GENERATE AS-BUILT PLANS USING
FHWA-TFHRC DIGITAL HIGHWAY MEASUREMENT SYSTEM

Vehicle and Phase I Sensors

The Digital Highway Measurement (DHM) System uses multiple sensors to accurately measure the horizontal and vertical alignments of roads and highways. Profiles of the roadside and the characteristics of pavement surface are also created, all while traveling at normal traffic speeds and at levels of accuracies that are not available commercially.

The large data sets from each of the sensors are fused to define an accurate geometry of the road and the roadside. The vehicle wander in the lane is then removed from the data to produce an accurate centerline trace. From this centerline an accurate project coordinate system is defined.
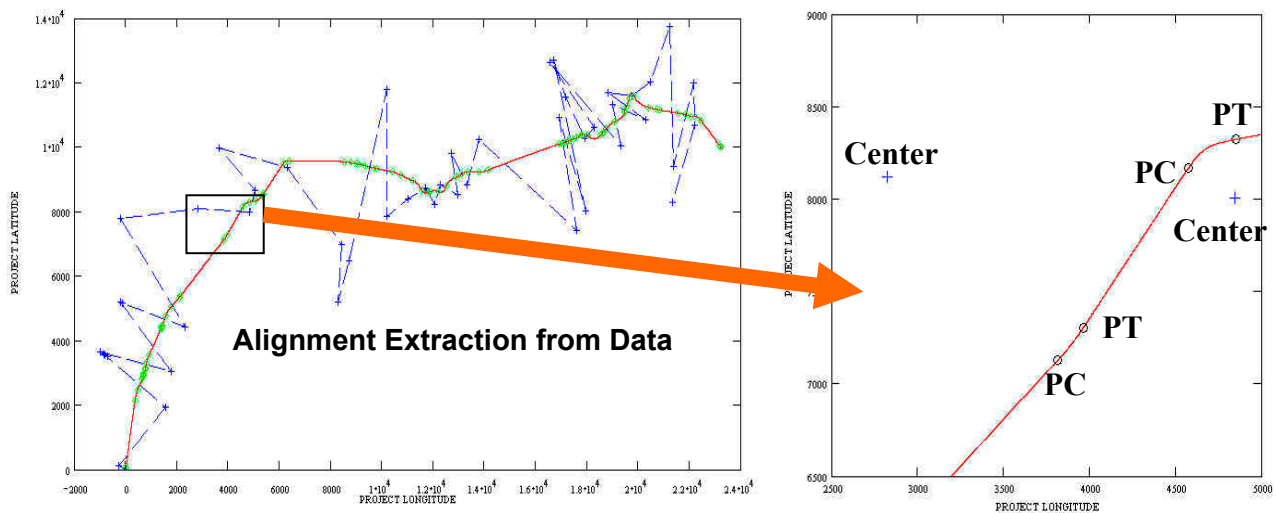
Figure 1. Multiple sensors collect data.

Figure 2. Measured alignment—plan view and detail.

The post-processing software extracts key points of the horizontal alignment from the measured centerline. Horizontal curves are defined by identifying the point of curvature and tangency as illustrated on the plan view of the centerline in figure 2. The centers of curvature, radii, and degrees of curvature are computed. This capability is a powerful tool when no accurate as-built plans exist for a roadway site.
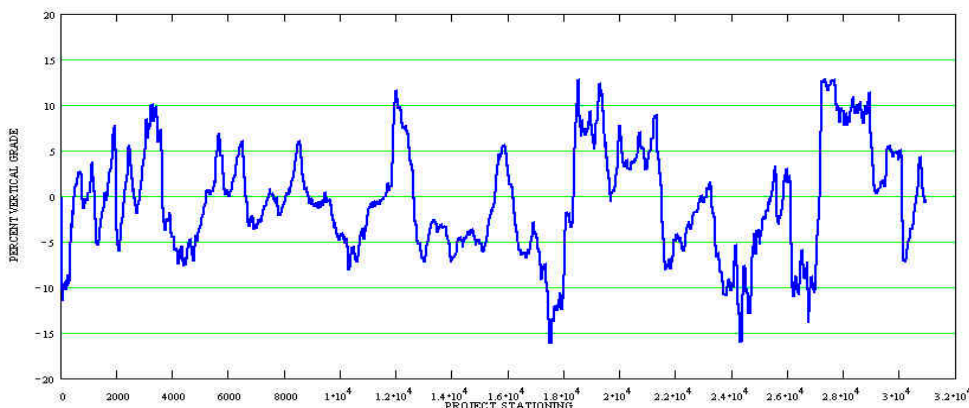

When possible, a similar post-process is performed on the vertical profile to identify points of vertical curvature and tangency. Otherwise, the average percent grade is computed every 7.6 meters (25 feet) and presented as shown in figure 3 in addition to the elevation plot. The accuracy of the results is exceptional for both the horizontal and vertical alignments.
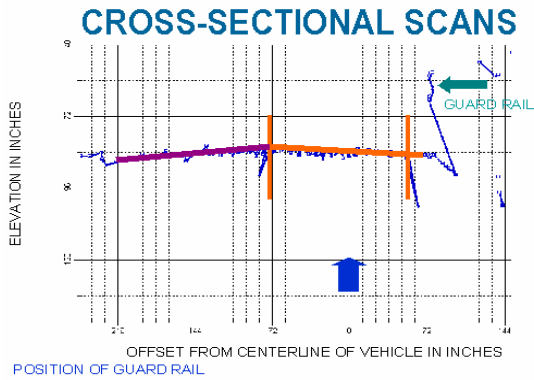
Figure 3. Percent grade versus project stationing.
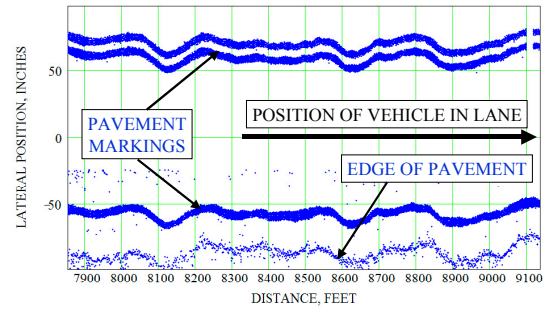
Figure 4. Typical transverse scan.

Figure 5. Map of pavement markings.

Vehicle wander is determined using a map of the pavement markings generated from data produced by the DHM vehicle's scanning laser. A typical transverse scan is shown in figure 4. From the same data, the edge of pavement, though less accurate, is estimated. Figure 5 shows a mosaic of the location of pavement markings with respect to the vehicle for a series of scans. The observed nonlinearity of the pavement markings in figure 5 is the effect of the vehicle wander in the lane. Combining data collected in the different lanes, a cross-section of the road is constructed from the vehicle trajectory to the reference centerline, edges of pavement, and edge of pavement markings (figure 6). The roadside profiles from the scanning laser can be added to the pavement cross-section. Rutting and roadside safety hardware position measurements are extracted from the scans. The profile of a guardrail is present in the example scan, figure 4.
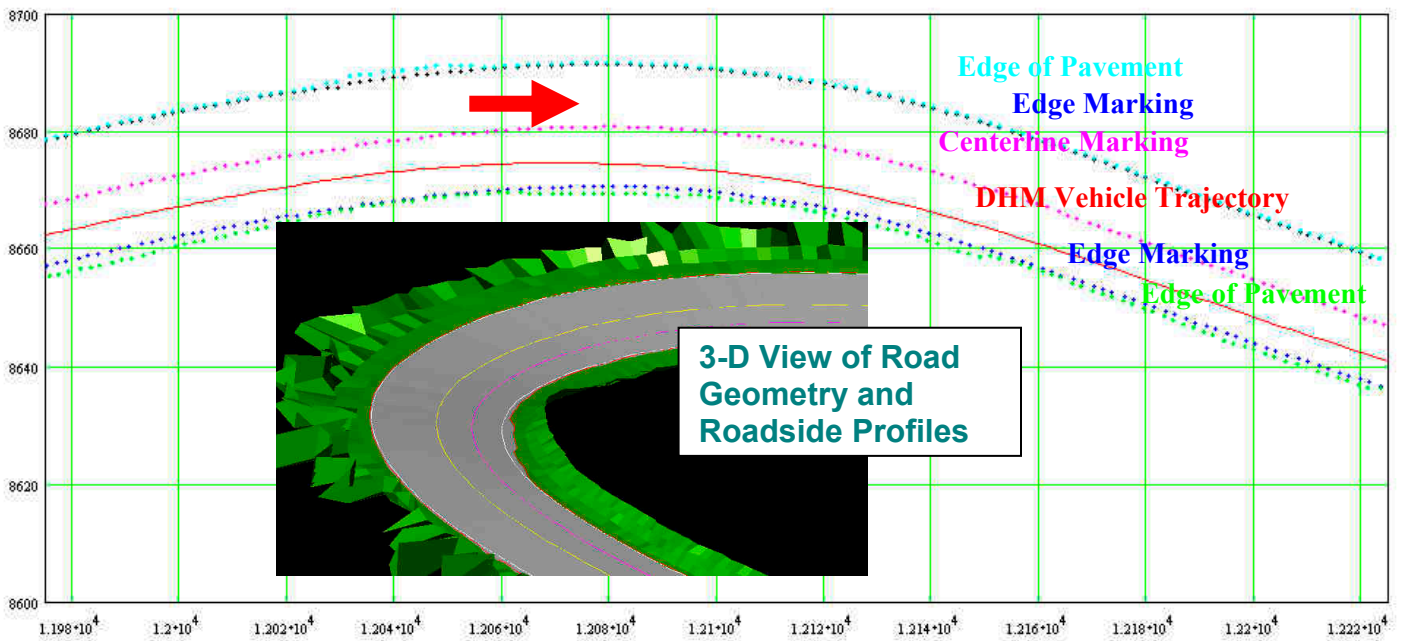

Figure 6. Plan view of two-lane rural road geometry and vehicle trajectory.

Given accurate vehicle position and road geometry, a high level of accuracy is achieved for the linear referencing of any measured pavement condition parameters. Subsequent project phases will explore the roadside hardware inventory and sub-surface condition using ground-penetrating radar. For technical details, please contact M.K. Mills at 202–493–3338, Pete.Mills@fhwa.dot.gov or M. Oskard at 202–493–3339, Mort.Oskard@fhwa.dot.gov.