Alternatives: Strategies for Transit Systems Change

There is a broad array of options for modification of transit operations to make it more cost effective and efficient. These are typically examined to deal with financial pressures or to improve the quality of service to customers. The options listed below can be used to reduce costs or to increase revenues. Costs depend on how many vehicles are operated.

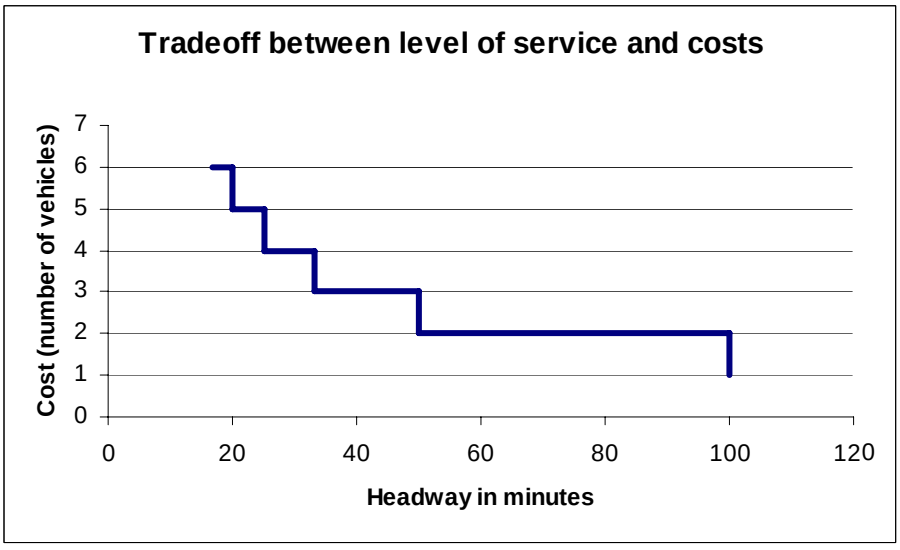
Question: *What does it cost to add one vehicle to a transit system? Assume it will operate for two drive shifts (16 hours per day) and operate 300 days per year (weekdays, Saturdays, some holidays)*

Answer: The vehicle operates 4800 hours per year. Costs depend on the hourly operating costs of a vehicle. At $50 per hour, this gives an annual cost of $240,000.

Adding or removing a vehicle from service can change the costs of transit operations substantially. Care must be taken to provide a good match with vehicle provided and demand.

Vehicle supply and operating costs depend on the cycle time on a route. Cycle time is the total time it takes for a vehicle to travel the length of the route and return including layovers at each end. The number of vehicles needed is the cycle time divided by the time interval between vehicles (headway) on the route. For example, a route with a cycle time of 100 minutes and a 20 minute headway requires five vehicles, If the headway is changed to 25 minutes, four vehicles are needed. If the headway is changed to 30 minutes, four vehicles are still needed, not 3.33, since it cannot be a fraction of a vehicle. The headway would have to be 34 minutes for three vehicles.

Note the tradeoff between headway, demand and level of service. If there is high demand, headways are low and vehicles can be cut from a route with little impact on passengers.



The following tables give a list of some of the options available for transit operations changes.

Changes in the Level of Transit Service

- Increase headways (cut buses from routes)
- Change hours of operation
- Change days of operation (Saturday, Sunday, summer)
- Add new routes
- Eliminate routes
- Turn back buses
- Split routes
- Shorter routes
- Reroute
- Eliminate overlapping portions of routes
- Change running time
- Deadheading routes
- Schedule coordination
- Improved transfer facilities
- Coordinate with trip generators
- Express service
- Running time improvement
- Modify layover time

Revenue Changes

- Increase base fares
- Increase pass fare
- Increase tickets or token price
- Zone fares
- Change fares for special groups
- Change transfer policies
- Change hours for special fares
- Peak/off-peak pricing
- Employee pass sales
- Marketing campaign
- Special Events Service

Equipment Changes

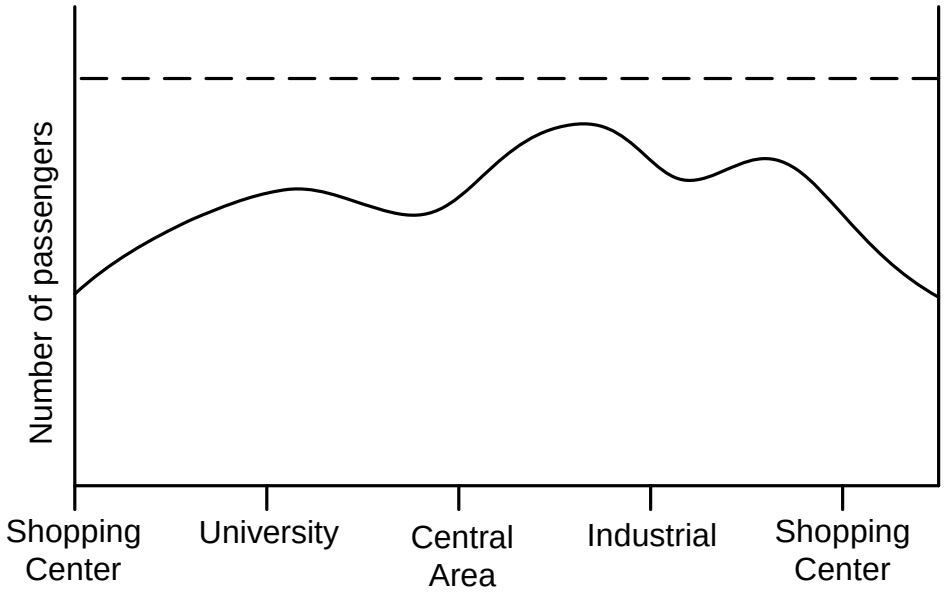
- Small bus/large bus
- Articulated buses
- Taxicab substitute; route ends, off peak
- Preventative maintenance

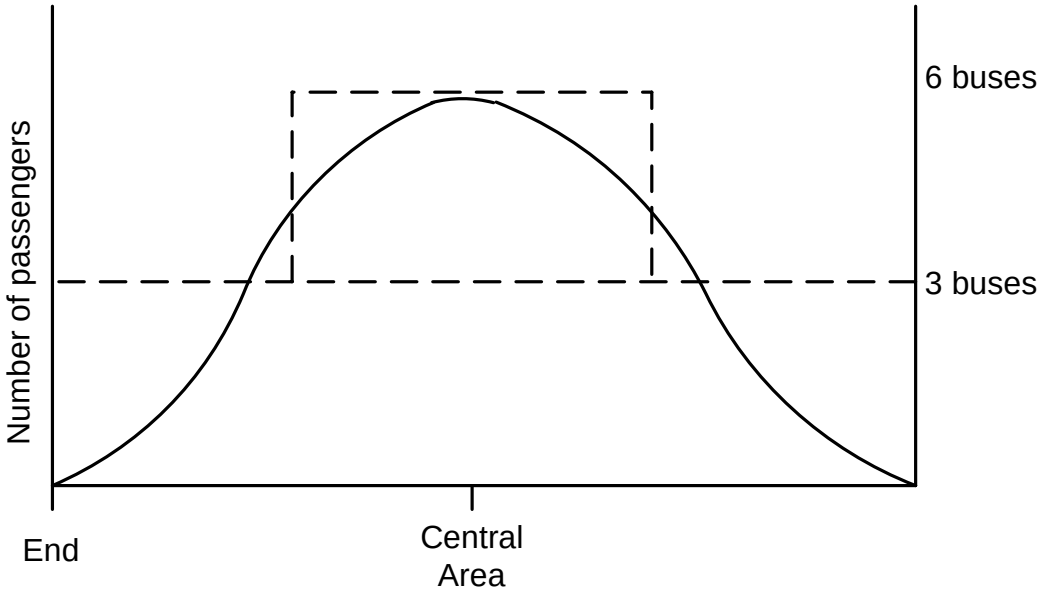
Cost Changes

- Renegotiate labor contract
- Use of part-time labor
- Change phase in period for new employees
- Insurance pooled risk
- Cooperative purchasing
- Cooperative maintenance
- Private contractors

The following charts are useful in analyzing a particular route. The top diagram shows and ideal situation where the route serves multiple trip generators and has a relatively uniform ridership along the route and begins and ends at substantial destinations. In this case, few changes can be made. In the second diagram, ridership is low at the ends of the route and peaks at the middle. Service can be cut back on the ends of the route to provide a better match with demand.

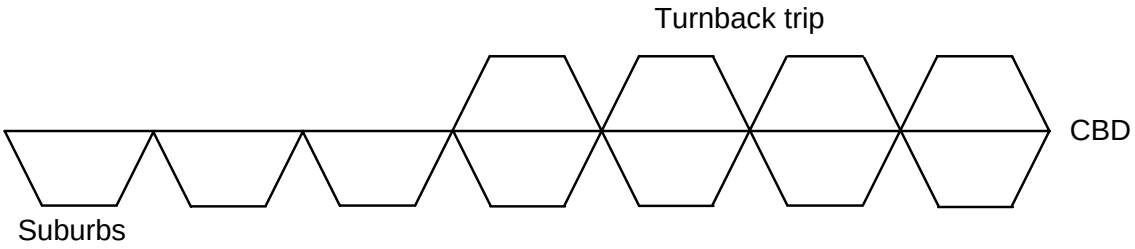
ROUTE PROFILES -- BY LOCATION



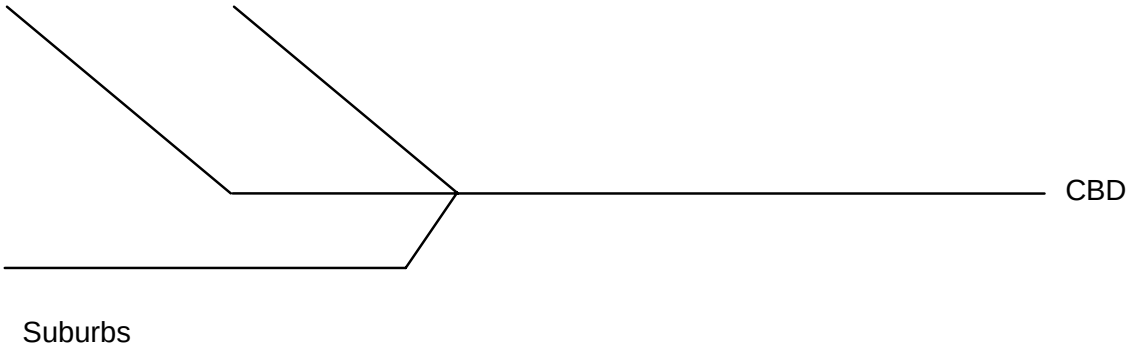


OPERATING STRATEGIES

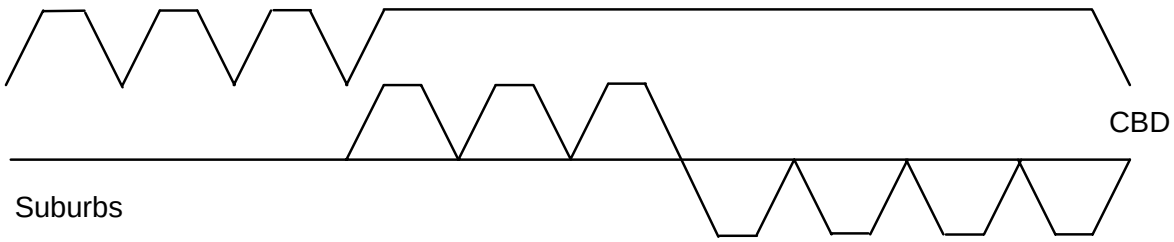
1. Turnbacks or short-turning



2. Route branching or splitting

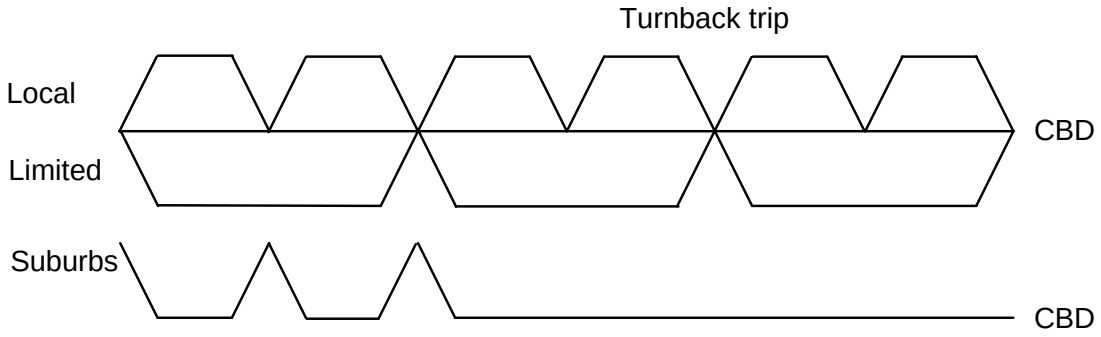


3. Zone scheduling

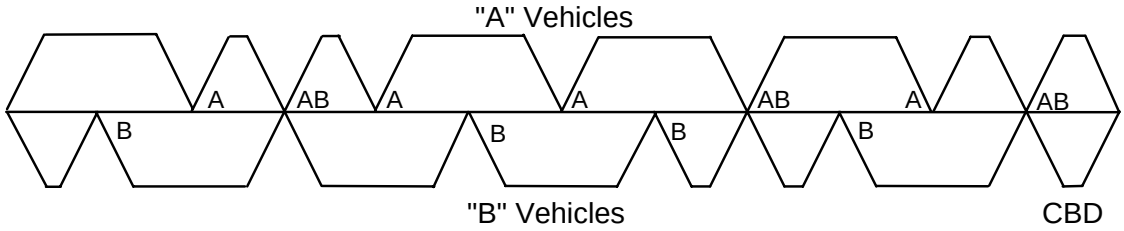


OPERATING STRATEGIES (continued)

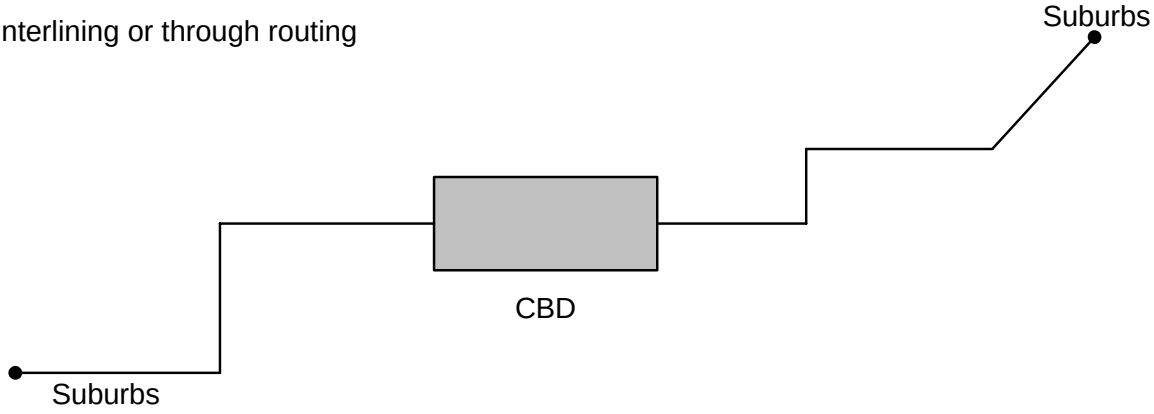
4. Overlapping service types



5. Skip stop operation



6. Interlining or through routing



Pulse transit:

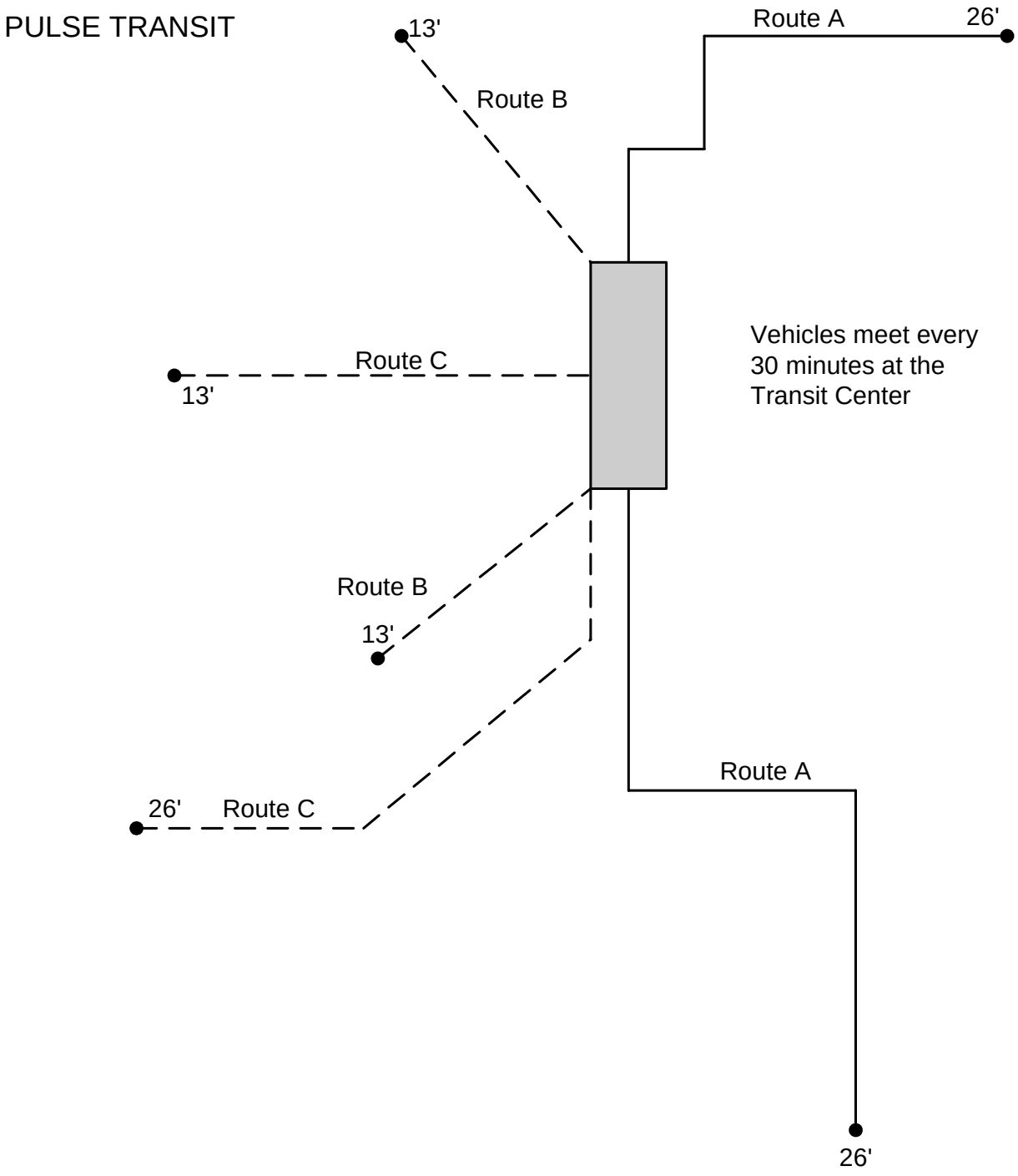
Pulse transit systems are common in smaller communities and typically operate out of the central area with vehicle meeting at a fixed interval, say every 30 minutes. Routes are located and designed so that the cycle time for each route is the same and equal to some multiple of the pulse interval. Pulse transit minimizes transfer time between routes. However, trips between outlying points have to go into the city center and transfer and this can lead to longer travel times

For the pulse transit system shown, how many vehicles are required, if vehicles are to meet at the central area every 30 minutes?

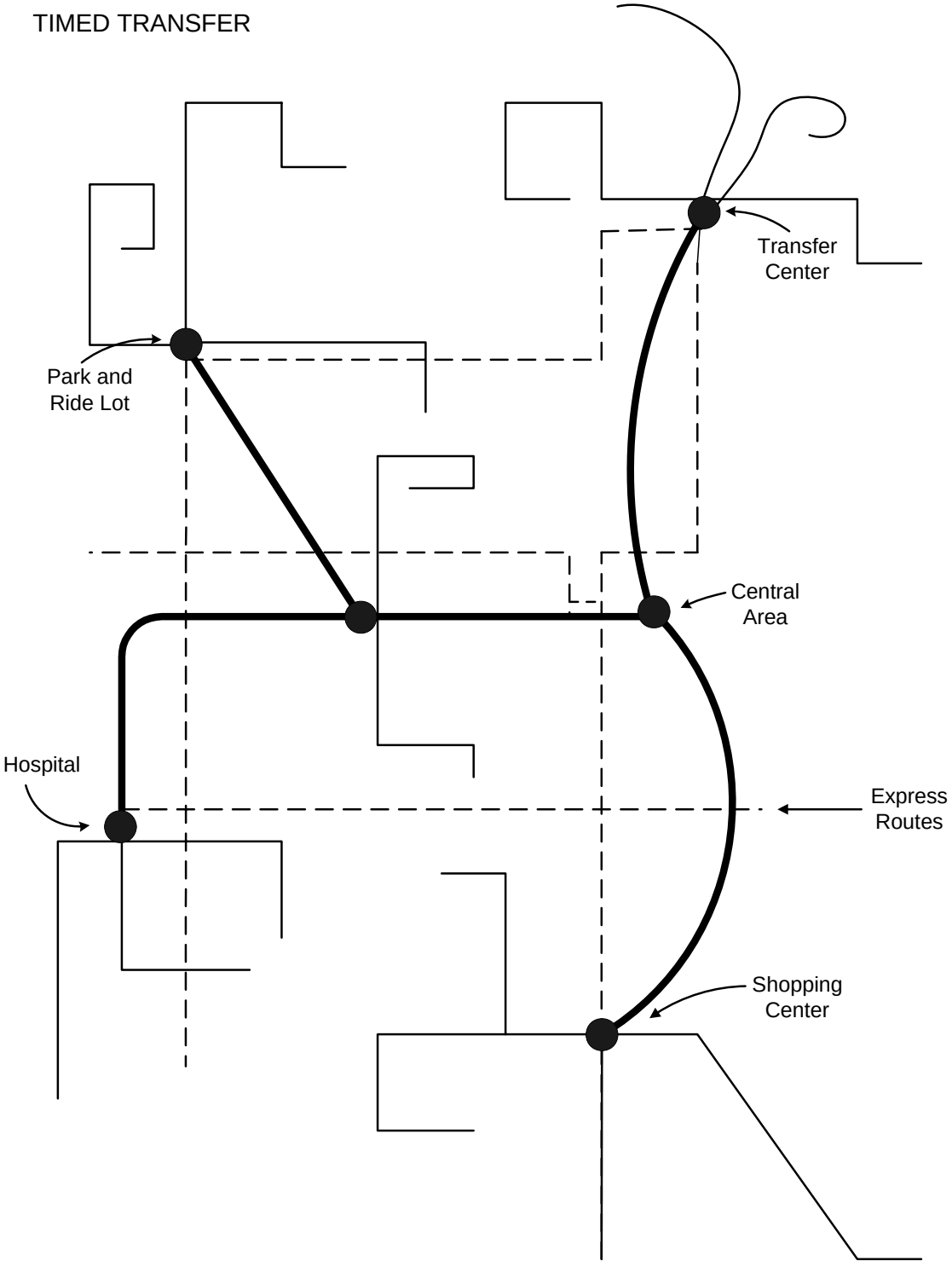
Answer: The vehicles that take 13 minutes to get to the end of the route can make one cycle in 30 minute which includes a brif layover. The branches that take 26 minutes to the end of the route require two vehicles each. Thus the needs are:

- 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.

Pulse transit can also be used in larger cities with a series of timed transfer centers. Ideally these are located and major trip generators that are destinations themselves and provide opportunities for joint use. The centers could also be linked by trunk line or express transit services.


PULSE TRANSIT
13'
Route A
26'
Route B
Vehicles meet every
30 minutes at the
Transit Center
Route C
13'
Route B
13'
Route A
26'
Route C
26'

TIMED TRANSFER



Note: Routes should be of equal cycle time and operate on a pulse schedule into each center.

Relationships between problems, performance measures and actions

The following table links problems with performance indicators and actions that can be used to deal with the problems.

Problem	Indicators	Possible Actions
1. Financial		
A. High Total Operating Cost	PRIMARY INDICATORS Expense/vehicle mile Expense/vehicle hour Expense/passenger SECONDARY INDICATORS Expense/revenue hour Administrative expense/expense	Decrease expenses Reroute service Expand ridership Decrease deadhead Modify fares Eliminate marginal routes Part time help Renegotiate labor contract Shorten phase-in for new employees Cooperative purchasing and maintenance
B. Poor Cost Effectiveness	PRIMARY INDICATORS Revenue/revenue hour Revenue/passenger SECONDARY INDICATORS Pass revenue/revenue mile Pass revenue/revenue hour Pass revenue/passenger Pass revenue/expense Fares/revenue Pass revenue/revenue	Insurance pooled risk Private contractors Increase speed Increase service Stop unproductive routes Decrease headways Increase stop locations Increase fares Reduce administrative cost Increase fare paying passengers Increase contract service Increase ancillary services
C. Limited Subsidy Revenue	PRIMARY INDICATORS Revenue/expense Subsidy/vehicle mile Subsidy/vehicle hour Subsidy/pass	Reduce administration Reduce staff Streamline procedures Reduce service Reroute and reschedule Improve promotions Increase fares Modify fare structure Increase contract service Improve fleet reliability

2. Quality of Service	PRIMARY INDICATORS	
A. Poor Service Quality	% stops on time Complaints/driver SECONDARY INDICATORS Stops with signs/stops Vehicle mile/road call	Monitor drivers Change stop dwell time Reroute congested areas Speed up fare collection Increase stop spacing Improve on-time performance Improve vehicle reliability Improve employee training Improve bus cleanliness Improve preventative maintenance Rehabilitate and replace vehicles Improve passenger amenities
B. Schedule Adherence Problem	PRIMARY INDICATORS Percent of trips late	Holding strategy Increase run time and/or layover Modify route
C. Unacceptable crowding	PRIMARY INDICATORS Load factor	Increase frequency Articulated buses
2. Efficiency	PRIMARY INDICATORS Revenue/cost	Decrease frequency Split route
A. Poor Productivity	Load factor Passengers/vehicle hour	Short turn strategies Local/express/zonal strategies Partial deadheading
B. Poor Vehicle Utilization	PRIMARY INDICATORS Rev/cost Pass/vehicle hour	Eliminate route segments Eliminate trips Extend route Modify schedule
4. Ridership	PRIMARY INDICATORS Passengers/vehicle mile Pass/vehicle hour SECONDARY INDICATORS Fare pass/pass Elderly pass/pass Percent change pass/year	Improve cleanliness, safety, and reliability Modify fare structure Fare incentives Alter routes and schedules Increase vehicle speed Improve marketing Decrease deadhead Increase number of fare passengers

Data required for primary and secondary indicators

Performance Concern	Data Needed for Primary Indicators	Data Needed for Secondary Indicators
1. Financial		
A. Expense	Passengers Total expense Vehicle hours Vehicle miles	Administrative expense Total expense Vehicle hour
B. Revenue	Passengers Revenue hours Revenue miles Total revenue	Expense Fares Passengers Passenger revenue Revenue hours Revenue miles Total revenue
C. Subsidy	Passengers Subsidy Total expense Total revenue Vehicle hours Vehicle miles	
2. Quality of Service		
A. System Quality	Complaints Drivers Stops Stops on time	Road calls Stops Stops with signs Vehicle miles
B. Schedule Adherence	Trips late Trips	
C. Crowding	Load factor	

3. Efficiency

A. Productivity	Cost Load Passengers Total revenue Vehicle hours	
B. Vehicle Usage	Cost Passengers Total revenue Vehicle hours	

4. Ridership

A. Low Ridership	Passengers Vehicle hours Vehicle miles	Elderly passengers Fare passengers Passengers Prior year's number of passengers Year's number of passengers