Alternate bus route design assignment

The problems associated with mixed traffic conditions on urban streets of developing countries are unique. Pedestrians, bicycles, buses, cars, motorcycles, auto-rickshaws. Cycle- rickshaws and various other kinds of travel modes share the same street space without lane discipline creating inefficient mobility conditions that reduce the economic potential of cities In developing countries.

Also, handicraft demand Is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is known as a traffic Jam or traffic snarl-up. In metropolitan cities, usually a bus carries more passengers than Its capacity and passengers wait for longer time at all the stages and thus cause more discomfort and dissatisfaction to the passengers.

The reasons for this situation are many. Out of these some are controllable (frequency of buses, traffic signal, road indention, bus condition) and some are uncontrollable (traffic Jam, breakdown, etc.). Frequency of buses is one of the important issues that have bearing on the waiting time of passengers as well as on the operating cost of buses. A flexible, comfortable, easily available and reliable bus service may encourage shift from private vehicles to public transport.

Since travel demand varies over time and space, public transport systems often have neutralized capacity at non peak hours and high load factor in peak hours. The objective of an efficient system is to meet the diverse

demands and minimize operator’s loss. This requires that the optimizing, routing, scheduling and synchronizing problems are given special attention, while designing an efficient bus system. A method is developed to simultaneously select an alternate route for an existing bus route and assign frequencies for a bus transit system.

The method is intended to concentrate the flow of passengers on the road network In such a way that the passenger riding comfort level Is maintained according to the bus capacity and the bus frequency is optimized in such a way on the existing as well as the alternate bus out that appropriate bus service is maintained across the entire day. A new analytical model is proposed to determine optimal frequency for urban bus transit under variable demand. The effect of road congestion and speed variation Is also considered which in turn affects the traveling time of the routes considered.

The model is applied to find the number of buses to be diverted on the alternate route selected for ETC bus number 764 running in Delhi and to optimize frequency of buses. The trickled effect of this alternate route provision is the disconnecting long the existing route of travel at the point of diversion of buses which in turn increases the speed of traffic flow on the existing route without largely affecting the traffic flow speed on the alternate route that has been selected out of the various routes available.

KEY FEATURES OF THE P REJECT (MODEL DEVELOPED) The operations of high passenger demand bus routes (typically defined as those 1 OFF influences that can greatly impact the level of service provided to passengers. Route rationalization for a particular bus is done that remains overcrowded due to

the excessive demand and thus the out of the existing fleet size it is decided that how many number of buses are to be maintained on the existing route and the number of buses to be diverted on the alternate route chosen out of the already constructed roads under use but not being used by the particular bus.

It is also to be decided whether the existing fleet size is sufficient to cater to the demands or it need to be changed to suit the passenger travel. The number of buses in the fleet size considered is to be decided accordingly as per the results of the developed model. As, we know that the demand for buses varies non uniformly throughout the day with the demand being high during peak hours and low during non peak hours, the bus frequency has to be categorically found out so that the bus capacity never gets under or over utilized.

An optimization model is developed for determination of bus frequency on a particular existing route by minimizing number of buses on the route. The problem of disconnecting is also to be solved as a consequence of the optimization of frequency of buses on the alternate route. As the buses are diverted on the alternate route, the corresponding decrease in congestion on the existing route is also found out. The layout of the route is used to create a framework within the optimization model to accept the key stop (schedule time points and stops with higher passenger demand) and segment specific parameters.

The number of minor stops per segment is necessary to build a visual representation of the bus route with the key stops appropriately spaced and

the minor stops appropriately clubbed together. Lingo 11 is used for solving the mathematical model developed. The number of buses to be maintained on the existing route and the number of buses to be diverted on the alternate route is obtained after the algorithm formulation. The output of the simulation model gives us the number of trips to be made for a two hour slot that is considered for algorithm formulation.

This eventually gives us the number of buses to be included in the fleet size thus enabling frequency determination or headway of buses. RESULT AND THEIR ENGINEERING SIGNIFICANCE On the basis of application of the algorithm to bus route number 764 of Delhi Transport Corporation, the number of buses out of the current fleet size to be maintained on the existing route and number of buses out of the current fleet size to be diverted on the new route is determined.

Idle flow capacity curves are also drawn that help in determining the time at which a particular bus is overcrowded and time at which the bus moves at its ideal capacity. The idle bus capacity is calculated so as to identify the stops having maximum passenger demand and to analyze the capacity utilization of buses so that we may conclude as to where the frequent running of uses is required if not necessarily along the entire route length. Excessive number of buses between stops having low passenger demand may be terminated.

Disconnecting of traffic at the diversion point is to be observed as the positive side effect of frequency optimization. The current route of ETC bus 764 is highly overcrowded during the peak hours of am-AMA and pm-pm. During the morning whereas during the evening peak hours, the trips from

Nehru place to Niagara have high passenger demand. The alternate route that has been provided to reach Nehru place from Niagara is by diversion at bus stop of APS colony to reach Dhal Guan and taking the route via Alms flyover and Melancholia flyover to finally reach Nehru place.

The maximum capacity of the bus is considered to be 90 passengers. The ideal bus capacity is considered to be 70 passengers including seating as well as standing capacity. For each time slot, the idle bus capacity is considered relative to the passengers in the bus between any two bus stops. Capacity in transit operations is measured as the maximum number of passengers that can be carried past a single mint on a fixed route, in a given period of time. Passenger demand is realized in the model as boarding and alighting passengers at each key stop.

The number of passengers that can actually board the bus depends on the bus capacity after the passengers have alighted. This helps in rationalizing the bus route according to The structuring of routes and the assignment of frequencies is done for a given desired trip matrix leading to appropriate results for both peak and non-peak traveling hours. There is constant overcrowding in buses during peak hours whereas they are not ailed up to their capacity during non peak hours.

Traffic congestion is also a common problem encountered along bus routes due to narrowing down of roads and decrease in number of lanes. Bottlenecks are important considerations because they impact the flow in traffic, the average speed of vehicles and an immediate reduction in the capacity of roadway. Schedule information and route data at the key stop

level of detail are necessary to represent the route accurately and optimize frequency of buses operating on the route.

For each trip, information on the pattern, scheduled inning times and relief are necessary to start and end the trip in the correct location. Bus passenger demand varies across the day. It is high during the peak hours and low during non-peak hours. The varying passenger demand forms a major part of bus operations. Number of buses to be maintained on existing route and the number of buses to be diverted on the alternate route are obtained to be run with a particular frequency. Disconnecting of the road is also observed as a positive side effect of the solution obtained to the problem.