Make this Section a part of the Standard Specifications:

"**SECTION 694 - PORTABLE CONCRETE BARRIER AND INERTIAL BARRIER SYSTEM**

694.01 Description. This section is for furnishing, hauling, installing, maintaining, relocating, and subsequently removing portable concrete barriers and inertial barrier systems according to the contract documents.

694.02 Materials.

(A) Portable Concrete Barriers. Materials shall meet the requirements specified in the following subsections of Division 700 - Materials.

Reinforcing Steel	709.01
Reflector Marker	750.07
Preformed Pavement Marking Tape	755.04
Structural Steel	713.01
High Strength Bolts and Studs	718.02

(B) Inertial Barrier System (Portable Concrete Barrier End Treatment).

(1) Container. The Inertial Barrier shall consist of modules in 200, 400, 700, 1400, and 2100 lbs. sizes. 200, 400, 700 and 1400 lbs. modules shall consist of a container molded in one piece with a minimum capacity of 21 cubic feet. The material shall be durable, weatherproof, and shall be formulated to resist deterioration from ultraviolet rays. The color shall be yellow. This model must be of continuous molded construction and be nestable. The modules shall be designed and manufactured from a frangible polyethylene material which shall shatter upon impact to permit dispersion of the sand mass container within.

(2) Lid. Each module shall have a black lid which locks securely over the top lip of the outer container. Material shall be durable, weatherproof, and shall be formulated to resist deterioration from ultraviolet rays.

(3) Insert. All 200, 400 and 700 lbs. modules will require a cone-shaped supporting insert used to support various sand masses. Cone inserts shall be of one-piece molded construction and be nestable.

(4) Sand. Sand placed into these modules should be washed concrete sand conforming to ASTM-C-33 or equal.

Each Inertial Barrier System array shall be configured to provide a satisfactory average rate of deceleration (8 g's maximum preferred for each row) for errant vehicles in the weight ranges of 1810 to 4410 lbs. The inertial barrier system shall meet the requirements of NCHRP 350 for Test Level 3 for non-redirective gating crash cushions. For impact vehicles weighing between 1810 and 4410 lbs. and traveling at speeds of up to 62 mph, the maximum 24-inch occupant fail space velocity shall be less than 39 ft/sec and the vehicles' highest 10 millisecond occupants' ride-down acceleration shall be less than 20 g's.

The center of gravity of each properly filled module shall be at a height which will aid in controlling the pitch of standard passenger vehicles.

The components of the modules shall interface to prevent leakage of sand contained therein. The interface shall, however, permit drainage of excess water contained within the sand mass.

694.03 Construction Requirements.

(A) Portable Concrete Barriers.

(1) Fabrication. Construct the portable concrete barriers in accordance with contract plans and as modified herein. The barriers shall be in 20 - foot segments. The identification and date of design shall be placed at the location shown in the plans. Modify date of design "Oct 2001" to "Oct 2001A". Prior to fabrication of the portable concrete barrier, submit detailed shop drawings to the Engineer for acceptance.

(a) Forms. Forms shall be according to Section 503 - Concrete Structures.

(b) Concrete. Use 5000 psi concrete with synthetic structural fiber reinforcement (structural fiber). Use an amount of structural fiber that will result in an average residual strength of 265 pounds per square inch. ASTM C1399 shall determine average residual strength. Structural fiber shall be a system made of a twisted bundle combination of fully-oriented non-fibrillation monofilament and a fibrillating copolymer/polypropylene network fiber system. All material shall be 100% virgin material and shall be non-corrosive, non-magnetic and be 100% alkali proof. The fibers shall have a tensile strength not less than 90 ksi. Structural fiber shall have a nominal length of 2-¼", gray in color to match the concrete and comply with or exceed ASTM C-1116. It shall have an aspect ratio (length divided by the equivalent diameter of the fiber) between 115 and

165. The Engineer has determined and accepted that 7.5 pounds of Forta Ferro® fiber per cubic yard of concrete will result in 265 pounds per square inch average residual strength. When structural fiber is specified in pounds per cubic yard of concrete, it shall mean the specified dosage is an amount of Forta Ferro® fiber that will provide the required average residual strength. The dosage of another manufacture's structural fiber may not have the same results and shall be adjusted and accounted for. No additional compensation will be granted for the additional weight of fiber.

(c) Placing Concrete. Moisten the form thoroughly and immediately prior to the placing of the concrete. Place the concrete in accordance with Section 503 - Concrete Structures.

(d) Curing. Steam or water-cure the portable concrete barriers in accordance with Subsection 504.03(G) - Curing.

(e) Handling. Do not handle the portable concrete barriers until the concrete has attained a compressive strength of more than 3,000 pounds per square inch. Use the lifting holes to hoist the portable concrete barrier. Do not use the drainage slots that are located at the bottom of the barrier to lift or move barricades. Repair or replace units damaged by improper handling at no increase in contract price and contract time.

The Engineer will permit stacking of precast units with prior acceptance by the Engineer of the method to be employed by the Contractor.

(f) Accessories. Furnish, install maintain one RM-2 reflector marker on top of the concrete barrier (not RM-3 as shown on the Standard Plan), a longitudinal 6-inch by 20 feet permanent retroreflective marking tape, Type XI (color to match appropriate roadway pavement stripe) on the lower sloped side of the barrier facing traffic, and a steady burn amber lamp on each barrier unit. The longitudinal 6-inch retroreflective marking tape shall be installed on a surface that has the tape's manufacturer's recommended primer applied to it in a manner acceptable to the manufacturer and the Engineer. If a 6-inch retroreflective tape is not acceptable a permanent preformed pavement marking tape should be considered.

Type II Barricade with a steady burn amber lamp on each barricade in accordance with MUTCD Chapter 6.

(g) Ownership. The portable concrete barriers and the portable concrete barrier end treatments shall become the property of the Contractor upon completion of the project.

(2) Installation. Erect all units as shown on the contract documents or as specified by the Engineer. Set the units in a vertical position, closely following the roadway grade. The units shall have a maximum of 1/4-inch offset in any direction between adjacent panels at the connections.

Horizontal alignment of the panels shall be such that any panel is not out of alignment by more than 1/2-inch from straight line. Furnish and install steel pins for connecting the barrier sections according to contract documents.

Do not leave barrier ends exposed to traffic, and shall provide treatment that complies with NCHRP 350 Test Level 3 criteria. Do not mix portable concrete barriers not constructed in accordance with the October 2001A design with barriers with newly constructed units within the same barrier installation.

Relocate any units or existing barriers during construction at the locations shown in the contract documents or as ordered by the Engineer.

Upon completion of the work, clean, repair, remove, haul, off load and store all units at the location shown in the contract documents or as ordered by the Engineer. If the final designation is not available when the units are ready to be removed, haul the units to an interim location or to an alternate Engineer designated location at no additional cost to the State.

The cleaning and repair of the units shall be performed regardless of cause, such as accidents, 'wear and tear' or improper handling by the Contractor during use. Repair all damaged unit back to its original configuration, i.e., undamaged condition. A damaged unit that, in the judgment of the Engineer, is considered irreparable shall be replaced with a new unit at no increase in contract price or contract time. The Engineer will inspect and find if all units are acceptable at the storage area designated in the contract documents or at a location designated by the Engineer. Any unit that is not cleaned or repaired to an acceptable condition shall be removed from the designated storage site and not returned until is made acceptable.

(3) Type II Barricades. Furnish, install and maintain Type II Barricades with lamp as channelizing devices. Spacing shall be in accordance with the requirements of MUTCD part 6. Their position shall comply with MUTCD Typical Application 5, found in part 6.

(B) Inertial Barrier System (Portable Concrete Barrier End Treatment).

(1) The portable concrete barrier end treatment shall be a non-redirective, energy-absorbing terminal providing impact protection. It shall meet NCHRP 350, Test Level 3 criteria for Non-Redirective Crash Cushions, as accepted by FHWA. Submit a brochure of the product to be used for acceptance by the Engineer prior to ordering the end treatment.

(2) The portable concrete barrier end treatment shall be designed for easy attachment to and removal from the end of the concrete barrier. The nose of the system shall be equipped with a chevron sign, a crash cushion object marker (CCOM) which shall be reversible to match the corresponding traffic direction.

(3) Installation and use of the end treatment shall be consistent with shy-line and placement guidelines specified in the current edition of the AASHTO Roadside Design Guide.

(4) Provide, install, and maintain a NCHRP 350 compliant end treatment compatible with the barrier units. The end treatment shall be attached and installed in compliance with the manufacturers instructions. If requested by the Engineer, provide three copies of the maintenance and operational manual for the end treatments along with an instructional class for State personnel on the installation and removal of the end treatment.

(5) Haul the portable concrete barrier end treatment to the project site. Prepare the beds and set the portable concrete barrier end treatment at a location shown in the contract documents or as directed by the Engineer.

(6) Furnish, install, and maintain attachment for connecting the portable concrete barrier end treatment to the barrier unit.

(7) Furnish install and maintain crash cushion object marker (CCOM) on each portable concrete barrier end treatment in accordance with the contract documents.

(8) Relocate the portable concrete barrier end treatment during construction at the locations shown in the contract documents or as ordered by the Engineer.

(C) Pavement Striping and Markers for Lane Shifting.

Furnish and install pavement striping and markings according to Section 629 - Pavement Markings, Subsection

629.03(C) – Pavement Striping and Markers for Lane Shifting. Do not use temporary pavement striping and markers. Striping shall be done in accordance with the contract documents or as directed by the Engineer. If no striping plan is provided, submit striping plan for review and acceptance by the Engineer a minimum of14 days prior to the setting of the units. Upon completion of the contract work, remove the lane shift striping and markers, and restore original striping and markers in accordance with the contract documents or as directed by the Engineer.

694.04 Method of Measurement. The Engineer will not measure Contractor-furnished portable concrete barriers and inertial barrier modules (end treatment).

The Engineer will not measure installing, maintaining, and subsequently removing lane shift pavement striping and markers for payment.

694.05 Basis of Payment. The Engineer will pay for the accepted Contractor-furnished portable concrete barriers on a contract lump sum basis. The price includes full compensation for work prescribed in this section and the contract documents.

The Engineer will not pay separately for installing, maintaining, relocating, and subsequently removing the portable concrete barriers. The price includes full compensation for preparing beds; hauling and setting portable concrete barriers; installing connector pins; maintaining reflector markers, lamps, and permanent preformed pavement marking tape or retroreflective tape; cleaning and relocating portable concrete barriers during construction; cleaning and hauling the portable concrete barriers after completion of the project to the designated locations or as directed by the Engineer; and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work.

The Engineer will pay for the accepted inertial barrier modules (end treatmen) on a contract lump sum basis. The price includes full compensation for work prescribed in this section and the contract documents.

The Engineer will not pay separately for installing, maintaining, relocating, and subsequently removing the inertial barrier modules. The price includes full compensation for submitting a list of materials and equipment to be incorporated in the work; grading and compacting the ground; furnishing, assembling, and installing an inertial barrier system; relocating inertial barrier modules to locations specified in the contract; filling each installed inertial barrier module with sand; removal and disposal of sand; cleaning and hauling the empty modules to the designated locations or as directed by the engineer upon completion of the project, and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work.

The Engineer will not pay separately the pavement striping and markers for lane shifting. The Engineer will consider the cost for the lane shift pavement striping and markers included in the contract price for portable concrete barrier. The price includes full compensation for submitting the striping plans; removing the existing pavement striping and markers; installing the lane shift pavement striping and markers; removing the lane shift striping and markers; and restore original striping and markers according to the contract or as directed by the Engineer; and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work.

The Engineer will make payment under:

Contractor-Furnished Portable Concrete Barrier	Lump Sum
Inertial Barrier Module	Lump Sum

The Engineer will make partial payments as follows:

(1) Pay 40% of the amount bid when the barrier are furnished and delivered to the jobsite and prepared the ground for installation.

(2) Pay 20% of the amount bid when the barrier are assembled and installed at the initial location shown in the contract documents.

(3) Divide 30% of the amount bid by the number of months remaining in the contract. Pay that percentage each month, when barriers are satisfactorily relocated and maintained during construction, and damaged barriers replace.

(4) Pay the remainder of the contract amount upon removal and delivery of the barriers and modules after completion of the project or as directed by the Engineer."

END OF SECTION 694