# PRIORITY SIGNALING FOR BUS RAPID TRANSIT SYSTEM: CONTEXT OF INDORE CITYBUS TRANSPORT LIMITED (ICTL)

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## ABSTRACT

Day by day the life is going faster and the boundaries of the city are expanding. To travel 40-60 km a day is very general case. This is not only the case of metros in India, even the condition of cities like Hyderabad, Amhedabad are also same. This requires attention so that the infrastructure can cope with the expanding industrialization and increasing population. In this scenario a good and effective transport system is needed. It must be cost effective as well as time effective. All this led to need of the better public transport system for balanced and proper development. Bus Rapid Transit System(BRTS) provides a very good solution for public transport.

In this paper we studied the implementation aspects of BRTS for Indore and how to reduce the travel time.

## INTRODUCTION

### Indore City Transport Service Limited

Indore City Transport Service Limited (ICTSL) provides public transport facility for the city. Its functioning includes the centralized monitoring of city buses, automatic ticketing and provide passenger information system. It is in existence at Indore since last four years and has won several accolades nationwide for monitoring vehicles through extensive use of GIS and GPS technology. ICTSL has a fleet of 114 buses, out of which 96 buses run in urban and rest in suburbs.

### Bus Monitoring

ICTSL buses are equipped with GPS receiver which sends following six data signal to monitoring center (latitude, longitude, current Date, current Time, Speed and odometer reading.) Based on the above six data a location of bus is determined and the delay at a bus stop is calculated.

### Bus Rapid Transit System

Bus Rapid Transport System (BRTS) is a broad term given to a variety of transportation systems that, through improvements to infrastructure, vehicles and scheduling, attempt to

use buses to provide a service that is of a higher quality than an ordinary bus line. Each BRT system uses different improvements, although many improvements are shared by many BRT systems. The goal of such systems is to at least approach the service quality of rail transit while still enjoying the cost savings of bus transit.

In BRTS a dedicated lane is provided for city bus, emergency service vehicle and VIP vehicle by least affecting rest of the vehicular movement. In Indore BRTS has been proposed consisting of total 8 corridors .The total length of which is 120 KM. First phase work is under process in which 23 KM of road will be converted to BRTS corridor.

## Intelligent Transport system

Intelligent Transport system (ITS) aims to provide improved safety, reduction in vehicular wear, reduce transportation time and fuel consumption. For these reasons BRTS includes ITS.
Following are the aspects:

- Automatic vehicle locator : online tracking and bus monitoring
- Passenger information system: Online schedule display , stop arrival destination indicators
- Electronic fare collection : reliability
- Vehicle Guidance: perfect docking of bus at platforms
- Traffic Signal priority : Avoids delays at intersection

## Transport Signal Priority

Due to erratic traffic and congestion at various level the priority signaling for special vehicle is the solution. In present scenario many developing and developed cities are working on BRTS. In our paper we are focusing towards improvement in the traveling time using TSP.

Various methods for TSP:

For transit signal priority various methods are available.

- Vehicle actuator using Radio Frequency,

In vehicle actuator signal sensors are fitted at the traffic intersection. When a bus is approaching a traffic signal and receives red signal then the transmitters in the bus will send a signal to the sensor for priority signaling.

- Using GPS

We are working with GPS. All the buses are equipped with GPS devices. By which we know the exact location of bus. The location of each traffic signal is also known to us. When bus is arrived at an intersection and having red signal then the bus will send a request for signal priority. The red signal is truncated and green signal is given for the

bus. After the bus cross the intersection the traffic light is resynchronized and continues in normal mode.

## Methodology

The basic concept is that when a BRTS bus reaches a traffic intersection it should get the priority to cross the intersection so that the time delay on the signal can be reduced and thus the overall journey time can be reduced. There are many factors which govern the TSP.Following points can be considered.

- First the priority will be given only in case the bus is running late of its schedule time.
- Between two buses the priority should be given to the bus which is having the greater number of passenger.

Our focus is on those densely crowed traffic intersections near RAJWADA. This is commercial area so during day time mostly 2 wheelers are the main source of traffic including light motor vehicles and small goods vehicle as tempo and hand carts .The width of road is so narrow that if bus halts at the traffic intersection there is no chance for other vehicle to cross the signal prior to the bus. If a bus moves then it vacates a large area. So this will create some ease for other traffic to move rapidly. The frequency of Bus at this intersection is 15 min i.e. on this particular signal after each 15 min there a bus arrives from one or other direction. At this square irrespective to the delay of bus or any other variable the main focus is that the bus should cross the intersection.

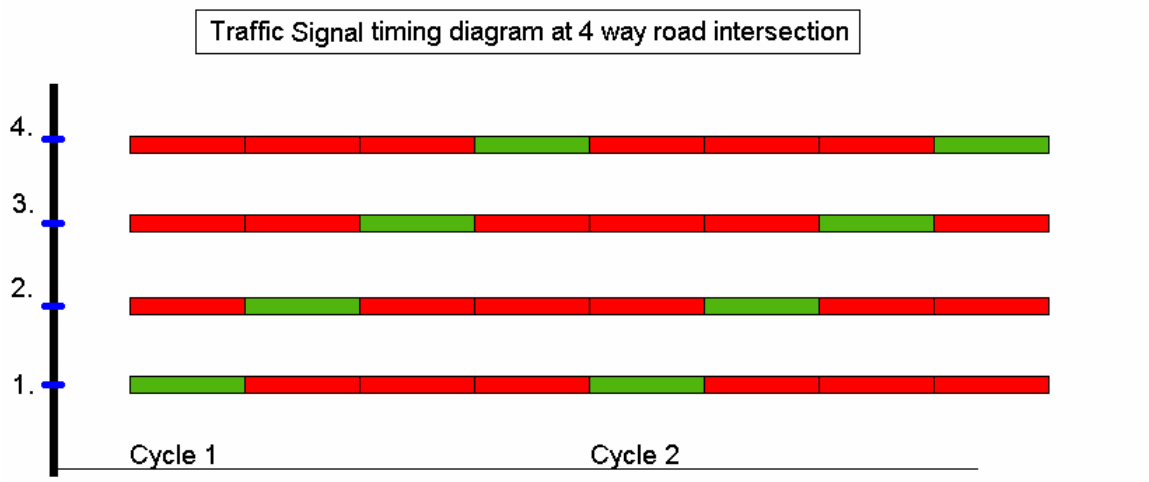


FIGURE 1.Traffic signal timing diagram at 4 way intersection in normal mode

The following are the 4 conditions that is possible on this intersection when a bus arrives from any direction

- Signal is green and till the time bus reaches node it is green. This is ideal condition; nothing is required from our side.

- Signal is red right now but will become green till bus reaches node. This is also ideal condition; nothing is required from our side.

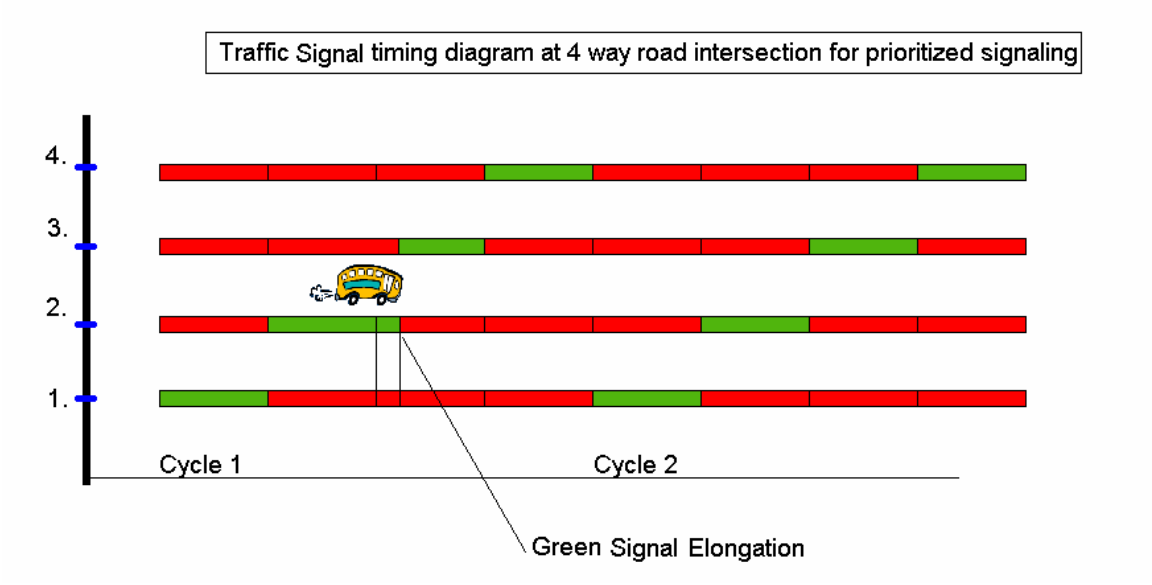


FIGURE 1.Traffic signal timing diagram at 4 way intersection in elongated green mode

- Signal is green but will become red till bus reaches node. In this case the bus will

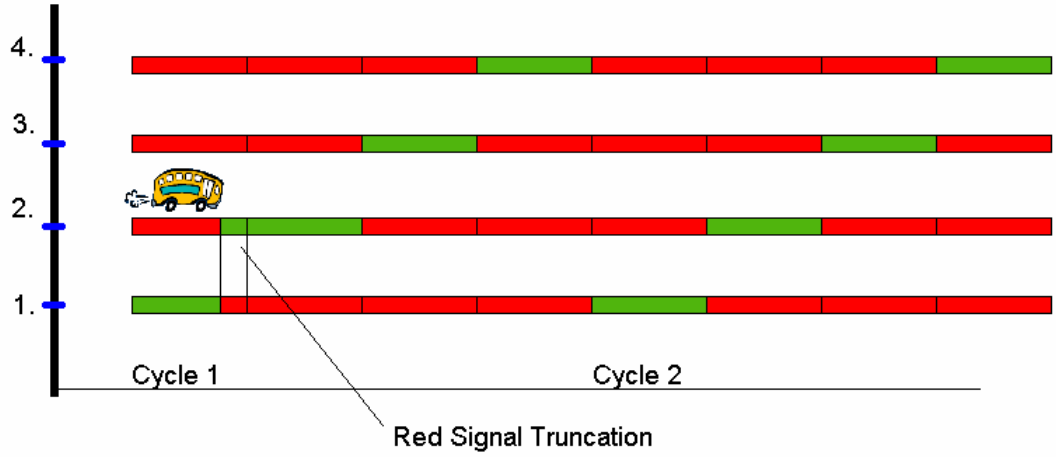


FIGURE 3.Traffic signal timing diagram at 4 way intersection in truncated RED mode

- send a signal for priority to cross the signal. The controller will elongate the signal by a fixed duration and the bus needs to cross the signal in this specified time.
- Signal is red and when bus reaches the signal is red . In this situation whole cycle of the signal is needed to be truncated.

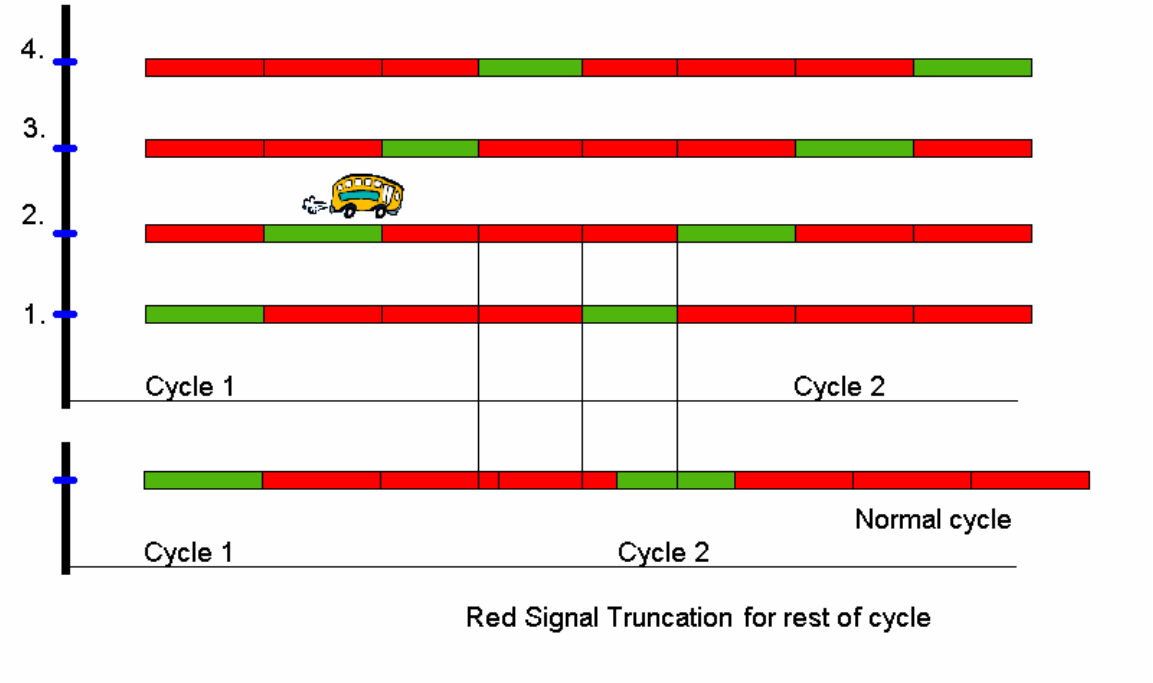


FIGURE 4.Traffic signal timing diagram at 4 way intersection in truncated RED for rest of cycle.

| Current Signal | When bus reaches | Cycle completion | | |
|---|---|---|---|---|
| RED | RED | 0-1/4 | Truncation for whole cycle | |
| | | 1/4-2/4 | | |
| | | 2/4-3/4 | Truncation. | |
| RED | GREEN | | IDEAL | |
| GREEN | RED | | Elongation | |
| GREEN | GREEN | | IDEAL | |

TABLE 1. Various possible modes of signal priority

## Conclusion

So far we studied TSP and its implementation constraints for Rajwada square. In above diagram (figure 1-5) it has been shown that if the priority signaling is implemented for the BRTS bus then at most 90 sec of time is cutoff from the total waiting time of bus at one intersection. If the same priority has been implemented at all intersections then at most 90x10=900 sec 15 min of time can be reduced from the total journey time of the bus (considering 10 traffic intersections)

Other aspect is that while elongation green for BRTS bus the red signal is extended only by 20 sec for other traffic which has negligible effect on overall working of the traffic signals.

## Further Implementation

The algorithm has been developed and now we would implement this, by integrating GIS with GPS.

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