IV. Network and Route Design

Public Transport Planning and Regulation: An Introduction
# Planning and Analysis Building Blocks

## Schedule Building

- Performance Analysis
  - Measures & Standards
    - Network and Route Design
      - Market Factors and Demand Analysis
  - Cost Analysis and Financial Planning
    - Service Monitoring and Data Collection
      - Terminology and Basic Relationships

**Focus of Discussion**

- Fares and Revenue: Policy, Analysis, and Collection
- Network and Route Design
- Measurables and Demand Analysis
Network and Route Design

• Public transport services tend to evolve over time as cities grow and markets change
  – Usually, they have not been planned as an integrated network
• Complex travel patterns require that individual routes be designed to form an integrated network
• Individual routes should be designed to serve specific markets
Network Structures

- Radial
- Grid
- Hierarchical
  - Trunk-Feeder
Radial Network

Traditional structure focused on a single dominant activity center
Grid Network

Provides direct access to many destinations with no more than one transfer
Hierarchical “Trunk-Feeder”

• Different types of routes perform different functions
  – Feeder: Collection/distribution (e.g., barrios)
  – Trunk: Long distance, major destinations (e.g., City Center)

• Generally, higher service frequencies and larger vehicles on trunk routes
Trunk-Feeder Schedule Coordination

- Easy for *Feeder-to-Trunk* movement since trunk frequencies are typically higher than feeder frequencies

- Difficult for *Trunk-to-Feeder* movement since trunk users may just miss a lower-frequency feeder bus
  - Very reliable trunk service may help since users can plan their trunk trip to meet the feeder departure
Feeder Route Crowding

• Not an issue for Feeder-to-Trunk movements
  – Easier to schedule adequate feeder capacity

• Difficult issue for Trunk-to-Feeder since large trunk loads may arrive and exceed feeder (and possibly terminal) capacity
  – Important to monitor trip-by-trip loadings and design appropriate service (e.g., irregular intervals, doubleheader buses)
  – Real-time dispatching and adjustments can address immediate problems
Feeder Route Design

• Linear routes are preferable to loop routes

• One-way loop routes require users to travel more than halfway around the loop either going to or coming from terminal

• Short loops minimize this problem
Setting Feeder Intervals

• Setting feeder intervals based on demand may result in inconvenient service
  – Inconsistent with user needs
  – Long waits

• Minimum policy intervals may be needed to provide convenient service

• Policy intervals may result in low productivity feeder routes

• Important to view the trunk and feeder routes as one product
Types of Routes

• Local
  – Partial Service
  – Branching
• Limited Stop
• Express
Local Service

• Approach
  – Service provided to each designated stop on route
  – All trips operate entire length of route

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Importance of Designated Stops

• User
  – Communicates passenger information on availability of service
  – Can provide passenger information on routes/schedules
  – Can provide passenger amenities (e.g., shelters, lighting)
  – Facilitates passenger interchanges

• Operator
  – By combining loading points, operating speed increases

• General Public
  – Improves traffic safety (buses, cars, pedestrians)
  – Improves traffic flow
  – Facilitates service monitoring and data collection
Partial Service

- **Approach**
  - Service provided to each stop on route
  - Only some trips operate entire length of route

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Load Profile Data Essential for Effective Design

![Bar Graph]

- **Electronic City**: 20
- **Kudlu Gate**: 60
- **Madiwala**: 120
- **Maharanis College**: 100
- **City Market**: 40

**Maximum Load**

- **Passengers Onboard Leaving Stop**
- **Stops**: Electronic City, Kudlu Gate, Madiwala, Maharanis College, City Market
Partial Service

• Advantage: Match supply and demand

• Disadvantage: Passenger confusion on outbound trips (e.g., to Suburb)
Local Service: Route Branching

• Approach
  – Service provided to each stop along the route “trunk”
  – Trips alternate to the outer “branches”

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Reasons for Route Branching

- Consolidate two “weak” routes
- Provide service to new origins or destinations
Load Profile Data Essential for Designing Effective Branches

• Must insure that there is sufficient vehicle capacity to serve passenger demand on:
  – Each branch
  – The trunk

Maximum Passenger Load Branch A
Maximum Passenger Load Trunk
Maximum Passenger Load Branch B
Route Branching

• Advantage
  – Match supply and demand

• Disadvantage
  – Passenger confusion on outbound trips to a branch (e.g., to A)
  – Possible “bunching” on trunk

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Making Branches Less Confusing?

• “Label each branch a separate route”

• Disadvantage: Makes it difficult to provide information to passengers with origins and destinations on the trunk
  (e.g., Bangalore has over 1,700 routes)
Limited Service

• **Approach**
  – Service provided to selected stops on route
    • High passenger boardings and alightings
  – All trips operate entire length of route
  – Usually supplements local service

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Origin-Destination Data Essential for Designing Limited Service

- Boarding and alighting data may not be sufficient!
Limited Service

- Advantages
  - Improved passenger speed
  - Increased operator efficiency
    - Frees up space on local buses and at stops

- Disadvantage
  - Passenger confusion
    - Catching correct bus inbound and outbound
Express Service

• **Approach**
  - Non-stop service provided between stop(s) in outer area and stop(s) in central city or key destination
  - All trips operate entire length of route
  - Usually supplements local service

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Origin-Destination Data Essential for Designing Express Service

• Boarding and alighting data may not be sufficient
Express Service

• Advantages
  – Improved passenger speed
  – Increased operator efficiency
    • Frees up space on local buses and at stops

• Disadvantage
  – Passenger confusion
    • Catching correct bus inbound and outbound
  – Possible decreased operator efficiency
    • No passenger turnover, may only get one bus trip per peak period
Keep in Mind

• From passenger perspective, *simplicity is a virtue!*
  – No more than 4 distinct services at any stop other than major passenger interchanges or destinations
  – Unique numbering of route variations (e.g., local, limited, express) may still cause passenger confusion

• From an operator perspective, too many routes at a stop may cause delays (buses waiting) and increase costs
Summary

• Described a wide range of service types

• *Remember*, good planning requires:
  – Consideration of a variety of service types—there is no one *magic solution*
  – Good demand data on origin-destination flows