

Overlays Webinar 1 – Questions and Answers

Thank you for your participation in the first National CP Tech Center webinar on Concrete Overlays. We hope you will join us in the coming weeks as we further explore this technology. The questions submitted during the webinar follow with answers that our speakers have provided. Please note that there are several references to CP Tech Center guides and reports that are available without charge in PDF format through the website:

<https://cptechcenter.org/concrete-overlays/>

1. Age & strength of concrete to open to traffic? Can high early or very high early strength concrete be used to open roads to traffic earlier, especially for cross traffic / intersections?

Conventional concrete mixes are typically used for concrete overlays. There has been some concern regarding potential detrimental effects of faster-setting concrete mixtures and reduced construction times on the long-term durability of concrete due to excessive shrinkage, heat generation, and poor microstructure. It is not uncommon, however, to see the use of early strength mixtures for crossovers and intersections.

2. How much time is allowed for curing before opening?

Opening of the concrete overlays is generally a function of strength gain in the concrete.

3. What psi required for opening?

While specified opening strengths for pavements (including overlays) vary significantly across the country, the “*Guide to Concrete Overlays*” offers suggested opening strengths based on slab thickness. (Table 16, page 77)

4. Do you have any data on Geogrid as opposed to Geofabric for unbonded overlays?

We are not aware of data or of any application where a geogrid has been substituted for a geofabric, bond breaking interlayer. Our concern would be that geogrid would not prevent bonding between layers.

5. What procedures do you recommend for detecting poor support areas during construction, after milling and before overlay?

In general, additional analysis (testing) to refine design inputs is only necessary when the existing pavement is in poor condition and/or heavy traffic is anticipated. The tools most generally used in the area of support would be the falling weight deflectometer or dynamic cone penetrometer. (Pages 15 of the “*Guide to Concrete Overlays*”)

6. Even if we provide a geotextile as a bond breaker, we may not still prevent reflection cracking.

As previously mentioned, we are not aware of a large incidence of reflective cracking in unbonded overlays using the geotextile interlayer. Please let us know if you have examples.

7. Because of this layer, deflection will increase, which implies that a high possibility of distress.

Again, we would be interested in reports or examples of significant reflective cracking.

8. Is there any data on the performance of roadways with high much volume?

Anything to share on overlay performance on high-volume roads in IA, like Interstates?

Iowa has observed good performance for thick unbonded overlays that have been in service for 10-15 years on high traffic volume facilities on rural divided highways and interstate highways. These overlays have tended to be 8-9 inches thick with 10-12 foot joint spacing. Full details can be found in the *“Performance of Concrete Overlays on Iowa’s Roadways”* study.

Other states have built overlays in higher traffic volume facilities and report good long term performance. (Check ACPA’s *Concrete Overlay Explorer*)

9. Have states used a tack-coat sprayed onto an old pavement to keep Geofabric separation layers from moving?

Yes. Some geotextile manufacturers actually sell their own adhesive coatings that they recommend for use with their fabrics.

10. Have you found a particular coarse size aggregate and type to perform better in overlays? Additionally, have overlays been done with three or four aggregate size (optimization) and if so how did they compare to standard two aggregate mixes?

If you are using a very thin overlay you may need to reduce the top size. Optimizing the combined gradation will help workability and finishability of the mixture – regardless of the number of bins. (See pages 75 and 76 of the *Guide to Concrete Overlays*). If you can send us your gradations we can help with that analysis.

11. How did you handle widened lanes if you had those cases?

Two lane road with widening is not a good candidate for this application.

Widened shoulders and widened lanes are common features on PCC overlays. The *“Guide for the Development of Concrete Overlay Construction Documents”* manual offers recommendations on how to design the widening.

12. How do you drain the separation layer when you have curbed streets?

The *“Guide to Concrete Overlays”* shows a detail for drainage of the separation layer into an intake when the existing curb is not removed. (Figure 90, page 74)

13. If I complete a bonded concrete overlay over existing asphalt (BCOA), once that bonded overlay has served its service life, what are my options for next actions if there is no money to replace?

Can the concrete overlay material(s) be disposed of cheaply?

Depending on the structural condition of the original pavement, rehabilitation has included patch/grind of the overlay, mill the concrete overlay off and place or an HMA overlay.

Last year a county engineer built an overlay over an existing concrete overlay from the 1980s – showing that concrete overlays can also serve as the base for another concrete overlay as well.

14. What minimum thickness of existing asphalt pavement you recommend for thin concrete overlay?

In bonded PCC over HMA, the existing HMA must be thick and in a fair condition. Could you please be a bit specific about the HMA thickness and condition? Thanks

We have historically recommended a 3” minimum base on field experience. This provides some structural stability and would typically withstand construction traffic. We are aware of a few overlays that have been place on less than three inches of asphalt that reportedly performing well. Again, this is an engineering judgement call based on the condition of the existing pavement and foundation system.

15. In residential settings, is the curb line compromised when the overlay goes down?

The overlay can be designed to match existing curb (for example, by milling the asphalt down by the same amount of thickness of the PCC overlay), or the existing curb is removed prior to overlay. There have been some instances where the curb was also overlaid.

16. Is it possible to use regular concrete for overlays or does it have to be modified concrete. Please explain if there are situations where one would be preferred over the other. If modified, what type of modified concrete / additives work best?

No special concrete is required. We would recommend using guidance from the PEM program for all of your mixtures.

17. Are existing concrete transverse joints needed to be repaired/removed before placing concrete overlay? Existing structure is 200-mm reinforced concrete with ~100mm of asphalt overlay. Considering to put 7" concrete overlay on top.

Some transverse joint repair may be needed if there is evidence of significant loss of support or loss of load transfer the composite system. One should also consider filling wide, 2” plus cracks in the existing asphalt.

18. For unbonded pavement designs, I’ve heard of engineers using ¼ inch asphalt millings from crown correction as a separation layer, and sometimes no separation layer at all with any joints/cracks filled with sand to prevent keying. What are your thoughts on pros/cons/risks of these two strategies?

Can crushed granite material be used as separation layer (stress relief)?

We would not recommend using granular materials for the interlayer. There are several instances where this has resulted in constructability issues and eventual loss of support.

19. Regarding use of a geotextile for drainage - what of the susceptibility to clogging?

Any concern with clogging of the geotextile?

It is possible – but no instances have been reported nor is there any data available thus far.

20. How does overlay hold up to regular snow plowing and frost heaves?

Plowing effects will depend on faulting as with any pavement. Typical faulting reported so far is about 1 mm. The effect of frost heaves will continue to be a problem for any pavement.

21. Was the Internal Curing data field data or was it computer modeling?

The data reference was field data.

22. We have seen many projects without the tie bars. Tie bars really help against different distresses. Should they must be used or not?

Tie bars can be used as normal in relatively thicker overlays, but might become impractical at thicknesses in the range of 4-5 inches. In those cases, fiber-reinforcement might be an alternative that could help provide some of the same benefits as tie bars.

23. What are the durability expectations for 3"-6" overlays in areas with high traffic volumes such as interstates?

Durability will depend on the mixture. 3" to 6" will likely fail due to overload for interstate traffic though. Thickness does need to be designed for the traffic. The BCOA-ME design procedure should be able to give you a sense of thickness and design life expectations for any given traffic level.

24. What if there was an overlay already done and somehow it failed? Do you recommend trying to overlay again and if so, would there be a different process?

In the case of early distress/early failure, it is important to investigate the cause to see if it's possible to repair the overlay. There are instances of concrete overlays on good base pavements being removed by milling and another concrete overlay installed.

25. What is the advantage of concrete overlay in comparable to asphalt concrete overlay? Concrete overlays have been shown to be cost competitive in many situations and are generally considered a more economical life cycle cost.

If you have an existing HMA, would it be better using concrete or asphalt overlay?

We would suggest that you compare structural designs for both pavements and consider life cycle cost and competition factors.

26. What was the ESAL count for the 6"x12"x12' overlay in Iowa?

<2000 vehicles per day + 10-20% trucks

27. Will the BCOA or UBCOA be also very beneficial for interstates? If yes, how can we increase the friction on the surface course?

Both of these types of overlays have been applied to interstates. Surface friction has not been noted as an issue for concrete overlays anymore that with full depth concrete pavements. These issues, while limited, generally are related to aggregate characteristics and selection.

28. Are there any repair methods that should be avoided in the interest of future concrete overlays? Materials or methods?

We are not aware of any precautions about repair methods or materials.

29. You said it, but I missed it. Why did UBCO over asphalt do better than UBCO over concrete?

Although UBCOA is not designed to bond to the underlying asphalt layer, experience (e.g. field observations, FWD test data) tells us that bond still occurs to some extent, for some amount of time. Given UBCOA and UBCOC projects of the same thickness, the UBCOA projects appear to benefit from the additional structure of the asphalt they are bonded to.

30. Comment: Underground utilities are pavements worst enemy in rural settings.

Agreed!

31. Could width of roadway (e.g. 22-feet where the volume of large, heavy trucks is on the rise) and right-of-way concerns also be an issue in considering bonded overlays?

Yes – there are lots of options with PCC overlays for widening traffic lanes and/or tied shoulders. (Check out the Guide for the Development of Concrete Overlay and Construction Documents”

32. Any typical recommendations for HMA mix type used for separation layer (stress relief)?

I had a question regarding the type of asphalt material used as an asphalt separator layer for unbonded concrete overlays. Specifically, what type of asphalt material is typically used for a separator layer? For example, a dense graded asphalt mixture. Has anyone tried using an open graded drainage layer instead of a dense graded asphalt?

33. How important is density when using a thin asphalt overlay as a bond breaker?

See pages 48 and 78 of the “*Guide to Concrete Overlays*” for more specific information regarding HMA separation layers)

34. If asphalt pavement shows signs of stripping, how should this be considered in choosing bonded or unbonded overlay?

I would be worried about the existing asphalt continuing to strip thus removing support to the overlay. Drainage will have to be provided to prevent further loss. If the asphalt is very badly stripped it may have to be removed.

35. How is bonding of PCC with PCC or HMA achieved in practice? Tack-coating?

For a PCC overlay of asphalt, the existing pavement surface should be clean and free of any contaminants. For bonding concrete to concrete, several different surface preparation methods may be considered, such as shotblasting. For more information, refer to the Overlay Guide Chapter 3 pg. 37 for PCC/PCC and the table on Ch. 7 pg. 100 for surface preparation for all overlay types.

36. Can you provide more details about the internal curing? What is it? How is it accomplished? Are there field tests that can predict how the internal curing is working?

A review of internal curing is available in
https://intrans.iastate.edu/app/uploads/2018/09/IC_guide_spec_w_cvr.pdf

37. What traffic level do you recommend for thin concrete overlay?

Thin overlays are capable of serving many traffic levels, but how well and for how long will depend on factors such as the truck mix and on the desired service life. Thickness design software such as BCOA-ME can help designers evaluate the use of a thin overlay in any type of traffic environment.

38. What is an average cost/syd for thin concrete overlay?

The CP Tech Center's [*Guide to Concrete Overlay Construction Documents*](#) contains cost information from projects that were let between 2008-2015 in eight states.