Miami
PROJECT EXECUTIVE COMMITTEE (PEC) MEETING
JANUARY 28, 2014
Beach Corridor Transit Connection Study
Project Executive Committee (PEC)
Meeting

Stephen P. Clark Center
111 NW 1st Street, Miami
Conference Room 18-4
January 28, 2014
Today’s Meeting Goals

• Provide project background
• Review 2004 Locally Preferred Alternative (LPA)
• Roundtable discussion on LPA refinements
• Identify PEC preferences
• Set future meeting date
Project Background: Studies for Miami - Miami Beach System

1988 - Miami Beach Light Rail Feasibility Study
1992 - Dade County Priority Corridors Transitional Study
1995 - East-West Multimodal Corridor Study Draft Environmental Impact Statement (DEIS)
2002 - Miami-Miami Beach Transportation Corridor (Bay Link) Study
2003 - Miami-Dade MPO adopts Locally Preferred Alternative (LPA)
2013 - Beach Corridor Transit Connection Study (Current Study)
Project Background: Study Organization

Agency/Organization

- Miami-Dade MPO
- Florida Department of Transportation (FDOT)
- Miami-Dade County
- City of Miami
- City of Miami Beach
- Miami DDA

Study Contribution

$ 150,000
$ 75,000
$ 25,000
$ 25,000
$ 25,000
$ 25,000

$ 325,000 Total

The Miami-Dade MPO serves as the lead agency.
Project Background: Project Executive Committee Members (PEC)

5-member Committee appointed by Elected Officials and comprised as follows:

- MPO Governing Board (2)
- Miami-Dade County
- City of Miami
- City of Miami Beach
Project Background: Supporting Agencies

- Miami-Dade MPO
- Miami Dade Transit
- PortMiami
- FDOT District 6
- Miami DDA
- MDX
- Miami-Dade Regulatory and Economic Resources (RER) Department
- Miami Parking Authority
- City of Miami
- City of Miami Beach
- Miami-Dade Public Works and Waste Management (PWWM) Department

Supported by Gannett Fleming Consulting Team
1. Update the key elements of 2004 study
   • Refinements to the 2004 LPA
   • Identify potential extensions
   • Identify maintenance facility location(s)
   • Study wireless modern streetcar technology
   • Update cost estimates and financial plan
   • Conduct high level environmental screening

2. Gain consensus on how to move forward
### Project Background: Study Schedule

**BEACH CORRIDOR TRANSIT CONNECTION STUDY**

#### TASK SCHEDULE

<table>
<thead>
<tr>
<th>Task Description</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - STUDY COORDINATION/ PROJ. MGMT.</td>
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<tr>
<td>1.0 Progress Meetings</td>
<td></td>
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<tr>
<td>1.1 TSC Committee Prep &amp; Meetings</td>
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<td>1.2 PEC Committee Prep &amp; Meetings</td>
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<td>1.3 MPO, Cities, Agency Coordination</td>
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<td>1.4 Stakeholder Group Meetings</td>
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<tr>
<td>2 - DATA COLLECTION</td>
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<tr>
<td>3 - REFINEMENT OF LPA</td>
<td></td>
<td></td>
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<td>4 - FINANCIAL ANALYSIS</td>
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<td>5 - ENVIRONMENTAL SCREENING</td>
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<tr>
<td>6 - VISUALIZATION</td>
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<tr>
<td>7 - PROJECT CONSENSUS</td>
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<tr>
<td>8 - PROJECT DEVMT DOCUMENTATION</td>
<td></td>
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<tr>
<td>9 - FINAL REPORT</td>
<td></td>
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<tr>
<td>10 - DELIVERABLES</td>
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#### Milestones and Deliverables
- **Milestone, Meeting or Deliverable**
- **Intermittent Work**
- **Roll Up Task**
2004 Locally Preferred Alternative (LPA)
2004 LPA: Miami Beach Alignment

- Two independent loops:
  - Counter Clockwise Loop: Causeway/Regional Connector (red line)
  - Clockwise Loop: Local Circulator (green line)
2004 LPA: Causeway Alignment

- **Causeway Connector** *(red line)*
  - Two elevated stations
  - Double track segment in exclusive guideway
  - Located on south side of causeway
  - Pedestrian bridge at Watson Island to connect to Jungle Island
2004 LPA: Downtown Miami Alignment

- Split Service (red line)
  - Counter clockwise outer loop
  - Clockwise inner loop
  - Optional alignments remained viable (dotted line)
- Assumed Miami Streetcar (yellow)
2004 LPA: Cost and Funding Sources

Funding Source:  
- Federal (50% 5309)  
- State (25% FDOT)  
- Local (25% PTP)  

Capital Cost by Source*:  
- Federal (50% 5309): $241.35  
- State (25% FDOT): $120.68  
- Local (25% PTP): $120.68  

Total: $482.71

*In millions of 2004 dollars
LPA Refinements: Grouping of Alternatives in Downtown Miami

• **Direct Connection**: most direct connection from the Causeway to the Government Center transit hub

• **Operational Loop**: small loop that runs around the block on a single track thus improving street operations

• **Circulation Loop**: large one-way loop with several blocks in between that covers larger area

• **Independent Lines**: separate routes that operate independent of each other
LPA Refinements: Downtown Alternatives
LPA Refinements: Downtown Alternatives
LPA Refinements: Downtown Alternatives

DIRECT CONNECTION
OPERATIONAL LOOP

GOVERNMENT CENTER

NW 1ST AVENUE

NE 6TH STREET

NE 3RD STREET

NE 2ND STREET

SE 1ST STREET

BISCAYNE BOULEVARD

PORT MIAMI
LPA Refinements: Downtown Alternatives
LPA Refinements: Downtown Alternatives

DIRECT CONNECTION
OPERATIONAL LOOP
CIRCULATION LOOP
INDEPENDENT LINES
LPA Refinements: Grouping of Alternatives in Miami Beach

- **Direct Connection**: most direct rail connection from the Causeway to the Convention Center
- **Operational Loop**: small loop that runs around the block on a single track thus improving street operations
- **Circulation Loop**: large two-way loop with several blocks in between that covers larger area
- **Independent Lines**: separate two-way routes that operate independent of each other
LPA Refinements: Miami Beach Alternatives
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DIRECT CONNECTION
OPERATIONAL LOOP
LPA Refinements: Miami Beach Alternatives
LPA Refinements: Miami Beach Alternatives
PEC Preferences

• Prefer more direct route over circulation element?
• Train operating in exclusive right-of-way or mixed traffic?
• Facilitate future extensions?
• Avoid right-of-way acquisition at all costs?
• Removing on-street parking for exclusive guideway?
• Which is the primary travel market to be served (i.e. residents, employees or visitors)?
• Are phasing options desirable?
• Any other refinement options or extensions?
FUTURE PEC MEETING
Future PEC Meeting

• Date
• Location
• Agenda
  o Reduced number of LPA refinements
  o Updated costs
  o Identify funding options
  o Wireless technology assessment
Downtown Core
Bay Islands
South Pointe
Convention Center
Downtown Core
Bay Islands
South Pointe
Government Center
Entertainment District
Beach Corridor Transit Connection Study

Policy Executive Committee Meeting
April 2, 2014
Today’s Agenda

Modern LRT/Streetcar Overview
LPA Refinements and Extensions Review
Conceptual Cost Estimates Review
TIGER Grant Application
Next PEC Meeting Agenda
Today’s Agenda

- Modern LRT/Streetcar Overview
- LPA Refinements and Extensions Review
- Conceptual Cost Estimates Review
- TIGER Grant Application
- Next PEC Meeting Agenda
Modern LRV/Streetcar Specifications

- Capacity: 62 – 231 total
- Length: 66 – 105 feet
- Width: 7’5”, 7’9”, 8’, or 8’7”
- Speeds: 26 – 66 mph (45 – 50 mph most common)
- Power: battery, underground, super capacitors (overhead most common)
- Wireless car builders: Alstom, Bombardier, Brookville, CAF, Kawasaki, Kinkisharyo, United Streetcar
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- **Wireless car builders:** Alstom, Bombardier, Brookville, CAF, Kawasaki, Kinkisharyo, United Streetcar
Wireless Modern LRT

Seville, Spain

Bordeaux, France

Reims, France

Al Sufouh, Dubai
Wireless Modern
LRT

Seville, Spain

Bordeaux, France

Reims, France

Al Sufouh, Dubai
Wireless Modern LRV/Streetcars

- Dallas, Texas
- Marseille, France
- Brookville Liberty Vehicle (testing wireless)
- Zaragoza, Spain
Wireless Modern
LRV/Streetcars

Dallas, Texas

Brookville Liberty Vehicle
(testing wireless)

Marseille, France

Zaragoza, Spain
LPA REFINEMENTS AND EXTENSIONS REVIEW
Activities Since Last Meeting

- Met twice with Technical Steering Committee
- Met with Miami Worldcenter developer
- Revised the Downtown alignment
- Narrowed down LPA refined alternatives
- Developed two system-wide alternatives
- Refined the extensions
- Developed capital and operating conceptual costs
Activities Since Last Meeting

- Met twice with Technical Steering Committee
- Met with Miami Worldcenter developer
- Revised the Downtown alignment
- Narrowed down LPA refined alternatives
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- Developed capital and operating conceptual costs
PEC/TSC Preferences

- Convenient transfers
- Different from existing premium service
- Connection between Downtown & Beach first
- Exclusive transit lanes
- On-street parking removal if necessary
- Minimize use of “loops”
- Phased implementation
- Wireless technology

- PEC Concurrence
- No PEC Concensus
2004 Refined LPA Alignment
2004 Refined LPA Alignment
Direct Connection (DC) Alternative
Direct Connection (DC) Alternative
Extension to New Miami Conference Center
Extension to New Miami Conference Center
Operational Loop + Alton (OLA) Alternative
Operational Loop + Alton (OLA) Alternative
Typical Section
NE 2nd Street

Existing

Operational Loop + Alton (OLA)

Direct Connection (DC)
“Transit Mall”
Typical Section
NE 2nd Street

Existing

Operational Loop + Alton (OLA)

Direct Connection (DC)
“Transit Mall”
Typical Section
Biscayne Blvd.

Option 1: DC & OLA

Existing
(from SE 1st St. to NE 6th St.)

Option 2: DC & OLA
Typical Section
Biscayne Blvd.

Existing
(from SE 1st St. to NE 6th St.)

Option 1: DC & OLA

Option 2: DC & OLA
Typical Section
MacArthur Causeway

Existing

DC & OLA
Typical Section
MacArthur Causeway

Existing

DC & OLA
Typical Section 5th Street

Option 1: DC & OLA

Existing

Option 2: DC & OLA
Typical Section 5th Street

Option 1: DC & OLA

Option 2: DC & OLA

Existing
Typical Section
Washington Av.

Existing

Option 1: DC & OLA

Option 2: DC & OLA
Typical Section
Washington Av.

Existing

Option 1: DC & OLA

Option 2: DC & OLA
DC & OLA

Extensions

Express Buses
Extensions
OLA
Express Buses
DC
Metrorail
Metromover
Typical Section
Julia Tuttle Causeway

Existing

Extension with Train
Typical Section

Julia Tuttle Causeway

Existing

Extension with Train
Methodology for Updating Capital Costs

Steps to updating LPA capital costs

- FTA capital cost databases for similar projects
- Performed reasonableness tests for cost of major components (structures)
- Cost increases between 2004 and 2013 averaged 55%

Steps to updating refined LPA alternatives and Extensions

- Calculated cost/linear foot (Downtown, Causeway and Beach)
- Estimated lengths of each alternative
Methodology for Updating Capital Costs

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## 2004 LPA

### Capital Cost

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<th>2004 (Millions)</th>
<th>2013 (Millions)</th>
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<td>Guideway Elements</td>
<td>$135.52</td>
<td>$210.05</td>
</tr>
<tr>
<td>Yards &amp; Shops (Support Facilities)</td>
<td>$26.57</td>
<td>$41.18</td>
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<td>System Elements</td>
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<td>Passenger Stations</td>
<td>$35.97</td>
<td>$55.75</td>
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<tr>
<td>Vehicles</td>
<td>$43.22</td>
<td>$92.40</td>
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<th>Beach</th>
<th>Vehicles</th>
<th>Maint. Fac.</th>
<th>Total</th>
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* Assumes utilizing Phase 1 maintenance facility
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Extension

Assumptions

- LRT rail vehicle technology for costing
- Express bus costs not included
- Comparable service frequencies as DC
- Comparable rail vehicle speeds on both LPA Refined Alternatives
Extension

Assumptions

- LRT rail vehicle technology for costing
- Express bus costs not included
- Comparable service frequencies as DC
- Comparable rail vehicle speeds on both LPA Refined Alternatives
Extensions (with DC & OLA)
Options & Capital Costs
Extensions (with DC & OLA)
Options & Capital Costs

- Express Buses Extensions
- Options & Capital Costs
- DC
- Metrorail
- Metromover

- Capital $133 M
  - 2.7 miles
- Capital $282 M
  - 4.2 miles
- Capital $114 M
  - 1.5 miles
Methodology and Assumptions:

- Calculated new station to station miles, minutes, and speeds
- Assumed fewer stations
- Calculated number of vehicles required based on higher capacity LRT vehicle
- Used Charlotte’s 2012 Cost Model for cost factors
- Compared costs to similar LRT systems
Refined Alternatives’ O&M Cost ($2012)

Methodology and Assumptions:

- Calculated new station to station miles, minutes, and speeds
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## Refined Alternatives’ O&M Cost Statistics

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<tbody>
<tr>
<td>Number of Routes</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Round Trip Distance</td>
<td>30.3 route miles</td>
<td>13.5 route miles</td>
<td>27 route miles</td>
</tr>
<tr>
<td>Round Trip Travel Time</td>
<td>55 minutes each for regional routes (35 minutes for Beach Circulator)</td>
<td>41 minutes each route</td>
<td>41 minutes each route</td>
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<tr>
<td>Number of Stations</td>
<td>42</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>Number of Trains</td>
<td>18 in peak 18 in off-peak</td>
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Direct Connection (DC)
Operating Plan

5 min. Peak
10 min. Off-Peak
Direct Connection (DC) Operating Plan

5 min. Peak
10 min. Off-Peak
Operational Loop + Alton (OLA)
Operating Plan

Miami Beach Portion
10 min. peak per route
10 min. off-peak per route

Downtown & Causeway Combined
5 min. peak & off-peak
Operational Loop + Alton (OLA)

Operating Plan

Miami Beach Portion
10 min. peak per route
10 min. off-peak per route

Downtown & Causeway Combined
5 min. peak & off-peak
## Annual O & M ($2012) Cost Summary

### 2004 LPA:
- **Total:** $45 M

### Direct Connection (DC):
- **Total:** $22 M

### Operational Loop + Alton (OLA):
- **Total:** $34 M

### Extensions:
- Collins Avenue
  - **Total:** $5 M
- Julia Tuttle
  - **Total:** $14 M
- 2nd Avenue
  - **Total:** $9 M

### Subtotals:
- **Total:** $28 M

---

**Note:** The figures are in millions of dollars ($M).
Annual O & M ($2012)

Cost Summary

2004 LPA: Total: $45 M

Direct Connection (DC): Total: $22 M

Operational Loop + Alton (OLA): Total: $34 M

Extensions:
- Collins Avenue Total: $5 M
- Julia Tuttle Total: $14 M
- 2nd Avenue Total: $9 M
TIGER GRANT APPLICATION
TIGER Grant 2014
Summary

- Notice of Funding Availability (February 25, 2014)
- Allows for planning and capital activities
- Total funding up to $600M; $35M set aside for planning
- Planning activities include project-level or regional plans
- Federal participation capped at 80% in urban areas
Notice of Funding Availability (February 25, 2014)

Allows for planning and capital activities

Total funding up to $600M; $35M set aside for planning

Planning activities include project-level or regional plans

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TIGER Grant 2014

Application Process

- Application submittal deadline is April 28, 2014
- Applicants may submit a maximum of 3 planning applications
- Competitively awarded using selection criteria
  - Infrastructure conditions
  - Economic competitiveness
  - Livability
  - Environmental sustainability
  - Safety
- Additional consideration given to innovation and partnerships
TIGER Grant 2014

Application Process

- Application submittal deadline is April 28, 2014
- Applicants may submit a maximum of 3 planning applications
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- Additional consideration given to innovation and partnerships
Submit request for Beach Corridor Project Development phase activities

- Conduct NEPA process
- Community outreach
- Ridership forecasts
- Secure funding sources
- Selection of LPA

Partnership between the FDOT, Miami-Dade County, Cities of Miami and Miami Beach, and the MPO
TIGER Grant 2014
Application Proposal

Submit request for Beach Corridor Project Development phase activities

- Conduct NEPA process
- Community outreach
- Ridership forecasts
- Secure funding sources
- Selection of LPA

Partnership between the FDOT, Miami-Dade County, Cities of Miami and Miami Beach, and the MPO
Project Development Funding Proposal

Estimated Project Cost for Project Development Phase is $ 3M

Assume 50% Local Match to be Nationally Competitive

Maintain Similar Funding Structure from the Current Study

- TIGER $ 1,500,000
- FDOT $ 750,000
- MDT $ 250,000
- City of Miami $ 250,000
- City of Miami Beach $ 250,000

Secure Local Match Commitments Prior to Submittal Deadline
Estimated Project Cost for Project Development Phase is $3M

Assume 50% Local Match to be Nationally Competitive

Maintain Similar Funding Structure from the Current Study

- TIGER $1,500,000
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- Miami & DDA $250,000
- Miami Beach $250,000

Secure Local Match Commitments Prior to Submittal Deadline
Financial Plan

Wireless Technology Assessment

Maintenance Facility Locations

Revised Station Locations

June 2014
PROJECT EXECUTIVE COMMITTEE (PEC) MEETING
JULY 8, 2014
Policy Executive Committee Meeting
July 8, 2014
PURPOSE OF MEETING
New Beach Hybrid Option

Off-wire technology assessment and recommendations

Financial analysis results and recommendations
BEACH HYBRID ALIGNMENT OPTION
Beach Hybrid Alignment Option

Derived from TSC Members
More Frequent Service in South Beach
Circulation on East & West Sides
Duplicative Bus Service Eliminated
Potential Bus O&M Cost Savings
### Capital and O&M Cost Summary

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<th>2004 LPA</th>
<th>DC</th>
<th>OLA</th>
<th>DC+ Hybrid</th>
<th>Extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Cost</td>
<td>$774 M</td>
<td>$532 M</td>
<td>$646 M</td>
<td>$694 M</td>
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</tr>
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<td>Annual O&amp;M Cost</td>
<td>$45 M</td>
<td>$22 M</td>
<td>$34 M</td>
<td>$49 M*</td>
<td>$28 M</td>
</tr>
</tbody>
</table>

* 5 Min peak and off-peak headways both segments
Vehicle Marketplace

- 400+ streetcar/tram/LRT systems worldwide, (8,000+ low-floor vehicles)
- US is only a small portion of the global marketplace for rail transit equipment
- Streetcar/tram vehicle market has evolved considerably since 2000
- Power supply technology still developing
Why Eliminate Overhead Wires?

- **Aesthetic concerns** - e.g. historic district
- **Route optimization** - solution to a specific problem (impaired clearance, narrow right-of-way, utility conflict, etc.)
- **Cost?** (difficult to know with certainty)

*Overhead wire visual impact can be minimized*
<table>
<thead>
<tr>
<th>Streetcar / LRT Power Supply</th>
<th>Energy Storage System (ESS) Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Battery</td>
</tr>
<tr>
<td></td>
<td>Super Cap</td>
</tr>
<tr>
<td></td>
<td>Flywheel</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conventional System</th>
<th>OCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCS is primary power source.</td>
<td></td>
</tr>
<tr>
<td>ESS used for energy savings.</td>
<td></td>
</tr>
<tr>
<td>ESS can also provide emergency power.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ground-Level Power System</th>
<th>OCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLPS / OCS is primary power source.</td>
<td></td>
</tr>
<tr>
<td>ESS used as emergency power source in case of GLPS segment outage.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Off-Wire Capable Vehicle</th>
<th>OCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESS is primary power source in sections without external power.</td>
<td></td>
</tr>
<tr>
<td>Recharging via regenerative braking and intermittent OCS or GLPS.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>&quot;Hybrid&quot;</th>
<th>GLPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Adds generator)</td>
<td></td>
</tr>
<tr>
<td>ESS is primary power source.</td>
<td></td>
</tr>
</tbody>
</table>

"Speaking the Same Language"
Ground Power Supply

- Power supply replaced overhead wire
- Segmented power supply turns on only when vehicle is over it
- Proprietary infrastructure and vehicle equipment
- Significant underground infrastructure
- Complicates track design
- Typically used for a portion of system (first full system now under construction)
- Continuous vs. blended approach, inductive variant
State of the Art: Ground Power Supply

**Under Contract:**
Beijing, China (5.8 miles) Breda

**Under Construction:**
Dubai, UAE (6.2 miles 2014) Alstom
Zhuhai, China (5.4 miles 2016) Breda
Cuenca, Ecuador (portion of 6.5 mile line, 2016) Alstom

**Revenue Service:**
Bordeaux (8 mile portion, 2007) Alstom
Angers (0.9 mile portion, 2011) Alstom
Reims (1.25 mile portion, 2011) Alstom
Orleans (1.25 mile portion, 2012) Alstom
Tours (1.1 mile portion, 2013) Alstom
Onboard Energy Storage

- Vehicles use external power supply or on-board energy storage (OESS)
- Batteries and Super Caps most common energy storage technologies
- Off-wire “range” dependent on operating conditions and OESS capacity
- New technology evolving rapidly
- Energy (battery) storage devices have limited life
- Weight added to vehicle; increased energy consumption
- Reduced acceleration rate, reduced AC
State of the Art: Onboard Energy Storage

**Planned:**
- 2016 Detroit (portions)
- 2017 Ft. Lauderdale (segment)
- ? Washington, DC (portion)
- ? Budapest, Hungary (portion)
- ? Konya, Turkey (1.1 mile segment of 3.2 mile line)

**Under Construction:**
- 2014 Seattle (one direction of new 2.5 mile line)
- 2014 Dallas (2 vehicles, 1 mile of 1.6 mile line)
- 2014 Kaohsiung, Taiwan (13.7 mile line, charging at stops)
- 2014 Guangzhou, China (4.8 mile line, charging at stops)
- 2015 Nanjing, China (10.6 miles, some overhead)
- 2015 Doha, Qatar (7.2 miles, charging at stops)
Revenue Service:

- 2007 Nice, France. 0.6 of 5.5 mile line
- 2011 Seville, Spain. 0.4 of 1.4 mile line
- 2011 Zaragoza, Spain. 1.25 of 8 mile line
- 2013 Shenyang, China. Portion of new system
“Hybrid” (add generator)

E.g. hydrogen fuel cells or diesel generator

Significantly less progress compared to ground power supply and onboard energy storage

Fuel cells still in prototype phase

Some notable but limited applications of diesel generators

FEVE Hydrogen tram prototype

Nordhausen; Siemens Combino DUO
Comparing O&M Costs

Off-wire O&M savings:
- Less overhead wire to maintain
- Reduces conflicts with other users of the right-of-way

Off-wire O&M added costs:
- Replacement /disposal of batteries
- Additional maintenance costs:
  - Batteries, additional subsystem complexity
  - Additional maintenance hazards
  - Current collector (e.g. pantograph) cycles
  - Proprietary parts issues
  - “New Technology” unknowns

Variables:
- Technology employed
- Length of off-wire section
- Duty cycle
## State of the Art (Summary)

<table>
<thead>
<tr>
<th>Carbuilder</th>
<th>Ground Power Supply</th>
<th>Onboard Energy Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prototype</td>
<td>Under Contract</td>
</tr>
<tr>
<td>Alstom *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bombardier *</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Brazil- Bom Sinal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breda *</td>
<td></td>
<td></td>
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<tr>
<td>Brookville *</td>
<td></td>
<td></td>
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<tr>
<td>CAF *</td>
<td></td>
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<tr>
<td>China- CSR</td>
<td></td>
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<tr>
<td>China- CNR Changchun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyundai Rotem / KRRI *</td>
<td></td>
<td></td>
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<tr>
<td>Inekon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kawasaki *</td>
<td></td>
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<tr>
<td>Kinkisharyo *</td>
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<tr>
<td>RTRI Japan</td>
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<tr>
<td>Siemens *</td>
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<tr>
<td>Skoda</td>
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<tr>
<td>Stadler</td>
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<tr>
<td>United Streetcar *</td>
<td></td>
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<tr>
<td>Vossloh</td>
<td></td>
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</tr>
</tbody>
</table>

* Have delivered Buy-America compliant vehicles
Local Issues

Duty Cycle
- Stops per mile (mixed traffic vs. exclusive guideway)
- Grades
- Climate (HVAC)

Vehicle length and weight

Exclusive guideway opportunities

Utility impacts

Full off-wire; or only partial?
- At 6.75 miles Miami “DC” option would be among the longer off-wire systems
- Time under wire is time spent charging
- Some wire provides flexibility to optimize the amount of on-board energy storage
- Marketplace might still respond with a fully off-wire solution
Conclusions

Don’t define the solution--define the need and let the marketplace propose solutions

Define the *business case* for off-wire; understand cost/benefit

Being an early adopter of a new technology has risks; mitigate by using project delivery that shares that risk

Ground power supply not a good match to flood-prone areas

Stay flexible; partially wired system has important advantages

Reduce energy demand; keep vehicles out of mixed traffic

Use longer vehicles (~98 ft); more room for OESS, greater future passenger capacity
FINANCIAL ANALYSIS
Financial Analysis

Project is enabled by:

- Funding & Finance Strategy
- Alternative Delivery Mechanisms
- Revenue Sources for CapEx & OpEx
- Partnerships (e.g., P3; TOD)
Cost Framework: Initial Estimates of CapEx and Opex

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Funding Questions

1. Should the project be funded with a corridor-specific source?
2. Should Federal New Starts funds be applied?
3. What funding mechanisms are viable for this project?
4. What is the potential for new tolls?
5. What is the potential for value capture?
6. What are the benefits and real opportunities for P3?
1. Should the project be funded with a corridor-specific source?

- Probably yes
- No county-wide source available
- Benefits are localized to Miami and Miami Beach travel market and development
- Self-sufficient and viable corridor-specific funding sources are available
- Avoids county-wide prioritization process
2. Should Federal New Starts funds be applied?

- If County and Cities commit to local, dedicated funding, then answer is “no”
- Complicated process, competitive, and over-prescribed
- Constrains flexibility in procurement opportunities, especially for P3
- Adds 2+ years to the opening day
- Forego potentially ~$200M capital dollars
- Viable mix of non-Federal funding sources are available to cover full project costs
3. What funding mechanisms are viable for this project?

- Numerous sources identified for capital and O&M costs.
- Several sources could fund project in its entirety.
- Two seem most promising.
## Funding & Financing Landscape

<table>
<thead>
<tr>
<th>Operating Revenues</th>
<th>Capital Revenues</th>
<th>Financing Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger Fare Revenue</strong></td>
<td><strong>Traditional/Existing Sources</strong></td>
<td><strong>Traditional/Existing</strong></td>
</tr>
<tr>
<td><strong>Traditional/Existing Sources</strong></td>
<td>Federal grants:</td>
<td>- Debt and GO Bonds</td>
</tr>
<tr>
<td>• FHWA CMAQ operating (3 yr limit)</td>
<td>- TIGER (8th or 9th cycle)</td>
<td><strong>Alternative Delivery &amp; Innovative Mechanisms</strong></td>
</tr>
<tr>
<td>• Dept. of Public Works (DPW)</td>
<td>- FTA New Starts Capital</td>
<td>- Florida (FDOT) SIB loans</td>
</tr>
<tr>
<td>- 6 cent LOGT</td>
<td>- TA Formula Grants</td>
<td>- Tax credit bonds</td>
</tr>
<tr>
<td>- County Gas Tax</td>
<td>- Real Property Ad Valorem Tax</td>
<td>- TIFIA</td>
</tr>
<tr>
<td>- 9th cent Gas Tax</td>
<td>- Local Option Gas Tax (LOGT)</td>
<td>- P3 mechanisms</td>
</tr>
<tr>
<td>• MDT</td>
<td>- County Option Sales Tax Surtax</td>
<td>- Availability payments</td>
</tr>
<tr>
<td>- Direct Operating Revs.</td>
<td>- Local Gov Infrastruc Sales Surtax</td>
<td>- Private activity bonds (PAB)</td>
</tr>
<tr>
<td>- Fed/State Grants incl. FDOT Transit</td>
<td>- HEFT/MDX Toll Revenue Share</td>
<td>- Private equity</td>
</tr>
<tr>
<td>- PTP Surtax (operations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Innovative/New Sources</strong></td>
<td><strong>Innovative/New Sources</strong></td>
<td></td>
</tr>
<tr>
<td>• Advertising (pillars/kiosks) and marketing; naming rights</td>
<td>• TOD/joint development</td>
<td></td>
</tr>
<tr>
<td>• Right-of-Way / Air rights</td>
<td>• Special assessment districts</td>
<td></td>
</tr>
<tr>
<td>• Digital Ecosystem</td>
<td>• Tax increment districts (TIFD)</td>
<td></td>
</tr>
<tr>
<td>• Station revenues</td>
<td>• Tourist and Convention Devel.</td>
<td></td>
</tr>
<tr>
<td>- Concessions (travel retail; food; ATMs)</td>
<td>• Parking surcharge</td>
<td></td>
</tr>
<tr>
<td>- FL State Energy Program (SEP)</td>
<td>• Vehicle Miles Traveled (VMT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Partner agencies (e.g., CRAs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Causeway (2) Tolling</td>
<td></td>
</tr>
</tbody>
</table>
4. What is the potential for new tolls?

- Projected annual yield of ~$75 -- $150 million/year (2014$) combined on both Causeways.
  - Range assumes $1 toll and $2 toll, respectively
- USDOT procedures for Interstates (e.g., I-395) constrains, but could be modified. USDOT considering eliminating the prohibition.
5. What is the potential for value capture?

- Tax Increment Financing yield: $18 million/year
- Special Assessment District yield: $12 million/year
- 1% local option surtax to the Tourist and Convention Development Tax yield: $10 million/year
- Total: ~$40 million/year
6. What are the benefits and real opportunities for P3?

- Expedited and efficient project delivery:
  - Saves time and money
  - Allocates risks to parties best able to manage

- Miami-Dade region is national leader in successful P3 projects.

- National best practices in P3 streetcar systems demonstrate effectiveness. (e.g., Portland Streetcar; Denver RTD Eagle Project).
Alternate Delivery Mechanisms: Project Implementation Techniques

Design - Bid - Build

Design - Build

Design – Build – Operate - Maintain

Design – Build – Finance

Design – Build – Finance – Operate – Maintain: Availability Payments

Design – Build – Finance – Operate – Maintain: Availability Payments

Design – Build – Finance – Operate – Maintain: Tolls with Revenue Risk (generally, highway only)

Concession Agreement/ Private Financing

Alternate Delivery/ Public Financing

Traditional Model

Degree of Private Sector Involvement

Degree of Private Sector Risk
Typical P3 Business Model

Single point responsibility for project implementation
Need for coordination with Operator during design and commissioning
Benefit of P3: Value for Money

Drivers of Savings:
- Optimal allocation of risks
- Innovation: design and construction efficiencies
- Focus on life cycle costs
- Integrated planning and design
- Single point responsibility for management and control

Public Sector Comparator (D-B-B) vs. Adjusted Shadow Bid

A: Base Costs
B: Financing Costs
C: Retained Risks
D: Ancillary Costs
### Alternative Project Delivery

#### Typical Risk Allocations

<table>
<thead>
<tr>
<th>Risk</th>
<th>Design Bid Build</th>
<th>Design Build</th>
<th>DBFOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Scope</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
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<tr>
<td>NEPA Approvals</td>
<td>Public</td>
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<td>Public</td>
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<tr>
<td>Permits</td>
<td>Public</td>
<td>Shared</td>
<td>Private</td>
</tr>
<tr>
<td>Right of Way</td>
<td>Public</td>
<td>Public</td>
<td>Shared</td>
</tr>
<tr>
<td>Utilities</td>
<td>Public</td>
<td>Shared</td>
<td>Shared</td>
</tr>
<tr>
<td>Design</td>
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<td>Private</td>
</tr>
<tr>
<td>Ground Conditions</td>
<td>Public</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Hazmat</td>
<td>Public</td>
<td>Public</td>
<td>Shared</td>
</tr>
<tr>
<td>Construction</td>
<td>Private</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td>QA / QC</td>
<td>Public</td>
<td>Shared</td>
<td>Private</td>
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<td>Security</td>
<td>Public</td>
<td>Public</td>
<td>Shared</td>
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<tr>
<td>Final Acceptance</td>
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<tr>
<td>O&amp;M</td>
<td>Public</td>
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</tr>
<tr>
<td>Financing</td>
<td>Public</td>
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<td>Private</td>
</tr>
<tr>
<td>Force Majeure</td>
<td>Public</td>
<td>Shared</td>
<td>Shared</td>
</tr>
</tbody>
</table>
North America P3 Projects
Denver RTD Eagle P3 Project

Project Description

- Gold Line Corridor: 11.2-mile rail transit corridor from Denver Union Station to the vicinity of Ward Road
- East Corridor: 22.8-mile commuter rail transit between Denver Union Station and Denver International Airport
- North Metro Corridor: 18-mile rail link between Denver Union Station and 162nd Ave
- Maintenance Facility
Denver RTD Eagle P3 Project

Concessionaire – Denver Transit Partners

- Macquarie (90%) - sold to Uberior and John Laing
- Fluor (10%)
- Design Build Contractors:
  - Fluor – 50% of the EPC & 33% of the O&M
  - Balfour Beatty - 50% of EPC and 33% of O&M
  - HYUNDAI -Rotem (USA) – rail vehicles
  - Ames Construction
  - HDR – engineering
Financial Details

• 46 year concession reduced by mutual agreement to 34 years
• Lifecycle cost reduced by $817.5m (2010$) by 12 yr reduction in term of concession
• Total Investment: $1.6bn (Phase 1)
• FTA New Starts Grant: $1.0bn
• Private Equity: $50.4m
  – Superior: $24.5m (45%)
  – Laing: $24.5m (45%)
  – Fluor: $5.4m (10%)
• PABs: $398m
• RTD Bridge Financing: $142m (includes $44m of service payments for early completion)
Denver RTD Eagle P3 Project

Benefits of P3

• Cost Savings - $300 million less than the RTD cost estimate
• Faster delivery – delivery scheduled 11 months in advance of RTD’s deadline
• Transfer of certain construction risks and O&M risks from RTD to P3 concessionaire
Alternative Project Delivery: Benefits for this Project

- Risk sharing (or transfer)
- Accelerated project delivery (time) and cost certainty
- Contractor/engineer innovation
- Life-cycle cost efficiencies
- Increased leverage of existing revenue streams
- Negotiation, partnership, collaboration
Conclusions and Next Steps

- Need dedicated, available and stable funding source(s), not just a portion of revenues.
  - Several funding options are promising; some with lead time or enabling legislation
- Add project into transit project development programming (TDP and TIP).
- Prioritize transportation investment utilizing latent capacity in existing funding sources and new local revenues.
- Checklist of “readiness” steps for P3.
DID WE ADDRESS ALL QUESTIONS?

✓ Is a partially wired system acceptable?
✓ Should the project be funded with corridor-specific funding sources?
✓ Should we pursue Federal New Starts funding?
✓ Should we further explore tolling the two Causeways?
✓ Should we further explore value capture funding mechanisms?
✓ Should we further explore a P3 arrangement?
✓ Should we amend the LRTP to include this project?
✓ Should the Miami Beach Hybrid Option be considered in the first phase, or a later phase?
Tiger Grant Summary

- Notice of Funding Availability (NOFA) announced February 25th, 2014
- $35M available for planning projects
- TIGER grant submitted on April 26th, 2014
- Requested $1.5M (50% of anticipated project cost)
- Expect response by September/October 2014
## Options for Funding Next Phase

<table>
<thead>
<tr>
<th></th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIGER</td>
<td>$ 1,500,000</td>
<td>$ 0</td>
<td>0</td>
</tr>
<tr>
<td>FDOT</td>
<td>$ 750,000</td>
<td>$ 1,500,000</td>
<td>?</td>
</tr>
<tr>
<td>MDT</td>
<td>$ 250,000</td>
<td>$ 500,000</td>
<td>?</td>
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<tr>
<td>Miami</td>
<td>$ 250,000</td>
<td>$ 500,000</td>
<td>?</td>
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<tr>
<td>Miami Beach</td>
<td>$ 250,000</td>
<td>$ 500,000</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td><strong>$ 3,000,000</strong></td>
<td><strong>$ 3,000,000</strong></td>
<td></td>
</tr>
</tbody>
</table>
Next PEC Meeting
Date

DATE:   October 2, 2014, 2:00 pm
TIME:   2:00 pm – 3:00 PM
LOCATION:  TBD
AGENDA:
  • Maintenance Facility Locations
  • Tiger Planning Grant Update
  • Implementation Plan/Next Steps
PROJECT EXECUTIVE COMMITTEE (PEC) MEETING
MAY 4, 2015
Policy Executive Committee Meeting

Date: May 4, 2015

Beach Corridor Transit Connection Study
• **Study Results**
  - LPA Alignment Refinement
  - Stations
  - Technology Assessment
  - Capital and O&M Costs
  - Funding Analysis
  - Environmental Screening

• **Implementation Plan**

• **Next Steps**
  - Funding Next Phase
  - Agency Roles and Responsibilities
Study Results
• Screened over 30 alignment options
LPA ALIGNMENT REFINEMENT

- Identified extensions
• **PEC recommendations**
  • Concentrate on an affordable, most direct first phase
  • Use the MacArthur Causeway; most direct route between Government Center and Miami Beach Convention Center
• **PEC recommendations**
  • Consider the “hybrid” circulator option in Miami Beach on Alton Road in next phase
PEC recommendations

- Light rail system shall operate in exclusive right-of-way

NW/NE 2nd Street Transit Mall, Miami

Washington Avenue, Miami Beach
### Number of Stations by Alternative

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<tr>
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<tr>
<td>Downtown</td>
<td>16</td>
<td>7</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Causeway</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Beach</td>
<td>24</td>
<td>6</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>15</td>
<td>24</td>
<td>26</td>
</tr>
</tbody>
</table>

- **PEC recommendations**
  - Stations will be kept simple to keep costs down
Don’t define the solution, define the need
Mitigate by using project delivery that shares the risk
Stay flexible; partially wired system has important advantages

PEC recommendations
- Maximize off-wire technology and/or limited overhead wire if it reduces costs
- Consider both overhead storage system and in-ground energy source for off-wire technology
• **PEC recommendation**
  • Concentrate on an affordable, most direct first phase

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<tr>
<td><strong>Capital Cost</strong></td>
<td>$774</td>
<td>$532</td>
<td>$646</td>
<td>$694</td>
</tr>
<tr>
<td><strong>Annual O&amp;M Cost</strong></td>
<td>$45</td>
<td>$22</td>
<td>$34</td>
<td>$49*</td>
</tr>
</tbody>
</table>

Note: Updated costs based on 2004 LPA. Values in million 2014 dollars.

* Increase service frequency compared to DC option
• Causeway tolling is the largest source of revenue
• Without tolling, will need combination of other sources
• Estimated P3 availability payments
  • ~36 - 54 M/year for DC
  • ~67 - 91 M/year for DC + Hybrid
    • Order of magnitude values
    • Cash flow analysis required

• PEC recommendations
  • Will not pursue federal capital funding at approximately 50% participation
  • Countywide and corridor specific funding sources will be examined
  • Tolling the causeways as a funding source will not be considered

* For partial capital costs and all O&M costs
- Some change in the natural and man-made environment from 2004
- Age of document requires complete update
- Major issues to be addressed in NEPA
  - Biscayne Bay Impacts
  - FEC railroad crossing
  - Utility relocation impacts
  - Construction impacts
  - ROW impacts at stations
  - Roadway drainage and sea level rise

- PEC recommendation
  - Follow NEPA process to leave federal funding option open at a later date and expedite permitting
Implementation Plan
# Implementation Strategy and Schedule

## Year/Activity

<table>
<thead>
<tr>
<th>Year/Activity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD&amp;E/NEPA</td>
<td></td>
<td></td>
<td>$10 M (DEIS)</td>
<td></td>
<td>(FEIS)</td>
<td></td>
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</tr>
<tr>
<td>Project Oversight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In-House</td>
<td>$7.5 M</td>
<td></td>
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<tr>
<td>PE</td>
<td></td>
<td></td>
<td>$20 M</td>
<td></td>
<td></td>
<td>$26 Million</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>P3 RFI (Market Interest)</td>
<td></td>
<td></td>
<td>$3 M</td>
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<td>$3 M</td>
<td>$16.5 M</td>
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<tr>
<td>P3 RFQ / RFP (Procurement)</td>
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<td></td>
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<td></td>
<td></td>
<td>$472.5 M</td>
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<tr>
<td>ROW ACQ</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$22 M / Year~</td>
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<tr>
<td>Design &amp; Constr.</td>
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<td></td>
<td>$532.5 M*</td>
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<tr>
<td>Revenue Service</td>
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</tr>
</tbody>
</table>

- * Assumed DC Alternative
- Note: Assume start date Jan 2016

- Secure Capital/ O&M Funding
- Different colors denote separate contracts
• Single lead agency for environmental, preliminary engineering and P3 procurement documents

• Prepare and approve a Memorandum of Understanding between all involved agencies prior to environmental phase

• Consolidate contract for environmental, preliminary engineering and P3 procurement

• Expedite the implementation of less complex segments of corridor into the environmental phase, as supported by a City of Miami Beach resolution passed on April 29, 2015
<table>
<thead>
<tr>
<th>Lead Agency</th>
<th>Agency Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPA / EIS / PE</td>
<td>PROJECT OVERSIGHT</td>
</tr>
<tr>
<td>MPO</td>
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</tr>
<tr>
<td>Miami-Dade County</td>
<td>✓</td>
</tr>
<tr>
<td>FDOT</td>
<td>✓</td>
</tr>
<tr>
<td>Miami Beach</td>
<td>✓</td>
</tr>
<tr>
<td>City of North Bay Village</td>
<td>✓</td>
</tr>
<tr>
<td>City of North Hialeah</td>
<td>✓</td>
</tr>
</tbody>
</table>
Next Steps
• Potential Funding Distribution
  • Various options considered
  • Reviewed by TSC and achieved consensus
  • Strong funding commitment by FDOT and CITT

<table>
<thead>
<tr>
<th>Agency</th>
<th>Percentage</th>
<th>Dollars</th>
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</thead>
<tbody>
<tr>
<td>FDOT</td>
<td>50.0%</td>
<td>5.0 mil</td>
</tr>
<tr>
<td>CITT</td>
<td>37.5%</td>
<td>3.75 mil</td>
</tr>
<tr>
<td>Local</td>
<td>12.5%</td>
<td>1.25 mil</td>
</tr>
<tr>
<td>- County</td>
<td>4.17%</td>
<td>417 K</td>
</tr>
<tr>
<td>- Miami</td>
<td>4.17%</td>
<td>417 k</td>
</tr>
<tr>
<td>- Miami Beach</td>
<td>4.17%</td>
<td>417 k</td>
</tr>
</tbody>
</table>
• MPO Board endorsement of PEC recommendations
• Municipal and County Commission approvals
• CITT Approvals
• Secure funding
• Secure agency agreements
• Proceed with preparation of Beach Corridor Environmental Impact Statement (EIS)
• Explore expediting minimum operating segments within South Beach and Downtown Miami
• Did we agree on the Recommended Strategy and Schedule?

• Were any previous PEC recommendations changed?

• Does the PEC needs to meet again during transition period?
Questions?