

Resiliency Webinar – Questions and Answers – 10/20/2020

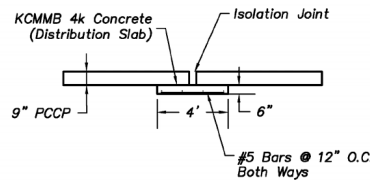
The questions submitted during the webinar follow with answers that our speakers have provided.

Resources:

- [Joint Layout - Including 6-Step Method for Roundabouts](#)
- [Jointing Concrete Pavements](#)
- [Concrete Roundabouts - ACPA Research and Technology Update](#)
- [EUPAVE's Concrete Roundabouts Publication](#)
- [Roundabout Guide from Kansas DOT](#)

1. Noticed on one of the plan sheets a note for a "distribution slab." What is that?
Oklahoma

The distribution slab in the example from Kansas would also be termed a sleeper slab. This allows two sections of concrete to be isolated from one another and reduce the differential deflection between the two by increasing the support. A from that example is below.



DISTRIBUTION SLAB DETAIL

KCMMB 4K CONCRETE DISTRIBUTION SLAB		
LOCATION	LENGTH	QUANTITY
NW Quad	79.6	5.9
NE Quad	79.8	5.9
SW Quad	79.9	5.9
SE Quad	80.7	6.0
Total Cu. Yd.		23.7

2. Could you please explain more about the importance of aspect ratio? Iowa

The aspect ratio of transverse to longitudinal joint spacing is a way of evaluating the slab dimensions. An aspect ratio of 1.25 would mean that the spacing between transverse joints is 1.25 times longer than the longitudinal joint spacing. A typical spacing between longitudinal joints is a 12 ft lane width. So assuming an aspect ratio of 1.25 would mean the transverse joint spacing is 15 ft. We recommend trying to maintain an aspect ratio of 1.25, and not to exceed 1.5. Larger aspect ratios result in a greater risk of cracking within the slab because of higher stresses.

3. Have you had any evidence that dowel bars lockup as the radius of the circular roadway decreases? Nebraska

This concern has been raised, but I have not seen examples of it in the field. If this is a concern, one possible solution would be to use plate dowels or diamond dowels that allow for multi-directional movement. These types of dowels are more common in the industrial market where two-directional doweling is a little more common.

4. Do you have any experience with using plate dowels for roundabouts (and/or standard intersections)? Pennsylvania

The concept of using plate dowels and diamond dowels for intersections and roundabouts has been raised, however I do not have photos or specific examples in the field. The benefit of using some plate dowels and diamond dowels is that they allow for two directional movement of the slabs and should be less likely to lockup a joint (see previous question for a little more discussion on this).

5. What is the practice for truck aprons, dowel or do not dowel? Pennsylvania

The decision to dowel or not dowel the truck apron is usually on a case-by-case basis and should include a consultation with the geometric designer. With a smaller diameter roundabout, more/most of the trucks will need to utilize the truck apron, and once you approach 80 to 100 trucks per day, dowels are recommended. With a larger diameter roundabout, hopefully fewer trucks will need to use the truck apron, and dowels may be overkill. However, in most cases the initial cost to dowel this area is quite small compared to the overall budget for a roundabout project and is usually a good idea if either of both of the intersecting roadways have significant amounts of heavier truck traffic.

6. What is the recommendation for texturing a roundabout? Pennsylvania

Since most roundabouts are low speed, a heavy burlap or broomed texture is common. Artificial turf drag has also been used. Although not required due to the low speeds involved, a few roundabouts have utilized a tined texture.

7. Eric: It would be great if you could share more pictures and info of the CRCP roundabout in the Netherlands. I look into this in the past and I recall that we only had one CRCP roundabout in the US (Texas). I believe CRCP roundabout is attractive because the joint design should be simpler since we only have terminal joints. California

EUPAVE (the European Concrete Paving Association) has a [roundabout publication](#) that shows some additional photos and details on CRCP roundabouts. There's also a report on the [Dutch Practice of CRCP Roundabouts](#).

There have been a few CRCP roundabouts done in Texas. There was recently a [presentation](#) given at ACPA's Annual Meeting that covered a couple of these.

There are definitely some benefits to using a CRCP roundabout as it provides a long-term, low-maintenance pavement that should handle significant truck traffic for a very long time. The cost-benefit should of course be evaluated using best engineering practices and a Life-Cycle Cost Analysis.

8. Are there criteria that will help the designer select the type of roundabout - whether isolated circle, pave-through or pinwheel? Iowa

The decision on the type of roundabout joint layout is best left to the overall project engineer in consultation with the traffic engineer and geometric designer. If the "contractor joint layout" option is used, the contractor's submittal requires approval by the project engineer prior to starting concrete placement. That said, the pinwheel option is quickly becoming popular with many engineers. Contractors will usually live with whatever joint layout is decided upon, subject to field modifications for constructability.

9. What type of base material (if any) is recommended to be placed under the truck apron? Florida

The same base material that is under the rest of the roundabout pavement should extend into the middle under the truck apron.

10. Steve: Do you ever run into issues with "contractor joint layouts" when agency/engineer require changes and increased costs, i.e. additional joints, dowels, tie bars, etc? Kansas

In Michigan, projects with concrete intersections (including roundabouts) are bid with the following bid items at a minimum: square yards of X inch concrete pavement, lineal feet of transverse doweled joints, lineal feet of tied sawcut longitudinal joints, lineal feet of tied edge-formed longitudinal joints, and lineal feet of plain sawcut plane-of-weakness joints. So the contract will have prices for these items, even if the engineers are off on some of their quantities. In many cases, the engineer still produces a joint layout for their own quantity determination purposes and does not publish it in the plan set released for bid. So to answer your question, there are times when an agency requires changes that were not considered beforehand, and items need to be added to the bid. There is a standard process for this that is followed that controls the allowable price ranges. But most projects have the flexibility to increase some item quantities and/or decrease others without significant cost to the project as a whole.

11. Eric: In the Kansas example it looked like the wheelpaths were at a longitudinal joint because of the way the lanes were striped. Is that a concern for roundabouts or is it unavoidable? Texas

We do want to avoid placing longitudinal joints in the wheel paths whenever possible. In some cases where the longitudinal joints can't match up with lane stripes, they may be placed within the lane, but it is still recommended to keep them out of the wheel path if possible (especially with heavy truck traffic).

12. What is the purpose of the flat section on the inner radius of some of the roundabout examples shown? Nebraska

Mountable truck apron. This allows articulated semi-trucks (think WB-50 or WB-53 in geometric design terms) the ability to navigate the relative tight turn radius of a roundabout, with the front wheels staying on the main roundabout pavement while the rear wheels of the trailer sweep across the truck apron.

13. What is the filling material of the core at the dead-end joint? Quebec

The fill material can be a weak sand mortar mixture or joint sealant material if the hole is smaller.

14. What volume of truck traffic typically determines whether asphalt or concrete would be best utilized for a roundabout? Oregon

AND

Is there any guidance out there to select concrete roundabout or asphalt roundabout? California

Concrete can be used for any roundabout regardless of what the traffic is. Concrete can be used for nearly any pavement facility. The selection of the paving material should be done with good engineering judgement, design, and should use a life-cycle cost analysis (the subject of next month's CPTECH Webinar) to help make a decision. Having alternate paving alternatives creates more competition that can reduce costs for both paving materials. More information on this concept will be discussed in the LCCA webinar and can also be found on [MIT's Concrete Sustainability Hub website](#).

15. It seems to be that the public perception of roundabouts is often negative, especially when first installed. Is that something that you have found goes away when the public gets more used to using them or how do you deal with negative public opinion? Iowa

Public perception and reaction is generally resistant to any change to the norm. Public outreach and effective communication help to get public buy-in to a project.

Typically, with changing an intersection to a roundabout will receive some resistance until the decision is explained or until it has been in place long enough for the public

to get used to the change. Oftentimes the negative perception wears away as drivers get used to the new intersection.

16. Are there any dowels at the joints? Florida

Dowels are typically used in roundabouts, especially when there is a decent amount of truck traffic.

17. Need good communication with the Inspectors as well as the contractor! Florida

Yes! Good communication between all parties on the project is essential for achieving project success.

18. Please define the terms you used: Rutting and shoving. Florida

Rutting and shoving are distresses that are often seen in asphalt pavements, especially at intersections and roundabouts that see significant truck traffic.

19. In the dead-end treatment with a hole, how is the hole sealed? Do we use concrete or joint fillers? Minnesota

The fill material can be a weak sand mortar mixture or joint sealant material if the hole is smaller.

20. Please explain what isolation joint is. Is this the same as expansion joint? Do we seal that type of joint? Minnesota

Many people call isolation joints expansion joints. ACPA uses the term isolation joint to differentiate it from expansion joints used for bridges. A short [ACPA publication](#) discusses the difference.

These joints are often sealed as well. You can find more information on this on [WikiPave's Jointing](#) page as well as in ACPA's [Joint Sealing technical bulletin](#).

21. Have you studied the effects of joints that do not complement pavement markings at 2x2 multi-lane roundabouts? Isolated circle jointing seems okay/preferable for single-lane roundabouts, however, can lead to improper lane changing at multi-lane exits due to outer lane vehicles following the joint instead of exiting. Same with Pave-through unless it is a 2x1 RAB lane configuration. For 2x2 the pinwheel pattern seems beneficial to have the jointing complement the pavement markings to reinforce proper lane use. Texas

AND

It is important to consider how joint patterns can influence driver perceptions of lane geometry, particularly in wet weather. Especially at a multi-lane roundabout, the

isolated circle method differs from the MUTCD pavement marking patterns, and doing so can lend an air of legitimacy to the most common driver errors at multi-lane roundabouts, such as illegal left turns from the outer lane(s). Pinwheel patterns keep the joints in conformance with the MUTCD lane configurations. Michigan and Wisconsin I think have been national leaders in this area. MN

The pinwheel joint pattern was developed in Michigan in 2005 primarily for this reason - to appease the concern of traffic engineers with regard to the influence of joint patterns on driver behavior. More important, however, is proper signage and pavement markings. Joint patterns can enhance but do not override these aspects, but they can help function as lane markers in wet weather. Anecdotal evidence from around the country shows that all types of joint patterns can work for most situations, given the proper geometric design, sign type and placement, and pavement markings. Most roundabouts, regardless of pavement type, require some tweaking of signs and pavement markings after they are opened to traffic.

22. Do you have any jointing examples for Turbo Roundabouts? Oklahoma

No. Turbo-roundabouts are still a fairly new concept as the first one was constructed around 2000 in the Netherlands. So far there are only about 400 of these type of roundabouts with most being built in the Netherlands (<http://www.turboroundabout.com/turbo-roundabout.html>). The FHWA Safety Program has released an [Informational Primer on Turbo Roundabouts](#) for more details. As this is a fairly new concept in the U.S., we currently don't have any jointing examples, but would encourage anyone interested in building one in concrete to reach out to your local ACPA Chapter or ACPA National for help in developing a joint layout.

23. What are common designs for the curb and gutter? Can you go with no curb or gutter and just have a shoulder on the outside? We are having issues with larger tractors in ND. North Dakota

Curb and gutter profiles range from taller (6"+) barrier curb, to 3" or less mountable curb, flat gutter, and 18" wide to 4'+ wide sections, tied and untied to the concrete pavement, and everything in between, including granite slabs in the Northeast. Local preference usually prevails here. Concrete roundabouts can accommodate many if not all of these types. The main concerns to remember are that curb & gutter functions as a path for drainage, a guide to motorists, and edge support for the concrete pavement. If you decide not to use curb and gutter and will have heavy (tractor) loads at the free edge, the pavement thickness can easily be designed for this, and usually only requires an extra inch vs. tied curb and gutter. Concrete shoulder also functions as edge support just like curb and gutter and can work just fine in a more rural concrete roundabout situation.