

Sample Validation of Vehicle Probe Data Using Bluetooth Traffic Monitoring Technology

Data taken from the Northern Section of I-495 (Capitol Beltway) on June 17, 2008

The I-95 Corridor Coalition is a partnership of state departments of transportation, regional and local transportation agencies, toll authorities, and related organizations from Maine to Florida. In December 2007, the Coalition contracted with INRIX®, Inc. to provide comprehensive and continuous real-time travel information (travel times and speeds) of over 2500 miles of freeways and arterials to member agencies. The travel time and speed data is to support the dissemination of travel information using 511 and websites; display of travel times on variable message signs, traffic management during incidents and performance measurement. The contract specifies two primary data quality specifications related to accuracy and timeliness that would be independently validated. Additional information and details of the accuracy specifications are available at the project web site at <http://www.i95coalition.org/vehicle-probe.html>.

The validation of the accuracy and timeliness of the data is based primarily on a Bluetooth Traffic Monitoring system developed at the University of Maryland, though some drive testing will also be performed. In preparation for the validation phase of the project that would commence on July 1, of 2008, the University of Maryland and INRIX Corporation jointly performed a data collection and comparison exercise on June 17, 2008. The exercise was conducted on the northern portion of the I-495 Capital beltway between the junctions of I-270 and I-95 as shown in the Map of Figure 1. The University of Maryland placed Bluetooth Traffic Monitoring equipment at the four interchanges indicated on the map. Sensor locations were chosen to correspond as closely as possible with the beginning and end points of TMC codes used by INRIX to report data. Drive tests were also performed on the route during the AM and PM rush hours. During the AM rush hour, sensors were placed along the outer loop to record westbound travel times on the beltway, and in the evening the sensors were placed on the inner loop of the beltway to record eastbound travel times. During the same periods, INRIX reported speeds from their pre-production I-95 Vehicle Probe data system that subsequently went into operation on July 1, 2008. The results of the Bluetooth, drive testing, and INRIX data are reported below.

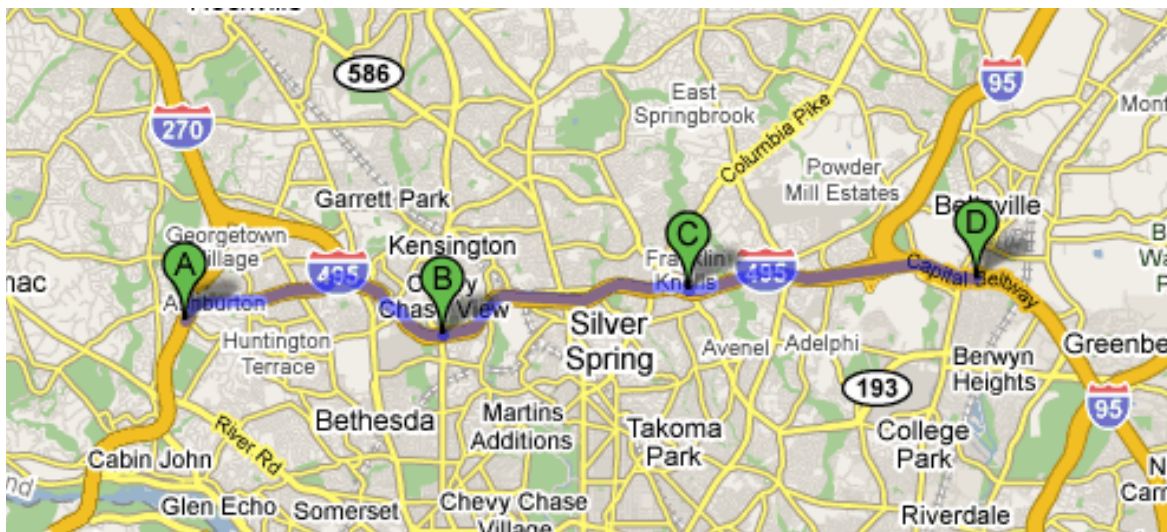


Figure 1 Map of data collection and sensor placement on June 17 2008.

The results of the exercise are presented in two charts for each segment in the AM and PM peak. The first chart is a comparison of travel time of the three sources of data, and the second chart is

a comparison of the same data but viewed in the speed domain. An explanation of each data set is provided in the following section.

Data Explanation

Figure 2A is a graph of the Bluetooth travel time data taken between the portion of the beltway between sensors A and B of east bound traffic on the Capital Beltway between 2:00 PM and 7:30 PM (14:00 to 19:30 using a 24 hour clock as labeled in Figure 2) on June 17. Each data point represents the travel time of a vehicle between points A and B on the beltway. The free-flow travel time is approximately 5 minutes as observed near 7 PM.

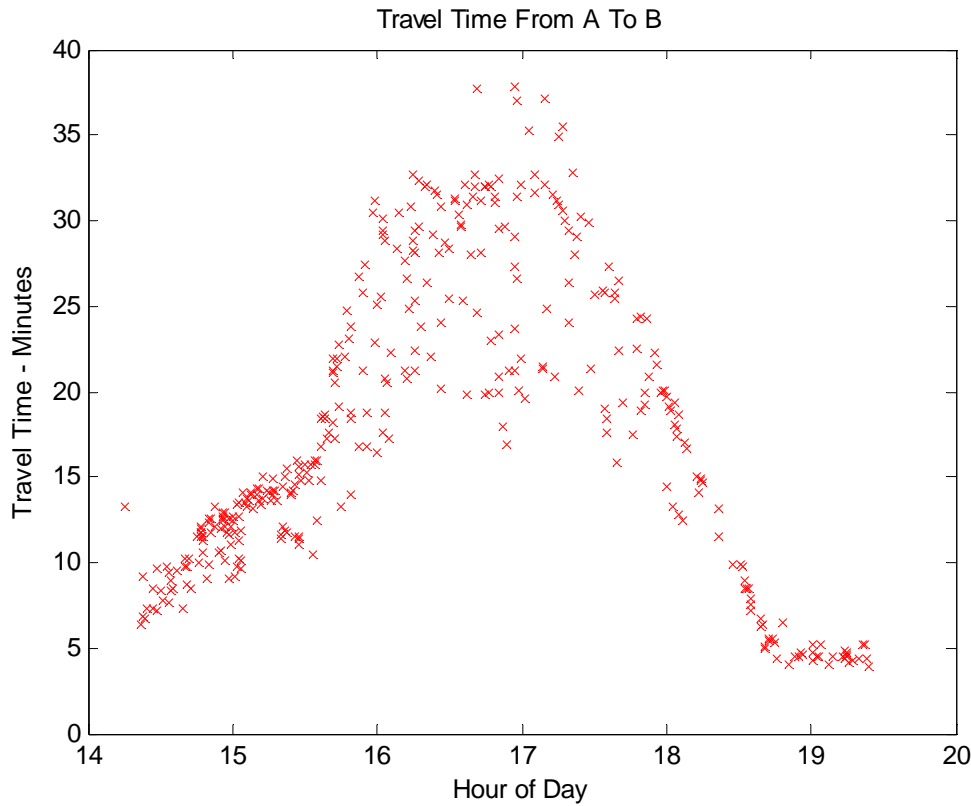


Figure 2A Travel time as recorded from Bluetooth Traffic Monitoring sensors at points A to B on the inner loop during the evening of June 17, 2008

Figure 2B overlays the drive test data performed by the University of Maryland during the same time period. The black circles represent the four runs during this period. The UMD drive test vehicle had a Bluetooth device that was detected by the sensors. The corresponding travel times detected by the sensors are marked in Figure 2B. The initial drive test travel time of approximately 13 minutes is a result of the extra time needed to place the Bluetooth sensor at location A.

Lastly Figure 2C overlays the Inrix data provided by the pre-production I-95 Vehicle Probe system. The data for this particular section was divided into six separate TMCs (Traffic Message Channel segments) varying in length from 0.37 miles to 1.93 miles as shown in Table 1. The speed of each TMC segment was converted to its equivalent travel time based on the distance of each TMC segment, and then summed to obtain the travel time across the entire distance between A and B. The Inrix data on July 17 was reported in 5 minute intervals, so this transformation was performed on each 5 min data set.

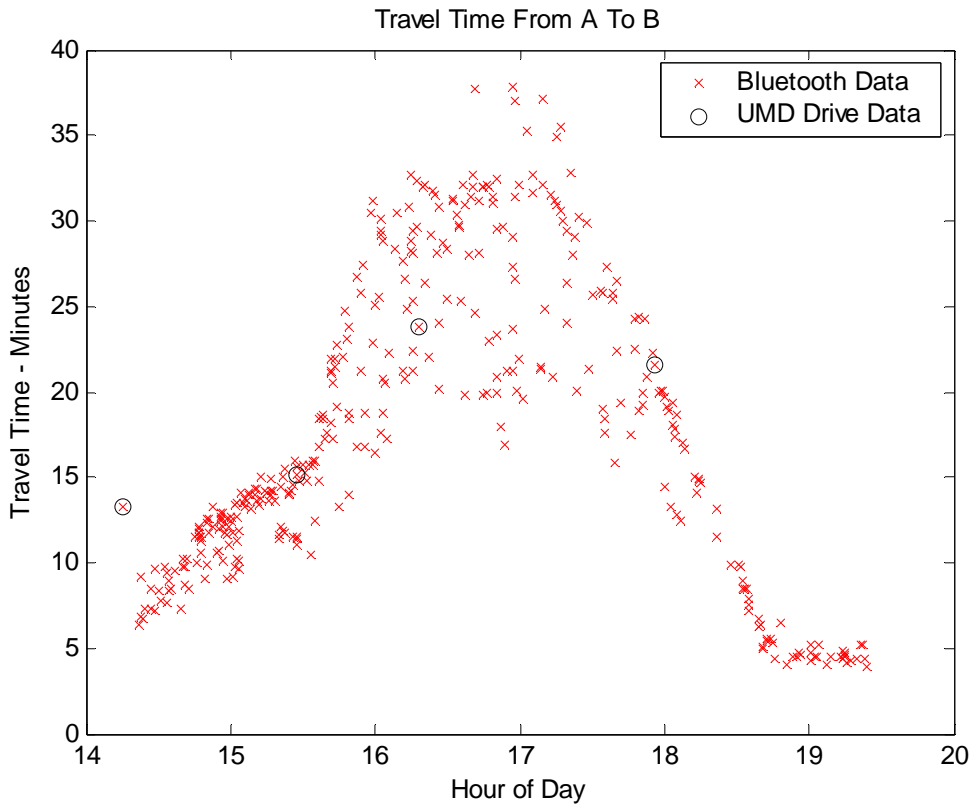


Figure 2B Drive test data overlaid on Bluetooth Travel Time data

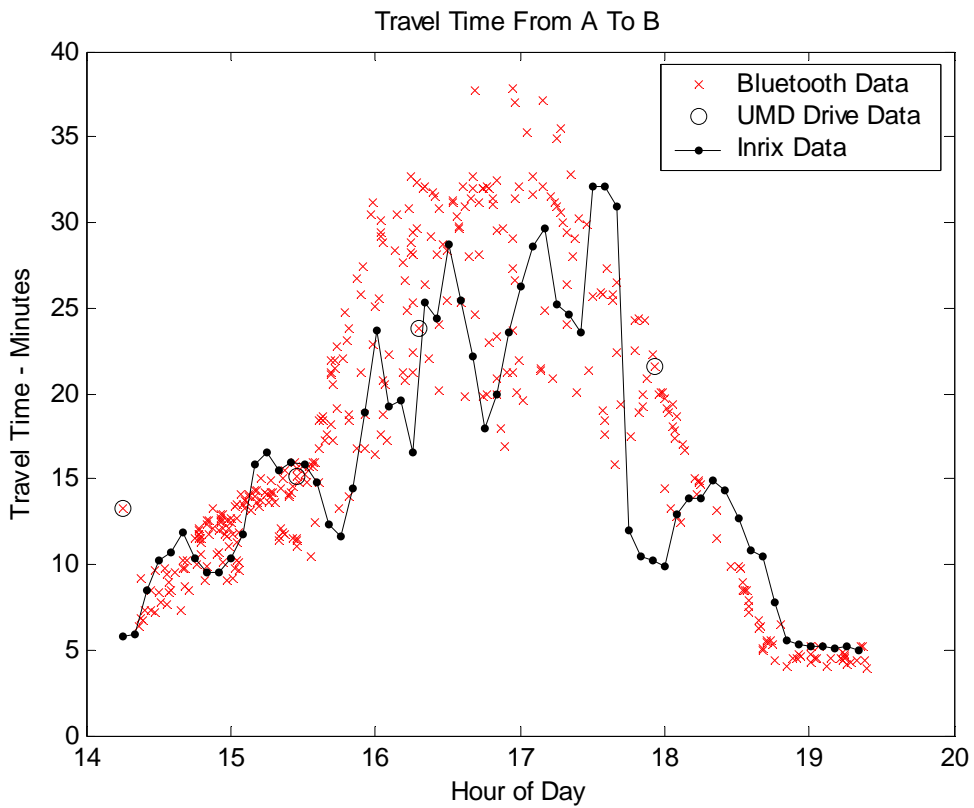


Figure 2C Inrix travel time data overlaid on Bluetooth and UMD drive Test data

The travel time data from each source was converted to its equivalent speed by dividing by the distance between locations A and B. Figure 3 represents the same data displayed in Figure 2C, but as speeds instead of travel times.

TMC Segments from A->B	
TMC Code	Distance (Miles)
110+04619	1.930193
110+04620	0.36818
110+04622	1.115289
110P04619	0.378743
110P04621	0.686336
110P04622	0.435664

Table 1 TMC segment information for I-495 between points A and B, eastbound

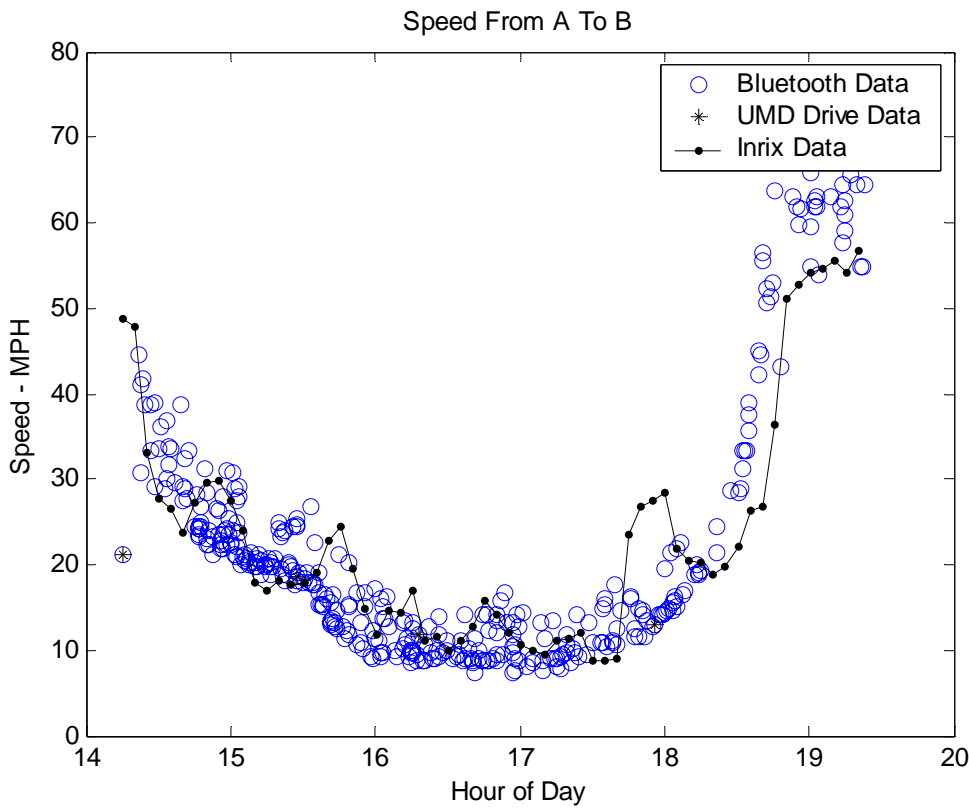


Figure 3 Comparison of all three sources of data in the speed domain

The graphs on the remaining pages show the travel time and speed charts for the remaining segments: B to C and C to D in the afternoon, and then B to A, C to B, and D to C in the morning.

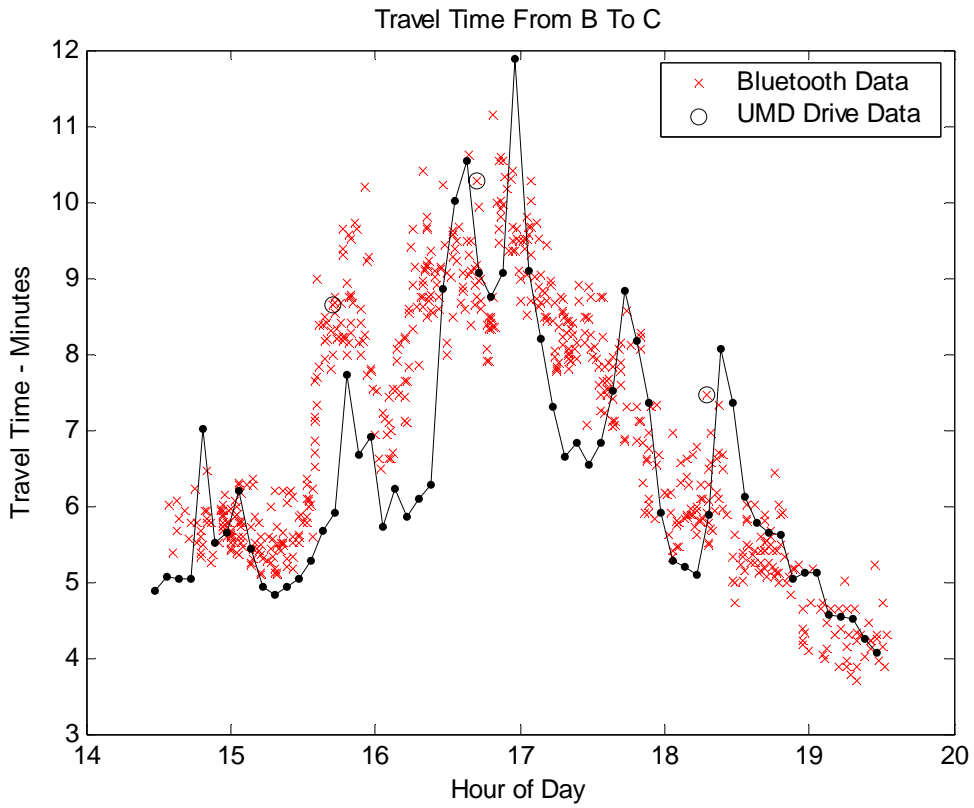


Figure 4A Comparison of travel time data for PM eastbound traffic from B to C

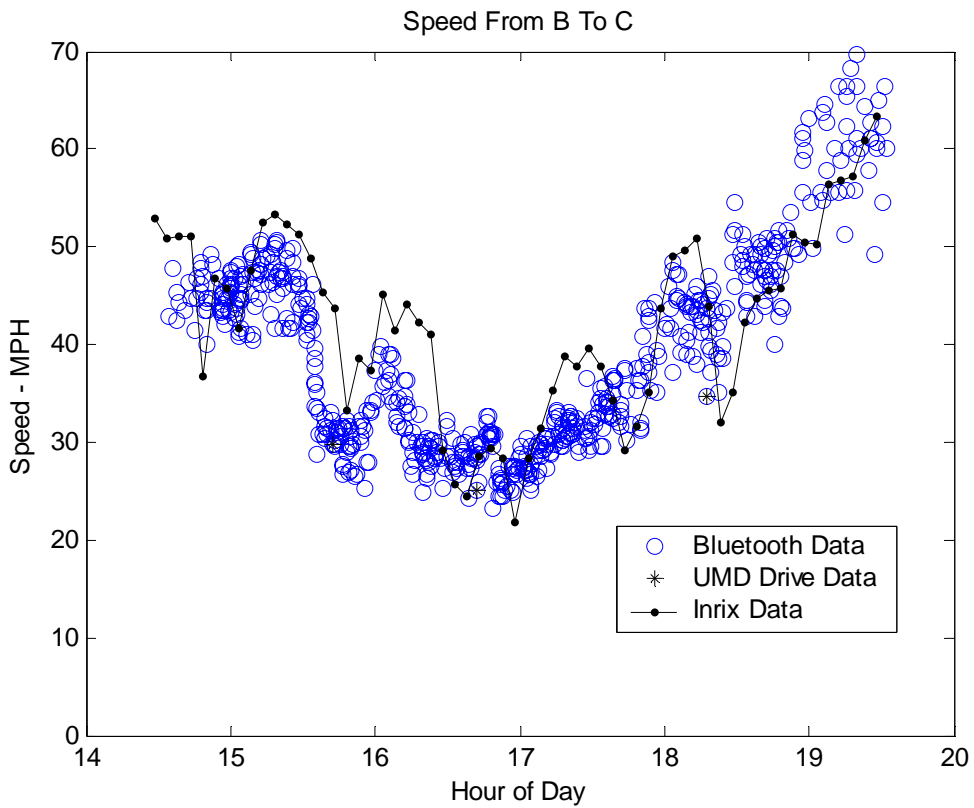


Figure 4B Comparison of speed data for PM eastbound traffic from B to C

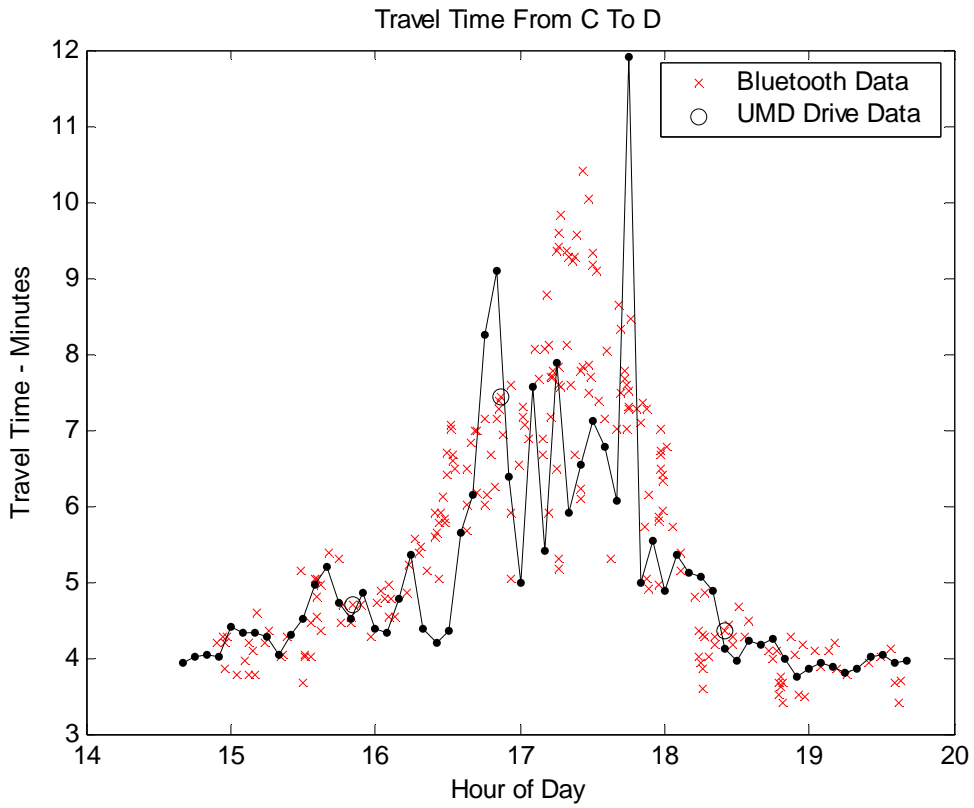


Figure 5A Comparison of travel time data for PM eastbound traffic from C to D

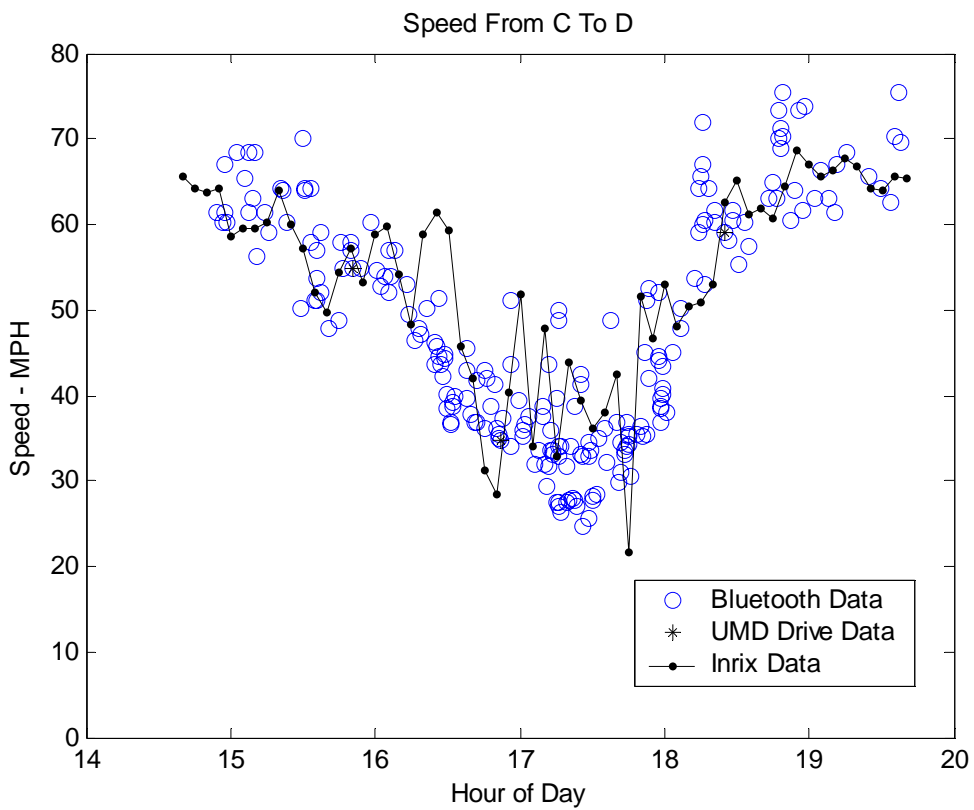


Figure 5B Comparison of speed data for PM eastbound traffic from C to D

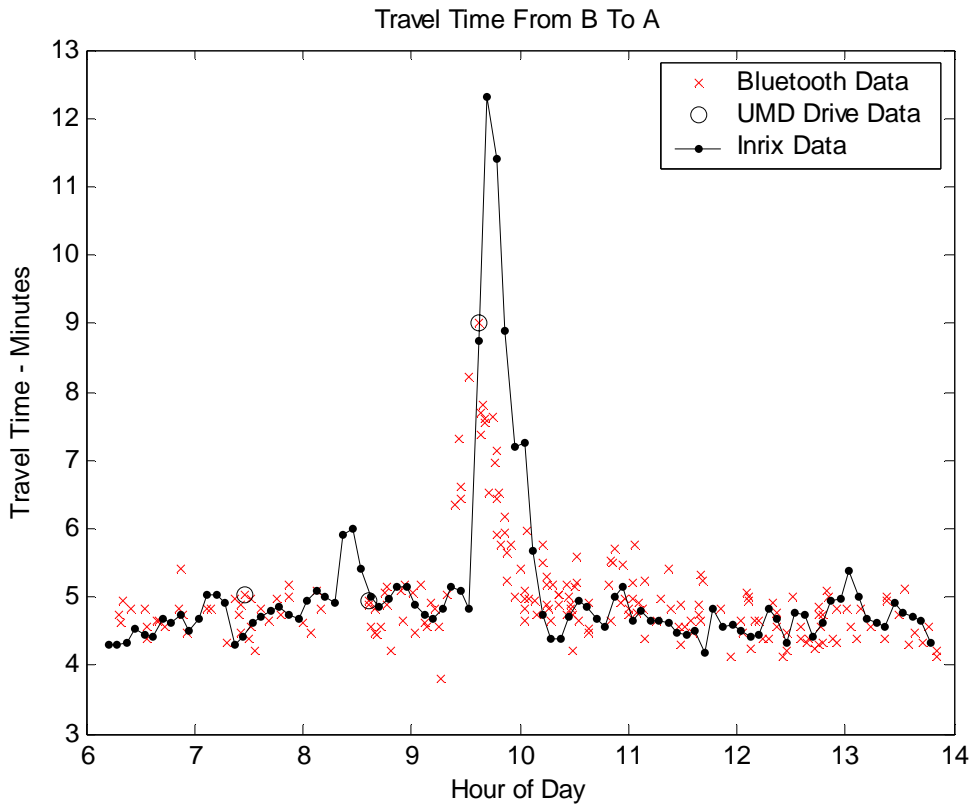


Figure 6A Comparison of travel time data for AM westbound traffic from B to A

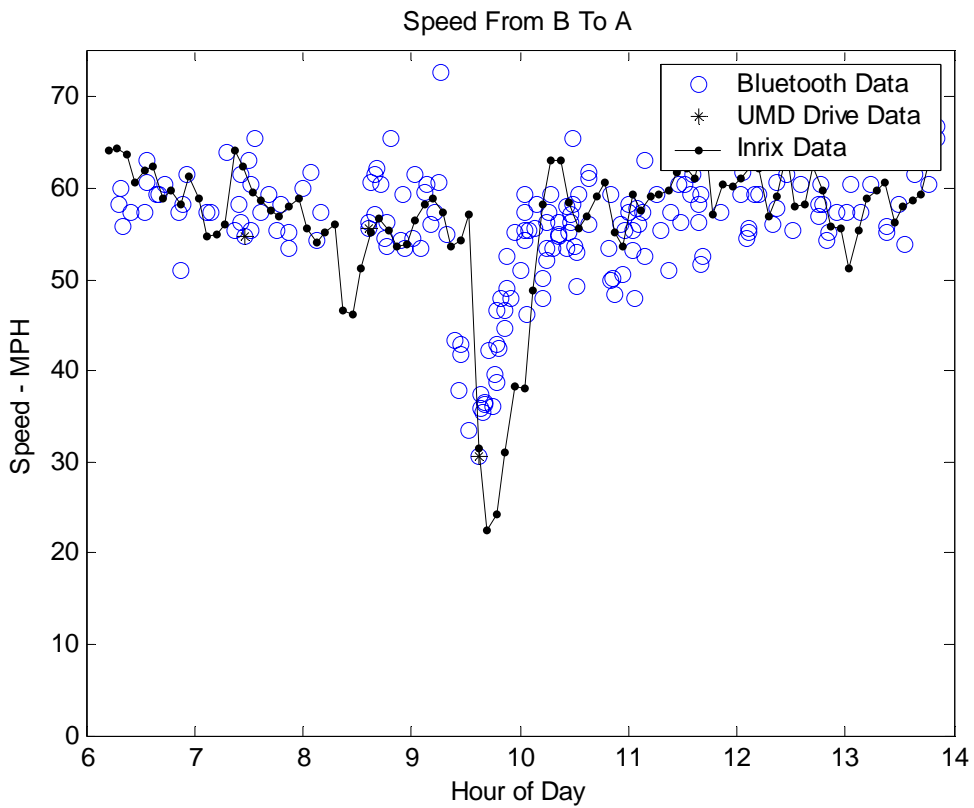


Figure 6B Comparison of speed data for AM westbound traffic from B to A

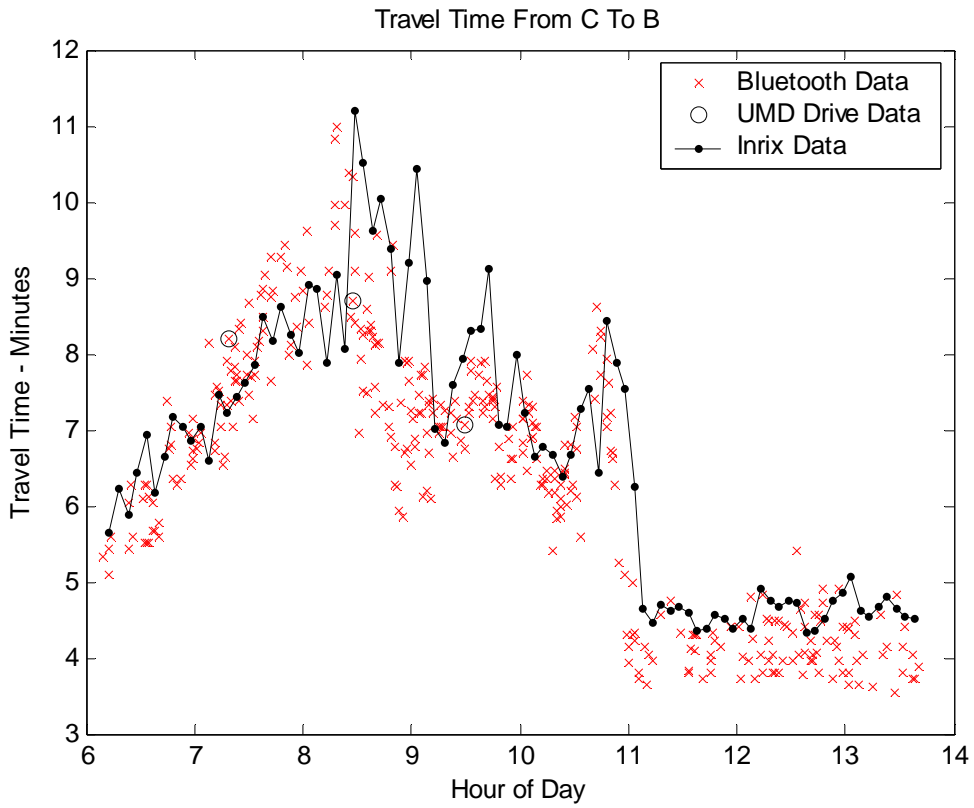


Figure 7A Comparison of travel time data for AM westbound traffic from C to B

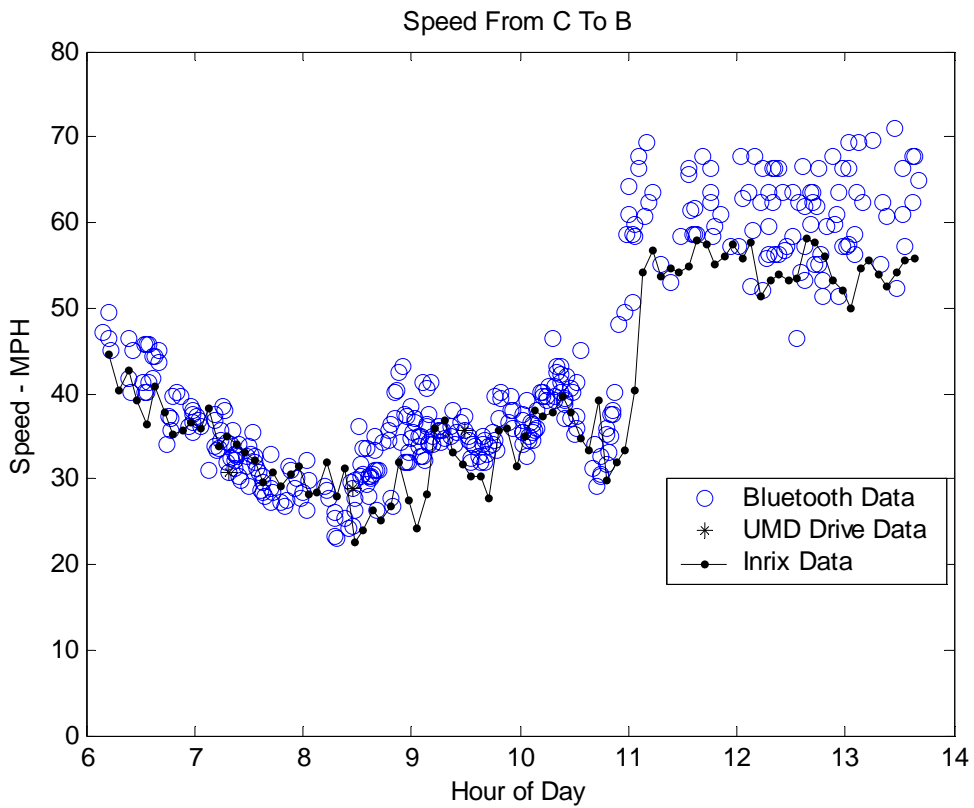


Figure 7B Comparison of speed data for AM westbound traffic from C to B

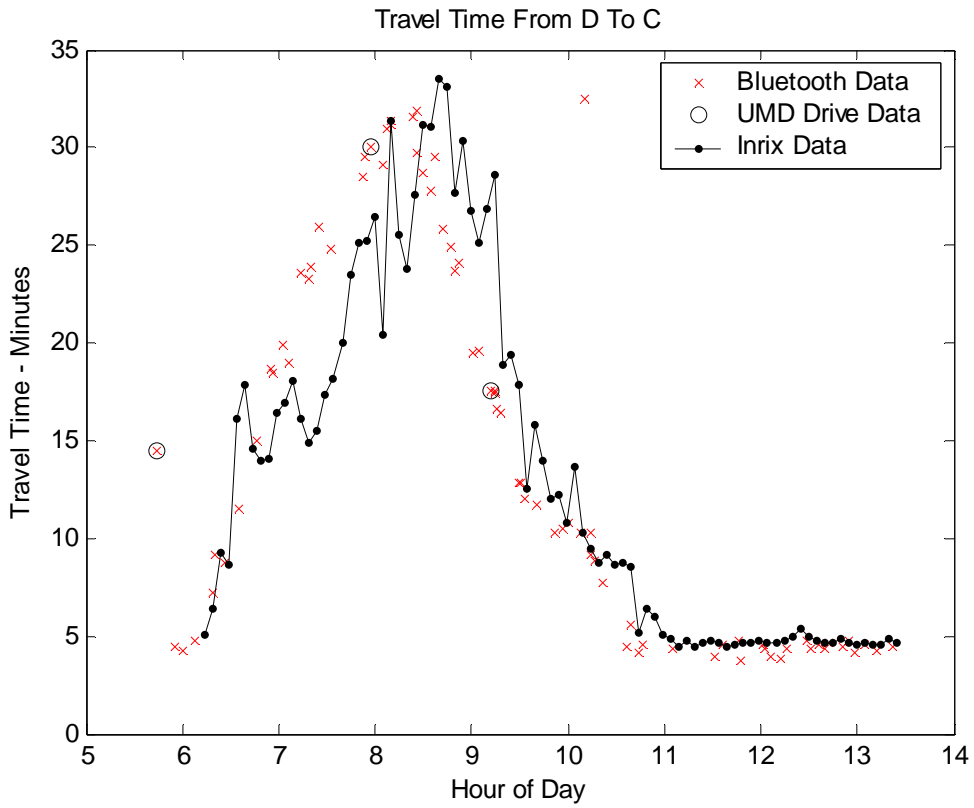


Figure 8A Comparison of travel time data for AM westbound traffic from D to C

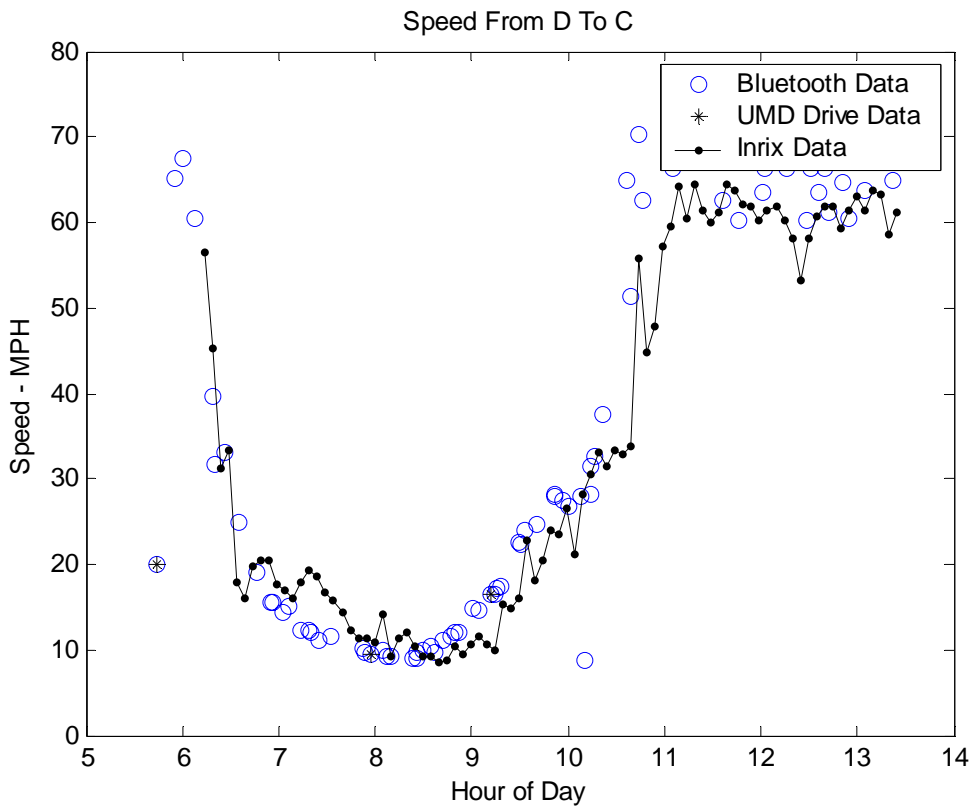


Figure 8B Comparison of speed data for AM westbound traffic from D to C