

Case ID: 051117-01

Accident Narrative

On 17 November 2005, in the very late night of the “Loy Kra Tong” festival, a passenger car hit four pedestrians and later hit the sign post on Highway No.3214 at KM.4+500, near the Thammasat University. Four persons were reported to be fatally injured and two other were seriously wounded. The injured persons were admitted to Thammasat hospital.

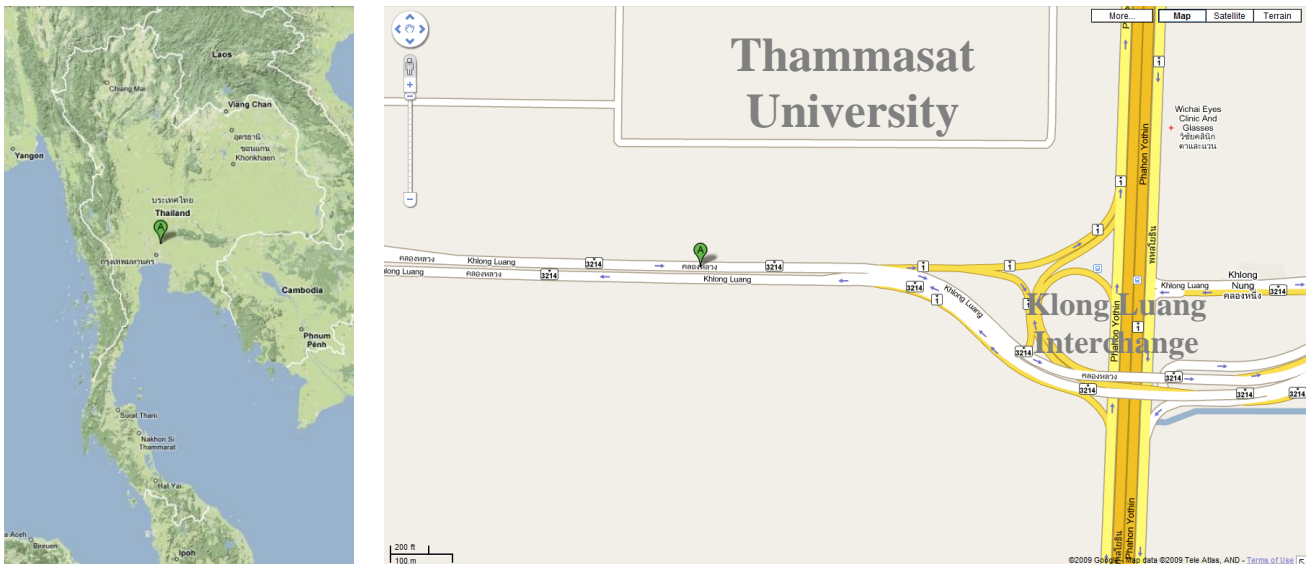


Figure 3-1: Crash Location

After picking up the passenger at around 4:15, the journey started. The female driver and her passenger agreed to settle their misunderstandings related to their friendship inside the car. She was driving very fast as the passenger claimed, in the inner lane of Highway No. 3214. Suddenly, she swerved into the left side and hit four pedestrians. Later the car was found struck with the post of the overhead directional sign with its right side of the passenger compartment. Three pedestrians and driver were killed instantly and the passenger and one pedestrian suffered serious injuries.

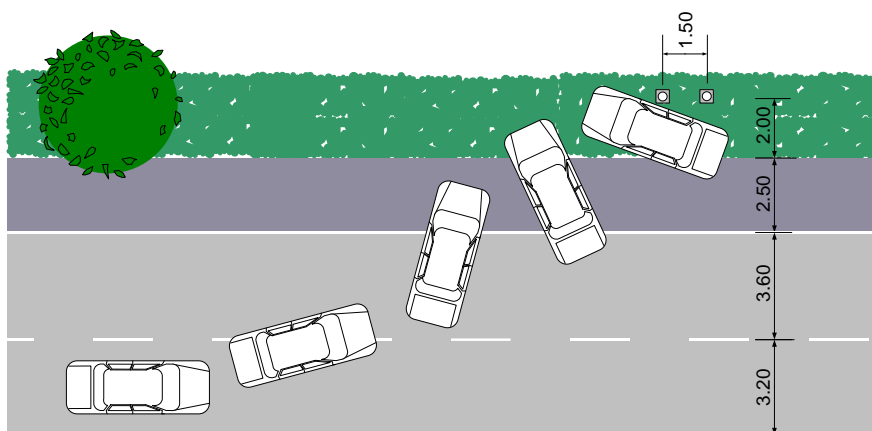


Figure 3-2: Schematic of the Crash

Vehicle Information

The passenger car was a sedan Honda Civic Dimension, 2000 cc. patrol engine with a 4-speed automatic transmission and front wheel drive. It was bronze in color. The original dimensions were 1.72 m. wide, 4.45 m. long, and 1.44 m. high. The original wheels were modified, but the spare tire was mounted on the rear right wheel. The vehicle was designed for two bucket seats for both the driver and the front passenger. Both seats were equipped with lap-shoulder belts.

Damages

The right part of the passenger compartment directly struck with the concrete foundation and steel member of the sign post. The marks on the steel member which struck with the A-pillar of vehicle were measured at 1.90 m. and near the C-pillar 1.75 m. high from the ground. This satisfactorily matches the height of the deformation of the roof panel. The roof panel was also pushed to the left side from the impact with the steel member of the post.

The width of direct damage along the passenger compartment was measured to be 1.89 m. However, the center-to-center spacing of the concrete foundation was 1.50 m. Moreover, the induced damage was measured to be 2.88 m. long.

The space of the driver's position was compressed from the right side impact from the combined effect of the concrete foundation and steel member. The direct intrusion came from the right door panel being pushed inside of the compartment. The steering wheel was found to indicate a left turn and the windshield was broken.



Figure 3-3: Damages to the Passenger Car

Highway Information

Highway No.3214, 15 km. long, connected East-West corridor between Highway No.347 to Highway No.3010 in Klong Luang, Pathumthani. At KM.4+600, about 100 m. west from the Klong Luang Interchange. It was an 8-lane divided road, 3.6 m. lane wide concrete pavement and 2.5 m. wide asphaltic concrete shoulder. The coefficient of pavement friction was measured to be 0.6.

Physical Evidences

The yaw marks were printed on the road surface, starting from the inner lane extending up to the left shoulder. The chord length of the yaw mark was measured to be 28.8 m. and the middle ordinate 0.6 m. prior to the impact. The location of the pedestrians hit by the vehicle can be estimated from the vehicle movement path.

The left post of the sign post foundation was located at 2.0 m. from the edge of the left shoulder. The 40x40 cm² rigid concrete foundation had a height of 50 cm. The end to end distance of the concrete foundation was 1.90 m. The blood stain at 4.15 m. from the edge of left shoulder was found on the vegetation along the roadside indicating the rest position of the one of the deceased pedestrians. However, the traces of the other two pedestrians were also flown to 9.20 m. from the edge of the left shoulder on the marshy area along the roadside vegetation.



Figure 3-4: Evidences on Crash Scene

Pedestrians

After consuming some alcoholic drinks from the roadside bar, some group of people crossed the main road and started to walk along the shoulder. They were walking along the road to go to the apartment as one of that pedestrian group claimed. Suddenly, they were hit from the rear by the passenger car. Three of the pedestrians were found dead with serious head injury and one with a fracture in the left femur.

Injuries Information

The driver was found dead with severe head injury and the passenger received bruises along the left shoulder to the right side of the abdomen, right elbow fracture and serious injuries near the stomach region. A summary of occupants and pedestrians' injuries is shown in **Table 3-1**.

Table 3-1: Injury Summary of the Casualties

No.	Role	Sex	Age	Seating Position	Protection System	Severity
1	Driver	Female	26	Front-right	Not used	Fatal
2	Passenger	Male	21	Front-left	Not used	Serious
3	Pedestrian	Male	21	N/A	N/A	Fatal
4	Pedestrian	Male	-	N/A	N/A	Fatal
5	Pedestrian	Male	-	N/A	N/A	Fatal
6	Pedestrian	Male	19	N/A	N/A	Serious

Accident Contributing Factors

Speed Calculation

After getting the data of chord (C) and middle ordinate (M), the radius (R) of the curve can be determined to be 173.1 m. The coefficient of friction of the road surface and the shoulder measured at the scene were 0.76 and 0.72 respectively. As a result, the traveling speed at the onset of the yaw can be obtained from the speed-radius relation and found to be 129 km/h.

However, the impact speed can also be determined from the damage profile the vehicle received from the impact with the concrete foundation and the steel member. Different crush measurements, i.e. C₁, C₂, C₃, C₄, C₅ and C₆ at 37.8 cm. interval of 1.89 m. wide direct damage were taken during the investigation of the damaged vehicle. The total damage area corresponding to the direct damage was found to be 6.2 m² at the height of 0.72 m. from the ground.

Matching the wheelbase criteria to get the stiffness coefficient A and B from CRASH3 manual were found to be: A = 24,550 N/m and B = 462,549 N/m² for side impact condition. However, the impact angle equals to 30 degree was also assessed from the damage condition of the vehicle. The crush energy (E) was determined to be 88,466.39 N-m. Getting the curb weight for the model of the car, the Equivalent Barrier Speed (EBS) was found to be 140 km/h based on the crush energy analysis. The traveling speed of the vehicle was 120 – 140 km/h. Results from accident reconstruction are shown in **Figure 3-19** and **Figure 3-20**.

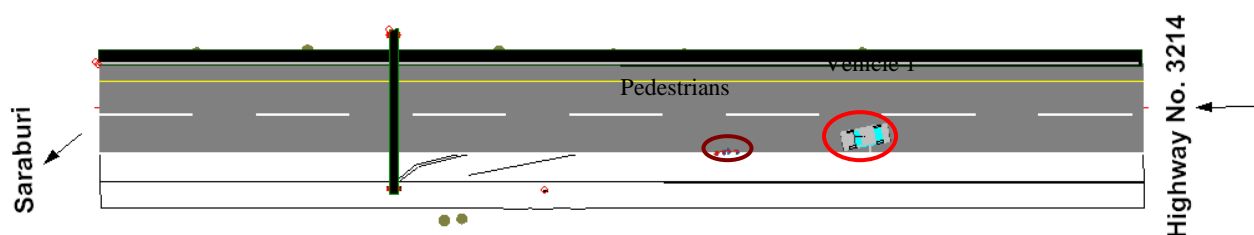
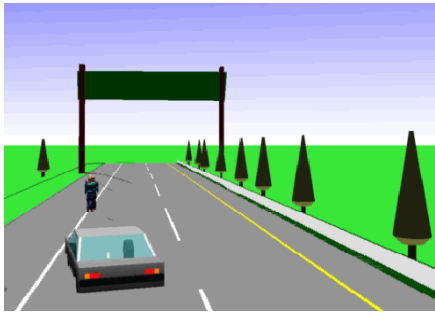
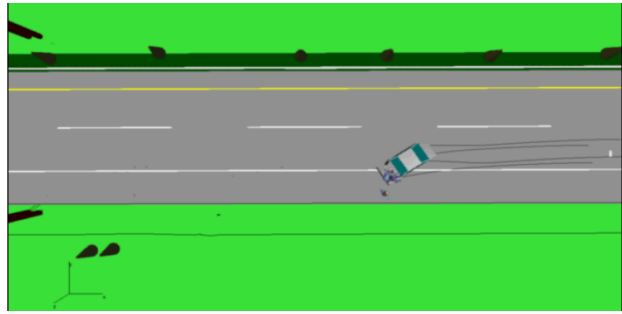
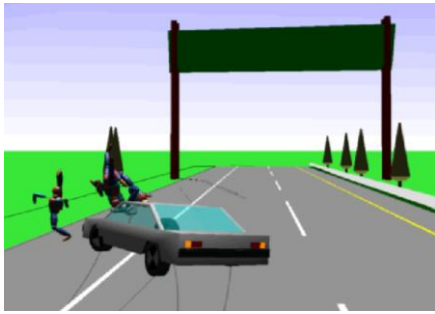


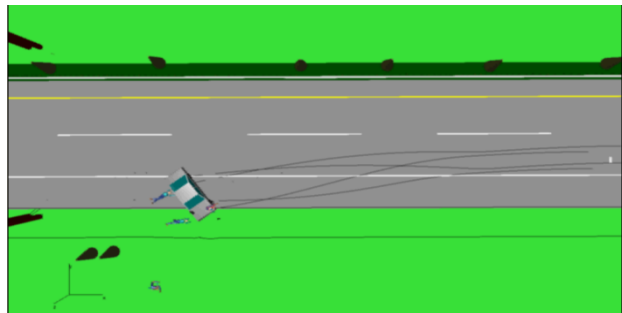
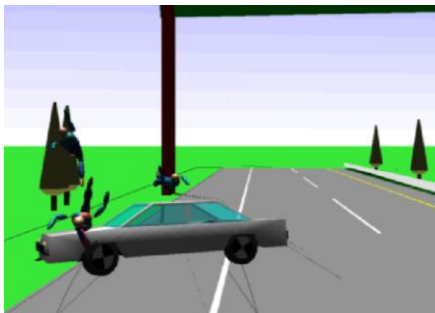
Figure 3-5: Plan View of the Crash Scene



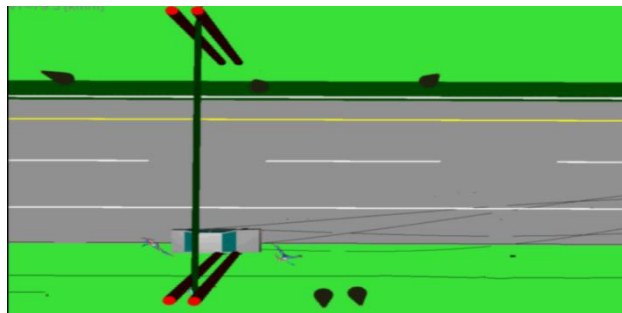
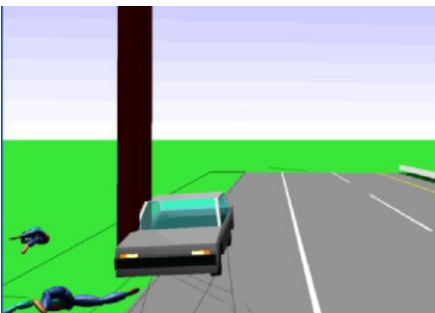
(1) Sudden Change of Direction



(2) Hitting the Pedestrians



(3) Spinning about the Vertical Axis



(4) Rest Position after hitting with Steel Post

Figure 3-6: Accident Reconstruction Simulation

Occupant Injuries

The effectiveness of vehicle safety equipments, related to this crash, is difficult to be ascertained. The team found that seatbelts were not used by both occupants. While the driver’s belt was stuck between B-pillar and driver seat, the passenger’s belt was stuck in the retractor spool during the investigation. In addition, the driver and passenger’s airbags were not deployed even though the passenger airbag cover was opened. Two sensors, located at the front bumper were in good condition.

Both the seatbelts and the airbags in the vehicle can't do much to reduce the level of injury in this side-impact collision with the post, especially for the driver. Her head hit the B-pillar (evidence found from her hair at the interior damage). The additional safety equipment can probably be considered to reduce the severity in this type of crash.

The 40x40 cm² concrete foundation, with a steel structure, double post is quite strong—without any protection surrounding this assembly. No major damage on this post was found during the investigation. The “Forgiving Highway” concept can be taken as an issue to reduce the severity of crashes; regardless what the cause of this crash is.

Significant Factors

TARC determined that the probable cause of the 051117-01 crash occurrence was the driver's inability to perform a safe maneuver at her driving speed. The severity of the crash's consequence was increased due to the lack of sufficient roadside protection system.