

Memorandum

TO: Leslie Fordjour, NYMTC

FROM: Ben Mandel, CALSTART; Chris Lamm, Cambridge Systematics, Inc.

DATE: December 14, 2021

RE: Clean Freight Corridors Planning Study Task 5C Draft Deliverable: Optimal Mix of New Clean Freight Corridors

INTRODUCTION

NYMTC has initiated a Clean Freight Corridors Planning Study to advance high-efficiency, low-emission alternative transportation technologies in the region's freight fleet.

Part of the Regional Freight Plan component in NYMTC's Plan 2045 Regional Transportation Plan, the study will develop a strategic plan to support alternative fuel technologies for goods movement by identifying roadway corridors suited to be designated as Clean Freight Corridors for future investment in alternative fueling/electric charging infrastructure.

This technical memorandum describes the methodology and results of a new Clean Freight Corridor designation process, developed in partnership with NYMTC, the study's Technical Advisory Committee (TAC), and industry and public sector stakeholders.

NEW CLEAN FREIGHT CORRIDOR DESIGNATIONS

METHODOLOGY

For the purposes of this analysis, clean fuels are defined as electricity, hydrogen, compressed natural gas (CNG), and liquefied petroleum gas (LPG). Draft clean freight corridor recommendations were developed by calculating a **readiness** score for each fuel type. The readiness scores are drawn from three weighted variables: fuel station coverage, proximity to freight demand clusters, and existing truck

volume (Table 1). Weights were calculated from a ranking exercise conducted with the TAC in March 2021. Based on the readiness score percentile rank, corridor segments were grouped into three relative readiness levels (high, medium, low) for each fuel type, with 9-to-11 segments assigned to each level.

In addition to the readiness score, a score was developed to estimate each corridor's **need** for clean fueling infrastructure. The need score included projected demand for each fuel type in 2045 (based on a prior analysis conducted as part of this study), as well as air quality in census tracts adjacent to the segment, based on diesel particulate emissions (Table 2). Notably, future demand for LPG is projected to be minimal, and need scores were not developed for LPG as a result.

This methodology was presented for review by industry, agency, and community stakeholders as well as the TAC.

TABLE 1: INPUTS TO WEIGHTED COMPOSITE READINESS SCORE

Variable Name	Variable Description	Data Source	Related Indicator from TAC Meeting	Weight
<i>Fuel station coverage (by fuel type)</i>	<i>Percent of segment located within a 5-mile buffer of fuel station</i>	<i>FHWA 2020</i>	<i>Gaps in existing fueling infrastructure</i>	<i>44%</i>
<i>Freight demand clusters</i>	<i>Number of nearby Major Freight Demand Clusters</i>	<i>Cambridge Systematics analysis</i>	<i>Proximity to major freight generators</i>	<i>29%</i>
<i>Existing truck volume</i>	<i>Number of freight trucks utilizing the corridor</i>	<i>Transearch and FAF network analysis</i>	<i>Freight volumes</i>	<i>27%</i>

TABLE 2: INPUTS TO WEIGHTED COMPOSITE NEED SCORE

Variable Name	Variable Description	Data Source	Related Indicator from TAC Meeting	Weight
<i>Projected demand (by fuel type)</i>	<i>Number of trucks projected to be domiciled in zip codes adjacent to the segment</i>	<i>CALSTART analysis</i>	<i>Alternative fuel vehicle technology adoption by fleets</i>	<i>50%</i>
<i>Air quality</i>	<i>Diesel particulate matter emissions</i>	<i>EPA Environmental Justice Index 2019</i>	<i>Particulate matter emissions</i>	<i>50%</i>

RESULTS

Results from the readiness and need analyses are summarized in Table 3 and Figure 1, and presented in detail in Tables 4-7 and Figures 2-5. In total, 21 of the 31 highway segments evaluated rank as either high readiness or high need for at least one fuel type (Table 3). Of these, ten rank as high readiness for two or more fuel types. Eight of these also rank as high need for at least two fuel types (highlighted in yellow in Table 3). The combination of high readiness and high need across multiple fuel types on these eight segments make them the strongest candidates for Clean Freight Corridor designation. An additional three segments (NY25 and NY27, highlighted in red), should be considered for priority development as they rank high in need for electric, hydrogen, and CNG infrastructure, but low in readiness.

Additional segments should be considered for priority development to ensure a complete network of infrastructure. For example, I-495 in Nassau County ranks high readiness for only two fuel types and doesn't rank high need for any. However, it connects I-495 in Queens and Suffolk Counties (which are both high readiness segments) and should therefore be prioritized for EV and hydrogen infrastructure development to provide continuous reliable fueling opportunities. Based on stakeholder feedback, all segments of I-95 should also be prioritized for interstate connectivity in alternative fueling networks.

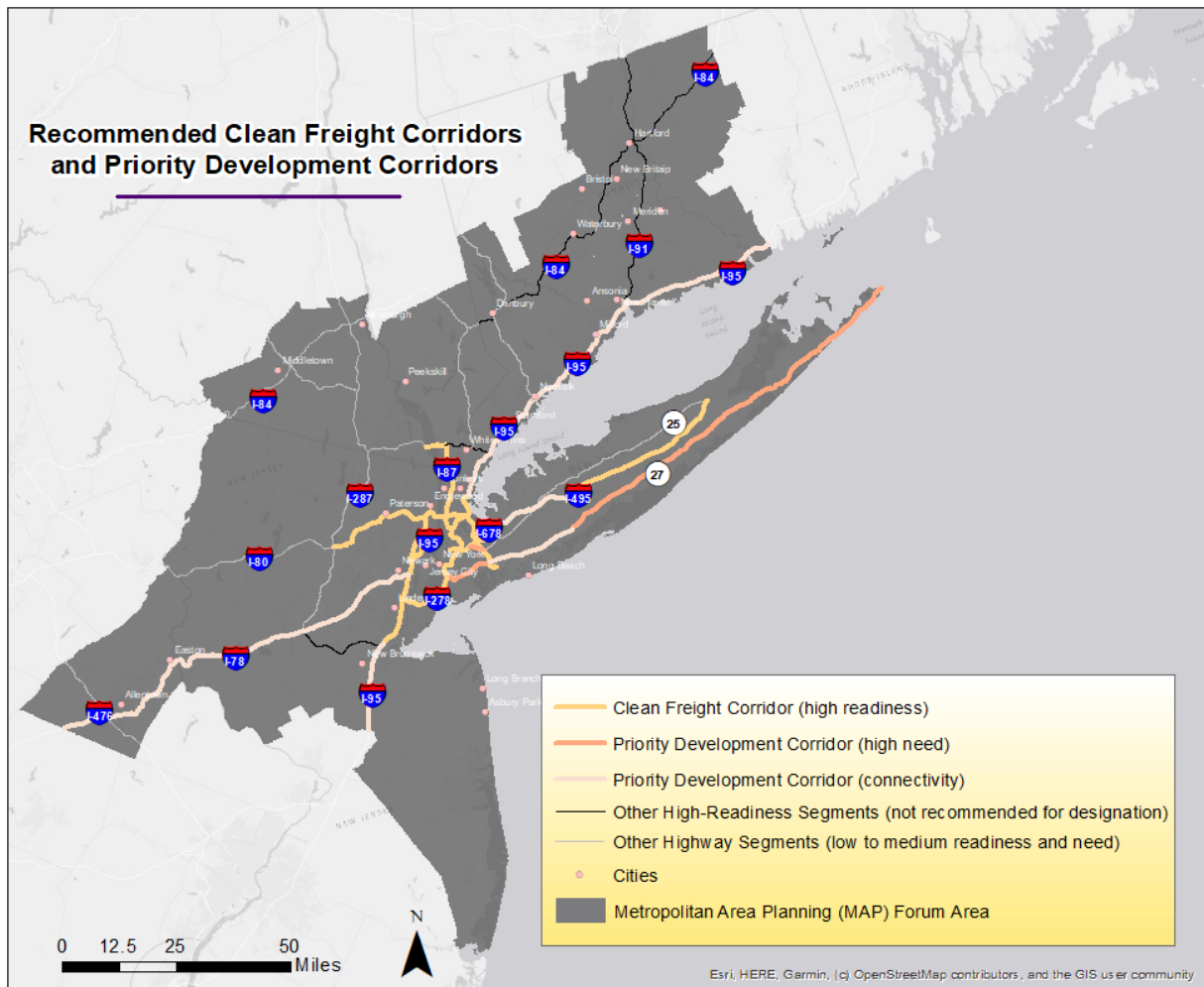
Further, NYMTC should consult with adjacent jurisdictions to ensure continuity of fueling infrastructure for longer-distance trips. For example, the Pennsylvania Department of Transportation plans to advance EV and CNG infrastructure along I-78¹. Segments of I-78 in this study's focus area did not rank as high priority but could become more important in the future as connecting segments are developed.

¹ [Final \(ver7-12-21\) PennDOT I81-I78 AFC Deployment Plan Report.pdf](#)

TABLE 3: RECOMMENDED CLEAN FREIGHT CORRIDORS AND PRIORITY DEVELOPMENT CORRIDORS

	Highway	Segment	High Readiness				High Need		
			EV	H2	CNG	LPG	EV	H2	CNG
Clean Freight Corridor (High Readiness, High Need)	I-278	Total length	X	X			X	X	X
	I-495	Queens	X	X	X		X	X	X
	I-495	Suffolk	X	X	X	X	X	X	X
	I-678	Total length	X		X		X	X	X
	I-80	New Jersey (east of 287)	X	X		X			
	I-87	Westchester and Bronx	X	X	X		X	X	X
	I-95	New Jersey (north of Exit 10)	X	X	X	X	X	X	X
	I-95	Manhattan and Bronx	X	X	X		X	X	X
Priority Development Corridor (High Need, Low Readiness)	NY 25	Queens			X		X	X	X
	NY 27	Kings and Queens			X		X	X	X
	NY 27	Suffolk					X	X	X
Priority Development Corridor (Connectivity)	I-95	New Jersey (south of Exit 10)	X			X			
	I-95	Westchester		X					
	I-95	Fairfield County				X			
	I-95	New Haven County							
	I-495	Nassau			X	X			
	I-78	Pennsylvania				X			
	I-78	New Jersey (east of 287)							
	I-78	New Jersey (west of 297)							
	NY 27	Nassau		X					
Other High Readiness Segments (not designated)	I-84	Connecticut		X		X			
	I-287	New Jersey (east of 78)	X						
	I-287	Rockland and Westchester			X				
	I-91	Connecticut				X			

FIGURE 1: RECOMMENDED CLEAN FREIGHT CORRIDORS AND PRIORITY DEVELOPMENT CORRIDORS



FUTURE STUDY

A notable gap in this analysis is the proximity of highway segments to environmental justice (EJ) communities. Air quality as measured by particulate matter emissions was used to approximate exposure to pollution, but other pollutants and demographic factors such as race and income were not considered.

While the project team lacked a consistently defined, cross-jurisdiction dataset to address this gap under the project scope,² stakeholders highlighted this as a priority for future study of clean freight corridor development. As a next step, the clean freight corridor designations proposed in this memo should be analyzed for proximity to EJ communities, and adjustments should be made to ensure that benefits are prioritized to the communities most historically afflicted by diesel pollution.

² *In compliance with Title VI of the Civil Rights Act of 1964, NYMTC designates census tracts with at least 57% minority population and 14% of persons below the poverty line as “Communities of Concern.” The study team does not have data on similar designations in portions of the study area outside of NYMTC’s planning region.*

TABLE 4: ELECTRIC (EV) READINESS AND NEED

Highway	Segment	EV Readiness Score	EV Readiness Level	EV Need Score	EV Need
I-95	New Jersey (north of Exit 10)	0.98	high	0.62	high
I-278	Total length	0.80	high	0.98	high
I-495	Queens	0.79	high	0.72	high
I-95	New Jersey (south of Exit 10)	0.69	high	0.27	medium
I-495	Suffolk	0.69	high	0.39	high
I-95	Manhattan and Bronx	0.67	high	0.57	high
I-287	New Jersey (east of 78)	0.62	high	0.26	low
I-87	Westchester and Bronx	0.62	high	0.49	high
I-80	New Jersey (east of 287)	0.60	high	0.38	medium
I-678	Total length	0.59	high	0.48	high
I-287	Rockland and Westchester	0.58	medium	0.29	medium
I-95	Westchester	0.56	medium	0.26	low
NY 27	Kings and Queens	0.56	medium	0.55	high
I-87	Orange and Rockland (to 287)	0.52	medium	0.20	low
I-84	Orange	0.50	medium	0.14	low
NY 27	Nassau	0.50	medium	0.37	medium
NY 25	Queens	0.50	medium	0.50	high
I-495	Nassau	0.49	medium	0.29	medium
NY 25	Nassau	0.49	medium	0.38	high
I-95	Fairfield County	0.45	medium	0.26	medium
I-84	Connecticut	0.43	low	0.29	medium
I-78	Pennsylvania	0.40	low	0.26	medium
I-287	New Jersey (north of 78)	0.39	low	0.20	low
NY 27	Suffolk	0.38	low	0.43	high
I-80	New Jersey (west of 287)	0.35	low	0.19	low
I-91	Connecticut	0.31	low	0.34	medium
NY 25	Suffolk	0.29	low	0.26	low
I-78	New Jersey (east of 287)	0.29	low	0.27	medium
I-95	New Haven County	0.28	low	0.19	low
I-78	New Jersey (west of 287)	0.19	low	0.12	low
I-84	Putnam and Dutchess	0.16	low	0.12	low

TABLE 5: HYDROGEN (H2) READINESS AND NEED

Highway	Segment	H2 Readiness Score	H2 Readiness Level	H2 Need Score	H2 Need
I-95	Manhattan and Bronx	0.66	high	0.57	high
I-95	New Jersey (north of Exit 10)	0.56	high	0.63	high
I-278	Total length	0.42	high	0.98	high
I-84	Connecticut	0.37	high	0.30	medium
I-495	Queens	0.35	high	0.54	high
I-87	Westchester and Bronx	0.34	high	0.49	high
I-495	Suffolk	0.34	high	0.39	high
I-80	New Jersey (east of 287)	0.29	high	0.38	medium
I-95	Westchester	0.28	high	0.26	low
NY 27	Nassau	0.28	high	0.37	medium
I-287	New Jersey (east of 78)	0.27	medium	0.26	low
I-78	Pennsylvania	0.26	medium	0.27	medium
I-84	Orange	0.26	medium	0.14	low
I-95	New Jersey (south of Exit 10)	0.25	medium	0.27	medium
I-91	Connecticut	0.25	medium	0.34	medium
I-80	New Jersey (west of 287)	0.23	medium	0.19	low
I-287	New Jersey (north of 78)	0.21	medium	0.21	low
I-78	New Jersey (west of 287)	0.19	medium	0.13	low
I-495	Nassau	0.19	medium	0.29	medium
I-87	Orange and Rockland (to 287)	0.19	medium	0.19	low
I-678	Total length	0.19	medium	0.48	high
NY 25	Nassau	0.18	low	0.38	medium
I-78	New Jersey (east of 287)	0.17	low	0.27	medium
I-95	New Haven County	0.17	low	0.19	low
I-95	Fairfield County	0.17	low	0.27	medium
I-287	Rockland and Westchester	0.14	low	0.29	medium
NY 25	Suffolk	0.14	low	0.26	low
NY 27	Suffolk	0.14	low	0.43	high
NY 27	Kings and Queens	0.12	low	0.55	high
I-84	Putnam and Dutchess	0.10	low	0.12	low
NY 25	Queens	0.06	low	0.50	high

TABLE 6: COMPRESSED NATURAL GAS (CNG) READINESS AND NEED

Highway	Segment	CNG Readiness Score	CNG Readiness Level	CNG Need Score	CNG Need
I-95	New Jersey (north of Exit 10)	0.78	high	0.53	high
I-495	Queens	0.74	high	0.72	high
I-95	Manhattan and Bronx	0.73	high	0.60	high
I-495	Suffolk	0.67	high	0.47	high
I-287	Rockland and Westchester	0.58	high	0.29	medium
I-495	Nassau	0.52	high	0.32	medium
NY 27	Kings and Queens	0.51	high	0.60	high
I-87	Westchester and Bronx	0.51	high	0.49	high
NY 25	Queens	0.50	high	0.50	high
I-678	Total length	0.47	high	0.48	high
I-95	Westchester	0.45	medium	0.27	medium
I-78	Pennsylvania	0.43	medium	0.27	medium
I-278	Total length	0.39	medium	0.98	high
I-91	Connecticut	0.37	medium	0.29	medium
I-84	Connecticut	0.37	medium	0.33	medium
I-78	New Jersey (east of 287)	0.33	medium	0.26	low
I-95	New Haven County	0.31	medium	0.21	low
I-80	New Jersey (east of 287)	0.29	medium	0.34	medium
NY 27	Nassau	0.29	medium	0.38	medium
NY 25	Nassau	0.28	medium	0.39	medium
NY 27	Suffolk	0.27	low	0.59	high
I-287	New Jersey (east of 78)	0.27	low	0.25	low
I-84	Orange	0.26	low	0.16	low
I-95	New Jersey (south of Exit 10)	0.25	low	0.25	low
I-80	New Jersey (west of 287)	0.23	low	0.17	low
I-287	New Jersey (north of 78)	0.21	low	0.20	low
I-95	Fairfield County	0.20	low	0.26	low
NY 25	Suffolk	0.20	low	0.31	medium
I-78	New Jersey (west of 287)	0.19	low	0.12	low
I-87	Orange and Rockland (to 287)	0.19	low	0.23	low
I-84	Putnam and Dutchess	0.10	low	0.13	low

TABLE 7: LIQUIFIED PETROLEUM GAS (LPG) READINESS

Highway	Segment	LPG Readiness Score	LPG Readiness Level	LPG Need Score	LPG Need
I-95	New Jersey (north of Exit 10)	0.81	high	n/a	n/a
I-80	New Jersey (east of 287)	0.55	high	n/a	n/a
I-495	Suffolk	0.54	high	n/a	n/a
I-84	Connecticut	0.54	high	n/a	n/a
I-495	Nassau	0.51	high	n/a	n/a
I-95	Fairfield County	0.50	high	n/a	n/a
I-91	Connecticut	0.50	high	n/a	n/a
I-78	Pennsylvania	0.49	high	n/a	n/a
I-95	New Jersey (south of Exit 10)	0.47	high	n/a	n/a
I-278	Total length	0.39	medium	n/a	n/a
I-78	New Jersey (west of 287)	0.39	medium	n/a	n/a
I-95	New Haven County	0.37	medium	n/a	n/a
I-84	Orange	0.37	medium	n/a	n/a
I-495	Queens	0.35	medium	n/a	n/a
NY 27	Nassau	0.35	medium	n/a	n/a
I-78	New Jersey (east of 287)	0.35	medium	n/a	n/a
I-287	New Jersey (north of 78)	0.31	medium	n/a	n/a
I-95	Manhattan and Bronx	0.29	medium	n/a	n/a
I-80	New Jersey (west of 287)	0.29	medium	n/a	n/a
I-287	New Jersey (east of 78)	0.27	medium	n/a	n/a
NY 25	Nassau	0.26	low	n/a	n/a
I-87	Westchester and Bronx	0.26	low	n/a	n/a
I-87	Orange and Rockland (to 287)	0.25	low	n/a	n/a
NY 27	Suffolk	0.20	low	n/a	n/a
I-678	Total length	0.15	low	n/a	n/a
I-287	Rockland and Westchester	0.14	low	n/a	n/a
I-84	Putnam and Dutchess	0.12	low	n/a	n/a
I-95	Westchester	0.12	low	n/a	n/a
NY 27	Kings and Queens	0.12	low	n/a	n/a
NY 25	Suffolk	0.06	low	n/a	n/a
NY 25	Queens	0.06	low	n/a	n/a

FIGURE 3: HYDROGEN BIVARIATE MAP

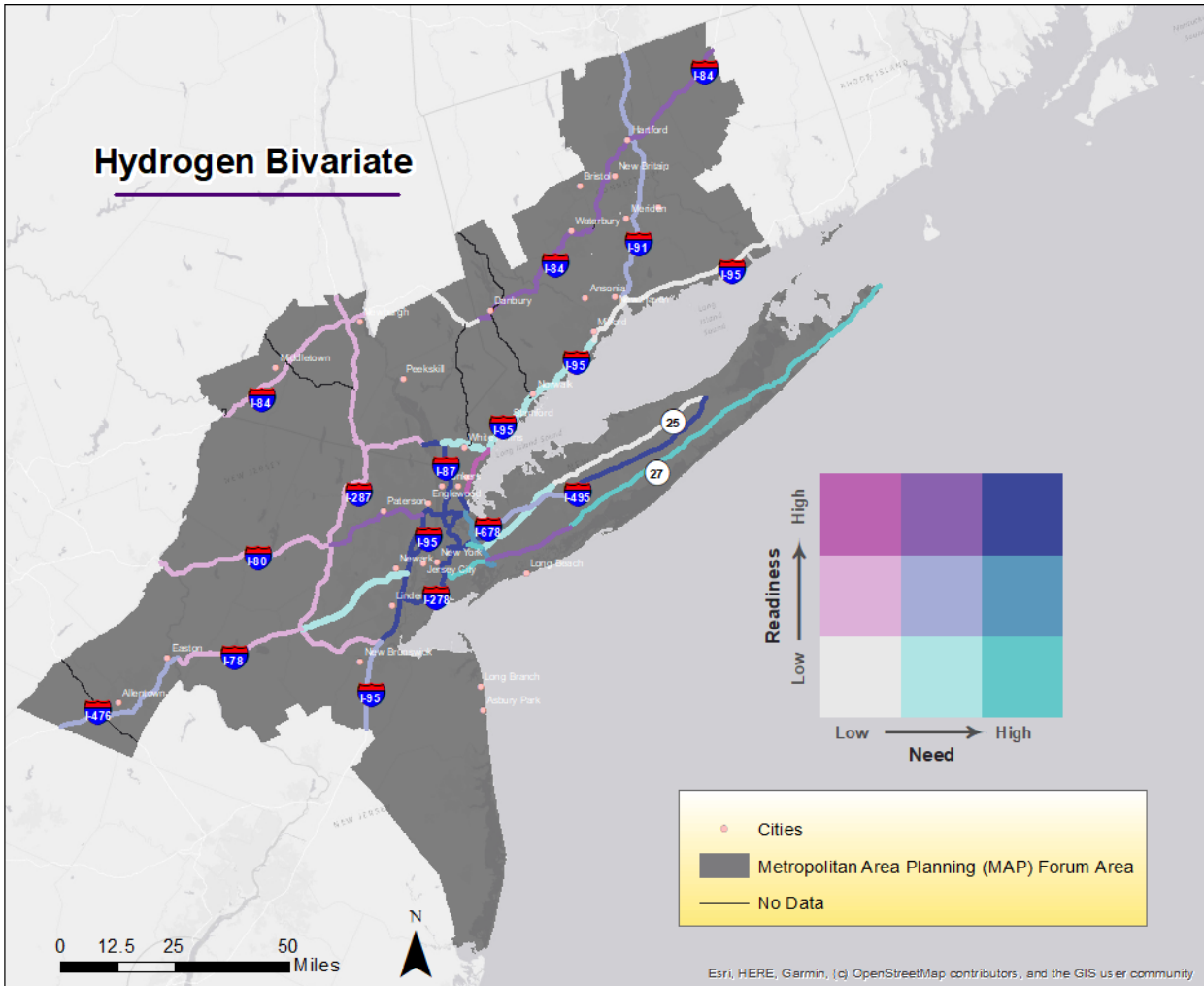


FIGURE 4: COMPRESSED NATURAL GAS (CNG) BIVARIATE MAP

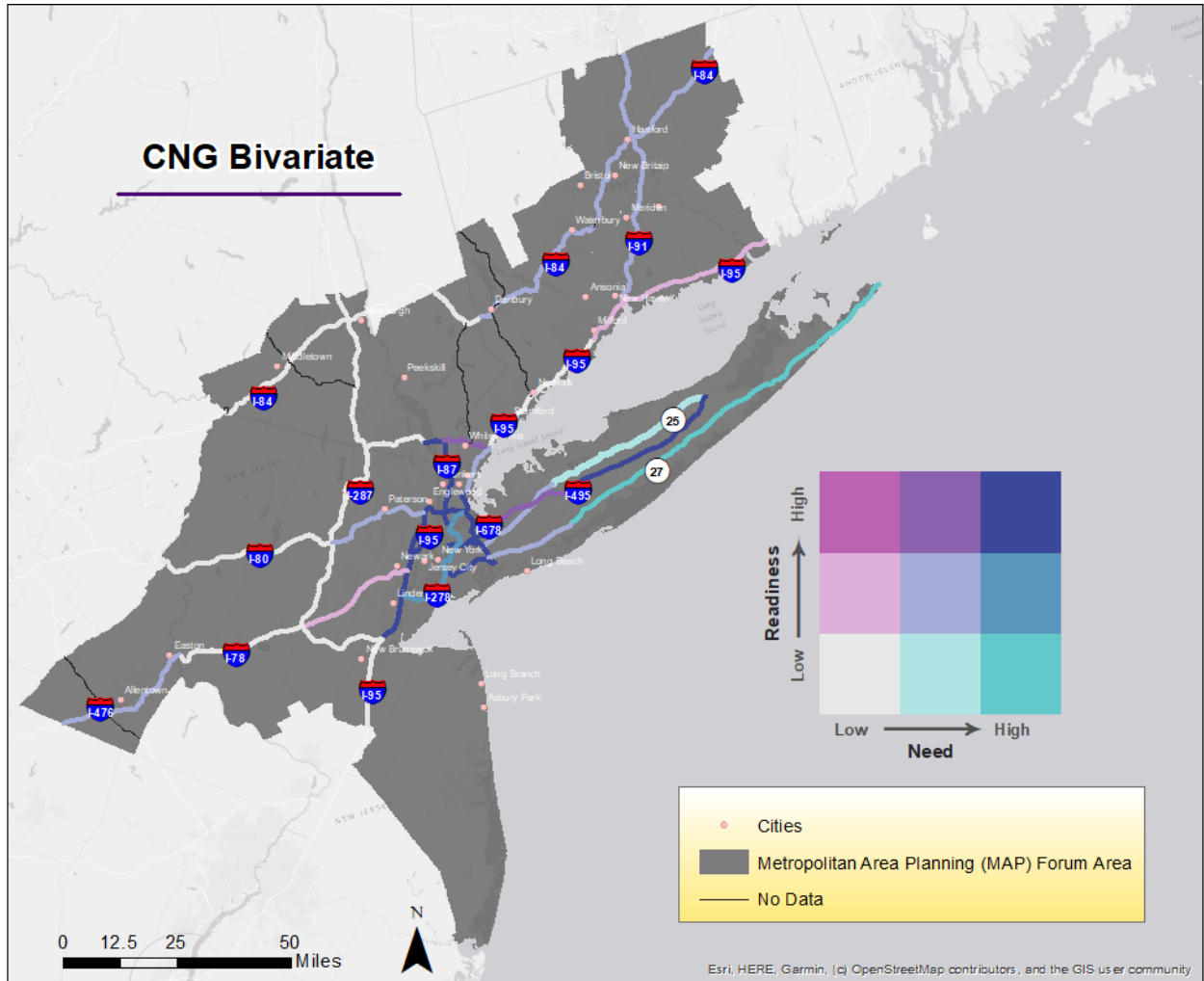


FIGURE 5: LIQUEFIED PETROLEUM GAS (LPG) READINESS MAP

