CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The main contribution of this study was:

(1) To develop a procedure to create digitized route maps

(2) To compare them with the base maps and assess the consistency between the two maps.

The base maps contain GPS data points obtained directly from data collection while the digitized route maps are made up of links and nodes.

In the thesis, the use of a GPS unit, Trimble GeoExplorer II receiver to collect the required data necessary to produce route maps and the various options that need to be set in the receiver to collect the data were explained. The initial preparation phase in the office, data collection in the field and post processing steps were discussed in detail. A procedure was developed to produce the digitized route maps with link-node representation of the route. Finally, the digitized route map and the base compared were compared. This chapter draws conclusions from the previous three chapters.

5.1 GPS data collection

GPS was chosen because of its ability to provide up-to-the-second position and time measurements. The GPS unit used in this study was the GeoExplorer II model. The GeoExplorer II receiver provides a horizontal accuracy typically in the order of 2 to 5 meters. Feature Id, UTC time (Universal Coordinate Time, formerly known as Greenwich Mean Time), latitude, longitude of each point are logged to a file each time a trip is made. The critical and non-critical parameters required to be set in the office prior to the field, data collection in the field and data post processing including the conversion to a coordinate system were discussed.

5.2 Route map digitizing

The GPS data in the form of coordinates, for every point logged by the GPS unit, was digitized and contains nodes at fixed intervals of distance whereas the base map contains GPS data points at random intervals. The digitized route map has coordinates representing nodes and links at equal distances. The digitized route map has the following two features:

(1) The coordinate of the node always lies on a segment joining two points in the base map. This ensures that the new coordinate is not far away from any point on the base map.
(2) The coordinate of any node is always at a prefixed distance or interval from the previously obtained node in the digitized map.

An algorithm was developed and coded in Matlab and the procedure was automated. The program is shown in Appendix C. A specific route, Tom's Creek A bus route, was chosen to illustrate the process of constructing the digitized map. The execution of the procedure was discussed in detail for that route.

5.3 Accuracy of digitized route maps.

Four base maps of the same route were digitized at intervals of 10, 30, 50 and 70 meters using the procedure described in chapter 2. The digitized route maps were compared with different base maps and the results are given in chapter 4. The results showed that the digitized route maps are in good agreement with the base maps.

GPS data was collected for a different route. The base map of the route was also digitized. Its accuracy was examined. The results obtained were similar to those for the route studied in detail, indicating that the procedure was not route sensitive.

GPS data was collected for a different interval time of 5 seconds on the Tom's Creek A route. The base map was digitized to produce the digitized route map. This digitized route map was compared with the base maps containing GPS data at one-second interval. The results clearly

indicated that the resultant digitized map was close in accuracy to the digitized route map obtained by digitizing GPS data collected at one-second intervals.

5.4 Future work

The choice of the link length is a trade off between the accuracy and the amount of data processing effort required**.** For a desired level of accuracy, one may want to study the optimal link length, i.e. the longest link one can use for the targeted accuracy level.

The free flow travel time for each link needs to be obtained for arrival time prediction. One may estimate the link travel time under free flow condition simply based on the bus schedule. One may also want to incorporate other information into link travel time estimation such as speed limit, traffic condition, traffic control and other factors.

Another area of study is to consider links with variable lengths. Since the bus speed could vary along its route, it might be advantageous to use short links to represent roadway segment along which buses usually travel slowly and long links to represent roadway segment along which buses usually travel at a high speed. Besides, the entire procedure should be able to handle any changes in bus route on a real time basis for some special events.

The use of GIS software such as AutoCAD map, MapixTM or Arc/Info for arrival time prediction can be studied. The method indicated in Chapter 5 involved clicking the links along the route manually. This is bound to cause some error. An automated way of obtaining node positions using the Network Topology feature of Arc/Info can be investigated. This will increase the accuracy and can be handled in quick time by a skilled person. The use of the GIS software helps in case of detour as the situation can be handled in the office.