Committee Correspondence

Name of Committee: SAE Accident Investigation Techniques, Task Group 1

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Gentlemen:

Thank you all for attending the CRASH coefficient protocol subgroup on October 22, 1987. I enjoyed meeting with you.

This letter has been prepared to reiterate some points that were made at the meeting and to initiate an informal open exchange for our subgroup for periods between meetings. In consideration of the existence of the Engineering Dynamic database and the upcoming papers at the '88 Expo related to our subgroup task, I am reiterating some points that I believe to be important in relation to the calculation of CRASH damage coefficients.

(1) The CRASH computer program calculates the impact speed-change up to the point of a common velocity (approach period delta-V), not the total impact speed-change. The statement in the EDC publication (pub 1043, pI-1) that the CRASH empirical coefficients are "used in the calculation of the total dissipated energy and ultimately the velocity change (delta-V) for vehicular collisions" tends to obscure that point. It should be clearly stated in all CRASH-related documents that the basis of and results from CRASH are for the delta-V to the point of a common velocity which should not and does not include restitution. The total speed change (delta-V total) includes effects of restitution which act to reduce the residual damage while increasing the speed-change.

(2) The use of a single full-scale crash test data point for a given vehicle, combined with an assumption regarding a "no-damage" intercept, to calculate custom-fitted CRASH coefficients for that particular vehicle must be recognized as a crude "first-approximation" procedure. Any suggestion that the resulting coefficients constitute a reliable definition of the structural responses of a given vehicle is misleading and is not in keeping with sound engineering practices and principles. Problems associated with the repeatability of full-scale

crash test results produce scatter which limits the reliability and accuracy of a single data point. Minimum scientific principles would appear to require a minimum of three data points before any claims of reliability can be supported. The assumptions regarding the delta-V value for the "no-damage" intercept and the linearity of the delta-V versus crush relationship further detract from claims of reliability and accuracy.

In view of the cited considerations and the lack of multiple crash tests for many individual vehicle makes/models, an important need is seen for attention to the problem of classification of vehicles with similar structural responses so that several data points can be grouped and used to define representative properties of the individual vehicle "class" or "group."

(3) The assumption within the EDC conversion program of a "no-damage" intercept at 5 MPH front, 5 MPH rear and 2.5 MPH side should be carefully evaluated prior to general acceptance by the CRASH community. The existence of non-energy absorbing bumpers in pre-1973 and post-1986 vehicles needs to be addressed. Also, one should consider the 2.5 MPH standard for rear energy absorbing bumpers, and the absence of bumpers on the sides and the availability of IIHS data points for some vehicles in 5-15 MPH barrier crashes. The cited items are seen as supporting a need for the consideration of an optional "data-point" for low speed impacts in the CRASH coefficient protocol so that the effects of variations may be investigated and included.

(4) The protocol outlined in the EDC publication (EDC pub 1043, p-I-1 thru I-3) to convert from full scale crash tests to CRASH empirical coefficients utilizes Campbell's relationships between the approach period Delta-V and the residual crush which provide the basis for calculating CRASH3 A, B & G. To reduce scatter in the crash-test results, a weight correction factor should be applied to multiple tests with the same make/model vehicles (or clones) (i.e. 5 Citation tests, etc.) For example, consider two 35 MPH crash tests with the same make/model vehicle at different test weights (i.e., one loaded, one empty). The crush for the heavier vehicle will of course be greater whereas the structure is identical. Corrections of the measured crush dimensions should be made to correspond to a standard weight. (see Campbell, SAE 740565 for related discussion). The effects may not be great for most applications; however, anything which reduces the scatter of the data will be beneficial.

I invite your questions/comments regarding the above discussion and hope that we can use informal correspondence and/or meetings to exchange ideas. I hope that this and future letters can serve to provide a forum during the time periods between meetings.

I look forward to your comments.

Sincerely,,
MCHENRY CONSULTANTS, INC.

Brian G. McHenry

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