

# Multiple-Fatal Highway Transit Bus Collisions - The Facts No One Wants To Know

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The latest multiple-fatal, transit bus collision occurred on the AP7 highway near Freginals, Spain at approximately 0600 hours on Sunday, March 20, 2016. The bus was carrying close to 60 passengers when it reportedly struck a guardrail and another vehicle, although the order of impact is not clear. The bus eventually rolled onto its side in the median of the expressway. Initial reports indicated that 13 passengers were killed.

As typical, almost all news-gathering agencies focused on the final rest position of the bus, as if the one with the most detailed photos was entitled to some form of prize in journalism. Only one photo, apparently taken by an Associated Press photographer (name not provided) gave an overall view of the collision site as shown below.



Figure 1: View of the multiple-fatal bus crash site taken by an unidentified Associated Press photographer.

While the numbers of deaths and the identity of the deceased are important what continually occurs is that the cause of these events is not revealed nor discussed. In the present case a typical red herring was flashed before the public's eyes by indicating that the bus driver was being held captive by police and that speed, alcohol, inattention and those standard matters would be the focus of the investigation. It turned out that the driver was an experienced operator who had a clear driving record and there was no indication of any alcohol or other drugs in his system. So this scapegoat was not available in this case. Still no one in the press wanted to ask the question: Well, if these standard driver issues was likely not the cause, what else might have been a factor?

The bus was reportedly northbound on the AP7 expressway. The collision events were reported in various ways. For example, an article by Harold Heckle of The Associated Press quoted Jordi Jane, " a spokesman for Spain's northeastern Catalonia province" as follows:

*"The bus, which was carrying 57 passengers, appeared to have hit a guardrail of the AP7 highway before cartwheeling across the road, slamming through a divider and landing on its side."*

*"Television images from state broadcaster TVE showed the bus also crashed into an oncoming car on the opposite side of the highway. The passengers in the car were injured, the Catalan government said."*

Another article authored by Gerard Couzens (Getty-EPA) described the occurrence as follows:

*"The accident happened around 6am today as the vehicle - carrying around 60 passengers - collided with a car and overturned on the AP-7 motorway."*

*"The coach is understood to have smashed through a motorway central reservation after colliding with a car."*

These comments do not provide a clear and unified explanation of what transpired. This is where photographs of the surrounding area, including the path of the bus leading to its final rest position would allow outside agencies such as Gorski Consulting to determine what occurred independent of what subjective descriptions might be provided. Again, such photographs, as is the usual case, were not provided.

Even without this critical information, useful conclusions can be drawn. Thus, the damage to the bus can provide substantial evidence of what took place. A useful photo was that provided by Spain's TVE television network, which showed the bus as it was being lifted up by a crane from its resting position. That view is shown in Figure 2.

As in previous analyses that have been reported by Gorski Consulting, we ask readers to observe the damage to this bus and take note of what it means.



Figure 2: View of the front end of the damaged bus as it is lifted from its rest position on its side.

A vehicle involved in a severe, injury-producing collision typically shows evidence of crush and indications of its dissipation of kinetic energy. Why, because it is the change-in-velocity over a short time which is the dangerous element. As an example, when we fly in a jet airplane and come to a landing we experience a very large change-in-velocity but that change occurs in a long time frame and thus the accelerations experienced are very low. It is the small time frame in which a collision occurs that makes it a dangerous event.

If a vehicle experiences a change-in-velocity over a long time then there ample opportunity to prevent injury. In a typical highway, head-on, collision two light vehicles, the impact may be completed in slightly more than a 10th of a second, or just over 100 milli-seconds. That represents a challenge to vehicle manufacturers to manage all the kinetic energy of the event in a controllable manner such that the collision forces applied to the human occupant are minimized. Even at these tremendous challenges where a vehicle might sustain a change-in-velocity of 50 km/h or higher in that 10th of a second, safety systems such as air bags, seat-belts and other interior designs help to reduce the impact forces on the human body such that, without structural intrusion or other complications, occupants are highly likely to survive. But the result is that there will be a great deal of crush exhibited in the vehicle because, by design, the vehicle is made to deform and crush for the specific purpose of dissipating the kinetic energy of the crash. If this was not so, and we had a very stiff structure such as that of the Sherman tank, the vehicle would appear undamaged yet the kinetic energy would be transferred to occupant's impact with the interior. Thus, using the Sherman tank analogy, without vehicle crush the vehicle would stop instantaneously and so would the front "dash" areas of the vehicle. Meanwhile the occupant approaches the "stopped" interior at

his/her original velocity. Now the severity of the impact is arm more severe between the human body and the vehicle interior. That would be the primary killing mechanism if there was no energy dissipation engineered into the vehicle design.

So, returning to the real-life collision of the bus crash and looking at Figure 2, we must ask where is the evidence that indicates that this bus was involved in a severe, injury-producing, life-threatening impact? Where is all the evidence of crush and deformation that indicates that this vehicle was involved in a high, change-in-velocity impact?

Clearly, when we examine the exterior of the bus as shown in Figure 2 we see essentially no damage, not even to its corners where the damage should be most evident.

Certainly the bus did experience some crush. As we look to the back of the bus, as shown in Figure 3, we confirm that this was not just an undamaged bus that fell onto its side. There is substantial crush to the rear corner of the roof that could be life-threatening in certain instances.



Figure 3: View of the crush exhibited to the rear corner of the roof of the bus.

However, this is also misleading. In our work of examining injuries and comparing them to roof intrusion, there are many instances where major roof intrusion does not lead to life-threatening injuries. When the mechanism is studied in detail it is recognized that the human body is a flexible and yielding mass. When pressed down by an intruding

roof the human body does not act like a stiff board but more like a soft, deforming and yielding mass. Thus a moderate roof intrusion may cause large lacerations and concussions but in a number of instances this is all that occurs. When comparing the severity of injuries and what kills you, large lacerations and certain concussions are not as bad as vault/basal skull fractures and subarachnoid hematomas. Unless the roof crush is extreme there is often plenty of living space available in which the human body can contort itself and escape a direct blow.

The other factor that is misunderstood is that many of these rollover events with major roof intrusion the direction of the applied force is not constant because the vehicle is rotating. So, even when there is a substantial force, its direction changes and the likelihood that an occupant would sustain an impact in direct opposition to the occupant's direction of motion is not common.

While we are not saying that rollover events with roof intrusion are minor and unimportant, we are saying that lay persons over-emphasize the likelihood that life-threatening injuries are inevitable and this is why we appear to be minimizing that relationship. A seat-belted occupant in a large inter-city bus should be capable of surviving almost every collision situation because of the large volume of space available to the sides and front and above the occupant's head. In addition most situations will involve impacts with vehicles of a smaller mass.

When looking at the photos of the bus in the present case, it is not only a tragedy that so many young lives were lost. The greater tragedy is that so many young lives were lost needlessly and the loss of those lives could have been prevented had there been attention paid to the previous, similar instances when there was an opportunity to raise the red flag of warning.

In a February 9, 2016 News item that was uploaded to the Gorski Consulting website News page we discussed a similar bus rollover (See Figure 4) that occurred on February 8, 2016 on I-95 near Madison Connecticut. Approximately 30 of the 55 passengers on the bus were injured. Conflicting reports indicated that several passengers sustained critical injuries and these conflicting accounts were never properly sorted out. Again, it would appear that the bus was tripped by the guardrail that it struck and had it remained upright the collision consequences would like have been much less. As part of our review of that tragedy we made the following comments:

*"However, the following point has been stated many times on this Gorski Consulting website. We have discussed a number of bus and heavy truck collisions in the past where the large vehicle plows through a guardrail or barrier, or is tripped by that guardrail or barrier. Large trucks and intercity buses are not compatible with the roadside infrastructure such as guardrails and barriers because the vehicles are simply too massive or the barriers are too low. In fact, in many instances a small or low barrier or guardrail increases the potential that persons will be injured because a rollover is caused. A rollover can be a benign creature but when the occupants or a vehicle are spilled out because of lack of seat belt use, or through opening of the structure, injuries can be serious and fatal. Particularly with buses, they possess weak roof structures and*

*they are also often occupied by dozens of persons. This is a recipe for creating multiple deaths.*

*While we present this problem we recognize that we also have not provided a solution. The retrofitting of the roadsides of all highways in North America to make guardrails and barriers compatible with large vehicles would be extremely costly. On the other hand these changes do not have to occur this instant and a gradual change over might be a solution.*

*Secondly the roof structures of large buses need to be strengthened. This is a very important change that needs to be done very soon.*

*Thirdly, the general populace needs to be informed of the special dangers when riding on intercity buses or driving large trucks. Naturally there is a resistance to this as it could involve some economic loss to companies in the business of operating large intercity buses. However, this needs to be done for the public's protection."*



Figure 4: View of an intercity bus that rolled over onto its side on Interstate I-95 in Connecticut.

Gorski Consulting also reported on another bus rollover that occurred on January 15, 2015, also on the News page of our website, in Japan. A bus tripped over a guardrail

and exposed its soft roof to impact with a tree resulting in multiple fatalities, as shown in Figure 5.



Figure 5: View of bus rollover in Japan that resulted in multiple fatalities.

In this incident the roof crush was severe. Figure 5 shows the portion of the guardrail that was damaged as the bus crashed through it. Again had the bus been retained on the roadway the collision consequences would have been much less. Even if the bus was not retained on the road but remained upright the collision consequences would also have been much less. The critical factor was the rolling of the bus onto its side and the exposure of the soft roof to the non-yielding tree was the principal cause of the roof intrusion. These obvious facts were never mentioned in any news media accounts or by any official entities involved in the investigation.

The incidents mentioned on the Gorski Consulting website are not isolated or recent. They have been occurring for many years. They involve multiple deaths. They also attract much media attention in the early days of their occurrence. Yet the crucial facts that need to be passed onto the general public about what is happening are not being passed on. This may be a reality that persons in the news gathering system are simply incapable of understanding what is important.

Yet, those persons who are given the authority and exclusive access to the collision evidence have less of an excuse. While it is our observation that police investigations are biased toward indentifying driver infractions and criminal actions, that cannot used as an infinite excuse by those police investigators who have gained sufficient experience to be capable of recognizing when other factors beyond driver actions need to be identified. When persons die because of driver alcohol intoxication, distraction or

high speed, it is essential for the public's safety to identify those factors and have the matter dealt with in a court of law. However, when persons die unnecessarily because of an inappropriate roadside infrastructure which is incompatible with a large number of vehicles using a highway, the death is not any less tragic or important. In the opinion of Gorski Consulting it is unethical for official investigators and those working in public positions of policing, insurance and government, who should be aware of these dangerous conditions, not to report them. These actions of hiding the facts prevent the essential actions that need to be taken to prevent the next tragedy from occurring.

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