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SEP 2 4 1999

Frank Seales, Jr.
Acting Deputy Administrator
NATIONAL HIGHWAY TRAFFIC
SAFETY ADMINISTRATION
400 Seventh Street, S.W., Room 5220
Washington, DC 20590

Dear Mr. Seales:

Re: **Settlement Agreement**
Section B. Fire Safety Research

Enclosed are presentation materials prepared by Paul T. Eichbrecht of General Motors Corporation, entitled, "Overview of FMVSS 301 Upgrade Testing at GM." They relate to the testing procedures, vehicle selection process and preliminary test results associated with Project B.5 (Development of Crash Test Protocols).

These presentation materials were orally presented at the SAE Government/Industry Meeting held in Washington, DC, on April 21, 1998, during the session entitled, "Post Crash: Fire Safety Research Session."

Yours truly,

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Overview of FMVSS 301 Upgrade Testing at GM

Paul T. Eichbrecht

SAE Government / Industry Meeting
Post Crash: Fire Safety Research Session
Washington, DC
April 21, 1998

Good morning. Today, I would like to provide a brief overview of some recent research crash tests GM conducted. The tests are associated with the National Highway Traffic Safety Administration's ongoing efforts to enhance Federal Motor Vehicle Safety Standard 301. As you may know, FMVSS 301 presently requires fuel system integrity performance in a set of prescribed crash tests, including 30 mph frontal, 30 mph rear, and 20 mph side impacts, with flat rigid barriers. NEXT SLIDE

GM / DOT Settlement Agreement / Fire Safety Research Project

- **Agreement (excerpt)**
  - **Undertake / finance research to further the development of an enhanced standard**
- **Project - Development of Crash Test Protocols**
  - **Including barrier configuration, impact location, and test speed**

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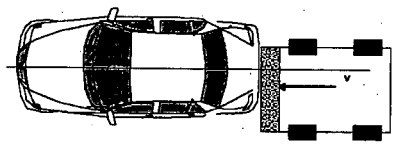
As background, part of the GM/DOT Settlement Agreement established that GM would undertake and finance research to further the development of an enhanced standard.

One of the Fire Safety Research projects Carl Ragland mentioned was established to help develop crash test protocols. Protocols were identified as including the impact barrier configuration, the impact location, and crash test speed. The remainder of my presentation focuses on this project.

NEXT SLIDE

NHTSA Research Testing



- **Test configuration: Offset Rear Moving Barrier (ORMB)**
  - **80 km/hr**
  - **70% collinear overlap (toward fuel filler side)**
  - **FMVSS 214 MDB (not crabbed) with face lowered 50 mm**
  - **Basis from NASS/FARS data subset (basis not public yet)**
  - **Instrumented front seat Hybrid III 50th % adult male test dummies**
- **Initial energy approximately two-thirds greater than present FMVSS 301 rear moving barrier test**

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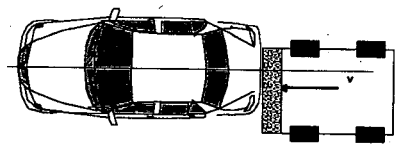
NHTSA already had initiated research to develop a rear impact enhancement for FMVSS 301. That research focused on a high speed offset rear moving barrier crash test. The moving barrier impacts the rear of a stationary target vehicle at 80 km/hr. The impact configuration is collinear, with the barrier overlapping the struck vehicle's rear end by 70%. Overlap is established toward the fuel filler neck side of the vehicle. The impactor is the 1365 kg moving deformable barrier defined for FMVSS 214 dynamic side impact testing. However, its face is lowered 50 mm to represent a pre-impact braking / underride-override condition between the striking and struck vehicles.

NHTSA has indicated that the field collision data basis for this test configuration and speed comes from a study of National Accident Sampling System data (that is, NASS) and a subset of cases from the Fatality Analysis Reporting System (that is, FARS). Complete details of this basis have not been released publicly yet.

Instrumented Hybrid III 50th percentile adult male test dummies were placed in the outboard front seats of the test vehicles. The instrumented test dummies were used to help assess the injury potential for such occupants under this crash condition.

For comparison, the initial impact energy of this test is about twice that of the present FMVSS 301 rear moving barrier test. NEXT SLIDE

NHTSA Research Testing - Results



- **Six ORMB tests on '96 M.Y. vehicles**
  - **Sport coupe, mid-size SUV, mini-van**
    - » **Trace or no fuel system fluid spillage**
  - **Subcompact sedan, small SUV**
    - » **Impact test fuel system fluid spillage > FMVSS 301 limits**
  - **Compact sedan**
    - » **Post-impact rollover test spillage > FMVSS 301 limits**
  - **Some test dummy data > injury assessment reference values**

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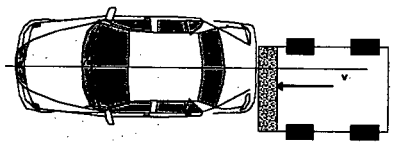
Results from a set of six tests NHTSA conducted are summarized here. There was no fuel system fluid spillage, or in two cases only a trace, in the tests of the three larger vehicles in the group - the sport coupe, mid-size sport utility vehicle (SUV) and the mini-van. The subcompact sedan and the small SUV exhibited spillage over FMVSS 301 limits following the impact test. The compact sedan exhibited similarly substantial spillage during the post-impact rollover test.

Additionally, some of the test dummy injury data measurements exhibited values greater than recognized or proposed injury assessment reference values. NEXT SLIDE

NHTSA / GM Agreement



- **GM to conduct 5 of these ORMB tests to further assess small car performance**
  - **Car selection criteria**
    - **'98 M.Y. cars**
    - **Small car sales leaders**
    - **Car or "sister" car not previously tested by NHTSA**
    - **No more than one car from any one manufacturer**
  - **Test configuration, conditions and setup as in NHTSA tests**

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The mixed performance results among the NHTSA tests indicated that additional assessment was warranted for small vehicles. For this reason, it was agreed that part of the Settlement Agreement research dollars would be used to conduct 5 of these offset rear moving barrier tests to further assess small car performance.

1998 model year cars were chosen. The models chosen were small car sales leaders, wtih two additional criteria applied. First, the car or its "sister" car had not been tested previously in the NHTSA test series. Second, no more than one car from any one manufacturer was chosen. These criteria were intended as a way to select a broader, reasonably equitable assortment of small car designs to test.

The test configuration, conditions and setup were very similar to the NHTSA tests.
NEXT SLIDE

The tests were completed in December 1997 and January 1998, and this slide shows a pre-test view of one of the tests. NEXT SLIDE

This slide and the next two, showing a post-impact view of each car, will give you pretty good idea of the high energy nature of this test condition. For example, based on visual inspection, there was a substantial reduction in rear seat occupant space in each of the tests.

[Sequence through the next 2 slides, pausing for 7-10 seconds on each slide]

As you'll see in the next slide, data from some of the front seat test dummies also suggest the test severity.

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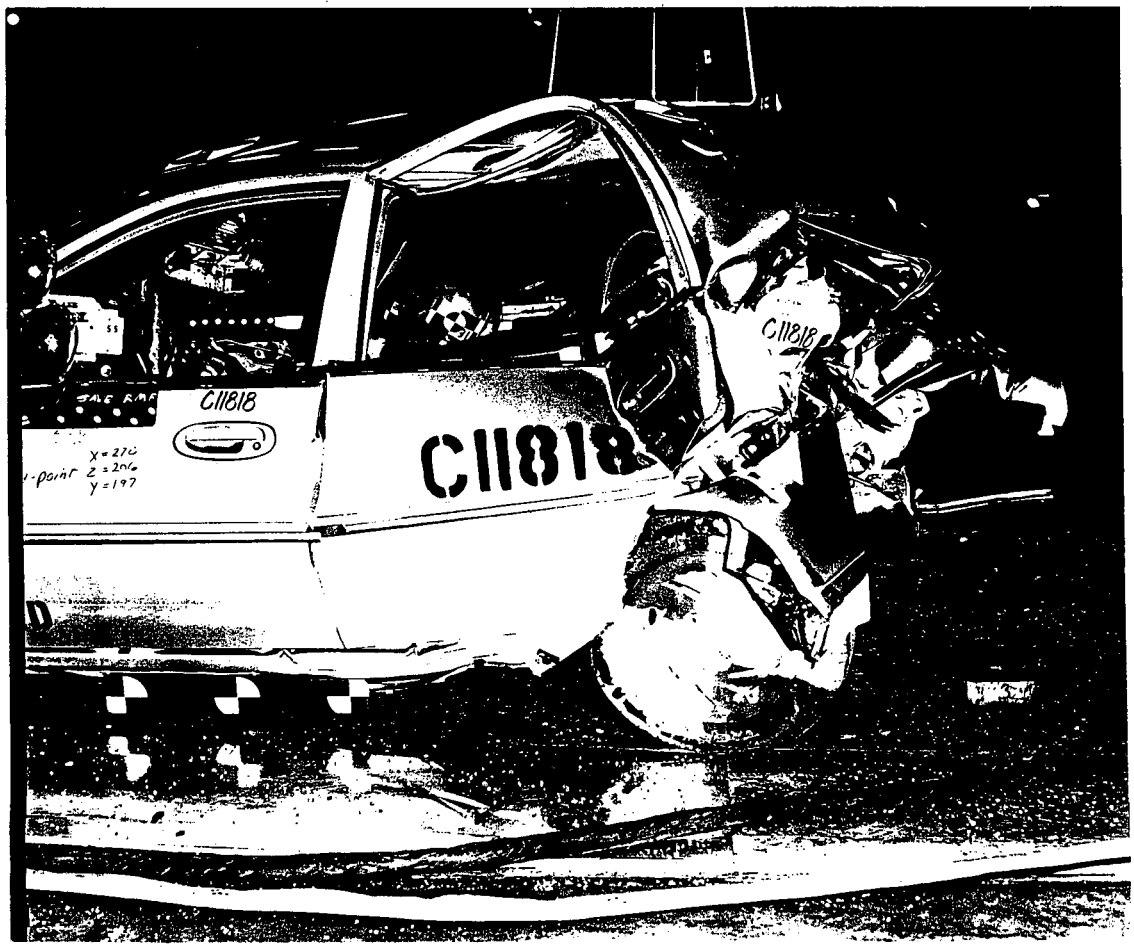
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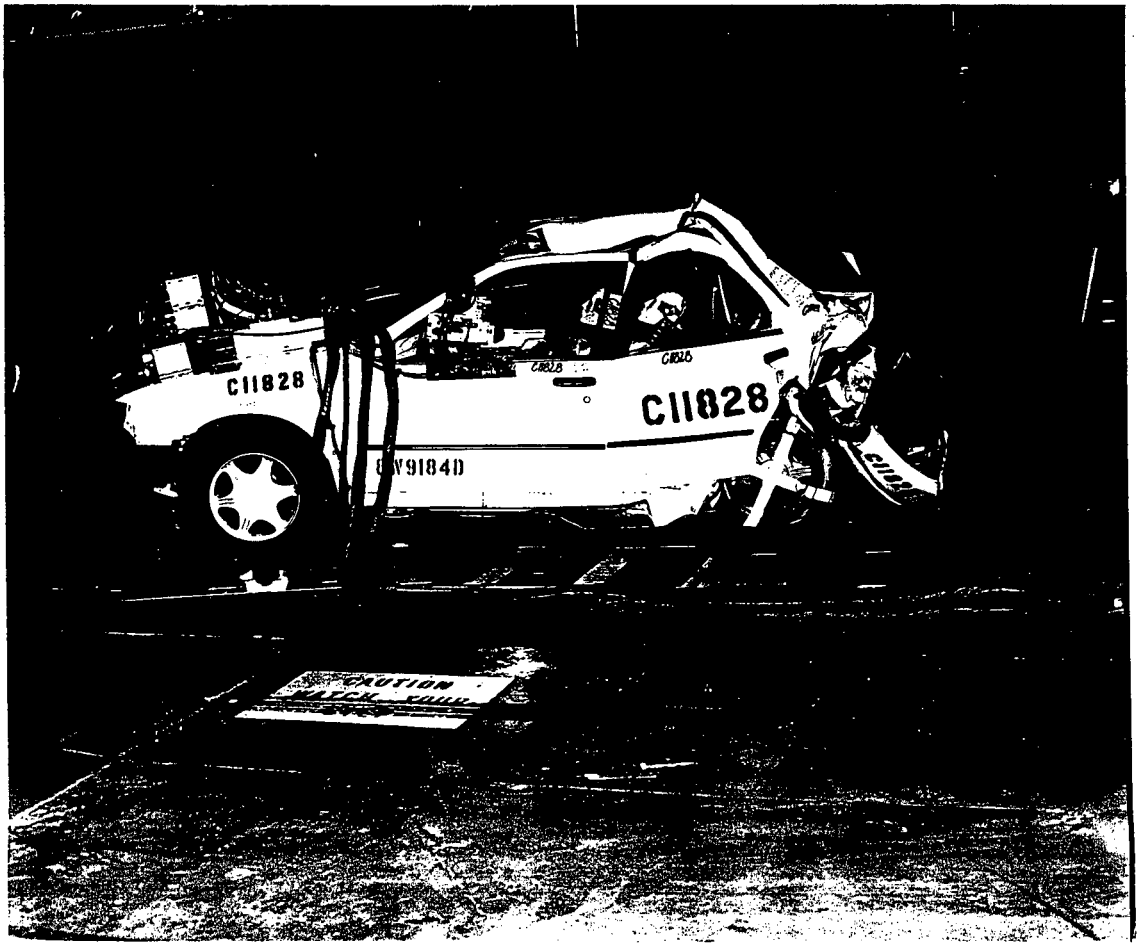
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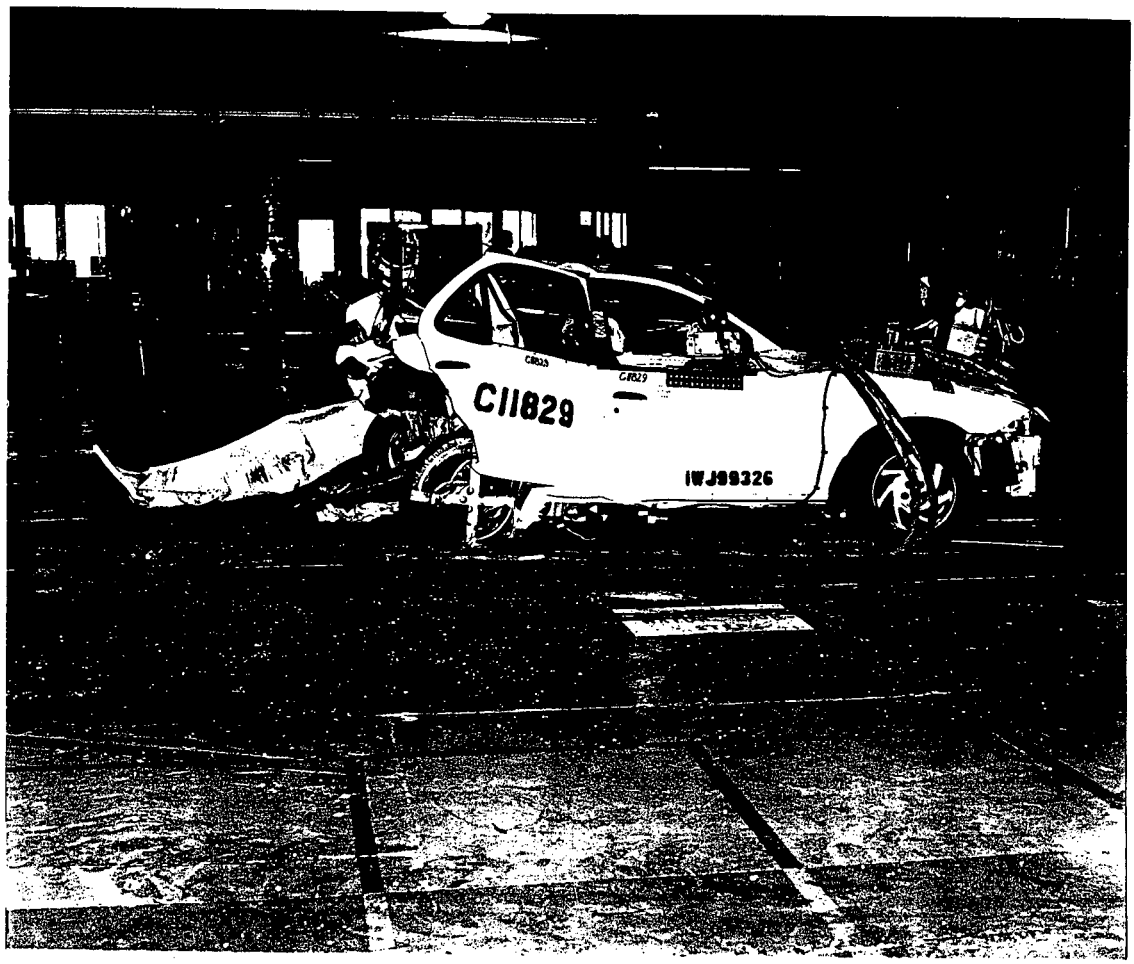
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GM Tests - Results Summary

Car	Impact Test Spillage	Rollover Test Spillage	Test Dummy Data
#1	None	None	All < IARVs
#2	Trace	> FMVSS 301 limits Fractured filler cap seal	RF HIC > IARV All others < IARVs
#3	> FMVSS 301 limits Fractured fuel sender seal plate	No rollover conducted	All < IARVs
#4	None	Trace	All < IARVs
#5	> FMVSS 301 limits Cut in fuel tank	No rollover conducted	RF HIC > IARV RF Nk. Ext. > IARV All others < IARVs

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A brief summary of the primary test results is shown here.

Car numbers 1 and 4 exhibited no fuel system fluid spillage except for a trace (that is, a few drops) observed during the post-impact quasi-static rollover test on car number 4.

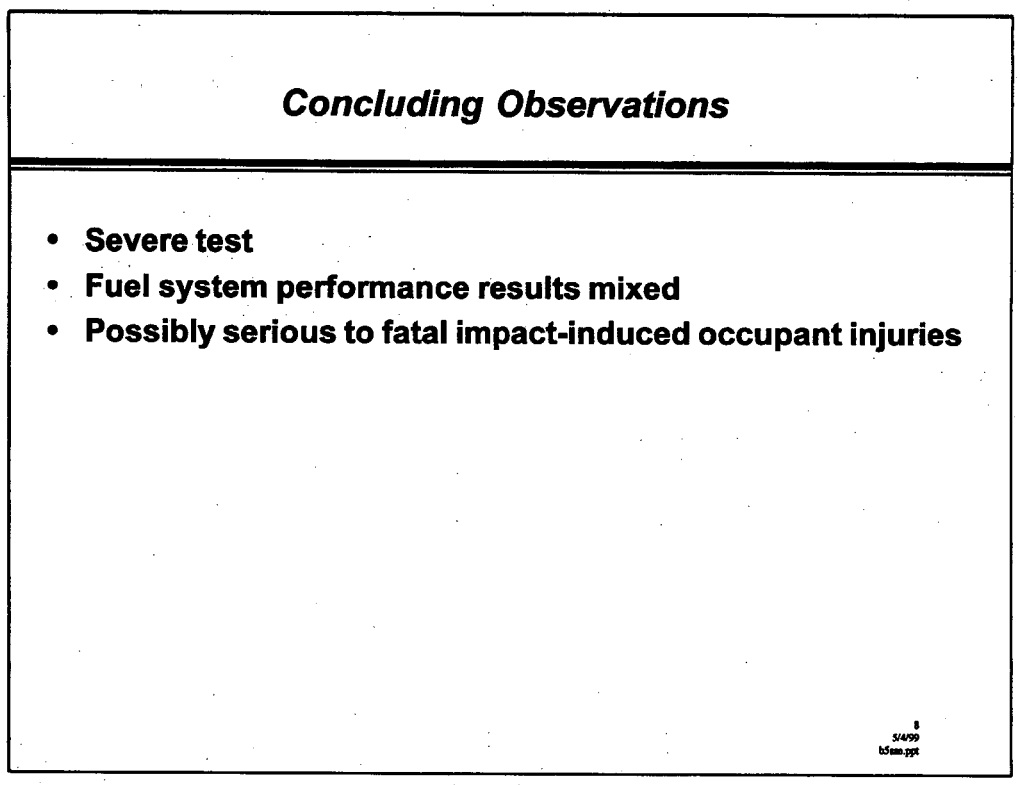
The other three cars exhibited spillage amounts above existing FMVSS 301 limits from the locations listed here. Spillage occurred at the impact site for car numbers 3 and 5. For car number 2, spillage occurred during the post-impact static rollover test.

As in the NHTSA tests, some front seat test dummy injury data measurements, as listed here, exceeded injury assessment reference values. NEXT SLIDE

GM Tests - Additional Results

Car	Delta V (km/hr)	Residual Crush Driver / Passenger Sides (mm)
#1	41.5	1190 / 465
#2	40.5	1030 / 495
#3	40.4	490 / 990
#4	42.8	970 / 465
#5	40.2	640 / 1250

This slide simply shows some basic additional data from the tests, including target vehicle velocity change and residual crush measurements. NEXT SLIDE



I would like to conclude my presentation with a few basic observations from the tests.

First, this is a severe test, based on the evident high levels of car deformation.

Second, the fuel system performance was mixed among the cars tested, and no measure of performance repeatibility is available. Two of the small cars did perform reasonably well, however.

Finally, the substantially reduced rear seat occupant space observed in the tests, and front seat test dummy injury criteria data in some of the tests, indicate that possibly serious to fatal impact-induced occupant injuries could occur under this crash condition. Accordingly, even if motor vehicles, especially small cars, could be developed to meet fuel system performance requirements repeatably in this test, further consideration seems appropriate regarding whether occupants will survive the crash forces. That concludes my presentation.
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