CAMBRIDGE SYSTEMATICS

2050 Long Range Transportation Plan Needs Assessment for State of Good Repair and Resilience

Final Report

prepared for

Hillsborough Transportation Planning Organization

prepared by

Cambridge Systematics, Inc.

with

Quest Corporation of America, Inc.

November 20, 2023

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Table of Contents

1.0 Introduction

The state of good repair and resilience of transportation assets in Hillsborough County are imperative to its continued well-being, prosperity, and growth. Recognizing the integral role of the transportation network, the Hillsborough Transportation Planning Organization (TPO), along with project stakeholders City of Plant City, City of Tampa, City of Temple Terrace, Florida Department of Transportation (FDOT), Hillsborough County, and Hillsborough Transit Authority, has completed this Needs Assessment, with a specific focus on pavement, bridges, and transit assets. Each stakeholder—as an owner of pavement, bridge, or transit assets—contributed greatly to the creation of this report with their data, knowledge, and experience in asset perseveration and resilience.

This report supports the TPO's 2050 Long Range Transportation Plan (LRTP), which analyzes the transportation system twenty-five years into the future. Thus, the LRTP can direct Federal and State funding toward transportation investments valued countywide and achieve the goals set for two decades from now. The report compiles asset management and resilience data from each project stakeholder, and countywide; defines measures by which asset management and resilience are evaluated; describes two investment spending levels, under which the performance measures are calculated; presents and analyzes the results for both spending levels; and finally, summarizes the findings of all analyses for the region.

Preservation of assets plays a key part in all facets of our transportation network. Pavement preservation is a suite of strategies to extend the service life of road surfaces and mitigate the impacts of environmental and vehicular damage. Bridge preservation aims to proactively mitigate the deteriorative impacts of weather, traffic, and time on critical structures. The SOGR of the bus fleet, in addition to that of behind-the-scenes transit infrastructure like maintenance, storage, administration, and communication facilities, are pivotal to ensuring the accessibility and usability of public transit. This report delves into the state of pavement preservation, bridge preservation, and transit asset preservation in Hillsborough County and highlights their significance in shaping a resilient, efficient, and enduring transportation system.

2.0 Needs Assessment Data

2.1 Data Collection

Data collection began with a request to project stakeholders, asking for information on their asset inventory, condition, maintenance strategies, resilience projects, and budget. Specifically, the following elements were sought:

- Condition data for pavement and bridges, using standard performance measures for comparability across jurisdictions.
- Maintenance program for each asset type.
- Revenue forecasts.
- Documentation of performance measure methodologies and asset management processes.
- Tools, methods, and investments employed to increase resilience of assets.

- Available funding, budgetary shortfall, and total backlog in unfunded maintenance to date.
- Treatment types and their associated unit costs, including those to improve resilience.
- A list of assets prioritized for maintenance within the next ten years.

Subsequently, one-on-one coordination meetings were held with each available stakeholder. These meetings gave stakeholders an opportunity to ask questions about the data collection request and streamline the process of providing their data. Throughout the project, stakeholders were asked to verify this analysis—both its inputs and findings—and provide feedback.

Where the requested data were not available, other sources were consulted to fill in those data gaps, such as the Federal Highway Administration's InfoBridge portal. Funding data was drawn from a database of available Capital Improvement Plans (CIP), maintained by Hillsborough TPO in support of the 2050 LRTP update.

2.2 Asset Inventory

In total, there are 12,433 lane miles of roadway and 817 bridges countywide. On average, over $136 million is allocated annually for pavement preservation and over $19 million for bridge preservation. Summaries of each stakeholder's pavement and bridge assets, and preservation strategies, are listed in Table 2.1.

Table 2.1 Pavement and Bridge Asset Summary by Stakeholder

Element	City of Plant City	City of Tampa	City of Temple Terrace	Florida Department of Transportation	Hillsborough County
Roadway	331 lane miles	2,477 lane miles	179 lane miles	2,046 lane miles	7,400 lane miles
Resurfacing Cycle Target	15 years	17 years[1]	17 years[1]	12 years	20 years
Annual Resurfacing	22 lane miles	32 lane miles	4 lane miles[2]	171 lane miles[2]	23 lane miles
Resurfacing Cost Per Lane Mile	$160,987[3]	$171,563[3]	$176,000	$714,228[4]	$191,176
Annual Resurfacing Funding	$3,541,713	$5,490,000	$735,000	*based on need*	$5,413,200
Bridges	5	28	0	528	256

[1] Value based on regional standard.

[2] Value calculated from annual funding and cost per lane mile.

[3] Value calculated from annual funding and annual miles resurfaced.

[4] Value averaged from agency costs for urban and rural highway resurfacing.

Element	City of Plant City	City of Tampa	City of Temple Terrace	Florida Department of Transportation	Hillsborough County
Annual Bridge Preservation Funding	$130,000	$250,000	*N/A*	*based on need*	$1,657,400

Source: stakeholder publications, stakeholder interviews, TPO CIP database, and FHWA InfoBridge.

While FDOT is committed to maintain a state of good repair for their pavement and bridge assets, they do not subdivide their preservation budget by county. Instead, funding is tracked at the district level—District 7 includes Citrus, Hernando, Hillsborough, Pasco, and Pinellas counties. Therefore, preservation spending in the county may fluctuate widely year to year. For the purposes of calculation, it was assumed that FDOT funds on average approximately $121 per year for pavement preservation and $17 million per year for bridge preservation—based on the average rate of lane miles or bridges to be preserved annually, and FDOT's self-reported unit costs for preservation.

As the public transit provider for Hillsborough County, the Hillsborough Transit Authority (HART) is the sole stakeholder maintaining transit assets. A summary of HART's bus assets and replacement strategy is available in Table 2.2.

Table 2.2 Transit Bus Asset Summary

Stakeholder	Buses	Annual Mileage Per Bus	Target Replacement Age	Target Replacement Mileage	Annual Replacement Funding
Hillsborough Transit Authority	132	55,000	12 years	500,000	$12,000,000

Source: stakeholder publications, stakeholder interviews, and TPO CIP database.

In addition to buses, HART owns thirteen buildings, two of which—the Administration, and the Heavy Maintenance buildings—are overdue for replacement. The authority funds $22,227,700 per year for facilities and construction, with more than $105 million in overdue renovation or replacement costs in 2022, as shown in Table 2.3.

Table 2.3 Transit Building Asset Summary

Building	Age[5]	Estimated Cost Due for Renovation or Replacement	Due for Replacement[5]
Administration	40	$5,162,457	✗
Purchasing Annex	26	$255,617	
Heavy Maintenance	40	$100,000,000	✗

[5] As of March 7, 2022.

Building	Age[5]	Estimated Cost Due for Renovation or Replacement	Due for Replacement[5]
Marion Transit Center	18	$18,839,916	
Netpark	14	$1,851,240	
North West Transit Center	13	$3,844,817	
Preventive Maintenance	31	$2,766,772	
Radio	12	$105,696	
Streetcar Facility	19	$4,115,859	
University Area Transit Center	22	$1,125,392	
West Tampa Transit Center	14	$1,642,506	
Ybor City Facility	14	$7,879,611	
Yukon Transit Center	35	$709,555	

Source: 2022 HART Transit Asset Management Plan.

2.3 Resilience Data

For the resilience analysis in this report, the project team gathered data related to resilience needs, potential projects and estimated cost, and current/typical spendings on resilience related improvements. The data from the *Resilient Tampa Bay: Transportation Pilot Program Project* conduced in 2020 was obtained for the analysis of resilience needs and estimated costs in Hillsborough County. The baseline spending data for Hillsborough County's 2050 LRTP was obtained for the estimation of current funding assigned for stormwater and drainage improvements and road maintenance.

3.0 Performance Measures

3.1 Pavement Assets

To evaluate pavement asset performance, two measures were considered:

- An estimate of the **resurfacing cycle for a given lane mile of roadway**, derived from stakeholders' lane miles of roadway owned and lane miles resurfaced on average per year.
- An estimate of the **percentage of roadway resurfaced within the target resurfacing cycle**, derived from stakeholders' estimated resurfacing cycle for a given lane mile and target cycle between resurfacing for a given lane mile.

Both are calculatable for individual stakeholders as well as for the Hillsborough County area as a whole. When an input to either measure was not available, it was estimated from other data elements submitted by

that stakeholder or on record with Hillsborough TPO. The latter measure served as the primary measure for pavement asset performance.

3.2 Bridge Assets

Similar to pavement assets, to evaluate bridge asset performance, two measures were considered:

- An estimate of the **preservation cycle for a given bridge**, derived from stakeholders' number of bridges owned and bridges preserved on average per year.
- An estimate of the **percentage of bridges preserved within the target preservation cycle**, derived from stakeholders' estimated preservation cycle for a given bridge and target cycle between preservation for a given bridge.

These measures are also calculatable for both individual stakeholders and the entire region as one. When an input to the measures was not available, it was estimated from stakeholder's other data elements and average unit costs reported by FDOT in their 2022 Transportation Asset Management Plan (TAMP). Also, similarly to pavement assets, the latter measure served as the primary benchmark for bridge asset performance.

3.3 Transit Assets

Lastly, to evaluate transit bus performance, two additional measures were considered:

- An estimate of the **percentage of the bus fleet past the end of its useful life**, derived from HART's recommended bus retirement age and funded bus minimum lifecycle.
- An estimate of the **number of road calls per weekday**, derived from HART's estimated average bus age and average annual miles driven per bus.

A road call is an in-service failure, causing a vehicle to be pulled from service and leading to disruption for riders. Road calls are estimated based on a function published by the Federal Transit Administration in *Useful Life of Transit Buses and Vans*. The former served as primary benchmark for transit bus asset performance.

As reported in HART's recent Transit Asset Management Plan update, the agency's reported backlog for building maintenance—more than $105 million—shows an urgent need for preservation of assets essential to an operational public transit system.

4.0 State of Good Repair Analysis

4.1 Methodology

To forecast performance in 2050, for all asset types, two spending levels were developed and compared:

1. In the **Trend Spending** level, it was assumed stakeholders' current funding levels (described in Chapter 2.0) continue unchanged into the future.

2. In the **Performance Spending** level, it was assumed each stakeholder's funding levels adjusted to meet goals for the cycle between preservation treatments (or replacement).

Under both potential spending levels, the performance measure defined in Chapter 3.0 (i.e., resurfacing cycle for a given lane mile of roadway pavement; percentage of roadway pavements resurfaced within the target resurfacing; preservation cycle for a given bridge; percentage of bridges preserved within the target preservation cycle; percentage of the bus fleet past the end of its useful life; and number of road calls per weekday) is calculated with the assumed funding level appropriate to that scenario.

4.2 Performance Targets

For each of the primary performance measures, a performance target value was established:

- 100 percent of roadway treated within the target resurfacing cycle.
- 100 percent of bridges treated within the target preservation cycle.
- Zero percent of the bus fleet past the end of its useful life, as defined by the Federal Transit Administration.

4.3 Results

Countywide, the Trend Spending scenario resulted in:

- **28 percent of roadway** will be resurfaced within the target resurfacing cycle.
- **72 percent of bridges** will be preserved within the target preservation cycle.
- **Zero percent of the transit bus fleet** will be past the end of its useful life.

In the Performance Spending scenario, to meet the defined performance targets:

- **With $87 million of additional annual funding, 100 percent of roadway will be resurfaced within the target resurfacing cycle**—this is, a given lane mile of roadway resurfaced every 18 years.
- **With $7.4 million of additional annual funding, 100 percent of bridges will be preserved within the target preservation cycle**—this is, a given bridge preserved every 40 years.
- Assuming no change to the bus fleet size, **no additional funding is needed to keep 0 percent of the bus fleet past the end of its useful life,** and the bus fleet will experience 3.8 road calls per weekday. Additional analysis may need to be conducted if projections for bus need through 2050 differ.
- **Over $105 million of backlogs in transit building maintenance remain**, including replacement of HART's heavy maintenance facility, which is already past the end of its useful life and in marginal condition.

Overall, two stakeholders—Plant City and FDOT—are meeting their stated pavement preservation goals at existing funding levels. The other stakeholders require varying levels of additional funding to meet their goals, as seen in Table 4.1.

Table 4.1 Summary of Pavement Assets Scenario Analysis Results by Stakeholder

Stakeholder	Trend Scenario *Roadway Pavement Resurfaced within Target Cycle*	Performance Scenario *Additional Annual Funding Needed to Meet Performance Targets*
City of Plant City	100%	$0
City of Tampa	22%	$19,500,000
City of Temple Terrace	40%	$1,100,000
Florida DOT	100%	$0
Unincorporated Hillsborough County	6%	$66,300,000

Source: scenario analysis.

Of the four stakeholders who own and maintain bridges, only one—FDOT—meet the preservation target cycle performance goal at current funding levels. The other three need varying levels of additional funding to meet these goals, as seen in Table 4.2.

Table 4.2 Summary of Bridge Assets Scenario Analysis Results by Stakeholder

Stakeholder	Trend Scenario *Bridges Preserved within Target Cycle*	Performance Scenario *Additional Annual Funding Needed to Meet Performance Targets*
City of Plant City	80%	$40,000
City of Tampa	27%	$670,000
Florida DOT	100%	$0
Unincorporated Hillsborough County	65%	$6,700,000

Source: scenario analysis.

Results in both the Trend Spending Level and Performance Spending Level are estimates of asset performance in 2050 and are highly dependent upon the data collected used as inputs, as described in Chapter 2.0.

5.0 Resilience Analysis

5.1 Methodology

To assess the potential funding gaps for resilience improvement in Hillsborough County, the project team analyzed the estimated funding needs for resilience projects identified in the *Resilient Tampa Bay: Transportation Pilot Program Project* conduced in 2020 and compared it with Hillsborough County's funding assigned for stormwater and drainage improvements and road maintenance in the 2050 LRTP. As part of the Resilient Tampa Bay study, high critical roads were identified as assets highly important to regional mobility, connectivity, equity, and emergency operations. In addition, in the scenario of category 3 storm plus high sea level rise projection, roads that are inundated by greater than or equal to 11 feet were considered having high vulnerability; and roads that are inundated by 6 to 10 feet were considered having moderate vulnerability.

Two scenarios were evaluated in this analysis:

- A **Trend Spending** level to estimate the number of miles of vulnerable and critical roads with typical annual trend funding levels for stormwater and roadway hardening, based on Hillsborough County's funding assigned for stormwater and drainage improvements and road maintenance in the 2050 LRTP.
- And a **Performance Spending** level to identify a total cost to address the resilience needs on highly critical and highly to moderately vulnerable roads identified in the *Resilient Tampa Bay: Transportation Pilot Program Project.*

5.2 Results

5.2.1 Trend Spending Scenario

According to the 2050 LRTP baseline spending (Table 5), there is on average about $1.6 million funding annually on projects exclusively related to stormwater and drainage improvement, and on average about $82.3 million funding annually road maintenance related projects in the Hillsborough County area as a whole. Road maintenance related projects include resurfacing, bridge repair/rehabilitation, sidewalk repair and restoration, and street maintenance requests

Table 3 Baseline Spending on Stormwater and Road Maintenance in 2050 LRTP

	Year 2023	Year 2024	Year 2025	Year 2026	Year 2027	Total Spending	Annual Average
Stormwater and Drainage	$4,739,547	$1,348,548	$1,511,593	$180,000	$180,000	$7,959,688	$1,591,938
Road Maintenance	$174,836,370	$136,963,494	$60,583,394	$21,157,209	$22,010,064	$411,875,531	$82,375,106

Source: Hillsborough TPO 2050 Revenue Forecast.

There are 71 miles of roads being identified as highly critical and highly to moderately vulnerable to extreme weather and climate stressors in the Hillsborough County area. About 25 miles of them are overlapped with the stormwater and drainage improvement projects in the 2050 LRTP. Even assuming that these projects will mitigate the impacts from the hazard (category 3 storm with high sea level rise projection) analyzed in the Resilient Tampa Bay project, there will still be about 46 miles of highly critical roads with high to moderate vulnerability in Hillsborough County that will not be treated for resilience improvements.

5.2.2 Performance Spending Level

The Resilient Tampa Bay Transportation stakeholders—consisting of the three MPOs, the Tampa Bay Regional Planning Council, and the Florida Department of Transportation District 7—have conducted a regional climate vulnerability study in the three counties with the awarded FHWA Resilience and Durability to Extreme Weather grant in 2020. The purpose of the study was to assist in meeting the new federal mandate and to inform the LRTP updates for Tampa Bay's three Metropolitan Planning Organizations (MPOs): Hillsborough MPO; Pasco MPO; and Pinellas MPOs, and the regional LRTP.

The study followed the FHWA vulnerability assessment and adaptation framework, and assessed the potential climate vulnerability and risks on the transportation network due to storm surge, inland flooding, and sea level rise. The study screened and prioritized critical and vulnerable transportation facilities, identified adaptation strategies and candidate projects, and provided planning-level estimation of adaptation costs. There were **71 miles** of roads identified as highly critical and highly to moderately vulnerable to extreme weather and climate stressors in Hillsborough County.

To identify funding needs to improve resilience for the highly critical and highly to moderately vulnerable roads, the project team summarized the estimated cost of the 27 projects on these roads identified in the regional climate vulnerability study as highly critical and highly to moderately vulnerable. Table 6 provides information on the 27 potential resilient projects with high criticality and high or moderate vulnerability. The recommended adaptation strategies and their planning level estimated costs for these projects were used to calculate the funding needs for resilience improvement in Hillsborough County, including:

- Drainage enhancement;
- Raising road profiles;
- Asset hardening measures; and
- Coastal protection.

As shown in the "Drainage Enhancement" column of Table 6, it is estimated that the funding needed for stormwater/drainage related improvements on highly critical roads that are highly to moderately vulnerable is about **$297 million**, which equals to about **$14.8 million annually** for a 20-year timeframe. Current spending on stormwater ($1.6 million annually) only accounts for 11% of the funding needed to improve stormwater/drainage on critical roads that are moderately to highly vulnerable.

As shown in the "Roadway Improvement" column of Table 6, the funding needed for roadway related improvements such as hardening pavement and sub-base, raising profile of road, shoreline preservation, for highly critical roads that are highly to moderately vulnerable is about **$1,349.5 million**, which equals to about **$67.4 million** annually for a 20-year timeframe. The funding needed to harden/protect critical roads that are moderately to highly vulnerable is about 82% of the entire current road maintenance budget.

Table 4 Potential Resilient Projects with High Criticality and High or Moderate Vulnerability

ID	Road Name	From	To	Criticality	Vulnerability	Length	Drainage Enhancement	Roadway Improvement	Sum
1	Campbell Causeway	Bayview Ave	SR 589	High	High	10.30	$43,239,400.00	$233,428,900.00	$276,668,300.00
2	I-275	4th St N	SR 60	High	High	7.28	$30,561,440.00	$164,986,640.00	$195,548,080.00
3	Hillsborough Ave	Race Track Rd	SR 589	High	High	7.00	$29,386,000.00	$158,641,000.00	$188,027,000.00
4	US 41	College Ave	Big Bend Rd	High	High	6.64	$27,874,720.00	$137,202,320.00	$165,077,040.00
5	Kennedy Blvd	I-275	Church Ave	High	High	4.10	$17,211,800.00	$84,718,300.00	$101,930,100.00
6	SR 60	Hillsborough Ave	I-275	High	High	4.00	$16,792,000.00	$90,652,000.00	$107,444,000.00
7	US 41 / 50th St	CR 676A	Distribution Dr	High	High	3.88	$16,288,240.00	$80,172,440.00	$96,460,680.00
8	20Th St	Durham St	US 41	High	High	3.40	$14,273,200.00	$70,254,200.00	$84,527,400.00
9	West Shore Blvd	Prescott St	Euclid Ave	High	High	2.89	$12,132,220.00	$65,496,070.00	$77,628,290.00
10	SR 60	45Th St	Consoweld Dr	High	High	2.50	$10,495,000.00	$51,657,500.00	$62,152,500.00
11	Causeway Blvd	US 41	78th St	High	High	2.02	$8,479,960.00	$45,779,260.00	$54,259,220.00
12	College Ave	US 41	21St St	High	High	1.69	$7,094,620.00	$34,920,470.00	$42,015,090.00
13	SR 60	19Th St	39Th St	High	High	1.40	$5,877,200.00	$31,728,200.00	$37,605,400.00
14	Channelside Dr	Nebraska Ave	SR 618	High	High	1.09	$4,575,820.00	$24,702,670.00	$29,278,490.00

15	Kennedy Blvd	Brevard St	Marion St	High	High	0.68	$2,854,640.00	$14,050,840.00	$16,905,480.00
16	N 21st St	E 2nd Ave	Selmon Exp	High	High	0.45	$1,889,100.00	$9,298,350.00	$11,187,450.00
17	Dale Mabry Hwy	Interbay Blvd / SR 573	Palmira Ave	High	Moderate	3.42	$14,357,160.00	$15,513,120.00	$29,870,280.00
18	CR 676A	50Th St	Falkenburg Rd	High	Moderate	2.80	$11,754,400.00	$12,700,800.00	$24,455,200.00
19	I-275	SR 60	Glen Ave	High	Moderate	2.15	$9,025,700.00	$9,752,400.00	$18,778,100.00
20	Selmon Expy	Gandy Blvd	Carrington St	High	Moderate	0.68	$2,854,640.00	$3,084,480.00	$5,939,120.00
21	I 75	Harney Rd	N/A	High	Moderate	0.58	$2,434,840.00	$2,630,880.00	$5,065,720.00
22	US 92	US 301	N/A	High	Moderate	0.45	$1,889,100.00	$2,041,200.00	$3,930,300.00
23	Nebraska Ave	Bird St	Robson St	High	Moderate	0.40	$1,679,200.00	$1,814,400.00	$3,493,600.00
24	Jackson Street	Ashley Dr / Ashley St	Pierce St	High	Moderate	0.32	$1,343,360.00	$1,451,520.00	$2,794,880.00
25	US 92	River Blvd	Highland Ave	High	Moderate	0.32	$1,343,360.00	$1,451,520.00	$2,794,880.00
26	Columbus Dr	Fremont Ave	Rome Ave	High	Moderate	0.15	$629,700.00	$680,400.00	$1,310,100.00
27	US 301	Moody Rd	N of Palmetto St	High	Moderate	0.15	$629,700.00	$680,400.00	$1,310,100.00
	Total						**$296,966,520.00**	**$1,349,490,280.00**	**$1,646,456,800.00**

Source: Resilient Tampa Bay: Transportation Pilot Program Project, 2020.

5.2.3 Return on Investment of Resilience Improvements

To help evaluate potential tools and methods that can be used to inform the selection and prioritization of resilience improvements, the project team tested the Resilience and Disaster Recovery (RDR) Tool on its function to estimate the return on investments (ROI) using four resilience projects in the Hillsborough County area from the *Resilient Tampa Bay: Transportation Pilot Program Project (2020)*.

RDR tool

The RDR Tool was developed by the Volpe National Transportation Systems Center (Volpe Center) to help transportation agencies estimate the ROI of resilient infrastructure projects across a range of uncertain future hazards (such as flooding, earthquake, etc.) for long-range transportation planning.

The RDR Tool:

- Uses established robust decision-making concepts to address future scenarios that are highly uncertain.
- Ranks projects based on economic ROI using Benefit-Cost analysis (BCA), BCA under Uncertainty/Regret analysis, or Breakeven Analysis, depending on user data.
- Includes benefits of reduced repair cost, faster recovery time, and improved roadway network connectivity.
- Allows for use of default values or customized benefit and cost calculations based on agency data and knowledge.

The ROI results can be used to inform overall transportation infrastructure project prioritization in combination with other prioritization factors such as equity, safety, engineering considerations, and budgets.

Project Locations

The projects to be analyzed using the RDR Tool were selected by considering

- The high criticality and high/moderate vulnerability projects identified in the Resilience Tampa Bay project.
- The list of Transportation Improvement Program and CIP projects.
- Suggestions by the Hillsborough TPO Geographic Information Systems (GIS) team.

The team selected four high criticality and high/moderate vulnerability projects: two projects in Hillsborough County and two in the City of Tampa. Three out of the four projects are overlapped with locations of CIP projects.

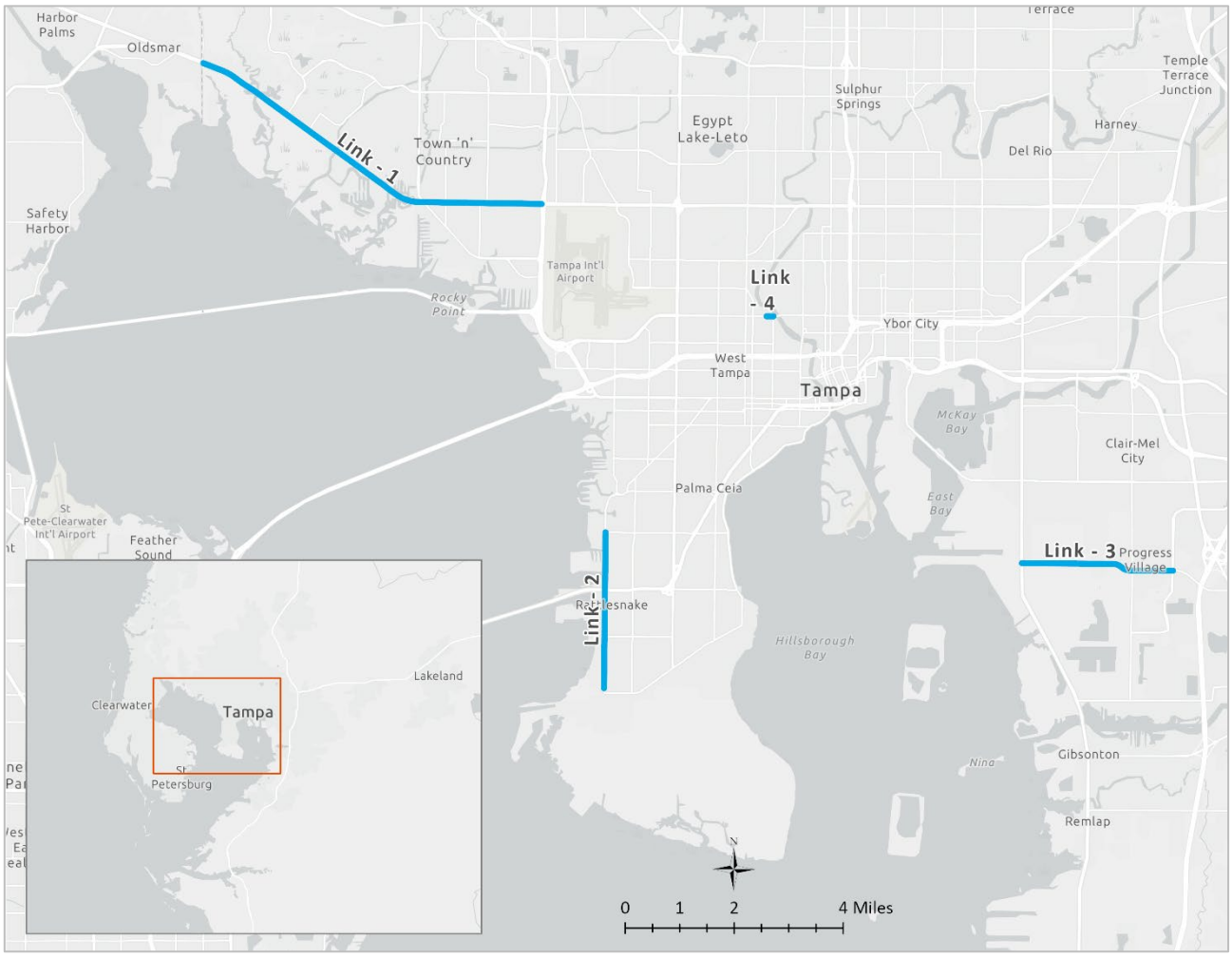
Table 7 lists these four projects and Figure 1 shows their location.

Table 5: Summary of Project Analyzed by the RDR Tool

Link No.	Road Name	From	To	Criticality	Vulnerability	Mileage	Jurisdiction	CIP
Link 1	Hillsborough Ave	Race Track Rd	SR 589	High	High	7.00	FDOT, Hillsborough County	46137015
Link 2	West Shore Blvd	Prescott St	Euclid Ave	High	High	2.89	City of Tampa	
Link3	CR 676A	50Th St	Falkenburg Rd	High	Moderate	2.80	FDOT, Hillsborough County	61150000
Link4	Columbus Dr	Fremont Ave	Rome Ave	High	Moderate	0.15	City of Tampa	69631105

Source: Resilient Tampa Bay: Transportation Pilot Program Project, 2020.

Figure 1: Projects Location Map



Source: Cambridge Systematics, 2023.

Project Alternatives

Nine project alternatives were analyzed by the RDR Tool against impact from category three storm plus high projection sea level rise. These include a baseline alternative with no resilience improvement, a full mitigation alternative, and a partial mitigation alternative for each of the four project locations described above (Table 8). The full mitigation project alternatives included improvements of raising the road profile, drainage enhancement, asset protection, and coastal protection as identified in the previous Resilience Tampa Bay study. This analysis assumed that these resilience improvements will be able to fully mitigate the impact from study hazard. The associated planning level costs from the Resilience Tampa Bay study were used to calculate the total project costs.

For partial mitigation projects, this analysis assumes they will be able to mitigate half of the impact from the study hazard, therefore, the exposure mitigation value for each network link of the associated asset was set to half of the maximum inundation depth for the respective project location. The cost of raising road profile component in the partial mitigation projects were set to half of those in the respective full mitigation alternatives.

It should be noted that the types of resilience improvements, implementation costs, and their ability to mitigate impact from the study hazard are assumptions made based on planning-level desktop analysis for the sole purpose of testing the capability of the ROI tool. They do not represent real world condition and should not be used to inform decision making without going through proper engineering evaluations.

Table 6: Project Alternatives and Cost Configuration for ROI Analysis (Million US$)

Project Name	Road Name	Raise Road Profile	Drainage Enhancement	Asset Protection	Coastal Protection	Project Cost
Link 1 Full Mitigation	Hillsborough Ave from Race Track Rd to SR 589	$112.9	$29.4	$31.8	$14.0	$188.0
Link 2 Full Mitigation	US 41 from College Ave to Big Bend Rd	$41.6	$12.1	$13.1	$5.8	$72.6
Link 3 Full Mitigation	Kennedy Blvd from I-275 to Church Ave	$40.3	$11.8	$12.7	-	$64.7
Link 4 Full Mitigation	SR 60 from Hillsborough Ave to I-275	$2.2	$0.6	$0.7	-	$3.5
Link 1 Partial Mitigation	Hillsborough Ave from Race Track Rd to SR 589	$56.4	$29.4	$31.8	$14.0	$131.6
Link 2 Partial Mitigation	US 41 from College Ave to Big Bend Rd	$20.8	$12.1	$13.1	$5.8	$51.8
Link 3 Partial Mitigation	Kennedy Blvd from I-275 to Church Ave	$20.1	$11.8	$12.7	-	$44.6
Link 4 Partial Mitigation	SR 60 from Hillsborough Ave to I-275	$1.1	$0.6	$0.7	-	$2.4
No Resilience Project	-	-	-	-	-	-

Source: Resilient Tampa Bay: Transportation Pilot Program Project, 2020.

Study Hazard

Category 3 storm plus high projection of sea level rise was considered as the only hazard scenario. The team chose category 3 to represent a significant event that could have a likely chance of occurring within the next two decades. Bolstering the decision was the general assumption of more frequent and stronger storms in the future.

Analysis Assumptions

The RDR tool estimates network performance under a range of uncertain future hazard scenarios and resilience investments using travel demand model (TDM) results to provide initial inputs and an open-source routing model called AequilibraE to produce disruption scenario results. It then monetizes investment, repair, and change in performance under disruption with and without resilience investments that mitigate the disruption at a given location. The tool offers options to evaluate ROI using BCA, BCA under Uncertainty/Regret Analysis, or Breakeven Analysis. It also includes an optional Exposure Analysis tool to help the analyst overlay agency-supplied hazard severity information into their transportation network.

In this analysis, data from the previous Resilience Tampa Bay study was used to provide network disruption information and only one hazard scenario (category three storm plus sea level rise) was analyzed. The standard BCA approach was applied. Below are some of the key assumptions for running the tool.

- Start and end period of analysis used were 2023 and 2050, respectively.
- Network and trip information were derived from the Tampa Bay Regional Planning Model (TBRPM). The tool interpolates trip information for the analysis period (2023 to 2050) based on 2015 and 2045 trips from the model. Other network information such as facility types, lane capacity, speed, and toll amount were also obtained from the model.
- Default flood exposure function that uses depth-disruption function adapted from an existing function, where the availability of a roadway decreases from 100% to 0% at a linear rate between 0 and 300 millimeters of flood depth. This function converts exposure into a corresponding level of disruption for each individual segment in the road network.
- Project life is assumed to be 50 years and annual maintenance cost to be $33,333 per lane mile according to a policy study by Reason Foundation.

Results

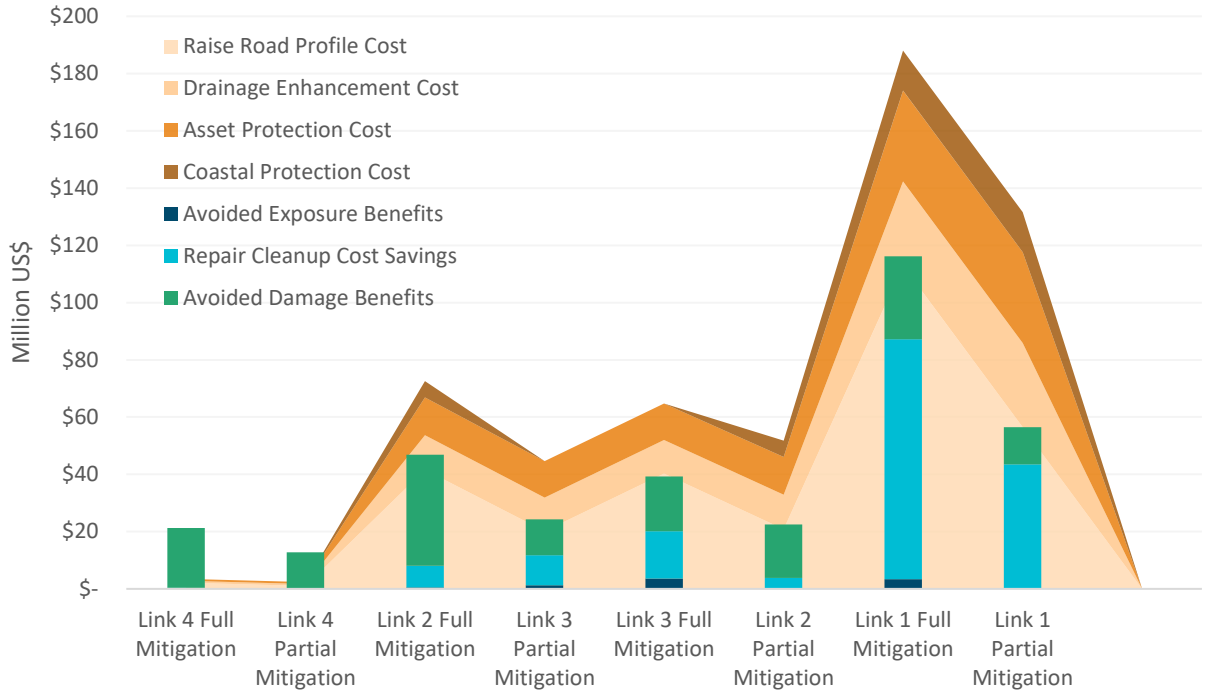
Table 9 shows the results from the analysis of projects using the RDR Tool, including their Net Benefits and benefit cost ratio (BCR). The project alternatives at SR 60 show positive net benefits with BCRs over one. It should be noted that the benefit amounts are only reflecting the monetized avoided disruption impact from one hazard scenario and does not capture all benefits of the resilience investment. The BCRs of these projects will increase with additional range of hazard scenarios and their probabilities being added to the analysis. In addition to the BCR, the Net Benefits/Break Even amounts are also helpful to better understand what the constraints are in terms of their projects' deployment costs.

Table 7: ROI Analysis Results by Project

Project Name	Asset	Project Cost (Million US$)	Benefit (Million US$)	Net Benefits / Break Even (Million US$)	Benefit-Cost Ratio
Link 4 Full Mitigation	SR 60 from Hillsborough Ave to I-275	$3.03	$21.29	$18.26	7.03
Link 4 Partial Mitigation	SR 60 from Hillsborough Ave to I-275	$2.09	$12.68	$10.59	6.08
Link 2 Full Mitigation	US 41 from College Ave to Big Bend Rd	$63.41	$49.07	$(14.33)	0.77
Link 3 Partial Mitigation	Kennedy Blvd from I-275 to Church Ave	$38.95	$24.15	$(14.80)	0.61
Link 3 Full Mitigation	Kennedy Blvd from I-275 to Church Ave	$56.54	$40.01	$(16.53)	0.70
Link 2 Partial Mitigation	US 41 from College Ave to Big Bend Rd	$45.25	$23.59	$(21.66)	0.52
Link 1 Full Mitigation	Hillsborough Ave from Race Track Rd to SR 589	$164.23	$110.68	$(53.55)	0.67
Link 1 Partial Mitigation	Hillsborough Ave from Race Track Rd to SR 589	$114.93	$48.07	$(66.86)	0.42

Figure 2 illustrates a breakdown of the costs (stacked column) and benefits (stacked area) for each of the mitigation scenarios. Avoided exposure benefit is defined as the benefit of avoided system performance reduction during the hazard event. The avoided damage benefits represent the benefits due to links not being damaged and being available to traffic during and after the hazard events. For Link 1 though, a significant amount of benefits comes from repair cleanup savings.

Figure 2: Project Costs and Benefits Breakdown



Source: Cambridge Systematics, 2023.

Discussion

This analysis has tested the main functions of the RDR Tool and found that it enables transportation agencies to assess transportation asset-specific resilience ROI over potential future conditions and hazard scenarios, which can inform project prioritization processes as well as evaluation of adaptation strategies. Even though this analysis has not tested all the function of the RDR Tool, the information provided by the RDR Tool have shown to be helpful for informing resilience decision making by the Hillsborough TPO.

It should be noted that this analysis was conducted to gain understanding of the RDR Tool, and various assumptions were made to developed analysis inputs, including adaptation strategies, project costs, and study hazard scenario. The BCRs generated from this analysis do not fully capture the potential avoided impacts (resilience benefits) from various hazard that could occur in the Hillsborough County are; therefore, the results from this analysis should not be used for decision making. As potential next steps, the TPO can use the RDR tool to conduct more comprehensive analysis with a range of representative hazard scenarios, adaptation strategies and mitigation capability identified through Project Development and Environment (PD&E) studies, and engineering approved cost estimates.

6.0 Conclusion

To meet the transportation asset state of good repair goals set by Hillsborough TPO as a whole will require considerable investment. But that investment also comes with considerable benefits. At current spending levels, pavement and bridge assets cannot be maintained on a schedule appropriate for the asset type and size of the transportation network. Overall, an addition $97.4 million in annual funding would mean that, throughout the county:

- All roadway pavements are resurfaced once every 15–20 years.
- All bridges are inspected and preserved on an appropriate schedule.
- All buses remain within their useful lifespan.

Additional benefits from such an investment are manifest:

- Beyond the financial benefits of timely intervention, pavement preservation fosters safer and smoother journeys for transit riders, cyclists, and motorists.
- Bridge preservation minimizes the need for costly and disruptive reconstruction and leads to safety improvements for all users.
- Transit asset preservation allows public transportation to connecting more communities and provide an indispensable service to residents.

However, there would remain unmet needs in transit asset preservation. First, this report assumed no change to the bus fleet size, which has shrunk by more than 30 percent since 2019. Were HART to expand transit service, and consequently require a larger fleet of revenue vehicles, additional funding would be needed to support the expansion. Second, though not modeled, HART currently has over $105 million in overdue maintenance for its building assets. Without functioning infrastructure, public transportation cannot safely connect communities, no matter the size and condition of its bus fleet.

In additional, there were 71 miles of roads identified as highly critical and highly to moderately vulnerable to extreme weather and climate stressors in the Hillsborough County area. The current funding level for road maintenance and stormwater/drainage enhancement are not sufficient to meet the resilience needs for protecting them from disruption and damage caused by extreme weather or climate events. As the frequency and intensity of potential climate hazards increases, additional analysis should be conducting to consider incorporating resilience improvement in asset management practices and identify potential additional funding opportunities. The Volpe Center's RDR tool can be useful for determine the benefits of resilience improvements.