

The Intersection of Paratransit, Mobility on Demand, and Technology

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Mobility on Demand— Paratransit in the 21st Century

- Para-Transit: Neglected Options for Urban Mobility (1974) by Ron Kirby, Kiran Bhatt, Michael Kemp etc. defined the set of mobility services encompassed by the term “paratransit”
- Defined paratransit as shared ride services (mostly) with flexible and/or dynamic elements, comprised of:
 - DRT (including multiple forms of flexible transit like jitneys)
 - Organized Ridesharing: Carpooling, Buspooling, Vanpooling
 - Car Sharing (short term rental cars were focus, but identical in concept to contemporary car sharing services)
 - Taxi Service (and variants)

Mobility on Demand— Paratransit in the 21st Century

- The term “Paratransit” has been unfortunately corrupted to mean—for many—solely a demand responsive transit service for people with disabilities
- In reality, paratransit is a spectrum of services, relevant to any population segment, whose defining features are:
 - On Demand (real-time or via advance reservation)
 - Flexible (potential origins and destinations are not fixed)
 - Shared Use of transportation resource (e.g., vehicle, driver)
- Mobility on Demand services have essentially the same features as paratransit as originally defined

General Public DRT/Flex Services— Public Transit Mobility on Demand

- DRT for general public market developed in 1970's
- Explicitly technology-based from the start
- Rochester DRT service (1974-77, MIT team) used 1970's era versions of many current technologies
- From DRT's start, focus on 3 types of trips:
 - ASAP/immediate response
 - Advance reservation--typically same day, 1-2 hours ahead
 - Can also include subscriptions (recurring trips on pattern)
 - Trips to/from fixed route transit--transit schedule determines when DRT customers need to be serviced

General Public DRT/Flex Services— Public Transit Mobility on Demand

- Note what DRT includes that TNC service does NOT

Service Type	General Public DRT	TNC (Uber/Lyft)
Immediate Response	YES	YES
Advance Reservation	YES	NO
Subscription	YES	NO
Feeder to Transit	YES	Not time coordinated
Shared Ride Operation	YES	Not default mode

- GP DRT in USA grew to 500 communities/services from 1970's to 1990's (closer to 600 today)

General Public DRT/Flex Services— Largely Shunned by Metro Transit Agencies

- Few metro transit agencies interested in 1970's and 1980's despite DRT adoption in small cities/suburbs
- Basic issue: Demand densities typically far below level needed for truly productive DRT/Flex service
- Result: much higher cost/passenger than fixed route
- Prior to ADA, metro transit agencies perceived DRT to be too expensive—largely correct, but simplistic
- After ADA advent, transit agencies had NO interest in DRT other than for ADA paratransit services
- **HOWEVER ...** Technology is now changing the game

A New Era of General Public DRT?

- 2 decade hiatus in DRT development associated with focus on ADA paratransit is starting to recede
- Advent of TNCs has made transit agencies aware of new potentials for on-demand services
- New technology options exist for providing such services, “technology-enabled” DRT is the new term
- Some agencies are beginning to experiment with or plan for “Flex” and first mile/last mile DRT services
- Denver RTD’s use since 2009 of technology-enabled GP DRT concretely demonstrates feasibility and promise of multiple forms of this service

Improved Transit Planning Thinking About DRT

- Transit planning task: determine appropriate role of DRT/flexible services in family of transit services
- ADA paratransit a poor fit for “real” DRT—long trips, very low demand density, long dwell times, onerous advance booking requirements
- Led to misconceptions about possible value of DRT
- “Real” DRT is for short trips—1 to 3 miles, moderate demand levels, dispersed trip patterns for O/D/O-D
- Two key roles for DRT/flexible services
 - Feeder to line-haul transit at regional/supra-local scale
 - Local circulation in low/moderate demand environments

Notable Examples of “Next Generation” Technology-Enabled GP DRT Services (USA)

- Denver RTD—22 service zones, operated via technology platform since 2009, variety of service configurations
- San Jose (VTA)—Technology-enabled “Flex” service including first mile/last mile aspect (started in January)
- AC Transit (Newark & Castro Valley)—likely June start, checkpoint service, first mile/last mile plus local service
- Orlando LYNX—Q2/3 start, checkpoints, on-demand, app
- Pace Bus (Chicago)—8 service zones, modeled after Denver, incremental implementation underway
- HART—first mile/last mile, Split technology, Q3/Q4 start

Key Characteristics of USA-Based First Mile/Last Mile DRT/Flex Services

- 1 to 3 vehicles per service zone; 2 to 8 sq. mi. zones
- Feeder to line haul transit (LRT, RRT, express bus)
- Limited service capacity (creates scheduling challenges)
- Structured—cycle points, checkpoints, “Flex” service
- Use of contemporary technology—smartphone and web-based booking & notification, fully automated vehicle scheduling, “real-time” service orientation
- Good service productivity for DRT—5 to 8 passengers per VSH in Denver

Major European Examples—Helsinki

- Kutsuplus system—operated for 2+ years, but shut down at end of 2015, not commercially viable
- Provided shared ride service (DRT) between transit stops in Helsinki—15 vehicles in operation
- Privately developed and operated but publicly subsidized during initial (and only) phase
- Fully automated, real-time smartphone-based service engagement, similar technologies as TNCs
- Ridership was in hundreds per day, needed to be much more to support continuation

Major European Examples—Belgium

- Belbus service in Flanders
- Provides DRT feeder service to line-haul transit and limited local circulation service in extensive region
- 250 total vehicles, organized in service zones
- 1 or 2 DRT vehicles per service zone
- Small number (1 or 2) of bus stops per service zone
- Largest general public DRT operation in Europe & North America—6500+ trips per day
- Implementing new generation technology system now, completed by June

Major European Examples—Denmark

- FlexDenmark provides DRT service management to all 6 Public Transport Organization's in country
- 15,000 trips/day, utilize 450+ service providers; 5X ridership growth over past 5 years
- Open and integrated service, for general public, special needs, target populations, health care trips
- Sophisticated, highly automated technology platform is key to system—many years in evolution
- SUTI standards-based data transmission to vehicles
- Continuous real-time schedule (re)optimization

Experience with TNCs Helps Clarify Thinking About Publicly Subsidized DRT

- High level of automation in TNC service production, no manual processes (dispatching, fare payment)
- Consumer friendly, eliminates transactional frictions, interactive application, real-time on-demand emphasis
- TNC trips are lower cost than taxis, typically 30-50% less; major factor in market penetration and success
- Short (3 mile or less) TNC trip can cost as little as \$5-6 in many cities
- Illustrates important cost advantage of using non-dedicated vehicles when feasible

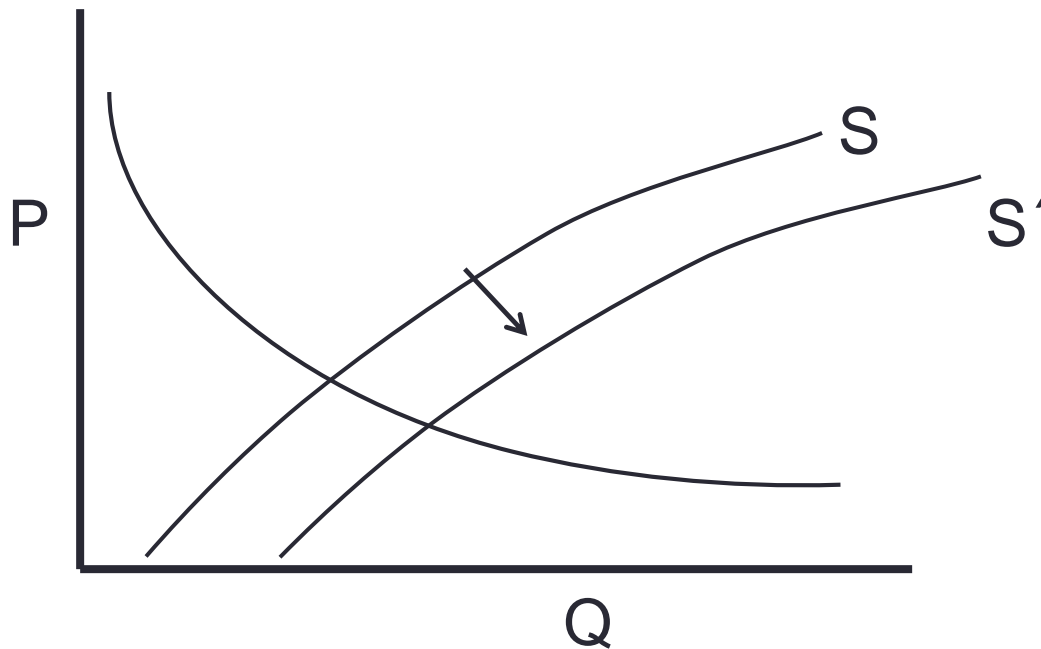
Experience with TNCs Helps Clarify Thinking About Publicly Subsidized DRT

- TNCs are potential supplier of segments of a DRT operation—cost, flexibility, availability attributes
- TNCs could provide capacity augmentation—or off-peak service “replacement”—with appropriate arrangements
- Taxi companies could in theory do the same, but current driver arrangements are not good fit for this
- Major transit contractors are working on new DRT service delivery models with more flexible elements than traditional dedicated vehicle operations

Why Does Technology Make a Difference?

- Technology provides the means whereby the supply curve can be shifted with resultant usage increase
- Automation—cost saving by reducing/eliminating labor content in DRT service production
- Improved production process—scheduling optimization, use of multiple providers to match supply and demand, low cost provider selection, provider ease of use (by drivers)
- Ease of use by customers—reduces generalized cost of connecting to and using DRT service

Shift in Transportation Supply Curve



Lower generalized cost/higher utility for service leads to increased quantity of use

Technology for DRT

- Technology platform is the key, encompasses multiple software services and applications
- Mobile device-capable consumer and driver applications, web-based and cloud-hosted
- Consumer reservation/notification “app” on smartphone with Uber-like features
- Fully automated scheduling using “classic” shared ride DRWTW algorithms able to support both real-time on-demand trip requests and reserved/subscription trips
- No manual dispatching required, full computer control
- Denver and Newark (CA) services are examples

Impact of Technology Platforms

- Technology platforms such as those of FlexDenmark also make possible higher levels of service organization and more robust service delivery approaches
- Are key mechanism for enabling seamless service coordination with multiple funding sources and service providers
- Can facilitate service delivery models that make much more extensive use of non-dedicated vehicles and their service providers, may be much more cost-effective
- FlexDenmark relies heavily on NDVs and their service providers, has organized the market via its platform, its processes, and use of SUTI-based data standards

Whither Public-Transit Provided Technology-Enabled Mobility on Demand

- Technology creates the opening for increasing net value of paratransit/DRT/on-demand services
- Technology platforms can have far-reaching impacts, FlexDenmark provides a possible preview of how these could affect developments in USA
- “Experiments” will help define what works—and increasing numbers are underway or planned
- Private sector developments will clearly be impactful
- Shared autonomous vehicles are on the distant horizon, a major game changer due to cost impacts

Questions?

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