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# HISTORY OF EXPANSION JOINT USE ON IOWA'S PRIMARY ROAD SYSTEM

MAY, 1975

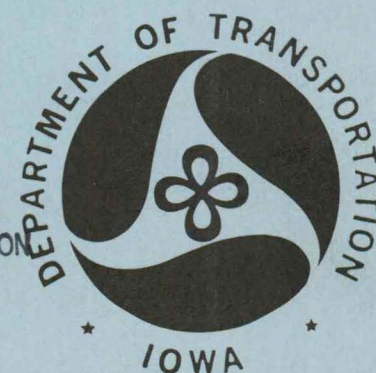
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#### GENERAL:

Expansion joints are constructed transversely across the roadway to accommodate the expansive movement of P. C. Concrete Pavements caused by fluctuations in temperature, thereby providing protection to adjacent structures or pavements from damage caused by this movement. Expansion joints may be constructed using a combination of dowels and compressive materials, however, in recent years dowels have been generally omitted. The compressible material used must be able to resist the elements, rebound to its original shape after each compressive cycle, and must not itself develop damaging compressive forces.

Expansion joints have been used by the Iowa State Highway Commission as part of its earliest road building endeavors. The use and type of expansion joints have varied through the years. The following report will discuss the major applications of the expansion joint in highway construction in Iowa.

#### TRANSVERSE PAVEMENT JOINTS:

Transverse joints in concrete pavements are used to control pavement cracking. Until about 1918 the only joint used for this purpose was an expansion joint constructed at from 25 to 36 ft. intervals. This procedure ended approximately in 1918 and pavements were constructed with no transverse joints until about 1929. At that time the use of the transverse joint was revived and expansion joints were constructed at intervals of from 40 to 100 ft. This procedure continued until approximately 1931 when the joint spacing and width was made dependent upon the type of aggregate used for the concrete. This resulted in a spacing and joint width which varied from a 1/2 inch expansion joint at 40 ft. intervals for work constructed with decomposed feldspathic rock to a 1 inch expansion joint at 80 ft. intervals for work constructed with limestone aggregate. This practice continued until about 1934 when the use of expansion joints as the only transverse pavement joint ended. The use of expansion joints continued until approximately 1947 in



combination with contraction joints. These combinations consisted of specifying the distance between the expansion joints with contraction joints spaced at 30 ft. intervals in between. The distances specified between expansion joints were 60 ft. from approximately 1935 to 1936, 90 ft. from 1937 to 1939, and 120 ft. from 1940 to 1948. In about 1948 the policy of using contraction joints at 20 ft.± spacing was adopted as the normal transverse pavement jointing procedure and has continued through the present time.

#### INTERSECTIONS:

Intersections of two or more paved roads normally included expansion joints as part of the construction details for many years. The type of expansion joint used coincided with the typical joints shown in Appendix A for the years indicated. Any deviation from the normal joint was indicated on the jointing details. This Policy was followed from approximately 1930 until 1966 for rural intersections and from 1930 through 1969 for urban intersections. Examples of expansion joint usage at urban and rural intersections are shown in Appendix B.

#### RAILROAD CROSSINGS:

At-grade railway crossings with P.C. Concrete roadways did not specifically require expansion joint construction prior to approximately 1947. As was previously stated in the section on expansion joints for transverse pavement joints, the mainline pavement jointing included an expansion joint constructed at specified intervals prior to this date. After 1947, when the expansion joint was no longer used as the normal transverse pavement joint, railway crossing construction details began specifying the location and type of expansion joint which was to be constructed at each approach to the crossing. The earliest details, through approximately 1959, required that one expansion joint be placed at each approach



approximately 300 to 500 ft. from a railroad crossing. Refer to Appendix A for details of the expansion joint which was used during these years. From approximately 1960 until the present time, the type and location for expansion joint construction at railway crossings has been covered by Standard Road Plan RH-6. This standard required the following expansion joint construction and spacings in P. C. Concrete roadways at each approach to at-grade crossings during the years indicated: 1960 - 1966, two doweled expansion joints filled with 1" performed bituminous fiber at 20 ft. and 300 ft., respectively, from the crossing; 1967-1968, two 2" doweled expansion joints filled with poly-foam compression material at 20 ft. and 300 ft. from the crossing; 1969-1970, one "AB" joint consisting of a 3" to 4" void with notched sides filled with flexible foam located from 100 ft. to 200 ft. from the crossing; 1970-1971, same "AB" joint required with the location changed to 50 ft. to 100 ft. from the crossing; 1971- 1973, "AB" joint changed to "OV" joint with only difference being that the joint was left void by the contractor and filled with flexible foam by maintenance personnel at a later date; 1973 - present, one "CF" joint consisting of a 4 $\frac{1}{4}$ " void filled with performed urethane foam joint material located from 50 ft. to 100 ft. from the crossing. Examples of several railway crossing details are shown in Appendix C.

#### BRIDGE APPROACH SECTIONS:

P. C. Concrete approaches to roadway bridges have specifically required expansion joint construction since about 1920. The expansion joints were required to protect the bridge abutment from the expansive concrete movement. Because of the importance of this protection, specific details were included in all roadway plans involving bridge approach construction.



In the early 1920's, two 1/2 inch skewed expansion joints filled with asphalt were constructed at 75 and 100 ft. from the bridge. This was modified in the mid-20's to three transverse 1 inch doweled bituminous felt joints constructed 10, 60 and 110 ft. from the bridge. In the late 1920's the number of expansion joints was increased to five 2 inch bituminous filled joints with the first joint being constructed at the bridge end and the remainder at 15, 30, 45, and 90 ft. from the bridge. In the early 1930's through approximately 1963, a 1 inch joint was constructed at the bridge and 2 inch joints constructed at 15 and 30 ft. from the bridge. The 1 inch joint was filled with bituminous fiber and the 2 inch joints were filled with 1 inch of wood and 1 inch of bituminous fiber. From 1964 to 1967 the approach was constructed with five 2 inch joints filled with compression material at 0, 15, 30, 45, and 60 ft. from the bridge. In 1967 separate details were used for two-lane approaches and for four-lane urban approaches. The two-lane details specified a 1 inch type "E" expansion joint at the bridge with three 4 inch type "AB" joints at 15, 30 and 130 ft. Refer to Appendix A for details of all joints with letter designations. The four-lane urban approach details required four "AB" joints at 0, 15, 30 and 80 ft. from the bridge. From 1971 through 1973 approaches were constructed with an "OV" expansion joint 80 and 100 ft. from the abutment. An additional "OV" joint was constructed at the bridge for movable abutments or a 1 inch "E" joint at bridges with fixed abutments. The "OV" joint was not filled by the contractor but rather by maintenance personnel at a later date. In 1973 the previous detail was modified by replacing the "OV" joint was filled by the contractor with a preformed urethane foam joint material.

Expansion joints in approaches to bridges where continuously reinforced pavement was used were spaced differently from normal pavement sections. The late 1967 to mid-1968 approach details

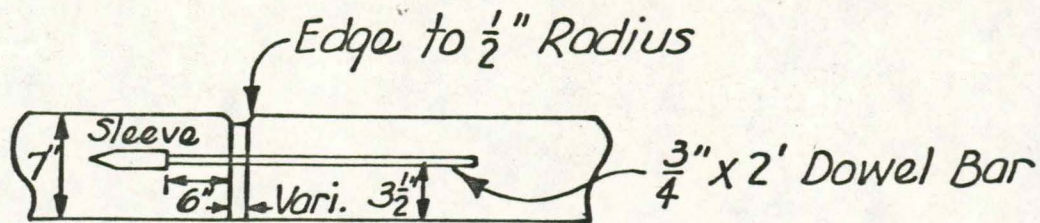


required four "AB" joints at 0, 15, 30, and 45 ft. from the bridge. In 1968 this was revised to a 3 inch "AB" joint at the bridge with 4 inch "AB" joints constructed 22.5 and 45 ft. from the bridge. The "AB" joint was replaced with an "OV" joint in 1971 and with a "CF" joint in 1973. The required joint spacings have not changed since 1968.

Examples of expansion joint locations in bridge approach sections are shown in Appendix "D".



# APPENDIX A



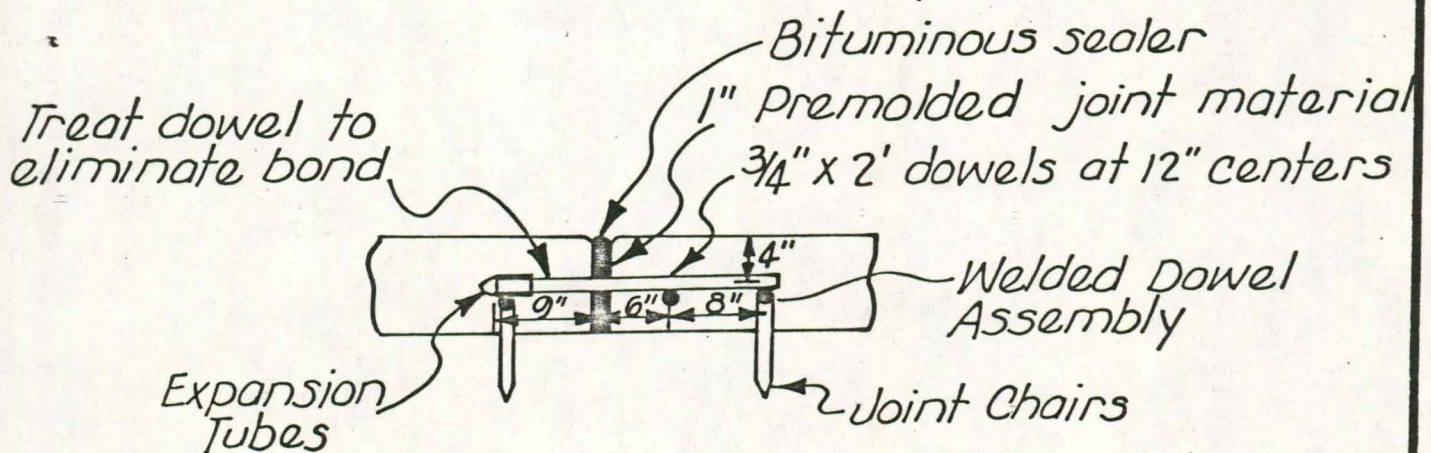
Joints may be either poured or premolded, in either case installation devices are to be approved before being used.

1" Expansion Joints at 80' centers shall be used on work constructed with lime stone aggregate.

$\frac{3}{4}"$  Expansion Joints at 60' centers shall be used on work constructed with gravel aggregate.

$\frac{1}{2}"$  Expansion Joints at 40' centers shall be used on work constructed with decomposed feldspathic rock.

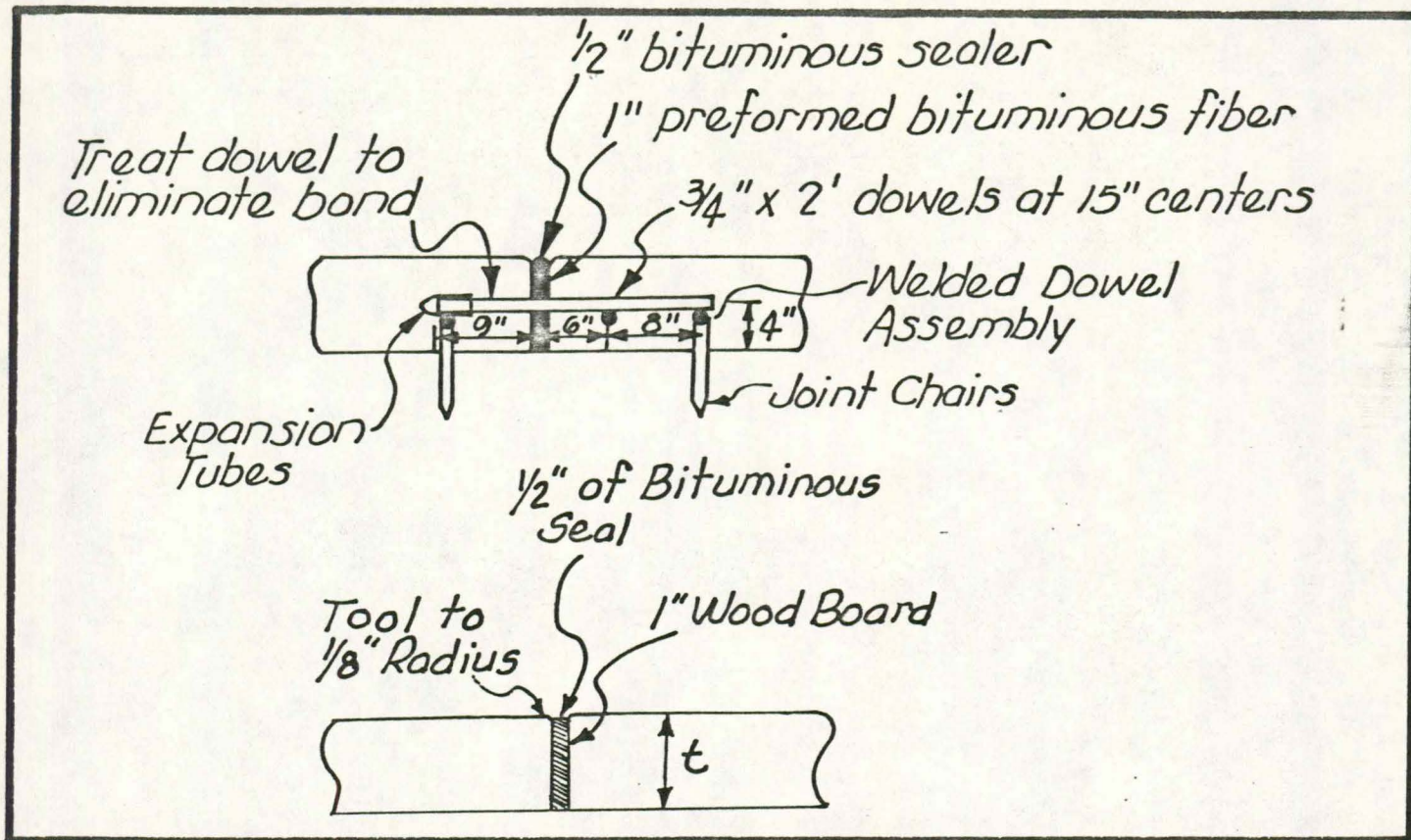
1929-1934\*



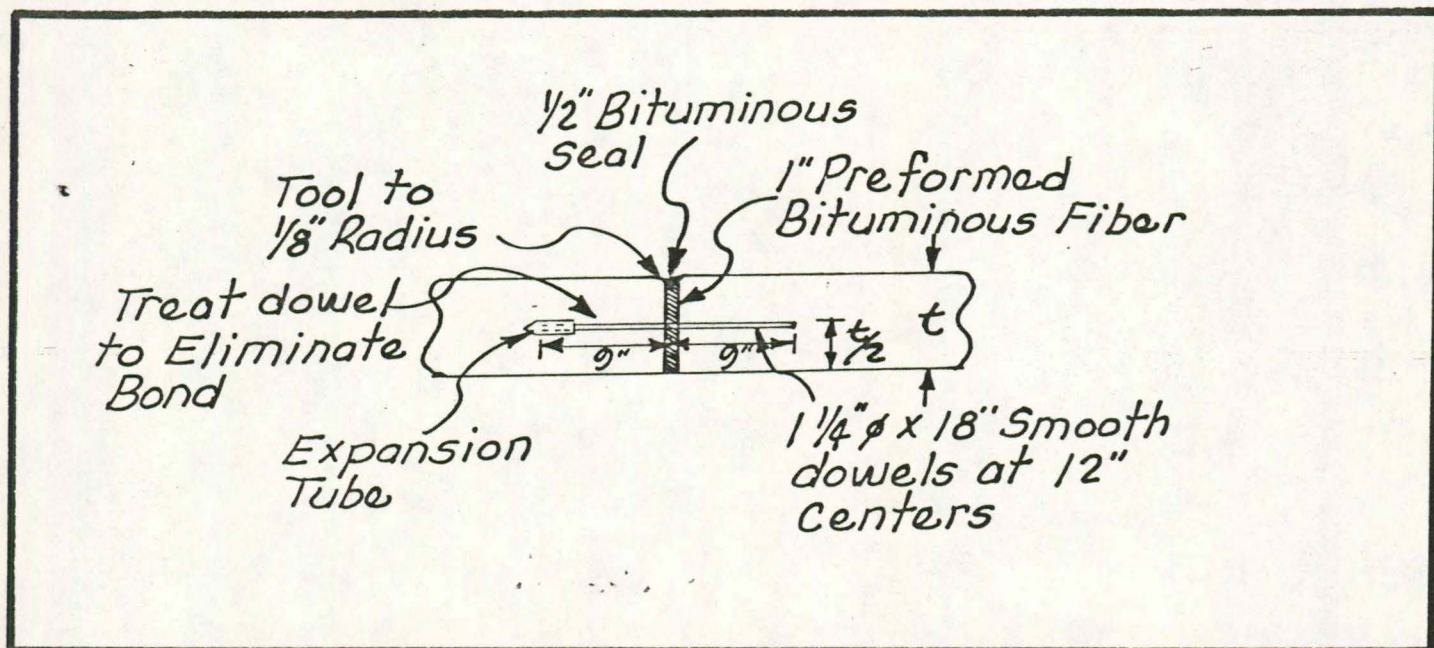
1935-1949\*



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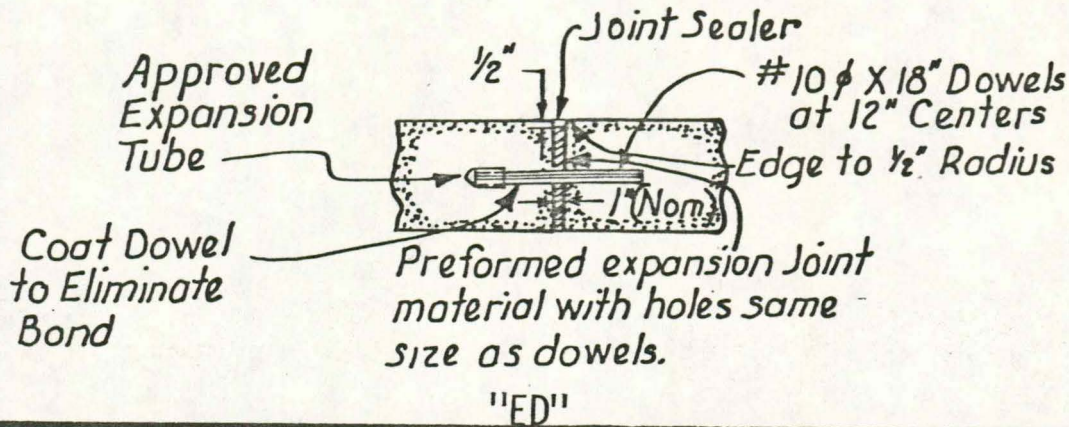
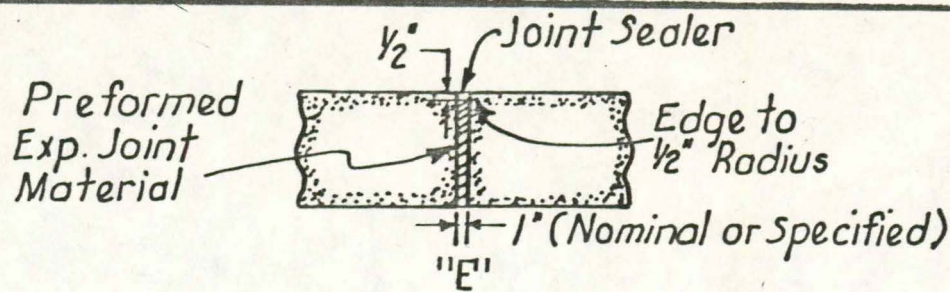
1950-1958\*



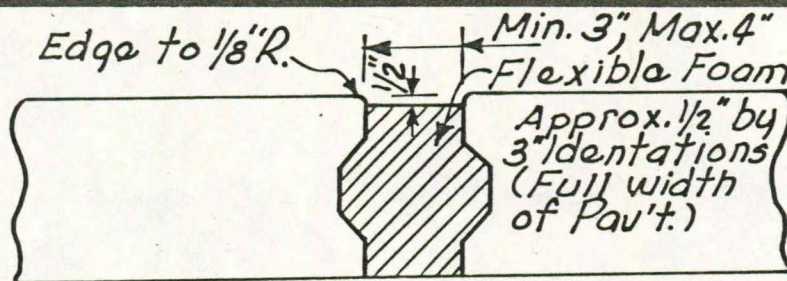
1959-1960\*

\* ALL YEARS ARE APPROXIMATE

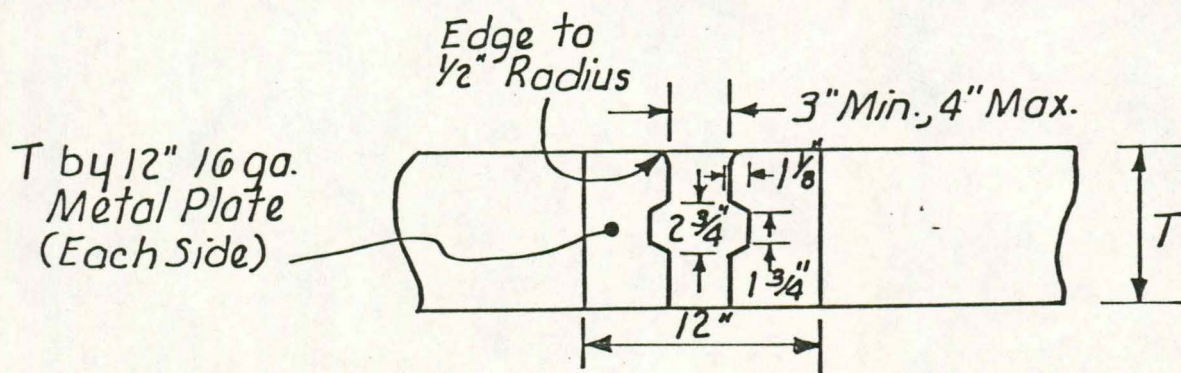




1961-1975\*



1969-1971\*

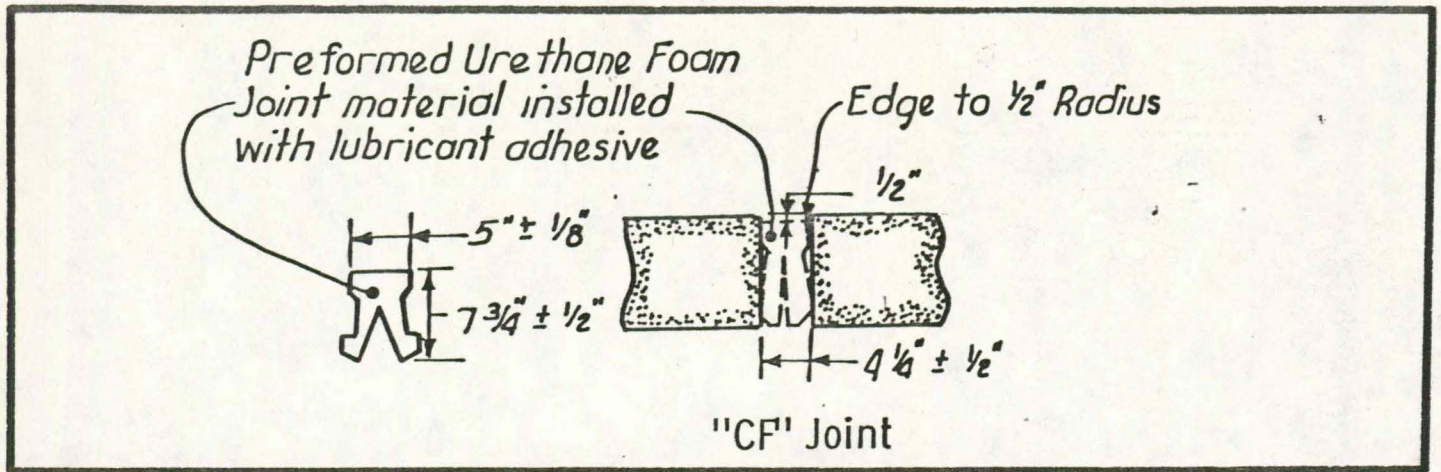


1971-1973\*

\*ALL YEARS ARE APPROXIMATE



# APPENDIX A

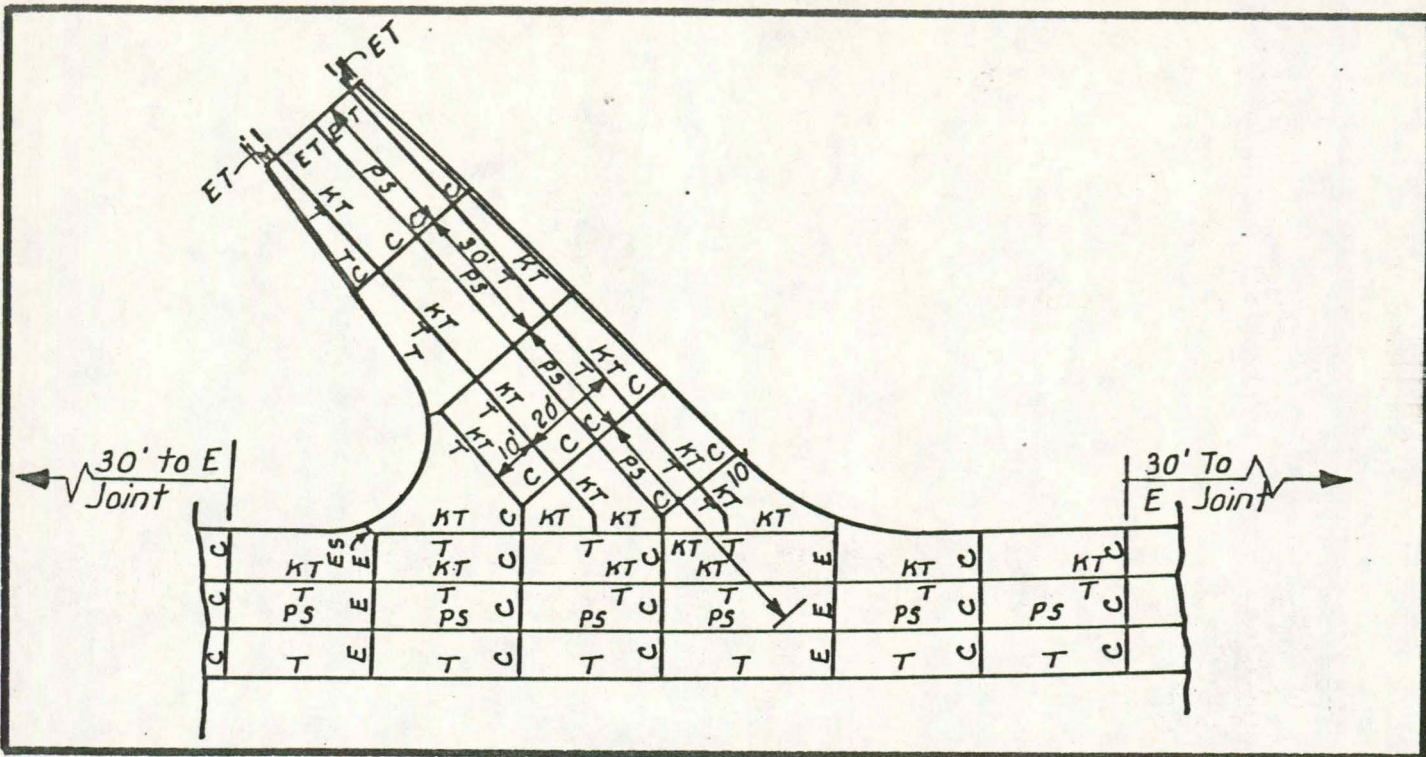


1973-1975\*

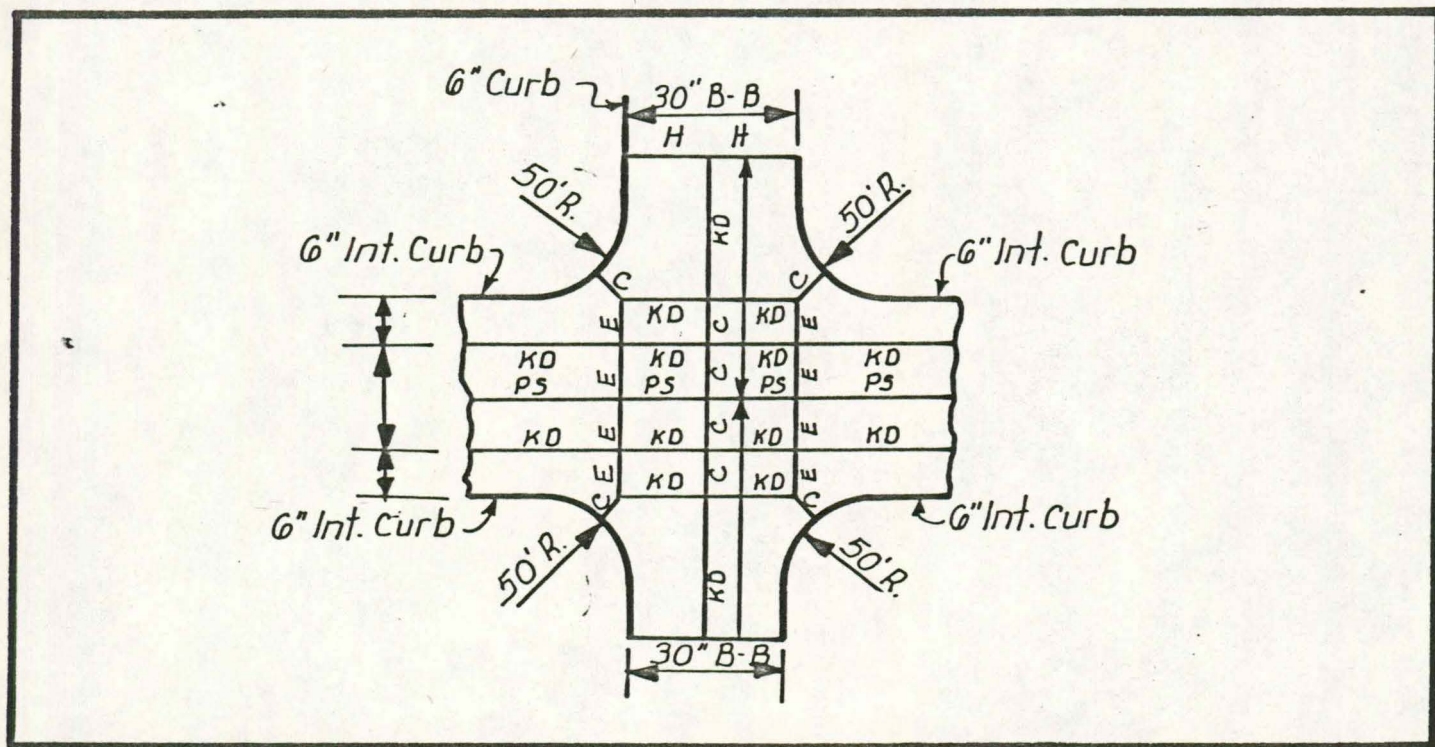
\*ALL YEARS ARE APPROXIMATE



## APPENDIX B



1930-1940\*

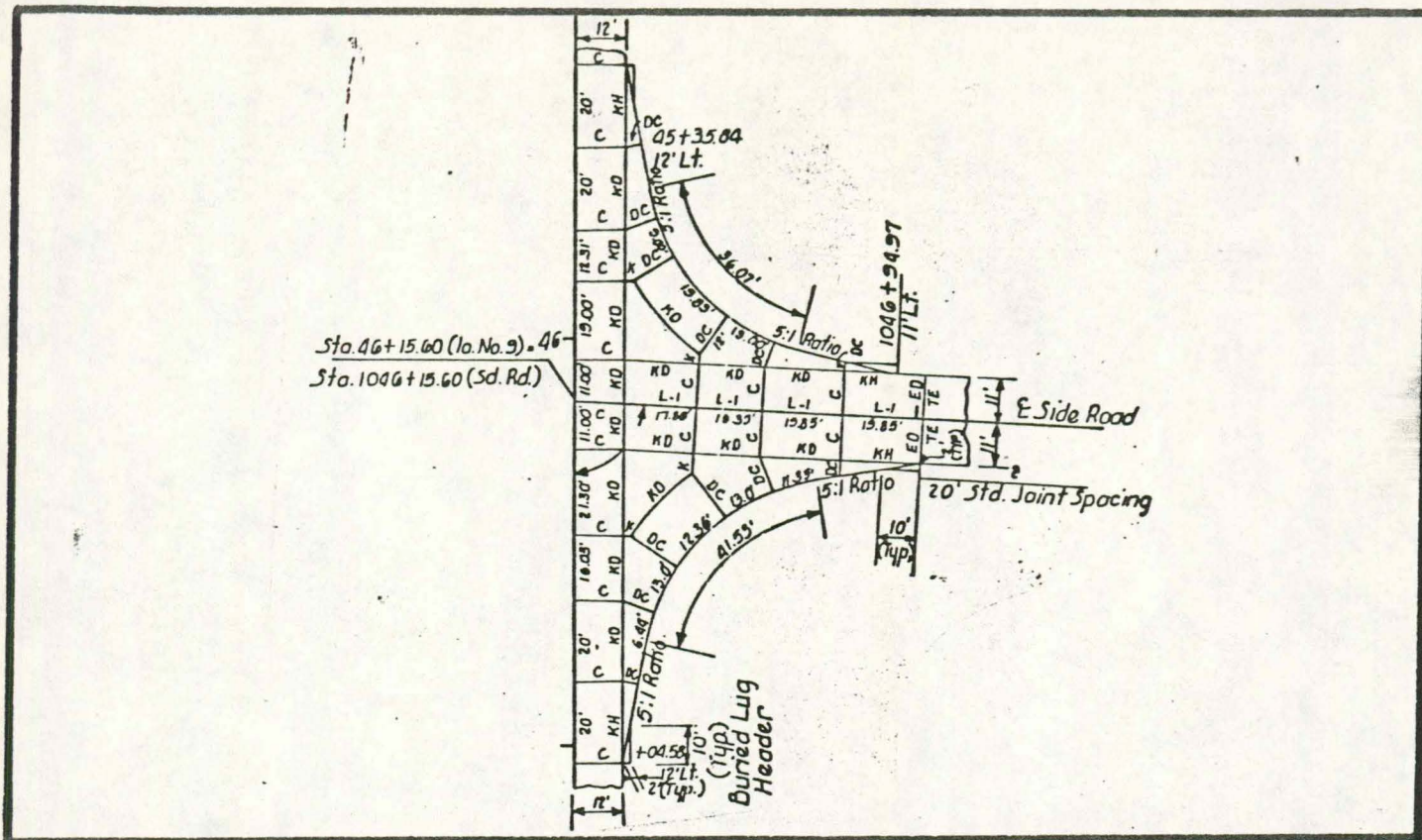


1940-1950\*

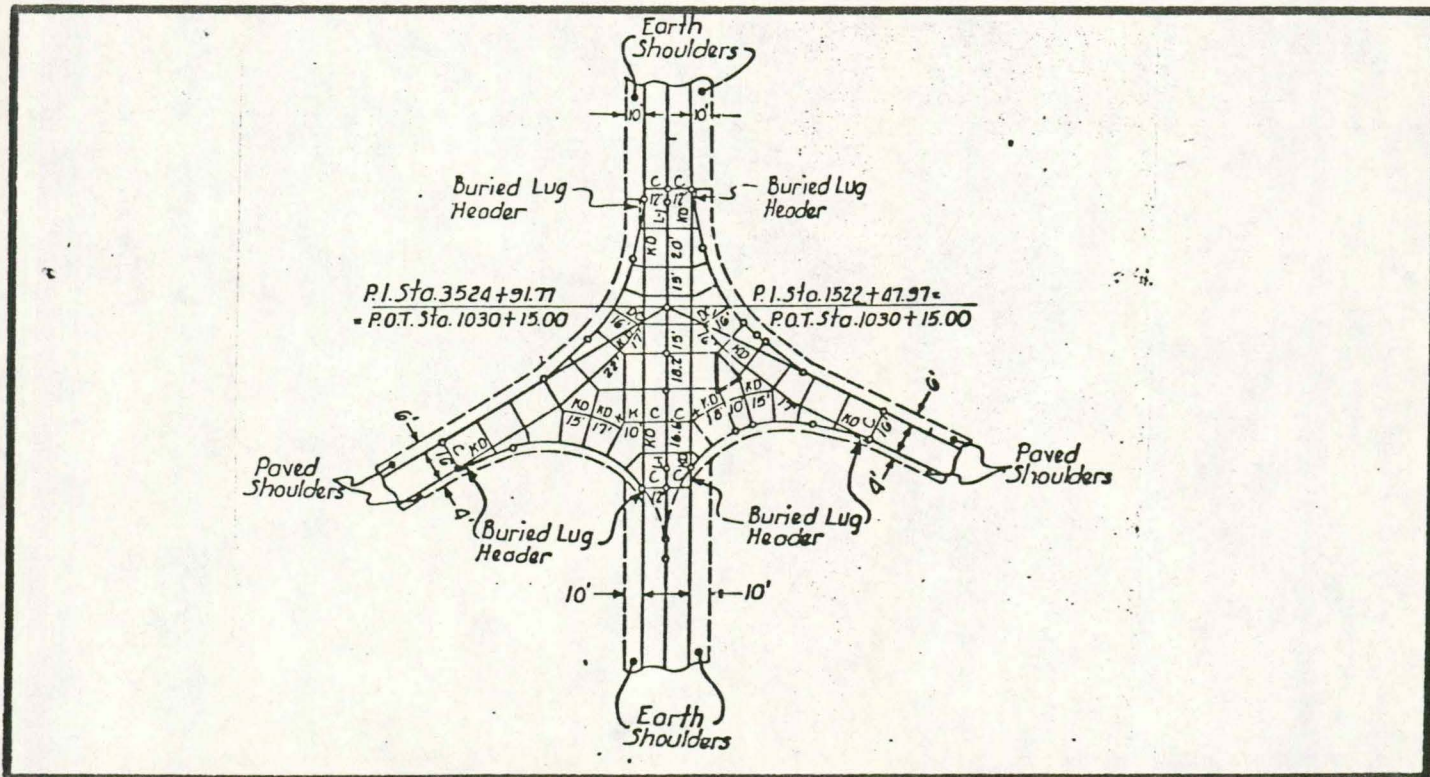
\* ALL YEARS ARE APPROXIMATE



## APPENDIX B



1950-1966\*

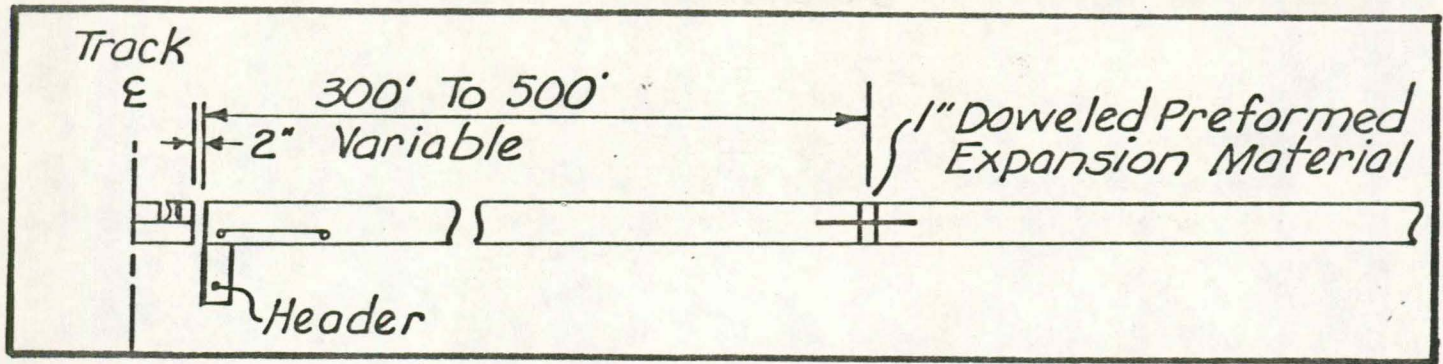


1966-1975\*

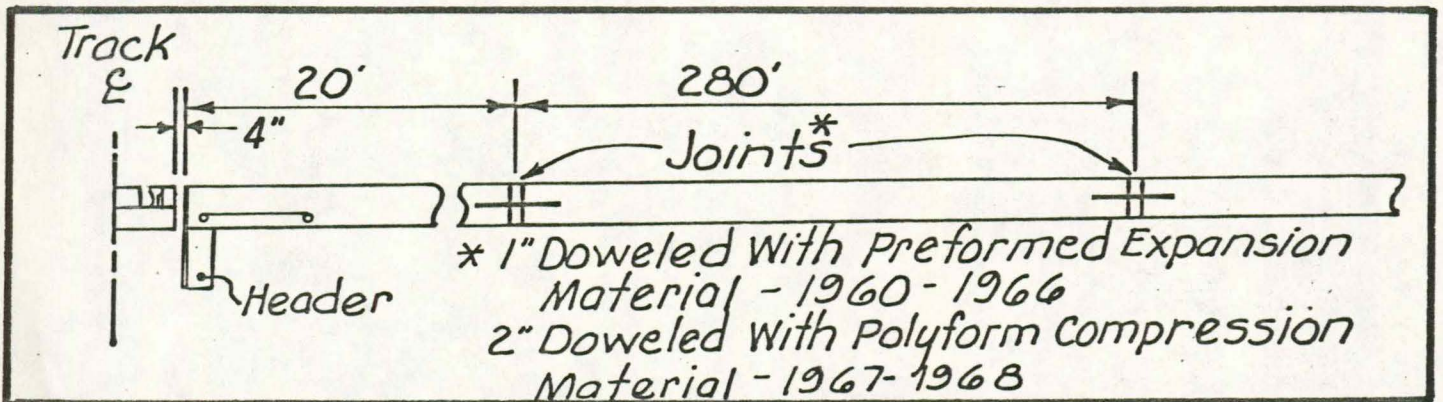
\* ALL YEARS ARE APPROXIMATE



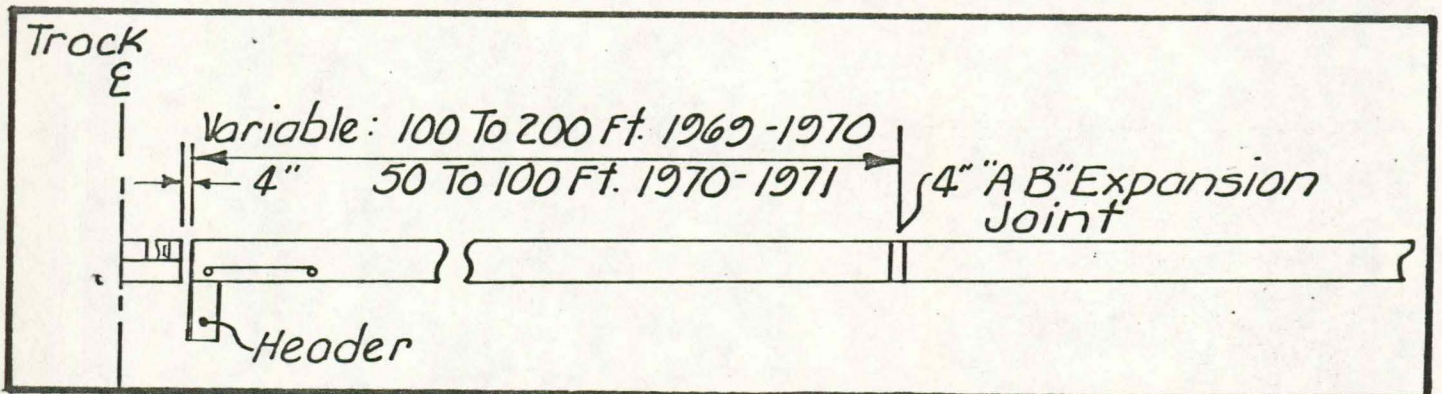
# APPENDIX C



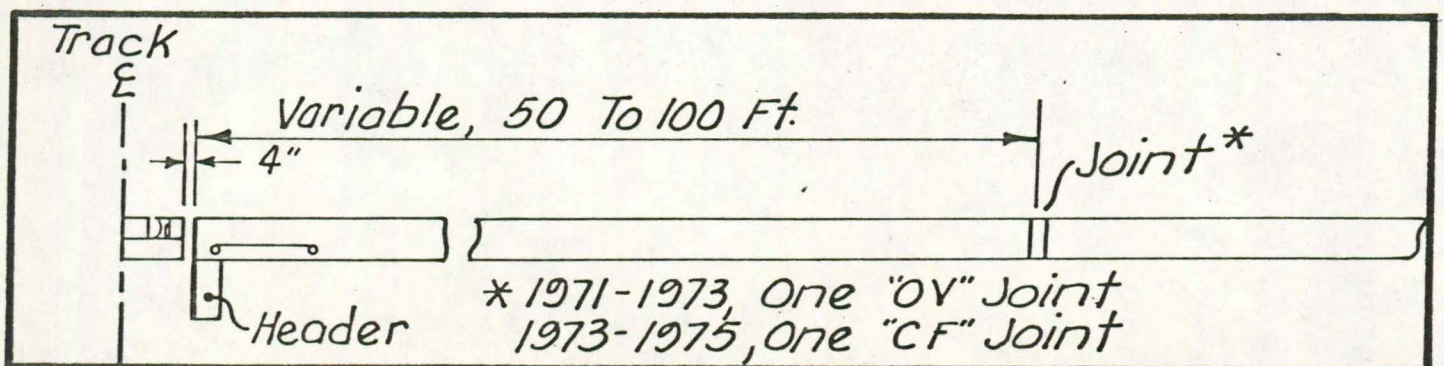
1948-1959\*



1960-1968\*



1969-1971\*

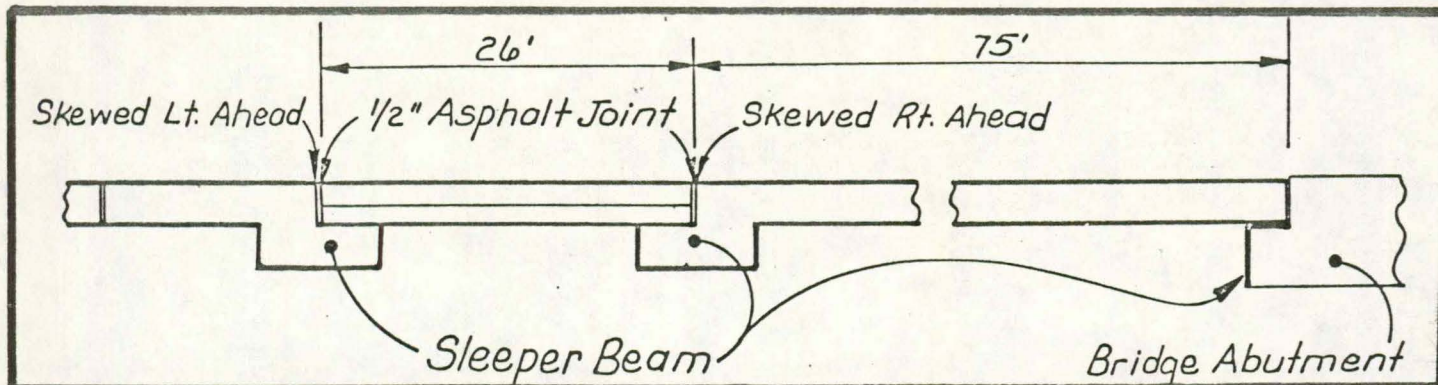


1971-1975\*

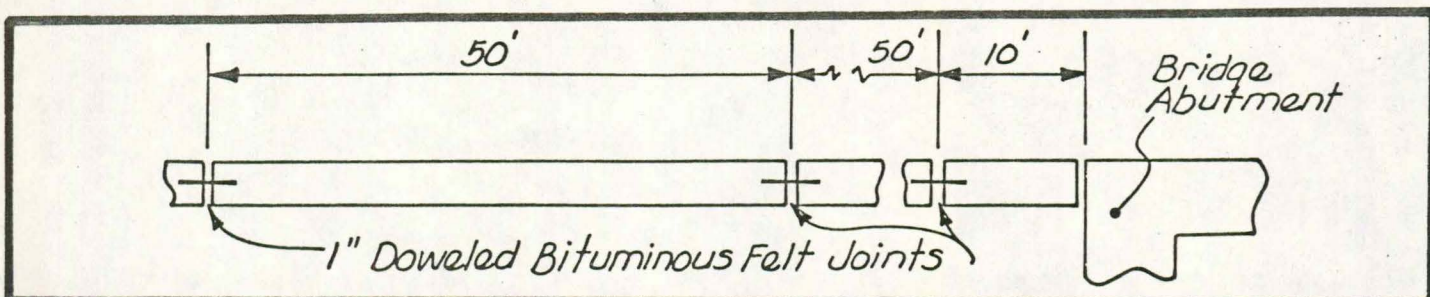
\* ALL YEARS ARE APPROXIMATE



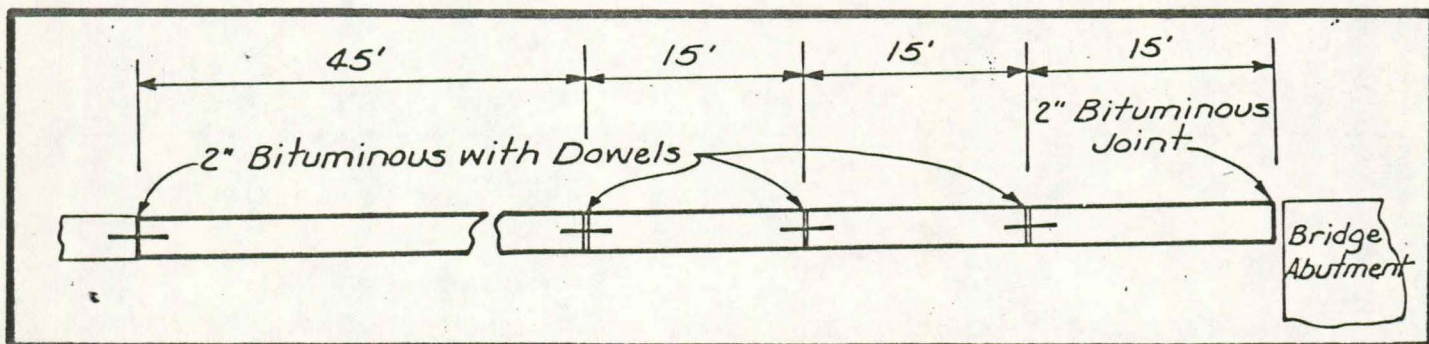
# APPENDIX D



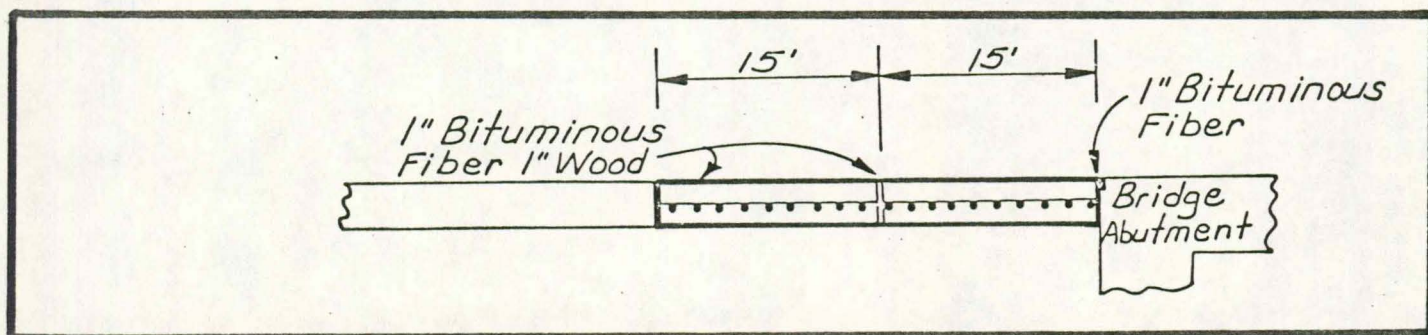
Early 1920



Mid 1920



Late 1920

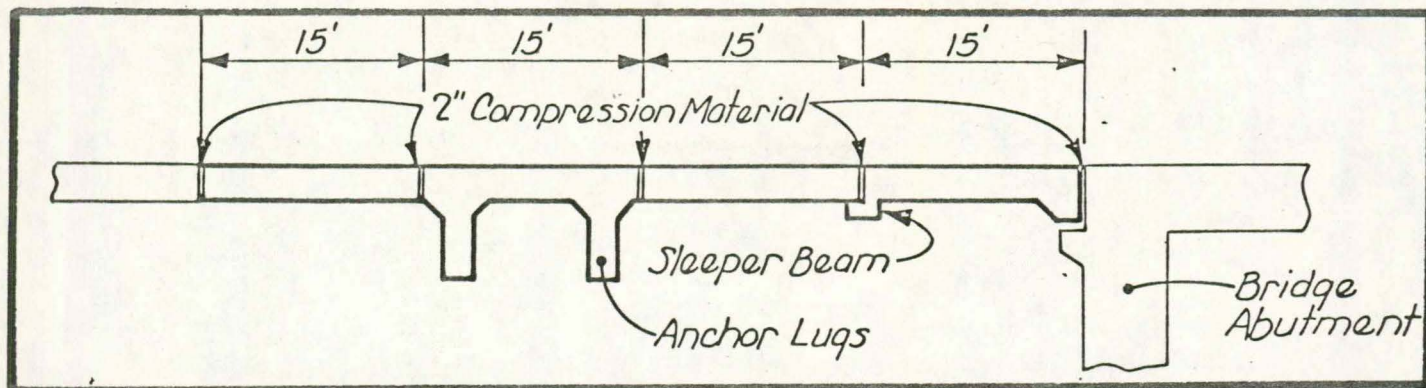


1930-1964\*

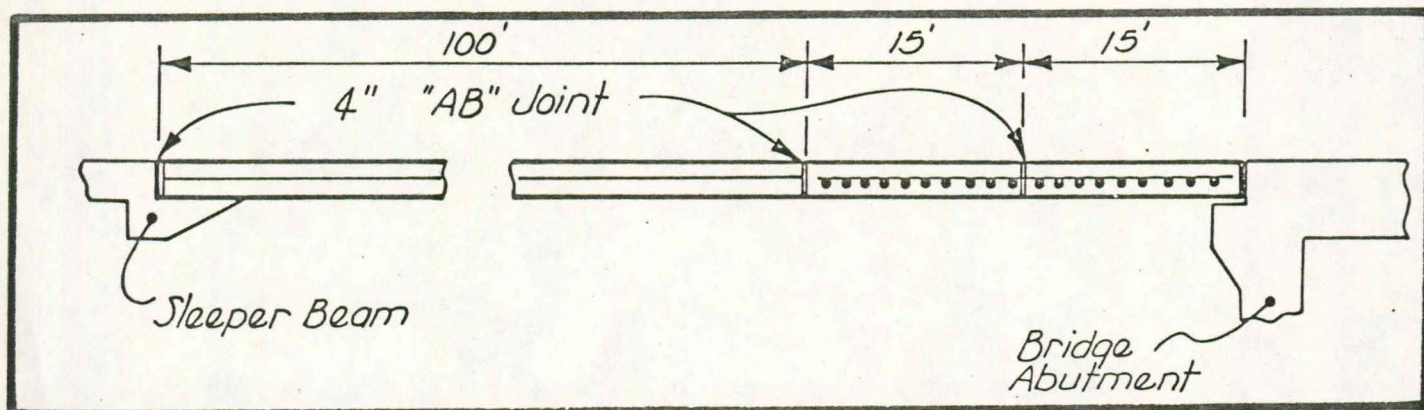
\*ALL YEARS ARE APPROXIMATE



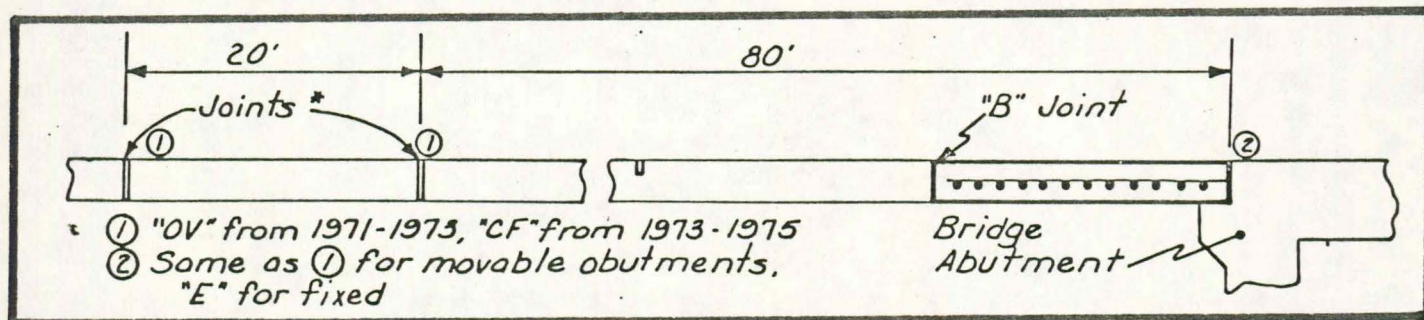
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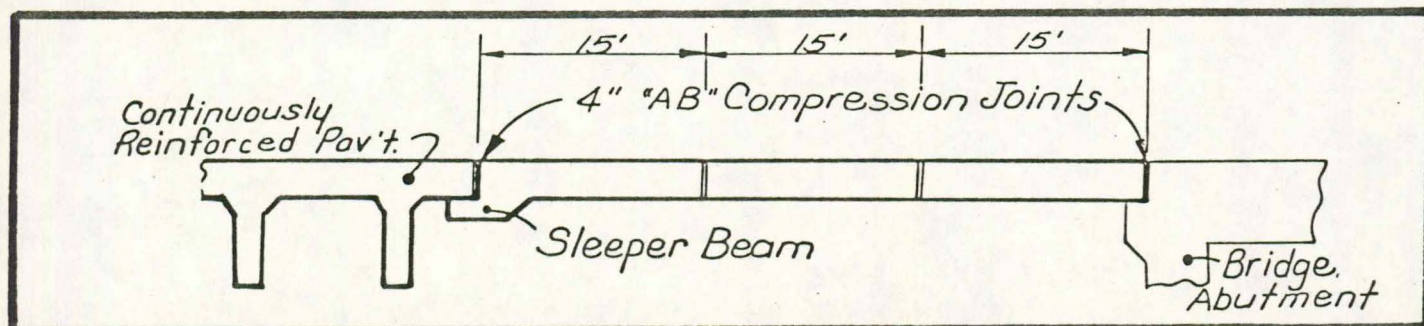
1964-1967\*



1967-1971\*



1971-1975\*

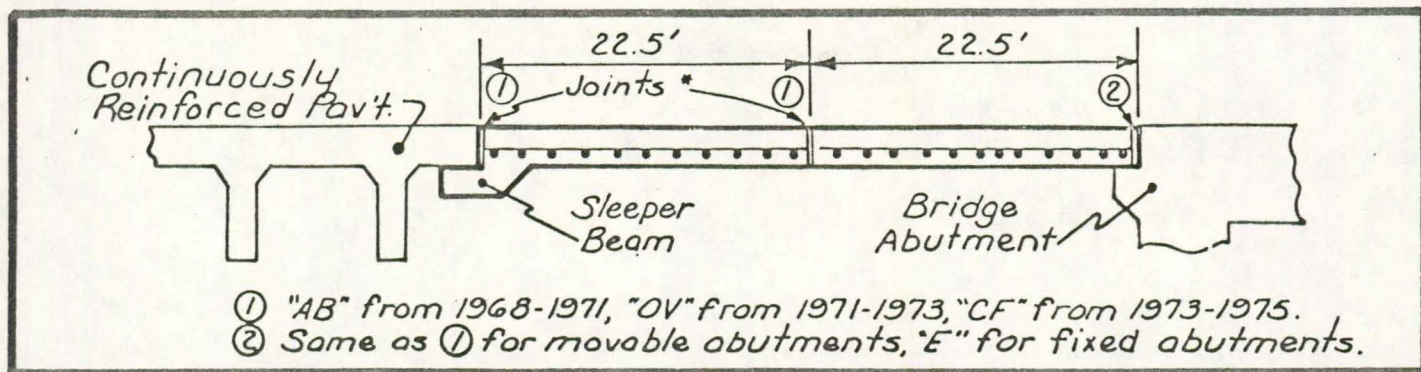


Early 1968

\* ALL YEARS ARE APPROXIMATE



# APPENDIX D



1968-1975\*



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