not to exceed that which would be caused by the satellite operating without an inclined orbit;

(3) Not claim protection in excess of the protection that would be received by the satellite network operating without an inclined orbit; and

(4) Continue to maintain the space station at the authorized longitude orbital location in the geostationary satellite arc with the appropriate east-west station-keeping tolerance.

8. Section 25.282 is added to read as follows:

§ 25.282 End-of-Life disposal.

(a) A space station authorized to operate in the geostationary satellite orbit under this Part may operate using its authorized tracking, telemetry and control frequencies, and outside of its assigned orbital location, for the purpose of removing the satellite from the geostationary satellite orbit at the end of its useful life, provided that the following conditions are met:

(1) The satellite is capable of being removed to, and the operations at variance from the assigned orbital location are designed to maneuver the satellite to, an orbit with a perigee with an altitude of no less than:

$36{,}021 \text{ km} + (1000 \cdot C_R \cdot A/m)$

where C_R is the solar pressure radiation coefficient of the spacecraft, and A/m is the Area to mass ratio, in square meters per kilogram, of the spacecraft.

(2) All stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures.

(3) Tracking, telemetry and control transmissions are planned so as to avoid electrical interference to other satellites, and coordinated with any potentially affected satellite networks.

(b) [Reserved]

PART 97—AMATEUR RADIO SERVICE

9. The authority citation for part 97 continues to read as follows:

Authority: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064–1068, 1081–1105, as amended; 47 U.S.C. 151–155, 301–609, unless otherwise noted.

10. Section 97.207 is amended by revising paragraph (g) to read as follows:

§ 97.207 Space station.

* * * * *

(g) The license grantee of each space station must make two written pre-space station notifications to the International Bureau, FCC, Washington DC 20554. Each notification must be in accord with the provisions of Articles S9 and S11 of the ITU Radio Regulations.

(1) The first notification is required no less than 27 months prior to initiating space station transmissions and must specify the information required by Appendix S4 and Resolution No. 642 of the International Telecommunication Union Radio Regulations. The first notification shall also include a description of the design and operational strategies the space station will use to mitigate orbital debris, including a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft. The notification must also include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end-of-life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures.

(2) The second notification is required no less than 5 months prior to initiating space station transmissions and must specify the information required by Appendix S4 and Resolution No. 642 of the Radio Regulations.

* * * * *

[FR Doc. 02–10995 Filed 5–2–02; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Part 572

[Docket No. NHTSA 2002–11838]

RIN 2127–AI39

Anthropomorphic Test Devices; Instrumented Lower Legs for Hybrid III–50M and –5F Dummies

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

ACTION: Advance notice of proposed rulemaking.

SUMMARY: The agency is concerned about the number and severity of lower limb injuries in full- and offset-frontal vehicle crashes and the pain and suffering, disability, long-term impairment, and high rehabilitation costs frequently associated with such injuries. The agency believes that there is considerable merit in utilizing crash test dummies with instrumented lower legs in vehicle crash tests to either assess the risk of occupant injury or mitigate either the number or severity of these injuries. This document requests comments on two potential devices for assessing the injury potential to lower limbs in full- and offset-frontal vehicle collisions. Under consideration are two types of instrumented lower legs that can be retrofitted to the Hybrid III 50th percentile male and 5th percentile female dummies.

DATES: You should submit your comments early enough to ensure that Docket Management receives them not later than August 5, 2002.

ADDRESSES: Comments should refer to the docket number above and be submitted to: Docket Section, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590. Alternatively, you may submit your comments electronically by logging onto the Docket Management System (DMS) Web site at *http://dms.dot.gov.* Click on ''Help & Information'' or ''Help/Info'' to view instructions for filing your comments electronically. Regardless of how you submit your comments, you should mention the docket number of this document.

You may call the Docket at 202–366–9324. Docket hours are 9:30 a.m. to 4 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: For non-legal issues, Mr. Stanley Backaitis, Office of Crashworthiness Standards (Telephone: 202–366–4912) (Fax: 202–493–4329). For legal issues, Mr. Robert Knop, Office of the Chief Counsel (Telephone: 202–366–2992) (Fax: 202–366–3820). Both can be reached by mail at the National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590.

SUPPLEMENTARY INFORMATION:

Background

NHTSA is concerned about the number of lower limb injuries in full- and offset-frontal vehicle crashes and the pain and suffering, disability, long-term impairment, and high rehabilitation costs frequently associated with such injuries. A number of research studies have shown that knee-tibia-ankle-foot (KsTAF) injuries incurred in full- and offset-frontal automobile crashes frequently result in severe disability and impairment.[1] Though they present a less serious threat to life than head or chest injuries, these injuries are still responsible for a large part of the total vehicle crash-related suffering, impairment, and injury costs. An analysis of data from the Wisconsin Crash Outcome Data Evaluation System (CODES) project, for example, found that one in six occupants hospitalized after a crash had serious lower limb injuries.[2]

The agency estimates that annually approximately 110,000 occupants sustain lower limb injuries with a severity rating of 2 or 3 on the Abbreviated Injury Scale (AIS).[3] Slightly less than half of these injuries occur below the knee and, of those, ankle and foot injuries are the most frequent and responsible for long-term impairment.[4] Female drivers have been found to be at a greater risk of sustaining lower extremity injuries than male drivers in two separate studies.[5] The annual cost of AIS 2 and 3 lower extremity injuries to passenger car occupants in all automotive crashes has been estimated to run as high as $21.5 billion.[6]

Until now, the agency has primarily focused its research and safety standard rulemaking on developing and implementing methods, procedures, and test tools designed to reduce crash-related injuries to the head, neck, and torso because such injuries are the ones most likely to result in fatalities. Currently, the only specified injury limits for the lower extremities in Standard No. 208 are those for the knee-thigh-hip complex. Federal Motor Vehicle Safety Standard No. 208 limits the axial force measured in the femur to 2250 pounds (10 kN) for the 50th percentile adult male Hybrid III dummy and 1530 pounds (6805 N) for the 5th percentile adult female Hybrid III dummy to minimize knee-thigh-hip injuries. Knee-thigh-hip complex injuries account for about 55 percent of AIS 2+ lower extremity injuries and 42 percent of the associated functional Life-years Lost to Injury.[7] The remaining 45 percent of AIS 2+ lower extremity injuries (and 58 percent of the associated functional Life-years Lost to Injury) occur below the knee and are not currently addressed by our Standards.

Now that safety improvements such as air bags and better vehicle crashworthiness are being implemented to achieve significant fatality reductions, the agency can begin to focus on reducing non-fatal high consequence injuries, like those to the lower extremities. The agency believes that significant reductions in lower extremity injuries below the knees and in the associated costs may be achieved if vehicle structures and interior environments are designed to minimize the forces exerted on lower extremities in vehicle crashes. A necessary first step in developing safer vehicle structures and interiors, however, is the availability of adequate tools to measure forces exerted on the lower extremities in vehicle crash tests. The agency believes that dummy legs currently incorporated into the standards do not provide any measurements of crash loads applied to the lower extremities below the knee in either full-frontal or offset-frontal crash tests.

The agency believes there would be considerable merit in utilizing instrumented lower legs in vehicle crash tests to assess the risk of occupant injury. Before the agency does this, however, it wishes first to explore the issue of what degree of leg instrumentation and design sophistication is needed to adequately and appropriately assess the risk of injury and develop more friendly vehicle interiors.

Two commercially available technologies exist for addressing lower leg injuries in frontally-oriented impacts: (1) The Hybrid III/Denton (HIII/Denton) instrumented leg and (2) the more recently designed Thor-Lx Hybrid III Retrofit (Thor-(F)Lx/HIIIr) leg. Both of these instrumented lower legs have been designed to fit the existing 50th percentile male and 5th percentile female Hybrid III dummies. While the Denton leg has been used over a number of years by the automotive industry for vehicle development, the newer Thor leg, with substantially improved ankle and tibia biofidelity and a broader set of instruments, has been evaluated at the research level by a more limited number of vehicle manufacturers and research laboratories. After assessing received comments and our own data, the agency intends to incorporate only one of these two available lower leg designs into part 572, subpart E (50th percentile male Hybrid III test dummy) and subpart O (5th percentile female Hybrid III test dummy). To facilitate a more in-depth understanding of the issues and technical details that the agency is addressing in this Advance Notice of Proposed Rulemaking, the agency is concurrently placing a comprehensive technical support document (hereinafter ''Technical Report'') in the docket. [8]

HIII/Denton Instrumented Leg

Both the HIII/Denton-50M and the HIII/Denton-5F instrumented leg designs consist of an instrumented tibia that fits into the existing leg of the dummy, fastening between the knee slider assembly and the ankle. The instrumented tibia contains a clevis at the knee that can be instrumented to measure the compressive load on each side of the tibia, an upper tibia load cell, a tibia tube, and a lower tibia load cell. The load cells are each capable of measuring up to five channels of data.

The HIII/Denton instrumented legs employ the existing knee slider, knee housing, knee flesh, and knee insert used on the current Hybrid III 50th percentile male and 5th percentile female dummies. The knee slider assembly can be instrumented with a linear potentiometer to measure tibia-femur displacement. An optional ball bearing version knee slider is also available that is less influenced by compressive tibia loads.

The ankle and foot assemblies are also unchanged from the standard Hybrid III 50th percentile male and 5th percentile female dummies. The ankle assembly consists of a ball and socket joint with an adjustable frictional resistance level. The level of frictional resistance is controlled by a set screw at the ankle ball that can be tightened to increase the ankle's resistance to motion. The ankle joint is typically set at a ''1G [9]

[1] The tibia is the inner and larger of the two bones connecting the knee to the ankle.

[2] Karlson, Trudy; Bigelow, Wayne; Beutel, Patricia, ''Serious Lower Extremity Injuries from Motor Vehicle Crashes, Wisconsin, 1991–1994,'' DOT Technical Report No. DOT HS 808 791, September 1998.

[3] National Automotive Sampling System—Crashworthiness Data System, 1994–1996, U.S. Department of Transportation, National Highway Traffic Safety Administration.

[4] Morgan, R., et al., ''Ankle Joint Injury Mechanism for Adults in Frontal Automotive Impact,'' Proceedings of the 35th Stapp Conference, 1991, and Kuppa, S., et al., ''Lower Extremity Injuries and Associated Injury Criteria,'' Seventeenth International Technical Conference on the Enhanced Safety of Vehicles, Amsterdam, June, 2001.

[5] Crandall, et al., ''Biomechanical Response and Physical Properties of the Leg, Foot, and Ankle,'' Paper No. 962424, Proceedings of the 40th Stapp Conference, Albuquerque, N.M., November 1996; and Karlson, Trudy; Bigelow, Wayne; Beutel, Patricia, ''Serious Lower Extremity Injuries from Motor Vehicle Crashes, Wisconsin, 1991–1994,'' DOT Technical Report No. DOT HS 808 791, September 1998.

[6] Miller, T., ''Societal Costs of Transportation Crashes,'' from The Full Costs and Benefits of Transportation, Edited by Greene, D., Jone, D., Delucchi, M., Springer-Verlag, 1997 and National Automotive Sampling System—Crashworthiness Data System, 1994–1996, U.S. Department of Transportation, National Highway Traffic Safety Administration.

[7] Kuppa, S., et al., ''Lower Extremity Injuries and Associated Injury Criteria,'' Paper No. 98–57–070, 17th ESV Conference, Windsor, Ontario, Canada, 1998.

[8] Docket No. NHTSA 2002–11838.

[9] ''1G'' denotes one times the force of gravity.

suspended'' setting. To assess the rotation of the foot relative to the ankle, the foot can be instrumented with accelerometers, two at the ankle and one at the toe.

To summarize, the HIII/Denton instrumented leg has the following measurement capabilities:

- Upper tibia forces and moments (Fx, Fy, Fz, Mx, My)[10] (Load cell drawing PSA 572–S30)
- Lower tibia forces and moments (Fx, Fy, Fz, Mx, My) (Load cell drawing PSA 572–S31)
- Knee clevis[11] loads (Fz left and right portions of the clevis) (optional)
- Biaxial accelerations near the ankle (Ax, Az) (optional)
- Uniaxial acceleration near the toe (Az) (optional)
- Knee shear displacement

Mechanical drawings of the HIII/Denton legs designed for the 50th percentile male and 5th percentile female Hybrid III dummies are available through Denton ATD, Inc. NHTSA will also make these drawings available to the public without proprietary claims when the final rule is issued, should the agency decide to incorporate the HIII/Denton lower leg assemblies in part 572, subparts E and O.

Cost of HIII/Denton Instrumented Leg

The costs associated with specifying the use of HIII/Denton lower legs in vehicle crash tests may be broken down as follows: (1) The cost of the legs themselves; and (2) the data acquisition costs (per test). NHTSA estimates the procurement cost to be approximately $32,500 per pair for both the 50th percentile male and 5th percentile female dummies. The agency believes that most, if not all, vehicle manufacturers have already acquired these legs. Accordingly, if the agency were to specify the use of the instrumented Denton lower legs in vehicle crash testing, the costs associated with acquiring the legs would be minimal. With respect to the data acquisition costs, the agency estimates that each test utilizing the Denton lower legs would cost approximately $2,200 per dummy per crash test, assuming use of the upper and lower tibia load cells and knee shear displacement data channels.

Thor-Lx/HIIIr and Thor-Flx/HIIIr Instrumented Legs

Like the HIII/Denton instrumented lower legs, the Thor-(F)Lx/HIIIr instrumented lower leg assemblies are designed to fit the 50th percentile male Hybrid III dummy (the Thor-Lx/HIIIr) and the 5th percentile female Hybrid III dummy (the Thor-FLx/HIIIr). The Thor lower leg assemblies incorporate the features of the lower extremities from the Thor dummy. The legs were developed by two NHTSA contractors: General Engineering and Systems Analysis Company and Applied Safety Technologies Corporation (now Denton ATD, Inc.).

Thor-Lx/HIIIr Assembly

The Thor-Lx/HIIIr assembly mounts directly to the distal end of the 50th percentile male Hybrid III femur. The Thor-Lx/HIIIr assembly is comprised of the Thor-Lx foot and ankle segments, the Thor-Lx tibia segment (with integrated Achilles tendon assembly), the standard Hybrid III knee housing, a modified Hybrid III knee flesh, new molded side knee covers, and the Hybrid III ball bearing knee slider assembly as an option.

The Thor-Lx/HIIIr assembly includes the following new hardware elements as compared to the existing Hybrid III leg design:

- Side-mounted knee covers, which augment the existing narrow Hybrid III knee housing profile, to improve the realism of knee interaction with vehicle knee bolsters;
- A compliant tibia element, which modulates tibia response to axial impact to more realistically reflect human response data;
- Provision for independent control of foot mobility about three axes of rotation (dorsiflexion/plantarflexion, inversion/eversion, and internal/external rotation[12]) by means of progressive rubber elements whose characteristics are based upon human data;
- A representation of the Achilles tendon load path, which contributes to improved realism of tibia axial forces, tibia bending moments, and dorsiflexion motion of the foot.

The Thor-Lx/HIIIr assembly includes the following instrumentation:

- Upper tibia forces and moments (Fx, Fz, Mx, My) (Load cell drawing PSA 572–S32)
- Lower tibia forces and moments (Fx, Fy, Fz, Mx, My) (Load cell drawing PSA 572–S33)
- Tibia accelerations at mid-shaft (Ax, Ay) (optional)
- Foot angular displacement about 3 axes
- Mid-foot accelerations (3 axes) (optional)
- Achilles tendon tension (uniaxial) (optional)
- Knee shear displacement

Comprehensive mechanical drawings for the Thor-Lx/HIIIr, together with the associated users' manual and proposed certification procedures are available on NHTSA's Web site at the following web address: *http://www-nrd.nhtsa.dot.gov/departments/nrd-51/thor__lx/thorlxweb.html.*

Thor-FLx/HIIIr Assembly

The Thor-FLx/HIIIr assembly, which is mounted directly to the distal end of the 5th percentile female Hybrid III femur, is nearly identical to the Thor-Lx/HIIIr. Given the inherent space constraints of the Thor-FLx/HIIIr relative to the Thor-Lx/HIIIr, however, two primary design differences were necessary. First, the 5th percentile female Thor-FLx/HIIIr assembly has a shaped-cam ankle design that is different from that of the 50th percentile male Thor-Lx/HIIIr. Second, the Thor-FLx/HIIIr contains two custom-made hardware elements that are not used on the Thor-Lx/HIIIr: a four-axis upper tibia load cell (drawing PSA 572–S34) and a five-axis lower tibia load cell (drawing PSA 572–S35). These load cells are lighter and smaller than the tibia load cells used on the Thor-Lx/HIIIr, enabling a better fit with the smaller diameter of the Thor-FLx/HIIIr tibia.

Comprehensive mechanical drawings for the Thor-FLx/HIIIr, together with the associated users' manual and proposed certification procedures are available on NHTSA's Web site at the following web address: *http://www-nrd.nhtsa.dot.gov/departments/nrd-51/thor__flx/ThorFLxweb.html.*

Cost of Thor Instrumented Leg

The costs associated with specifying the use of Thor-Lx or Thor-FLx/HIIIr lower legs in vehicle crash tests may be broken down as follows: (1) The cost of the legs themselves; and (2) the data acquisition costs (per crash test). NHTSA estimates the procurement cost to be approximately $52,600 per pair for both the 50th percentile male and 5th percentile female dummies. Because the agency does not believe that many vehicle manufacturers already have acquired these legs, it is reasonable to

[10] The following directional designations are used throughout this document: ''x'' denotes the fore-aft direction; ''y'' denotes the left-right direction; and ''z'' denotes the up-down direction.

[11] A clevis is a single-axis, u-shaped joint allowing angular, flexion-type motion between two joined parts.

[12] Dorsiflexion/plantarflexion rotation is foot motion about the ankle's lateral axis. Inversion/eversion rotation is foot motion about the ankle's for- and aft-axis. Internal/external rotation is foot motion about the tibia's longitudinal axis.

assume that many, if not most, vehicle manufacturers would need to purchase them. With respect to the data acquisition costs, the agency estimates that each test utilizing the Thor-Lx/Thor-FLx lower legs would cost approximately $2,600 per dummy per crash test, assuming use of the upper and lower load cells, knee shear displacement, and ankle rotation data channels.

Performance of Instrumented Lower Leg Assemblies

The agency has conducted a series of static and dynamic laboratory and vehicle crash tests to evaluate the performance of the HIII/Denton-50M, HIII/Denton-5F, Thor-Lx/HIIIr, and Thor-FLx/HIIIr. These tests allow a direct comparison between the HIII/Denton-50M and the Thor-Lx/HIIIr and between the HIII/Denton-5F and the Thor-FLx/HIIIr. In laboratory tests, the Thor-Lx/HIIIr and the Thor-FLx/HIIIr exhibit more biofidelic, or human-like, responses than the HIII/Denton-50M and the HIII/Denton-5F. The significance of this difference in biofidelity and the need for design sophistication to predict the risk of injury are the most important issues that the agency hopes to resolve with comments from end users and others.

Laboratory Tests

The agency conducted the following laboratory calibration type tests and sled tests to evaluate the performance of the Denton and Thor lower leg assemblies per procedures set forth in Sections 3 and 4 of the Technical Report: (1) A quasi-static ankle motion test; (2) two pendulum impact tests (one on the ball of the foot and the other on the heel of the foot); and (3) a series of eight sled tests.

Quasi-Static Ankle Motion Tests

In the quasi-static ankle motion test, the tibia of the instrumented leg is held rigidly while the foot is rotated in four directions (dorsiflexion, plantarflexion, inversion, and eversion). This test was performed on two HIII/Denton-50 legs, four Thor-Lx/HIIIr legs, two HIII/Denton-5F legs, and four Thor-FLx/HIIIr legs. Each ankle was tested four times under identical test conditions, yielding a mean value for each of the four directions. Both the Denton and the Thor legs exhibited repeatable performance. The mean response values were plotted on a graph and compared to the biofidelic specifications for each directional test as shown in Figures 3–1 through 3–8 of the Technical Report. The results indicate that the Thor-Lx/HIIIr and Thor-FLx/HIIIr exhibit a response that is closer to biofidelic specifications than the HIII/Denton-50M and HIII/Denton-5F. Additional details regarding the test procedures and test results may be found in Section 3 and Appendix 3 of the Technical Report.

Pendulum Impact Tests

Two different pendulum impact test series were conducted on both leg designs. The first test, the ball of foot impact test, examined the dynamic dorsiflexion response of the ankle assembly. The second test, the heel of foot impact test, examined the compliance of the foot flesh and tibia. These tests were performed on two HIII/Denton-50 legs, four Thor-Lx/HIIIr legs, two HIII/Denton-5F legs, and four Thor-FLx/HIIIr legs. Each lower leg assembly was tested four times under identical test conditions. In these pendulum impact tests, both the Denton and Thor lower leg assemblies exhibited repeatable performance and no structural issues were noted. A full description of the test procedures and test results may be found in Section 3.2 and Appendix 3 of the Technical Report.

Sled Tests

A series of eight sled tests were conducted by the University of Virginia to evaluate the performance of the Thor lower leg assemblies relative to the Denton lower leg assemblies. Two of the tests, designed to simulate the New Car Assessment Program (NCAP) 56 kilometer per hour full-frontal crash conditions, were conducted using a Ford Taurus floor pan configuration with an intruding toeboard. Six tests, designed to simulate the European Union (EU) 40 percent offset frontal crash test conditions (although at 56 kilometers per hour rather than at 60 kilometers per hour because of concerns about the structural integrity of the sled at 60 kilometers per hour), were conducted using a Dodge Neon floor pan configuration with an intruding toeboard. A full description of the test procedures and test results may be found in Section 4 and Appendix 4 of the Technical Report.

These tests were designed to determine: (1) The effects of leg design on the peak femur response values; (2) the differences in other lower extremity response values between the two designs; (3) the effects of leg design on the upper body response values; (4) the repeatability of dummy response values; and (5) durability of the leg design. With respect to the effects of leg design on the peak femur response values, the tests revealed a difference in right femur response values between the HIII/Denton-50M and the Thor-Lx/HIIIr. The right femur response values for the HIII/Denton-50M were higher than those of the Thor-Lx/HIIIr. Differences were also noted between other lower extremity response values of the Denton and Thor lower leg assemblies.

The observed differences, in the judgment of the University of Virginia's researchers, were attributable to differences in the Thor-Lx's anterior geometry and kinematic response due to the Thor-Lx continuous joint stop. Although both the right femur and other lower extremity response values were higher for the Denton lower leg assemblies than the Thor lower leg assemblies, we consider these differences to be relatively insignificant when compared to the much higher injury limit values. As to the upper body response values, the recorded values were very similar for both the Denton and Thor 50th percentile male and 5th percentile female dummies indicating that differences in the designs of the lower legs have minimal influence on the rest of the dummy responses. As to repeatability, in both the full frontal and offset-frontal sled tests, the test-to-test repeatability of the Denton and Thor lower leg assemblies was found to be generally acceptable. Finally, with respect to durability, neither the Denton nor the Thor lower leg assemblies experienced any structural failures in the sled tests.

Vehicle Crash Tests

The agency conducted 16 vehicle crash tests allowing assessment of the performance of paired 50th percentile male and 5th percentile female Hybrid III dummies with Denton and Thor-(F)Lx lower leg assemblies. Four vehicle models were used: the 1996 Toyota Camry, the 2000 Nissan Altima, the 1998 Dodge Neon, and the 2000 Subaru Legacy. In these tests, a Hybrid III 50th percentile male or 5th percentile female dummy outfitted with either Denton or Thor instrumented lower legs was seated in the driver's position and the vehicle was crashed into an EU deformable barrier at approximately 60 and 64 kilometers per hour with 40 percent of the vehicle's frontal structure engaging the barrier. A full description of the test procedures and test results may be found in Section 5 and Appendix 5 of the Technical Report.

Such offset frontal crash tests generally produce significant intrusion of the toepan, thereby allowing for measurement of forces exerted on the lower extremities. Significant differences were noted with respect to the response values of the Thor and Denton lower leg assemblies in these crash tests. The response values of the Thor-Lx/HIIIr and Thor-FLx/HIIIr exceeded the foot and ankle preliminary injury limits in the vehicle crash tests, thus predicting a higher potential for foot and ankle injuries than tibia shaft fractures. In addition, the foot and ankle response values of the Thor-FLx/HIIIr were higher than those of the Thor-Lx/HIIIr, thus predicting a higher incidence of foot and ankle injuries in small women than in mid-sized men. The same differences between the female and male versions of the Denton leg could not be observed because it is not equipped to measure ankle rotation. Real-world crash data indicate that ankle and foot injuries are more common than leg shaft fractures and that women are at greater risk of sustaining lower limb injuries than men. Therefore, it appears that the Thor lower leg assemblies are better able to predict the location of lower extremity injuries in real-world crashes than the Denton lower leg assemblies.

Questions for Public Comment

The agency believes that lower extremity injuries are a serious and pervasive safety problem. They frequently result in significant pain, disability, and economic cost. The agency believes that these human and economic costs can be significantly reduced by enhancing vehicles' crashworthiness and occupant protection systems.

In order to evaluate the effectiveness of particular designs in accomplishing this goal, however, the dummies used in vehicle crash tests must be equipped with appropriately instrumented lower limbs that will help predict the severity and extent of lower limb injuries. As noted above, two different leg designs are available for this purpose: the HIII/Denton legs and the Thor-(F)Lx//HIIIr. To aid the agency in determining which of the two leg designs would better facilitate the design and manufacture of occupant compartments that minimize the severity and extent of lower limb injuries, the agency is seeking comments on the following issues:

Experience With Instrumented Legs

(1) Please indicate how many years of experience, if any, you have had in using instrumented legs to improve lower leg injury protection and describe that experience.

(2) Please provide detailed information on any experience you have had in using the following instrumented lower legs:

a. Thor-Lx legs;
b. HIII/Denton legs;
c. Other.

(3) The lower limb consists of the following component parts: femur, knee, tibia plateau, tibia, ankle, foot, and pelvis as an attachment bone for the femur. Please rate each of these component parts in terms of the relative importance you place on it for injury reduction purposes using a 5 (five) to indicate a high degree of importance and a 0 (zero) to indicate low or no importance. Please also explain the basis for each rating and how the injury risk for that anatomical area is determined.

(4) Please provide an opinion, based on your experience, whether the availability of highly instrumented tibia, ankle, and foot (TAF) and knees (Ks) would facilitate the development of vehicles capable of reducing lower leg injuries. Please describe the key aspects of your experience that give rise to your opinion.

(5) In your test experience, did use of either of the instrumented legs influence other crash test measurements, such as those for the head, neck, thorax, etc.?

Injury Assessment Goals

(6) What are your vehicle design or performance goals for the minimization of lower limb injuries? Please cite the impact modes, restraint configurations, and collision speeds at which the lower legs tested in your vehicles begin to incur AIS2+ injuries.

(7) Please provide a list of injury assessment measures that you employ to assure KsTAF protection. Please explain the basis for their selection, including a demonstration of how they correspond to field data.

(8) What, in your opinion, is the minimum level of (KsTAF) instrumentation needed to allow accurate assessment of potential injuries?

(9) Please provide the methodology, techniques, and procedures you currently use to identify and assess the KsTAF injuries.

(10) Please describe fully the test conditions under which you perform KsTAF injury assessment, *i.e.*, static and/or dynamic measurements; component and/or systems tests; crash intensities, directions, mathematical simulations, visual evidence, etc.

(11) Please provide descriptions of the test tools and instrumentation that you employ for items 9 and 10.

(12) Please provide typical response samples and test conditions from tibia/ankle/foot measurements that you are using to make injury reduction or injury risk assessments, and state why you think they are important.

Adequacy of Instrumented Legs To Assess the Injury Potential

(13) Given that the instrumented HIII/Denton leg only measures the potential for tibia and malleolus fractures and not ankle injuries, if you prefer the HIII/Denton leg, please provide information on how you would address the reduction of ankle and foot injuries.

(14) The Thor-Lx/HIIIr instrumented tibia is more elastic in axial loading and has a number of other more human-like features than the rigid HIII/Denton tibia. Please indicate which, if any, of those features are critical for your safety work, which would be desirable to have, and which would not be used. Please provide the rationale and reasons for your choices.

(15) Please provide your views regarding the relative desirability and benefits of the instrumented lower legs having a higher degree of biofidelity and greater injury predicting capability, but more mechanical complexity vs. less biofidelity and less accurate injury protection, but a simpler design.

(16) Would either or both of the instrumented lower leg designs be adequate for assessing injury risk if used in the full- and offset-frontal crash tests specified in Federal Motor Vehicle Safety Standard No. 208?

a. If not, what tests, test environments, and impact speeds would you recommend?

b. If the current leg and foot placement procedures in Federal Motor Vehicle Safety Standard No. 208 are not appropriate for assessing the potential for KsTAF injuries, please recommend procedures that would provide proper assessment.

(17) Please indicate the extent to which you believe that one or both of the instrumented lower legs are, or may be, useful to address brake pedal and clutch intrusion issues. If you believe that it is or may be useful, please provide details of dummy set-up and associated test procedures.

(18) Which of the available ankle sensors should be specified for injury assessment purposes and why?

(19) Which of the available foot sensors should be specified for injury assessment purposes and why?

Calibration/Certification

(20) Should the agency specify calibration tests for instrumented lower legs to assure that they work correctly in the vehicle crash environment? Please provide details and a rationale for your recommendation.

(21) Should certification specifications for the lower limbs be related to injury measurements and risk of injury levels?

(22) How much overload capacity do you believe the instrumented lower legs should have before they begin to experience structural failures?

Lead Time Needs

(23) Please indicate, and justify, your lead time needs to become familiar with and generate the required test data should the agency specify the use of the following instrumented lower legs in FMVSS No. 208 crash testing:

a. HIII/Denton legs;
b. Thor-Lx/HIIIr legs;
c. Other (described in your response to question 2(c) above).

Costs

(24) Please provide an itemized estimate of expected additional test costs (equipment, calibration, additional channels) if the agency specified use of the HIII/Denton or Thor(F)Lx-HIIIr legs for:

a. FMVSS No. 208;
b. NCAP.

(25) Will the benefits of measuring and collecting this additional data be worth the additional costs?

International Harmonization

(26) Please provide your views on the extent to which international harmonization of the instrumented leg should be a factor in the agency's decision-making process. How should the desire for harmonization be weighed against the overriding factor of safety and against other relevant factors?

Rulemaking Analyses and Notices

Executive Order 12866 and DOT Regulatory Policies and Procedures

This advance notice was not reviewed under Executive Order 12866 and under the Department of Transportation's regulatory policies and procedures.

This notice primarily addresses the possibility of proposing to amend 49 CFR part 572 by adding design and performance specifications for instrumented lower legs that can be fitted to crash test dummies and used in vehicle crash tests for assessing the injury potential to lower limbs in full- and offset-frontal vehicle collisions. If these amendments are ultimately proposed and adopted as final, they would affect only those businesses that choose to manufacture or test with dummies fitted with those legs. The amendments would not impose any requirements on anyone. The agency is planning to conduct a separate rulemaking proceeding in which the agency would propose to amend the Federal motor vehicle safety standards to specify the use of dummies fitted with these legs in crash testing.

For these reasons, it does not appear that this rulemaking, which concerns the incorporation of the instrumented lower legs into part 572, would be significant. However, due to the preliminary nature of this document, NHTSA has limited current cost information that might be relevant to any potential changes. Accordingly, NHTSA is unable now to evaluate the economic impacts that this rulemaking might ultimately have.

NHTSA will reassess this rulemaking in relation to the Executive Order, the DOT Regulatory Policies and Procedures, the Unfunded Mandates Reform Act of 1995 and other requirements for analyzing rulemaking impacts after using the information received in response to this advanced notice to select specific proposed amendments. To that end, the agency solicits comments, information, and data useful in assessing the impacts of making changes to the various requirements discussed in this document.

Comments

How Do I Prepare and Submit Comments?

Your comments must be written and in English. To ensure that your comments are correctly filed in the Docket, please include the docket number of this document in your comments.

Your comments must not be more than 15 pages long. (49 CFR 553.21). We established this limit to encourage you to write your primary comments in a concise fashion. However, you may attach necessary additional documents to your comments. There is no limit on the length of the attachments.

Please submit two copies of your comments, including the attachments, to Docket Management at the address given above under **ADDRESSES.**

You may also submit your comments to the docket electronically by logging onto the Dockets Management System Web site at *http://dms.dot.gov*. Click on ''Help & Information'' or ''Help/Info'' to obtain instructions for filing the document electronically.

How Can I Be Sure That My Comments Were Received?

If you wish Docket Management to notify you upon its receipt of your comments, enclose a self-addressed, stamped postcard in the envelope containing your comments. Upon receiving your comments, Docket Management will return the postcard by mail.

How Do I Submit Confidential Business Information?

If you wish to submit any information under a claim of confidentiality, you should submit three copies of your complete submission, including the information you claim to be confidential business information, to the Chief Counsel, NHTSA, at the address given above under **FOR FURTHER INFORMATION CONTACT.** In addition, you should submit two copies, from which you have deleted the claimed confidential business information, to Docket Management at the address given above under **ADDRESSES.** When you send a comment containing information claimed to be confidential business information, you should include a cover letter setting forth the information specified in our confidential business information regulation. (49 CFR part 512.)

Will the Agency Consider Late Comments?

We will consider all comments that Docket Management receives before the close of business on the comment closing date indicated above under **DATES.** To the extent possible, we will also consider comments that Docket Management receives after that date. If Docket Management receives a comment too late for us to consider it in developing a proposal (assuming that one is issued), we will consider that comment together with the comments on the proposal.

How Can I Read the Comments Submitted by Other People?

You may read the comments received by Docket Management at the address given above under **ADDRESSES.** The hours of the Docket are indicated above in the same location.

You may also see the comments on the Internet. To read the comments on the Internet, take the following steps:

1. Go to the Docket Management System (DMS) Web page of the Department of Transportation *(http://dms.dot.gov/).*
2. On that page, click on ''search.''
3. On the next page *(http://dms.dot.gov/search/),* type in the four-digit docket number shown at the beginning of this document. Example: If the docket number were ''NHTSA–1998–1234'', you would type ''1234''. After typing the docket number, click on ''search''.
4. On the next page, which contains docket summary information for the docket you selected, click on the desired comments. You may download the comments. Although the comments are

imaged documents, instead of word processing documents, the ''pdf'' versions of the documents are word searchable.

Please note that even after the comment closing date, we will continue to file relevant information in the Docket as it becomes available. Further, some people may submit late comments. Accordingly, we recommend that you periodically check the Docket for new material.

List of Subjects in 49 CFR Part 572

Motor vehicle safety, Incorporation by reference.

Issued: April 30, 2002.

Stephen R. Kratzke,

Associate Administrator for Safety Performance Standards.

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