

Case ID: 060816-01

Accident Narrative

At about 12:00 on Wednesday, 16 August 2006, the inter-city bus in Don Tal – Roi Et – Bangkok route that was traveling southbound on Highway No. 2, a four-lane divided highway, hit the rear of a ten-wheel truck. Both vehicles lost control and departed the roadway in different directions. The truck went to the left while bus went to the right crossing the depressed median into the opposite northbound direction. The vehicles eventually stopped in a rolled over position. **Figure 3-1** shows the location of the accident.

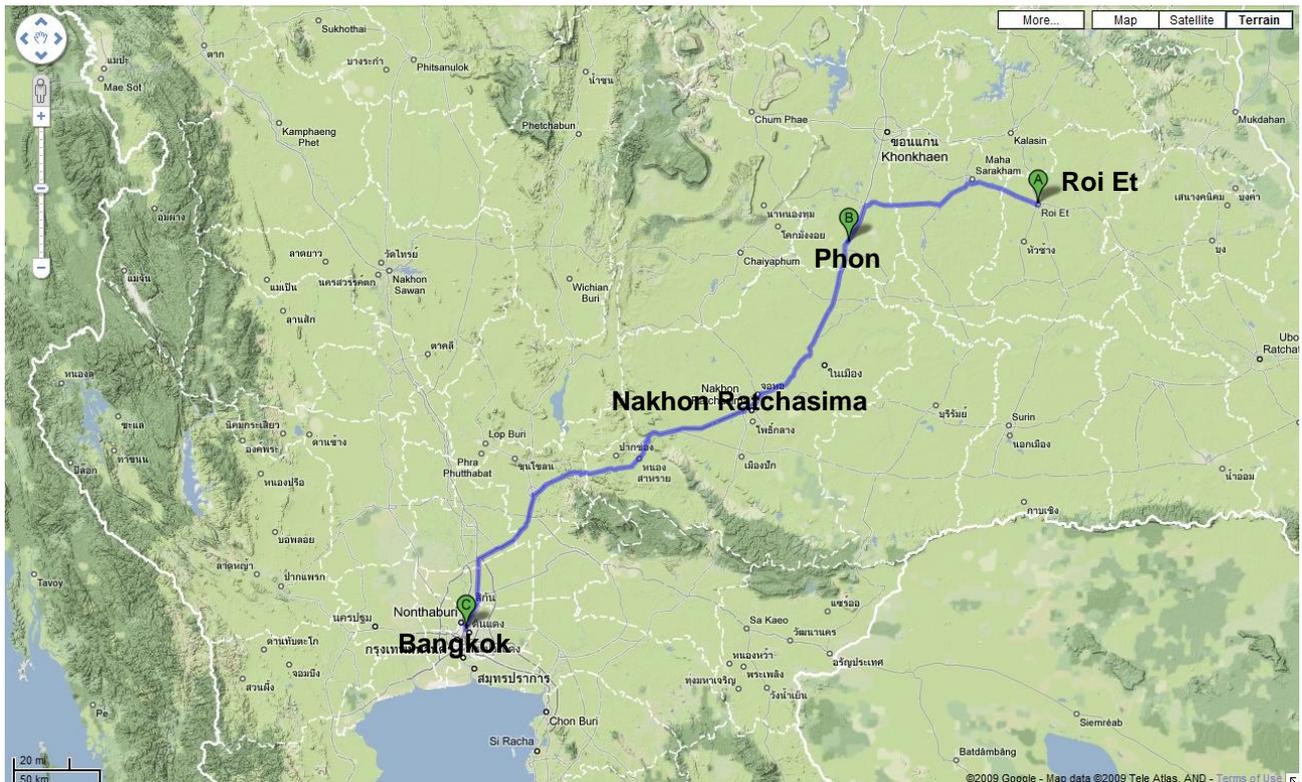


Figure 3-1: Accident Location

According to the bus staff, the bus left Bua Khaow, the trip's origin, at about 8:10. It stopped at Phon Tong and Roi Ed which are routine stops at around 9:10 and 10:15, respectively. Most of the passengers told the TARC team during an interview that the bus was not travelling fast, some even insisted that it was too slow for them. One passenger summarized that before crash, the bus was travelling along the 1st lane, the inner lane. After that, the driver moved to the 2nd lane, the outer lane, allowing one passenger car to take over. The crash occurred when the bus tried to come back onto the inner lane to overtake a truck in front of it but could not manage and hit at the right-rear end. The major events of the crash are shown in **Figure 3-2**.

Out of total 36 occupants on the bus, two persons suffered serious injuries, while the rest were slightly injured. The truck driver suffered serious injuries from a broken hand. The victims were transferred by EMS and admitted to Muang Phol Hospital and Khon Kaen Hospital. The bus driver resisted arrest. **Table 3-1** presents the summary of the number of victims. The TARC staff arrived at the accident scene at around 13:00. Both vehicles were in the rest position and all of victims were already moved to a nearby hospital. The interview was performed with twenty bus passengers as well as the truck driver.

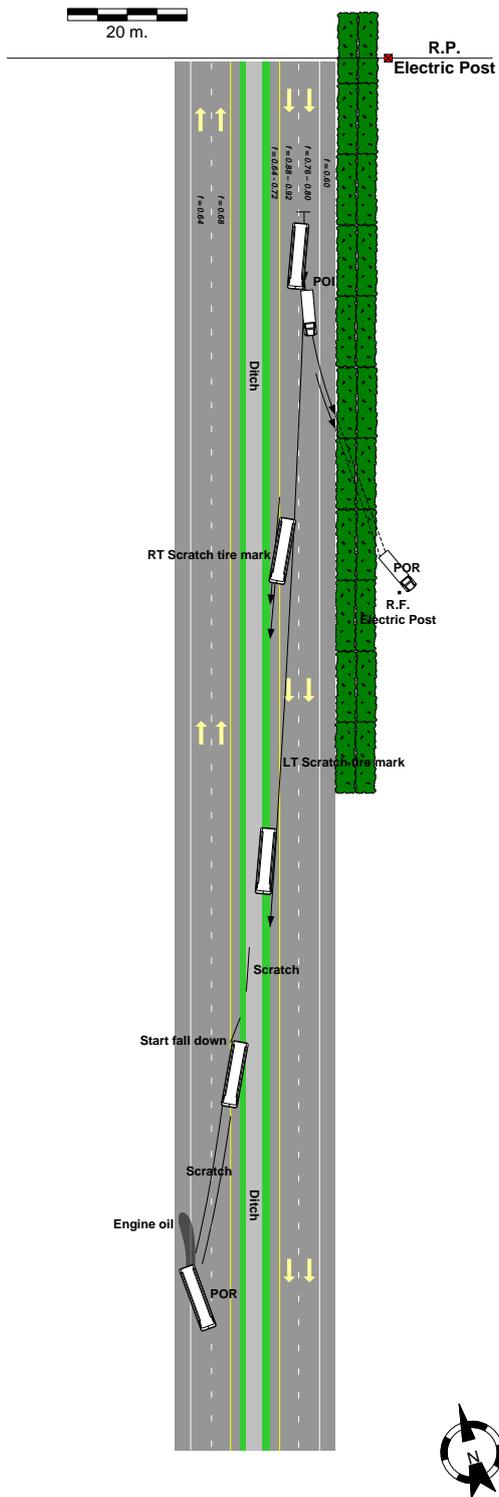


Figure 3-2: Schematic of Accident Scene

Table 3-1: Summary of Crash Victims

Vehicle	Fatality	Serious Injury	Slight Injury	No Injury
V1-Bus	-	2	34	-
V2-Truck	-	1	-	-

Vehicle Information

Bus

Vehicle number 1, the bus, was a six wheel Isuzu bus, white-blue in color, manual transmission, and rear-wheel driven. The vehicle's curb weight was 12,800 kg. There were a total of 45 passenger seats without any seat belt installed.

The bus rolled over on its right at the rest position. The bus sustained frontal crush and the damage extended to the exterior on the right. The windshield was missing. The windows on the right side were shattered while the first windows on the right were damaged. The front left corner showed a massive crush. All pillars on the right side were intact, while the left A-pillar (the first one), front bumper and front left door were pushed inward. The crush extended into the interior compartment. The bus staff's seat, beside the driver's seat, was displaced. Seats number 1 AB, 3AB, and 4AB detached from their position. **Figure 3-3** and **Figure 3-4** show the extent of damages to the bus.



Figure 3-3: The Bus at Point of Rest



Figure 3-4: Extended Damages on the Right of the Bus

The front tires on the bus were Yokohama RY 237, size 295/80 R22.5, while the other four were Michelin XZ E 2, size 11.00 R 20. No damages were found on the wheels and tires during investigation.

Truck

Vehicle number 2, the ten wheel Hino truck, contained a full load of salt in a wooden cargo compartment. It was green in color. During the investigation, the car was in an about 225 degree roll over. The roof was deflected downward damaging the front pillar supporting the roof. The right wooden trunk had been separated, causing the cargo material to be ejected and scattered all over the place at the truck's rest position. **Figure 3-5** and **Figure 3-6** show the extent of damages to the truck.



Figure 3-5: The Truck at Point of Rest



Figure 3-6: The Damage from Rollover

The vehicle's tire brands and sizes were quite varied. The front wheels equipped with Firestone FS 495, 9.00 – 20. On the second axle, High Hero Mighty HX 101, 9.00 – 20 were used as both inner and outer tires. Four wheels on the second-right-axle and third-left-axle had the same Firestone L 542, 9.00 – 20, while Vee rubber Lug, 9.00 – 20, and were installed for the rest, third-right-axle wheels.

Driver Information

Information on the bus driver was missing since the driver wanted to escape the arrest and public inquiry about the crash. The bus owner told the TARC staff that at his age of fifty, neither any major crash occurred nor was this driver ever found guilty. This was also supported by the company's staff.

One passenger who sat next to him informed the TARC team that she had seen the driver taking two bottles of energy drinks. However, most of the passengers told the driver drove smoothly, not fast. However, some mentioned he drove slowly. Two stops, for picking up passengers, were made at Phon Tong on 9:10 and Roi Et on 10:15.

The truck driver, a 52 years old male, originally started the trip in Sakol Nakhon province at about 21:00 on 15 August. He stopped for sleeping along the roadside near Khon Kaen and resumed the trip at around 9:00 to Rangsit, Pathumthani as the destination. The graphic chart compares the driving hours of the two drivers, illustrated in **Figure 3-7**. According to an interview, he did not notice the rear traffic. He could not manage to control the vehicle back into the roadway after being hit.



Figure 3-7: Bus and Truck Driving Hours

Highway Information

The accident occurred on the southbound lane of Highway No. 2 in Amphor Phol, Khon Kaen province running from Nong Khai to Saraburi. The straight-level section of the two lanes southbound and the two lanes northbound were divided by a 5.05 m. depressed median. The Inner and outer lanes are 3.2 m. and 3.5 m. wide, respectively with a 1.6 m. outside shoulder. The southbound concrete pavement had a coefficient of friction of 0.90 and 0.78 for both the inner and outer lanes, respectively whereas the northbound asphalt concrete pavement had a coefficient of friction of 0.64 and 0.68 for the inner and outer lanes, respectively.

Depressed Median

The depressed median was asymmetric in design since there was a roughly 0.65 m. difference in elevation of the roadway. The total width of the southbound road edge was 9.4 m. A short length of concrete open channel was installed inside the median and about 7.4 ms long scratch marks were found in the sloped open channel. The cross section of the roadway at the crash scene is shown in **Figure 3-8**.

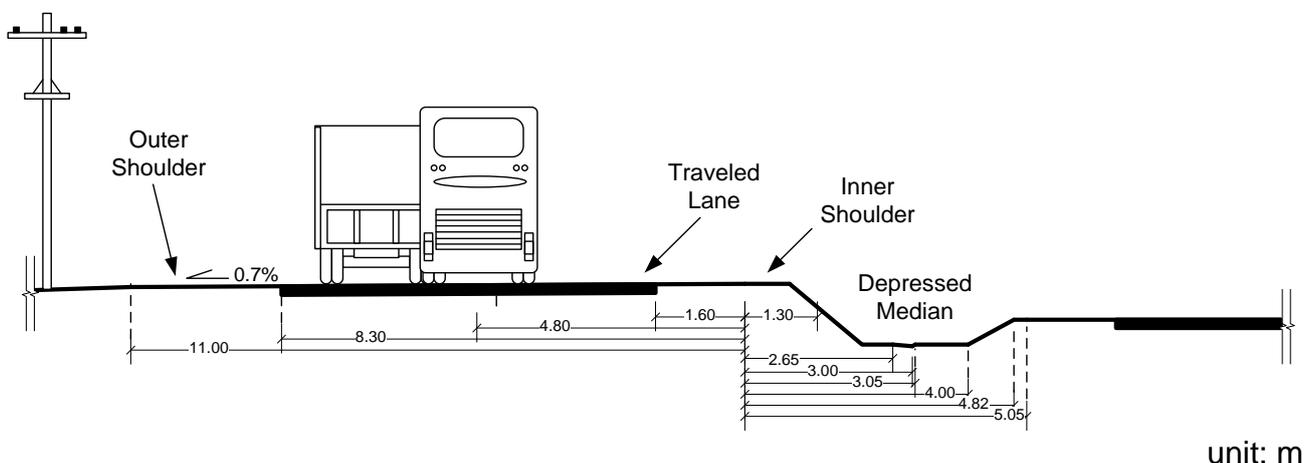


Figure 3-8: Depressed Median at Crash Scene

Physical Evidence

The evidence on the road gave valuable guidance for the TARC team to connect all the events together. From the vehicles' rest position, direction of traveling, tire marks, the start of the collision could be divided into four main events.

At the point of impact, two obvious tire marks, single mark and double mark printed on the 2nd southbound lane, two diverging tire marks were found followed by an about 11.8 ms long single tire marks. They moved almost in the same path before separating in a Y shape as shown in **Figure 3-9**.



Figure 3-9: Crash Scene at the Point of Impact

The truck left the roadway after a tire mark length of about 24.7 m. from the diverging point the of Y-shape. Then it went into the grassy roadside and traveled about 13.4 m. and an additional 10-15 m. on the marshy plane before it rolled over. There was one mark showing the tire print on the soil, indicating the roll over path of the truck on its right. The salt cargo had been ejected after the vehicle left the roadside for 10 - 15 m. The vehicle stopped at the embankment near the rice field close to an electric pole. It travelled a total of about 48 to 53 m. from the point of impact, as shown in **Figure 3-10**.



Figure 3-10: Crash Scene at the Truck's Point of Rest

While the truck left the roadway, the bus still travelled about 116 m. after the diverging point of the Y-shape before leaving the shoulder. After a travel of 32.5 m., the bus swayed to the right into the 1st lane and continued to the right shoulder as found by the mark of left tire (**Figure 3-11**).

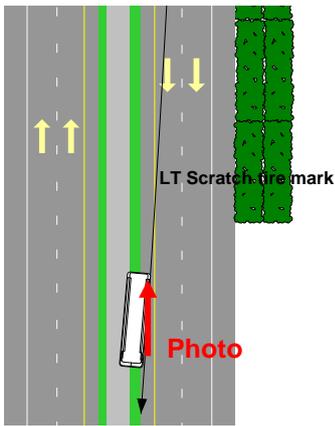


Figure 3-11: Crash Scene showing Bus Travelling Path after Collision

Immediately after leaving the roadway, the bus started to roll over clockwise, according to the scratch mark on the concrete open channel. It kept moving on its right into the northbound lane and stopped in the rest position as shown in the **Figure 3-12**. The bus had moved about 49 ms after falling into the concrete channel to its rest position.

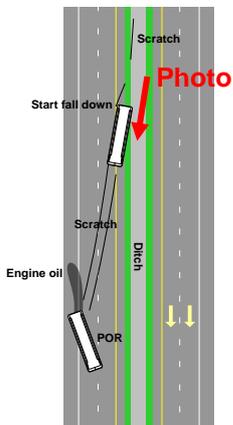


Figure 3-12: Crash Scene at the Bus's Point of Rest

Injury Information

21 of the 37 crash victims were closely examined for their injuries their sources. There were no seat belts in any seats of both vehicles. From a total of 36 passengers in the bus, two suffered serious injuries. One, who had a fracture and another one who had unspecified parts of the lumbar spine and pelvis, identified her seat as D5 while another could not remember her seat. The truck driver, however, was injured with a broken hand.

The other 34 victims were found slightly injured. Nine of them informed they were air borne and hit another seat in front of them. Two suffered injuries by other passenger who fell down and stepped on them, while another eight had injuries through broken windows on the ground. **Table 3-2**, with seating position in **Figure 3-13**, shows injuries were coded as ICD10 standard.

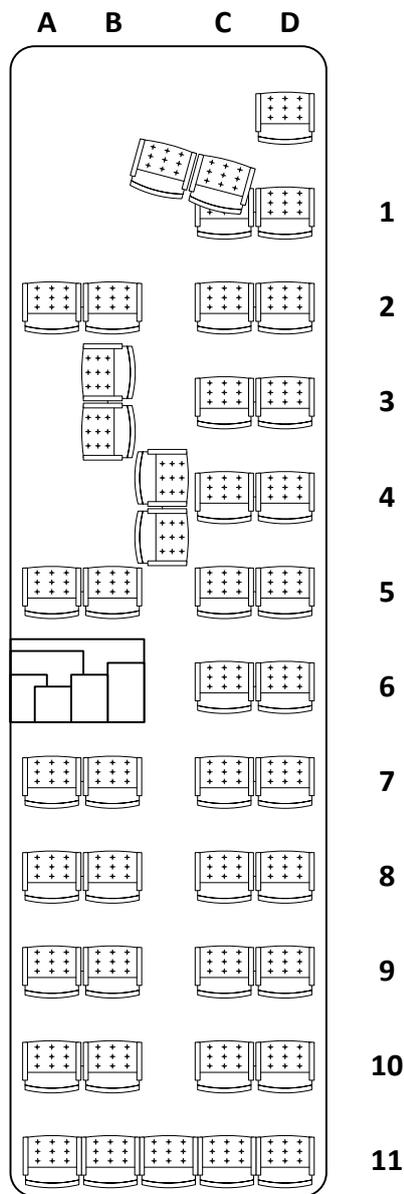


Figure 3-13: Occupant Seating Position

Table 3-2: The Summary of Occupant Injuries

No.	Level of Injury	Seat Number	Injury	ICD 10	Source of Injury
1	Slight	Front	Open wound of upper arm	S41.1	N/A
			Open wound of elbow	S51.0	Broken mirror
			Open wound of other parts of wrist and hand	S61.8	Broken mirror
2	Slight	D1	Contusion of ankle	S90.0	N/A
			Contusion of knee	S80.0	Broken mirror
			Contusion of elbow	S50.0	N/A
			Contusion of elbow	S50.0	N/A
			Contusion of thorax	S20.2	N/A
3	Slight	A2	Contusion of toe(s) without damage to nail	S90.1	Broken mirror
			Contusion of thigh	S70.1	N/A
4	Slight	B2	Multiple superficial injuries of lower leg	S80.7	An armrest of front seat
			Contusion of thorax	S20.2	N/A
			Superficial injury to the other parts of head	S00.8	N/A
5	Slight	C2	Superficial injury to the other parts of head	S00.8	Front seat shelf
			Contusion of thigh	S70.1	Fall down occupant
			Contusion of thigh	S70.1	Fall down occupant
6	Slight	D2	Superficial injury to the other parts of head	S00.8	Pillar
			Contusion of knee	S80.0	Front seat
7	Slight	A3	Superficial injury to the other parts of head	S00.8	Front seat
			Contusion of other and unspecified parts of lower leg	S80.1	Seat incline handle
			Contusion of thigh	S70.1	N/A
8	Slight	A4	Contusion of ankle	S90.0	Broken mirror
			Contusion of knee	S80.0	N/A
			Contusion of finger(s) without damage to nail	S60.0	N/A
9	Slight	C4	Contusion of toe(s) without damage to nail	S90.1	N/A
			Contusion of abdominal wall	S30.1	Interior
			Other superficial injuries to the abdomen, lower back and pelvis	S30.8	Interior
10	Serious	D5	Open wound of knee	S81.0	Broken mirror
			Contusion of shoulder and upper arm	S40.0	Fall down occupant
			Open wound of knee	S81.0	Broken mirror
			Fracture of other and unspecified parts of lumbar spine and pelvis	S32.8	N/A
			Contusion of thigh	S70.1	N/A
11	Slight	D6	Open wound of nose	S01.2	Broken mirror
			Multiple superficial injuries to the lower leg	S80.7	N/A
			Contusion of ankle	S90.0	N/A
12	Slight	C7	Contusion of elbow	S50.0	Front seat
			Open wound of scalp	S01.0	Broken mirror
			Superficial injury to the other parts of head	S00.8	Front seat
			Contusion of knee	S80.0	Vehicle floor
			Contusion of knee	S80.0	Vehicle floor
13	Slight	A8	Open wound of other parts of head	S01.8	N/A
			Contusion of other parts of wrist and hand	S60.2	N/A
			Contusion of other parts of wrist and hand	S60.2	N/A
14	Slight	B9	Superficial injury to the other parts of head	S00.8	Front seat
			Contusion of abdominal wall	S30.1	Armrest
			Contusion of knee	S80.0	N/A
15	Slight	C10	Contusion of thigh	S70.1	Front seat
			Other superficial injuries to the abdomen, lower back and pelvis	S30.8	Seat
			Open wound of lip and oral cavity	S01.5	Front seat
16	Slight	D10	Multiple superficial injuries of lower leg	S80.7	N/A
17	Slight	Rear Fourth from Left	Multiple superficial injuries of lower leg	S80.7	Front seat
			Contusion of ankle	S90.0	Front seat
			Contusion of ankle	S90.0	Front seat
			Superficial injury to the other parts of head	S00.8	Front seat
			Open wound of knee	S81.0	Broken mirror
18	Slight	Rear First from Right	Contusion of ankle	S90.0	Broken mirror
			Contusion of knee	S80.0	Side interior
			Contusion of shoulder and upper arm	S40.0	Side interior
			Sprain and strain of cervical spine	S13.4	Side interior
			Superficial injury to the lip and oral cavity	S00.5	Front seat

Table 3-17: The Summary of Occupant Injuries (Cont.)

No.	Level of Injury	Seat Number	Injury	ICD 10	Source of Injury
19	Slight	N/A	Open wound of toe(s) without damage to nail	S91.1	N/A
			Open wound of toe(s) without damage to nail	S91.1	N/A
20	Serious	N/A	Open wound of eyelid and periocular area	S01.1	N/A
			Superficial injury to the other parts of head	S00.8	N/A
			Contusion of abdominal wall	S30.1	N/A
21	Slight	N/A	N/A	N/A	N/A
22	Slight	N/A	N/A	N/A	N/A
23	Slight	N/A	N/A	N/A	N/A
24	Slight	N/A	N/A	N/A	N/A
25	Slight	N/A	N/A	N/A	N/A
26	Slight	N/A	N/A	N/A	N/A
27	Slight	N/A	N/A	N/A	N/A
28	Slight	N/A	N/A	N/A	N/A
29	Slight	N/A	N/A	N/A	N/A
30	Slight	N/A	N/A	N/A	N/A
31	Slight	N/A	N/A	N/A	N/A
32	Slight	N/A	N/A	N/A	N/A
33	Slight	N/A	N/A	N/A	N/A
34	Slight	N/A	N/A	N/A	N/A
35	Slight	N/A	N/A	N/A	N/A
36	Slight	N/A	N/A	N/A	N/A
37	Serious	Truck Driver	Fracture of shafts of both ulna and radius	S52.4	N/A

Accident Contributing Factors

The analysis part discusses the significant factors causing the crash and injuries. The details found from the crash scene and interviews will be raised as an issue. The findings and significant factors, finally, are concluded.

Inattentive Driving

The bus attempted to pass the lead vehicle, 10-wheels truck, from the outer lane (2nd lane) into the inner lane (1st lane). According to one passenger's statement, the bus let one passenger car overtake, then the bus tried to overtake the truck. Unfortunately, the driver could not maneuver properly and hit the rear-right corner of the truck with its front-left corner. The misjudgment of speed differential by the bus driver is a significant factor in this crash.

Bus Driving Schedule

The regular driving schedule for the bus driver has been massively raised in developed countries. Road and Traffic Authority, New South Wales, Australia, allowed five hours of driving and thirty minutes of rest for commercial bus drivers in case of continuous driving (RTA). Department of Transport, United Kingdom, has one study about Drivers' Hours and Tachograph Rules for Road Passenger Vehicles in the UK and Europe (DOT, 2005). The rule in EC countries allows the driver nine hours (which can be increased to 10 hours twice a week) taken between two consecutive daily rest periods or between a daily rest period and a weekly rest period. In the UK, however, the drivers are allowed 5 1/2 hours driving – after this, a break of at least 30 minutes must be taken in which the driver is able to take rest and refreshment.

Rollover

The truck was found rolled over on a roadside paddy-field, the left side of the traveled road, on its right making 0.375 turns about its longitudinal axis. From the point of impact, the truck traveled 48 – 53 m. consisting of on-road and shoulder and off-road, until it stopping in the rest position. On the other hand, the bus was found rolled over on the opposing traffic lane, right side of the traveled road, on its right making a 0.25 turn about its longitudinal axis. The total travelling distance after the crash was about 217 ms up to its rest position.



Roll-over of 10-Wheel Truck (0.375)



Roll-over of 6-Wheel Bus (0.25)

Figure 3-14: Rest Positions of Rolled-over Vehicles

Unsafe Roadside Slope

Median: There was a difference in elevation of the inbound and outbound road. The 4-lane 2-way road was separated by a depressed median of 5.05 m. (on average) wide. **Figure 3-15** shows the cross section of the highway at the crash location.



Upstream of In- & Out-bound Road & Elevation



Downstream of In- & Out-bound Road & Elevation

Figure 3-15: Unsafe Roadside Slope-Median

Roadside Embankment: On the other hand, the roadside embankment on the left side of the traveled road was not 'errant friendly' for the heavily loaded 10-wheel truck particularly the uneven road softened due to presence of a paddy-field.



Roadside Embankment (left side)



Rest Position Partly on Paddy-field

Figure 3-16: Unsafe Roadside Slope-Roadside Embankment

Injury to the Bus Occupants

There were 36 passengers sitting on the bus. Out of the total, two (females) were reported to be seriously injured and the rest of them slightly injured. The source of injuries of the occupants was the interior of the bus: broken glass, seat, armrest etc. Seat belts designed to hold the occupants in place against harmful movements can help significantly reduce this kind of injuries.

Significant Factor

Thailand Accident Research Center determined that the probable cause of the 060816-01 crash was the lack of attention of the bus driver in his attempt to overtake the lead vehicle in straight traffic. He could have chosen to decelerate and manage to overtake later with a proper gap. The crash severity was raised up by unsafe roadside, causing the vehicles to roll over. In addition, the lack of occupants' restraint system inside the bus also contributed to injuries among the road crash victims.