

Case ID: 080126-01

Accident Narrative

The bus with 37 passengers started the trip from Sam Koak, Pathumthani (A) at about 21:00 on 25 January 2008. They planned to visit a funeral ceremony of a famous monk in Sanklaburi, Kanchanaburi (**Figure 3-1**). After arriving Thongphaphum (B) at 02:00, they decided to stop and sleep at the gas station, and started the trip again at 05:00.

However, at about 07:15 on 26 January 2008 the bus lost control at km. 66+400 on Highway No. 323, Sangklaburi, Kanchanaburi. It hit concrete barrier and land to the gravel ground. In total, 8 persons were found instantly dead, 2 persons died on the way to hospital, and another 3 persons died at the hospitals.

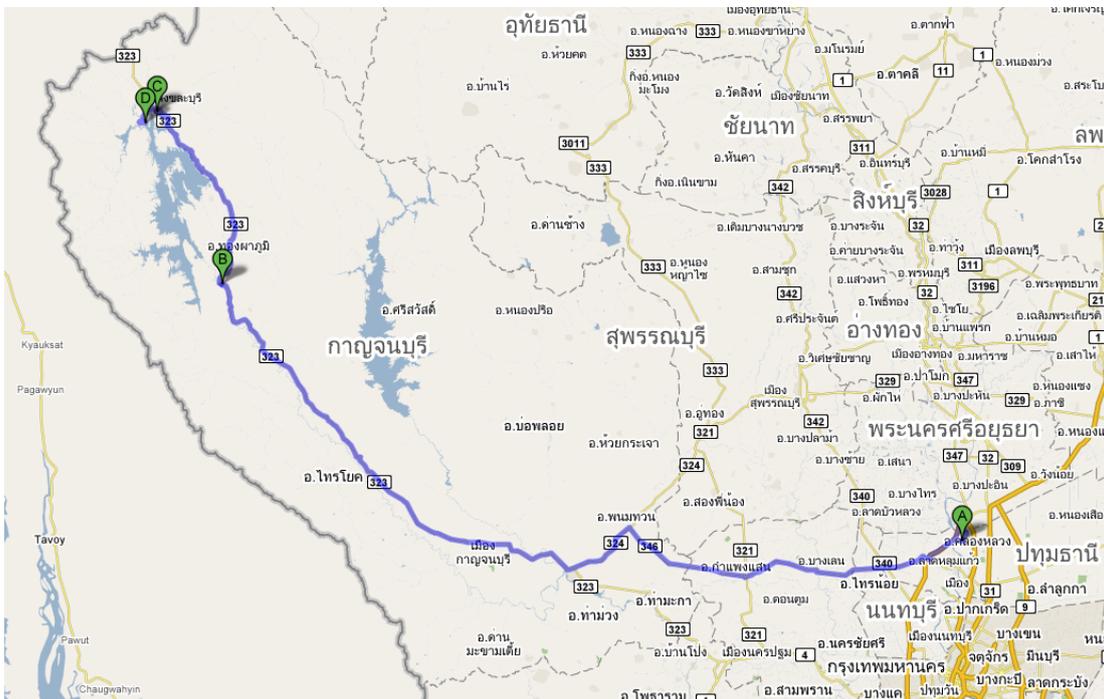


Figure 3-1: Bus Route

The road section at km. 65+000 is the mountainous area (Before point C in **Figure 3-2**). The driver applied the first gear on the uphill section and change to the second gear on the downhill. At that time, he decided to overtake the slower truck in front but it was not success since there is a set of concrete barriers protecting vehicle overtaking at that area. The bus then collide the truck at its rear because the bus driver could not slow it down.



Figure 3-2: Mountainous Section at Sangklaburi

The truck stopped on the left trying to have some conversation with the bus driver. Some passenger said the truck driver waved his hand guiding the bus entering the emergency ramp. However the driver found the problem of braking system. His wife got out from the bus with a big piece of wood obstructing the bus at the front wheel but it was too small. The bus then moved without turn the engine on to the steep slope about 300 m. The bus hit the concrete barrier at km. 66+310 (**Figure 3-3**) making it rollover and stopped at about 23.5 m further.

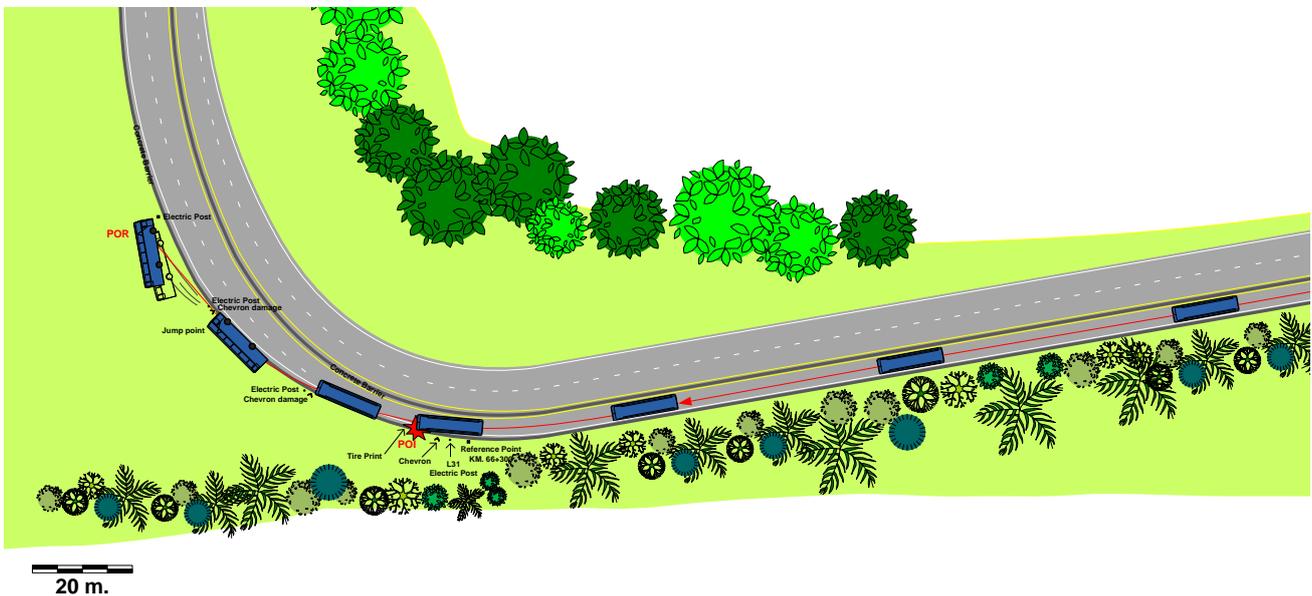


Figure 3-3: Collision Diagram

Vehicle Information

A six-wheel bus equipped with Nissan Turbo engine, 6-cylinder and 285 hp. The body color is blue-yellow. The bus dimensions were 3.68 m high, 12 m long, and 2.40 m wide. The wheel base is 6.20 m. All of the dimension details are shown in **Figure 3-4**.

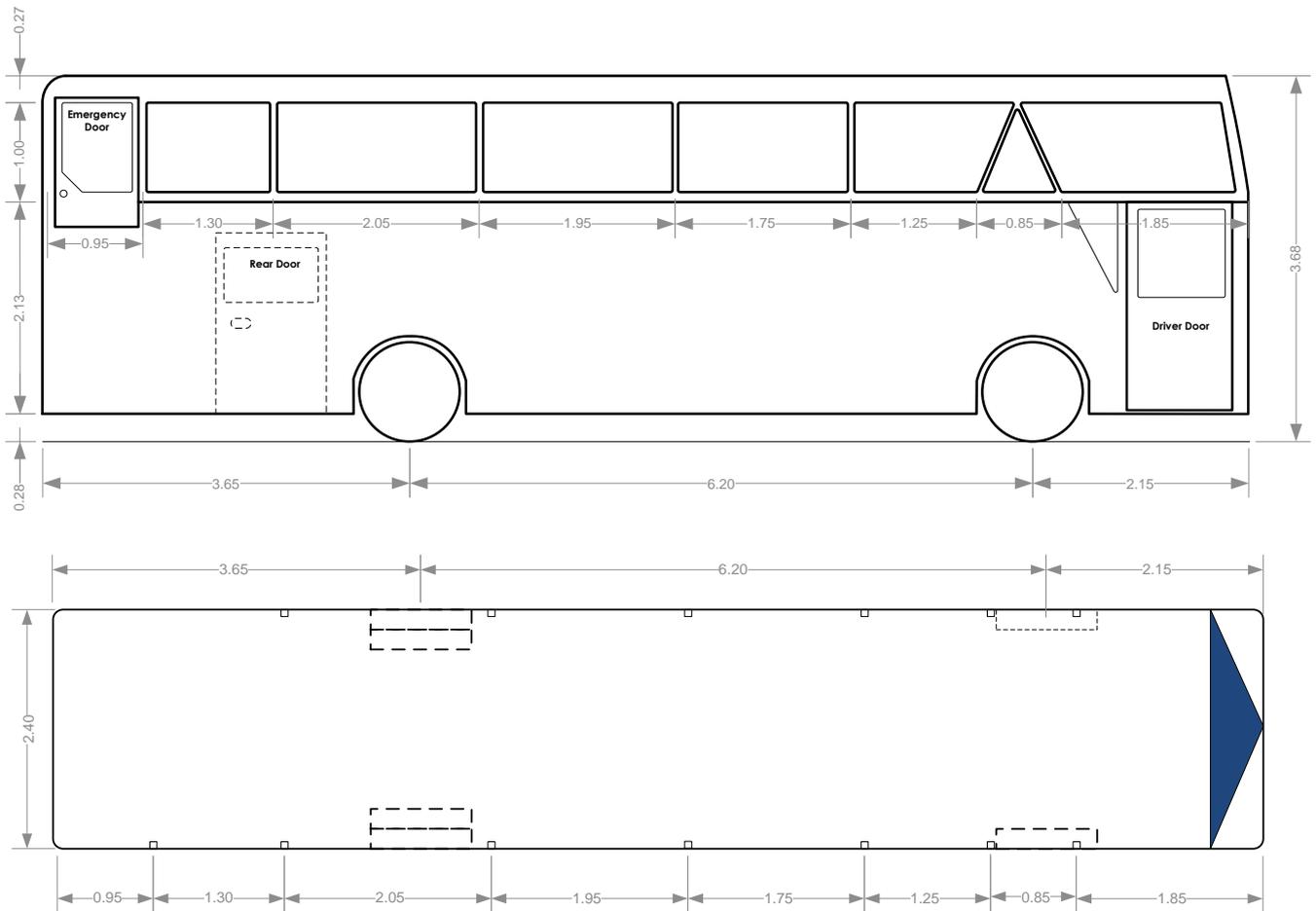


Figure 3-4: Bus Dimension

In total, there are 45 seats available on this bus. The seating configuration consists of 10 rows with 19 set of passenger seats. The eleventh rows comprises of five seats connected to each other. The seating pad was measured 0.46 m high from the walkway. The entire seats equipped to the bus body by a set of 4 bolts (**Figure 3-7**). There are seatbelts installed at the first row but they were fastened behind the seats (**Figure 3-8**).

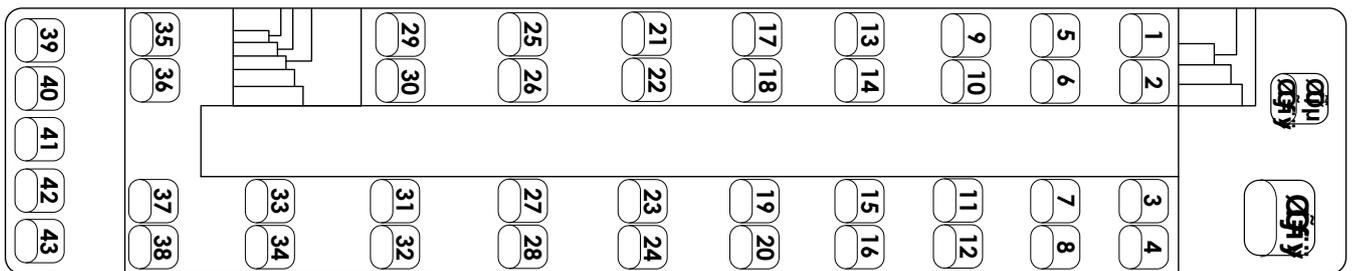


Figure 3-5: Seating Configuration

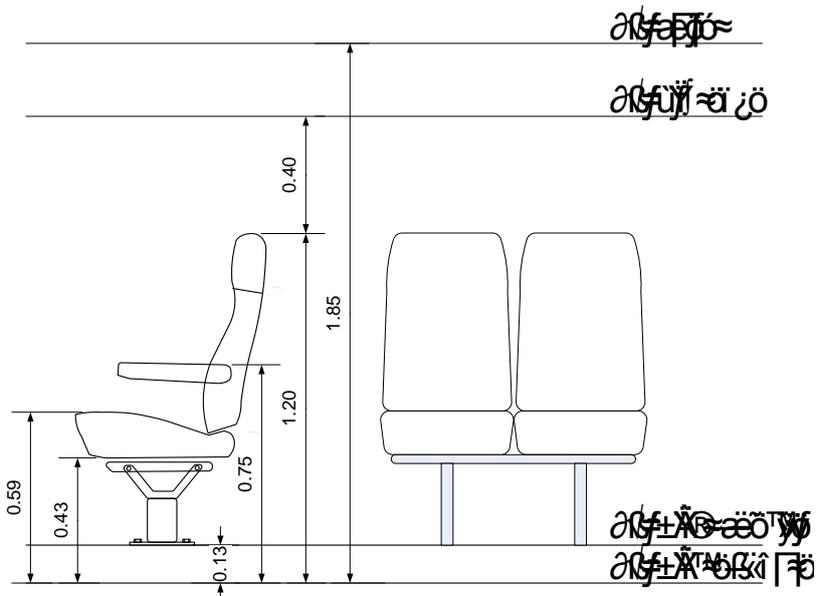


Figure 3-6: Seating Dimension



Figure 3-7: Seats Installation



Figure 3-8: Seatbelts

The suspension and brake system were inspected by the Department of Land Transport. The findings are summarized as follows;

1. Brake pads were in good condition. The thickness was about 6-9 mm for front wheels, and 12 mm for the rear wheels. The brake system was damaged during the collision
2. All tires were in good condition
3. Steering rod is good
4. Gear box is good

Wreckage

The mark printed by the concrete barrier is located about 1.30 – 1.40 m high (**Figure 3-9**). The bus was damaged on its left by the scratch marks during landing, located about 1.60 – 2.00 m high. The moving angle was measured 23 degree (**Figure 3-10**).



Figure 3-9: Damage Pattern



Figure 3-10: Scratch Marks

The windshield was separated from original position. At the height of 0.30 in the front, there is an intrusion made by the impact force with the concrete barrier (**Figure 3-11 and Figure 3-12**). However, it is lower than the barrier height because the bus was lifting during the time of impact.



Figure 3-11: The Front of the Bus



Figure 3-12: An Intrusion in the Front

Damage occurred when hitting the truck was located 1.40 m high from the ground, near the headlamp (**Figure 3-13**).



Figure 3-13: Damage near the Headlamp

There is no major damage on the right and rear of the bus. All of windows were separated from original position (**Figure 3-14** and **Figure 3-15**).



Figure 3-14: Bus Body on the Right



Figure 3-15: Bus Body on the Rear

The bus was pushed from the left side during landing. Therefore, the body structure was bended to the right as shown in **Figure 3-16**.

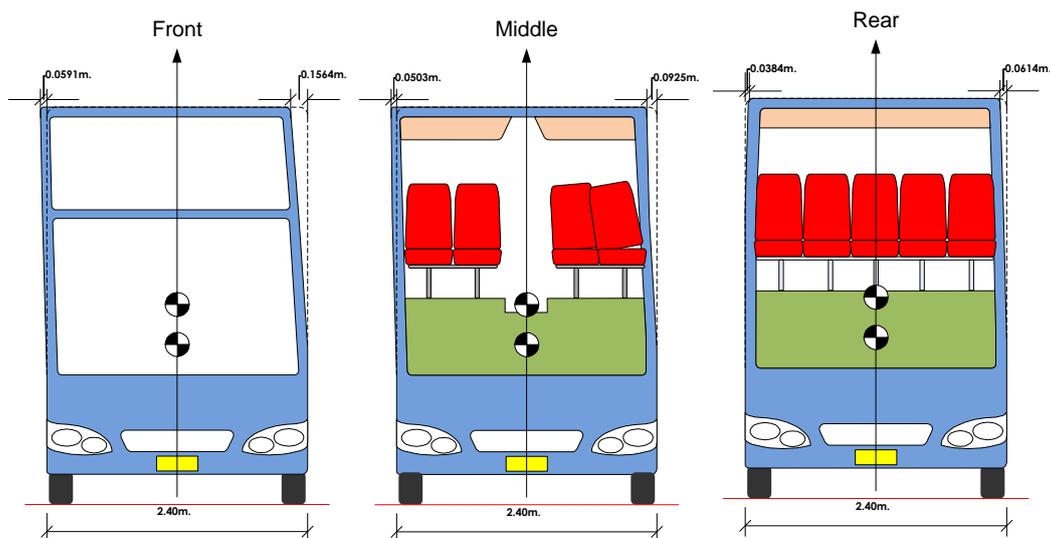


Figure 3-16: The Deformed Structure

Driver Information

The driver is 57 year old male. He was a native of Pathumthani but lived in Ratchaburi. He was granted a Driver License Class II since 23 March 1980. The existing license has been validated for the period from 26 March 2550 until 25 March 2010. He started his carrier since 1976 when he was 25 year old. He drove both fixed and non fixed routes. During the past five years, he experienced no accident record. In addition, he has owned this car for about 4 years, providing a public transportation service with about 60 km per day.

At the date before crash, he woke up at 05:00 and went to a high school in Ratchaburi at 06:00. They travelled to Chonburin for a field trip and returned to Ratchaburi about 14:00. After that, the driver went to Sam Koak to collect the passenger for this trip at about 21:00. **Figure 3-17** shows the time table of the bus driver.



Figure 3-17 The Bus Driving Hours

Highway Information

The accident occurred on Highway No. 323, connecting between Thongpaphum and Sangklaburi. The road is two-lane two-way. At the area of crash (**Figure 3-18**), the road expands to two uphill lanes with a concrete barrier installed on the lane line.

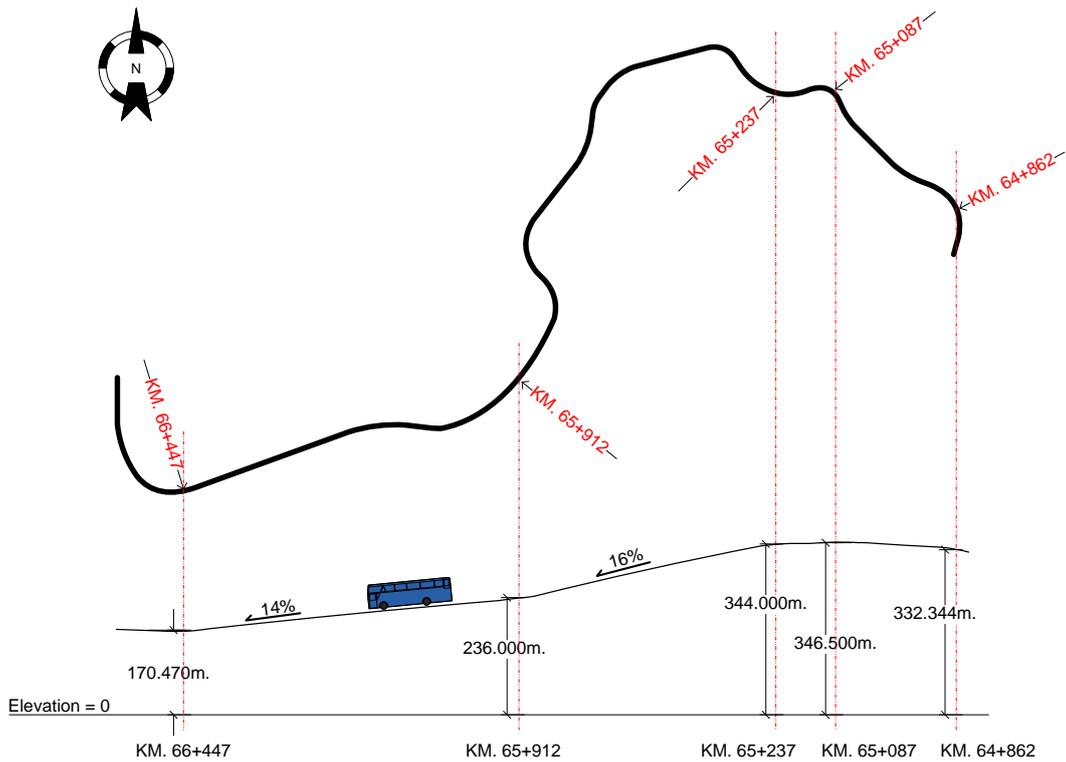


Figure 3-18: The Crash Location

Accident Statistic

Table 3-1: Accident Types

	No.
Single Vehicle Accident	67
Two or More Vehicles Accident	8
Total	75

Table 3-2: Casualties

Gender	Fatalities	Injuries
Male	17	103
Female	28	60
Total	45	163

Table 3-3: Vehicles Involved

Vehicle	No.
Passenger Car	15
Pickup	20
Minibus	1
Small Truck	16
Bus	7
Heavy Truck	16
Trailer	4
Other	7
Total	86

Emergency Exit

At km. 66+000, there is an emergency exit (**Figure 3-19**) allowed malfunction vehicle to reduce the speed and stop safely at the top of the exit.



Figure 3-19: Emergency Exit

A grade of carriage way between km 66+000 and 66+330 was measured 14% downhill, connected with a sharp curve with 57 m curve radius. A superelevation rate is 0.05 m/m and increase to 6.5% uphill grade after leaving the curve. The concrete barrier type I with 0.81 m high is installed along the curve (**Figure 3-20**).

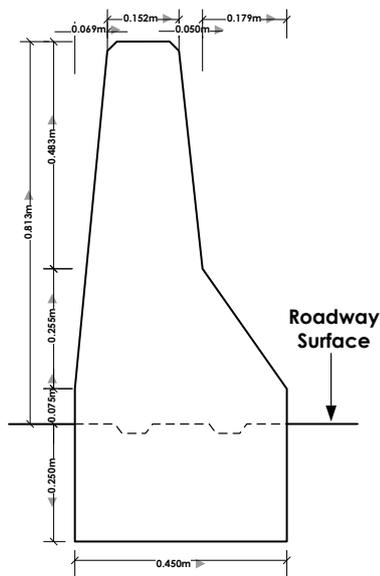


Figure 3-20: Concrete Barrier

A set of traffic control is installed prior to approach the curve (Figure 3-21 and Figure 3-22). They include;

- Warning sign "Use Low Gear"
- Message sign "Use First Gear"
- Warning sign "Sharp Curve, reduce speed"
- Warning chevron sign
- Delineator on the top of barrier
- Flashing yellow light
- Lighting System



Figure 3-21: Traffic Warning Signs



Figure 3-22: Treatment

Physical Evidences

After closely examine the crash scene, there is evidences showing near the point of impact as (Figure 3-23) as follows;

- POI is located 10.3 m further from the kilometer post 66+300. The bus's body color printed on the concrete barrier, making damages on its top. There was a tire mark printed on the barrier at the next 2.4 m. (Figure 3-24)
- The bus started lost control and left the scratch marks 21.7 m from Point of Impact. The chevron warning sign and electric post were damages. (Figure 3-25)
- The bus starting rollover and falling from the barrier 44.5 m measured from the POI. It hit another electric post and slide on the ground 52.2 m. (Figure 3-26)
- The bus stopped near the sandy mound, measure 23.5 m from the landing point. (Figure 3-27)

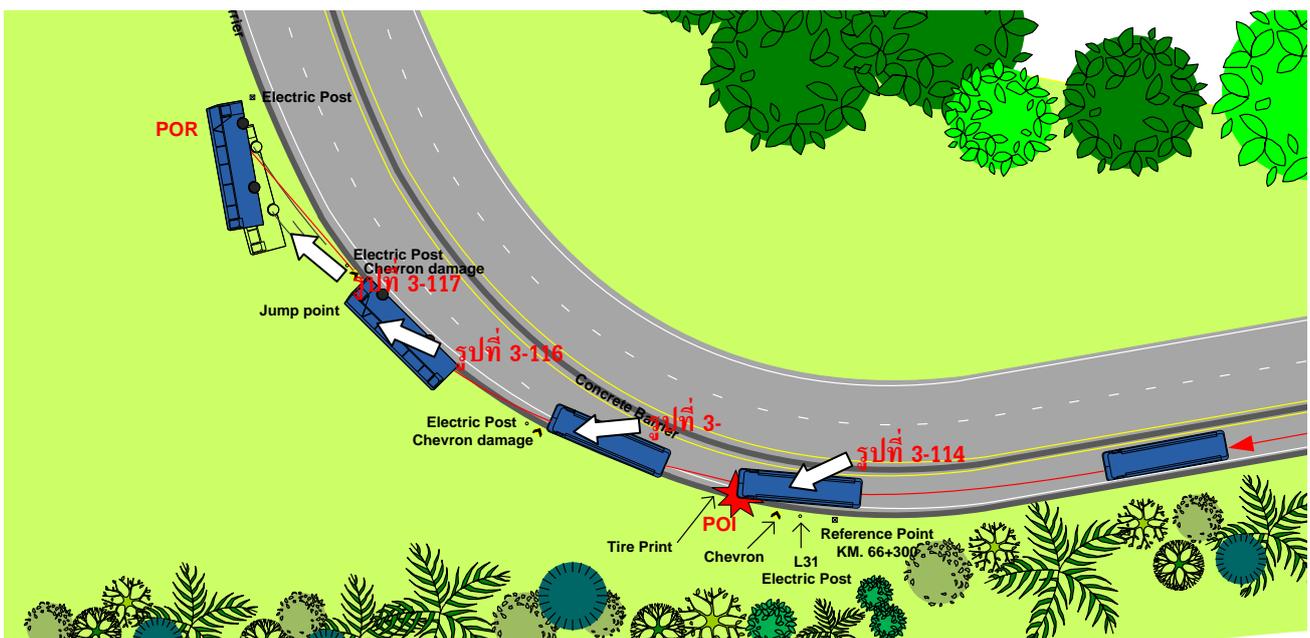


Figure 3-23: Physical Evidences



Figure 3-24: Point of Impact



Figure 3-25: The damages of Chevron Sign and Electric Post



Figure 3-26: Landing Point



Figure 3-27: Point of Rest
(Courtesy of Police Col. Panlan Pathomponwiwat)

Injury Information

In total of 37 occupants, there were 13 fatalities, 8 serious injuries, and 15 slight injuries. **Figure 3-28** presents the seating position identified by level of injuries.

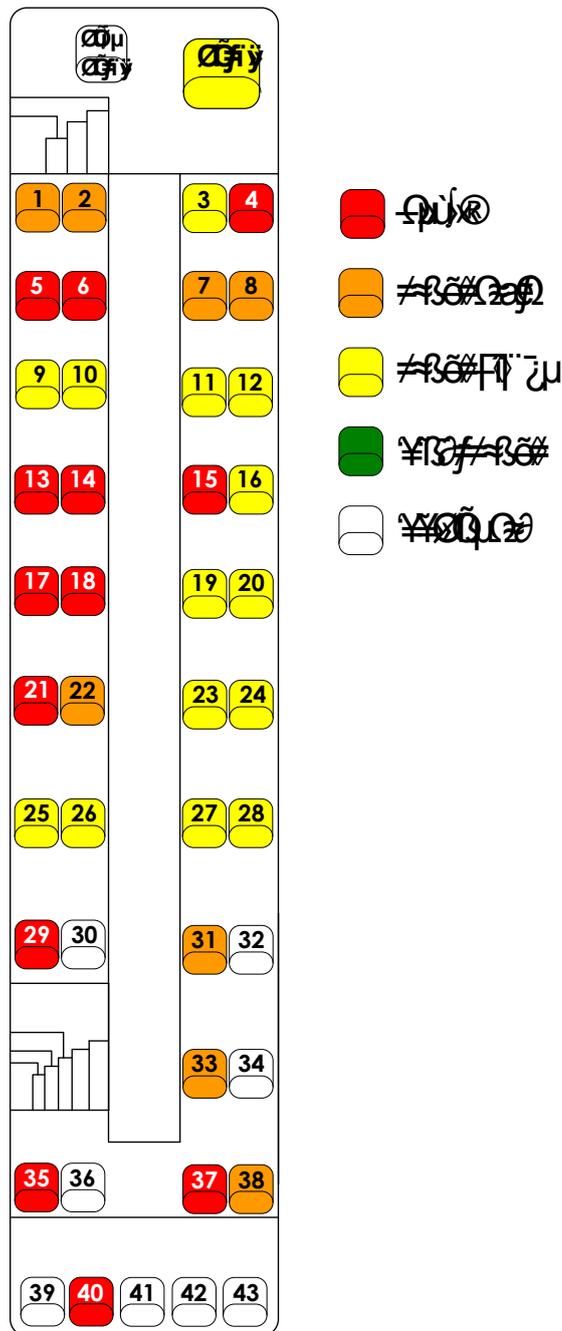


Figure 3-28: Seating Position by Level of Injuries

Accident Contributing Factors

Driving Downhill

This road section connected between Thongpaphum and Sangklaburi is routed at the mountainous section more than 60 km in length. At km 65+000 at the top of the hill the terrain change to negative 16% grade for 1 km and reduce to 14% before arriving the crash scene. TARC evaluated the traffic speed profile at three locations which are 1) km. 65+000 at the top of the hill 2) km. 66+000 at the emergency exit and 3) km. 66+400 at the crash scene. The mode of transportation was separated for motorcycle, car, and heavy vehicle. However, during the time of doing the survey there were no passenger cars and buses. The result is shown in **Figure 3-29**.

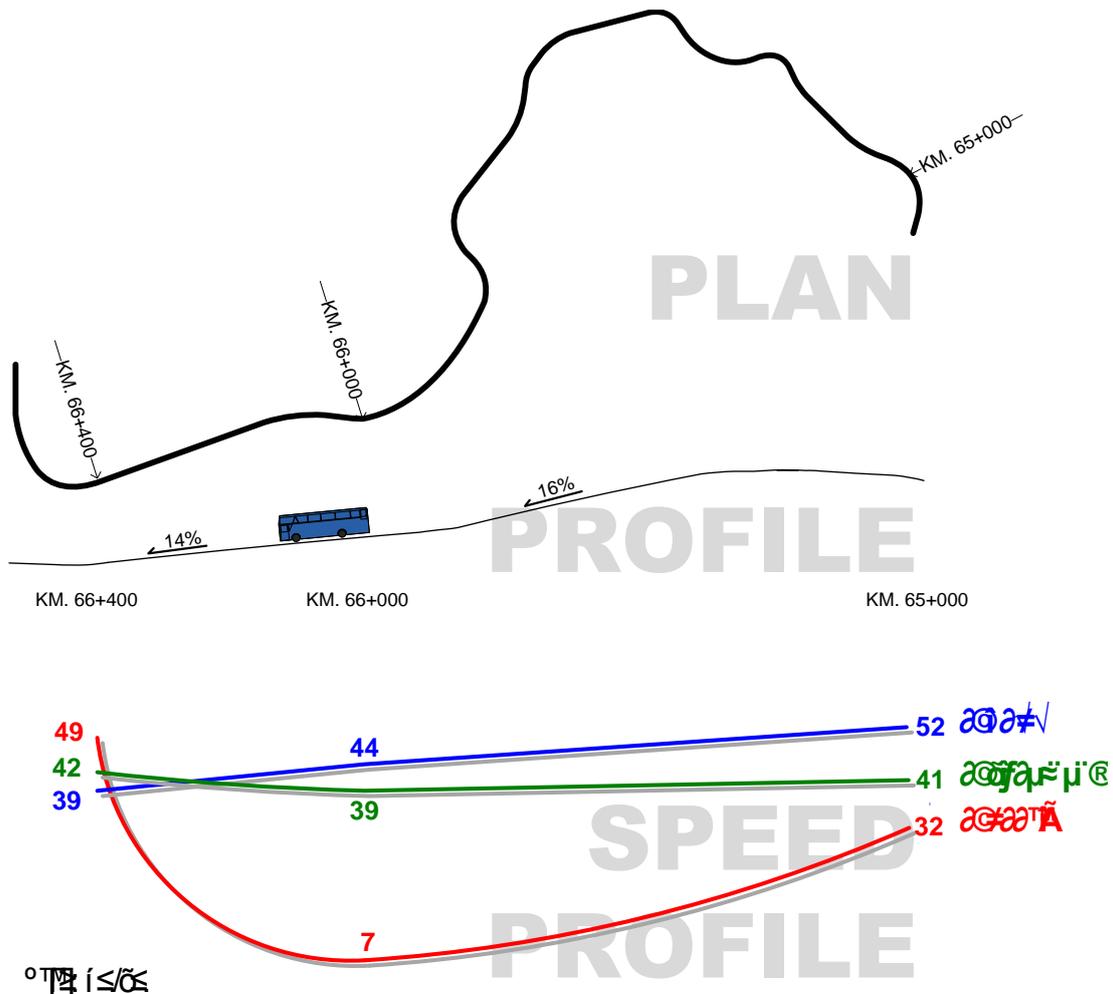


Figure 3-29: Speed Profile

There is a big different of the driving behavior between small vehicles and heavy vehicles. The motorcycle and pickup maintained the relatively same speed entire road section, from 41 km/hr to 42 km/hr for the motorcycles and from 52 km/hr to 39 km/hr for the pickups. However, the truck reduced the speed as low as possible. There were only 7 km/hr driving on 14% grade downhill with a low driving gear. They then started to accelerate after approaching the curve which can be reached to 49 km/hr. This survey has shown that the truck drivers understand well how to drive on this road section. It is unsafe to drive with a high speed without the support of engine brake.

Unsafe Driving Behavior

The bus could not reduce the speed as the same as in front truck and tried to overtaking at this prohibited section. It was found that the braking system was malfunction after the bus passed through the truck. However, instead of using the emergency exit as recommend by the truck driver, the driver asked his wife to stop the bus by use a piece of wood obstructed the front wheel. However, it was not success, causing the bus ran freely into the curve. Moreover, it was found from the mechanical inspection that the driving gear was in the position of third gear.

Crash Incompatibility

The impact speed of the bus was calculated to be 73 km/hr with a marginal impact angle. It was reduced to 55 km/hr at the landing point. This impact speed is below the threshold of barrier crash test mentioned in NCHRP Report 350. However, the different between the bus dimension and barrier height is not compatible causing the bus rolling over the barrier.

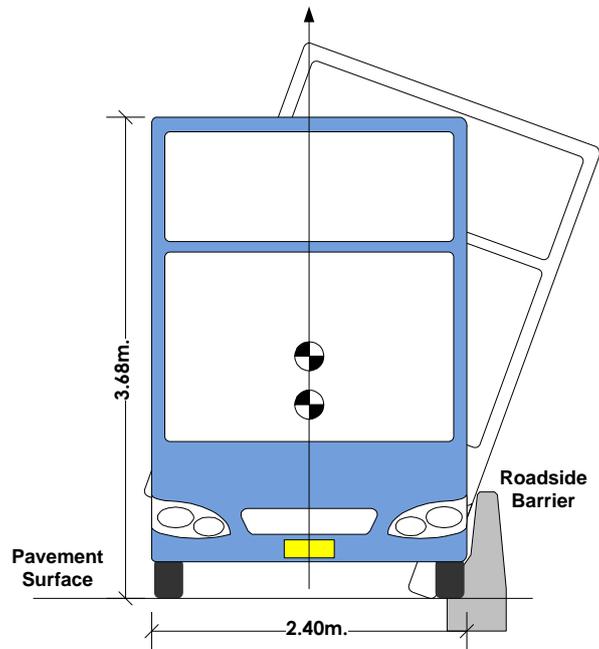


Figure 3-30: Incompatibility between Bus and Concrete Barrier

Restraint System

Four passengers were reported ejecting from the bus and found dead underneath the wreckage bus. All passengers revealed not use the seatbelt. However, there is only 4 seatbelts available on the front row but there were fasten behind the seats