**DESIGN MEMORANDUM NO. 03-07**

TO: Chief District Engineers
Design Engineers
Active Consultants

FROM: David E. Kratt, P.E.
Director
Division of Highway Design

DATE: December 13, 2007

SUBJECT: Crash Cushion Type VI Class B and Class C, and
Crash Cushion Type VII Class B and Class C
Standard Drawings RBE-040 and RBE-060

As announced in Design Memorandum No. 02-07, *Standard Drawings Revision No. 1 to Reprint No. 9* is being published and will be effective on January 1, 2008 and thereafter. In the Revision, new classes have been created for the Crash Cushion Type VI and VII. The two new classes for these crash cushions are Class B and Class C.

Class B crash cushions are fully redirectional and energy absorbing. Class B crash cushions are to be used in areas where crash history is not known to be severe. The Crash Cushion Type VI Class B may also be utilized for temporary use and construction zones (Class BT).

Class C crash cushions are also fully redirectional and energy absorbing. However, this class of crash cushion requires minimal replacement of parts, if any, after a hit and will be quickly repaired and placed back into service. This unit is considered a severe use crash cushion. If hits to the cushion are frequent, the Class C crash cushion will have a lower life-cycle cost than the Class B crash cushion. The Crash Cushion Type VI Class C may also be utilized for temporary use and construction zones (Class CT).

When selecting between the Crash Cushion Class B or Class C, the following factors should be considered:

- Is the hazard to be shielded located in a high risk or low risk impact area?
- Would the life-cycle cost of the crash cushion justify a higher initial installation cost?
- How difficult would the restoration of the system be after impact? The importance of this factor will be related to the traffic and hazard levels at the site. More traffic or a higher hazard level will make speedy repair or replacement a higher priority. A suggested ADT range is given on the Standard Drawing for guidance. This guidance should not supersede the application of sound engineering principles by experienced design professionals.

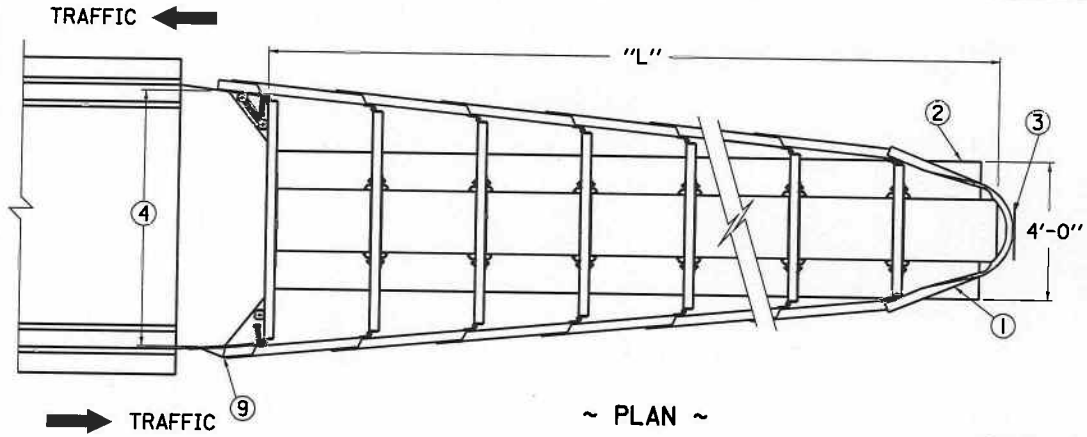
Since the new classes of crash cushions replace the models used previously, designers should examine their projects and update any reference to the Type VI and VII crash cushions to reflect the new policy. The new bid items codes are as follows:

| | |
|---|---|
| 08900 | CRASH CUSHION TYPE VI CLASS B TL2 |
| 08901 | CRASH CUSHION TYPE VI CLASS BT TL2 |
| 08902 | CRASH CUSHION TYPE VI CLASS B TL3 |
| 08903 | CRASH CUSHION TYPE VI CLASS BT TL3 |
| 08904 | CRASH CUSHION TYPE VI CLASS C |
| 08905 | CRASH CUSHION TYPE VI CLASS CT |
| 08906 | CRASH CUSHION TYPE VII CLASS B TL2 |
| 08907 | CRASH CUSHION TYPE VII CLASS B TL3 |
| 08908 | CRASH CUSHION TYPE VII CLASS C |

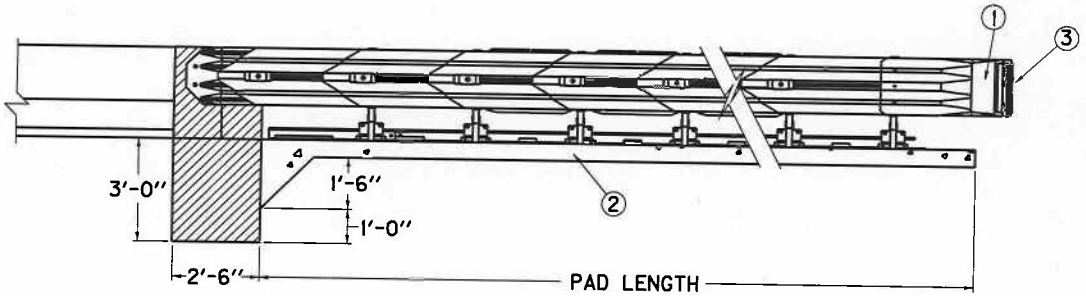
Included with this memorandum are the revised drawings for the Crash Cushion Type VI and VII. Please direct any questions regarding this memo to our office.

DEK:JDJ:CW

Attachments




~ PLAN ~

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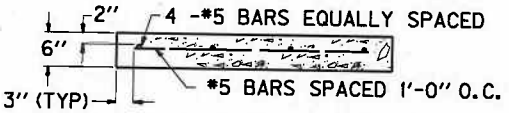



~ CONCRETE PAD SECTION ~

~ LEGEND ~

① NOSE ASSEMBLY
② 6" CONCRETE PAD
③ OBJECT MARKER TYPE I, (SEE CUR. MUTCD MANUAL FOR DETAILS) CENTER HORIZ. AND VERT.
④ MEDIUM WIDTH = 70 ½", APPROX. 2.8 CU. YD. CONC. AND 265 LBS. OF STEEL FOR MED. BACKUP. WIDE WIDTH = 91 ½", APPROX. 3.8 CU. YD. CONC. AND 299 LBS. OF STEEL FOR WIDE BACKUP.

| CLASS | SPEED (MPH) | ATTENUATOR | | | APPROX. CU. YD. CONC. FOR PAD | SUGGESTED ADT* RANGE (P.C.P.L.)** |
|---|---|---|---|---|---|---|
| | | MODEL | PRODUCT NAME | LENGTH | | |
| B | 45 & LESS | TL2 | SHORTRACC | 14'-0" | 1.12 | UP TO 12,000 |
| | | | 3-BAY QUADGUARD | 12'-0" | 0.87 | |
| | OVER 45 | TL3 | TRACC | 21'-0" | 1.63 | |
| | | | 6-BAY QUADGUARD | 21'-0" | 1.53 | |
| C | OVER 45 | TL3 | SCI100GM | 23'-0" | 1.7 | 8,000 AND OVER |
| | | | QUADGUARD ELITE | 33'-4" | 2.46 | |

* AVERAGE DAILY TRAFFIC
** PASSENGER CARS PER LANE

~ NOTES ~

1. THE CONTRACT UNIT PRICE SHALL BE CRASH CUSHION TYPE VII, CLASS ♠ , ⬡ , △ .
   ♠ CLASS _B_ OR _C_, AS REQUIRED
   ⬡ TEST LEVEL 2 (TL2) OR TEST LEVEL 3 (TL3), AS REQUIRED.
   △ EITHER _M_ MEDIUM , OR _W_ WIDE , OR _S_ SPECIAL WIDE UNITS
2. THE CONC. PAD SHALL BE REQUIRED ONLY WHEN THE UNIT IS CONSTRUCTED ON NON-RIGID PAVEMENT AND SHALL BE MEASURED AND PAID FOR PER CUBIC YARD OF CLASS "AA" CONC., WHICH SHALL INCLUDE ALL NECESSARY EXCAVATION AND REINFORCING STEEL. THE PAD SHALL BE CURED AND FINISHED AS EITHER SIDEWALK OR PAVEMENT. REAR FOOTINGS AND REAR BACK-UP WALL, EXCEPT ON STRUCTURES, SHALL BE REQUIRED AT ALL INSTALLATIONS, WHICH SHALL BE MEASURED AND PAID FOR AS CLASS "AA" CONCRETE AND SHALL INCLUDE ALL NECESSARY EXCAVATION AND REINFORCING STEEL.
3. THE CROSS SLOPE ON THE PAD OR PAVEMENT SHALL NOT EXCEED 5 PERCENT.
4. WHEN INSTALLED ON A STRUCTURE , DETAILS FOR ANCHORAGE SHALL BE DEVELOPED AND SHOWN ELSEWHERE ON THE PLANS .
5. SPECIAL WIDTH UNITS ARE AVAILABLE FROM THE MANUFACTURERS. WHEN SPECIAL WIDE UNITS ARE REQUIRED DETAILS OF THE UNIT SHALL BE DEVELOPED AND SHOWN ELSEWHERE ON THE PLANS.
6. SEE SHOP DRAWINGS FROM MANUFACTURER FOR BACK UP DETAILS.
7. CONCRETE PAD AND BELOW GRADE ANCHOR SHALL BE PLACED MONOLITHICALLY.
8. CRASH CUSHION TYPE VII IS A PATENTED (ONE SOURCE) PRODUCT MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC. OF CHICAGO, IL., TRINITY INDUSTRIES, INC. OF DALLAS, TX. OR SCI PRODUCTS, INC. OF ST. CHARLES, IL.

⑨ END SHOE MAY BE ELIMINATED WITH ONE WAY TRAFFIC.

10. THE CRASH CUSHION TYPE VII MAY ALSO BE UTILIZED FOR TEMPORARY USE AND CONSTRUCTION ZONES (CLASS BT OR CLASS CT).
11. A CRASH CUSHION TYPE VII CLASS B IS TO BE USED IN AREAS WHERE CRASH HISTORY IS NOT KNOWN TO BE SEVERE.
12. A CRASH CUSHION TYPE VII CLASS C IS CONSIDERED A SEVERE USE CRASH CUSHION.
13. WHEN SELECTING BETWEEN THE CRASH CUSHION CLASS B OR C, CONSIDER THE FOLLOWING FACTORS:
    - WHETHER THE HAZARD TO BE SHIELDED IS LOCATED IN A HIGH OR LOW RISK IMPACT AREA;
    - INITIAL, MAINTENANCE, AND RESTORATION COST; AND
    - EASE OR DIFFICULTY OF RESTORATION OF THE SYSTEM AFTER IMPACT.

    THE IMPORTANCE OF THIS FACTOR WILL BE RELATED TO THE TRAFFIC AND HAZARD LEVELS AT A SITE. MORE TRAFFIC AND HIGHER HAZARDS WILL MAKE SPEEDY REPAIR OR REPLACEMENT A HIGHER PRIORITY. A SUGGESTED ADT RANGE IS GIVEN IN THE TABLE BELOW FOR GUIDANCE. THIS GUIDANCE SHOULD NOT SUPERSEDE THE APPLICATION OF SOUND ENGINEERING PRINCIPLES BY EXPERIENCED DESIGN PROFESSIONALS.

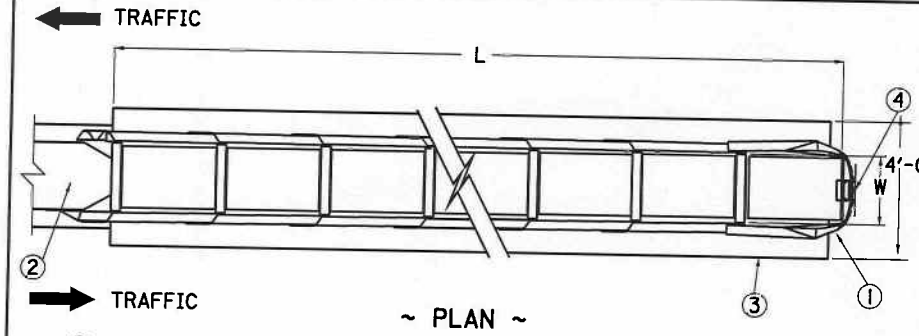
KENTUCKY DEPARTMENT OF HIGHWAYS

# CRASH CUSHION TYPE VII CLASS B AND C (ONE & TWO DIRECTION)

STANDARD DRAWING NO. RBE-040-09

SUBMITTED _____ DIRECTOR DIVISION OF DESIGN — 11-21-07 DATE

APPROVED _____ STATE HIGHWAY ENGINEER — 11-21-07 DATE

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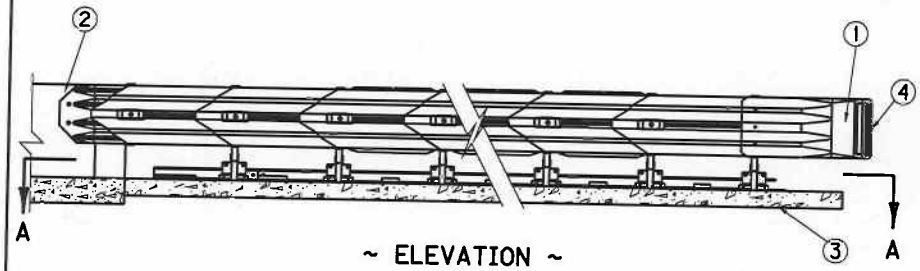


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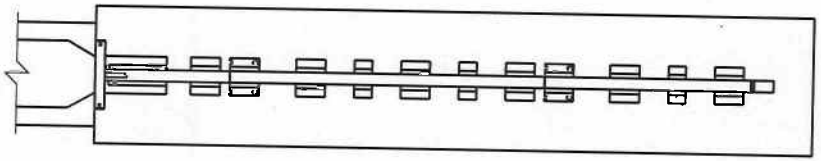
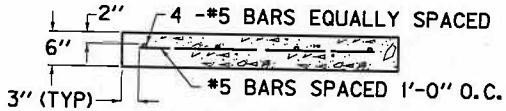


~ SECTION A-A ~




~ CONCRETE PAD SECTION ~

~ NOTES ~

1. CRASH CUSHION TYPE VI, CLASS ♠, ☆, △
   - ♠ CLASS _B_ OR _C_, AS REQUIRED
   - ☆ EITHER TEST LEVEL 2 (TL2) OR TEST LEVEL 3 (TL3), AS REQUIRED.
   - △ SEE "CONNECTION DETAILS OF CRASH CUSHION TYPE VI TO DOUBLE FACE GUARDRAIL".
2. THE CONCRETE PAD, PAD EXCAVATION AND STEEL REINFORCEMENT, INSTALLED IN PLACE SHALL BE INCLUDED IN THE UNIT PRICE BID FOR CRASH CUSHION TYPE VI. USE CLASS AA CONCRETE TO CONSTRUCT CONCRETE PAD (SEE CONCRETE PAD SECTION FOR STEEL REQUIREMENTS). THE PAD SHALL BE CURED AND FINISHED AS EITHER SIDEWALK OR PAVEMENT. THE CROSS SLOPE OF THE PAD OR PAVEMENT SHALL NOT TO EXCEED 5%. THE PAD WILL NOT BE REQUIRED WHEN THE UNIT IS CONSTRUCTED ON RIGID PAVEMENT.
3. CRASH CUSHION TYPE VI MAY BE USED AT THE END OF: CONCRETE MEDIAN BARRIER, BRIDGE PIERS AND STEEL "W" BEAM GUARDRAIL (DOUBLE FACE).
4. WHEN CRASH CUSHION TYPE VI CONNECTS TO: CONCRETE MEDIAN BARRIER OR BRIDGE PIER THE CONTRACT UNIT PRICE SHALL INCLUDE: CRASH CUSHION TYPE VI, ALL HARDWARE, ADDITIONAL RAIL ELEMENTS, POST, CONCRETE PAD AND ALL OTHER INCIDENTALS NECESSARY TO COMPLETE THE INSTALLATION.
5. THIS DRAWING DEPICTS CONNECTION OF CRASH CUSHION TYPE VI TO CONCRETE MEDIAN BARRIER END. FOR THIS APPLICATION SEE CURRENT STD. DWG. RBE-065 " CONCRETE MEDIAN BARRIER END ".
6. WHEN CRASH CUSHION TYPE VI CONNECTS TO DOUBLE FACE GUARDRAIL SEE CURRENT STD. DWG. RBC-110 "CONNECTION DETAILS OF CRASH CUSHION TYPE VI TO DOUBLE FACE GUARDRAIL".
7. PERMISSABLE ALTERNATES FOR CRASH CUSHION TYPE VI ARE PATENTED ITEMS: QUADGUARD MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC. OF CHICAGO, IL., TRINITY INDUSTRIES, INC. OF DALLAS, TX. OR SCI PRODUCTS, INC. OF ST. CHARLES, IL.
8. THE MANUFACTURER SHALL FURNISH TWO (2) SETS OF SHOP PLANS TO THE CONTRACTOR WITH EACH INSTALLATION.
9. THE CRASH CUSHION TYPE VI MAY ALSO BE UTILIZED FOR TEMPORARY USE AND CONSTRUCTION ZONES (CLASS BT OR CLASS CT).
10. A CRASH CUSHION TYPE VI CLASS B IS TO BE USED IN AREAS WHERE CRASH HISTORY IS NOT KNOWN TO BE SEVERE.
11. A CRASH CUSHION TYPE VI CLASS C IS CONSIDERED A SEVERE USE CRASH CUSHION.
12. WHEN SELECTING BETWEEN THE CRASH CUSHION CLASS B OR CLASS C, CONSIDER THE FOLLOWING FACTORS:
    - •WHETHER THE HAZARD TO BE SHIELDED IS LOCATED IN A HIGH-OR LOW-RISK IMPACT AREA;
    - •INITIAL, MAINTENANCE, AND RESTORATION COST; AND
    - •EASE OR DIFFICULTY OF RESTORATION OF THE SYSTEM AFTER IMPACT. THE IMPORTANCE OF THIS FACTOR WILL BE RELATED TO THE TRAFFIC AND HAZARD LEVELS AT A SITE. MORE TRAFFIC AND HIGHER HAZARDS WILL MAKE SPEEDY REPAIR OR REPLACEMENT A HIGHER PRIORITY. A SUGGESTED ADT RANGE IS GIVEN IN THE TABLE BELOW FOR GUIDANCE. THIS GUIDANCE SHOULD NOT SUPERCEDE THE APPLICATION OF SOUND ENGINEERING PRINCIPLES BY EXPERIENCED DESIGN PROFESSIONALS.

| CLASS | SPEED (MPH) | ATTENUATOR MODEL | ATTENUATOR PRODUCT NAME | ATTENUATOR LENGTH | APPROX. CU. YD. CONC. FOR PAD | SUGGESTED ADT* RANGE (P.C.P.L.) ** |
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| | | | QUADGUARD ELITE | 33'-4" | 2.46 | |

W= 2'-0" ( INSIDE BAY WIDTH )

* AVERAGE DAILY TRAFFIC
** PASSENGER CARS PER LANE

~ LEGEND ~

1. NOSE ASSEMBLY
2. BACKUP
3. 6" CONCRETE PAD
4. OBJECT MARKER TYPE I, (SEE CUR. MUTCD MANUAL FOR DETAILS) CENTER HORIZ. AND VERT.

USE WITH CUR. STD. DWGS. RBE-065 OR RBC-110 AS APPLICABLE

KENTUCKY DEPARTMENT OF HIGHWAYS

# CRASH CUSHION TYPE VI ♠ ___ ☆ ___ △ ___ (ONE & TWO DIRECTION)

STANDARD DRAWING NO. RBE-060-13

SUBMITTED _____ DIRECTOR DIVISION OF DESIGN — 11-21-07 DATE

APPROVED _____ STATE HIGHWAY ENGINEER — 11-21-07 DATE