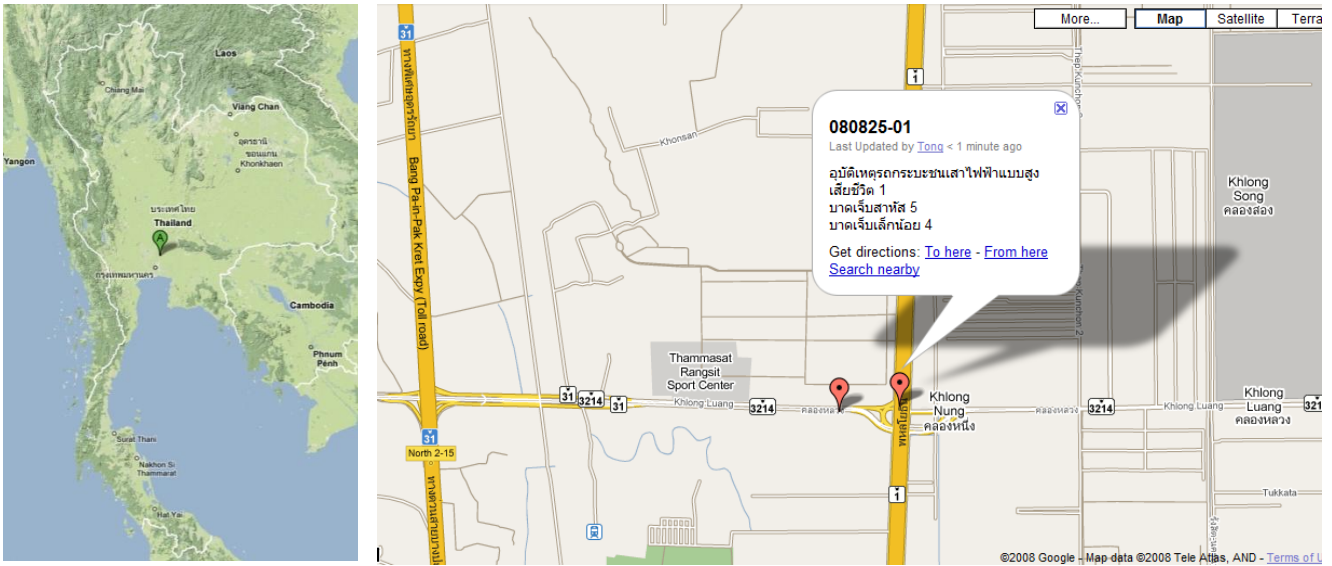


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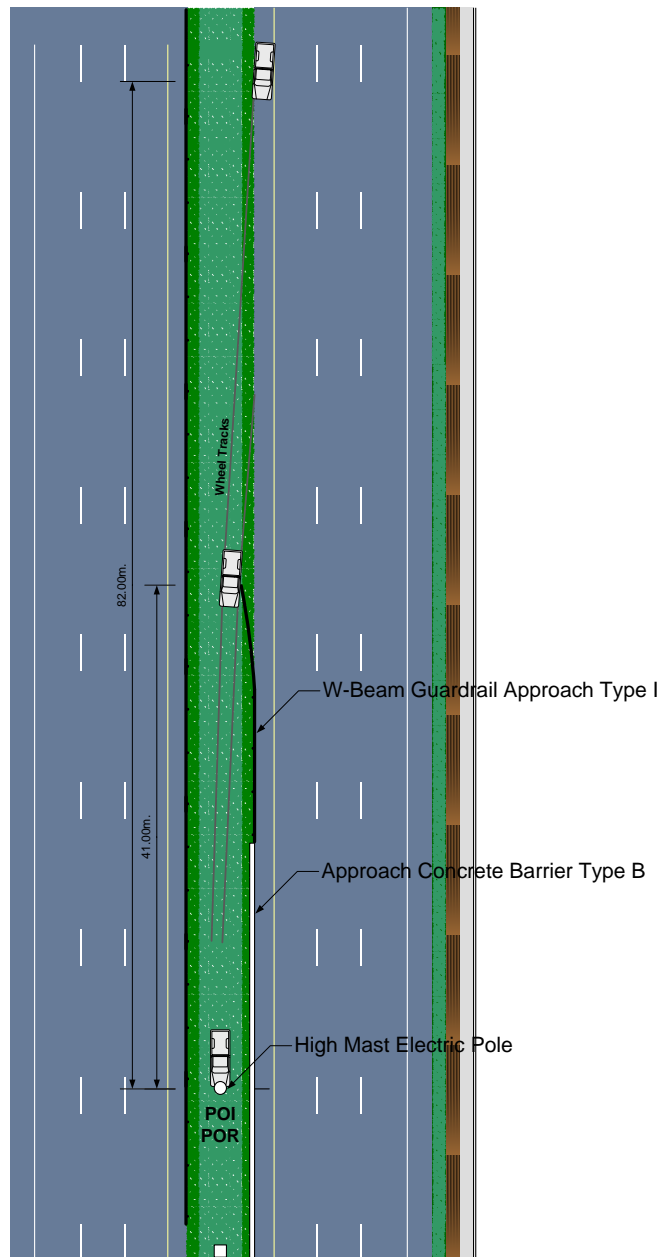
## Accident Narrative

At about 21:00 AM on 24 August 2008, a pickup with 10 occupants started the trip from Burrirum, heading to Bangkok. In the early morning at about 5:00, while travelling on Highway No.1, a ten-lane highway with frontage roads, at KM.40+500 in front of Thammasat University, the pickup left the roadway on the right side of the road and fell into a depressed median. It moved straight continuously and directly hit a high mast electric pole with its front.



**Figure 3-1: Location of Crash Site Highway No. 1 KM. 40+500**

The depressed median is shielded by a guardrail and a concrete barrier. However, the pickup fell into a space between two sets of guardrails. From 10 occupants in total, one person was found dead while 5 experienced serious injuries and another 4 sustained slight injuries. According to witnesses, the fatality was located at the pickup bed. The victims were treated at Thammasat University and Phatara Thonburi Hospitals.



**Figure 3-2: Schematic of Accident Scene**

## Vehicle Information

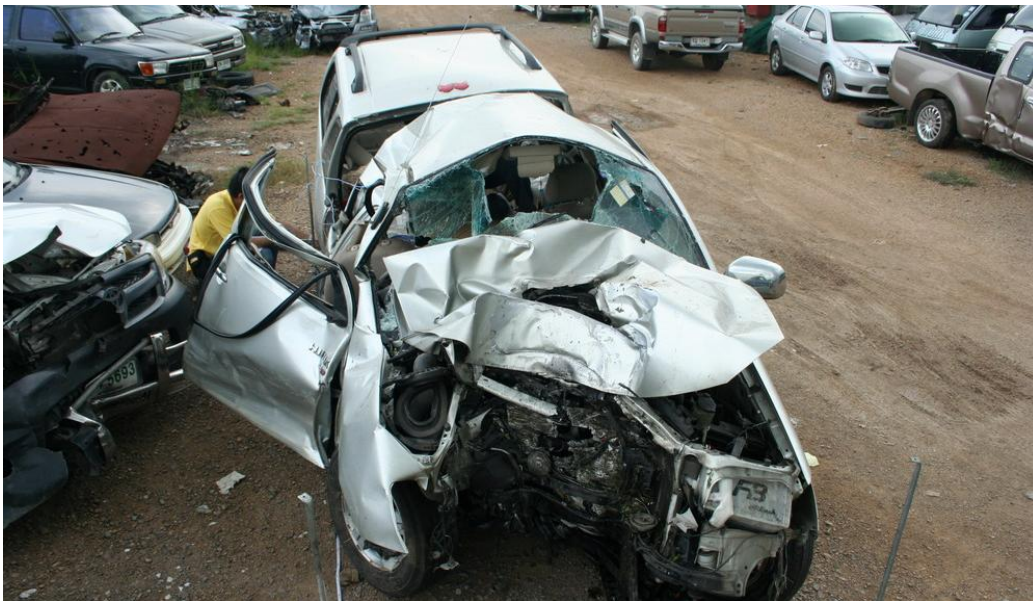
The pickup was a 3,000 CC. Toyota Hilux Vigo extended cab pickup. It was equipped with a 4 cylinders and 16 valves diesel engine with 5-speed manual transmissions, and rear-wheel drive. It was also equipped with disk brakes on the front and drum brakes on the rear axles. The dimensions of the pickup are presented in **Table 3-1**.

**Table 3-1: Pickup Dimensions and Weight**

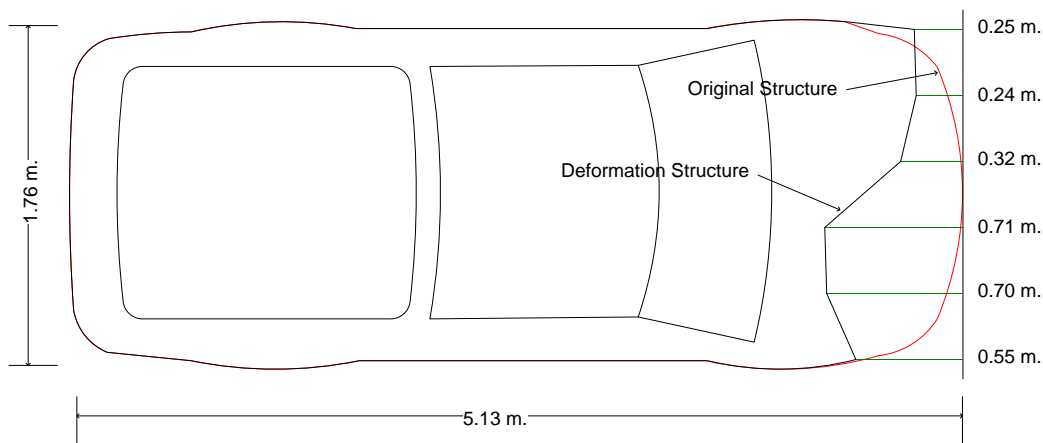
Item	
Length	5.130 m
Width	1.760 m
Height	1.680 m
Wheelbase	3.085 m
Weight	1,550 kg

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

The pickup sustained a massive frontal crush deformation (**Figure 3-3**). The front beam, boiler, engine, and hood were totally damaged. The A pillar was bent and the windshield was shattered. The crush extended into the front axle and the occupant's compartment, where the roof and driver's door were deformed. The driver's airbag was activated. However, the damage close to the extended cab on the right side occurred during an evacuation by the emergency team. TARC evaluated the Collision Deformation Coded (CDC) for the pickup as 12FZ0EW4. The detail of the documented deformation is presented in **Figure 3-4**.



**Figure 3-3: The Damage of the Pickup**



**Figure 3-4: Crush Deformation**

All the tires of the pickup were Michelin Vanpix 205/70 R15C, manufactured in the 11<sup>th</sup> and 12<sup>th</sup> week. The tread depths were 6 mm. Only the front-left tire was found damaged due to the crash. Details of the tires (post crash) are shown in **Table 3-2**.

**Table 3-2: Tires Details**

Location	Damage	Manufacture	Tire Name	Year	Size	Load Index & Speed Symbol	Tread Depth (mm)	Pressure (psi)
1L	Yes	Michelin	Vanpax	1207	205/70	R15 C	6	N/A
1R	No	Michelin	Vanpax	1207	205/70	R15 C	6	38
2L	No	Michelin	Vanpax	1207	205/70	R15 C	6	38
2R	No	Michelin	Vanpax	1107	205/70	R15 C	6	20

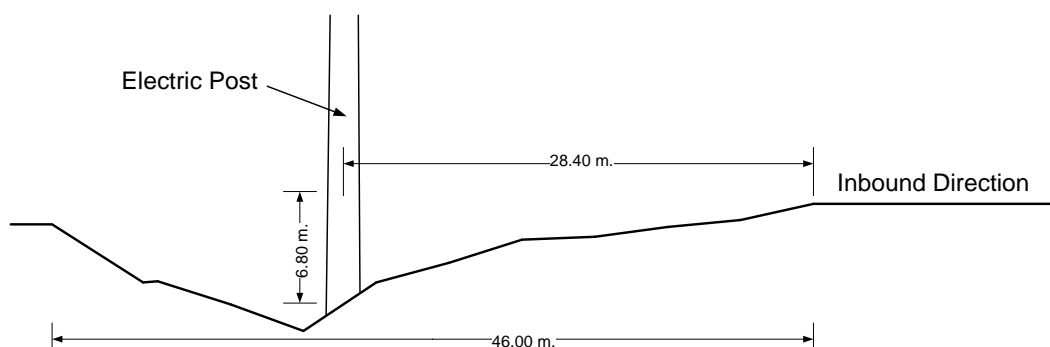
## Highway Information

The crash occurred on the south approach of Highway No.1 in Klong Luang, Pathumthani. It is a primary road connecting Bangkok to the Northern and Northeastern parts of Thailand. It starts at Victory Monument in Bangkok, runs through the province of Pathumthani, Ayutthaya, Saraburi, Lopburi, Nakhon Sawan, Chainat, again Nakhonsawan, Kamphaeng Phet, Tak, Lampang, Phayao and ends in Mae Sai district of Chiang Rai. The total length of the road is approximately 1,005 km.

In the area of the crash, the road is a ten-lane divided road with frontage. There are 3.6 m three-lane on the main road and two-lane on the frontage road with a 2.7 m outer shoulder and a 2.4 m inner shoulder in each direction. The asphalt pavement had a coefficient of friction of 0.80 on the travelled lanes and shoulders.

### Depressed Median

A 5 m wide grassy depressed median separated the traffic between the two main roads. There was a set of pepper flower planted about 1.0 m from the road. The cross section of the median is shown in **Figure 3-5**. The deepest is 1.1 m located 3.5 m from the road edge. The side slope of the median on the south approach is 5:1.



**Figure 3-5: Median Cross Section in the Area of Crash.**

### High Mast

25 m. tall steel high mast lightings are installed every 100 m. starting from Pratunam Pra-In. The circumference of the pole measured about 1.8 m. from the ground and was 1.47 m. or equal to 23.40 cm. in radius. The pole was still in position after the crash. However, it was massively deformed by the impact force from the pickup and needed to be uninstalled by the Pathumthani Highway sub district to prevent it from collapsing.



**Figure 3-6: High Mast Lighting after Crash**

### **Barrier**

In the area of the crash, the high mast was shielded by a 20 m. W-Beam guardrail approach type I (**Figure 3-7**) installed on the south approach. Especially at KM. 40+500, the approach concrete barrier type B, 20 m. in length, was also installed to protect the pedestrian bridge pole.



**Figure 3-7: Roadside Barrier**

## Physical Evidence

The wheel tracks were clearly found in this crash. The starting point of the wheel tracks, measured 82 m. from the high mast, represents where the vehicle started leaving the road. Two pepper flowers were detached. The wheel tracks on the depressed median were also clearly seen until stopping at the high mast lighting. No other marks or evidences were found on the road.

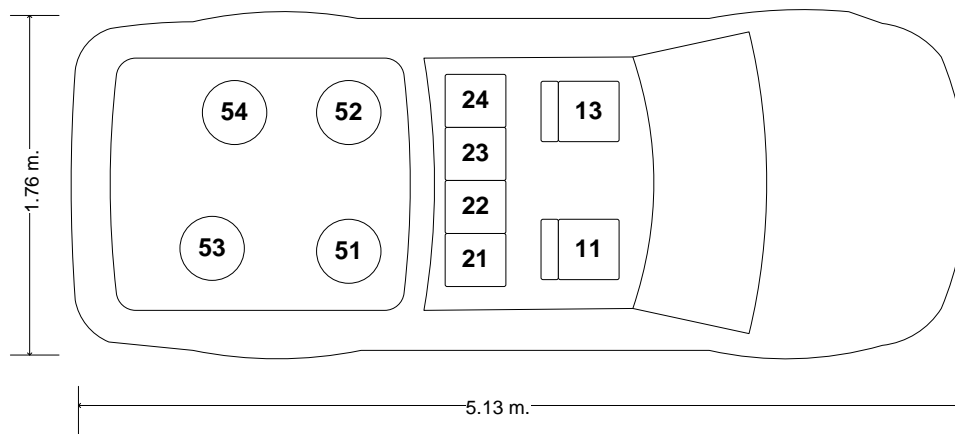
After close examination, it was found that the pickup had not hit any protection equipments, i.e. guardrail or concrete barrier. Besides, the left wheel track was just less than one meter away from the beginning of the guardrail approach (**Figure 3-8**).



**Figure 3-8: Wheel Track**

## Injury Information

There were 10 occupants on board at the time of the crash. In the occupants' compartment four passengers were sitting on the bench seats in the extended cab. Combined with the driver and front passenger; there were 6 people in this compartment. 4 more persons were on the pickup's bed. The fatality, a 23 years old male, was reported sitting on the right side of the pickup. He was ejected from the pickup and suffered a serious head injury and rib fractures. The detail is shown in **Table 3-3**.



**Figure 3-9: Occupant's Seating Position**

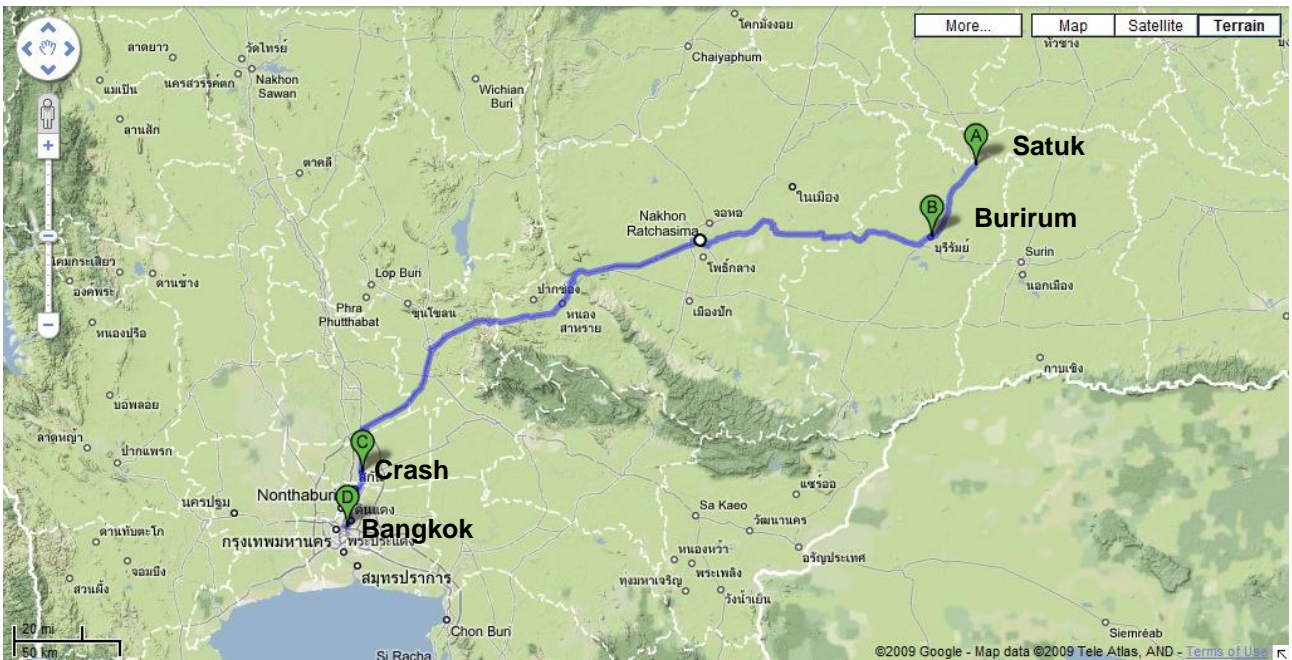
**Table 3-3: Summary of Occupant's Injuries**

Person	Gender	Age	Level of Injury	Seating Position	Seat belt	Injury
1 (Driver)	Male	22	Serious	11	Used	Superficial neck injury to the Fracture of forearm
2	Female	18	Serious	13	Used	Superficial injuries to the finger Open wound of thigh Fracture of upper arm Dislocation of neck Superficial injury to theto the face
7	Male	22	Slight	22	Not installed	Superficial injury to theto the upper limb Injuries to the lower limb Superficial injury to theto the cheek
5	Female	23	Serious	24	Not installed	Superficial injuries to the finger Injury to theto the liver
3	Male	23	Fatal	51	Not installed	Traumatic hemorrhage Fracture of rib Injuries to the lung Injury to theto the liver Superficial injury to theto the neck
6	Male	23	Serious	51	Not installed	Superficial injuries to the chest Open wound of toe Tear of ligament of knee Fracture of upper end of tibia Injuries to the lung Injury to theto the liver
4	Male	N/A	Serious	N/A	Not installed	Injuries to the lung Injury to theto the liver
8	Male	18	Slight	N/A	Not installed	N/A
9	Female	26	Slight	N/A	Not installed	N/A
10	Male	36	Slight	N/A	Not installed	N/A

## Accident Contributing Factors

### Long Hour Driving

The trip started in Satuk, Burirum (A) at about 21:00 on 24 August 2008. They first stopped at Muang, Burirum (B) about 40 km. from the origin. During the long trip to the destination, some passenger mentioned they stopped at several gas stations. The crash occurred in the early morning at about 05:00 on 25 August 2008, at Highway No.1 KM.40+500 (C) at a distance of about 390 km from the origin. **Figure 3-10** shows the travelled route prior to the crash.



**Figure 3-10: Traveled Route**

**Left the Roadway**

Starting from Wang Noi interchange at KM. 66+000, there is only one long radius curve on the Bang Pa-In interchange at KM. 52+000. Meaning that this widen road section is more than 12 km. in length without being interrupted by any geometric changes. Likewise, according to scene documentation, there were no marks or evidences on the pavement showing the movement of the vehicle prior to leaving the roadway. According to victims, there was influence from other vehicles involved in the crash.



**Figure 3-11: Long Straight Road Section on Highway No.1**



### Barrier

The pickup left the road without hitting the roadside protection. The w-beam guardrail approach was installed 20 m. from the targeted object, the high mast lighting. With the total length of 21 m., the run out length of the barrier is 41 m. In this crash however, the pickup left the roadway 81 m. before the high mast lighting, causing the frontal impact as mentioned. While the question has been raised for the length of barrier, normal w-beam guardrails are installed continuously on the opposite direction.

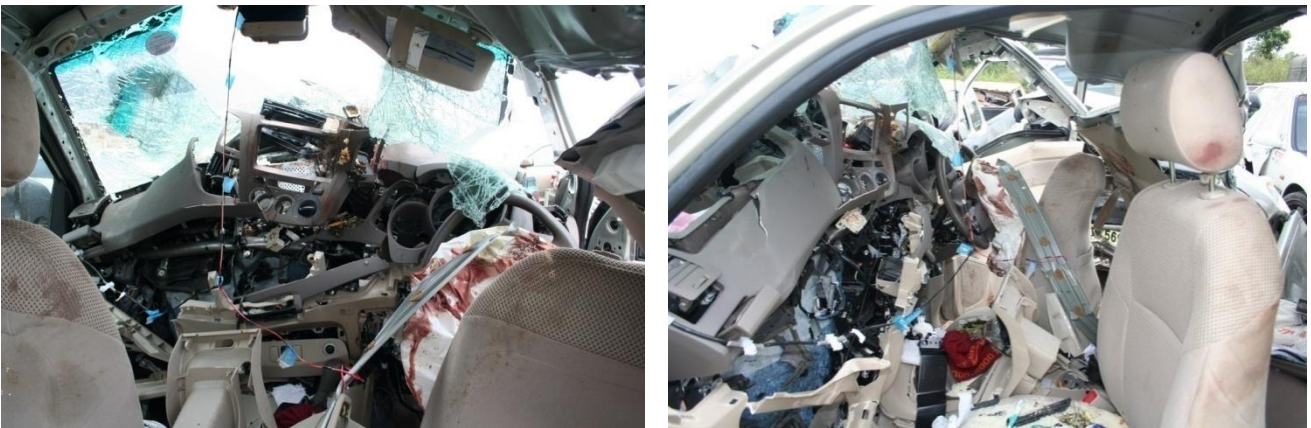
### Speed Estimation

Crush energy analysis is used to determine the pickup speed in this crash. The frontal impact crash test for the 1999 Toyota pickup is selected. The crash test from the National Highway Traffic Safety Administration is derived by Visual Statement. The stiffness coefficient A and B equal 69,295 N/m and 979,159 N/m<sup>2</sup>, respectively. Considered the crash as a full frontal impact, finally, the equivalent barrier speed of the pickup was found to be 50 km/h.

### Occupants' Injuries

Only two occupants, the driver and front passenger, used the seatbelt, according to victims' statement. Other occupants, including the four on the extended cab and the four on the pickup's bed were sitting in positions where no seatbelt were installed. The deceased was reported sitting on the front right of the pickup's bed, suffered traumatic hemorrhage, fracture of the ribs, injuries to the lungs and injuries to the liver, according to hospital report.

Another four occupants suffered serious injuries, including the driver and front passenger. The driver suffered superficial injuries to the neck and fracture of the forearm while the front passenger suffered superficial injuries to the finger, open wound on the thigh, a fracture of the upper arm and dislocation of neck. It is clearly seen that the deployed driver's airbag was bloody and bunched hair was fasten near the music player. **Figure 3-12** presents the intruded damages of pickup console.



**Figure 3-12: Damaged Console**

### Significant Factors

TARC determined that the probable cause of the 080825-01 crash occurrence was the drowsiness of the driver after long hours of driving on the long straight road section as supported by the mentioned evidences. The crash consequences were increased by the high traveling speed and the lack of sufficient roadside protection system. Sitting in positions without any safety protection also increased the level of injuries to the occupants in the extended cab and pickup's bed.