Houston’s University District
AV Transit Circulator System Project

Presentation Content

- Introduction
- Near Term Deployment
- Summary of University District Near Term Deployment Phases
- Long Range Implementation Planning
- Summary of Key Research Purposes and Mission
Introduction – University District, Partnership and Advocacy
The University District Partnership

**Team Houston**
- Houston METRO
- City of Houston
- Houston-Galveston Area Council
- Gulf Coast Rail District

**Universities**
- University of Houston
- Texas Southern University

**Industry/Research Team Members**
- National Renewable Energy Laboratory
- 2getthere ATN Systems
- Oceaneering – Entertainment Division
- Kimley-Horn and Associates, Inc.
TEXAS SOUTHERN UNIVERSITY

3rd LARGEST HBCU

ENROLLMENT: 9,700

CENTRALLY LOCATED
The University District Partnership – Advocating a Time for Action

Challenges the Houston Region is Facing

❖ Houston is the *Center of the Energy Universe* for Transportation Modes
  □ Fossil Fuel Engines will soon be heavily supplemented by *Electric Propulsion Systems*

❖ *Houston’s future with 14 million in 2050* regional population will more than double the current population and bring transportation challenges that require:
  □ New *high capacity transit* in major travel corridors
  □ Efficient and effective *first-mile/last-mile transit connections* in a number of large urban districts
Houston’s Urban Core

University District

AV Transit Circulator System
Houston’s Urban Core

University District

AV Transit Circulator System
The University District Partnership – Advocating a Time for Action

Challenges the Universities are Facing

- Large campus setting imposes a major challenge for *perimeter parking and internal circulation* between classes
- Land use planning by U of H and TSU is becoming more challenging as the *price of land is increasing*
- *Adjacent LRT stations* at campus perimeter require a difficult pedestrian connection to access either campus using transit
- Nearby Eastwood Transit Center provides opportunity for direct *connections to a major high capacity transit corridor*
University District – Phased Long Term Implementation Plan Over Next 10 Years

Early Implementation Phases deploy a fully operational transit system, followed by Medium Term to Long Term Implementation Phases (next 5-15 years) driven by funding availability and not technical capabilities.

---

TSU Early Deployment Ph. A-D
U of H ERC Connections Early Depl. Phase E
U of H Main Campus Medium and Long Term
Early Depl. Ph. C LRT Station – Southeast LRT Connection
Early Depl. Ph. E LRT Station – Southeast LRT Connection
Long Term METRO Eastwood Transit Center Connection
Near Term Deployment Phases
Early Implementation Projects

Near Term Deployment Projects will *implement progressive phases of an AV Transit Circulator*, starting on the campus of *Texas Southern Univ*.

- Phase A starts now
- Phase B and C design studies start soon after Phase A begins
Early Implementation Projects for Near Term Deployment and R&D Initiatives

• **Phase A:** TSU AV Transit Circulator Preliminary Shuttle Deployment

• **Phase B:** TSU AV Transit Circulator South Extension and Operational Enhancement

• **Phase C:** University of Houston Supporting R&D and Maintenance Site Development (concurrent with all phases)

• **Phase D:** TSU AV Transit Circulator North Extension and LRT System Connection

• **Phase E:** AV Transit Circulator and Inter-Campus Connector System Deployment
Phase A: TSU AV Transit Circulator Initially Deployed as a Fixed Route Shuttle Operation

Texas Southern University Campus

TSU’s Tiger Walk is a linear pedestrian facility where the initial AV shuttle operations will be deployed
University District
AV Transit Circulator System
Early Implementation Project

Phase A – TSU AV Transit Shuttle Deployment

Texas Southern University

Campus Plan

Parking Garages
123 North Garage at Bragg
139 Collier Garage at Simpson

TSU Tiger Walk
TSU West Parking Garage

Early Deployment Phase A – TSU Campus Shuttle System
Phase B: South Extension and Operational Enhancement

University District AV Transit Circulator System

TSU Tiger Walk
TSU West Parking Garage
TSU Student Housing

University District AV Transit Circulator System
Early Implementation Project

Phase B – TSU AV Transit Circulator South Extension
Phase D: North Extension and LRT System Connection
Phase C: University of Houston Leading R&D and Maintenance Site Development

Concurrent R&D Project(s) Support Early Deployment Phases

1. Power Supply and Battery Charging R&D Program
2. Initial Site Development for ultimate Operations Control Center (OCC), and Maintenance and Storage Facility (M&SF)
3. Demonstration of AV transit operations within Energy Research Center (ERC) Campus
Phase A-D: TSU AV Transit Early Deployment has Access to U of H Energy Research Center Campus

Deployment of a Fully Operational Transit System

- Start with a small vehicle fleet and four stations
- Progressively expand fleet and stations to reach UofH campus
- Initial initial OCC at TSU (ultimate use as Remote Operations Center)
- U of H ERC access via existing ped and bikeway for periodic vehicle heavy maintenance
Early Deployment Phases will include Design Development and Operations Research Tasks

- Research of automated AV operations within a pedestrian environment
- Station configuration and equipment design for compliance with ADA
- Vehicle battery charging equipment design assessment and power supply infrastructure design for continuous operations with air conditioned vehicles

Source: 2getthere
Phase E: AV Transit Circulator and Inter-Campus Connector System Deployment

Final phase of early deployment projects extends AV Transit Circulator operations and adds stations within U of H Main Campus along Wheeler Ave. corridor and ERC Campus.
Summary of University District
Near Term Deployment Phases
Early Implementation Projects for Near Term Deployment and R&D Initiatives

- **Phase A:** TSU AV Transit Circulator Preliminary Shuttle Deployment
- **Phase B:** TSU AV Transit Circulator South Extension and Operational Enhancement
- **Phase C:** University of Houston Supporting R&D and Maintenance Site Development (concurrent with all phases)
- **Phase D:** TSU AV Transit Circulator North Extension and LRT System Connection
- **Phase E:** AV Transit Circulator and Inter-Campus Connector System Deployment
Early Implementation Projects and Approximate AV Transit System Length

- **Phase A:** TSU AV Transit Circulator Preliminary Shuttle Deployment
  0.5 miles (0.8 kilometers) System Length

- **Phase B:** TSU AV Transit Circulator South Extension
  0.5 miles (0.8 kilometers) System Extension Length

- **Phase D:** TSU AV Transit Circulator North Extension
  0.5 miles (0.8 kilometers) System Extension Length

- **Phase E:** AV Transit Circulator Inter-Campus Connector
  1.5 mile (2.4 kilometers) System Extension Length

**3.0 mile (4.8 kilometers) Total AV Transit System Operational Length in Early Deployment Phases**
Importance of Near Term University District AV Transit Circulator System Projects

- *Deployment of existing automated transit network (ATN) technology* for circulator system within TSU campus
- Creation of an *Automated Mobility District* (defined by DOE/NREL) encompassing the combined TSU and University of Houston campuses
- Expansion of the AV transit system by *progressively more complex mixed-traffic operations*
- Deployment phases with a *progressively more complex Operating Plan* for the AV Transit Circulator System
Importance of Near Term University District AV Transit Circulator System Projects

- **Deployment of existing automated transit network (ATN) technology** for circulator system within TSU campus
  - Automated, unmanned roadway vehicle technology
    - *SAE Level 4* Driving Automation
    - *Other automated functions* to provide safe and efficient transport of passengers
  - Operations control center with communications systems linking OCC with each vehicle for:
    - *Continuous human monitoring* of automated dispatch
    - *Remote driving/control* functions for rapid failure response
Importance of Near Term University District AV Transit Circulator System Projects

- Creation of an *Automated Mobility District* (defined by DOE/NREL) encompassing the combined TSU and University of Houston campuses

- Expansion of the AV transit system by progressively more complex *mixed-traffic operations*
  - High activity level pedestrian environment
  - Low activity level automobile environment
  - High activity level automobile environment
Importance of Near Term University District AV Transit Circulator System Projects

- Deployment phases with a *progressively more complex Operating Plan* for the AV Transit Circulator System
  - Shuttle System Line-Haul Operations
  - Network System Demand-Response Dispatch Operations
  - First-Mile/Last-Mile Transit Connections
Long Range Implementation Planning

LR Planning Task accomplished as part of MPO’s regional transportation Unified Planning Work Program (UPWP)
Long Range Implementation Planning – Conceptual Definition, Preliminary Engineering and Sustainability Analysis

Task 1  Conceptual Transit Circulator System Definition and Operational Case Studies  *

Task 2  Vehicle System and Power Supply/Charging System Preliminary Engineering Studies  *

Task 3  Environmental and Sustainability Analyses  *

Task 4  Benefit/Cost Analysis

Task 5  Final Report

* Utilizing ALPS – the Advanced Land Transportation Performance Simulation – through modeling and analysis partnership with NREL and Kimley-Horn
Medium Term Implementation (5 Yrs) Extends AV Transit Throughout U of H Main Campus with Extensive On-Demand Dispatch Operations
Simulation Based Analysis of Complex System Operations under Dynamic Ridership Demands

Simulation-based study of Conceptual Automated Transit Network System for Cal State University – Fresno Campus

ALPS
Simulating Peak Performance

University District
AV Transit Circulator System
Simulation Based Analysis of Complex System Operations under Dynamic Ridership Demands

Simulation-based study of Conceptual Automated Transit Network System for Cal State University – Fresno Campus

University District AV Transit Circulator System
Long Range Implementation Planning Task – Conceptual Definition, Preliminary Engineering and Sustainability Analysis

- **Simulation Analyses Performed** to define progressive operating plan and fleet sizing during phased deployments
  - Alternative operational concepts
  - Case study demand scenarios and variations in transit access to campus
  - Station locations and configurations

- Simulations model *propulsion/braking power demands* and continuous *energy consumption* for the analysis of:
  - Battery charge each vehicle and recharge cycle implications
  - Electrical Power Supply infrastructure needs
  - Sustainability benefits
Long Term Implementation (10 Yrs) Provides FM/LM Connections to High Capacity Transit Corridor
Summary of Key Research Purposes and Mission
Key Research Purposes of the University District AV Transit Circulator System

- Establishment of a "living laboratory" to study AV transit system design/operating conditions and human/machine interactions:
  - Fully automated, unmanned (L4) vehicles
    - Supervisory Control System for automated dispatching
    - Operations Control Center (OCC) for human monitoring of vehicle operations and passenger activity
  - Remote Operations Centers for fast recovery from vehicle/system operational failures
    - Operating base for roving operations personnel
    - Remote vehicle operator control functions focused at these locations
University District Mission

- **Become** a *living research laboratory* to study management of energy use and passenger services for public transportation operating agencies deploying fully automated AV Transit.

- **Prepare** our *university students for their roles* in the new world of AV technology.

- **Provide** an effective solution for U of H and TSU *internal campus circulation issues*, reducing the burden of being a pedestrian in Houston’s heat and inclement weather conditions.

- **Develop** *transit industry benchmarks* for operational planning, safety/security, sustainability and power supply infrastructure.

- **Demonstrate** how AV Transit can serve *connections between a major urban district and a high capacity transit* corridor.