otherwise, the application and its contents shall be non-proprietary.

Selection Criteria

Applicants must submit acceptable Regional Coordination, Technical, and Financial Plans that together provide sound evidence that the proposed conversion can successfully be completed in a timely fashion.

Proposals should be organized into the following three sections:

1. Regional Coordination Arrangements

The proposed conversion should demonstrate a coordination among affected agencies and firms in reaching agreement to convert existing traveler information telephone numbers to 511. Letters of agreement, memorandums of understanding (MOUs), and other documents shall be referenced and included as appropriate.

(a) The application should discuss current working relationships, existing cooperation, and information sharing among State, local, and other relevant public agencies, and the private sector for the dissemination of travel information services. The proposed conversion should demonstrate a commitment to cooperation among agencies, jurisdictions, and the private sector.

(b) The application should discuss any institutional or organizational issues that arose during discussions with affected parties, and the resolution of these issues. Any key decisions related to the timely implementation of the conversion shall be identified, especially if the decisions have not been made prior to application submittal.

(c) Memorandums of understanding, or other appropriate documentation, that clearly define the responsibilities and relationships of all parties, including institutional relationships and financial agreements needed to support the conversion, should be attached to the application.

2. Technical Plan

The Technical Plan shall describe how the proposed conversion will take place and describe the quality of the traveler information to be provided. The Technical Plan shall demonstrate that the appropriate telephone service providers have provided detailed plans and schedules for telephone number conversions.

In addition, an acceptable Technical Plan should:

(a) Contain an operational concept and technical approach that demonstrate how the proposed conversion will be fully implemented, as well as any incremental stages leading to full implementation. The specific roles and responsibilities of the all parties should be defined.

(b) Contain a technical approach that responds to traveler information needs of the entire affected area. A description of the affected area, including geographic size and major jurisdictions served. Any data or information exchanges among traveler information services and/or telephone service providers should be described along with implementation schedules.

(c) Describe the type(s) of information that will be available to a caller, and the method that will be used to access information. Descriptions of the information will include how frequently it is updated, any variations in details provided across the affected geographic area, any variations in coverage or details based on the time of the day, and the primary source(s) of the information, e.g., construction schedules, transit schedules, transportation management systems, enforcement dispatch systems.

(d) Demonstrate that the proposed system follows the privacy principles developed by ITS America. For further information, see ''References and Note to Applicants'' below. Where the privacy principles conflict with applicable Federal and State law, the latter shall prevail.

References and Note to Applicants: The ITS privacy principles are available from ITS AMERICA, 400 Virginia Avenue SW., Suite 800, Washington, DC 20024, telephone (202) 484–4847. The document is also available on the Internet at http://www.itsa.org.

3. Financial Plan

The Financial Plan should demonstrate that sufficient funding is available to successfully complete all aspects of the proposed conversion as described in the Technical Plan. The Financial Plan should also provide the financial information described under the heading, Matching Share/Cost Sharing.

An acceptable Financial Plan should:

(a) Provide a clear identification of the proposed funding for the conversion of traveler information telephone numbers to 511, and a commitment that no more than 80 percent of the total cost will be supported by these Federal ITS funds. All financial commitments, from both the public and private sectors, should be documented in signed MOUs, or other appropriate documents.

(b) Describe how the conversion will be implemented and how the traveler information service(s) will be operated to ensure the timely implementation and the continued, long-term operations of the system.

(c) Include documented evidence of continuing fiscal capacity and commitment from anticipated public and private sources.

(d) Include corresponding public and/or private investments that minimize the relative percentage and amount of Federal ITS funds.

Authority: sec. 5001(a)(5), Pub. L. 105–178, 112 Stat. 107, 420; 23 U.S.C. 315; and 49 CFR 1.48.

Issued on: August 1, 2000.

Kenneth R. Wykle,

Federal Highway Administrator.

[FR Doc. 00–20083 Filed 8–8–00; 8:45 am]

BILLING CODE 4910–22–P

DEPARTMENT OF TRANSPORTATION

Federal Motor Carrier Safety Administration

[FMCSA Docket No. FMCSA–98–3611]

Guidelines for Development of Functional Specifications for Performance-Based Brake Testers Used to Inspect Commercial Motor Vehicles

AGENCY: Federal Motor Carrier Safety Administration (FMCSA), DOT.

ACTION: Notice of final determination.

SUMMARY: The FMCSA is announcing its final determination establishing functional specifications for performance-based brake testing machines purchased with Federal funds from the agency's Motor Carrier Safety Assistance Program (MCSAP). The FMCSA is nearing the completion of a multi-year research program to evaluate prototype performance-based brake testing technologies, including roller dynamometers, flat-plate testers, breakaway torque testers, an on-board electronic decelerometer, and an infrared brake temperature measurement system. To date, the FMCSA has determined that certain performance-based brake testing machines are eligible for funding under MCSAP, but only as screening and sorting devices in commercial vehicle inspections. The FMCSA is establishing generic functional specifications that will be applicable to a range of brake testing technologies. The States may use the functional specifications as guidelines to determine whether the purchase of a specific brake tester would be an eligible expense item under the MCSAP.

DATES: The effective date for this determination is September 8, 2000.

FOR FURTHER INFORMATION CONTACT: Mr. Gary Woodford, Office of Bus and Truck

Standards and Operations, FMCSA, (202) 366–4009, or Charles Medalen, Office of the Chief Counsel, HCC–20, (202) 366–1354, Federal Highway Administration, Department of Transportation, 400 Seventh Street, SW., Washington, D.C. 20590. Office hours are from 7:45 a.m. to 4:15 p.m., e.t., Monday through Friday, except Federal holidays.

SUPPLEMENTARY INFORMATION:

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Electronic Access

Internet users may access all comments received by the U.S. DOT Dockets, Room PL–401, 400 Seventh Street, SW., Washington, DC 20590–0001, in response to the previous notice on this subject, by using the universal resource locator, (URL): *http://dms.dot.gov,* and referencing the docket number at the beginning of this notice. The URL is available 24 hours each day, 365 days each year. Please follow the instructions online for more information and help.

An electronic copy of this document may be downloaded using a modem and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512–1661. Internet users may reach the Office of the Federal Register's home page at: *http://www.nara.gov/fedreg* and the Government Printing Office's database at: *http://www.access.gpo.gov/nara.*

Background

Assessment of large truck and bus braking capability in the United States has traditionally been done using visual- and sensory-based inspection methods. These include visual examination of components, measurement of push-rod travel on air braked vehicles, and listening for air brake system leaks. Truck and bus fleets, repair and maintenance facilities, and the enforcement community all generally use these methods to look for defective brakes. While these methods have been successful, they do have limitations. These include: (1) Falsely identifying adequately braked vehicles as unsafe and placing them out-of-service (OOS), (2) failure to detect brake force-related deficiencies that cause no visually apparent defects, and (3) inability to inspect the brake systems on more than a small portion of the commercial vehicle population due to the time involved. With regard to roadside inspections conducted by Federal and State officials, guidelines developed by the Commercial Vehicle Safety Alliance (CVSA) are used to determine when violations of the Federal Motor Carrier Safety Regulations (FMCSRs) are severe enough to warrant placing the vehicle OOS. These guidelines are known as the North American Uniform Vehicle Out-of-Service Criteria, used by officials in the United States, Canada, and Mexico.

In the early 1990s, the Federal Highway Administration (FHWA) [1] initiated research to evaluate various types of performance-based brake testing technologies for application to commercial motor vehicle inspections. The purpose of the research was to determine, through laboratory investigation, if performance-based brake testers (PBBTs) could be used to evaluate commercial vehicle braking capability. A PBBT is a device that can assess vehicle braking capability through quantitative measure of individual wheel brake forces or overall vehicle brake performance in a controlled test. The PBBTs cannot replace an inspector in finding brake defects unrelated to immediate brake performance, such as air leaks, chafed brake hose, or thin brake pads. However, they can provide an objective and consistent measure of vehicle braking performance, irrespective of brake type, energy supply, or actuation method, and without having to crawl underneath the vehicle as with the current inspection method. PBBTs are widely used for brake inspection in Europe and Australia, and are beginning to emerge in the United States as both an enforcement tool and diagnostic aid for private sector maintenance and repair shops.

Field Test Evaluations

After analyzing various PBBT technologies during the above referenced research, the FHWA selected several types for further evaluation in roadside field-test inspections. The types selected were the: (1) Roller dynamometer, (2) flat-plate tester, (3) breakaway torque tester, (4) infrared system, and (5) decelerometer. During the field testing, joint roadside inspections with State officials were conducted on almost 3,000 commercial vehicles. The joint inspections consisted of a CVSA Level 4 inspection [2] and a PBBT test. Ten States and several commercial fleets participated in the program with each evaluating a specific type of PBBT. The ten States which volunteered to participate in the evaluation were Colorado, Connecticut, Indiana, Maryland, Minnesota, Nevada, Ohio, Oregon, West Virginia, and Wisconsin. The roller dynamometer, flat-plate, and breakaway torque testers were evaluated for at least one year by CVSA Certified State Inspectors. The infrared system and decelerometer were also investigated in the field, though less extensively than the three other types of PBBTs. The PBBTs used in this program were first-and second-generation prototype machines to which improvements have since been made by the PBBT manufacturers.

During the field evaluation testing, data were collected from both the CVSA Level 4 inspections and the PBBT measurements. The degree of correlation between the two methods was identified. Data on the operational characteristics of each PBBT were also collected and evaluated, including set-up and tear down times, maintenance requirements, calibration, operator skill level needed, user interface, and vehicle inspection times. These data on operational characteristics were gathered to help in the development of PBBT functional specifications, which are the subject of this notice and are discussed below in more detail.

Agreement on individual weak or defective brakes identified by the CVSA inspection method versus those identified by a PBBT ranged from 53 to 88 percent, depending on the type of PBBT. This was considered reasonable since the two methodologies assess different brake system characteristics. The PBBTs used in the field tests were not necessarily faster than the brake-only portion of the CVSA inspection, considering time for data entry, driver instruction, and printing of test results. However, the times were generally considered comparable. It was apparent that 30 to 80 five-axle vehicles per eight-hour workday could be screened for further CVSA inspection using one of

[1] On December 9, 1999, the President signed the Motor Carrier Safety Improvement Act of 1999 (Public Law 106–159, 113 Stat. 1748), which established the FMCSA in the Department of Transportation. Prior to that time, the functions that are now carried out by the FMCSA were carried out within the FHWA.

[2] Level 4 inspection is the CVSA designation for a Special Inspection, which typically includes a one time examination of a particular item in support of a study or to verify or refute a suspected trend. In this study the CVSA Level 4 inspection comprised the brake and tire portions of a full Level 1 inspection. Level 1 is the most thorough inspection, including the tires, brake system, driver documents, and a variety of other vehicle safety systems.

the PBBT technologies. Accurate screening is important since only approximately 8 to 12 vehicles per eight-hour workday per inspector can be checked using a CVSA Level 1 inspection. [3]

The overall results of the field test evaluations indicated there were no insurmountable performance or operational limitations with the roller dynamometer, flat-plate, or breakaway torque testers that would prevent them from being used for screening purposes or enforcement. However, the infrared and decelerometer technologies did present some difficulties. In the case of the onboard decelerometer, which measures deceleration rate during a vehicle stop, finding a convenient and large enough space to perform a panic stop with a commercial motor vehicle was at times difficult. Moreover, it is likely that few commercial vehicle drivers would be willing to perform a panic stop in other than an emergency situation because of the potential damage to onboard cargo. Results using the decelerometer were also found to be strongly dependent on driver skill. In the case of the infrared system, applicability of this technology was found to be limited to the detection of inoperative brakes or brakes with push rod stroke measurements in excess of 12.7 millimeters (mm) (0.5 inch) beyond the recommended adjustment limit. The FMCSA is continuing its research into use of the infrared technology as a possible brake screening device for vehicles.

A final report describing in greater detail the results of these field test evaluations has been placed in the docket referenced above. The report is titled, ''Development, Evaluation, and Application of Performance-Based Brake Testing Technologies,'' February 1999, Report No. FHWA–MC–98–048. Copies of the report may be purchased from the National Technical Information Service (NTIS), Springfield, VA 22161, telephone (703) 605–6000. The NTIS accession number for this publication is PB99-134454.

[3] A Level 1 inspection usually takes approximately 20 to 30 minutes if there are no violations of applicable regulations, and includes both the driver and the vehicle. The inspector reviews the driver's license, medical certificate, record of duty status (or log book) and any readily available supporting documents. The inspection of the vehicle includes an examination of the brake system, coupling devices, exhaust system, frame, fuel system, cargo securement, steering system, suspension system, tires, trailer body, wheels, rims and hub assemblies, windshield wipers, lights, and horn.

Round Robin Tests

In July 1998, the FHWA conducted a series of round robin tests to assess the suitability of PBBTs for use in enforcement. These tests were conducted at the National Highway Traffic Safety Administration's (NHTSA) Vehicle Research and Test Center. The purpose of the tests was to evaluate the ability of current generation PBBTs to accurately and consistently: (1) Measure the brake forces and wheel loads of commercial motor vehicles, and (2) predict the vehicle's deceleration capability from a 32.2 kilometers/hour (km/hr) (20 miles per hour (mph)) on-road stop.

The test program involved PBBT tests and 32.2 km/hr (20 mph) stops using two different vehicles, which were tested fully laden and unladen, with weak brakes on selected wheels. The vehicles were (1) a two-axle flatbed straight truck, and (2) a three-axle tractor, two-axle flatbed semi-trailer combination. These vehicles were selected for the tests because they were considered representative of a majority of the commercial vehicle axle configurations on the road. There were eight PBBTs used in the testing: five roller dynamometers (two in-ground and three portable), two flat-plate testers, and one breakaway torque tester.

The tests indicated that, under most conditions, the accuracy and repeatability of most of the PBBT results, regardless of the principle of operation, were acceptable for meeting the functional specifications (discussed below). Therefore, they were considered suitable for use in enforcement in the event the FMCSA amends 49 CFR 393.52, Brake performance, to allow the use of these devices to determine compliance with certain provisions of the rule. Nearly all of the PBBTs were able to accurately measure the vehicle brake forces. In contrast, several of the PBBTs had difficulty reporting accurate vehicle weights. For the most part, however, this was related to test procedures. Calibration checks of the PBBT weighing mechanisms indicated that all of them could meet the functional specifications. In those instances where PBBT accuracy did not achieve acceptable performance, the problems were identified and conveyed to the PBBT manufacturers as recommendations for improvement. Most of the recommendations were consistent with the requirements of the PBBT functional specifications.

Copies of the report, further describing the round robin tests, are available in the docket referenced above. The report is titled, ''PBBT Round-Robin Testing,'' February 2000.

MCSAP Funding Eligibility

During the period 1996–98, the FHWA issued four policy memoranda advising that specific PBBTs are eligible for funding under the MCSAP. Copies of the memoranda are available in the docket referenced above and are dated April 1, 1996, October 8, 1996, March 13, 1997, and November 3, 1998. The MCSAP is a Federal program, administered by FMCSA, providing funds to States and U.S. territories in support of commercial motor vehicle safety. This means that States or territories may use MCSAP funding to purchase one of the approved PBBTs for use in commercial motor vehicle brake inspections. To date, however, these prototype devices have been used only for screening or sorting purposes, and not enforcement, since PBBT pass/fail criteria have not yet been established within the FMCSRs. Specific pass/fail criteria for use with PBBTs are being proposed and published elsewhere in today's **Federal Register**. The proposed criteria would enable enforcement officials to issue citations based upon PBBT test results.

The PBBTs which have been approved to date for MCSAP funding are:

- Hunter B400T Flat Plate Tester (in-ground)
- Nepean [4] Mark III Roller Dynamometer (portable)
- Nepean Mark IV Roller Dynamometer (portable)
- Hicklin RBD Roller Dynamometer (portable)
- Radlinski RAI 12200 Roller Dynamometer (in-ground)
- Radlinski RAI 20200 Roller Dynamometer (portable)

The above referenced policy memoranda set forth requirements and suggested procedures for States to follow in using the PBBTs to help in gathering field evaluation data and information relative to the PBBT functional specifications. As the memoranda were issued, they reflected the evolving progress made in the development of functional specifications for PBBTs.

PBBT Functional Specifications

On December 8, 1997, the FHWA held a public meeting at the NHTSA's Vehicle Research and Test Center to discuss the development of functional specifications for PBBTs. A notice announcing the meeting was published in the **Federal Register** on November 13,

[4] Nepean is now called Vehicle Inspection Systems (VIS).

1997 (62 FR 60817). Data gathered during the PBBT field evaluation tests, referenced above, served as background information for draft functional specifications, which were discussed at the meeting. In addition to the NHTSA and the FHWA, the following companies were represented at the meeting: Battelle, B&B Automotive, B&G Technologies, Inc., Dennis National Lease, Hicklin Engineering, Hunter Engineering Company, Gooch Brake, MGM Brakes, Motion Control Industries, Inc., Nepean Engineering Pty. Ltd., Radlinski & Associates, Inc., and Truckalyser Canada, Inc. Most of the participants were either manufacturers of PBBTs or distributors of such devices.

On June 5, 1998, the FHWA published a **Federal Register** notice (63 FR 30678) requesting public comments on the proposed functional specifications, which incorporated comments received during the public meeting. The agency requested further public comment through this notice to ensure that all interested persons who were unable to attend the meeting would have an opportunity to comment on this subject. The functional specifications are intended to be generic and, therefore, applicable to a range of PBBT technologies. They include requirements for: (1) Functional performance, such as measurement accuracy with tolerances, calibration, and operator interface, (2) physical characteristics including portability, (3) environmental resistance, (4) operator safety, (5) documentation, including operator and maintenance manuals, and (5) skill level and number of operator personnel required. The specifications also include quality assurance provisions or methodologies for verifying PBBT compliance with each of the functional specification requirements. The intent is for the functional specifications to serve as a guideline for States in determining whether a particular PBBT would be eligible for funding under MCSAP, and to ensure a certain level of PBBT accuracy and performance.

In this **Federal Register** notice, the FMCSA is announcing its final determination establishing functional specifications for performance-based brake testing machines purchased with Federal funds through the agency's MCSAP. The final specifications reflect revisions to the draft functional specifications, based on comments received in response to the June 5, 1998, **Federal Register** notice referenced above. Those comments and revisions are discussed below.

Discussion of Comments

The FMCSA received submissions from six commenters in response to the June 5, 1998, **Federal Register** notice. The submissions are from: B & G Technologies, Inc. (B&G); Cantlon Computer Consulting (Cantlon); Hicklin Engineering (Hicklin); McKay Security Supplies; Radlinski & Associates, Inc. (Radlinski); and an individual, Mr. John Fobian. The submission from McKay Security Supplies was not responsive to the notice, and therefore will not be discussed further. It consisted of a copy of functional specifications for a brake system screening device using infrared technology, IRISystems, which is outside the scope of the functional specifications being addressed here. The specific issues raised by the remaining commenters are discussed below, along with our response.

Determining Braking Capability at Full Vehicle Load

The draft functional performance specifications require PBBTs to measure braking force at current vehicle load.[5] There is no requirement for PBBTs to predict stopping capability at full vehicle load.

B&G stated that testing and certifying the braking performance of vehicles at their current weight is a step back in safety, since it provides no assurance the vehicle will stop adequately when fully loaded. It argued that the current method of measuring allowable, brake push rod travel[6] is a predictive test, since the limits of travel were established to ensure stopping capability within the full range of the vehicle's weight capacity. B&G believes the draft functional specifications should be changed so that if a vehicle is not fully loaded when tested, then the PBBT should be capable of predicting stopping performance at full load (gross vehicle weight rating). Similarly, Cantlon expressed concern that the specifications not be limited to determining whether a vehicle can stop at its current load, but also allow for determining stopping capability when fully loaded. As with B&G, Cantlon stated that without this specification there is no assurance that a vehicle with adequate braking at current load would necessarily stop safely at full load.

The FMCSA does not agree that the draft functional performance specifications represent a step back in safety. Overall, the agency believes that the current method of measuring allowable brake push rod travel, or brake adjustment, is no more predictive of vehicle braking performance, over a full range of operating conditions, than are some PBBT tests. For example, the table of push rod readjustment limits used by enforcement officials does not take into account brake temperature. Moreover, visual- and sensory-based inspection methods have limitations, as indicated earlier. These include: (1) Falsely[7] identifying adequately braked vehicles as unsafe and placing them OOS, (2) having brake force-related deficiencies, but no visually apparent defects, and (3) the inability to thoroughly inspect the brake systems on more than a small portion of the commercial vehicle population due to the time involved.

In addition, the ability to check brake adjustment on some vehicles can be hindered because brake push rods are not always readily accessible for measurement. Brake push rod travel, or brake misadjustment, is only one factor which can contribute to poor braking performance. In contrast, PBBTs objectively measure the actual braking performance of the vehicle, regardless of the factors which may contribute to weak brakes.

The functional performance specifications do not require PBBTs to be capable of predicting brake performance at full load on a vehicle that is not fully loaded. At the same time, however, the specifications do not preclude a PBBT manufacturer from incorporating this capability into its brake tester. At the time of the field evaluation tests referenced above, there were only three PBBTs which had this capability.[8] The FMCSA is hopeful that more PBBT manufacturers will enhance the design of their brake testers to

[5] Current vehicle load is the weight of the vehicle and its load at the time of inspection.

[6] Allowable brake push rod travel is an indicator of brake adjustment as well as lining wear. It is one criteria used by State and local enforcement personnel in determining whether a vehicle should be placed out of service, and is contained in the North American Uniform Out-of-Service Criteria established by the CVSA.

[7] In a February 1995 FHWA study, ''Evaluation of Brake Adjustment Criteria for Heavy Trucks,'' Report No. FHWA–MC–94–016, it was found that 936 of 2,146 vehicles with S-cam brakes were placed out-of-service for their brake adjustment. Among the 936 vehicles, it was found that 480 had braking capability that was greater than 80 percent of what the braking capability would have been if the brakes were fully adjusted. Thus, these vehicles were incorrectly placed out-of-service. (Under current CVSA guidelines, a vehicle is placed out-of-service if 20 percent or more of its brakes are found defective, which includes improper adjustment.) This report is available in the docket referenced above and through the National Technical Information Service, Springfield, VA 22161.

[8] As with the method of measuring brake push rod travel, these PBBTs do not take into account future brake performance at higher brake temperatures.

predict braking performance at full load on a vehicle that is not fully loaded. However, the agency does not believe this should currently be required, since that would eliminate a majority of brake testers, thereby precluding use of this new technology for enhancing heavy vehicle safety. For these reasons, the FMCSA believes that the use of PBBTs to measure braking performance at current load will not degrade heavy vehicle safety, and has, therefore, decided not to revise the functional specifications with respect to this issue.

The remaining comments are presented in the same order as the items to which they relate in the draft functional specifications, published with the June 5, 1998, **Federal Register** notice, as follows:

Item 2. Abbreviations/Definitions

Mr. John Fobian commented on the abbreviation/definition for kg_f, which reads ''Kilograms force (common metric unit used for weight).'' He stated that the correct term for weight is mass, and that the common metric unit for mass is kilogram (kg), or kilogram mass (kg_m). The FMCSA disagrees with this assertion. Although weight and mass are related, they are not the same. Weight is the measured heaviness of a particular object, equal to the product of the object's mass and the value of gravitational acceleration [weight = (mass) × (acceleration of gravity)]. In other words, the weight of an object is the force due to the acceleration of gravity acting upon its mass. So, the mass of an object is different from, but proportional to, its weight. Therefore, the FMCSA is retaining the term ''weight'' in the definition, since that is the intended measurement.

In addition, Mr. Fobian states that the newton, rather than kilograms force, is the common metric unit for force. The FMCSA agrees that this is generally true for most force measurements. However, with respect to weight (gravitational force), the agency believes that ''kilogram'' rather than ''newton'' is more commonly used. Therefore, the agency has decided to retain the term ''kilograms force (kg_f)'' and the definition remains unchanged.

3.1.2 Determining Braking Capability

Hicklin and Radlinski requested clarification of the last sentence in this requirement, which states ''The road/tire friction coefficient should be considered to be at least 0.6.'' They both asked whether this refers to the friction coefficient between tire and brake tester, or tire and typical road surfaces. Further, they asked how this should be used, if it refers to typical road surfaces.

This sentence refers to the friction coefficient between the tire and a typical road surface. The intent of the requirement, *Determining Braking Capability,* is to assure that braking force measurements are representative of, or can be related to, the braking forces the tires would impart to the ground. Thus, by stating that road/tire friction coefficient should be considered to be at least 0.6, the sentence means that manufacturers should maintain a coefficient of friction between the test surface and the tire of at least 0.6. This is confirmed in a subsequent requirement, 3.1.4, *Coefficient of Friction,* which specifies that friction coefficient between test surface and a standard tire must be at least 0.6 under dry conditions.

3.1.3 Brake Force Determination

This requirement states in part that ''Independent determination of maximum brake forces on each side of an axle is required [of brake testers].'' The purpose of this requirement is to assure that brake testers are capable of measuring braking forces at each wheel.

Radlinski stated that in using independent determination of maximum braking force, it should be specified that brake force imbalance across an axle is to be measured at first wheel lockup, rather than at lockup of each wheel. Similarly, Hicklin requested clarification of the statement, ''Independent determination of * * * brake forces * * *,'' and asked whether it referred to a specific method of testing.

The purpose of this particular requirement is to simply assure that brake testers are capable of measuring braking forces at each wheel. The requirement does not refer to a methodology, nor is that the intent. The subject of test methodology is being addressed in another notice on pass/fail criteria for vehicles tested with a PBBT. That notice is being published elsewhere in today's **Federal Register**. The particular section of that notice addressing this issue is *Braking Stability,* and PBBT manufacturers and users are encouraged to provide comments in response to that notice.

3.1.4 Coefficient of Friction

This item requires that the coefficient of friction (COF) between the PBBT test surface and a standard tire (e.g., 295/75R22.5) be reported for a range of loads. The COF must be at least 0.6 under dry conditions.

Radlinski and Hicklin both stated that the standard tire needs to be better defined to assure that the COF for all brake testers is measured the same way. Hicklin suggested that the tread design of the standard tire be specified, since it has found that different tread designs can yield different results. It also stated the tire compound may be a consideration, which may require a specific tire brand or material. Hicklin also stated, however, that the specification should not require expensive testing methods, thereby eliminating some PBBT manufacturers due to cost. Radlinski requested that at least the size and tread type of the standard tire be specified, and suggested a tire size of 11R24.5 with rib type tread design be used, since this is a tire commonly used on heavy trucks. Neither commenter provided supporting data.

After analyzing this matter, the FMCSA concurs with Radlinski and Hicklin on the need for a more specific definition of the standard tire. As indicated earlier, the goal of this specification is to assure that brake testers have a COF of at least 0.6, although it may be higher than 0.6. The agency agrees with Radlinski that a tire size of 11R24.5 with a rib type tread design is a commonly used heavy truck tire. The FMCSA has, therefore, revised the final functional specification to reflect this as the standard tire. Specifying such a commonly used truck tire as the standard will make it more accessible for PBBT manufacturers when certifying the COF of their brake testers. In addition, specifying a particular tread design will assure greater consistency in results, since tread design can affect tire-to-test surface friction.

For the same reason the FMCSA has decided to specify limits for the inflation pressure of the standard tire, as well as vehicle load, when certifying brake tester COF. Both of these factors have a direct bearing on the amount of friction that exists between the tire and test surface. The agency has decided to require that the inflation pressure of the standard tire be within (plus or minus) 2 pounds per square inch (psi) of the tire manufacturer's recommended cold inflation pressure for a given load on the tire. This is consistent with the tolerances used by the NHTSA in testing passenger car tires under its Uniform Tire Quality Grading Program.[9] It is also consistent with the accuracy of readily available tire pressure measuring equipment (tire gauges). For vehicle load during the PBBT certification test, the agency is specifying that COF be at

[9] In this program, the NHTSA rates the performance of new passenger car tires for tread life, temperature, and traction, based on actual testing, and requires tire manufacturers to provide this information to consumers.

least 0.6 for wheel loads ranging from 2,500 through 7,000 [10] pounds per tire, since this is the expected range of wheel loads on vehicles that will be commonly tested by PBBTs.

Finally, the FMCSA has decided not to specify tire material compound for the standard tire. Although this was suggested by Hicklin, it provided no supporting data to justify such a requirement. The tire compound could influence COF results, however, the agency believes that the degree of influence would be minimal for purposes of this test. Moreover, the agency anticipates that PBBT manufacturers will assure that the COFs of their PBBTs will be sufficiently above 0.6 for the range of truck tire compounds available on the market. This is because it is advantageous for PBBT manufacturers to have adequate COF on their PBBTs. Inadequate COF could result in false PBBT brake force measurements.

3.1.5 Weighing Capability

The functional specification, *Weighing Capability,* states that many of the criteria to be used for identifying weak brakes require determination of gross axle weight (GAW) or gross vehicle weight (GVW). For brake testers which use this criteria, the capability of measuring GAW or GVW is preferred, but not required. For those brake testers which have no weighing capability, the necessary weight measurements can be obtained independently. However, those testers must still be capable of having independent weight measurements entered into their operating and analysis software, so that comparisons of such data can be made in conjunction with the measured brake forces.

In commenting on this requirement, Radlinski expressed concern over placing vehicles OOS using weights measured on certain machines. It stated that brake testers which require vehicles to use ramps are known to give false weight measurements for individual axles. Therefore, any OOS criteria using such measurements could be challenged.

Since Radlinski provides no specific recommendations for revising the *Weighing Capability* requirement, the FMCSA is leaving the requirement unchanged. The agency notes that weighing capability is not a required machine specification, but rather preferred. Among those machines for which accurate weight measurements are in question, accurate weight data could still be obtained independently. Through ongoing research, the FMCSA plans to work with the PBBT Manufacturers Association to help manufacturers overcome the kind of problem cited by Radlinski. Also, the functional specifications require PBBT manufacturers to certify their machines to a specific level of accuracy.

3.1.7.1 Initial Calibration Certification

This requirement states that brake testers shall be supplied with calibration certificates guaranteeing system measurement accuracy ''. . . traceable to NIST [National Institute of Standards and Technology] standards.'' Radlinski commented that since brake testers may be manufactured outside the United States, calibration certifications should be allowed based on recognized organizations in other countries that are similar in function to NIST.

The FMCSA agrees, however, PBBTs manufactured to these functional specifications could be used for enforcement of FMCSRs on braking performance. Therefore, the agency believes it is important, for purposes of traceability, to allow only calibration certifications from those standards organizations that meet certain qualifications.

On October 14, 1999, the national metrology institutes of 38 member States of the Metre Convention, and two international organizations, including NIST, signed a Mutual Recognition Arrangement (MRA). As signatories to the MRA, they agreed to a number of issues, including establishing a degree of equivalence of national measurement standards and providing for the mutual recognition of calibration and measurement certificates. Further information on the MRA is available at the world wide web site, *http://www.bipm.fr/enus/8_Key_Comparisons/mra.html.* To assure a minimum level of equivalence, the FMCSA believes that only those organizations that signed the MRA along with NIST should be recognized for the purpose of the functional specifications. Therefore, the requirement, 3.1.7.1, Initial Calibration Certification, has been revised accordingly. The 38 Member States of the Metre Convention that signed the MRA are: South Africa, Germany, Argentina, Australia, Austria, Bulgaria, Belgium, Brazil, Canada, China, Republic of Korea, Denmark, Spain, United States, Finland, France, Hungary, India, Ireland, Italy, Japan, Mexico, Norway, New Zealand, The Netherlands, Poland, Portugal, Romania, United Kingdom, Russian Federation, Singapore, Slovakia, Sweden, Switzerland, Czech Republic, Thailand, Turkey, and Uruguay. The two international organizations are: (1) International Atomic Energy Agency and (2) European Commission Directorate General, Joint Research Centre.

3.1.7.4 Calibration History

This requirement states that ''. . . sufficient calibration histories . . . shall be maintained with the tester in hard copy form and in a software file that can be accessed upon request by the user.'' Radlinski and Hicklin both asked for clarification of the phrase, ''software file.'' They asked whether the term means: (1) A computer generated file created as part of a computer based calibration routine, or (2) a computer file generated by manually entering pertinent calibration data into a computer file on the machine.

The intent of the term ''software file'' was to allow either one of the interpretations set forth by Radlinski and Hicklin. The FMCSA agrees that ''software'' is confusing, since it tends to imply a specific calibration related software that generates the necessary data. Therefore, the agency has replaced ''software file'' with the more generic phrase, ''computer file.''

3.1.10 Identification of Faulty Tests

This requirement states that the machine shall be able to identify an improperly run test or one that was otherwise invalid, and the reason for the invalid test shall be indicated to the machine operator. It further states that examples include low coefficient of friction between the test surface and tires, insufficient data for computations, premature test termination, unreasonable or out of range values, and malfunctioning or improperly connected transducers. Radlinski and Hicklin both asked that this requirement be clarified to refer to the identification of faulty individual tests, and not long term machine self diagnostics, such as monitoring changes in surface coefficient of friction.

The FMCSA believes that no clarification of this requirement is necessary, since it refers to a single ''test.'' The requirement does not refer to long term machine self diagnostics, nor is that its intent. However, to the extent that a particular feature, such as machine surface coefficient of friction, deteriorates over time and improperly affects a particular test, the machine must be capable of identifying this

[10] The Tire and Rim Association 1999 Yearbook specifies 7,160 pounds as the maximum load limit at 120 psi cold inflation pressure for 11R24.5 radial ply tires mounted on 15 degree drop center rims and used on trucks, buses, and trailers in normal highway service. The Yearbook for 1999 is available for purchase ($50) from the Association at 175 Montrose Ave. West, Copley, OH 44321.

invalid test, along with the reason, to the machine operator.

3.1.11 Inspection Time

The purpose of this requirement for brake testers is to assure that the amount of time required to conduct a full vehicle braking capability assessment is minimal. The requirement states that it shall take skilled operators no longer than 15 minutes to perform a brake test on a five-axle tractor-trailer combination. In addition, the range of actual inspection times, including paperwork, for various truck configurations shall be included in the brake tester Operation Manual.

Radlinski and Hicklin both suggested that the amount of time required per axle be required, rather than specifying the time involved for all vehicle configurations. They stated that the amount of time per axle would be sufficient to determine the amount of time involved for any vehicle combination.

The FMCSA has decided not to incorporate these comments. While it would be feasible to specify brake tester time per axle, such an approach would not take into account the amount of time involved between axle tests on a given vehicle. This cumulative amount of vehicle time could vary significantly, depending upon the brake tester design. However, the agency notes that wording in the draft requirement was somewhat vague in stating ''. . . inspection times for *various* [emphasis added] truck configurations . . . shall be listed.'' Therefore, in order to provide more specificity to this requirement, the FMCSA has revised the second sentence to require that inspection times on three different vehicle configurations be listed in the Operation Manual. These are: (1) A two-axle straight truck or bus, (2) a five-axle tractor-trailer combination, and (3) a five-axle tractor-double trailer combination, e.g., a two-axle tractor pulling a one-axle semi-trailer coupled to a converter dolly and semi-trailer. The agency has specified these because it believes they are representative of the range of heavy vehicle configurations most likely to be encountered by brake testers.

3.3.3 Water Resistance

This requirement states that all PBBT electrical systems shall be sealed against water intrusion from wind driven rain, and that towed brake testers shall meet water intrusion requirements when being towed in the rain at typical towing speeds.

Radlinski and Hicklin both asked for clarification of the phrase, ''water intrusion requirements.'' Radlinski asked whether this was a specific requirement published by a recognized organization. If so, it asked that the requirement reference be identified. Similarly, Hicklin asked whether this referred to a specification that needs to be identified, and suggested that perhaps a measurable requirement should be stated.

The phrase ''water intrusion requirements'' does not refer to a specific requirement limiting a measurable amount of water. The agency notes that this requirement is consistent with the other environmental requirements in the functional specifications, including temperature, humidity, sunlight, and ultraviolet radiation. None of the environmental requirements specify measurable performance limits. This is because their intent is to serve as design guidelines for PBBT manufacturers. The agency believes that free market competition will encourage PBBT manufacturers, through design and warranties, to provide an acceptable level of protection against environmental degradation. Further, the FMCSA notes that functional specification 4.1, *Compliance,* states that failure to perform adequately in the field could result in manufacturer penalties.

3.5.1 Operation Manual

This requirement states that the Operation Manual shall explain how to properly and safely operate the brake tester, including setting it up, conducting tests, and interpreting and printing out results. It must be written for a first time user, which is described as one unfamiliar with the equipment, at the skill level described in functional specification 3.6.2. The skill level attributes described there include ''. . . familiarity with using personal computers and common operating systems.''

Radlinski and Hicklin both commented that a manual for an ''untrained'' user is impractical. Radlinski cited the level of complexity of the brake testers. Both commenters stated that this specification should address an operation manual for trained users.

The FMCSA believes that PBBT manufacturers can write the Operation Manual for persons with some training and level of familiarity with brake testers in general. However, the agency believes that no change to the functional specifications are necessary. Specification 3.6.2, *Skill Level,* refers to personnel having ''. . . familiarity with using personal computers and common operating systems.'' Moreover, the specifications for *Skill Level* and *Operation Manual* do not use the word ''untrained'' personnel, as referenced by Radlinski and Hicklin. However, the specification on *Operation Manual* refers to personnel ''. . . unfamiliar with the equipment . . . .'' This refers to someone unfamiliar with a particular manufacturer's PBBT, but not PBBTs in general. The agency anticipates working with the CVSA, PBBT manufacturers, and others, as appropriate, to develop PBBT operator training. This subject is further discussed elsewhere in today's **Federal Register** in the proposal setting brake performance pass/fail criteria for use with PBBTs. PBBT manufacturers and users are encouraged to submit comments on this subject, as discussed in that notice.

4.1. Compliance

The draft functional specifications, Section 4.1, *Compliance,* stated that compliance with the performance requirements in Section 3, be accomplished by one or more methods of verification. These included analysis, test, demonstration, inspection, and certified vendor data. The draft further stated that ''Self-certification is acceptable, although failure to adequately perform in the field could result in [brake] tester decertification.'' This wording implied that there was an alternative method to self-certification, such as certification through an outside entity. However, no such entity was named in the draft with the exception of a reference to FHWA (now FMCSA) under the *Test* method of verification, Section 4.1.2. There it stated that ''Self-certification of compliance is permissible provided that the Test Plan is pre-approved by the FHWA and the Test Report is submitted to the FHWA for approval.''

Radlinski and Hicklin both commented, requesting that compliance be achieved solely through self-certification by PBBT manufacturers with appropriate penalties for non-compliance. Radlinski likened this to the way the NHTSA imposes penalties on vehicle manufacturers, which self-certify to Federal safety standards, but may fail to comply. Hicklin stated that self-certification should be allowed rather than requiring oversight by an entity that is not named in the specifications.

After considering these comments, the FMCSA has concluded that self-certification by PBBT manufacturers should be the sole method of certifying PBBTs to the functional specifications. The alternative is to have an oversight entity, which would be the FMCSA or its representative, certify each PBBT

design through a documented type-approval process. The agency believes that this approach would be too costly, burdensome, and time consuming for FMCSA technical staff. Self-certification is much more appropriate, since it places responsibility for compliance with the PBBT manufacturer, which is the most knowledgeable about its design.

Self-certification means that a PBBT manufacturer certifies its PBBT to meet the functional specifications at the time of manufacture, and clearly states which specifications, if any, its PBBT does not meet. PBBTs which are certified to meet the functional specifications are eligible for funding under the MCSAP. This means that States or territories may use MCSAP funding to purchase certified PBBTs for use in commercial motor vehicle brake inspections.

The agency agrees with Radlinski and Hicklin that penalties should be imposed for flagrant non-compliance. The FMCSA has no regulatory authority over PBBT manufacturers and therefore cannot impose civil penalties. However, the agency will require each manufacturer to sign a declaration, under penalty of perjury, that its PBBT meets the functional specifications at the time of manufacture. States will be allowed to spend MCSAP funds for a PBBT only if the manufacturer has signed such a declaration and presented it to the State. This does not mean that every minor flaw or service interruption will make the PBBT manufacturer liable to prosecution for perjury. The warranty requirement included in the functional specifications is intended to address routine repairs or service that may be necessary. The FMCSA will consider referring a matter to the Department of Justice for prosecution only if a State experiences pervasive problems with a PBBT which could reasonably be explained only by significant non-compliance with the functional specifications.

Accordingly, the FMCSA has revised Section 4.1, *Compliance,* to reflect this in the final functional specifications.

4.4. Extended Verification Duration

The draft functional specifications stated that any item requiring an extended period of time for evaluation of compliance shall be warranted by the manufacturer, and failure to comply may result in decertification of the tester. The items so designated were: (1) Accuracy between calibrations, (2) re-calibration interval, (3) ruggedness, (4) appearance, (5) temperature, (6) humidity, (7) water resistance, and (8) UV radiation. The methods for verifying compliance of these include demonstration, inspection, or certified vendor data, depending on the requirement involved.

Radlinski and Hicklin both requested that any method for verifying compliance with these items be replaced by manufacturer warranty. Radlinski further stated that the results of long-term demonstrations are meaningless unless a very specific and uniform test procedure can be developed and followed by all suppliers. This would be a costly and complicated process, according to Radlinski, and one that is not practical in light of all the possible weather scenarios. Radlinski stated that the desired result—a machine durable in all weather—can be achieved if manufacturers are required to warrant these items for a period of one year.

After reviewing this matter, the FMCSA sees no need to change the wording in this requirement, since it states that a manufacturer's warranty must be provided for those items referred to by Radlinski and Hicklin. The agency does not concur with their suggestion that the method of verification be replaced by the word, ''warranty.'' Even though a warranty is provided, there must still be a method for determining compliance. The FMCSA anticipates that PBBT manufacturers will clarify the method for determining compliance through their specific warranty. In addition, the agency concurs with Radlinski in specifying a one year warranty. This is discussed below in more detail.

Warranties

No comments were submitted regarding the subject of warranties. However, the agency has added a new Section 4.5, *Warranty,* for the purpose of clarification. Under this specification, a manufacturer shall be required to warrant the functional performance of its PBBT for a period of at least one year from the date of purchase. The FMCSA believes that such a warranty is necessary to ensure that PBBTs are designed and built with a satisfactory level of quality, particularly since they will be used for enforcement. The agency also believes that such a warranty is appropriate, since relatively large amounts of MCSAP funds will be used to purchase certified PBBTs, each of which can cost several hundred thousand dollars. Therefore, the FMCSA has specified one year as the warranty period to assure a minimum level of brake tester reliability. However, PBBT manufacturers may, if they wish, provide a warranty period that is longer than one year, and the FMCSA is hopeful that PBBT manufacturers will take the initiative to provide longer warranty periods consistent with the useful life of PBBTs. Accordingly, Section 4.5, *Warranty,* is added to the final functional specifications.

Paperwork Reduction Act

The FMCSA has determined that this action is exempt from the information collection provisions of the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3501 *et seq.*). There is a certification requirement that is imposed on six PBBT manufacturers, as discussed above in 4.1, *Compliance.* However, OMB clearance is not required because there are less than 10 public entities affected by this certification requirement. See 49 CFR 1320.(3)(c). In addition, there is no new paperwork requirement on the part of the States, because they would only be required to complete the same paperwork they currently prepare, when requesting funds for the purchase of PBBTs from the FMCSA. Accordingly, the agency has determined that the certification requirement does not constitute a ''collection of information'' covered by the PRA.

Authority: 49 U.S.C. 31102, 31136, 31502; and 49 CFR 1.73.

Issued on: July 24, 2000.

Clyde J. Hart, Jr.,

Acting Deputy Administrator.

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APPENDIX:
FUNCTIONAL SPECIFICATIONS FOR PERFORMANCE-BASED BRAKE TESTERS FOR COMMERCIAL MOTOR VEHICLES

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FUNCTIONAL SPECIFICATIONS FOR PERFORMANCE-BASED BRAKE TESTERS FOR COMMERCIAL MOTOR VEHICLES

1. SCOPE

1.1 **Identification** – This specification establishes the performance, verification, and documentation requirements for developing a Performance-Based Brake Tester for Commercial Vehicles (herein referred to as the "brake tester").

1.2 **General Description** - A performance-based brake tester for commercial vehicles is considered to be any device that can determine the braking capability of a vehicle based on the results of a physical measurement related to slowing or stopping the vehicle. Examples of different brake tester configurations include roller dynamometers, instrumented skid plates, breakaway torque testers, and decelerometers. The determination of braking capability shall be independent of the type of brake (disk or drum), method of application (hydraulic, pneumatic, or electric), or rate of brake application by the vehicle driver.

Once the braking capability has been measured, the brake tester shall be able to compare the available braking to preset performance limits or criteria in order to determine whether a particular brake or vehicle has sufficient brake force to stop safely. Based on this comparison, the brake tester shall clearly indicate to the operator(s) whether or not the individual brake or vehicle satisfies the predetermined performance criteria. Lastly, the brake tester shall be able to both print a hardcopy of the test results showing the target criteria and whether the individual brake or vehicle passed, and must accommodate the transmission of the data electronically in Commercial Vehicle Information Systems and Networks (CVISN)-compatible Electronic Data Interchange (EDI) formats and transaction sets.

2. ABBREVIATIONS/DEFINITIONS

ASCII	American Standard Code Information Interchange
ASME	American Society of Mechanical Engineers
COF	Coefficient of Friction
CVISN	Commercial Vehicle Information Systems and Networks

CVSA	Commercial Vehicle Safety Alliance
EDI	Electronic Data Interchange
FMCSR	Federal Motor Carrier Safety Regulations
FMVSS	Federal Motor Vehicle Safety Standards
g	The magnitude of deceleration equal to the magnitude of the acceleration due to gravity (32.2 ft/sec^2 or 9.8 m/sec^2).
GAW	Gross Axle Weight
GVW	Gross Vehicle Weight
kg_f	Kilograms force (common metric unit used for weight)
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
Brake force (BF)	The force that the outer diameter of the tire imparts on the road surface as a result of the brakes being applied.
Deceleration	The rate of change of a decreasing velocity profile.
Accuracy	How closely a reported measurement agrees to the true value of that quantity.
Tolerance	The allowable deviation of a reported measurement from its true value.
UV	Ultraviolet

3. REQUIREMENTS

3.1 Functional Performance

3.1.1 Vehicles to be Tested – The brake tester shall be designed to maximize the number of truck and bus configurations in the North American trucking and motorcoach fleets that can be tested. Examples of configuration differences that can impact brake tester design include tire sizes, axle spacing, ground clearance, full time drive axle interlocks, dynamic or unstable cargo, and aerodynamic fairings. The tester software should be able to accommodate up to 11 axles. Any limitations in vehicles that can be tested shall be clearly outlined in the Operation Manual (See section 3.5 Documentation).

3.1.2 Determining Braking Capability – The brake tester shall be able to determine braking capability either by measuring brake forces at the tire perimeter, stopping distance, or deceleration. It is imperative that the braking force measured on the tester is representative of, or can be related

to, the braking force that the tires would impart to the ground. The road/tire friction coefficient should be considered to be at least 0.6.

NOTE : The braking capability of a commercial vehicle can be determined either with respect to an individual wheel or to the vehicle as a whole using the three types of measurements above. Often the brake force measurement is limited by the traction between the vehicle tire and the surface with which it is contacting, so any method of increasing the amount of tractive force transferred through the tire contact patch is beneficial. Braking capacity for an entire vehicle can be inferred by summing brake forces measured at each wheel and comparing the total BF to the GVW, by measuring the stopping distance of a vehicle, or by measuring the average vehicle deceleration during a stop.

3.1.3 Brake Force Determination – Independent determination of maximum brake forces on each side of an axle is required. If a gross technique, such as stopping distance or deceleration is proposed, it is up to the tester supplier either to make a disclaimer or to demonstrate how such a device can be made to comply with this requirement.

3.1.4 Coefficient of Friction - The COF between the test surface and a standard tire, 11R24.5, rib type tread design, must be reported for the machine for a wheel load ranging from 2,500 through 7,000 pounds per tire. Standard tire inflation pressure must be within (+) or (-) two psi of the tire manufacturer's recommended cold inflation pressure for a given tire load. The COF must be at least 0.6 under dry conditions.

3.1.5 Weighing Capability – Many of the criteria to be used for identifying insufficient brakes require determination of either GAW or GVW. While the ability to measure individual axle weights or entire vehicle weight using the tester is preferred, it is not required. If the machine has no weighing capability, then the ability to compare brake forces with GAW, GVW, or remotely measured axle weights shall be part of the operating and analysis software.

3.1.6 Measurement Accuracy – Overall system accuracy requirements shall be within the tolerances specified in Table 1 below. Stopping distance and deceleration accuracy requirements may be ignored by suppliers of testers of braking forces.

Table 1. Required System Accuracy

Measured Quantity	Unit	System Accuracy (% of reading)
Brake Force	Lbs. (N)	+/- 2.5
Weight	Lbs. (kg_f)	+/- 2.5
Air Pressure*	psi (kPa)	+/- 2.5
Brake Pedal Force*	Lbs. (N)	+/- 2.5
Velocity	ft/s (m/s)	+/- 2.5
Deceleration	%g	+/- 2.5
Stopping Distance	ft (m)	+/- 2.5

* If so equipped

3.1.7 Calibration

3.1.7.1 Initial Calibration Certification - The brake tester shall be supplied with calibration certificates guaranteeing system measurement accuracy as specified by the manufacturer within the tolerances listed in Table 1, traceable to NIST standards, or other national metrology institutes which are signatories to the Mutual Recognition Arrangement of October 14, 1999.

3.1.7.2 Accuracy Between Calibrations - System accuracy shall be maintained to within allowable tolerances between calibrations, subject to verification at any time.

3.1.7.3 Recalibration Interval – The recalibration interval required to maintain accuracy shall be maximized. The minimum allowable calibration interval under normal service shall be no shorter than 180 days. More frequent calibrations may be needed after factory authorized adjustments or modifications are made or if severe usage occurs where measurement accuracy may be compromised.

3.1.7.4 Calibration History – Calibrations shall be traceable to NIST standards, or other national metrology institutes which are signatories to the Mutual Recognition Arrangement of October 14, 1999. Sufficient calibration histories (to show compliance to tester specifications) shall be maintained with the tester in hardcopy form and in a computer file that can be accessed upon request by the user.

3.1.8 Identification of Faulty Brakes - The unit shall have the capability to be set by the tester supplier so that the results of a performance-based brake test are compared with predetermined user criteria and can subsequently designate a "pass" or "fail" to that brake or vehicle tested. This pass/fail criterion shall be selected by the appropriate agency using the machine and may include a combination of stopping distance, average deceleration, brake force and weights, brake force and air pressure, or simply brake force over time.

3.1.9 Operator Interface – A computer system and operating software shall be part of the brake tester. In addition, it shall meet the requirements listed in 3.1.9.1 through 3.1.9.6.

Note: Current off-the-shelf computers and peripherals are preferred from a repair and replacement standpoint; however, well-designed custom equipment is acceptable.

Note: Brake testing software that can run in a MS Windows-type environment is preferred although other common operating systems are acceptable.

3.1.9.1 Measurement Units – The software shall allow the operator to conduct tests and provide output in both Metric and English units.

3.1.9.2 Language – All operator interfaces shall use the English language.

3.1.9.3 Results Presentation - The brake tester shall have the capability of providing results of the brake test, with a clear indication of each brake's performance as appropriate, and that of the vehicle as a whole. Output showing a comparison of brake forces to actual wheel or axle weights, GVW, and/or application air pressure, is required depending upon the criteria used for assigning the target value. An ASCII format file for output of brake forces and wheel loads is required for each axle measured.

3.1.9.4 Unique Test Identification - For enforcement purposes, the unit shall be capable of assigning each test a unique test identification number and shall also have, at a minimum, two (2) user-defined fields for input of other information. For example, a corresponding CVSA inspection report number or a unique vehicle identification code.

3.1.9.5 Printer Output - Hardcopy printout capability is required, and capability for digital storage of the results for future reference is also required using standard ASCII character output.

3.1.9.6 Results Transmission – The brake tester computer must accommodate the transmission of the data electronically in CVISN-compatible EDI formats and transaction sets. At a minimum, this shall include a standard RS232 serial port. The ASCII file format will be defined in a subsequent document.

3.1.9.7 User Defined Inputs – A minimum of two blank fields for additional test vehicle information, such as truck type and driver information shall be included in the software's input functions.

3.1.10 Identification of Faulty Tests - The machine shall be able to identify a test that was improperly run or otherwise invalid. The reason for the invalid test shall be indicated to the machine operator. Examples include: low COF between the test surface and the tires, insufficient data for computations, premature test termination, unreasonable or out of range values, and malfunctioning or improperly connected transducers.

3.1.11 Inspection Time – The amount of time required to conduct a braking assessment for a vehicle shall be minimal. In no instance shall it take skilled operators longer than 15 minutes to perform a brake test on: (1) A two-axle straight truck or bus, (2) a five-axle tractor-trailer combination, or (3) a five-axle tractor-double trailer combination, e.g., a two-axle tractor pulling a one-axle semi-trailer coupled to a converter dolly and semi-trailer. The actual range of inspection times for various truck configurations including paperwork shall be listed in the Operation Manual (See section 3.5 Documentation).

3.1.12 Setup/Tear Down Time – The amount of time required to get the brake tester operational shall be minimal. In no instance shall it take two skilled operators longer than 30 minutes to setup or tear down a portable machine or longer than 10 minutes to start up or shut down a fixed installation. The actual setup and teardown times for a two-person crew shall be listed in the Operation Manual (See section 3.5 Documentation).

3.2 Physical Characteristics

NOTE: The brake testers do not have a predefined dimensional specification, although they shall be sized to be transportable by ship, rail, or truck using conventional shipping containers and semi trailers.

3.2.1 Capabilities

3.2.1.1 Weight Capacity – The brake tester shall be capable of operating with up to a 40,000 lb. (18,000 kg_f) axle or a 100,000 lb. (45,000 kg_f) total vehicle weight. If this limit is impractical for a given tester, it should be so stated to avoid damage to the tester and clearly documented in the tester's specifications section of the owner's manual.

3.2.1.2 Brake Force Capacity – The brake tester shall be capable of measuring, within the required accuracy, brake forces of 25 percent of maximum axle weight capacity.

3.2.2 Portability - Any unit that is to be towed from one location to another shall have a trailering device, or self-contained trailering system, that meets the requirements listed in 3.2.2.1 through 3.2.2.4.

3.2.2.1 Trailer Safety - All lighting, markings, brakes, wheels, tires and safety attachment devices shall be consistent with 49 CFR 393 (the FHWA's safety regulations for commercial motor vehicles, including trailers) and 49 CFR 571 (the NHTSA's manufacturing standards, the FMVSSs, for new motor vehicles, including trailers) and other applicable State requirements as dictated by the State agency responsible for the unit.

3.2.2.2 Towing Requirements - All machine specifications pertinent to towing the machine shall be outlined clearly in the Operation Manual (See section 3.5 Documentation) so that a suitable tow vehicle and hitch arrangement can be purchased by the user.

3.2.2.3 Ruggedness - Portable units shall be constructed with a ruggedness to withstand the shock and vibration associated with towing the brake tester over any road surface.

3.2.2.4 Spare Tire – All portable machines shall be fitted with a secured, full-size spare tire and rim compatible with the tires on the trailer.

3.2.3 Utilities

3.2.3.1 Power Source – Brake testing machines may run on either a self-contained power source or electric or pneumatic utilities available at the installation site. Equipment requiring external utilities hookup shall be designed for standard North American voltages, AC frequency, and/or air pressure.

3.2.3.2 Battery Power – If battery power is required for computers or engine starting/running, and there is no onboard charging device, the batteries shall have enough power to allow the brake tester to run for an entire 8-hour shift without recharging.

3.2.3.3 Recharging of Brake Tester Batteries by the Tow Vehicle - Reliance upon the tow vehicle for battery recharging during brake tester operation is not acceptable.

3.2.4 Appearance – All exposed surfaces of the brake tester need to be made of either a corrosion-resistant material or be coated with a durable finish that can withstand repeated abrasion associated with normal machine usage, as well as protect the painted surfaces from corrosion due to water, road salt, or other de-icing chemicals. Lastly, any protective coatings shall be unaffected by contact with gasoline, diesel fuel, and oils.

3.3 **Environment** – Equipment shall be suitable for the environment in which it is to be used as described in 3.3.1 through 3.3.5 below. Any portable brake tester or permanent outdoor installation shall meet all of the requirements below. Fixed indoor installations shall only meet the applicable requirements.

3.3.1 Temperature – The brake tester shall be capable of operating in ambient temperatures ranging from 0° Fahrenheit (F) (-18° Celsius (C)) to 120° F (49° C).

3.3.2 Humidity – The brake tester shall be capable of operating in relative humidities ranging from 5 to 100 percent over the operating temperature range listed above.

3.3.3 Water Resistance – All electrical systems shall be sealed against water intrusion from wind driven rain. Trailered testers also shall meet water intrusion requirements when being towed in the rain at typical towing speeds.

3.3.4 Sunlight – All controls and computer readouts shall be visible to the operator in direct sunlight. If shading devices are required, they must be included with the unit.

3.3.5 UV Radiation – All exposed surfaces shall be resistant to degradation from ultraviolet light. This is especially important for appearance coatings, hoses, and unpainted plastic parts.

3.4 **Safety** – Depending on how the brake tester is constructed, there are several classes of hazards to which the operators may be exposed. Noise, electrical shock, pressurized systems, rotating machinery, trip hazards, slip hazards, lifting hazards, and pinch points are just some of the hazards that may be present in brake testers. In order to ensure operator safety, the brake tester design shall address these and any other applicable safety issues. While no specific standards are listed in this specification, regulatory agencies such as OSHA, NEC, ASME have standards applicable to mitigate these hazards. The manufacturer may select applicable standards from any recognized regulatory agency (e.g., NEC) and submit a list of those standards for approval.

3.5 **Documentation** – Two copies each of the following manuals shall be provided with the brake tester. All documentation shall be in English and shall be easily understood by an individual who meets the personnel requirements in section 3.6.

3.5.1 Operation Manual – This manual shall explain how to properly and safely operate the system. This manual shall be written so that a first-time user, with a skill level as listed in Section 3.6.2, unfamiliar with the equipment, can set up the brake tester, conduct tests using it, interpret the results, and print out hardcopy evidence of braking capability for the vehicle being tested.

3.5.2 Maintenance Manual – This manual shall specify preventive maintenance procedures and schedules, the tools required for performing maintenance, diagnostic procedures, and information for ordering replacement parts.

3.5.3 Calibration Procedure – This document shall be provided with the unit, and shall include, at a minimum, the following:

i. A detailed list of calibration equipment and materials required to perform the calibration
ii. A calibration strategy, or summary
iii. Detailed calibration procedures
iv. Sample calibration data sheets (if hardcopies) and calibration data file
v. Recommended calibration interval
vi. Conditions where more frequent calibrations are required
vii. Error analysis showing that the machine is capable of meeting the overall accuracy requirements.

3.5.4 Drawings – A full set of assembly drawings is not required to be provided to the purchaser; however, exploded-view drawings shall be provided to help in identifying part numbers and descriptions. This document can be included in the Maintenance Manual if desired.

3.6 Personnel Requirements

3.6.1 Number of Personnel – The number of people needed to set up and to operate the brake tester, excluding the vehicle driver, shall be no more than two. The actual number of operators needed to run the brake tester shall be listed in the Operation Manual (See section 3.5 Documentation).

3.6.2 Skill Level – The brake tester shall be designed to be operated by English-speaking personnel that have at least a secondary school education and a familiarity with personal computers and common operating systems. The brake tester shall also be designed so that a vehicle operator that is unfamiliar with the tester can easily perform the tasks that will be asked of him by the machine operators.

4. QUALITY ASSURANCE PROVISIONS

4.1 Compliance – Showing compliance with the requirements listed in Section 3 shall be accomplished by one or more of the verification methods defined below. Each manufacturer shall certify that its PBBT meets these functional specifications at the time of manufacture (or identify those specifications which it does not meet). Each self-certification shall end with the following statement: "I declare (or certify, verify, or state) under penalty of perjury pursuant to 28 U.S.C. 1746 that the foregoing is true and correct. Executed on (date). (Signature)." If the field performance of the PBBT fails to meet the terms of the self-certification, even after the manufacturer has had an opportunity to correct

the deficiencies, the FMCSA will consider referring the matter to the Department of Justice for prosecution.

4.1.1 Analysis - Verification by analysis includes mathematical or graphical studies that demonstrate with a high degree of confidence that a requirement can be met.

4.1.2 Test - Verification by test requires that a test be carried out in accordance with a pre-approved written Test Plan and followed by a Test Report, with quantitative results, showing that each requirement has been met. Examples of requirements to be verified by this method include measurement accuracy of weight, force, and pressure. Verification tests may be performed by any agency or engineering firm equipped to perform and document NIST, or NIST equivalent, traceable measurements. NIST equivalent organizations are those 38 Member States of the Metre Convention, and two international organizations, including NIST, which signed a Mutual Recognition Arrangement (MRA) on October 14, 1999. As signatories to the MRA, they agreed to a number of issues, including establishing a degree of equivalence of national measurement standards and providing for the mutual recognition of calibration and measurement certificates. Self-certification of compliance is permissible provided that the Test Plan is pre-approved by the FHWA and the Test Report is submitted to the FHWA for approval.

4.1.3 Demonstration - Verification by demonstration requires that the item be operated and that the required function be carried out and witnessed to perform satisfactorily. Little or no quantitative data is generally required. Examples of requirements to be verified by this method include operator skill level and the brake tester's capability to handle a variety of commercial vehicle configurations.

4.1.4 Certified Vendor Data - For purchased items, certified vendor data shall be provided to document compliance with requirements. Examples of requirements to be verified by this method include sensor accuracy and resistance of components to water intrusion or UV radiation.

4.1.5 Inspection - Verification by inspection is carried out by a visual check of the requirement. Examples of requirements to be verified by this method include lighting, existence of spare tire (portables only), dimensions.

4.2 **Non-Compliance Disclosure** - The vendor shall provide a list of all requirements listed in Section 3 that cannot be met and include either the reasons why the requirements cannot be met or how close the brake tester can come to satisfying the requirement. For requirements that are not applicable to a particular type of brake tester, simply indicate that the requirement does not apply.

4.3 **Methods of Verification** - Table 2 defines the verification methods to be used for each requirement.

4.4 **Extended Verification Duration** – Items that require an extended period of time for evaluation of compliance (see Table 2) shall be warranted by the manufacturer. Failure to comply may result in decertification of the tester.

4.5 **Warranty** - The functional performance of a PBBT shall be warranted for a period of at least one year from the date of purchase. This means that the PBBT manufacturer is responsible for repair of the brake tester and its components during this one-year period, except for repair of damage caused by accidents or abuse of the equipment.

Table 2. Verification Requirements Summary

Requirement	Paragraph	Verification Method(s) Required
Vehicles to be Tested	3.1.1	Analysis or Demonstration
Determining Braking Capability	3.1.2	Test or Demonstration
Brake Force Determination	3.1.3	Demonstration
Coefficient of Friction	3.1.4	Test
Weighing Capability	3.1.5	Demonstration (if applicable)
Measurement Accuracy	3.1.6	Test
Calibration Certification	3.1.7.1	Inspection
Accuracy Between Calibrations*	3.1.7.2	Demonstration
Recalibration Interval*	3.1.7.3	Demonstration
Calibration History	3.1.7.4	Demonstration
Identification of Faulty Brakes	3.1.8	Demonstration
Operator Interface	3.1.9	Inspection
Measurement Units	3.1.9.1	Demonstration
Language	3.1.9.2	Demonstration
Results Presentation	3.1.9.3	Demonstration
Unique Test Identification	3.1.9.4	Demonstration
Printer Output	3.1.9.5	Demonstration
Results Transmission	3.1.9.6	Demonstration
User Defined Inputs	3.1.9.7	Inspection
Identification of Faulty Tests	3.1.10	Demonstration
Inspection Time	3.1.11	Demonstration
Setup/Tear Down Time	3.1.12	Demonstration
Weight Capacity	3.2.1.1	Analysis, Test, or Demonstration
Portability	3.2.2	Inspection
Trailer Safety	3.2.2.1	Inspection
Towing Requirements	3.2.2.2	Inspection
Ruggedness*	3.2.2.3	Inspection
Spare Tire	3.2.2.4	Inspection
Power Source	3.2.3.1	Demonstration or Inspection
Battery Power	3.2.3.2	Analysis or Demonstration
Tow Vehicle Recharging	3.2.3.3	Analysis or Demonstration
Appearance*	3.2.4	Inspection or Certified Vendor Data
Temperature*	3.3.1	Demonstration
Humidity*	3.3.2	Demonstration
Water Resistance*	3.3.3	Demonstration
Sunlight	3.3.4	Demonstration
UV Radiation*	3.3.5	Test or Certified Vendor Data
Safety	3.4	Inspection
Operation Manual	3.5.1	Deliverable
Maintenance Manual	3.5.2	Deliverable
Calibration Procedure	3.5.3	Deliverable
Drawings	3.5.4	Deliverable
Number of Personnel	3.6.1	Demonstration
Skill Level	3.6.2	Demonstration

* Requires extended period of time to establish compliance.

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