U.S. Department of Transportation

MOD

MOBILITY ON DEMAND

ACCESSIBLE TRANSPORTATION TECHNOLOGIES RESEARCH INITIATIVE

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MOD
MOBILITY ON DEMAND

What is Mobility on Demand?

An **integrated and connected multi-modal** network of **safe**, **affordable**, and **reliable** transportation options that are **available to all**



Trends: What's driving MOD?

Societal Trends

- Over the next 30 years, the U.S. population is expected to grow by 70 million
- By 2045 the number of Americans over the age of 65 will increase by 77%
- Shared economy

Technological Trends

- Transportation is increasingly relying on data
- 72% of Americans own a smartphone
- Automated transportation offers new possibilities

Mobility Trends

- On average, Americans spend over 40 hours stuck in traffic each year, costing $160 billion
- There is growing popularity of shared mobility services
- Auto sector

Shifting Transportation Landscape

Innovative partnerships and new technologies are changing how we travel

- State and local DOT's leveraging TNCs, taxis, and volunteer drivers to address service gaps
- Integrated multimodal traveler information apps improving to include a variety of public and private options
- Carpool and rideshare start-ups enabling high-occupancy commuting
- Auto manufacturers rebranding as mobility companies, acquiring start-ups, and pursuing self-driving vehicles
- Mobility as a Service (MaaS) piloting in Europe (e.g. Finland, Sweden, Netherlands)

MOD - Guiding Principles

- Traveler Centric/Consumer Driven
  - MOD is defined by performance
  - Quality and Carefree personal mobility choice for individuals
- Data Connected/Platform Independent
  - MOD (the end state) drives the technology
  - Technology does not change the MOD vision, it provides the capability to realize in an interoperable fashion
- Mode Agnostic/Multimodal
  - MOD embraces all modes and resources to support personal mobility choice in an integrated, connected and multimodal manner

Redefine role of PUBLIC Transportation

A New ~~Transit~~ Intermodal Mobility Concept

Key Challenges

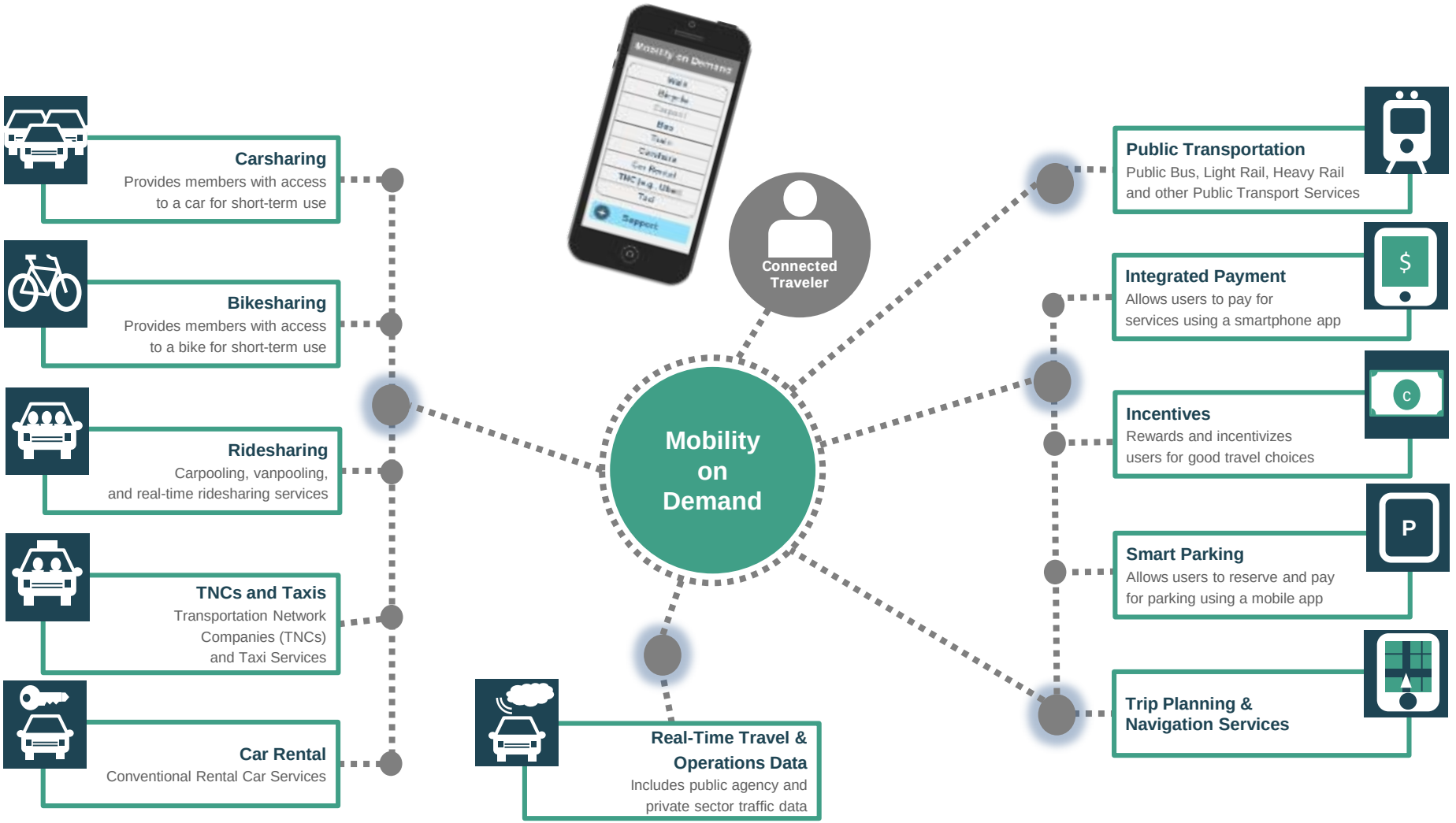
- In addition to current social, technological, and mobility trends:
  - Bridging first-and-last mile connections to public transportation;
  - Improving access and knowledge of personal mobility options;
  - Enhancing infrastructure, information technology, and fare payment multimodal connectivity;
  - Improving real-time information services and bridging information gaps; and
  - Enriching the customer experience, making alternative modes more convenient, accessible, and affordable.
  - Applying economic principles to mobility
  - Advancing innovative business models
  - Identifying policy and legislation
  - Maximizing existing infrastructure and network capacity;
  - Improving productivity and efficiency

Current MOD Activities

MOD Research Efforts:

- MOD Foundational Research
- MOD Performance Metrics
- MOD Innovation & Knowledge Accelerator
- MOD Sandbox Demonstrations
- MOD Sandbox Evaluations
- Stakeholder Engagement & Outreach
- Policies and Practices
- Guidance and lessons learned

User-centric Travel Options



MOD - Who Benefits

Travelers

- Access to more transportation options
- Builds a more efficient, effective, and customer-centered transportation network

Public Transit Providers

- Connects ALL regional transportation services and assets into a seamless public transit network
- Extends service quality and coverage

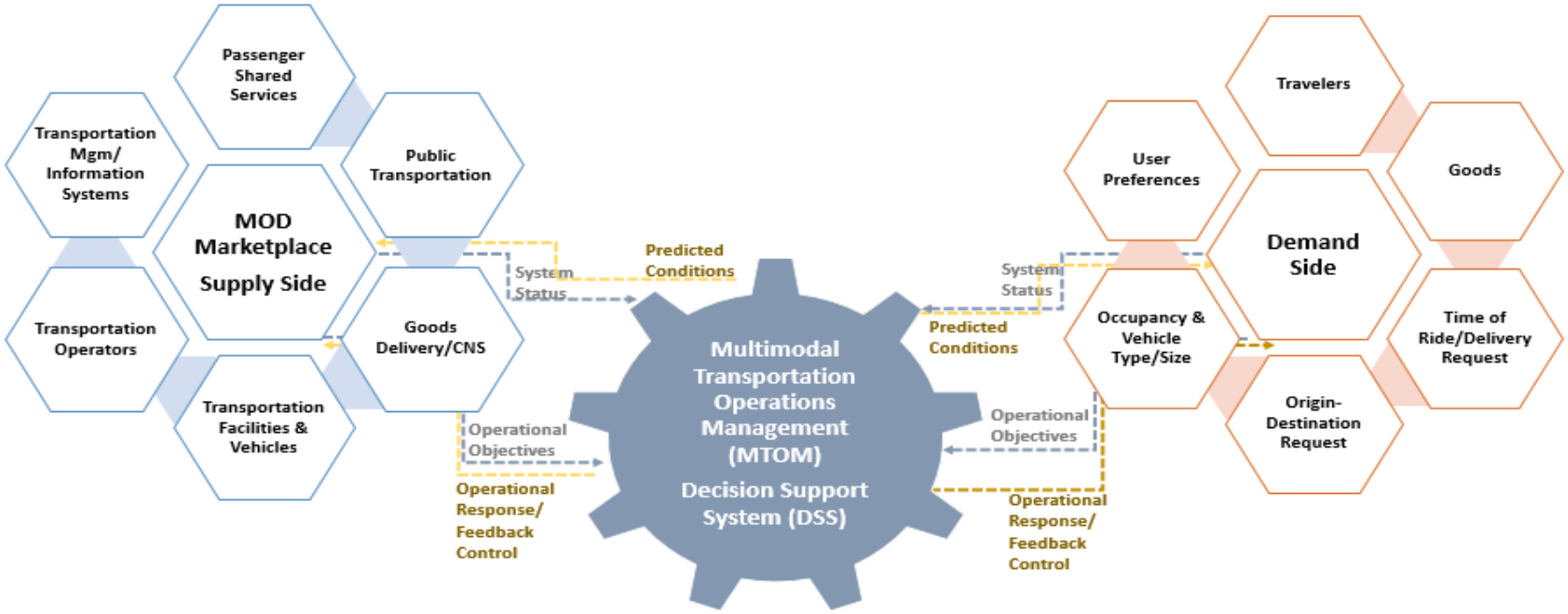
Shared-Use Transportation Providers

- Connects travelers to provider services
- Provides an easy to use, common technology platform for mobility options

Mobility Managers

- Streamlines information for transportation options
- Growing partnerships between employment and transportation

MOD Ecosystem

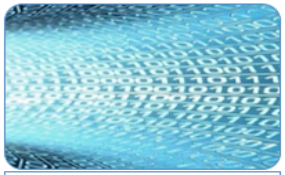


Infrastructure

Land Use
Built Environment
Transportation Infrastructure

Emerging Technologies

Wireless Comms.
GPS
Sensors
CV/AV
High Speed Computation



Real-time Data Management

Big Data
Dynamic Data
Data Storage
Predictive Analytics

Policies & Regulations

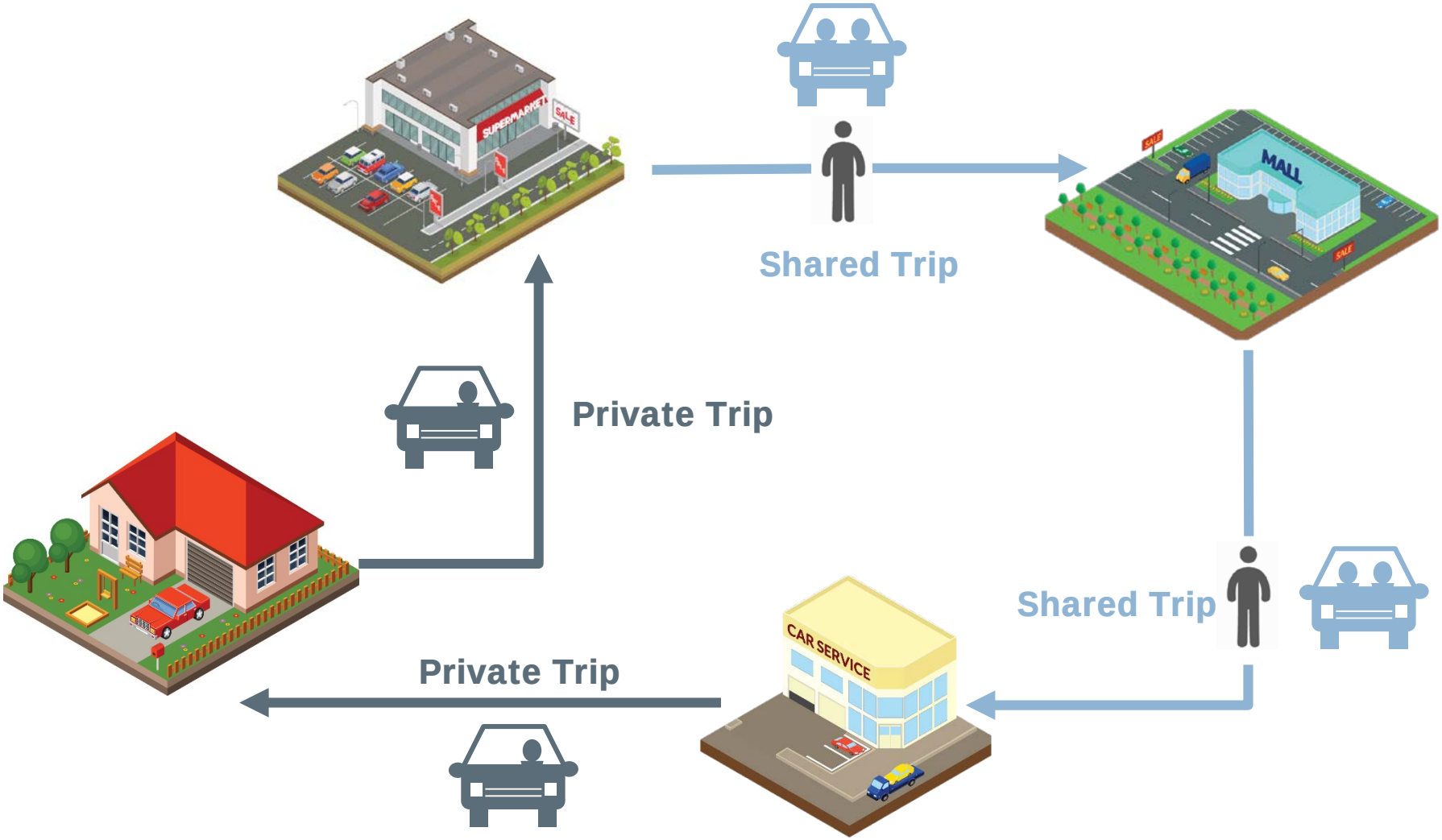
Equity Considerations
Safety Considerations
Mobility Issues
Standardization

Business Models

Strategic Partnership
Incentives
Financing

MOD Enablers

Private vs. Shared Use Travel



MOD and Land Use Typologies

CITY CENTER

High-density downtown/CBD employment centers and surrounding neighborhoods

SUBURBAN

Predominantly lower-density residential users with some segregated mixed uses

EDGE CITY

Medium-density employment centers outside of the urban core

EXURBAN

Very low-density residential uses on the urban fringe

RURAL

Typically unincorporated

Performance Metrics

Identify MOD performance measures and data collection

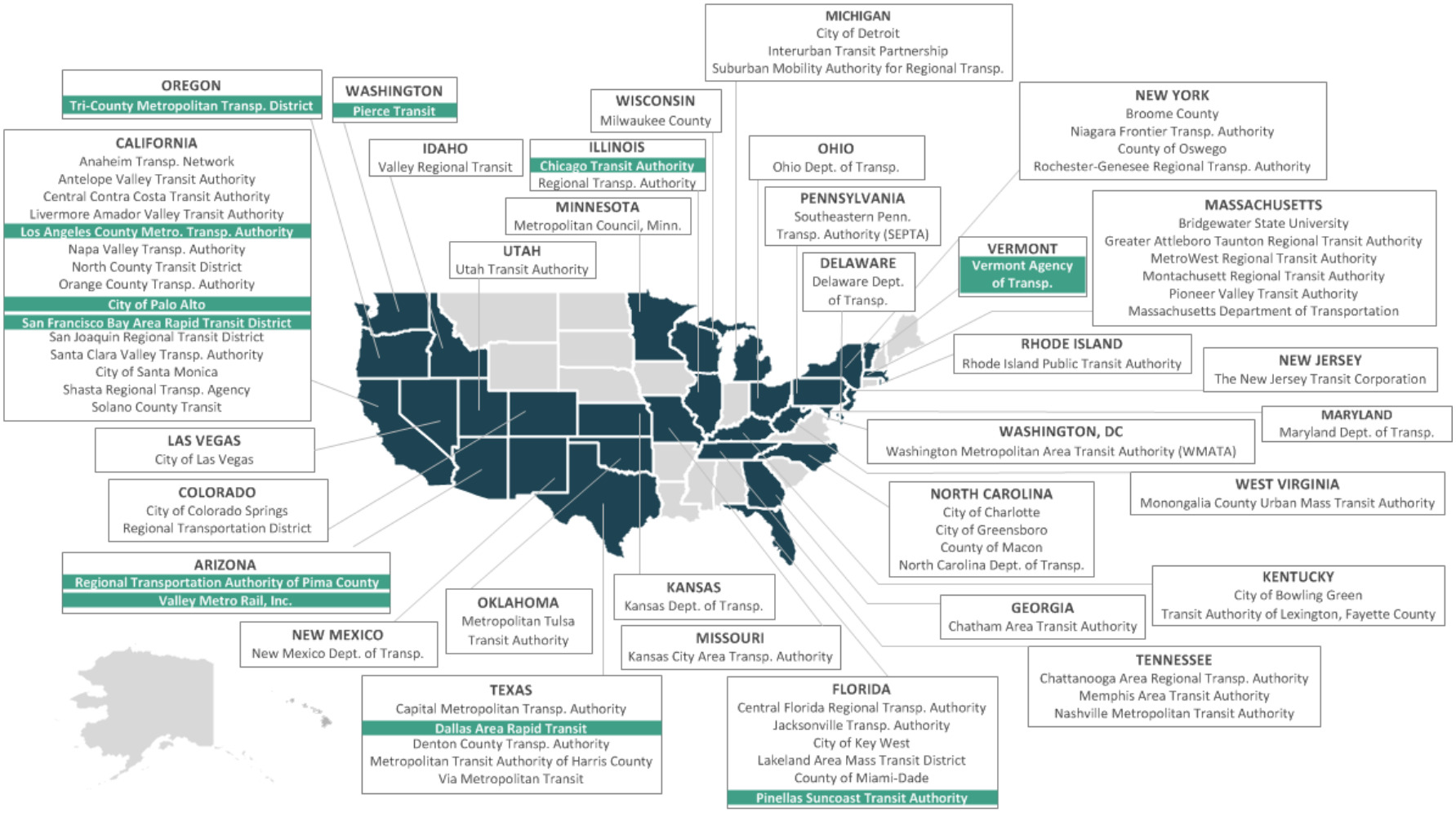
- Identify performance metrics with respect to MOD.
- Inform the Sandbox evaluations and site data collection activities.

MOD Sandbox Program Overview

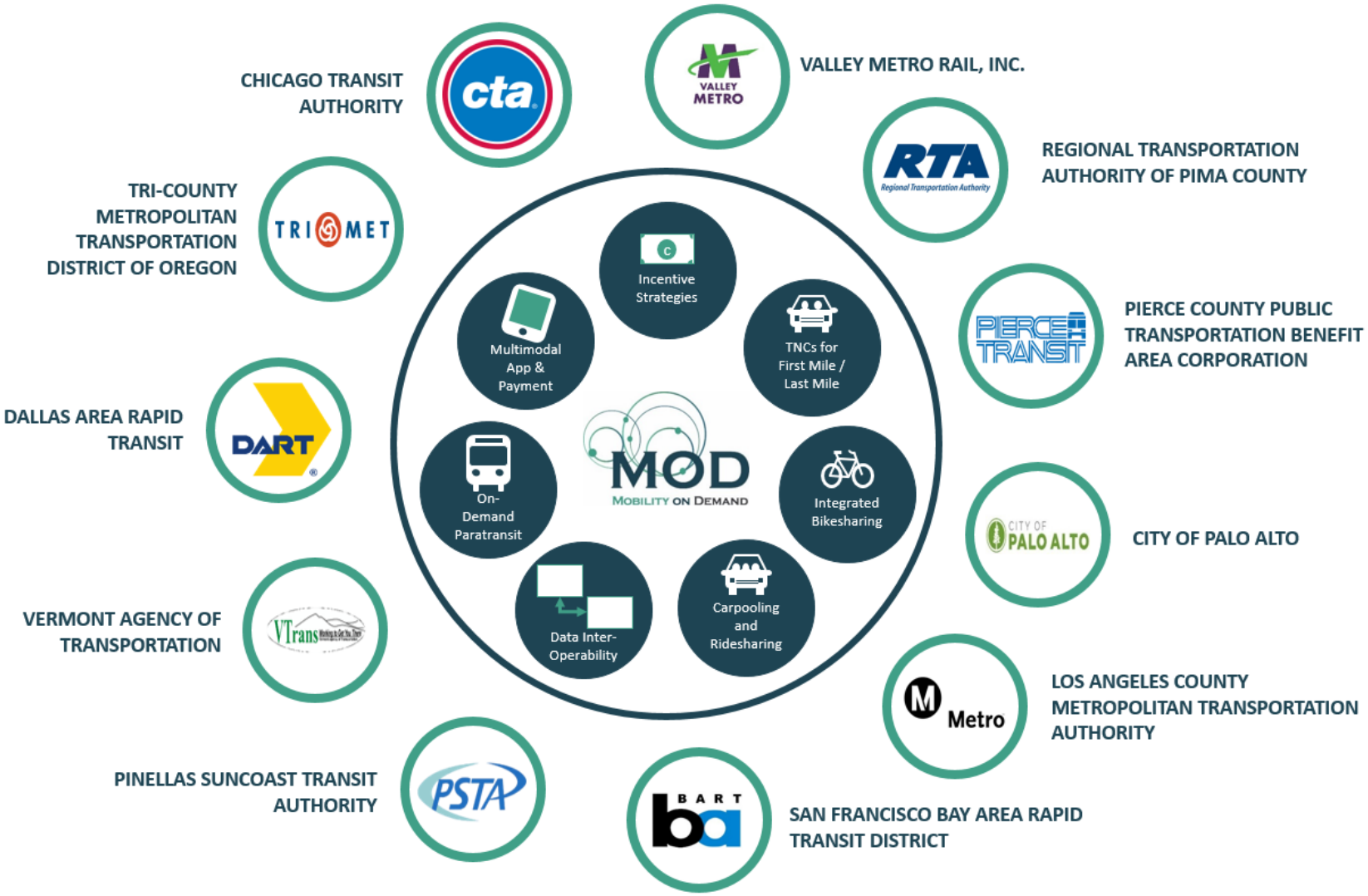
Demonstration Program to Explore MOD Models

- **Explores** innovative approaches to integrate MOD solutions with public transportation
- **Empowers** project teams to implement innovate business models to deliver high-quality, seamless and equitable mobility options
- **Informs** the MOD program on how to approach MOD and structure future MOD policies, and support grantees

MOD Sandbox Applicants & Awardees



MOD Sandbox At a Glance



MOD Sandbox: At a Glance

REGIONAL TRANSPORTATION AUTHORITY OF PIMA COUNTY (PIMA COUNTY, AZ)

Integrating fixed route, subscription based ride-sharing and social carpooling services into a platform to address first mile/last mile issues.

VALLEY METRO RAIL (PHOENIX, AZ)

Smart phone mobility platform that integrates mobile ticketing and multimodal trip planning, including ride-hailing, bike sharing, and car-sharing companies.

CITY OF PALO ALTO, CA

Commuter planning project incorporating trip reduction software, a multi-modal trip planning app, and workplace parking rebates.

LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION

Mobility on demand partnership with the car-sharing company, Lyft. *This project, led by LA Metro, includes a companion project in Seattle, WA.

MOD Sandbox: At a Glance

SAN FRANCISO BAY AREA RAPIC TRANSIT

Integrated carpool-to-transit program.

PINELLAS SUNCOAST TRANSIT AUTHORITY (PINELLAS COUNTY, FL)

On-demand paratransit using taxis and a car-sharing company to provide door-to-door service.

TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT OF OREGON

Platform integrating transit and shared-use mobility options. By integrating data, the project will allow users to plan trips that address first/last mile issues while traveling by transit.

DALLAS AREA RAPID TRANSIT

Integrates ride-sharing services into DART's GoPass ticketing app.

MOD Sandbox: At a Glance

VERMONT AGENCY OF TRANSPORTATION

Statewide transit trip planner incorporating flex-route, hail-a-ride, and other non-fixed-route services into mobility apps.

PIERCE TRANSIT (PIERCE COUNTY, WA)

Limited Access Connections project connects service across two transit systems – local and regional – and ride-share companies to increase transit use across the Seattle region.

CHICAGO TRANSIT AUTHORITY

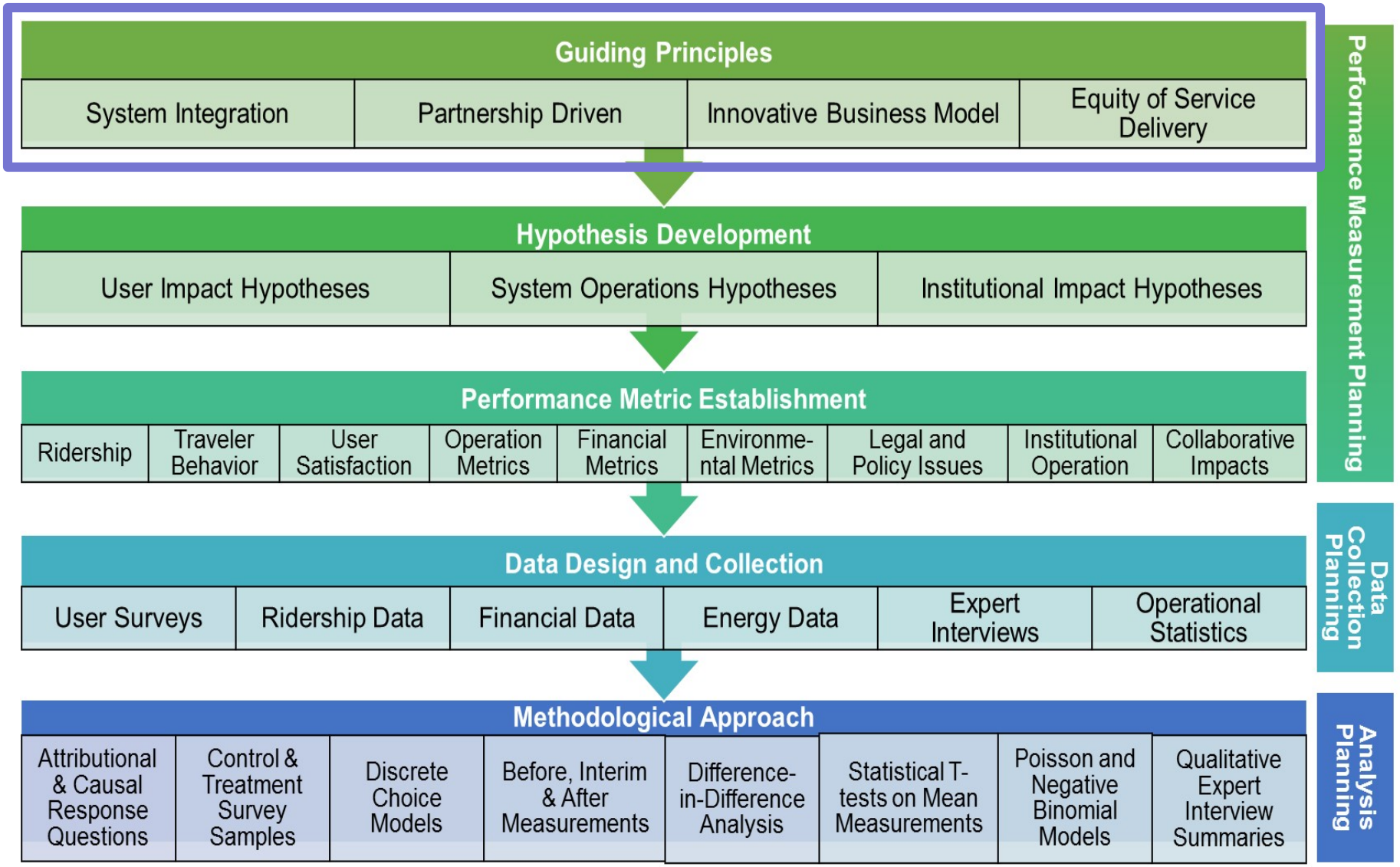
Incorporates local bike-sharing company Divvy into CTA's transit trip planning app.

MOD Sandbox Evaluations

Conduct Comprehensive Independent Evaluation (IE) of the MOD Sandbox Demonstration Projects:

- Analysis of project impacts
- Assessment of the business models and policies and regulations

Overall Evaluation Framework



Guiding Principles

	System Integration	Partnership Driven	Innovative Business Model	Equity of Service Delivery
Chicago CTA	Integration of Divvy Bike Share into the Ventra App.	Partnership between Ventra and Divvy.	Utilizes Ventra application to capitalize on existing infrastructure of Divvy bike share	Ventra App allows all users to have access to Divvy bike rentals.
Dallas DART	Soft integration for TNCs and car share companies into DART's "GoPass"	Dallas Area Rapid Transit partners with TNCs.	Utilizes "GoPass" ticketing app to implement a soft integration into TNC Apps	Integrated Mobility application and account-based fare payment systems to accommodate unbanked users
LA County MTA/ Puget Sound	Integrate Lyft rides into the regional TAP pass.	LA County and Pudget Sound partner with Lyft.	Provide Lyft as a publicly supported option	Provide subsidies for riders
City of Palo Alto	Utilizes Mobility Aggregation	Consists of a 31 member consortium	Utilizes a "six-way win" of mutual benefit	Provides low-income commute gap-filling work
Pierce County WA	Riders will select from pilot service app that most transit customers already possess.	Pierce College Puyallup, Sound Transit, and rideshare partners.	Cost-effective method to overcome geographic barriers	Equitable geographic access to transit
Pima County AZ	Integrates 3 multimodal transportation services	RTA, Metropia, RubyRide and other stakeholders	Transport Rita Ranch residents more efficiently	Encourage users to donate unused credits to charity
Pinellas Suncoast FL	Overarching software integration will be hosted by Transloc, Inc.	Partnership with United Taxi and CareRide, develop a new partnership with Lyft	Increased efficiency through flexible and responsive mode choices	Provides service to over 12,500 eligible ADA paratransit customers
San Francisco BART	Target transit facilities as a destination and integrates BART's parking payment and reservation system	Partnership of Scoop (Private Sector), with MTC & BART (Public Sector)	Targets transit facilities instead of employment centers, as focal point for destinations and origins	Implemented equally at all 33 BART stations, with parking facilities in four Bay Area counties
Tri-Met OR	The Open Trip Planner (OTP) will create shared-use mobility (SUM) options.	Two public transportation agencies and three for-profit organizations	Open Trip Planner creates multiple shared-use mobility options for all users.	Allow for more pedestrian and wheelchair access
Valley Metro AZ	Valley Metro Mobility Platform will build upon RideKickTM.	Public-Private Partnerships (P3s) formed between Valley Metro and TNC's (Lyft & GR:D Bike Share).	Utilizes a combination of OTP SUM platform and GR:D Bike Share to give users multiple transit forms	Utilizes smart phones to enhance trip planning and payment methods for smartphone users
Vermont VTA	Trip Planner will utilize an emerging open data specification, GTFS-flex.	Contains both private and public partners who have worked together for years	Utilizes OTP SUM platform, combined with GTFS-Flex data	Develop a trip planner that works well in rural areas

ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

ATTRI Program

Persons with Disabilities

Veterans with Disabilities

Older Adults

- A U.S. DOT Multi-Year, Multimodal, Multi-Agency Research and Development Effort
- Identifying user needs of travelers with disabilities to develop new transformative applications to increase personal mobility
- Building collaborative research and deployment partnerships with other US and International research communities, both public and private
- Unique opportunity to develop and deploy novel applications for accessible transportation and extend those benefits to all travelers

The Challenge

- 56.7 million; 19% US population
- Unemployment Rate – 13.2 %; Income: $38,400 ($61,000)
- Poverty: 24.7% (9.0%)
- Rise in Autism: 1 in 150 (2000) to 1 in 68 (2010)
- Fed expenditures: $226 B (2002); $357 B (2008)

- 21.4 million Americas are Veterans
- Disability claims: 104,819 (2006) vs. 634,743 (2012)
- 2.6 million deployed in 2012, 45% of eligible Veterans file claims for disability
- Spending: $0.93 billion (2006) vs. $5.95 billion (2012)

- Disability rates rise as people get older
- 43.1 million age 65 + in 2012 or 1 in 7 people
- 28% live alone
- Expected to reach 72.1 million by 2030

Opportunities

- 76% people with disabilities say adequate transportation is important to their job search
- 29% consider it a significant problem in accessing jobs [1]

Targeted Populations

Persons with Disabilities

Veterans with Disabilities

Older Adults

Types of Disabilities

Vision

Mobility

Hearing

Cognitive

Enabling Technologies

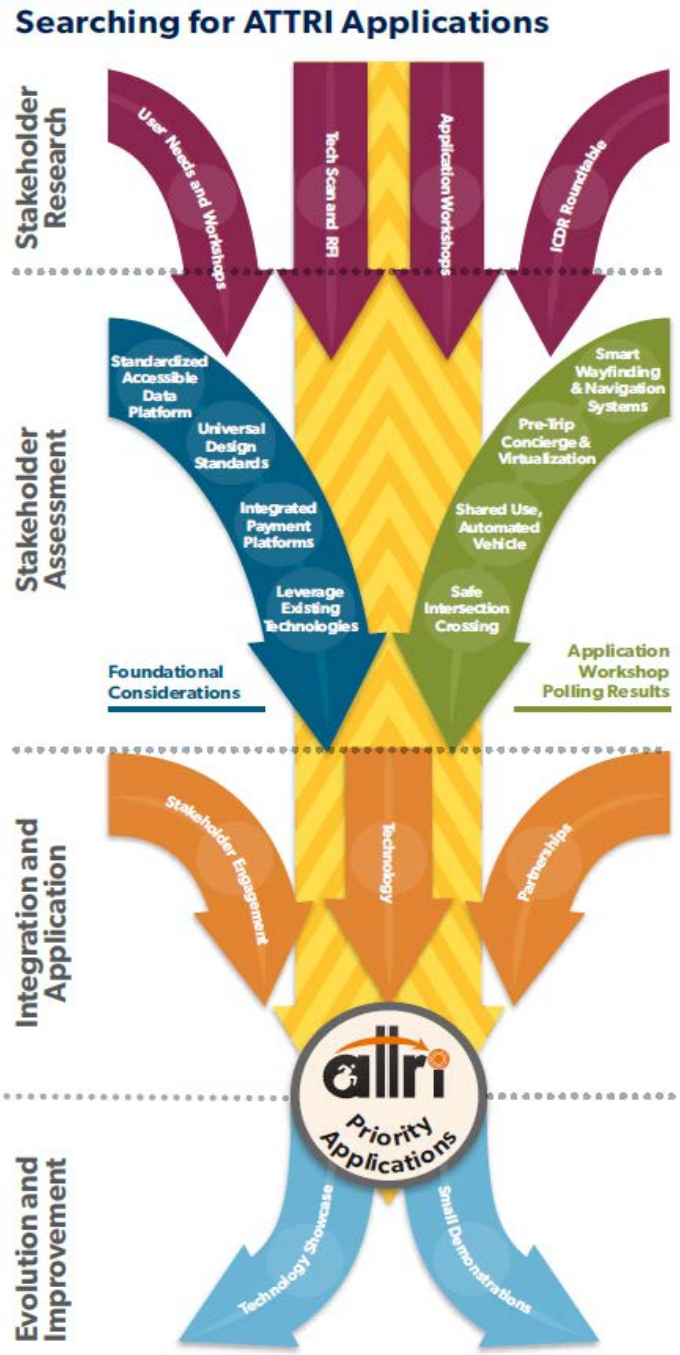
- ITS, Wireless & Sensors
- Connected Vehicles
- Automated Vehicles/ Personal Mobility
- Robotics, Artificial Intelligence
- Accessible Data

Application Development Process

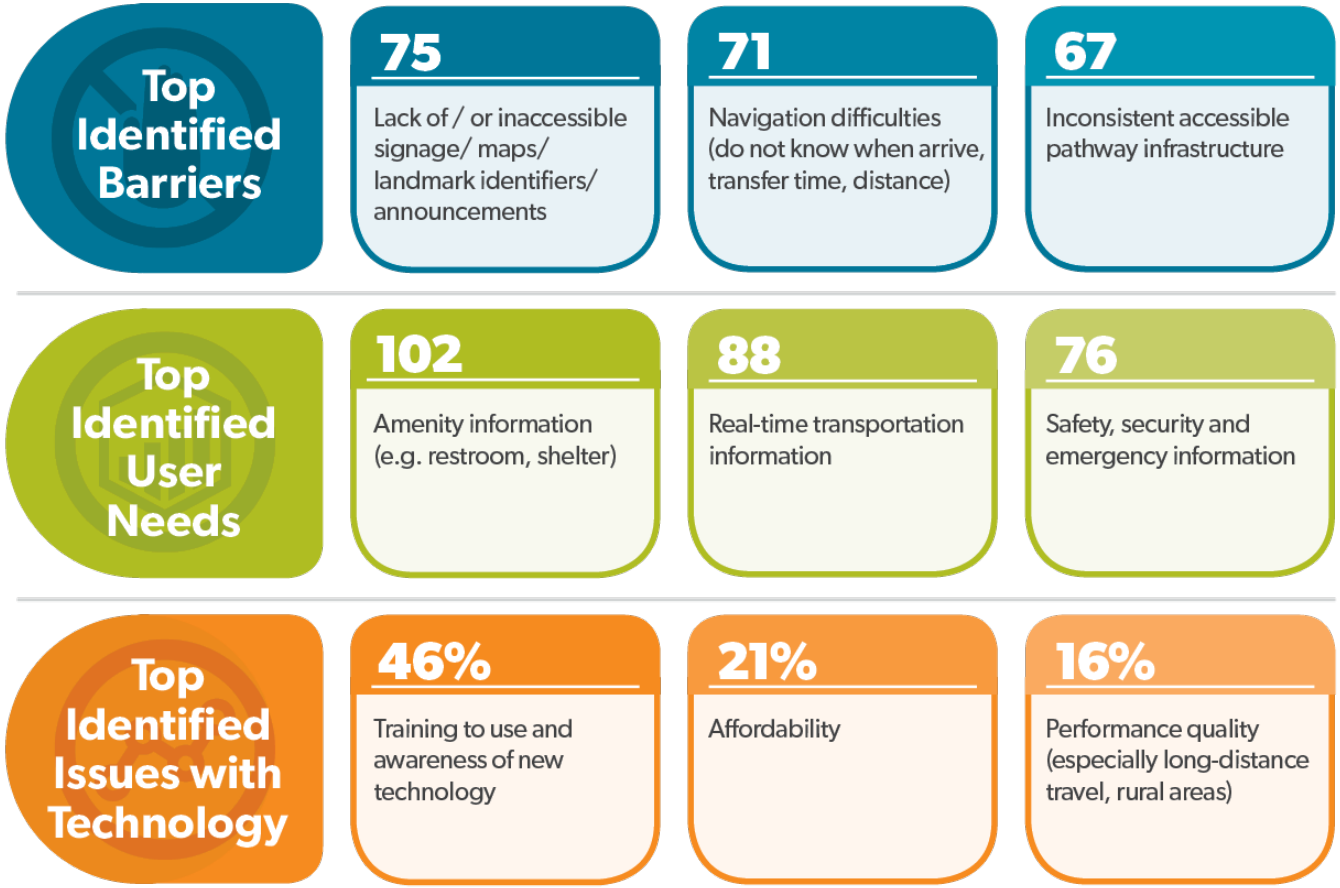
- Stakeholder Engagement and User Needs Assessment
- Technology State of Practice and Innovation Scan
- ICDR Roundtable
- RFI
- Applications Workshop

- Foundational Considerations
- Priority Application Areas
- Partnerships
- USDOT BAA & NIDILRR FOA

- Application Development
- Prototyping & Testing
- Technology Showcases and Demonstrations



Documenting User Needs



User Needs Final Report Available on the ATTRI Website:

http://www.its.dot.gov/research_archives/attri/index.htm

Technology Recommendations

Wayfinding & Navigation Solutions

- Focus on integration of map data and standardized infrastructure descriptions from various sources
- New data unique and specific to ATTRI users should be developed

ITS & Assistive Technologies

- Focus on remote assistance for stakeholders and opportunities to inform and aid barrier traversal
- Modernizing assistive technology maintenance and asset management (area for advanced research)

Automation & Robotics

- Shared neighborhood autonomous vehicles which are cost effective and aid at traversing distances between transit stops, homes, and places of employment.
- Assist service models, electric vehicles, and autonomous vehicles create opportunities for novel accessible designs

Data Integration

- Reduce complexity and identify coordination in service matchmaking through open data and services
- Develop environment for community generated data

Enhanced Human Services Transportation

- Support initiatives by ridersharing services to involve ATTRI stakeholders and develop accessible versions of these services.
- Support mode shift through private on-demand ride services

Links to Final Reports

Applications Development

Foundational Considerations

- Standard Accessible Data Platform
- Universal Design Standards
- Integrated Payment
- Leverage Existing Technologies

Smart Wayfinding & Navigation Systems

- Wayfinding and navigation systems for indoor and outdoor use
- Wearable technologies
- Community navigators

Pre-Trip Concierge & Virtualization

- Pre-trip and in-route traveler information
- Connected travelers
- Virtual caregiver help for pre-trip planning an on route support

Robotics & Automation

- Assistive and collaborative robotics to enhance mobility
- Ability to plan and execute trips, associated services
- Transformative transportation alternatives

Safe Intersection Crossing

- Intersection crossing assistance for all travelers
- Pedestrians interface with traffic signals, vehicles and nomadic devices
- Guidance, notifications and alerts for optimization

Building the ATTRI Vision

- However, the current solutions are not comprehensive and do not address the complete trip:
  - ADA implementation has been largely focused on wheelchair accessibility
  - Wayfinding technologies do not have accuracy needed for precision navigation
  - Automated vehicles are not yet designed to accommodate all users
- If any part of a trip is inaccessible, the whole trip becomes inaccessible.
- The complete trip solution cannot be achieved by any single entity.
- ATTRI has an important role as integrator of various types of technologies to advance the vision of a fully accessible, complete trip.

ATTRI Complete Trip

ATTRI - THE COMPLETE TRIP

After his doctor's appointment, Andy decides to take a spontaneous trip to meet a friend at a coffee shop in an unfamiliar part of town. Using ATTRI's **pre-trip concierge**, **wayfinding and navigation**, **robitics and automation**, and **safe intersection crossing** applications, Andy can travel with confidence throughout his trip.

1. Plan and Book a Trip

Andy uses a **pre-trip concierge application** to plan and book his trip from the doctor's office to the coffee shop.

2. Travel to Transit Station

An **automated shuttle** (rideshare service) is dispatched to take Andy to the transit station based on his booked trip. Once there, an **assistive robot** helps Andy to his bus platform.

3. Ride the Bus

While on the bus, Andy receives direction on when to pull the Stop Request cord from his **wayfinding and navigation application**. After he departs the bus, the application provides Andy with turn-by-turn walking directions to the coffee shop.

4. Cross the Street

As Andy approaches an intersection, his **safe intersection crossing application** communicates with the traffic signal to ensure sufficient time for him to safely cross the street, and notifies him when it is safe to begin crossing. The application also communicates with nearby cars to notify them of Andy's presence in the intersection.

5. Arrival at Destination

Andy safely arrives at his destination, while the **pre-trip concierge application** plans his return trip home.

ATTRI Prototype Development

***Title:* Accessible Transportation Technology Research Initiative (ATTRI) Application Development**

Description: Development of applications in three areas:

1. Smart Wayfinding and Navigation Systems
2. Pre-Trip Concierge and Virtualization
3. Safe Intersection Crossing.

***Title:* Disability and Rehabilitation Research Projects (DRRP) Program: Accessible Transportation**

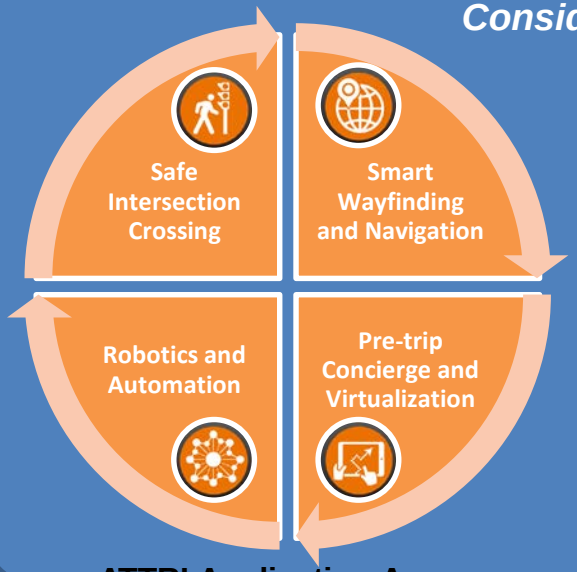
Description: Development, prototyping, demonstration, and evaluation of accessible transportation technologies in automation and robotics

For links to the funding opportunities visit the ATTRI website at:
http://www.its.dot.gov/research_archives/attri/index.htm

Exploratory Research

- Strategic Planning and Stakeholder Engagement
- Extensive Outreach
- Strong Partnership Development
- User Needs Assessment
- Innovation Tech Scan
- International Coordination Plan
- Institutional and Policy Issues Assessment
- Applications Workshop and RFI

Identification of ATTRI Application Areas and Foundational Considerations



ATTRI Application Areas

Foundational Considerations

- Standard Accessible Data Platform
- Universal Design Standards
- Integrated Payment
- Leverage Existing Technologies

Prototype and Innovation

Application Development

- Wave 1 Application Development:
  - FHWA BAA
  - NIDILRR Grant - Robotics & Automation
- Wave 2 Application Development

Supporting Application Development

- Standards assessment, development, and harmonization
- ATTRI application specific policy assessment
- Prototype performance metrics and evaluation
- Evaluate new Emerging Technologies for wave 2
- Stakeholder Engagement and Outreach

Operational ATTRI Prototypes and New Emerging Technology Areas

Deployment Readiness

- Field Operational Testing
- Joint Complete Trip Demonstrations with Partners and Cities
- Deployment Guidance and Support Tools
- Stakeholder Outreach and KTT
- International Twinning Projects