State Benefits and Opportunities Study for Rapid Speed Transportation

May 29th, 2019
Collaborative Effort Meeting
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Colorado Department of Transportation
Why this Study?

• Focus on Rapid Speed Feasibility in Colorado
• Multiple technology types evaluated
• Need to understand paths to implementation
  • Planning and Environmental
  • Safety Certification
  • Governance and Policy
  • Financial and Legal
  • Procurement and Partnerships
  • Project Oversight and Management
Builds Upon Previous Studies

• State Freight and Passenger Rail Plan (2018)
• Statewide Transit Plan (2015)
• Advanced Guideway System Study (2014)
• Interregional Connectivity Study (2014)
• High Speed Rail Feasibility Study (2010)

*Above studies are available at https://www.codot.gov/programs/transitandrail/plans-studies-reports
FRA Rail Passenger Service Development Plan
Next Steps: Planning & Environmental

• Complete Request for Proposals; Hire Consultant for FRA Rail Passenger Service Development Plan and Environmental Work
  • Determining the timing and level/type of environmental analysis (NEPA)
  • Evaluating the right blend of Consultant and CDOT staff
  • Proposed Schedule: RFP Release May 2019 → Notice to Proceed August 2019

• Elements Required in FRA Rail Passenger Service Development Plan
  • Purpose and Need for Front Range Passenger Rail Service
  • Corridor options/potential feasible alignments, including possible connections to RTD’s Passenger Rail Corridors
  • Potential speeds/technology: Ridership forecasting based on speed/technology
  • Levels of service (number of trains per day)
  • Stations/Mobility Hubs/transit connections
  • High level environmental analysis
  • High level cost estimates for Pre-construction, Construction, Equipment, Operating, etc.
  • Potential Service operator (Amtrak, host freight railroad, Private Rail/Transit Company, etc.)
  • Governance (Special District, Regional Transportation Authority [RTA], etc.)
Key Findings

• Rapid speed technologies have the potential to transform the way we move in Colorado, and could help advance our mobility goals alongside other modes/systems.

• Application of new technologies is a complex process; the partnerships will vary.

• Technologists* need clarity and speed; creative partnerships and streamlining strategies need to be advanced.

*Technologist is defined as the company that develops the technology under consideration (i.e. Virgin Hyperloop One).
High Speed Rail Case Studies
Brightline

- Miami to Orlando (Florida)
  - 240 Miles/125 mph max speed
  - Phase 1: Operation
  - Phase 2: Planning/Design
- Project Sponsor: All Aboard Florida (Subsidiary of Florida East Coast Industries) is the private developer of the project.
- Brightline is privately owned and operated project
- $3.7 billion (estimated Phase 1 and 2)
- ~$15 million/mile
Texas Central Railroad

- Dallas to Houston (Texas)
  - 240 miles/205 mph max speed
  - Planning/Design
- Texas Central Partners (TCP) is an investor-funded company that has proposed the project.
- The Central Japan Railway Company (JRC) acts as technical advisor to TCP
- $12 billion
- ~$50 million/mile
California High Speed Rail

- Los Angeles to San Francisco (California)
  - 520 miles/200 mph (max Speed)
  - Central Valley Segment: Construction (119 miles)
  - Remaining Segments: Planning/Design
- California High-Speed Rail Authority (CHSRA) is a California state agency established to develop and implement high-speed intercity rail service.
- $77.3 billion (Phase 1)
- ~$148 million/mile
- (Current Phase Under Construction: $10.6 billion [~$89 million/mile])
Rapid Speed Technologies
Overview
<table>
<thead>
<tr>
<th>Rapid Speed Technology</th>
<th>Overview of Technology</th>
<th>Potential in Colorado</th>
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</thead>
</table>
| **Vactrain ("Hyperloop") Technologies**          | Vactrain, or Hyperloop, technologies are elevated guideways that propel vehicles using magnetic levitation via electric propulsion. Passenger or cargo “pods” in an evacuated (airless) or partly evacuated (low-pressure) tube can travel at airline speeds, up to 700 mph, for long distances due to ultra-low aerodynamic drag.  
  • Representative companies include Virgin Hyperloop One (VHO), Hyperloop Transportation Technologies (HTT), and TransPod, among others.  
  ➔ **Range:** Inter-city & Regional (Appropriate for long-distance travel options)                                                                 | If constructed in Colorado, it is likely in a greenfield alignment, as the curve radii for these speeds would be larger than that of conventional railroad, highway, or utility corridors.                                                                                       |
| **Automated MagLev Technologies**                 | Automated MagLev technologies are at-grade guideways that move “sleds”, operating in exclusive barrier-separated lanes. Sleds can carry personal automobiles, pallet sized freight, or technology-specific vehicles, and can travel up to 200 mph.  
  • Arrivo is a representative company that has developed this technology. As of December 2018, however, the company had announced its closure.  
  ➔ **Range:** Regional & Intra-city (appropriate for medium-distance travel options)                                                                 | If constructed in Colorado, it is likely within highway rights-of-way, as travel pattern would likely be within one defined area/region.                                                                                      |
| **Underground Tunnel Technologies**                | Underground tunnel technologies are below grade guideways that transport passengers on autonomous electric “skates” traveling at speeds up to 125-150 mph. Skates can carry personal automobiles, cargo, or technology-specific vehicles.  
  • The Boring Company, founded in 2016 by Elon Musk, is the only company known to date developing this type of rapid speed technology.  
  ➔ **Range:** Intra-city & Metro (appropriate for medium- to short-distance travel options)                                                                 | If developed in Colorado, it is likely underground largely within highway, railroad, or other public rights-of-way.                                                                                                                   |
| **Personal Rapid Transit (PRT) Technologies**     | PRT technologies are aerial guideway networks (“podways”) transporting passengers on suspended, ultralight, automated electric vehicles (“pods”). Pods are typically sized for individual or group travel, traveling at speeds between 30 to 45 mph.  
  • Representative companies include SkyTran and TransitX.  
  ➔ **Range:** Intra-city & Metro (appropriate for medium- to short-distance travel options)                                                                 | If constructed in Colorado, it could be part of a first or last mile solution in a business park or retail power center.                                                                                                    |
Vactrain ("Hyperloop") Technologies

Sample Companies: VHO, HTT

• Technology
  • Passengers or Cargo in "pods" floating above the track using magnetic levitation via electric propulsion through a low-pressure tube.
  • Both Maglev and vacuum tube technologies have been implemented in various applications, but not together.

• Status
  • Since 2013, many companies working to advance various aspects of technology.
  • Virgin Hyperloop One (VHO) has constructed a ½ mile full-scale test track in North Las Vegas.
  • In 2017, Hyperloop Transportation Technologies (HTT) began construction of the first full-scale passenger capsule.
Automated MagLev Technologies

Sample Company: Arrivo

• Technology
  • System focuses on Maglev technology using sleds to transport passengers and freight. Speeds up to 200 MPH.

• Status
  • Arrivo considered the potential for a test track in the Metro Denver area. However, in December 2018 (near completion of this study), Arrivo announced it’s dissolution.
Underground Tunnel

Sample Company: The Boring Company

- **Technology**
  - Infrastructure and tunnel construction company founded by Elon Musk.
  - Selected by the Chicago Infrastructure Trust, on behalf of the City of Chicago, to design, build, finance, and operate O’Hare Express service (Chicago Express Loop, 17 miles), traveling on autonomous electric skates at up to 150 mph.

- **Status**
  - Tunneling for mass transit has been around since the late 1800’s; high cost technology.
  - Musk believes smaller tunnel boring machines will cut capital costs significantly.
  - Not yet considered in Colorado.
Personal Rapid Transit (PRT) Technologies

*Sample Companies: Transit X/SkyTran*

- **Technology**
  - Proposed as a suspended, ultra-narrow gauge rail network with ultralight pod vehicles.
  - High capacity, automated network would provide non-stop, single-seat travel from origin to destination on an exclusive right-of-way.

- **Status**
  - Pods are proposed to be ADA compliant and at each stop, vertical lifts would provide easy access to the platform above.
  - There is currently no funding to advance this technology within Colorado.
Implementation Framework
Planning and Environmental

- Is NEPA required for these technology applications?
- Which agency would act as the lead Federal agency?
- Are there strategies to streamline the planning process?
Planning and Environmental

- New rapid speed technology will likely require NEPA.
  - Safety Certification requirements
  - Use of Federal Funding (including federal loan programs)
- Lead agency dependent on alignment right-of-way
  - FHWA likely if built in Highway right-of-way, and non-rail based
  - FRA likely if rail technology in railroad right-of-way (most experience with NEPA in High Speed transportation projects)
  - Surface Transportation Board (STB) may be involved
Planning and Environmental

• Other environmental considerations for rapid speed technologies may include:
  • Human Health
  • Electromagnetic effects
  • Vibration
  • Emergency management
  • Energy use and sources
  • Secondary or induced growth
  • Farmland and wildlife impacts (particularly for greenfield alignment)
  • Visual resources (particularly for greenfield alignment)
Safety Certification

• Which agency or entity certifies for system safety?
• Will a new entity need to be formed to certify these new technologies?
• How does the safety process overlap with planning and environmental?
Safety Certification

• To-date, the safety certification for high speed rail in the U.S. has been through FRA in the form of Rules of Particular Applicability (RPA)

• National Highway Traffic Safety Administration (NHTSA) enforces many standards in the auto industry (safety)

• Agencies certify high speed rail in other countries (European TÜVs - Technical Inspection Association, Railway Bureau of the Ministry of Land, Infrastructure, Transport, and Tourism for the Japanese Shinkansen System)
Governance and Policy

• Who owns the right-of-way? Who operates the technology?
• Could a technologist authorize eminent domain?
• How does governance overlap with financial?

• System Governance Options:
  • CDOT owns land/Technologist owns and operates system
  • Other public entity owns land/Technologist owns and operates system
  • Technologist owns land and operates system
## Project Delivery Strategy

### Increased Public Role vs. Increased Private Role

<table>
<thead>
<tr>
<th>Traditional Model</th>
<th>Public-Private Partnerships (P3S)</th>
<th>Full Privatization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td></td>
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<tr>
<td>Build</td>
<td></td>
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<tr>
<td>Finance</td>
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<td>Operate</td>
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<td>Maintain</td>
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<tr>
<td>Own</td>
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### Traditional Model
- Risks retained by public sector
- Multiple procurements
- Fragmented team
- First-cost focus
- Payment by percent complete
- Public facing

### Integrated Delivery Model
- Risks transferred/mitigated
- Integrated procurements
- Collaborative unified team
- Full life cycle cost focus
- Payment on delivery
- Private third-party financing
Financial and Legal

• How would the implementation of a new technology be funded?
• How does funding overlap with planning?
• What would CDOT’s role be (including HPTE) in the financial and legal processes?

• Complexity and Challenges
  • It is assumed that a Rapid Speed endeavor will require “megaproject” funding levels with significant private investment
  • Build America Bureau administers federal transportation credit programs
Financial and Legal

• Possible Sources of Funds
  • Public Funds (state and local funding, federal discretionary funds, value capture opportunities)
  • Service or Asset-Related Revenue-Generating Funding Mechanisms (passenger and freight fares, commercial property development, ancillary revenues)
  • Public Innovative Financing (federal credit assistance, bonding and debt instruments [i.e. TIFIA, RRIF, and PAB])
  • Private Financing (private lenders, corporate bonds, mezzanine debt, private equity)
Procurement and Partnerships

- Public-private partnership (P3) approach to procurement of a Rapid Speed system in Colorado
  - Enhanced by vetted Project Delivery Selection processes
- Colorado’s P3 Delivery and Innovative Financing experience is demonstrated by a proven track record.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>COST</th>
<th>DATES</th>
<th>DELIVERY METHOD</th>
<th>MARKETS SERVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-470 (47 mi)</td>
<td>$1.21B</td>
<td>1991 – 2003</td>
<td>Design-Build, CM/GC</td>
<td>Highway</td>
</tr>
<tr>
<td>T-REX (20 mi)</td>
<td>$1.67B</td>
<td>2001 – 2006</td>
<td>Design-Build</td>
<td>Highway, Transit</td>
</tr>
<tr>
<td>EAGLE P3 (36 mi)</td>
<td>$2.2B</td>
<td>2011 – 2016</td>
<td>P3</td>
<td>Transit</td>
</tr>
<tr>
<td>Union Station</td>
<td>$375M</td>
<td>2012 – 2014</td>
<td>Design-Build</td>
<td>Transit</td>
</tr>
<tr>
<td>US36 Express Lanes (18 mi)</td>
<td>$497M</td>
<td>2012 – 2016</td>
<td>Design-Build, P3</td>
<td>Highway, Transit</td>
</tr>
<tr>
<td>Central 70 (10 mi)</td>
<td>$2.2B (est.)</td>
<td>Ongoing</td>
<td>P3</td>
<td>Highway</td>
</tr>
</tbody>
</table>
Rapid Speed Related Revenue Generation

• **Value Capture**
  • Tax Increment Financing
  • Special Assessments Districts
  • Transit-Oriented Development
  • Transit Joint Development (partnered with developers)

• **Potential Utility Partnerships**
  • Leveraging funding by selling or leasing access to utility providers to utilize planned ROW
    • Fiber Optic (telecommunications)
    • Water and Sewer (drinking and wastewater)
    • Oil and Gas (pipeline)
    • Power (electricity and natural gas)
Summary

• Rapid speed technologies have the potential to transform the way we move in Colorado, and could help advance our mobility goals alongside other modes/systems.

• CDOT will likely play a key role in advancing these technologies, in coordination with other local, state, and federal agencies.

• Technologists need clarity and speed; creative partnerships and streamlining strategies need to be advanced.
Thank you

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EXTRA SLIDES