6175

L. W. Camp
Director
Automotive Safety Office
Environmental And Safety Engineering

Ford Motor Company
330 Town Center Drive
Dearborn, Michigan 48126

August 18, 1999

NHTSA 98-3390-51

Honorable Ricardo Martinez, M.D.
Administrator
National Highway Traffic
Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Dr. Martinez:

Re: Supplement to Petition for Reconsideration -- FMVSS 225, Child Restraint Anchorage Systems (Docket 98-3390, Notice 2; 64 Fed. Reg. 10786, March 5, 1999)

Ford Motor Company (Ford) herein provides additional test data in support of its petition, and the petition of the Alliance of Automobile Manufacturers, for reconsideration of Standard 225 regarding child restraint anchors. This letter updates our 2000 model year FMVSS 225 compliance status, and the attachment details some significant test objectivity issues that were identified during our recent tests.

Update on 2000 MY Compliance Issues

Ford's April 19, 1999, petition for reconsideration raised several significant compliance-related issues concerning our 2000 MY products. Redesigns and/or additional testing resolved some issues. Some issues remain, but agency plans to allow interim optional compliance with CMVSS 2 10.1 and ISOFIX standards provided temporary relief from the excessive requirements in Standard 225. Ford has not redesigned its voluntary built-in tethers on light trucks to meet the FMVSS 225 displacement limits. The center tether anchor is being installed in the Focus hatchback and station wagon for the U.S. and Canada, even though it does not meet our interpretation of the FMVSS 225 displacement limit.

Ford modified the design of the Focus lower anchors to eliminate the fold-away feature, in order to meet the new rigidity test of S9.1.1(g). We believe some of our customers would have appreciated the fold-away feature and it would not have adversely affected safety. However, the modified rigid anchors comply with all FMVSS 225 requirements and are simpler to use. They will be standard in the 2000 MY Focus.

Ford modified the Windstar to meet FMVSS 225 lower anchor specifications. Our petition noted that we were developing bucket seat pedestal modifications to try to meet the lateral displacement limit. By stiffening seat tracks, changing the rear seat crossmember shape, relocating the built-in tether anchor, and adding a rear crossmember reinforcement, the bucket seat can now comply with the FMVSS 225 lateral displacement limit. Ford is proceeding with earlier plans to install ISOFIX anchors at four seating positions in the Windstar (as displayed at Lifesavers 17).

As noted in our petition for reconsideration, most three passenger seats (including the rear seat in the Focus and the third row seat in the Windstar) will have a non-complying child restraint anchor systems at the center position. The resulting anchor system typically has an anchor separation different from the 280 mm specification, and is formed by the center tether anchor and the inboard lower anchors for the outboard seating positions. The first printing of the Owner Guides for the Windstar and Focus states that this center rear position cannot be used for installation of ISOFIX-compatible child restraints, because the child restraint attachments may fail (if attached to anchors more than 280 mm apart). We believe that our customers may install ISOFIX-compatible child seats at these center positions even though we advise customers not to use the anchors in this way. We are conducting tests to confirm that webbing-attached child restraints can be safely used in this seating position. If testing is successful, later printings of the Owner Guides will be changed to recommend installing ISOFIX-compatible child seats with webbing attachments at these center positions, even though the lower anchors are more than 280 mm apart.

Ford and its suppliers expended considerable effort to quickly redesign and retest vehicles in order to meet the requirements of FMVSS 225. Ford reiterates our position that the original designs were safe and effective restraint systems. Changes were initiated to the extent practicable within the limited time available, because of uncertainty that rulemaking issues could be resolved prior to the effective date of the final rule and prior to start of 2000 model year production.

If you or your staff have any questions about this supplemental petition, please contact Mr. W. F. Eagleson on (313) 337-2813.

Sincerely,

L. W. Camp

Attachment

Attachment
August 18, 1999

Ford Motor Company
Supplement to Petition for Reconsideration
FMVSS 225, Child Restraint Anchorage Systems
(Docket 98-3390, Notice 2; 64 Fed. Reg. 10786, March 5, 1999)

Displacement of Seat-Mounted Tether Anchors

In its April 19 petition, Ford noted that a test of a center tether anchor showed a displacement of 123 mm, after a 28 second force application and a 2 second hold period. Recent tests of two additional light truck models showed displacement of the center tether anchor that substantially exceeded 125 mm. The displacement of the outboard tether anchors also substantially exceeded the 125 mm limit. These tether anchors mount to the vehicle seat frames, but there was no noticeable movement of the anchors in the vehicle seat frame. The anchor movement was largely caused by floor distortion where the seat mounts to the floor, plus some forward rotation of the seat back relative to the seat cushion frame. Floor distortion allows the seat to tip and translate forward. (Inboard seat belt lower anchors in these vehicles mount to the seat frame, moving the belts as the seat cushion moves to convert the passenger area into cargo area.)

In all three of these vehicle designs, the tether anchor moves primarily because of the forces on the lap and lap/shoulder belts, not because of forces the tether strap applies to the tether anchor. Excessively high forces required by the Standard on the three Static Force Application Devices (SFADs) pull on the lap and lap/shoulder belts restraining the three SFAD 1s, as well as on the tether strap. The extreme forces on the inboard lower anchors of the lap and lap/shoulder belts distort the floor near the seat anchorages. The seat-mounted tether anchors move with the seat as it is pulled and tipped forward. These seat and floor deformations are similar to those seen in FMVSS 2 10 tests of seat belt anchorages. But FMVSS 2 10 does not include a limit on anchor displacement, and the agency previously rejected the concept of applying a displacement limit to anchorage tests using a long force application period.

Measuring Tether Anchor Displacement in Pickup Cabs

The recent test of a Ford pickup cab demonstrates the lack of objectivity of the anchor displacement measurement. The agency has not established a method that can accurately measure anchor displacement in all vehicles. The pickup design tested recently has tether anchors near the lower rear edge of the seat back, mounted to the seat frame. At the start of the test, the upper part of the seat back nearly touches the back panel of the cab, so the anchors cannot be seen. We cannot measure anchor displacement relative to the floor or the back panel, because the extremely high forces on the SFAD 1 substantially distort the floor and cab back panel during the test. There was no way to accurately measure both the longitudinal and vertical displacement of the anchors without cutting large holes into the back panel of the pickup cab. However, the holes weaken the cab structure and thus increase the measured displacement. In this particular test, a single large hole was cut to accommodate all six potentiometer cables. Six smaller holes in the structure would reduce (but not eliminate) the weakening effect of the holes and reduce the measured displacements. Smaller holes increase the risk that one of the six potentiometer cables will contact the edge of a hole, invalidating one or more of the displacement measurements. An invalid test of a future model destroys a scarce, hand-built prototype body and could force structural redesign and delay model introduction.

How will the agency measure the displacement of the tether anchors in such a vehicle without affecting the movement of the anchors during the test? Ford sees no need to measure tether anchor

displacement in this type of test. As noted above, the agency has acknowledged that limiting displacement during a test with such a long force application period is inappropriate.

Measuring Tether and Lower Anchor Displacement in Body-Frame Vehicles

In addition, these tests raise the issue of the reference from which to measure anchor or SFAD displacement. In particular, for body-frame vehicles such as these light trucks, will the agency measure displacement relative to the body or relative to the chassis frame? These tests apply a force of 45 kN (over 10,000 pounds) to the vehicle body. This excessively high force substantially deforms elastomeric body mounts. It also could distort the area of the body or frame contacting the body mounts. It may also cause some minor flexing of the frame. The degree of frame flexing may depend on the means used to secure the frame. In some FMVSS 210 tests that apply forces higher than those specified by the agency, the test forces may separate the body from the frame if elastomeric body mounts are used without modification.

The agency has not issued any FMVSS 225 test procedure. All Ford tests of seat belt anchorages and tether anchors in body-frame vehicles have observed the long-standing Ford practice of using a body-in-white mounted to the vehicle frame using aluminum spacers in place of the body mounts to the rear of the passenger compartment. (The rear spacers are visible in the "after" photo of the tested pickup.) The chassis frame is mounted rigidly to the bed-plate of the test apparatus with the front of the frame rails butted up against a vertical surface. A 6 mm thick washer is used inside the body under the head of each rear body mounting bolt. For short bodies such as regular length pickup cabs, braces are installed between the top corners of the windshield opening and the front vertical surface that stops the frame rails. Anchor displacement is measured relative to the undeformed areas of the vehicle body. If it is not practicable to measure displacement using body-mounted potentiometers, frame-mounted potentiometers are sometimes used.

Ford believes that the only potentially relevant anchor displacement is movement relative to the body structure, seats, etc. ahead of the SFAD. We see little, if any, relevance to vehicle safety of the displacement measured in these tests because the long force application causes displacements that are much greater than any observed in even the most severe crashes and dynamic tests. Displacement of the body relative to the chassis frame in such a non-representative test has no relevance to child safety. If an agency audit test secured the frame of a vehicle to the bed plate of the test apparatus without holding the body rigidly, and measured displacement relative to the bed plate, the displacements measured in body-frame vehicles would be greater than those measured in these Ford tests.

To establish an objective standard for displacement at these excessive forces, the agency must clearly specify that displacements are to be measured relative to the undeformed body, and the method of securing the vehicle, the body, or the seat. The method of securing the chassis frame, the vehicle body, or the seat structure to the test apparatus affects the displacement of tether anchors and the displacement of the SFAD 2 used to evaluate lower anchor stiffness. Vehicle manufacturers must be told in advance how the agency plans to conduct its audit procedures. Any forward tipping of the body on the frame as the force is applied will change the vertical direction of the force on the SFAD. Agency contractors frequently test anchorages by passing cables through door openings and around pulleys within the vehicle. This method of applying forces will have a different effect on the vertical angle of the force as the cab tilts than the traditional method of pulling on cables passing through holes in the front of the body. Thus the present rule does not provide vehicle manufacturers with an objective means of measuring whether their vehicle will comply.

For lower anchors, the ISO standard for ISOFIX was not intended to include deformation of body-to-frame mountings, etc. ISO specifies testing in the vehicle or sufficient parts to represent the strength and rigidity of the vehicle. Thus, an ISOFIX test of lower anchors in the Windstar includes only the readily removable vehicle seat mounted to anchor bars on the bed plate similar to those in the floor of the Windstar, because those seat-mounting bars are rigidly mounted in the Windstar vehicle structure. Ford believes that the intent of the agency is to limit anchor and SFAD 2 displacement relative to the undeformed portions of the vehicle body, for both forward and lateral tests. (Ford previously raised the issue of the effect of body-frame mounting flexibility on test results in FMVSS 2 16 rulemaking. [*Supplemental Comments on Notice of Proposed Rulemaking - Light Truck Roof Crush Resistance (Docket 89-22; Notice 1, 54 Fed. Reg. 46275, November 2, 1989*, dated April 23, 1990])

Lateral Positioning of the SFAD and the Vehicle Seat for Lateral Tests

Recent tests demonstrate that displacement of Point X of SFAD 2 in the lateral force test can vary substantially depending on initial positioning of the SFAD 2 on the anchor bars. In addition, results for readily removable seats vary depending on the initial lateral position of the vehicle seat on its attaching bars. The preload force of 500 N was expected to remove this slack from the system before the start of the displacement measurement, but recent Ford tests show that the preload is insufficient to consistently remove all lateral slack in these attachments.

Because anchor bars can be up to 40 mm wide and the SFAD 2 attaching bars are 25 mm wide, displacement in the lateral test can vary by about 15 mm depending on the initial placement of the SFAD 2 on the anchor bars by the test contractor (if the preload does not cause the SFAD 2 to slide along the anchor bar). Details of the design of the SFAD 2 attaching bars and their condition also affect the propensity of the SFAD 2 to slide along the anchor bars during application of the preload force.

Readily removable seats are typically mounted on anchor bars that are about 50 mm long, to aid customer reinstallation of seats. A further lateral slippage of 20-25 mm can occur in this seat attachment during force application. Thus, differences in initial lateral placement of the SFAD 2 and vehicle seat can vary displacement by as much as 35-40 mm, a substantial portion of the allowed 125 mm movement. To significantly reduce these known causes of test variability, the test procedure should specify that the SFAD 2 is to be positioned as far along the anchor bars as possible toward the direction of pull for lateral tests, with the side of at least one of the anchor attaching bars contacting the end or side of the vehicle's anchor bars. For readily removable seats, the vehicle seat should be positioned at the lateral midpoint of possible positions along the seat anchor bars.

Location of Flexible Routing Devices

Section 6.2.1.2(b)(1) specifies that any flexible or deployable tether strap routing device must be not less than 65 mm behind the torso line for that seating position, measured horizontally and in a vertical longitudinal plane. This provision is intended to keep the routing device far enough back to remove slack from the tether strap, particularly a tether strap that is mounted high on the back of a child restraint. But S6.2.1.2 does not specify the conditions under which this dimension is to be measured. The intent is to measure the position of the routing device during use, while a tether strap is routed through it and tensioned.

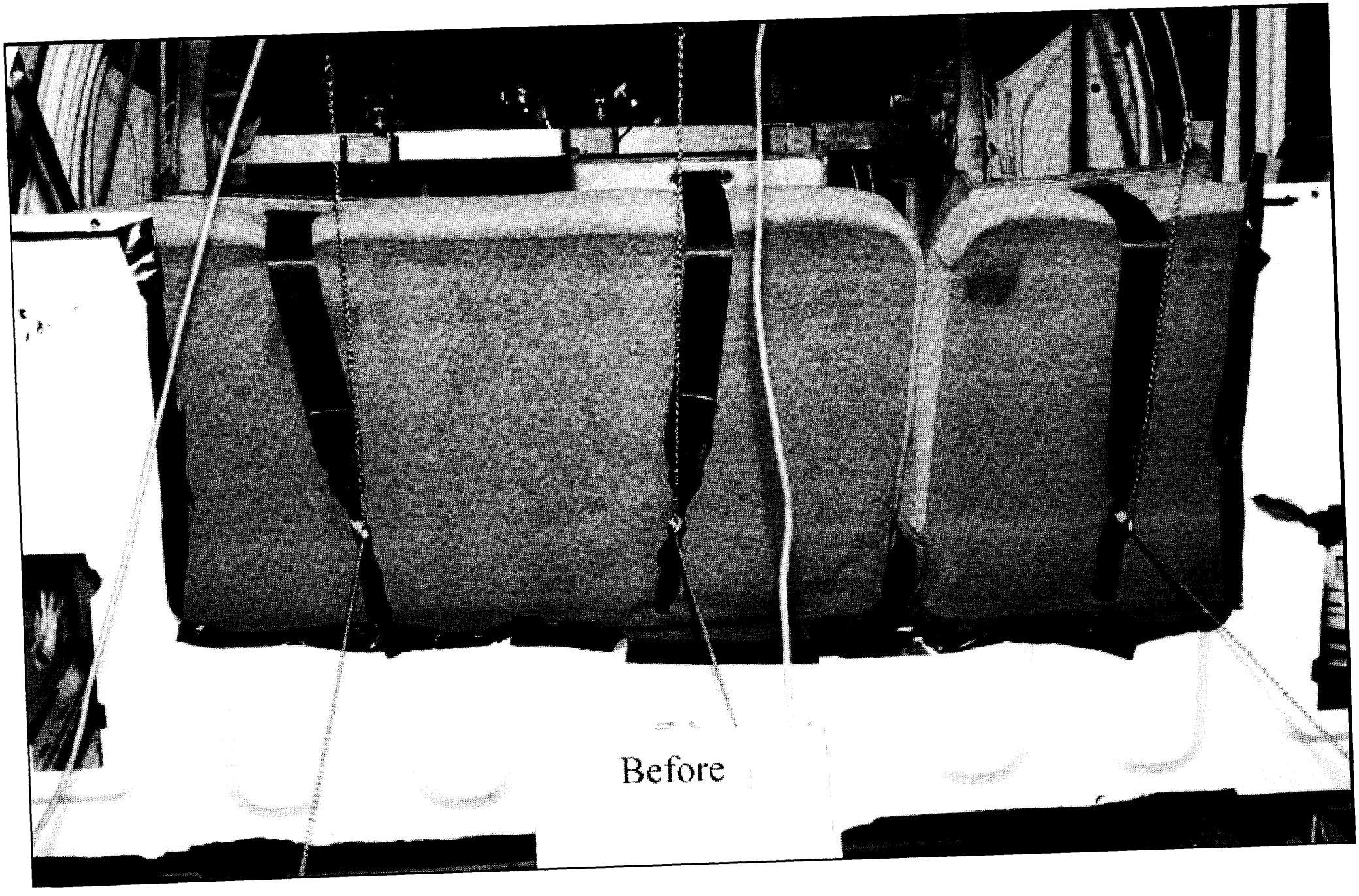
For seating positions with ISOFIX anchors, Ford suggests that a procedure be developed using SFAD 2. Such a procedure should install the SFAD 2 on the anchor bars (with the length of the anchor attaching bars properly adjusted) and the front part of the SFAD 2 base touching the seat cushion. A

40 mm wide nylon tether strap would be routed through the tether routing device and hooked to the appropriate tether anchor, following owner's manual instructions. The forwardmost contact point between the strap and the routing device should be 65 mm or more behind the torso line when the tether strap is clamped flat against the top surface of the SFAD with a tension of 55 to 65 N in the strap.

For seating positions without ISOFIX anchors, it may also be possible to use the SFAD 2. The SFAD must be held with its central lateral plane in the central vertical longitudinal plane of the designated seating position. For this measurement, the adjustable anchor attaching bars of the SFAD 2 should be replaced by spacers that end flush with the back surface of the SFAD base. If SFAD 1 is used for this test measurement, that fixture might contact the routing device and push it rearward of the 65 mm limit in some seats, which would not meet the intent of the 65 mm limit.

CRF Tether Strap Attachment Point

Figure 2 shows a tether strap attachment point on the back of the child restraint fixture (CRF). The back view shows a dimension of 55 mm from the base of the CRF to the tether strap attachment. It appears that this dimension should be 550 mm to be consistent with the location on the figure. But the purpose of this "tether strap attachment" is unclear. This point is not included on the ISO version of the CRF. How is this point used in determining compliance with Standard 225?



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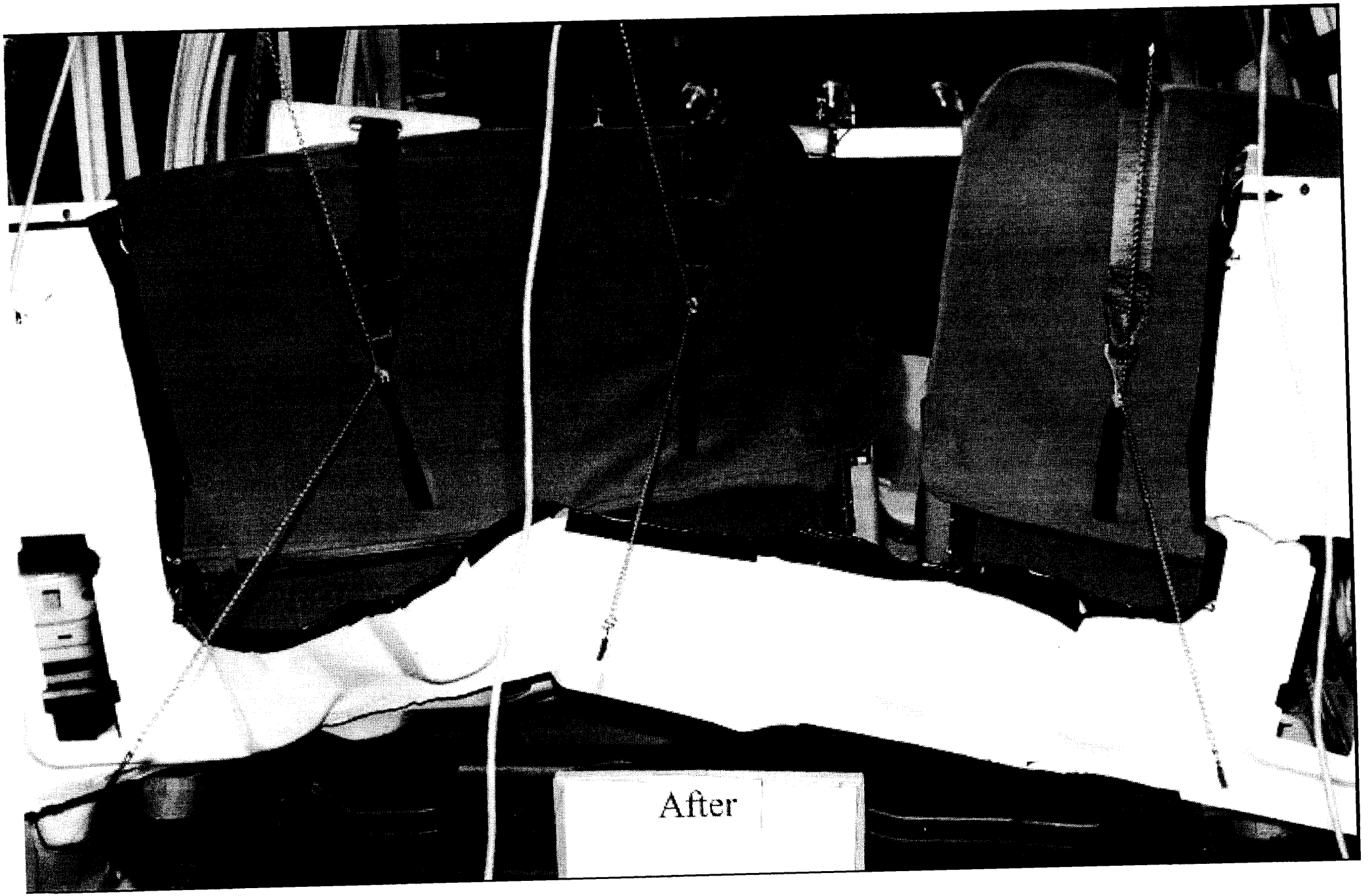
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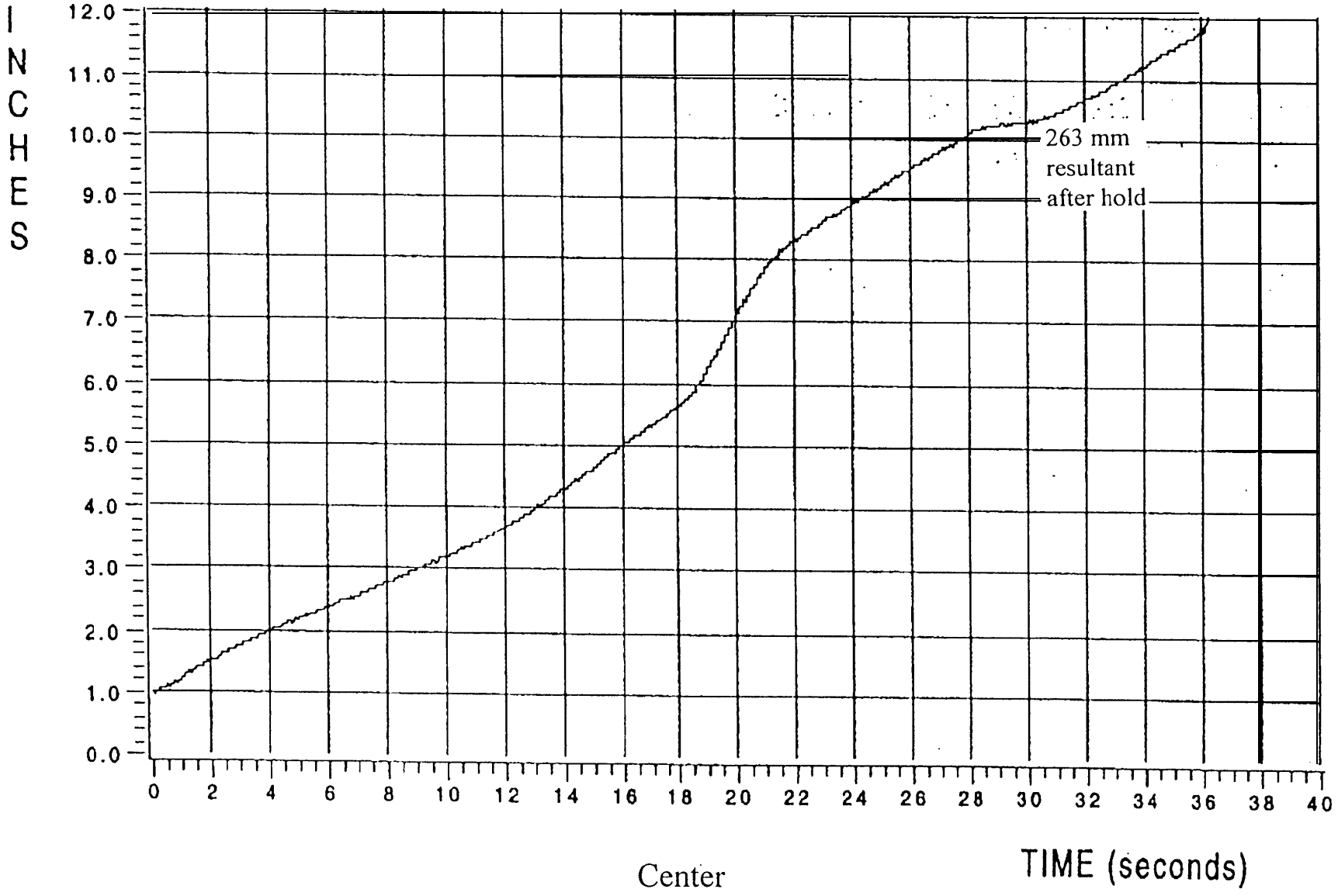
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after hold
TIME (seconds)

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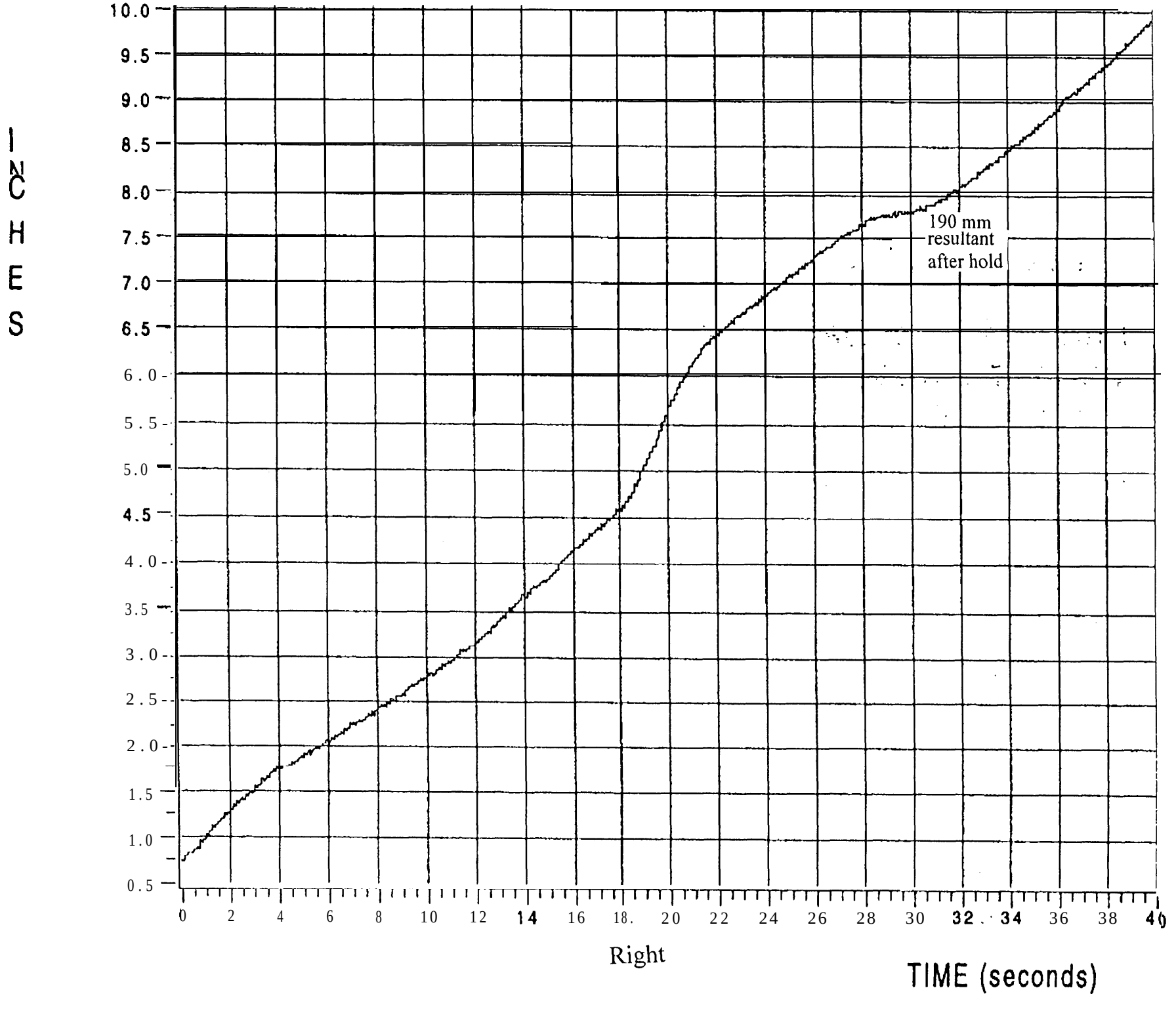
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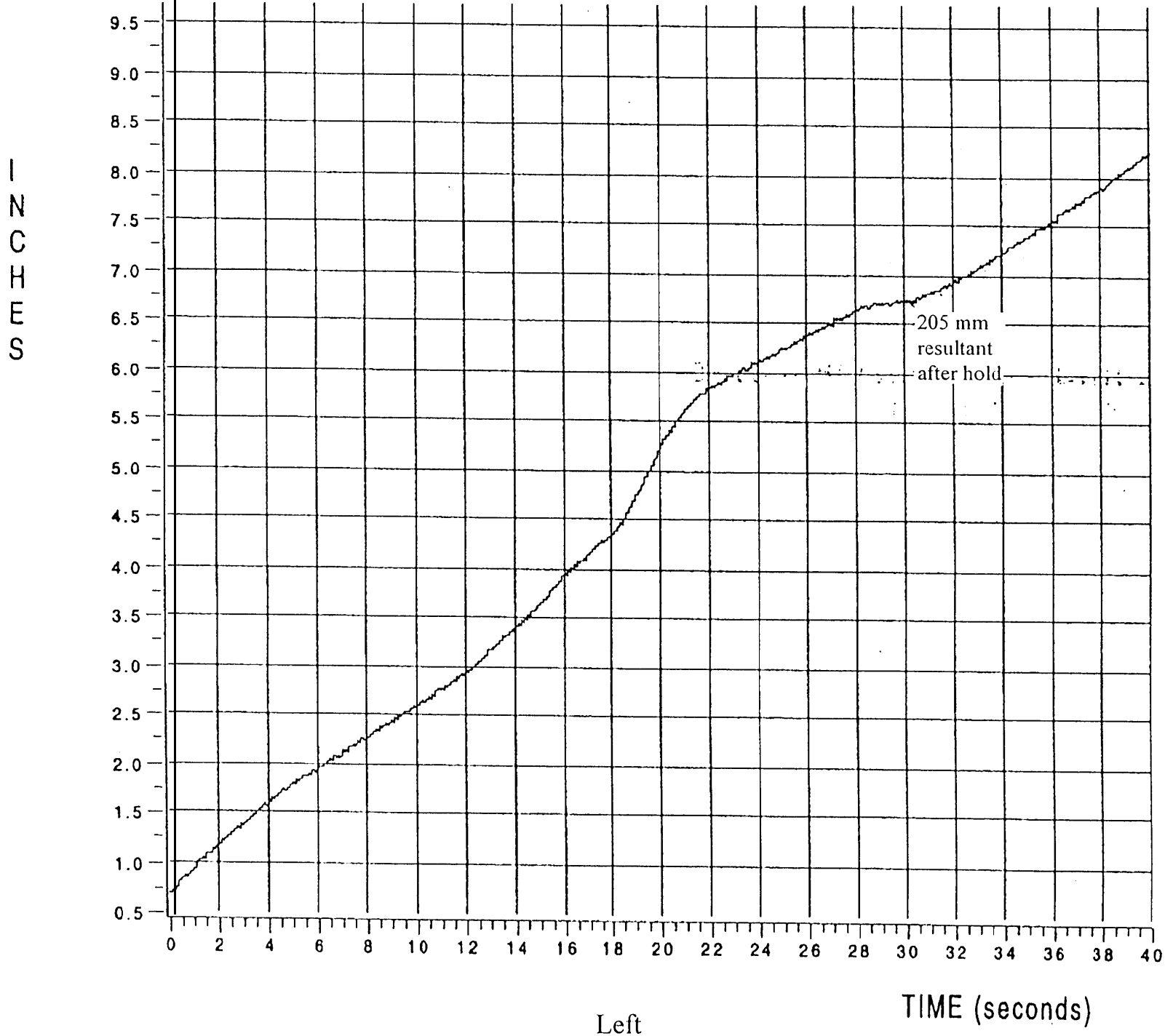
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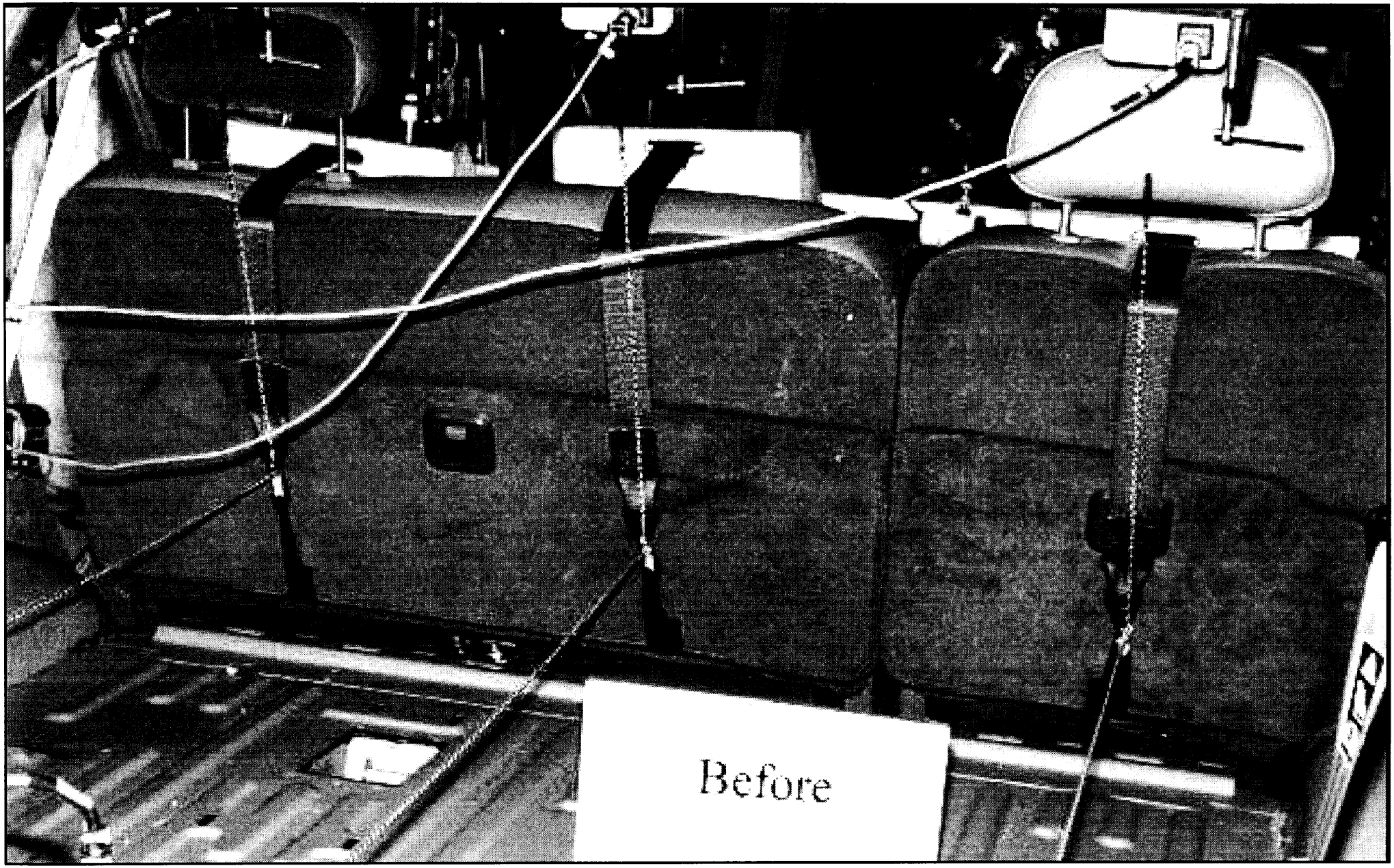
Left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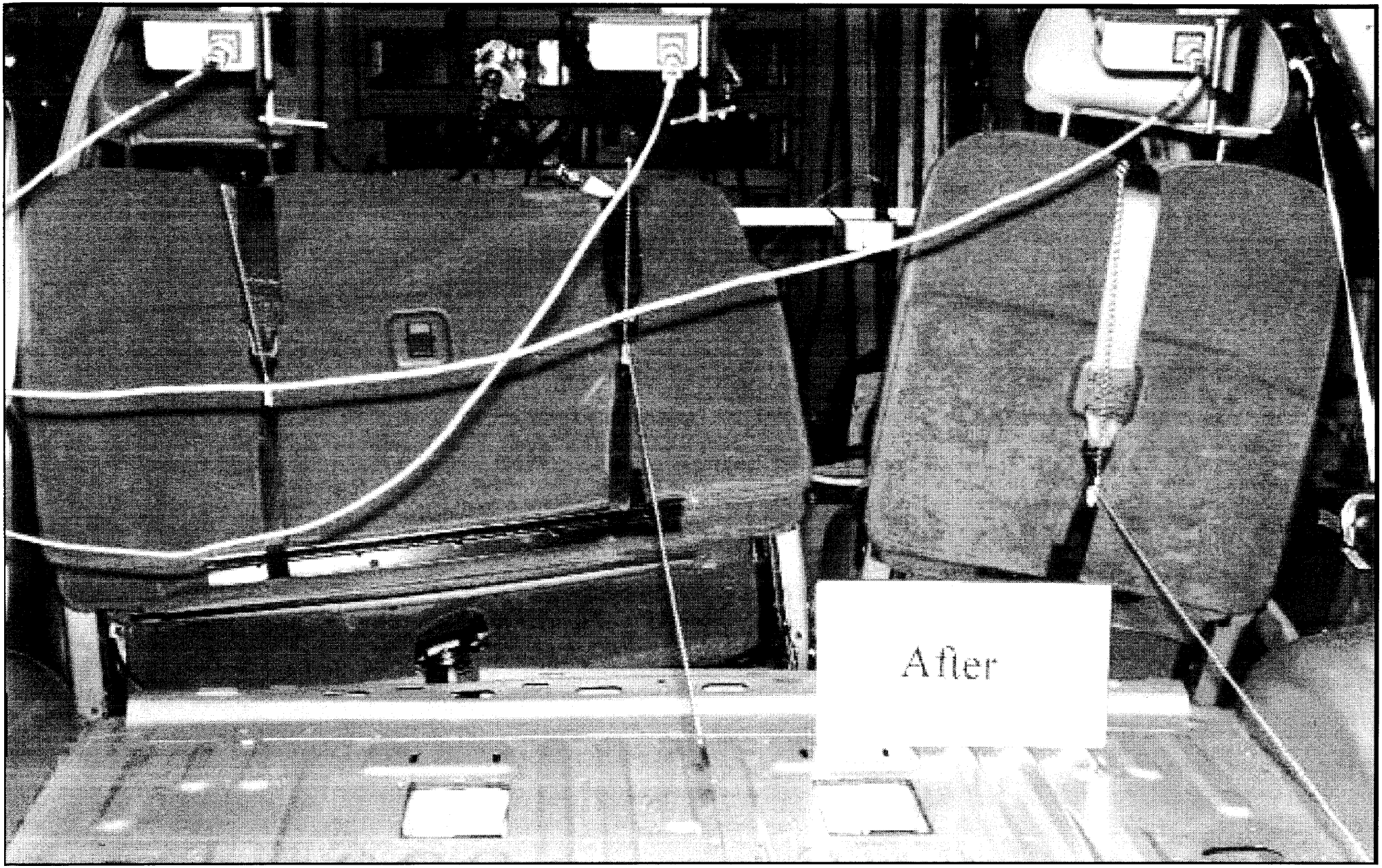
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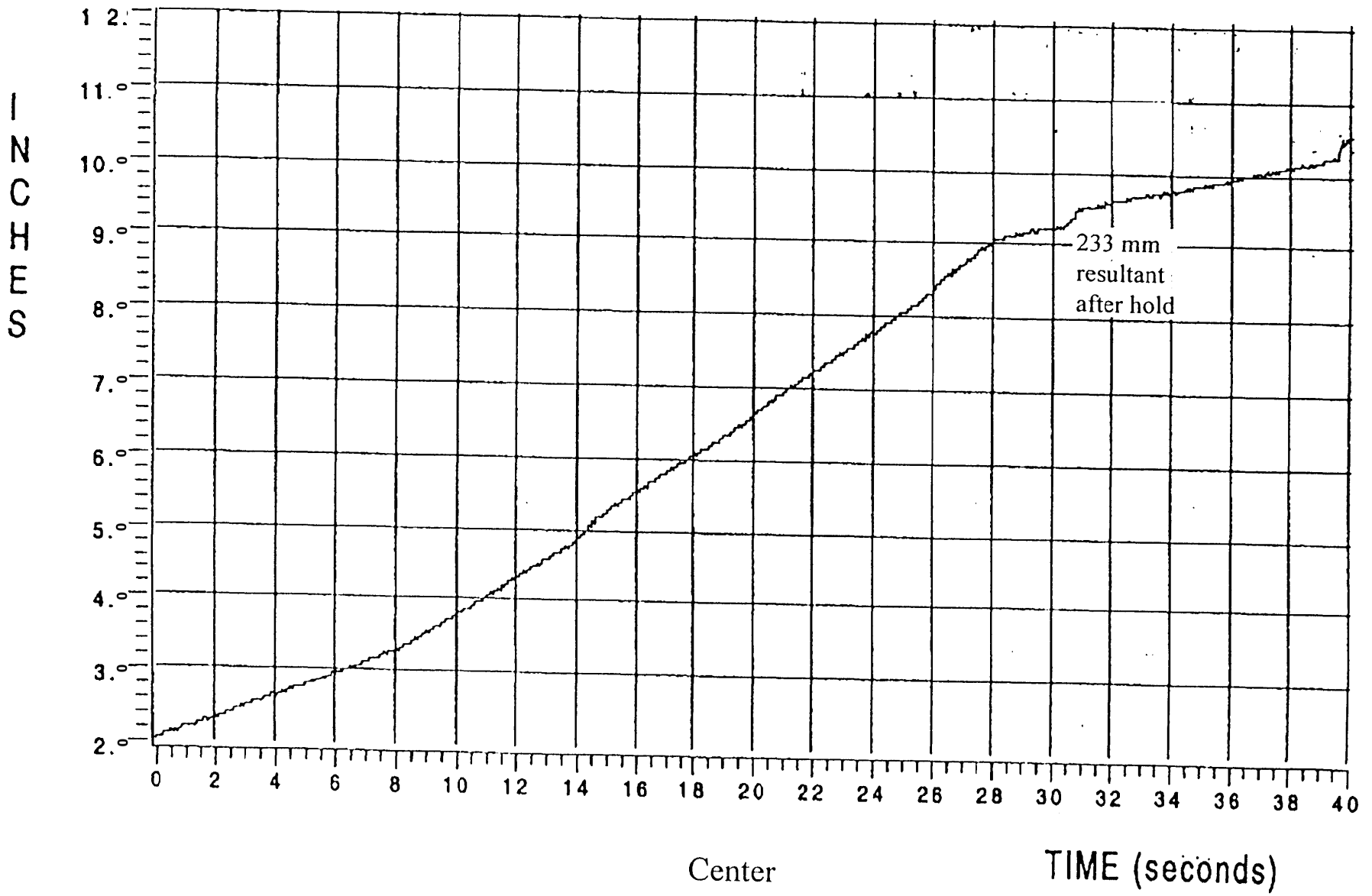
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233 mm
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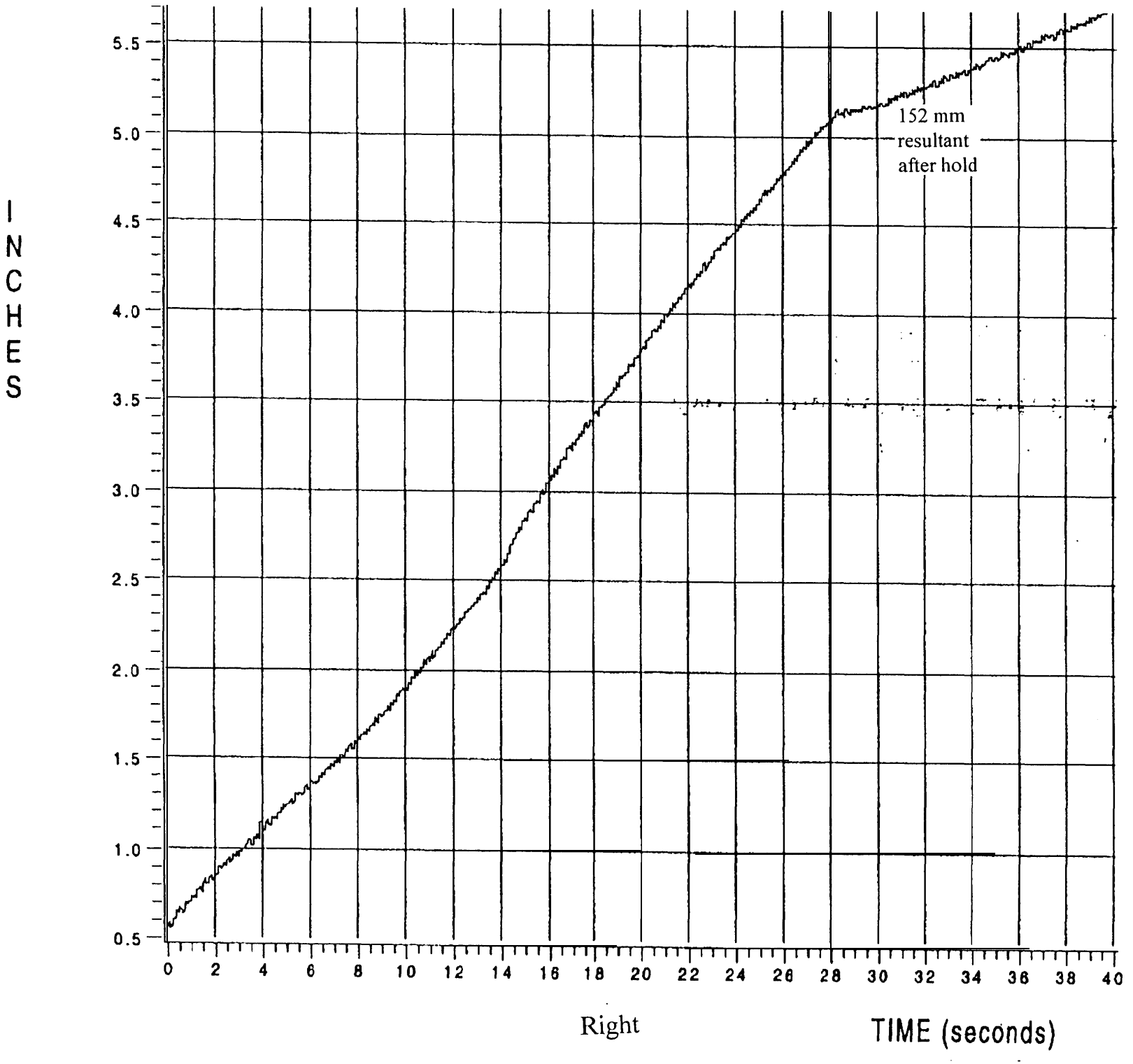
after hold
Center
TIME (seconds)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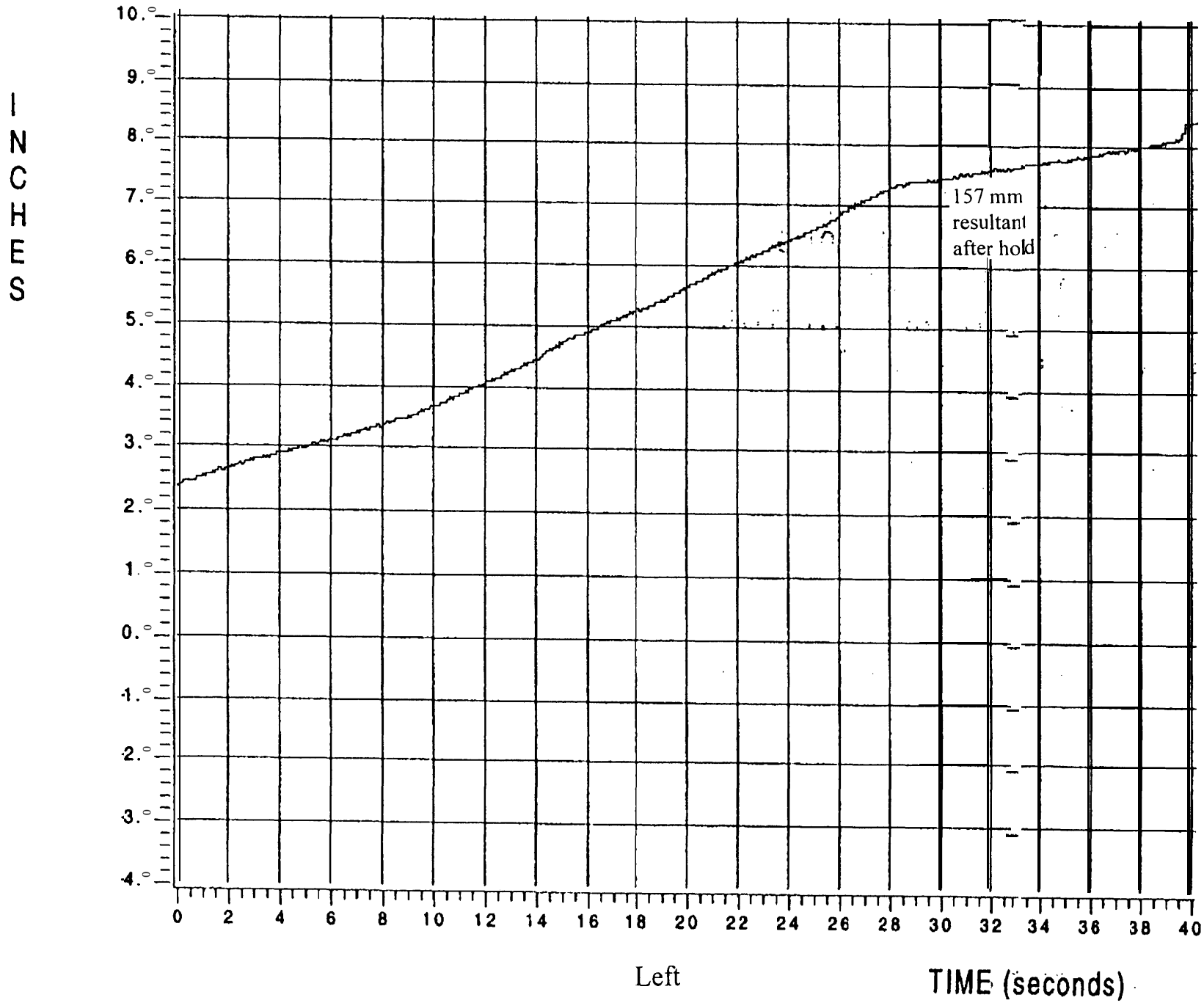
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157 mm
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