

Case ID: 060815-01

Accident Narrative

On the rainy day of Tuesday, 15 August 2006, at about 14:25 the pickup, traveling eastbound on highway no. 209, a four-lane divided highway, near Chiang Yeun, Mahasarakham (**Figure 3-1**), lost the control and rolled over into median. The vehicle, finally stopped in on-wheel position, heading backward to the oncoming direction. The schematic of the accident scene is shown in **Figure 3-2**.



Figure 3-1: Accident Location

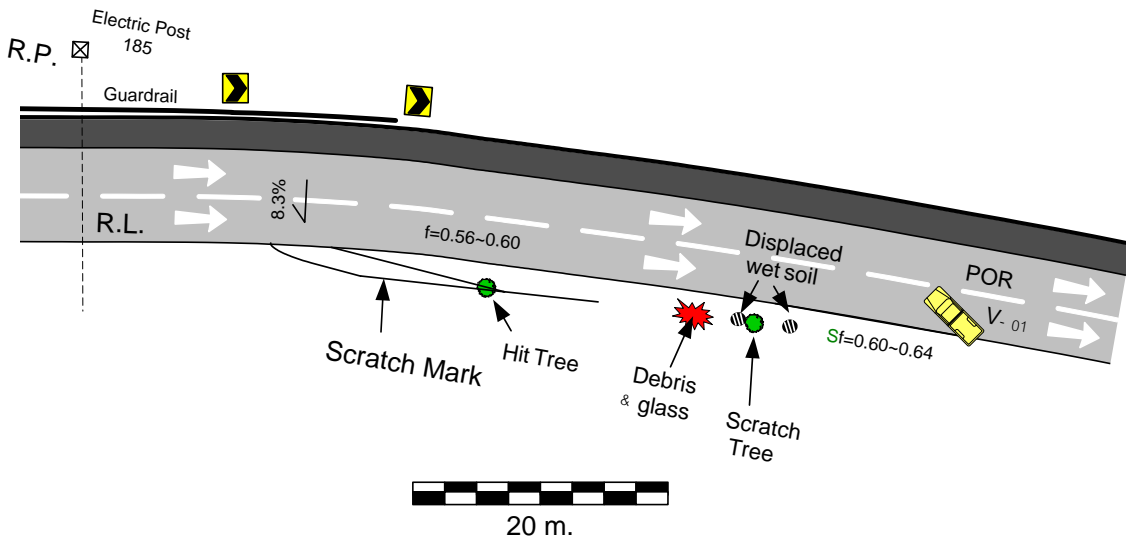


Figure 3-2: Schematic of Accident Scene

The driver, the only occupant in the pickup, informed the TARC team that he negotiated the right horizontal curve but the vehicle suddenly lost control and rolled over. He suffered slight injuries at the ear and shoulder. No immediate hospitalization was required.

Vehicle Information

V1, the pickup, was a Toyota Hilux D4D Common Rail, 3,000 CC. diesel engine with a 5 speed manual transmission, and rear-wheel driven. The wheel base was 3.08 m., 5.03 m. in total length, and 1.62 m. in total height. The details of vehicle are shown in **Table 3-1**.

Table 3-1: Pickup Dimension and Weight

Item	Dimension
Overall Length	503.5 cm
Width	170.0 cm
Height	162.5 cm
Wheelbase	308.5 cm
Curb Weight	1,490 kg

The vehicle was designed for two split seats for the driver and front passenger. Both seats were equipped with lap-shoulder belts. The cab, space behind the front seats, was equipped with a bench.

The post crash vehicle showed substantial damage on the right side, especially around the driver's compartment area, as shown in **Figure 3-3**. The roof was deflected downward at the driver's seating position. The right A-pillar was deformed inwardly into the driver, causing the windshield to be damaged. The intrusion started from the right door and extended to the cab compartment. The front bumper was displaced at the front right corner. The right rear view mirror was also missing. On the left side, the head lamp and left turning signal were missing. TARC evaluated the Collision Deformation Code (CDC) for the pickup as **02RY1AO3**.



Figure 3-3: Vehicle Position and Its Damage

Driver Information

The pickup driver was a 33 years old male, the vehicle's owner. He had been driving from Khon Kaen for about 20 minutes when the accident occurred with about 20 minutes remaining to reach Lam Pao Dam, the destination. The graphic in **Figure 3-4** shows his traveled plan. He had an experience of four years with this vehicle and more than ten years with pickups. He used to use this pickup daily, while rarely traveling on this route.

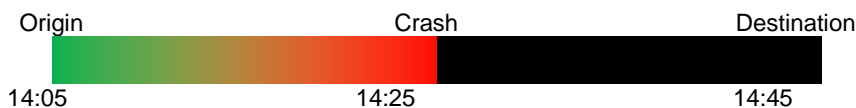


Figure 3-4: Travelling Hours

Highway Information

The accident occurred on the westbound lane of Highway No. 209 in Chiang Yeun, running from Khon Kaen to Kalasin. The right curve section of the two lanes eastbound and the two lanes westbound are divided by a 4.1 m. raised median. All lanes are 3.6 m. width, with a 2.4 m. outside shoulder. The asphalt pavement, during the investigation, had a coefficient of friction of 0.56 with an 8.3% super-elevation, as shown in **Figure 3-5**.

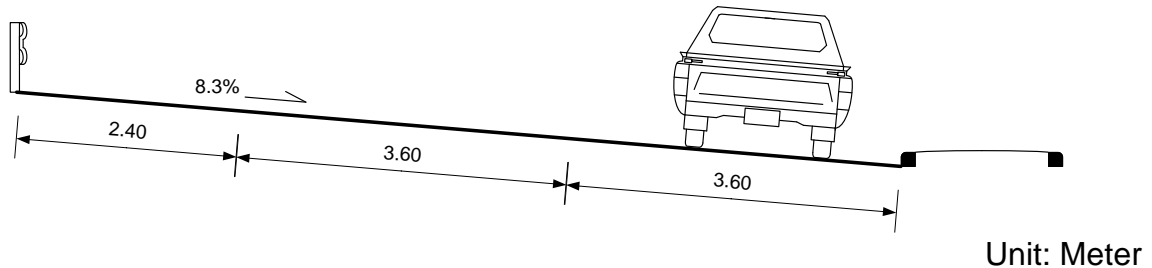


Figure 3-5: Highway Number 209 Cross Section at the Crash Scene

Raised Median

The raised median was constructed as a concrete curb, in the middle along the roadway. It was located about 30 cm. apart from the yellow-inner lane line, with 4.1 m. in total width. The height of the curb was 15 cm., as illustrated in **Figure 3-6**, from the road surface. It was filled with soil and covered by grass. The coefficient of friction showed 0.64.

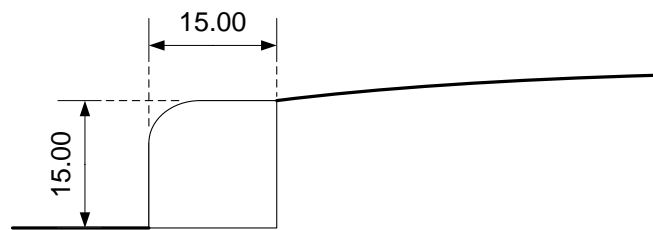


Figure 3-6: Raised Median at Crash Scene

Physical Evidence

An electric pole no. 185 was selected as a reference point. No tire marks were found around the crash scene. Several gouge marks were found on the grassy median, as a path of vehicle roll over. It started 14.7 m. from the reference point. From the beginning of the mark until the point of rest of the vehicle the total distance was 66.8 m. One small tree on the median was damaged due to vehicle's impact. **Figure 3-7** shows the traveling path at the crash scene.



Figure 3-7: Evidence on the road

Injuries Information

The driver was wearing the lap-shoulder seat belt. He suffered slight injuries. He claimed no hospitalization was required. **Table 3-2** presents the details of injuries to the victim.

Table 3-2: The Summary of Occupant Injuries

Person Number	Restraint Use	Severity	ICD10	Injury	Source of Injuries
P1	Lap-shoulder seatbelt	Slight	S00.4 S40.9	Superficial injury to the ear Superficial injury to the shoulder and upper arm	Interior damage Interior damage

Accident Contributing Factors

Horizontal Curve and Wet Surface

The road surface was found to be wet during the crash. The coefficient of friction was measured along the direction of travel of pickup to be 0.56-0.60. The road was a horizontal curve of 377.5 m. in length with a super-elevation of 8.3%. The 2-lane 2-way raised median divided highway had a 226.5 m. guard rail along the curve as shown in **Figure 3-8**.



Wet Surface



Travel Direction of the Pickup on Wet Surface



Right Turn Horizontal Curve



Super-elevated Curve

Figure 3-8: Road Geometry and Wet Road Surface

It is very common that the slippery surface will cause more difficulties in driving. Several studies have been conducted considering the relations between crash and surface conditions. The study from the Transport Department, London, shows that the accidents risk due to vehicles skidding on pavements with a friction coefficient reduction of 25% is 20 times higher. Moreover, if the coefficient of friction of a road is reduced by 50%, the accidents risk is 300 times higher (TD, 1994).

Page and Butas found that the accident rates on wet pavements were the highest in horizontal curves, especially when the surface friction co-efficient (SFC) was less than 0.25. Accident rates were also higher on wet pavements for both uphill and downhill slopes (steeper than 3%) than for flatter terrain (Page and Butas, 1986). Farber et al. reported that only 2.3% of wet surface accidents occurred on tangent sections of roads, where the friction demand is low (Farber et.al, 1974).

Improper Steering

The traveling path of the pickup showed over steering while negotiating the curve, showing that the radius of the travelling path was less that the radius of the traveling lane. Over steer is a phenomenon that can occur in an automobile which is attempting to turn, when the rear wheels do not track behind the front wheels but instead slide out towards the outside of the turn. It can throw the car spinning over the traveling direction.



Vehicle Movement into Median



Upstream- Right Turn into the Curve

Figure 3-9: Vehicle Traveling Direction in Pre and Post Crash

To overcome an improper steering maneuver, recently, EURONCAP has introduced Stability Control, the electronic sensors, when a driver is about to lose control by detecting the differences between a car's course and the driver's intended direction. The system has been developed from other technologies such as ABS brakes and traction control. By selectively applying the brakes to individual wheels, Stability Control helps the driver to maintain control of the car and to steer safely. This can make the difference between an accident and a near-miss (Euroncap.com).

Rollover

The pickup went inside of the raised median and made a right turn full rollover (360°). From **Figure 3-10**, the final rest position of the pickup was on the four wheels partially inside of the median and inner lane of the highway. The vehicle showed most damages on the right side.



Figure 3-10: Final rest Position of Pickup after Rollover

Seatbelt Effectiveness

Even though there was full turn roll-over, the driver was belted and slightly injured at his shoulder and neck.

Significant Factor

Thailand Accident Research Center determined that the contributing factor of the 060815-01 crash was the improper driving maneuver while negotiating the curve in wet surface conditions. The contributing factor to the crash severity was the vehicle roll over which occurred after hitting the median curb. All these factors combined as a chain of events.