

NHTSA believes that the above procedure recommended by Ford is objective and will meet the intent of the requirement. This final rule adds language to S6.2.1.2 to reflect this.

*f. Performance and Testing of Anchorage Systems*

1. Strength of Tether Anchorages

The NPRM proposed that the tether anchorage would be tested in a static pull test. A force of 5,300 Newtons (N) would be applied by a belt strap that attaches to the tether anchorage, and applied in the forward horizontal direction. The proposal was based on a Transport Canada requirement of 5,300 N which had been applied in Canada to non-user-ready tether anchorages in passenger cars prior to 1999. The NPRM proposed that the 5,300 N force would be attained within 30 seconds, with an onset force rate not exceeding 135,000 N per second, and maintained at the 5,300 N level for one second. The NPRM proposed that each structural component of the anchorage must withstand the 5,300 N force, and that there must not be any complete separation or failure of any anchorage component.

The final rule adopted a static pull test using a test fixture, instead of a belt strap, to apply the test forces to the tether anchorage. The fixture has a configuration representative of a child restraint system and applies the test forces in a more realistic manner than does a belt strap. The fixture is attached to the tether anchorage at the fixture's top, and to the vehicle seat at the fixture's bottom end (at the intersection of the vehicle seat cushion and back) using the vehicle's seat belt or the lower bars of a child restraint anchorage system. The test force is applied pulling on a strap that is attached to a point on the fixture. A force of 15,000 N is applied to the fixture, which in turn, applies the force to the three anchorage points (the tether anchorage and the seat belt anchorages or the lower bars). Since the fixture is attached to three anchorage points, only a portion of the 15,000 N force is actually applied to the tether anchorage. The 15,000 N force is attained within 30 seconds, at an onset force rate of not more than 135,000 N per second; and maintained at the 15,000 N level for one second. The final rule requires that (a) there must not be any point on the tether anchorage displaced more than 125 millimeters (mm) (approximately 5 inches); and (b) there must not be complete separation of any anchorage component.

The 15,000 N force level was selected because the agency believed it to be

sufficiently high to ensure that the anchorage will withstand the loads generated by children in forward-facing restraints. This determination was based on test data from Transport Canada. (Transport Canada obtained these data after it had adopted a 10,000 N strength requirement for testing tether anchorages. As discussed later, Transport Canada subsequently raised its requirement to 15,000 N.) Canada conducted 48 km/h (30 mile-per-hour (mph)) dynamic tests of a prototype child restraint (weighing 32 lb) that had rigid LATCH attachments and a tether ("CANFIX"), and a 3-year-old (33 lb) dummy. It found dynamic loads of about 3,500 N and 4,000 N on the tether anchorage (loads on the lower attachments ranged from 3,000 N to 4,000 N). Transport Canada then conducted a static pull test to determine the amount of force that would have to be applied to the CANFIX child restraint to produce a static load of 3,000 to 4,000 N on the lower anchorages. The pull force was 14,000 N (applied to three anchorage points by way of a fixture). NHTSA determined that a 15,000 N load requirement was needed to ensure that an anchorage system will not fail in a crash. In addition, the agency believed that simultaneously applying a 15,000 N load to the three LATCH anchorages was comparable to applying an approximate 5,000 N load to a single anchorage.

The Alliance, Ford and other manufacturers opposed the strength requirements. Petitioners believed that the agency's rationale for the 15,000 N requirement was invalid. The Alliance and Ford said that applying a 15,000 N load to the three LATCH anchorages by means of the SFAD fixture is not the same as applying a 5,300 N load to any single anchorage by a belt strap. Petitioners also believed that the Transport Canada test used an unrepresentative child restraint and sled pulse. Petitioners further suggested that an 8,000 N load application applied by an SFAD in the forward direction is sufficient for motor vehicle safety, regardless of whether lower anchors or top tether anchors are being tested. A child restraint manufacturer, E-Z-On, petitioned to increase the 15,000 N requirement, believing that it should be higher to account for the tethering of vests and harnesses that restrain children and young adults with special needs who may weigh up to 120 pounds. All significant issues raised by each of these petitions are addressed below.

*i. Final Rule's Basis for the Strength Requirement*

The petitioners believed that it was incorrect for the agency to believe that the test load applied to the test fixture at a point approximating the center of gravity of a child/CRS system is similar to testing each of the anchors separately. The Alliance stated that the conclusion "ignores the fact that forces are vector quantities having both a magnitude and direction that cannot be summed in a direct arithmetic (scalar) fashion when they are not acting in the same direction." Ford stated in an April 19, 1999 petition for reconsideration that in many sedans in which the tether anchorage is mounted to the filler panel between the top of the rear seat and the rear window, it is common for 70 to 85 percent of the 10,000 N force on SFAD-1 (used to test tether anchorages at seating positions with seat belts) to be transferred into the top tether strap. Ford stated that at a 15,000 N SFAD force, the percent of the force on the top tether is 65 to 80 percent in many sedans.

Ford stated that when using SFAD-2, the total forces on the lower anchors are greater than the force applied to point X on the SFAD "because the fixture applies realistic vertical forces as well" the amount of this reaction force will vary somewhat in different vehicle designs, but will typically be 6 to 7 kN. The resulting total force on both the lower anchors from the 8 kN force is about 10.5 kN. \* \* \* Ford stated that "11 kN force applied to point X resulted in a force of 9.3 kN on the outer anchor and 6.7 kN on the inner anchor, for a total anchor load of 16 kN on both lower anchor \* \* \*."

The Alliance also believed that the 15,000 N requirement was based on a Transport Canada test which petitioners said—

did not accurately simulate vehicle seats or child restraints. It did not accurately simulate the loads paths that a child restraint and child would have on child restraint anchorages in an actual vehicle. Thus, the 15 kN force has only a tenuous relation to what would occur in a vehicle crash and should not be used as a basis for setting the static test force level in FMVSS 225.

Ford stated that the test used a "very heavy and rigid child restraint, a very rigid tether anchor, and a high strength/low elongation tether strap."

*Response.* The agency does not agree with the Alliance or with Ford that the strength requirement should be revised. Ford's finding that one anchorage can be subjected to more or less load than another is not surprising, since the SFAD is positioned on the vehicle seat