

# Roundabout Joint Layout

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*Moving forward with concrete results*

Roundabout Joint Layout

## Why are Joints Necessary ?

- Concrete cracks
  - Concrete drying shrinkage
  - Changes in temperature and moisture
    - Ambient (contraction)
    - Gradient (curling)
  - Subbase restraint (friction or bond)
  - First applied loads
- Joints force the concrete to crack where we want.

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# Joint Types and Purpose

- Contraction Joints
  - Transverse
  - Longitudinal
- Expansion (Isolation) Joints
  - Transverse
- Construction Joints
  - Transverse
  - Longitudinal

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# Joint Depth

- T/4 (Granular Sub-base)
- T/3 (Stabilized Sub-base)
- Tape Inserts not recommended
- Sawing preferred

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# Joint Spacing

- 2 x T (Granular Sub-base)
- 1.5 x T (Stabilized Sub-base)
- 15 ft absolute maximum for street & highway pavements
- 1.25 times lesser dimension

- Keep it Short!
- Keep it Simple!
- Keep it Practical!

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## Rules of Jointing: Ensure

- Develop a jointing plan (Birds eye view)
- Match existing joints or cracks when adding lanes
- Place joints to meet in-pavement structures
- Meet pavement width changes
- Error on the short side
- Exact spacing not important



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## Rules of Jointing: Avoid

- Slabs < 1 foot wide
- Slabs > 15 feet wide
- Angles < 60° (<90° is better)
  - Do this by dog-legging joints through curve radius points
- Interior corners (L-shaped slabs)
- Odd shapes (keep slabs square or pie-shaped)

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## Jointing of Roundabouts

- Joints in circular portion radiate from the center of the circle.
  - Isolate truck apron transverse joints from roadway transverse joints using an isolation joint.
  - Ensure width of pie shape does not exceed maximum joint spacing (15 feet).
- Align joints with lane lines and/or pavement marking

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## Jointing of Roundabouts

- Establish uniform lane widths to accommodate slip-form paver.
  - Most slipform operations will end at the intersection of the circulatory roadway with the legs of the roundabout.
  - Provide at least one uniform lane width to maximize the use of slipform equipment.
- Joints in legs are normal (perpendicular)

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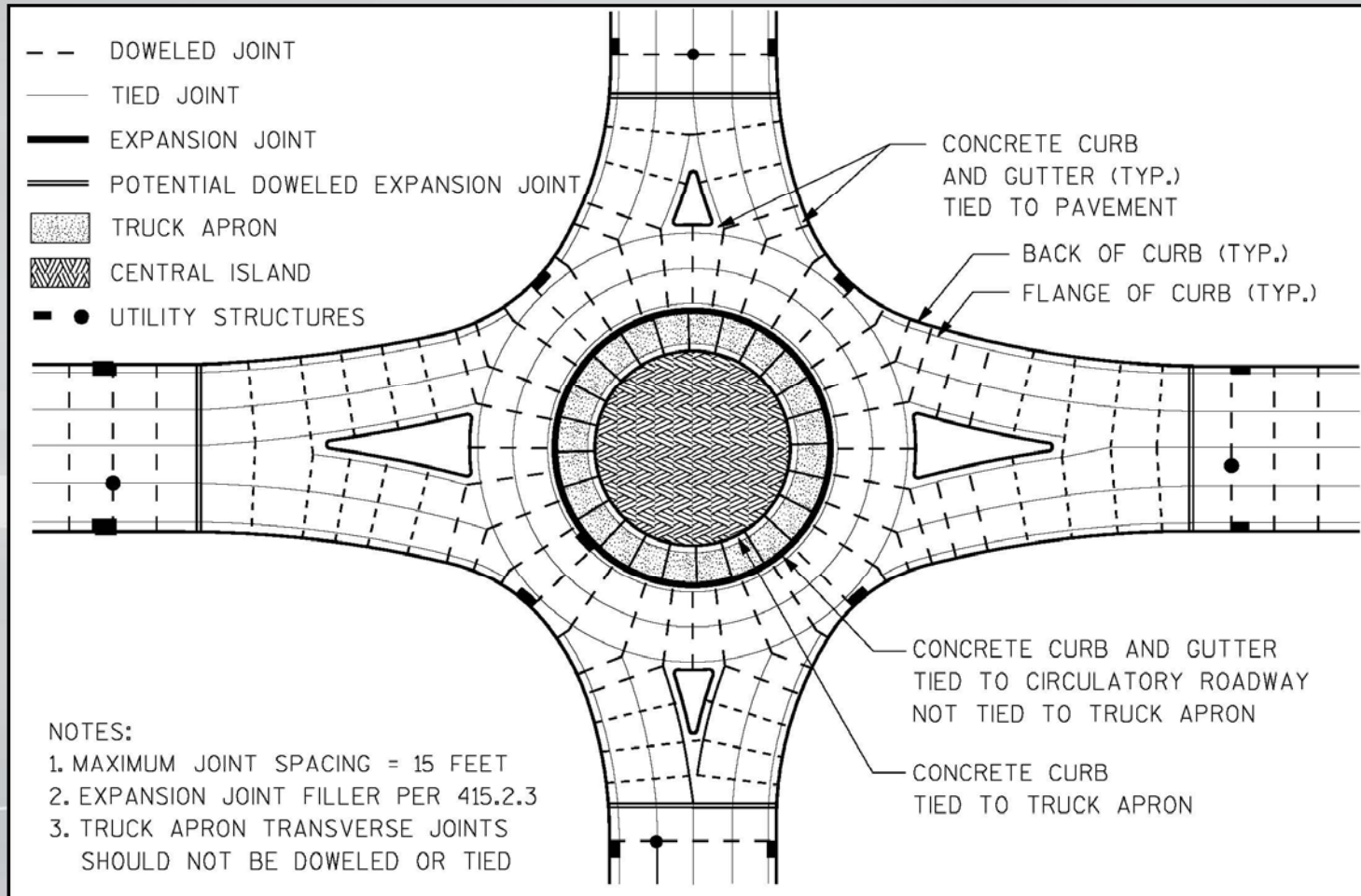
## Jointing of Roundabouts

- Utilize 2-foot kickers at pavement width changes.
  - Provide kickers in pavement at transverse joint location where slab width increases by 2-feet.
  - Provide kickers in curb and gutter at transvers joint location where slab width increases by 2-feet.
  - Square off island noses with transverse joint locations.



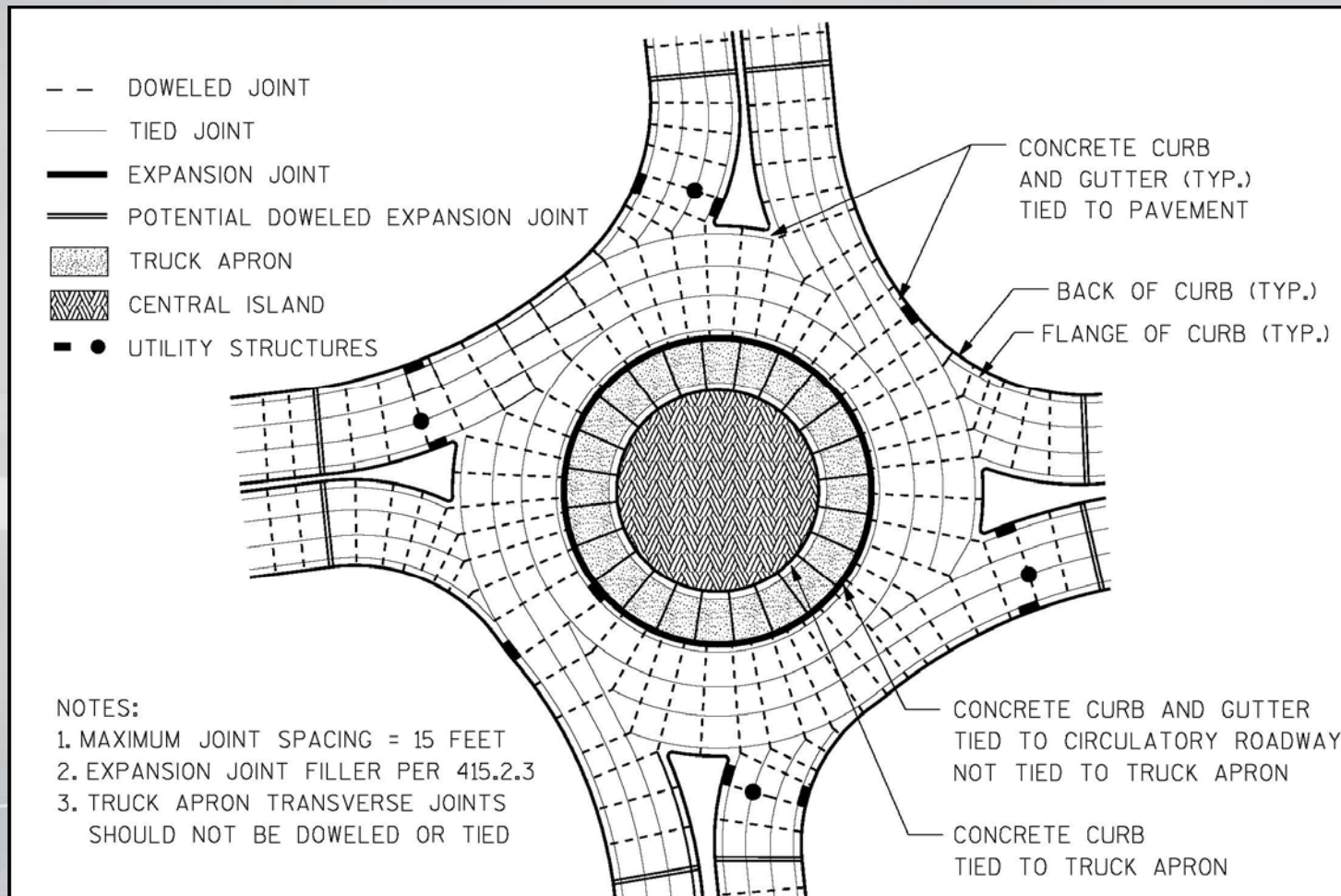
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# Isolated Circle Jointing Example



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# Pinwheel Jointing Example



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# Publications for Reference

**CONCRETE PAVING Technology**

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**Intersection Joint Layout**

Designers and contractors should outline an intersection joint layout while developing project plans. The initial plan view of an intersection provides the best field view for locating the main intersection. During construction it is difficult to simulate an intersection because of construction staging.

A good jointing plan will save construction by providing clear guidance. It is common practice for some designers to leave intersection joint layout to the field engineer and contractor. These designers often justify this practice by citing the many field adjustments that occur during construction, which they contend negates the usefulness of a jointing plan. However, it is not desirable to eliminate the jointing plan except for very simple intersections. A jointing plan and appropriate field adjustments are both necessary for more complex intersections, because islands, medians and turning lanes complicate joint layout and require some forethought before construction. The plan will also enable contractors to more accurately bid the project.

During construction it is likely that location changes will be necessary for some joints within an intersection. The primary reason is to ensure that joints pass through features embedded in the pavement like manholes or drainage inlets. It is common for the actual location of these features to vary from the location shown on the plans. As a result it will be desirable for the construction crew to adjust the location of some joints so that they coincide with the actual location of a manhole or inlet. The designer should consider placing a note on the plan to give the field engineer and contractor the latitude to make appropriate adjustments.

The transverse and longitudinal joints in concrete pavement are necessary primarily to control cracking. The desirable transverse joint spacing depends on the slab thickness and subgrade, but is usually about 15 ft (4.5 m). On typical roadway pavements, longitudinal joints divide lanes of traffic and in most cases are no more than about 12 ft (3.6 m) apart. Because the transverse and longitudinal joint spacing are usually not identical, it is difficult to maintain an even spacing on either roadway through an intersection.

The two-step method in this publication provides intersection joint layout fundamentals. The examples show a right angle and a skewed intersection. The detail diagrams show preferable alternatives, but there may be certain intersections with unique geometry that the methodology does not fully address. This publication does not address dowel and reinforcing requirements for joints.

**Joint Layout Terminology**

**Designer:** Construction block-out at points where the pavement changes width. (See page 5 for details.)

**Circumference Return Line:** A lightly drawn line 1.5 ft (0.45 m) to 1.0 ft from the face of the gutter along the curve between the edge of the intersecting roads. For obtuse angles, the line is 1/2 the nominal lane width from the gutter. Any joint that meets the circumference return line is brought along the curve's radius to the back of the curb and gutter. Older publications use the term "cut set point" to refer to the points where joints return to the back of the curb.

**Turner Return Line:** A lightly drawn line 1.5 ft (0.45 m) from the face of the gutter at the start of a turn lane type. Any longitudinal joint that meets a Turner return line defines a location for a designer's joint.

**Over Road Return Line:** A lightly drawn line 1.5 ft (0.45 m) from the edge of a the mainline roadway at a skewed intersection. Any cross-road longitudinal joint will meet a turnover joint for the mainline roadway or the cross-road return line.

**Intersection Line:** The line formed by the edge of the mainline and intersecting paving lanes (including turning lanes).

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**Concrete Intersections**  
A Guide for Design and Construction

**Introduction**

Traffic causes damage to pavement at grade street and road intersections perhaps more than any other location. Heavy vehicle stopping and turning can stress the pavement surface severely along the approaches to an intersection. The pavement within the junction (physical area) of an intersection also may receive nearly twice the traffic as the pavement on the approaching roadway.

At busy intersections, the added load and stress from heavy vehicles often cause asphalt pavements to deteriorate quickly. Asphalt surfaces tend to rut and show under the stress or load of buses and trucks stopping and turning. These deformed surfaces become a safety concern for drivers and costly maintenance problems for roadway agencies.

Concrete pavements better withstand the loading and turning movements of heavy vehicles. As a result, city, county and state roadway agencies have begun rebuilding deteriorated asphalt intersections with concrete pavement. These agencies are extending road and street system maintenance funds by eliminating the expense of intersections that require frequent maintenance.

At-grade intersections along business, industrial and arterial corridor routes are some of the busiest and most vital pavements in an urban roadway network. Closing these roads and intersections for pavement repair creates costly traffic delays and disruption to local businesses. Concrete pavements provide a long service life for these major corridors and intersections.

Concrete pavements also offer other advantages for intersections, including:

1. A long-term pavement solution.
2. Low maintenance costs.
3. No softening or deterioration caused by oil and/or fuel drippings.
4. Better light reflectivity than asphalt, enhancing pedestrian and vehicle safety at night and in inclement weather.
5. A durable and skid resistant surface.



An intersection constructed with well concepts.

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**R&T UPDATE**  
Concrete Pavement Research & Technology

**Concrete Roundabouts**  
Rigid Pavement Well-Suited for Increasingly Popular Intersection Type

In certain areas of the United States, traffic engineers are recognizing the benefits of using roundabouts instead of traditional signalized intersections. These benefits include reduced accident rates, reduced delay time, and lower speeds, to name a few.

Today's roundabouts are different than traffic circles. When designed and striped correctly, roundabouts offer better traffic flow and safety characteristics than most other intersection types. The vehicles on the entering roadways must yield to traffic in the circulating roadway. This ensures that there is no gridlock in the roundabout.

**Why Concrete for Roundabouts**

The roundabout designer has a choice of pavement type for roundabouts, concrete or asphalt. Concrete roundabouts are long-lasting and easy to maintain, because concrete does not push, shove, or rut under the turning motion of heavy vehicles around the intersection. Concrete provides a long-term fix, and is well-suited to areas where future disruption to traffic must be kept to a minimum.

In high-traffic areas, where safety is a priority, concrete will stand up to the pounding of heavy traffic. It does not require periodic rehabilitation, such as overlays, every 5 to 10 years like asphalt does. And drainage characteristics are preserved over time, because concrete does not rut, shove, or succumb to potholes. Additional benefits like good skid resistance and lighter colored, more reflective paving material make concrete the better choice.

Concrete pavements can be constructed more quickly than asphalt pavements, because they are placed in one pass of the paver instead of multiple lifts. Concrete mixtures can also be easily colored and textured to differentiate traffic patterns and distinct areas of the intersection.

**Design**

The two primary design aspects for any intersection construction project and for roundabouts in particular, are pavement thickness design and jointing system design.

In most pavement thickness design procedures, designing the pavement structure requires, at minimum, determining the following factors:

1. **Concrete Properties** – Flexural strength or modulus of rupture, IRI, and modulus of elasticity, E.
2. **Support Conditions** – Strength of the subgrade, or subgrade-subbase combination (modulus of subgrade reaction, k).
3. **Desired Life** – Design period, which is typically 20 years, but may range from less than 5 to more than 50 years.
4. **Expected Traffic** – The weights, frequencies, and types of truck axle loads that the pavement will carry during the design period.
5. **Design Features** – Use of dowels for load transfer at transverse joints, and provision of edge support along side edges.
6. **Reliability** – As it relates to the predicted number of cracked slabs at the end of the design life.

Because an intersection carries traffic from two or more roadways, the concrete slab thickness may need to be greater than the thickness on the approaching roadways. For both roundabouts and traditional intersection pavements, typical concrete thicknesses can range from 5 to 10 inches (125 to 250 mm). The exact required thickness will depend on expected traffic, local conditions, past history, and other factors. See Table 1 on the next page for more detail.

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# QUESTIONS???

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CTH 'A' Concrete Pavement Overlay in Dodge County