First-Mile/Last-Mile Solutions for Transit Access: A National Perspective on What Has—and Hasn’t—Changed in 45 Years of Experience

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Essence of First-Mile/Last-Mile (FM/LM) Problem

• Prospective transit users cannot easily access desired transit services via walking or by driving to park-n-ride facility
• Core assumption: prospective transit user is strong candidate to actually use transit if access problem can be solved
• Strong implication: line-haul transit is of very good quality and capable of attracting choice riders as well as transit captives
• Conventional transit solutions—fixed route buses, shuttles, etc.—have typically NOT been effective as first mile/last mile strategies
• More flexible, user-tailored services often needed to attract riders
Long History of First Mile/Last Mile Services

- Problem/opportunity first identified circa 1970
- Original Haddonfield DAR project had major first mile/last mile element
  - Feeder service to/from PATCO rail rapid transit station
- Westport, CT early 1980’s demo/on-going project (commuter rail focus)
- DRT services for FM/LM attempted a few places in 1970’s and 1980’s, but technology still basic and except for Westport, little impact occurred
- Denver RTD and DART (Dallas) have implemented significant number of such services in past 10 years with expansion of their LRT systems
- Renaissance of interest with technology-enabled on-demand services
Prominent Current Examples

• Denver RTD: 15 of 22 general public DRT service zones have a first mile/last mile focus
• DART (Dallas) has 7 DRT service zones with FM/LM focus
• VTA Flex service pilot project in 2016 (San Jose area)
• AC Transit on-going Flex service pilot projects—Newark & Castro Valley, checkpoint DRT feeder to BART stations
• Pinellas County pilot projects (now on second, expanded phase serving 20+ transit stops, TNCs and taxis involved)
What is New Today for First Mile/Last Mile Services?

- Technology—self-service booking apps (Web, smartphone), cloud-based computing, low cost in-vehicle devices, ubiquitous data
- TNCs
  - Availability in almost all urban areas
  - Lower per trip cost than taxis, production costs lower than traditional DRT
- More good FM/LM opportunities—LRT and express bus/BRT expansion in a number of metro areas
- Increased decentralization of employment creates significant opportunity in reverse commuting markets if there is transit access
- Blended operating models managed via technology platforms, use of both dedicated and non-dedicated vehicles in single service
Denver RTD DRT Service Zones
## Denver RTD First Mile/Last Mile Service Zones

### Regular commute - 4
### Reverse commute - 7
### Balanced commute (44%-56% split) - 4

<table>
<thead>
<tr>
<th>Call-N-Ride Zone</th>
<th>Sq. Mi.</th>
<th>Pop. &amp; Emp./Acre</th>
<th>Peak Veh.</th>
<th>Weekday Riders</th>
<th>Trip Ends at Station</th>
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<tbody>
<tr>
<td>Arapahoe</td>
<td>4.66</td>
<td>9.2</td>
<td>1</td>
<td>40</td>
<td>83%</td>
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<tr>
<td>Bellevue</td>
<td>1.52</td>
<td>43</td>
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<td>68</td>
<td>85%</td>
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<td>Belmar</td>
<td>7.77</td>
<td>9.3</td>
<td>2</td>
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<tr>
<td>Broomfield</td>
<td>7.49</td>
<td>8.3</td>
<td>1</td>
<td>54</td>
<td>28%</td>
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<tr>
<td>Dry Creek</td>
<td>5.21</td>
<td>13</td>
<td>1</td>
<td>56</td>
<td>82%</td>
</tr>
<tr>
<td>Golden</td>
<td>5.5</td>
<td>7</td>
<td>3</td>
<td>269</td>
<td>89%</td>
</tr>
<tr>
<td>Green Mountain</td>
<td>8.85</td>
<td>8.4</td>
<td>3</td>
<td>121</td>
<td>81%</td>
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<tr>
<td>Interlocken</td>
<td>8.05</td>
<td>7</td>
<td>1</td>
<td>64</td>
<td>92%</td>
</tr>
<tr>
<td>N Inverness</td>
<td>2.22</td>
<td>16.4</td>
<td>3</td>
<td>224</td>
<td>98%</td>
</tr>
<tr>
<td>S Inverness</td>
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<tr>
<td>Lone Tree</td>
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<td>9.2</td>
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<td>Louisville</td>
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<tr>
<td>Meridian</td>
<td>1.14</td>
<td>13.1</td>
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<td>157</td>
<td>98%</td>
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<tr>
<td>Orchard</td>
<td>2.92</td>
<td>17.4</td>
<td>2</td>
<td>91</td>
<td>91%</td>
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<tr>
<td>South Jeffco</td>
<td>16.33</td>
<td>7.4</td>
<td>4</td>
<td>132</td>
<td>82%</td>
</tr>
<tr>
<td>Median</td>
<td>5.5</td>
<td>9.2</td>
<td>2</td>
<td>68</td>
<td>83%</td>
</tr>
<tr>
<td>Average</td>
<td>6.27</td>
<td>8.8</td>
<td>2</td>
<td>104</td>
<td>79%</td>
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FM/LM Service Zones on LRT Line
Market Analysis and Service Planning is Key to Effective First Mile/Last Mile Service

• Begins with understanding of market for transit service that FM/LM is connecting to

• High speed, high capacity line-haul services (rail transit, express bus, BRT) are by far the most attractive connecting services

• Local bus services whose use is predominantly by transit captives are typically not a promising FM/LM market
  • Transit captives generally located within walking distance—and already use the bus service
  • Choice users are deterred by overall transit level of service, not just issues with access to nearest transit stop
Market Analysis and Service Planning is Key to Effective First Mile/Last Mile Service

- Transit planners have tools for structuring and configuring flexible services that can achieve good productivity (6 to 10 pass/VSH)
- Objective is to achieve good balance between service tailored to users, service responsiveness and productivity
- Key tools are cycle points, scheduled and un-scheduled checkpoints, flexible routes, zone layout, dynamic service areas
- Want to minimize vehicle movement at same time as serving as many riders as possible
- Temporal flexibility of service configuration another key tool
Conventional DRT Service

4 Outbound Passengers Board DRT Vehicle at Transit Station, are Distributed

2 Passengers Are Inbound to Transit Station, Picked Up During Tour
Time windows at Designated Stops provide opportunity for vehicle to deviate from fixed route.

Key is small service zones, less than 10 square miles/25 square km.
Service Structuring Features

- Flex Route
- CheckPoint
- Transit Station
- Cycle Point
- Pickup
- Dropoff
- Gathering Zone
- Scheduled CheckPoint
Characteristics of Successful
First Mile/Last Mile DRT/Flex Services

• Small service zones—6 to 8 square miles or less
• Primary transit service is rail transit or high quality express bus service (BRT is best) with medium-high frequency
• Frequent scheduled visits to transit station by DRT/Flex vehicles
• Use of structuring constructs to reduce vehicle travel time and increase service frequency and ease of user access
• Allow walk-on passengers and subscription trips—huge in Denver—80%+ of trips in most FM/LM focused zones
• Highly streamlined booking process, use technology to manage
Technology-Enablement of FM/LM DRT/Flex Services

• Full automation essential to keep costs low—albeit with phone booking capability for user
• “Effective” integration with connecting transit service essential
  • Trade-off between service productivity and real-time coordination
  • TNC/Taxi service can be highly responsive but simply a “throw it over the fence” approach, little ability to impact shared use of service
• Static integration is often acceptable if “meets” at station result in short waiting time to access FM/LM service, Denver has focused on this
• High quality real-time notification system essential for support of needed pick-up flexibility for in-bound subscription trips
Technology-Enablement of FM/LM DRT/Flex Services

• Changing service modality by time of day is often essential
• More structured services—flex-route, scheduled checkpoints, gathering zones—are potentially feasible during peak periods
• Structured services improve productivity and provide higher quality of service to more riders in shared use service
• Potential replacement of off-peak dedicated vehicle service with NDVs (taxi, TNC), technology system must support this
• Capacity augmentation with taxis/TNCs during peaks is another option to support with technology
Denver RTD Technology (MobilityDR) Features

- Full automation, no dispatchers, schedulers, or agents—since 2009
- Quickboard process at transit stations and major cycle points
- Riders need no reservation, destinations entered in tablet computer, automated scheduling determines best vehicle tour
- Also incorporates scheduled pickups into tour as appropriate
- Web- and smartphone-based booking system
- Notification system (text, email, IVR) that tells user when vehicle will arrive and shows location on map
- DART pilot project of same technology system begins May 1
Performance Expectations—Traditional FM/LM and TNC-Based Services

- FM/LM services usually perform best during peak periods.
- 2 to 4 times more trips per hour during peak than off-peak in Denver and Dallas.
- Service productivity of 6 to 9 passengers per VSH should be the goal of most dedicated vehicle (DV) services for peak periods.
- With typical DRT production costs of $45-50 per VSH, good FM/LM service costs $5 to $8 per trip using DVs.
- TNC and taxi-based services may cost only $6 to $8 per trip.
Relative Cost of Service for FM/LM Trips

Cost per Passenger Trip for DRT Providers
2 Mile Average Trip Length

- TNC
- Taxi
- DRT DV
Performance Expectations: Off-Peak Conundrum

- Lower demand during off-peak hours may not be able to be matched by reduced capacity in DV-oriented services
- Demand during off-peak may simply be too low for cost-effective DRT/Flex service when delivered by DVs
- No service constructs or configurations can mitigate impact of very low demand densities on DV service productivity
- TNCs and taxis appear to be best candidates to deliver low volume cost-effective off-peak FM/LM services
- Important reason for considering blended operating models
Future Development Path for FM/LM Services

• TNC-based services have generated low ridership in limited trials to date—10-15 trips per day in publicized cases
• This result is unsurprising given nature of transit environments in which such FM/LM services have been deployed
• But …. TNC-based services have also had relatively low costs compared to often-expensive DV-based DRT/Flex services
• Smart, technology-enabled DRT/Flex services can provide cost-effective FM/LM access, but only in relatively favorable markets
• In low demand density situations, TNC/taxi approach may be better
• Blended operating models appear to offer significant potential, this is likely Denver RTD strategy for its DRT services going forward