Case ID: 081227-01

Accident Narrative

Late at night on 27 December 2008, a group of friends were driving back from a restaurant in Pathumthani. On the way the passenger car with six occupants on board left the travelling way before approaching the Klong Luang Interchange at KM.4+600 on Highway No. 3214 (**Figure 3-1**). The vehicle flew from a roadside concrete barrier and landed into the structure of high mast lighting. The car broke into two parts and all six occupants died instantly.
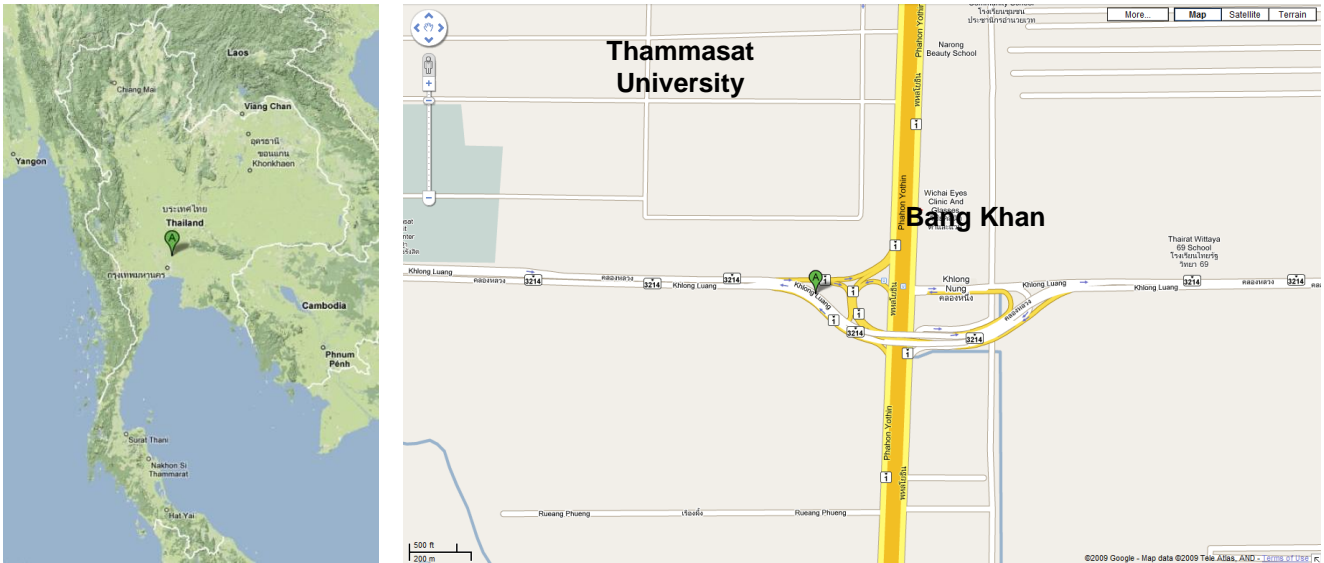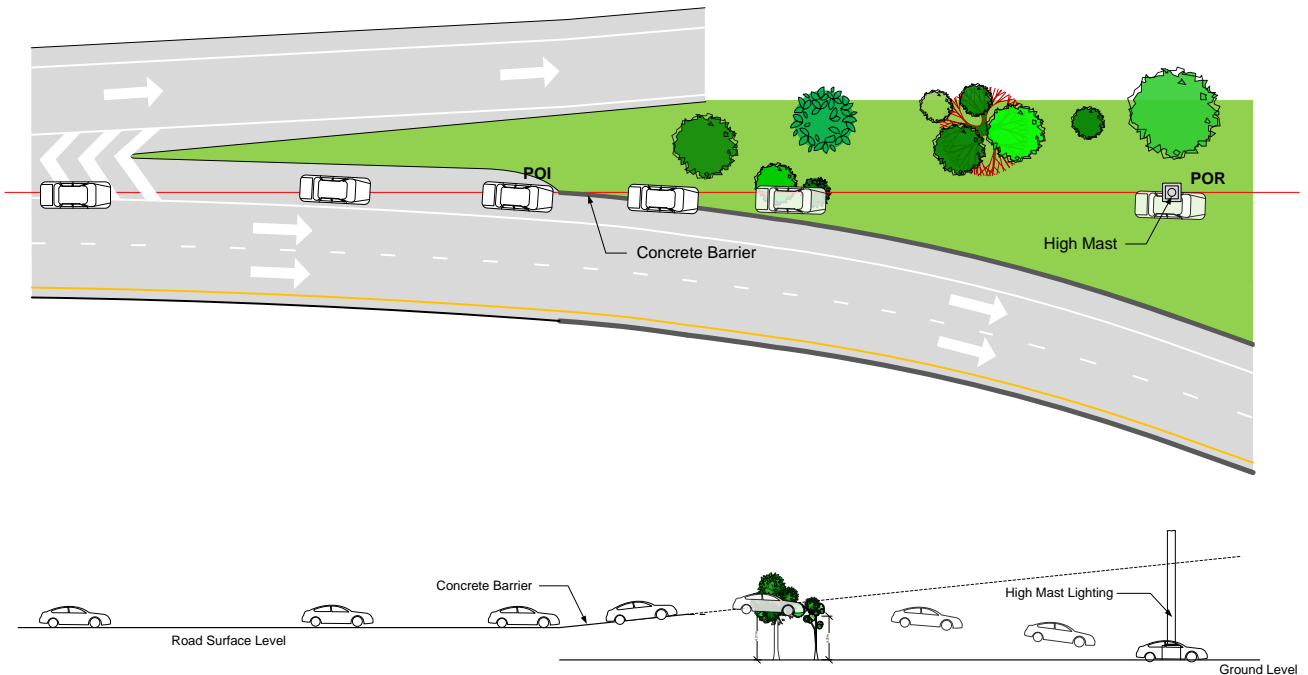

Figure 3-1: Crash Location

Figure 3-2: Collision Diagram

Based on evidences found on the crash scene (**Figure 3-2**), the vehicle was out of the travelling way while negotiating the curve. A tire print, which is left wheel tire was found on the footing of the New Jersey concrete barrier. The vehicle kept moving on the top of the

concrete barrier for some distance. The cut branches of the tree showed the vehicle movement path in the air. Finally, the top left part of the car landed on the concrete structure, resulting in the death of the six persons.

Vehicle and Wreckage Information

The passenger car was a Nissan Teana, 2,000 CC. patrol engine with automatic speed transmission and ABS equipped (**Figure 3-3**). It was white in color. The original dimensions were 4.85 m long, 1.80 m wide, 1.49 m high, and 2.78 m wheelbase. The 3 cm diameter longitudinal safety beams were fitted on each side of the car. All tires were of size 205/65 R16, manufactured in year 2005. The details of the vehicle's tires are shown in **Table 3-1**. The driver and front passenger seats were designed as individual bench with lap-shoulder belt installed. The left and right rear seats were equipped with lap-shoulder belts while the middle seat was fitted with a lap belt.
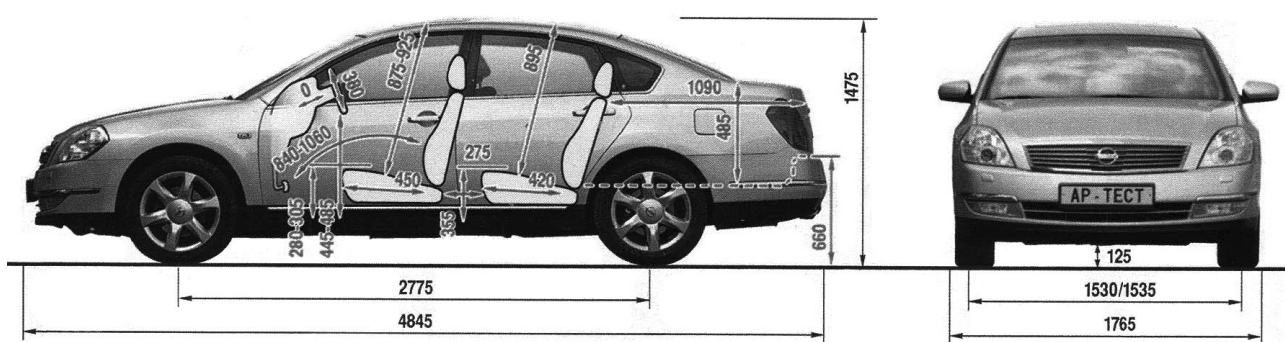

Figure 3-3: Car Dimension

Table 3-1: Tires Detail

Location	Damage	Manufacture	Tire Name	Year	Size	Load Index & Speed Symbol	Tread Depth (mm)	Pressure (psi)
1	Yes	Bridgestone	3390	3205	205/65 R16	95H	5	N/A
2	No	Bridgestone	3390	3205	205/65 R16	95H	5	32
3	Yes	Bridgestone	3390	3205	205/65 R16	95H	5	N/A
4	No	Bridgestone	3390	3205	205/65 R16	95H	5	32

The TARC team found that the car was dramatically damaged at the junkyard in the Klong 3 workshop. It was broken into two parts. The frontal part included the engine compartment, front seat row, and left doors. Other components, including the roof and right doors were to be found with the rear part. The cutting line was measured to be 2.00 m long from front bumper (**Figure 3-4**).

Figure 3-4: Vehicle Damages

The evidences from the impact were mainly found in the rear part. The roof structure was compressed into a tiny piece, showing a rupture force from right to left. The curvature shape of the driver's door was the source of impact with a high mast column.

As for the front part (**Figure 3-5**), the left wheel was found damaged on the rim. The hood had disappeared. The interior inspection showed that the seatbelts remained their original positions and were found unused. The blood stained driver and front passenger's airbags were activated on the steering wheel and console, respectively. All control gauges, air condition control, and music player were massively destroyed. Blood splashed on the front passenger's door (**Figure 3-6**).

Figure 3-5: Frontal Part Damages

Figure 3-6: Blood Stain on Front Passenger Door

Driver Information

The driver was a 25 years old female. According to a witness, the driver' friend, all occupants were a group of friends. They had a party for the graduation ceremony of the driver and one passenger at a pub in Chiang Rak. The crash occurred on the way back home, which is about 3 km away from the crash scene (**Figure 3-7**).
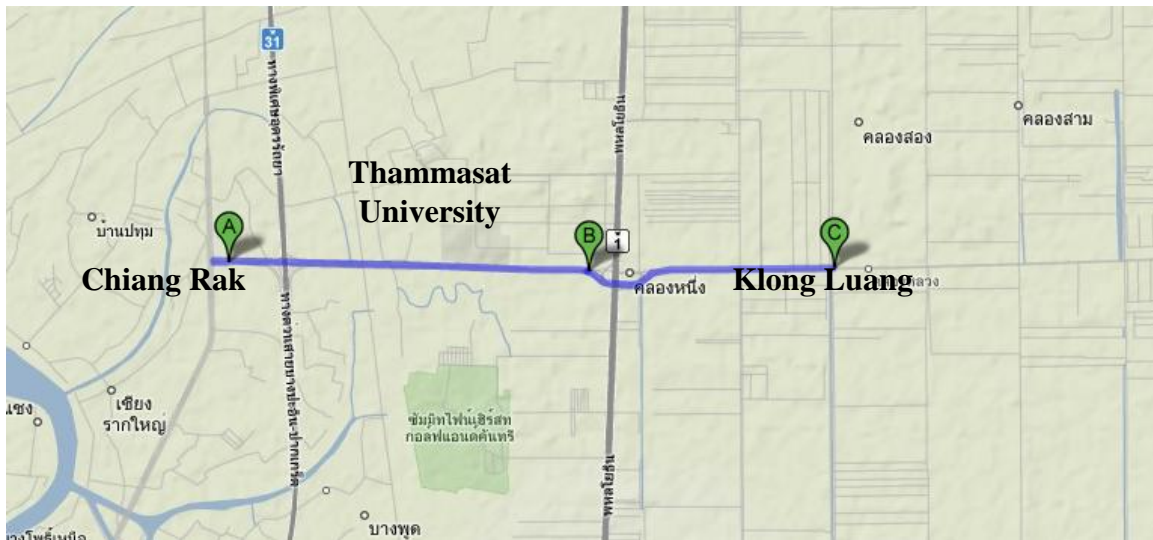
Figure 3-7: Vehicle Route

Highway Information

Highway No.3214, 15 km long, connects the East-West corridor between Highway No.347 and Highway No.3010 in Klong Luang, Pathumthani. It is a 6-lane divided road, with a 3.7 m wide lane of concrete pavement and a 2.3 m shoulder asphaltic concrete. The diverging area is on the West approach at km.4+600 in the area of the Klong Luang Interchange. It divides the left lanes to Highway No.1 and remaining two-lane routes to the interchange. A 200 m in radius curvature connects the straight road and the overpass bridge. The details of the interchange's geometry are shown in **Figure 3-8**.
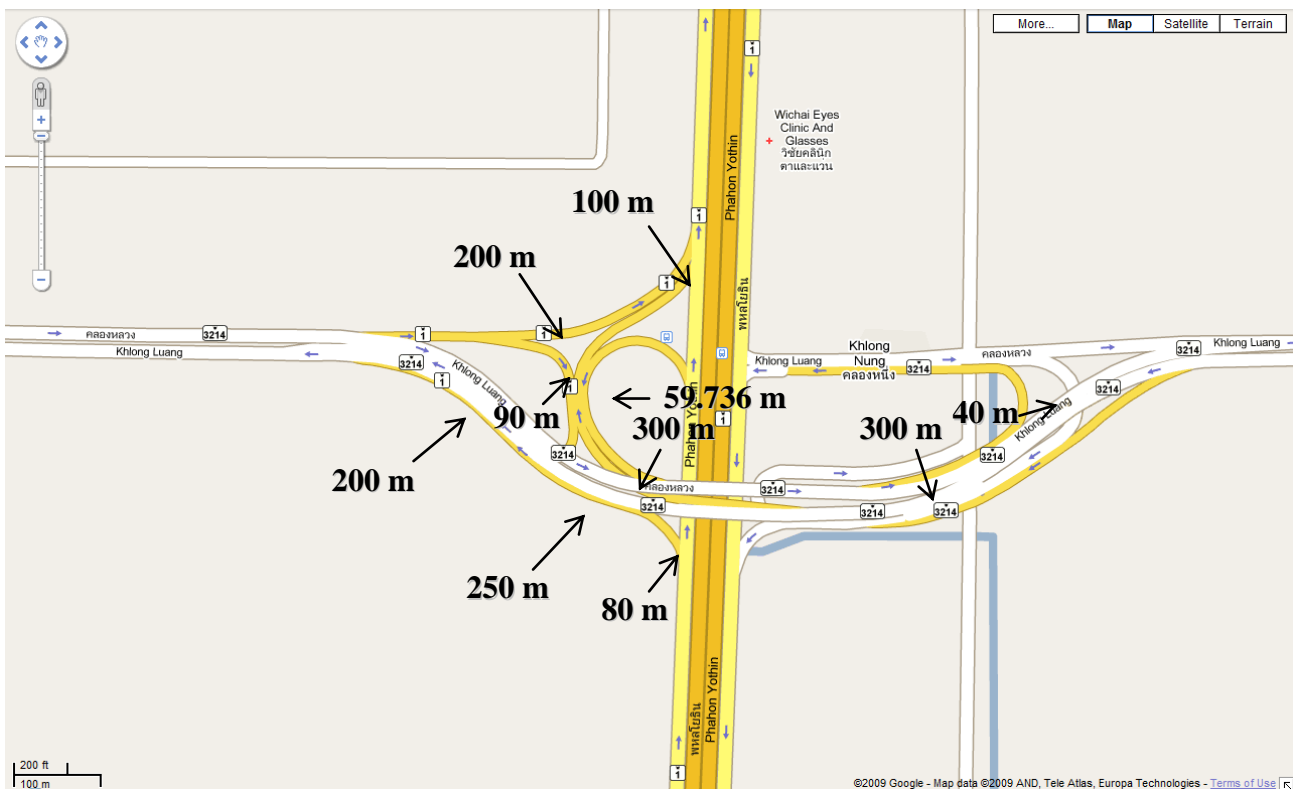

Figure 3-8: Klong Luang Interchange

High Mast Lighting Pole
The 25 m. tall steel high mast lighting, is mainly installed every 100 m. along the route. The circumference of the pole is 190 cm. or equal to a radius of 30 cm. The steel column stands

on a 140x140 cm rectangular concrete foundation. **Figure 3-9** shows the details and dimensions of the high mast and its foundation. The reference line indicates the same level of approach concrete barrier.
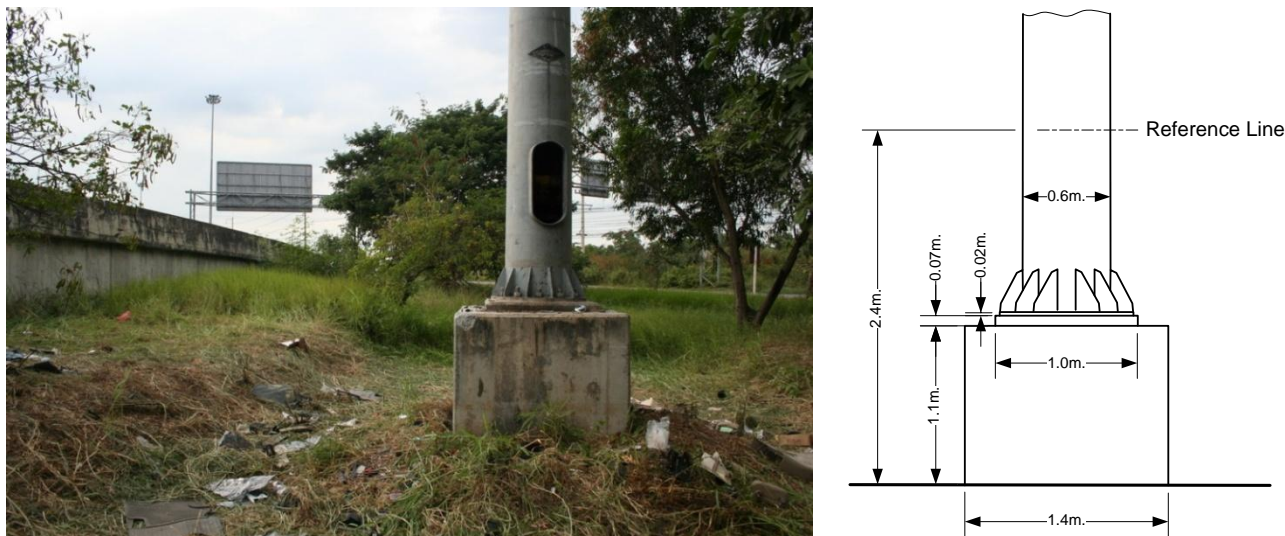

Figure 3-9: High Mast Lighting Pole

Barrier

At a distance of 65 m. from the diverging gore area, the concrete barrier is installed on the left side of the road. The beginning of the barrier is set up with the "Approach Concrete Barrier Type B". The total length is 10.25 m. The details of the standard drawing of the approach barrier are shown in **Figure 3-10**.
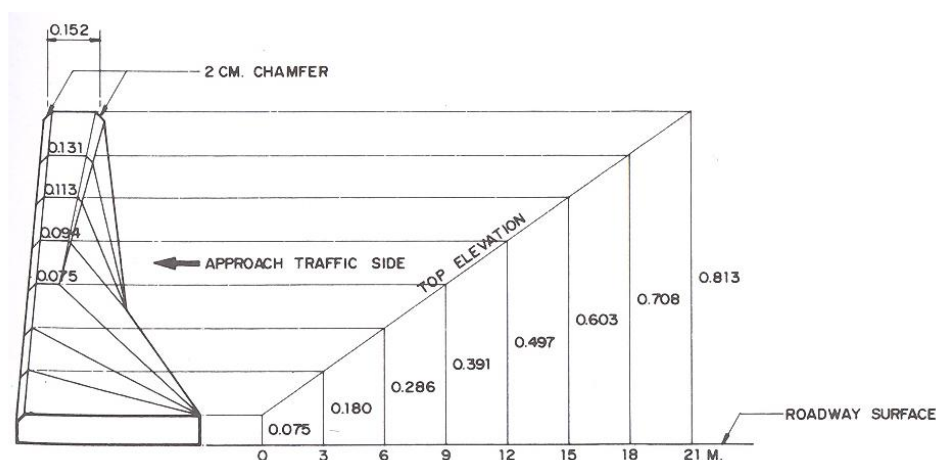

Figure 3-10: Standard Drawing of Approach Concrete Barrier Type B
Source: Department of Highways (1994)

Physical Evidence

The evidence found from the scene (**Figure 3-11**) began with a tire mark printed on the footing of the approach concrete barrier **(point no.1)**. Within a further meter, there were plenty of scratch marks showing on the concrete surface on the top of the barrier (**point no.2**). 8.40 m from point no.1, a tire mark was printed again on the top of the barrier with 1.30 m in total length (between **points no.3** and **4**).

Another set of evidences were documented at the trees on the roadside where the branches of trees were broken. The first (**point no.5**) was found between 2.13 and 3.11 m above the ground. The next (**point no.6**) , a broken branch, at a height of 2.20 m from the ground was found on the smaller tree which was located 3.03 m further away

The last evidence was located at the concrete foundation (**point no.7**) of the high mast lighting post, 46.35 m away from point no.1. It has to be noted here that there was no evidence found between point no.6 and point no.7 which means that it is highly possible that the vehicle flew from the concrete barrier at 6° over the trees and landed exactly at the concrete foundation without touching the ground.
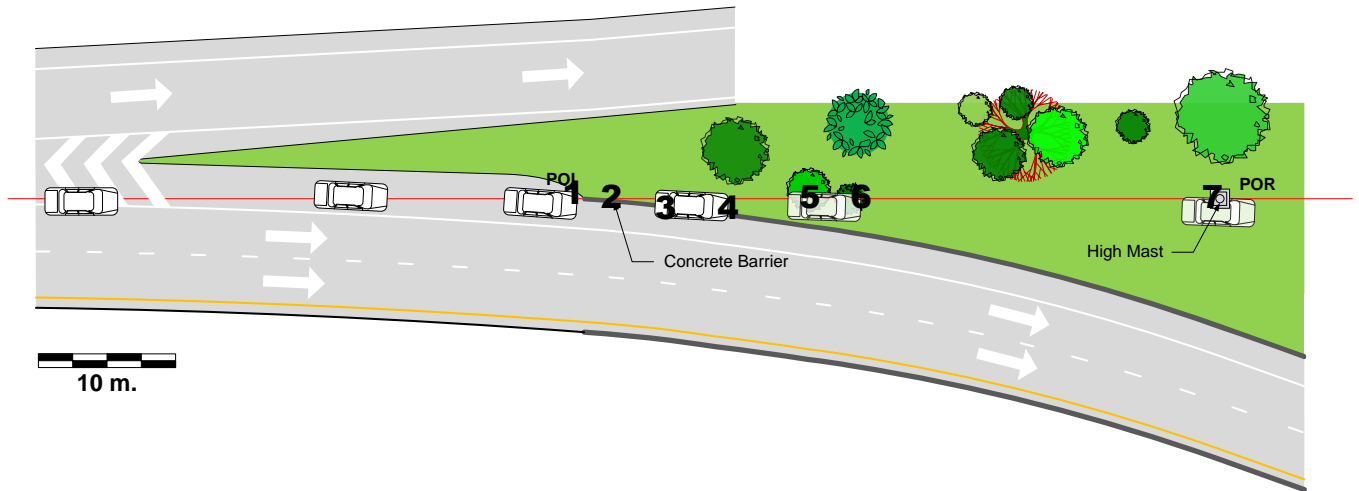
Figure 3-11: Set of Evidences Documented at the Crash Scene

Injuries Information

All six occupants died instantly inside the wrecked car. An autopsy was performed on the bodies at Thammasart University Hospital. The summary of the crash injuries is shown in **Table 3-2**.

Table 3-2: Summary of Occupants Injury

Person	Gender	Age	Level of Injury	Seat belt	Injury	ICD 10
1 (Driver)	Female	25	Fatal	N/A	Fracture of base of skull	S02.1
					Laceration of brain	S06.3
2	Male	24	Fatal	N/A	Fracture of base of skull	S02.1
					Laceration of brain	S06.3
3	Female	24	Fatal	N/A	Multiple fractures of ribs	S22.4
					Laceration of lug	S27.3
4	Female	24	Fatal	N/A	Fracture of base of skull	S02.1
					Laceration of brain	S06.3
5	Male	24	Fatal	N/A	Laceration of lug	S27.3
					Laceration of liver	S36.1
6	Female	23	Fatal	N/A	Fracture of base of skull	S02.1
					Laceration of brain	S06.3

Accident Contributing Factors

Left the Roadway with High Speed
The conclusion on the recognition error and why the driver lost control will not be discussed in this report since there was insufficient information. No information on the distraction from other traffic or environment. No blood test was performed by the hospital. Nevertheless, the speed estimation can be determined from the evidences found on the crash scene. In this case, the car was documented to be traveling through the air from the approach concrete barrier to the concrete foundation. The horizontal and vertical distances were measured to be 46.35 m. and 2.45 m., respectively. The physic of projectile motion is used for this calculation. The equation (Fricke, 1990) to calculate the speed of the car at the point of takeoff is;

$$v = d \sqrt{\frac{g}{2 \cos\theta \, (d \sin\theta - h \cos\theta)}}$$

Where;

v	=	speed (m/s)
d	=	horizontal distance (m)
g	=	acceleration of gravity (m/s^2)
h	=	vertical distance (m)
θ	=	takeoff angle

A vertical distance is negative in this case since the landing point is below the takeoff point. Therefore, by using the above equation, the speed of the car at the takeoff point is equal to 137 km/h. In addition, while the car was traveling in the air, it had a relative effect of pitch and yaw movement that which made it land on the roof.

Approach Concrete Barrier
The approach concrete barrier type B at the crash scene resulted in an adverse outcome regarding the safety for errant vehicles. This type of end , called sloped concrete end treatment by AASHTO or similar to a turned-down guardrail terminal, is intended to collapse

on impact and lead the vehicle to pass over the object without becoming unstable or airborne (AASHTO, 1996). However, AASHTO recommended using it in areas where the traffic speeds are lower than 60 km/hr. This treatment should be installed where the barrier is flared out beyond the clear zone or where the end-of impacts are not likely to occur. In this regard, the approach concrete barrier is not considered a sufficient treatment to protect an errant vehicle at this critical location.

Significant Factors

TARC determined that the probable cause of the 081227-01 crash occurrence was the car leaving the roadway with a high speed as supported by the above mentioned evidences. The severity of the crash consequences increased for lack of a sufficient roadside protection system.