

# Southwest Rail Conference 2019

## Planning and Design for High Performance

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**ARUP**

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# What is High Performance?

## DEFINITIONS

- High: Great, or greater than normal, in quantity, size, or intensity.
- Performance: The process of carrying out an action, task, or function.
- Transportation: A system or means of moving people or goods.

Simply put, a **high-performance rail system must move people better.**

- Convenient, reliable, and frequent service
- Safe and efficient operations
- Stations integrated into development

This requires:

- A focus on the customer.
- Application of corridor appropriate technology and service offerings.

*"If you do what you've always done, you'll get what you've always gotten." - Tony Robbins*

# Is the Customer Always Right?

One woman who frequently flew on Southwest was constantly disappointed with every aspect of the company's operation.

She didn't like the fact that the company didn't assign seats; she didn't like the absence of a first-class section; she didn't like not having a meal in flight; she didn't like Southwest's boarding procedure; she didn't like the flight attendants' sporty uniforms and the casual atmosphere.

Herb Kelleher wrote back and said, "Dear Mrs. Crabapple, We will miss you. Love, Herb."

- Understand what customers want.
- Understand how customers will interface with the system.
- Understand that customer expectations and reliance on systems for information is ever increasing.
- Understand that things will evolve and design must be flexible.



*"Quality in a product or service is not what the supplier puts in. It is what the customer gets out and is willing to pay for." - Peter Drucker*

# Evolving Customer Demands



## Metro outreach heard four distinct themes:

- **Connections:** More transit connections to more destinations.
- **Speed & Reliability:** Expand the network with frequent transit routes that attract high ridership.
- **Customer Experience:** Deliver a safe, flexible, and high-quality transit experience.
- **Innovation:** Utilize advanced technologies to meet passenger needs.



**MORE TRANSIT, MORE PLACES**  
Expansion of METRO's current transit system, including light rail, commuter, and local bus routes



**SPEED AND RELIABILITY**  
Buses and trains that are on time, have fewer stops, and come more frequently



**COMMUTER SERVICE**  
Long-distance buses or rail that go to more places



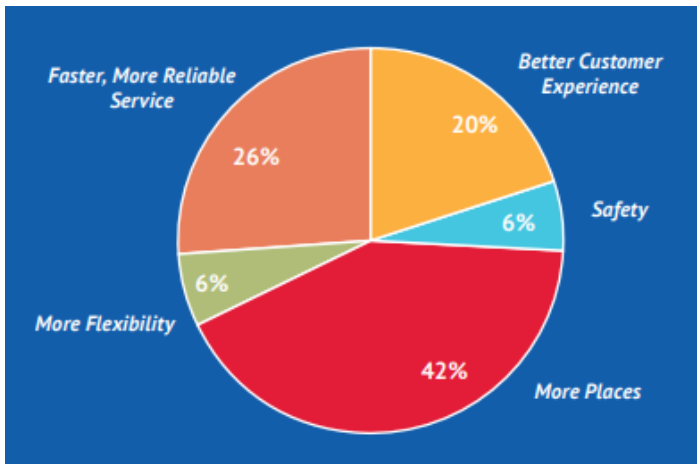
**ACCESSIBILITY**  
Sidewalks, ramps, and transit stops that are accessible for all



**FREQUENCY**  
Buses and trains that arrive more often



**DEDICATED LANES**  
Trains and buses that are separated from other vehicles

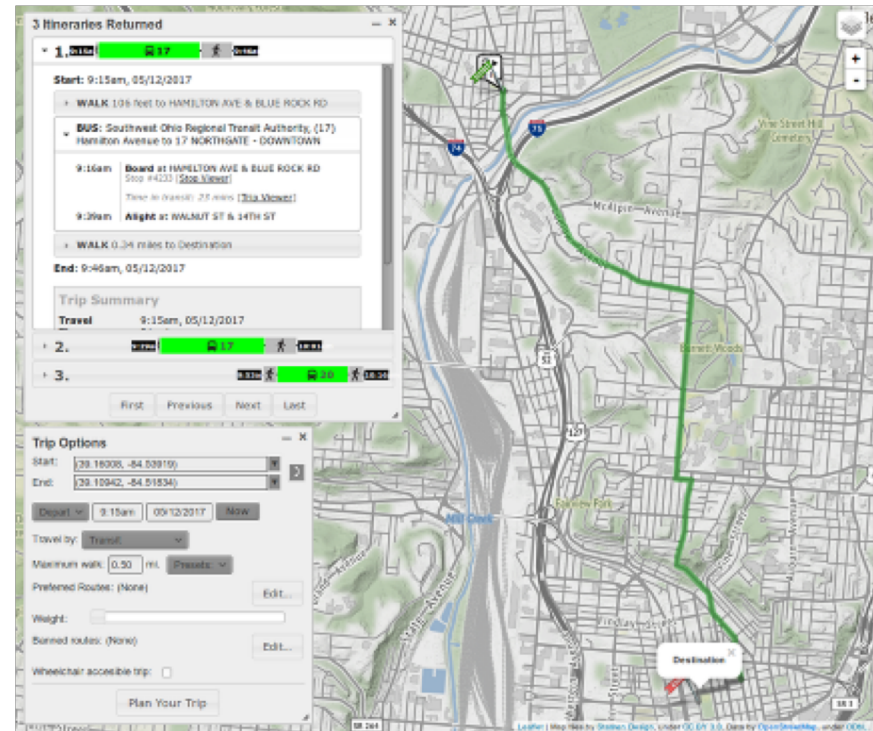


Source: METRO Next - Public Involvement Phase I Brochure - January 2019

# Expectations: Trip Planning Tools

A **journey planner, trip planner, or route planner** is a specialized search engine to find optimal means of travelling between locations, sometimes using more than one transport mode.

The growth of the Internet, the proliferation of geospatial data, and the development of information technologies generally has led to the **rapid development of self-service browser-based on-line intermodal trip planners.**



OpenTripPlanner transit journey route by transit.



# Expectations: Integrated Mobility Platforms

## Mobility as a Service (MaaS)

- Account based smart cards
- Contactless systems
- Multi-modal trip planning
- Routing options
- Scheduling and alerts
- Open source solutions



**Mobility on Demand (MOD)** working group formed by NCTCOG in January 2017.



## Open source solutions for Smart Cities

- Tolling
- Smart parking
- Electric vehicle charging

# Expectations: On Request Services



To advance a vision of mobility on demand promoting *safe, carefree, and reliable transportation for everyone.*

- Integrated Mobility Innovation
- Mobility on Demand (MOD) Sandbox
- Strategic Transit Automation Research (STAR)
- Mobility Payment Integration (MPI)
- Accessible Transportation Technologies Research Initiative (ATTRI)

# Is Uber a Help to Transit?

“Is Uber a substitute or complement for public transit?”

Key Study Conclusions:

- Uber and other ride-hailing companies have **changed how people get around in cities.**
- Uber’s entry **increases public transit use** for the average transit agency and that the **effect grows over time.**
- Customers are using Uber to **circumvent the fixed-route, fixed-schedule problem.**
- Uber has a **large complementary effect on rail ridership and a negative effect on bus ridership.**

Jonathan D. Hall, University of Toronto; Craig Palsson, Utah State University; Joseph Price, Brigham Young University and NBER. October, 2018.

“Is Uber a substitute or complement for public transit?”

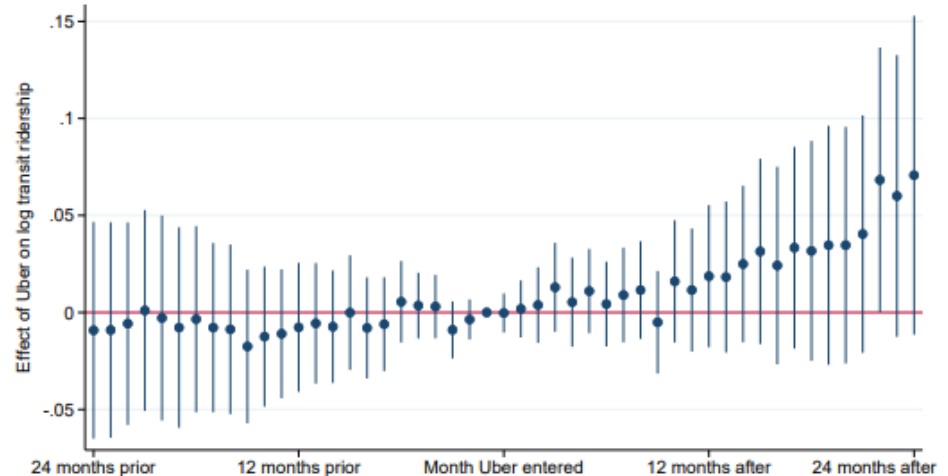


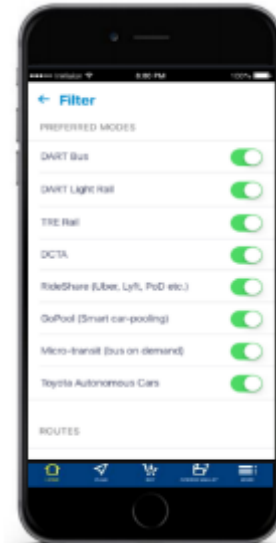
Figure 6: Effect of Uber on log transit ridership before and after entry



# Solving the First and Last Mile Problem



- Roughly 25% of residences and jobs more than ¼ mile from transit in DART service area.
- NCTCOG and DART at the forefront of new technology solution.
- DART integrating GoPass ticketing app with Transportation Network Companies
  - Improve service and connectivity for customers.
  - More efficient and cost effective operations.
- Smart-app switching to request and pay for rides.
  - GoTaxi – Taxi-services with wheelchair accessible services
  - GoLink – Microtransit services and on-demand services
  - GoPool – Carpool services
  - GoConnect – DART public on-demand and TNC services
  - GoBike – Bike sharing



*Integrated Ticketing, Payment, and Mobility Options.*

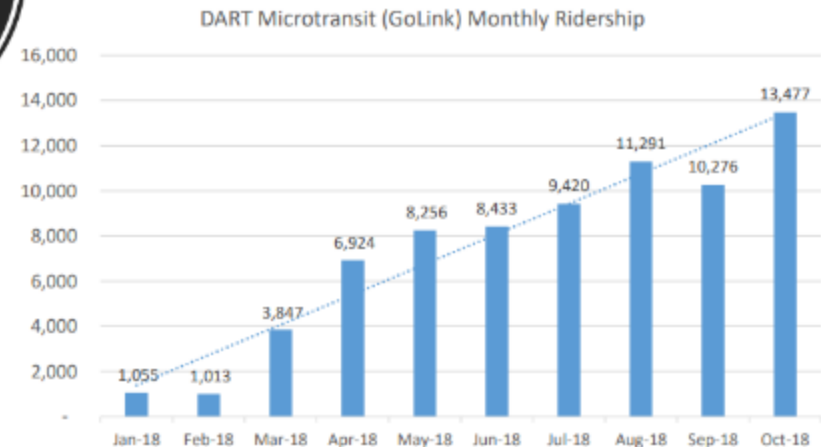
# Combined Effect

- Ride hailing services are becoming more intertwined with mass transit.
- 95.5% of weekly rideshare riders utilize public transit
- 9.2% using rideshare instead of transit
- “..learn from and operate in partnership with new mobility options...by implementing the...convenience features found in ridesharing...and integrating multiple transit modes to deliver full first-last mile mobility.” Brian Zanghi, CEO of Masabi

Source: Patrick Sisson, Curbed, May 2018.  
“Are Uber and Lyft helping or hurting public transit?”

## Since DART Initiated GoLink Service Ridership has exploded

- Significant ridership increases in areas with service gaps
- Decrease in call volumes due to app usage
- Substantial decline in dispatch activity
- Service provided with 10 minutes of request in all zones



# Corridor Appropriate Technology and Services

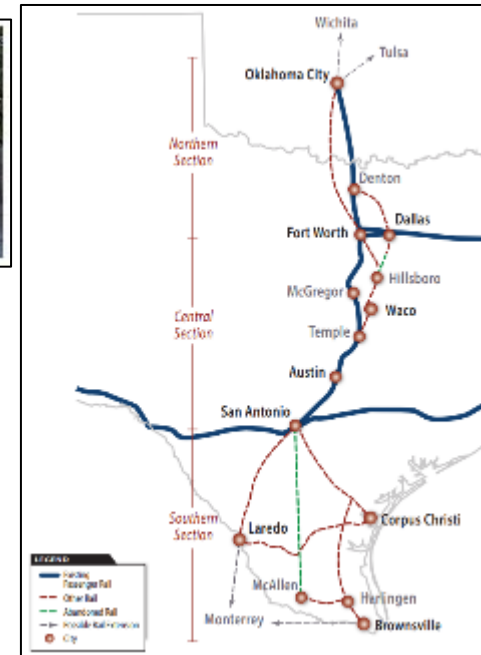
Numerous planning projects underway to develop, expand, or improve rail systems and services in the Southwest Region



DART D2 and Platform Extensions



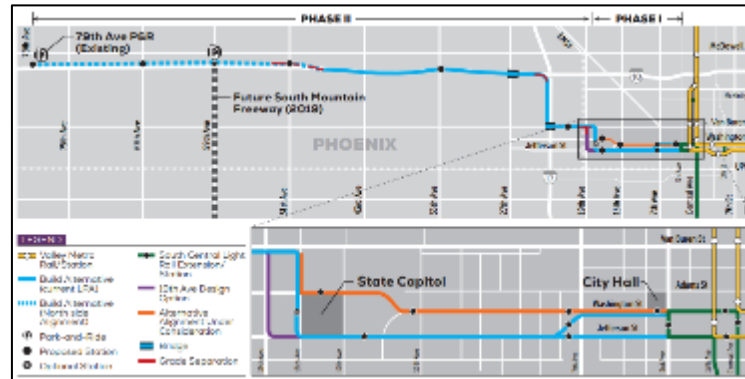
Capital MetroRail Downtown Station



New High Speed Rail Systems



Rio Metro Fleet Enhancements



Phoenix Light Rail Extensions

# Lessons Learned from Focus on HSR

## China

- Over 12,500 miles of HSR, more than rest of world.
- More than half the passengers are “generated traffic”.
- Key Goals:
  - Locate stations where development desirable.
  - Cap size of cities so they are easier to manage
  - Connect mid size cities with HSR.
  - Expand labor pool for cities.
  - More affordable housing for employees.
  - Technology and investment spread to rural areas.



## Spain

- Europe’s most extensive high-speed network at 2,010 miles.
- Connect big cities with large population centers and attractions.
- Helped Spain boost its technological capacity, improve its manufacturing efficiency, and export its expertise.
- High ticket prices and low ridership on many lines.
- Revenue does not cover infrastructure costs.

OECD estimates 90% more expensive to build for 205mph than 186 mph.

China and Spain slowed trains to 190 mph for safety and O&M costs, but both designed primarily for 215 mph.

## SOURCES:

The Economist – January, 2017. “China Has Built the World’s Largest Bullet Train Network”

Sheehan, Fresno Bee, September 2015. How Spain’s high-speed rail offers lessons for California’s project”

# High Performance Rail

- The U.S. must focus on high-performance rail (HPR) not high-speed rail (HSR).
- Public generally unwilling to support a system they perceive as fast trains for business people and tourists.
- Efficient, reliable, and comfortable systems that get passengers to their destinations, as one well-integrated component of an overall journey.
- Choosing appropriate rail solutions by corridor is the key to success, with thoughtful phasing to deliver tangible early gains and long-term potential.
- Measure system performance in terms of ride quality, capacity, frequency, reliability, safety, security, on time performance, amenities, station environments, multimodal connectivity, and speed.

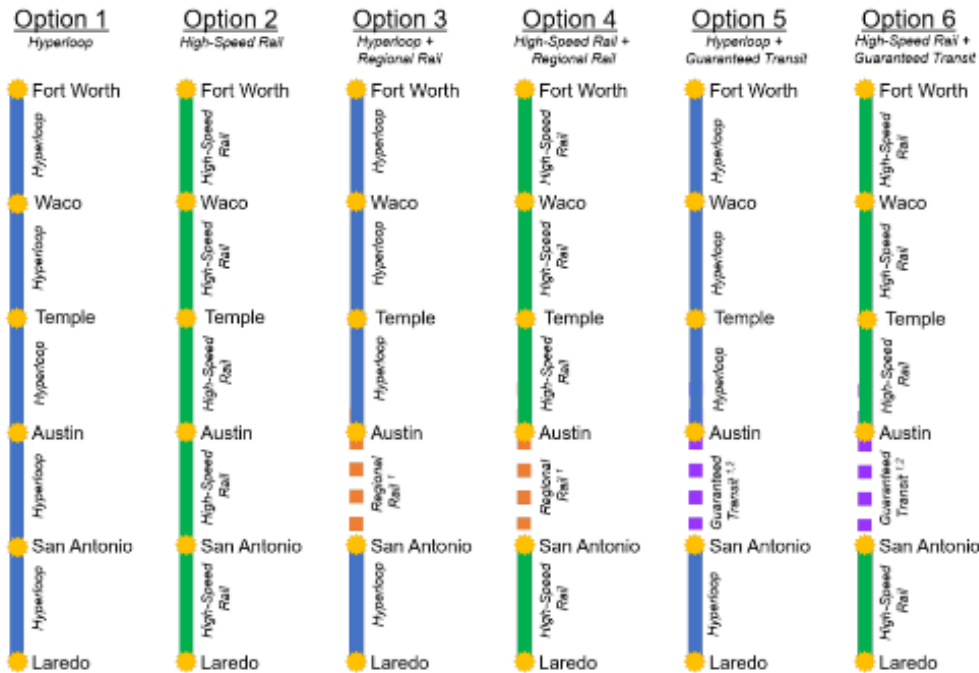
Source: “Speed thrills, but performance wins” Christopher Taylor, Railway Age October 2011

# Corridor Specific Solutions

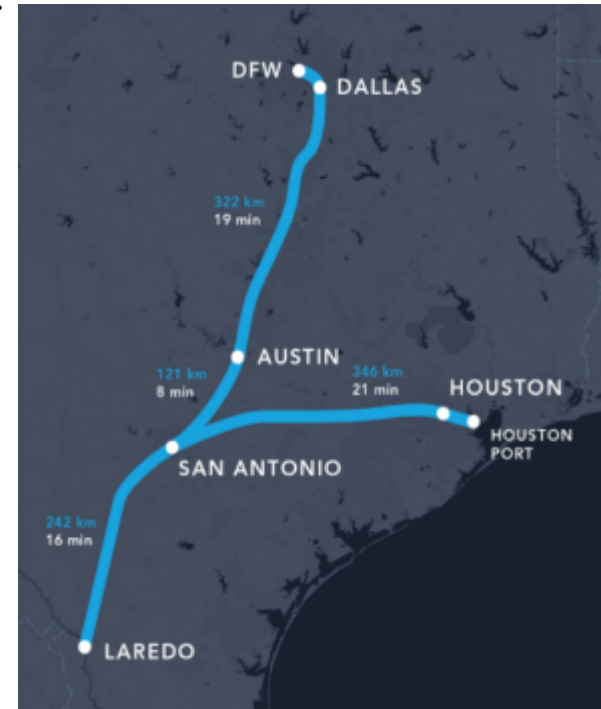
## NCTCOG RFP - October 2018: FORT WORTH/WACO/TEMPLE-KILLEEN/AUSTIN/SAN ANTONIO/LAREDO HIGH-SPEED TRANSPORTATION STUDY

- Need to study corridor and segment specific technology solutions.
  - Hyperloop, high-speed rail, regional rail, and transit.
- Need for multimodal transfers and staged implementation.

### Brainstorming High-Speed Passenger Service Examples

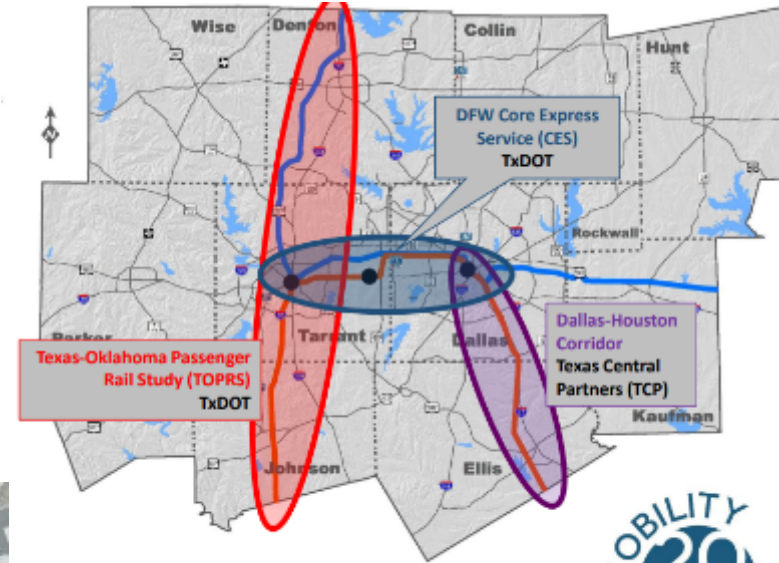


Notes:  
 1. Regional rail and guaranteed transit would have more frequent stops  
 2. Guaranteed transit would be dedicated next generation transit vehicles operating on the managed lanes on IH 35



# High Speed or High Performance in North Texas?

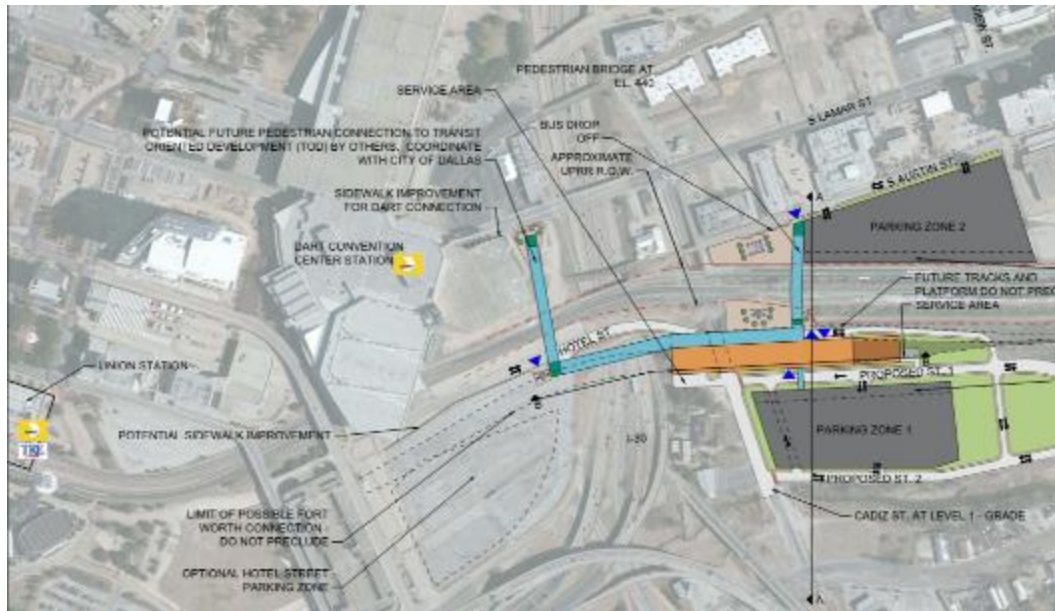
- Dallas-Houston being planned for true HSR.
- Laredo to Oklahoma City technology neutral.
- Dallas-Fort Worth not precluded by Texas Central for possible one seat ride.
- TRE commuter rail connection between Dallas and Fort Worth. Possible upgrade of TRE and mode transfer.
- Existing DART light rail and bus lines nearby.
- Significant redevelopment potential.



Corridor-specific alignment, design, and operational characteristics for the intercity passenger, regional passenger, and freight rail systems will be determined through capacity evaluation and ongoing project development. Refined rail forecasts are necessary to determine technology and alignment in future rail corridors.

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Source: Dallas-Fort Worth High Speed Rail Industry Forum.  
June 20, 2016



Source: Texas Central Final Draft Conceptual Engineering

# What is Important?

Based on University of California at Berkeley study, 5 of the top 8 reasons people give up on transit are related to experience at stations and transfer points.

1. Delayed on board due to transit vehicles backed up or problems on the transit route downstream.
- 2. Experienced long wait at a transfer stop.**
- 3. Missed departure due to wrong real-time information.**
- 4. Unable to board or denied boarding due to crowding.**
5. Delayed on board due to emergency or mechanical failure.
- 6. Experienced long wait at origin stop.**
- 7. Ran to stop but the bus or train pulled away.**
8. Delayed on board due to traffic.

Source: “Top Eight Reasons People Give Up on Public Transit.” Forbes. Jeff McMahon. March 2013.



# The Whole Journey

The customer experience includes the whole journey from planning the trip, to travel, and to enjoying the stations.

- Interactive journey planning.
- Navigating stations and platforms.
- Comfort and service on the ride.
- Connections for onward travel.
- Incident management.



# Integrated Transfers

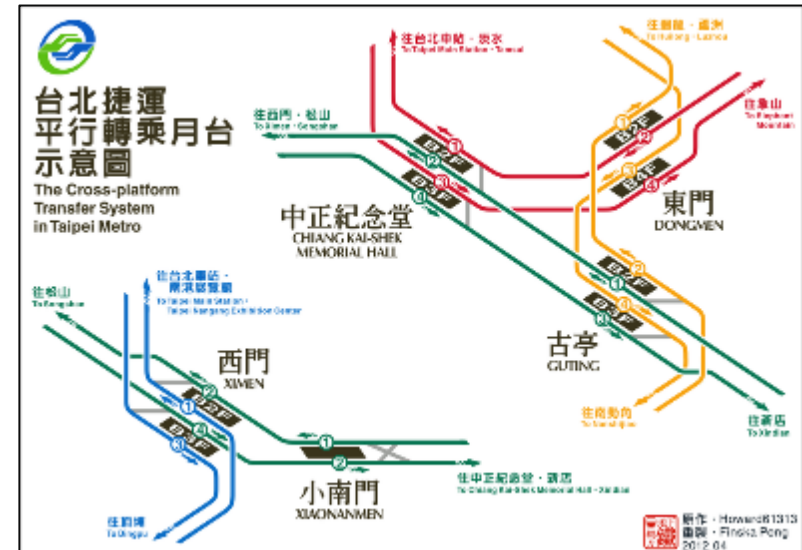
## Cross-platform Interchanges

- Eliminates need for passengers to use vertical circulation for transfer.
- Increased convenience and accessibility.
- At grade crossings bring safety and capacity concerns.
- Flyovers increase efficiency but are costly.
- Consider early with future service possibilities.

## Multi-Modal Interchanges

Consider early with future service possibilities.

- Airport People Mover to Rail or Bus
- Rail to BRT or Bus
- Bus to Uber
- Autonomous vehicle staging areas



Portland Tri Met Multi-Modal Transfers

# Flexible Design

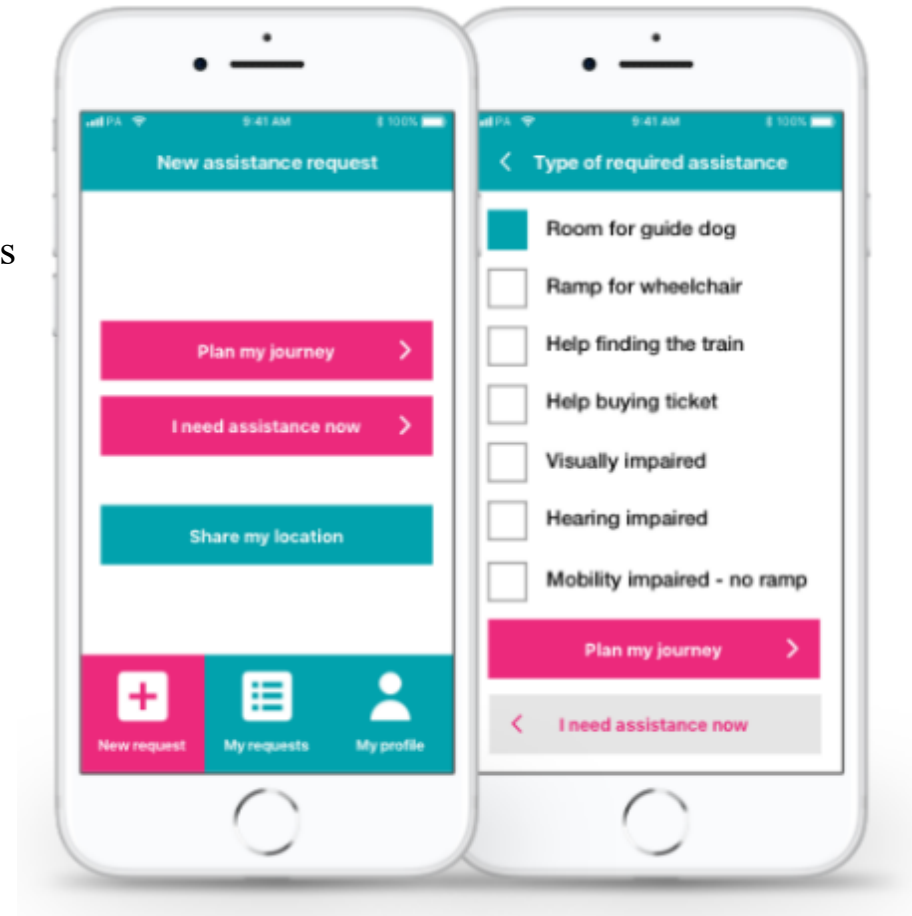
## Arup Shrinking Streets

- LEDs alter the width of pavements based on demand.
- Transfer zone at rush hour, pedestrian plaza at lunchtime, and loading zone overnight.
- Long term possibility for dynamic assignment of curb space linked with intelligent infrastructure.



# Design for Access for All

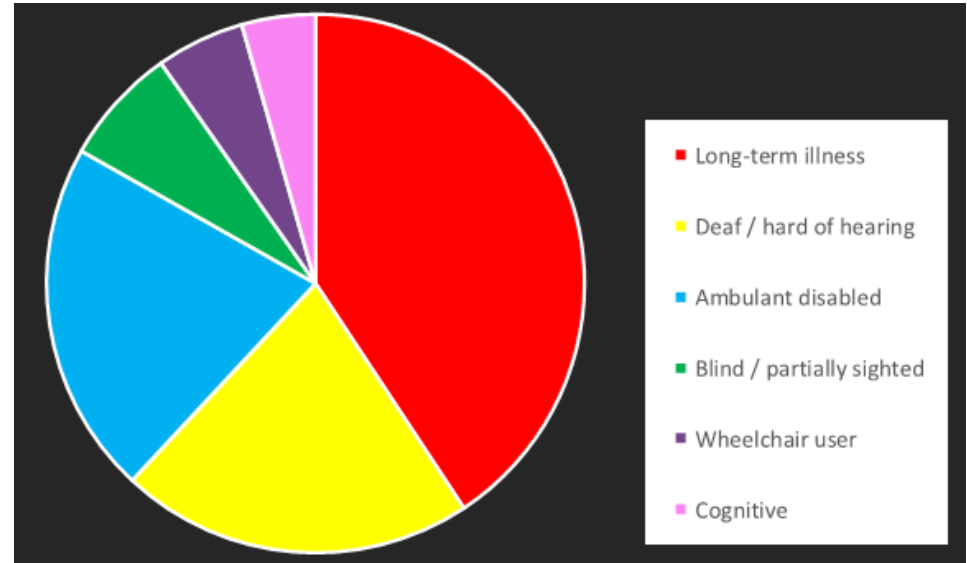
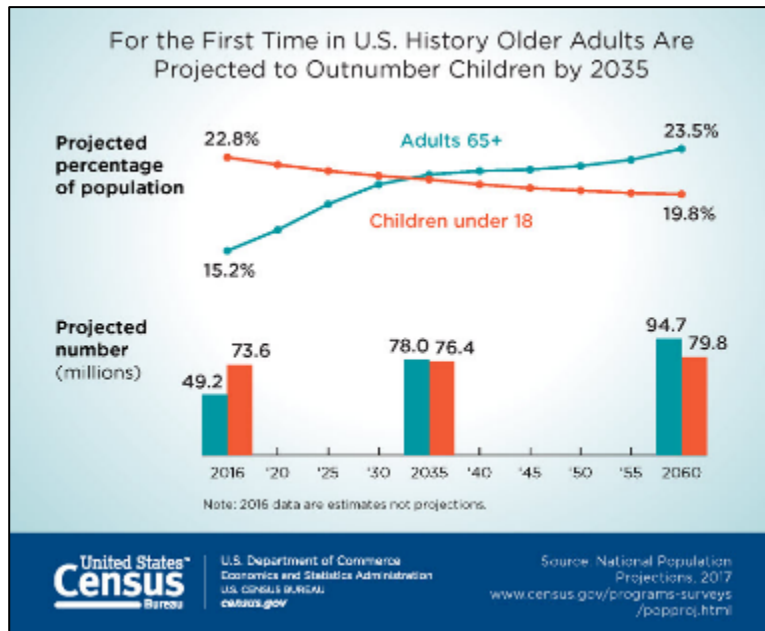
- Train travel can be hassle for disabled passengers
- Wheelchair users often rely on staff to assist.
- New apps under development
- **Passenger Assist** app allows disabled travelers to create unique user profiles including name, photo and special requirements.
- Wheelchair users can request a ramp.
- Hearing or visually impaired passengers can request help for ticketing and transfers.
- Can track both staff and passengers.
- Can identify train traveling in to preempt and resolve issues.
- Can report on issues.



# Accessibility versus Inclusivity

Inclusive environments must be the goal.

- Ambulatory issues and wheelchairs.
- Hearing and vision impaired.
- Cognitive disabilities.
- Travelers and foreign languages.
- The elderly and the young.
- Bariatric design.



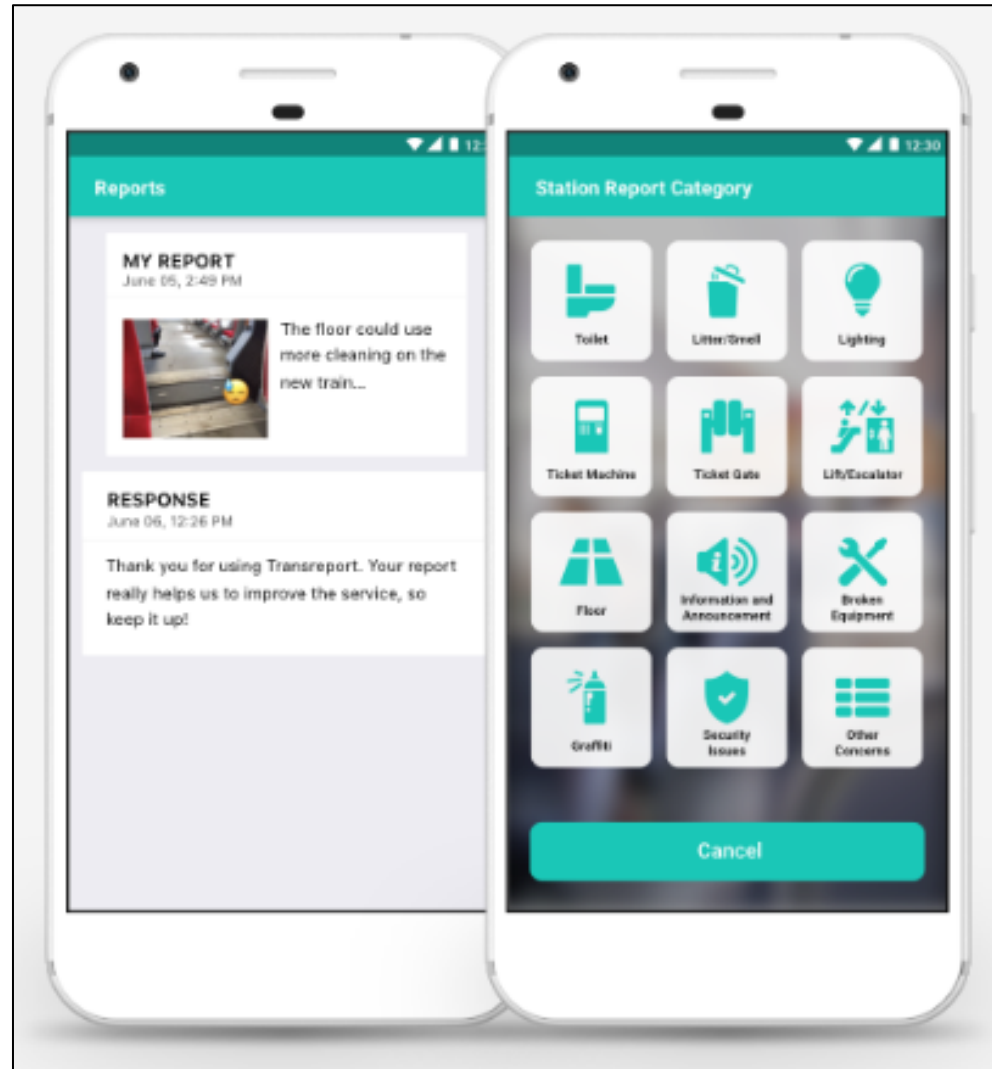
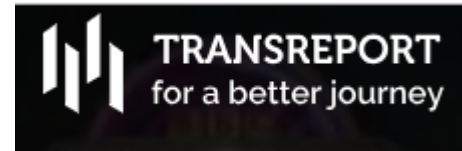
Arup Accessible Environments Team, London

- 19% of the working population is disabled.
- 9% registered caregivers
- 40% of population at retirement age by 2035.
- 45% of retirement age are registered as disabled.

Sources: Disabled Living Foundation.  
Department for Work and Pensions.

# System Management

- **Transreport** app to provide system information in real time.
- Gives a voice to the customers.
- Issues and concerns can be immediately raised to operators.
- Enhances security and safety.
- Enables tracking of issues and feedback.



# Wayfinding

- Interior spaces are complex and ever changing.
- Difficult to navigate large, busy, and noisy spaces.
- Static signage and maps are inadequate.
- Indoor navigation systems.
- GPS repeaters for accurate real time information.
- Bluetooth Low Energy (BLE) beacons for positioning and navigation.
- Audio navigation wayfinding.
- Augmented reality wayfinding.
- Digital Information Display Boards.
- Interactive Display Boards and Digital Maps.



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# Information

- Consistent and recognizable system identify.
- Low maintenance design - vandal and graffiti proof.
- Integrated systems elements for ease of technology upgrade.



*Ethnography - observing behaviour rather than asking about it.*

*Futurology - monitoring long term trends to predict what will be needed/*



# A New Digital Environment

## RAIL INDUSTRY CHALLENGES:

### External Factors

- Modal competition, old (air, road) and new (e.g. autonomous vehicles)
- Urbanization
- Government funding, subsidy & economic shocks
- Increasing customer expectations
- Climate Change & Environmental Resilience

### Rail Industry Factors

- Ageing, complex asset base
- Capacity constraints
- High capital cost
- Aversion to risk
- Disruption management



## WHAT CAN TECHNOLOGY HELP US ACHIEVE:



Launch new digitally-enabled **services**, customer information and ticketing



Move passengers and freight **sustainably**



Anticipate and adapt to significant regulatory, technological and societal **change**



Convert data into intelligence, to better manage asset **performance and risk**

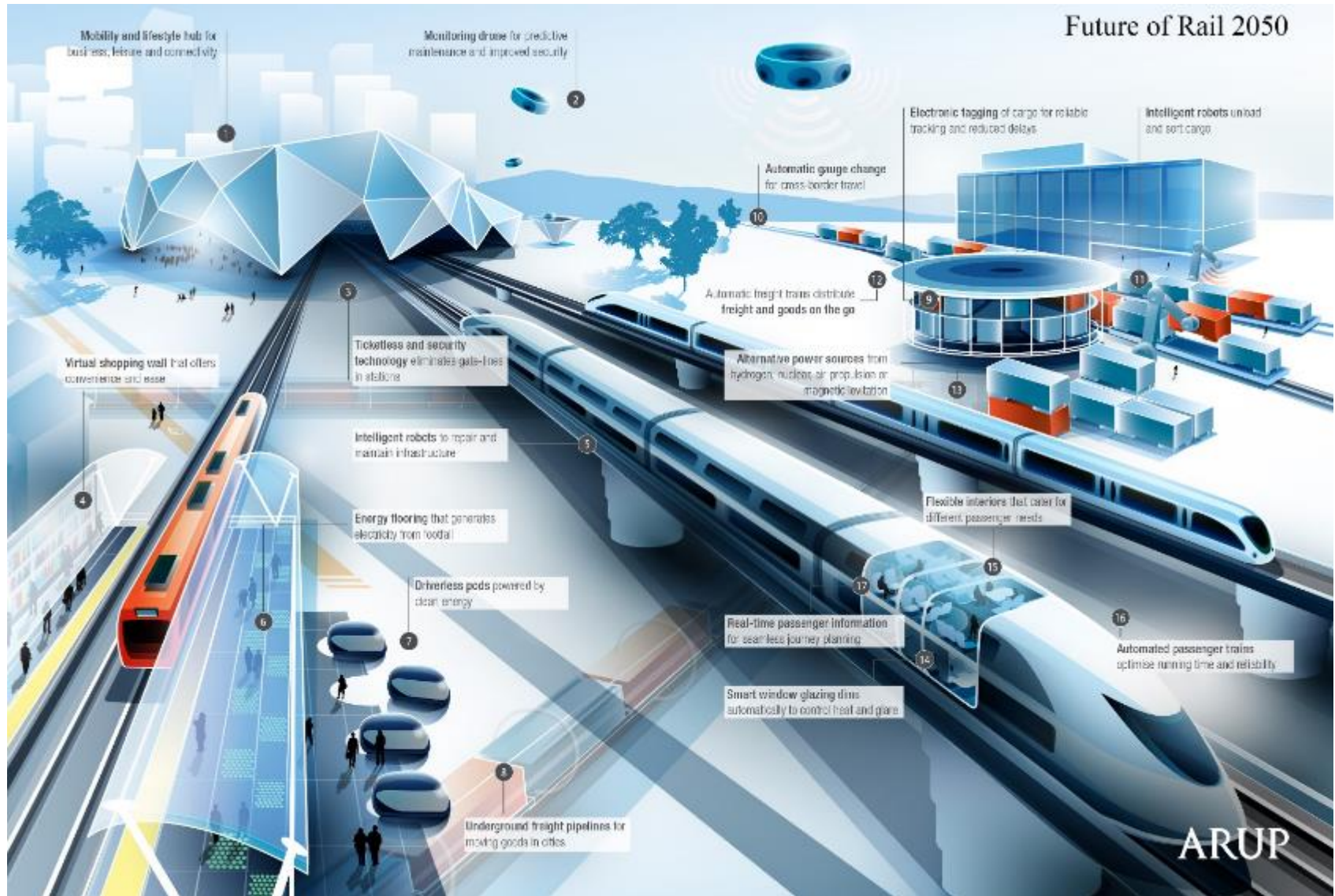


Plan & implement industry strategy via an innovative & agile **culture**



Disruptive **productivity improvement** through innovation and new technology adoption

# Technology Oriented Design – the new TOD



# Stations as a Destination

- Train stations are not just a starting point, they're a destination and a “public place”.
- Stations that integrate retail and multi-modal transportation are critical to passenger attraction and retention.
- Tourists and locals head to mass transit stations to shop, dine, or enjoy leisure activities.
- Stations designed for customers, commuters and visitors, staff, businesses, and local communities.

*St. Pancras station is used by ~40 million people a year, yet a quarter of the station's visitors don't board a train.*



# Liverpool Street Station, London England



Local and Regional Commuter Station

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# Euston Station, London England, HS2

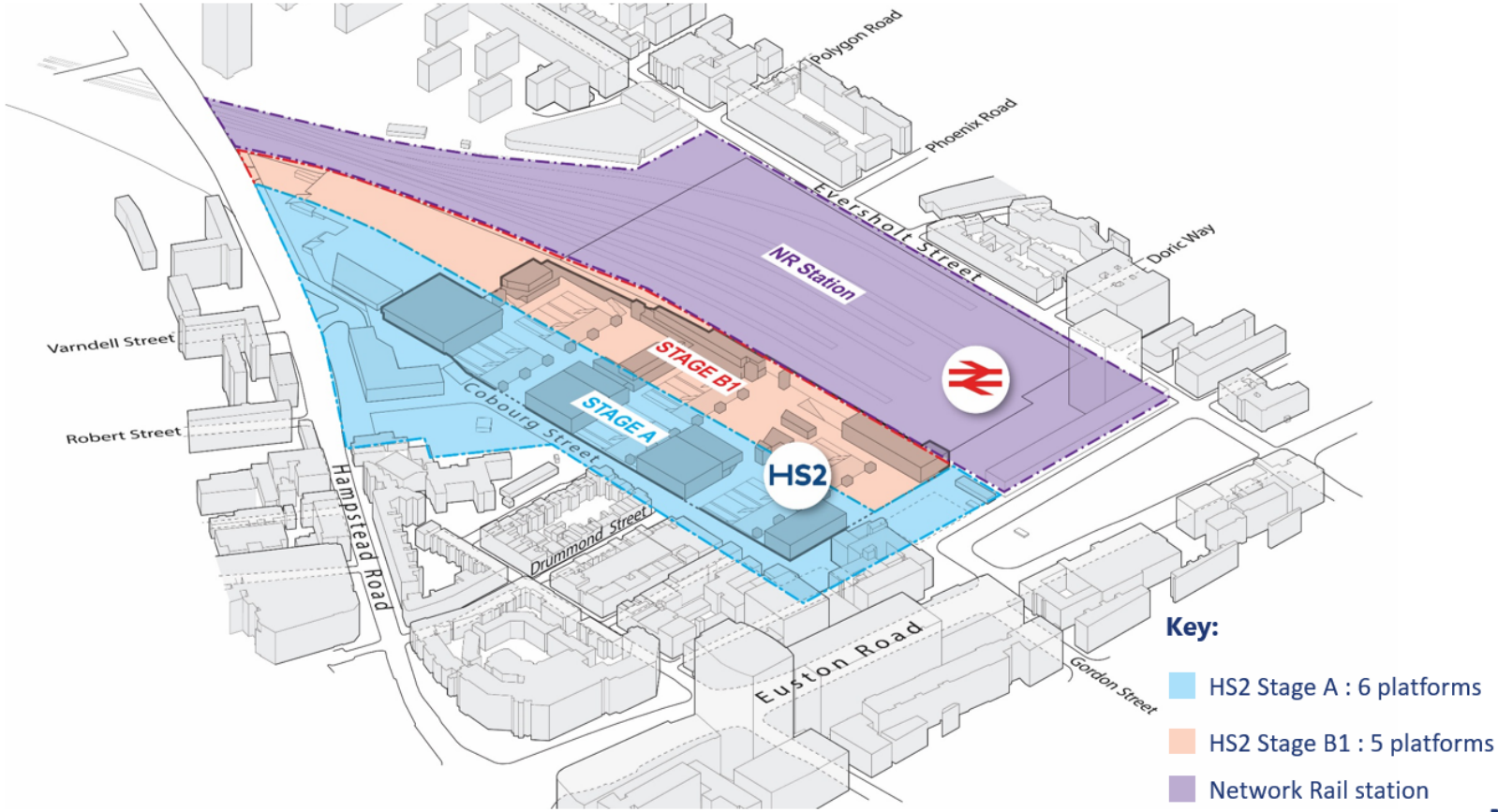


Multimodal High Speed Rail Station

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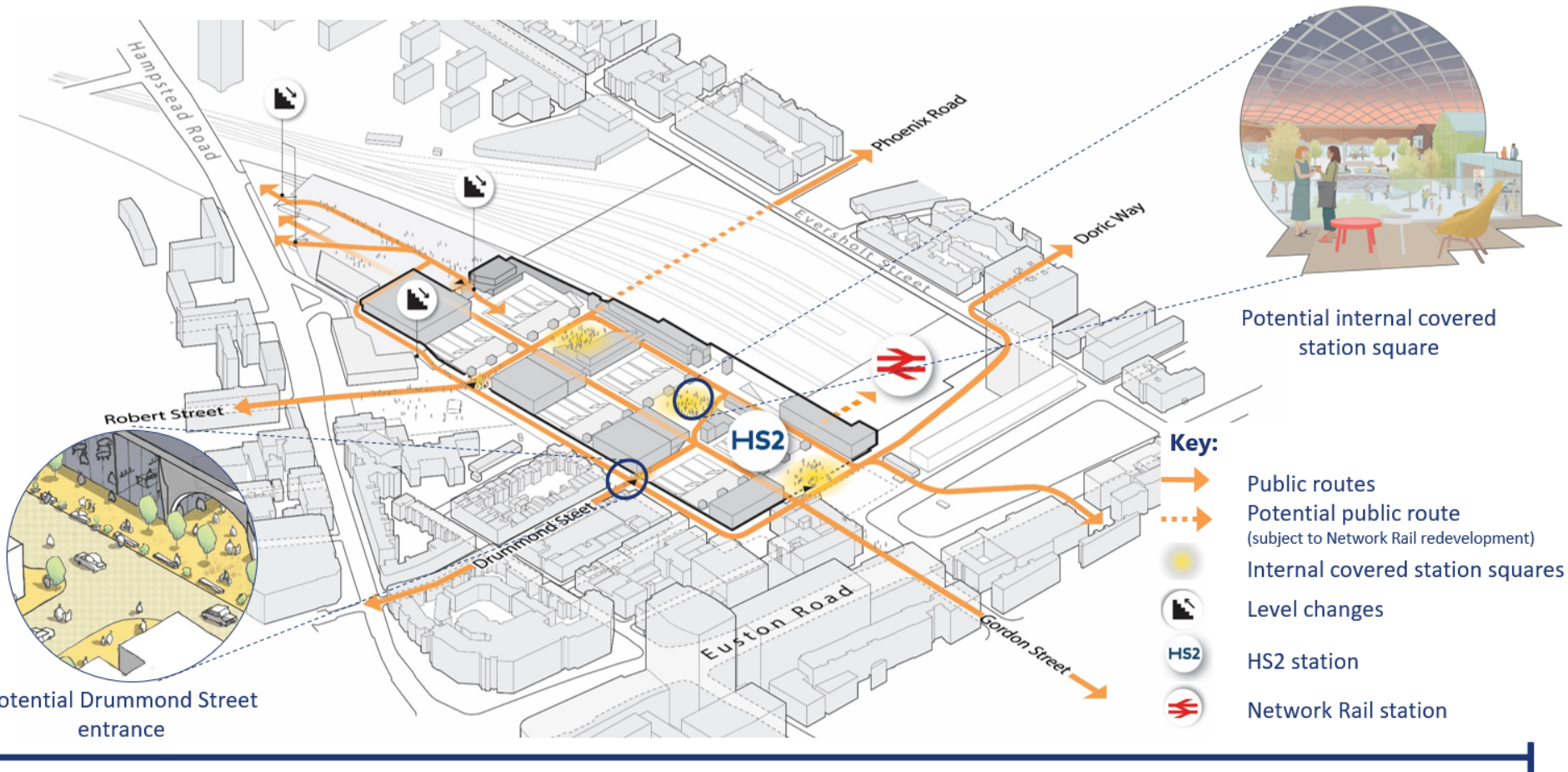
# Euston Station, London England, HS2

## Phased Implementation



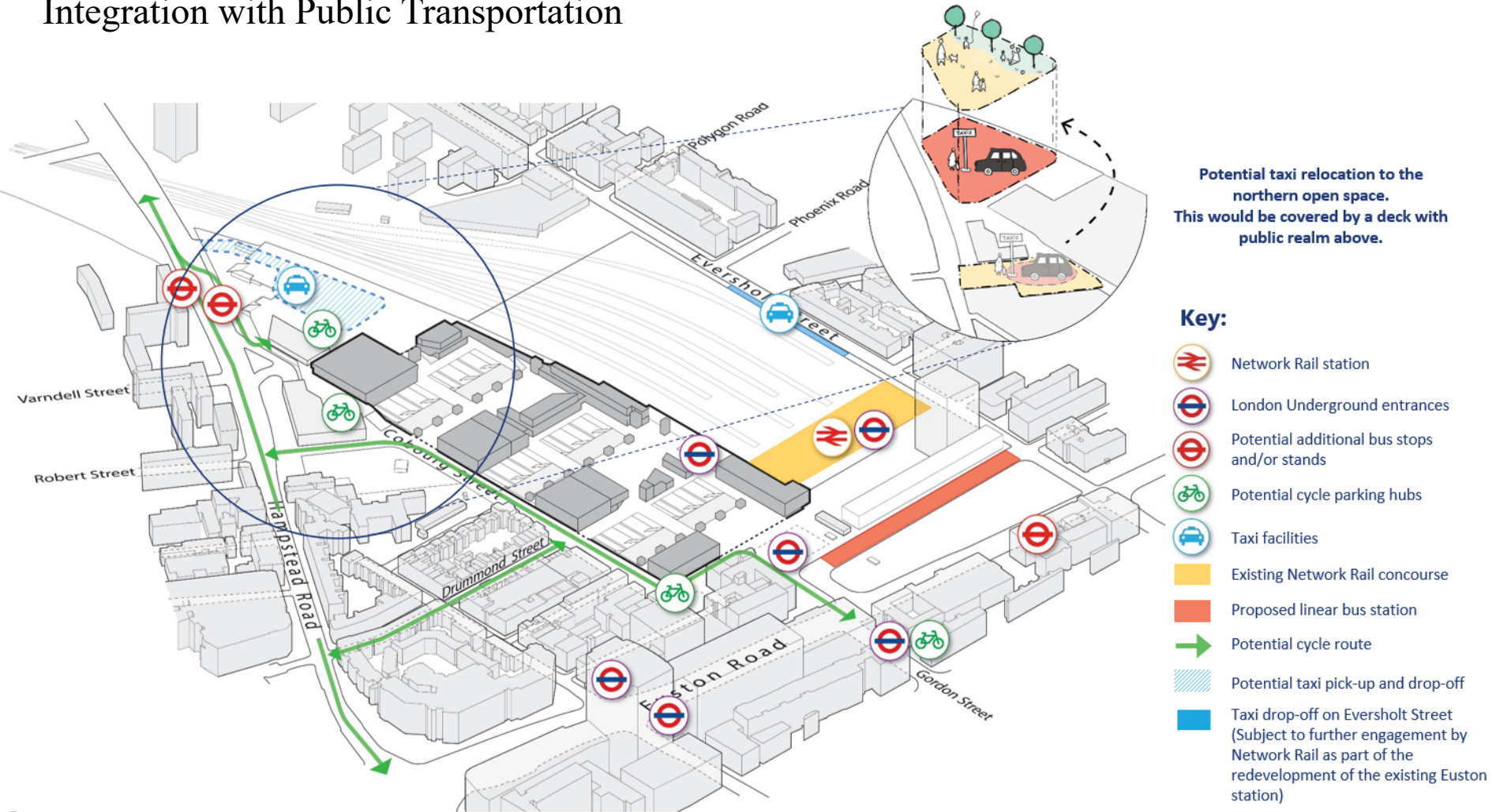
# Euston Station, London England, HS2

## Integration with Street Grid



# Euston Station, London England, HS2

## Integration with Public Transportation





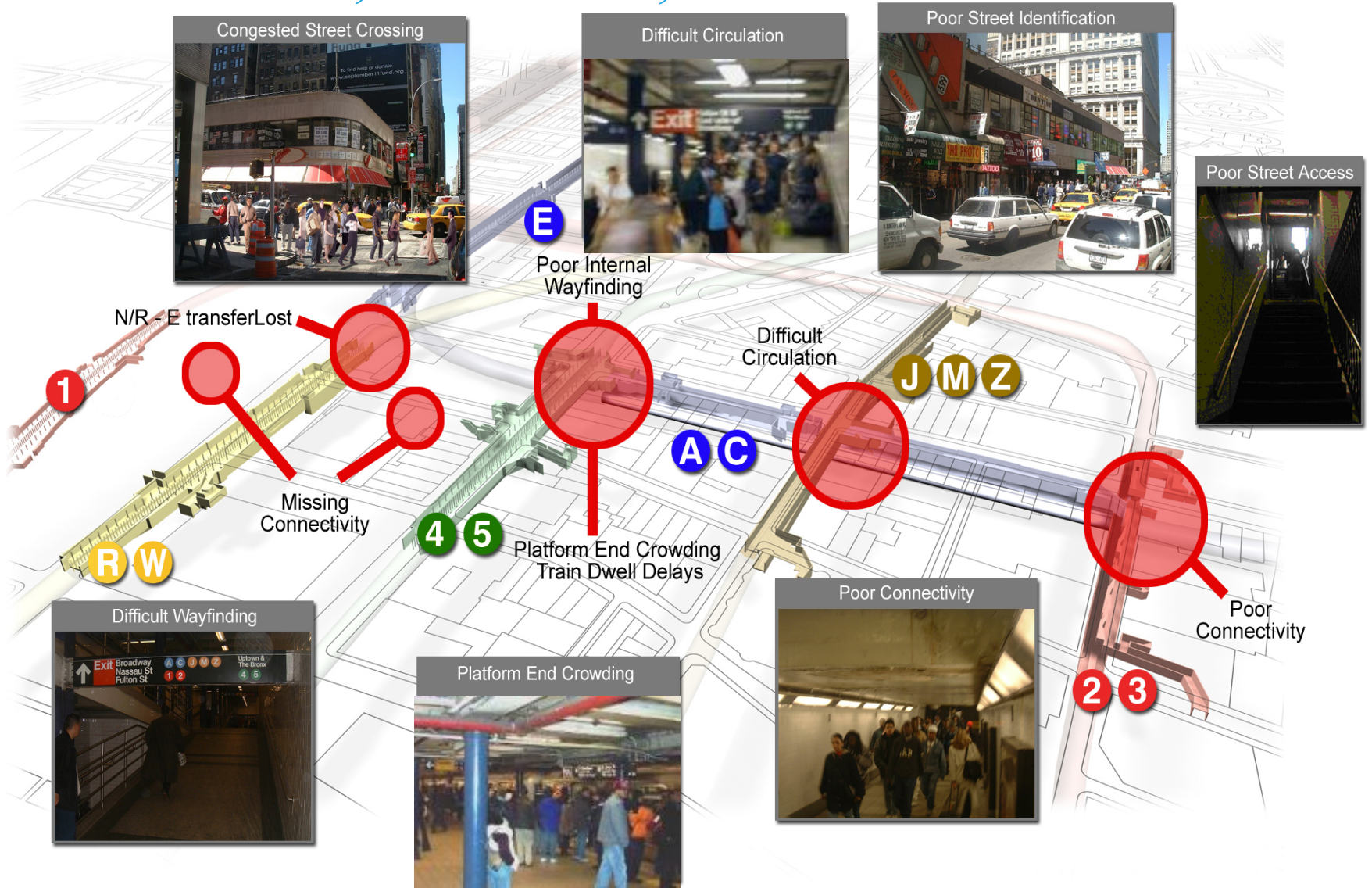
# Fulton Center, New York, NY



Urban Transit Station

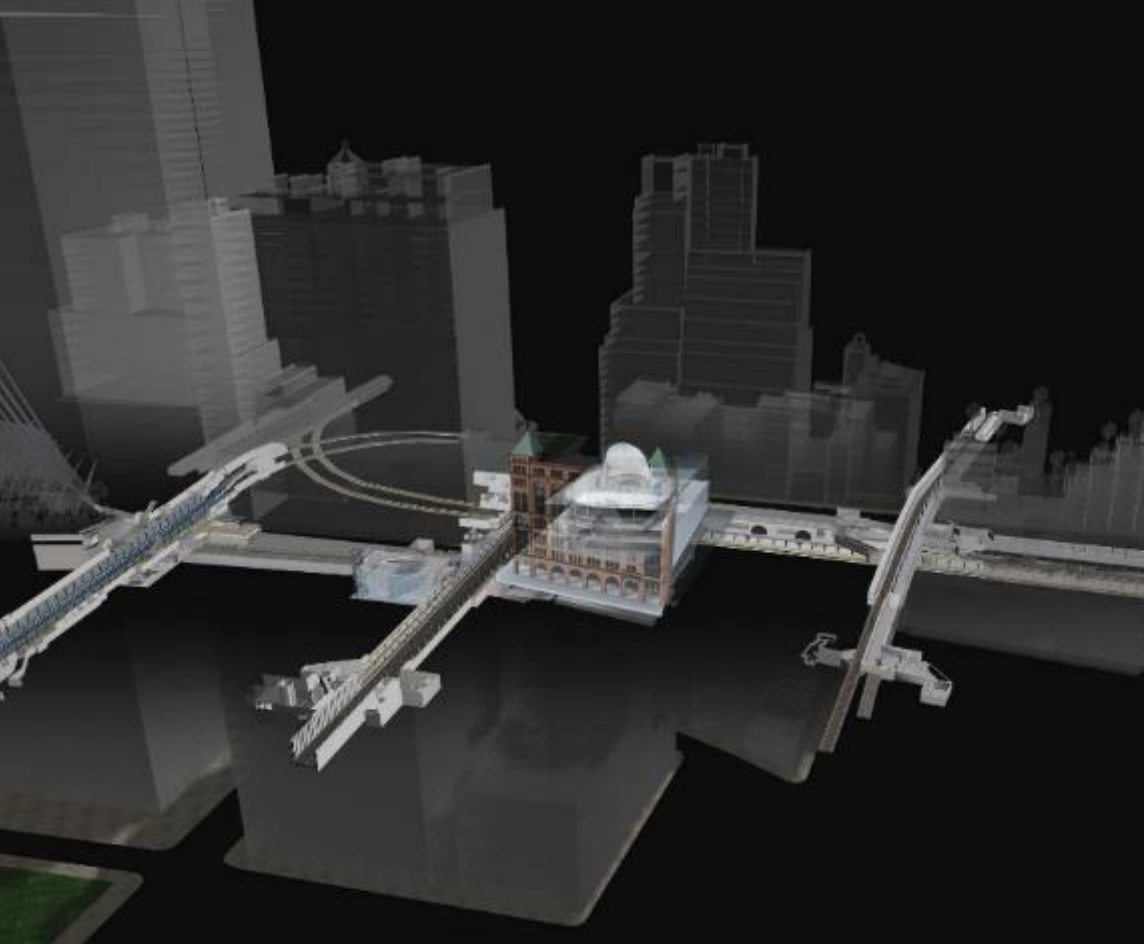
ARUP

# Fulton Center, New York, NY



## Total Design

- Better distribution of passengers for improved train and station operations.
- Seamless connectivity - 8 subway lines and PATH to NJ.
- Better surface distribution and integration with development - welcoming passageways and street entrances.
- Expansive and open paid and unpaid areas - lighting, information, advertising, retail.
- Enhanced customer environment and revenue – concessions.
- Resiliency features – mechanical and systems relocated to second floor.
- Integration of historic structures and elements.



# Station Design - Inspiring



Fulton Center, New York, NY

# Station Design - Inviting



# Station Design - Integrated



# Station Design - Intuitive



# Station Design - Inclusive





# Station Design - Informative



# The Take Aways

Changing demographics, development patterns, and technology will increase demand.

Ever increasing mobile platforms, new technologies, and adoption of on-request transportation services and will increase expectations amongst users and design requirements.

Planning and design must focus on:

- The customers
- Flexible systems, services, and infrastructure
- Connectivity and inclusivity
- All elements of the journey
- Stations as multi-purpose destinations
- Digitally Oriented Design / Technology Oriented Design