NOTE: If a Single Net Blanket is used the side with the netting should be on the top once the blanket is installed.

3.8 staples per square yard using 8-inch 11 gauge wire "U" staples.
EROSION CONTROL
FIBER ROLL PLACEMENT DETAILS

*Optional Weir* Use in flat areas, such as the Red River Valley, where there is potential for water to back up on adjacent property. Do not use 20-inch fiber rolls in flat areas where there is potential for water to back up on adjacent property.

**12 OR 20 INCH FIBER ROLL - DITCH BOTTOM**

<table>
<thead>
<tr>
<th>FIBER ROLL DIAMETER</th>
<th>NOMINAL STAKE SIZE</th>
<th>MINIMUM STAKE LENGTH</th>
<th>MINIMUM TRENCH DEPTH</th>
<th>MAXIMUM TRENCH DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>2&quot; x 2&quot;</td>
<td>18&quot;</td>
<td>2&quot;</td>
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<tr>
<td>12&quot;</td>
<td>2&quot; x 2&quot;</td>
<td>24&quot;</td>
<td>2&quot;</td>
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<tr>
<td>20&quot;</td>
<td>2&quot; x 2&quot;</td>
<td>36&quot;</td>
<td>3&quot;</td>
<td>5&quot;</td>
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</table>

NOTE: Runoff must not be allowed to run under or around roll.
Two Lane, Two Way Roadways

- Display a 360 degree rotating, flashing, oscillating or strobe light on the working vehicle.
- Use flagger to protect the work area and warn oncoming traffic.
- Use these layouts during daylight hours and in areas of good visibility only.
- Use flagger to protect the work area and warn oncoming traffic.

Multilane Roadways

- Display a 360 degree rotating, flashing, oscillating or strobe light on the working vehicle.
- Operate a sequencing arrow panel Type C in chevron mode on the shadow vehicle for Multilane Roadway.
- Use these layouts during daylight hours and in areas of good visibility only.
- Use flagger to protect the work area and warn oncoming traffic.

Notes:
1. Display a 360 degree rotating, flashing, oscillating or strobe light on the working vehicle.
2. Display a 360 degree rotating, flashing, oscillating or strobe light on the shadow vehicle. Operate a sequencing arrow panel Type C in chevron mode on the shadow vehicle for Multilane Roadway.
3. Use these layouts during daylight hours and in areas of good visibility only.
4. Use flagger to protect the work area and warn oncoming traffic.

Typical Protection Vehicle
- Flagger
- Protection vehicle with flashing or rotating beacon
- High intensity flashing lights
- Truck mounted attenuator - optional

Typical Protection Vehicle
- Sequencing Arrow Panel Type C - Chevron Mode
- Truck mounted attenuator - optional
**Advance Warning Sign Spacing (A)**

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance between signs min. (ft)</th>
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<tr>
<td>Urban - Low Speed (30 mph or less)</td>
<td>A (240) B (360) C (480)</td>
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<tr>
<td>Urban - Low Speed (over 30 to 40 mph)</td>
<td>240</td>
</tr>
<tr>
<td>Urban - High Speed (over 40 mph to 50 mph)</td>
<td>360</td>
</tr>
<tr>
<td>Rural - High Speed (over 50 mph to 65 mph)</td>
<td>720</td>
</tr>
<tr>
<td>Urban Expressway and Freeway (50 mph to 65 mph)</td>
<td>850 1330 2200</td>
</tr>
<tr>
<td>Rural Expressway and Freeway (70 mph to 75 mph)</td>
<td>1000 2040</td>
</tr>
<tr>
<td>Interstate/4-Lane Divided</td>
<td>750 1020 1500</td>
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</table>

**Notes:**

1. Place mount signs a distance of 2A following the End Road Work (D20-3-4G) sign (maximum 2 signs per project)

2. Use sign on rural projects with a 30 day or longer duration (not required on short duration projects)

3. Do not place sign in urban areas or within city limits.
**Notes:**

1. Torque slip base bolts as specified by manufacturer.
2. Use anchor with 65.9 KSI yield strength and 99.9 KSI tensile strength.
3. Provide 4" vertical clearance for anchor or breakaway base. Measure the 4" clearance from post location and back and ahead of post.
4. In concrete sidewalk, use same anchor without wings.
5. Provide more than 7° between the first and fourth posts of a four post sign.

---

**Perforated Tube**

---

**Telescoping Perforated Tube**

<table>
<thead>
<tr>
<th>Tube Size</th>
<th>Wall Thickness</th>
<th>U.S. Standard Gauge</th>
<th>Weight per Foot</th>
<th>Moment of Inertia</th>
<th>Cross Sec. Area</th>
<th>Section Modulus</th>
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<tbody>
<tr>
<td>3&quot; x 1 1/2&quot;</td>
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<td>1.702</td>
<td>0.380</td>
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<tr>
<td>2 1/4&quot; x 2 1/2&quot;</td>
<td>0.105</td>
<td>12</td>
<td>2.773</td>
<td>0.561</td>
<td>0.095</td>
<td>0.202</td>
</tr>
<tr>
<td>2 1/2&quot; x 3&quot;</td>
<td>0.105</td>
<td>10</td>
<td>3.432</td>
<td>0.880</td>
<td>0.141</td>
<td>0.386</td>
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<tr>
<td>2 1/8&quot; x 3 1/4&quot;</td>
<td>0.105</td>
<td>10</td>
<td>3.141</td>
<td>0.804</td>
<td>0.083</td>
<td>0.143</td>
</tr>
<tr>
<td>2 1/4&quot; x 3 1/4&quot;</td>
<td>0.105</td>
<td>10</td>
<td>4.506</td>
<td>1.010</td>
<td>0.107</td>
<td>0.785</td>
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</tbody>
</table>

**Properties of Telescoping Perforated Tube**

<table>
<thead>
<tr>
<th>Tube Size</th>
<th>Wall Thickness</th>
<th>U.S. Standard Gauge</th>
<th>Weight per Foot</th>
<th>Moment of Inertia</th>
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<th>Section Modulus</th>
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<td>10</td>
<td>4.506</td>
<td>1.010</td>
<td>0.107</td>
<td>0.785</td>
</tr>
</tbody>
</table>

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**Top Post Receiver**

**Bottom Soil Stub**

**Notes:**

1. Use breakaway base when support is placed in weak soils. Engineer determines if soils are weak.
2. Use anchor with 43.9 KSI yield strength and 59.3 KSI tensile strength.
3. Provide 4" vertical clearance for anchor or breakaway base. Measure the 4" clearance from post location and back and ahead of post.
4. In concrete sidewalk, use same anchor without wings.
5. Provide more than 7° between the first and fourth posts of a four post sign.
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

U-Channel Post

Alternate A Steps of Installation

1. Drive anchor unit to within 12" of ground level.
2. Alternate proper assembly by lining up bottom hole of retainer strap with 5th hole from the top of the anchor unit.
3. Drive anchor unit to within 12" of ground level.
4. Rotate strap to vertical position.
5. Drive anchor unit to within 12" of ground level.
6. Rotate strap to horizontal position.
7. Assemble strap to back of anchor unit using (3/8" x 2" bolt, lock washer and nut).
8. Alternate closes two connector bolts.
9. Alternate closes two connector bolts.
10. Assemble strap to back of anchor unit using (3/8" x 2" bolt, lock washer and nut).

Alternate A Notes:

1c. See Alt. A Note 3.
2. See Alt. A Note 4.
3. See Alt. A Note 5.
5. See Alt. A Note 7.
7. See Alt. A Note 9.
8. See Alt. A Note 10.
CONSTRUCTION SIGN DETAILS
TERMINAL AND GUIDE SIGNS

**Road Work Next XX Miles**
- G20-1-60
  - Legend: black (non-refl)
  - Background: orange

**No Work in Progress**
- G20-1b-60
  - Legend: black (non-refl)
  - Background: orange

**End Road Work**
- G20-2-48
  - Legend: black (non-refl)
  - Background: orange

**SPEED LIMIT ENFORCED**
- G20-55-96
  - Legend: black (non-refl)
  - Background: orange

**Detour**
- G20-5a-72
  - Legend: black (non-refl)
  - Background: orange

**Exit**
- E5-1(L or R)-48
  - Legend: white
  - Background: green (orange optional)

**Arrow Details**
- M4-8(L or R)-30 & M4-9(L or R)-30
  - Advanced Right or Left
- M4-6(L or R)-30
  - Straight

**NOTES:**
- Arrow may be right or left of the legend to indicate construction to the right or left.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4688, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation.
Detour and Roadway Diversion Sign Layouts

Type I: 2-lane highway when roadway is closed and detour provided.

Type J: 2 lane highway with widened section.

Road Closure with a Diversion Sign Layout

2-lane highway when roadway is closed and detour provided.

Type II: Roadway with widened section.

Type III: Roadway with widened section and traffic maintained in both directions.

Notes:
1. Variables:
   - Distance Between Signs: 0.50 - 0.60
   - Sign Type:
     - Barricade Mounted: 0.50
     - Post Mounted: 0.60
2. Possible use of variable distance between signs and signs on a variable number of posts.
3. Spaced delineator drums and vertical panels at 0.02 mile intervals.
4. Determining the necessary speed limit and roadside signs before construction. Where speed limits exceed 0.60, install a secondary speed limit sign with the desired speed reduction (not to exceed 0.20 mph).
5. Approximate speeds for sign impacts are not complete. Mixed 0.26 to 0.30 signs as shown.
6. Provide adequate clearance for speed limit signs.
7. Ensure clear visibility of speed limit signs from motorists.
8. Site service area signs in accordance with NDDOT Standard Drawing D-704-21.
9. The minimum distance between signs is not less than 0.10 mile.
10. Use 0.20 of double dowels for signs that are installed.
11. No establish speed limit: Determine existing speed limit in the field, dependent on location and conditions.

Date: 9-27-13

Kirk D. Hoff,
Reg. # 4683
on 11/1/19 and the original document is stored at the North Dakota Department of Transportation.

This document was originally issued and sealed by Kirk D. Hoff, Reg. # 4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation.
MOBILE OPERATION
(PAVEMENT MARKING)

Two-Way Roadway with Paved Shoulders

Two-Way Roadway without Paved Shoulders

Undivided Multi-Lane Roadway

Notes:
1. Use additional vehicles per Note 2 to block traffic with the truck mounted attenuator, at your own expense.
2. Display yellow flashing beacons or arrow lights on shadow and work vehicles, unless otherwise stated in this plan.
3. Use Type B or Type C flashing arrow panels connected to traffic control vehicle.
4. Profile each vehicle with necessary electronic communication equipment.
5. Move shadow vehicle 1 from shadow other convoy vehicles which change lanes.
6. Vary vehicle spacing between shadow vehicle 1 and work vehicle 2 based on traffic conditions. Minimum spacing achieved for work convoy need to be calculated according to lane closure and traffic levels per the applicable MUTCD.
7. Sign Colors
   - Letter: Black
   - Outline: Black
   - Background: Orange
8. As per Note 5, use work vehicles 1 & 2 if the paint binder vehicle;
9. Use work vehicle CW21-10A only during painting operation;
10. Pull over work and shadow vehicles periodically to allow motor vehicle traffic to pass on two-lane - two-way roadways.

KEY

Slip
Truck mounted attenuator
Flashing arrow panels:
- Right directional
- Left directional
- Double arrow directional
- CurbCut Move

This document was originally issued and sealed by Kirk J. Hoff, Registration Number PC-4683, on 11/08/19 and the original document is stored at the North Dakota Department of Transportation.
PORTABLE SIGN SUPPORT ASSEMBLY

Notes:
1. The maximum weight of the assembly is 250 pounds.
2. Use a 14" wheel and tire.
3. Automotive and equipment axle assemblies may not be used for trailer-mounted sign supports.
4. Other NCHRP 350 crash tested assemblies are acceptable.

D-704-50

This document was originally issued and sealed by
Roger Weigel
Registration Number
PE: 2930,
on 11/23/10 and the original document is stored at the
North Dakota Department of Transportation.
CONCRETE PIPE, CATTLE PASS, OR PRECAST CONCRETE BOX CULVERT TIES

- **EYE BOLT TIE (PIPIES ONLY)**
  - 32" (Adj. + 1 1/2 min.)
  - 2" max.
- **ADJUSTABLE TIE (RCB AND PIPES ONLY)**
  - 32" (Adj. + 1 1/2 min.)
  - 2" max.
- **U BOLT TIE (RCB, PIPES, OR CATTLE PASSES)**
  - 32" + as required to produce an acceptable joint
  - 2" max.
- **WELDED TIE (RCB AND PIPES ONLY)**
  - 6" usable thread (typ)
  - 8" min.
- **CANOPY TIE (PIPIES ONLY)**
  - 32" (Adj. + 1 1/2 min.)
  - 2" max.
- **HIDDEN TIE (RCB ONLY)**
  - 7/8" (typ)

**SECTION A-A**

** DETAIL A **

- **DETAIL B**

- **PLAN VIEW**
- **END VIEW**

**NOTES:**
1. The pipe slips listed are the inside diameters of round pipe or the equivalent diameter of pipe with lids.
2. Cattle passes and boxed pipe slips shall have pipe slips inserted from the inside of the pipe and ground into the pipe. Jacked and boxed pipe slips shall be at least 24" in diameter or less and do not require pipe slips.
3. Nuts and washers are not required on jack and boxed pipe slips or pipes with a pipe diameter of less.
4. This is only for holding pipes or RCB sections together, not for pulling sections tight.
5. The bolt assembly shall be hot dip galvanized, according to AASHTO M232.
6. Holes in place to accommodate tie bolts can be procured or drilled, however holes are permitted when procured. Holes shall have a diameter ½" larger than the diameter of the thread. Holes in round RCB's shall contain bolt sleeves with an inside diameter of 1/2".
7. The contractor has the option of selecting the type of bolt used from those shown.
8. The cost of procuring or drilling the holes and turning up and installing the tie bolts shall be included in the priced bid for the appropriate comb or RCB pipe item.
9. All connections and approach RCB or RCB pass shall be hot. Storm drain systems shall have the first three bolts including the end section of all three ends that are hot.
10. The bolts shall be hot dip galvanized. This does not terminate at the line or grade. Offset cutouts, with end nozzles which shall be adjacent clamps are examples of free exits.
11. Place joint wrap prior to installing ties. Overlap the joint by 1/2 in both directions.
12. The bolts shall conform to ASTM A 36. Nuts shall be be heavy hex and conform to ASTM A 569. Washers shall conform to ASTM F 436. Type 1 welded pipe sleeves and cast-in bolt sleeves shall conform to ASTM A 55, Grade B.
Notes:
1. Curved Roadways: Use a 3' clearance from face of the curb except where right of way or sidewalk width is limited. Use a minimum 2' clearance. Increases the horizontal clearance if required to maintain a minimum sidewalk clear width of 4' from the sign support, not including any attached curbs.

2. Minimum vertical clearance: Provide at least 7' measured from the bottom of the sign to the edge of the driving lane or auxiliary lane at the side of the road in rural districts. Provide at least 7' clearance in the bottom of the sign where parking or pedestrian movements occur.

Install signs on expressways a minimum height of 7'.

Install signs at highway signs on Freeways at least 7' above the edge of the driving lane.

Maximum vertical clearance is 0' greater than the minimum vertical clearance.

3. Offset signs: Use a vertical clearance of 5' above the edge of the driving lane for signs placed 30 feet or more from the edge of the traveled way.

4. Provide a horizontal clearance from edge of shared-use path to edge of sign of 7', except where width is limited. Provide a minimum clearance of 2'.

Horizontal Clearance Table

<table>
<thead>
<tr>
<th>Shoulder Width (ft)</th>
<th>Offset (ft)</th>
<th>0 to 2</th>
<th>2 to 4</th>
<th>&gt;4 to 6</th>
<th>&gt;6 to 8</th>
<th>&gt;8 to 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>16</td>
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</table>

Shared Use Path
Bicycle - Pedestrian Paths

Typical Section (without curb)

Stop Sign Location
Wide Throat Intersection

Use layout for the placement of "Stop" signs.
Breakaway Coupler System for Perforated Tubes

Notes:
1. 4" Vertical diameter of anchor or breakaway base. The 4" x 60" measurement is above and below post location and also back and ahead of post.
2. Use anchor unit of the same size and specification as the post.
3. Provide a minimum 8" diameter between the first and fourth posts on four post signs.
4. Use the breakaway base system on standard D-754-24 or the breakaway coupling system manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements specified by DENT BREAKAWAY IND., INC. which meets the test requirements of NCHRP Report 350.

### Telescoping Perforated Tube

<table>
<thead>
<tr>
<th>Number of Posts</th>
<th>Post Size</th>
<th>Wall Thickness Gauge</th>
<th>Sleeve Size</th>
<th>Wall Thickness Gauge</th>
<th>Slip Base</th>
<th>Anchor Size</th>
<th>Slip Base Wall Thickness Gauge</th>
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</tbody>
</table>

### Shoulder Bolt

Shimming agent to reduce tolerance between 3" anchor unit with 2½" post. (Use of standard 5/8" diameter grade 8 bolt allowed with proper shims)

Max protection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on either side of the support to a point in the ground surface on the other side.

---

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/30/19 and the original document is stored at the North Dakota Department of Transportation.
Notes:

[A] Use 3/4" dia. takedown or other non-rust vandal resistant fastener with flat washer. Use 3/4" flat washer.

[B] At locations of approach guardrail with reflectors and end terminal with impact head object markers, do not install object markers.

[C] Use two object markers for back to back mountings. On bridges where the distance between object markers is less than the approach, install object markers on both sides of the bridge railing on each side of highway to mark the horizontal clearance.

[D] When object marker is located 8' or less from shoulder or curb, provide 4' minimum vertical clearance from near edge of traveled way to bottom of sign. When located more than 8' from shoulder or curb, provide 4' minimum vertical clearance from ground to bottom of sign.

[E] Use Type XI reflectors for Type II object markers. Use Type III reflectors for Type III object markers and ASTM Type IV background sheeting with ASTM Type IV reflectors for Type II object markers.

F] When object markers are mounted on non-steel posts, provide 4' minimum vertical clearance from near edge of traveled way to bottom of sign. When located more than 8' from shoulder or curb, provide 4' minimum vertical clearance from ground to bottom of sign.

[G] Use 4" vertical clearance for anchor or breakaway base. Provide 4x8" measurement above and below post location and back and ahead of post.