region between the target and aircraft center section. The center wheel assembly was also excluded from the model due to a lack of information regarding wheel placement. The center wheel assembly does have significant mass and disregarding this component could lead to an under prediction of applied loads. Future analyses will confirm or deny the validity of neglecting outer aircraft components. A was considered for the analysis, which is thought to present a "worst-case" scenario with respect to residual velocity of the target and force imparted to the target.

4

Ex2

For the CTH analyses, the target did not include the underlying concrete pad. The reason for this was to avoid earlier problems encountered with the CTH interface tracker, which lead to a non-physical attachment between the base of the target and the pad. Consequently, the scenario modeled can be equated to frictionless contact between the target and pad. The CTH mesh resolution was nominally 10 cm; however, the mesh was refined to a 4 cm resolution in the initial region of impact to provide a better assessment of the target structural response. Mesh refinement occurred only along the CTH x-axis, which was aligned with the aircraft velocity vector.

Results for two different CTH analyses are presented in Figures 1.1A-1 to 1.1A-3. The only difference between the two results is a modification on the concrete model used for the cask. As the results show, there is very little difference between the two models. Figure 1.1A-1 shows the momentum imparted to the target. Figure 1.1A-2 shows the average target velocity, and Figure 1.1A-3 shows the total force on the target. A movie of the 150 msec analysis is included in the companion CD with this report (Task 1.1A/Mechanical/CTH results).

expand

Explain what is "49" Run?

Ex2

Figure 1.1A-1. Momentum imparted to the target

Information in this record was deleted in accordance with the Freedom of Information Act, exemptions 2
FOIA- 2003-0184

Ex 2 portions

H/6

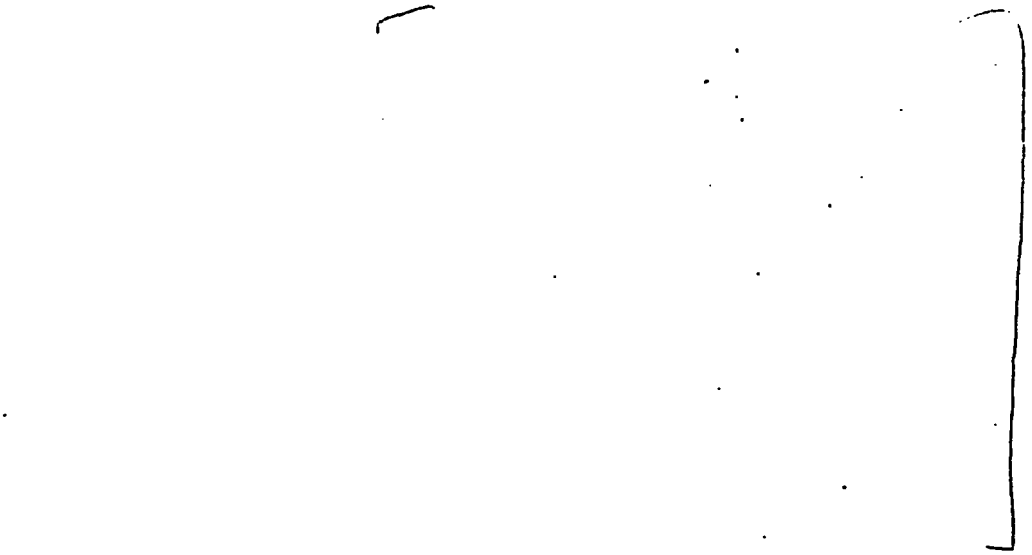


Figure 1.1A-2. Average target velocity

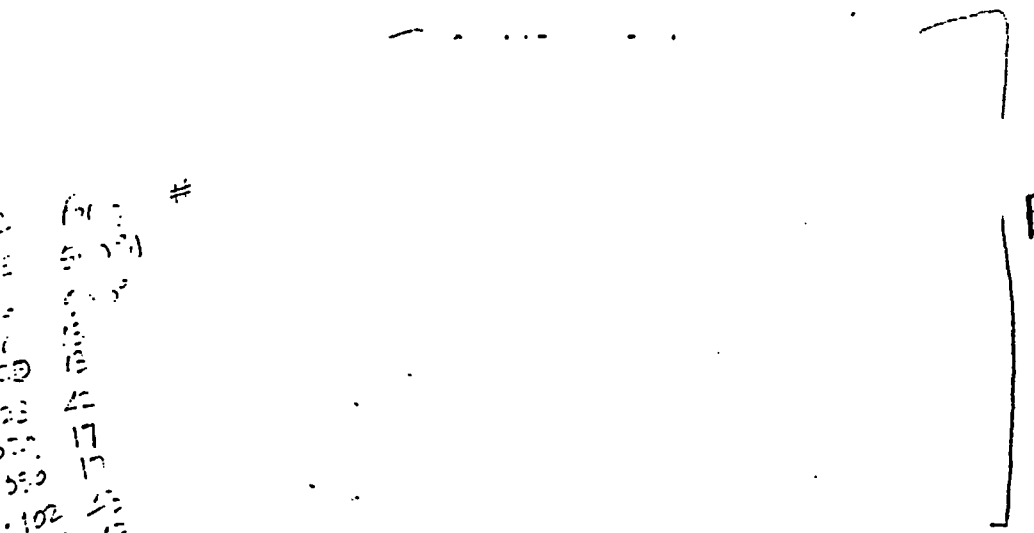


Figure 1.1A-3. Total force on the target

Modifications were made to the ZAPOTEC code and some initial results are available. There are some significant differences between the CTH analyses and the ZAPOTEC analysis. The ZAPOTEC analysis uses the same simplified aircraft model, but includes the underlying soil and concrete pad (these were neglected in the CTH analyses discussed above). The coefficient of friction between the cask and pad was 0.53 and between the target and the aircraft was 0.13. Also, due to some run difficulties, all nodes in the aircraft model were prescribed the [redacted] Therefore, the mesh does not decelerate during the impact. Thus, the results presented are still preliminary and there are issues that must be resolved before the results can be considered conclusive. Ex 2

Figures 1.1A-4-6 show the 80 msec. ZAPOTEC results plotted with the CTH results shown above (plots of momentum, average velocity, and force verses time, respectively).

Ex 2 portions

Note there is a significant difference in the momentum imparted to the target. Consequently, there is a significant difference in the average target velocity (roughly a factor of 3 at 80 msec). Use care when interpreting the computed forces on the target. These are based on momentum output at 5 msec intervals (force was computed as f= d(mv)/dt to get a "ballpark" loading on the target). Essentially, the force data has been filtered for the ZAPOTEC results. So peaks corresponding with the wheel impact will be smaller than normal. However, the trend-wise comparison is useful and shows much lower loads imparted to the target.

6

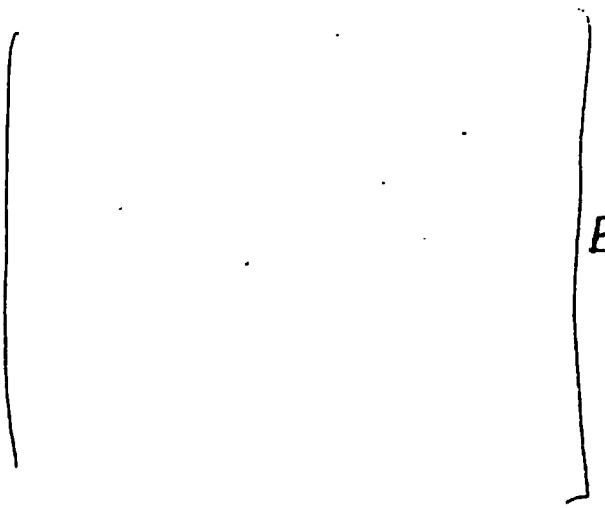


Figure 1.1A-4 CTH and ZAPOTEC - Momentum imparted to the target

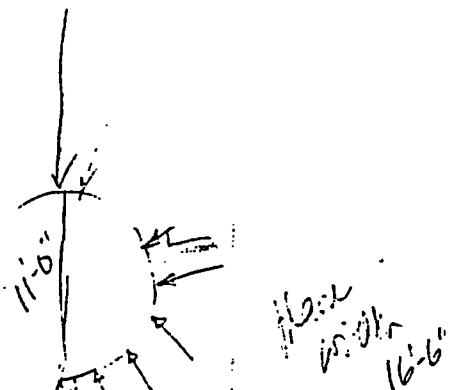
Merlin-Urp's

Ex 2

Figure 1.1A-5 CTH and ZAPOTEC - Average target velocity

Ex 2 portions

1



Ex 2

Figure 1.1A-6 CTH and ZAPOTEC - Total force on the target

A movie of the ZAPOTEC results is included with the companion CD (folder Task 1.1A/Mechanical/ZAPOTEC results). Figure 1.1A-7 shows the graphics of the impacts for the CTH and ZAPOTEC analyses at 5.5 msec. The ZAPOTEC results show the more than the CTH analysis. Also, for the ZAPOTEC results the by 5.5 msec.

Ex 2

Currently, the effort on the global analysis is focusing on completing a ZAPOTEC run that is equivalent to the CTH analysis. These runs will be compared. The cask to pad interface is also being examine. Finally, a PRONTO analysis with a Reira curve pressure loading is being run to compare with the ZAPOTEC and CTH analysis. This is part of the effort to determine the velocity of the cask after impact. The initial results of the cask velocity have varied and these analyses are an effort to verify the cask speed.

Portions Ex 2