

THE TPB REGION HIGH-CAPACITY TRANSIT (HCT) NETWORK

Phase I Analysis

Kyle Hearing
Senior Transportation Planner, Foursquare ITP

Walker Freer
Senior Transportation Planner, ICF

Regional Public Transportation Subcommittee
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Agenda

- Project Goals
- Detailed Methodology
 - Accessibility Analysis
 - Station Classification
 - Gap Analyses
- Discussion



Web Application



bit.ly/46KqTOV





The map displays a network of transit routes in the National Capital Region, centered on Washington, D.C. and Arlington, VA. Major stations and areas labeled include Potomac, North Bethesda, Wheaton-Glenmont, Silver Spring, Adelphi, Beltsville, South Laurel, Greenbelt, College Park, Hyattsville, Columbia Heights, Trinidad, Arlington, Washington, Kettering, McLean, Annandale, Lincolnia, Alexandria, Oxon Hill, Hillcrest Heights, Camp Springs, and Prince George's. The routes are shown as dark lines with various symbols indicating different service types or frequencies.

PROJECT GOALS

Understanding HCT Service



Understanding HCT

- Contextualize HCT with analyses of:
 - Service level
 - Accessibility
 - Proximity to Activity Centers and Equity Emphasis Areas
 - Existing and forecast population/employment
 - Gaps in HCT access
- Develop context-dependent, station-level needs



A map of the National Capital Region showing transit routes and station locations. The map is overlaid with a semi-transparent blue grid. Major transit lines are shown as thick black lines with circular station markers. The map covers areas from Potomac in the northwest to Prince George's in the southeast, and from Wheaton-Glenmont in the north to Alexandria in the south. A horizontal orange line is positioned below the main title.

DETAILED METHODOLOGY

Access | Classification | Gaps



Overview



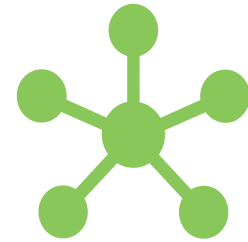
Accessibility Analysis

- Visualizes average travel time to the nearest HCT station
- Highlights gaps in infrastructure and transit



Station Classification

- Defines level of service and people and destinations served by each HCT station
- Informs station-level needs and facilitates development of context-dependent solutions



Gap Analysis

- Explores suitability of connections between equity emphasis areas and activity centers
- Provides framework for POI-based accessibility analysis and ultimately the identification of new/improved connections



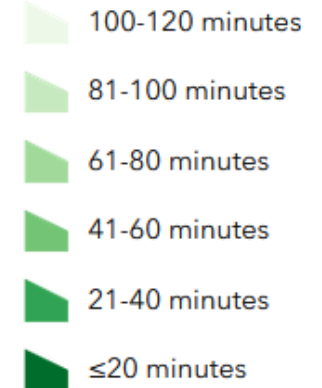
Accessibility Analysis

- Regional network modeling of the median travel time to the closest HCT station
 - Walking, transit
 - Biking, transit

Accessibility Analysis Layer (Foursquare ITP/bit.ly/46KqTOV)

Biking/Transit

Travel Time (Minutes)



Conveyal R5 Routing Engine

- Provides a measure of multimodal travel time
- Utilizes OpenStreetMap (OSM) and GTFS data to model trips every minute over the course of an hour

conveyal / r5 (Public)

Code Issues 193 Pull requests 24 Actions Security Insights

dev 101 branches 54 tags

Go to file Code

About

Developed to power Conveyal's web-based interface for scenario planning and land-use/transport accessibility analysis, R5 is our routing engine for multimodal (transit/bike/walk/car) networks with a particular focus on public transit

[conveyal.com/learn](#)

transit accessibility modeling transportation gtfs planning

Readme MIT license 224 stars 16 watching 61 forks Report repository

Releases 22

February 2023 v6.9 (Latest) on Feb 6



Conveyal R5 Routing Engine

- OSM allows for regional comparisons
- Replicable

```
In [8]: 1 # set gtfs
2 wmata_rail = os.path.join(path_gtfs, "WMATA_rail_gtfs_2023_05_30_rev1.zip")
3 wmata_bus = os.path.join(path_gtfs, "WMATA_bus_gtfs_2023_03_01.zip")
4 rideon = os.path.join(path_gtfs, "RideOn_gtfs_2023_05_04.zip")
5 art = os.path.join(path_gtfs, "ART_gtfs_2023_02_06.zip")
6 cue = os.path.join(path_gtfs, "CUE_gtfs_2023_05_02.zip")
7 dash = os.path.join(path_gtfs, "DASH_gtfs_2023_05_21.zip")
8 circulator = os.path.join(path_gtfs, "DC_Circulator_gtfs_2023_05_09_rev1.zip")
9 ffx_connector = os.path.join(path_gtfs, "ffx_connector_gtfs_2023_04_20.zip")
10 lct = os.path.join(path_gtfs, "LCT_gtfs_2023_04_24.zip")
11 marc = os.path.join(path_gtfs, "MARC_gtfs_2023_04_06.zip")
12 mta = os.path.join(path_gtfs, "MTA_commuter_gtfs_2023_04_15.zip")
13 omniride = os.path.join(path_gtfs, "OmniRide_gtfs_2023_02_15.zip")
14 thebus = os.path.join(path_gtfs, "thebus_PGC_gtfs_2023_05_10.zip")
15 transit_fred = os.path.join(path_gtfs, "transit_frederick_gtfs_2023_03_31.zip")
16 vango = os.path.join(path_gtfs, "vango_gtfs_2019_11_22_rev1.zip")
17 vre = os.path.join(path_gtfs, "VRE_gtfs_2023_05_30.zip")
18 streetcar = os.path.join(path_gtfs, "DC_Streetcar_gtfs_2023_04_28.zip")
19
20 # OSM
21 OSM = r"C:\Users\KyleHearing\Foursquare\ITP\Projects - MMCOG HCT Analysis\Data\Geospatial-Processed\OSM\mid-atlantic-highways.osm.pbf"
```

```
In [9]: 1 # create a network
2 from r5py import TransportNetwork
3
4 network = TransportNetwork(OSM, [wmata_bus, wmata_rail, rideon, art, cue, dash, streetcar, circulator, ffx_connector, lct, marc, mta, omniride, thebus, transit_fred, vango, vre])
```

```
In [13]: 1 # configure network
2 import datetime
3 from r5py import TravelTimeMatrixComputer, TransitMode, LegMode
4
5 travel_time_matrix_computer = TravelTimeMatrixComputer(
6     network,
7     origins=origin,
8     destinations=points,
9     departure=datetime.datetime(2023, 5, 26, 8, 0),
10    transport_modes=[TransitMode.TRANSIT, LegMode.BICYCLE],
11    percentiles=[25, 50, 75]
12 )
```

```
In [14]: 1 # compute travel times
2 travel_time_matrix = travel_time_matrix_computer.compute_travel_times()
3 travel_time_matrix.head()
```

```
Out[14]:
```

	from_id	to_id	travel_time_p25	travel_time_p50	travel_time_p75
0	1	8007	NaN	NaN	NaN
1	1	10016	NaN	NaN	NaN
2	1	10017	NaN	NaN	NaN
3	1	10019	112.0	NaN	NaN
4	1	10020	NaN	NaN	NaN

```
In [15]: 1 # drop na rows
2 ttm_clean = travel_time_matrix.dropna()
```

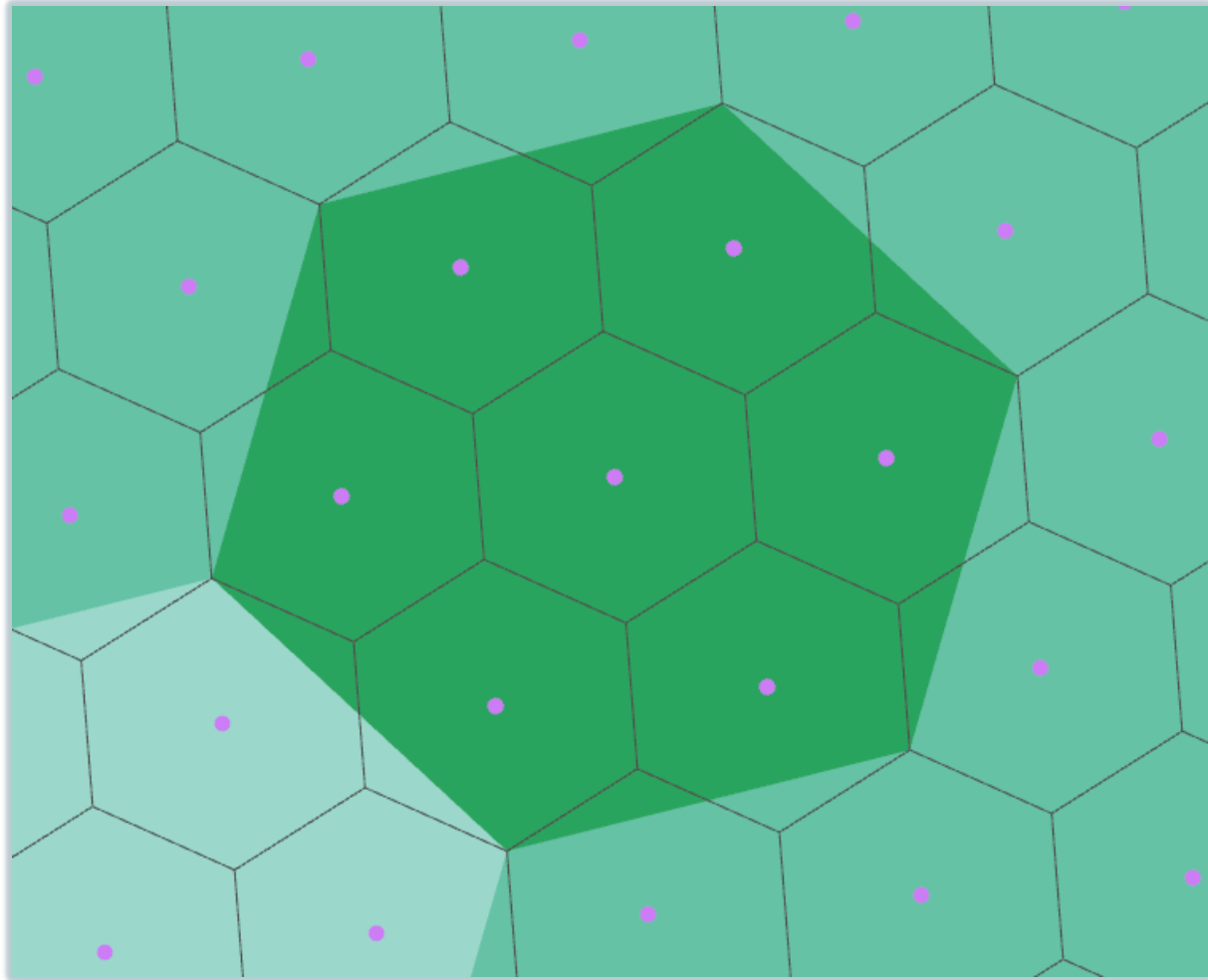
```
In [16]: 1 # extract travel time for closest HCT station
2 pivot = ttm_clean.pivot_table(
3     values=['travel_time_p50', 'travel_time_p25', 'travel_time_p75', 'to_id'],
4     index=['from_id'],
5     aggfunc={'travel_time_p50': min}
6 )
```

```
In [17]: 1 # export table
2 pivot.to_csv(output)
```



Geographical Framework

- Uniform
- Hierarchical



Station Classification

Level of Service

- High-capacity service informs analyses of how well the region's residents and destinations are served by HCT
- Local transit service informs analyses of how well local transit complements HCT

People and Destinations Served

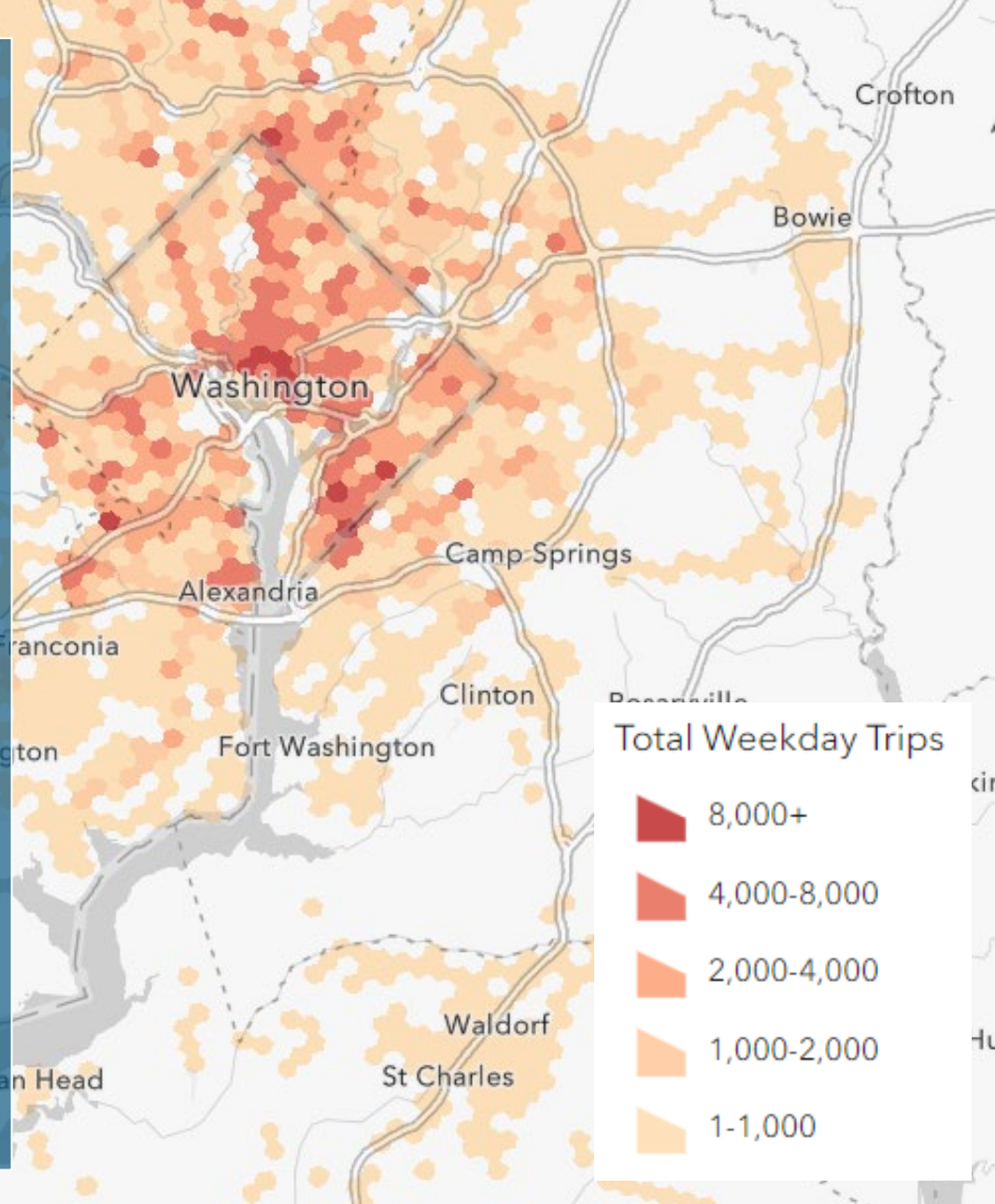
- Transit potential combines the population and employment densities to indicate the viability of transit service; classification incorporates both existing and future transit potential
- The relationship between HCT and Activity Centers provides a means of ensuring planning prioritizes existing towns and urban centers, as well as priority growth areas throughout the region
- Leveraging the EEA index scores of census tracts surrounding HCT provides yet another means of classifying stations to identify gaps in access



Level of Service

- Retrieved GTFS for each agency in COG region
 - Processed and rectified errors
 - Aligned calendars
- Produced hex layer of total trips by stop
 - Summed total daily trips by stop
 - Joined stops to hex grid
 - Disaggregated trips by stop by service type

Level of Service Analysis Layer (Foursquare ITP/bit.ly/46KqTOV)



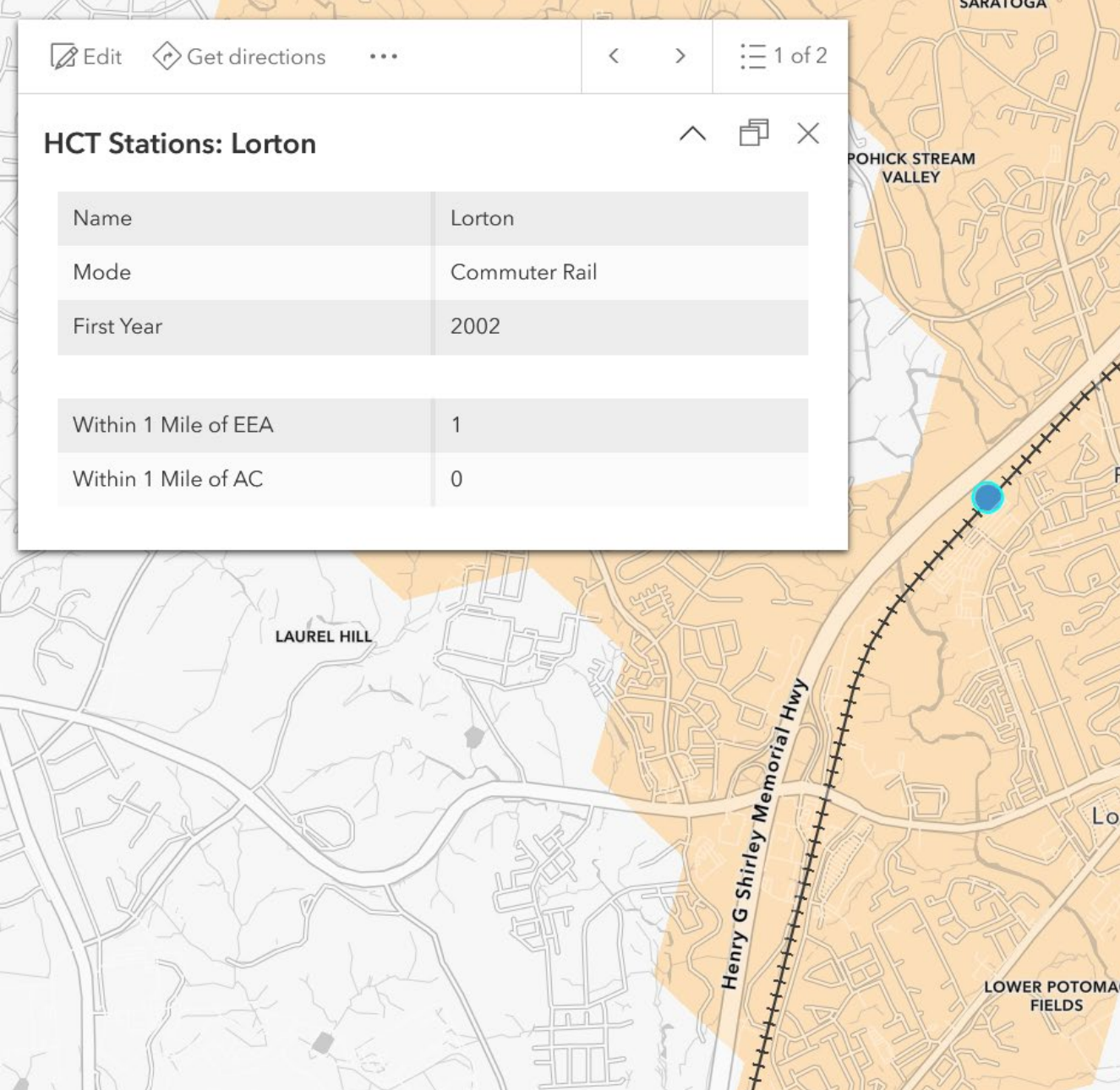
Edit Get directions ...

< > 1 of 2

HCT Stations: Lorton

^ [] X

Name	Lorton
Mode	Commuter Rail
First Year	2002
Within 1 Mile of EEA	1
Within 1 Mile of AC	0



People and Destinations

- Classified stations based on proximity to Equity Emphasis Areas and Activity Centers
- Interpolated population and jobs to station areas using MWCOG 9.2 Forecast

Station Classification Layer
(Foursquare ITP/bit.ly/46KqTOV)



Gap Analyses

- Examine relationship between travel time and:
 - Equity Emphasis Areas
 - Activity Centers
 - Points of Interest



Gap Analyses

Equity Emphasis Areas

- Mean travel time between Equity Emphasis Areas and HCT
- Bivariate analysis of equity index and mean travel time
 - Identifies areas where new or improved connections will result in the largest impact

Activity Centers

- Mean travel time between Activity Centers and HCT
- Evaluates the adequacy of HCT service to critical regional hubs

Points of Interest

- Travel time to HCT from regional points of interest within five miles of HCT stations
- Analyzes the effectiveness of connections between HCT stations and nearby points of interest



Equity Emphasis Area Gap Analysis

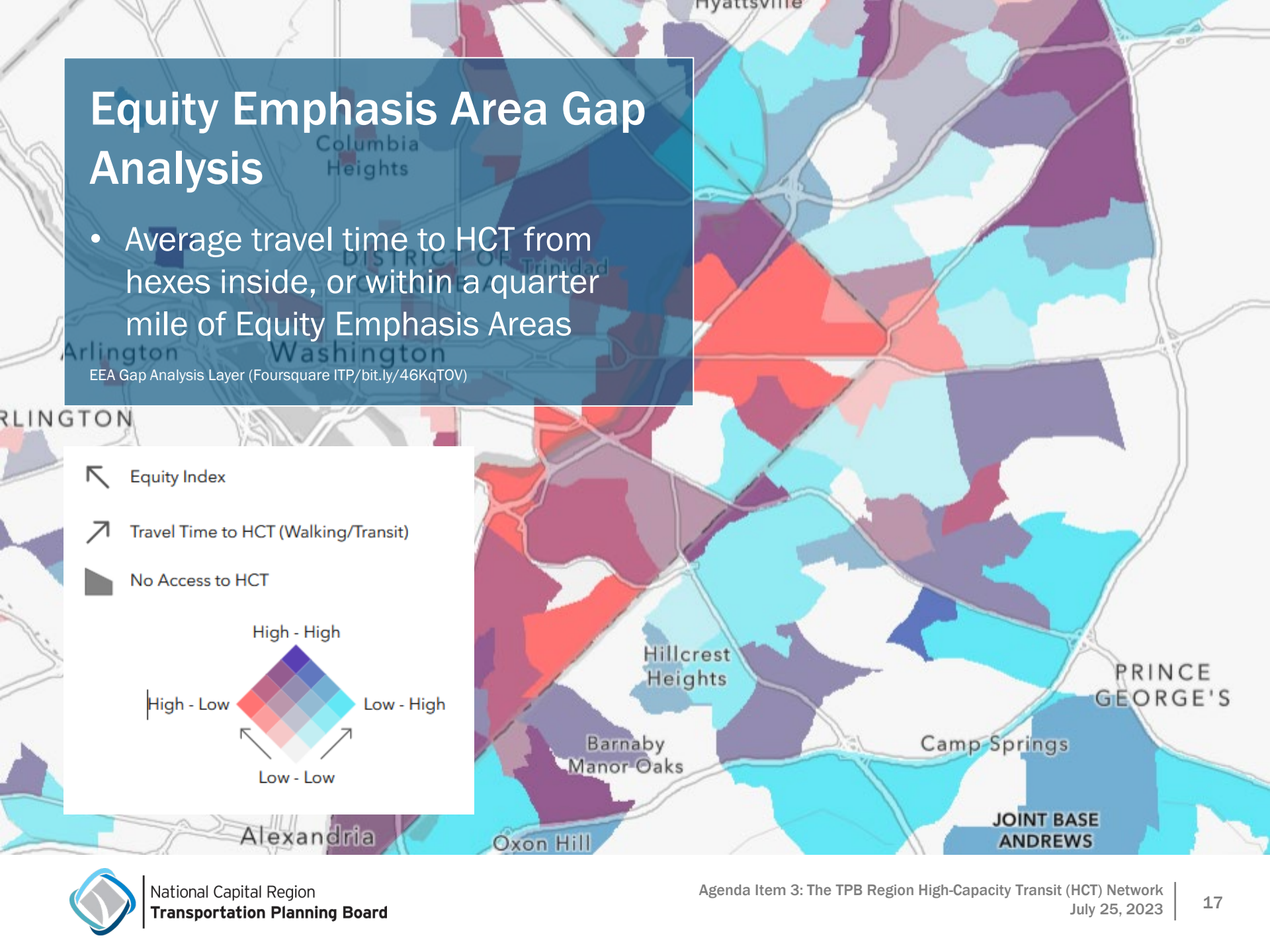
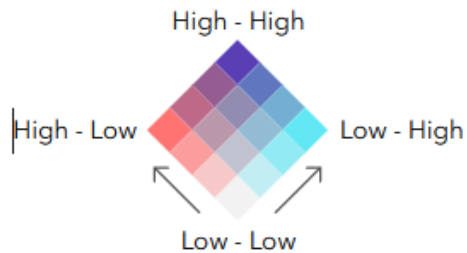
- Average travel time to HCT from hexes inside, or within a quarter mile of Equity Emphasis Areas

EAA Gap Analysis Layer (Foursquare ITP/bit.ly/46KqTOV)

↖ Equity Index

↗ Travel Time to HCT (Walking/Transit)

■ No Access to HCT

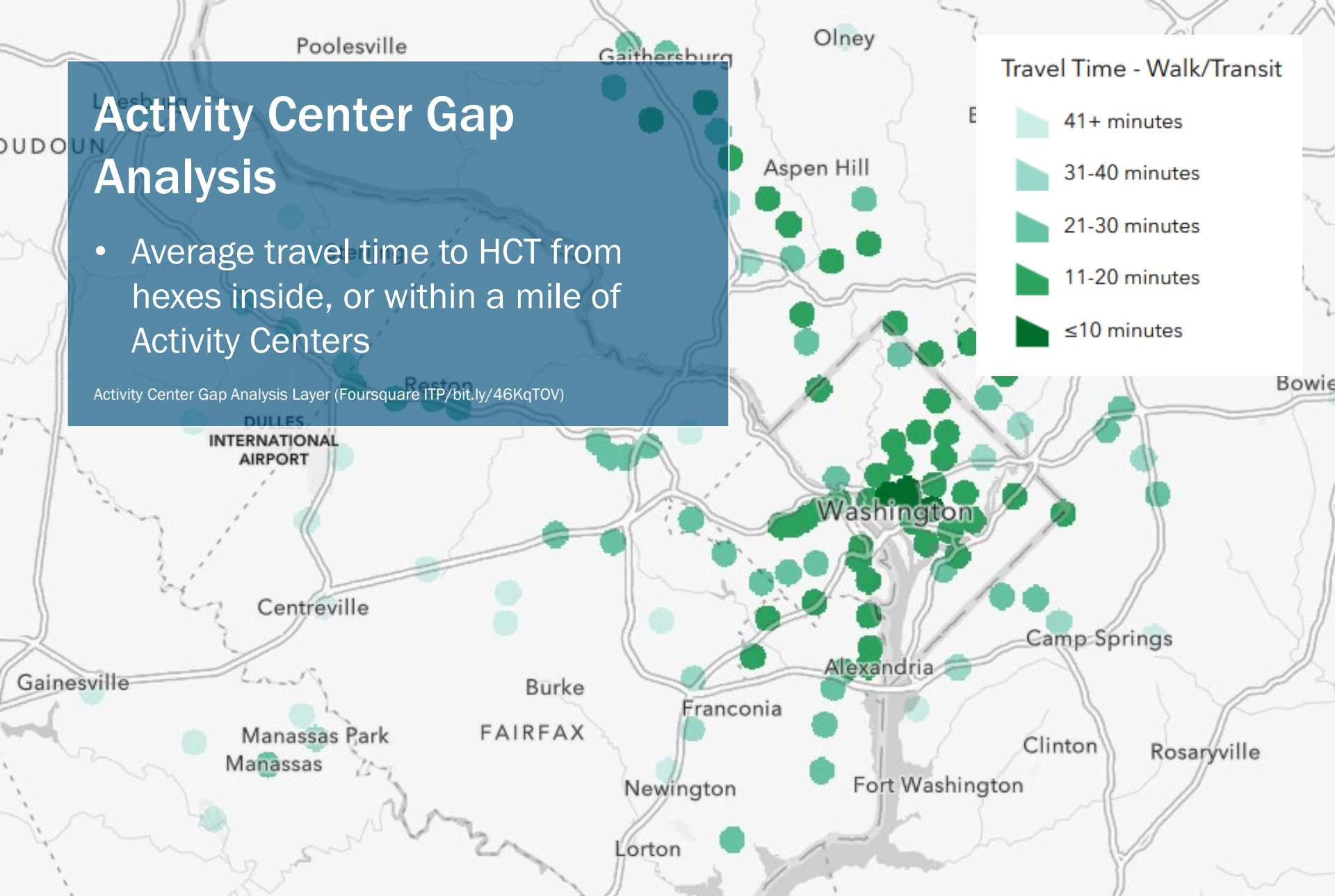
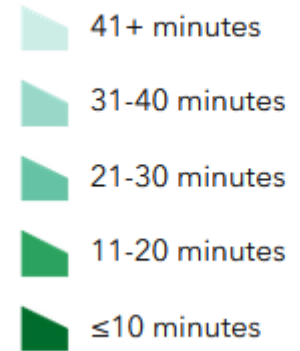


Activity Center Gap Analysis

- Average travel time to HCT from hexes inside, or within a mile of Activity Centers

Activity Center Gap Analysis Layer (Foursquare ITP/bit.ly/46KqTOV)

Travel Time - Walk/Transit



Points of Interest Gap Analysis

- Using the Google Places API, identified POI throughout the TPB region within five miles of HCT
- Calculated travel time to the closest HCT station using R5

POI Gap Analysis Layer
(Foursquare ITP/bit.ly/46KqTOV)

El Progreso Market

Place Types	grocery_or_supermarket, supermarket, food, point_of_interest, store, establishment
Minimum Walking/Transit Time	11
Minimum Walking/Transit Time Category	0-20 minutes

Zoom to





The map displays the National Capital Region's transit network. Major stations are marked with black dots, and lines represent transit routes. The map includes labels for various areas: Potomac, North Bethesda, Wheaton-Glenmont, Silver Spring, Adelphi, Beltsville, South Laurel, Greenbelt, College Park, Bethesda, Hyattsville, Columbia Heights, Trinidad, Arlington, Washington, Kettering, McLean, Annandale, Lincolnia, Alexandria, Oxon Hill, Hillcrest Heights, Camp Springs, and Prince George's. A thick horizontal line is drawn across the map, passing through the center of the Washington and Arlington area.

DISCUSSION

Future Directions



Next Steps

- Overview
 - Solicit feedback
 - Refine analyses
 - Identify and prioritize station-level needs
- Schedule
 - HCT station classification by need | Jul. – Oct. 2023
 - Finalize products and develop report | Oct. 2023 – Jan. 2024



Next Steps

- Network-based HCT station accessibility
 - Population
 - Employment opportunities
 - Points of interest
- Synthesize results of station classification and gap analyses to propose contextualized recommendations based on:
 - Local transit need
 - Active transportation need
 - Existing/forecast travel demand
 - Station typology



Feedback

- Questions about:
 - Methodology?
 - Results?
 - Next steps?
- Does what we've presented prompt:
 - Analysis recommendations?
 - Useful application data/functionality?
 - Any other ideas?



bit.ly/46KqTOV



Kyle Hearing

Project Manager & Senior Transportation Planner

(301) 637-0284

khearing@foursquareitp.com

Foursquare ITP

Metropolitan Washington Council of Governments

777 North Capitol Street NE, Suite 300

Washington, DC 20002



National Capital Region
Transportation Planning Board