Jointing Rural Intersections

This section describes how to joint rural intersections by following the guidelines outlined in Iowa DOT Design Manual Section 7A-3. The first example illustrates a step-by-step process for jointing a T-intersection. The second example discusses the jointing of an intersection at a divided highway. Even though not all rural intersections will be exactly like the ones in these examples, the process described is applicable to other layouts.

A. Example 1: T-Intersection

The first example is a T-intersection of a rural two-lane highway and a paved sideroad. The intersection has returns on each side (see Figure 5G-4.01) and the pavement thickness is 10 inches. The design year truck volume on the sideroad is 250 vpd.

Step 1: Place Joints with Predetermined Locations

1. **Longitudinal Joints:** Because the location of longitudinal joints for both the mainline and the sideroad are predetermined by the lane pavement width, these joints should be placed first. Within the intersection, the road that is paved first, or already exists, determines which joints are longitudinal and which are transverse. In this example, assume that the mainline is paved first. Since the mainline is a rural two lane highway, the longitudinal joints are spaced at the lane pavement width. The longitudinal joints running down the centerline and edges of the sideroad define the locations of the first transverse joints for the mainline (see Figure 5G-4.01).

   To determine an appropriate longitudinal joint to use, refer to SUDAS Specifications Figure 7010.101. Normally, the type of joint used depends on the pavement thickness. Since the pavement thickness is greater than 8 inches in this case, either a KT-2 or an L-2 joint is appropriate.

2. **Joints at End-of-taper:** The only other joints with predetermined locations are the transverse joints that are placed where the end-of-taper sections terminate. End-of-taper sections are 2 foot wide sections placed at the ends of an intersection return (see Figure 5G-4.01). They are used to prevent the return from narrowing to a point as it intersects with the pavement. Concrete less than 2 feet in width is weak and cracks readily.

   As Figure 5G-4.01 shows, normal practice is to place a transverse joint in the mainline or sideroad pavement where the end-of-taper section terminates. Figure 5G-2.02 in Section 5G-2 indicates a CD joint should be used on the mainline if the pavement thickness is greater than or equal to 8 inches. On the sideroad, CD joints are also used since the design year truck volume is greater than 200 vpd (C joints could be used on the sideroad if the design year truck volume was less than 200 vpd).

   Note that the transverse joints within the intersection are not skewed.

Step 2: Locating Difficult Joints

Difficult locations to joint, such as intersection returns and traffic islands, are addressed next. After joints have been placed in these locations, the rest of the joints can be worked in around them.

1. **Intersection Returns:** The two intersection returns are shaded in Figure 5G-4.01. To help vehicles negotiate the turn, a curved longitudinal joint (normally offset 12 feet from the free edge of the pavement) is placed in the intersection return to delineate the turning path. A second curved longitudinal joint (normally offset 24 feet from the free edge of the pavement) is placed if enough area is available.

2. **Traffic Islands:** Joint design at the traffic islands is not an exact process. It is done by trial-and-error until satisfactory results are achieved.

   The first thought may be to place CD transverse joints at every radius point of the island (see Figure 5G-4.01, Detail A). However, with this layout, the 17 foot maximum and 12 foot minimum spacings for a CD joint are violated.

   Detail B shows joints at the desired 17 foot interval. Although the spacing of this placement is correct, an awkward area of pavement is formed and a crack is likely to develop as shown in Detail B.

   Detail C illustrates a combination of the methods used in the first two details. No rules of spacing are violated and no awkward areas of pavement exist.

   The transverse joints attached to the island are extended across the sideroad and mainline pavements and across the intersection return adjacent to the island, as shown in Figure 5G-4.01. The joints used in one area must also be acceptable for any other areas into which they are extended. If the extended joints do not satisfy spacing or other criteria in any adjacent areas, they must be redesigned in the original area.

Step 3: Locating Remaining Joints

After the joints at difficult locations are located, the remaining joints (generally transverse joints) are placed in appropriate locations. As noted in Step 1, the appropriate transverse joint for both the mainline and the sideroad is the CD joint. The maximum spacing for CD joints is 17 feet and the minimum spacing is 12 feet. Therefore, the remaining areas that need transverse joints should have CD joints spaced within this range.

1. **Mainline and Sideroad:** The location of the remaining transverse joints on the mainline and sideroad is largely determined by the location of joints already placed in Steps 1 and 2 (see Figure 5G-4.01). The remaining joints are spaced between 12 and 17 feet between these already-placed joints. However, you must also consider how these joints will be extended into the returns (described below).

2. **Intersection Returns:** After the transverse joints have been located in the mainline and the sideroad, they are extended into the intersection returns to be used as transverse joints for those areas as well. As with other transverse joints, those in intersection returns must intersect with the free edge of the pavement. However, the acute angle between the joint and the pavement edge (and between the joint and other joints) must be greater than or equal to 70 degrees. Details A, B, C, and D in Figure 5G-4.02 illustrate how to intersect joints with the free edge of the pavement (and with other joints) under various conditions.

- Detail A shows a transverse joint that intersects with the free edge of the pavement unaltered. This is acceptable because all angles between the transverse joint and the longitudinal joints and between the transverse joint and the free edge of the pavement are greater than 70 degrees.
- Detail B uses a dashed line to show the original position of a transverse joint whose angle with the free edge of the pavement is less than 70 degrees. This joint should be skewed to make it perpendicular to the free edge of the pavement, as shown by the solid line.
- Detail C illustrates a situation where skewing the joint to make it perpendicular to the free edge of the pavement causes the angle between the joint and the edge of the mainline to be less than 70 degrees. When this situation occurs, the joint is extended a minimum of 2 feet beyond the edge of the mainline or sideroad, and then it is skewed to make it perpendicular to the free edge of the pavement.
- Detail D shows the curved longitudinal joints that were placed in the intersection return in Step 2. Each of these joints terminates at an intersection with a transverse joint. The intersection of these joints is required to be at least 2 feet from the edge of the mainline or sideroad. This requirement determines the appropriate transverse joint at which the longitudinal joint terminates. The dashed line in the detail indicates the position of the longitudinal joint if it is extended too far. Because the intersection with the transverse joint is less than 2 feet from the pavement edge, the longitudinal joint is terminated at the previous transverse joint.

After all joints are placed, the layout should be checked to ensure that all joint spacings and angles are acceptable. If they are not, the spacing of the mainline or sideroad joints may need to be changed, one or more joints may be added, or joints within the returns may be modified. Figure 5G-4.02 shows all of the transverse joints appropriately placed.

Step 4: Label Joints

The completed jointing layout of the T-intersection is shown in Figure 5G-4.03. As stated on SUDAS Specifications Figure 7010.101, the L-2 and KT-2 joints may be used interchangeably at the contractor's discretion, depending on the paving sequence. Therefore, the designer may identify the longitudinal joints as either L-2 or KT-2 on the jointing layout. The transverse joints in the end-of-taper sections are C joints because they are only 2 feet long, which are not long enough to use a doweled transverse joint like the CD. The joints on the right side of the traffic island are also C joints.

It is not necessary to identify every joint on the jointing layout. A few key joints on the diagram should be identified and whenever a series of joints changes to a different type of joint, the joint at the location of the change should be identified. Also, any joint that may be a source of confusion should be identified.

Joint lengths are also shown on the jointing layout, normally rounded to the nearest foot. Similar to labeling joint types, not every length needs to be indicated. However, any length that cannot be inferred from the diagram should be labeled. For example, the distance the mainline or sideroad transverse joints extend into the intersection returns before being skewed perpendicular to the free edge of the pavement, should be dimensioned (see Figure 5G-4.03).

B. Example 2: Intersection at a Divided Highway

The jointing design process for a four-way intersection at a divided highway is basically the same as the T-intersection, except that there is also a paved median opening to deal with.

As with the T-intersection, start out by placing the longitudinal joints that are predetermined by the lane pavement width. After doing this, place longitudinal joints through the opening (see Figure 5G-4.04). The edges of the left-turn lanes define the location of two of these joints. The remaining longitudinal joints in the opening are spaced roughly a lane width apart - somewhere in the range of 10 to 16 feet is acceptable.

After this, the process is basically the same as the T-intersection:

- Place the transverse joints at the end-of-taper sections.
- Place the curved longitudinal joints in the return.
- Place the transverse joints around the islands. Figure 5G-4.04 illustrates the design through this point.
- Place the remaining transverse joints and extend them into the returns and into the median opening. Refer back to the T-intersection example for details on how the joints should intersect with the free edge of the pavement and with other joints.
- Label the joints.

Figure 5G-4.05 illustrates the final jointing layout.

Figure 5G-4.01: Placement of Predetermined and Difficult Joints

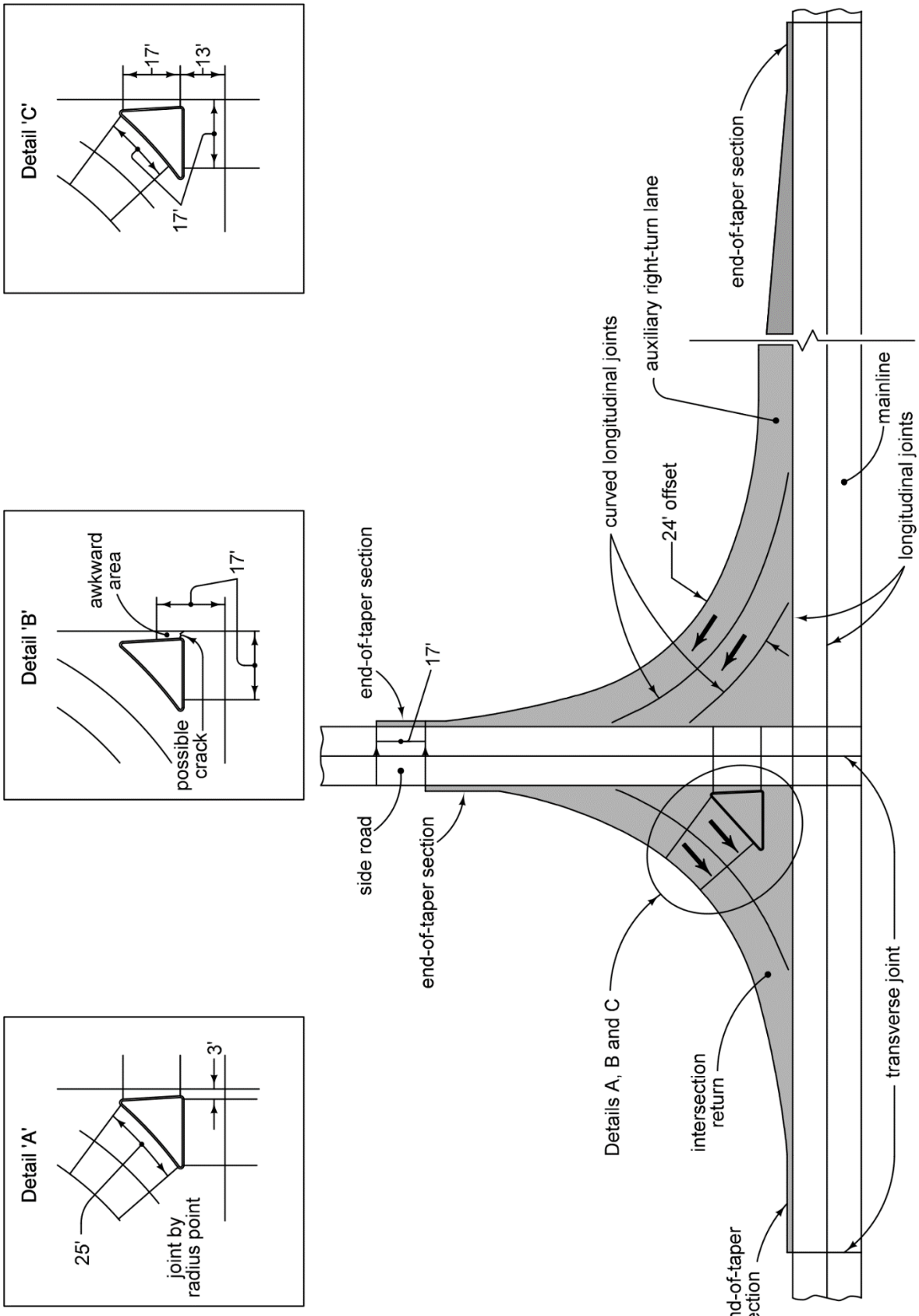


Figure 5G-4.02: Placement of Remaining Joints

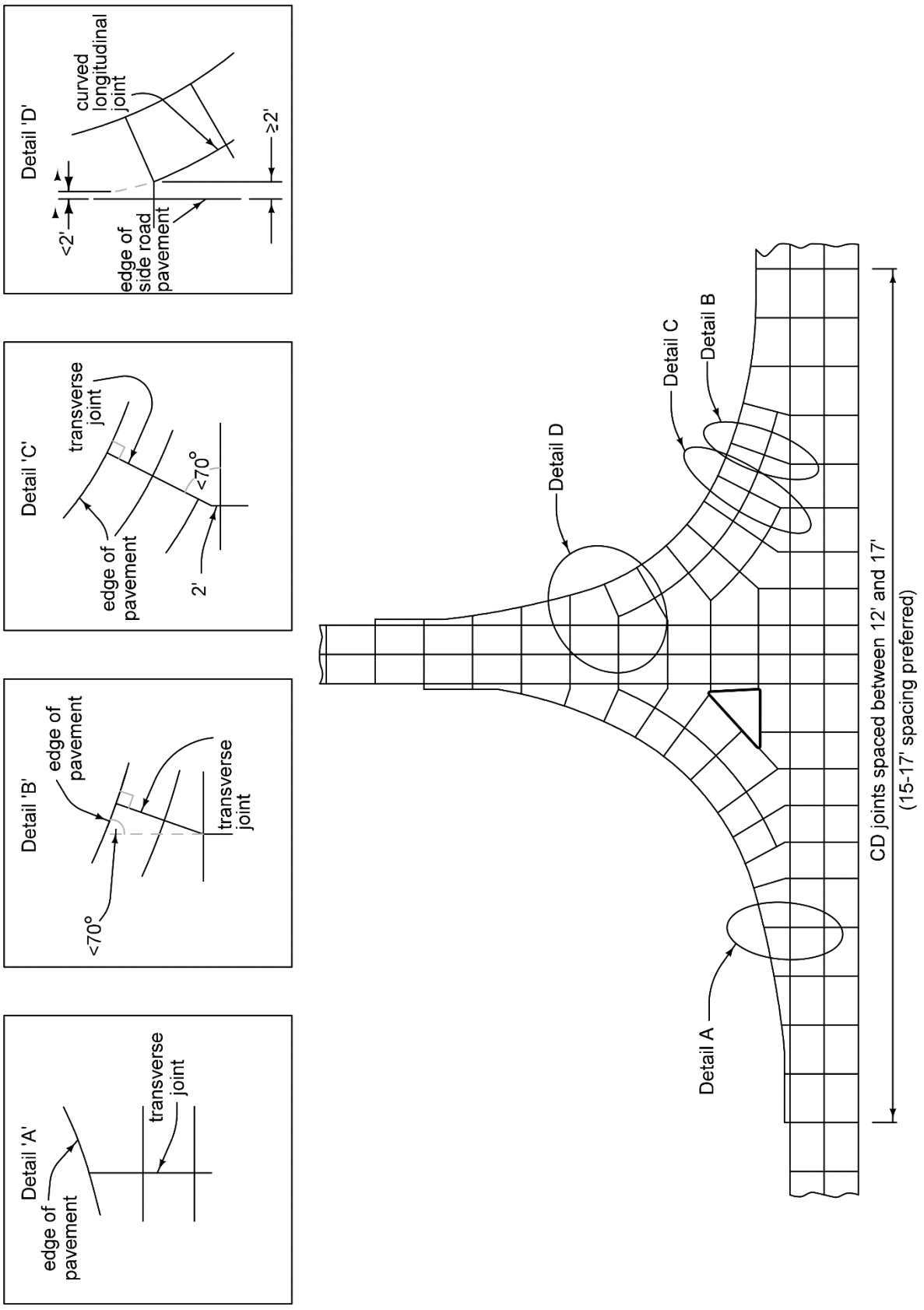


Figure 5G-4.03: Final Joint Layout

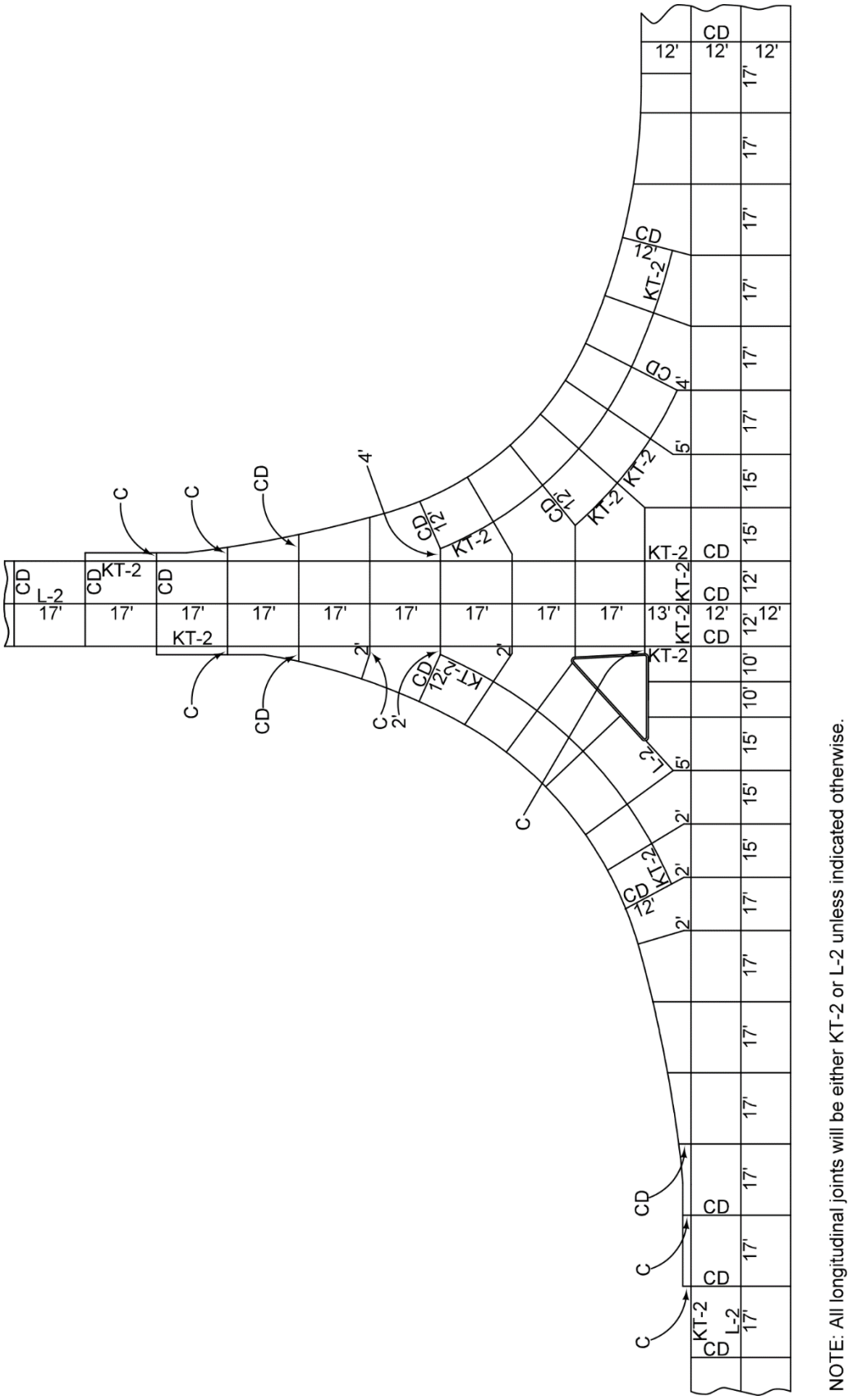


Figure 5G-4.04: Placement of Predetermined and Difficult Joints

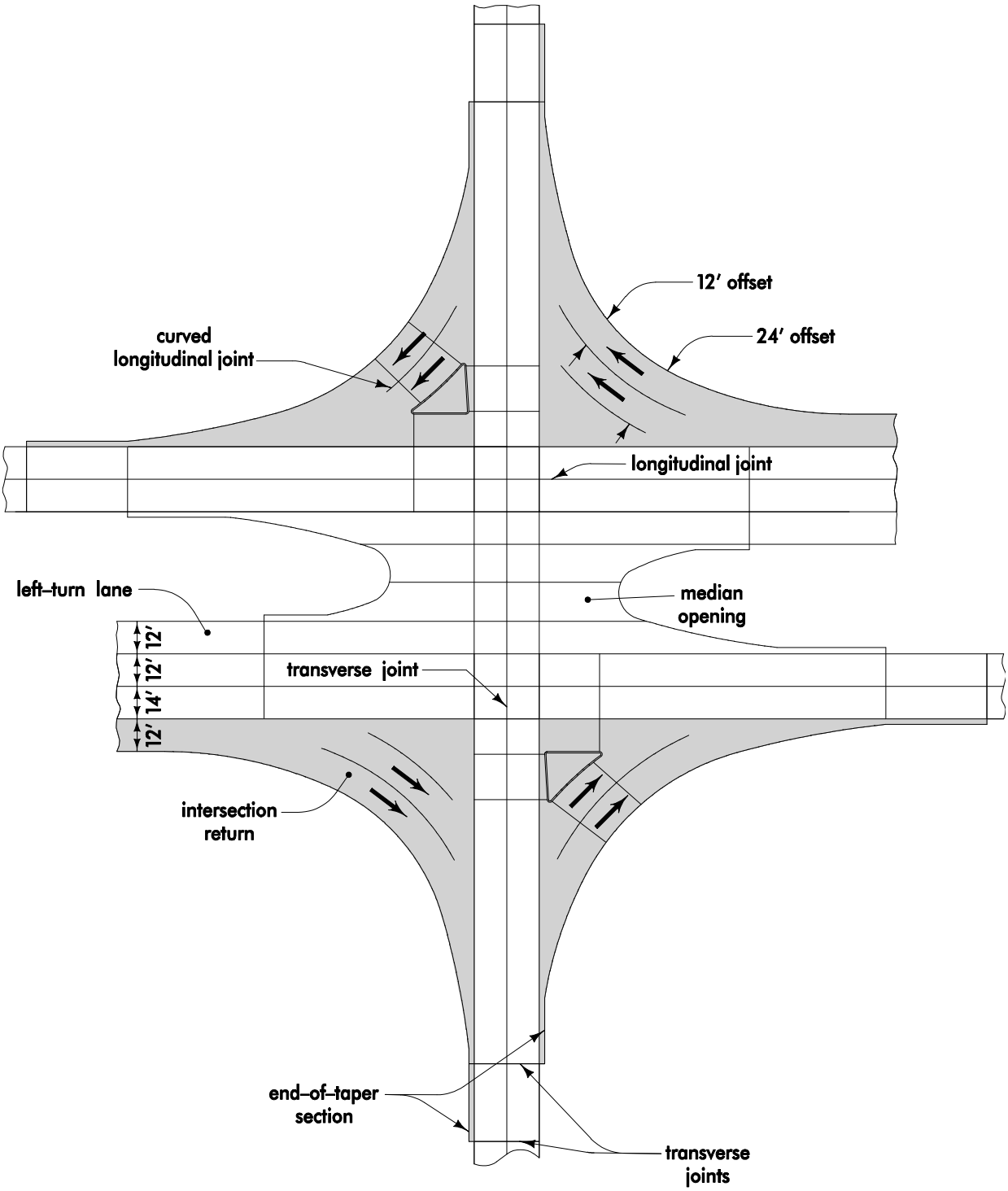
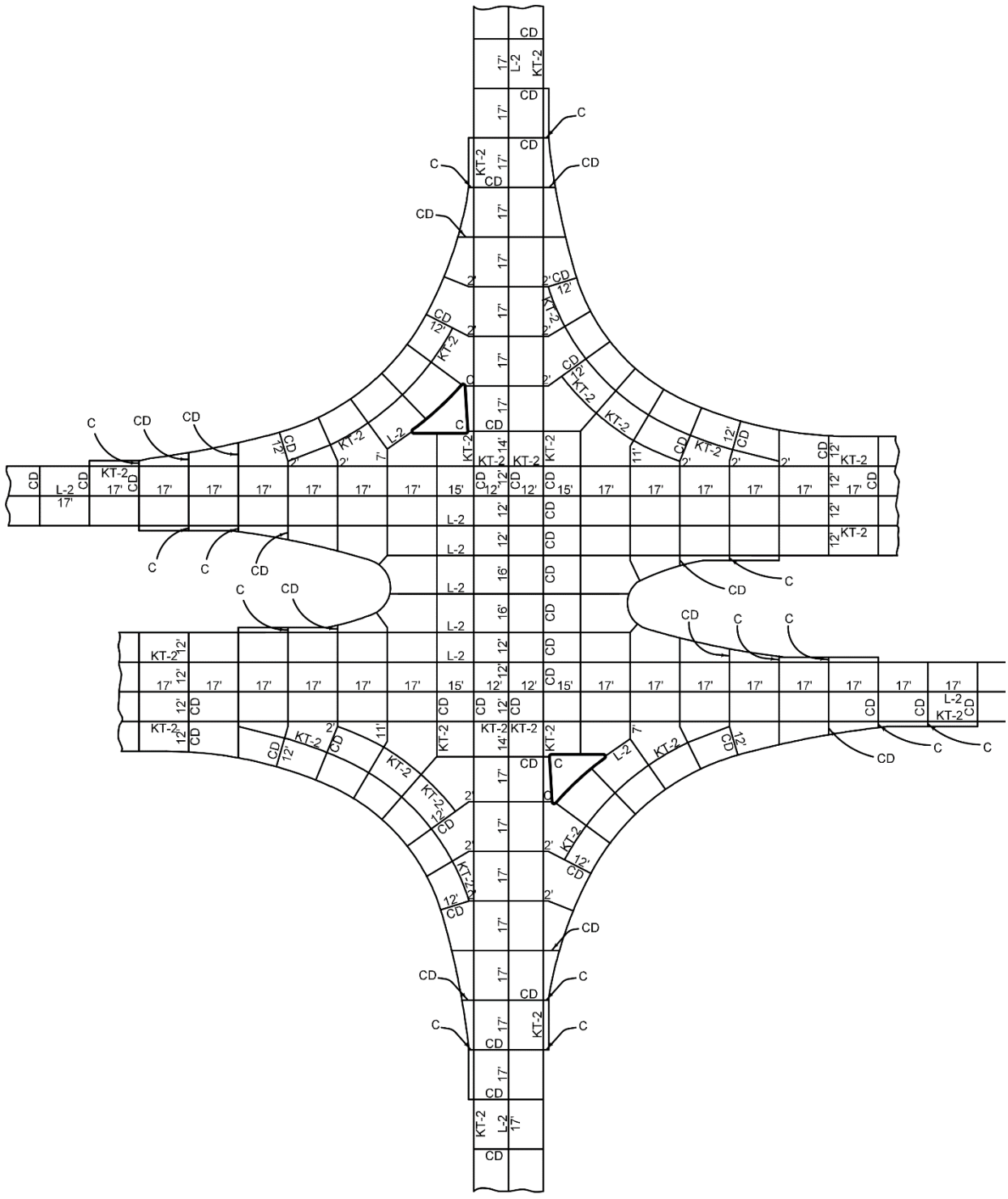


Figure 5G-4.05: Final Jointing Layout



Note: All longitudinal joints will be either KT-2 or L-2 unless indicated otherwise.