NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

January 23, 2009

Rail Collision Vehicle Performance Study

D.A. Crider

A. ACCIDENT: DCA-08-MR-009

Accident Type:	Train Collision
Location:	Near Chatsworth CA
Date:	September 12, 2008
Time:	Approximately 4:23 PM Pacific Daylight Time
Trains:	Metrolink No. 111 and Union Pacific No. LOF6512

B. GROUP IDENTIFICATION:

No group was formed for this activity

C. SUMMARY

On Friday, September 12, 2008, at approximately 4:23 p.m. pacific daylight time, westbound Metrolink passenger train No. 111 and Union Pacific freight train No. LOF6512 collided head-on while operating in a 6 degree curve on Metrolink's Ventura Subdivision between control point Topanga and tunnel No. 28 near Chatsworth, California. The Metrolink train derailed its locomotive and lead passenger car; the UP train derailed two locomotives and 10 cars. As a result of the collision, the Metrolink locomotive was shoved about 50 feet into the lead passenger car. Emergency response agencies reported that 102 injured persons were transported to local hospitals. There were 25 fatalities.

Damage is estimated at $10.6 million. Environmental conditions were daylight, clear skies, haze, calm winds and a temperature of 73 degrees F with visibility of four miles.

D. DETAILS OF INVESTIGATION

Track Data

Track geometry (latitude and longitude) near the collision point and the locations of the signal circuits, Topanga switch, Chatsworth station stopping point and the collision point were obtained from a total station survey conducted by Metrolink[1]. This latitude and longitude was converted to east and north coordinates from the Topanga switch using the Safety Board's Winlat program. Distance along the track was determined in an excel spreadsheet by adding the segment distances between track points. These distances were then converted to true miles along the track using the Topanga switch location at milepost 444.383 as the anchor point. The portion of the track covered in the Metrolink survey is shown in figure 1.

[1] For details see the track chairman's factual report.

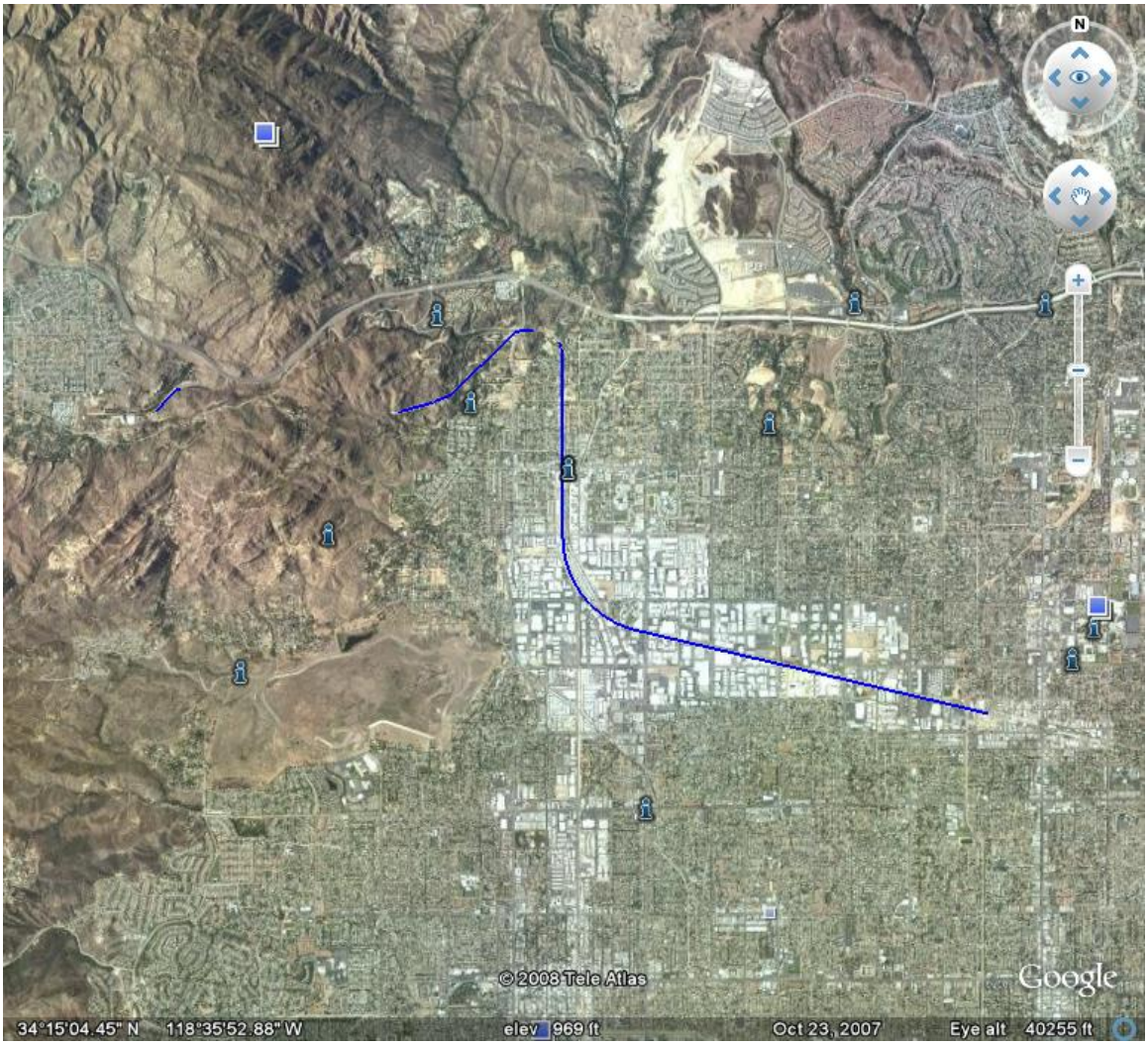

Figure 1 Metrolink Survey

The Federal Railway Administration (FRA) provided a larger area of track data from their Track Data Management System (TDMS). The FRA uses track geometry survey cars as part of the Automated Track Inspection Program (ATIP) as the source of this data. This track data is shown in red in figure 2 with the Metrolink survey data shown in blue.

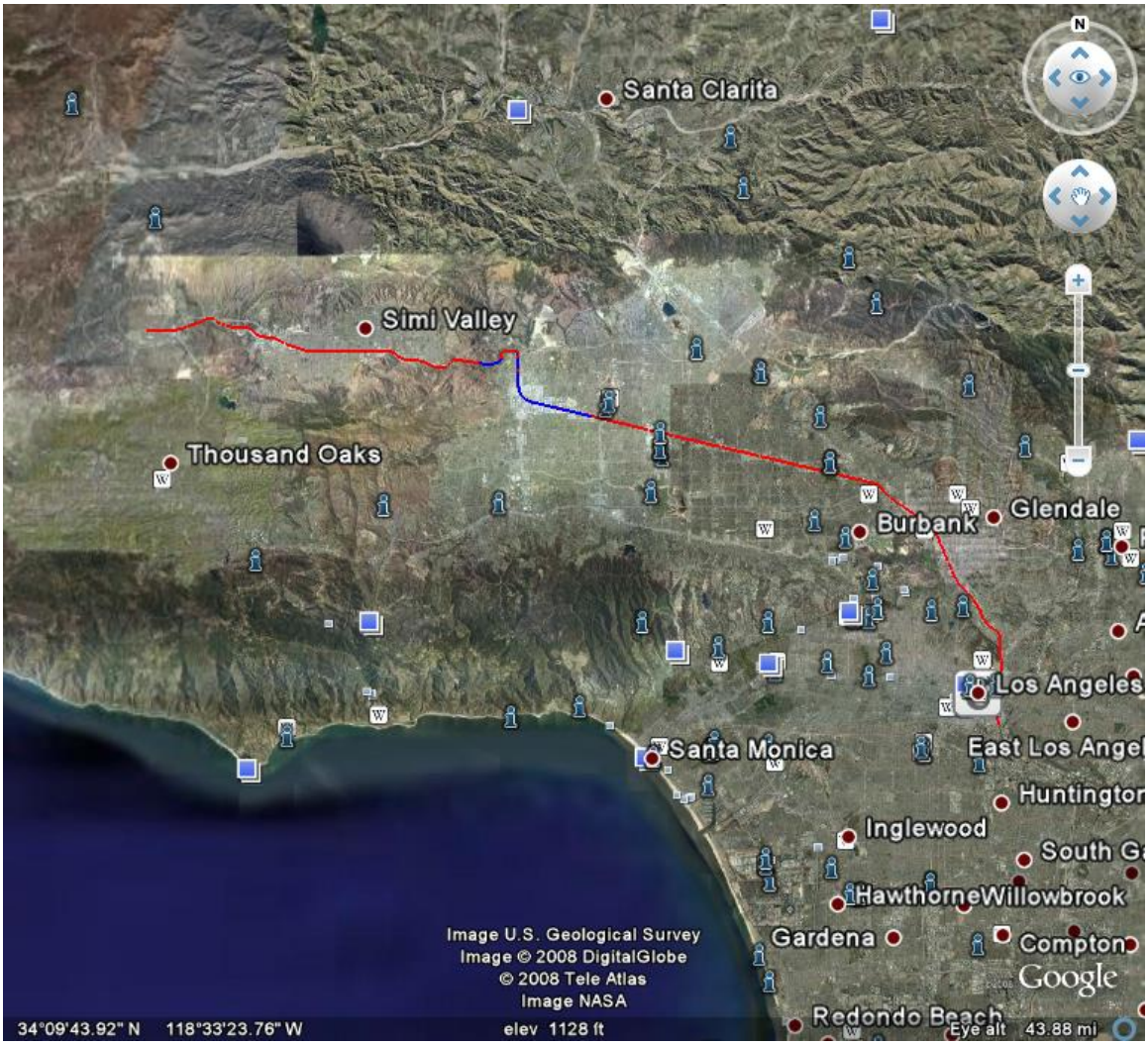

Figure 2 FRA TDMS survey track.

The positions of the station stopping points along the track were used in the position integration (described below). Metrolink conducted a survey to provide these points[2]. These latitudes and longitudes were then converted to true track miles along the track using Rail_Track program. The resulting track miles along with latitude/longitude of the station platform ends are given in table 1.

Station	Latitude	Longitude	Miles
Track_5_On_Tangent-Bumping_Post-Union_Station	34.05447	-118.235	473.8813
Track 5-On_Tangent-at_middle_of_ADA_Ramp-Union_Station	34.05467	-118.235	473.8624
Track 5 - On Tangent - 3 Car Spot - Union Station	34.05533	-118.235	473.8624
Track 1 - East End Platform - Glendale	34.12294	-118.259	468.2518
Track 1- On Curve - 3 Car Spot - Glendale	34.12466	-118.26	468.1143
Track 1 - West End Platform - Glendale	34.12528	-118.261	468.0561
Track 1- On Curve - East End Platform - Burbank	34.17846	-118.312	463.1978
Track 1- On Curve - 3 Car Spot - Burbank	34.17902	-118.313	463.1372
Track 1 - On Curve - West End Platform - Burbank	34.17952	-118.313	463.0863
Track 1 - On Tangent - East End Platform - B. Hope Airport	34.19247	-118.351	460.6717
Track 1 - On Tangent - 3 Car Spot - B. Hope Airport	34.19267	-118.352	460.6126
Track 1- On Tangent - West End Platform - B. Hope Airport	34.193	-118.354	460.5179
Track 2- On Tangent - East End Platform - Van Nuys	34.2111	-118.446	455.1179
Track 2- On Tangent - 3 Car Spot - Van Nuys	34.2113	-118.447	455.0567
Track 2-On_Tangent-West End Platform-Van Nuys	34.21161	-118.448	454.9676
Engineer's stopped position 3 car train at Northridge	34.2307	-118.545	449.2788
Engineer's stopped position 3 car train at Chatsworth	34.2532	-118.6	445.4531

Table 1 Station stopping positions

The FRA TDMS track data did not go into LA Union station, a shunt of the main line, but followed the main line. Accordingly, to calculate the distance, the "Union equivalent" spot was determined as the point on the main line (with TDMS data) the same distance from the station shunt line junction as the station platform. This Union station equivalent point was at 34.05418648 N, 118.2284135 W at track mile 473.75.

[2] For details see the track chairman's factual report.

Position Integration

The time history of the position of Metrolink 111 was determined by integrating the cab speed. To avoid the accumulation of error over time, a factor was applied to the speed to enforce the constraint that the train stops in the stations. The required factors are presented in table 2. The speed time history is presented in figure 3.

Segment	Factor
Chatsworth to collision point	1.0
Northridge to Chatsworth	0.971
Van Nuys to Northridge	0.975
Bob Hope Airport to Van Nuys	0.985
Downtown Burbank to Bob Hope Airport	0.948
Glendale to Downtown Burbank	0.982
LA Union to Glendale	0.972

Table 2 Speed factors

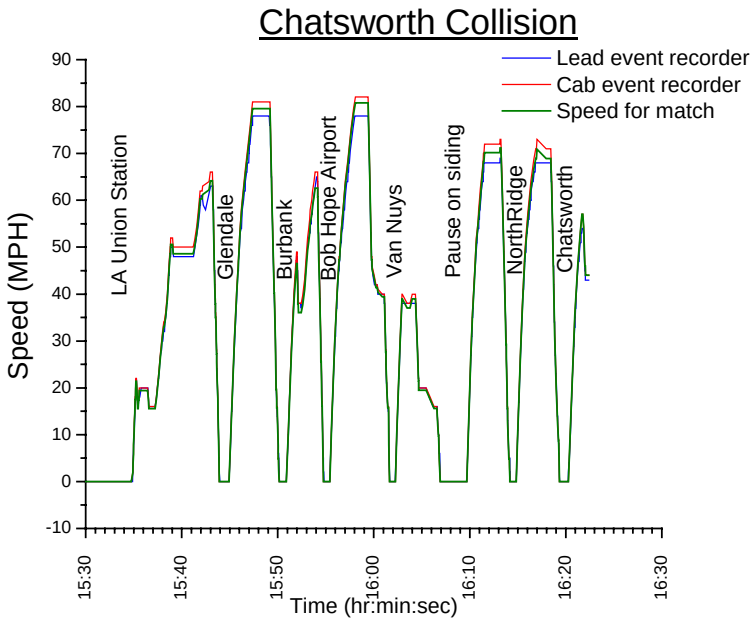

Figure 3 Speed

The position of the Metrolink 111 train along the track (in true miles based on the 444.383 Milepost of the Topanga switch) is plotted as a function of time in figure 4 for the entire trip from LA Union station. Position is plotted on a smaller scale to show the

details between the stations in figures 5 to 11. These data shows that Metrolink 111 stopped (presumably on the siding) between the Van Nuys and Northridge stations. These plots also show the times, length and type of the text messages to and from the Metrolink 111 engineer's phone. Details of these text messages can be found in the Cellular/Wireless Device Records Factual Report.

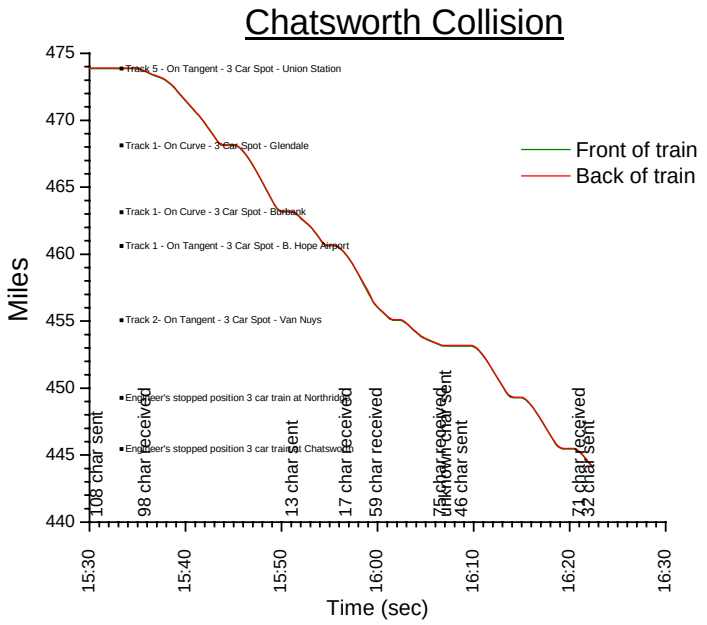

Figure 4 Metrolink 111 position as a function of time

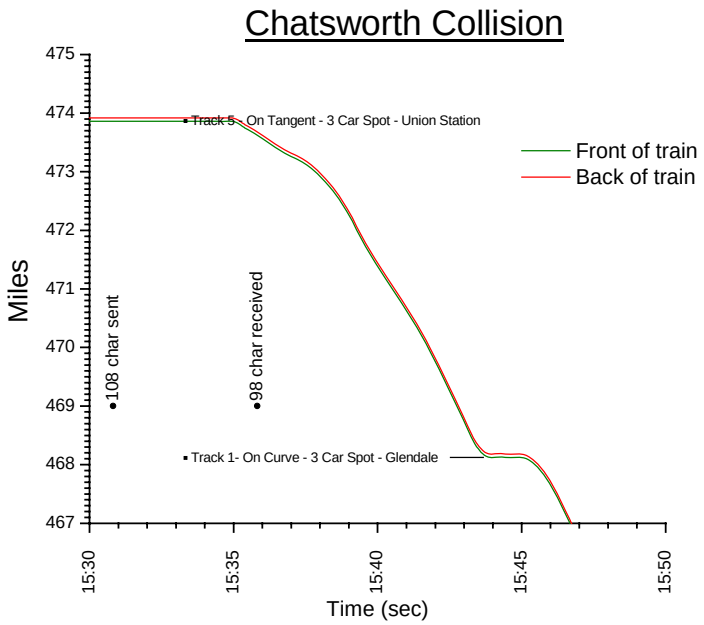

Figure 5 Position Union station to Glendale

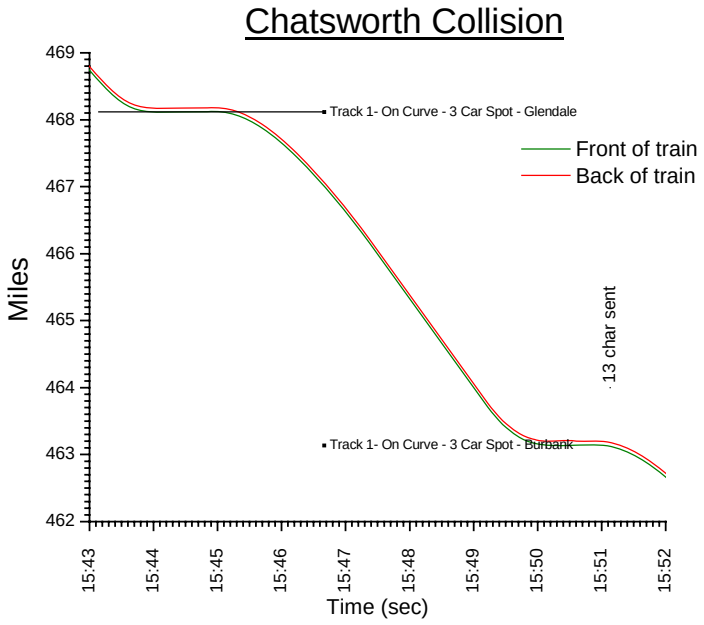

Figure 6 Position, Glendale to Burbank

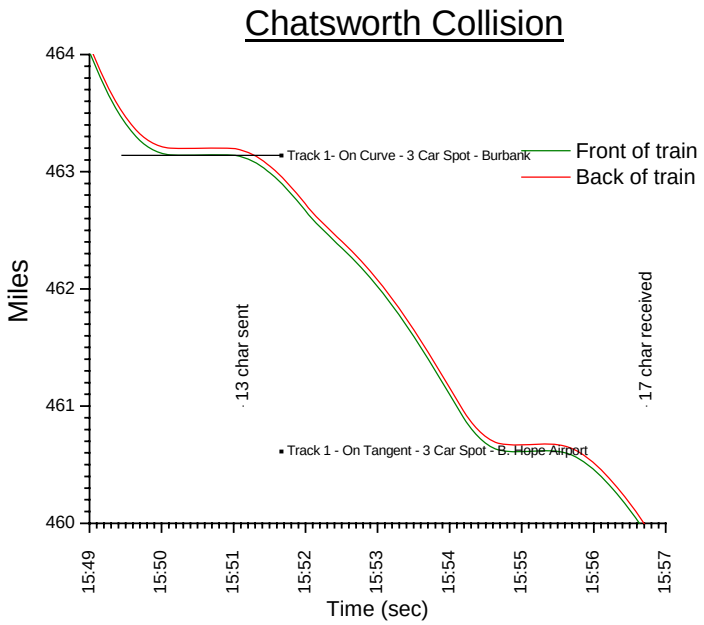

Figure 7 Burbank to Bob Hope Airport

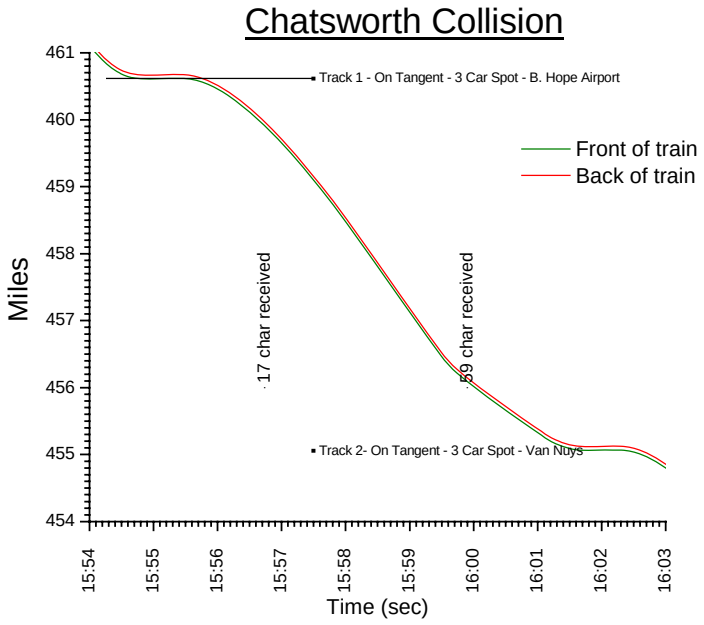

Figure 8 Position, Bob Hope Airport to Van Nuys

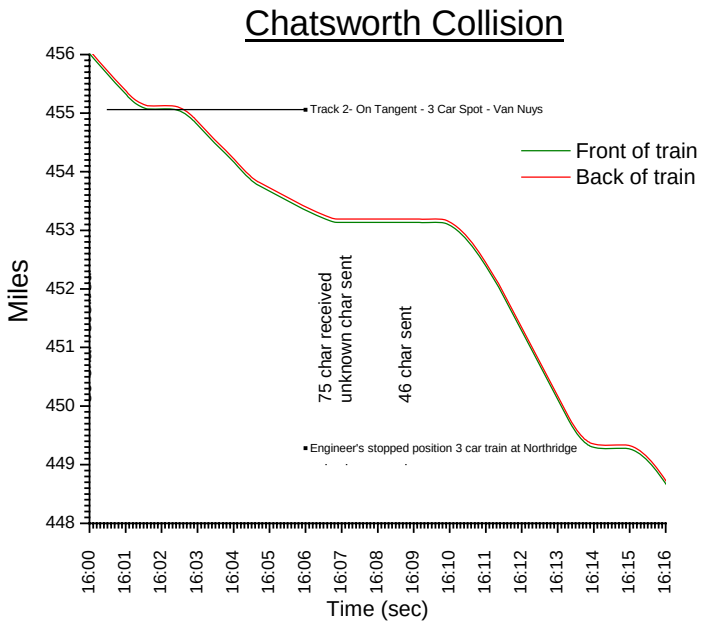

Figure 9 Position, Van Nuys to Northridge

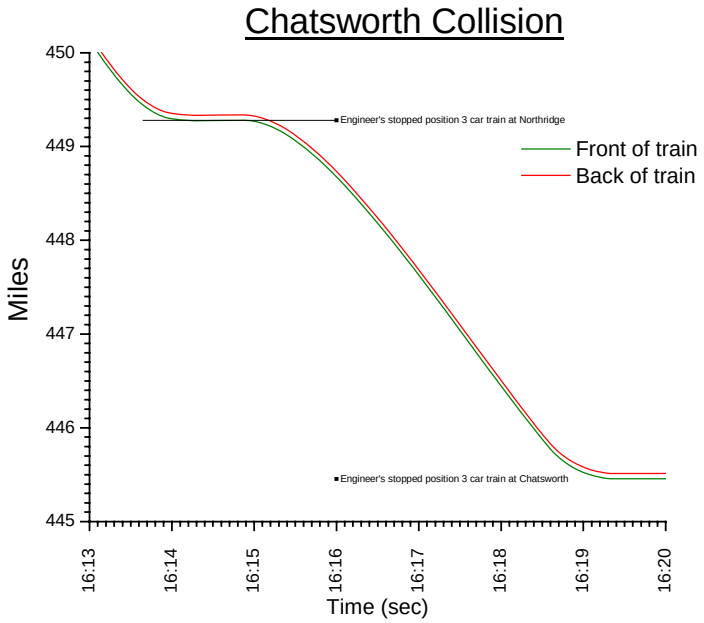

Figure 10 Position, Northridge to Chatsworth

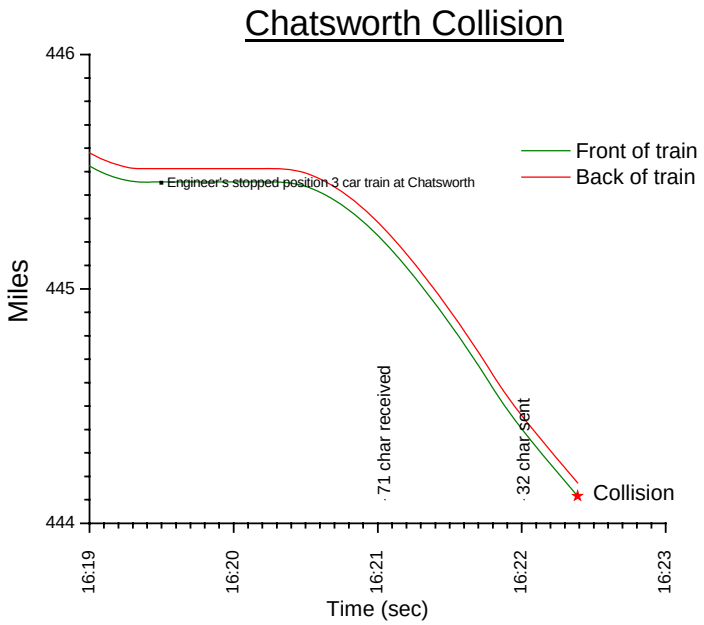

Figure 11 Position, Chatsworth to collision point

The position of the Union Pacific was similarly determined by integrating the lead locomotives recorded speed. Unlike the Metrolink, both Union Pacific locomotives recorded latitude & longitude. These latitudes and longitudes were then converted to true track miles along the track using Rail_Track program. The integrated distance along the track is compared to track miles calculated from recorded position in figure 12. No speed adjustment was required to obtain this match. Note that though not apparent on this scale, the integration is much smoother.

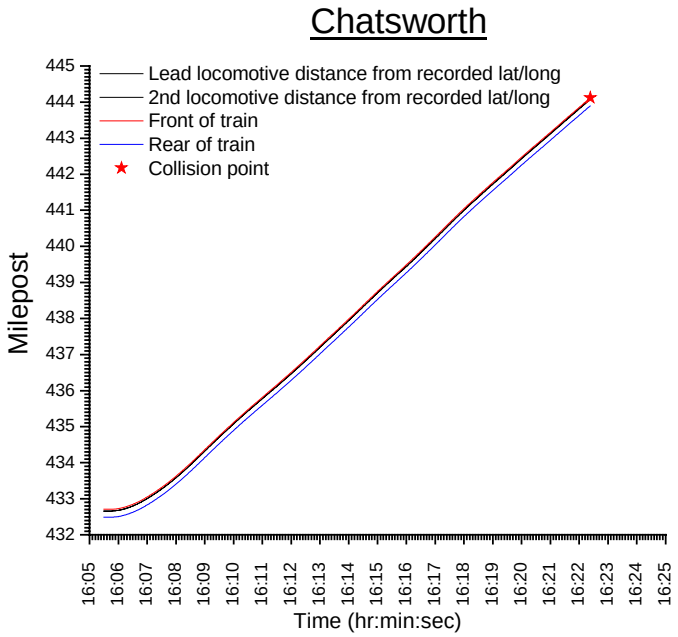

Figure 12 Union Pacific position

Signal Passage Positions

The times that the trains passed various signal locations on the track was readily obtained from the integrations and summarized in table 3 for Metrolink 111. Note that some events involve the lead wheels and some events involve the rear most wheel set on the train.

Place	EVENT	Time
Signals 4483 & 4484	ML111 occupies westbound approach circuit	16:16:23
CP BERNSON Westbound Signal (east end)	ML111 passes westbound signal and occupies the CP Bernson (OS) track circuit.	16:17:45
CP BERNSON Eastbound Signal (west end)	ML111 is off the CP Bernson (OS) track circuit.	16:17:53
Signals 4451 & 4452	ML111 passes Intermediate Signal 4451 and occupies the main track between CP Topanga and Intermediate Signal 4451.	16:18:41
CP TOPANGA Westbound signal (east end)	ML111 occupies the CP Topanga (OS) track circuit between westbound and eastbound signals	16:21:56
CP TOPANGA Point of Switch	CP Topanga switch is out of correspondence (ML111 runs through switch)	16:22:02
CP TOPANGA Westbound signal (east end)	ML111 is off the CP Topanga westbound approach circuit.	16:22:00
CP TOPANGA Eastbound Signal (west end)	ML111 is off the CP Topanga (OS) track circuit between westbound and eastbound signals.	16:22:14

Table 3 Metolink 111 signal location passage times

The times that the trains passed various signal locations on the track is summarized in table 4 for Union Pacific freight train No. LOF6512.

Place	EVENT	Time
CP DAVIS Eastbound Signal (west end)	LOF 6512 passes eastbound signal	16:17:47
CP DAVIS Westbound Signal (east end)	LOF 6512 pass the west bound signal at CP Davis	16:17:55
Signals 4426 & 4427	LOF 6512 pass the 4426 intermediate signal	16:20:25

Table 4 Union Pacific LOF6512 signal location passage times

Wireless Event Positions

The position and times of the text messages as well as selected signal positions and states are shown in figure 13 for the entire trip from LA Union station to the collision point and in closer view for the track leading up to the collision in figure 14.

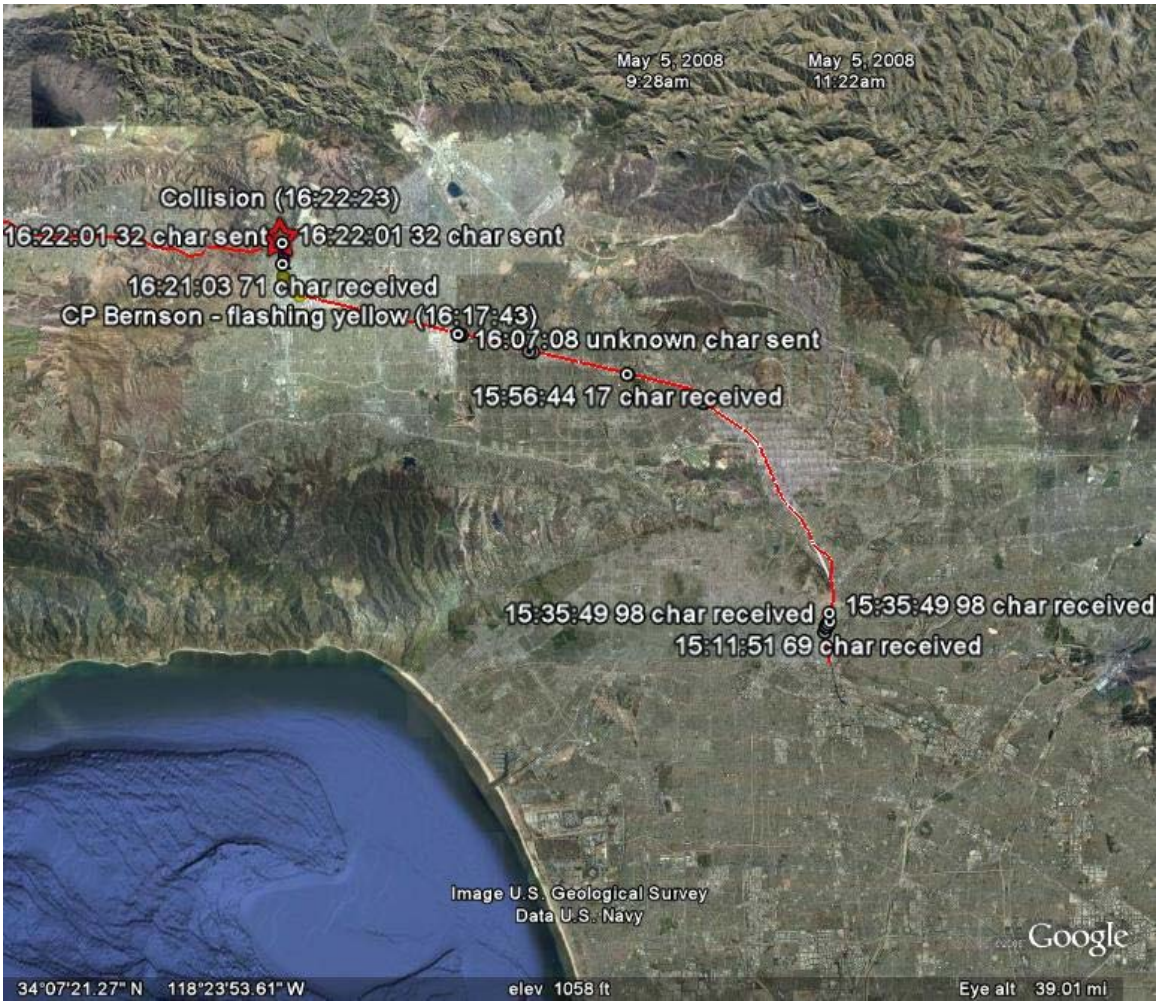

Figure 13 Metrolink 111 text message and signal positions

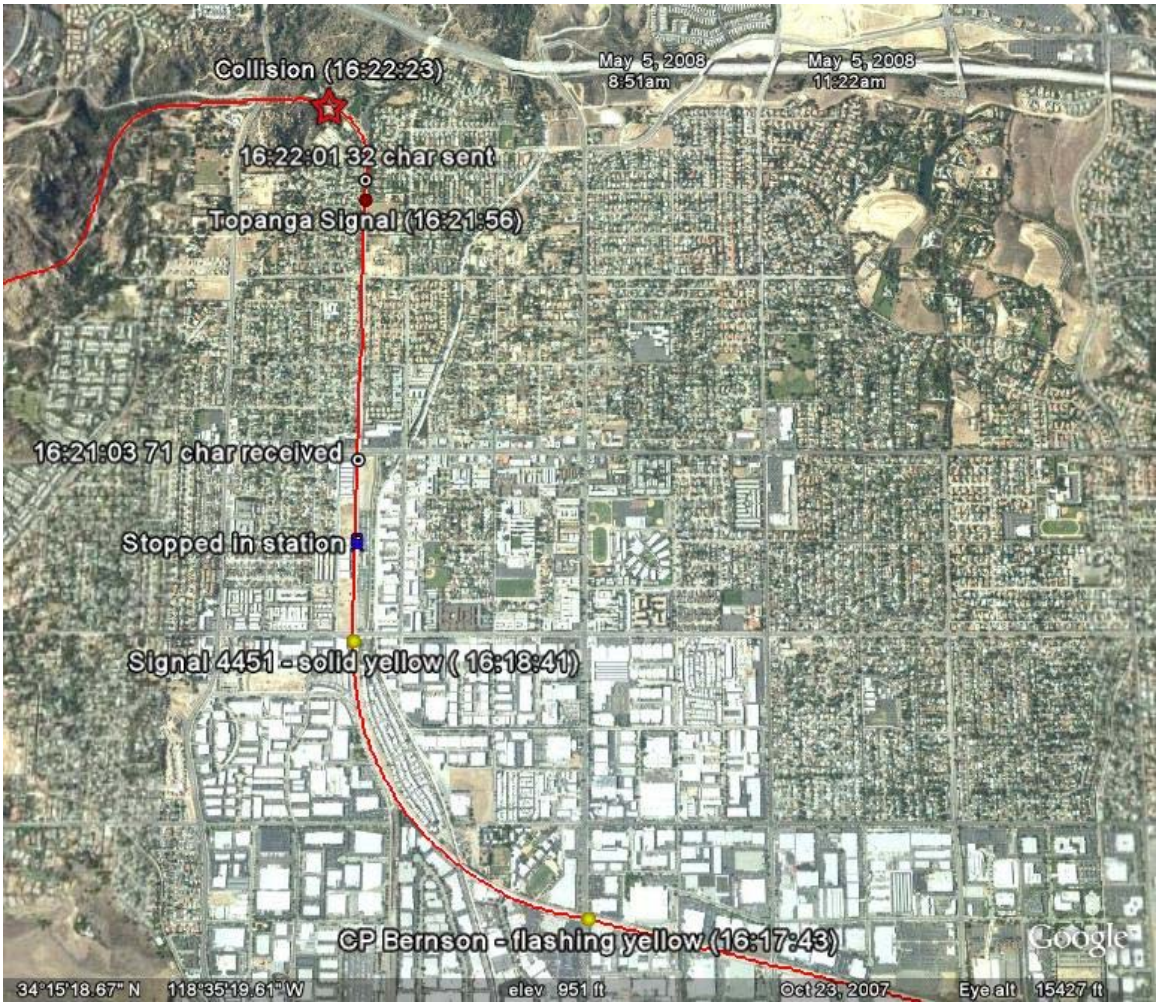

Figure 14 Metrolink 111 text message and signal positions (collision close-up)