

## **Introduction**

The Route 114, also known as “Peppers Ferry Road”, is a 13-mile long, two-lane rural road, which is located in Montgomery County, Virginia. The main function of Rt. 114 is being a connector rural road between the Town of Christiansburg and the City of Radford. Both towns are situated in the southwestern region of the Virginia State. Combined population this area, including residential settlements between two towns, is approximately 60,000.

As a short-cut alternative to Interstate-81 between two towns, Rt. 114 handles a considerably high load of traffic. Average daily volume on this rural road is around 12,600 vehicles. Short section of the road in the vicinity of the City of Radford was rebuilt as 4-lane highway (approximately 2.5 miles long). In recent years, Rt. 114 has developed an infamous reputation as “The Death Road”. In past three years, 6 serious traffic accidents resulted in 10 deaths. Four of these accidents have occurred within half-a-mile long stretch of Rt. 114, which is closely located to the border of Christiansburg. Six people lost their lives in four accidents, which all of them were head-on collisions at high speeds. The geometry of this part of the Rt.114 consists of three consecutive vertical curves. One vertical curve, which is located in the middle of other two, is the scene of these accidents. Although “No-Passing” signs and road surface markings are at present, in each of four accidents, one of the drivers attempted to make an overtake maneuver on this vertical curve, without having clear sight of the opposing traffic. By the time the two vehicles were visible to each other, there was no chance to stop a fatal head-on collision.

The purpose of this research project is to develop and later to implement a functional, real-time collision warning and avoidance system for the dangerous vertical curves, by using intelligent / automated transportation concept and tools. Since there is no previous research or application available for this type of collision warning and avoidance systems, this research's results should be carefully tested prior to any field deployment.

# Chapter-1

## 1.1 Background

Rt. 114 is a two-lane rural connector road between the Town of Christiansburg and the City of Radford. Total length of the road is approximately 13-mile. The vertical curve which is the subject of this research project, is located at 0.6 mile west of the Christiansburg town limit and, in the near vicinity of the County Road 1286. In this section of the two-lane road, the pavement is approximately 30 ft. wide (uniform), and the shoulder width is around 4 ft. on each side (not uniform). Pavement surface conditions are satisfactory, and yellow no-passing zone markings on the pavement are clearly visible.

The total length of this vertical curve is 700 ft. Apex (crest top) is located 150-ft. off-center, to the east (Christiansburg). East side of the crest top is 2.0% slope, which extends about 900 ft. to the following sag vertical curve. West side of the crest to is 4.6% slope, extending westward, approximately 350. ft. Average daily volume in this section of the Rt.114 is 13,000 vehicles ( VDOT Records-1996). The entire Rt.114, and especially the section located near Christiansburg town limits, is accessible from a number of side road and driveways.

In recent years, traffic volumes in this region of Virginia, and on Rt.114 have risen dramatically. This was mainly boosted by the commercial and population growth in this

area. A number of factors make the Rt. 114 dangerous. Drivers who use this road are often impatient, and reckless. The volume on the Rt. 114 sometimes exceeds the capacity of a two-lane rural road. In some cases, residents who are living on Rt. 114 wait up to five minutes on their driveway, in order to merge to the ongoing traffic.

There are projects and proposal advocated by the area residents and the Virginia Department of Transportation local office, which is designed to provide a solution to the problems of Route 114.

## **1.2 Problem Statement**

The Route 114, in particular the crest vertical curve located around the mile points 96-116 (see Figure-I.1) on the same road, is posing an extreme danger to the drivers and the residents of the area. Due to the road geometry and conditions, and as well as the traffic violations committed by the drivers, there have been many traffic accidents (some of them with fatalities), and many near misses occurred in this section of the rural road.

One of the problem elements is the geometry of the vertical curve located between mile points 103-112. Although the area is marked as no-passing zone with solid stripes, and no-passing signs are on both sides of the road, drivers' passing violations are observed constantly. Main reason of the passing violations may lie with the fact that this particular curve is surrounded by two other curves at each direction (stretches on east-west axis). When the variety of cars with different horsepower are cruising on this road, the slopes,

especially one with the 4.6% inclination, can reduce the climbing speed and the performance of smaller cars and loaded trucks, and thus degrades the following vehicle's climbing performance. In most cases, the following vehicle's driver would not like to compromise his or her climbing speed, and will ignore the traffic signs and markings, and will try to complete an overtake maneuver at or near the crest top. Although the exact reason and motivation will never be found, above scenario is most likely the starting of the events resulted in fatal crashes in recent accidents.

The other element of the problem can be classified as the potential violation behavior of the drivers. In this part of the Virginia State, especially on the rural roads, cruising speeds maintained by the drivers are considerably high. Given the fact that in some areas posted speed limits may exceed the speed associated with the geometry of the road, high cruising speed habit becomes more and more important in occurrence of the accidents. Besides this, traffic markings and signs may not be attracting sufficient attention of the drivers, especially during the evening and night hours, when the drivers' alertness and proper reaction abilities are lower, due to the accumulated daily fatigue, and anxiousness.