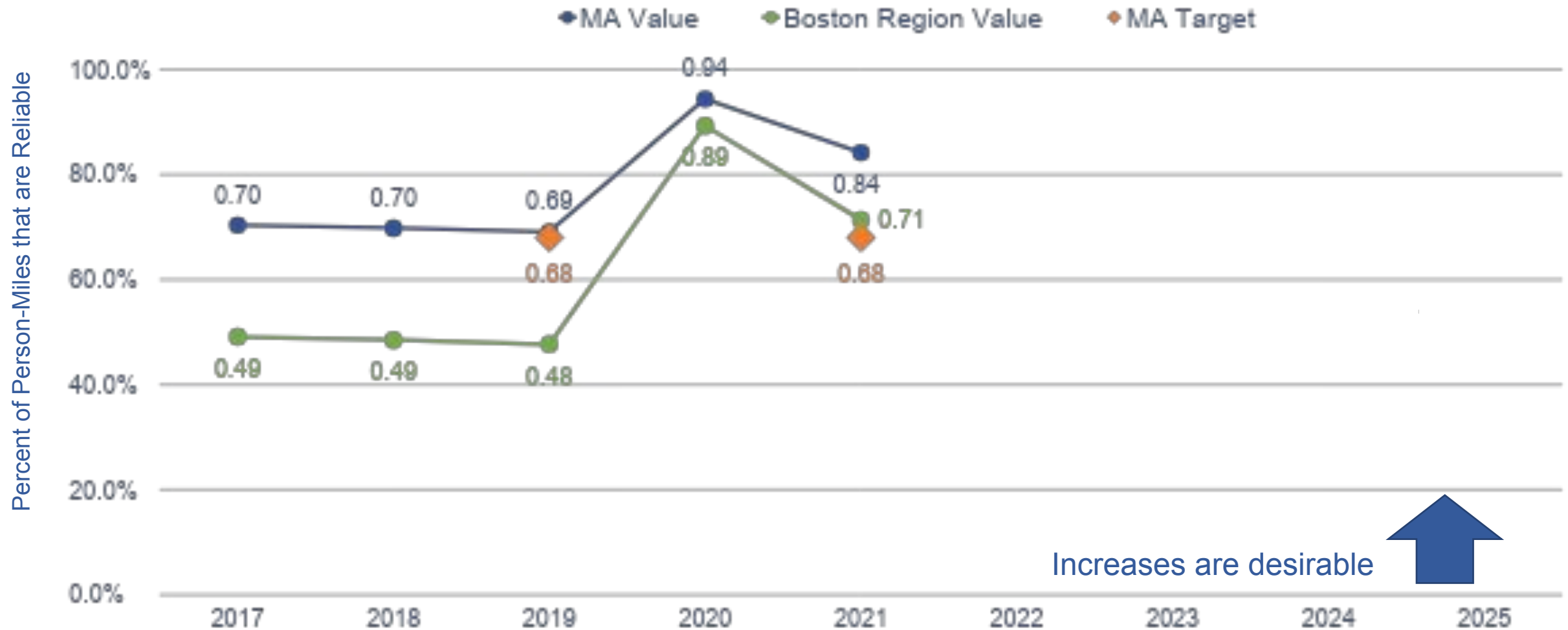
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Percent of person-miles  
that are reliable

Interstates



# Percent of Person-Miles that are Reliable (Interstates): Past Values

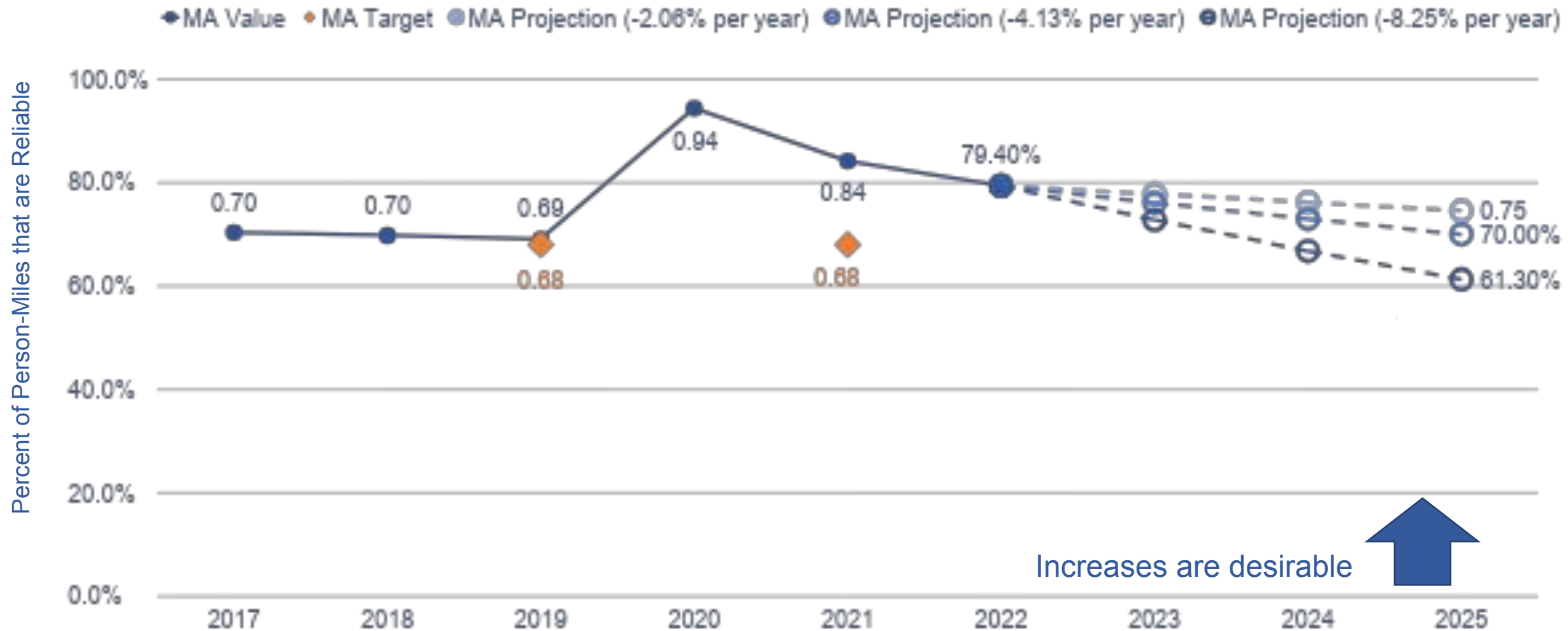


Note: The number of municipalities in the Boston Region MPO area decreased from 101 to 97 in 2018. This change may have affected 2017 values calculated using the RITIS platform in 2022 as compared to baselines determined when targets were initially set in 2018. MA = Massachusetts.

Sources: National Performance Management Research Data Set, Regional Integrated Transportation Information System, the Massachusetts Department of Transportation, and Boston Region MPO staff.



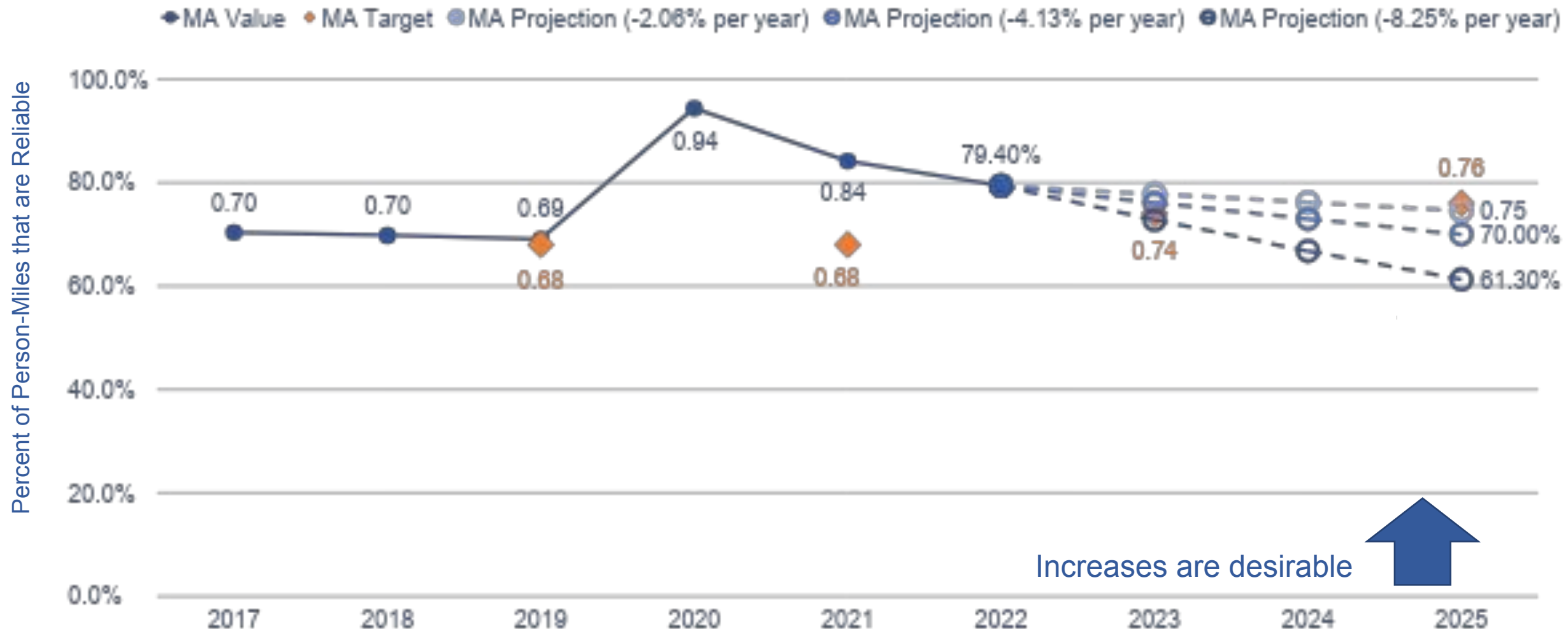
# Percent of Person-Miles that are Reliable (Interstates): Projections



Notes: The number of municipalities in the Boston Region MPO area decreased from 101 to 97 in 2018. This change may have affected 2017 values calculated using the RITIS platform in 2022 as compared to baselines determined when targets were initially set in 2018. 2022 is a “year-to-date” measure as of July 2022. MA = Massachusetts.

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# Percent of Person-Miles that are Reliable (Interstates): Projections and Targets

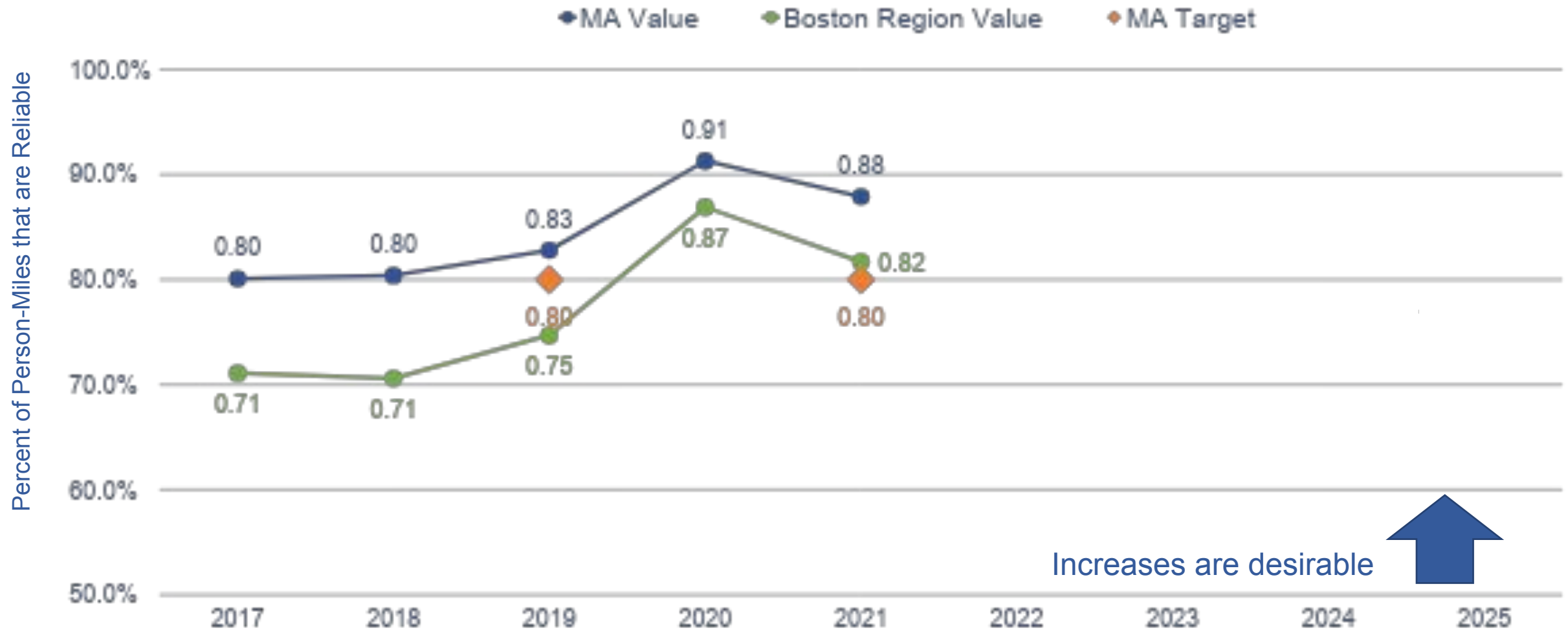


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# Non-Interstate National Highway System

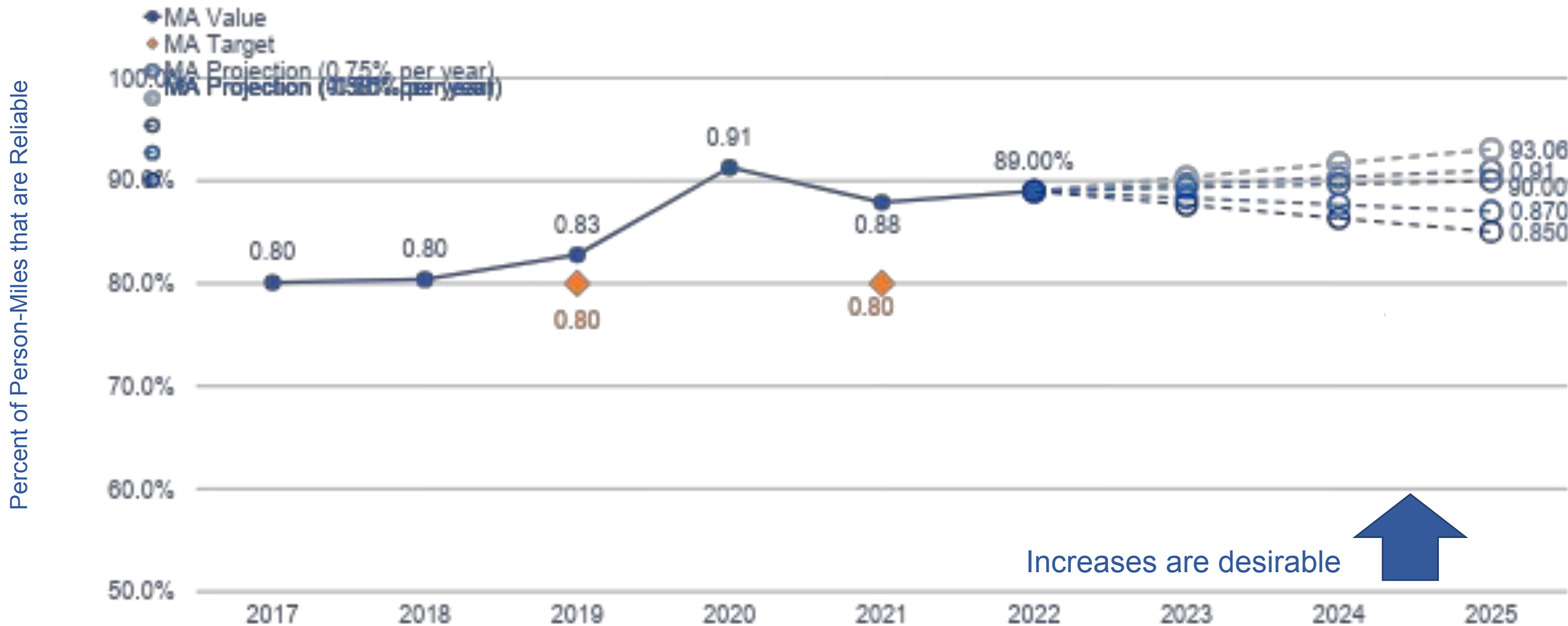
# Percent of Person-Miles that are Reliable (Non-Interstate NHS): Past Values



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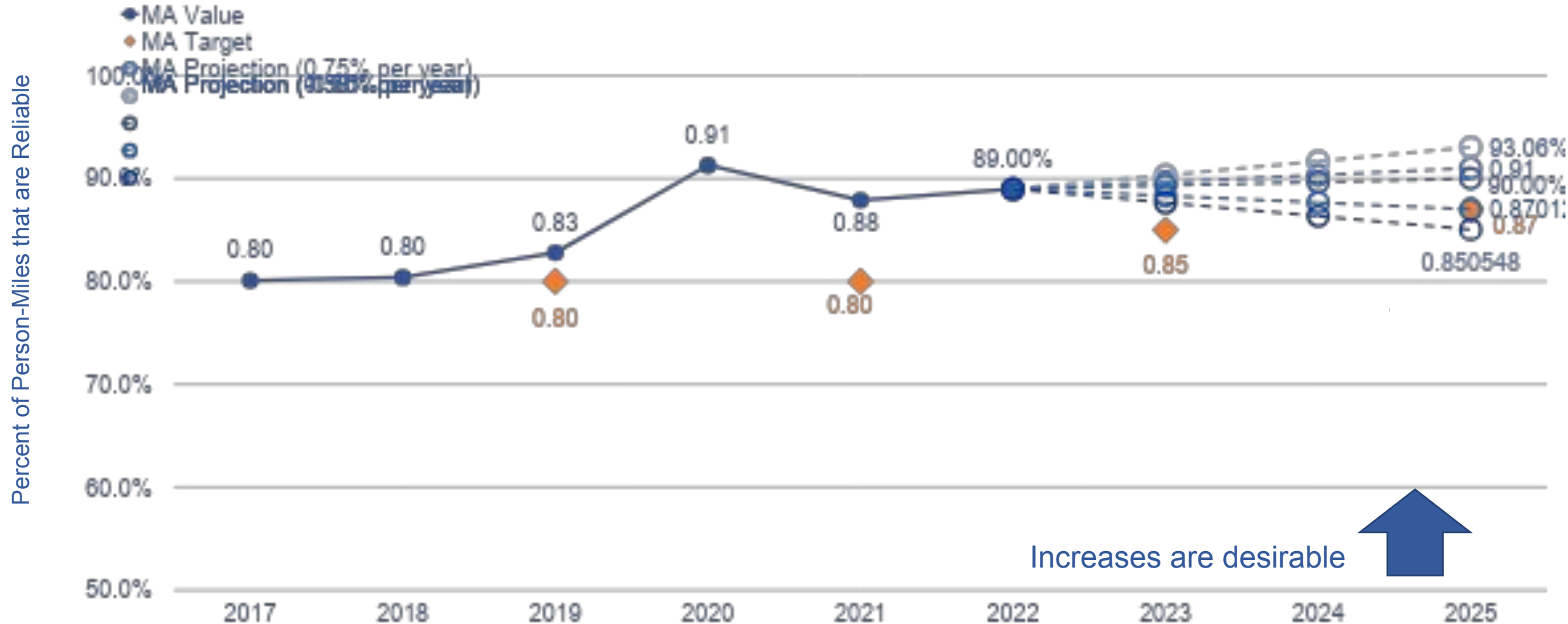
# Percent of Person-Miles that are Reliable (Non-Interstate NHS): Projections



Notes: The number of municipalities in the Boston Region MPO area decreased from 101 to 97 in 2018. This change may have affected 2017 values calculated using the RITIS platform in April 2022 as compared to baselines determined when targets were initially set in 2018. Note: 2022 is a “year-to-date” measure as of July 2022. MA = Massachusetts. NHS = National Highway System.

Sources: National Performance Management Research Data Set, Regional Integrated Transportation Information System, the Massachusetts Department of Transportation, and Boston Region MPO staff.

# Percent of Person-Miles that are Reliable (Non-Interstate NHS): Targets



Notes: The number of municipalities in the Boston Region MPO area decreased from 101 to 97 in 2018. This change may have affected 2017 values calculated using the RITIS platform in 2022 as compared to baselines determined when targets were initially set in 2018. Note: 2022 is a “year-to-date” measure as of July 2022. MA = Massachusetts. NHS = National Highway System.

Sources: National Performance Management Research Data Set, Regional Integrated Transportation Information System, the Massachusetts Department of Transportation, and Boston Region MPO staff.

# Freight Reliability Measure

$$\text{Truck Travel Time Reliability (TTTR) Index} = \frac{\text{Longer Truck Travel Time (95}^{\text{th}} \text{ Percentile)}}{\text{Normal Truck Travel Time (50}^{\text{th}} \text{ Percentile)}}$$



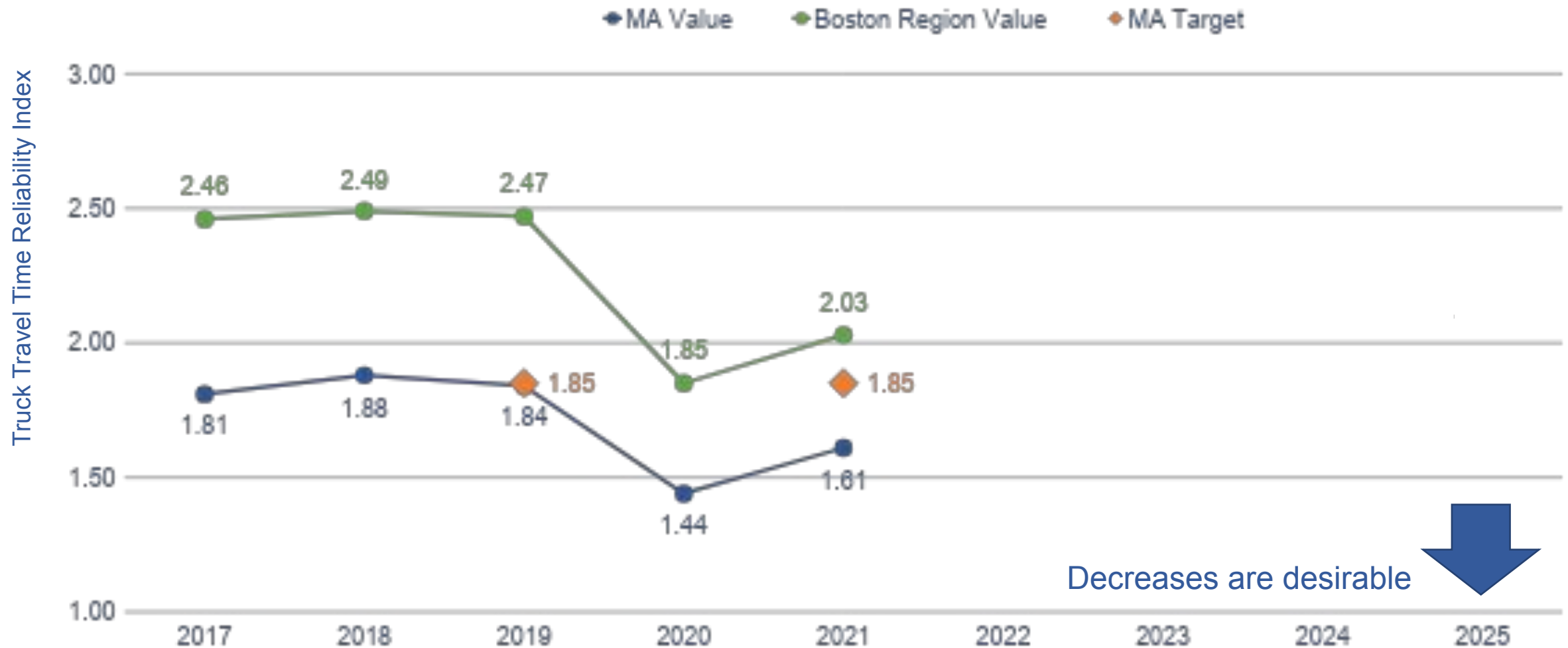
Federal Highway Administration has not set specific thresholds for the TTTR Index

# Truck Travel Time Reliability (TTTR)

- The maximum TTTR value for all relevant time periods becomes the TTTR value for that segment.
- TTTR values are weighted by segment length.
- Weighted values are used to calculate a TTTR value for the relevant portion of the Interstate network.



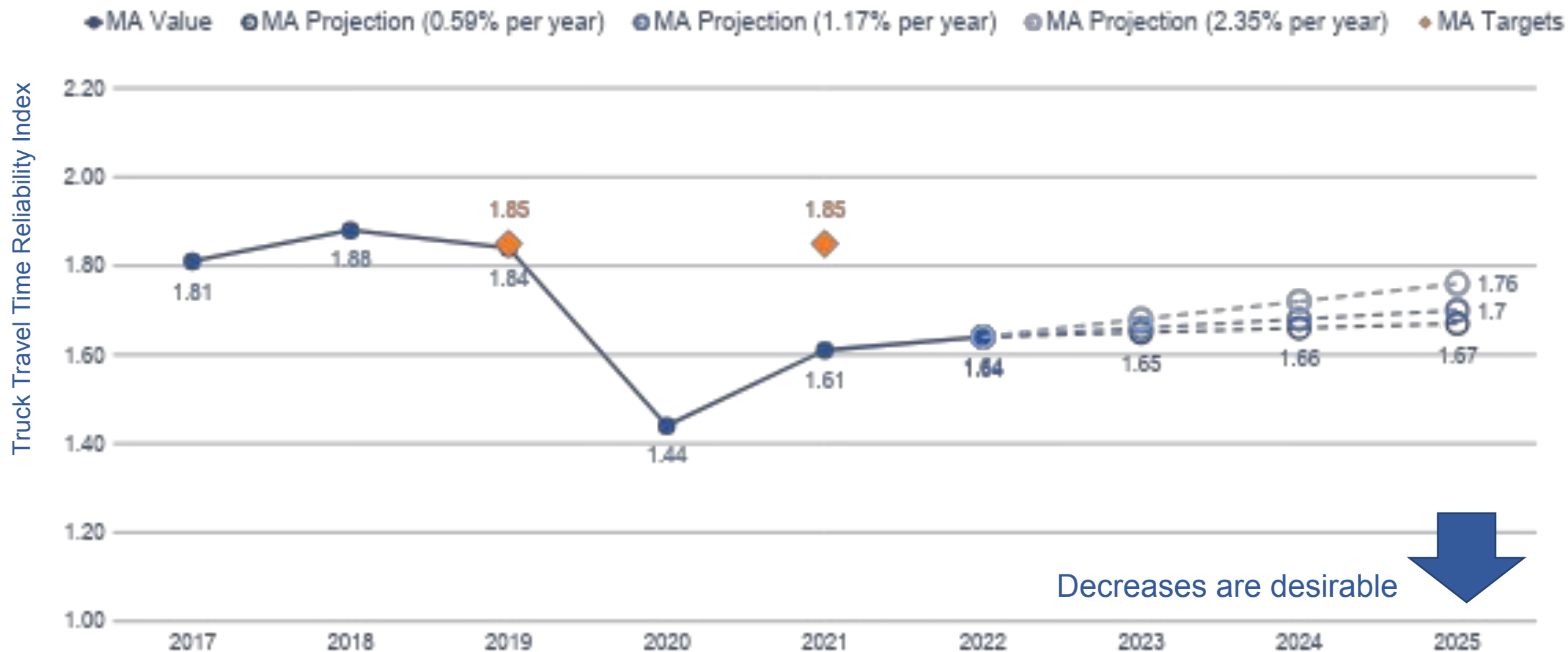
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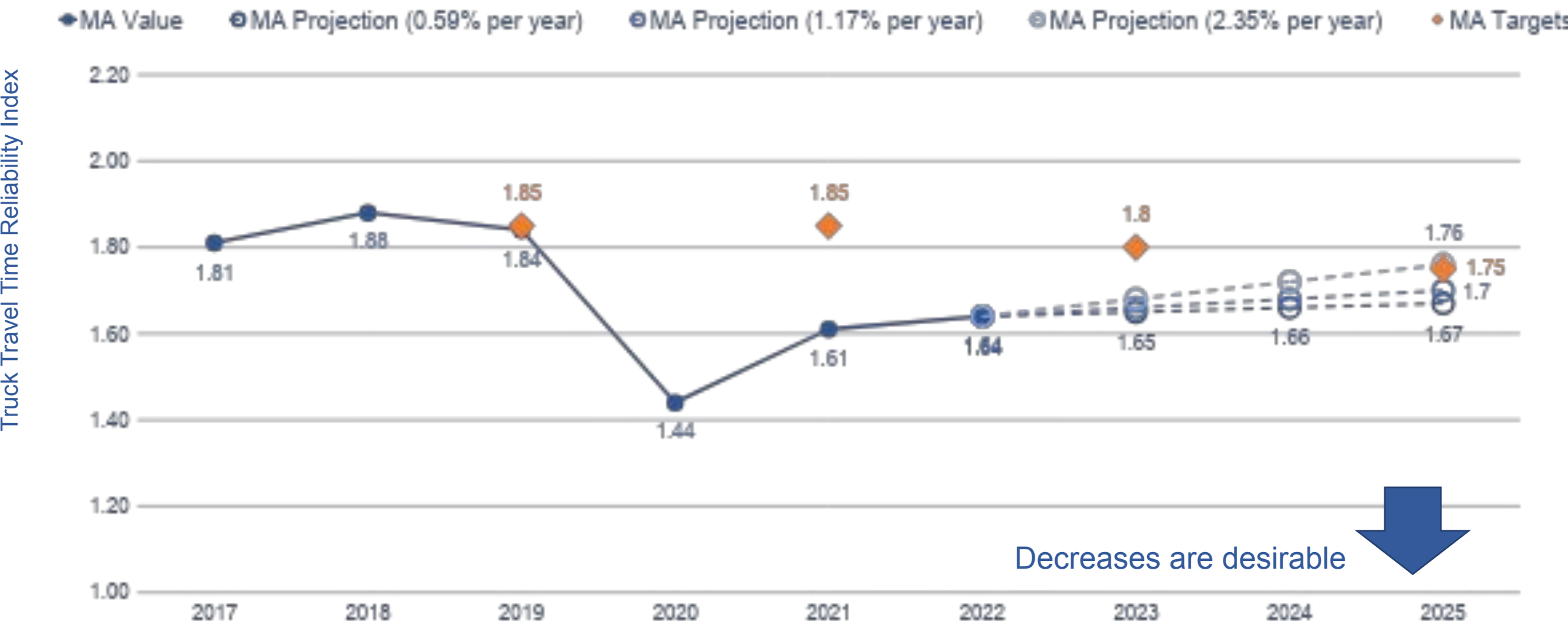
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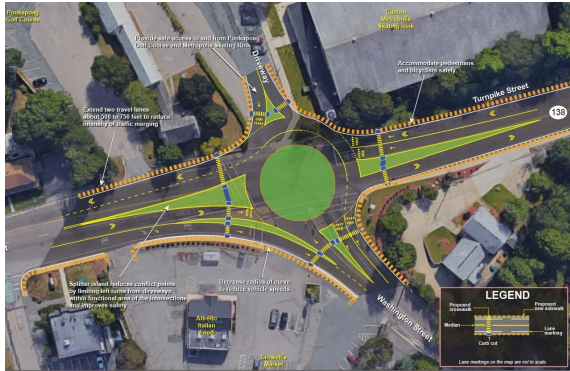
# Truck Travel Time Reliability Index (Interstates): Targets



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Sources: National Performance Management Research Data Set, Regional Integrated Transportation Information System, the Massachusetts Department of Transportation, and Boston Region MPO staff.

# Example Strategies to Address Travel Time Reliability



**Geometric Improvements**



**Bus/Truck Only Lanes**



**Mode Shift**



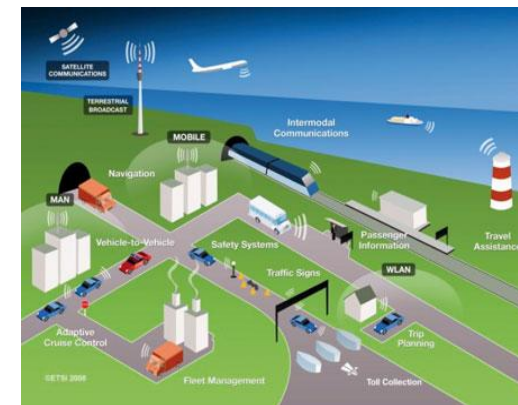
**Remote Work**



**Signal Retiming**



**High Occupancy  
Toll Lanes**



**Intelligent Transportation  
Systems**



**Emergency Response**

Image sources: CTPS (top left), Faller Davis and Associates (bottom left), Boston Globe (top left-of-center), American Society of Civil Engineers–National Capitol Section (bottom left-of-center), CTPS (top right-of center), ETSI 2012 (bottom right-of center), Christina Morillo (top right) CTPS (bottom right).



# MPO Action Requested

- Vote to support MassDOT's travel time reliability targets
- Next steps:
  - **April 2023:** Reflect updated travel time reliability performance targets in the Transportation Improvement Program
  - **October 2022 to August 2023:** Incorporate information learned from performance-indicators into Long-Range Transportation Plan development

# Massachusetts Targets Summary

Category	Measure	Desired Direction	MA Baseline Value (2021)	MA Two-Year Target (2021)	MA Four-Year Target (2021)
Travel Time Reliability	Percent of the person-miles traveled on the Interstate System that are reliable	↑	84.2%	74.0%	76.0%
Travel Time Reliability	Percent of the person-miles traveled on the non-Interstate NHS that are reliable	↑	87.9%	85.0%	87.0%
Freight reliability	Truck Travel Time Reliability Index	↓	1.61	1.80	1.75

MA = Massachusetts. NHS = National Highway System.

Backup Slides

January 5, 2023

## AGENDA

# Existing Congestion and Mobility Metrics (CMP)

CMP Performance Measures	Description	Express Highway Dashboard	Arterial Dashboard
Speed Index	Indicates congestion by comparing posted speed to travel speed	✓	✓
Average Speed	Mobility indicator associated with specific roadways	✓	
Congested Time	Average number of minutes that drivers experience congested conditions	✓	✓
Delay Per Mile	Extra time needed to traverse a roadway segment	✓	
Travel Time Index	Compares peak-period travel time conditions with free-flow travel time conditions for contingency planning	✓	✓
Planning Time Index	Compares near-worst-case travel time to free-flow travel time for contingency planning	✓	

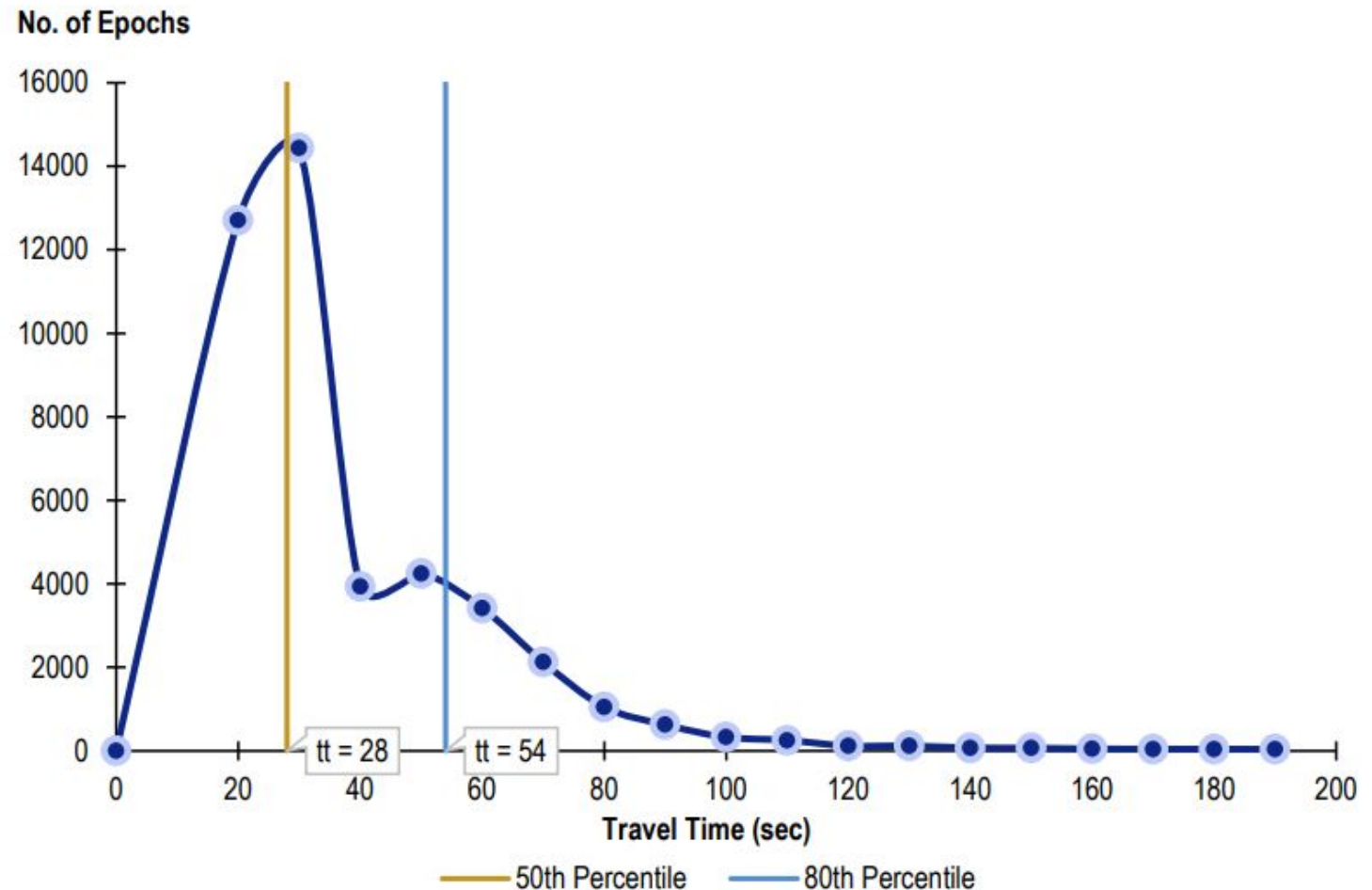
Technical difficulties? Call Stella Jordan at 857.702.3675 or email [rfoley@ctps.org](mailto:rfoley@ctps.org).

CMP = Congestion Management Process.



## AGENDA

# Level of Travel Time Reliability

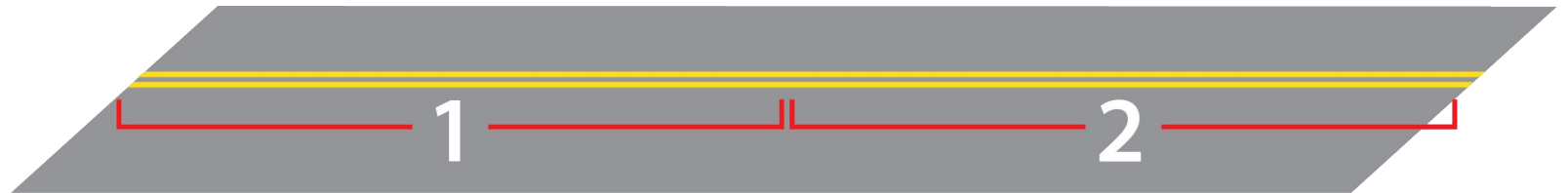


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Source: Federal Highway Administration.

# Identifying Reliable Segments

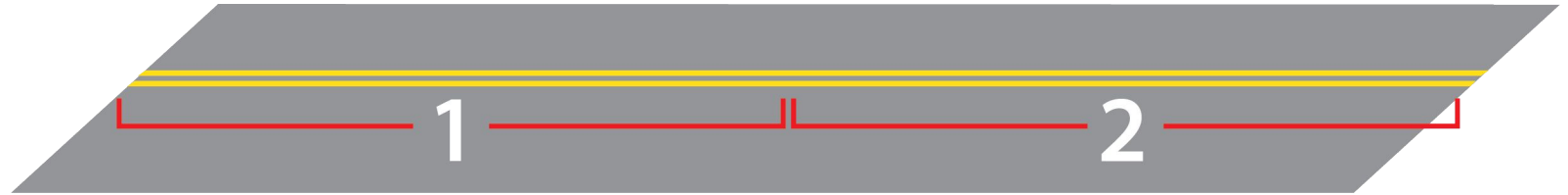
**Reliable = LOTTR < 1.50 for all relevant time periods**



	Segment 1	Segment 2
LOTTR: Weekdays 6 AM to 10 AM	1.35	1.60
LOTTR: Weekdays 10 AM to 4 PM	1.20	1.40
LOTTR: Weekdays 4 PM to 8 PM	1.45	1.80
LOTTR: Weekends 6 AM to 8 PM	1.10	1.50
Considered reliable?	YES	NO

LOTTR = Level of Travel Time Reliability.

# Calculating Share of Reliable Person-Miles

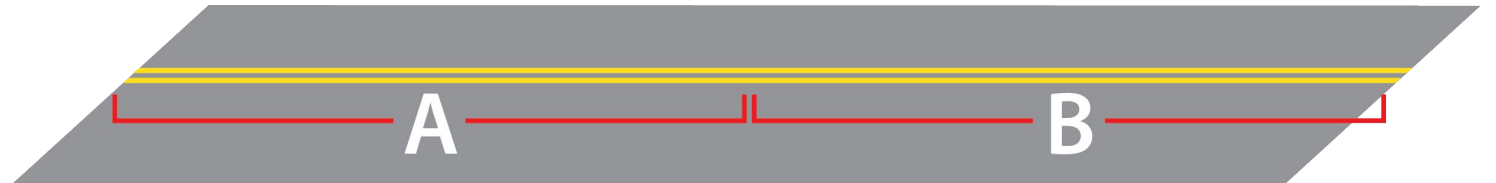


	Segment 1	Segment 2
Considered reliable?	YES	NO
Annual vehicle volumes	100,000	80,000
Vehicle occupancy factor	1.7	1.7
Annual number of travelers	170,000	136,000
Segment length (miles)	0.5	0.5
Person-miles	85,000	68,000

$$\frac{\text{Reliable Person-Miles}}{\text{Total Person-Miles}} = \frac{85,000}{153,000} = 55.5\% \text{ person miles that are reliable}$$

# Truck Travel Time Reliability (TTTR)

Identify maximum TTTR Index value across all relevant time periods



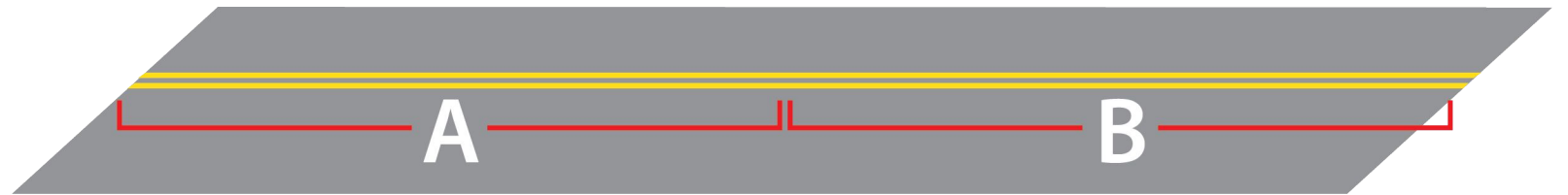
	Segment A	Segment B
TTTR: Weekdays 6 AM to 10 AM	1.50	1.80
TTTR: Weekdays 10 AM to 4 PM	1.37	1.28
TTTR: Weekdays 4 PM to 8 PM	1.70	1.62
TTTR: Weekends 6 AM to 8 PM	1.30	1.18
TTTR: All Days 8 PM to 6 AM	1.21	1.24
Maximum TTTR	1.70	1.80

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## AGENDA

# Interstate Reliability for Trucks

Calculate weighted TTTR Index value for Interstate network



	Segment A	Segment B
Maximum TTTR Index value	1.70	1.80
Segment length (miles)	1.00	1.25
Segment length weighted by TTTR value	1.70	2.25

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