I. Presentations:
   1. High Capacity Transit Modes and Emerging Technology Overview

ADA Compliance

Reasonable modifications and equal access to communications are provided upon request. Please call (512)389-7458 or email gina.estrada@capmetro.org if you need more information.

BOARD OF DIRECTORS: Wade Cooper, chairperson; Delia Garza, vice chair; Juli Word, board secretary; Terry Mitchell, Pio Renteria, Jeffrey Travillion, Rita Jonse and Ann Kitchen. Board Liaison: Gina Estrada (512)389-7458, email gina.estrada@capmetro.org if you need more information.

The Board of Directors may go into closed session under the Texas Open Meetings Act. In accordance with Texas Government Code, Section 551.071, consultation with attorney for any legal issues, under Section 551.072 for real property issues; under Section 551.074 for personnel matters, or under Section 551.076, for deliberation regarding the deployment or implementation of security personnel or devices; arising regarding any item listed on this agenda.
TITLE: Project Connect
High Capacity Transit Modes and Emerging Technology Overview
INTRODUCTION

PROJECT CONNECT OVERVIEW

AUSTIN STRATEGIC MOBILITY PLAN + CORRIDOR OFFICE COORDINATION

DEDICATED PATHWAYS

MODES

NEXT STEPS
INTRODUCTION

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Project Overview

System investments to support our future

+ Emerging Technologies
+ Multimodal Integration

High-Capacity Transit Network
Phased Approach to Project Development

1. **BIG IDEAS, BOLD START**
   With public input, identify and review potential projects for building a high capacity transit system.

2. **REAL SOLUTIONS**
   Study the selected projects and present options to the community that are consistent with regional and local priorities.

3. **PATH TO IMPLEMENTATION**
   Approval of Project Connect system vision and development of partnerships with stakeholders, agency board and community members.

4. **PROJECT DEVELOPMENT**
   Further study the costs, benefits and ridership of a potential project—all of which are impacted by mode choice—to determine whether the project will be competitive for FTA funding.
Phased Approach to Project Development

5. BEGIN PE/NEPA
   Identify the potential impacts within the project area based on mode options (including pathway configuration, station footprint, and other systems). Initiate NEPA coordination with the FTA and determine one of three different Classes of Action for the project.

6. NEPA AND LOCALLY PREFERRED ALTERNATIVE
   Advanced preliminary engineering and design to identify a Locally Preferred Alternative (LPA), which includes mode choice and station locations. The NEPA process and requirements for a project is different depending on the class of action determined in step 2.

7. NEPA DETERMINATION & GO/NO-GO DECISIONS
   Receive NEPA approval from the FTA, which allows the project to become eligible for federal funds and proceed to final design. After this point, only minor changes can be made to the project scope. Major changes will require restarting the NEPA process.

8. ENGINEERING AND CONSTRUCTION
   Finalize design, acquire real estate and begin construction on the program of projects.
Project Connect All High-Capacity Modes

- Heavy Rail
- Commuter Rail
- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)
- Autonomous Rapid Transit (ART)
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City of Austin and Project Connect: Key Coordination Points
Austin Strategic Mobility Plan
What is the Austin Strategic Mobility Plan?

The ASMP is the City’s new transportation plan, covering all the ways we get around Austin. It will:

- Guide our transportation policies, programs, projects, and investments
- Have a 20+ year horizon
- Be presented to City Council for adoption, amending Imagine Austin

+ An Updated, Multimodal Roadway Table

Objectives | Policies | Programs | Projects | Action Table
---|---|---|---|---
ASMP
# Planning Approach

**Technical:**

**Scenario Planning**

*Definition (Def):* A method to explore how well different mobility strategies make progress toward achievement of goals and objectives.

<table>
<thead>
<tr>
<th>Public Engagement: Targeted to Focus Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth (24 and younger)</td>
</tr>
<tr>
<td>Seniors (65 and older)</td>
</tr>
<tr>
<td>People of Color</td>
</tr>
<tr>
<td>People with Mobility Impairments</td>
</tr>
</tbody>
</table>
What did we hear?

“More Transit”
“More Multimodal”
“More Street Capacity”
“More Balanced”
“More Bicycling”
“More Sidewalks”
Top Strategies Chosen (by total # of votes)

**Overall Population**
1. Provide more public transit service and enhance connections to/from public transit (Travel Choice - 1,996)
2. Promote transportation modes that reduce reliance on fossil fuels (such as bicycling, walking, transit and electric vehicles) (Sustainability - 1,782)
3. Improve signal timing and other transportation technologies (Commuter Delay - 1,765)
4. Prioritize travel choices, such as taking public transit, walking, or bicycling, making them more convenient and efficient (Commuter Delay - 1,683)
5. Reduce serious injuries and fatalities by designing streets for appropriate vehicular speed (Health & Safety - 1,637)

**Focus Populations**
1. Provide more public transit service and enhance connections to/from public transit (Travel Choice - 674)
2. Offer more choices in how we travel to reduce personal costs associated with car ownership (Affordability - 581)
3. (TIE) Improve signal timing and other transportation technologies (Commuter Delay - 575)
3. (TIE) Reduce serious injuries and fatalities by designing streets for appropriate vehicular speed (Health & Safety – 575)
5. Promote transportation modes that reduce reliance on fossil fuels (such as bicycling, walking, transit and electric vehicles) (Sustainability - 569)

Total strategies to choose from: 27
ASMP Coordination with Project Connect & Capital Metro

• Regular coordination meetings at all levels – technical, community engagement and program leaders
• Project Connect and ASMP shared Multimodal Community Advisory Committee (MCAC)
• Updated CAMPO model to reflect Capital Metro transit service
• Multimodal pinch point analysis
• Transit Priority Policy *(Council Resolution No. 20160414-07)*
Schedule

Establish Advisory Committee & Public Engagement Plan

Phase I Outreach

Phase II Outreach

Phase III Outreach

Mobility Strategy review

Approval Process starts

2016
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

2017

2018

2019
Sep Oct Nov Dec Jan

Project Initiation & Phase I Public Outreach

Scenario Planning/Analysis & Phase II Public Outreach

Preferred Strategy & Phase III Public Outreach

Plan Review & Adoption

1.1.a Packet Pg. 19
Corridor Program
CORRIDOR MOBILITY PROGRAM

CORRIDOR CONSTRUCTION PROGRAM:
1. North Lamar Boulevard (US Hwy. 183 to Howard Lane)
2. Burnett Road (Koenig Lane to MoPac Expressway)
3. Airport Boulevard (North Lamar Boulevard to US Hwy. 183)
4. East MLK Jr. Boulevard/FM 969 (US Hwy. 183 to Decher Lane)
5. South Lamar Boulevard (Riverside Drive to Ben White Boulevard/US Hwy. 290 West)
6. East Riverside Drive (I-35 to SH 71)
7. Guadalupe Street (MLK Jr. Boulevard to W. 29th Street)
8. William Cannon Drive (Southwest Parkway to McKinney Falls Parkway)
9. Slaughter Lane (FM 1626 to Vertex Boulevard)

PRELIMINARY ENGINEERING:
10. North Lamar Boulevard (Lady Bird Lake to US 183) / Guadalupe Street (W. 29th St. to North Lamar Boulevard)
11. E MLK Jr. Blvd/FM 969 (North Lamar Boulevard to US 183)
12. South Congress Avenue (Lady Bird Lake to Slaughter Lane)
13. Manchaca Road (South Lamar Boulevard to FM 1626)
14. South Pleasant Valley Road (Oliver Street to Slaughter Lane)

PRELIMINARY AND DESIGN WORK:
15. West Randerville Lane (Burnett Road to Metric Boulevard)
16. East Randerville Lane (Cameron Road to Ferguson Lane)
17. Colony Loop Drive (Loyola Lane to Decher Lane)
FUNDING CATEGORY:
Full Design and Construction

Corridor-wide Mobility Improvements on all 9 corridors

Enhanced Multimodal Improvements
- East Riverside Dr – Shore District Dr to Montopolis Dr
- South Lamar Blvd – Riverside Dr to Barton Springs Rd
- CAMPO Grant: William Cannon Dr – Running Water Dr to McKinney Falls Pkwy
- CAMPO Grant: Slaughter Lane – MoPac to Brodie Ln
CORRIDOR CONSTRUCTION PROGRAM TIMELINE

- CORRIDOR MOBILITY PLAN DEVELOPMENT
- CORRIDOR CONSTRUCTION PROGRAM DEVELOPMENT PHASE
- PROJECT DESIGN PHASE
- BID/AWARD/EXECUTION
- CONSTRUCTION PHASE


EARLY-OUT PROJECTS
Capital Metro Coordination

- Optimization of transit access
- Cap Remap included in conceptual design of Corridor Construction Program
- Ongoing evaluation of how Project Connect outcomes may affect Corridor Mobility Program
Questions?

Annick Beaudet, Assistant Director, Austin Transportation Department
Mike Trimble, Director, Corridor Program Office
INTRODUCTION

PROJECT CONNECT OVERVIEW

AUSTIN STRATEGIC MOBILITY PLAN COORDINATION

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Competitor Cities Outpacing Austin
Mode Split for Commutes into Downtown: Primary Indicator of Mobility System Health

Seattle Downtown Commute
Regional Seattle Population (MSA): 3,870,000
Seattle Population: 725,000

- Drive Alone: 48%
- Transit: 25%
- Carpool: 3%
- Walk: 10%
- Bike: 6%
- Other: 8%

Denver Downtown Commute
Regional Denver Population (MSA): 2,800,000
Denver Population: 705,000

- Drive Alone: 39%
- Transit: 39%
- Carpool: 5%
- Walk: 4%
- Bike: 4%
- Other: 8%

Sources: US Census ACS data, Seattle (Commute Seattle), Denver (Den

Attachment: Sep. 14 Joint CMTA Board City Council Meeting - FINAL (4218 : Project
Meanwhile in Austin

“...the latest [...] forecast for the five-county Austin-Round Rock metro area is for 83 percent growth over 30 years — from 2,064,000 residents in 2016 to 3,780,000 in 2046.”
- Statesman Article

Austin Region-Wide Commute
Regional Austin Population (MSA): 2,064,000
Austin Population: 950,000

Sources: City of Austin via American Community Survey, Statesman Article
Must Fix Throughput
How Many People Can We Get Through an Intersection in a Minute?

Without space for transit:

With dedicated space for transit:
Must Fix Throughput
How Many People Can We Get Through an Intersection in a Minute?

126 People move through this roadway during each light cycle. 80 in transit.

235 People on a road with transit-only lanes move through this roadway during each light cycle. 204 in transit.
Multiple Configurations to accommodate R.O.W. constraints

Primary Options

Center Running
- **COST:** Low
- **SPEED & RELIABILITY:** High
- **CONSTRUCTION CHALLENGES:** Low

Curb Running
- **COST:** Low
- **SPEED & RELIABILITY:** Low
- **CONSTRUCTION CHALLENGES:** Moderate
Multiple Configurations to accommodate R.O.W. constraints

Secondary Options

**Elevated**
- **COST:** High
- **SPEED & RELIABILITY:** High
- **CONSTRUCTION CHALLENGES:** High

**Underground**
- **COST:** High
- **SPEED & RELIABILITY:** High
- **CONSTRUCTION CHALLENGES:** High
First Hurdle to Overcome: Right-of-Way

Future-Proofing Requires Dedicated R.O.W.

Travel times and reliability suitable for Project Connect high capacity transit ridership projections will require dedicated R.O.W.
Dedicated R.O.W. Case Study: Seattle’s Third Ave
Dedicated for Buses and Bikes Only as of August 21, 2018

Third Street Peak Hour: 200 buses/hour
(Capital Metro Peak Hour: 60 buses/hour)

“It comes down to math. At the pace we’re growing, we can’t move people in cars. That is hugely involved in success. If we let buses get mired in congestion, we wouldn’t see these ridership increases.”

- Andrew Glass Hastings, SDOT
Austin Hurdles to Overcome:

1. Actively building towers with lots of parking and driveways

- 405 Colorado – breaking ground on 4th and Colorado
- The Republic – Proposed for 308 Guadalupe
- Situation on Guadalupe Today

**An invitation for single occupancy gridlock:** towers with 25-50% of the structure parking are STILL being built
Austin Hurdles to Overcome:

2. Optics of “not enough buses” to justify dedicated lane

Guadalupe: Currently 60 buses per hour during rush hour, with competitive travel speeds due to dedicated transit lanes

Project Connect network: high frequency trunk lines allowing more transit routes to leverage speed advantage in dedicated ROW
The Los Angeles Metro Orange Line is a BRT route that operates in dedicated lanes with stations spaced approximately every 1 mile.

A 2007 study observes a mode shift of 18% from car drivers to Orange Line riders. This agrees with a 2005 study that observes a 17% reduction in congestion on CA highway 101 as a result of new Orange Line service.
After years of talk, the City of Boston finally “tested” a one-day pop-up lane of its own on a chronically jammed high ridership route. Findings showed that travel times decreased by 34% and variability decreased by 35% during the morning peak.
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AUSTIN STRATEGIC MOBILITY PLAN + COORDINATOR OFFICE COORDINATION

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### Heavy Rail At-A-Glance

<table>
<thead>
<tr>
<th>Defined as</th>
<th>Train operating in exclusive right of way with high frequencies to carry many people to destinations in and around the downtown core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Every 2 - 9 minutes during rush hour</td>
</tr>
<tr>
<td>Typical Daily Passengers Per Route&lt;sup&gt;2&lt;/sup&gt;</td>
<td>250,000 – 275,000 per route</td>
</tr>
<tr>
<td>Cost to build&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$200M - $1B/mile</td>
</tr>
<tr>
<td>Distance between stations&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Stops ½ to 1 mile apart</td>
</tr>
<tr>
<td>Per Vehicle Capacity&lt;sup&gt;5&lt;/sup&gt;</td>
<td>150-200 passengers per car, with 2-8 cars in a train</td>
</tr>
</tbody>
</table>

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<sup>1</sup> WMATA + MBTA

<sup>2</sup> NTD for CTA and MBTA

<sup>3</sup> Connect Greater Washington Report

<sup>4</sup> National Transit Database

<sup>5</sup> All costs inflated to 2018 $
Heavy Rail Case Study: Chicago CTA

Chicago CTA Platform

Elevated

Level Boarding

Chicago CTA Platform in the downtown Loop area
# Commuter Rail

## Commuter Rail At-A-Glance

<table>
<thead>
<tr>
<th>Defined as</th>
<th>Also called suburban rail; primarily operates between a city center and middle to outer suburbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency(^1)</td>
<td>Currently 30 minutes during rush hour</td>
</tr>
<tr>
<td>Typical Daily Passengers Per Route(^2)</td>
<td>2,500 - 7,400 per route</td>
</tr>
<tr>
<td>Cost to build(^3)</td>
<td>$6M - $115M/mile</td>
</tr>
<tr>
<td>Distance between stations(^4)</td>
<td>Stops 2 to 10 miles apart</td>
</tr>
<tr>
<td>Per Vehicle Capacity(^5)</td>
<td>150 – 290 passengers per car, with 2 – 10 cars in a train</td>
</tr>
</tbody>
</table>

\(^1\) TRE and CMTA Red Line
\(^2\) TRE and CMTA Red Line, NTD
\(^3\) Connect Greater Washington Report
\(^4\) Bombardier and Stadler
\(^5\) Connect Greater Washington Report

All costs inflated to 2018 $
Commuter Rail Case Study: CMTA Red Line

- Covered Shelters
- ADA-Accessible Ramps
- Dedicated ROW
- Higher Vehicle Profile
### Light Rail Transit (LRT)

#### LRT At-A-Glance

<table>
<thead>
<tr>
<th>Defined as</th>
<th>Rail service that operates in a dedicated lane, providing rapid service to connect local activity centers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency¹</td>
<td>Every 5 minutes during rush hour</td>
</tr>
<tr>
<td>Typical Daily Passengers Per Route²</td>
<td>Typically 30,000 – 55,000 per route</td>
</tr>
<tr>
<td>Cost to build³</td>
<td>$60M - $170M per mile</td>
</tr>
<tr>
<td>Distance between stations⁴</td>
<td>Stops every 3/4 – 1.5 miles</td>
</tr>
<tr>
<td>Per Vehicle Capacity⁵</td>
<td>140 - 240 passengers per car, with 2 - 3 cars in a train</td>
</tr>
</tbody>
</table>

¹ DART and King County Metro  
² Average of NTD Sources  
³ Connect Greater Washington Report  
⁴ Connect Greater Washington Report  
⁵ Siemens  

All costs inflated to 2018 $
LRT Case Study: Houston Metro

- Pedestrian Refuge
- ADA-Accessible Ramp
- Level Boarding
- Dedicated Lane
- Parking
- General Traffic
Bus Rapid Transit (BRT)

**BRT At-A-Glance**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defined as</td>
<td>Bus routes that operate in dedicated lanes and provide rapid service to connect local activity centers.</td>
</tr>
<tr>
<td>Frequency&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Every 5-10 minutes during rush hour</td>
</tr>
<tr>
<td>Typical Daily Passengers Per Route&lt;sup&gt;2&lt;/sup&gt;</td>
<td>15,000 – 20,000</td>
</tr>
<tr>
<td>Cost to build&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$35 - $75M / mile</td>
</tr>
<tr>
<td>Distance between stations&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Stops 1/2 mile apart</td>
</tr>
<tr>
<td>Per Vehicle Capacity&lt;sup&gt;5&lt;/sup&gt;</td>
<td>50 - 100 passengers per vehicle</td>
</tr>
</tbody>
</table>

<sup>1</sup> RVA Health Line and Silverline  
<sup>2</sup> Metro Planning  
<sup>3</sup> Connect Greater Washington Report  
<sup>4</sup> Connect Greater Washington Report  
<sup>5</sup> New Flyer  

All costs inflated to 2018 $
BRT Case Study: Cleveland Health Line

Return on Investment = $114 for every $1 spent

- **Fast, Reliable Service**: Operates 24/7, with 5-minute bus frequency during peak periods
- **High-Quality Investments**: 63-foot hybrid-electric vehicles with doors on both sides
- **Smart System Design**: Replaced 108 bus stops with 36 conveniently spaced stations
## Bus Rapid Transit Light (BRT Light)

### BRT Light At-A-Glance

<table>
<thead>
<tr>
<th>Defined as</th>
<th>Bus routes that operate in mixed traffic and transit priority lanes and provide rapid service to connect local activity centers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency¹</td>
<td>Every 10 minutes during rush hour</td>
</tr>
<tr>
<td>Typical Daily Passengers Per Route²</td>
<td>3,500 – 10,000</td>
</tr>
<tr>
<td>Cost to build³</td>
<td>$1M - $2.5M/ mile</td>
</tr>
<tr>
<td>Distance between stations⁴</td>
<td>Stops 1/4 – 1/2 mile apart</td>
</tr>
<tr>
<td>Per Vehicle Capacity⁵</td>
<td>50 - 100 passengers per vehicle</td>
</tr>
</tbody>
</table>

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¹ San Antonio Primo Rt. 100, San Diego MTS Rt. 215  
² KPBS and Capital Metro  
³ Connect Greater Washington Report  
⁴ Connect Greater Washington Report  
⁵ New Flyer  

All costs inflated to 2018 $
BRT Light Case Study: MetroRapid

Transit Priority Lanes – only some of the benefits of dedicated lanes

Curb-Level Boarding  One-Door Boarding  Shorter Platforms
Autonomous Rapid Transit (ART)
What is Autonomous Rapid Transit (ART)?

- Emerging train/bus mode that will operate using driverless technology
- Currently being developed in Singapore, France, Germany, and China
- Will optimize vehicle-to-vehicle (V2V) technology
- Holds huge potential to optimize routes and roadspace through platooning
- Four key components to this technology: Autonomous, Connected, Electric, Shared (ACES)

Zhuzhou Concept

Singapore Driverless Concept

Mercedes Future Bus

Volvo ART Bus Concept

Dresden Autotram
# Automation in Transit

## A short history

<table>
<thead>
<tr>
<th>System</th>
<th>Year Opened</th>
<th>Type of System</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFW Airport</td>
<td>1974</td>
<td>Automatic Train Operation - airport</td>
<td>Low</td>
</tr>
<tr>
<td>Miami Metro Mover</td>
<td>1996</td>
<td>Automated Guideway Transit</td>
<td>Medium</td>
</tr>
<tr>
<td>Paris Metro Line D</td>
<td>1993</td>
<td>Automatic Rubber Tire</td>
<td>High</td>
</tr>
<tr>
<td>Singapore, NE Line</td>
<td>2002</td>
<td>Automatic Train Operation</td>
<td>High</td>
</tr>
</tbody>
</table>

*Source: Vuchic, 2002 (abridged)*
Autonomous Rail Case Study: Honolulu Driverless Train

- 20-mile elevated rail line between downtown and outlying communities with a planned opening in 2020.
- Can carry **800 riders per train**, with racks for both bicycles and surfboards.
- **First fully automated wide-scale urban transit system in the U.S.** Instead of human drivers, a centrally-located computer system will control stops, departures, and speed, and even open and close doors.
Autonomous Rail Case Study: Vancouver SkyTrain

- SkyTrain is the oldest and one of the longest automated driverless light rapid transit systems in the world (opened in 1986)
- 49.5 miles
- Uses fully automated trains on grade-separated tracks running on underground and elevated guideways
- Service levels of 2-10 minute headways made viable by lower operating costs
- Daily Ridership: 477,500
Automation in Transit
Development of Autonomous Technology

<table>
<thead>
<tr>
<th>No Autonomy</th>
<th>Driver Assistance</th>
<th>Partial Autonomy</th>
<th>Conditional Autonomy</th>
<th>High Autonomy</th>
<th>Full Autonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Occupancy</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>High Occupancy</td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
<td><img src="image10.png" alt="Image" /></td>
</tr>
</tbody>
</table>
ART Case Study: Mercedes Future Bus City Pilot

• The technology of the CityPilot in the Mercedes-Benz Future Bus is based on that of the autonomously driving Mercedes-Benz Actros truck with Highway Pilot presented in 2014.

• The CityPilot is able to recognize traffic lights, communicate with them and safely negotiate junctions controlled by them. It can also recognize obstacles, especially pedestrians on the road, and brake autonomously.

• It approaches bus stops automatically, where it opens and closes its doors.

Source: Daimler
**ART Case Study: Automation in Parking**

- Automated Bus Parking demonstrates the capability of an autonomous-equipped vehicle to execute precise maneuvers within a bus depot.

- Cameras, sensors and image processing technologies precisely guide the vehicle within very tight spatial tolerances.

*Source: RATP Group, European Union’s Horizon 2020 Program*
ART Case Study: Singapore

• Volvo Buses and Nanyang Technological University (NTU) in Singapore have signed a cooperation agreement on a research and development program for **autonomous electric buses**.

• NTU’s vice-president for research, Professor Lam Khin Yong, said the development of a driverless bus will dovetail with the Government’s vision to have autonomous vehicles in Punggol, Tengah and the Jurong Innovation District in **2019 for testing 2022 for commuter use**.

*Source: Volvo, Straits Times*
Emerging Transportation Technology
Platooning and V2V Communication

- Transit vehicles share current locations and speeds in real time, allowing for the safe operation of very short headways (less than 2 minutes)
- Vehicle to Vehicle (v2v) communication – allows for optimal allocation of street space (similar to platooning)
Autonomous Rapid Transit (ART)

**ART At-A-Glance**

<table>
<thead>
<tr>
<th><strong>Defined as</strong></th>
<th>Emerging train/bus mode that will operate using driverless technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>Comparable to LRT: Every 5 - 10 minutes during rush hour</td>
</tr>
<tr>
<td><strong>Typical Daily Passengers Per Route</strong></td>
<td>Under development; likely comparable to BRT/LRT: 20,000 - 40,000</td>
</tr>
<tr>
<td><strong>Cost to build</strong></td>
<td>Under development; likely comparable to BRT: $35 - $75M per mile</td>
</tr>
<tr>
<td><strong>Distance between stations</strong></td>
<td>Comparable to LRT: Stops 1/2 - 1 mile apart</td>
</tr>
<tr>
<td><strong>Per Vehicle Capacity</strong></td>
<td>Under development; likely comparable to LRT/BRT (100 - 200 passengers per vehicle)</td>
</tr>
</tbody>
</table>

---

1. LRT and BRT sources
2. Metro Planning; Average of NTD Sources
3. Connect Greater Washington Report
5. New Flyer, Siemens

All costs inflated to 2018 $
# Mode Considerations

## Building the System

<table>
<thead>
<tr>
<th>Mode</th>
<th>Infrastructure Costs</th>
<th>Construction Timeline and Impacts (after funding secured)</th>
<th>Repaving/Utility Relocation Impacts</th>
<th>Vehicle Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRT</td>
<td>$60M - $170M per mile</td>
<td>5 - 10 years construction; moderate disruption</td>
<td>~4 feet</td>
<td>$3M - $5M per vehicle</td>
</tr>
<tr>
<td>BRT</td>
<td>$35M - $75M per mile</td>
<td>3 - 5 years; minimal disruption</td>
<td>~2 feet</td>
<td>$500K – $1M per vehicle</td>
</tr>
<tr>
<td>ART</td>
<td>TBD but likely comparable to BRT</td>
<td>TBD but likely comparable to BRT</td>
<td>~2 feet</td>
<td>Less than LRT and more than BRT</td>
</tr>
</tbody>
</table>
## Mode Considerations

### Keeping the System Working

<table>
<thead>
<tr>
<th>Mode</th>
<th>Operational Costs</th>
<th>Maintenance Costs</th>
<th>Repair and Replacement Costs</th>
<th>Other Supporting System Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRT</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
</tr>
<tr>
<td></td>
<td>Moves the most people for the lowest operational cost</td>
<td>Tracks and power system carry high maintenance costs</td>
<td>Vehicle and track replacement costs are high</td>
<td>Most expensive maintenance and support facilities; power supply system</td>
</tr>
<tr>
<td>BRT</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
</tr>
<tr>
<td></td>
<td>Needs more fuel or charge and operators per passenger than LRT</td>
<td>Maintenance costs limited to vehicles and stations</td>
<td>Vehicle costs are lower, but vehicle lifetimes are shorter</td>
<td>Minimal supporting system costs beyond maintenance facility</td>
</tr>
<tr>
<td>ART</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
</tr>
<tr>
<td></td>
<td>Fewer operators, but needs support personnel</td>
<td>Costs unknown, but likely between BRT and LRT due to cost of technology maintenance</td>
<td>Costs unknown; likely higher between BRT and LRT due to cost of technology components</td>
<td>Costs unknown, but moderate supporting system costs for IT system and AV components</td>
</tr>
</tbody>
</table>
INTRODUCTION

PROJECT CONNECT OVERVIEW

AUSTIN STRATEGIC MOBILITY PLAN + CORRIDOR OFFICE COORDINATION

DEDICATED PATHWAYS

MODES

NEXT STEPS
Next Steps

October 1: Austin Chamber of Commerce Regional Mobility Summit

October-November: Community Engagement, District Town Halls

October 22: Capital Metro Board of Directors Meeting- Staff Presentation of Recommended System Plan

December 17: Capital Metro Board of Directors Meeting- adoption of Project Connect Vision Plan