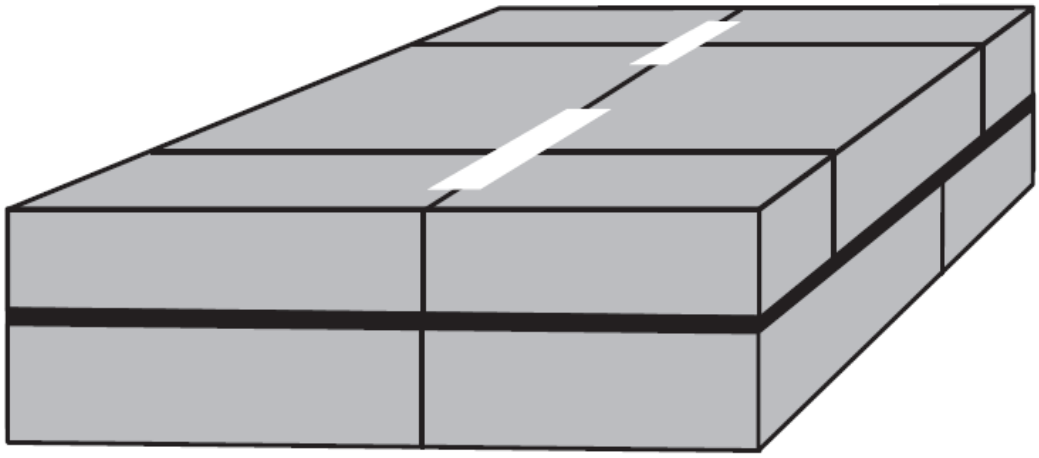
Unbonded Concrete Overlay

Design Procedures



Minnesota Department of Transportation
Office of Materials & Road Research
Pavement Engineering Section
July 2010

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNBONDED CONCRETE OVERLAY OF CONCRETE PAVEMENT
DESIGN PROCEDURE

An unbonded overlay may be placed to improve both the structural capacity and the functional condition of an existing concrete pavement. The concrete overlay is placed on a flexible interlayer that separates the overlay from the existing pavement and is intended to prevent reflective cracking. The current minimum design life is 15 years.

Feasibility

An unbonded overlay is a feasible rehabilitation alternative for PCC (Portland Cement Concrete) pavements for practically all conditions. However, a PCC unbonded overlay would not be considered feasible under the following conditions where:

1. The amount of deteriorated slab cracking and joint spalling is not large and other alternatives such as CPR would be much more economical.

2. Vertical clearance of bridges is inadequate for required overlay thickness. This may be addressed by reconstructing the pavement under the overhead bridges or by raising the bridges. Thicker unbonded overlays may also necessitate raising signs and guardrails as well as flattening side slopes and extending the culverts.

3. The existing pavement is susceptible to large heaves or settlements.

4. Alignment changes of significant length are involved, resulting in short segments of unbonded overlays. (A Life Cycle Cost Analysis (LCCA) will help to determine if an Unbonded Concrete Overlay of Concrete Pavement is an economical option.)

5. The existing pavement is an urban design with curb and gutter where it is impossible or cost-prohibitive to raise the grade.

6. The existing pavement is 20 ft or less in width.

7. Traffic cannot be detoured sufficiently for construction of the unbonded overlay. This situation can generally be overcome, but on occasion it may pose a problem.

Pre-Overlay Repairs

In the design procedures, pre-overlay repair refers to minor repairs or fracturing of the existing concrete slab (or milling of an existing asphalt overlay). One major advantage of an unbonded overlay is the amount of repair to the existing pavement prior to overlay is minimized. However, the objective of the unbonded overlay is to restore the structural integrity, load transfer, and continuity. Unbonded overlays are not intended to bridge localized areas of non-uniform support. The following distress types should be reviewed and repaired prior to placement of the overlay so as to prevent reflection of cracks that may reduce its service life:

1. Existing Jointed Concrete Pavements (JPCP and JRCP)

   Most of the serious deterioration in existing JPCP and JRCP that requires pre-overlay repair occurs at joints and cracks. The following table describes common distresses and recommended repair for these types of pavements.

Distress type	Repair
Working Crack	- No repair needed
Spalling	- Remove loose material - Patch with bituminous mixture
Severe Faulting	- No repair of the joint or crack for faulting will be necessary
High deflection/poor load transfer (<50%)	- Concrete grinding - Dowel bar retrofit
Pumping/free water	- Permeable stress relief layer, interceptor drain and edge drain
PCC Durability (D-cracking and ASR problems)	- Remove loose pieces of concrete - Patch with bituminous mixture before placing the stress relief layer - Place [>1in] permeable stress relief layer, interceptor drain, and edge drain - Fracturing of the D-cracked pavement is an alternative
Rocking or unstable slab with high deflection or pumping problems	- Repair subbase/subgrade where soft spots or if excessive loss of support exists - Replace pavement with full-depth concrete
Badly shattered slab with working cracks	- Repair subbase/subgrade where soft spots or if excessive loss of support exists - Replace pavement with full-depth concrete - Few isolated spot locations, supplemental steel in the overlay or fracturing of the pavement to obtain uniform support are also alternatives
Settlement	- Level-up with bituminous mixture
Severe Frost Heave	- Subgrade correction and concrete repair

2. Existing Continuously Reinforced Concrete Pavement (CRCP)

   The most serious distress in CRCP that require repair is punchouts and ruptured steel. The following table describes common distresses and recommended repair for this type of pavement.

Distress type	Repair
Punchout, Blowups, High severity D-Cracking	- Full-depth concrete removal (repair area should extend at least 1.6 ft beyond the area of distress - Excavate and recompact the subbase and subgrade - Replace full-depth with concrete
Deteriorated or Working Transverse Cracks with ruptured steel and construction joints with high-severity spall	- Repair full-depth with concrete

3. Fracturing of Existing Concrete Pavement

   For severely deteriorated concrete pavement with major structural deficiencies and other durability related problems that can cause future problems in the overlay, fracturing the existing pavement may be the best alternative for achieving uniform support that eliminates reflection cracking.

   Rubbilizing is recommended for pavements that have a lot of durability problems or that require extensive repairs over more than 50 to 70 percent of the surface area of the existing pavement. The concrete overlay must be designed as a new pavement over a high-quality base and not as an unbonded concrete overlay. This will result in thicker overlays, but no pre-overlay repair is needed, except, perhaps, a level-up with bituminous mixture if the pavement profile is too rough for paving a uniform slab thickness.

   To determine the cost-effectiveness of rubbilizing, the designer should compare the increased overlay cost and the cost of rubbilizing with the cost of pre-overlay repairs.

4. Existing Bituminous Overlay Over Concrete Pavement

   On rare occasions, the existing HMA overlay may be used as all or part of the stress relief layer. If badly deteriorated, it should be removed and replaced with a stress relief layer. Otherwise, it should be milled to provide a smooth surface and to establish the cross-slope on which to build the overlay. The texture of the milled surface may influence joint spacing and performance of the slab

   In summary of the suggested pre-overlay guidelines, each distress type should be evaluated and the suggested repair should be determined and modified / changed, if necessary, to satisfy the conditions at hand. Questions relative to pre-overlay repairs should be addressed to the Pavement Design and Concrete Units of the Office of Materials and Road Research.

<u>Design Methods</u>

The Mn/DOT design procedure includes averaging the results of two different design methods. They are the Corps of Engineers' (COE) and Portland Cement Association (PCA) design methods. The COE and PCA methods are as follows:

A. Corps of Engineers (COE) Design Method
(This method was empirically developed.)

$$D_{OL} = \sqrt{D_N^2 - C(D_E)^2}$$

D_{OL} = required unbonded PCC overlay thickness. (inches)

D_N = required new PCC pavement thickness to carry future traffic. (inches)

D_E = thickness of existing pavement. (inches)

C = Coefficient depending on the structural condition of the existing pavement determined by visual inspection. The practice has been to use the following values for C; however, other values can be used.

C = 1.0 Existing pavement is in good overall structural condition with little or no cracking.

C = 0.75 Existing pavement has initial joint and corner cracking due to loading but no progressive structural distress or recent cracking.

C = 0.50 Badly D-Cracked pavements (unless FWD load testing indicates that the load transfer across joints and cracks is adequate, then use C=0.65)

C = 0.35 Existing pavement is badly cracked or shattered.

B. PCA Method

This procedure was mechanistically derived and is based on results of pavement analyses conducted using the finite element computer program JSLAB.

The stress data used to prepare the design charts for determination of unbonded overlay thickness were developed by using the program JSLAB. These charts are applicable to existing concrete pavements that have effective modulus of elasticity values ranging from about 3,000,000 to about 4,000,000 psi

Design charts are presented for three cases of existing pavement condition. These cases are as follows:

Case 1. Existing pavement exhibits a large amount of midslab and corner cracking with poor load transfer at joints and cracks. Badly D-Cracked pavements use Case 1, unless FWD load testing indicates that the load transfer across joints and cracks is adequate, and then use Case 2.

Case 2. Existing pavement exhibits a small amount of midslab and corner cracking. It exhibits reasonably good load transfer at the joints and cracks. Localized repairs were performed to correct distressed slabs.

Case 3. Existing pavement exhibits a small amount of midslab cracking and good load transfer at the cracks and joints.

The design chart for Case 1 was developed using data from analyses of overlay sections containing a crack in the existing pavement directly under an edge load on the overlay. The design chart for Case 3 was developed using data from the analysis of overlay sections with no cracking in the existing pavement. The design chart of Case 2 was developed through interpolation between Case 1 and Case 3 conditions. The design charts are given in Figures 1, 2, and 3 for Cases 1, 2, and 3; respectively.

The first step in the design process involves determination of the thickness of a new concrete pavement that would be needed for the anticipated subgrade soil conditions and future traffic.

Design charts in Figures 1, 2 and 3 are then used to compute the thickness required for the unbonded overlay. Begin at the appropriate design chart, by creating a vertical line from the calculated new pavement thickness to the 'Base Line'. At the intersection with the 'Base Line' create a horizontal line to the intersection with the existing pavement thickness from the top of the chart. At this new intersection interpolate between the unbonded overlay thickness curves on the chart to find the design unbonded overlay thickness (D_{OL}).

Representative values of unbonded overlay thickness determined from Figures 1, 2, and 3 are summarized in Table 1. These thicknesses are listed for different values of existing pavement thicknesses and equivalent new concrete pavement thickness. The determination of the actual overlay thickness is influenced by the condition and thickness of the existing base pavement and the equivalent new thickness.

Comparison of the COE and the PCA design methods indicates that PCA Cases 1, 2, and 3, closely simulate the COE design method existing pavement condition coefficient, C, values of 0.3 to 0.5, 0.5 to 0.7, and 0.7 to about 0.9, respectively.

In comparing these two design methods, it can be observed that the ratings (Cases 1, 2 and 3 and C factors) involved a certain degree of subjectivity. Because of the subjectivity involved, various engineers may rate a pavement differently and thereby obtain different thickness for the overlay.

Mn/DOT Overlay Design Procedure

The design process will consist of the following:

A. Existing pavement evaluation.

1. Pavement condition survey.
   Utilize the PMS data relative to ride and distresses. The type, extent and severity of the distresses should be identified. The pavement should be divided into analysis sections based on pavement design, construction history, traffic usage and location.

2. Existing Pavement.
   a) Type of pavement (JPCP, JRCP, CRC)
   b) Slab thickness & width
   c) Type of load transfer
   d) Type of shoulder (tied, PCC, other)

3. FWD Testing.
   It is strongly recommended that FWD load testing be performed, if possible, on all existing concrete pavements where an unbonded concrete overlay is considered as a possible rehabilitation alternative.

FWD load testing should be especially considered where there exists significant load and material related distresses. The load testing should be carried out to determine the severity of the problem and the pavement and subgrade soil materials characteristics/ properties. The load testing should be conducted at joints and working cracks to determine the relative deflection across the joints and cracks and to estimate the joint and crack load transfer efficiency. In addition, FWD loads should be applied to the interior of the concrete panels so as to determine the pavement's elastic modulus and subgrade soils elastic modulus and the modulus of subgrade reaction. Results of the load testing can be used to better determine the case and C factors to be used for unbonded overlay design, verification/backcalculation of layer moduli, and new pavement thickness design.

B. Traffic Analysis

Use the following formula to derive the design CESALs for instances in which the traffic forecast does not provide the CESALs for the design number of years. The minimum recommended number of design years is 15.

$$CESALS_n = .000794 \cdot CESALS_{35} \cdot \left[\frac{(n+1)\cdot(n\cdot i+2)}{(i+.057143)}\right]$$

$CESALS_n =$ Accumulated CESALS for n design years
$n =$ number of design years
$CESALS_{35} =$ 35 year Accumulated CESALs from the traffic forecast
$i =$ HCADT Growth/Year from the traffic forcast (as a decimal)

Example:

Base Year 2010
$CESAL_{35}$ = 27,948,906
Design Life = 30 years
HCADT Growth/year = 1.9%

1. Design Year 2040

$$CESALS_{30} = .000794 \cdot 27{,}948{,}906 \cdot \left[\frac{(30+1)\cdot(30\cdot.019+2)}{(.019+.057143)}\right]$$

$$CESALS_{30} = 23{,}219{,}355$$

2. Design Year moved from 2040 to 2042

$$CESALS_{32} = .000794 \cdot 27{,}948{,}906 \cdot \left[\frac{(32+1)\cdot(32\cdot.019+2)}{(.019+.057143)}\right]$$
$$CESALS_{32} = 25{,}082{,}849$$
$$*CESALS_{1} = .000794 \cdot 27{,}948{,}906 \cdot \left[\frac{(1+1)\cdot(1\cdot.019+2)}{(.019+.057143)}\right]$$
$$CESALS_{1} = 1{,}176{,}851$$
$$CESALS_{30R} = CESALS_{32} - CESALS_{1} = 25{,}082{,}849 - 1{,}176{,}851$$
$$CESALS_{30R} = 23{,}905{,}998$$

*Note: In MnESAL, the 0th year is added to the calculation for the estimated CESALS; therefore, the 0th year needs to be accounted for in shifting the design year.

C. Subgrade Support (Modulus of subgrade reaction - (k.))

1. Design R-Value (Average minus one standard deviation)
2. $k = -1.17 + 63\sqrt{R}$

D. New Concrete Pavement Thickness - D_N

Use RigidPavement.exe program (based on 1972 AASHO, Revised 1981) with following parameters:

1. Design R-Value
2. design lane traffic = $CESALS_n$ x 0.93 (Modified for frozen subgrade effect.)
3. $P_t = 2.5$
4. Modulus of rupture = 500 psi
5. Modulus of elasticity = 4,200,000 psi
6. J-Factor
   1) J = 2.6 for 27-foot wide pavement
   2) J = 3.2 for 24-foot wide pavement

E. Overlay Thickness

3. Design Thicknesses

   a. Calculate the overlay thickness using both the COE and PCA methods and then average the results.
   b. Round the average result in accordance with the current rounding procedures* and use this value for the design thickness. However, the minimum design thickness should be in accordance with the following:

MINIMUM UNBONDED CONCRETE OVERLAY THICKNESS

		Overlay Width (ft)	
		27	**24**
Existing Pavement Width (ft)	**27**	6"	**
	24	7"	6"
	22		7" ***
	20	**	**

* <u>Rounding Procedure</u>
Customary Units
Thickness is x.0 to x. 1, round to x.0
x. 2 to x.6, round to x.5
x. 7 to x.9, round to (x+1).0

** Not appropriate design

*** Unless recommended otherwise by MR&E's Pavement Engineering Section.

F. Other Design Appurtenance/Considerations

1. Pavement Type

All unbonded concrete pavement will be designed as jointed plain concrete pavements (JPCP) unless otherwise determined by the Pavement Design Unit, Office of Materials and Road Research.

2. Transverse Contraction Joints
All transverse joints shall be as follows:

a. All transverse joints shall be doweled, using 1¼ in. dowels for unbonded overlays less than 10½ in. thick, and 1½ in. dowels for overlays greater than or equal to 10½ in. thickness.
b. Transverse joints should be uniformly spaced at 15 ft for all pavement thicknesses that are greater than 7 in., except as noted in d.
c. The Pavement Design Unit, Office of Materials and Road Research, should be contacted for the joint spacing and dowel bar size for all pavements which are 7 in. or less in thickness.
d. Do not locate transverse joints within 3 ft of an existing transverse joint or working crack. The most effective joint location is to place the overlay joint on the approach side of an existing joint or crack. This allows the leave slab to bridge the joint or crack and avoid cantilever deflections and pumping action beneath the existing slab (APCA).
e. Joints in the overlay shall be perpendicular to roadway centerline unless recommended otherwise by the Concrete and Pavement Design Units of the Office of Materials and Road Research.
f. All transverse joints should conform to Mn/DOT's Standard Plan Sheet 5-297.221 (1 of 2), Pavement Joints Contraction (Design C) and Expansion (Design E) (as of 4/14/10).
g. Dowel basket assembly detail and anchoring procedures should be in accordance with Mn/DOT's Standard Plate No. 1103K, Typical Dowel Bar Assembly (as of 4/30/10).
h. Transition from unbonded overlay to on grade pavements near bridges and other removal areas and associated supplemental steel detail should be in accordance with Figures 4 and Mn/DOT's Standard Plate No. 1070M, Supplemental Pavement Reinforcement (as of 4/30/10).

3. Joint Sealant

a. Transverse Contraction Joints (type C)
- Mn/DOT's Joint Sealing Guidelines.
- Mn/DOT's Standard Plans Sheet 5-297.221 (1 of 2), Pavement Joints Contraction (Design C) and Expansion (Design E) (as of 4/14/10) shows design details for the joint sealant reservoirs and sealant.

b. Longitudinal Joints (type L)
- Mn/DOT's Joint Sealing Guidelines.
- Mn/DOT's Standard Plans Sheet 5-297.221 (2 of 2), Pavement Joints Longitudinal (Design L) (as of 4/14/10) shows design details for longitudinal joints.

c. Questions concerning joint sealant types and uses should be addressed by the Concrete Unit, Office of Materials and Road Research.

4. Stress Relief Layer

Provide a 1 in. uniform thickness stress relief layer between the unbonded overlay and the existing pavement. The layer width should be as needed to support the paver tracks, refer to Mn/DOT's Standard Plans Sheet 5-297.432, Subsurface Drains (as of 2/25/97). If the in-place pavement is badly faulted, has poor load transfer (less than 50 percent), skewed joints, and/or has a rough profile due to cracked panels, D-Cracking, curling, etc., the stress relief layer thickness should be

greater than 1½ in. and placed to an uniform thickness to negate any potential detrimental effects on overlay performance.

5. Interceptor Drain

Provide interceptor drains when the overlay pavement is wider than the existing underlying pavement. The drains should be in accordance with Mn/DOT's Standard Plan Sheets 5-297.430, Subsurface Drains (as of 2/25/97) and 5-297.432, Subsurface Drains (as of 2/25/97).

6. Pavement Edge Drain

Provide edge drains for all pavements regardless of subgrade soil type in accordance with Mn/DOT's Standard Plan Sheet 5-297.432, Subsurface Drains (as of 2/25/97). Edge drains are to be provided, even for granular subgrade type soils, since the stress relief layer consists of a permeable stabilized material and therefore an outlet for positive drainage must be provided.

7. Extensive D-Cracking

Provide for the removal of unconfined and/or loose deteriorated concrete at the pavement joints, cracks and patches by air blasting and power sweeping. Air blasting shall utilize a nominal 100 psi pressure as directed by the Engineer. Depressions, which result from air blasting and/or power sweeping, at the transverse and longitudinal joints and cracks shall be patched with Bituminous Patching Mixture 2231 and compacted in accordance with the Ordinary Compaction Method (2360) with a pneumatic-tired roller. The patching of these areas shall be accomplished prior to paving the stress relief layer.

8. Shoulder Area Soils

If the overlay design involves cantilevering the pavement beyond the in-place pavement, the soils in the shoulder area beneath the overhang should be investigated. The investigation should focus on textural classification, density, and moisture and whether the shoulder heaves during the winter months. This area should contain non-frost susceptible soils. If this is not the case, the in-place soils should be excavated and replaced with non-frost susceptible material to the bottom of the in-place concrete pavement or to the bottom of any aggregate base under the concrete pavement, whichever is deeper. If frost susceptible soils are allowed to remain in place and the shoulder heaves, this may cause the pavement to crack. In addition, even if the soil doesn't heave, it should be replaced with non-frost susceptible soil so as to provide firm uniform support.

9. Transition Areas (bridge ends and other removal areas)

In transitional areas, which are located in slow drainage areas (i.e. at bridge ends or pavement ends on steep grades), and which are exposed to a significant number of heavy construction loads; a dense graded bituminous mixture can be utilized in order to achieve satisfactory stability, shown in Figure 4 (bottom). In order to insure proper drainage a layer of PASSRC shall be placed over the dense graded bituminous mixture. The thickness of the PASSRC layer should not be less than the PASSRC placed under the adjacent unbonded concrete pavement.

10. Unbonded Overlay Cantilevering

In some cases to avoid cantilevering the unbonded overlay beyond the width of the existing pavement, it may be desirable to widen the in-place narrow concrete pavement with bituminous or concrete.

The use of these types of widening should be discussed with the Pavement Engineering section prior to incorporating into the design.

G. Design Example

1. Design Information

a. Existing Roadway
- Four-lane divided highway
- 22 years old

b. Existing Pavement
- 9.0 in JRCP
- 5.0 in granular subbase
- 40 ft joint spacing
- 24 ft wide
- dowelled joints

c. Roadbed Soils
- Clay loam
- Design R-Value = 15
- k = 240 psi

d. Major Distresses
- Mid-panel cracks
- Joint deterioration (severely D-Cracked)
- PSR = 2.7
- PQI = 2.6

e. Traffic
$CESAL_{30}$ = 23,219,355 from previous example (page 7)

f. Proposed Design
- 15 ft joint spacing
- all joints dowelled
- 27 ft wide pavement

2. New Pavement Design

- Design R-Value - 15; k = 240 psi
- J = 2.6
- M_r= 500 psi
- E = 4,200,000 psi
- P_t = 2.5
- $CESAL_{30}$ = 23,219,355 x 0.93* = 21,594,000
  * 0.93 - frozen subgrade effect

RigidPavement.exe program results in a new full-depth pavement thickness of 9.7 in (D_N).

3. Overlay Thickness

a. COE Method

$$D_{OL} = \sqrt{D_N^2 - C(D_E)^2} = \sqrt{9.7^2 - 0.5(9.0)^2} = 7.3\ in$$

(D_N, C & D_E, defined on Page 3.)

b. PCA Method
Figure 1 (Case 1), D_{OL} = 8.2 in

Average of Methods (7.3+8.2)/2 = 7.8 in

Design Pavement 8.0 in thick

The above design procedures were derived from:

Tayabji, S.D. and P.A. Okamoto, "Thickness Design of Concrete Resurfacing," present at the Third International Conference on Concrete Pavement Design and Rehabilitation, April 1985.

FHWA's "Techniques for Pavement Rehabilitation" developed by ERES Consultants, Inc.

NCHRP “Evaluation of Unbonded Portland Cement Conrete Overlays”, Report 415.

Hutchinson, R.L. "Resurfacing with Portland Cement Concrete," NCHRP Synthesis of Highway Practice 99, Transportation Research Board, December 1992.

Darter, M.I., R.P. Elliot, K.T. Hall, "Revision of AASHTO Pavement Overlay Design Procedures," April 1992.

"AASHTO Guide For Design of Pavement Structures," 1993

Table 1 Representative Values of Unbonded PCC Overlay Thickness

t_n	t_e	Overlay Thickness, in		
in	in	Case 1	Case 2	Case 3
8	8	6.8	6.0	6.0
	7	7.2	6.0	6.0
	6	7.6	6.8	6.0
10	9	9.0	7.0	6.0
	8	9.2	7.8	6.0
	7	9.4	8.8	8.0
	8	11.7	10.8	10.0
	7	11.8	11.2	10.8

Notes: t_n = equivalent new PCC pavement thickness (to carry future traffic)
t_e = existing pavement thickness
Cases 1, 2, and 3 refer to condition of existing pavement described in the text.
Values in parentheses indicate minimum thickness requirement of 6 in.

Table 2 Unbonded PCC Overlay Thickness Determined Using Corps of Engineers' Equation

t_n	t_e	Overlay Thickness, in		
in	in	C = 0.35	C = 0.6	C = 0.8
8	8	6.5	6.0	6.0
	7	6.8	6.0	6.0
	6	7.2	6.5	6.0
10	9	8.5	7.2	6.0
	8	8.5	7.9	7.0
	7	9.1	8.4	7.8
12	9	10.8	9.8	8.9
	8	11.0	10.3	9.6
	7	11.3	10.7	10.2

Notes: t_n = equivalent new PCC pavement thickness (to carry future traffic)
t_e = existing pavement thickness
C = pavement condition coefficient
Values in parentheses indicate minimum thickness requirement of 6 in.

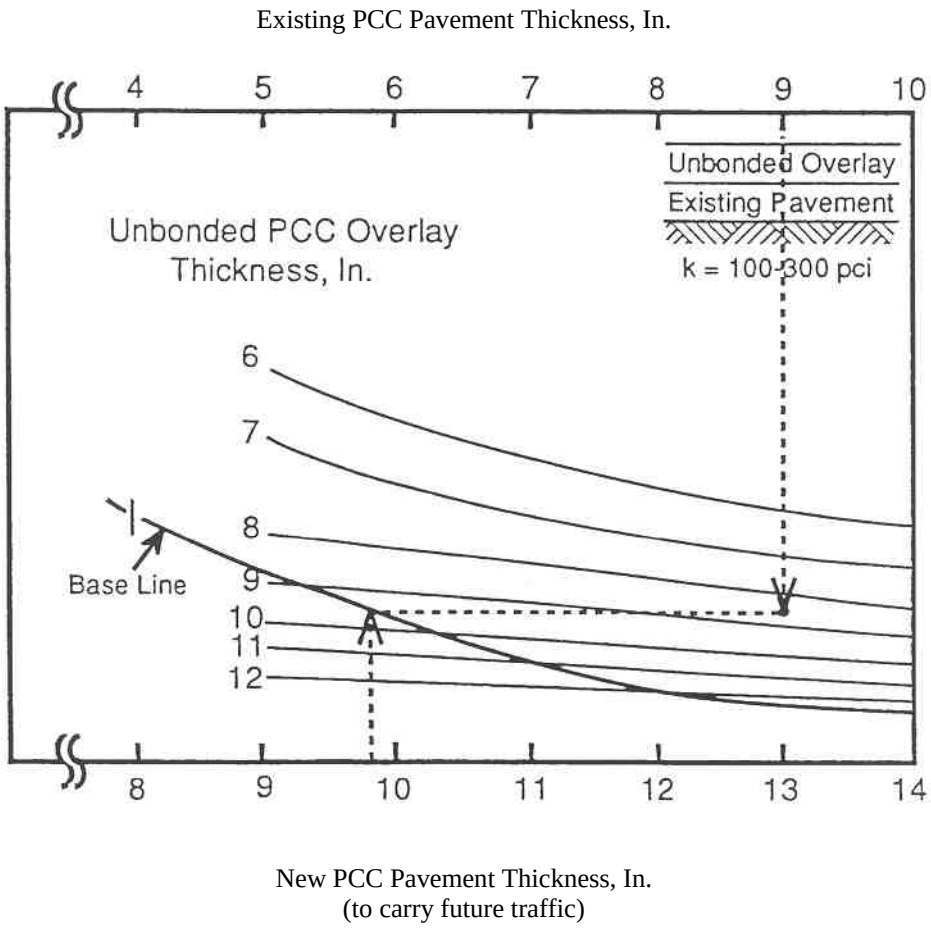
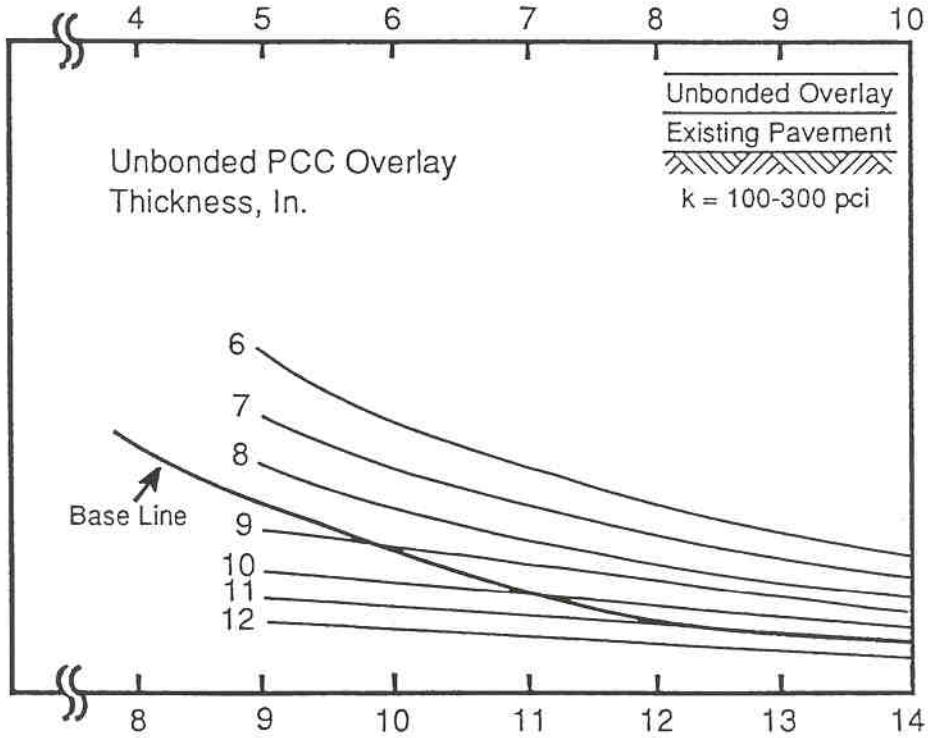


Figure 1. Design Chart for Case 1 Condition of Existing Pavement

Case 1: Existing pavement exhibits a large amount of midslab and corner cracking with poor load transfer at joints and cracks.

Existing PCC Pavement Thickness, In.



New PCC Pavement Thickness, In.
(to carry future traffic)

Figure 2. Design Chart for Case 2 Condition of Existing Pavement Existing PCC Pavement Thickness, In.

Case 2: Existing pavement exhibits a small amount of midslab and corner cracking. It exhibits reasonably good load transfer at the joints and cracks. Localized repairs were performed to correct distressed slabs.

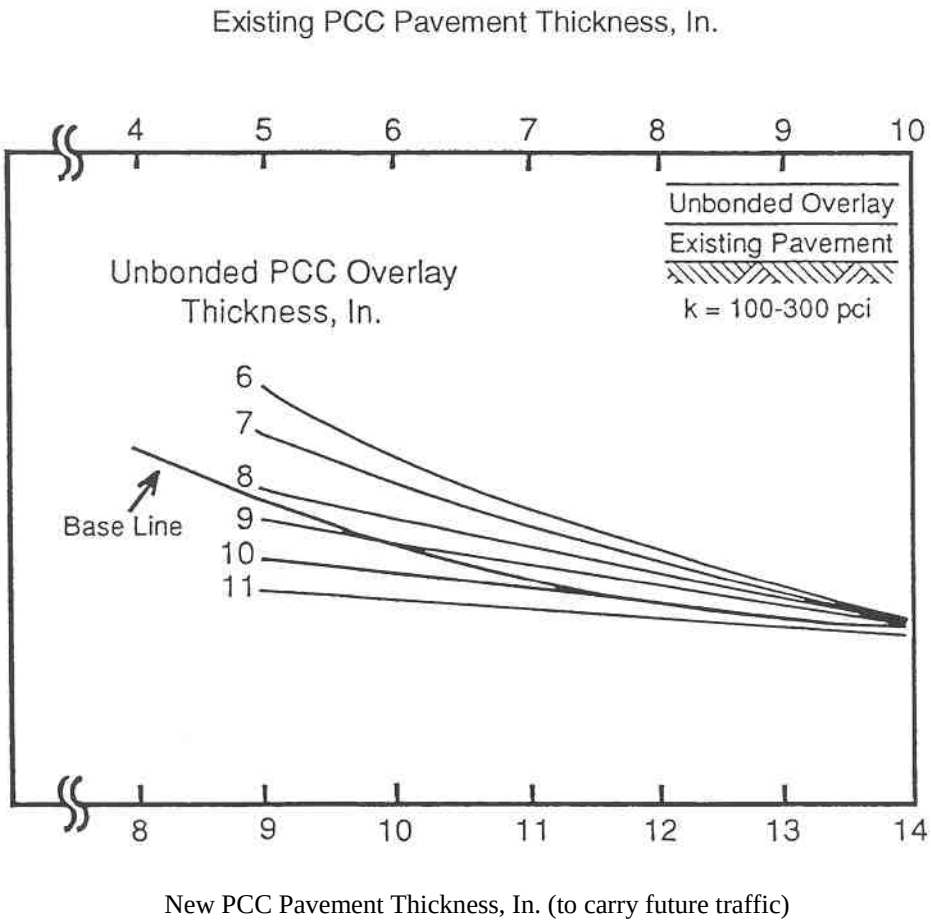
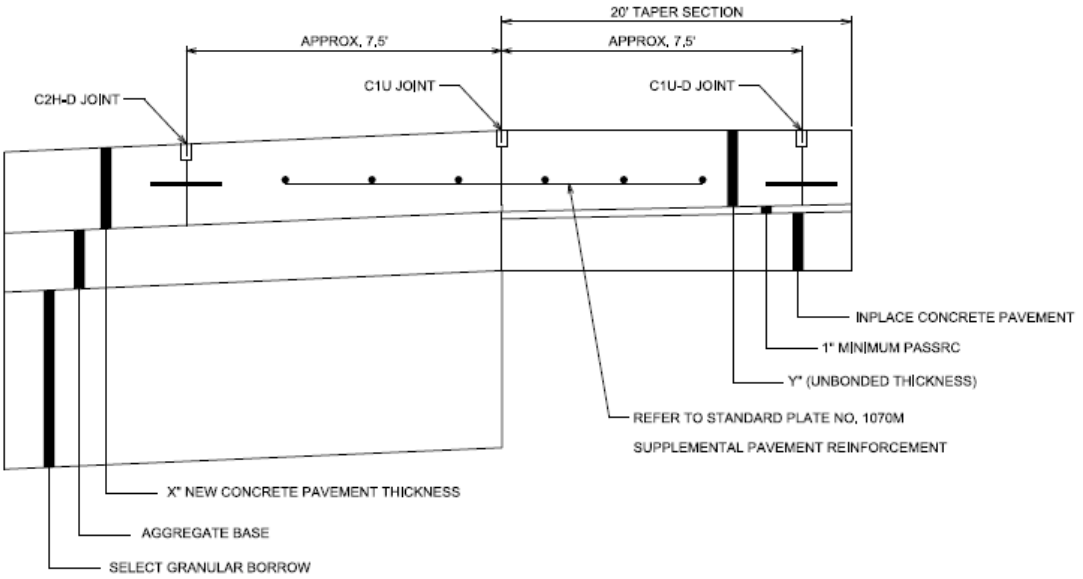


Figure 3. Design Chart for Case 3 Condition of Existing Pavement

Case 3: Existing pavement exhibits a small amount of midslab cracking and good load transfer at the cracks and joints.



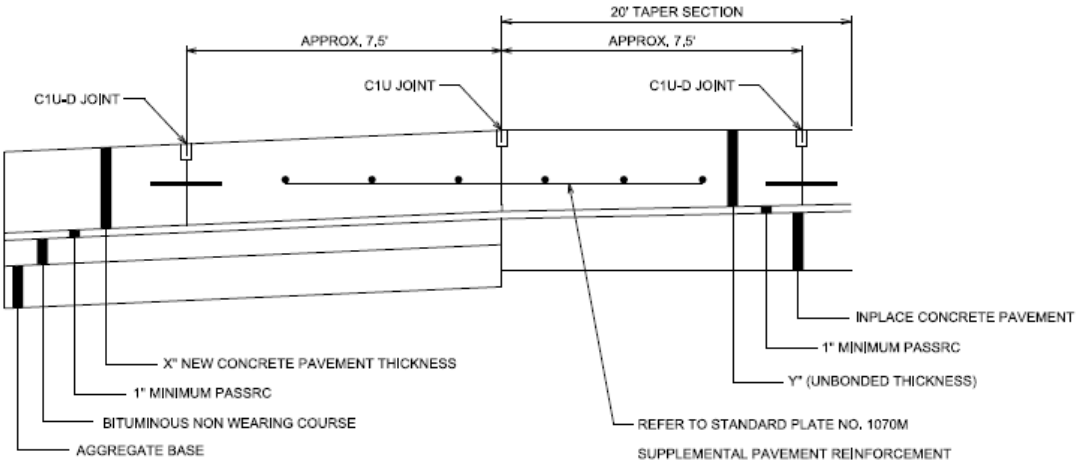


Figure 4. Transitions from Unbonded Overlay to Paving on Grade (use near Bridges and other removal area)

STATE OF MINNESOTA
Office Memorandum

DEPARTMENT : Transportation
Office of Materials Research and Engineering

DATE : January 15, 1993

TO : Darryl E. Durgin
Deputy Commissioner/Chief Engineer
Engineering and Operations Bureau

FROM : Richard H. Sullivan
Director
Office of Materials Research and Engineering

PHONE : (612) 779-5590

SUBJECT : Unbonded Concrete Overlay Policy

Attached for your approval is the "POLICY ON UNBONDED OVERLAYS RELATING TO PAVEMENT SELECTION." In summary, it allows the district to submit an Unbonded Overlay as an alternative to reconstruction, particularly to avoid subgrade problems.

It is the recommendation of our committee that this policy be implemented.

Richard H. Sullivan, Chair

Patrick C. Hughes

John E. Sandahl

Gerald J. Rohrbach

Approved: Darryl E. Durgin