



ACCESSIBLE TRANSPORTATION TECHNOLOGIES  
RESEARCH INITIATIVE

## ATTRI Project Update Webinar 4 – Safe Intersection Crossing

Carnegie Mellon University

February 8, 2018





# Navigating Adobe Connect

## Shortcuts for navigating pods, menus, and windows

Result	Windows	Mac OS
<b>Toggle between notification window and meeting room</b>	F8	F8
<b>Display application menu bar for keyboard navigation</b>	Ctrl+Space	Command+F2
<b>Move focus to next / previous pod</b>	Ctrl+F6 / Ctrl+Shift+F6	Command+F6 / Command+Shift+F6
<b>Display pod menu for keyboard navigation</b>	Ctrl+F8	Command+F8

Please refer to page 8 of the Adobe Connect User Guide for a complete list of shortcuts. The following link was sent to all registrants via email:

[http://help.adobe.com/en\\_US/connect/9.0/using/connect\\_9\\_help.pdf](http://help.adobe.com/en_US/connect/9.0/using/connect_9_help.pdf)



# Agenda

- **Welcome and Introductions**
  - Kevin Viita, ITS America
- **ATTRI Program Overview and Status**
  - Bob Sheehan, USDOT ITS-JPO
  - Govind Vadakpat, USDOT FWHA
- **Safe Intersection Crossing**
  - Stephen Smith, CMU
- **Q&A**
  - Kevin Viita, ITS America

## ATTRI's Vision



***Accessible Transportation Technologies Research Initiative (ATTRI) seeks to remove barriers to transportation by leveraging advanced technology to enable people to travel independently anytime of the day to any destination, regardless of their individual abilities.***

# The Challenge



**Persons with Disabilities**

- 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)



**Veterans with Disabilities**

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



**Older Adults**

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

# The Transportation Challenge



**2x**

people say it is important to their Daily Living Needs

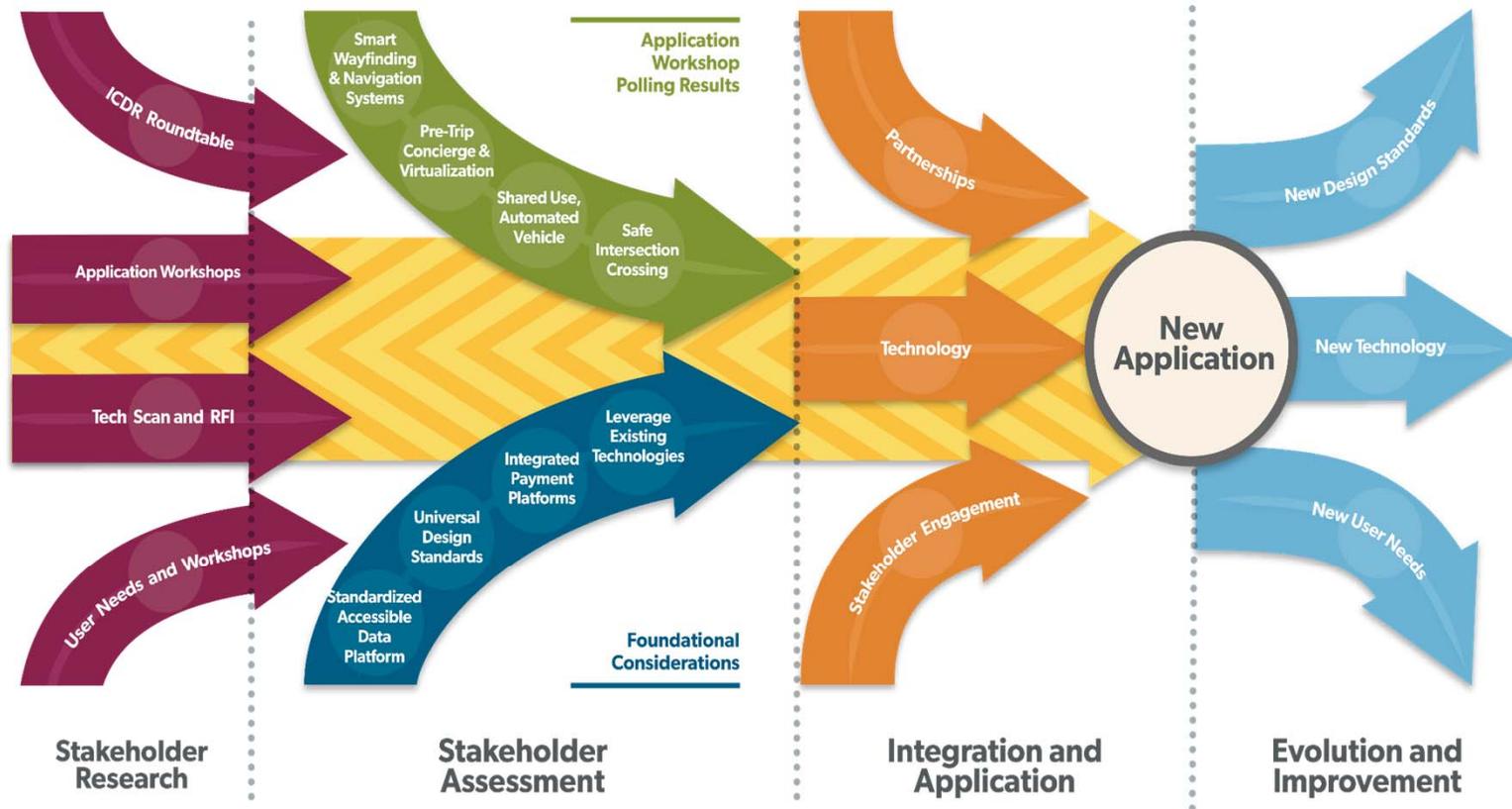
**76%**

say it is important to their job search

**29%**

consider it a significant problem in accessing jobs

# User Driven Application Development



# Challenge and Opportunity



## 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 Priorities & Consideration



## 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 and 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

# ATTRI Application Development: Safe Intersection Crossing



## Safe Intersection Crossing

- Enables pedestrians to connect mobile devices to vehicles and infrastructure
- Delivers context-based information helping to cross an intersection safely
- Provides guidance notification and alerts in accessible communication formats.



# ATTRI 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**, **robotics and automation**, and **safe intersection crossing** applications, Andy can travel with confidence throughout his trip.

## 5. Arrival at Destination

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



## 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.



## 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.



## 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.



# Broad Agency Announcement (BAA)



The objective of ATTRI BAA is to put contracts in place that will:

- Develop applications in three of the ATTRI priority application areas:
  - Aimed to advance the current knowledge and state-of-the-art in the sciences and technologies employed in the planning, design, construction, operation, maintenance and management of accessible transportation
  - Application development will include prototyping, demonstration and evaluation
- Collaborate with other application development areas under the ATTRI program

# Acquisition Approach



- USDOT BAA:
  - Application development for:
    - Wayfinding and Navigation,
    - Pre-Trip Concierge and Virtualization, and
    - Safe Intersection Crossing
- NIDILRR/HHS FOA
  - Application Development for:
    - Robotics and Automation for Accessible Transportation

# ATTRI Application Development Awards



## Wayfinding and Navigation:



### CITY COLLEGE OF NEW YORK

Smart Cane for Assistive Navigation (SCAN), a wayfinding solution for those with low vision integrated with a smart phone application



### ABLELINK

An open wayfinding media standard and related infrastructure to create geographically-specific, cloud-based libraries of routes in metropolitan or rural areas



### PATHWAYS SOLUTIONS

A wayfinding tool for wheelchair users and people with visual impairment that guides users along routes tailored to their preferences



### TRX SYSTEMS

A smart wayfinding and navigation system to obtain real-time location, en-route assistance, and situational awareness.

# ATTRI Application Development Awards



## Pre-Trip Concierge and Virtualization:



### ABLELINK

A suite of assessment, self-directed learning, and trip execution technologies to support pre-trip planning for individuals with cognitive disabilities.



## Safe Intersection Crossing:



### CARNEGIE MELLON UNIVERSITY

A tool to connect pedestrians with disabilities to the traffic signal systems infrastructure (and nearby connected vehicles and infrastructure) and create situational awareness to improve the safety of intersection crossing and increase independent mobility.



## Robotics and Automation:



The National Institute on Disability, Independent Living, and Rehabilitation Research, a key ATTRI partner, will make a separate award announcement for applications in the robotics and automation technology area.



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## Application Development Projects:



Connecting Pedestrians with Disabilities with Adaptive Signal Control for Safe Intersection Crossing and Enhanced Mobility



U.S. Department of Transportation  
Federal Transit Administration



U.S. Department of Transportation  
Federal Highway Administration



U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology



# Safe Intersection Crossing



- Develop prototype DSRC-based mobile app for pedestrians with disabilities that allows direct interaction with the intersection
- Integrate with Surtrac adaptive signal system to enable safe and efficient intersection crossing
- Demonstrate and evaluate safety/mobility advantages



# Project Organization



Booz | Allen | Hamilton  
100 YEARS



PRIME ACCESS  
CONSULTING, INC.



- **Carnegie Mellon University** is the lead organization on this project, with **Booz Allen Hamilton** managing the design documentation and prototype evaluation efforts.
- We are partnering with **Diyunu Consulting LLC** to engage users from the local disabled community, with **Diyunu** and **Prime Access Consulting** on design and implementation of the mobile app's user interface, and with **InTec LLC** for project management support.
- **Rapid Flow Technologies LLC** is providing in-kind support for developing back end traffic signal control functionality, and both the **City of Pittsburgh**, and the **Port Authority of Allegheny County** are providing support to enable live field testing of the technology

## Carnegie Mellon

# Background: **surtrac** Scalable Urban Traffic Control



- **Goal:** Real-time optimization of urban road networks
- **Technical Approach:** Collaborative online planning
  - Decentralized control
  - Coordinated Action

A screenshot of a Science magazine article titled "Five surprising ways AI could be a part of our lives by 2030" by Ben Panko, dated Sep. 12, 2016. The article features a photo of a traffic intersection at night with light trails from cars and a smart traffic light. The text discusses how smart traffic lights using AI can learn and adapt to traffic patterns in real time, making intersections safer and more efficient. It mentions that Carnegie Mellon University is testing smart traffic lights in Pittsburgh, Pennsylvania, and also in Los Angeles, California, and Bellevue, Washington. By 2030, they will likely be on every corner.

**Science** MAGAZINE

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**SHARE** Five surprising ways AI could be a part of our lives by 2030

By Ben Panko | Sep. 12, 2016, 5:45 PM

2K

Smart traffic lights

1

230

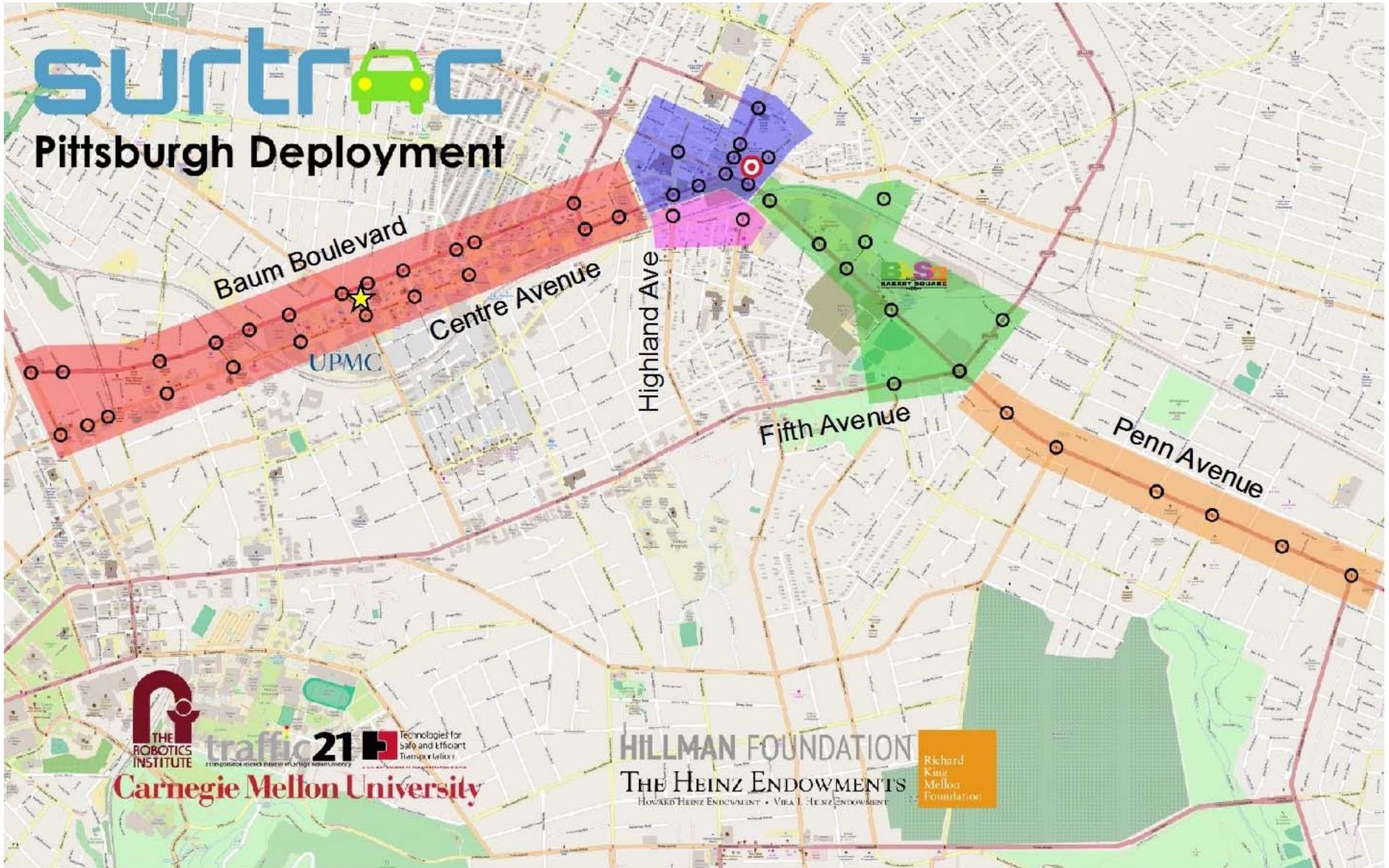
Smart traffic lights using artificial intelligence technology to learn and adapt to traffic patterns in real time could make intersections safer and more efficient. AsianDream/iStockphoto

Many people know the frustration of waiting at red lights while no traffic is moving through the intersection. Modern traffic lights typically run on a fixed schedule, with police officers occasionally intervening during special events and emergencies. So-called smart traffic lights are already able to use cameras and road sensors to adjust their timing minute by minute to handle traffic and pedestrians faster and more safely. By collecting data and making decisions independent of human guidance, such lights harness AI to adapt to the randomness of traffic. Easing traffic congestion in this way would not simply reduce commuting stress, but it would also cut down on air pollution from idling cars. Carnegie Mellon University is **already testing smart traffic lights in Pittsburgh, Pennsylvania**, which are also being tested in Los Angeles, California, and Bellevue, Washington. By 2030, they will likely be on your corner.



# surtrac

## Pittsburgh Deployment



# surtrac

intelligent traffic signals

surtrac.net  
@surtrac  
info@surtrac.net

### In the field ...

- 25% lower travel times
- 40% less time idling
- 30-40% fewer stops
- 21% lower emissions

### Key Capabilities

- True real-time response to traffic conditions
- Manages multiple dominant flows
- Scalable to road networks of arbitrary size
- Multi-modal optimization

# Setup in the Field



# Integration with Connected Vehicle Technology



- Better sensing
- Use of mode, route info.
- Incident detection and real-time re-routing



**24 intersections are equipped with DSRC Radio Communications**

# Proposed Pedestrian-to- Infastructure Capabilities



- Provide pedestrians with the ability to directly communicate personalized crossing constraints to the intersection and to directly influence traffic control decisions to ensure safe crossing
- Communicate intersection geometries to pedestrians to facilitate navigation via mobile app homing features
- Use provided route information to anticipate pedestrian arrival at intersections and streamline crossing time.
- Actively monitor pedestrian crossing progress and dynamically extend the green time if necessary
- Use real-time bus arrival information to better coordinate pedestrian bus connections

# Expected Impacts

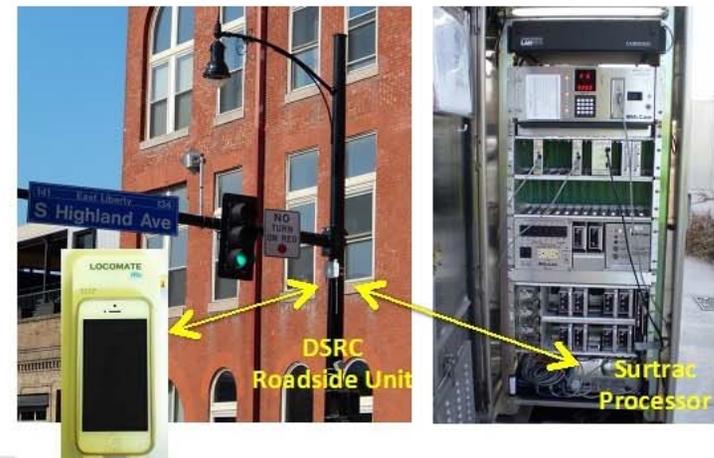


- Increase in perceived safety and reduction in pedestrian stress
- Decrease in intersection crossing incidents.
- Decrease in overall intersection crossing time at a given intersection
- Reduction in overall pedestrian travel time through the local neighborhood if pedestrian routes are communicated
- Reduction in pedestrian waiting time for the bus, once real-time bus information is integrated to synchronize pedestrian and bus arrivals.

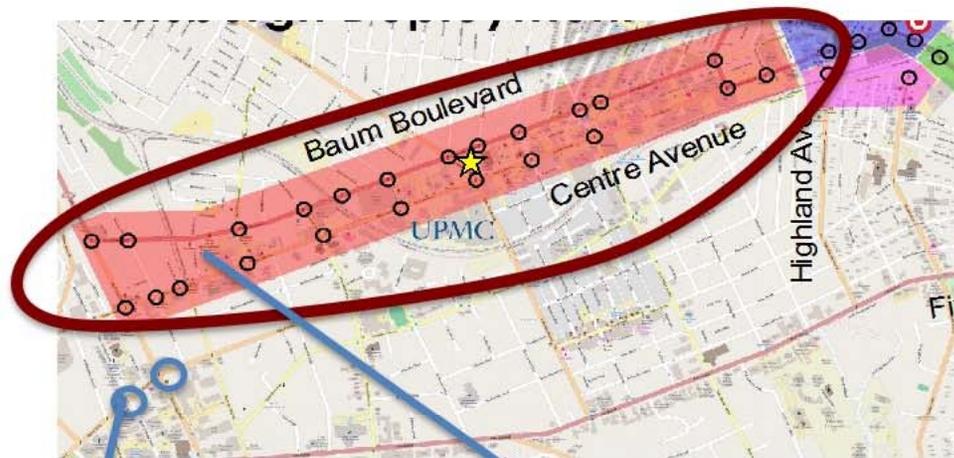
# Technical Approach and Rationale



- Couple a DSRC “sleeve” with an iPhone (pictured at right) to produce the mobile device.
- Integrate the mobile app with Surtrac to enable
  - dynamic adjustment/extension of green times to meet pedestrian’s crossing constraints, and
  - generation of pedestrian friendly timing plans
- Field test on the Pittsburgh Surtrac deployment



# Proposed Pilot Tests with local community volunteers



Western PA School for Blind Children



YEAR 2



YEAR 1

Carnegie Library for the Blind and Physically Disabled



# Year 1 Plans



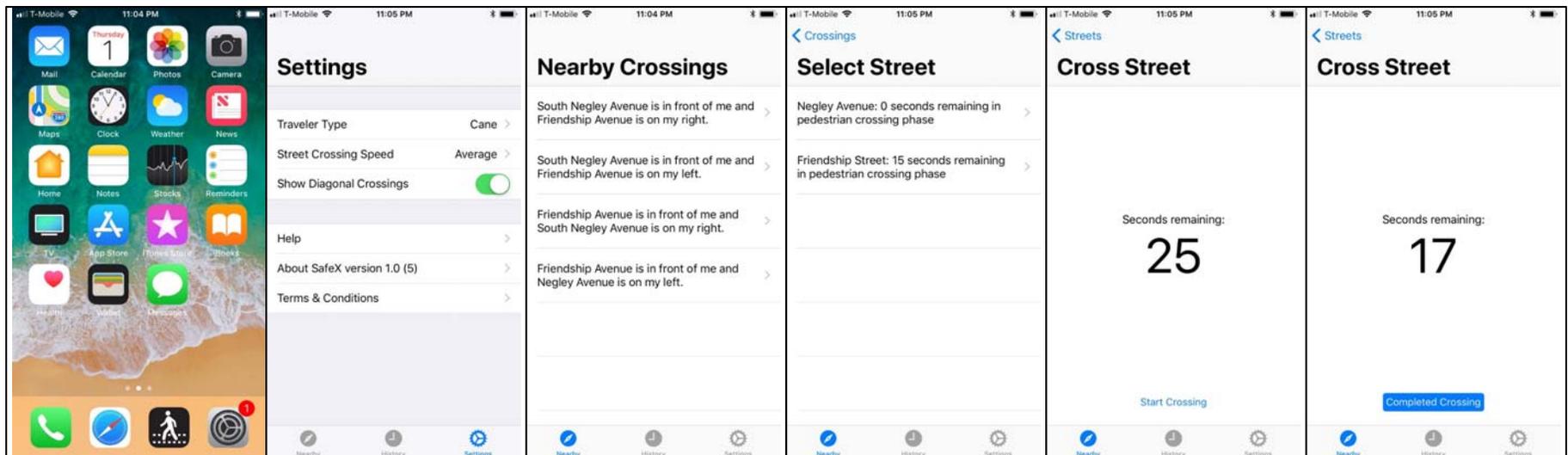
- Iterative Prototype Development
  - [2/18] Demonstration of basic safe crossing capability
    - App communication of crossing direction/speed
    - App support for orienting to cross and signaling to start
  - [4/18] Demonstration of capability to monitor pedestrian crossing progress and dynamically extend crossing time
  - [5-7/18] Pilot test and evaluation



# Status



- Workshop held with local disability community in October to determine user requirements
- App UI design reflecting workshop feedback complete
- Initial iteration of prototype under development



# Stay Engaged!

- Sign up for Friends of ATTRI's listserve
- Attend next ATTRI's webinar on NIDILRR Robotics and Automation
- Participate and give feedback on ATTRI technology development
- "ATTRI Complete Trip" demonstrations and testing
- ATTRI website for updates and resources



[https://www.its.dot.gov/research\\_areas/attri/index.htm](https://www.its.dot.gov/research_areas/attri/index.htm)

