



BIOMEDICAL RESEARCH AND ANALYSIS

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RE: ()
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Dear Ms. _____ :

Additional information was supplied to Biomedical Research & Analysis for review after the preparation of the original report. The additional information consisted of one photograph of the water loaded tractor-trailer at the scene of the impact, one photograph of the cement loaded tractor-trailer at the scene of the impact and one photograph of the cement loaded tractor-trailer after the time of the impact. These photographs provided a greater overall depiction of the water loaded tractor-trailer and the cement loaded tractor-trailer at the scene of the impact. Due to these additional photographs, measurements of the damage to the vehicles were able to be obtained and additional analyses were able to be performed.

The original supplied photographs of the water loaded tractor-trailer and the cement loaded tractor-trailer consisted of close-up views of the damage to the vehicles. As a result, minimal measurements were able to be obtained from the photographs due to a lack of known reference points visible in the photographs. Therefore, as described in the original report, the calculations in the original report were based on a combined energy-momentum-restitution analyses using staged sidewipe impacts.

However, the recently supplied photographs depict a greater overall view of the water loaded tractor-trailer and the cement loaded tractor-trailer. These views included known reference points in the photograph. As a result, measurements were able to be taken of both the water loaded tractor-trailer and the cement loaded

tractor-trailer. Based on these measurements, an additional damage analysis and an additional force analysis was performed.

The height of the lower edge of the trailer for the water loaded tractor-trailer was approximately 48 inches above the ground. The lower edge of the end surface of the lateral support beam was approximately 30 inches above the ground. Minor black scrape marks were evident along the upper portion of the rear edge of the support beam. As described in the original report, minor buckling and bending of the right side of the lateral support beam was also evident. The previously supplied photograph indicates that this bending and buckling was directed forward and outward from the trailer (see Figure 1 for photograph of damage to the water loaded tractor-trailer).



Figure 1: Photograph of damage to the lateral support member on the water loaded tractor-trailer

The upper height of the fender on the cement loaded tractor-trailer was approximately 46 inches above the ground. This height indicates that the trailer bed on the water loaded tractor-trailer would not contact the fender on the cement loaded tractor-trailer. Instead, only the end surface of the lateral support beam on the water loaded tractor-trailer would contact the fender on the cement loaded tractor-trailer. Based on the heights of the damages, orientation of the vehicles and direction of travel of the water loaded tractor-trailer at the time of the impact, the scrape marks at the rear edge of the support beam appear to be related to the impact between the water loaded tractor-trailer and the cement loaded tractor-trailer.

However, as described in the original report, the bending and buckling of the right side of the support beam is not related to the impact between the two vehicles. The bending and buckling of the support beam is from a forward directed force that was concentrated along the lower edge of the support beam. Based on the height of the damage, this damage is consistent with the water loaded tractor-trailer or cement loaded tractor-trailer reversing after the impact in an attempt to separate the two vehicles. As the vehicles would reverse, the lower edge of the support beam on the water loaded tractor-trailer would contact the tire on the cement loaded tractor-trailer. This contact would result in a concentrated forward directed force on the lower edge of the support beam consistent with the damage evident in the photograph.

Also, as described in the original report, minor damage was evident to the right fender located at the rear of the trailer for the cement loaded tractor-trailer. This damage consisted of a minor indentation in the side of the fender towards the rear. In addition, several of the support bolts were pulled through the fender and the mounting brackets were bent. From the additional supplied photograph it can be seen that two of the rear bolts were pulled through along with two bolts for the right support bracket (see Figure 2 for photograph of damage to the right fender).



Figure 2: Photograph of damage to right fender of cement loaded tractor-trailer

Based on this new photograph, an additional analysis was performed to determine the force required to result in the damage to the right fender. This analysis was based on the bolt pull through evident on the right fender.

Stress calculations indicate that the maximum force that would be exerted would be between 12 – 36 kips¹. These forces would result in average accelerations of 0.1 – 0.2 G. These forces are slightly lower than predicted using the method described in the original report. Calculations detailed in the original report indicate that average acceleration were on the order of 0.3 – 0.5 G. This difference in calculations is due to the conservative calculations performed in the original report based on the more limited photographs. These calculations further confirm the relatively low forces and minor accelerations that were imparted during this impact.

It should be noted that in the original report, the photographs of the water loaded tractor-trailer and the cement loaded tractor-trailer were mislabeled. The photographs that were labeled water loaded tractor-trailer were actually photographs of the cement loaded tractor-trailer and the photographs that were labeled cement loaded tractor-trailer were actually photographs of the water loaded tractor-trailer. As a result, the damage analysis in the original report incorrectly listed the vehicles and their related damages. Instead, the damage analysis in the original report should be reversed with regards to the names of the vehicles. This change has no effect on the original calculations since the damages listed and considered for the analysis are still the damages that were sustained in this impact. They were only labelled incorrectly. As a result, the calculations in the original report were performed based on the actual damages exhibited by the vehicles and are still valid.

Overall, based on the new photographs that were provided, a new damage analysis and force analysis was able to be performed to determine the probable forces and accelerations that were exerted on the cement loaded tractor-trailer due to the impact by the water loaded tractor-trailer. Based on the analysis of the new photographs, the scrape marks evident on the right side of the cross member of the water loaded tractor-trailer are consistent with the impact with the cement loaded tractor-trailer. However, the bending and buckling evident on the cross member are not consistent with the impact. Instead, these damages appear consistent with a reversing type maneuver to attempt to separate the vehicles after the impact.

The calculations performed during this supplement as well as the calculations performed for the original report indicate that the accelerations experienced by the cement loaded tractor-trailer during this impact would be on the order of 0.1 – 0.5 G. Due to the low accelerations, the cement loaded tractor-trailer would

¹ AISC 360-10

not have been moved as a result of the impact. Numerous biomechanical studies indicate that no injuries would occur for the bystander next to the cement loaded tractor-trailer.

Sincerely,

Bryan Schnick

A handwritten signature in black ink that reads "Bryan Schnick". The signature is written in a cursive style with a large initial 'B' and a distinct 'S'.

Biomedical Analyst