Toward A Sustainable Transportation Network in the Northeast Corridor

Paul Haven, EESI Transportation & Energy Policy Fellow
Maryland Planning Association 4/28/2016

EESI
Environmental and Energy Study Institute

Overview

EESI
Environmental and Energy Study Institute

- Transportation network
- Sustainable transportation
- Rail
- High-speed passenger rail
- Northeast Corridor
- NEC FUTURE
- Q & A

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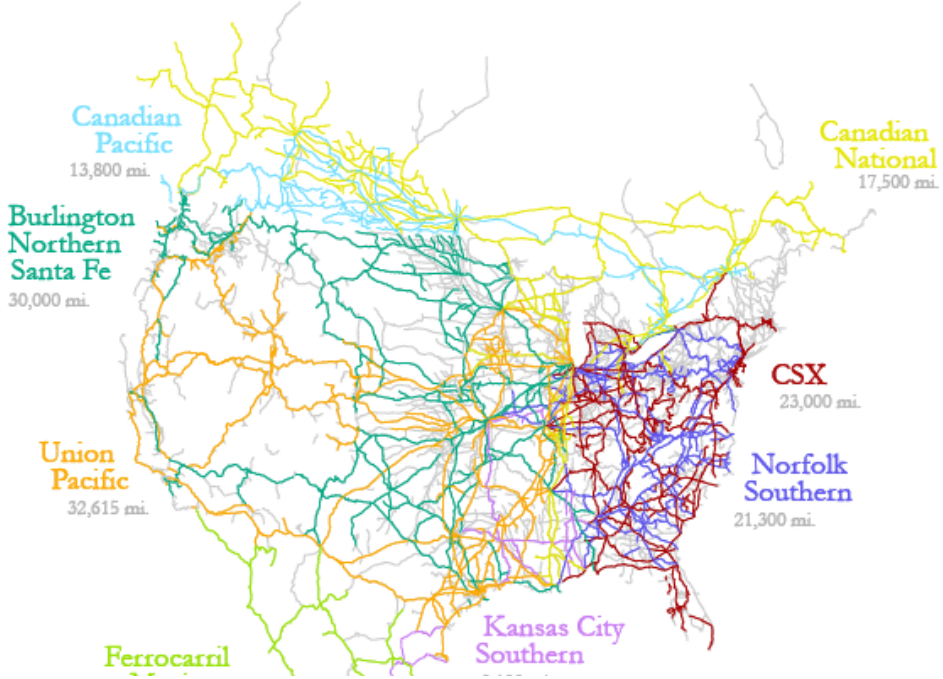
EESI
Environmental and Energy Study Institute

- Bipartisan Congressional caucus founded an independent non-profit in ‘84 ($0)
- Non-partisan information for policymakers
- Focused on win-win solutions to climate change in the energy, buildings, sustainable biomass, and transportation sectors
- Climate change: one of the most serious problems facing civilization today — impacts infrastructure, water, food, health, ecosystems, …

EESI
Environmental and
Energy Study Institute

- **EESI Approach:**
  - Non-partisan
  - Holistic & Interconnected
  - Solutions Oriented, Problem-Solving
  - Coalition & Consensus Building, Education
- **Benefits:**
  - Environment, Health, Economy, Development, Justice
- **Policy is Crucial**


Canadian Pacific
13,800 mi.
Burlington Northern Santa Fe
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Canadian National
17,500 mi.
CSX
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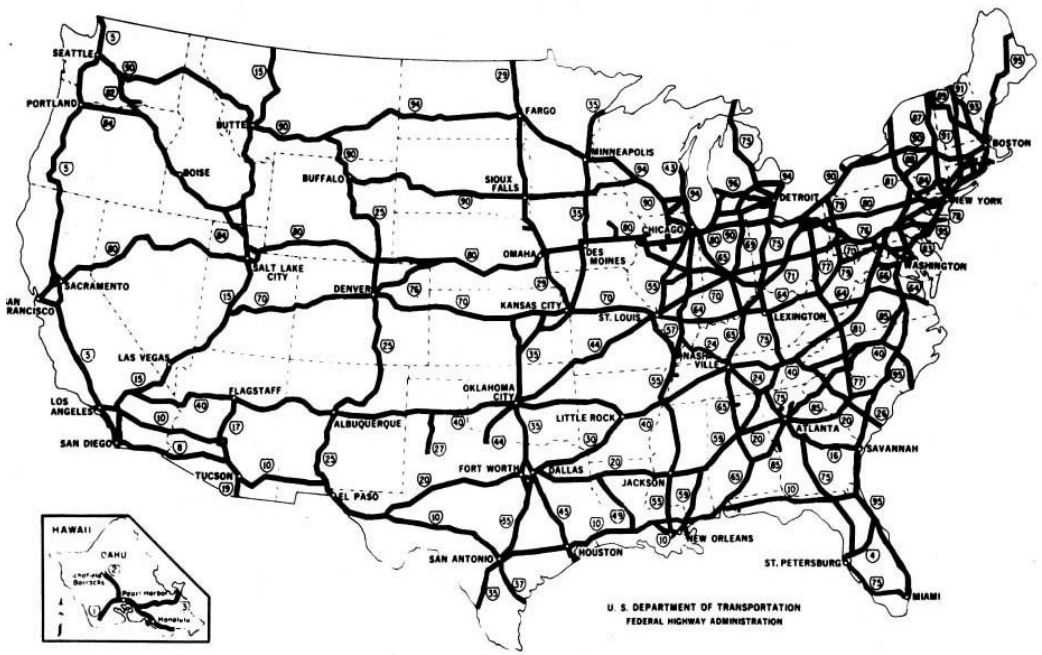
Union Pacific
32,615 mi.
Norfolk Southern
21,300 mi.
Kansas City Southern
Ferrocarril


Kalama
Vancouver
Portland
Pasco
Umatilla
Lewiston
Clarkston
Sacramento
Oakland
St. Paul
La Crosse
Milwaukee
Chicago
Albany
Dubuque
Quad Cities
Indiana Hbr
Pittsburgh
New York / New Jersey
Omaha
Kansas City
Cincinnati
Mt. Vernon
Parkersburg
Huntington
Louisville
St. Louis
Paducah
Nashville
Norfolk
Tulsa
Memphis
Knoxville
Wilmington
Little Rock
Decatur
Chattanooga
Vicksburg
Birmingham
Charleston
Shreveport
Baton Rouge
Savannah
Lake Charles
Pascagoula
Jacksonville
Houston
Panama City
Texas City
Freeport
Mobile
Gulfport
Tampa
Matagorda
Port Arthur
Beaumont
Plaquemines
New Orleans
Corpus Christi
S. Louisiana
Port Everglads


Long Distance Service
Corridor Service
Northeast Corridor Service
Suspended Service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LEXINGTON
LAS VEGAS
NASHVILLE
FLAGSTAFF
OKLAHOMA CITY
LOS ANGELES
ALBUQUERQUE
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SAN DIEGO
SAVANNAH
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DALLAS
TUCSON
JACKSON
EL PASO
HAWAII
OAHU
NEW ORLEANS
SAN ANTONIO
HOUSTON
ST. PETERSBURG
MIAMI
U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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Transportation Network

- Maps: Freight rail, intercity passenger rail, interstate highway system, inland waterways
- Airports: 540 Commercial Service & 2,764 General Aviation
- Inland Waterways: 12,000 miles of commercially navigable, 240 locks in 38 states; moved 604 million tons of cargo worth $232B, 14% of intercity freight, 60% of grain exports
- Walking, bicycling, airplane, bus, rail transit, commuter rail
- American Society of Civil Engineers 2013 Report Card – U.S. infrastructure D+ (B=state of good repair)
- Intermodal connections?

- *"The return on investment in transportation … is not just measured in how many people physically use it. It's also measured in improvements to the economy, decreases in people's commuting time, creation of new jobs and reduction in greenhouse gases." Stephanie Pollack, MA Secy Transp, Governing, April 2016*

Federal role:

- Article 1 gives Congress power "to regulate commerce with foreign nations, and among the several states, and with the Indian tribes."
- 4 of 5 transcontinental railroads received Federal land grants to enable construction 1860-1900
- 90% Federal funding to construct 41,000 mile "National System of Interstate and Defense Highways"
- Inland waterways maintained by Army Corps
- National airport system federally assisted

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Sustainable transportation system

- allows the basic needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, with equity within and between generations
- is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy
- limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, reuses and recycles its components, and minimizes the use of land and production of noise

Centre for Sustainable Transportation (1998) via TRB 2004 Black http://onlinepubs.trb.org/onlinepubs/archive/conferences/sustainability/Black.pdf

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Achieving sustainable transportation

- Transporting people & goods – 27% of US GHG emissions, 70% of US oil use (13.5 million barrels per day)
- Optimizing the accessibility and operational efficiency of the nation's transportation network can enable a 60 to 90 percent reduction in GHG emissions by 2050, and at the same time increase the nation's economic competitiveness, enhance its citizens' living standards, and provide energy security. This can be accomplished by:
  1. improving communities so that walking, bicycling and public transportation are feasible, attractive options;
  2. using fuels and technologies that increase modal energy efficiency and reduce carbon intensity, such as vehicles powered by alternative fuels and electricity.
  3. building a highly connected multimodal (water, rail, air, road, pipeline) network enabling the most efficient mode(s) to be used for each trip and;

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Progress toward a sustainable transportation network

- Improving Communities
  - Smart Growth
  - Complete Streets
  - Transit-oriented design
  - Baby-boomers, Millennials want or need to reduce auto-dependence

- Modal Energy Efficiency
  - Car, truck, transit bus, school bus, airplanes, locomotives, ships
  - CAFE
  - EV – hybrid, plug-in, fuel cell
    - Lower emissions even with current power mix in any state (UCS)
    - Transition power grid and hydrogen production to renewable energy
  - Biofuels, especially drop-in – fleet turn over is a long process
  - Alternate fuels

- Most efficient mode per trip
  - Mode characteristics: speed, accuracy, capacity, land use, energy use, weather impacts, safety
  - US since 1950s high public investment in road network expansion while rail network shrank and deteriorated
  - A modern intercity rail network would reduce pressure to expand capacity of air and road network
  - Improve mobility for larger portion of the population
  - Eliminating capacity constraints will constrain prices

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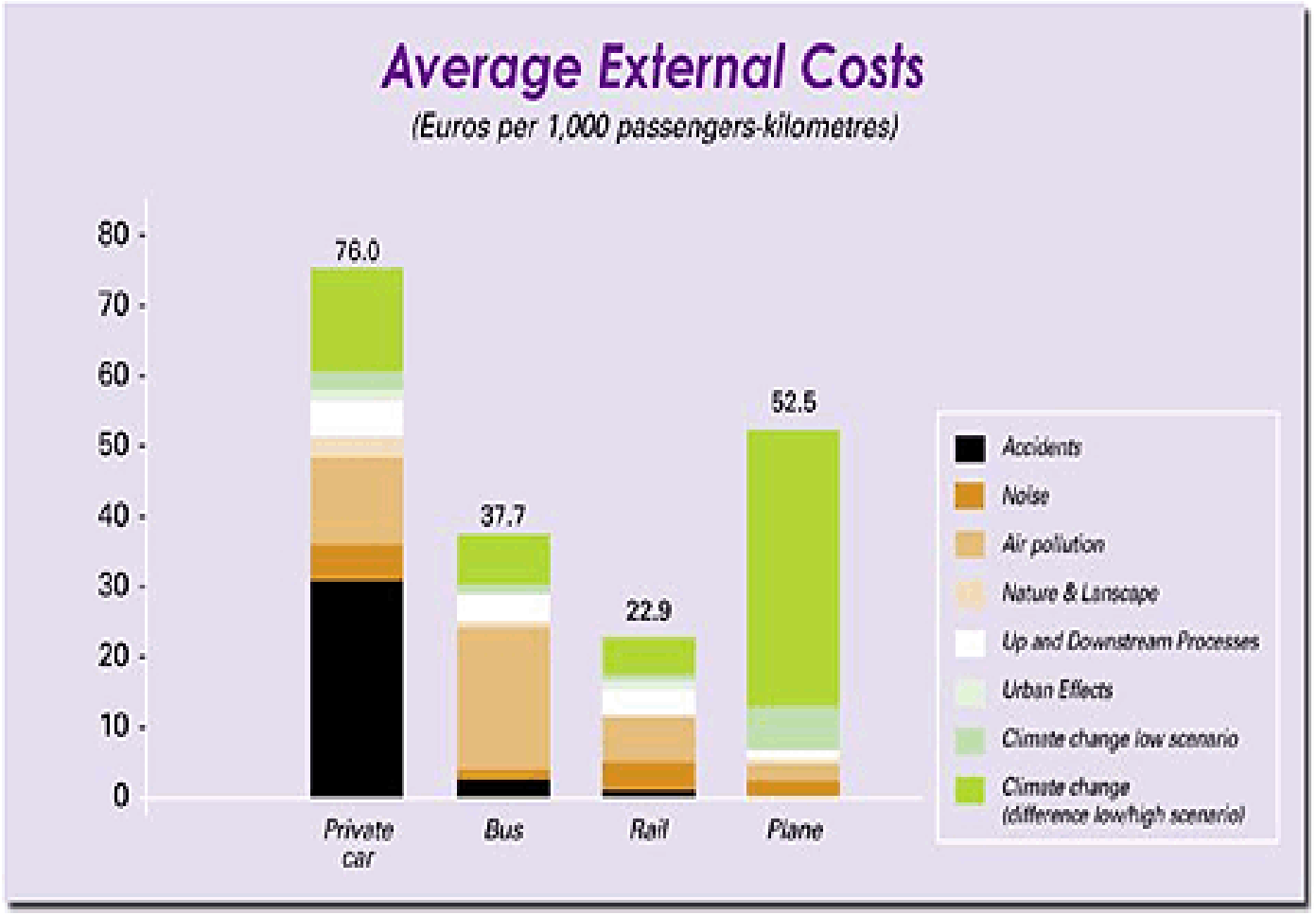
Rail's role in a sustainable transportation network

Table 7.14-5 : Energy Intensities by Mode (2012)	
Mode	**Energy Intensities (Btu per passenger-mile)**
Transit Buses	4,030
Personal Trucks	3,561
Cars	3,193
Commuter Rail	2,838
Aircraft	2,484
Motorcycles	2,475
Transit Rail	2,398
Intercity Rail	2,214

Source: U.S. Energy Information Administration, 2014



External costs lowest with rail. (Chart source: www.uic.org)

http://www.ushsr.com/ushsr.html

- energy cost
- climate change
- quality of life
- health
- mobility

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High-Speed Rail: US and the World

https://upload.wikimedia.org/wikipedia/commons/9/9a/Shinkansen_N700_with_Mount_Fuji.jpg

- World's 1st High Speed Rail = Shinkansen (1964)
- Speed upgraded from 125 to 180 mph in 1997
- 7513 km network (4500+ miles)
- 420,000 daily riders on Tokyo:Osaka route
- 0 of 27 operating passenger trains derailed, no passengers killed during March 2011 8.9 earthquake
- 2027 maglev plans Tokyo:Nagoya
- 3 car maglev trainset speed 581 km/h ~350 mph

http://www.nippon.com/en/files/h00077en_map21.png

http://www.eurail.com/sites/eurail.com/files/styles/asset_image_images_slider_big/public/tgv_high-spped_train_france.jpg?itok=jn0mfDzH

TGV: Sep 1981 passengers
100 m/s=360 km/h=236 m/h
normal over 200 mph, max 357

http://www.eurail.com/sites/eurail.com/files/styles/asset_image_train_full_route_map/public/assets/images/2014/08/map_with_tgv_high-speed_train_routes.jpg?itok=rAuuHeRg

http://www.eurail.com/sites/eurail.com/files/styles/asset_image_images_slider_big/public/ave_high-speed_train_in_saragossa_spain.jpg?itok=kTb3pA2N

AVE

3100 km

310 km/hr, 180+ mph

http://www.eurail.com/sites/eurail.com/files/styles/asset_image_train_full_route_map/public/assets/images/2014/07/ave.jpg?itok=WJl_Hwn7

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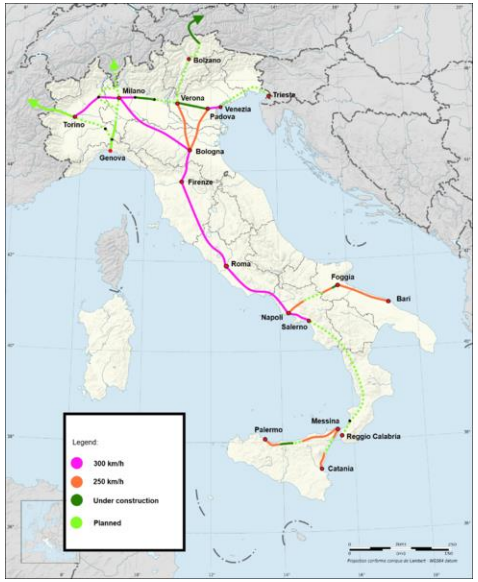
http://www.eurail.com/sites/eurail.com/files/styles/asset_image_images_slider_big/public/ice_high-speed_train_at_platform_hamburg_germany.jpg?itok=kKsI5jLj

ICE – introduced 1991
180 mph +

http://www.eurail.com/sites/eurail.com/files/styles/asset_image_train_full_route_map/public/assets/images/2014/07/ice.jpg?itok=5Dj-3tY6

AGV Italo April 2012 (Alstom)

- Max operation 360 km/h, 216 mph
- complies with the European TSI interoperability standard, which includes safety, reliability and availability, health, environmental protection and technical compatibility



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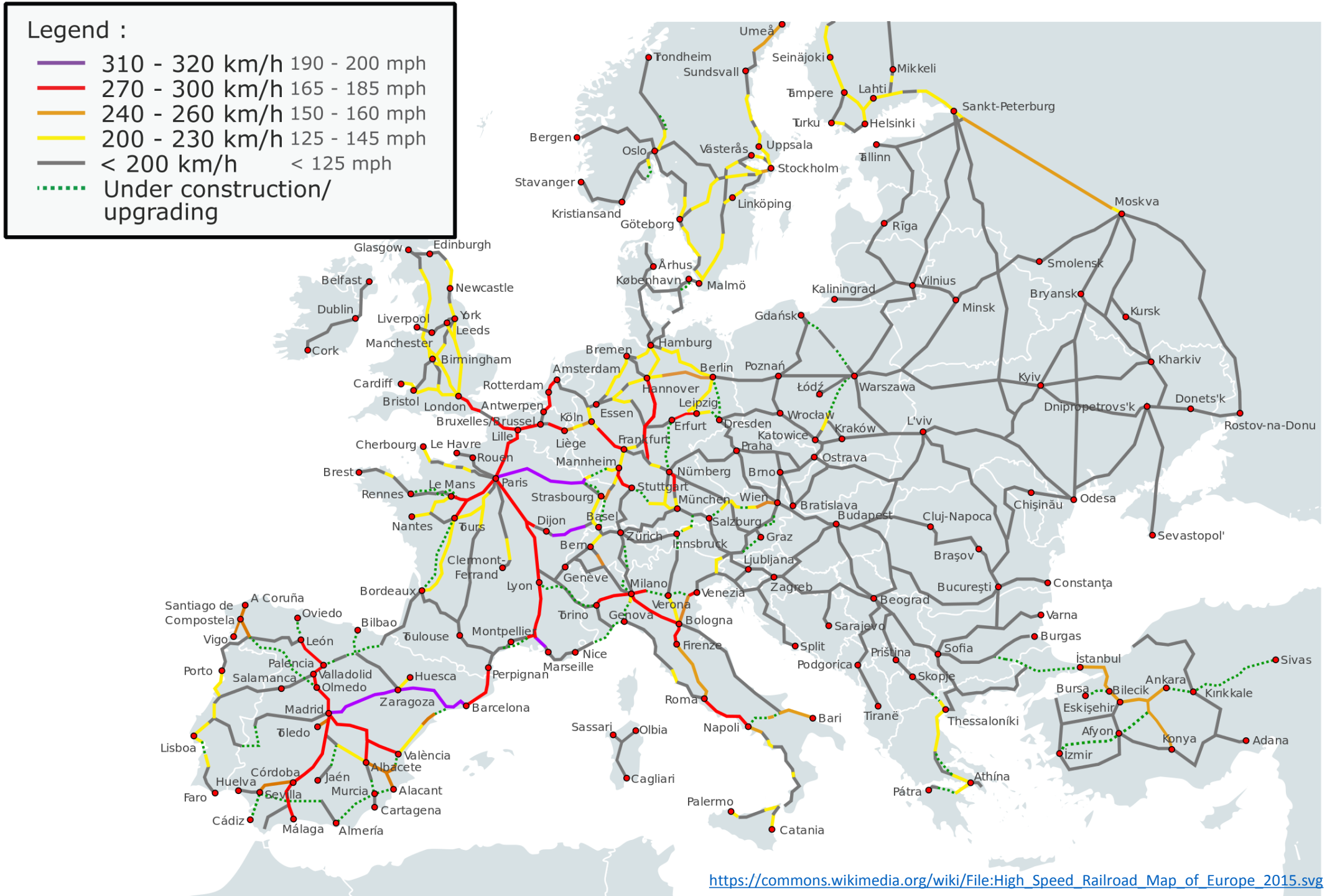

https://commons.wikimedia.org/wiki/File:High_Speed_Railroad_Map_of_Europe_2015.svg

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Railway map of China

Colored lines showing CRH and other high speed rail services

Last update: 2016-01-06

180 mph, increasing to 217 in 2016

11,800 mile network

target 31,000 miles 2020

https://upload.wikimedia.org/wikipedia/commons/thumb/f/fc/Rail_map_of_China.svg/1000px-Rail_map_of_China.svg.png

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Shanghai Maglev

https://commons.wikimedia.org/wiki/File:A_maglev_train_coming_out,_Pudong_International_Airport,_Shanghai.jpg

- Opened April 2004
- Length: 30.5 km
- Speed: maximum 430km/h, average 251 kmph.
- Runs between:
  - Metro's Longyang Road Station
  - Shanghai Pudong International Airport
- Shanghai Maglev Transportation Development Co. (SMTDC)
- Train Mfr: Siemens and ThyssenKrupp

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https://upload.wikimedia.org/wikipedia/commons/0/00/Taiwan-HighSpeedRail-700T-testrun-2006-0624.jpg

- Taiwan High-Speed Rail began operation 2007
- 1990 gov study found HSR highest volume, lowest landuse, highest energy savings, least pollution solution to corridor congestion
- Privately funded: 35 yr construct/operate, 50 yr 5 station dev't
- Shinkansen technology, Kawasaki trainsets
- 211 miles, 96 minutes, 186 mph max
- 128 – 154 (Sunday) 1-way train trips per day (2013)
- 129,000 / day June 2013

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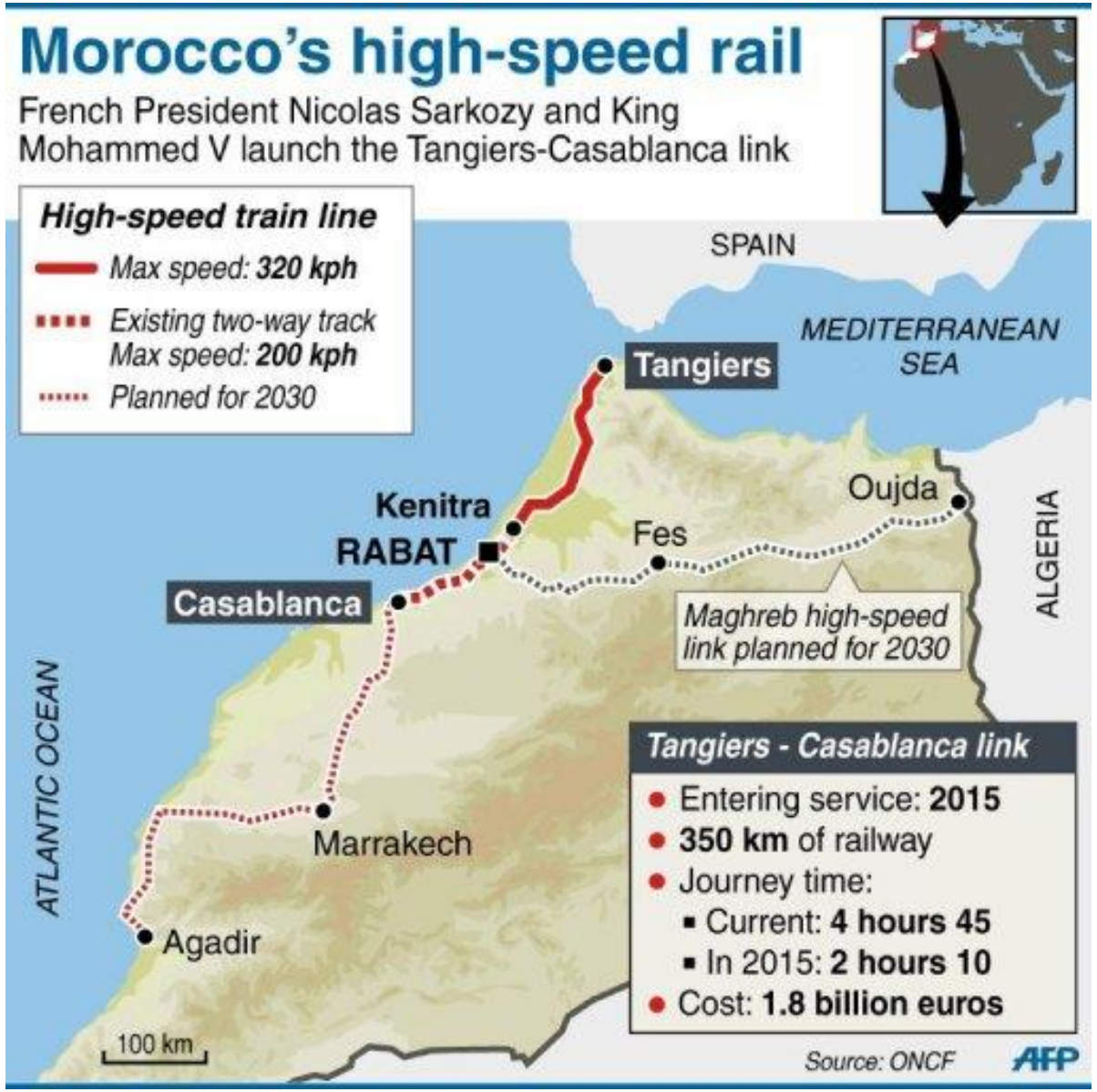
https://www.flickr.com/photos/magharebia/6220398054/in/photostream/

- French TGV technology, Alstom mfr
- maximum operating speed 320 km/h
- tests started January 18, 2016
- Tangier:Kenitra – 2017 target to begin operation
- Tangier to Casablanca in 2 hours instead of five hours on current train



http://en.starafrica.com/news/sarkozy-king-launch-work-on-moroccan-high-speed-rail-192944.html

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http://www.ushsr.com/hsr/hsrworldwide.html

- Saudi Arabia
- 1st 200 mile section to open Jan 2017
- Spanish technology
- 180 mph operating speed

HSR also in operation in Korea
HSR also under development in:

- Qatar
- Russia
- Poland
- South Africa
- India
- Argentina
- Mexico
- Brazil

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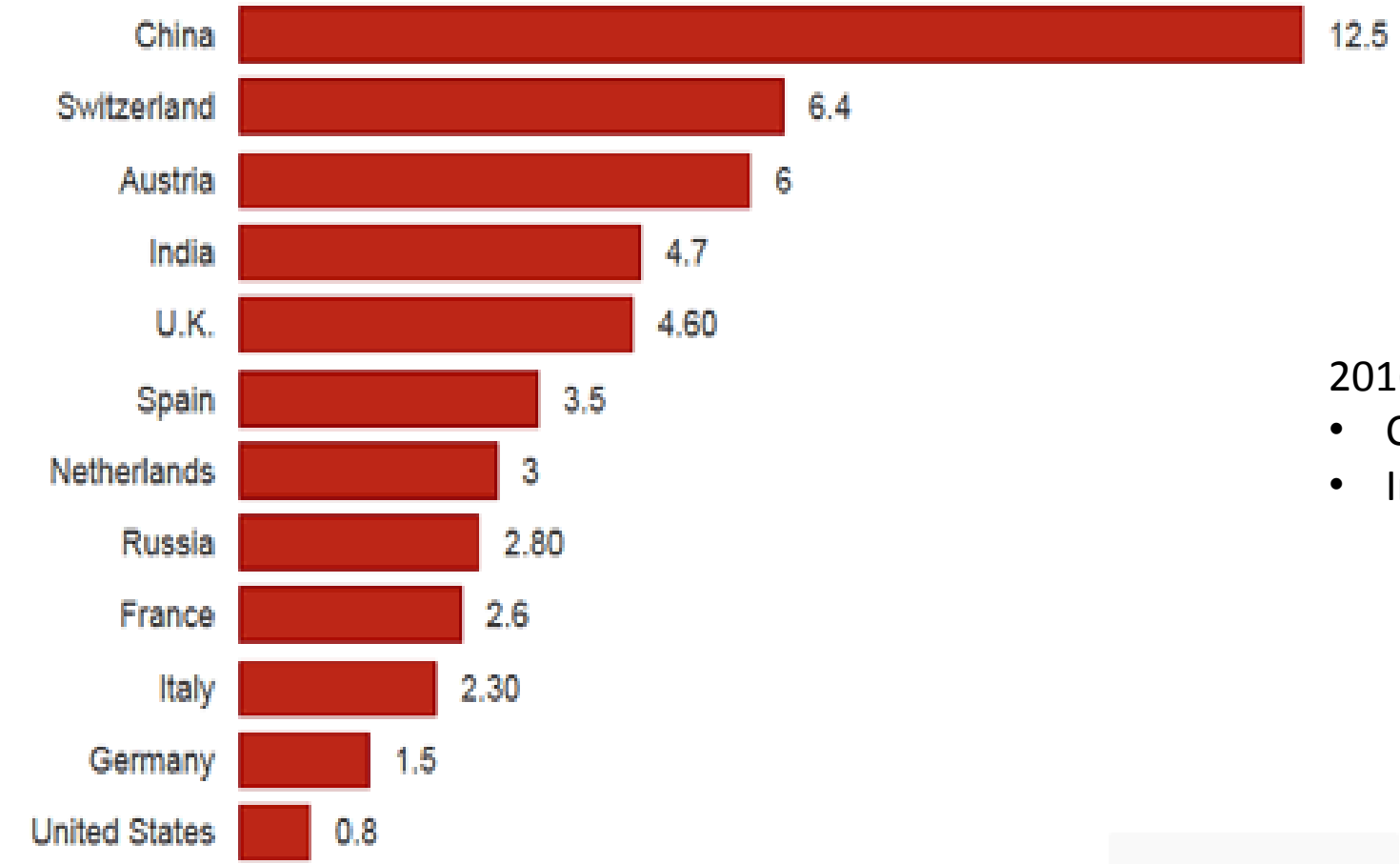
National Investment In Rail Infrastructure

Dollars per $1,000 of GDP (2008)



Source: SCI Verkehr/Worldwatch Institute Get the data

http://www.ushsr.com/ushsr.html

2016 Senate Appropriations

- Cut FAST authorization 27% for NEC
- Increased FAST authorization 5% for national

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Federal Railroad Administration's High-Speed Intercity Passenger Rail Program (HSIPR)

Apr 2009 – FRA's High-Speed Rail Strategic Plan

- 80% of population access to HSR within 25 years
- Authorized in PRIIA 2008 (Passenger Rail Investment and Improvement Act
- $8B American Recovery and Reinvestment Act (ARRA)
- 2009 & 2010 Appropriations added $2.1B

Jun 2009 – HSIPR Program established

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United States (high-speed?) passenger rail

Amtrak

- 31 million passengers FY14; 85,000 daily
- 300 trains to 500 stations in 46 states, DC, 3 provinces
- 21,300 miles
- “no country in the world operates a passenger rail system without some form of public support for capital costs and/or operating expenses”
- 72% of miles on host railroads’ track
- 29 state supported routes, 750 miles, 5 with over 1 million annual passengers, 4 with over ½ million

Northeast Corridor

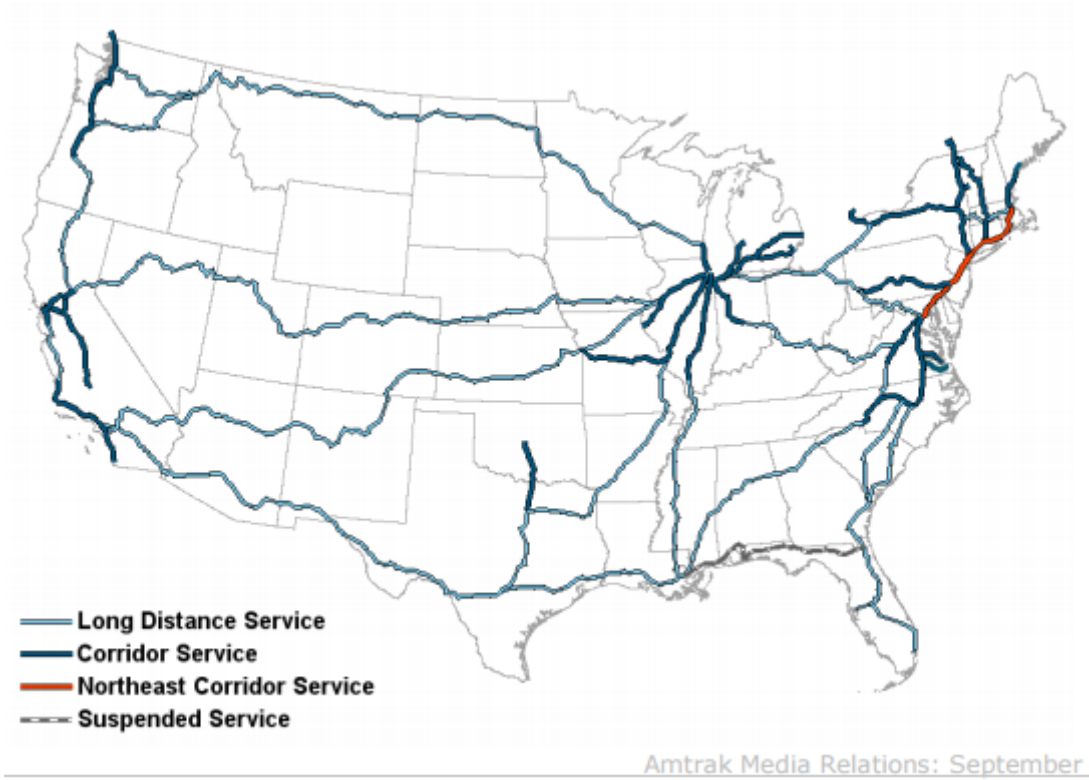
- 11.6 million passengers FY14
- Acela (nee 2000) 150 mph for 34 miles of 457 miles, 3.5 million passengers FY14

All Aboard Florida (Brightline) – Max 125 mph

- Miami:Cocoa:Orlando – 4 hrs; ‘17 start Miami:West Palm Beach, Siemens (CA)

California

Texas



- 2029 SF:LA 3 hours, 200+ mph
- 800 track miles including phase 2 (Sacramento, San Diego)
- 24 stations, 10 sections
- Air travel between LA & Bay Area – 5 million passengers/year
  - Busiest & most delayed short-haul in US – ¼ of flights 1+ hour late
- Equivalent capacity = 4300 highway lane miles, 115 airport gates, 4 new runways; $158B to build
- Maintaining added lane miles → $133B over 50 years
- Bakersfield:Fresno:Merced – ARRA $s by ‘17, high unemployment, test

http://thesource.metro.net/2013/04/15/california-high-speed-rail-authority-announces-bid-results-for-first-28-mile-segment-of-rail-construction/

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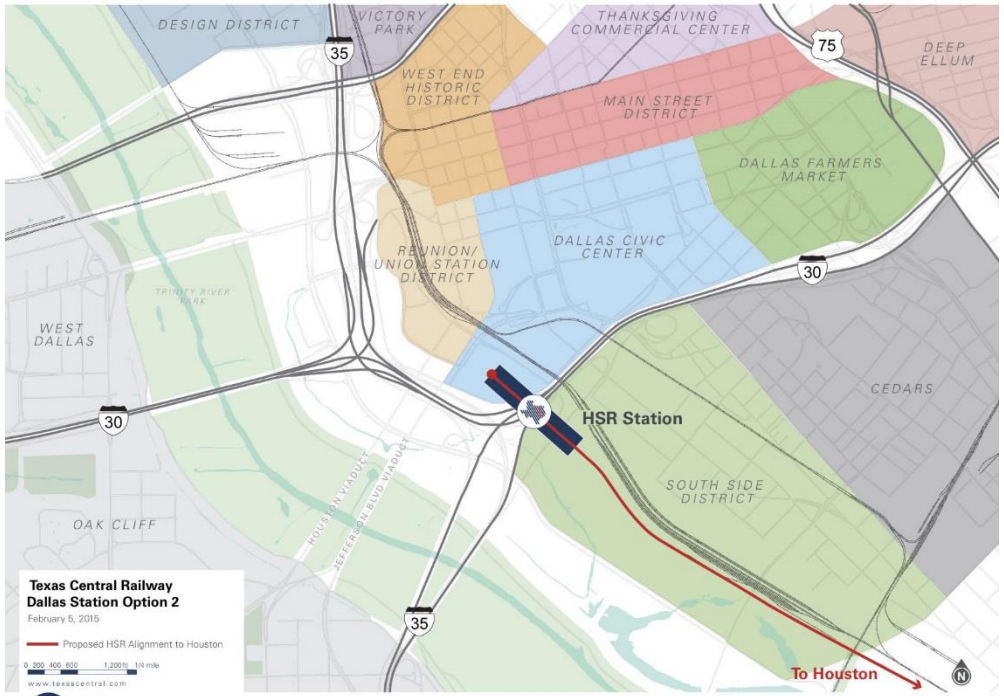
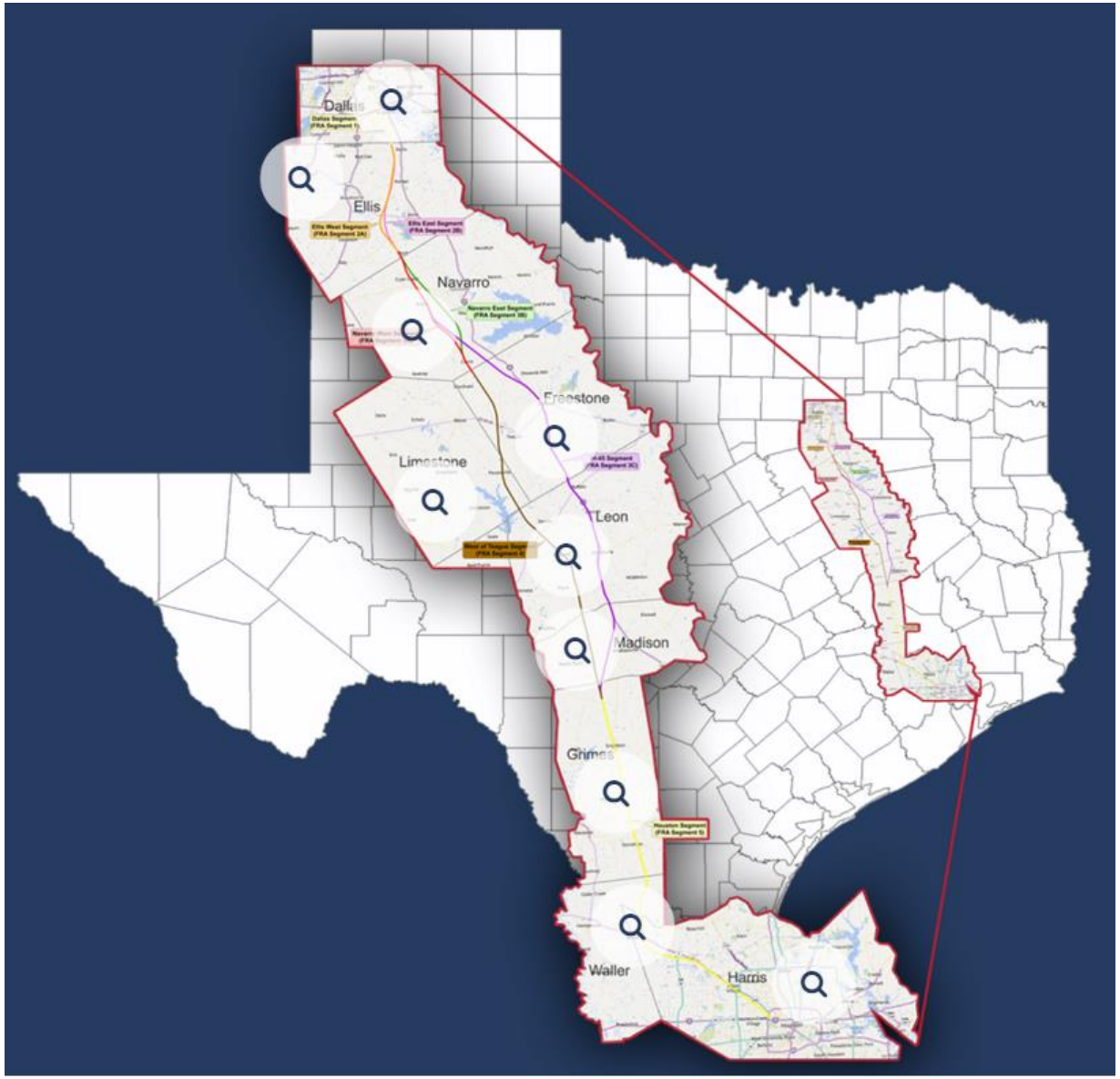
Texas Central Partners, LLC

- Connect Houston (Brazos Valley Station) & Dallas metro
- 90 minutes, up to 205 mph, about 240 miles
- 50,000 currently travel between the cities 1+ weekly
- Shinkansen technology (JRC operates Tokyo:Osaka
- Target construction start 2017, operational 2021
- Hourly off-peak, 30 minutes peak, 18 hours / day
- 1/8 energy per seat; 1/12 CO2 vs Boeing 777-200
- FRA draft EIS expected 2016 – starting with 6 draft alignment alternatives



http://www.texascentral.com/project/



http://www.texascentral.com/alignment-maps/

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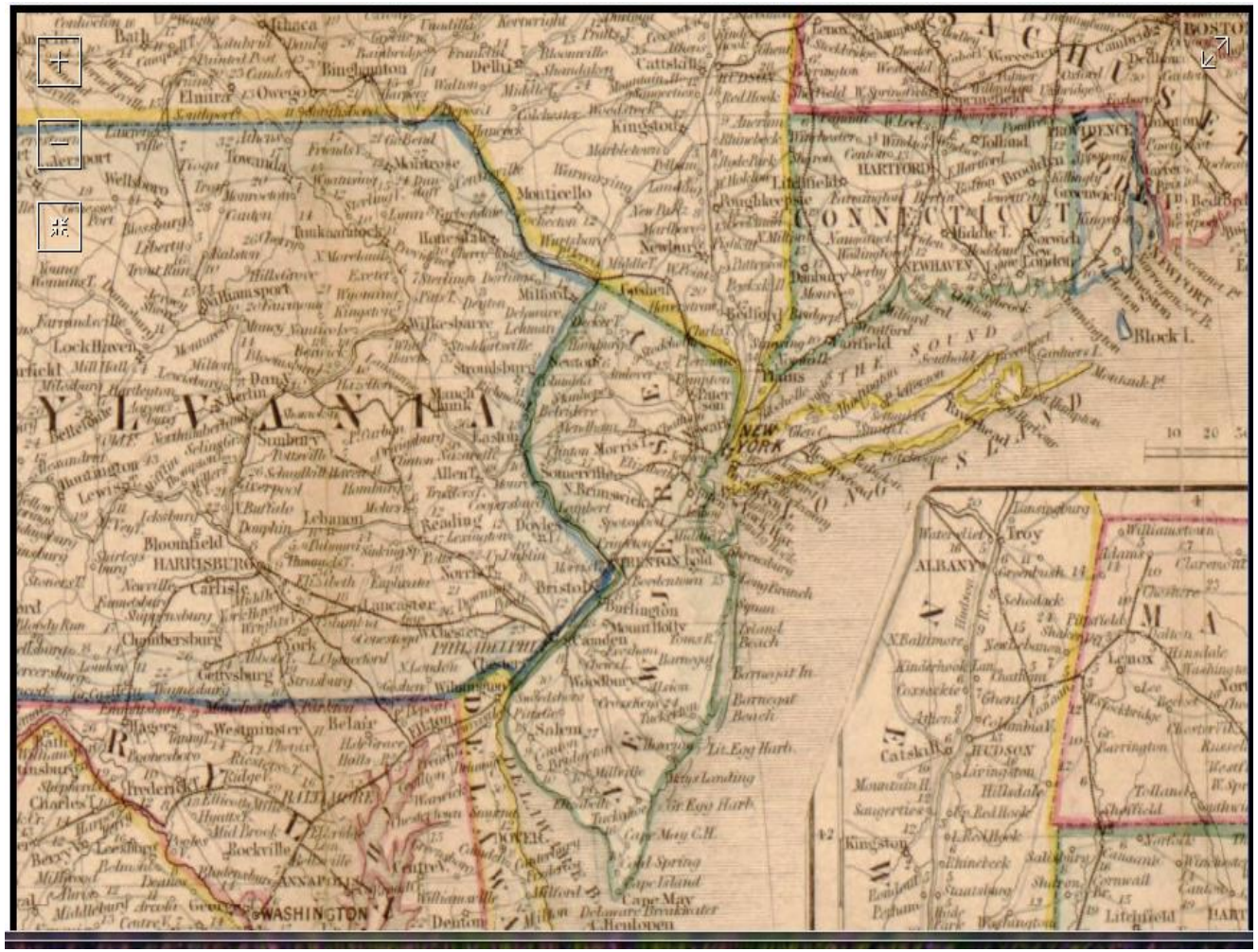
The Northeast Corridor – it wasn't born yesterday



1852 map of railways, canals, stage roads
https://www.loc.gov/resource/g3700.rr000200/

1878 - https://www.loc.gov/resource/g3701p.rr003400/

- 457-mile long Northeast Corridor between Washington D.C. and Boston
- Built between 1830 and 1917 by several railroad companies

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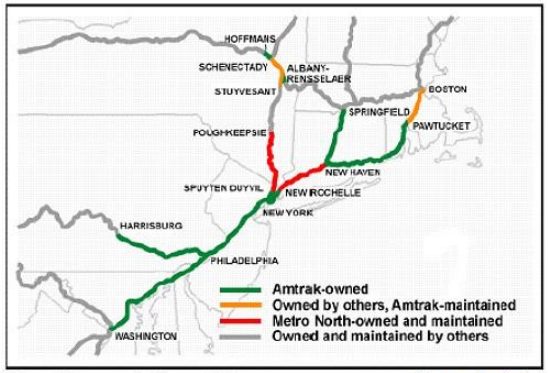
The Northeast Corridor Today



Operations

- Carries 750,000 passenger per day
- 2,200 trains per day operated by eight Regional rail authorities and Amtrak (2x ‘83)
- 4 freight railroads move 370,000 tons on 350,000 carloads 14 million car-miles annually
- Serves 4 of 10 largest US metropolitan areas globally top 25 GDP generated
- Acela – best average 80 mph DC:NY, 60 mph Boston:NY

The Region Served

- 51 million people – 14 percent of nation’s population
- generates $3 trillion in GDP annually – 21 percent of nation’s GDP
- Urban core generates 10x US average GDP/square mile
- 30 percent of US jobs on 2 percent of nation’s land area
- Region’s economic health is critical to nation’s health
- More than half of rail commuters use NEC for at least a portion of their trip
- Employment density around NEC stations is 680x US average
- High cost of living & doing business → high sensitivity to congestion costs, cost of time

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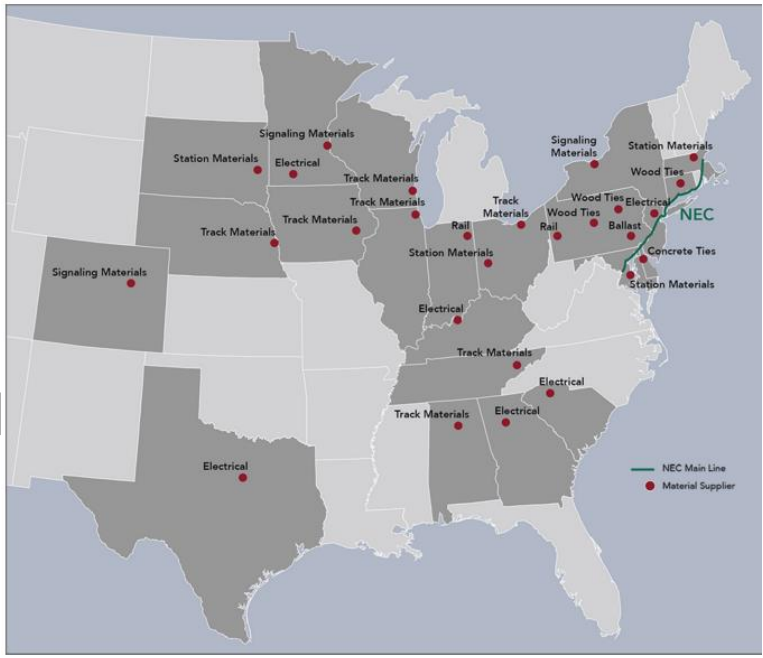
The Northeast Corridor Today

The Region's Transportation Network

- Passenger rail service demand at record levels
- Rail Ridership = 3x air between DC:NY, > air Boston:NY
- 50 percent of flight delays sourced in NY and Philadelphia
- 4 most delay-prone airports in the US
- 50 percent of nation's worst highway bottlenecks
- Freight volume highest (20-24/day) Baltimore:Newark, DE
- Residents take 15 million transit trips per day
- The Millennials are ~~coming~~ here (91% born after 1980 think investment in quality public transportation systems creates more jobs and improves the economy)
- 7 million new residents are coming, to the cities
- Unplanned 1 day NEC outage → $100M transportation related impacts & productivity losses

www.flickr.com/photos/beefortytwo/8775008274/sizes/n

ORIGINATING STATES FOR MATERIALS USED IN NEC CONSTRUCTION PROJECTS



Source: Amtrak, Metro-North

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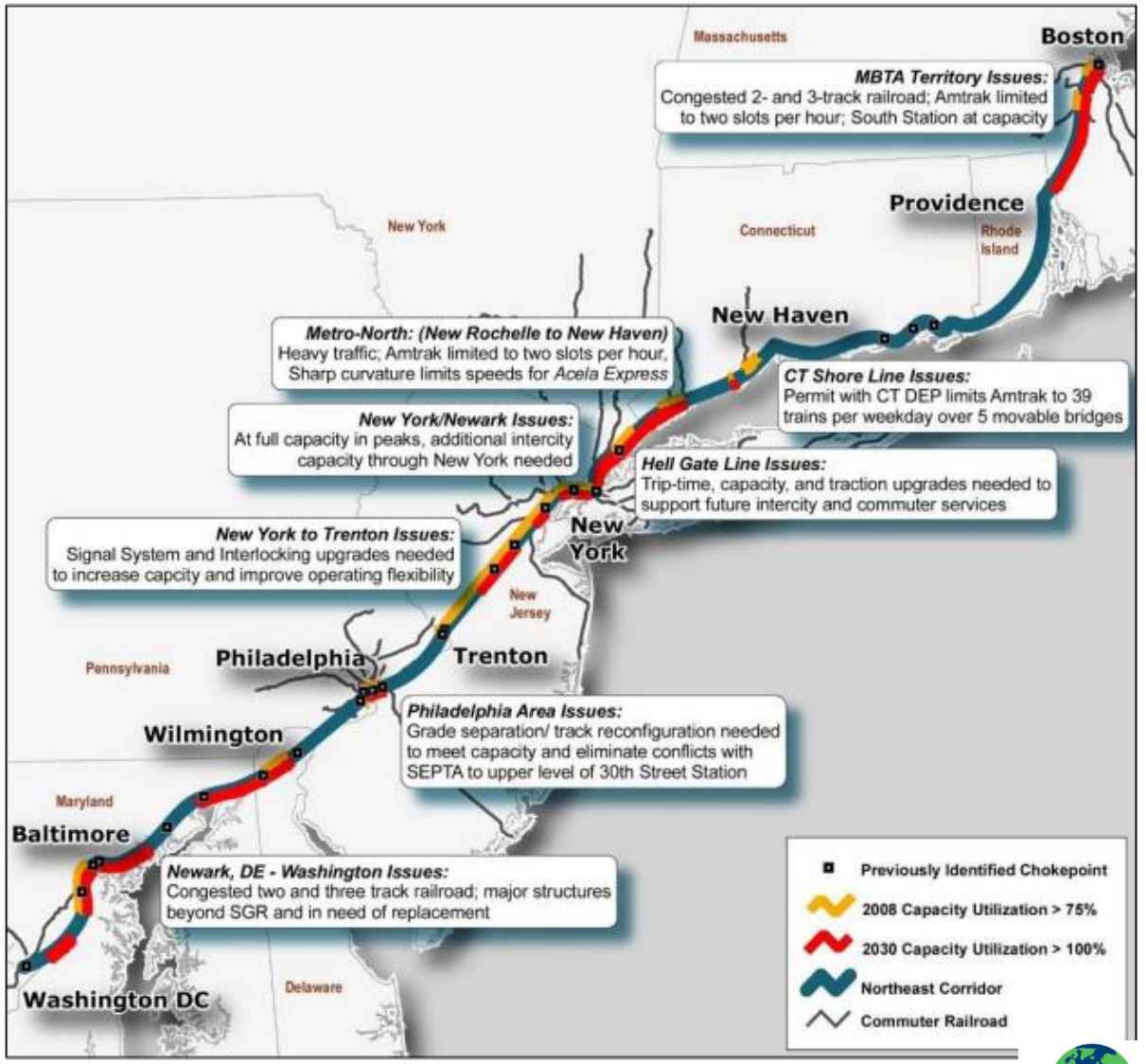
Can’t we just continue to muddle through?

- Hundreds of bridges and tunnels over 100 years old
  - 10 movable bridges (1890-1910), 1186 total
  - ‘13 Gunpowder River, Bush River (20 people to open)
  - ‘06 Susquehanna (30 ppl); Norfolk Southern:Port Balto.
  - 17 tunnels: 3 B&P – Civil War; Hudson – catenary ice patrol
- Electric traction power – major portions 75+ years old
- DC:NY catenary restricts to 135 mph (not constant tension)
- Signal systems decades old communications technology
- Capacity constrained by plethora of chokepoints
- Lack of reserve capacity → weekend/night maintenance +$
- Unreliability causes loss in productivity & competitiveness, constrains growth of region and nation
- Limited interoperability constrains connecting thru service
- Intermodal connectivity
- Vulnerable to climate change effects (sea level, heat, storm)
  - Precip from extreme events +70% since 1958
- 11 grade crossings after electrification New Haven-Boston
- Reduce transportation-related energy use & emissions
- Support continued economic growth, competitiveness

State of the Northeast Corridor Region Transportation System

Figure 28. ***Main Line Congestion and Constraints: NEC***
2008 and 2030



Source: NEC Infrastructure Master Plan.

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Northeast Corridor Commission

Mandated under PRIIA 2008, established 9 corridor goals:

- **Economic Growth** – Support the global economic competitiveness of the Northeast Region and nation.
- **Connectivity and Coordination** – Support regional travel through improved connectivity and coordination among Corridor users and with other modes of transportation.
- **Market Share and Network Capacity** – Increase the capacity of the rail network and expand rail's market share to support the existing and future demand for passenger and freight rail service.
- **Service Reliability** – Improve the reliability of passenger and goods movement in the Corridor.
- **Travel Time** – Reduce trip time to enhance rail as a competitive choice in the Corridor.
- **System Preservation** – Bring the corridor up to and then maintain a state of good repair.
- **Safety and Security** – Provide safe and secure transport of passengers and goods.
- **Community Development** – Enhance the integration between transportation investments and local development in communities throughout the corridor.
- **Energy and Environment** – Reduce energy use and protect the environment.

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NEC FUTURE program

Launched June 2012, enabled by 2010 Appropriations Act

U.S. Department of Transportation's Federal Railroad Administration (FRA)

- Federal Transit Administration (FTA) is a cooperating agency
- coordinating with state and local governments, passenger and freight railroads, many other stakeholders

Comprehensive planning effort – define, evaluate, prioritize future investments in the NEC

Upgrade infrastructure to improve reliability, capacity, connectivity, performance & resiliency of future Intercity & Regional passenger rail service, while promoting environmental sustainability & economic growth

Create a Passenger Rail Corridor Investment Plan (PRCIP)

- Components include Tier 1 EIS and Service Development Plan (SDP)
- Draft Tier 1 EIS released November 2015
- Final, describing & analyzing the preferred alternative expected by YE16 - starting point to advance Tier 2 projects
- 2040 (and beyond) time horizon – establish a long–term vision including high-speed rail (150-220 mph)
- Define current role of rail in the Northeast transportation system, explore and select future role
- Define and prioritize near-term actions and phased investment plan to achieve the vision
- Consider interrelationship with freight rail operations

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NEC Future

- Service types
  - Intercity Express – 160 – 220 mph, largest markets (Acela-like but faster)
  - Intercity Corridor – 110 – 160 mph – NEC & connecting corridors
  - Regional
- Action alternatives' operational improvements
  - Expand # of stations served by Intercity service
  - More through service at major stations (i.e. DC, NY)
  - Other enhanced service concepts
- Freight rail
  - Access preserved, opportunities to accommodate future growth
    - Access to Ports of Baltimore & Wilmington; Delmarva; LI, RI, SE CT, New England
    - Parallel high capacity high clearance line from DC to northern NJ
  - Not on tracks with trains operating over 160 mph
  - Temporal separation where high-speed tracks closely parallel existing tracks

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NEC FUTURE Draft Tier 1 EIS

1. Introduction
2. Readers' Guide
3. Purpose and Need
4. Alternatives Considered
5. Transportation
6. Economic Effects and Growth, and Indirect Effects
7. Affected Environment, Environmental Consequences, and Mitigation Strategies (21 sections – 459 pages)
8. Construction Effects
9. Evaluation of Alternatives
10. Phasing and Implementation
11. Agency and Public Involvement
12. References
13. Glossary
14. List of Preparers
15. Index

Appendix A, Mapping Atlas

Appendix B, Alternatives Documentation

Appendix C, Transportation

Appendix D, Economic Effects

Appendix E, Environmental Resource Documentation (20 sections – 896 pages)

Appendix F, Agency and Public Involvement

Appendix G, Section 106 Documentation

Appendix H, Preliminary Section 4(f) and Section 6(f) Evaluations

Over 2400 pages

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NEC Future – Public Engagement

Aug 2012 – 9 public & agency scoping meetings (8/14 – Baltimore, 8/21 – DC)
Mar 2012 – Mar 2015 – 66 meetings - State Transportation Agencies, rail operators (MDOT, MARC, MTA)
Jun 2012 – Jun 2015 – 22 meetings with MPOs and Local Agencies – Baltimore Council (Mar '13, Nov '14)
Apr 2012 – Nov 2014 – 20 regional resource agency meetings (Apr '12 Hanover)
Dec 2012 – April 2013 – 9 regional workshop dialogues (includes 3 webinars)
Nov 2014 – 9 Public Open Houses – Baltimore 11/18
Oct 2014 – 9 Economic Development Workshops 10/14 Baltimore

<u>Tier 1 Draft EIS Public Hearings '15 (4-7 PM, 90m presentation)</u>

Dec 9 Boston	Dec 17 Providence	Jan 14 Baltimore
Dec 14 New Haven	Jan 11 Philadelphia	Jan 19 Newark
Dec 15 New York	Jan 12 Mineola	Jan 20 Wilmington
Dec 16 Washington *	Jan 13 Hartford	

- EESI comment Dec 16 hearing, written comment 2/16
- *An alternatives analysis for the NEC Future is only realistic if it is done in the context of the entire multimodal transportation network, not just the rail network. The analysis must consider what would happen in the rest of the transportation network under each of the NEC Future alternatives.*

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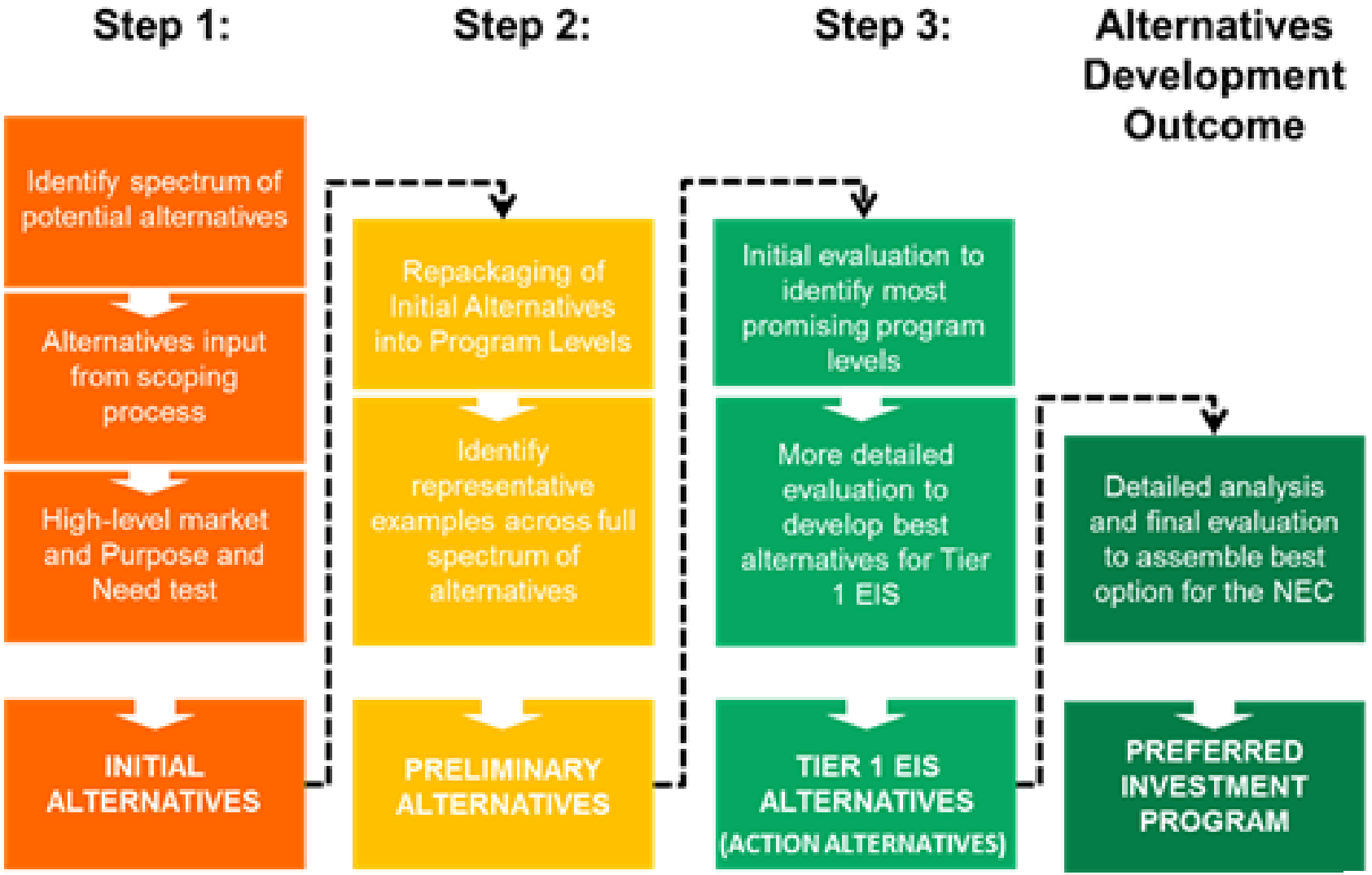
NEC Future – Alternatives, Process

- No Action
- Action Alternatives based on role of rail in corridor
- Alt. 1) maintain
- Alt. 2) expand
- Alt. 3) transform



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Initial Alternatives Development

- FRA developed about 100 initial alternatives
  - Travel demand and growth data analysis
    - Current travel patterns + population and employment forecasts → new travel patterns
  - Network / route alternatives
    - existing vs 2nd spine
    - new right of way segments
    - links to connecting corridors
  - Investment Level
    - Growth of existing markets
    - Add express, regional and/or connecting corridor services
    - Extensive expansion to serve new markets with high-speed rail service

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4 Program Levels & 15 Preliminary Alternatives

- A: State of good repair, some service & capacity increase along existing corridor
  - Service options: financially constrained, Standard, Enhanced mix of services
- B: Substantial service & capacity increases to existing & connecting markets
  - Service options: standard, max frequency, min trip time, max connecting corridor service
- C: Targeted expansion to new markets, reduce trip time, robust regional rail service
  - Service options: see B
- D: World-class high-speed rail through addition of 2nd spine…
  - mostly parallels entire existing corridor
  - Via Danbury – Hartford – Providence
  - Via Ronkonkoma, LI – Hartford – Worcester
  - Via Delmarva, Nassau County – Stamford – Danbury – Springfield

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Preliminary Alternatives Evaluation Criteria

Evaluation Criteria	Metrics
Growth and Capacity Expansion	Annual trips Annual passenger miles Peak-hour passengers at major screenlines* Peak-hour trains, Hudson River screenline
Aging Infrastructure	NEC in a state of good repair
Service Effectiveness and Performance	Express trip time savings Maximum trains per hour Peak-hour trains operating on NEC
Connectivity	Stations served by Intercity trains Station-pairs served by Intercity trains Airport stations
Environmental Consequences	Acres of environmental sensitivity

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Preliminary Alternatives Evaluated

- Alternatives dismissed
  - 2nd spine for entire DC:Boston corridor (service, cost, constructability)
  - Delmarva routing (environmental impacts, & market growth)
  - NYC – Uniondale – Hartford (underperformed)
  - Hartford – Springfield – Boston (underperformed)
  - Advanced guideway technologies i.e. maglev (new stations, no run-through connecting service, few in operation)
- Related projects in connecting corridors or unfunded in NEC
  - not in No Action, may be in an Action Alternative
  - i.e. DC:Richmond HSR, South Station expansion, Portal Bridge replacement, B&P tunnel replacement
- Representative routes – specific alignments not defined
  - DC:NY now 2-6 tracks
  - Alt 3 300 ft 2 HSR tracks adjacent to 6 track ROW vs Alt 1 & 2 existing 150 ft

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“No Action”

- More people on same number of trains – overcrowding
- $20B capital cost ($2014) - $8B funded, $11B unfunded, $1B mandated
- Requires $200M per year above norm of $600M level of last 10 years
- Short of state of good repair
- Will not address existing capacity constraints, connectivity gaps, underserved markets
- Lower level of funding will result in increased operating costs, lower service levels & reliability, lower ridership, slower speeds and longer travel times

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Alternative 1: Maintain Role

- Reduces unmet demand for rail travel
- Lessens economic penalties of capacity constraints
- Existing rail travelers best combined time/cost savings
  - was cost borne to expand other modes considered?
- Least savings for travelers who would divert to rail
- Intercity 2-3x service DC:NY, 8x NY:Boston 3h (-30m)
- Regional: Peak-hour 2x DC:NY
- Stations: existing 110 + 19 new
- Chokepoint relief – MD, DE-2, PA, NJ-3, NY, CT-2, MA
- New tracks – MD, MD:DE, N NJ, NYC, RI, MA
- New segments
  - 4 track Baltimore tunnel 2 mi
  - 2 Hudson tunnels 3 mi
  - 50 mile CT:RI avoiding movable bridges (-30m)

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Alternative 2: Grow Role

- Addresses capacity constraints
- Frequency: Intercity 5x no action, Regional peak 2x
- DC:NY in 2h30m -15m; NY:Boston 2h40m -50m
- Opportunities for connecting service improvement
- 24 new stations (including Philadelphia Airport IC)
- Chokepoint relief – MD, DE, PA, NJ-3, NY, CT, MA
- New track – DC:MD, 2 MD, NYC, RI:MA
- New segments:
  - 4 track Baltimore tunnel 2 mi
  - MD:DE 23 mi
  - DE 8 mi “Wilm bypass”
  - PA 10+8 mi including PHL
  - NJ 16 + 12 mi
  - NYC 8 mi
  - NY:CT 29 mi
  - MA 3 mi
- Added route CT/RI avoids 120 miles of movable bridges, freight and regional rail conflicts, shore

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Alternative 3: Transform Role

- Accommodates more off-corridor trips and meets demand beyond 2040
- Intercity peak 6x, Regional 3x peak south, 2x north
- DC:NY 1h40m -1h5m, NY:Boston 1h40m -1h50m
- Connecting corridor improved thru trips
- 31-41 new stations (downtown Baltimore & Phila, PHL)
- Chokepoint relief: MD 2, DE, PA, NJ 3, NY, MA
- New Track: MD 2, NYC, RI:MA
- New Segment: 2nd spine parallel to full NEC uses DC, Balto, BWI, Wilmington, Newark NJ stations
- 6 track segments: DC:Baltimore, Phila:NYC, CT
- 4 route options NY:MA
  - Central CT:Providence via Danbury, Storrs
  - LI:Providence – via Ronkonkama, Storrs
  - LI:Worcester – vis Nassau, Framingham
  - Central CT:Worcester – via White Plains, Beacon Pk

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Estimated alternative costs

Capital Cost ($2014 billions)			
Category	**Alternative 1**	**Alternative 2**	**Alternative 3**
Infrastructure	$52-54	$116-$121	$252-$293
Vehicles	$3	$5	$6
Subtotal	$54-$57	$122-$127	$257-$299
No Action	$9	$9	$9
Total	$64-$66	$131-$136	$267-$308

Infrastructure elements

- stations
- shops
- lengths of infrastructure
  - Tunnel
  - Aerial
  - Embankment
- rail systems

Annual Intercity O&M Costs & Revenues ($2014 millions)				
	No Action	**Alternative 1**	**Alternative 2**	**Alternative 3**
Revenue	$1,895	$2,065	$2,525	$2,740
Cost	$920	$1,220	$1,850	$2,165
Profit	$970	$840	$680	$570

Cost elements

- labor (e.g., train and maintenance crews)
- power and fuel
- management and administrative costs

Iterative, balancing operating costs with ridership and revenues

Effects evaluated in chapter:

5. Transportation: changes in mode, volume & accessibility near stations, and in and between metro areas
6. Economic: employment effects, induced growth at select stations, travel cost savings
7. Environment: benefits and consequences on built and natural resources
8. Construction: qualitative effects

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Transportation Effects

- Effects to the regional highway network as changes in total trips and VMT
- Effects to the aviation system as changes to enplanements and trips
- Effects to the passenger rail network as changes in Intercity and Regional rail travel within the Study Area for the following metrics:
  - Total trips within and between metropolitan areas
  - Travel time (hours:minutes) between metropolitan areas and/or stations
  - Passengers boarding at rail stations
- Consideration of the freight rail network as changes to the intensity of travel on shared corridors and the locations where conflicts between freight service and passenger rail service will change (robust consideration critical to Port of Baltimore)

- Is it assumed capacity exists for FAA air travel projections and highway VMT? Are the costs and impacts of adding capacity factored into decisions?

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Economic Effects

Short-term

Construction Employment – 300k job years (no action) – 3.5 million (alt 3) job years

Rail Operate/Maintain Employment – between 3,100 & 24,200 job years

Travel Market Effects: Monetize changes in travel time, reliability, cost, and safety, emissions

- Passenger and freight rail conflicts
- Potential for additional rail capacity
- Potential changes in net revenue contributions

Net Revenue Contribution – all positive but capacity constraints in the No Action Alternative result in higher fares, higher revenues, and comparatively lower O&M costs, higher

Longer term (receives more attention in Tier 2)

Increased flow of people within and between major metropolitan areas

- For households: Access to employment and leisure options → improve quality of life
- For businesses: Access to larger, more diverse, specialized labor pool → increases productivity

Station area development rises with faster, more frequent service, connection to more new markets

- Baltimore station connectivity – 1 of 3 markets with greatest gains, most with Alternative 3

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Station Development – Local Actions

Local mitigation strategies to minimize negative indirect effects

- Develop vision for growth supported by local government, stakeholders, and public involvement
- Phased investment in public infrastructure and services by state, local governments, and transit, and/or acquire contributions from developers for capital investment
- Coordinate with local agencies and regulatory authorities regarding sensitive environmental resources (cultural, historic, hydrological, ecological, agricultural, parklands, and air quality.
- Sensitivity to existing community concerns and identification of developer incentives (i.e., tax breaks, allow denser development), for affordable housing requirements in new development

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Environmental Impacts (MD) – Alternative 3

New Segments

Alternative 1 & 2 – Baltimore tunnel

Alternative 3 – new segment in Harford, Cecil (Perryville:DE)

Alternative 3 – new spine full route → right-of-way acquisitions

- Some in Prince George's, Anne Arundel
- Most in Harford, Baltimore County & City – potential EJ population impacts
- Anne Arundel & Harford – 300 acres of floodplain effects

New Stations

- Alternative 1 & 2 – Baltimore City (2 local, 1 hub), Cecil (local)
- Alternative 3 vs 1 & 2 – Baltimore City (+1 major hub, 1 hub), AA (major hub), Baltimore County (Local, Hub), Harford (1 local)

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Table 7.1-2: Summary of Effects (totals)

Resource	Washington, D.C. to New York City			
	Existing NEC	Alt. 1	Alt. 2	Alt. 3
Land Cover - Potential Conversion - Developed (acres)	3,510	3,510	3,985	8,175
Land Cover - Potential Conversion - Undeveloped (acres)	405	415	610	1,675
Land Cover - Potential Acquisitions - Developed (Existing NEC removed from Alts) (acres)*	—	65	900	3,995
Land Cover - Potential Acquisitions - Undeveloped (Existing NEC removed from Alts) (acres)*	—	5	245	1,215
Prime Farmland (acres)	75	75	140	395
Prime Timberland (acres)	325	325	480	1,290
Parklands (acres)	45	45	95	295
Wild & Scenic Rivers (acres)	1	1	1	2
Freshwater Wetlands (acres)	90	90	150	545
Floodplains (acres)	450	455	680	1420
Saltwater Wetlands (acres)	55	75	100	190
Coastal Zone (route miles)	55	55	70	115
ESH Terrestrial (acres)	320	320	510	1,530
ESH Aquatic Freshwater (acres)	25	25	40	110
ESH Aquatic Saltwater (acres)	55	70	100	185
T&E (# species in AE)	20	20	20	20
EFH (# species)	10	10	10	10
EFH (# crossings)	5	10	10	10
Seismic Hazards (presence # counties)	7	7	7	7
Sole Source Aquifers (presence # counties)	6	6	6	6
Karst Terrain (presence # counties)	0	0	0	1
Naturally Occurring Asbestos (presence # counties)	0	0	0	0

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Resource	Washington, D.C. to New York City			
	Existing NEC	Alt. 1	Alt. 2	Alt. 3
Acid Producing Soils (presence # counties)	13	13	13	13
Landslide Susceptibility (presence # counties)	4	4	4	4
Mineral Resources - Producer (#)	0	0	0	1
Mineral Resources - Occurrence (#)	0	0	0	1
Mineral Resources - Plant (#)	2	2	2	8
Mineral Resources - Inactive Producer (#)	0	0	1	2
Active Mines (#)	0	0	0	0
NPL Superfund (# sites)	0	0	0	0
Brownfields (# sites)	20	20	25	60
RCRA CORRACTS (# sites)	0	0	0	0
RCRA Info (# sites)	2	2	4	15
RCRA TSDF (# sites)	0	0	0	1
State (# sites)	25	25	40	85
NHL (#)	1	2	3	3
NRHP (#)	10	45	45	50
Total Population (AE)	2,068,324	2,087,480	2,013,836	2,483,362
Minority Population (AE)	1,227,667	1,242,102	1,195,965	1,417,921
Low Income Population (AE)	366,825	370,292	350,335	438,378
Percent Minority (AE)	59%	60%	59%	57%
Percent Low Income (AE)	19%	19%	18%	19%
EJ Tracts (AE)	349	353	342	407
Noise - severe or moderate (# counties)	N/A	16	16	16
Vibration Impact (# counties)	N/A	1	5	9
Climate Change - Total Area at Risk of Inundation (Acres)/% of total Representative Routes)				
Sea Level Rise (Current Climate Conditions)	45/< 1%	50/<1%	105/<1%	180/1%
Storm Surge (Current Climate Conditions)	210/< 1%	230/3%	460/4%	875/5%
Riverine (Current Climate Conditions)	460/ <1%	475/7%	755/7%	1,665/10%
Section 6(f) (acres)	15	15	25	170

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Table 6 -15: Range of Pricing/Service Type Options Serving Metropolitan Areas Daily

Geographic Scale	No Action	Alternative 1	Alternative 2	Alternative 3*
Greater Washington Area (Union Station)	Low-High 16 EXP 26 IC	Low-High 24 EXP 48 IC	Low-High 41 EXP 70 IC	Low-High 72 EXP 80 IC
Greater Baltimore Area (Baltimore Penn Station, Baltimore Downtown Station)	Low-High 16 EXP 26 IC	Low-High 24 EXP 48 IC	Low-High 41 EXP 70 IC	Low-High 52 EXP 80 IC

Table 6-18: Frequency of New Direct Connections

Geographic Scale	No Action	Net of No Action Alternative		
		Alternative 1	Alternative 2	Alternative 3*
Greater Washington Area (Union Station)	500	160	453	691-914
Greater Baltimore Area (Baltimore Penn Station, Baltimore Downtown Station)	546	160	453	585-808

Table 6-20: Shortest Travel Time to New York City

Geographic Scale	In hours and minutes			
	No Action	Alternative 1	Alternative 2	Alternative 3
Greater Washington Area	2:45	2:43	2:26	1:37
Greater Baltimore Area	2:09	2:11	1:56	1:23

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Table 6-1: Potential Construction Employment Impacts (Job-Years)

	No Action	Alternative 1		Alternative 2		Alternative 3*	
		Affected Environment	U.S.-Outside Affected Environment	Affected Environment	U.S.-Outside Affected Environment	Affected Environment	U.S.-Outside Affected Environment
Direct	147,300	377,200	7,410	761,000	15,800	1,543,600-1,823,000	16,600
Total	297,800	773,670	36,200	1,561,100	77,400	3,166,500-3,739,900	81,000

Table 6-3: 2040 Potential Employment Impacts for Full O&M Only (Job-Years)

Service Type	No Action		Alternative 1		Alternative 2		Alternative 3*	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total
Intercity-Express & Corridor; Regional Rail	2,300	3,100	8,000	11,000	15,700	21,900	20,600-23,100	28,900-32,300

Table 6-23: Jobs Accessible in a 30-Minute Train Travel Time

Hub Station	No Action Alternative	Net of No Action Alternative		
		Alternative 1	Alternative 2	Alternative 3*
Washington Union	1,570,000	60,000	440,000	430,000
Baltimore	1,640,000	60,000	1,030,000	1,030,000

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Table 6-11: Total Value of 2040 Potential Emissions Impacts

	Net of No Action Alternative, in millions of $2014		
	Alternative 1	Alternative 2	Alternative 3*
Existing Energy Profile	$22	$20	$6
Future Energy Profile	$25	$28	$18

	Alternative 3			
	Central Connecticut/ Providence (3.1)	Long Island/ Providence (3.2)	Long Island/ Worcester (3.3)	Central CT/ Worcester (3.4)
Existing Energy Profile	$3	($1)	$2	$21
Future Energy Profile	$14	$11	$15	$30

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Table 5-6: Airport Enplanements by Airport (2006, 2012, 2040)

Airports	2006	2012	2040 Projection	Percentage Growth 2006-2012	Percentage Growth 2012-2040*
Large-Hub Airports					
John F Kennedy International (JFK)	21,041,501	24,520,981	61,253,000	16.4	150
Newark Liberty International (EWR)	17,804,107	17,055,993	32,229,000	-4.2	89
Philadelphia International (PHL)	15,390,848	14,589,337	28,030,000	-5.2	92
Logan International (BOS)	13,544,552	14,293,695	22,606,000	5.5	58
LaGuardia (LGA)	12,925,697	12,818,717	16,302,000	-0.8	27
Washington Dulles International (IAD)	11,045,217	10,816,216	24,673,000	-2.1	128
Baltimore/Washington International Thurgood Marshall (BWI)	10,297,607	11,186,444	22,027,000	8.6	97
Ronald Reagan Washington National (DCA)	8,973,410	9,462,231	12,733,000	5.4	35
Medium-Hub Airport					
Bradley International (BDL)	3,409,938	2,647,610	n/a	-22.4	n/a
Large-Hub Total	**111,052,939**	**114,743,614**	**219,853,000**	**3.3**	**92**
All Total	**114,462,877**	**117,391,224**		**2.6**	

Capacity?

Source: Federal Aviation Administration Passenger and All-Cargo Data, Terminal Area Forecast Summary, Fiscal Years 2012 to 2040, 2012
*Federal Aviation Administration estimate

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Table 5-9: Intercity Ridership by Station (2006-2012)			
Station	2006	2012	Percentage Change in Ridership
Washington Union Station	3,859,117	5,013,991	30%
New Carrollton	206,830	174,054	-16%
BWI	561,505	703,604	25%
Baltimore	910,523	1,028,909	13%
Aberdeen	37,414	43,987	18%
Newark, DE	6,776	14,682	117%
Wilmington	712,219	737,846	4%
Philadelphia 30th Street	3,555,646	4,068,540	14%
North Philadelphia	605	294	-51%
Cornwells Heights	12,558	3,580	-71%
Trenton	436,058	419,446	-4%
Princeton Junction	65,679	40,947	-38%
New Brunswick	7,882	8,470	7%
Metropark	362,355	393,713	9%
Newark Liberty	96,382	126,705	31%
Newark Penn Station	609,184	680,803	12%
Penn Station New York	7,546,208	9,493,414	26%
New Rochelle	75,439	84,777	12%
Stamford	300,680	393,703	31%

Table 5-9: Intercity Ridership by Station (2006-2012)			
Station	2006	2012	Percentage Change in Ridership

Bridgeport	62,374	84,446	35%
New Haven	631,596	755,669	20%
Wallingford	11,342	18,148	60%
Meriden	30,202	34,483	14%
Old Saybrook	57,325	65,315	14%
New London	150,455	173,003	15%
Mystic	15,422	25,983	68%
Berlin	23,348	24,108	3%
Hartford	150,272	179,536	19%
Windsor	9,627	11,713	22%
Windsor Locks	11,973	18,491	54%
Springfield	112,465	143,605	28%
Westerly	32,178	42,023	31%
Kingston	135,796	162,837	20%
Providence	512,974	669,576	31%
Route 128	312,113	444,058	42%
Back Bay	298,340	528,040	77%
Boston South Station	988,842	1,447,501	46%
TOTAL	**22,909,704**	**28,260,000**	**24%**

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Table 5-10: Annual Passengers by Regional Rail Service Provider (2006 and 2012)

Regional Rail Service Provider	Regional Rail System	Initials	Primary Market(s) Served	2006 Ridership	2012 Ridership	2006-2012 Percentage Growth
Virginia Railway Express	Virginia Railway Express	VRE	Washington, D.C.	3,569,664	4,702,196	31.7
Maryland Transit Administration	Maryland Area Regional Commuter	MARC	Baltimore, Washington, D.C.	7,274,762	8,532,214	17
Southeastern Pennsylvania Transportation Authority	SEPTA Regional rail	SEPTA	Greater Philadelphia, Wilmington, Trenton	34,150,997	36,899,167	8
NJ TRANSIT Corporation	NJ TRANSIT Rail	NJT	New York City, Mid-Hudson Valley, Newark, Northwestern New Jersey, Trenton	75,394,695	81,353,894	8
Metropolitan Transportation Authority	MTA-Metro-North Railroad	MNR	New York City, Lower- and Mid-Hudson Valley, Stamford, Bridgeport, New Haven	76,527,572	82,807,689	8
	MTA-Long Island Rail Road	LIRR	New York City, Long Island	99,520,000	96,986,120	-3
Connecticut Department of Transportation	Shore Line East	SLE	New London, Old Saybrook, New Haven	445,564	624,172	40
Massachusetts Bay Transportation Authority	MBTA Commuter Rail	MBTA	Greater Boston Area	37,797,601	36,083,946	-4.5
			TOTALS	**334,680,855**	**347,956,398**	**4.0**

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Table 5-11: Freight Movement by Metropolitan Area (2011)

	Movement by Kilotons			Percentage of Total by Metropolitan Area		
	Truck	Rail	Other	Truck	Rail	Other
Washington CSA	231,013	10,172	22,050	87.8	3.86	8.38
Baltimore MSA	186,576	19,621	12,908	85.2	8.96	5.89
Delaware	65,586	5,374	29,421	65.3	5.35	29.31
Philadelphia CSA	367,673	25,031	114,420	72.5	4.94	22.56
New York City CSA	936,625	26,506	174,419	82.3	2.33	15.33
Connecticut	12,887	338	1,305	88.7	2.33	8.98
Hartford CSA	67,230	516	3,077	94.9	0.73	4.34
Rhode Island	45,189	334	3,830	91.6	0.68	7.76
Massachusetts	64,644	1,762	2,157	94.3	2.57	3.15
Boston	292,637	4,412	31,493	89.1	1.34	9.59
NEC-NEC movement	922,438	4,307	118,061			
TOTAL	**1,347,622**	**89,760**	**277,017**			
Percentage of Total	**78.6**	**5.2**	**16.2**			

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Table 5-12: Projected Freight Growth (2011-2040)

Mode	Kilotons 2011	Kilotons 2040 Estimate	2011-2040 Percentage Growth	2011 Percentage Mode Share	2040 Percentage Mode Share
Air (include truck-air)	1,167	3,570	206%	0.1%	0.1%
Multiple modes & mail	59,869	148,201	148%	3.5%	3.8%
Other and Unknown	25,263	60,592	140%	1.5%	1.5%
Pipeline	137,089	186,039	36%	8.0%	4.8%
Rail	89,760	149,235	66%	5.2%	3.8%
Truck	1,347,622	3,257,680	142%	78.6%	83.3%
Water	53,629	105,383	97%	3.1%	2.7%
TOTAL	**1,714,400**	**3,910,701**	128%	**100.0**	**100.0**

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Table 5-13: Annual Trips (1,000s) by Mode for the No Action and Action Alternatives (2040)

Mode	No Action Alternative	Alternative 1	Change vs. No Action (%)	Alternative 2	Change vs. No Action (%)	Alternative 3 (average)	Change vs. No Action (%)
Intercity rail	19,300	33,700	75%	37,100	92%	39,000	102%
Regional rail	419,800	474,500	13%	495,400	18%	545,500	30%
Highway	516,700	509,300	-1%	507,400	-2%	506,500	-2%
Air	23,000	21,900	-5%	21,600	-6%	21,200	-8%
Bus	20,500	19,400	-6%	19,100	-7%	18,900	-8%

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Table 5-18: Average Intercity Travel Time (Hours:Minutes) by Representative Station-Pair (2040)

Station 1	Station 2	No Action		Alternative 1		Alternative 2		Alternative 3*	
		Express	Corridor	Express	Corridor	Express	Corridor	Express	Corridor
Washington Union Station	Philadelphia	1:37	1:55	1:37	1:49	1:29	1:46	1:04	1:39
Washington Union Station	Penn Station New York	2:47	3:23	2:43	3:08	2:26	3:01	1:48	2:51
Washington Union Station	Boston	6:33	8:02	5:45	6:57	5:07	6:22	3:57	5:47
Washington Union Station	Newark, DE		1:24		1:25		1:19		1:11
Philadelphia	Odenton				1:39		1:32		1:22
Penn Station New York	Baltimore	2:11	2:39	2:11	2:30	1:56	2:24	1:29	2:16
Penn Station New York	Wilmington	1:28	1:49	1:28	1:41	1:15	1:37	1:08	1:31
Ronkonkoma	Baltimore							1:58	2:56
Penn Station New York	Philadelphia	1:07	1:23	1:04	1:18	0:55	1:11	0:43	1:10
Boston	Philadelphia	4:53	6:00	4:06	4:59	3:36	4:24	2:52	4:14
Nassau Hub	Trenton								1:11
Danbury	Newark Penn Station								1:01
New Haven Station	Newark Penn Station	1:59	2:16	1:36	1:43	1:24	1:34	1:14	1:31
Stamford	Secaucus						0:51		0:53
Boston	Penn Station New York	3:31	4:13	2:54	3:34	2:33	3:15	2:01	2:45
Hartford	Ronkonkoma							0:39	0:42
Boston	Storrs								0:49

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Table 5-21: Annual Intercity One-Way Trips by Representative Station-Pairs for the No Action Alternative and Action Alternatives (2040)

Annual One-Way Trips by Service Type by Station-Pairs		No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Station 1	Station 2				
Washington Union Station	Philadelphia	320,500	358,000	341,600	379,600
Washington Union Station	Penn Station New York	1,191,700	1,263,300	1,357,300	1,485,700
Washington Union Station	Boston	23,200	65,200	65,700	88,000
Washington Union Station	Newark, DE	0	21,900	23,300	48,000
Philadelphia	Odenton	0	14,800	29,300	29,800
Penn Station New York	Baltimore	214,200	219,800	232,500	267,600
Penn Station New York	Wilmington	188,200	204,800	222,600	187,900
Ronkonkoma	Baltimore	0	0	0	15,028
Penn Station New York	Philadelphia	1,201,600	1,465,600	1,525,900	1,558,900
Boston	Philadelphia	53,600	121,600	129,000	164,500
Nassau Hub	Trenton	0	0	0	1,900
Danbury	Newark Penn Station	0	0	0	1,200
New Haven Station	Newark Penn Station	1,700	4,200	1,200	1,200
Stamford	Secaucus	0	0	200	200
Boston	Penn Station New York	492,200	1,224,500	1,355,000	1,294,300
Hartford	Ronkonkoma	0	0	0	10,000
Boston	Storrs	0	0	0	25,700

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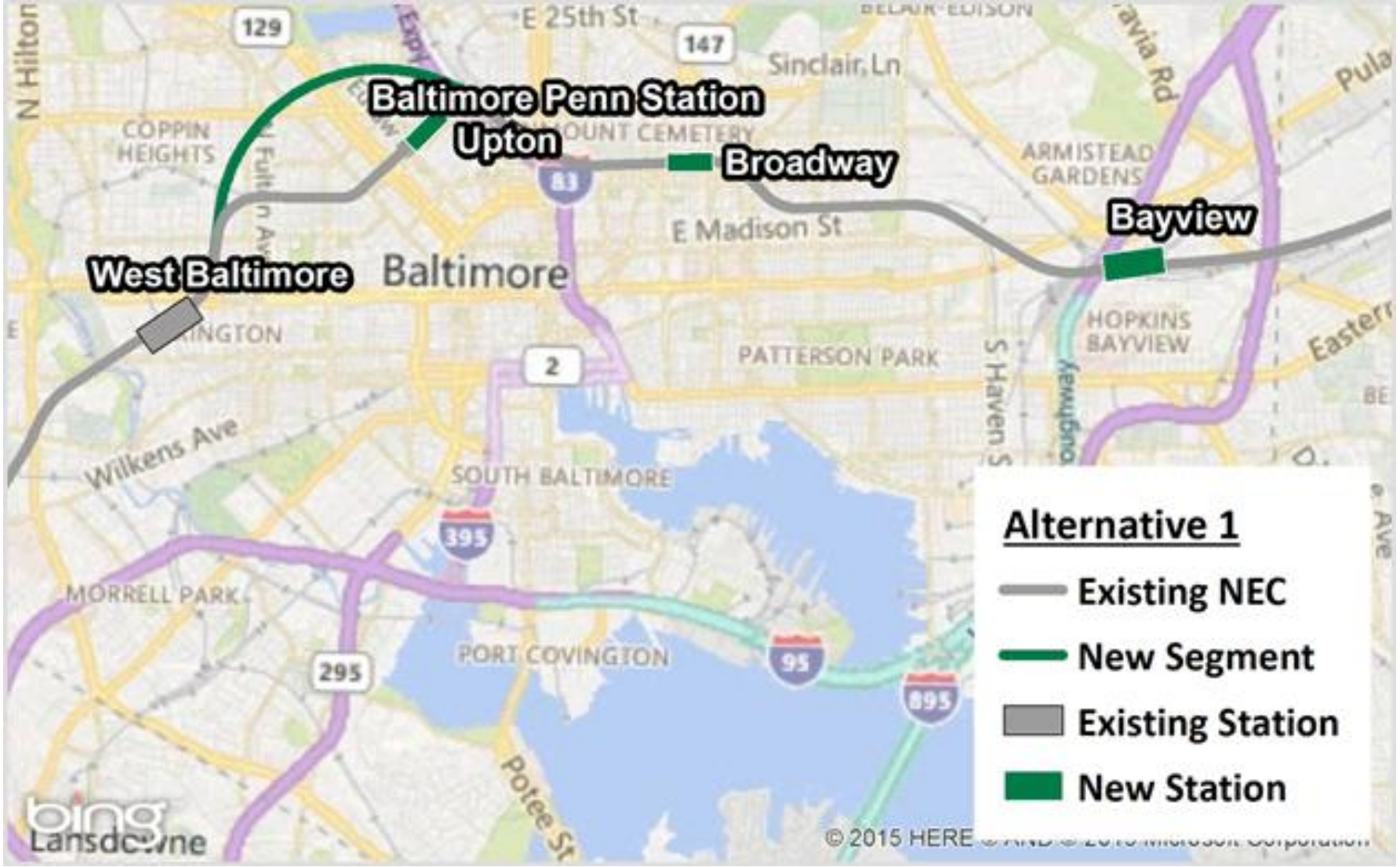

- New 2 mile segment for new 4 track Baltimore tunnel west of Penn Station
  - arching path under US 1 (North Av), south of Druid Hill Park, under I-83
- 4 new stations in MD: 3 in Baltimore – Upton, Broadway, Bayview; Elkton
- Upgrade Odenton & West Baltimore stations
- Chokepoint relief: New Carrollton 4 platform tracks – separates express/local
- New track: 4th track Odenton:Halethorpe, add tracks Bayview:Newark, DE

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New 23 mile segment Aberdeen to Newark, DE – aerial parallel US 40, at grade through North East, MD, to north side of I-95 in E Cecil

New track: 3rd track DC:New Carrollton; 4th track New Carrollton:Halethorpe and Bayview:Perryville

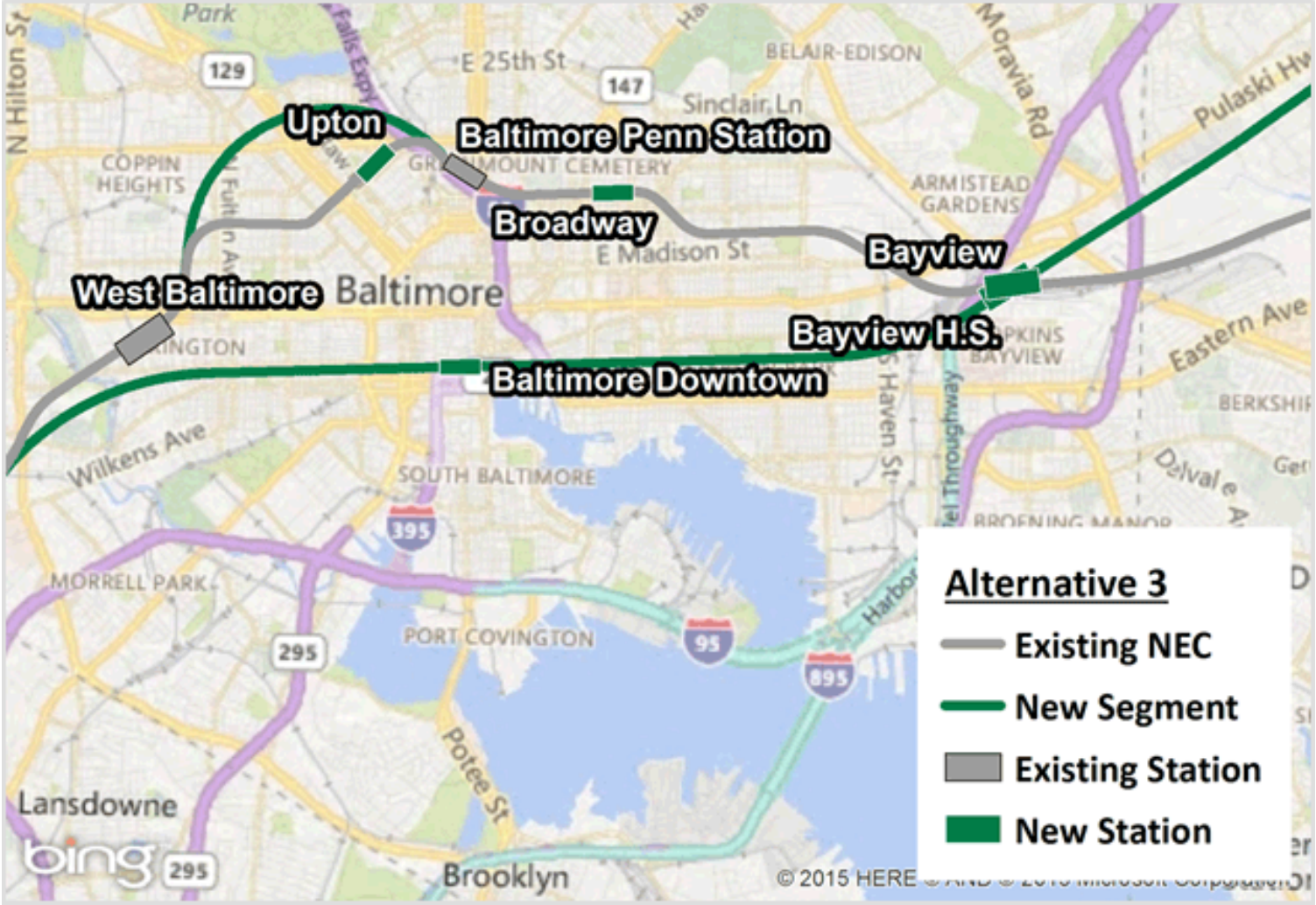
Track shifts: 300 ft in Baltimore City, E of Penn Station to east of I-895; 500 ft shift Baltimore & Harford centered on Gunpowder River; 250 ft shift east of Aberdeen station

New Stations

BWI HS

Baltimore downtown

Bayview HS



Exits Union Station next to existing NEC in tunnel until E of Bladensburg Road, generally runs at-grade or on embankment through Md

- 1,000 foot shift for short distances near Odenton and BWI Rail Stations
- shifts east of the existing NEC in tunnel through downtown Baltimore and north of the Inner Harbor
- at-grade near I-895 on the west side of Baltimore, through Rossville and White Marsh, parallel to US 40 through Edgewood and Riverside
- shifts closer to existing NEC near Aberdeen Proving
- shifts away from existing NEC near Perryville, parallels US 40

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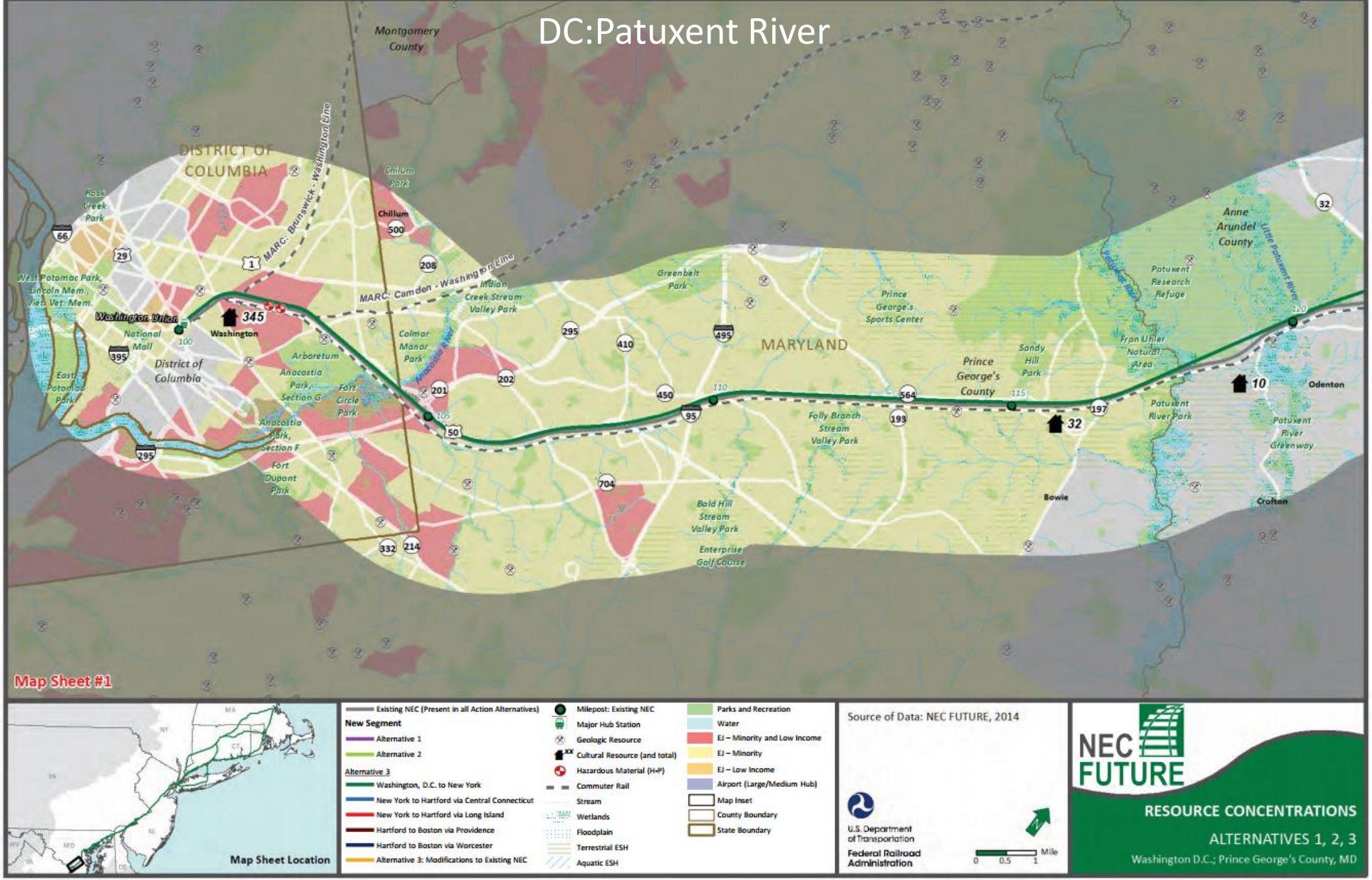
DC:Patuxent River



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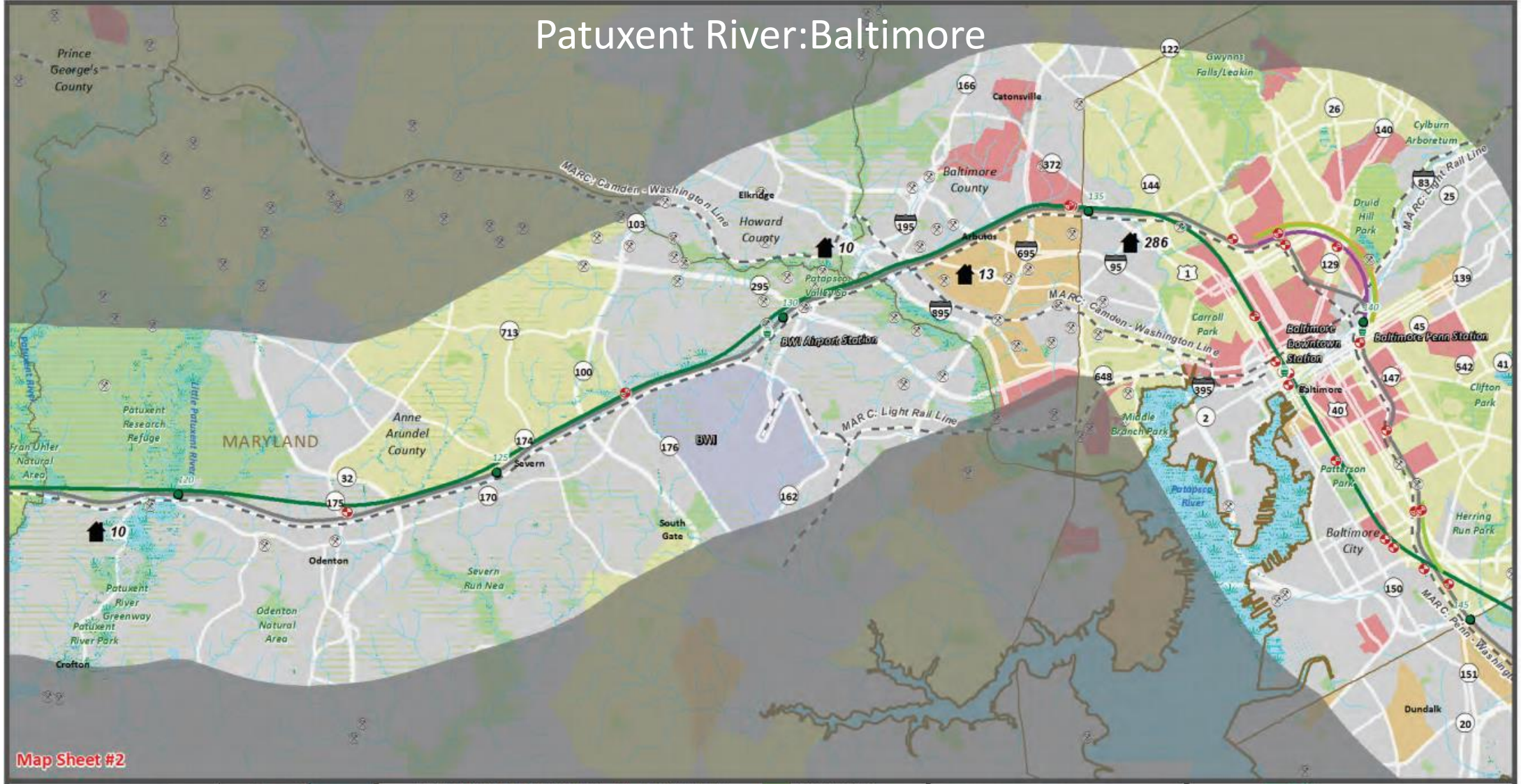
Patuxent River:Baltimore



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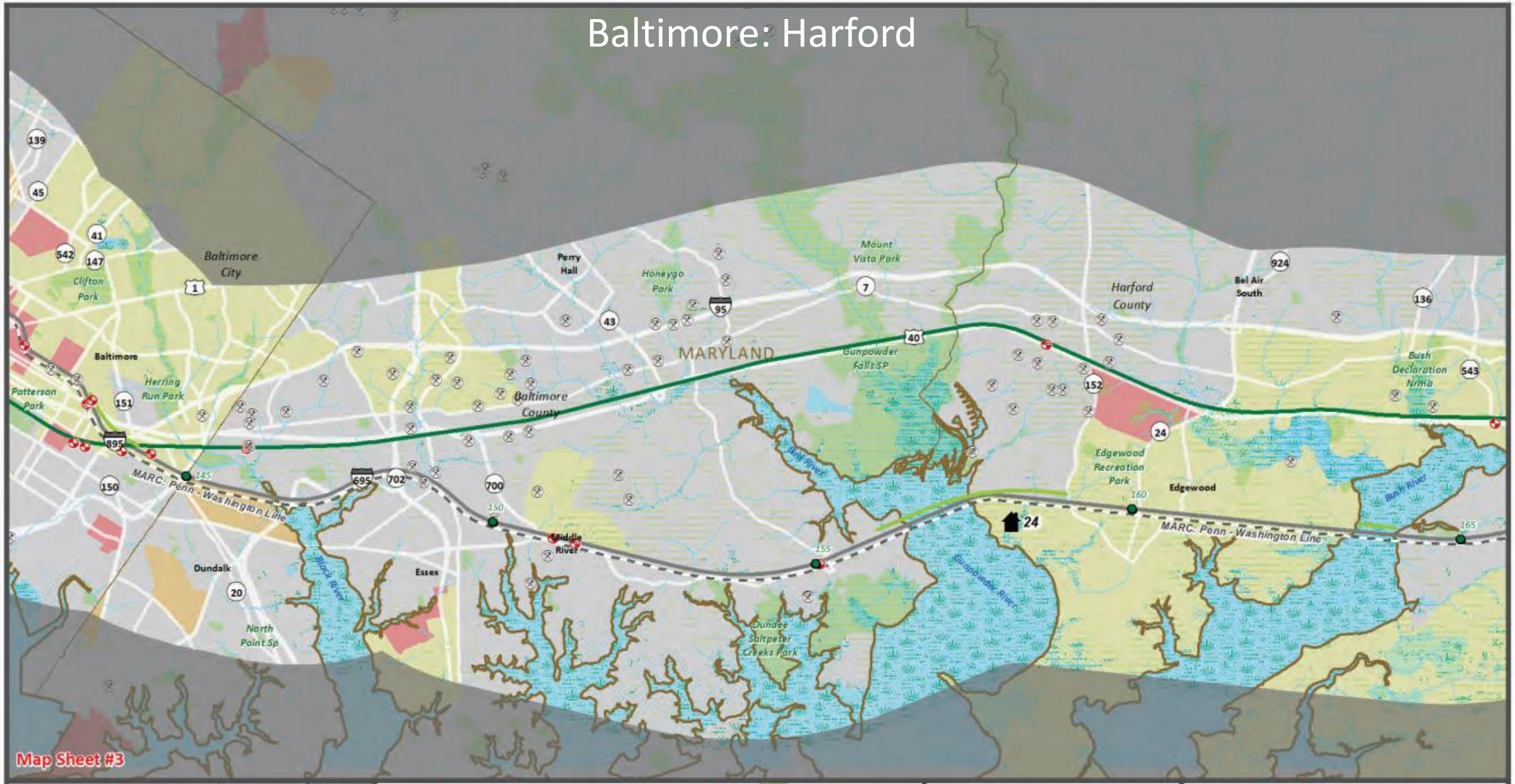
Baltimore: Harford



Existing NEC (Present in all Action Alternatives)

New Segment
- Alternative 1
- Alternative 2

Alternative 3
- Washington, D.C. to New York
- New York to Hartford via Central Connecticut
- New York to Hartford via Long Island
- Hartford to Boston via Providence
- Hartford to Boston via Worcester
- Alternative 3: Modifications to Existing NEC

- Milepost: Existing NEC
- Major Hub Station
- Geologic Resource
- Cultural Resource (and total)
- Hazardous Material (H+P)
- Commuter Rail
- Stream
- Wetlands
- Floodplain
- Terrestrial ESH
- Aquatic ESH

- Parks and Recreation
- Water
- EJ – Minority and Low Income
- EJ – Minority
- EJ – Low Income
- Airport (Large/Medium Hub)
- Map Inset
- County Boundary
- State Boundary

Source of Data: NEC FUTURE, 2014

U.S. Department of Transportation
Federal Railroad Administration

0 0.5 1 Mile

NEC FUTURE

RESOURCE CONCENTRATIONS

ALTERNATIVES 1, 2, 3

Baltimore City, Baltimore County, MD

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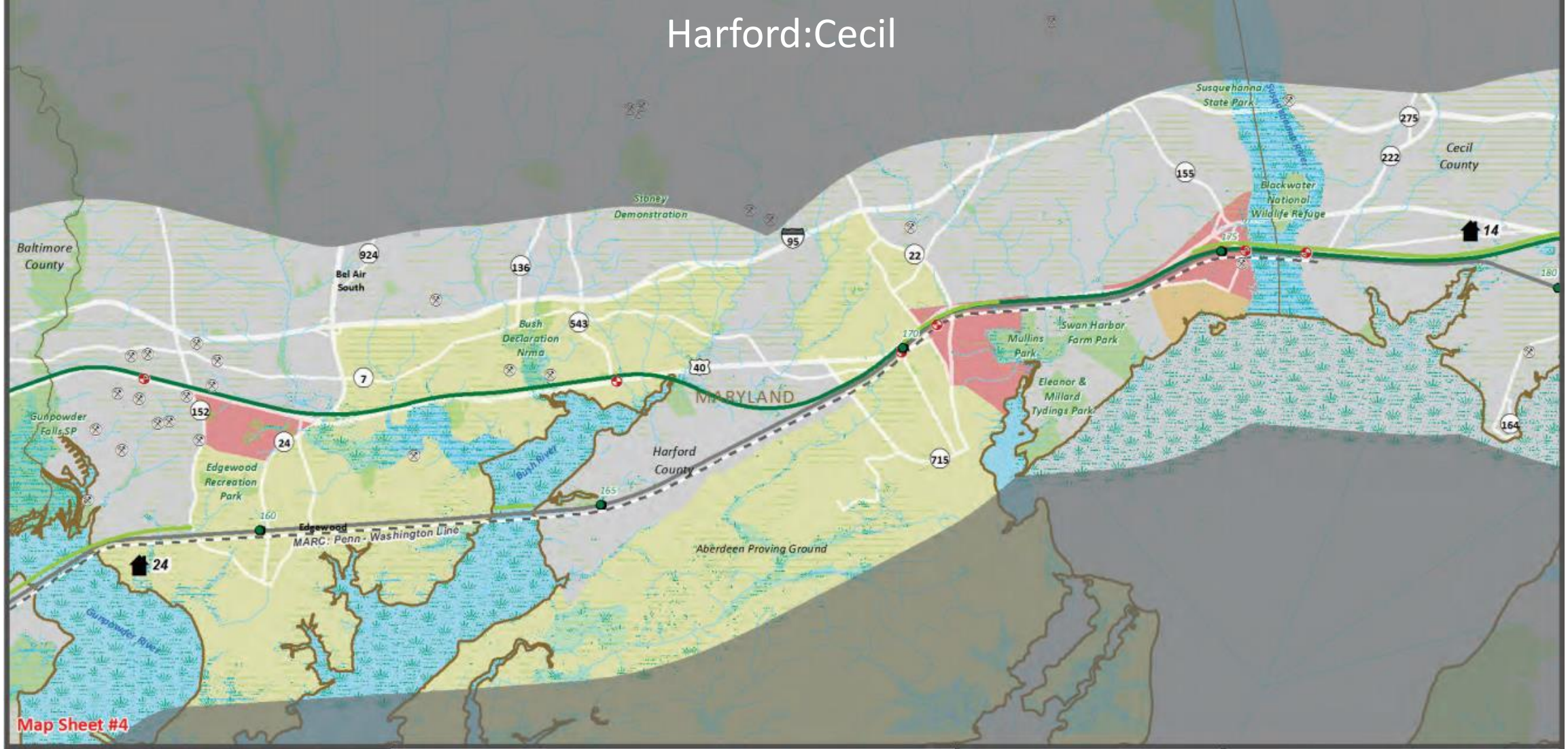
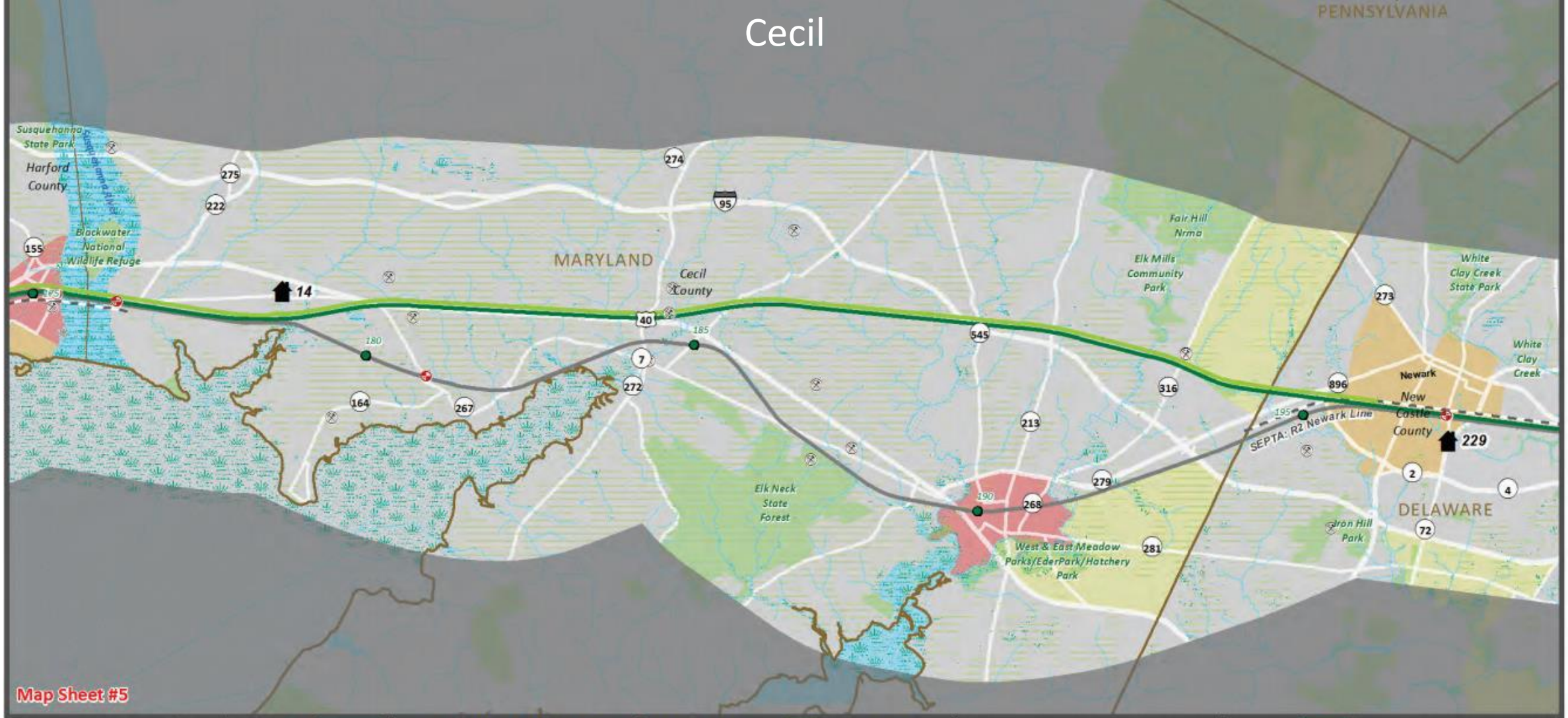
Harford:Cecil



EESI

Cecil



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Source of Data: NEC FUTURE, 2014

U.S. Department of Transportation
Federal Railroad Administration

Mile
0 0.5 1

NEC FUTURE

RESOURCE CONCENTRATIONS

ALTERNATIVES 1, 2, 3

Cecil County, MD

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THANK YOU!

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