Forward Pinellas

CONGESTION MANAGEMENT PROCESS

Technical Memorandum 3: Hot Spot Analysis

MAY 2021

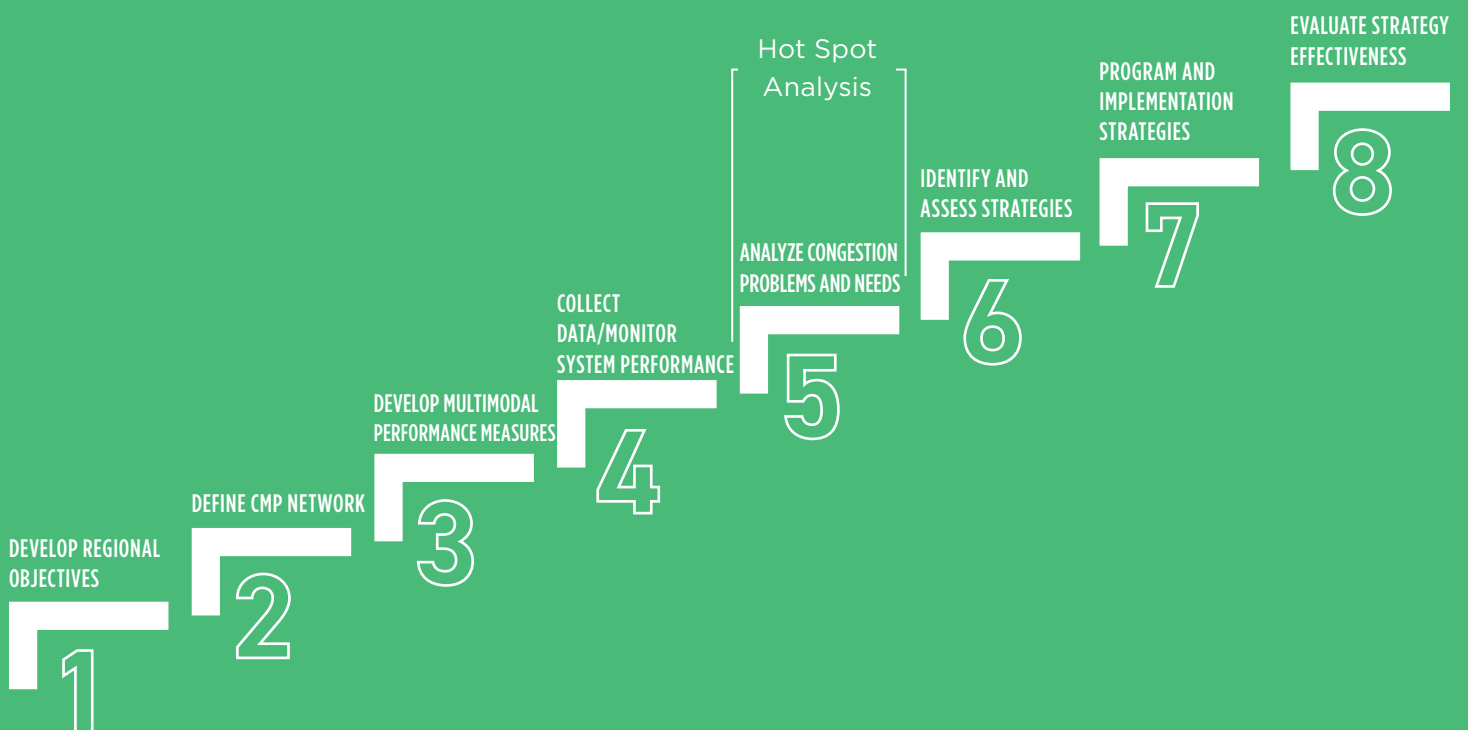**DRAFT**

FORWARD PINELLAS

CONTENTS

01. INTRODUCTION

The Congestion Management Process (CMP) update, as outlined by the Federal Highway Administration (FHWA) and illustrated in Figure 1, involves a performance-based planning process that hinges on quantifying the causes of congestion and monitoring them over time. Once regional objectives and CMP network are defined, the development of performance measures and analysis begins. Performance measures for the 2021 CMP were developed consistent with the Advantage Pinellas 2045 Long-Range Transportation Plan (LRTP), Federal Highway Administration (FHWA) guidance, and available data sources. Measures were identified both to measure congestion and congestion-related characteristics, like crashes, accessibility, transit on-time performance, and others. A subset of the comprehensive array of performance measures were used to perform a hotspot analysis, highlighting network segments with performance deficiencies. Three categories of measures were used to accomplish this task, including:

- Mobility – Difference in observed and posted speed limits
- Reliability – Level of Travel Time Reliability (LOTTR) and Truck Travel Time Reliability (TTTR)
- Safety – Overall and multimodal crashes, fatalities, and incapacitating injuries

This report describes analysis of the network with respect to the mobility, reliability, and safety performance measures and includes a baseline report of network performance that highlights those segments with performance challenges in those categories. The resulting hotspot analysis provides an assessment of the segments most in need of congestion mitigation or other treatments, depending on their context and function.

FIGURE 1. FHWA CONGESTION MANAGEMENT PROCESS MODEL

Hot Spot Analysis

1 DEVELOP REGIONAL OBJECTIVES
2 DEFINE CMP NETWORK
3 DEVELOP MULTIMODAL PERFORMANCE MEASURES
4 COLLECT DATA/MONITOR SYSTEM PERFORMANCE
5 ANALYZE CONGESTION PROBLEMS AND NEEDS
6 IDENTIFY AND ASSESS STRATEGIES
7 PROGRAM AND IMPLEMENTATION STRATEGIES
8 EVALUATE STRATEGY EFFECTIVENESS
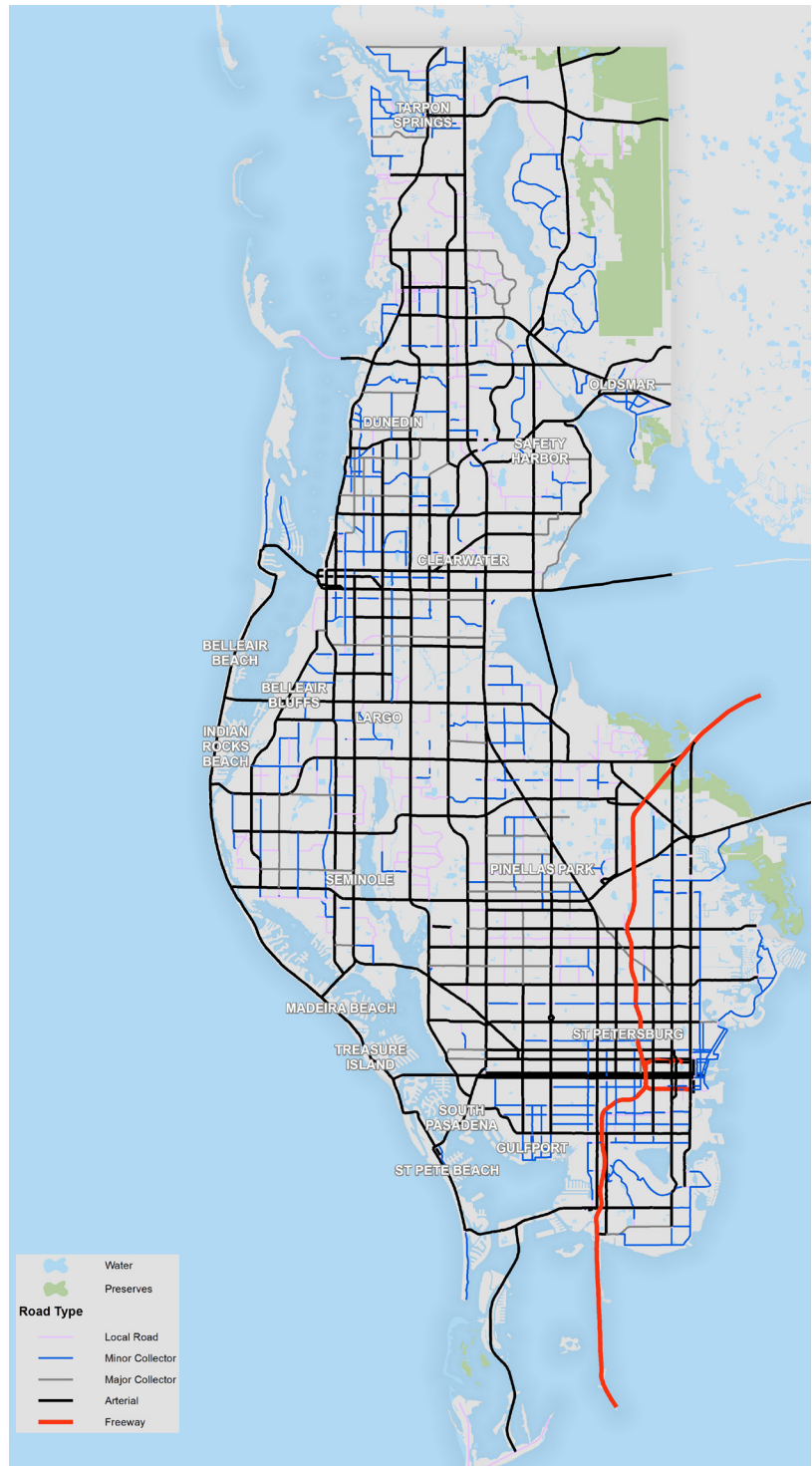
02. CMP NETWORK

The CMP Network was defined based on a base network monitored by Forward Pinellas, with the addition of facilities for which preliminary performance deficiencies were identified using safety, reliability, and mobility metrics. Those metrics are described in later sections of this report. The network includes more than 800 centerline miles of roadways in Pinellas County, comprised of limited access roadways, arterials, collectors, and local roads, as illustrated in Figures 2 and 3.

FIGURE 2. CMP ROADWAY MILES BY TYPE

PRINCIPAL ARTERIAL
177

LOCAL STREETS
89

42 MINOR COLLECTOR

CMP ROADWAY MILES BY TYPE

279
MINOR ARTERIAL

347
COLLECTOR
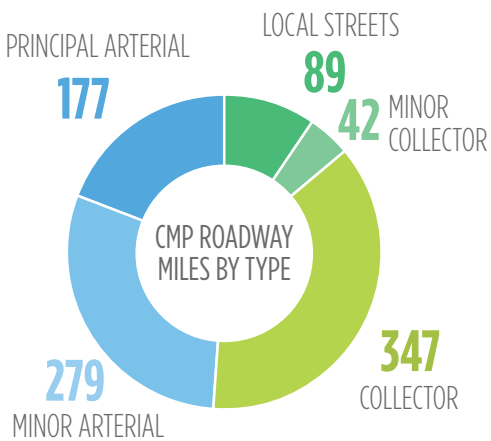
FIGURE 3. CMP NETWORK BY ROADWAY TYPE MAP

Road Type

- Water
- Preserves
- Local Road
- Minor Collector
- Major Collector
- Arterial
- Freeway

3. BACKGROUND

The purpose of the hotspot analysis is to identify the worst performing segments of the CMP Network using the performance measures and methodology presented in the Performance Measures Technical Memorandum. For the Hotspot Analysis, categories used to identify hotspots include Safety, Reliability, and Mobility.

SAFETY   **RELIABILITY**   **MOBILITY & ACCESSIBILITY**

Safety and Reliability are related to non-recurring traffic congestion, while mobility is related to recurring congestion. This memorandum includes a description of the methodology used to identify hotspots and presents analysis results in each respective category.

04. SAFETY

Safety is a critically important category of analysis in transportation planning and engineering studies in its own right. In addition to its inherent importance to protect travelers, particularly the most vulnerable users of the transportation system, safety is specifically important in the context of congestion mitigation, as crashes and other incidents tend to result in traffic bottlenecks, slowing traffic and creating congested conditions. The four safety metrics used to define the Top 20 safety hotspots on the CMP Network include:
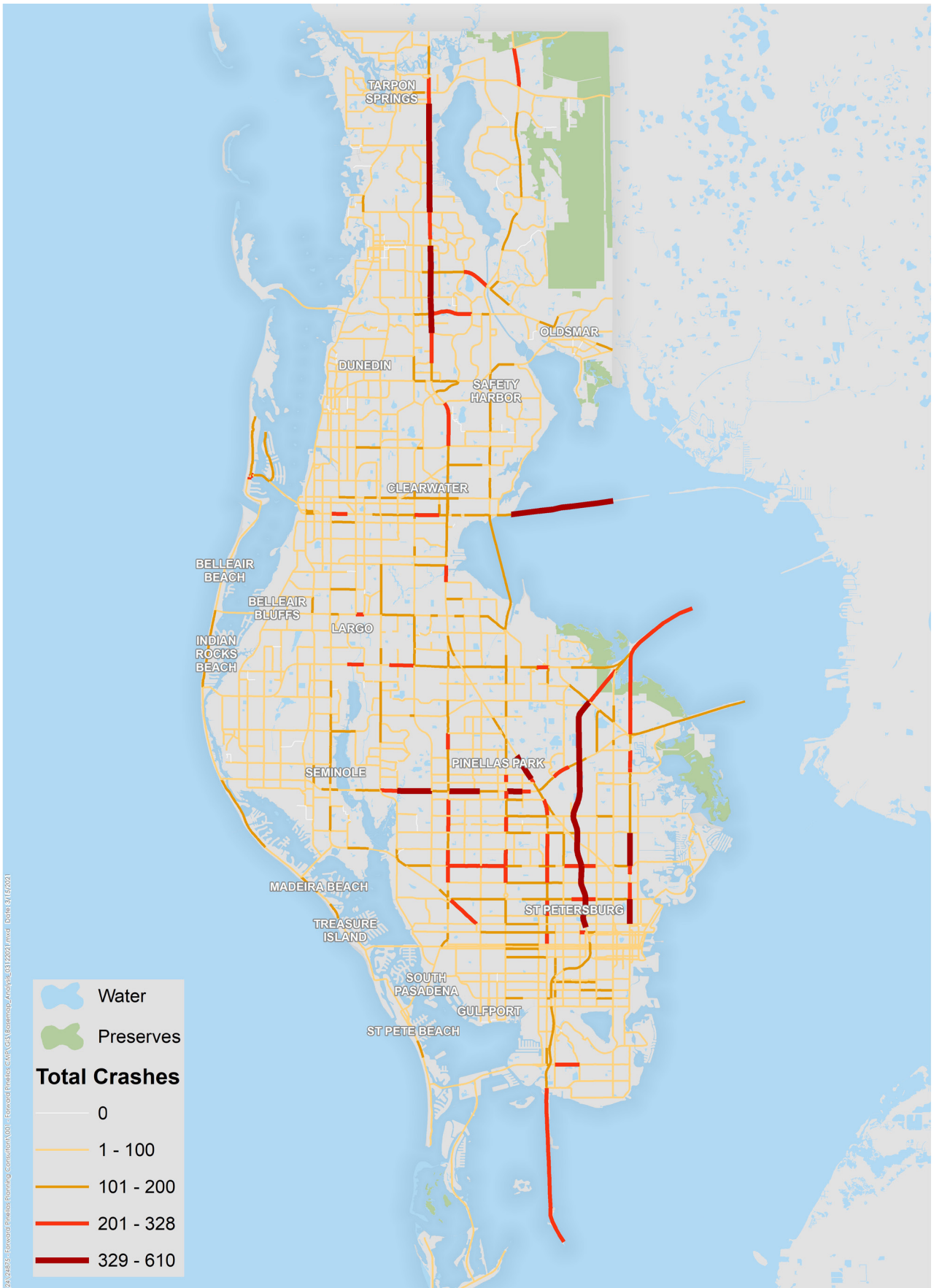
■ Total Crashes

■ Total Fatal and Incapacitating Injury Crashes

■ Total Bicycle and Pedestrian Crashes

■ Total Bicycle and Pedestrian Fatal and Incapacitating Injury Crashes

The four safety measures were assessed individually to identify safety hotspots, and a composite safety hotspot analysis was performed that incorporates all four of the metrics. The safety performance measures were calculated using crash data from 2015 – 2019 and spatially joined to each segment on the CMP Network. Further discussion on methodology is available in the Performance Measures Technical Memorandum.

Total Crashes represent the total number of crashes on each individual segment in the CMP Network between the years 2015 and 2019. Figure 4 shows the total number of crashes on the CMP Network by segment. Segments in the darkest color red are the top 20 segments with the most total crashes during the 5-year period, which are listed in Table 1 in order by number of crashes.

Table 1 highlights the fact that eighteen of the top twenty crash segments are on four roadways in Pinellas County, including US19 (8 segments), I-275 (5 segments), 4th St N (2 segments), and Park Plvd (3 segments).

FIGURE 4. TOTAL CRASHES ON THE CMP NETWORK BY SEGMENT

FIGURE 4. TOTAL CRASHES ON THE CMP NETWORK BY SEGMENT

TARPON SPRINGS

OLDSMAR

DUNEDIN

SAFETY HARBOR

CLEARWATER

BELLEAIR BEACH

BELLEAIR BLUFFS

LARGO

INDIAN ROCKS BEACH

SEMINOLE

PINELLAS PARK

MADEIRA BEACH

ST PETERSBURG

TREASURE ISLAND

SOUTH PASADENA

GULFPORT

ST PETE BEACH

Water

Preserves

Total Crashes

0

1 - 100

101 - 200

201 - 328

329 - 610

TABLE 1. TOP 20 TOTAL CRASH SEGMENTS

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	US 19	TAMPA RD	NEBRASKA AVE	610
2	I-275	54TH AVE N	GANDY BLVD	600
3	PARK BLVD	66TH ST N	58TH ST N	480
4	US 19	KLOSTERMAN RD	MLK	478
5	PARK BLVD	83RD ST N	71ST ST N | BELCHER RD	464
6	US 19	CR 39	TAMPA RD	459
7	PARK BLVD	49TH ST N	43RD ST	452
8	US 19	ALDERMAN RD	INNISBROOK DR	431
9	US 19	NORTHSIDE DR	CURLEW RD	429
10	I-275	GANDY BLVD	SR 686 | ROOSEVELT BLVD	415
11	4TH ST N	38TH AVE N	54TH AVE N	392
12	I-275	38TH AVE N	54TH AVE N	383
13	US 19	CURLEW RD	CR 39	379
14	4TH ST N	9TH AVE N	22ND AVE N	367
15	US 19	80TH AVE N	MAINLANDS BLVD	364
16	COURTNEY CAMPBELL CSWY	DAMASCUS RD	HILLSBOROUGH CL	362
17	I-275	5TH AVE N	22ND AVE N	349
18	I-275	22ND AVE N	38TH AVE N	342
19	US 19	INNISBROOK DR	KLOSTERMAN RD	339
20	49TH ST N	70TH AVE N	PARK BLVD	328

Similar to the total crashes measure, the same four roadways comprise the majority of hotspots with respect to fatalities and incapacitating injuries. New roadways highlighted by this metric also include Roosevelt Blvd, Gandy Blvd and the Bayside Bridge, in the Gateway area on the eastern edge of the County and 66th St further inland.

In addition to total crashes, Total Fatal and Incapacitating Injury Crashes by segment were analyzed and are displayed in Figure 5. Fatal and incapacitating injury crashes highlight the most severe crashes. The darkest red segments in Figure 4 indicates the top 20 segments with the greatest number of fatal and incapacitating injury crashes, also detailed in Table 2.

FIGURE 5. TOTAL FATAL AND INCAPACITATING INJURY CRASHES ON THE CMP NETWORK BY SEGMENT
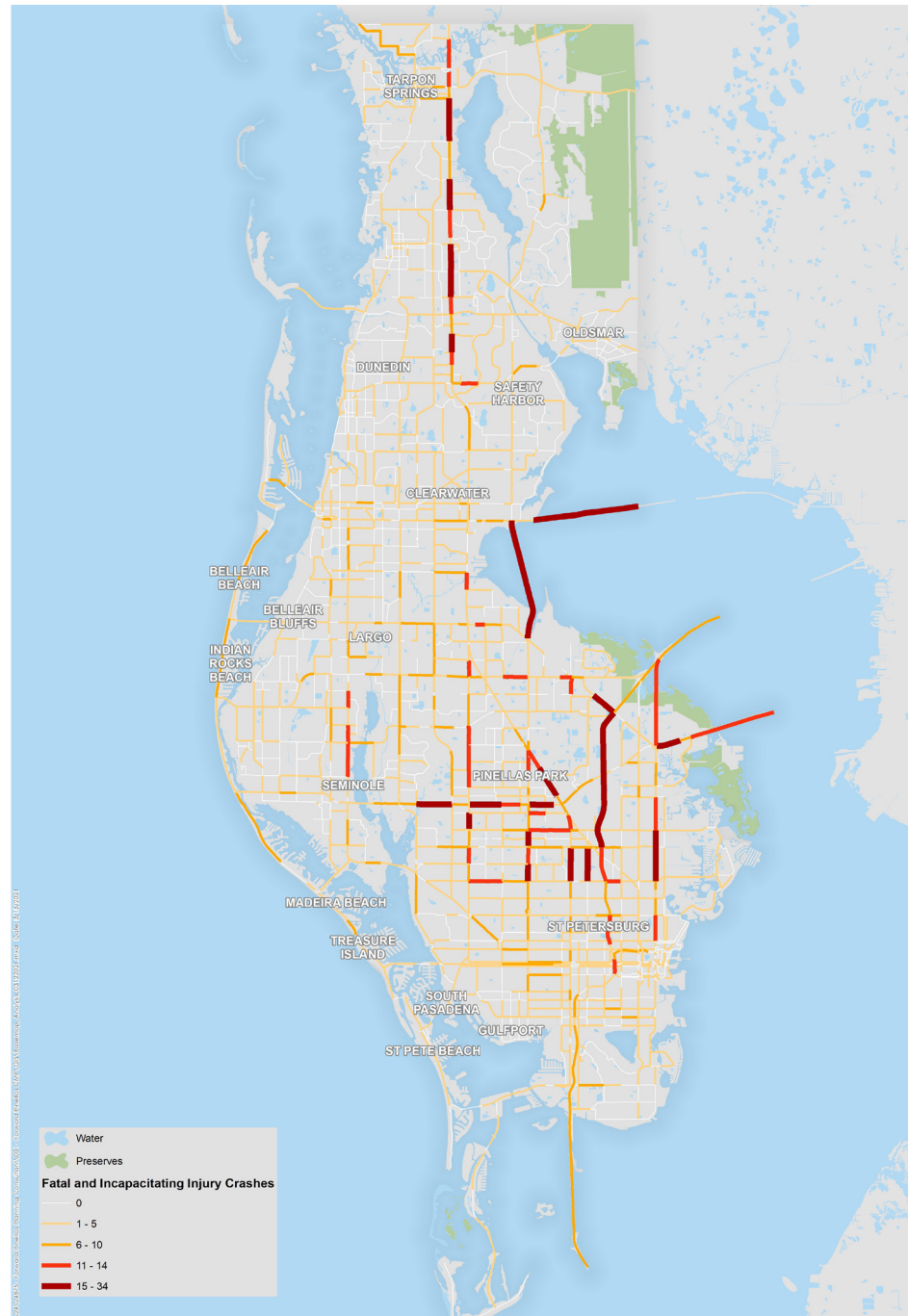
THE DARKEST RED SEGMENTS IN FIGURE 5 INDICATE THE SEGMENTS WITH THE GREATEST NUMBER OF FATAL AND INCAPACITATING INJURY CRASHES

TABLE 2. TOP 24 SEGMENTS WITH FATAL AND INCAPACITATING INJURY CRASHES

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	US 19	KLOSTERMAN RD	MLK	34
2	PARK BLVD	66TH ST N	58TH ST N	31
3	US 19	38TH AVE N	54TH AVE N	24
4	49TH ST N	54TH AVE N	62ND AVE N	23
5	US 19	80TH AVE N	MAINLANDS BLVD	22
6	PARK BLVD	83RD ST N	71ST ST N | BELCHER RD	22
7	US 19	CURLEW AVE	NORTHSIDE DR	22
8	I-275	54TH AVE N	GANDY BLVD	22
9	US 19	ALDERMAN RD	INNISBROOK DR	21
10	4TH ST N	38TH AVE N	54TH AVE N	20
11	US 19	CR 39	TAMPA RD	20
12	SR 686 | ROOSEVELT BLVD	I-275	28TH ST N	18
13	4TH ST N	54TH AVE N	62ND AVE N	16
14	66TH ST N	62ND AVE N	70TH AVE N	16
15	US 19	78TH AVE N	80TH AVE N	16
16	COURTNEY CAMPBELL CSWY	DAMASCUS RD	HILLSBOROUGH CL	16
17	49TH ST N	38TH AVE N	46TH AVE N	16
18	BAYSIDE BRIDGE	SR 686 | ROOSEVELT BLVD	GULF-TO-BAY BLVD	16
19	PARK BLVD	43RD ST	40TH ST N	16
20	PARK BLVD	49TH ST N	43RD ST	15
21	28TH ST N	38TH AVE N	54TH AVE N	15
22	GANDY BLVD	4TH ST N	BRIGHTON BLVD	15
23	US 19	TAMPA RD	NEBRASKA AVE	15
24	I-275	GANDY BLVD	SR 686 | ROOSEVELT BLVD	15

Figure 6 shows the total bicycle and pedestrian crashes on the CMP Network with the top 20 crashes highlighted in the darkest red, also detailed in Table 3.

The third safety measure isolates crashes involving bicyclists and pedestrians. The average number of multimodal crashes in the top twenty segments is 21 total crashes. Relative to total crashes, new areas highlighted by multimodal crash analysis include Gulf Blvd on the barrier islands, Seminole Blvd and 5th Ave N and 18th Ave S in St Petersburg. Figure 6 shows the total bicycle and pedestrian crashes on the CMP Network with the top 20 crashes highlighted in the darkest red, also detailed in Table 3.

FIGURE 6. TOTAL BICYCLE AND PEDESTRIAN CRASHES ON THE CMP NETWORK BY SEGMENT
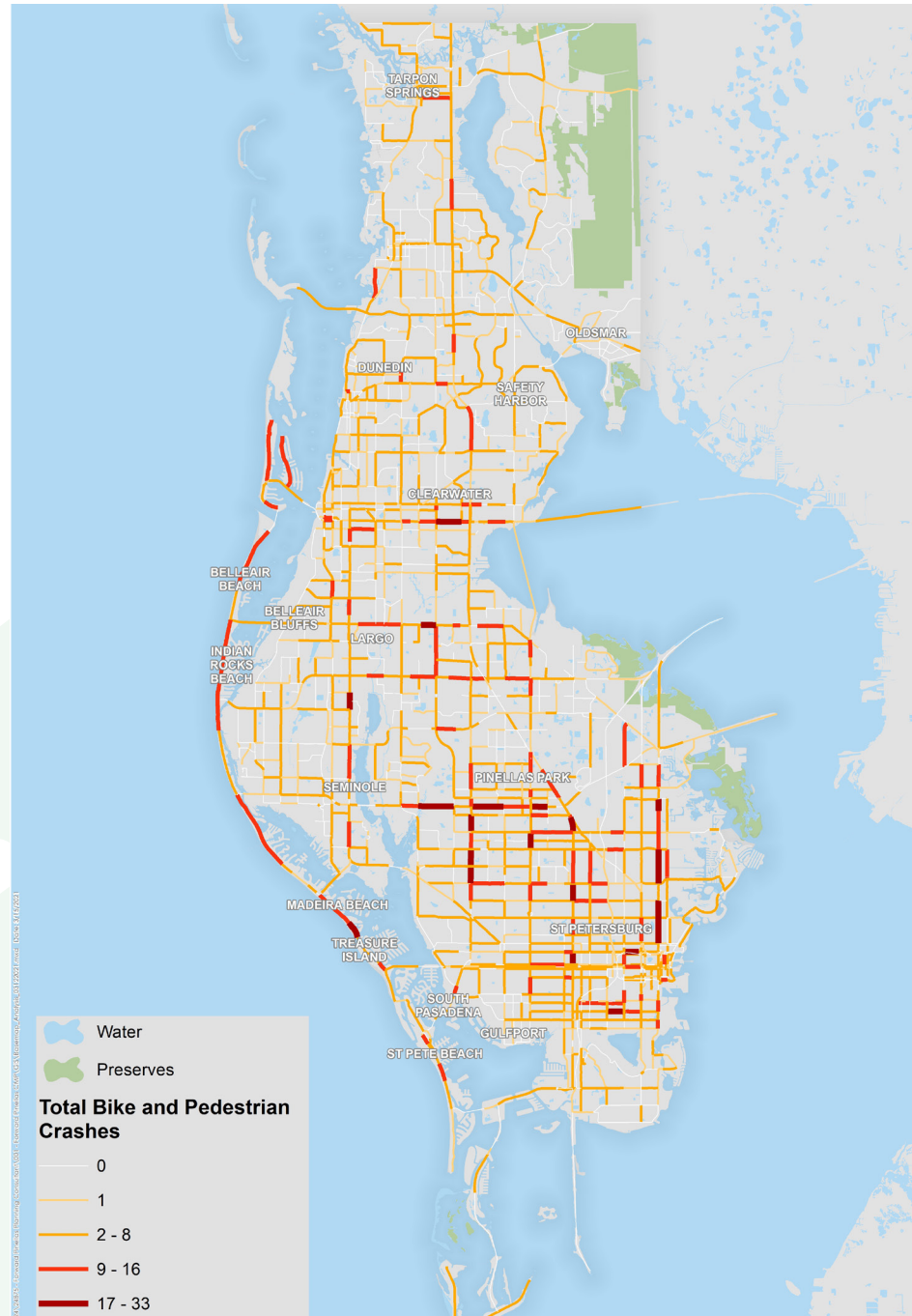
The average number of multimodal crashes in the top twenty segments is

21 TOTAL CRASHES

TABLE 3. TOP 20 SEGMENTS WITH BIKE AND PEDESTRIAN CRASHES

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	4TH ST N	38TH AVE N	54TH AVE N	33
2	PARK BLVD	66TH ST N	58TH ST N	28
3	US 19 | 34TH ST	30TH AVE N	38TH AVE N	28
4	SR 686 | EAST BAY DR	FULTON ST	BELCHER RD	26
5	PARK BLVD	49TH ST N	43RD ST	25
6	4TH ST N	9TH AVE N	22ND AVE N	24
7	66TH ST N	38TH AVE N	46TH AVE N	24
8	18TH AVE S	22ND ST S	16TH ST S	24
9	GULF BLVD	DRAWBRIDGE	133RD AVE N	22
10	5TH AVE N	16TH ST N	I-375 ON-RAMP	22
11	GULF-TO-BAY BLVD	BELCHER RD	OLD COACHMAN RD	21
12	4TH ST N	72ND AVE N	77TH AVE N	21
13	66TH ST N	62ND AVE N	70TH AVE N	20
14	US 19	62ND AVE N	66TH AVE N	19
15	US 19 | 34TH ST N	1ST AVE N	5TH AVE N	19
16	ALT US 19 | SEMINOLE BLVD	WALSINGHAM RD	126TH AVE	19
17	49TH ST N	54TH AVE N	62ND AVE N	18
18	4TH ST N	22ND AVE N	30TH AVE N	18
19	PARK BLVD	83RD ST N	71ST ST N | BELCHER RD	17
20	66TH ST N	46TH AVE N	54TH AVE N	17

The fourth safety measure analyzed for the hotspot analysis is the multimodal crashes that involve fatalities and incapacitating injuries.

Figure 7 shows the total bicycle and pedestrian fatal and incapacitating injury crashes. The darkest red segments represent the top 20 with the highest number of multimodal fatal and incapacitating injury crashes which are also detailed in Table 4.

FIGURE 7. TOTAL BICYCLE AND PEDESTRIAN FATAL AND INCAPACITATING INJURY CRASHES ON THE CMP NETWORK BY SEGMENT
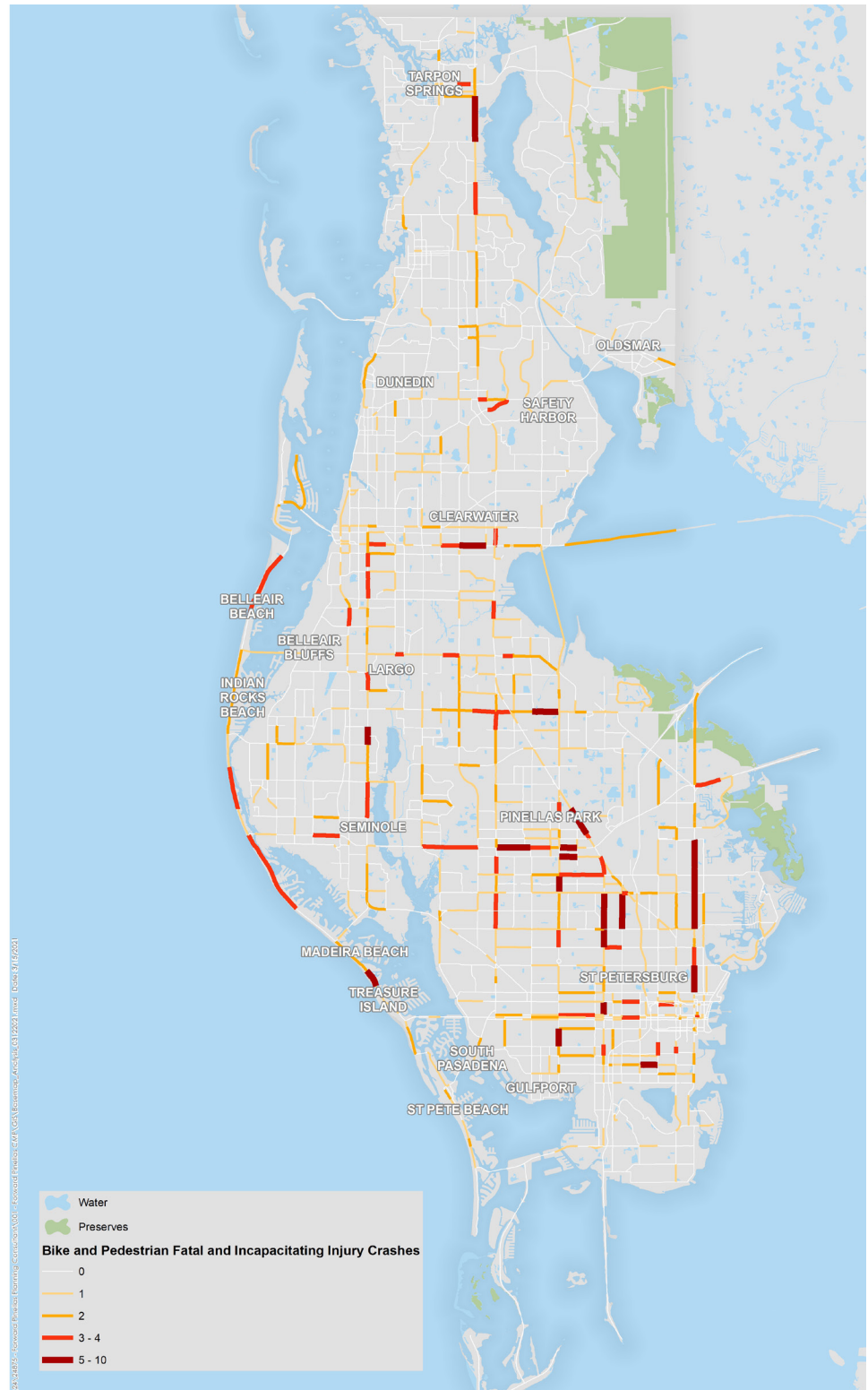
TABLE 4. TOP 20 SEGMENTS FOR BICYCLE AND PEDESTRIAN FATAL AND INCAPACITATING INJURY CRASHES

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	4TH ST N	72ND AVE N	77TH AVE N	10
2	49TH ST N	54TH AVE N	62ND AVE N	9
3	US 19	80TH AVE N	MAINLANDS BLVD	8
4	US 19	38TH AVE N	54TH AVE N	8
5	4TH ST N	38TH AVE N	54TH AVE N	7
6	ALT US 19 | SEMINOLE BLVD	WALSINGHAM RD	126TH AVE	7
7	PARK BLVD	66TH ST N	58TH ST N	6
8	SR 688 | ULMERTON RD	58TH ST N	49TH ST N	6
9	4TH ST N	54TH AVE N	62ND AVE N	6
10	70TH AVE N	49TH ST N	43RD ST N	6
11	18TH AVE S	22ND ST S	16TH ST S	6
12	US 19	KLOSTERMAN RD	MLK	5
13	PARK BLVD	49TH ST N	43RD ST	5
14	GULF-TO-BAY BLVD	BELCHER RD	OLD COACHMAN RD	5
15	4TH ST N	62ND AVE N	72ND AVE N	5
16	4TH ST N	9TH AVE N	22ND AVE N	5
17	US 19 | 34TH ST N	30TH AVE N	38TH AVE N	5
18	GULF BLVD	DRAWBRIDGE	133RD AVE N	5
19	US 19 | 34TH ST N	1ST AVE N	5TH AVE N	5
20	28TH ST N	38TH AVE N	54TH AVE N	5
21	49TH ST S	11TH AVE S	5TH AVE S	5

SEGMENTS WITH THE HIGHEST CRASH RATE
US 19 (6 segments), 4th St (5 segments), Park Blvd (2 segments)
ALSO HAVE THE HIGHEST NUMBER OF FATAL & INCAPACITATING INJURY MULTIMODAL CRASH

Unsurprisingly, the worst multimodal crash and fatal and incapacitating injury multimodal crash segments are largely the same. US 19 (6 segments), 4th Street (5 segments), and Park Boulevard (2 segments) represent the majority of segments relative to this metric.

A composite analysis was conducted to reconcile the four safety measures and identify overall safety hotspots. The composite weights the four measures equally and normalizes them in percentile terms with respect to each individual metric. The roadway segment with the highest number of crashes in each metric was used as the reference segment and all other segments were assigned a score relative to the reference segment. Equation 1 details the math used to calculate the composite safety scoring.

EQUATION 1. SAFETY COMPOSITE SCORE

$$\text{Composite Score} = \frac{\textit{Total Crashes}}{\textit{Max (Total Crashes)}} + \frac{\textit{F\&I Crashes}}{\textit{Max (F\&I Crashes)}} + \frac{\textit{Multimodal Crashes}}{\textit{Max (Multimodal Crashes)}} + \frac{\textit{Multimodal F\&I Crashes}}{\textit{Max (Multimodal F\&I Crashes)}}$$

where:

F&I Crashes are Fatal and Incapacitating Injury Crashes

Multimodal Crashes are Bicycle and Pedestrian Crashes

Figure 8 shows the top 20 segments using Equation 1 and Table 5 lists those segments.

Consistent with the individual safety metrics, the majority of composite safety hotspots are on Park Blvd (3 segments), US 19 (7 segments), and 4th Street (4 segments). Indeed, the top twelve segments are composed of those three facilities. The balance of eight segments are composed primarily of segments in the top 20 for one or more of the individual metrics, with the exception of 18th Ave S in St Petersburg, which is a composite safety hotspot, but not in the top 20 in any individual metric. This underscores the importance of the composite analysis. The composite hotspots listed in Table 5 represent the most problematic segments from a safety standpoint.

FIGURE 8. SAFETY COMPOSITE HOTSPOTS
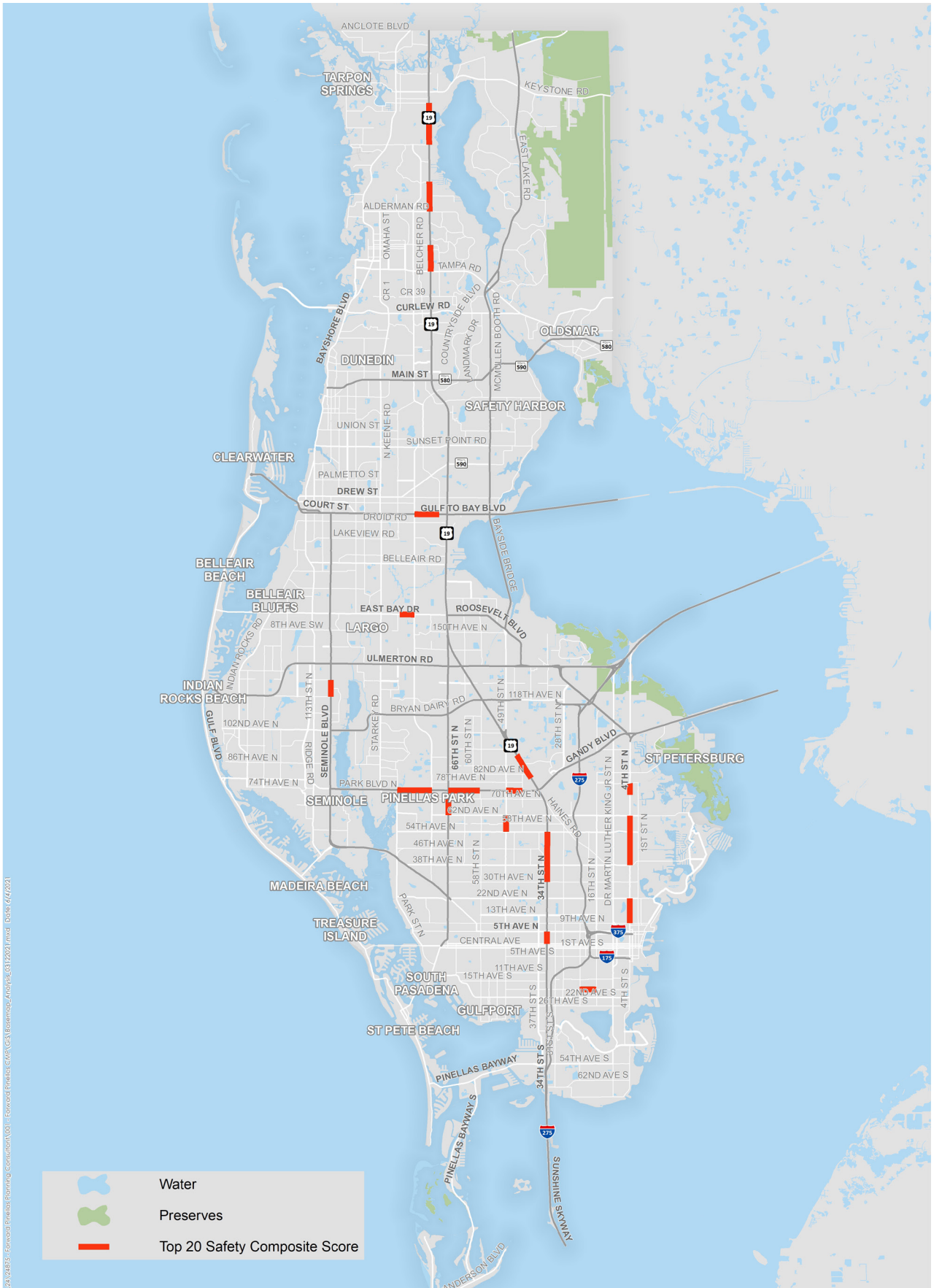
Legend:
- Water
- Preserves
- Top 20 Safety Composite Score

TABLE 5. TOP 20 SAFETY COMPOSITE SCORE

ID	ON STREET	FROM STREET	TO STREET
1	PARK BLVD	66TH ST N	58TH ST N
2	4TH ST N	38TH AVE N	54TH AVE N
3	49TH ST N	54TH AVE N	62ND AVE N
4	US 19	KLOSTERMAN RD	MLK
5	US 19	38TH AVE N	54TH AVE N
6	US 19	80TH AVE N	MAINLANDS BLVD
7	PARK BLVD	49TH ST N	43RD ST
8	PARK BLVD	83RD ST N	71ST ST N	BELCHER RD
9	4TH ST N	9TH AVE N	22ND AVE N
10	4TH ST N	72ND AVE N	77TH AVE N
11	US 19	34TH ST N	30TH AVE N	38TH AVE N
12	US 19	ALDERMAN RD	INNISBROOK DR
13	ALT US 19	SEMINOLE BLVD	WALSINGHAM RD	126TH AVE
14	4TH ST N	54TH AVE N	62ND AVE N
15	66TH ST N	62ND AVE N	70TH AVE N
16	GULF-TO-BAY BLVD	BELCHER RD	OLD COACHMAN RD
17	US 19	TAMPA RD	NEBRASKA AVE
18	18TH AVE S	22ND ST S	16TH ST S
19	SR 686	EAST BAY DR	FULTON ST	BELCHER RD
20	US 19	34TH ST N	1ST AVE N	5TH AVE N

TABLE 5 REPRESENT THE MOST PROBLEMATIC SEGMENTS FROM A SAFETY STANDPOINT

05. RELIABILITY

Travel time reliability is an important congestion measure that relates to non-recurring congestion resulting primarily from unpredictable incidents. The definition of travel time reliability is consistency, or dependability of travel times. In mathematical terms, reliability is measured as the variability of travel time during a defined period of time. Three reliability performance measures were used to define the Top 20 Least Reliable segments on the CMP Network:

■ Level of Travel Time Reliability (LOTTR)

■ Average Annual to Peak Season LOTTR Ratio

■ Level of Truck Travel Time Reliability (TTTR)

The reliability performance measures were calculated using HERE and NPMRDS data which were spatially joined to the CMP Network. Further discussion on methodology is available in the Performance Measures Technical Memorandum.

Level of travel time reliability (LOTTR) analysis identifies segments with high levels of non-recurring traffic congestion. LOTTR is typically defined as the ratio of 80th percentile travel time to 50th percentile travel time over a defined period of time. The ideal result of this ratio, in terms of reliable travel time, is 1.0 indicating a high degree of consistency in travel time over the measured period. The FHWA definition of unreliability is a ratio greater than 1.5, meaning that the 80th percentile travel time is 50 percent greater than the median travel time. A more detailed description of the LOTTR calculation methodology is available in the Performance Measures Technical Memorandum.
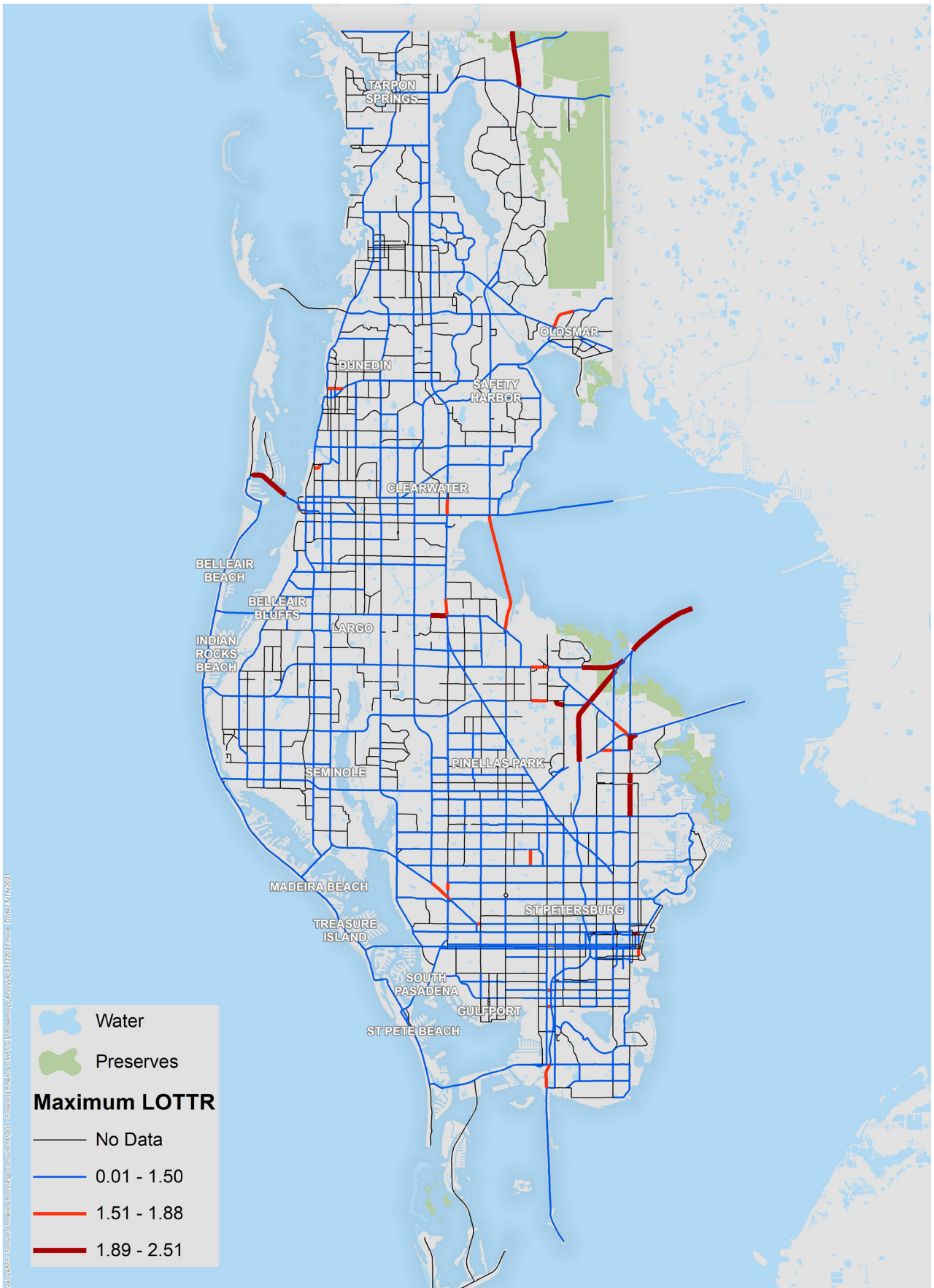
Figure 9 depicts the LOTTR of the CMP Network. Segments in the darkest reds include the 20 least reliable segments in the CMP Network for LOTTR, which are also listed in Table 6. 4th Street (6 segments), I-275 (3 segments), East Lake Road (3 segments), Memorial Causeway (3 segments), and SR 686 (2 segments) all have multiple segments that are in the 20 least reliable segments, with scores ranging from 1.9 to 2.5. This is not inclusive of all unreliable segments, defined as LOTTR greater than 1.5. Rather, it includes the 20 highest LOTTR scores.

A ratio of 1.0 indicates a high degree of travel time consistency
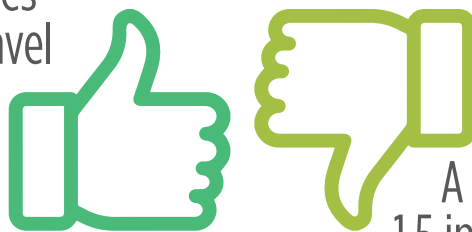
A ratio greater than 1.5 indicates unreliable travel time

FIGURE 9. LOTTR BY SEGMENT

FIGURE 9. LOTTR BY SEGMENT

Legend:

Water

Preserves

Maximum LOTTR

— No Data

— 0.01 - 1.50

— 1.51 - 1.88

— 1.89 - 2.51

TABLE 6. TOP 20 LEAST RELIABLE SEGMENTS

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	GANDY BLVD	I-275 WEST RAMPS	I-275 EAST RAMPS	2.5
2	I-275	GANDY BLVD	SR 686 | ROOSEVELT BLVD	2.5
3	I-275	SR 686 | ROOSEVELT BLVD	DR ML KING JR ST N	2.3
4	EAST LAKE RD	TRINITY BLVD	OLD E LAKE EXT	2.3
5	EAST LAKE RD	OLD E LAKE EXT	PASCO CO LINE	2.3
6	SR 688 | ULMERTON RD	FEATHER SOUND DR	I-275	2.2
7	MEMORIAL CSWY	ISLAND WAY	MEMORIAL CSWY LARGE BRIDGE W END	2.2
8	MEMORIAL CSWY	CLEARWATER BEACH ROUNDABOUT	MEMORIAL CSWY SMALL BRIDGE W END	2.2
9	MEMORIAL CSWY	MEMORIAL CSWY SMALL BRIDGE W END	ISLAND WAY	2.2
10	2ND ST N	4TH AVE N	5TH AVE N	2.2
11	4TH ST N	99TH AVE N	GANDY BLVD	2.0
12	EAST LAKE RD	KEYSTONE RD	TRINITY BLVD	2.0
13	4TH ST N	KOGER BLVD	GANDY BLVD	2.0
14	4TH ST N	94TH AVE N	KOGER BLVD	2.0
15	4TH ST N	78TH AVE N	83RD AVE N	2.0
16	4TH ST N	62ND AVE N	72ND AVE N	2.0
17	4TH ST N	72ND AVE N	77TH AVE N	2.0
18	CR 296 CONNECTOR	GATEWAY EXPRESS	BRYAN DAIRY RD | 118TH AVE N	1.9
19	I-275	4TH ST N	PINELLAS SHORELINE	1.9
20	SR 686 | EAST BAY DR	69TH ST N	US 19	1.9

In addition to LOTTR, the overall LOTTR for 2019 was compared to the LOTTR in the peak season months between November and April. This performance measure identifies segments that are less reliable during the peak tourism season. Segments that have a ratio less than 100% are less reliable in the peak season compared to the entire year. Figure 10 shows the yearly to peak season LOTTR ratio. The top 20 segments are shown in the darkest red, which are listed in Table 7. 4th St N (5 segments) has the greatest number of segments that are in the top 20. 66th Street North has the lowest yearly to peak season LOTTR ratio at 77.1 percent, which means that the segments are about 23 percent less reliable during the peak tourism season relative to annual travel time analysis.

FIGURE 10. YEARLY TO PEAK SEASON LOTTR RATIO
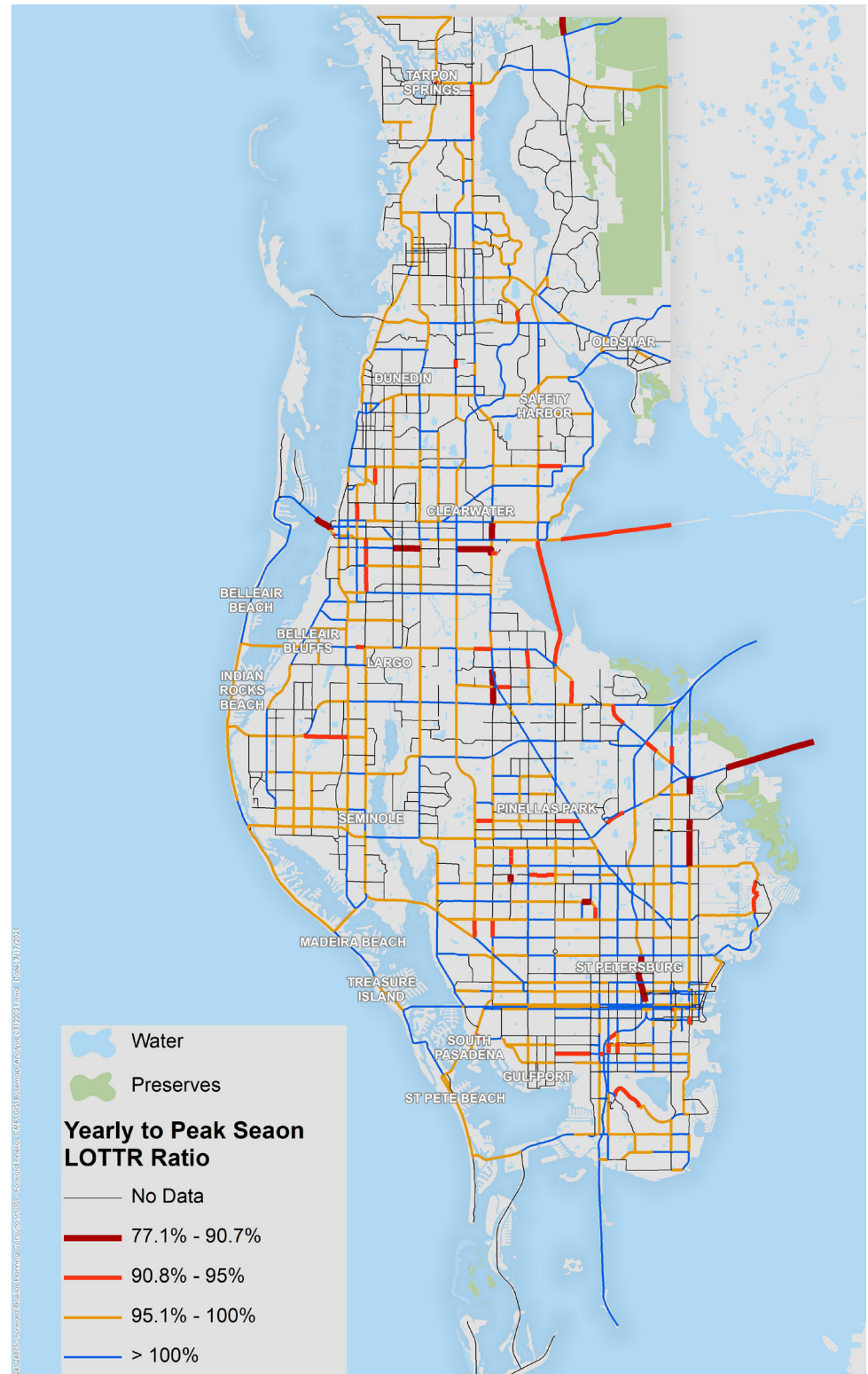
Segments that have a ratio less than 100% are less reliable in the peak season compared to the entire year.

TABLE 7. TOP 20 YEARLY TO PEAK SEASON SEGMENTS

ID	ON STREET	FROM STREET	TO STREET	TOTAL CRASHES
1	66TH ST N	142ND AVE N	US 19	77.1%
2	66TH ST N	ULMERTON RD	142ND AVE N	77.1%
3	GANDY BLVD	SAN MARTIN BLVD	PINELLAS SHORELINE	83.3%
4	I-275	I-375	5TH AVE N	85.4%
5	I-275	5TH AVE N	22ND AVE N	86.0%
6	4TH ST N	KOGER BLVD	GANDY BLVD	86.3%
7	4TH ST N	94TH AVE N	KOGER BLVD	86.3%
8	4TH ST N	78TH AVE N	83RD AVE N	86.3%
9	4TH ST N	62ND AVE N	72ND AVE N	86.3%
10	4TH ST N	72ND AVE N	77TH AVE N	86.3%
11	DRUID RD	HIGHLAND AVE	LAKE AVE	87.3%
12	DRUID RD	LAKE AVE	KEENE RD	87.3%
13	46TH AVE N	40TH ST N	37TH ST N	88.5%
14	EAST LAKE RD	TRINITY BLVD	OLD E LAKE EXT	89.6%
15	EAST LAKE RD	OLD E LAKE EXT	PASCO CO LINE	89.6%
16	US 19	GULF-TO-BAY BLVD	DREW ST	89.7%
17	MEMORIAL CSWY	MEMORIAL CSWY LARGE BRIDGE W END	MEMORIAL CSWY | WB/EB SPLIT	89.8%
18	DRUID RD	BELCHER RD	US 19	90.2%
19	62ND ST N	54TH AVE N	58TH AVE N	90.6%
20	SR 686 | EAST BAY DR	69TH ST N	US 19	90.7%

Truck travel time reliability (TTTR) was also used as a performance measure for reliability in the hotspot analysis. TTTR was calculated using NPMRDS data which includes a more limited network coverage, in terms of observed travel times specific to heavy truck routes and movements. TTTR is computed using the same equation as LOTTR, resulting in a travel time variability ratio, but differs in terms of the numerator in the ratio. Whereas for LOTTR, 80th percentile travel time is compared to median travel time, for TTTR, the 95th percentile travel time is used, resulting in a typically higher ratio, relative to LOTTR. There is not a threshold ratio defining reliability versus unreliability for TTTR, rather the truck travel time ratio is assessed on a relative basis. The least reliable segments in the CMP Network, from a truck travel time reliability standpoint, are depicted in Figure 11 and listed in Table 8. The least reliable segments for TTTR, in Table 8., include bridge segments such as the Memorial Causeway (4 segments), I-275 (5 segments), and Gulf-to-Bay Boulevard (2 segments) in the 20 least reliable TTTR segments.

FIGURE 11. TRUCK TRAVEL TIME RELIABILITY

Legend:
- Water
- Preserves

Maximum TTTR
- No Data
- 0.01 - 1.50
- 1.51 - 3.50
- 3.51 - 4.48
- 4.49 - 10.00
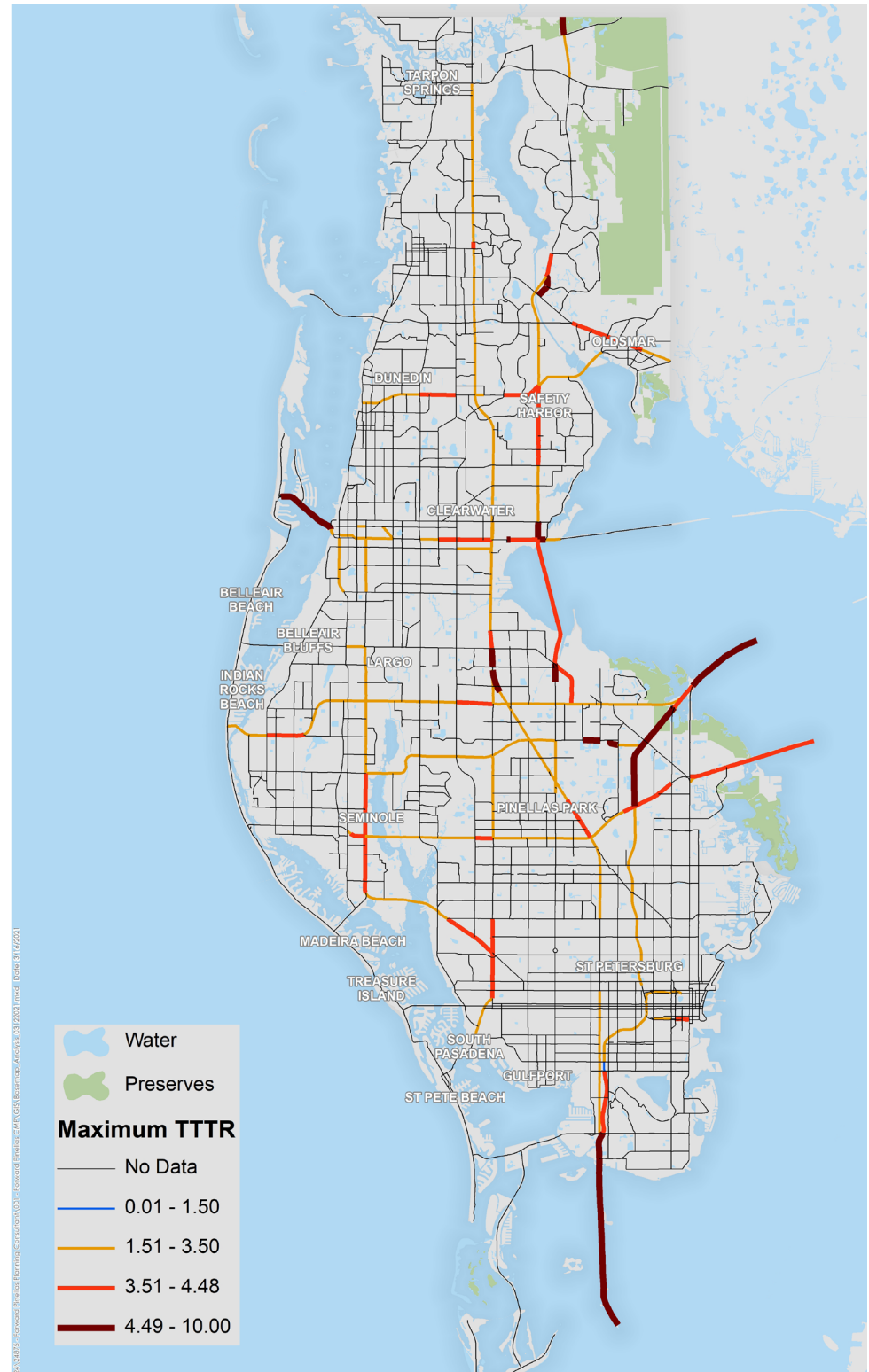
TABLE 8. TOP 20 LEAST RELIABLE TRUCK SEGMENTS

ID	ON STREET	FROM STREET	TO STREET	TTR MAX
1	MEMORIAL CSWY	ISLAND WAY	MEMORIAL CSWY LARGE BRIDGE W END	9.5
2	MEMORIAL CSWY	CLEARWATER BEACH ROUNDABOUT	MEMORIAL CSWY SMALL BRIDGE W END	9.5
3	MEMORIAL CSWY	MEMORIAL CSWY SMALL BRIDGE W END	ISLAND WAY	9.5
4	MEMORIAL CSWY	MEMORIAL CSWY LARGE BRIDGE W END	MEMORIAL CSWY | WB/EB SPLIT	6.5
5	I-275	SR 686 | ROOSEVELT BLVD	DR ML KING JR ST N	6.5
6	I-275	GANDY BLVD	SR 686 | ROOSEVELT BLVD	6.5
7	CR 296 CONNECTOR	GATEWAY EXPRESS	BRYAN DAIRY RD | 118TH AVE N	5.3
8	BRYAN DAIRY RD | 118TH AVE N	40TH ST N	34TH ST N	5.3
9	US 19	142ND AVE N SOUTH RAMPS	66TH ST N	5.2
10	US 19	150TH AVE N	E BAY DR	5.1
11	I-275	4TH ST N	PINELLAS SHORELINE	4.9
12	I-275	PINELLAS POINT DR	54TH AVE S	4.8
13	I-275	PINELLAS SHORELINE	PINELLAS POINT DR	4.8
14	EAST LAKE RD EAST SERVICE RD	WOODLANDS PKWY	NORTH SPLIT	4.7
15	EAST LAKE RD EAST SERVICE RD	TAMPA RD	WOODLANDS PKWY	4.7
16	MCMULLEN BOOTH RD	GULF-TO-BAY BLVD	DREW ST	4.7

ID	ON STREET	FROM STREET	TO STREET	TTR MAX
17	GULF-TO-BAY BLVD	MCMULLEN BOOTH RD	BAYSHORE BLVD	4.5
18	GULF-TO-BAY BLVD	SKY HARBOR DR	HAMPTON RD	4.5
19	49TH ST N	144TH AVE N	SR 686 | ROOSEVELT BLVD	4.5
20	EAST LAKE RD	TRINITY BLVD	OLD E LAKE EXT	4.5
21	EAST LAKE RD	OLD E LAKE EXT	PASCO CO LINE	4.5

Similarly to safety, a composite analysis was conducted to reconcile the reliability measures and identify overall reliability hotspots. The composite weights the three measures equally and normalizes them in percentile terms with respect to each individual metric. The roadway segment with the highest ratio for each respective metric was used as the reference segment and all other segments were assigned a score relative to the reference segment.
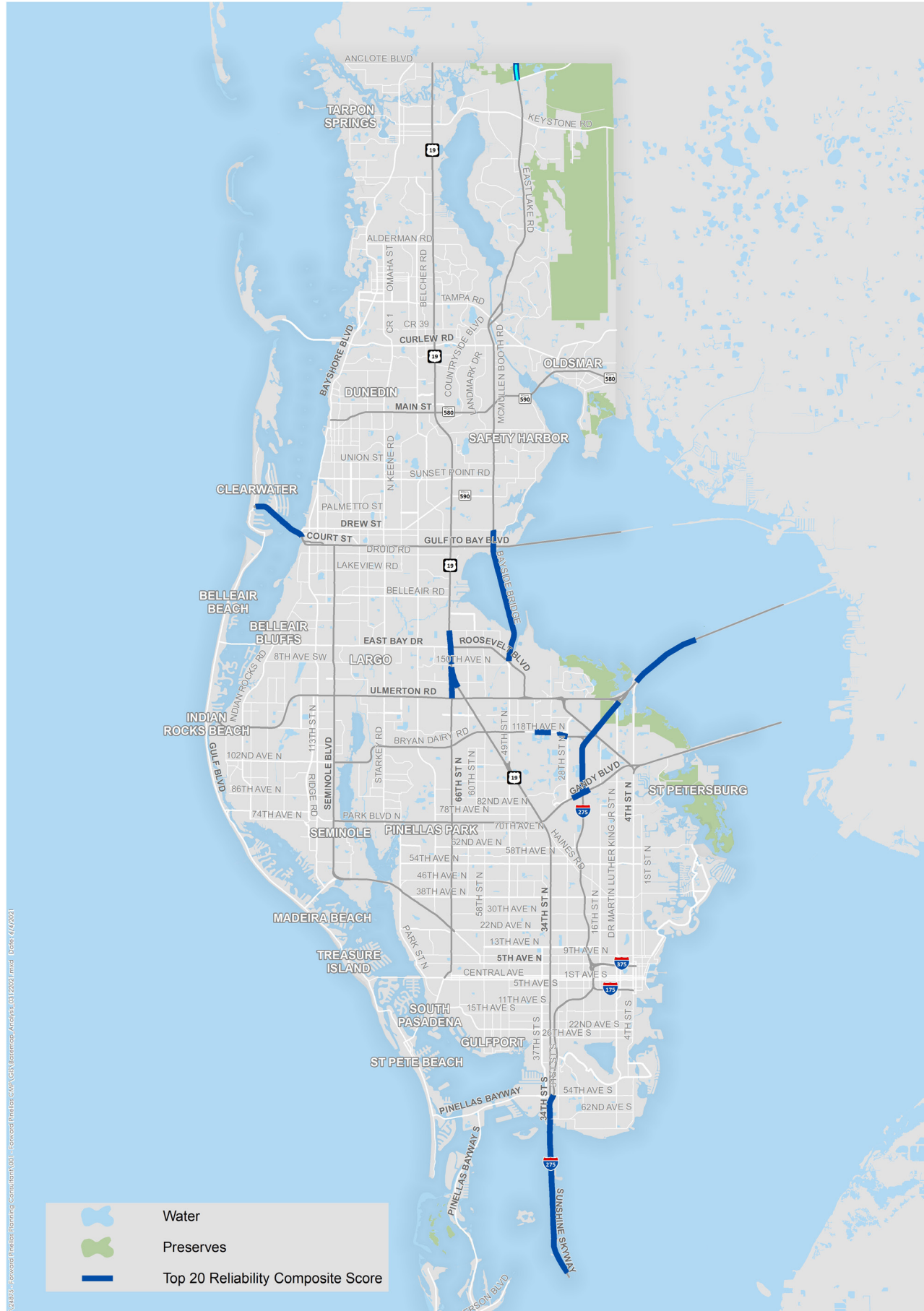
Equation 2 details the equation used to calculate the 20 least reliable segments composite score. For yearly to peak season ratio, a lower ratio means that the segment performs worse which is why the formula is adjusted compared to the LOTTR and TTTR.

EQUATION 2. SAFETY COMPOSITE SCORE

$$\text{Composite Score} = \frac{LOTTR}{Max\ (LOTTR)} + \frac{1}{(Yearly\ to\ Peak\ Ratio*1/Min(Yearly\ to\ Peak\ Ratio))} + \frac{TTTR}{Max\ (TTTR)}$$

Figure 12 depicts the 20 least reliable segments using the reliability composite scoring and Table 9 lists those segments, including bridge segments such as I-275 (5 segments), the Memorial Causeway (4 segments) and the Bayside Bridge (1 segment).

FIGURE 12. RELIABILITY COMPOSITE HOTSPOTS

FIGURE 12. RELIABILITY COMPOSITE HOTSPOTS

Legend:
- Water
- Preserves
- Top 20 Reliability Composite Score

TABLE 9. TOP 20 LEAST RELIABLE SEGMENTS

ID	ON STREET	FROM STREET	TO STREET
1	MEMORIAL CSWY	ISLAND WAY	MEMORIAL CSWY LARGE BRIDGE W END
2	MEMORIAL CSWY	CLEARWATER BEACH ROUNDABOUT	MEMORIAL CSWY SMALL BRIDGE W END
3	MEMORIAL CSWY	MEMORIAL CSWY SMALL BRIDGE W END	ISLAND WAY
4	I-275	GANDY BLVD	SR 686 | ROOSEVELT BLVD
5	I-275	SR 686 | ROOSEVELT BLVD	DR ML KING JR ST N
6	EAST LAKE RD	TRINITY BLVD	OLD E LAKE EXT
7	EAST LAKE RD	OLD E LAKE EXT	PASCO CO LINE
8	GANDY BLVD	I-275 WEST RAMPS	I-275 EAST RAMPS
9	MEMORIAL CSWY	MEMORIAL CSWY LARGE BRIDGE W END	MEMORIAL CSWY | WB/EB SPLIT
10	CR 296 CONNECTOR	GATEWAY EXPRESS	BRYAN DAIRY RD | 118TH AVE N
11	BRYAN DAIRY RD | 118TH AVE N	40TH ST N	34TH ST N
12	BAYSIDE BRIDGE	SR 686 | ROOSEVELT BLVD	GULF-TO-BAY BLVD
13	I-275	4TH ST N	PINELLAS SHORELINE
14	US 19	E BAY DR	WHITNEY RD
15	66TH ST N	142ND AVE N	US 19
16	66TH ST N	ULMERTON RD	142ND AVE N
17	I-275	PINELLAS SHORELINE	PINELLAS POINT DR
18	I-275	PINELLAS POINT DR	54TH AVE S
19	US 19	142ND AVE N SOUTH RAMPS	66TH ST N
20	US 19	150TH AVE N	E BAY DR
21	EAST LAKE RD	OLD E LAKE EXT	PASCO CO LINE

06. MOBILITY

The third and final category of performance data used to identify hotspots was used to represent recurring congestion on the CMP Network. Recurring congestion, categorically referred to here as mobility, differs from non-recurring congestion in that it identifies roadway segments that are reliably and predictably congested, typically in the peak hour or period. Two separate mobility measures were used to define the 20 worst performing segments, relative to this category:

■ Peak AM Speeds minus Posted Speed Limit
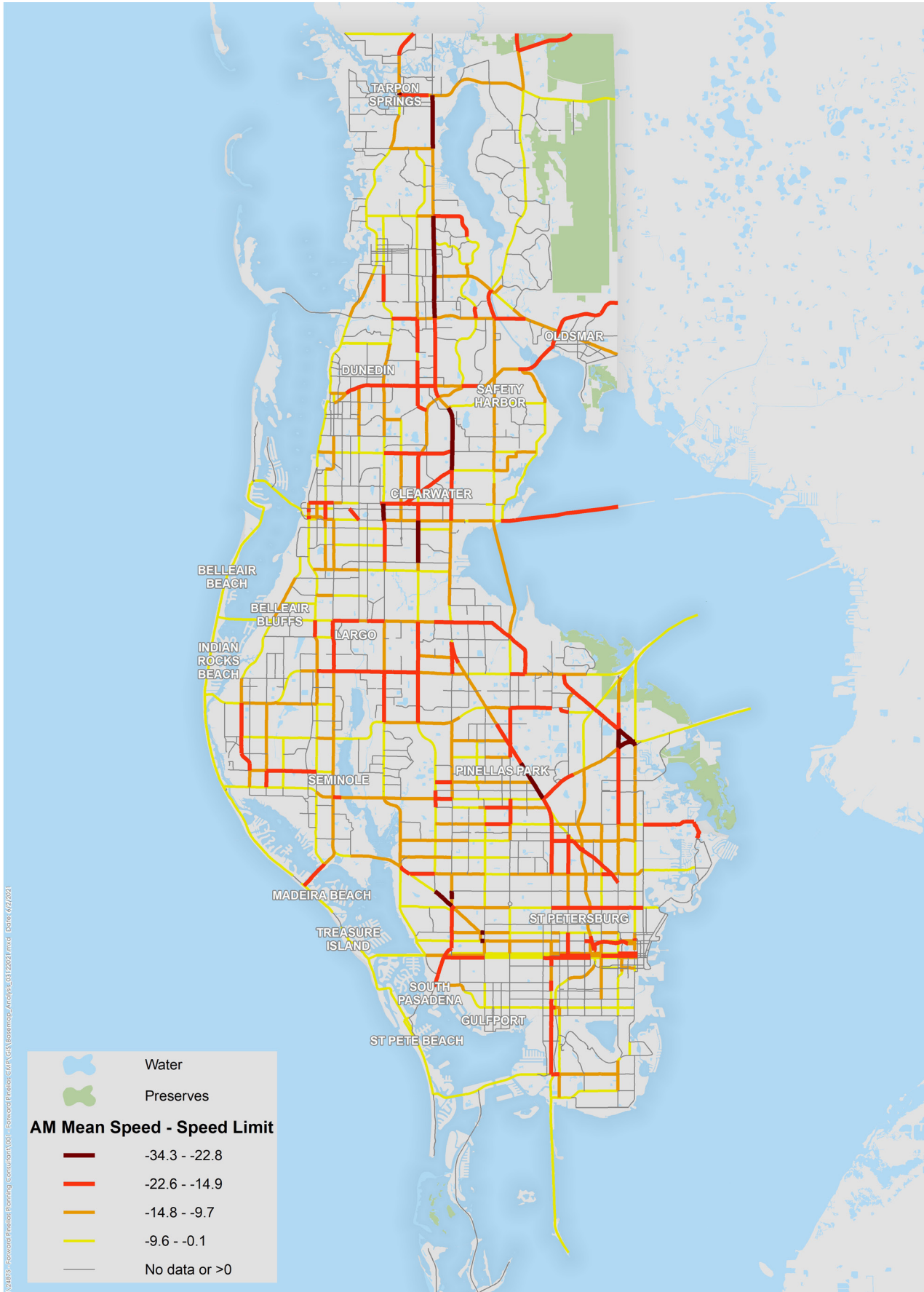
■ Peak PM Speeds minus Posted Speed Limit

AM and PM peak hour speeds were calculated using HERE data joined to the CMP Network , by direction, during the respective peak hour. The reported HERE speeds were compared to the respective segment speed limit to serve as a proxy for congestion. The posted speed limit was subtracted from the reported HERE speeds. A greater difference (more negative number) between the HERE speeds and posted speed limit suggests that the specific segment on the CMP Network is congested. Detailed methodology on the speed analysis is available in the Performance Measures Technical Memorandum.

The speed data analyzed for this category are an important part of the congestion management hotspot analysis, but cannot be used alone to determine the need for congestion management. The strategy framework outlined in the Strategy Framework Technical Memorandum distinguishes mobility and reliability hotspots based on roadway context and function as an important factor to use in the identification of appropriate mitigation strategies. A congested segment in a downtown area that has a high degree of livability and multimodal activity, for example, might best be addressed with multimodal strategies, rather than traditional congestion management strategies.

Figure 13 depicts the Peak AM Speeds and Posted Speed Limit Difference on the CMP Network by segment. Segments in the darkest red are segments that have an average AM peak hour speed 22 mph or less than the posted speed limit. The 20 worst performing segments are listed in Table 10, excluding segments that are less than 0.2 miles in length where low speeds may be a function of intersection density, rather than congestion.

Table 10 lists the 20 worst performing segments in the AM Peak period. US 19 (11 segments), Belcher Road (3 segments), Dr. Martin Luther King Jr Street (2 segments), and Alt US 19 (2 segments) all have multiple segments that score in the top 20 segments using this measure. All segments in the top 20 have an average AM peak hour speed 22 mph or less than the posted speed limit.

FIGURE 13. AM PEAK SPEED HOTSPOTS

Legend:

AM Mean Speed - Speed Limit

- Water
- Preserves
- -34.3 - -22.8
- -22.6 - -14.9
- -14.8 - -9.7
- -9.6 - -0.1
- No data or >0

TABLE 10. TOP 20 AM PEAK MOBILITY HOTSPOTS

ID	ON STREET	FROM STREET	TO STREET	AM PEAK SPEED LIMIT
1	US 19	MLK	TARPON AVE	-34.34
2	US 19	KLOSTERMAN RD	MLK	-34.34
3	US 19	HIGHLANDS BLVD	ALDERMAN RD	-33.10
4	US 19	SUNSET POINT RD	ENTERPRISE RD	-30.57
5	US 19	NE COACHMAN RD	SUNSET POINT RD	-30.57
6	DR MARTIN LUTHER KING JR ST N	102ND AVE N	ROOSEVELT BLVD	-29.72
7	DR MARTIN LUTHER KING JR ST N	GANDY BLVD	102ND AVE N	-29.34
8	SR 686 | ROOSEVELT BLVD	4TH ST N	DR ML KING JR ST N	-27.24
9	66TH ST N	26TH AVE N	30TH AVE N	-26.93
10	ALT US 19 | TYRONE BLVD	66TH ST N	68TH ST N	-26.93
11	ALT US 19 | TYRONE BLVD	68TH ST N	71ST ST N	-26.93
12	KEENE RD	GULF-TO-BAY BLVD	CLEVELAND ST	-24.04
13	US 19	CURLEW RD	CR 39	-23.62
14	US 19	CR 39	TAMPA RD	-23.62
15	US 19	NEBRASKA AVE	HIGHLANDS BLVD	-23.40
16	US 19	80TH AVE N	MAINLANDS BLVD	-23.30
17	US 19	GANDY BLVD	78TH AVE N	-23.30
18	US 19	TAMPA RD	NEBRASKA AVE	-23.23
19	GANDY BLVD	DR ML KING JR ST N	ROOSEVELT BLVD	-22.86
20	BELCHER RD	NURSERY RD	OAK GROVE MIDDLE SCHOOL ENTRY	-22.75
21	BELCHER RD	OAK GROVE MIDDLE SCHOOL ENTRY	HARN BLVD	-22.75
22	BELCHER RD	HARN BLVD	DRUID RD	-22.75

Figure 14 shows the Peak PM Speed and Posted Speed Limit Difference on the CMP Network by segment. Segments in the darkest red are segments that have an average PM peak hour speed 27 mph or less than the posted speed limit. The 20 worst performing segments are listed in Table 11, excluding segments that are less than 0.2 miles in length where low speeds may be a function of intersection density, rather than congestion.

Table 11 shows he 20 worst performing segments using the PM Peak Speed analysis. US 19 (10 segments), Belcher Road (3 segments), Dr. Martin Luther King Jr Street (2 segments), and Alt US 19 (2 segments) all have multiple segments that score in the top 20 segments using this measure. All segments in the top 20 have an average PM peak hour speed 27 mph or less than the posted speed limit.

FIGURE 14. PEAK PM SPEED HOTSPOTS
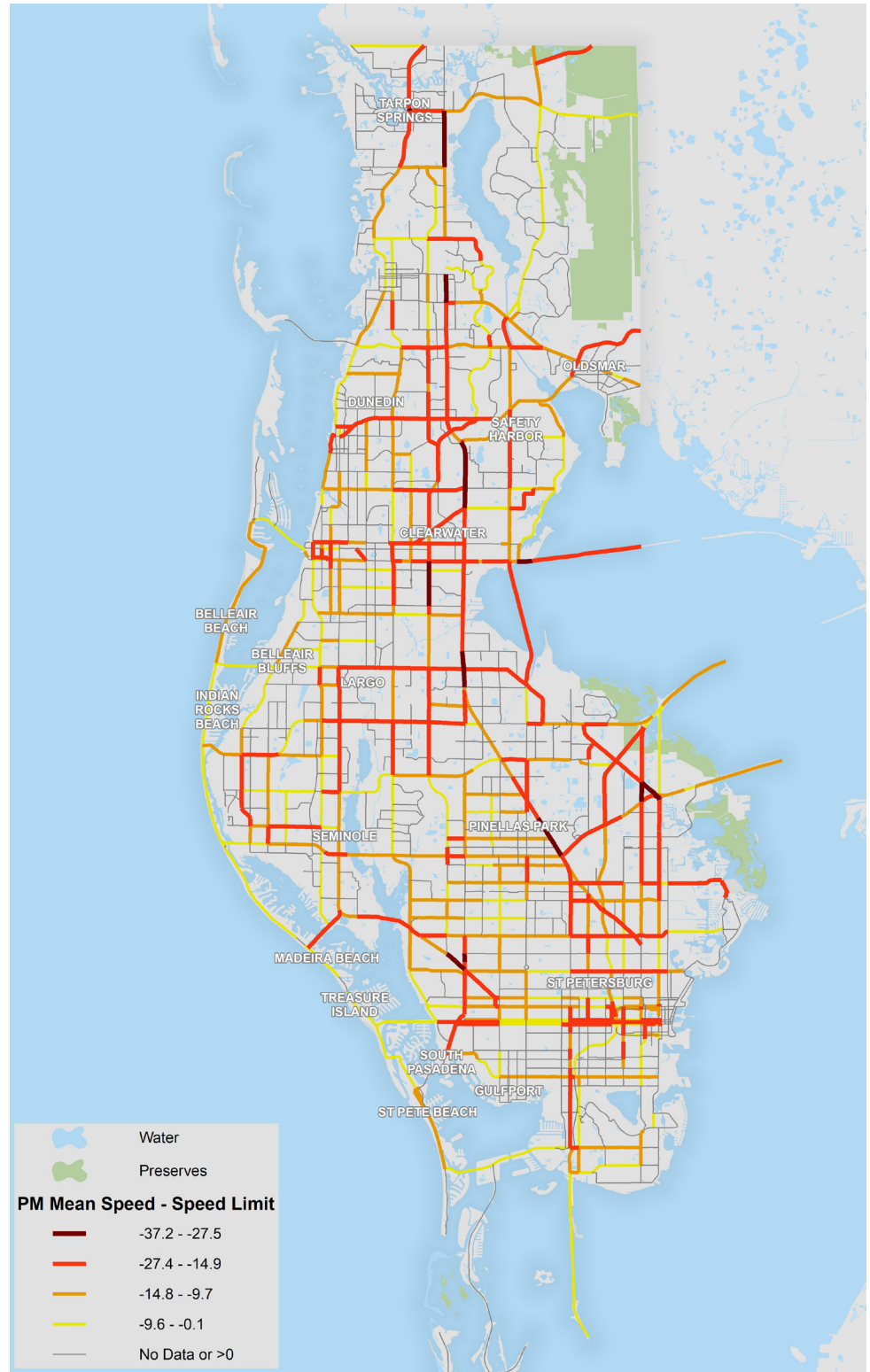
TABLE 11. TOP 20 PM PEAK MOBILITY HOTSPOTS

ID	ON STREET	FROM STREET	TO STREET	PM PEAK - SPEED LIMIT
1	US 19	HIGHLANDS BLVD	ALDERMAN RD	-37.19
2	US 19	MLK	TARPON AVE	-36.35
3	US 19	KLOSTERMAN RD	MLK	-36.35
4	DR MARTIN LUTHER KING JR ST N	GANDY BLVD	102ND AVE N	-34.23
5	US 19	SUNSET POINT RD	ENTERPRISE RD	-31.72
6	US 19	NE COACHMAN RD	SUNSET POINT RD	-31.72
7	US 19	E BAY DR	WHITNEY RD	-31.10
8	US 19	150TH AVE N	E BAY DR	-31.10
9	SR 686	ROOSEVELT BLVD	4TH ST N	DR ML KING JR ST N	-30.98
10	66TH ST N	26TH AVE N	30TH AVE N	-30.96
11	ALT US 19	TYRONE BLVD	66TH ST N	68TH ST N	-30.96
12	ALT US 19	TYRONE BLVD	68TH ST N	71ST ST N	-30.96
13	DR MARTIN LUTHER KING JR ST N	102ND AVE N	ROOSEVELT BLVD	-30.22
14	US 19	80TH AVE N	MAINLANDS BLVD	-29.99
15	US 19	GANDY BLVD	78TH AVE N	-29.99
16	US 19	TAMPA RD	NEBRASKA AVE	-29.23
17	BELCHER RD	NURSERY RD	OAK GROVE MIDDLE SCHOOL ENTRY	-28.73
18	BELCHER RD	OAK GROVE MIDDLE SCHOOL ENTRY	HARN BLVD	-28.73
19	BELCHER RD	HARN BLVD	DRUID RD	-28.73
20	COURTNEY CAMPBELL CSWY	BAYSHORE BLVD	DAMASCUS RD	-27.61

Similarly to safety and reliability analysis, a composite analysis was conducted to reconcile the mobility measures and identify overall mobility hotspots. The composite weights the AM and PM peak results equally and normalizes them in percentile terms with respect to the individual metrics. The roadway segment with the highest difference for each respective metric was used as the reference segment and all other segments were assigned a score relative to the reference segment.

Equation 3 shows how the mobility composite score is calculated.

EQUATION 3. MOBILITY COMPOSITE SCORE

$$\text{Composite Score} = \frac{\textit{AM Peak Speed Difference}}{\textit{min (AM Peak Speed Difference)}} + \frac{\textit{PM Peak Speed Difference}}{\textit{min (PM Peak Speed Difference)}}$$

where:

*AM Peak Speed Difference is the AM Peak Speed minus the Posted Speed Limit*

PM Peak Speed Difference is the PM Peak Speed minus the Posted Speed Limit

Figure 15 shows the 20 worst performing segments using the mobility composite scoring. The segments are listed in Table 12.

Table 12 shows the 20 worst performing segments using the mobility composite scoring. US 19 (10 segments), Belcher Road (3 segments), Dr. Martin Luther King Jr Street (2 segments), and Alt US 19 (2 segments) all have multiple segments that score in the top 20 segments using the mobility composite scoring.
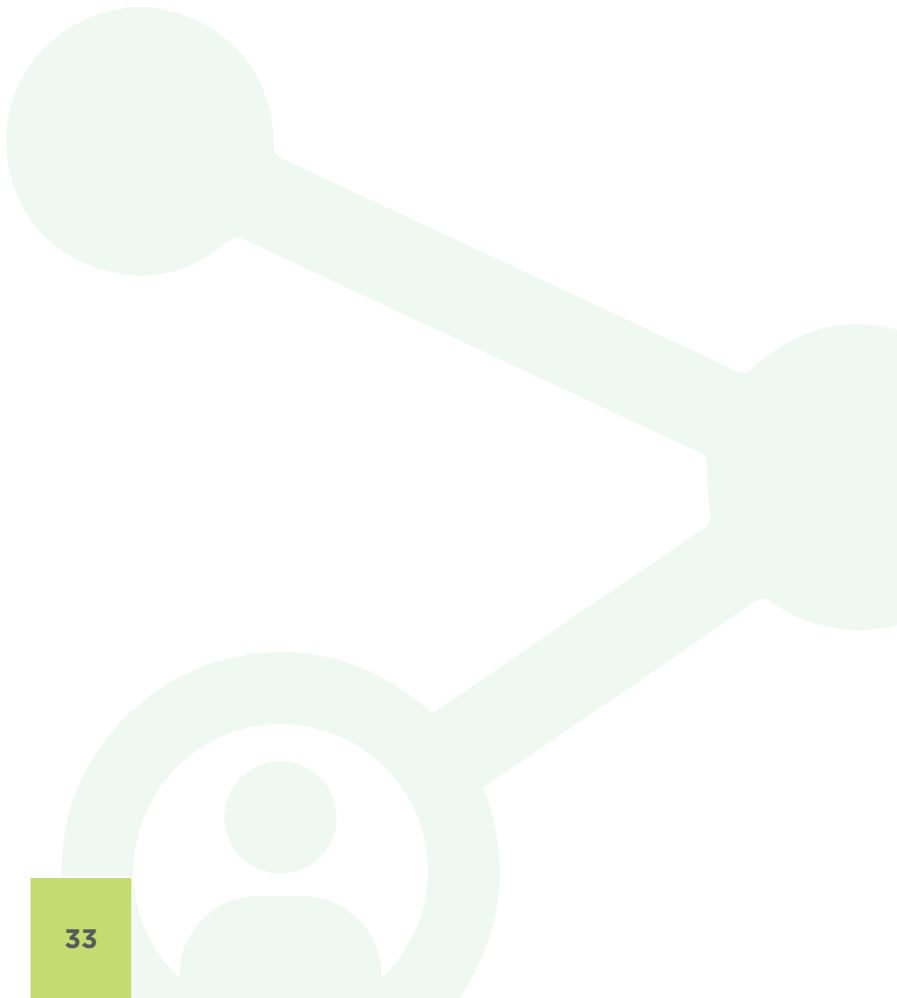
FIGURE 15. MOBILITY COMPOSITE HOTSPOTS
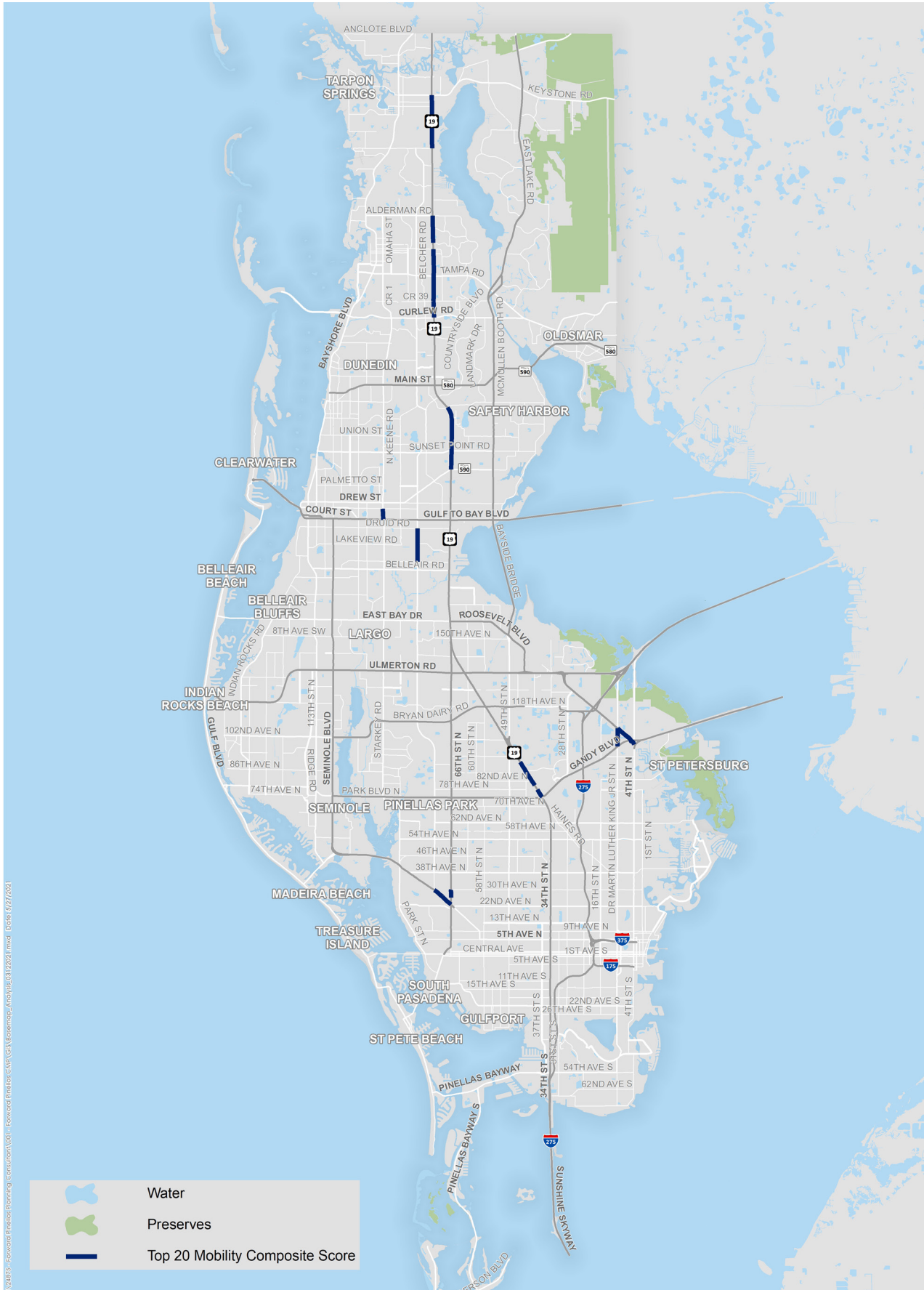
TABLE 12. TOP 20 MOBILITY HOTSPOTS

RANK	ON STREET	FROM STREET	TO STREET
1	US 19	MLK	TARPON AVE
2	US 19	KLOSTERMAN RD	MLK
3	US 19	HIGHLANDS BLVD	ALDERMAN RD
4	DR MARTIN LUTHER KING JR ST N	GANDY BLVD	102ND AVE N
5	US 19	SUNSET POINT RD	ENTERPRISE RD
6	US 19	NE COACHMAN RD	SUNSET POINT RD
7	DR MARTIN LUTHER KING JR ST N	102ND AVE N	ROOSEVELT BLVD
8	SR 686 | ROOSEVELT BLVD	4TH ST N	DR ML KING JR ST N
9	66TH ST N	26TH AVE N	30TH AVE N
10	ALT US 19 | TYRONE BLVD	66TH ST N	68TH ST N
11	ALT US 19 | TYRONE BLVD	68TH ST N	71ST ST N
12	US 19	80TH AVE N	MAINLANDS BLVD
13	US 19	GANDY BLVD	78TH AVE N
14	US 19	TAMPA RD	NEBRASKA AVE
15	BELCHER RD	NURSERY RD	OAK GROVE MIDDLE SCHOOL ENTRY
16	BELCHER RD	OAK GROVE MIDDLE SCHOOL ENTRY	HARN BLVD
17	BELCHER RD	HARN BLVD	DRUID RD
18	US 19	CURLEW RD	CR 39
19	US 19	CR 39	TAMPA RD
20	KEENE RD	GULF-TO-BAY BLVD	CLEVELAND ST