

1 (E) Anchoring

2 Design a delineator post for a permanent installation to resist overturning, twisting and
3 displacement from wind and impact forces.

4 (F) Temperature

5 Design flexible delineators that do not bend, warp or distort and remain straight, when
6 stored or installed at temperatures up to + 120°F. Design all components of the flexible
7 delineator, post and reflective sheeting to remain stable and remain fully functional
8 within a temperature range of - 20°F to + 120°F.

9 (G) Impact Resistance, Wind Resistance

10 Design flexible delineators that meet the impact and wind resistance of the current
11 evaluation criteria of the NTPEP.

12 (H) Product Identification

13 Provide flexible delineator post that are permanently identified, on the rear side, with the
14 manufacturer's name and the month and year of fabrication in order to provide a tracking
15 method for ongoing outdoor evaluation, and specification quality control. The letters
16 shall be at least 1/4" in height and permanently affixed to the rear of the marker.

17 (I) Material Certification

18 Furnish a Type 2 and Type 3 material certification in accordance with Article 106-3 for
19 all flexible delineators before use.

20 (J) Approval

21 All materials are subject to the approval of the Engineer.

22 **SECTION 1089**
23 **TRAFFIC CONTROL**

24 1089-1 WORK ZONE SIGNS**25 (A) General**

26 Grade B fluorescent orange sheeting shall be used on rigid work zone sign substrates.
27 The sheeting shall conform to Article 1092-2. Cover the entire sign face of the sign
28 substrate with Department approved Grade B fluorescent orange reflective sheeting. No
29 bubbles or wrinkles will be permitted in the material.

30 Roll-up sign retroreflective requirements shall conform to Article 1092-2.

31 (1) Work Zones Signs (Stationary)

32 Use Grade B fluorescent orange retroreflective sheeting that meets the reflective
33 requirements in Article 1092-2. Use approved composite or aluminum substrate for
34 sign backing. Signs and sign supports shall meet NCHRP 350 requirements for
35 breakaway devices.

36 (2) Work Zones Signs (Barricade Mounted)

37 Use approved composite or roll-up signs for barricade mounted sign substrates. No
38 other type of sign substrate is allowed on portable sign stands. Approved composite
39 barricade mounted warning signs (black on orange) shall be Grade B sheeting that
40 meets the retroreflective requirements of Article 1092-2. Sign and barricade
41 assembly shall meet NCHRP 350 for Work Zone Category II devices.

Section 1089

(3) Work Zones Signs (Portable)

Use approved composite or roll-up sign substrates on portable sign stands. No other type of sign substrate is allowed on portable sign stands.

(a) Composite

Use Grade B fluorescent orange retroreflective sheeting that meets the reflective requirements in Article 1092-2. Signs and sign supports shall meet NCHRP 350 requirements for breakaway devices.

(b) Roll-up Signs

Use fluorescent orange retroreflective roll-up signs that meet the reflective requirements of Grade B in Article 1092-2.

Use roll up signs that have a minimum 3/16" x 1 1/4" horizontal rib and 3/8"x 1 1/4" vertical rib and has been crash test to meet NCHRP 350 requirements and Traffic Control qualified by the Work Zone Traffic Control Unit.

(B) Material Certification

Furnish a Type 3 material certification in accordance with Article 106-3 for all new reflective sheeting used on work zone signs meeting the retroreflective requirements of Article 1092-2. Furnish a Type 7 material certification for all used signs meeting the minimum retroreflective requirements of ASTM D4956.

(C) Approval

All materials are subject to the approval of the Engineer.

(D) Warranty

Refer to Subarticle 1092-2(B) for warranty requirements of rigid sign retroreflective sheeting.

Roll-up fluorescent orange retroreflective signs will maintain 80% of its retroreflectivity as described in Article 1092-2 for years 1 and 2 and 50% for year 3.

Rigid and rollup fluorescent orange signs shall maintain a fluorescence luminance factor of 13% for 3 years when measured in accordance with ASTM E2301.

Rigid and roll up fluorescent orange signs shall maintain a total luminance factor of 25 for 3 years and conform to Article 1092-2 when measured in accordance with ASTM D4956.

1089-2 WORK ZONE SIGNS SUPPORTS

(A) General

(1) Work Zone Signs (Stationary)

Provide work zone sign supports for work zone signs (stationary) that are sturdy, durable and crashworthy. Work zone signs (stationary) and their supports shall meet appropriate NCHRP 350 crash criteria for Category II work zone devices.

Use 3-lb U-channel steel posts, 4" x 4" wood posts or perforated square steel tubing posts for all work zone signs with surface areas greater than 16 sf. Dual mount signs with surface areas greater than 10 sf on either 3-lb U-channel steel posts, 4" x 4" wood posts or perforated square steel tubing posts having the equivalent or greater strength of 3-lb U-Channel Steel posts. Perforated square steel tubing breakaway posts certified by the manufacturer for single mounting purposes may be used for the single mounting of stationary work zone signs for signs greater than 10 sf.

1 Three-pound steel U-channel posts shall comply with Subarticle 1094-1(B) and may
2 be galvanized steel or painted green by the post manufacturer.

3 (2) Work Zone Signs (Portable)

4 Use work zone signs and portable work zone sign stands that are sturdy, durable and
5 crashworthy.

6 **(B) Material Certification**

7 Provide portable work zone signs and stands that are listed on the NCDOT Approved
8 Product List. Furnish a Type 3 material certification in accordance with Article 106-3 for
9 all new work zone sign (stationary) posts and a Type 7 material certification for all used
10 work zone sign (stationary) posts before use.

11 Furnish a Type 3 material certification in accordance with Article 106-3 for all new
12 portable work zone sign stand assemblies and a Type 7 material certification for all used
13 portable work zone sign stand assemblies before use.

14 **(C) Approval**

15 All materials are subject to the approval of the Engineer.

16 **1089-3 BARRICADES**

17 **(A) General**

18 Construct barricades out of perforated square steel tubing, angle iron or other Department
19 approved materials that meet or exceed NCHRP 350 crash criteria for Category II work
20 zone devices.

21 Use barricade rails constructed of approved composite, hollow/corrugated extruded rigid
22 polyolefin, HDPE or other Department approved material that have a smooth face and
23 alternating orange and white retroreflective stripes that slope at an angle of 45°.
24 Barricade rails shall meet or exceed NCHRP 350 crash criteria for Category II work zone
25 devices.

26 **(B) Supports**

27 Support barricade rails in a manner that shall be visible to the motorist and provide
28 a stable support not easily blown over by wind or traffic.

29 **(C) Reflective Sheeting**

30 Use Grade B retroreflective sheeting that meets Article 1092-2. Flame treat rails before
31 applying the sheeting if required by the sign sheeting manufacturer. Apply the reflective
32 sheeting with a pressure sensitive adhesive to both sides of the rails.

33 Use the same color sheeting on each rail of any individual barricade.

34 **(D) Material Certification**

35 Furnish a Type 3 material certification in accordance with Article 106-3 for all new
36 barricades and a Type 7 material certification for all used barricades before use.

37 **(E) Approval**

38 All materials are subject to the approval of the Engineer.

39 **1089-4 CONES**

40 **(A) General**

41 Use cones made of ultraviolet stabilized plastic impact resistant material meeting
42 MUTCD and this article. Orange will be the predominant color on cones.

Section 1089

1 Use cones conical in shape with a minimum height of 28" or 36". The 28" cones shall
2 have a minimum base dimension of 13.75", and the 36" cones shall have a minimum base
3 dimension of 14.5" as shown in the *Roadway Standard Drawings*. The 28" and 36"
4 cones (excluding ballast) shall have a minimum weight of 7 lb and 10 lb respectively.
5 When in an upright position, have the cones display the same dimensions regardless of
6 their orientation to oncoming traffic.

7 (B) Ballast

8 Provide wind resistant cones that do not blow over under normal roadway conditions,
9 including high speed truck traffic in close proximity to the cones when properly ballasted.
10 Provide cones that do not permanently distort to a degree that would prevent reuse when
11 struck.

12 Achieve ballasting of the cones by using any of the following methods:

- 13 (1) Cones with bases that may be filled with ballast,
- 14 (2) Doubling the cones or using heavier weighted cones, or
- 15 (3) Cones with special weighted bases or weights such as rubber rings that can be
16 dropped over the cones and onto the base to provide increased stability.

17 Provide cones with 70% of the weight of the cone in the base. These added weights shall
18 not present a hazard if the devices are inadvertently struck.

19 (C) Retroreflective Sheeting

20 Where retroreflective cones are required, provide a cone with flexible, prismatic cone
21 sheeting having impact resistance and attached with precoated pressure sensitive
22 adhesive. The retroreflective sheeting shall meet or exceed the retroreflectivity
23 requirements of Grade B sheeting in Section 1092. Use 2 retroreflective bands, the top
24 one is 6" wide and the bottom one is 4" wide; see *Roadway Standard Drawings*.

25 (D) Material Certification

26 Furnish a Type 3 material certification in accordance with Article 106-3 for all new cones
27 with or without retroreflective sheeting and a Type 7 material certification for all used
28 cones with or without retroreflective sheeting before use.

29 (E) Approval

30 All materials are subject to the approval of the Engineer.

31 1089-5 CHANNELIZING DEVICES

32 (A) Drums

33 (1) General

34 Provide drums composed of a body, alternating orange and white 4 band pattern of
35 Type III-High Intensity or higher prismatic sheeting and ballasts evaluated by
36 NTPEP.

37 (2) Body

38 Provide a drum made of orange, impact resistant, ultraviolet plastic material capable
39 of maintaining its integrity upon impact throughout a temperature range of 20°F to
40 125°F. When struck, the drum shall not permanently distort to a degree that would
41 prevent reuse, nor roll excessively after impact. Design the drum to prevent water
42 from accumulating and freezing in the top or bottom.

1 Provide a drum that is cylindrical in shape with the following dimensions;
2 a minimum height of 36", a minimum top outer diameter of 18", a bottom outer
3 diameter of 21" to 24", and a minimum weight of 7 lb. The top outer diameter shall
4 not exceed the bottom outside diameter. Provide closed tops on drums to prevent
5 accumulation of debris.

6 (3) Retroreflective Stripes

7 Provide at least 4 retroreflective bands with 2 orange and 2 white alternating
8 horizontal circumferential bands. The top band shall always be orange. Use a 6" to
9 8" wide band Type III–High Intensity prismatic retroreflective sheeting or better that
10 meets Article 1092-2 for each band. Do not exceed 2" for any non-reflective spaces
11 between orange and white stripes. Do not splice the retroreflective sheeting to create
12 the 6" band. Apply the retroreflective sheeting directly to the drum surface. Do not
13 apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.
14 Do not place bands over any protruding corrugations areas. No damage to the
15 reflective sheeting should result from stacking and unstacking the drums, or vehicle
16 impact.

17 (4) Ballast

18 Ballast drums using the sandbag ballast method, the tire sidewall ballast method or
19 by the preformed weighted base ballast method. When properly ballasted, the drums
20 shall be wind resistant to the extent of withstanding wind created by traffic under
21 normal roadway conditions, including high speed truck traffic in close proximity to
22 the drums. Do not place ballast on top of the drum.

23 (a) Sandbag Ballast Method

24 Supply a sandbag with 50 lb of sand with each drum. Place the sandbag inside
25 the body on top of the detachable base. Upon impact the main body of the drum
26 shall deform and become detached from the base, allowing vehicles to easily
27 pass over the remaining base.

28 (b) Tire Sidewall Ballast Method

29 Design the base of the drums to accommodate no more than 2 tire sidewalls that
30 when combined will have a weight of at least 30 lb and no more than 50 lb. Use
31 the manufacturer's required tire sidewall ballast. Upon impact the main body of
32 the drum shall deform and become detached from the tire sidewalls, allowing
33 vehicles to easily pass over the tire sidewall ballasts.

34 (c) Preformed Weighted Base Ballast Method

35 Supply a preformed base specifically designed for the model drum. The weight
36 of each drum's preformed base will be self-certified by the manufacturers. Each
37 drum with preformed bases shall be approved by the Work Zone Traffic Control
38 Unit. Upon impact, the main body of the drum shall deform and become
39 detached from the base allowing vehicles to easily pass over the remaining base.

40 (5) Material Certification

41 Furnish a Type 3 material certification in accordance with Article 106-3 for all new
42 drums and a Type 7 material certification for all used drums before use.

43 (6) Approval

44 All materials are subject to the approval of the Engineer.

Section 1089

(B) Skinny Drums

(1) General

Provide skinny drums composed of a body, reflective stripes and ballasts evaluated by NTPEP.

(2) Body

Provide a skinny drum made of orange, impact resistant, ultraviolet plastic material capable of maintaining its integrity upon impact throughout a temperature range of -20°F to 125°F. When struck, the skinny drum shall not permanently distort to a degree that would prevent reuse, nor roll excessively after impact. Design the skinny drum to prevent water from accumulating and freezing in the top or bottom.

Provide a skinny drum that is cylindrical in shape with the following dimensions; a minimum height of 42", a minimum top outer diameter of 4" and a bottom outer diameter of 7.5". The top outer diameter shall not exceed the bottom outside diameter. Provide closed tops on drums to prevent accumulation of debris.

(3) Retroreflective Stripes

Provide at least 4 retroreflective bands with 2 orange and 2 white alternating horizontal circumferential bands for each skinny drum. The top band shall always be orange. Use a 6" to 8" wide band Type III-High Intensity or higher prismatic retroreflective sheeting that meets Article 1092-2 for each band. Do not exceed 2" for any non-reflective spaces between orange and white stripes. Do not splice the retroreflective sheeting to create the 6" band. Apply the retroreflective sheeting directly to the skinny drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting. Do not place bands over any protruding corrugation areas. No damage to the reflective sheeting should result from stacking and unstacking the skinny drums, or vehicle impact.

(4) Ballast

Ballast skinny drums using a preformed base specifically designed for the model skinny drum. Each base shall be at least 15 lb and circular or polygonal with equal sides. When properly ballasted, the skinny drums shall be wind resistant to the extent of withstanding wind created by traffic under normal roadway conditions including high speed truck traffic in close proximity to the skinny drums. Do not place ballast on top of the drum. Upon impact, the main body of the drum shall deform and become detached from the base allowing vehicles to easily pass over the remaining base.

(5) Material Certification

Furnish a Type 3 material certification in accordance with Article 106-3 for all new skinny drums and a Type 7 material certification for all used skinny drums before use.

(6) Approval

All materials are subject to the approval of the Engineer.

1089-6 FLASHING ARROW BOARDS

(A) General

Provide a trailer mounted arrow board that meets or exceeds the physical and operational requirements of the MUTCD and which has been evaluated by NTPEP. The following specifications supplement those basic requirements. Provide a totally mobile complete unit capable of being located as traffic conditions demand.

1 The display housing shall meet the minimum size requirements of a Type C panel with
2 a 15 or 25 lamp configuration.

3 The display housing shall have a hand-crank mechanism to allow raising and lowering
4 the display with a locking device to ensure the display housing will remain secured in
5 either position

6 The display housing will have a minimum height of 7 ft from the bottom of the sign to
7 the ground when raised in the upright position.

8 The display housing assembly shall be of weather resistant construction.

9 The lamps shall be controlled to provide the following modes as a minimum: Flashing
10 Right or Left Arrow, Flashing Double Arrow and Caution Mode (4 outermost corner
11 lamps).

12 **(B) Power System**

13 Provide a unit that is solar powered and supplemented with a battery backup system that
14 includes a 110/120 VAC powered on-board charging system.

15 The unit shall also be capable of being powered by standard 110/120 VAC power source.

16 The batteries, when fully charged, shall be capable of powering the display for
17 20 continuous days with no solar power.

18 Store the battery bank and charging system in a lockable, weather and vandal resistant
19 box.

20 **(C) Controller**

21 Provide an automatic brightness/dimming of the display and a manual override dimming
22 switch.

23 The controller shall provide a battery-charge status indicator.

24 Mobile radio or any other radio transmissions shall not affect the controller.

25 Store the controller in a lockable, weather and vandal resistant box.

26 **(D) Trailer**

27 Finish all exterior metal surfaces with Federal orange enamel per Federal Standard 595a,
28 color chip ID# 13538 or 12473 respectively. The trailer shall be able to support
29 a 100 mph wind load with the display fully extended.

30 The trailer shall be equipped with leveling jacks capable of stabilizing the unit in
31 a horizontal position when located on slopes 6:1 or flatter.

32 The trailer shall be properly equipped in compliance with North Carolina Law governing
33 motor vehicles.

34 Provide a minimum 4" wide strip of fluorescent orange retroreflective sheeting to the
35 frame of the trailer. Apply the sheeting to all sides of the trailer. The sheeting shall meet
36 the requirements of Section 1088-1. Drums may be supplemented around the unit in
37 place of the sheeting.

38 **(E) Reliability**

39 Provide a sign unit that all components are rated to operate at temperatures ranging from
40 -30°F to 165°F.

41 The sign manufacturer shall notify the Work Zone Traffic Control Unit whenever
42 modifications are made to a prequalified sign on the NCDOT Approved Products List.

Section 1089

1 The Work Zone Traffic Control Unit will review changes and per its discretion either
2 make no change to the sign's status or remove it from the list until the sign can be
3 reevaluated.

4 (F) Material Certification

5 Furnish a Type 3 material certification in accordance with Article 106-3 for all new
6 flashing arrow boards, a Type 7 material certification for all used flashing arrow boards,
7 and wind load certifications required in Subarticle 1089-6(D) for all new and used
8 flashing arrow boards before use.

9 (G) Approval

10 The sign shall be on the NCDOT Approved Products List before use on construction
11 projects in North Carolina. A sign may be removed from the NCDOT Approved
12 Products List due to unsatisfactory field performance and shall not return to the list until
13 the manufacturer identifies the reason for the failure and the problem has been corrected
14 to the satisfaction of the Department.

15 The sign manufacturer shall notify the Department whenever modifications are made to
16 their sign that was prequalified on the NCDOT Approved Products List. The Department
17 will review changes and per its discretion, either make no change to the sign's status on
18 the NCDOT Approved Products List or remove the sign from the list until the sign can be
19 reevaluated.

20 1089-7 PORTABLE CHANGEABLE MESSAGE SIGNS

21 (A) General

22 Provide trailer mounted portable changeable message signs that meet MUTCD and have
23 been evaluated by NTPEP.

24 Provide a totally mobile complete sign unit capable of being located as traffic conditions
25 demand.

26 (B) Display Panel

27 Provide 3 lines of a programmable message with at least 8 characters per line and
28 a character height of at least 18".

29 The display characters will be composed of LED elements. The display panel may be of
30 the following types- Full Matrix, Continuous Line Matrix, and Character Matrix.

31 Messages are to be automatically centered and proportionally spaced on each line of
32 a Full Matrix and Continuous Line Matrix displays. Character Matrix displays shall
33 display odd number character messages one character left of the centerline.

34 The display characters shall be protected with a polycarbonate lens that shall not decrease
35 the daytime visibility of the sign.

36 The display panel shall have an electro-hydraulic system to allow raising and lowering
37 the display with 360° rotation capability. A locking device(s) shall be provided to ensure
38 the display will remain secure in the raised, lowered and rotated positions. The sign shall
39 have the capability to be raised and rotated to its operating position by one person.

40 A manual backup mechanism for the raising and lowering the display panel shall be
41 provided in the event the electro-hydraulic system fails.

42 The display panel assembly shall be of weather resistant construction

43 (C) Power System

44 The unit shall be Solar powered and supplemented with a battery backup system which
45 includes a 110/120 VAC powered on-board charging system.

1 The batteries, when fully charged, shall be capable of powering the display for
 2 20 continuous days with no solar power. The unit shall be capable of being powered by
 3 standard 110/120 VAC power source.

4 Store the battery bank and charging system in a lockable, weather and vandal resistant
 5 box.

6 **(D) Controller**

7 The controller shall provide at a minimum; a keyboard, a display for message review and
 8 editing, a light source for nighttime operations, an event time clock and all other required
 9 controls for the operation of the display. Access to controller operations shall have the
 10 capability to be password protected.

11 The controller shall include the following capabilities; manually dimming the display,
 12 storing at least 99 user generated messages, adjusting the flash rate of display and display
 13 phasing and monitoring battery-charge status.

14 Mobile radio or any other radio transmissions shall not affect the controller.

15 The controller shall be stored in a lockable, weather and vandal resistant box.

16 The controller shall be pre-programmed with messages shown below and stored in
 17 memory:

MAX SAFE SPEED 25 MPH	MAX SAFE SPEED 30 MPH
STOP AHEAD	YIELD AHEAD
MAX SAFE SPEED 35 MPH	MAX SAFE SPEED 40 MPH
MAX SAFE SPEED 45 MPH	MAX SAFE SPEED 50 MPH
ONE LANE BRIDGE	SURVEY CREW
MAX SAFE SPEED 55 MPH	DETOUR AHEAD
CAUTION DETOUR AHEAD	LANE CLOSED AHEAD
RIGHT LANE CLOSED	LEFT LANE CLOSED
CENTER LANE CLOSED	SINGLE LANE AHEAD
MERGE LEFT	MERGE RIGHT
KEEP LEFT	KEEP RIGHT
PASS LEFT	PASS RIGHT
USE LEFT LANE	USE RIGHT LANE
MERGE AHEAD	ROAD MACHINES AHEAD
ROAD WORK AHEAD	FLAGGER AHEAD
BUMP	DIP
STOP AHEAD	YIELD AHEAD
BE PREPARED TO STOP	SIGNAL AHEAD
SIGNAL NOT WORKING	DO NOT PASS
ONE LANE BRIDGE	SURVEY CREW
SHOULDER WORK	SOFT SHOULDER
PAVEMENT ENDS	LANE ENDS
ROAD CLOSED 1/4 MILE	ROAD CLOSED 1/2 MILE
ALL TRAFFIC EXIT LEFT	ALL TRAFFIC EXIT RIGHT
ROAD NARROWS	ROAD CLOSED AHEAD
RAMP CLOSED	REDUCE SPEED
ROAD PAVING AHEAD	ALL TRAFFIC MUST STOP
SLOW MOVING TRAFFIC	NIGHT WORK AHEAD
CAUTION FLAGGER AHEAD	RUNAWAY TRUCK RAMP
MEDIAN WORK AHEAD	
LEFT LANE NARROWS	RIGHT LANE NARROWS
TEST PATTERN A ^A	TEST PATTERN B ^B

18 **A.** Test Pattern A is 1/2 of the LEDs/flip-discs/or combination on at a time.

19 **B.** Test Pattern B is for the remaining 1/2 of the LEDs/flip-discs/or combination on at
 20 a time.

Section 1089

1 (E) Trailer

2 Finish all exterior metal surfaces with Federal orange enamel per Federal Standard 595a;
3 color chip ID# 13538 or 12473 respectively except for the sign face assembly that shall
4 be flat black.

5 Provide a minimum 4" wide strip of fluorescent orange retroreflective sheeting to the
6 frame of the trailer. Apply the sheeting to all sides of the trailer. The sheeting shall meet
7 Article 1088-1. Drums may be supplemented around the unit in place of the sheeting.

8 The trailer shall be able to support a 100 mph wind load with the display fully extended.

9 The trailer shall be equipped with leveling jacks capable of stabilizing the unit in
10 a horizontal position when located on slopes 6:1 or flatter.

11 The trailer shall be properly equipped in compliance with North Carolina Law governing
12 motor vehicles.

13 (F) Reliability

14 Provide a sign unit that all components are rated to operate at temperatures ranging from
15 -30°F to 165°F.

16 (G) Material Certification

17 Furnish a Type 3 material certification in accordance with Article 106-3 for all new
18 changeable message signs, a Type 7 material certification for all used changeable
19 message signs and wind load certifications required in Subarticle 1089-7(E) for all new
20 and used changeable message signs before use.

21 (H) Approval

22 The sign shall be on the NCDOT Approved Products List before use on construction
23 projects in North Carolina. A sign may be removed from the NCDOT Approved
24 Products List due to unsatisfactory field performance and shall not return to the list until
25 the manufacturer identifies the reason for the failure and the problem has been corrected
26 to the satisfaction of the NCDOT.

27 The sign manufacturer shall notify NCDOT whenever modifications are made to their
28 sign that was prequalified on the NCDOT Approved Products List. The Department will
29 review changes and per its discretion either make no change to the sign's status on the
30 NCDOT Approved Products List or removed the sign from the list until the sign can be
31 reevaluated.

32 1089-8 TEMPORARY CRASH CUSHIONS

33 (A) General

34 Provide temporary crash cushions that meet NCHRP 350 for Work Zone Test Level 2 for
35 work zones that have a posted speed limit of 45 mph or less. Provide temporary crash
36 cushions that meet NCHRP 350 for Work Zone Test Level 3 devices for work zones that
37 have a posted speed limit of 50 mph or greater. Provide temporary crash cushions that
38 shall remain intact after a side impact, and without maintenance, be capable of sustaining
39 additional side or head-on impacts.

40 Contain the temporary crash cushion debris resulting from impact within the structure of
41 the temporary crash cushion.

42 Include in the temporary crash cushion package any required rear transition panels to
43 connect the back of the temporary crash cushion to rigid or flexible barrier systems as
44 well as any required portable base as recommended by the manufacturer of the temporary
45 crash cushion, to connect the bottom of the temporary crash cushion to a paved surface.
46 Temporary crash cushion shall not be placed on an unpaved surface.

(B) Retroreflective End Treatments

Provide a yellow nose wrap that visually matches the color chip that corresponds to the Federal Standard No. 595a for Yellow (Color No. 13538) for all temporary crash cushions.

The reflective end treatment shall meet the requirement for reflectivity in Article 1088-1 and *Roadway Standard Drawings*.

(C) Material Certification

Furnish a Type 3 material certification in accordance with Article 106-3 for all new temporary crash cushions and a Type 7 material certification for all used temporary crash cushions before use.

(D) Approval

Use temporary crash cushions that are on the NCDOT Approved Products List.

1089-9 TRUCK MOUNTED ATTENUATORS**(A) General**

Provide truck mounted attenuators that meet NCHRP 350 Test Level II for work zones that have a posted speed limit of 45 mph or less. Provide truck mounted attenuators that meet NCHRP 350 Test Level III for work zones that have a posted speed limit of 50 mph or greater.

Use trucks with gross vehicle tare weight as described in the NCHRP 350 crash test for the impact attenuator provided. Provide 2 axle flat bed type trucks with minimum gross vehicle tare weight of 5,000 lb that may be ballasted with sections of portable concrete barrier attached to the bed of the truck with bolts or straps, or concrete poured into the bed of the truck and attached to the truck with bolts, or a continuous layer of asphalt placed in the bed of the truck and attached to the truck with bolts.

Mount the attenuator on a truck chassis to provide a uniform clearance, as required by the truck mounted attenuator's manufacturer, between the bottom of the shell and the roadway. Use a steel backup support assembly of sufficient size and strength to permit mounting on the chassis by brackets, as required by truck mounted attenuator's manufacturer.

Provide truck mounted attenuators equipped with cartridges that have a standard trailer lighting system, including brake lights, tail lights and turn signals.

(B) Retroreflective End Treatment

The reflective end treatment shall meet Article 1088-1 and *Roadway Standard Drawings*.

(C) Material Certification

Furnish a Type 3 material certification in accordance with Article 106-3 for all new truck mounted attenuators and a Type 7 material certification for all used truck mounted attenuators before use.

(D) Approval

Use only truck mounted attenuators that are on the NCDOT Approved Products List.

Section 1090

1 **1089-10 FLAGGER**

2 **(A) Stop and Slow Paddle**

3 (1) Reflective Sheeting

4 Use reflective sheeting with a smooth, sealed outer surface that will display the same
5 color both day and night. Cover the entire sign face with Grade B reflective
6 sheeting. Reflective sheeting shall meet Article 1092-2. The distance from the
7 bottom of the sign to the ground shall be at least 7 ft.

8 (2) Material Certification

9 Furnish a Type 3 material certification in accordance with Sections 106-3 for all new
10 reflective sheeting used on flagger paddles and a Type 7 material certification for all
11 used sheeting before use.

12 (3) Approval

13 All materials are subject to the approval of the Engineer.

14 **(B) Vest**

15 (1) Reflective Sheeting

16 Use reflective sheeting with sealed outer surface that will display the same color both
17 day and night. Design the reflective sheeting similar to Department chevron vests.
18 Reflective sheeting shall meet Article 1092-2.

19 (2) Material Certification

20 Furnish a Type 3 material certification in accordance with Sections 106-3 for all new
21 reflective sheeting and a Type 7 material certification for all used sheeting on flagger
22 vests before use.

23 (3) Approval

24 All materials are subject to the approval of the Engineer.

25 **SECTION 1090**

26 **PORTABLE CONCRETE BARRIER**

27 **1090-1 PORTABLE CONCRETE BARRIER**

28 **(A) General**

29 Use portable concrete barrier that meets Section 854, Section 1077 and the plans. The
30 requirement for approved galvanized connectors will be waived if the barrier remains the
31 property of the Contractor.

32 **(B) Used Portable Concrete Barrier**

33 Used barrier will be acceptable provided the following conditions have been met:

34 (1) The Contractor has furnished a Type 7 material certification in accordance with
35 Article 106-3.

36 (2) The strength of the concrete in each barrier unit is at least 4,500 psi as evidenced by
37 nondestructive tests made in place by a rebound hammer in accordance with
38 ASTM C805.

39 **(C) Anchor Bolts**

40 Use anchor bolts that meet ASTM A325.

41 **(D) Approval**

42 All materials are subject to the approval of the Engineer.