Transit Route Location
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Elements of Successful Transit

- Concentrated trip ends: Activities that relate to transit should be located close to transit stops.
- Quality access system: Provide safe, direct and easy access to transit by pedestrians, bicyclists and automobile users. Minimize distances from vehicle door to buildings.
- Transit oriented street patterns: Permit through routing, direct service, few turns. Control through automobile traffic if necessary.
- Market orientation – User oriented transit
User Oriented Transit

- Services are designed to maximize customer satisfaction and needs
  - Direct trip origin to destination
  - No transfers
  - Schedules match needs
  - Reasonable cost
  - Similar users
  - Good access on both ends of the trip
  - Clean, comfortable vehicles
  - Good user information

Route Location

- Where should it be?
  - Concentrate on service to users, maximize demand

- How long should it be?
  - Determines vehicle fleet size, scheduling, costs
Route Location Guidelines

- Begin and end at major trip generators
- Serve as many major trip generators as possible
- Direct, two-way service, avoid loops or backtracking

Avoid overlapping of routes, maintain good route spacing; ½ mile if there is good pedestrian access
- Consider traffic operations, geometry, turn around, layover point locations
- Consider rider access, walk, park, drop-off
Routing Patterns

- Linear
- Through Routing
- Split Routes
- Loop
- Local/Express

Pulse Transit

- Similar to airline hub and spoke system.
- Vehicles meet at fixed time intervals (i.e. every 30 minutes) at a central location (transit center)
- Transit route length should be just less than ½ of the interval, i.e. 13 or 26 or 39 minutes for a 30 minute pulse interval, this uses 1, 2 or 3 vehicles
- Routes can be through routes, but layover is at transit center
How many vehicles?

- Route A: 4 vehicles, 2 for northeast side, 2 for south side
- Route B: 2 vehicles, 1 for northwest, 2 for southwest
- Route B: 3 vehicles, 1 for west, 2 for southwest
- 9 vehicles needed.
New Services

- New services should be labeled as experimental to the transit board and specific target goals should be set in order to continue the service on a permanent basis.
- New services should be aggressively marketed to potential users. Develop route level market information from the point of view of the user (a good idea for existing routes as well).
New Services

- When starting the new service, provide back-up capacity for the first week to handle higher than expected demand if it occurs. Adjust vehicle supply to demand over time.
- Generally new routes take some time to build ridership as shown below. Marketing can make this occur faster.

![Expected Patronage Growth Curve for New Bus Services](image)
Deletion of a Route

- Far more difficult than adding service
- Need for well defined and accepted deletion standards. Based on goals, objectives, performance indicators
- Need for real planning skills
  - No longer engineering but social policy
  - Work with community groups/affected citizens

Deletion of a Route (continued)

- Need for innovation
  - Consider substitute service, taxicabs, etc.
- Need for flexibility
Information Sources

- Census
  - Low income
  - Auto availability
  - Age
  - Journey to work

- Planning Agency
  - Land use
  - Major trip generators

Information Sources

- Traffic Department
  - Traffic data
  - Street Geometry
  - Parking regulations

- Field Check
  - Character of housing
  - Neighborhood character
  - Trip generators

- Community, Political comments
In-House Data

- Running times, speeds
- Schedule adherence
- Passenger, driver comments
- On-board surveys
- On-off counts
- Transfer counts

Route Diagnosis

- After developing a route network, it should never be considered “good for all time.”

- Transit rider requirements are apt to change over time, perhaps rapidly. Usage should be monitored and evaluated at regular intervals, perhaps once to twice each year, or more often in rapidly changing areas.
Route Diagnosis

- The following pages provide forms than can be used to evaluate current routes

### TABLE IV-3
CHECKLIST FOR POTENTIAL ROUTE IMPROVEMENTS

<table>
<thead>
<tr>
<th>Route:</th>
<th>Prepared by:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Date:</td>
<td></td>
</tr>
</tbody>
</table>

#### 1. Alignment
- a. Could the route be extended to serve major multidirectional activity centers?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- b. Could the route be curtained without losing significant patronage?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- c. Could segments of the route be realigned to provide better service/increase speed?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- d. Does the route duplicate other routes in serving major markets?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

#### 2. Headways/Turnbacks
- a. Are "load standard" headways excessive or insufficient?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- b. Are "policy" headways at variance with service standards?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- c. Could certain trips be "turned back" on a route without violating headway standards?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- d. Is there insufficient patronage early morning, late evening, or weekends to justify service on the route?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- e. Could schedules be better coordinated with precommute shuttle or school times?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

#### 3. Schedule Adherence/Running Time
- a. During short headway periods, do vehicles "bunch up"?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- b. Are there significant deviations between actual and scheduled running times in any segment of the route?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- c. Is there insufficient or excessive recovery time at each end of the route?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

#### 4. Schedule Coordination
- a. Two or more routes jointly scheduled with another route where service duplication exists?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- b. Where there is major transfer activity, should schedules be coordinated with local policy headway periods?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- c. Could route be "hooked" with another route where there is a major transfer activity?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

#### 5. Traffic Study
- a. Are recovery/timeliness points adequate for vehicle storage?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- b. Are there serious congestion points along the route?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _

- c. Does illegal parking/truck roading seriously impede vehicle movement?
  - Yes:  
  - No:  
  - If Yes, describe:  
  _
Basic Service Relationships

Cycle time = round trip travel time + layover time

\[
\text{Cycle time} = \frac{2 \times \text{Length}}{\text{Speed}} + \text{Layover time} = \frac{2 \times L \times 60}{S} + TA + TB = \frac{120L}{S} + TA + TB
\]

Varies by time of day and location.

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<tr>
<td>Date:</td>
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1. Alignment
   a. Could the route be extended to serve major residential activity concentrations?
   b. Could the route be curtailed without losing significant ridership?
   c. Could segments of the route be replaced to provide better service increase speed?
   d. Does the route duplicate other routes in serving major markets?

2. Headways/Curbbacks
   a. Are “load standard” headways excessive or insufficient?
   b. Are “policy” headways at variance with service standards?
   c. Could certain trips be “turned back” for route without violating headway standards?
   d. Is there insufficient patronage early morning, late evening, or weekends to justify service?
   e. Could schedules be better coordinated with predominant shift or school times?
Vehicles Required

Number of Vehicles is cycle time divided by headway

NV = Cycle time/Headway

Example: a route with a 100 minute cycle time and a 25 min headway needs 4 vehicles, at a 30 minute headway,
NV = 3.33, You must still provide 4 vehicles (round up to a whole number)
Costs directly relate to number of vehicles operated

Headway

- Policy Headway: Set by transit board, i.e. a vehicle every 30 minutes, regardless of demand.
- Demand based headway: Provide capacity to accommodate peak point demand in passengers per hour
  - Peak location on route
  - Peak direction
  - Peak time of day
- Headway = Vehicle capacity/Demand
Headway

- Vehicle capacity is the number of seats times a load factor
- \( \text{Headway} = 60 \times \text{Seats} \times \text{LF} / \text{Demand} \)
- Example, a route has a peak demand of 200 persons per hour, uses 40 passenger buses and allows a load factor of 1.25
  - \( \text{Headway} = 60 \times 40 \times 1.25 / 200 \)
  - \( \text{Headway} = 60 \times \frac{1}{4} = 15 \text{ minutes} \)

Combined equation:

- Combining all factors, the required number of vehicles is:
  \[
  NV = \frac{2 \times L \times D}{(S \times C \times LF)} + \frac{D \times (TA + TB)}{C \times LF \times 60}
  \]
Combined Equation

- Costs decrease inversely with:
  - Vehicle capacity (seats/vehicle)
  - Load factor
- Costs increase directly with:
  - Route length
  - Demand
  - Layover time
  - Average vehicle speed

Costs depend on daily hours and miles

Daily hours = (peak veh. * peak length + base veh. * base length) * pay/platform ratio
Daily miles = daily hours * speed * (1 + deadhead) * pay/platform ratio

- Pay/platform ratio, ratio of hours paid to drivers vs service hours
- Deadhead: Vehicle not in service, to and from garage
### Estimated Route Performance for Next Year

<table>
<thead>
<tr>
<th>Route</th>
<th>Red (1)</th>
<th>Brown (2)</th>
<th>Yellow (3)</th>
<th>Blue (4)</th>
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<tbody>
<tr>
<td>length (miles)</td>
<td>7.80</td>
<td>9.20</td>
<td>9.00</td>
<td>9.30</td>
</tr>
<tr>
<td>headways</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekdays peak</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
</tr>
<tr>
<td>weekdays base</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Sat/ hol</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
</tr>
<tr>
<td>speed (mph)</td>
<td>10.40</td>
<td>12.30</td>
<td>12.00</td>
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<tr>
<td>hrs peak</td>
<td>4.00</td>
<td>4.00</td>
<td>7.00</td>
<td>7.50</td>
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<tr>
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<td>8.00</td>
<td>5.00</td>
<td>4.50</td>
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<tr>
<td>hrs sat/hol</td>
<td>9.00</td>
<td>9.00</td>
<td>9.00</td>
<td>9.00</td>
</tr>
<tr>
<td>peak veh (calc)</td>
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<td>2.99</td>
<td>4.50</td>
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<tr>
<td>peak buses</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
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<tr>
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<td>2.99</td>
<td>3.00</td>
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<tr>
<td>base buses</td>
<td>3</td>
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Acknowledgements

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