APPENDIX P

LETTER FROM JOHN GARRETT
CALSPAN CORPORATION
AND
ATTACHMENT

March **12, 1975**

Calspan

March 12, 1975

Air Mail

Dr. Lawrence Goldmuntz
Economics and Science Planning
1200 18th Street, N.W.
Washington, D.C. 20036

Dear Dr. Goldmuntz:

Following our telephone conversation about two weeks ago, I gathered some material on our use of police photography for estimation of vehicle damage severity and/or speed, as I had agreed. The material is attached to this letter. To provide background, and some additional detail, I have summarized relevant information below.

We first became concerned with the problem of assessing accident severity in our Automotive Crash Injury Research (ACIR) program in the early to mid-1950's. At that time, we developed an accident Severity Index (Attachment A) based on damage to the vehicle. The police provided interior and exterior photographs of the accident vehicle but the ratings were made by a small staff of trained Calspan (then Cornell) personnel. This procedure tended to minimize the inter-coder variability that would have resulted if thousands of police had rated the accidents. Also, it was not necessary to train police to code, but only to take the proper photographs. Thus, training costs were kept low.

Accuracy of ratings were further assured through the use of fairly extensive computer edit procedures. "Illegal" (impossible) codes resulted in a case being returned for checking. Consistency checks also were used, i.e., a case that was rated minor could not have severe overall damage to the car elsewhere or any damage to basic structure such as the chassis. Low probability events that were inconsistent with the severity also required a recheck of the case. Thus, a fatality in a case where the severity rating for the vehicle was minor, warranted a check. Some corrections were made automatically, but many errors required a recheck.

The reliability of rating procedures also was checked periodically by ACIR to ensure that rater variability was kept to a minimum. A copy of one report on this subject (Attachment B) is enclosed.

Bob Campbell later developed the TAD scale which is used by police in North Carolina and several other states. Here, all ratings are made by police in the field. Bob's studies have shown that they do rather well, but I think that I would prefer the additional control which our system provides.

The Collision Deformation Code (CDC) developed by G.M. generally succeeded the earlier systems for use by many researchers and the in-depth teams. In some ways this always seemed odd to me since the in-depth teams had measurements of the actual vehicle damage which were more accurate than the CDC. This scale clearly is too complicated for police use in the field. However, we have compared CDC ratings obtained by our personnel from police photographs with those obtained by an experienced invetigator rating the CDC from actual inspection and measurement of the vehicle. The results were quite good (Attachment C, pages 37-56) and we would have confidence in ratings provided by such a system. Again, ratings were made by a small staff of Calspan personnel with appropriate checks to maintain accuracy.

We later summarized available data from Calspan crash tests in a first attempt to develop an aid for estimating speed from vehicle damage (Attachment D). The amount of useful data was limited and the approach was dropped when additional inputs were not forthcoming.

Development of the SMAC program by Ray McHenry permitted accurate estimates of impact speeds, but requires such information as vehicle damage, point of impact and vehicle rest positions. Use of the Calvan simplifies the collection procedure for police and ensures accuracy. Ray is now working on a simplified version of the START program for SMAC which, it appears, may provide reasonably accurate speed estimates. A brief description appears in Attachment E.

Data collection cost was another point that we discussed. The cost of our most recent program to collect police photographs (last year) was approximately $5,000 for 1,200 cases. Costs include only purchase and processing of film. We have purchased relatively inexpensive Instamatic cameras ($20-25) for police use, with good results. Generally, one camera per car is needed.

In our discussion, YOU also mentioned the possible use of templates for measuring the vehicle damage photographed. We explored this, but it is quite difficult to do without an overhead shot of the vehicle or the use of photogrammetry. If we go that far, then I believe that the Calvan would be competitive in terms of cost and would provide far better data.

Dr. Lawrence Goldmuntz
March 12, 1975

This has become a rather lengthy letter with many attachments, but since I agree that the use of police photographs can provide good vehicle damage/speed data, I have tried to provide what useful information I can. It may still be sketchy for your purposes, however. If so, I will be pleased to provide any additional information that we have available,

Sincerely,

John W. Garrett, Head
Accident Research Branch
Transportation Safety Department

JWG:jem
Attachments

ACIR INDEX OF ACCIDENT SEVERITY AND POTENTIAL SURVIVABILITY

Introduction

The method of rating accident severity described here was developed for use in the Automotive Crash Injury Research program (ACIR) of Cornell Aeronautical Laboratory, Inc. Thus far, 31 states have participated in the program. In this study, accident data are reported by participating state police on a report form designed by ACIR. Police also provide photographs of the vehicle interior and exterior. Medical data are provided by the physicians who attend the injured victims.

The description of the rating system which follows was prepared for use by ACIR case analysts. In assessing vehicle damage, photographs of the car and pertinent information from the accident report form are used. The report form provides information concerning damage to various structural elements of the car, such as the chassis frame, engine or mounts, firewall, floor, etc., which are not always visible in photographs. This information is essential if an accurate appraisal of vehicle damage is to be made.

Although the ACIR accident data have been collected by thousands of police officers throughout the country, rating of accident severity and survivability has been performed by a few ACIR case analysts. Thus, variability in rating can be minimized and closer control maintained over the process.

Discussion of Rating Method

The rating of accident severity and survivability represents an effort to classify accident-involved cars not only in terms of damage but in terms of the potential survival of occupants. Each car in an accident is evaluated and rated individually since severity and potential survivability often differ even for cars involved in the same accident. Data on which the evaluation is based are obtained from a series of interior and exterior photographs of the car, and from the accident report form which describes the accident and provides additional information on certain structural components: engine, engine mounts, chassis frame, firewall, front wheels, floor, etc. Accident severity and survivability are rated only when adequate photographs and sufficient accident information are available. When adequate photographs or accident data are not available, cases are classed as NAC (not able to classify).

The classification of accident severity and survivability requires an assessment of the type and amount of car damage, type of components affected, and the influence of this damage on potential survival of car occu-

pants. Accident severity and survivability are rated semi -independently although in fact they are inextricably related. Broadly speaking, accident severity is classified in terms of the type, extent and area (side, rear, etc.) of the car damaged, whereas survivability is classified in terms of occupant environment, i.e., whether there is collapse or invasion of the compartment. Accident severity and survivability are not mutually exclusive categories, as is shown in the gross relationship between car damage, accident severity, and survivability.

In classifying accident severity a six-point scale (below) ranging from minor to extreme is used. In descriptive terms, damage ranges from denting and scratching of surface metal to complete disintegration or crushing of the car. Thus, the accident severity rating rises progressively as damage increases and more of the structural elements of the car are affected.

Accident Severity and Survivability Scale

Car Damage	Accident Severity	Survivability y
Sheet Metal Damage		
No damage to basic structure; no invasion of compartment.	Minor	Survivable
	Mode rate	Survivable
	Moderately Severe	Survivable, Questionable or Partial
Structural elements progressively involved; compartment may, or may not be invaded.	Severe	Survivable, Questionable, or Partial
	Extremely Severe"	Survivable, Questionable, Partial, or Non -Survivable
Complete Destruction	Extreme	Non-Survivable

When an accident is rated minor ***or*** mode rate in ***severity*** it is conside red survivable. Moderately severe, severe or extreme 1 y severe accidents may also be survivable, or survivability may be rated as questionable or partial. Extremely severe accidents may also be classified as nonsurvivable. Extreme accidents are always regarded as non- survivable be cause they involve almost complete destruction of the car. A more detailed description of both accident severity and survivability is provided in the sections which follow.

Accident Severity

o Minor

Damage is most often confined to the sheet metal surface of the car although bumpers may be slightly dented, headlights or taillights broken, radiator grill bent or broken, ornamental molding torn free. When forces are applied to sheet metal, damage may be de scribed in such terms as “small dent”, “slight deformation", scratches ”, etc. Such damage is con side red minor whether a small or large area of the car is affected. Minor severity accidents never involve structural components of the car.

l Mode rate

Damage most often involves sheet metal, but such structures as bumpers, bumper guards, or radiator grill may be damaged. Sheet metal or grill damage may be described as “slight buckling”, “pushed in’ “crumpled”, or “torn”. For stronger components -- such as a steel burn per -- descriptive phrases such as “large dent”, “twisted”, or “bent” might be used. In accidents of mode rate severity, structural components of the car are undamaged.

l Moderately Severe

Damage involves forces sufficiently great so that stronger structural elements as well as sheet metal are affected. Usually sheet metal begins to collapse and, depending on the area of impact, comer posts, center posts, or chassis frame may be deformed.

l Severe

Damage in this category always involves collapse or marked displacement of structural elements, as well as c rushing or telescoping of sheet metal. This grade of accident severity often involves penetration of compartment are as ‘either as a result of direct impact, or as a result of displacement of other parts of the car due to impact or overturn.

- Extremely Severe

Damage to the impacted area in these accidents is very extensive. Structural elements and sheet metal in the affected areas are gene rally crushed . There is considerable telescoping of the impacted area, and there is usually some invasion or collapse of the compartment.

- Extreme

This category is reserved for accidents so severe that the automobile involved is almost completely demolished, and often is scarcely recognizable as an automobile. Damage may be de scribed as almost complete disintegration or crushing of the entire car. Photographs of extreme dam - age are not provide d in the figure illustrating accident severity because all damage beyond that illustrated for extremely severe is considered extreme.

Survivability

The concept of survivability is based on the assumption that survival is dependent on the compartment area remaining essentially intact. In rating survivability, it is recognized that other forms of protection -- interior redesign, padding, lap belt and harness, or even other devices as yet not available -- may be required in order to fully capitalize on the potential survivability afforded by the compartment. Without a reasonably intact environment, however, there is no assurance that occupants could survive even with other protective devices. The criteria used in determining survivability, there fore, are the degree of compartment collapse and its influence on the normal seated position areas, i. e. , whether there would be sufficient space for Survival if all seats had been occupied by persons seated in a normal, upright position, and all occupants had remained in their seats. In brief, whether the area surrounding each seat in the car could still hold an upright occupant.

Data concerning the actual fate of automobile occupants indicate that many occupants die in accidents that are relatively mild and, conversely, some occupants survive even when the car is demolished. Although all cars in the ACIR study contain at least one occupant, in classifying survivability the presence or absence of occupants, as well as the fate of those occupants actually present in the car, is ignored. In effect, the car is rated without considering the number of occupants or whether they lived or died. Thus, occupants may survive a non- survivable accident, or may die in a survivable accident.

A "survivable ” rating signifies that the compartment (occupant are a) was essentially intact and that there was no c rushing or invasion of the compartment. As the compartment area collapses or is progressively invade d by surrounding structure, survivability may be classified as survivable, questionable, partial, or non- survivable. Survivability categories and the appropriate accident severity categories are described below.

- Survivable

When there is little or no invasion of the compartment area, survivability for all occupant areas is normally assumed. Minor and moderte accident severities, by definition, must be considered survivable. Moderately severe, severe, and extremely severe accidents may be survivable if there is little invasion of the compartment. An extreme accident (again, by definition) cannot be considered survivable. (Rated survivable: Front photographs - minor, moderate, moderately severe; Side - minor, moderate, moderately severe, severe; Rollover - minor, moderate, moderately severe.)

- Questionable Survivability

When the area surrounding one or more seated positions is somewhat compressed, but there is some doubt as to whether one or more normally seated persons could survive, survivability is considered questionable. This classification may be used only with moderately severe, severe, and extremely severe accidents. (Rated questionable survivability: Side photograph - severe; Rear - extremely severe; Rollover - severe.)

- Partially Survivable

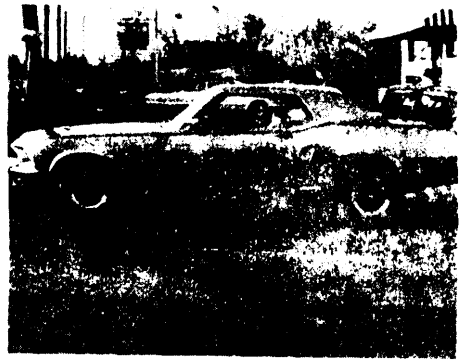
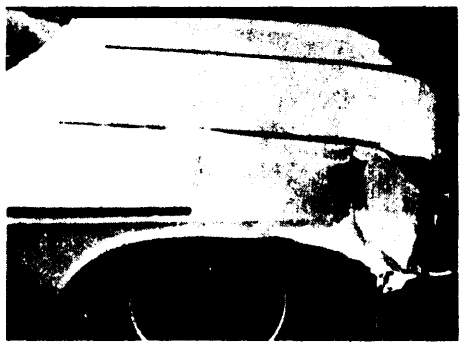
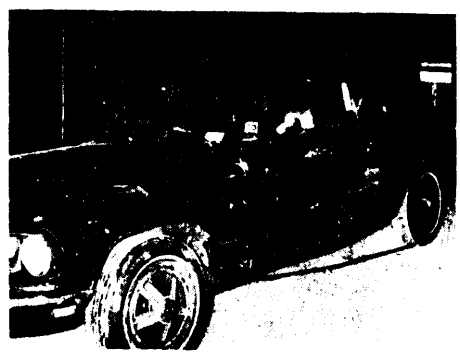
This category is used when one or more, but not all) seated posi - tions are compressed to such a degree that it is considered non-survivable for a normally se ate d person. This classification may be used only with mode rate 1 y severe, severe, and extremely severe accidents. (Rated partially survivable: Side photograph - extremely Severe.)

- Non-Survivable

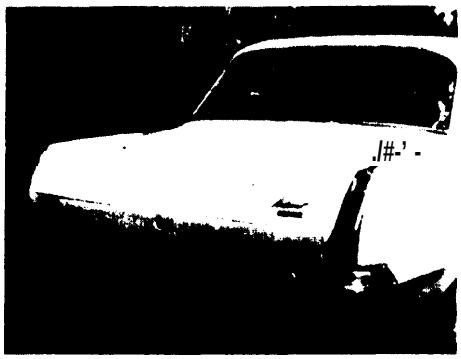
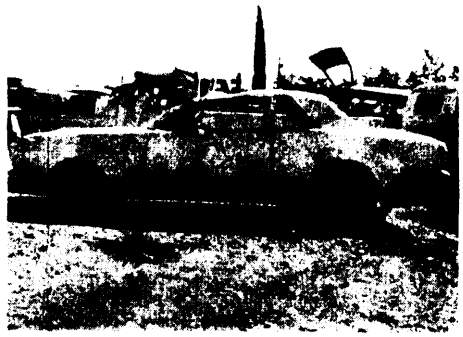
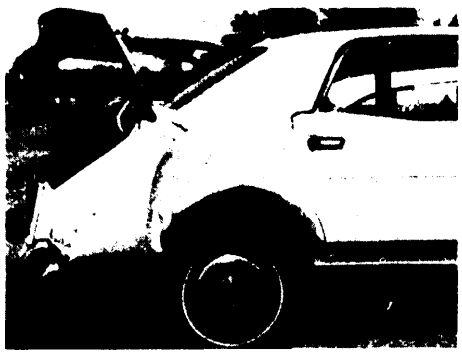
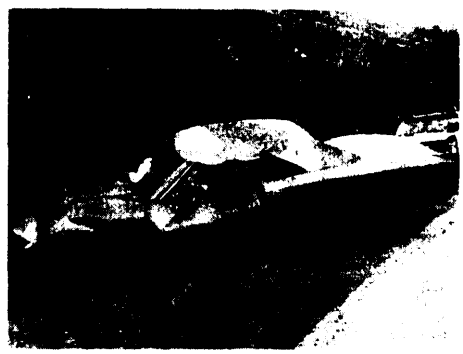
When the entire compartment is compressed Or invaded to such an extent that there is insufficient room for an occupant seated upright in all the normal seating areas, the accident is considered non- survivable. Extremely severe accidents may be classified as non-survivable, and extreme accidents must be so classified. (Rated non-survivable: Front photograph - extremely severe; Rollover - extremely severe.)

Accident Severity and Survivability — Column 69

Classification	Code
Survivable	
Minor	1
Moderate	2
Moderately severe	3
Sever e	4
Extremely severe	5
Non- survivable	
Extremely severe	E
Extreme	F
Partially survivable	
Moderately severe	L
Sever e	M
Extremely severe	N
Questionable survivability	
Moderately severe	T
Severe	u
Extremely severe	v
Not Able to Classify	X

	FRONT	SIDE
MINOR		
MODERATE		
MODERATELY SEVERE		
SEVERE		
EXTREMELY SEVERE		

SEVERITY

REAR	ROLLOVER	
		MINOR
		MODERATE
		MODERATELY SEVERE
		SEVERE
		EXTREMELY SEVERE

ACCIDENT RESEARCH BRANCH
TRANSPORTATION RESEARCH
CORNELL AERONAUTICAL LABORATORY