ROAD CONDITION REPORT

THE MICHAEL OSBORN AND MARTIN TUTTLE CRASH

By:

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Robson Forensic

Engineers, Architects, Scientists & Fire Investigators

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1. INTRODUCTION

This single-vehicle-run-off-the-road crash occurred 29 January 2003 at about 1:00 *p.m.* in Watchung Boro, Somerset County, New Jersey. The crash involved a 2002 Dodge 3500 passenger van driven by Conover Simms, with passengers Michael Osborn, Martin P. Tuttle, Eric G. Benson and Paul Clohosey.

Clohosey died and Simms, Osborne, Benson and Tuttle were injured as a result of the crash.

This investigation was performed to determine if dangerous roadway conditions were a cause of the crash.

2. AVAILABLE INFORMATION

1. New Jersey Police Accident Report by the New Jersey State Police.

2. Photos:

    a. Twenty-two crash scene photos, color, digital
    b. Twenty digital color photos of the approach and crash site, taken 11 Oct 2007 by Leiss.
    c. Two videos of the approach and crash site, taken 11 Oct 2007 by Leiss.

3. Deposition transcripts:

a.	Robert Bell, Jr.	September 6, 2006.
b.	Eric Benson	September 25, 2006.
c.	Jeffrey J. Callahan	July 28, 2008
d.	Richard W. Dunne, P.E.	January 28 and April 8, 2008.
e.	Alfred J. Brenner, III, P.E.	April 8, 2008.
f.	Robert Kraemer	July 28, 2008
g.	Timothy Meola	November 1, 2006.
h.	Stephen Motyczka	October 16, 2006.
i.	Helder Peixoto	September 6, 2006.
j.	Timothy Ponzio	June 20, 2006.
k.	Robert Scalera	September 6, 2006.
l.	Conover Simms	March 1, 2006.
m.	Ofc. Brad Sporer	May 24, 2006.
n.	Martin Tuttle	April 24, 2007.

4. Documents by the New Jersey Department of Transportation (NJDOT).

a. Drawings for the 1983-85 construction.
b. Drawings for a 1985-87 resurfacing.
c. Drawings for the 1999-2000 resurfacing.
d. Response to First Notice to Produce.
e. Response to Second Notice to Produce.
f. Response to From C and C(1) Interrogatories & Supplemental Interrogatories.
g. Bates Number documents from NJDOT 001 – 064, 67, 69-73
h. Letter of August 24, 2007, with attached accident reports from 1993 – 2003.
i. Accident reports 2000-2003.
j. Letter of January 17, 2008, with attachments.

5. Report by Williams, Leiss and Lacek, of Robson Forensic, April 14, 2008.

6. My December 6, 2007, inspection, measurements and photographs at the crash site.

3. DESCRIPTION OF THE CRASH and SITE CONDITIONS

Police Report:

Accident Scene:
This accident occurred on I-78 WB (Exit 41) Mile Post 42.4 in Watchung Boro, Somerset County. The conditions at or near the time of the accident were snowy, approximately 31 degrees Fahrenheit. The surface of the roadway was wet. The roadway, painted lines, and traffic signs were in good condition. The posted speed limit is 65 M.P.H. The lanes at the scene were curved with a downhill grade.

At this location the interstate consists of a left and right shoulder, three travel lanes, and a deceleration lane. The left shoulder measures 3 feet and is bordered by a grass berm. The left, center and right lane as well as the right shoulder and deceleration lane all measure 12 feet. The right shoulder is also bordered by a grass berm.

Vehicle Description:
This accident involved Vehicle #1: A 2002 White Dodge Ram 3500 bearing NJ Reg (NNE86N) VIN# 2B5WB35Z42K115658

Accident Description:
Vehicle #1 was traveling WB on I-78 exiting the interstate at Exit 41 (MP 42.2). Once on the ramp driver #1 was traveling at an excessive rate of speed for the conditions and lost control. Vehicle #1 traveled off the WB side of the ramp entering the grass berm. Once in the berm vehicle #1 remained out of control traveling approximately 35 feet before striking a large tree and coming to a final rest.
Driver #1 stated: "I was going too fast when I got off the ramp. I lost control and hit the tree."

Simms testified:

- He was a part time driver for LTI Transport (CS 9).
- He had driven this van before (CS 16).
- The weather conditions worsened. Coming out of East Rutherford the roads were wet. The weather changed from rainy bordering on freezing rain to some snow. (CS 47).
- As he was exiting Route 78, the weather caused the steering not to respond. He went off the road into a bank of trees (CS 51, 52).
- He had made this trip before and was familiar with where he was going. (CS 83).

Sporer is a police officer who witnessed elements of the crash from a position just beyond the end of the ramp. Sporer testified:

- There was a light, wet snow (BS 12).
- The road had wet slush on the surface (BS 12).
- The speed of the van was 30 – 35 mph as it left the ramp (BS 14).
- The van went straight off the ramp (BS 18).

Consistent with Sporer's speed observation, Williams, et al, concluded that Simms struck the tree at about 33 mph. At my site inspection I located the stump of the struck tree at 36 feet from the edge line of the ramp.

I conclude that the conditions of this crash were as follows: it was snowing, the pavement was wet, Simms went off the outside of the ramp curve at a speed of about 35 mph, and the vehicle struck a tree about 35 feet from the ramp.

4. DESCRIPTION OF THE CRASH SITE

The crash occurred at the Exit 41 ramp from I-78 westbound.

At the crash site, I-78 is a multi-lane, limited access, rural freeway, with opposing lanes separated by a median, oriented generally east-west and under the jurisdiction of the New Jersey Department of Transportation (NJDOT). Terrain is generally rolling and adjacent land use is rural. The speed limit was 65 miles per hour (mph).

Approaching the crash site from the east (Simms' direction of travel), I-78 curves gradually to the left. The Exit leaves from the left curve, starts with a taper, followed by a deceleration lane and the exit ramp. The ramp curves sharply to the right, descends grade and terminates at a Stop sign controlled intersection with Drift Road.

The asphalt ramp is marked with solid yellow left and solid white right edge lines. The roadway is superelevated down to the inside of the right hand curve. There is a curb along the inside edge of pavement. The outside edge of the ramp pavement has a narrow asphalt shoulder followed by a grassy field and large trees beyond the field. Measured normal (perpendicular, along a radius) to the curve, the struck tree was 36 feet from the edge line.

In addition to EXIT guide signs and pavement markings, a ramp advisory speed sign and two post type delineators were present as shown below:

The images of the ramp advisory speed sign and delineator are taken from the crash scene photos, from the view of an approaching driver.

5. DANGEROUS ROADWAY CONDITIONS THAT WERE A CAUSE OF THE CRASH

Simms traveled from I-78 onto the Exit 41 exit ramp. He traveled along the deceleration lane, encountered the ramp curve, and went off the outside of the curve.

The right-hand curve was too sharp for Simms' speed and the road conditions and his van went off the ramp and struck a tree.

As demonstrated in the Leiss photos and video, the pavement of the ramp through the curve cannot be seen until the driver is very close to the curve and the nature of the curve is not apparent until the driver is in the curve. As can be seen in the crash scene photos, no traffic control devices were present to warn the driver of the sharp nature of the ramp curve.

The exit ramp curve is sharper than usual for a freeway exit. The sharp curve is a violation of an exiting driver's expectancy and, in the absence of appropriate traffic control devices, made the roadway dangerous in a manner that caused this crash.

6. THE RAMP CURVE IS UNUSUALLY SHARP

As shown on NJDOT 48, starting from the end of the deceleration lane, the ramp has curves as follows:

500 feet radius, 110 feet long;
250 feet radius, 90 feet long, 4% superelevation plan;
100 feet radius, 123 feet long, 6% superelevation measured.

These radii are to the right edge line. The Simms vehicle left the ramp in the area of the 250 foot radius curve.

According to NJDOT's 1988 *Design Manual, Roadway*, sheet 7-12, issued in 1987, the minimum exit ramp radii for a freeway should be:

750 feet, 170 feet long;
500 feet, 110 feet long;
250 feet, 90 feet long;
170 feet, 68 feet long;
150 foot minimum.

The ramp curves are thus sharper than the sharpest shown in the NJDOT *Design Manual* in effect at construction.

The same conclusion is reached with regard to national criteria. AASHTO is the American Association of State Highway and Transportation Officials. AASHTO "…formulates and recommends highway engineering policies" through a number of "guide" publications (1984 edition, page iv). AASHTO's 1984 *A Policy on Geometric Design of Highways and Streets* states,

> …ramp design speeds should approximate the low-volume running speed on the intersecting highways. This design speed is not always practicable and lower design speeds may be necessary, but they should not be less than the low range in Table X-1. (page 1011)

Table X-1 (page 1012) shows for a highway design speed of 70 mph (the design speed for I-78 on the 1985 construction drawings and the appropriate design speed for the 65 mph speed limit) that the lowest ramp design speed is 35 mph. For a 35 mph design speed, and a maximum superelevation of .04, the minimum radius curve is 420 feet (page 177). Similarly, it can be seen that the design speed for the 250 foot radius curve is 25 mph, significantly lower than the minimum that is appropriate to the I-78 Exit ramp, and that the design speed for the 100 foot radius curve is about 20 mph. The safe speed for the ramp is 20 mph, consistent with the Ramp advisory speed sign.

The ramp has too sharp a curve according to both NJDOT and national criteria.

7. THE SHARP RAMP CURVE IS A VIOLATION OF DRIVER EXPECTANCY

The deceleration lane for Exit 41 slopes up slightly to a high point at the start of the ramp. The ramp then slopes down. Although the crest vertical curve is gradual, the pavement of the ramp curve and the pavement markings cannot be seen until the driver is about to enter the curve. Similarly, the horizontal ramp curve itself is so sharp that one cannot see its nature until into the curve. This is demonstrated in the Leiss videos.

The safety problem of not being able to see the nature of a curve ahead has been recognized since at least 1967. AASHO's 1967 *Highway Design and Operational Practices Related to Highway Safety*[7], in discussing interchange exit ramps, states:

> Ramps that drop out of sight are a potential hazard and should be avoided wherever possible [p. 29]

A similar statement is found in AASHTO's 1974 Highway Design and Operational Practices Related to Highway Safety[8].

As stated in a 1992 TRB paper[2], the designer should:

> Avoid designs in which the presence of a critical curve on a ramp is not obvious [p. 15]

Another 1992 TRB paper[4] states:

> Consistent alignment avoids introducing sharp curvature at or near the top of a crest vertical curve where the beginning of the curve cannot be perceived by the driver. [p. 14]

NJDOT's 1988 *Design Manual* states:

> BASIC GEOMETRIC DESIGN ELEMENTS
>
> 4-01 GENERAL
>
> Geometric design pertains to the visible features of the highway. …
>
> In applying these criteria and guidelines, it is important to follow the basic principle that consistency in design standards is of major importance on any section of road. The highway should offer no surprises to the driver in terms of geometrics. Problem locations are generally at the point where minimum design standards are introduced on a section of highway where otherwise higher standards should have been applied. The ideal highway design is one with uniformly high standards applied consistently along a section of highway, particularly on major highways designed to serve large volumes of traffic at high operating speeds. (Page 4-1, dated 3/14/85)

Driver expectancy is fundamental to driver behavior. The expectancy concept is not new, having been identified by psychologists in the early 1930's. In the early 1960's, the expectancy concept found its way into highway applications.

As stated in the USDOT's 1986 Driver Expectancy in Highway Design and Traffic Operations[10]:

> Drivers have difficulty preparing for unexpected features that they cannot see. They must have sufficient time to see and respond. Thus, any unseen feature, be it a standard intersection beyond a crest vertical or a lane drop beyond a horizontal curve is unexpected. [p. 34]

The exit ramp curvature is substandard, and the curve cannot be recognized by approaching drivers. This should have caused NJDOT to recognize the sharp ramp curve as a problem location, one that offers a surprise to the driver.

8. TRAFFIC CONTROL DEVICES

So called “driver error” is often identified as a leading contributor to crashes, when in fact the driver’s actions are a result of a deficiency in the roadway.

Many driver errors are a result of failures of the roadway system or of the traffic control devices in place. The U.S. Department of Transportation's 1986 “Driver Expectancy in Highway Design and Traffic Operations” identifies a number of causes of driver error that are correctable through proper application of highway and/or traffic engineering principles. These include

> expectancy violations.

And,

> These deficiencies cause drivers to miss or be unable to process traffic control information.

Driver Expectancy - Drivers using a roadway system come to expect certain things. For example, a driver expects to have the red light on top and the green light on the bottom at a signalized intersection. In the absence of any reason to stop or slow down, a driver expects traffic in front of him or her to continue traveling at a generally constant speed. Similarly, a driver expects the traffic signals visible to him to be for his direction of travel. This concept is called "driver expectancy" and is fundamental to driver behavior. The Driver Expectancy publication has the following to say about the subject:

> The nature of the driving task and the driver's information handling characteristics point to the importance of expectancies. For example, a driver's reaction time to an unexpected situation or source of information is longer than when the situation or information is expected. Conversely, drivers are less likely to become confused or commit errors when their expectancies are reinforced. Since the key to safe and efficient driving task performance is rapid, error-free information handling, what a driver expects and does not expect has a major impact on task performance, particularly under time pressures and/or high information loading.
>
> Because the expectancy concept is such an important consideration in driver task performance and information processing, it is one that engineers, designers, and operations personnel should understand and use. Expectancies affect all levels of the driving task, and should be accounted for in highway design, traffic operations, and traffic control applications.

A 1992 TRB paper[3] states:

> Driver performance is enhanced when forward sight distance provides a clear, unobstructed view of the interchange, its traffic, and its traffic control devices. Problems often occur when drivers are surprised by unexpected and/or unseen features. If there are any aspects of the interchange that could surprise drivers, advanced warning should be provided. (p. 9)

The Institute of Transportation Engineers (ITE) Transportation and Traffic Engineering Handbook, Second Edition[11] states:

> Traffic control devices...are the primary means of regulating, warning, or guiding traffic on all streets and highways. The need for well-designed, adequately maintained devices grows in proportion to the density of traffic, speed of operation, and complexity of maneuvering areas of highways and at intersections. (p. 707)

As stated in AASHTO's 1984 *A Policy on Geometric Design of Highways and Streets*:

> Traffic control devices provide guidance and navigation information that often is not otherwise available or apparent. These devices include regulatory, warning, and Route guidance information… These devices aid in the reception of information that might otherwise be overlooked or difficult to receive. Information relative to the proper traffic control devices is available in the *Manual on Uniform Traffic Control Devices.* (p. 41)

And,

> Signing and marking are directly related to the design of the highway or street and are features of traffic control and operation that the designer must consider in the geometric layout of such a facility. The signing and marking should be designed concurrently with the geometrics. The possibility of future operational problems can be reduced significantly if signing and marking are treated as an integral part of design.
>
> Although safety and efficiency of operation depend to a considerable degree on the geometric design of the facility, the physical layout must also be supplemented by effective signing as a means of informing, warning, and controlling drivers. Signing plans coordinated with horizontal and vertical alinement, sight distance obstructions, operation speed and maneuvers, and other applicable items should be worked out before completion of design. (p. 339)

USDOT's 1988 Manual on Uniform Traffic Control Devices[6] states:

> Traffic control devices are all signs, signals, markings, and devices placed on, over, or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn, or guide traffic. (p. vii)

And,

> Warning signs are used when it is deemed necessary to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street. Warning signs require caution on the part of the vehicle operator and may call for reduction of speed or a maneuver in the interest of his own safety and that of other vehicle operators and pedestrians.
>
> Typical locations and hazards that may warrant the use of warning signs are:
>
> > Changes in horizontal alignment
> > Changes in highway design

And,

> Warning signs should provide adequate time for the driver to perceive, identify, decide, and perform any necessary maneuver….

A means of mitigating the hazard of the sharp curve is by altering a driver's expectancy through installation of appropriate traffic control devices. In this case, devices should be provided to show approaching motorists that there is a sharp curve ahead with a safe speed of 20 mph and the nature of that curve. These devices should include a curve warning sign and chevrons to mark the outside of the curve. The chevrons are necessary because of their high elevation, so that they can be seen over the slight hill crest and because of their conspicuity. As can be seen in the scene photos, the post type delineator is not conspicuous under snow conditions.

9. HISTORY OF the RAMP CURVE

1983-1985 The Exit ramp was constructed as a Change of Plan to the construction contract for I-78. Construction was completed in 1985. The construction drawings showed eight Type 1A, Single yellow delineators placed around the outside of the ramp curve, at a spacing of 25 feet. The as-built quantities are consistent with these delineators having been placed. Other signs at the Exit were: W13-2, an Advisory Exit Speed sign;

W13-2

and Exit guide signs. The speed shown on the Advisory Exit sign is not known. See Figure 1 (attached) which is an extract from NJDOT 49, for the as-built traffic control devices.

1999-2000 As part of a contract for resurfacing of I-78, four W1-8R Chevron warning signs were to be placed along the outside of the curve. See Figure 2.

W1-8

2003 January 29. The traffic control devices in place the day of the crash are shown in Figure 3. There were two post-mounted delineators on the outside of the curve. Note that neither the Ramp advisory speed sign nor the post type delineators are the same as the devices to have been installed in 1985.

2007 October 11. The traffic control devices in place this day are shown on Figure 4. The curve was marked with Chevrons, there were no post type delineators. According to Dunne (RD-17), the Chevrons were placed 2004, 2005 as a result of a study prepared by his staff, and which he approved. The study was initiated by a complaint from the Mayor of the Borough of Watchung relative to the high number of accidents at the Exit. The results of the study, in terms of safety improvements, are shown on two sketches marked as NJDOT 72 and 73, dated 11-3-03. The sketches show changes as follows.

> Install five W1-8R Chevron signs (730 x 300 mm, 28 x 12") around the outside of the ramp curve.
>
> Install four sets of "reminder strips" on the deceleration lane.
>
> Install two W1-1R Right Turn signs (750 x 750 mm, 30 x 30") with advisory speed plate of 20 mph. (600 x 600 mm, 24 x 24"), one at the end of the taper and one on the deceleration lane, about 300 feet in advance of the ramp curve.
>
> Install one W13-2 Exit sign (1200 x 1500 mm, 48 x 60"), with 20 mph advisory speed.
>
> Remove two trees from the outside of the curve. One of these is the tree struck by the Simms vehicle.

Of all this scheduled work, only the Chevron signs and tree removal were evident at our inspection of October 11, 2007. See Leiss photos and video.

From the above, I conclude that per NJDOT documents: four Chevrons, and a series of yellow delineators at 25' spacing, should have been present along the outside of the ramp curve; however, these devices were not present at the time of the crash

10. EVALUATION OF TRAFFIC CONTROL DEVICES.

The Advisory ramp speed sign advises an approaching driver of the need to slow; however, there are no traffic control devices at the crash site to alert an exiting driver that they are about to quickly encounter a sharp curve. This is particularly important because they cannot see the curve in a timely manner.

Delineators. Delineators should have been in place along the outside of the curve at 25' spacing. As shown on the 1983 construction drawings (No. 231), the delineators consisted of two prismatic reflectors, about 3" in diameter each, mounted on a post 4 feet above the ground, and 2 to 4' from the edge of shoulder. This configuration is consistent with the then current MUTCD,

> Reflective elements for delineators shall have a minimum dimension of approximately 3 inches. Elongated reflective units of appropriate size may be used in place of two reflectors mounted as a unit.
>
> Delineators, if used, shall be mounted on suitable supports so that the top of the reflecting head is about 4 feet above the near roadway edge. They shall be placed not less than 2 or more than 6 feet outside the outer edge of the shoulder. … (1971 MUTCD, pp. 211, 212)

Spacing of 25' is consistent with Table III-1 of the 1971 MUTCD. As stated in the MUTCD,

> Road delineation markers are effective aids for night driving and are to be considered as guide markings rather than warning devices…. (Page 211)

However, as the MUTCD evolved, the function of delineators came to be seen as broader.

> Delineators are particularly beneficial at locations where the alignment might be confusing or unexpected, such as at lane reduction transitions and curves. Delineators are effective guidance devices at night and during adverse weather. An important advantage of delineators in certain locations is that they remain visible when the roadway is wet or snow covered. (2000 MUTCD, page 3D-1)

Delineators are known to provide guidance for sharp curves. According to the USDOT's 1983 *Functional Requirements of Highway Safety Features*[12]:

> The three specific cases where roadside delineation has proven beneficial are: 1) horizontal curves over 5^0… [p. 14-3]

The exit ramp has a degree of curvature of 23 to 28^0.

Chevrons. Four Chevrons should have been in place along the outside of the curve, as shown on the 1999 construction drawings. As stated in the MUTCD

Section 2C.10 Chevron Alignment Sign (W1-8)

Option:

The Chevron Alignment (W1-8) sign may be used to provide additional emphasis and guidance for a change in horizontal alignment. A Chevron Alignment sign may be used as an alternate or supplement to standard delineators on curves or to the Large Arrow (W1-6) sign.

Standard:

The Chevron Alignment sign shall be a vertical rectangle. If used, Chevron Alignment signs shall be installed on the outside of a turn or curve, in line with and at approximately a right angle to approaching traffic.

Guidance:

Spacing of Chevron Alignment signs should be such that the road user always has at least two in view, until the change in alignment eliminates the need for the signs. Chevron Alignment signs should be visible for a sufficient distance to provide the road user with adequate time to react to the change in alignment. (2000 MUTCD, Page 2C-11)

As can be seen in the Leiss video, the Chevrons provide notice of the sharp curve from a considerable distance before the start of the curve.

The missing delineators and Chevrons that were supposed to be in place along the outside of the curve was a critical lack of guidance to Simms that was directly related to the happening of the collision.

11. CRASH HISTORY

Police accident reports were available for the period 1993 through 2003. These were examined, and similar single vehicle run off the road (outside of ramp curve) collisions were found as follows:

Year	No. of similar collisions	No. with tree strike.
1993	1	
1994	1	1
1995	3	2
1996	3	1
1997	3	1
1998		
1999	2	1
2000	9	7
2001	2	1

2002	7	4
2003	5	2
Total	36	20

For all but one of the 10 years prior to this crash there was at least one crash similar to the Simms crash. The number increased dramatically in 2000: 2002 and 2003 also had a high number of similar crashes.

As should be expected, there have been a substantial number of collisions related to the sharply curved and unmarked exit ramp.

12. CLEAR ZONE

The struck tree was located 36 feet from the left edge of the Exit ramp.

The clear zone concept was solidly in place in 1983, when the ramp was constructed. 1983 construction drawings do not show clearing to a specific distance from the edge of pavement. They do show fill to about 20 feet from edge of pavement. The 1999 construction drawings show (Sheet 9/141) a tree line at 15 to 20 feet beyond the toe of slope. At the crash the trees were about 35 feet from the edge of pavement, consistent with my measurement of 36 feet to the stump of the tree struck in this crash. The trees now are at about 65 feet from the edge of pavement.

Based on criteria in NJDOT's 1988 *Design Manual, Roadway*, given the sharp curve, the clear zone should have been about 50 feet at the ramp. Crash history shows many of the SVROR crashes involved trees. Particularly many involved trees in 2000 and 2002, but at least one every year other than 1998.

I am not aware of any reason that trees beyond the cleared area could not have been removed and the area made traversable to errant vehicles.

It has long been recognized that there is an increased potential for errant vehicles to leave the traveled way on the outside of curves.

Given the above, removal of trees to a distance beyond 50 feet from the ramp would have been reasonable and prudent.

13. FINDINGS

Within the bounds of reasonable engineering certainty, and subject to change if additional information becomes available, it is my professional opinion that:

1. The conditions of this crash were as follows: it was snowing, the pavement was wet, Simms went off the outside of the ramp curve at a speed of about 35 mph, and the vehicle struck a tree about 35 feet from the ramp.

2. The right-hand curve was too sharp for Simms' speed and the road conditions.

3. There were no traffic control devices to warn Simms of the sharp ramp curve.

4. The ramp curve is sharper than usual for a freeway exit. The sharp curve is a violation of an exiting driver's expectancy and, in the absence of appropriate traffic control devices, made the roadway dangerous in a manner that caused this crash.

5. The safe speed for the ramp is 20 mph.

6. The ramp curve is too sharp according to both NJDOT and national criteria.

7. The exit ramp curvature is substandard, and the curve cannot be recognized by approaching drivers. This should have caused NJDOT to recognize the sharp ramp curve as a problem location, one that offers a surprise to the driver.

8. A means of mitigating the hazard of the sharp curve is by altering a driver's expectancy through installation of appropriate traffic control devices. In this case, devices should be provided to show approaching motorists that there is a sharp curve ahead with a safe speed of 20 mph and the nature of that curve. These devices should include a curve warning sign and chevrons to mark the outside of the curve.

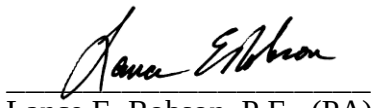
9. Per NJDOT documents four Chevrons, and a series of yellow delineators at 25' spacing, should have been present along the outside of the ramp curve; however, these devices were not present at the time of the crash.

10. The missing delineators and Chevrons that were supposed to be in place along the outside of the curve was a critical lack of guidance to Simms that was directly related to the happening of the collision.

11. For all but one of the 10 years prior to this crash there was at least one crash similar to the Simms crash. As should be expected, there have been a substantial number of collisions related to the sharply curved and unmarked exit ramp.

12. Removal of trees to a distance beyond 50 feet from the ramp would have been reasonable and prudent.

13. NJDOT's failure to place and/or maintain traffic control devices to warn motorists of the sharp curve and to remove trees for at least 50 feet from the outside of the sharp curve was palpably unreasonable and a cause of this crash.



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