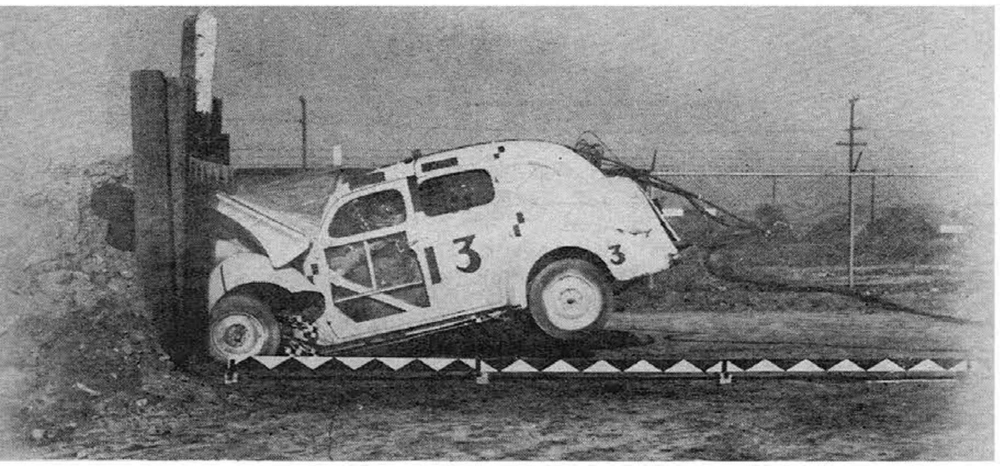
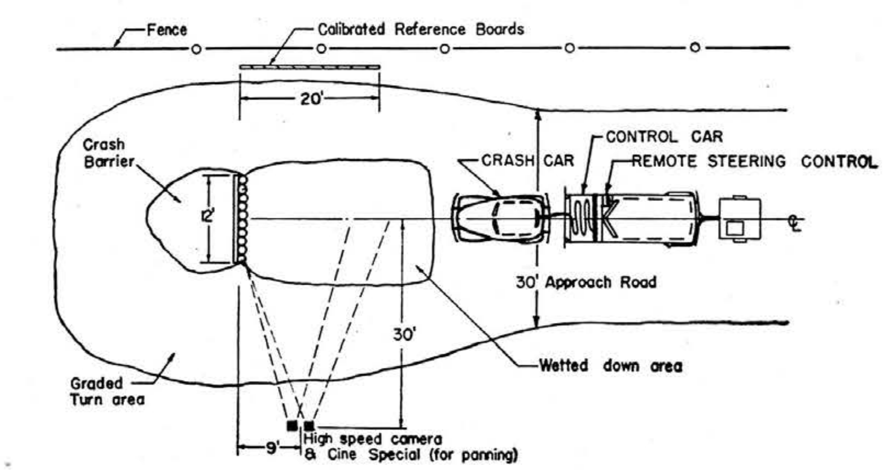
THE SEARCH FOR CAR SAFETY

Scientists at UCLA stage crashes under controlled conditions to get the answers

BY OCEE RITCH



With instrument cables trailing behind, impact car is deliberately rammed into barrier. Door panels have been removed so high speed cameras can record what happens in the front seat. The diagram below shows the testing setup in detail.



AN OLD SEDAN rolled along a deserted road in the outskirts of Los Angeles. Two erect figures in the front seat didn't move as the car sped toward the high barrier which stretched solidly across its path. Then came the impact, as it plowed into the obstruction.

The crash lasted approximately one-fourth of a second.

A trained engineer will spend a year in analyzing the data gathered in that brief interval. His findings may well contribute toward saving your life.

The old car with its human-like dummies is the property of the University of California at Los Angeles' Institute of Transportation and Traffic Engineering, headed by Prof. J. H. Mathewson. Nearly six years of preliminary research and experimentation preceded that actual destructive impact. The men of the institute are not in the business of staging spectacular wrecks for thrill-seeking spectators, nor for the fun of hearing a loud noise.

The sober purpose is to provide information which can be used in making the automobile safer. Their findings, while yet incomplete, may reshape the interior, chassis, seating arrangement and details of construction on the cars we will be buying in a few years. Their story is still in the making, but the infinite amount of patient attention to detail and scientific exactness which goes into the tests make a chapter worth reading.

To begin with, automobile accident injury has been the most neglected field of disability research in this country. We spend $65.97 per disability for the study of polio, $5.41 for cancer and only two cents for investigation on the subject of car safety. Driver education, equipment improvements and engineered highways have made their contribution to reduction in loss of life and accident rate, but little has been done toward making the auto itself safer . . . to make it serve as good protection against the hazards of crashes.

As far back as the '30s this idea was being brought before engineering societies by such men as Stoeckel, Halsey, Hunt and others, but because of the lack of basic knowledge of the nature and characteristics of accidents and resulting injuries, nothing happened.

When it is considered that one out of every five persons who read this article will be involved in an injury-producing crash and that nearly half of all the cars on the road today will be wrecked, it is plain to see that some serious study must be made. The men at UCLA deserve much credit for pioneering in the field and for evolving the accurate methods to collect the needed data.

Actually the basic hazard didn't originate with the car. "Reckless drivers" were roundly castigated in a Denver newspaper back in 1891 which stated that a policeman had been stationed at a busy intersection to prevent more "deadly horse and buggy catastrophes." Higher and higher speeds have only increased the severity of the resulting collision when two solid objects try to occupy the same interval in space-time.

The limitations of man, as subject to sudden change of direction and deceleration, were not very well known prior to WW II but observations of aircraft carrier landing crashes and other service-connected accidents, together with research, established a set of tolerance standards which could be used in estimating the chances of survival in car wrecks on highways.

As early as 1948 the department had gathered evidence on crashes by photographing the headon crackups performed by the Joie Chitwood thrill circus drivers. By installation of instruments in the cars, which were sent together at speeds up to a combined total of 60, it was learned that an average deceleration rate of about 13 G was attained. The survival of the drivers was due to the fact that they crouched behind the front seat with their backs toward the front of the car and

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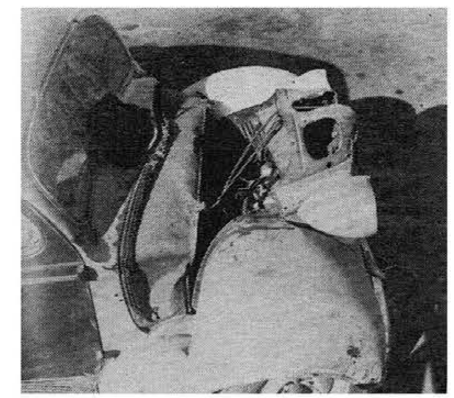
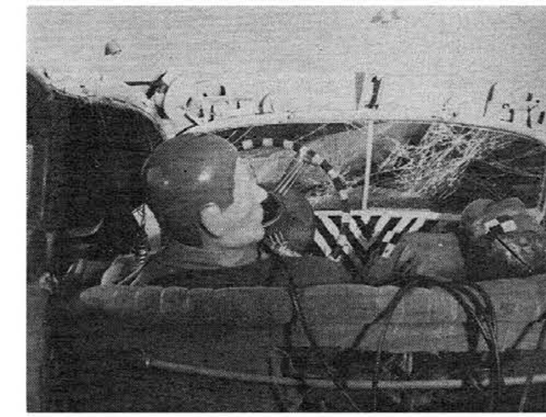
Crash car and control car are in position preparatory to another test from which evidence will be gathered by scientists.



Front end of this car crumpled under impact. The researchers have arrived at interesting conclusions on construction.



Dummies in crash car front seat following impact. Note the cables running from them which record the impulses.

were further cushioned by a mattress.

The terms used in the institute reports are highly technical and of little meaning to the layman, but "deceleration," which is a five-syllable synonym for "stop," and "G," meaning the force of gravity, will be borrowed.

One G is the weight you push against the sidewalk. If you are subjected to a 3-G load, you are carrying three times your normal weight. An automobile cannot be decelerated by its own brakes at a rate higher than about .9 of 1 G.

In order to impose higher deceleration to a car under conditions which would permit repeated tests and accurate measurements, D. M. Severy, now in charge of ITTE tests, attached an aircraft arresting-gear tail hook to his family sedan and drove it across cables attached to four one-ton concrete blocks at various speeds. These sudden stops produced G readings as high as 3.5 and resulted in no injury to Severy who was secured by a safety belt of the across-the-chest type.

At the same time the institute was accumulating information on actual highway crashes. Through the cooperation of the Police Department they were permitted to tune in official frequencies on car radios and rush to the scene where photographs were taken and witnesses interviewed. Although they arrived within minutes after the occurrence and made as careful an analysis as possible the facts obtainable were still insufficient to make solid conclusions and it was decided that only staged destructive crashes would provide the answers.

CONTROLLED TEST CONDITIONS

To carry out these tests a substantial barrier was built out of utility poles, well braced and backed with an earth fill of several tons. Three 1937 four-door sedans were acquired and modified.

The front doors were removed to permit photographic recording of the actions of the dummies representing passenger and driver, the cars were steam-cleaned thoroughly so no dust would obscure the field of vision and all glass was taken out. In the first car two four by six inch steel I beams were installed across the frame as a stable attaching point for seat and safety belt. This rigid support was thought necessary so that seat and belt loading could be measured by strain gages. The front seat was removed and a specially built one put in its place. On the second and third cars the seats were left as stock.

The dummies themselves could be the subject of an essay, since they so completely resembled human beings, including a partial fixation of the joints to simulate muscle tenseness which would be a pre-impact reaction. One, the creation of the ITTE, had face and head covered with a layer of glass cloth impregnated with plastic to resemble skin. The other, built by the Sierra Engineering Co., was of the type used by the Air Force in its studies. Both were of average height and weight (approximately 157 pounds). The weight distribution and center of gravity corresponded with that of humans.

For the first time in auto research history accurate medical assessment of the probable injuries which would have been sustained by human beings, had they been in the dummies' places, was made. Through the cooperation of Drs. Wendell Severy of UCLA and Charles Bechtol of Yale, the dummy damage was correlated to inferred contusions, fractures and internal injuries.

Measurement of the many factors inherent in the crashes was accomplished by three methods: mechanical, electronic and photographic. Each type contributed data and a sufficient overlap was planned to provide adequate correlation of the three systems. A mechanical self-contained recording accelerometer was developed by Art Gross for the tests and installed in the chest cavities of the dummies. Belt tensiometers of the electric strain gage type and accelerometers were connected to a Hathaway 12-channel recording oscillograph carried in a truck which had been equipped to push and guide the cars. A high speed (3,000 frames per second) motion picture camera and a slow-motion (64 frame) camera photographed the impact. A 60-cycle timing light superimposed a mark on the high speed film to provide accurate timing during the crashes.

The cars were painted with visual target points on the body which were not affected by the impact and background markers were set up. These were needed for the later frame-by-frame analysis of the movies by scientists.

To determine deformation of the frame and other chassis parts, metal screws were affixed at one-foot intervals for a distance of six feet back from the front edge of the bumper on the first car, which then was driven onto a sheet of three-quarter-inch plywood where positions of the screws were charted by plumb bob. After the crash, the measurements were again recorded and the distortion could then be plotted. This method, however, gave no clue to the rate and sequence of stress reactions, so in the last two tests metal rods were attached at six-inch increments along the frame and small flags on the ends of the rods produced a motion pattern which could be evaluated by a study of the films.

IMPACT RATE AND PATTERN

The aim of these experiments is to determine not only the maximum deceleration but the pattern and rate of onset during the impact. The body can tolerate relatively high Gs for a brief period of time and if not applied too suddenly. The hope of the ITTE is to learn how the forces of a crash are distributed and absorbed so that design changes in chassis and interior can make the shocks bearable without injury. The barrier smashes

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provided the worst possible conditions which might be encountered because of the unyielding nature of the wall. A car-to-car headon at the same speed would not create as much damage possibly because of the mutual-penetrating effect . . . sort of like pushing two hairbrushes together with your hands.

With the area well dampened down, the push truck containing the remote control mechanism for guiding the car and the recording apparatus rolled down the road shoving the test car up to a predetermined speed and cut-off point. The truck then slowed down, paid out the electronic cables and was stopped at the time the sedan struck the wall. To coordinate the necessary motions and to be sure the sedan would hit the barrier at the desired speed took a lot of rehearsing. The fact that each of the crashes produced usable scientific information is a tribute to the Institute.

What have the researchers learned?

Not enough, yet, they say, and estimate that another five years of continuing research will be necessary to provide them with the answers they seek. A few interesting disclosures have come out, however and make interesting study.

For one thing, the bumper is not a significant factor in taking up the forces of a front end smash. The steering column and wheel are dangerous because they are attached to the frame and when it collapses backward they are forced into the driver. The grille and front wheel assemblies bear their own weight, so to speak, in a wreck and absorb approximately that amount of the stress. The frame seems to bear as little as one-half the total load and may only have to absorb one-third the kinetic energy generated in the crash.

From their research it appears that the front of a car can be collapsed to the fire wall without transmitting more than 30 G to the intact portion. If properly restrained, the occupants could survive such a crash unless the motorists' compartment was collapsed. The passenger dummy in a 25 barrier smash, without the benefit of any belt, struck the windshield with a force estimated at 200 G. The driver dummy, whose weight approached 4,000 pounds (two tons) during the collision, stretched a nylon shoulder-loop belt so that his head barely contacted the steering wheel. Tensiometer readings showed that approximately 1725 pounds was being borne by the belt.

As test information is analyzed it is released by the institute, but due to the time lag in auto production it may be months or years before the facts are applied to design. In view of the fact, though, that we can hardly expect fewer accidents in the future, the industry should incorporate changes which will make the chances of injury less. •

WHEN IT BECAME A CUSTOM

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looks good. Even today's most expert customizers will view a photograph and admire the work. Sedans and coupes began to come in for restyling, particularly after the advent of the club coupe, where mostly open body styles had been preferred before. This restyling of the closed car accounted for a boom in sales of body lead which some artisans tried to substitute for hammer and muscle. Fortunately, good taste won out and the lead barge sank of its own weight.

No one can be found to accept the blame for chopping the first '32 coupe. It just suddenly appeared on the streets one day. To say that top-chopping was carried to extremes would not be far from the truth. As with any fad, it could be carried too far, and it was. The usual yardstick for determing how much window area to leave was a giant malt or a soda glass which, more often than not, formed the basic diet of the builder. If you could get barely a full malt glass through the window while parked at a drive-in, the top had been chopped right.

At first glance chopping looked like an impossible task, but the acetylene cutting torch was an ingenious tool. A determined amateur stylist could wrought no end of changes. Sometimes the side windows didn't fit when rolled up, but the coupe owner was probably getting more draft through holes in the firewall and floor than he needed anyway, so an ill-fitting window was a minor inconvenience.

With the lowered steel top came new sensitivity to interiors. Upholstery shops did a fine business in splashily colored materials. The Carson Top, a removable fabric-covered steel pseudo-convertible type, came into being. They were so finely done, inside as well as out, that the renovation of the seats and trim became the primary step in many expressions of individuality.

Among small touches, it's safe to say that the inset license plate holds top spot. This bit of body work was first performed by Frank Kurtis in 1936 on an Airflow DeSoto. It, more than any other single feature, marks the *California Car*.

By the late Thirties the customized or restyled car could be spotted anywhere. Lowered, de-chromed, with smooth hood and deck, plus set-in plates and maybe a chopped top—all these caused it to stand out in traffic and attract the curious who gazed on its sleek, upholstered interior and chromed dash in wonder.

The look of the future was about it and its lines created an impression of speed. No wonder that the movement spread. And Southern California will take the blame.

(NOTE: This is only the second in the series of articles on custom and restyling of automobiles. Others, also by OCee Ritch, will appear in following issues of Motor *Life.)* •