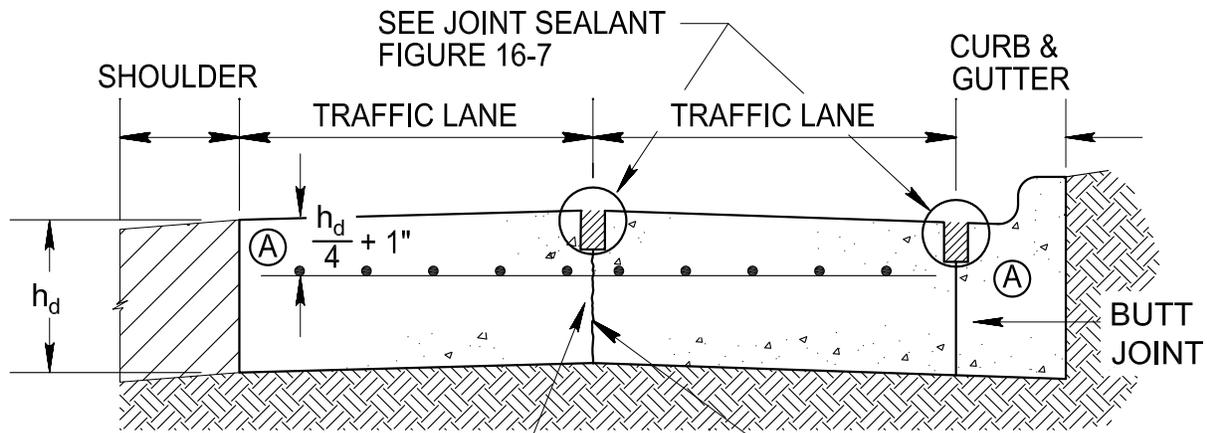


NOT TO SCALE

TYPICAL LAYOUT OF JOINTS AT INTERSECTION

DATE  
OCTOBER 2016

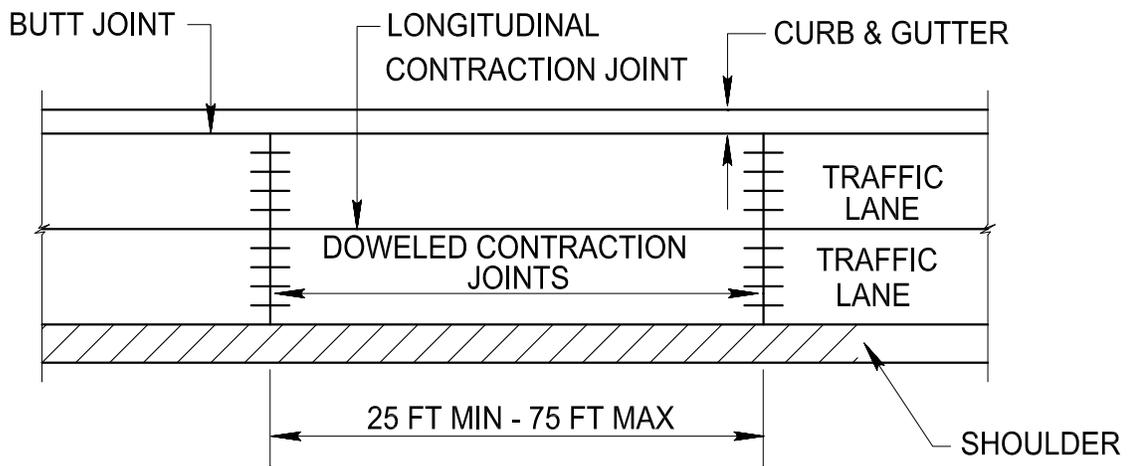
FIGURE  
14-1



REINFORCING STEEL IS CARRIED THROUGH THE LONGITUDINAL CONTRACTION JOINT

LONGITUDINAL CONTRACTION JOINT

**CROSS-SECTION**



**PLAN-VIEW**

— DOWELS: NO. 5 PLAIN STEEL BARS  
30" IN LENGTH, AND SPACED ON 30" CENTERS

Ⓐ END REINFORCING STEEL 3" FROM JOINT

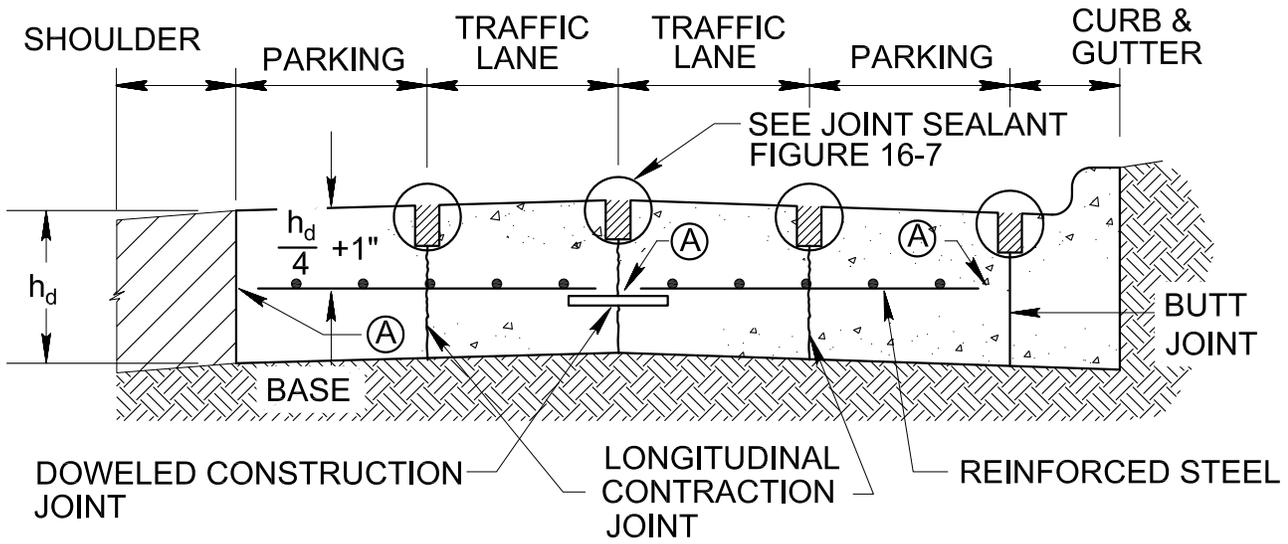
NOTE: DOWELS REQUIRED IN TRANSVERSE CONTRACTION JOINTS IN ALL REINFORCED CONCRETE PAVEMENTS

NOT TO SCALE

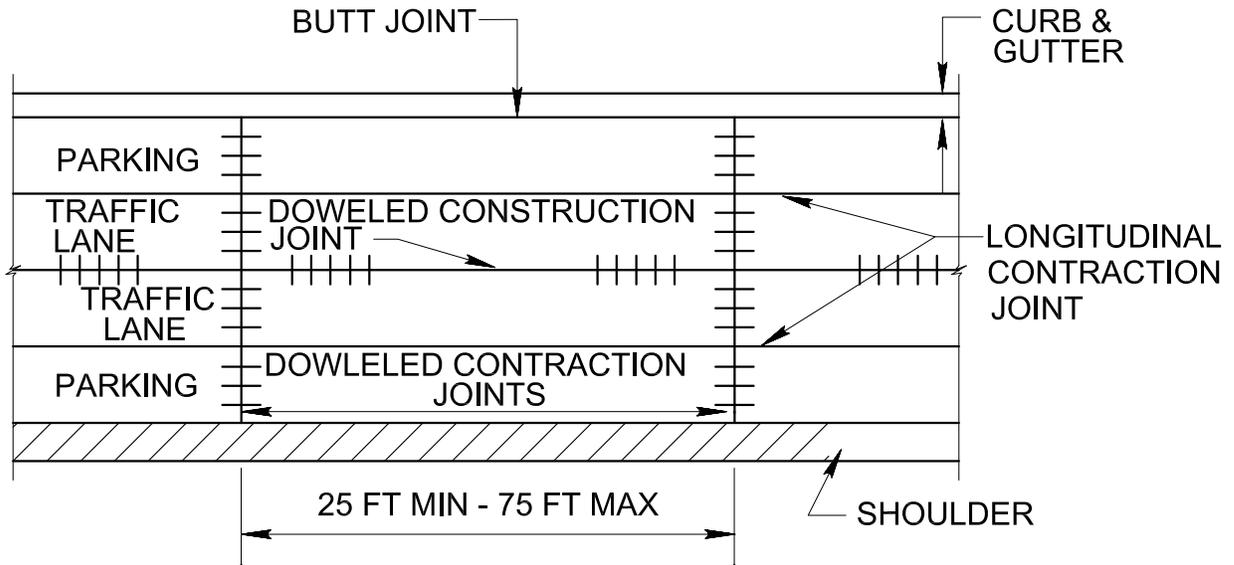
REINFORCED RIGID PAVEMENT  
WITH TWO TRAFFIC LANES

DATE  
OCTOBER 2016

FIGURE  
14-3A



**CROSS-SECTION**



**PLAN-VIEW**

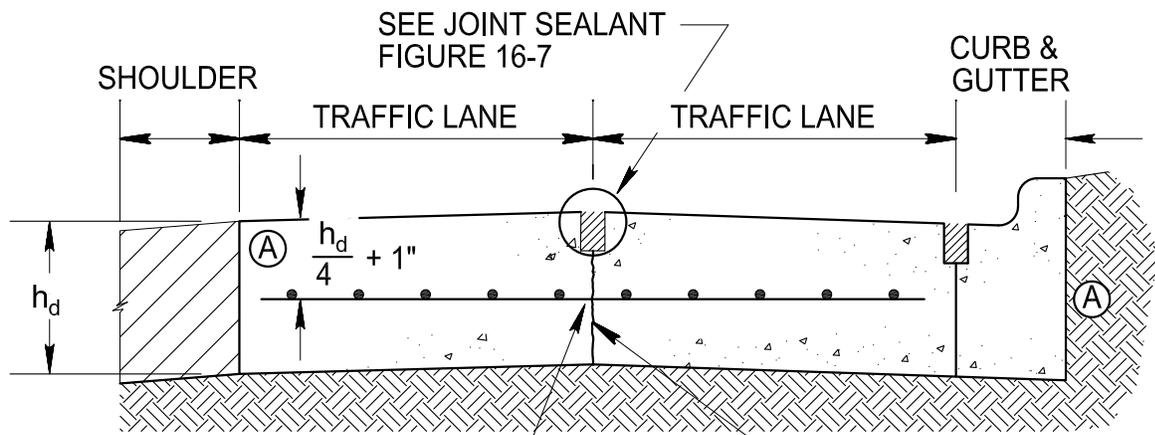
— DOWELS: NO. 5 PLAIN STEEL BARS  
30" IN LENGTH, AND SPACED ON 30" CENTERS

Ⓐ END REINFORCING STEEL 3" FROM JOINT

NOTES: REINFORCING STEEL IS CARRIED THROUGH THE LONGITUDINAL CONTRACTION JOINT ONLY.

DOWELED CONSTRUCTION JOINTS IN CONCRETE PAVEMENTS WITH 4 OR MORE LANES.

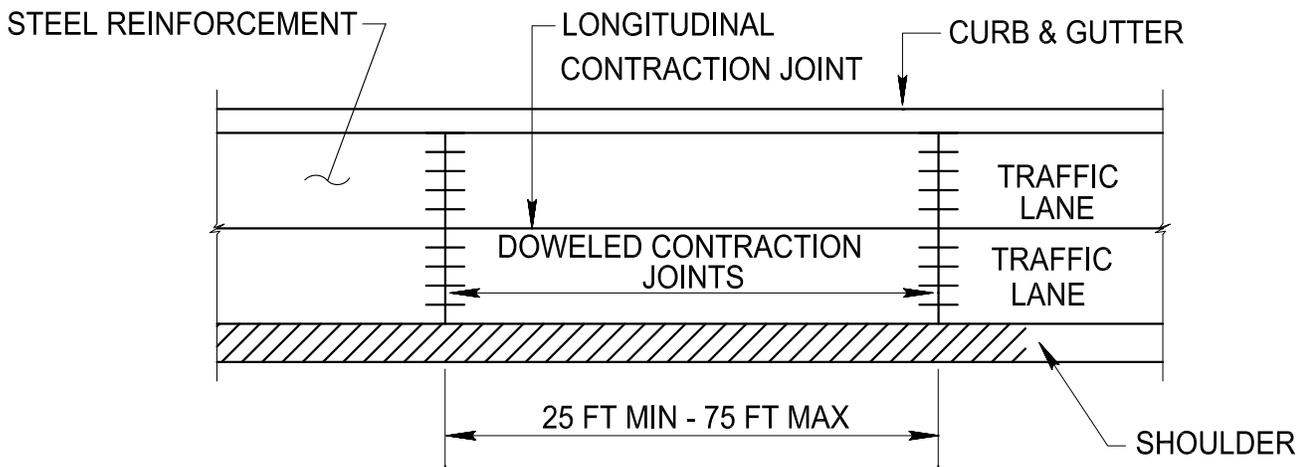
NOT TO SCALE



REINFORCING STEEL IS CARRIED THROUGH THE LONGITUDINAL CONTRACTION JOINT

LONGITUDINAL CONTRACTION JOINT

**CROSS-SECTION**



**PLAN-VIEW**

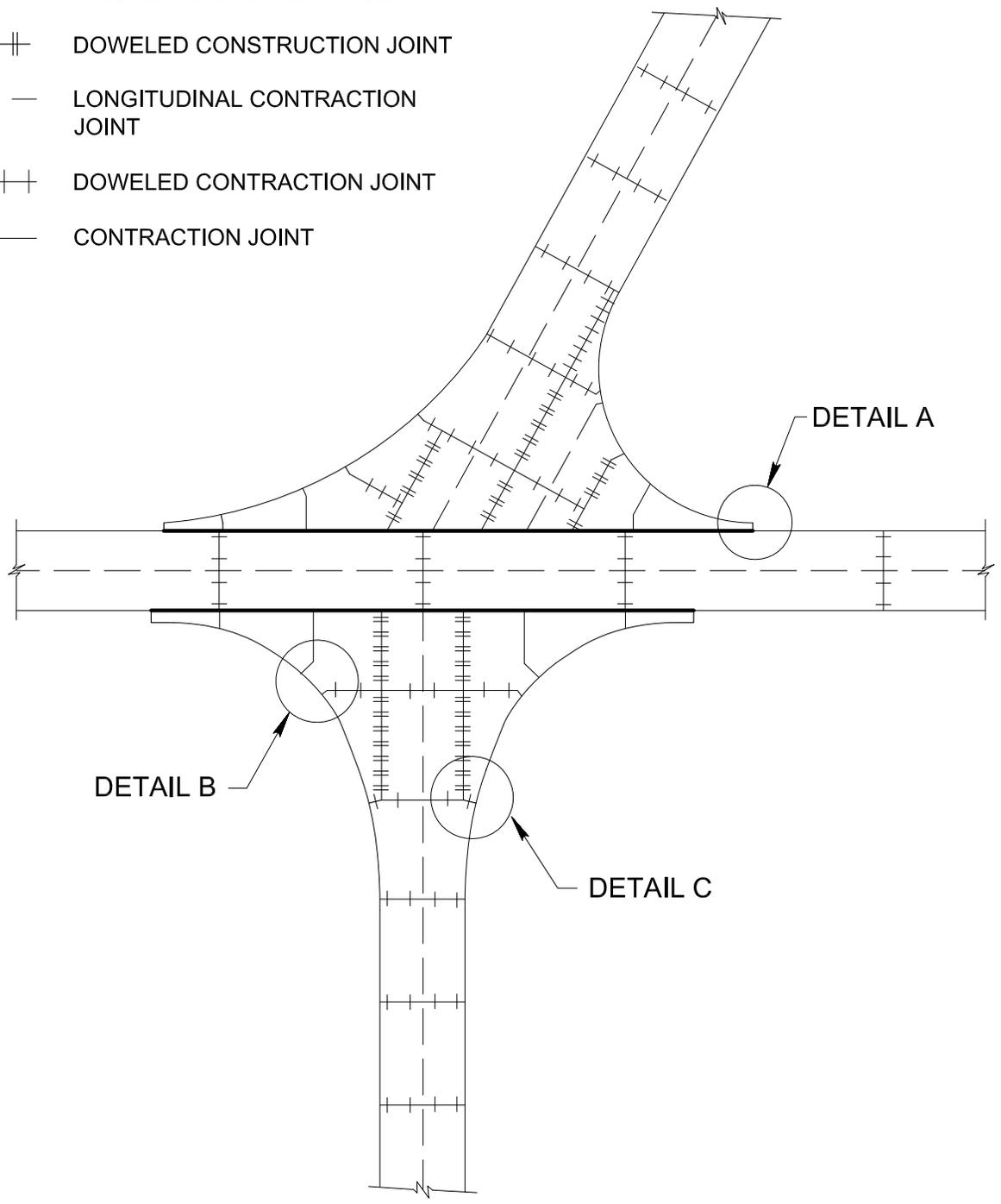
— DOWELS: NO. 5 PLAIN STEEL BARS  
30" IN LENGTH, AND SPACED ON  
30" CENTERS

Ⓐ END REINFORCING STEEL 3" FROM REAR FACE OF CURB. DOWELS REQUIRED IN TRANSVERSE CONTRACTION JOINTS IN ALL REINFORCED CONCRETE PAVEMENTS.

NOT TO SCALE

LEGEND

- THICKENED EDGE EXPANSION
- ||||| DOWELED CONSTRUCTION JOINT
- - - - LONGITUDINAL CONTRACTION JOINT
- + + + + DOWELED CONTRACTION JOINT
- CONTRACTION JOINT

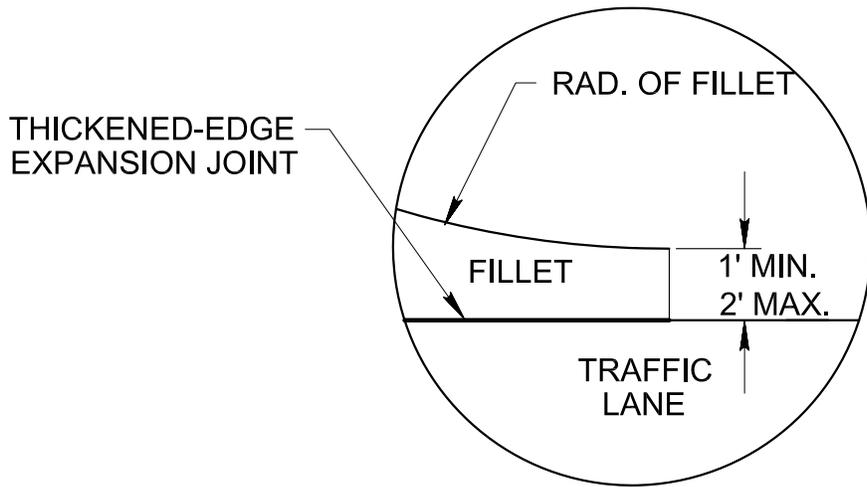


NOT TO SCALE

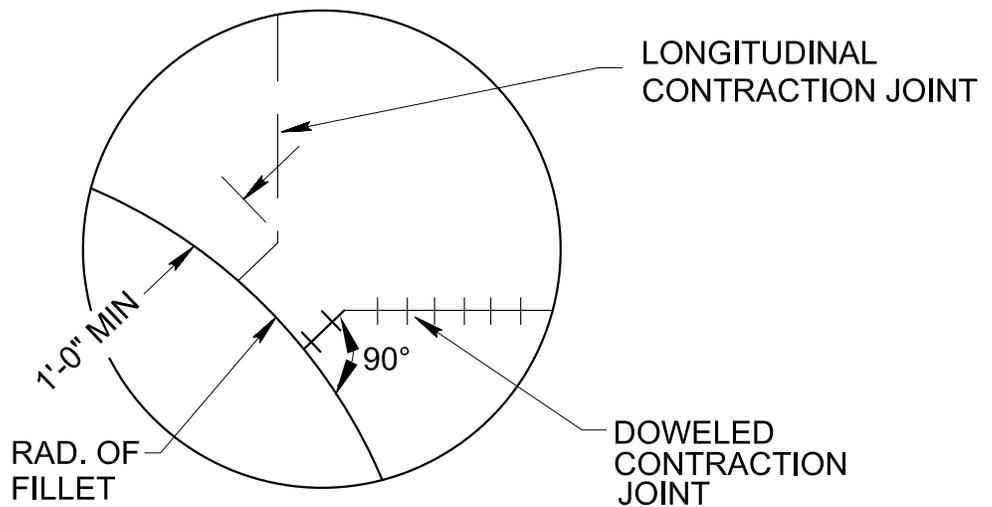
LAYOUT OF JOINTS AT THE INTERSECTION  
OF REINFORCED RIGID PAVEMENT

DATE  
OCTOBER 2016

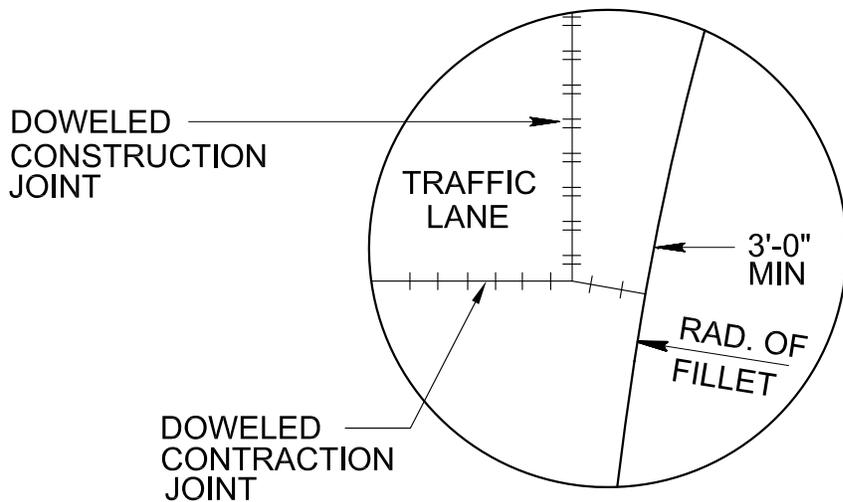
FIGURE  
14-5A



**DETAIL A**

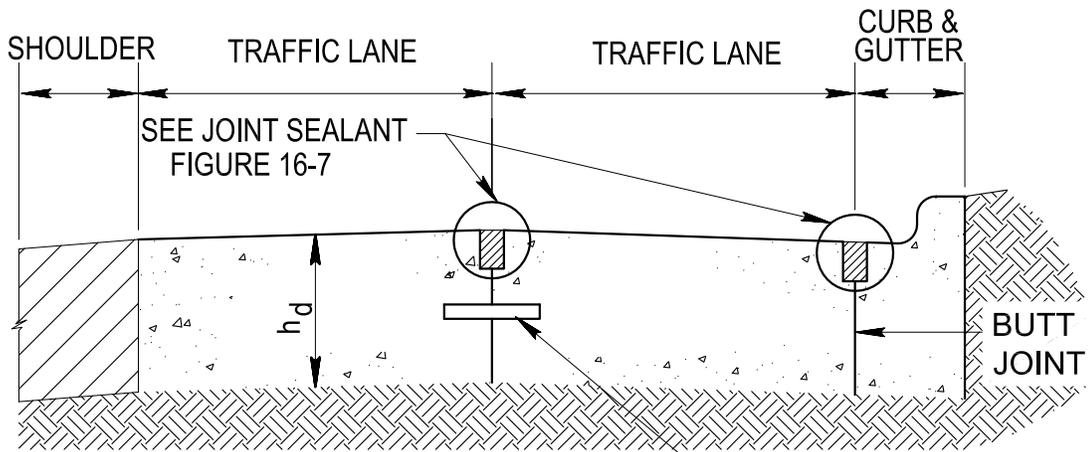


**DETAIL B**



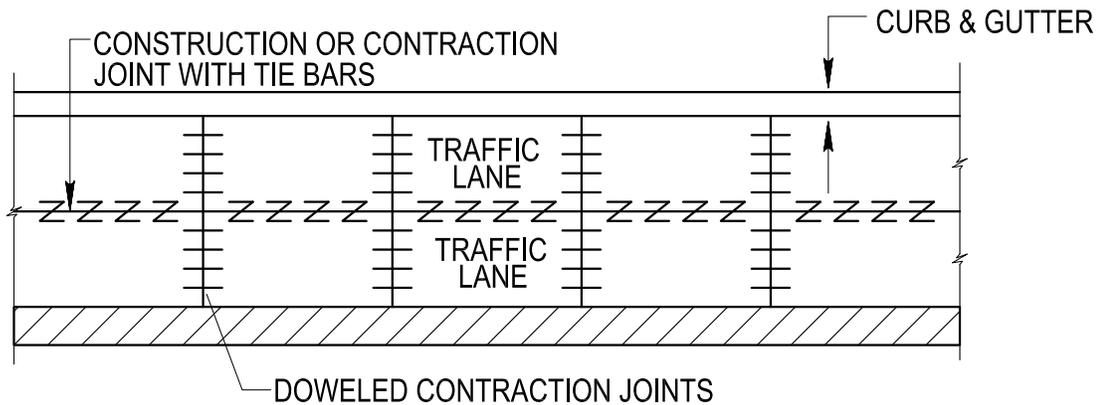
**DETAIL C**

NOT TO SCALE



BUTT CONSTRUCTION JOINT WITH TIE BARS OR  
CONTRACTION JOINT WITH TIE BARS

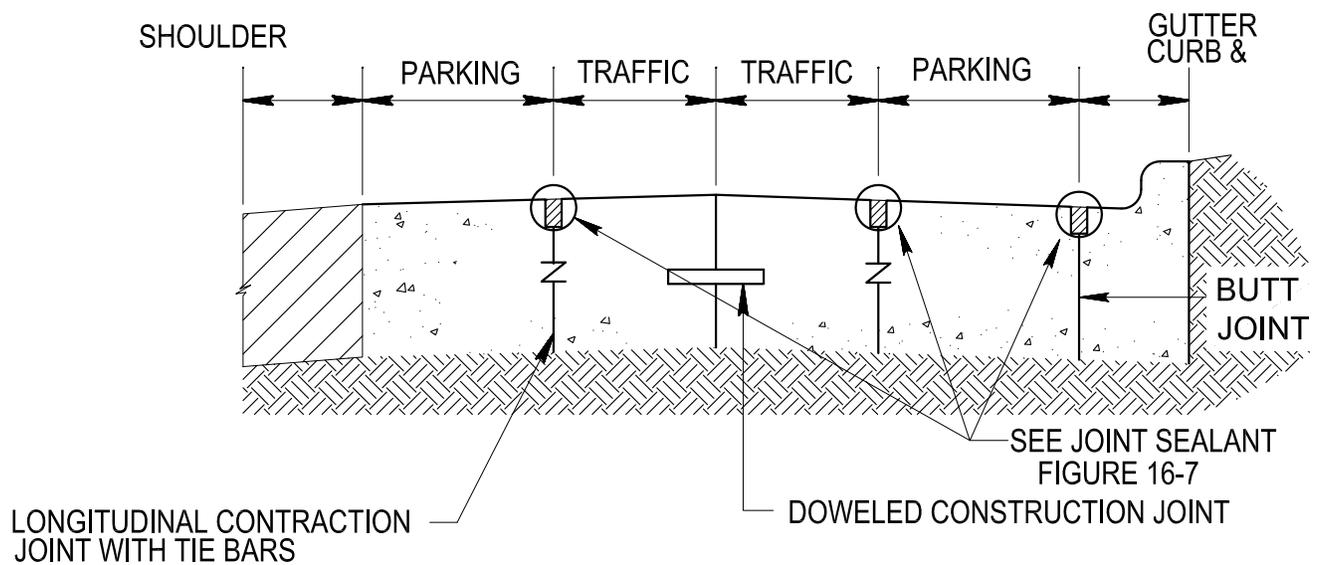
**CROSS - SECTION**



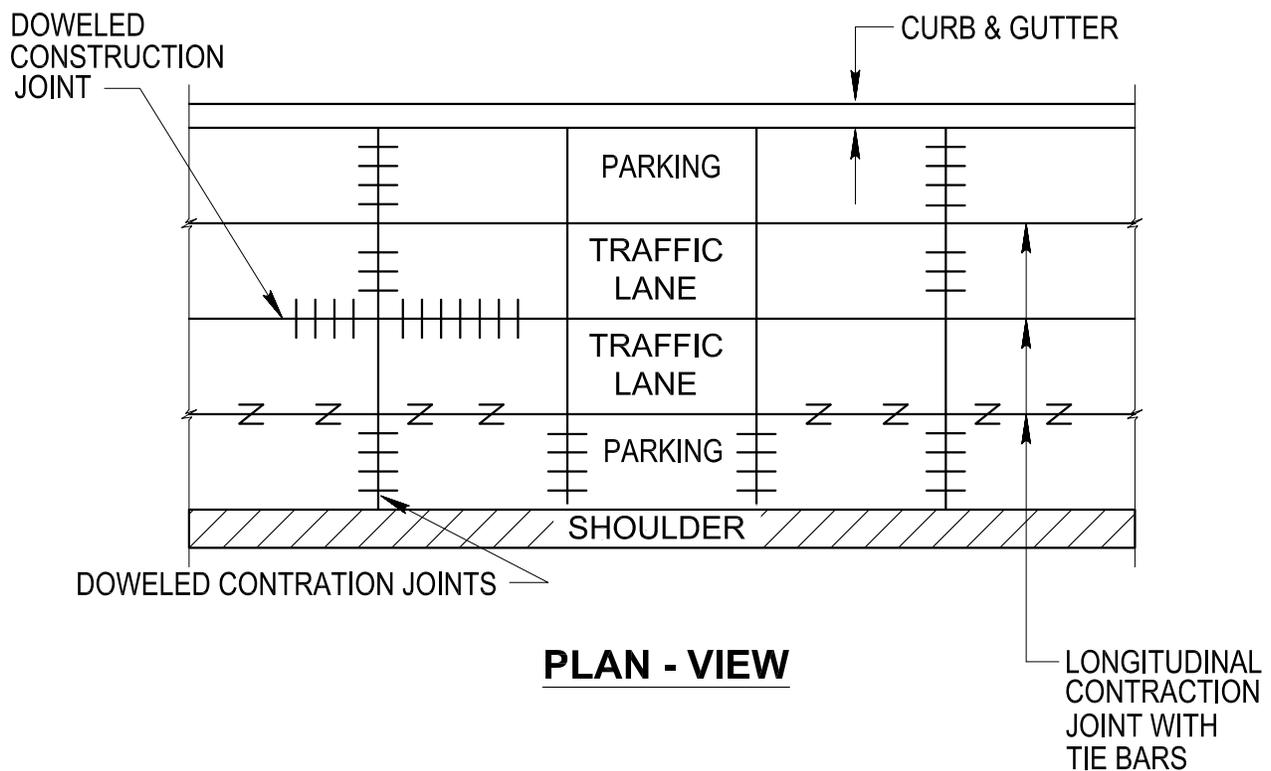
**PLAN - VIEW**

- DOWELS: NO. 5 PLAIN STEEL BARS  
30" IN LENGTH, AND SPACED ON 30" CENTERS
- ≧ TIE BARS: NO. 5 DEFORMED STEEL BARS  
30" IN LENGTH, AND SPACED ON  
30" CENTERS

NOT TO SCALE



### CROSS - SECTION



### PLAN - VIEW

- DOWELS: NO. 5 PLAIN STEEL BARS  
30" IN LENGTH, AND SPACED ON 30" CENTERS
- Z TIE BARS: NO. 5 DEFORMED STEEL BARS  
30" IN LENGTH, AND SPACED ON 30" CENTERS

NOT TO SCALE

EXPANSION JOINTS WILL BE USED TO PROTECT ABUTTING STRUCTURES OR AT INTERSECTIONS WITH NON-PARALLEL PAVING LANES WHEN NEW PAVEMENT IS LESS THAN 10" THICK AND PLACED IN COLD WEATHER.

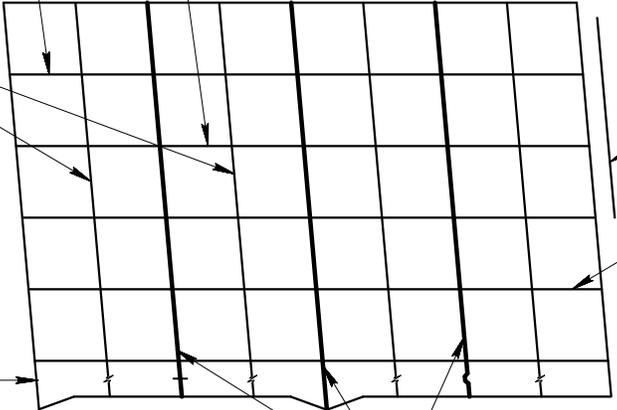
ALL TRANSVERSE CONSTRUCTION JOINTS IN NON-REINFORCED PAVEMENTS TO BE DOWELED BUTT JOINTS.

LAST TRANSVERSE CONTRACTION JOINT IS DOWELED

LONGITUDINAL CONTRACTION JOINTS REQUIRED:  
1. IF PAVING LANE WIDTH EXCEEDS MAXIMUM JOINT SPACING

2. IF 16" OR LESS FROM FREE EDGE OF PAVED AREAS GREATER THAN 100' WIDE, TIE WITH 5/8" DIAMETER 30" LONG DEFORMED TIE BARS.

WHERE PAVEMENT EXTENSION IS FEASIBLE, OUTSIDE EDGES WILL BE DOWELED, THICKENED EDGE OR WITH TIES FOR SLABS LESS THAN 8" THICK.



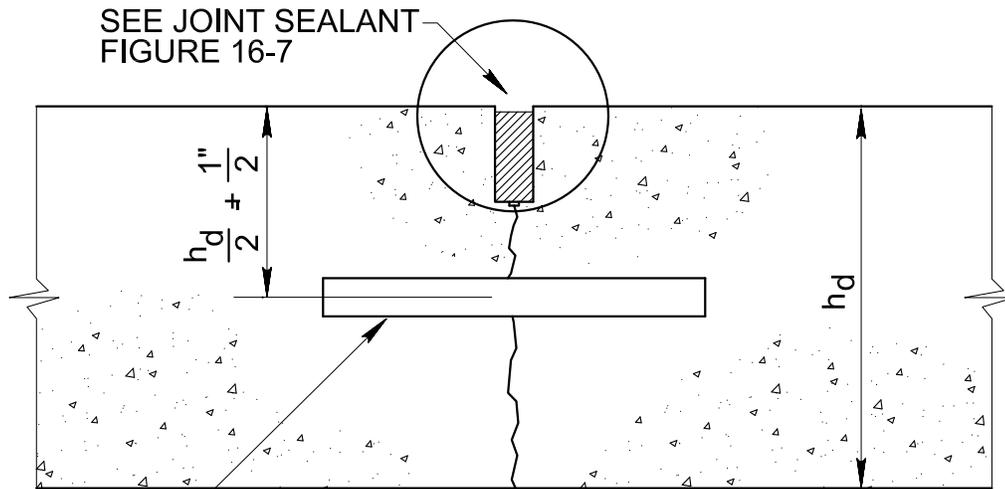
3. TRANSVERSE EXPANSION JOINTS WILL BE DOWELED EXCEPT TRANSVERSE EXPANSION JOINT 75' - 100' BACK FROM EDGE WILL BE USED IF SLIPPAGE AT INTERSECTION IS REQUIRED (SUCH AS AT ANGULAR INTERSECTION OF PAVEMENTS).

2. LONGITUDINAL EXPANSION JOINTS WILL BE THICKENED EDGE.

TRANSVERSE CONTRACTION JOINT SPACING WILL BE MAXIMUM EXCEPT AS REQUIRED TO KEEP SLAB LENGTH LESS THAN OR EQUAL TO 1.25 TIMES SLAB WIDTH. DOWELS MAY BE REQUIRED IF PAVEMENT IS REINFORCED.

LONGITUDINAL CONSTRUCTION JOINTS BETWEEN PAVING LANES: DOWELED THICKENED EDGE, OR KEYED.  
NOTE: IF NON-REINFORCED PAVEMENT IS LESS THAN 9" DO NOT USE KEYED JOINTS.

NOT TO SCALE



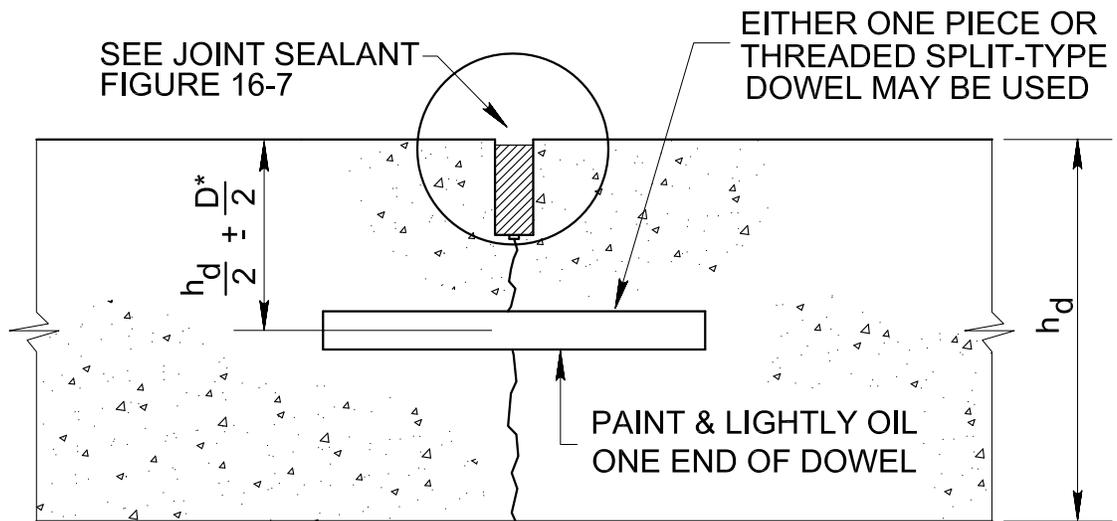
SEE JOINT SEALANT  
FIGURE 16-7

$$\frac{h_d}{2} + 1''$$

$h_d$

NO. 5 DEFORMED STEEL TIE BARS 2'- 6" LONG AND SPACED 2'- 6" ON CENTERS. USED ONLY IN JOINTS 15 FEET OR LESS FROM FREE EDGES OF PAVED AREAS GREATER THAN 100 FEET IN WIDTH.

**LONGITUDINAL**



SEE JOINT SEALANT  
FIGURE 16-7

EITHER ONE PIECE OR  
THREADED SPLIT-TYPE  
DOWEL MAY BE USED

$$\frac{h_d}{2} + \frac{D^*}{2}$$

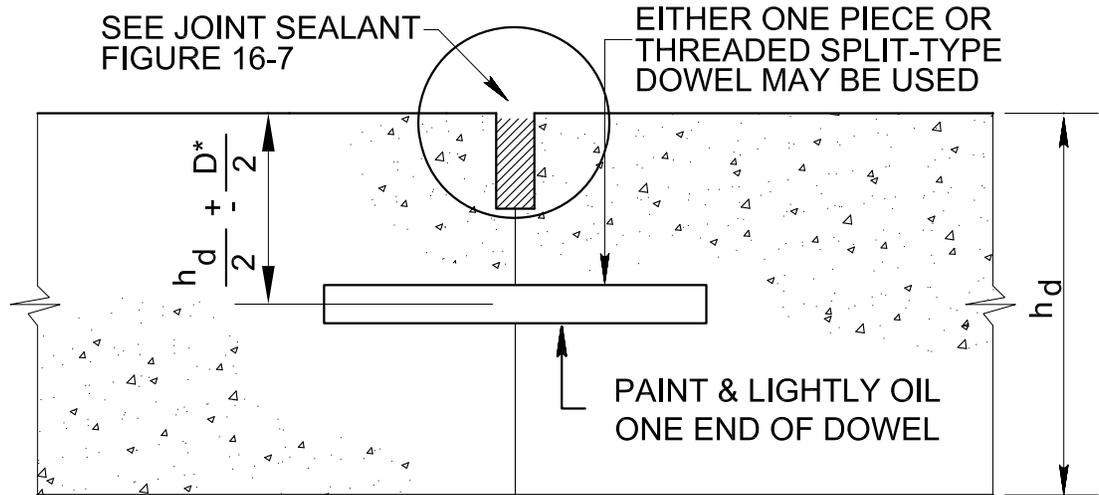
$h_d$

PAINT & LIGHTLY OIL  
ONE END OF DOWEL

D\* DENOTES DOWEL DIAMETER

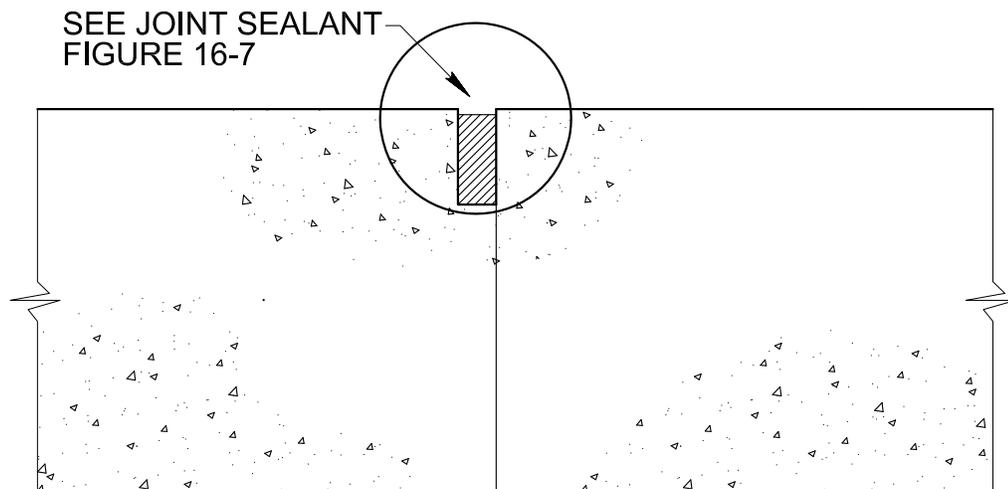
**TRANSVERSE**

NOT TO SCALE



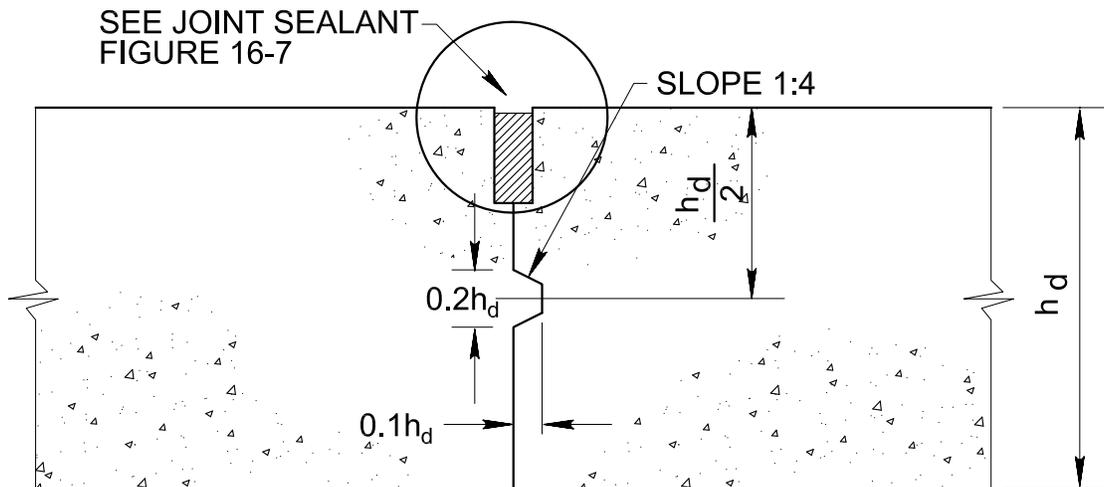
D\* DENOTES DOWEL DIAMETER

**DOWELED TRANSVERSE OR LONGITUDINAL**



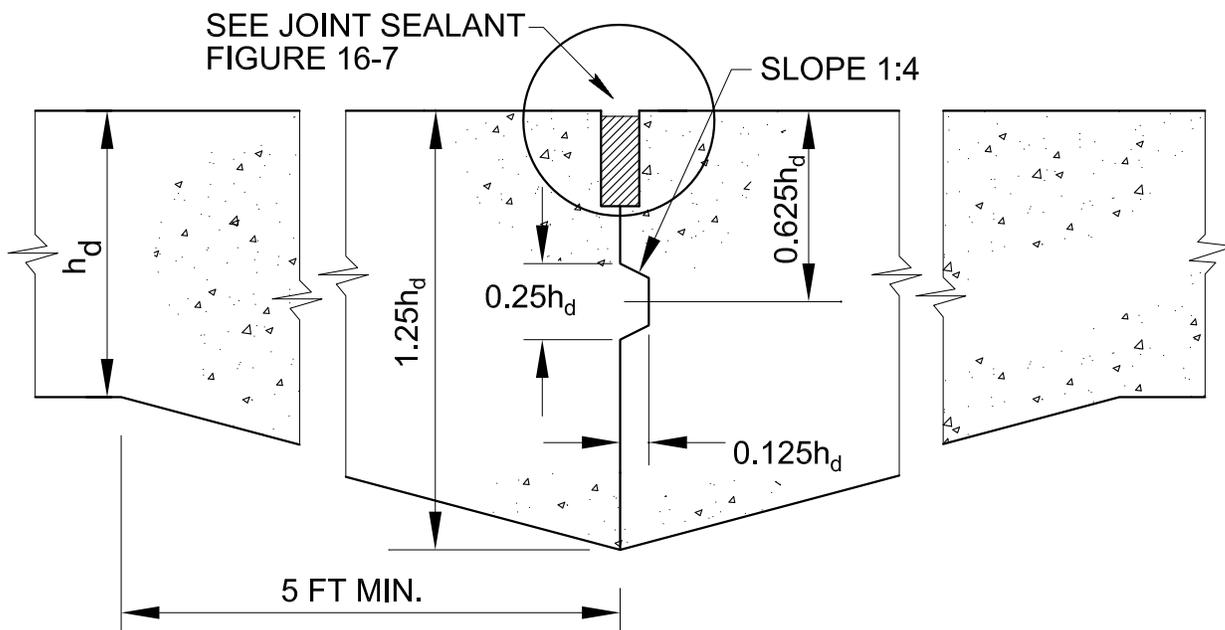
**BUTT JOINT**

NOT TO SCALE



A TOLERANCE OF  $\pm 1/16$ " MAY BE ALLOWED FOR KEY DIMENSIONS AND LOCATION

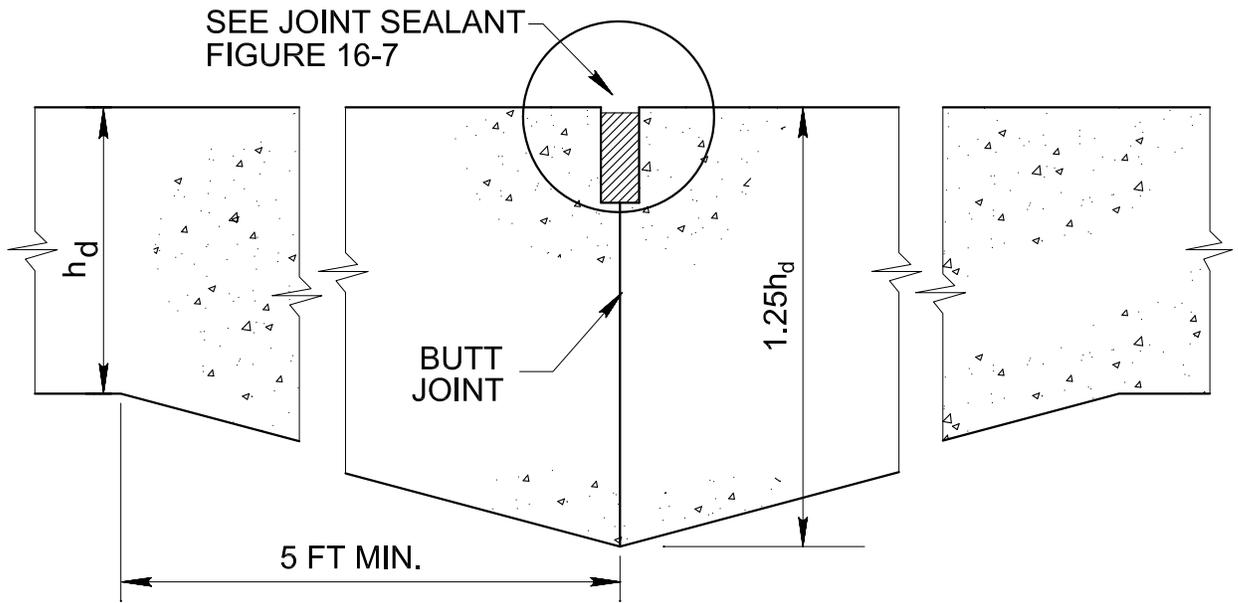
**KEYED LONGITUDINAL**



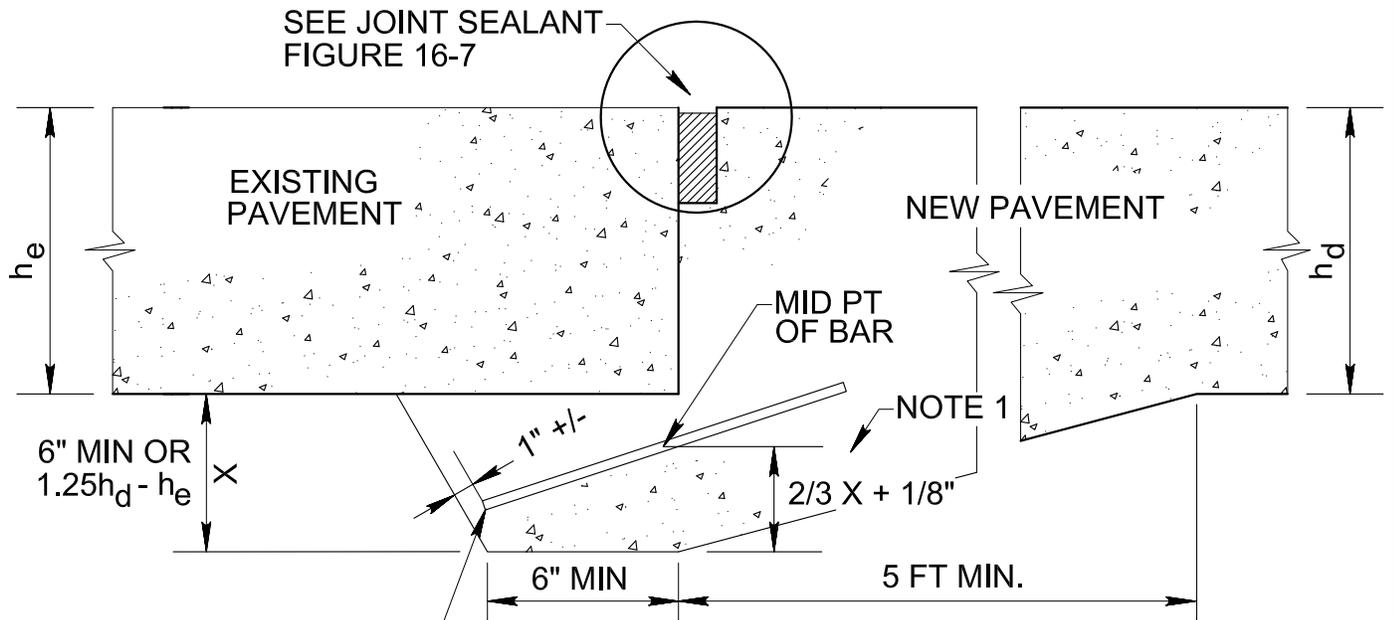
A TOLERANCE OF  $\pm 1/16$ " MAY BE ALLOWED FOR KEY DIMENSIONS AND LOCATION

**KEYED THICKENED EDGE LONGITUDINAL**

NOT TO SCALE



**THICKENED EDGE LONGITUDINAL**

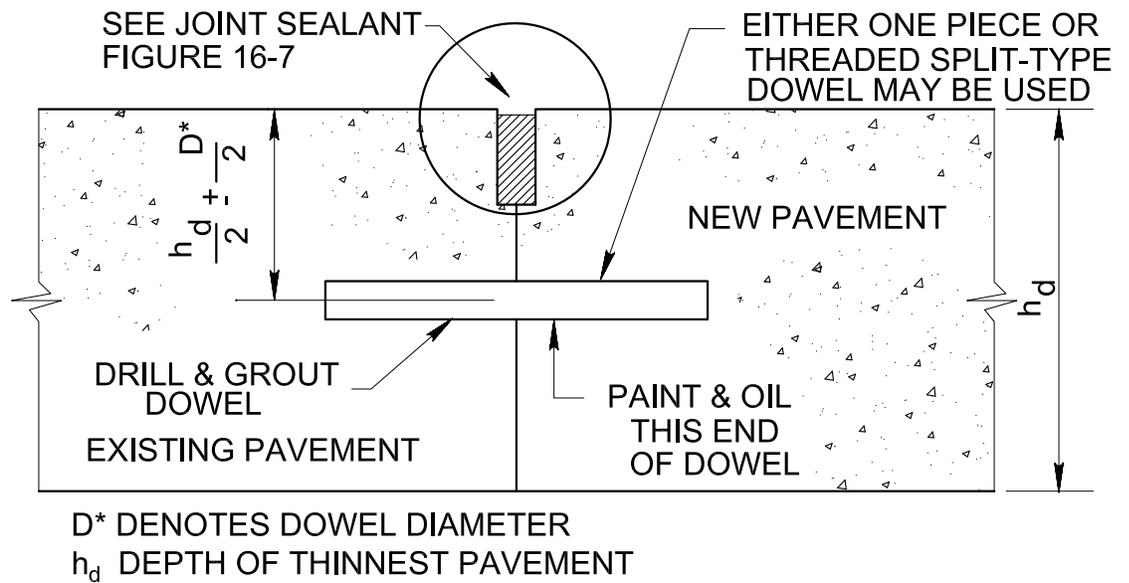


NO. 5 DEFORMED STEEL BARS 2' LONG, SPACED ON 1'-6" CENTERS, AND PLACED PARALLEL TO THICKENED EDGE.

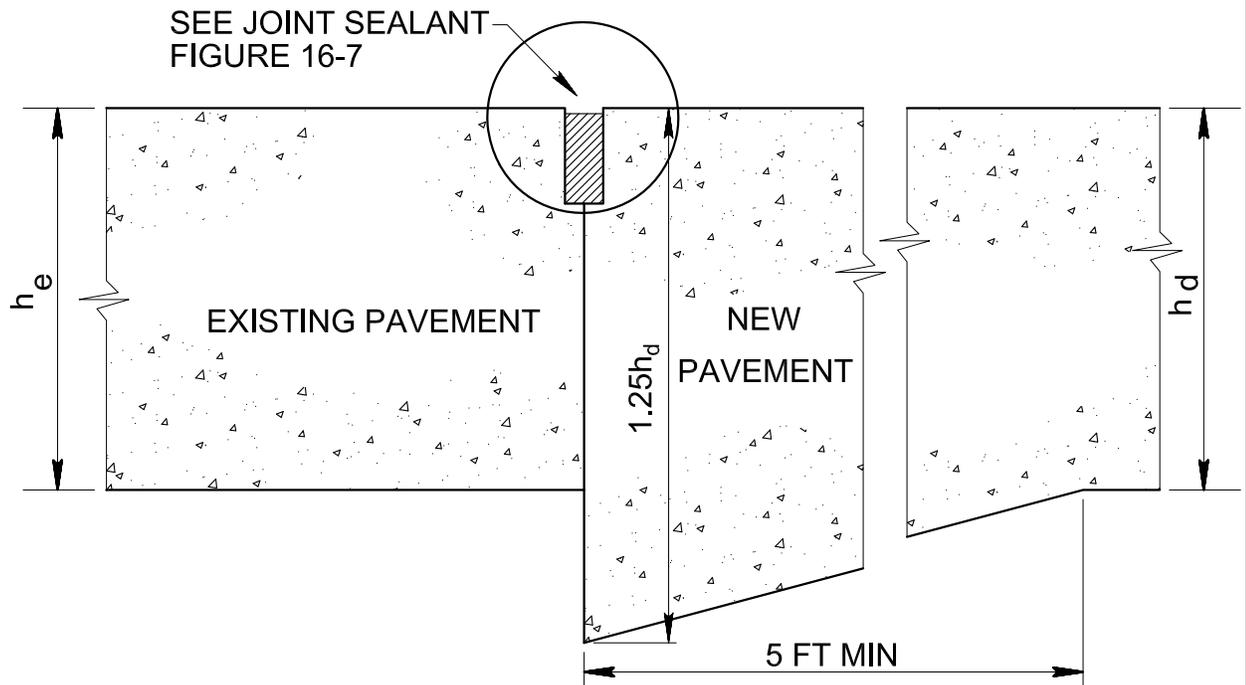
NOTE 1: PLACEMENT AND CONSOLIDATION OF THE NEW CONCRETE UNDER EXISTING PAVEMENT SHOULD BE CARRIED OUT IMMEDIATELY PRIOR TO CONSTRUCTION OF THE NEW PAVEMENT. PLACEMENT OPERATIONS SHOULD BE TIMED SO THAT THE INITIAL CONCRETE IS STILL PLASTIC WHEN THE REMAINDER OF THE CONCRETE PAVEMENT IS PLACED.

**SPECIAL JOINT BETWEEN NEW AND EXISTING PAVEMENT TRANSVERSE AND LONGITUDINAL**

NOT TO SCALE



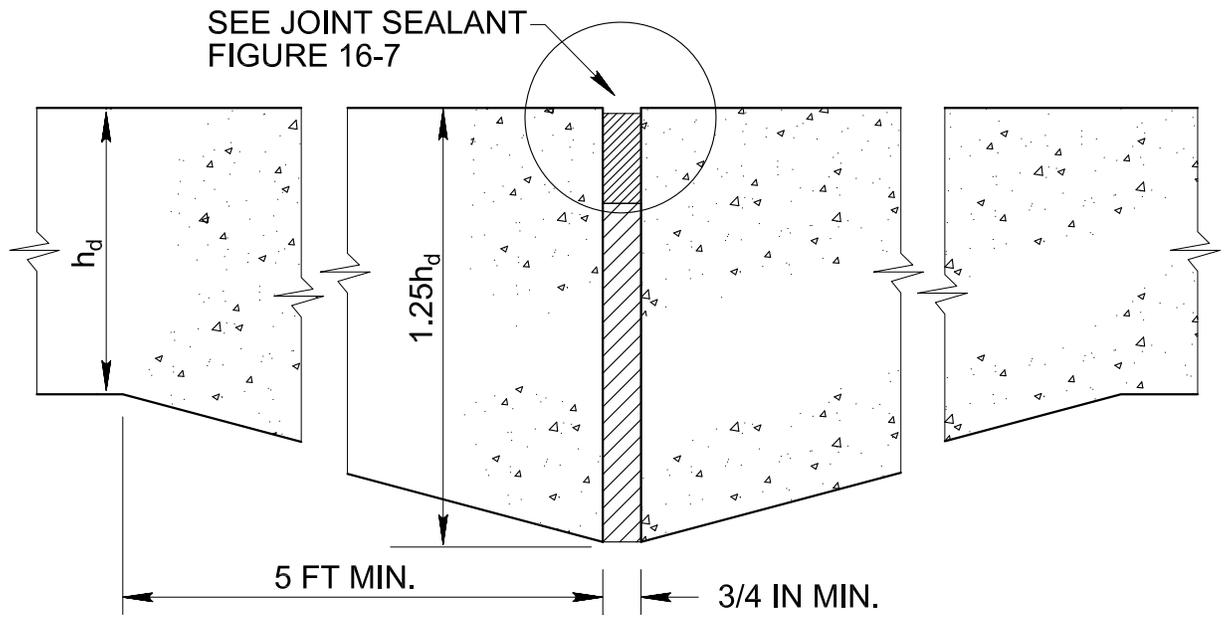
**DOWELED JOINT BETWEEN NEW  
AND EXISTING PAVEMENT**



\* NOTE : THIS TYPE JOINT SHOULD BE USED ONLY WHEN EXISTING PAVEMENT IS TO BE REPLACED IN A SHORT PERIOD OF TIME, SINCE WITHOUT LOAD TRANSFER IT WILL DETERIORATE QUICKLY!

**THICKENED EDGE JOINT BETWEEN  
NEW AND EXISTING PAVEMENT**

NOT TO SCALE



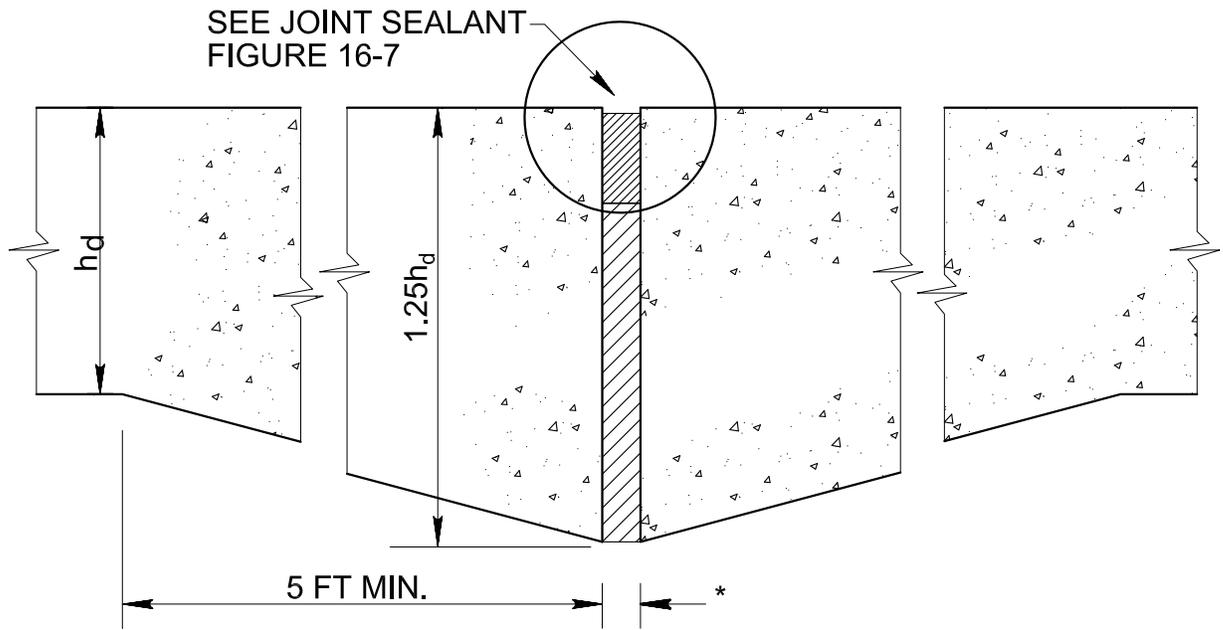
LONGITUDINAL

NOT TO SCALE

EXPANSION JOINTS FOR  
PLAIN CONCRETE PAVEMENTS

DATE  
OCTOBER 2016

FIGURE  
16-5



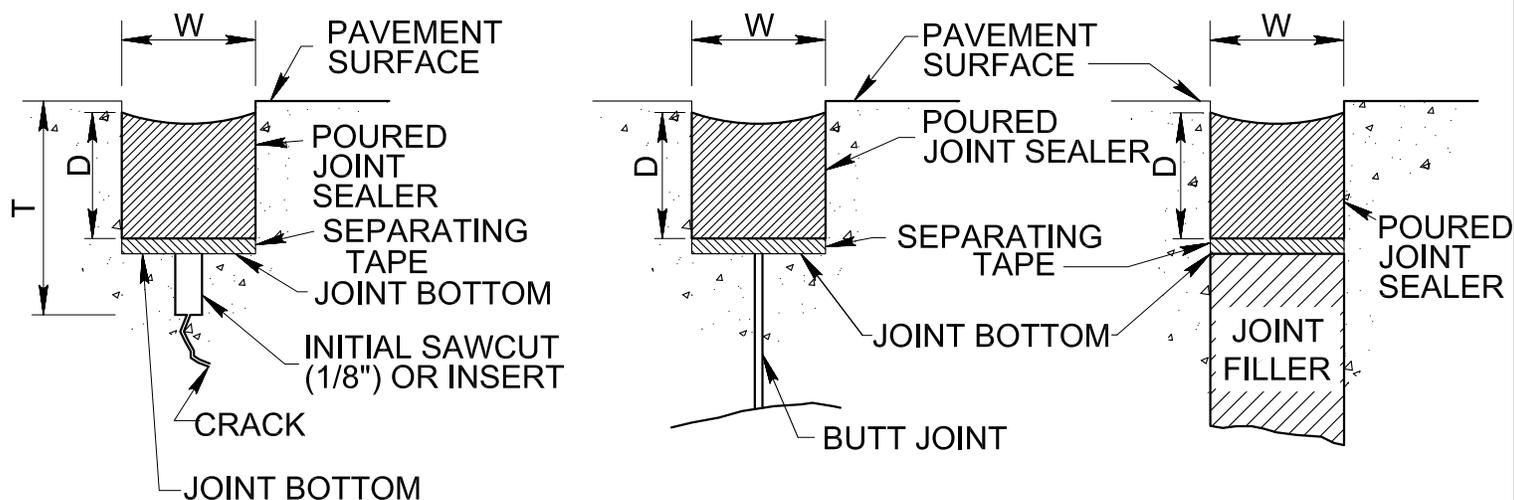
THE BOND-BREAKING MEDIUM WILL BE EITHER A HEAVY COATING OF BITUMINOUS MATERIAL NOT LESS THAN 1/16 INCH IN THICKNESS WHEN JOINTS MATCH OR A NORMAL NONEXTRUDING-TYPE EXPANSION JOINT MATERIAL NOT LESS THAN 1/4-INCH IN THICKNESS WHEN JOINTS DO NOT MATCH.

NOT TO SCALE

THICKENED EDGE SLIP JOINT

DATE  
OCTOBER 2016

FIGURE  
16-6



**CONTRACTION**  
**JOINT**

**CONSTRUCTION**  
**JOINT**

**EXPANSION**  
**JOINT**

W = WIDTH OF SEALANT RESERVOIR (3/4")

D = DEPTH OF SEALANT (1.0 TO 1.5 x W)

T = DEPTH OF INITIAL SAWCUT OR INSERT TYPE JOINT FORMER (CONTRACTION JOINT)

a. 1/4 SLAB THICKNESS FOR PAVEMENTS LESS THAN 12 INCHES

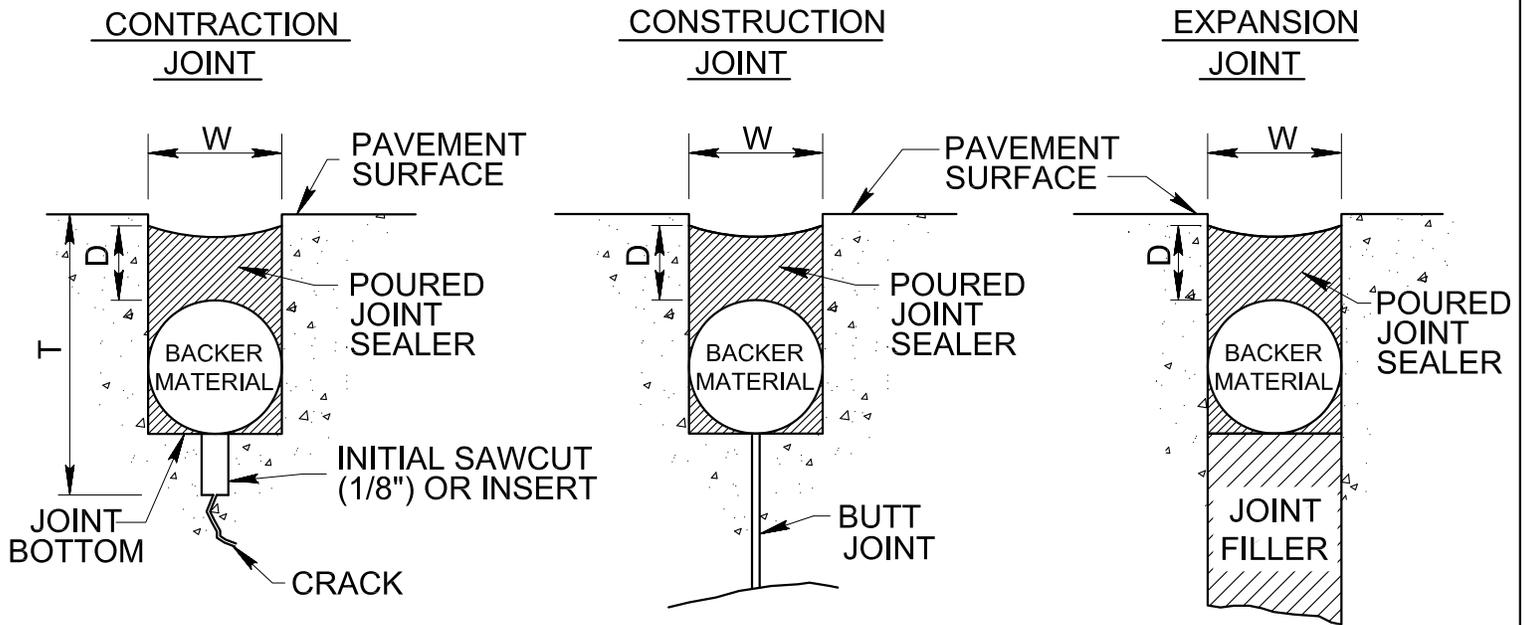
b. 3 INCHES FOR PAVEMENTS 12-18 INCHES \*

c. 1/6 SLAB THICKNESS FOR PAVEMENTS MORE THAN 18 INCHES \*

\* DESIGNER MAY WANT TO CONSIDER REQUIRING 1/4 SLAB THICKNESS

NOTE: TOP OF SEALANT WILL BE 1/8-IN. TO 1/4-IN. BELOW TOP OF PAVEMENT.

NOT TO SCALE



**CONTRACTION  
JOINT**

**CONSTRUCTION  
JOINT**

**EXPANSION  
JOINT**

W = WIDTH OF SEALANT RESERVOIR (3/4")

D = DEPTH OF SEALANT (1.0 TO 1.5 x W)

T = DEPTH OF INITIAL SAWCUT OR INSERT TYPE JOINT FORMER  
(CONTRACTION JOINT)

a. 1/4 SLAB THICKNESS FOR PAVEMENTS LESS THAN 12 INCHES

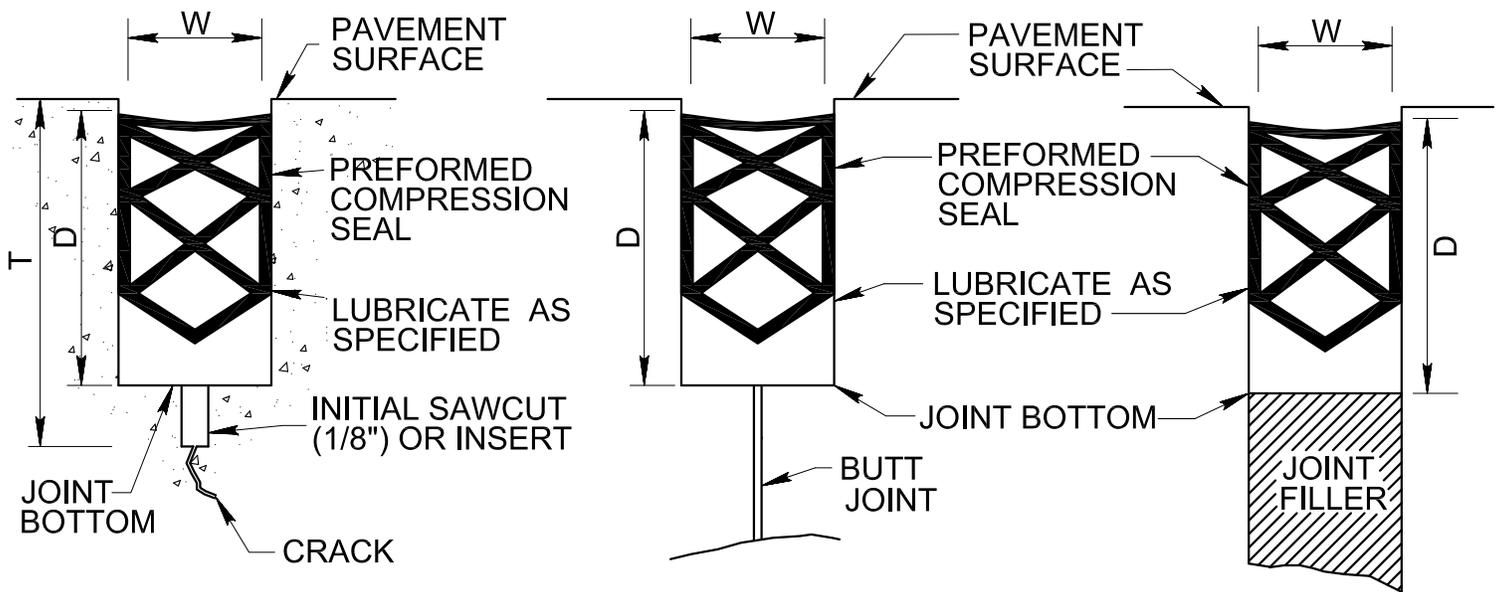
b. 3 INCHES FOR PAVEMENTS 12-18 INCHES \*

c. 1/6 SLAB THICKNESS FOR PAVEMENTS MORE THAN 18 INCHES \*

\* DESIGNER MAY WANT TO CONSIDER REQUIRING 1/4 SLAB THICKNESS

NOTE: TOP OF SEALANT WILL BE 1/8-IN. TO 1/4-IN. BELOW TOP OF PAVEMENT.

NOT TO SCALE



**CONTRACTION**  
**JOINT**

**CONSTRUCTION**  
**JOINT**

**EXPANSION**  
**JOINT**

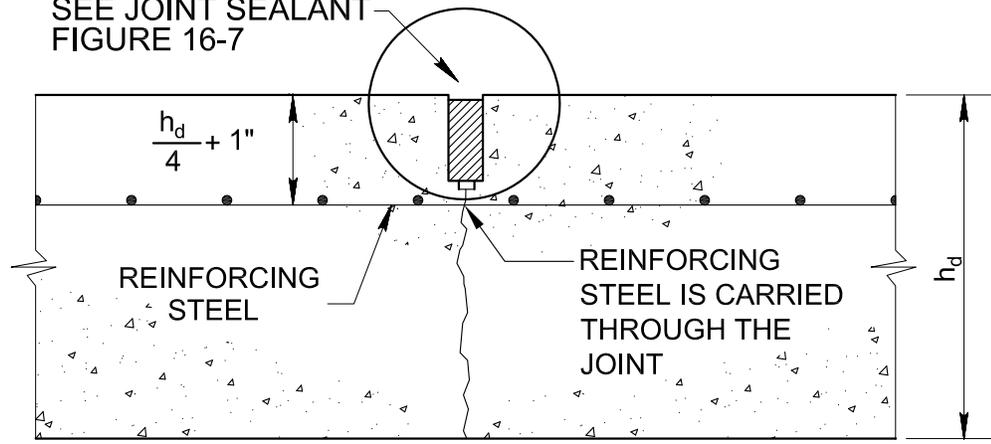
D, W, AND T DIMENSIONS : AS RECOMMENDED BY MANUFACTURER  
 D = 1.5 INCHES MINIMUM  
 W = 3/4 INCHES MINIMUM

TOP OF PREFORMED SEAL WILL BE 1/8 - 1/4 INCH BELOW  
 PAVEMENT SURFACE

COMPRESSION SEAL MUST BE IN COMPRESSION AT ALL TIMES.

NOT TO SCALE

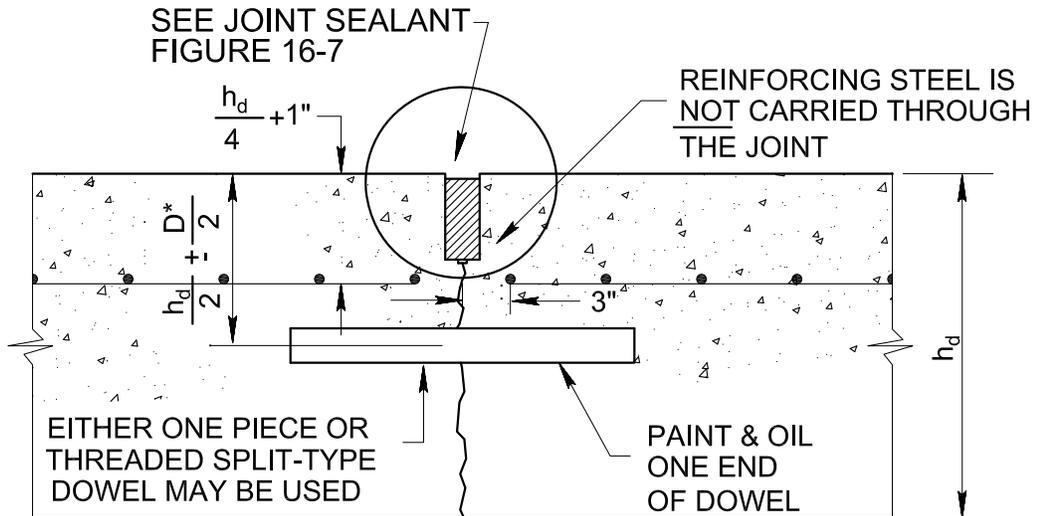
SEE JOINT SEALANT  
FIGURE 16-7



NOTE: SAW CUT WILL NOT EXTEND BELOW THE REINFORCING STEEL.

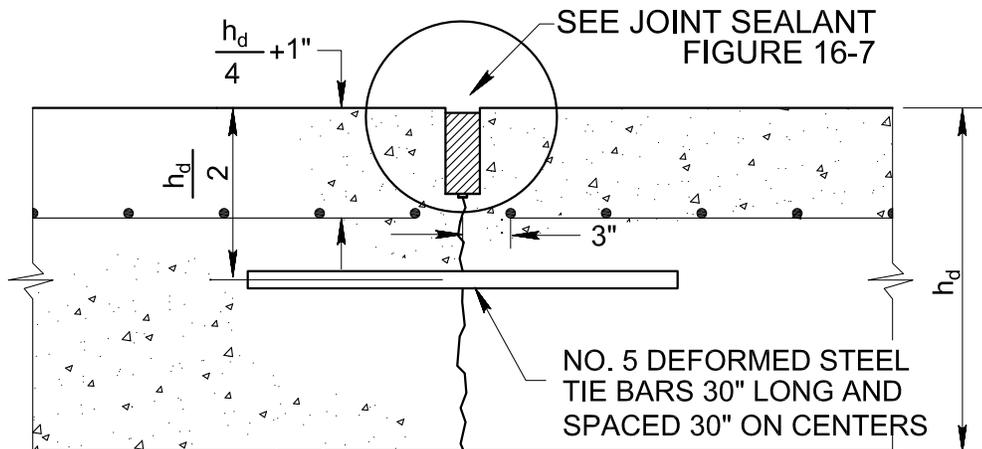
**LONGITUDINAL**

SEE JOINT SEALANT  
FIGURE 16-7



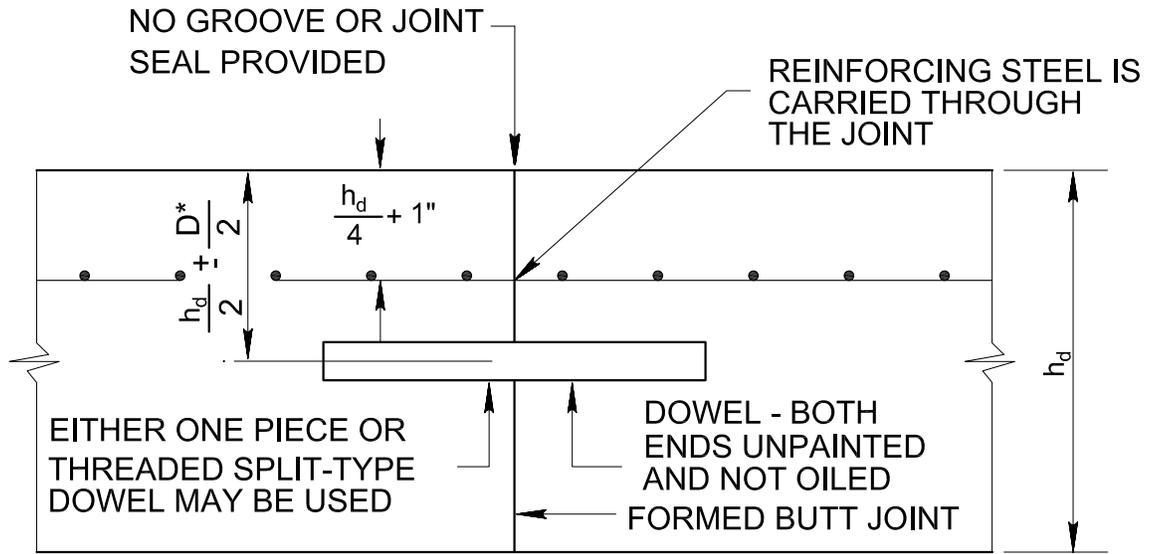
D\* DENOTES DOWEL DIAMETER

**TRANSVERSE**



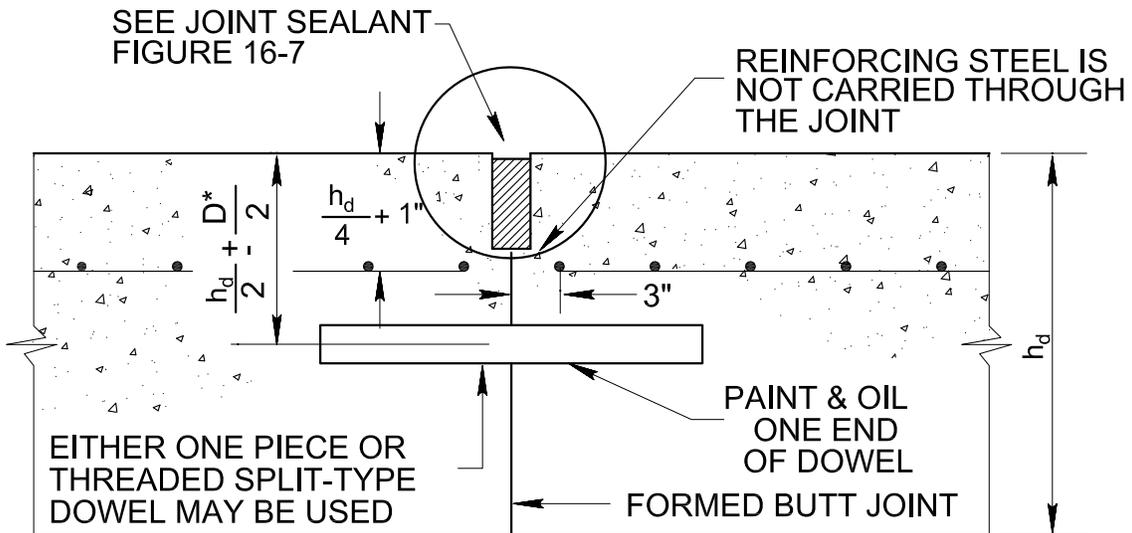
**TIED LONGITUDINAL**

NOT TO SCALE



D\* DENOTES DOWEL DIAMETER

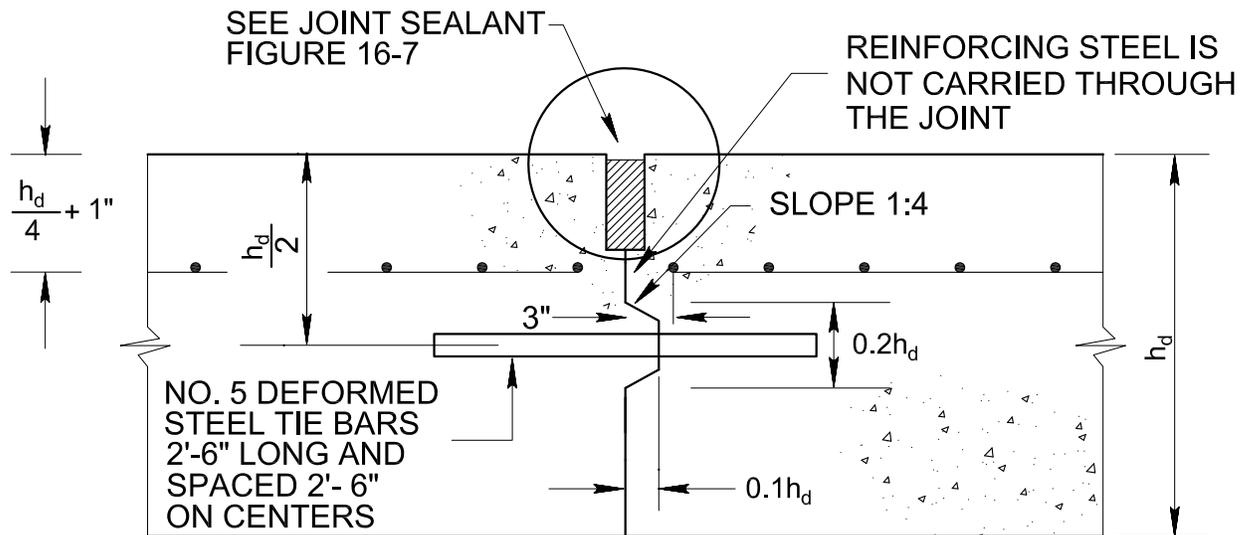
### DOWELED TRANSVERSE



D\* DENOTES DOWEL DIAMETER

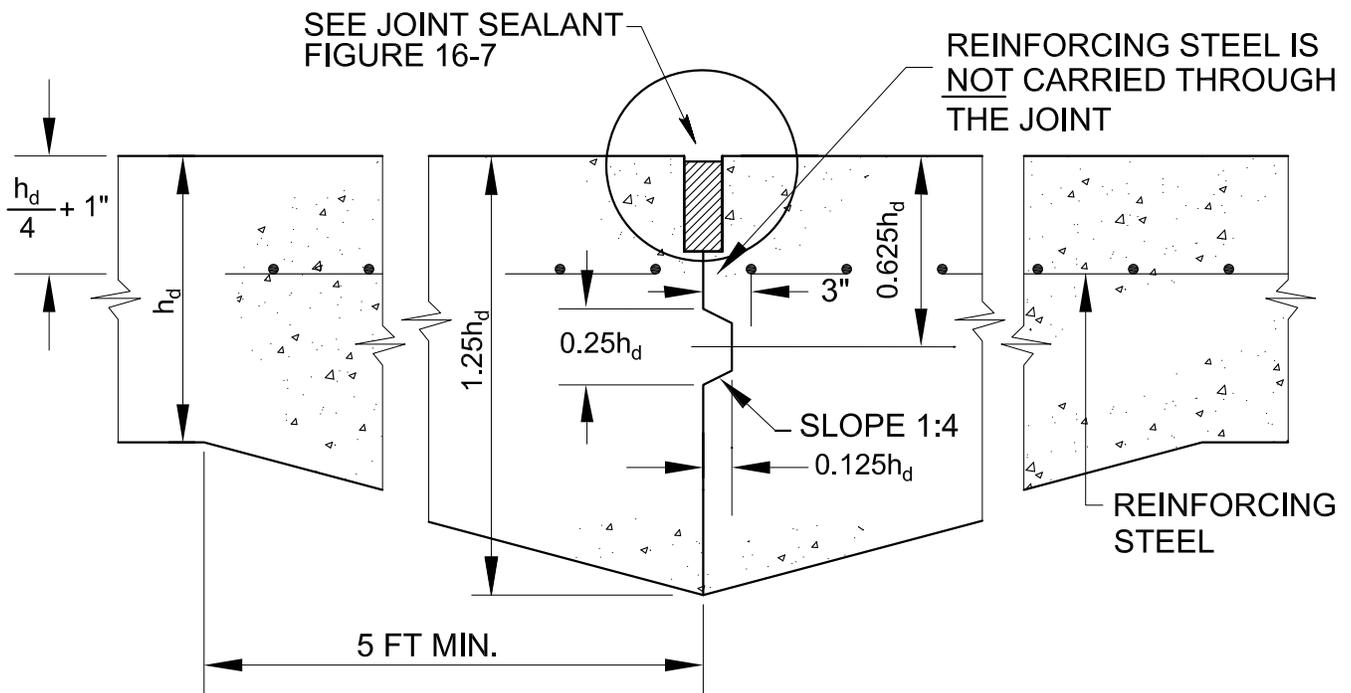
### DOWELED TRANSVERSE OR LONGITUDINAL

NOT TO SCALE



A TOLERANCE OF  $\pm 1/16$ " MAY BE ALLOWED FOR KEY DIMENSIONS AND LOCATION  
 A VERTICAL TOLERANCE OF  $\pm 1/4$ " IS ALLOWED FOR PLACEMENT OF THE TIE BAR

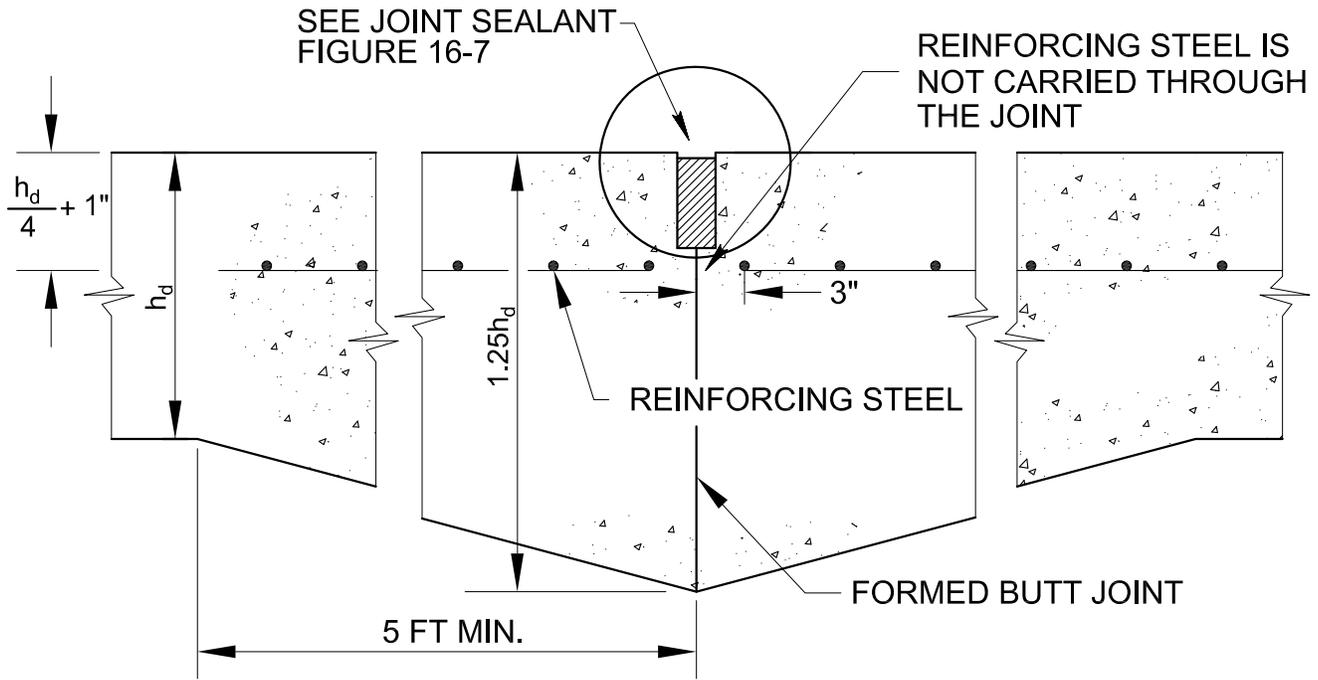
**KEYED AND TIED LONGITUDINAL**



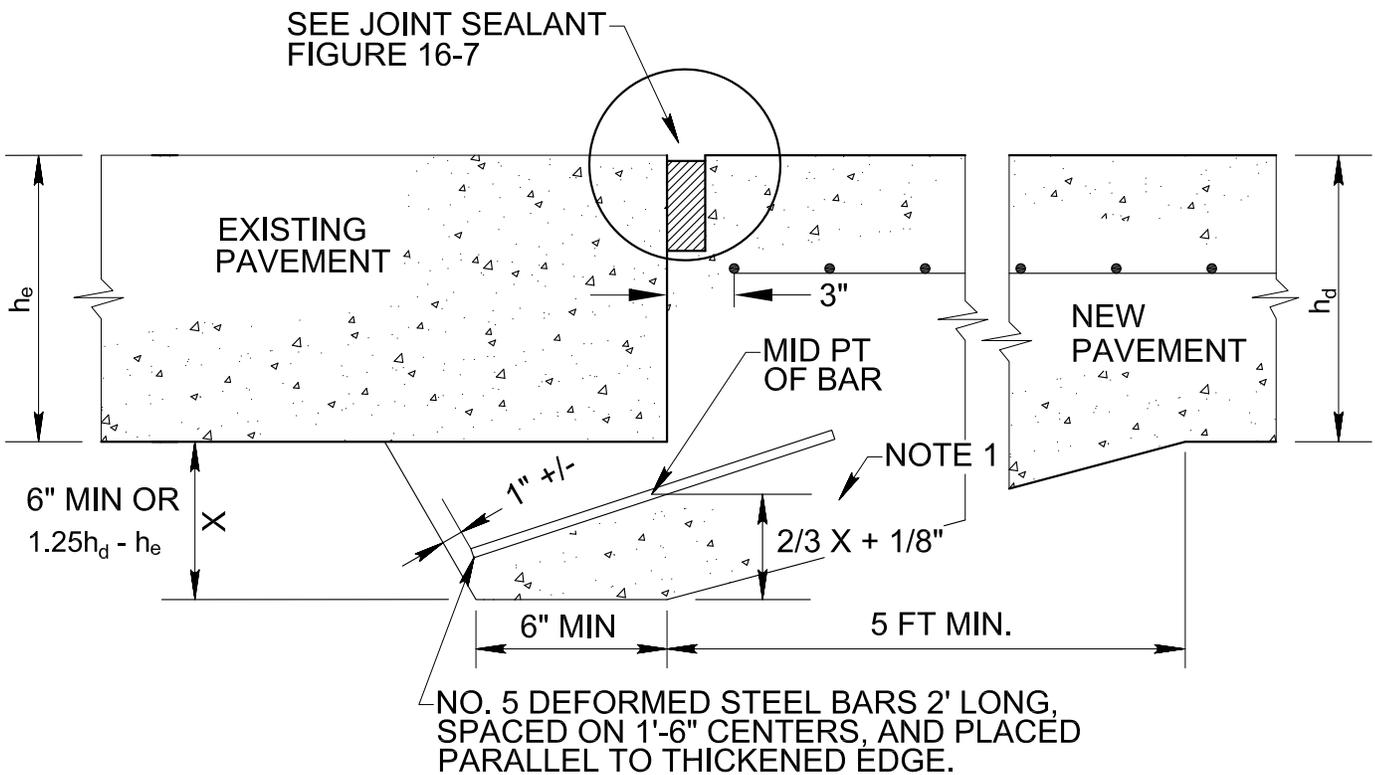
A TOLERANCE OF  $\pm 1/16$ " MAY BE ALLOWED FOR KEY DIMENSIONS AND LOCATION.

**KEYED THICKENED EDGE LONGITUDINAL**

NOT TO SCALE



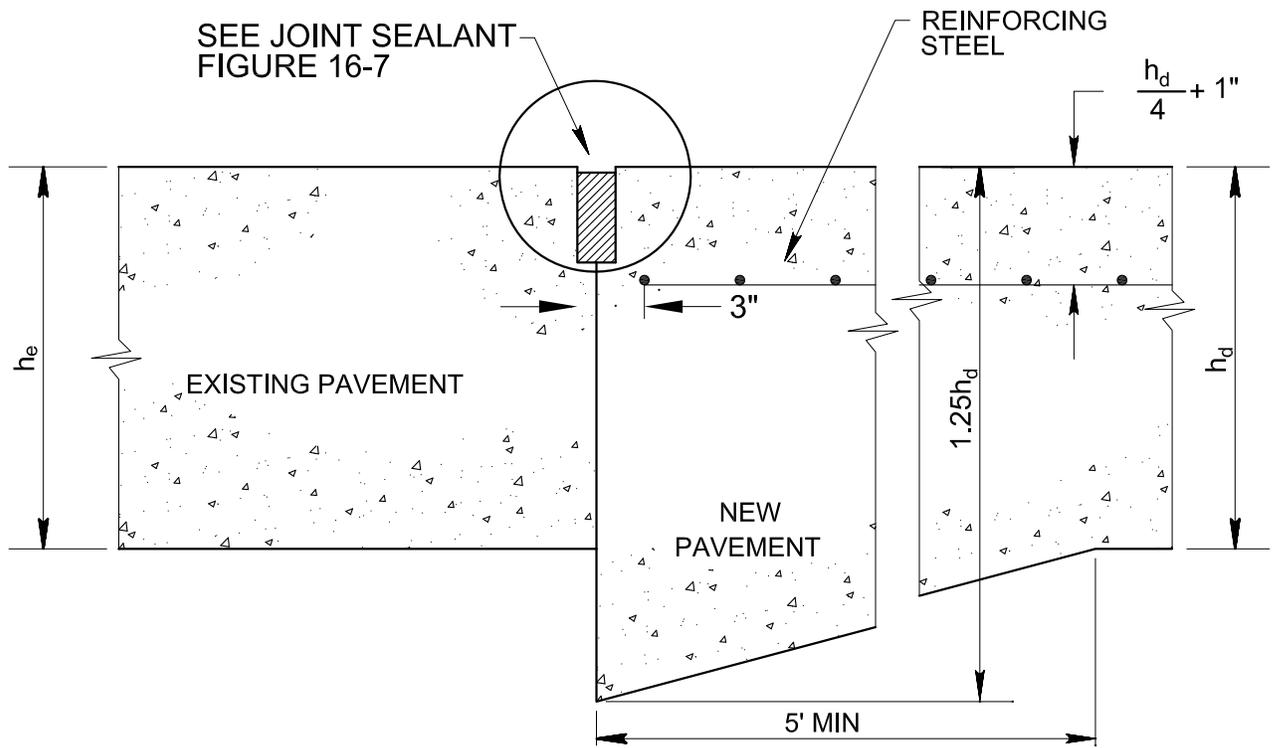
**THICKENED EDGE LONGITUDINAL**



NOTE 1: PLACEMENT AND CONSOLIDATION OF THE NEW CONCRETE UNDER EXISTING PAVEMENT SHOULD BE CARRIED OUT IMMEDIATELY PRIOR TO CONSTRUCTION OF THE NEW PAVEMENT. PLACEMENT OPERATIONS SHOULD BE TIMED SO THAT THE INITIAL CONCRETE IS STILL PLASTIC WHEN THE REMAINDER OF THE CONCRETE PAVEMENT IS PLACED.

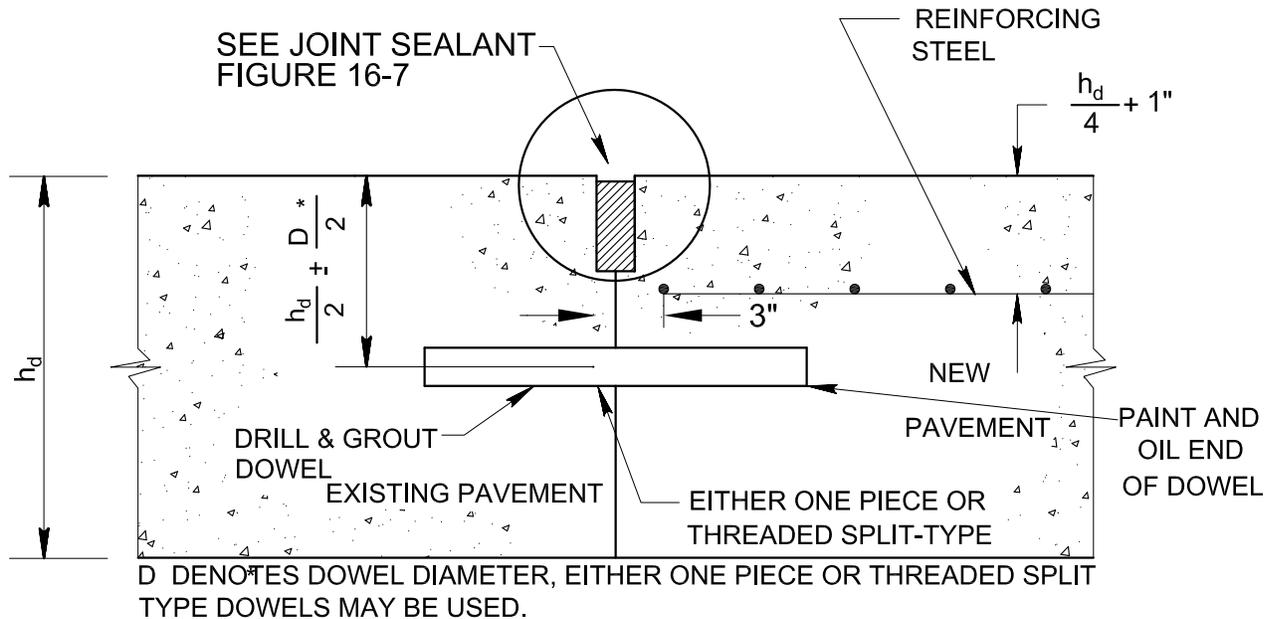
**SPECIAL JOINT BETWEEN NEW AND EXISTING PAVEMENT  
TRANSVERSE AND LONGITUDINAL**

NOT TO SCALE



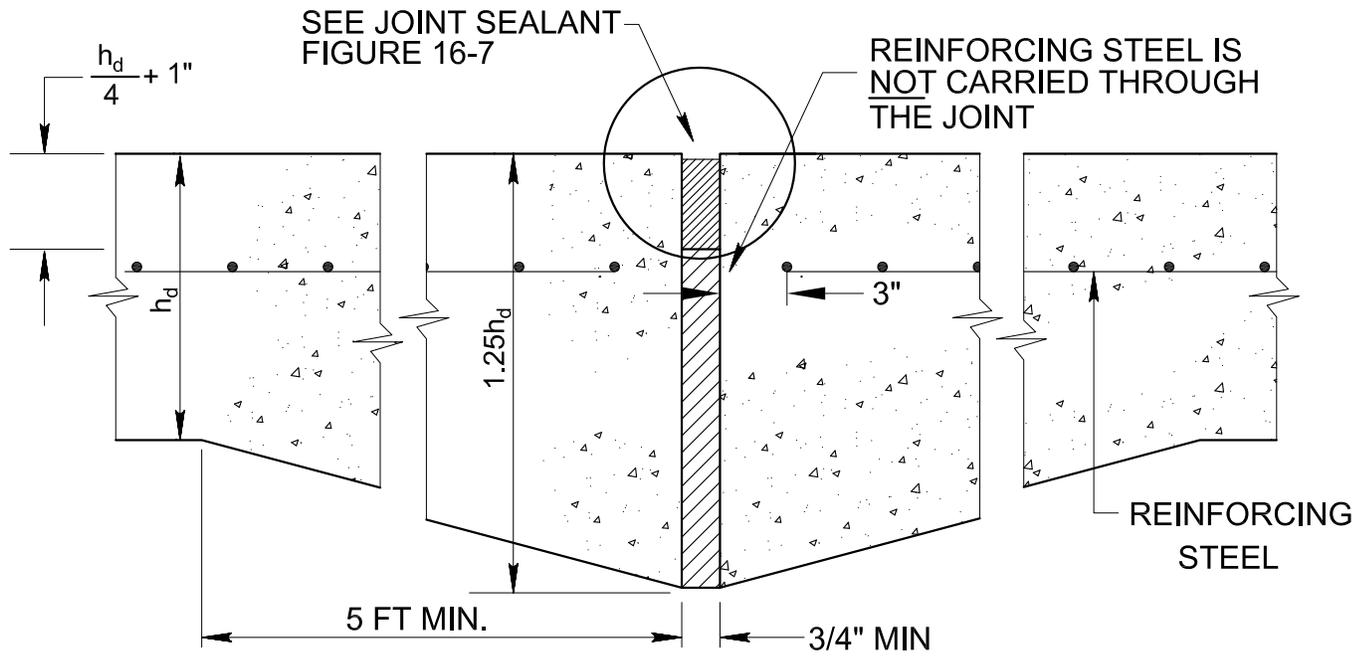
\* NOTE : THIS TYPE JOINT SHOULD BE USED ONLY WHEN EXISTING PAVEMENT IS TO BE REPLACED IN A SHORT PERIOD OF TIME, SINCE WITHOUT LOAD TRANSFER IT WILL DETERIORATE QUICKLY !

### THICKENED EDGE JOINT BETWEEN NEW AND EXISTING PAVEMENT



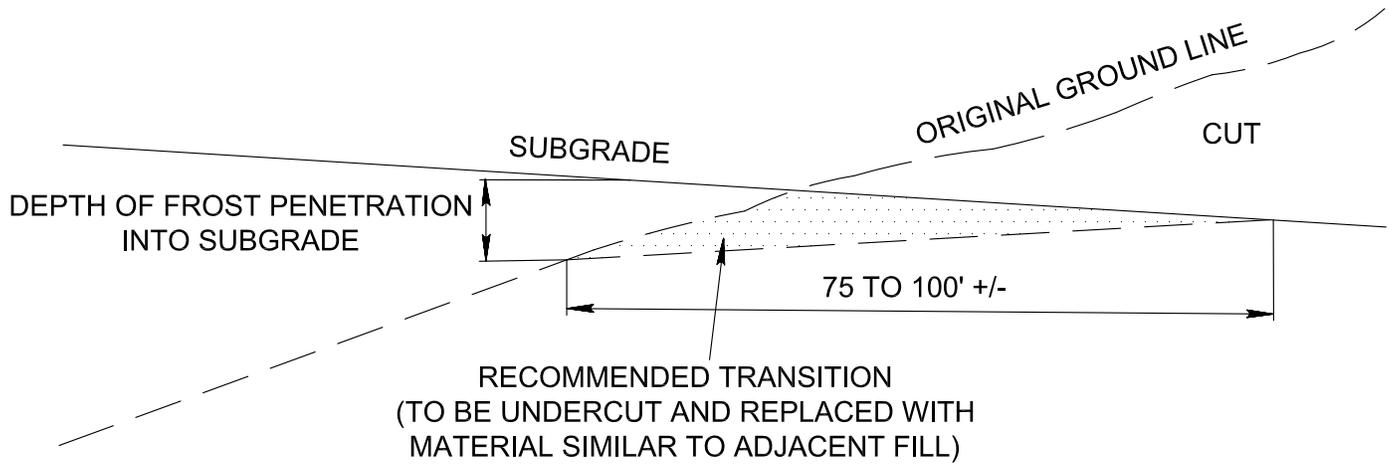
### DOWELED JOINT BETWEEN NEW AND EXISTING PAVEMENT

NOT TO SCALE

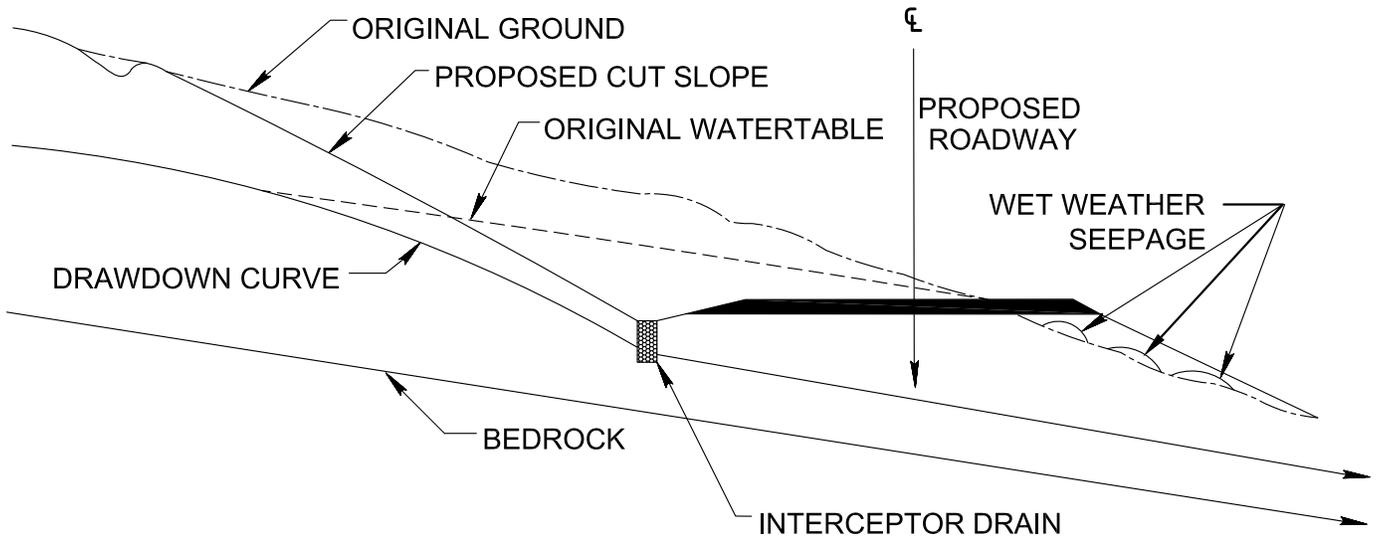


**LONGITUDINAL**

NOT TO SCALE



NOT TO SCALE

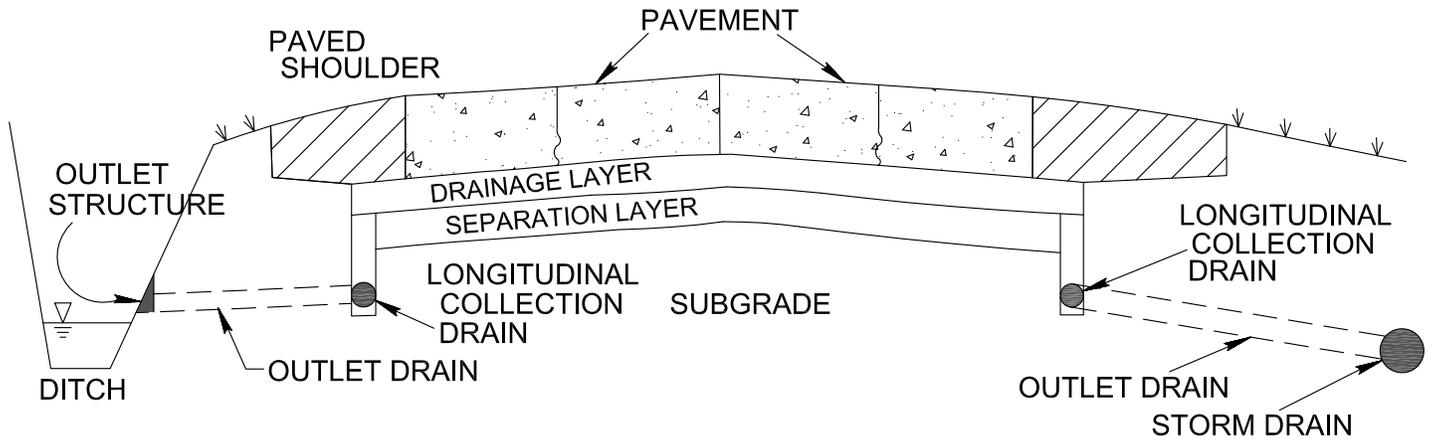


NOT TO SCALE

COLLECTOR DRAIN

DATE  
OCTOBER 2016

FIGURE  
20-1

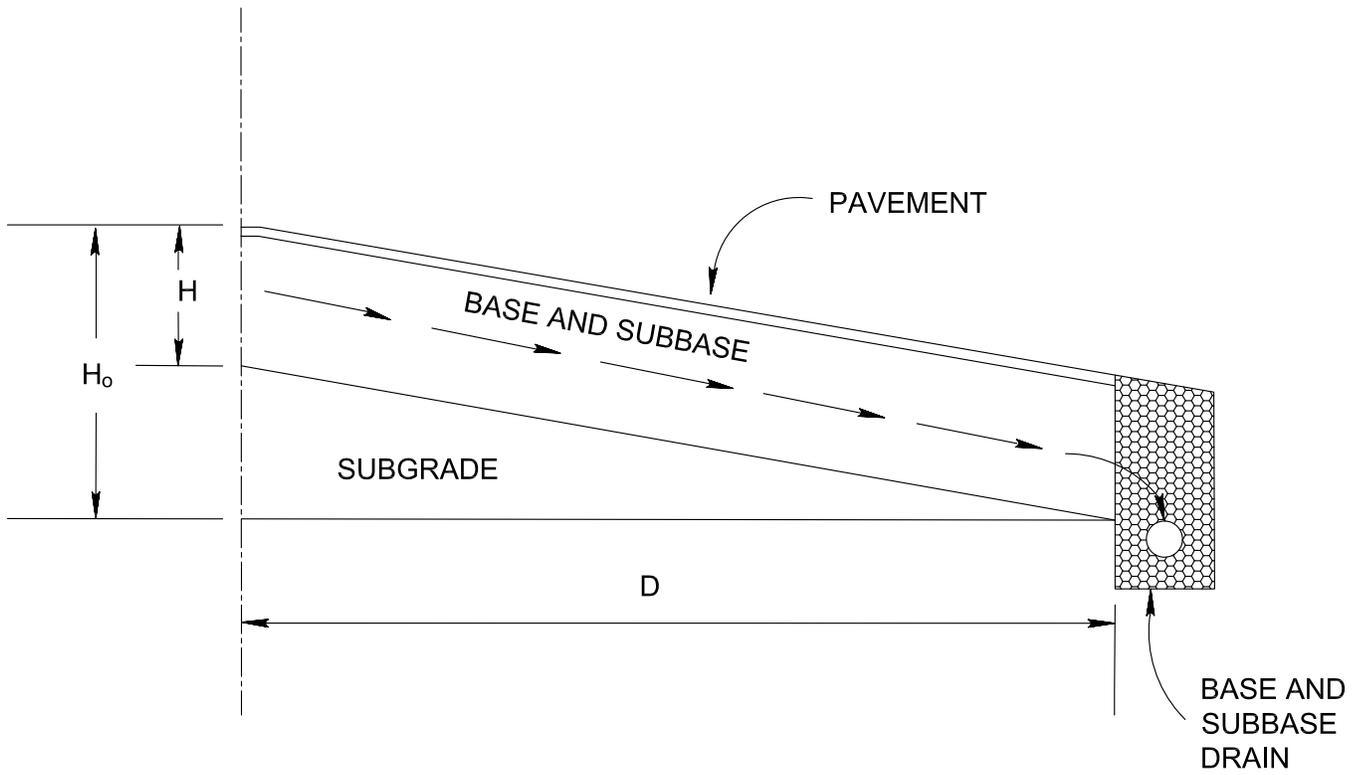


NOT TO SCALE

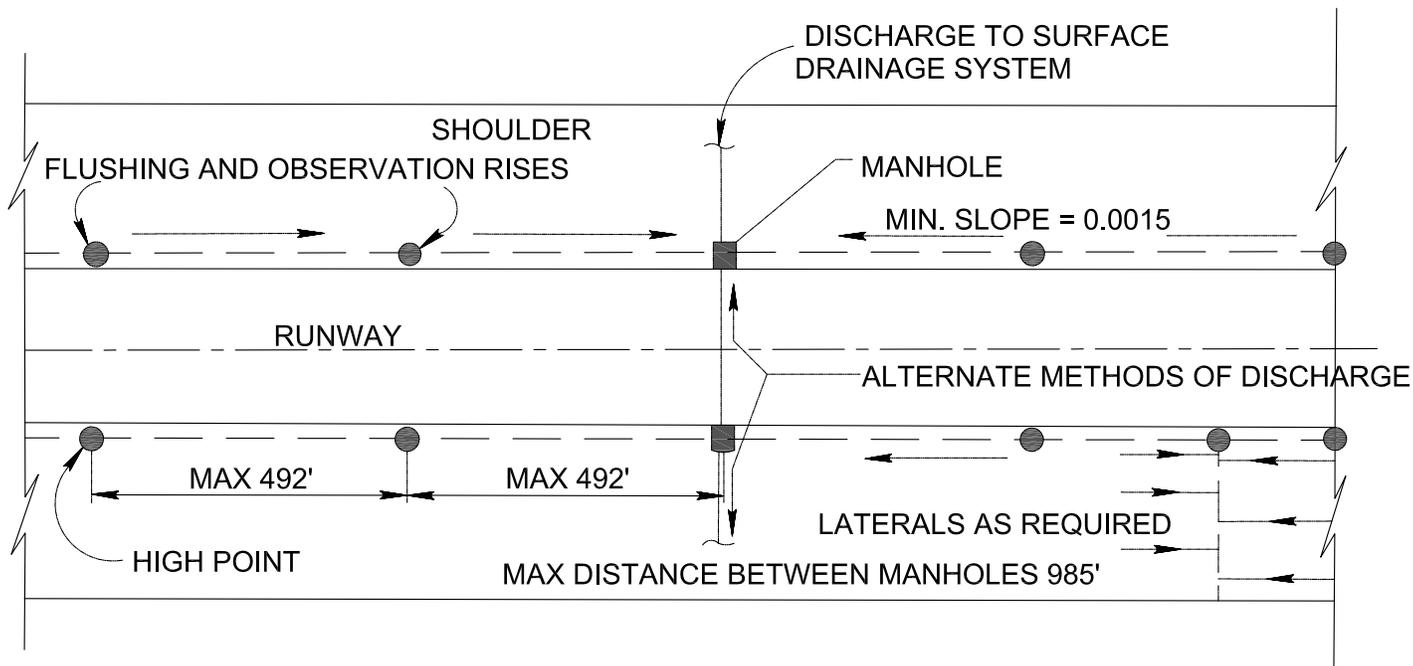
COLLECTOR DRAIN TO INTERCEPT SEEPAGE AND  
LOWER THE GROUNDWATER TABLE

DATE  
OCTOBER 2016

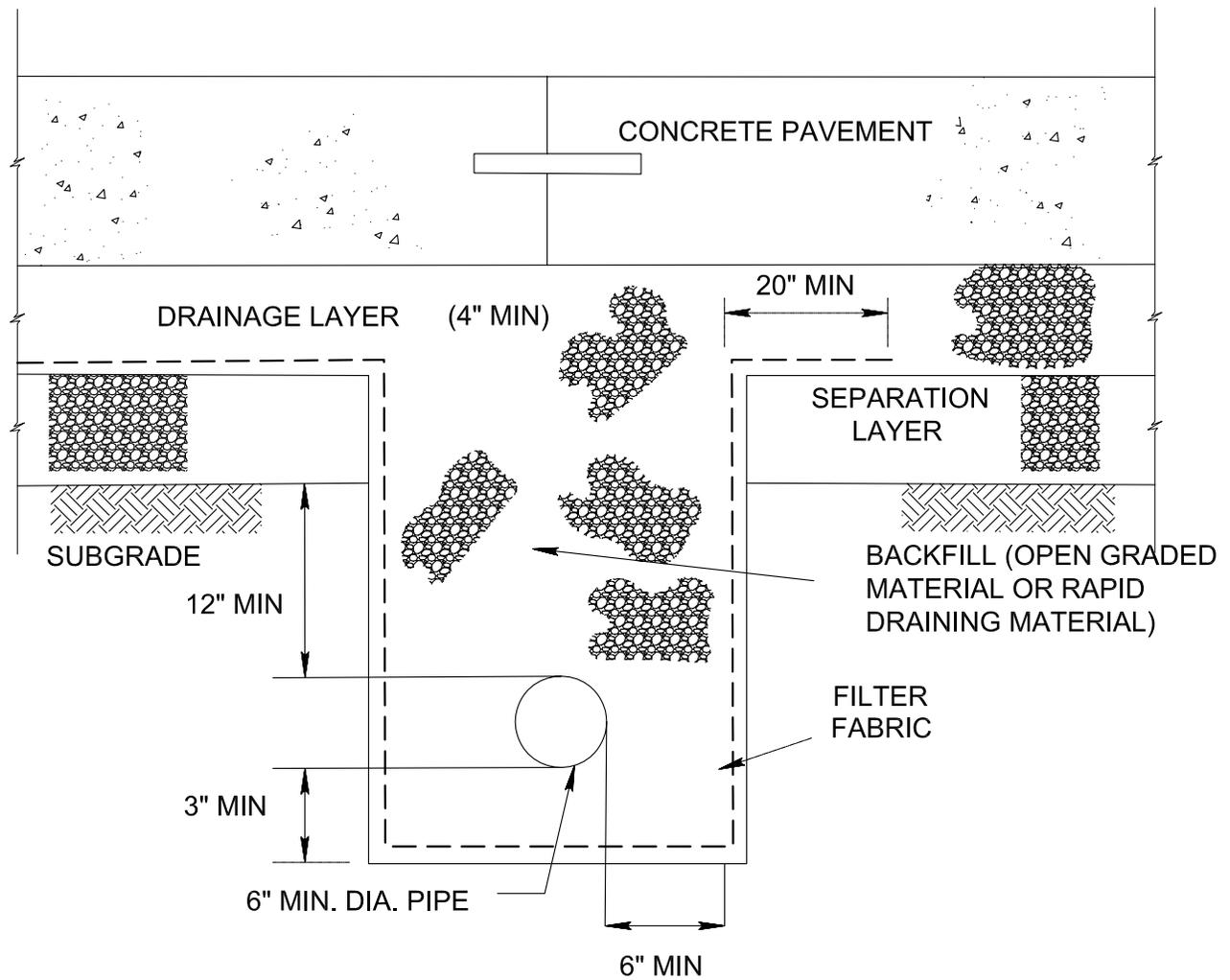
FIGURE  
20-2



NOT TO SCALE



NOT TO SCALE

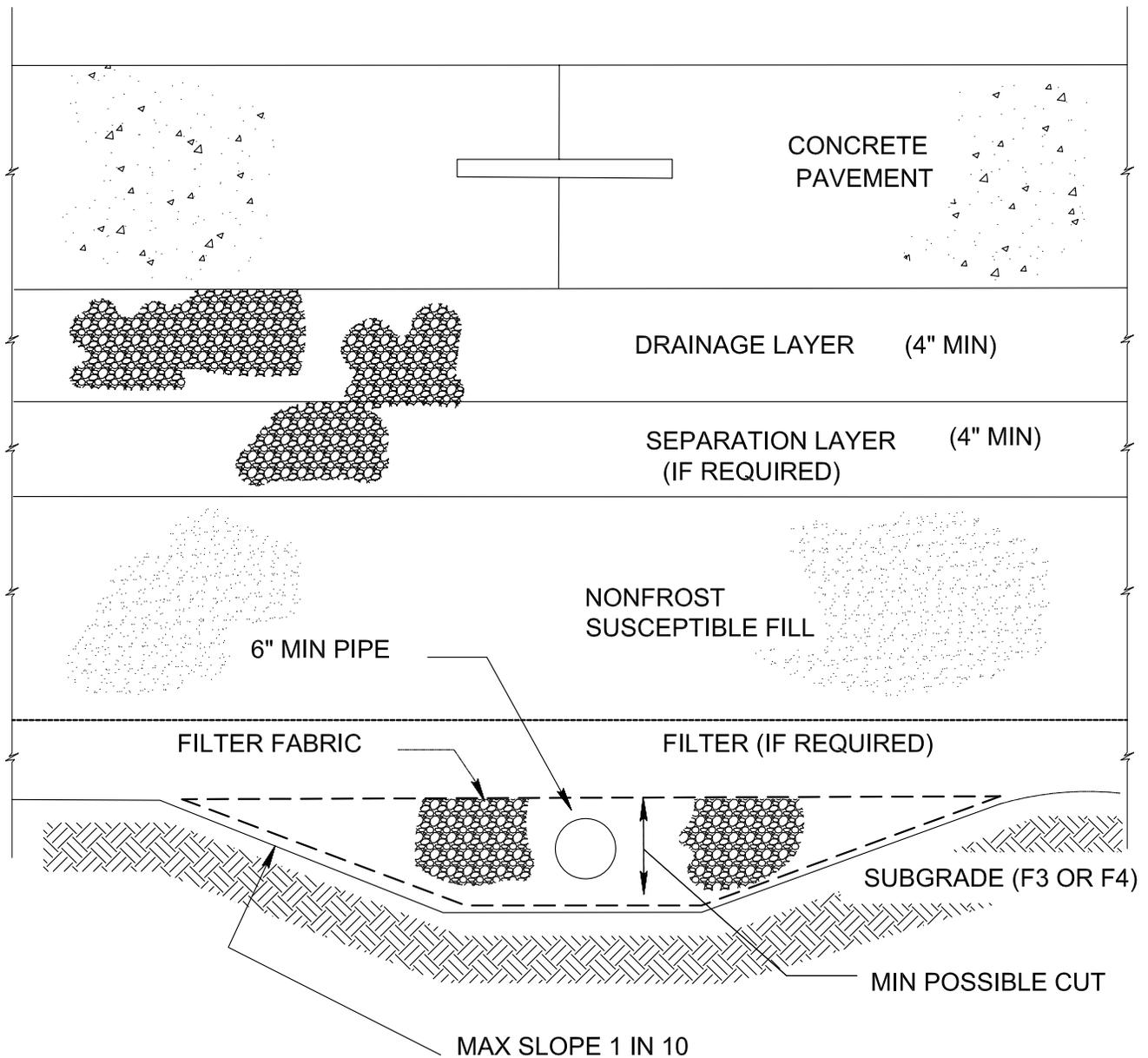


NOT TO SCALE

TYPICAL INTERIOR SUBDRAIN FOR RIGID PAVEMENT  
(NONFROST AREAS)

DATE  
OCTOBER 2016

FIGURE  
20-7A

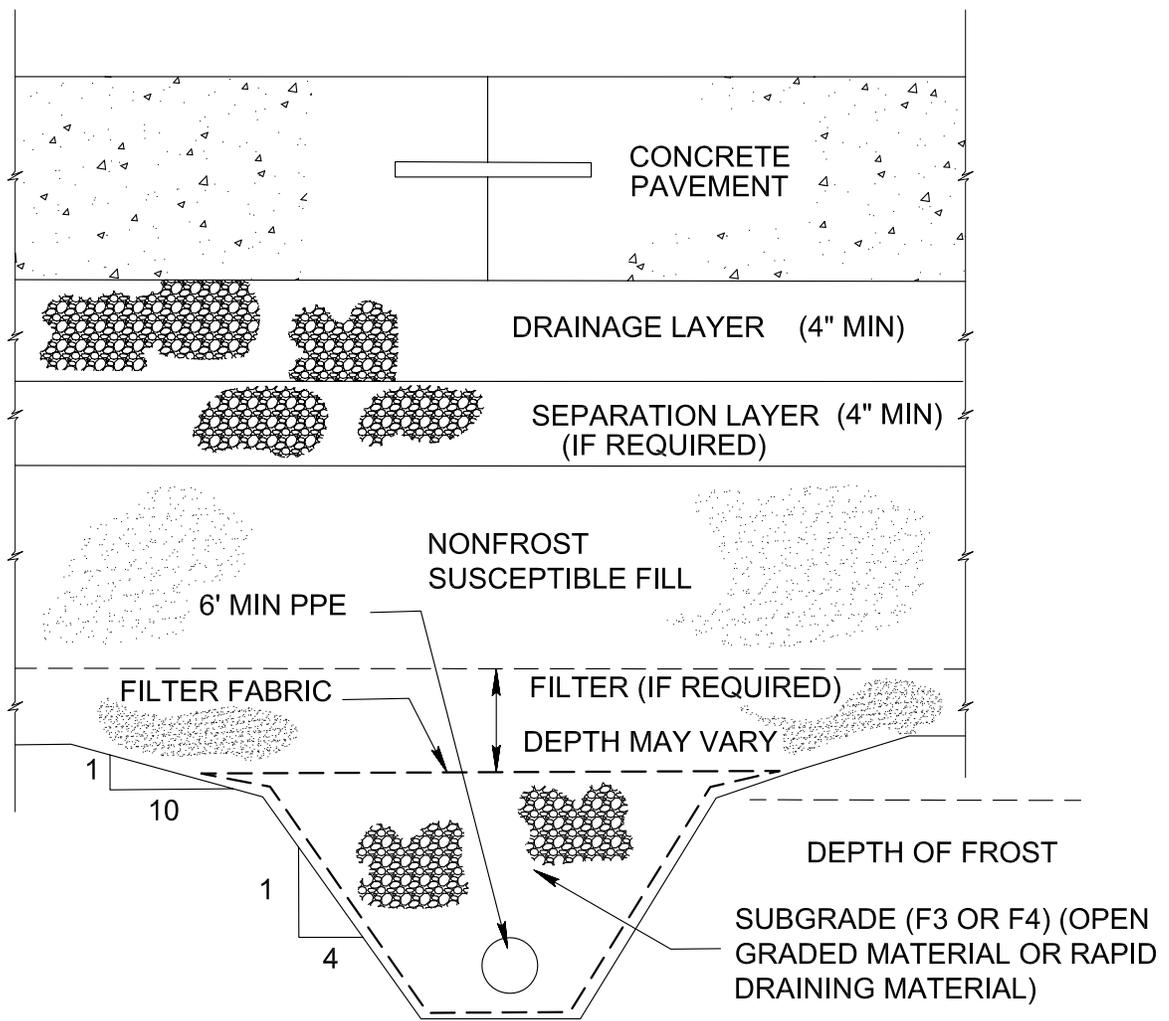


NOT TO SCALE

TYPICAL INTERIOR SUBDRAIN FOR RIGID PAVEMENT  
(FROST AREAS, DEPTH OF FROST > DEPTH TO PIPE)

DATE  
OCTOBER 2016

FIGURE  
20-7B

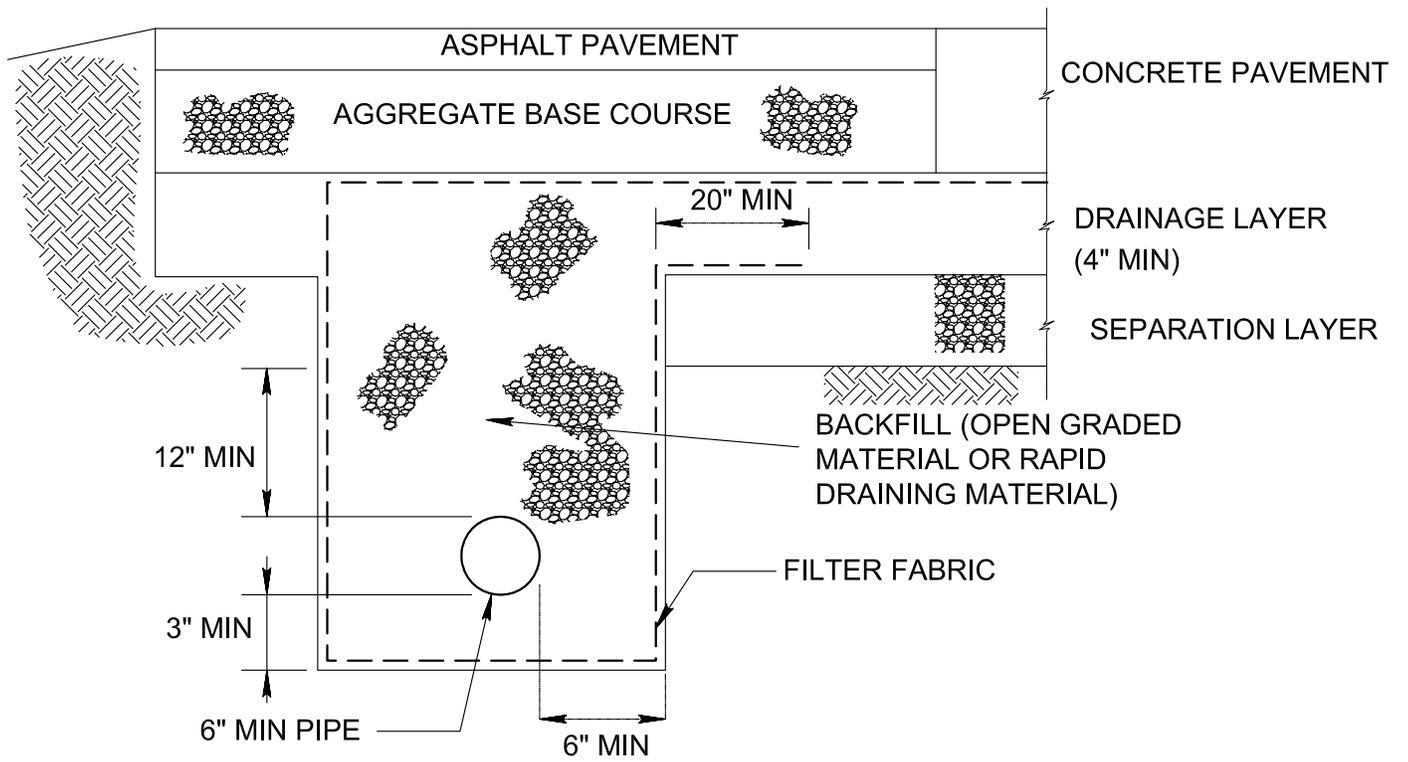


NOT TO SCALE

TYPICAL INTERIOR SUBDRAIN FOR RIGID PAVEMENT  
(FROST AREAS, DEPTH OF FROST < DEPTH TO PIPE)

DATE  
OCTOBER 2016

FIGURE  
20-7C

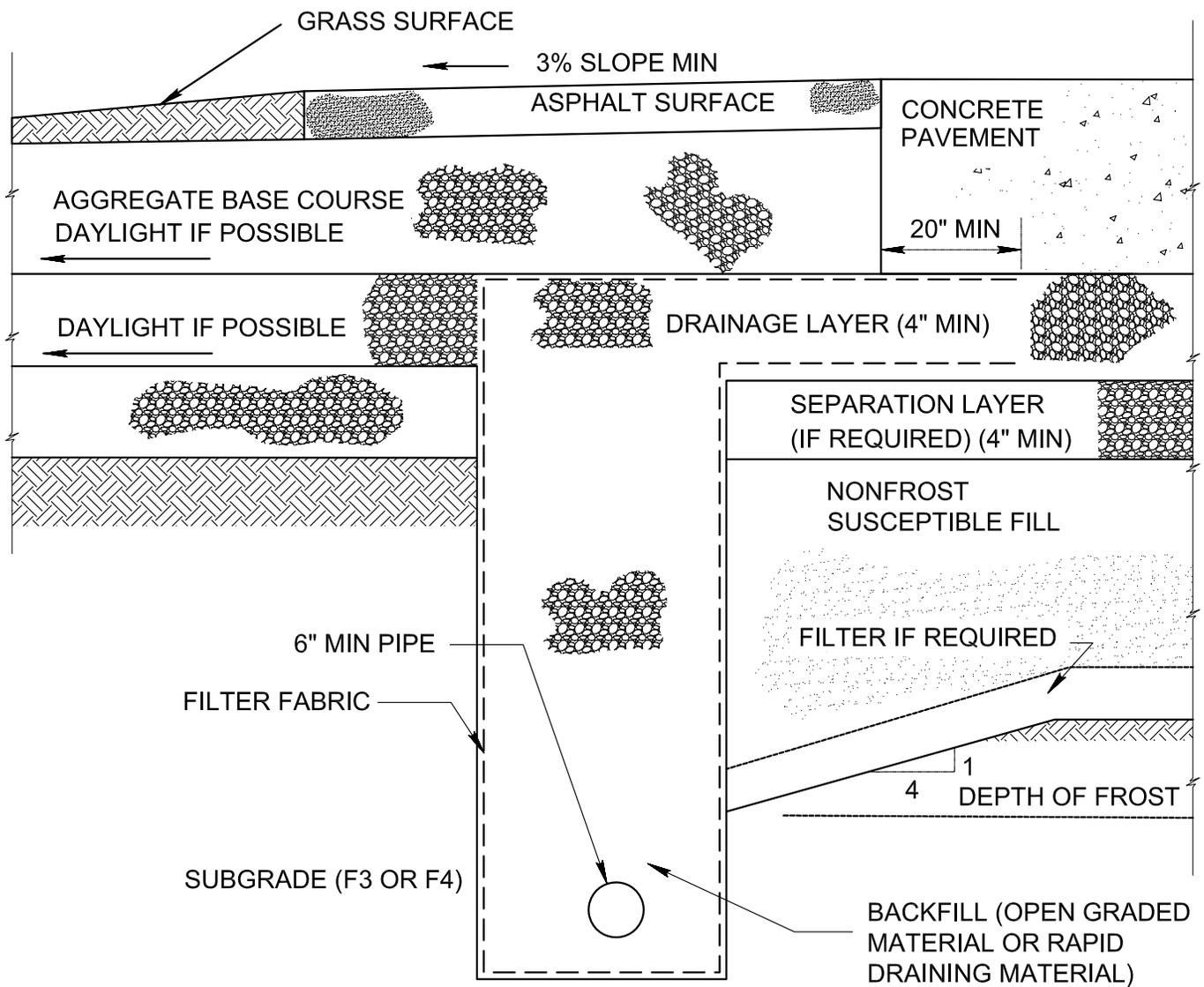


NOT TO SCALE

TYPICAL EDGE SUBDRAIN FOR RIGID PAVEMENT WITH SHOULDER (NONFROST AREAS)

DATE  
OCTOBER 2016

FIGURE  
20-8A

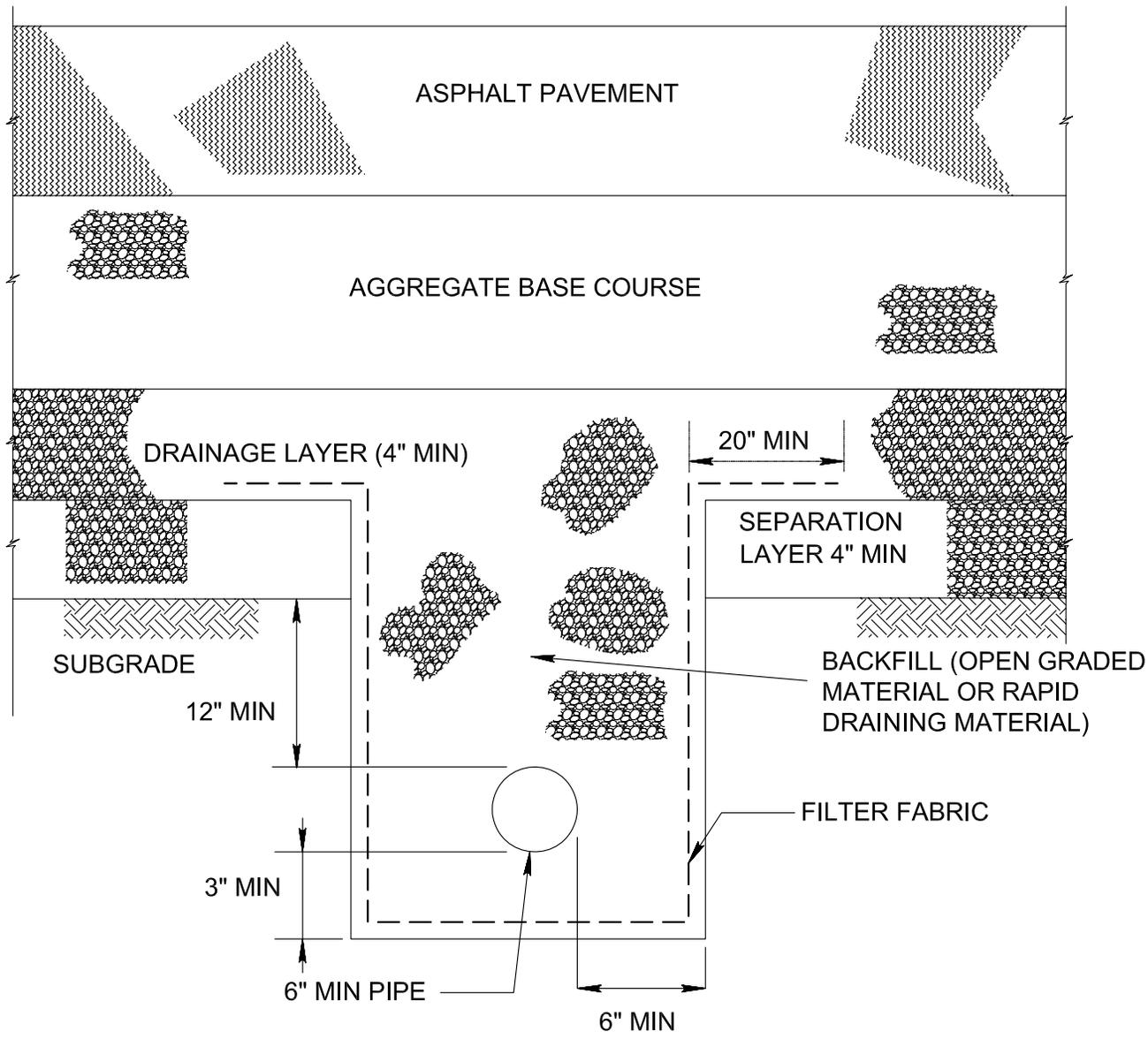


NOT TO SCALE

TYPICAL EDGE SUBDRAIN FOR RIGID PAVEMENT  
(FROST AREAS)

DATE  
OCTOBER 2016

FIGURE  
20-8B

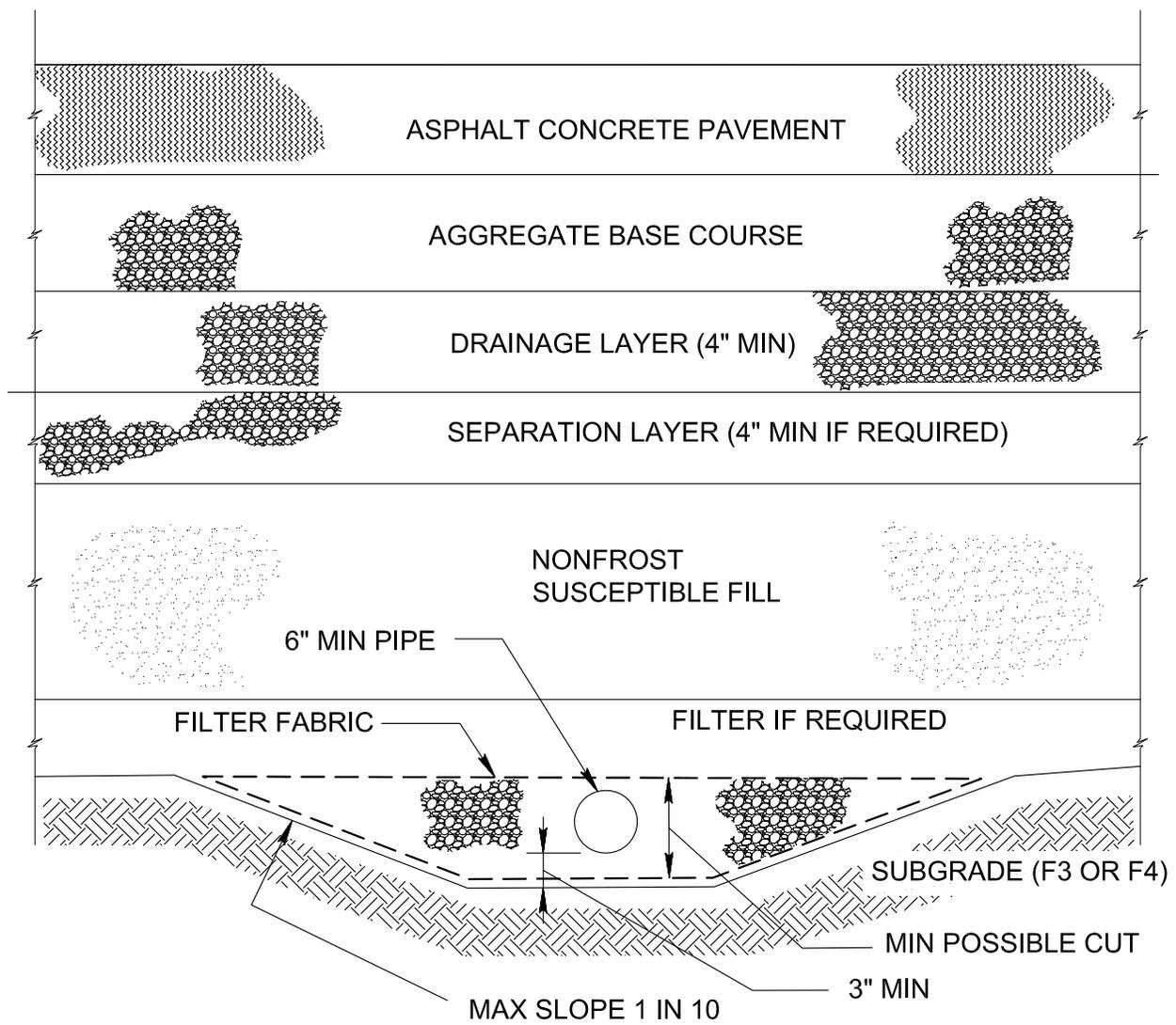


NOT TO SCALE

TYPICAL INTERIOR SUBDRAIN FOR FLEXIBLE PAVEMENT  
(NONFROST AREAS)

DATE  
OCTOBER 2016

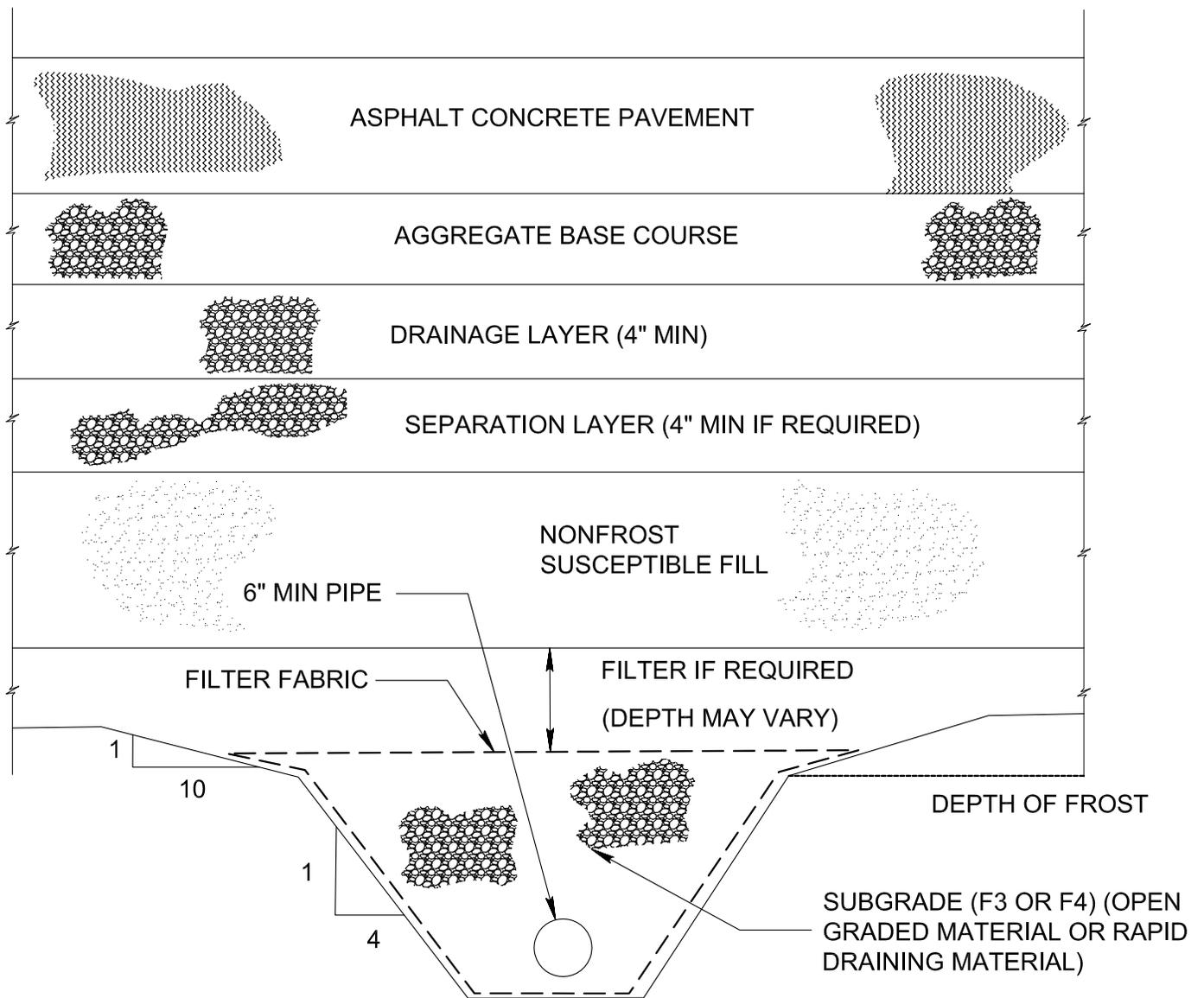
FIGURE  
20-9A



TYPICAL INTERIOR SUBDRAIN FOR FLEXIBLE PAVEMENT  
(FROST AREAS, DEPTH OF FROST > DEPTH OF PIPE)

DATE  
OCTOBER 2016

FIGURE  
20-9B

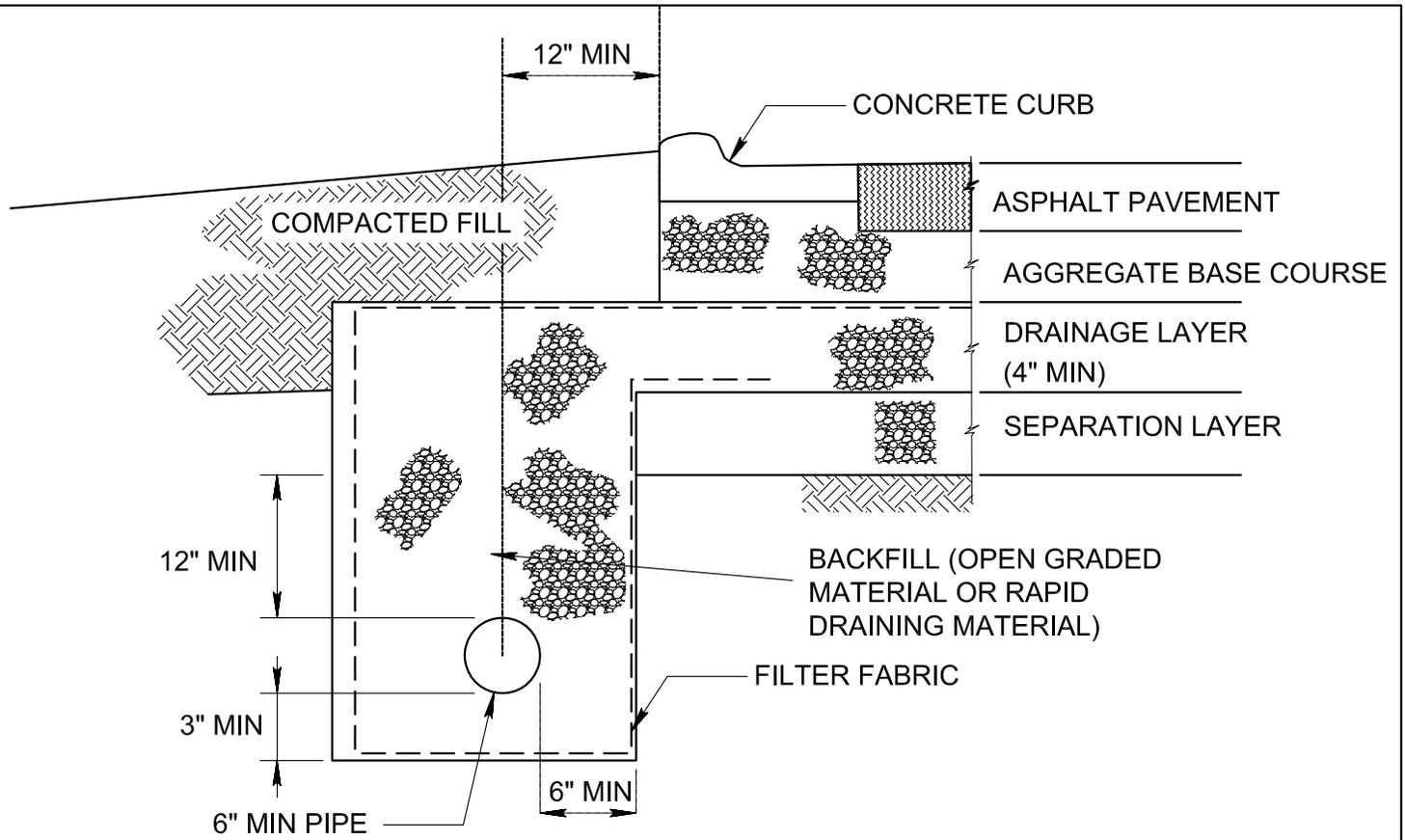


NOT TO SCALE

TYPICAL INTERIOR SUBDRAIN FOR FLEXIBLE PAVEMENT  
(FROST AREAS, DEPTH OF FROST < DEPTH OF PIPE)

DATE  
OCTOBER 2016

FIGURE  
20-9C

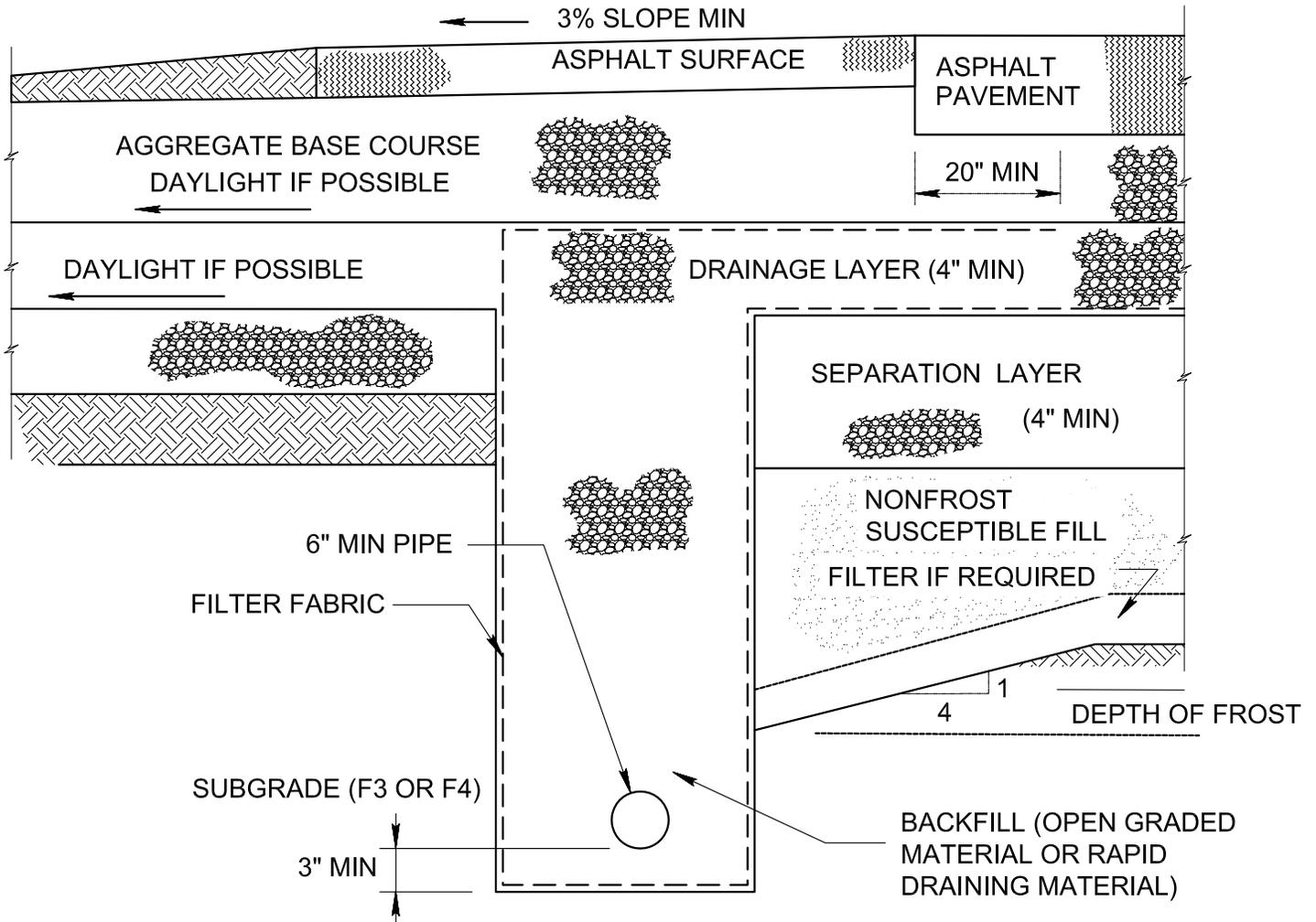


NOT TO SCALE

TYPICAL EDGE SUBDRAIN FOR FLEXIBLE PAVEMENT  
(NONFROST AREAS)

DATE  
OCTOBER 2016

FIGURE  
20-10A

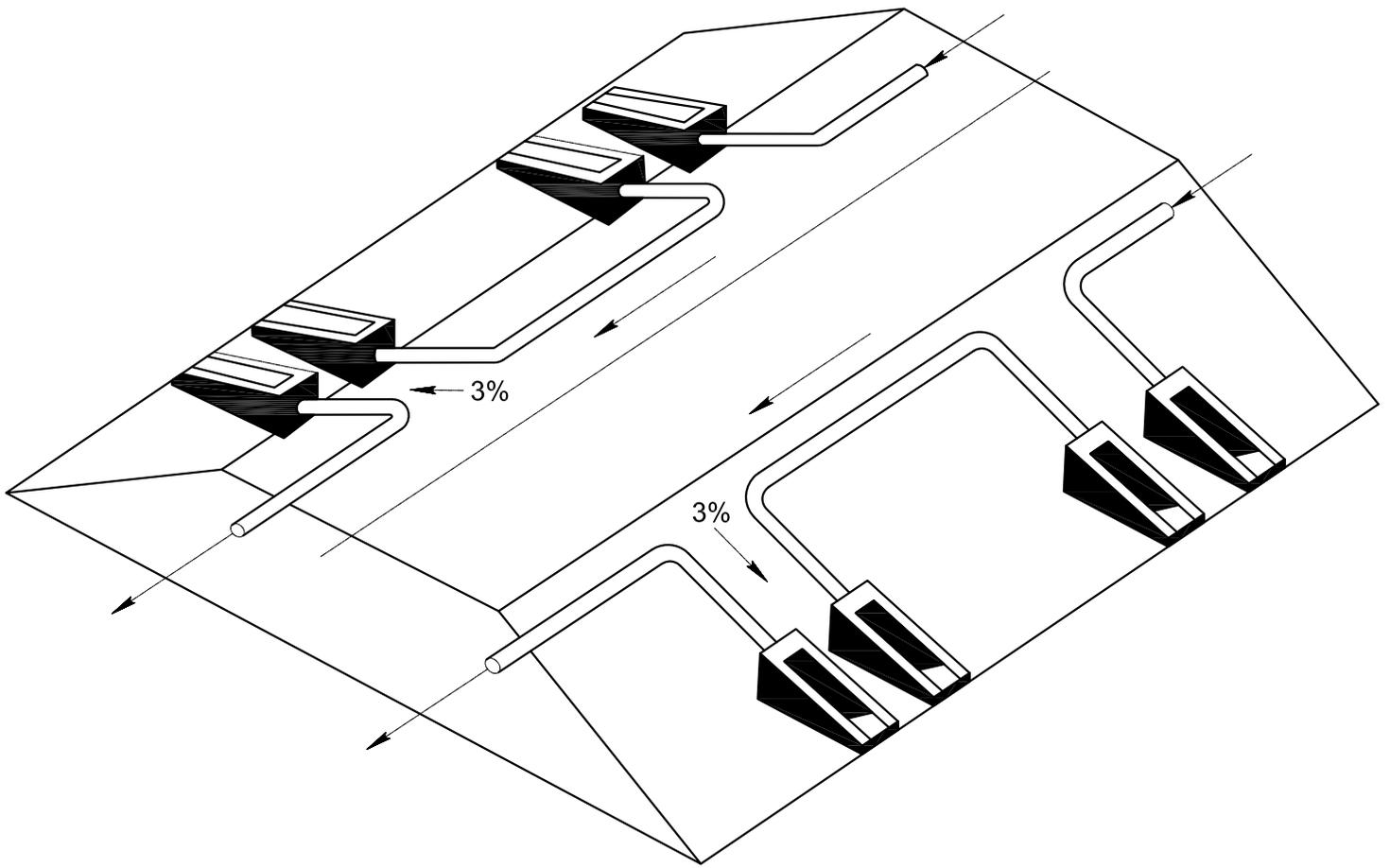


NOT TO SCALE

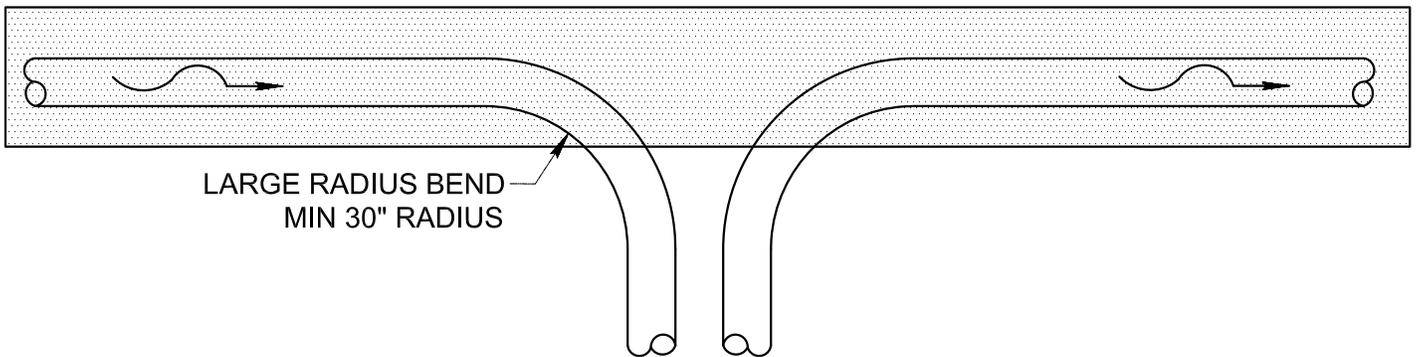
TYPICAL EDGE SUBDRAIN FOR FLEXIBLE PAVEMENT  
(FROST AREAS)

DATE  
OCTOBER 2016

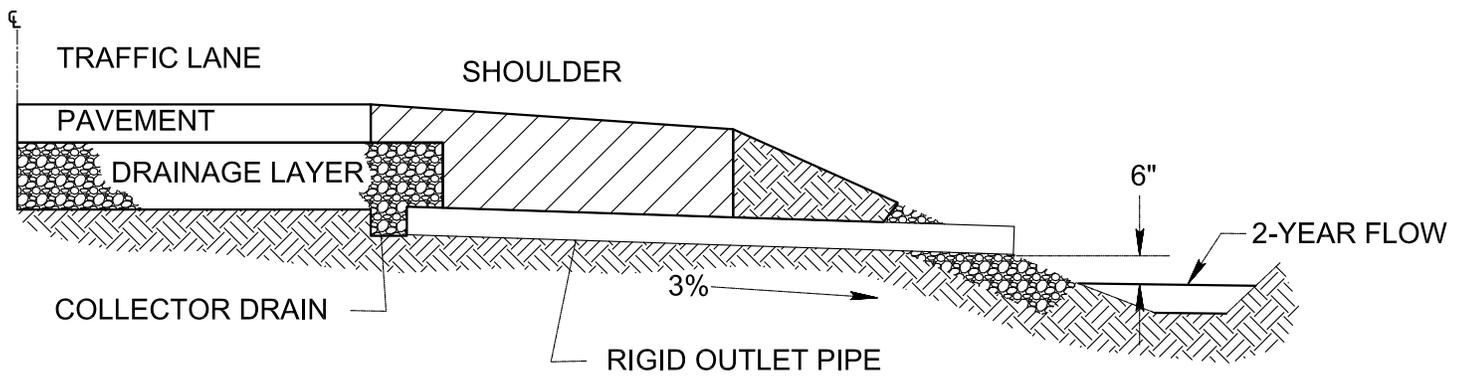
FIGURE  
20-10B



DRAINAGE TRENCH



NOT TO SCALE



NOT TO SCALE

RECOMMENDED OUTLET DESIGN

DATE  
OCTOBER 2016

FIGURE  
20-12