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15.0 ROAD AND RAILROAD CROSSINGS

15.1 INTRODUCTION

Several classes of roads will be crossed by the pipeline along the route. The roads can be simple dirt tracks leading to private properties, mining sites or public highways constructed and operated under the purview of the Alaska Department of Transportation and Public Facilities (DOT&PF). There are no railroad crossings along the alignment, although this section also addresses design at railroad crossings for the possibility that a railroad crossing may be required in the future. This section covers the codes, criteria and the procedures that will be employed in the design of both the pipeline and of the crossing at the crossing locations.

Essentially the criteria for the crossing design are not dissimilar to those employed in the lower forty-eight states. The departure occurs in the selection of the crossing location. Once an initial site has been selected a geotechnical and geothermal evaluation of the site will be conducted to ensure the integrity of both the pipeline and the road being crossed.

An analysis of the local drainage pattern will be done. Selection of the crossing design will ensure that the drainage pattern will not be impaired as a result of the installation of the crossing.

15.2 CODES AND CRITERIA

15.2.1 Codes

- Code of Federal Regulations (CFR)
  - Title 49, Transportation, Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
  - Title 18 – Conservation of Power and Water Resources
- Alaska Administrative Code (AAC), Title 17, Transportation and Public Facilities, Chapter 15, Utility and Railroad Permits
- Federal Right-of-Way (ROW) Grant for the Alaska Natural Gas Transportation System Alaska Segment, Serial No. F-24538 (December 1, 1980), as such may be updated and/or amended from time to time.
- Federal Energy Regulatory Commission conditional certificate of public convenience and necessity, issued on December 16, 1977, as such is finalized
- Federal Highway Administration, Uniform Traffic Code
- American Petroleum Institute (API), Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways, RP 1102 (not mandatory, but accepted by industry for use as a guideline in gas pipeline design)

15.2.2 Criteria

- Minimum cover of four feet, measured to the top of the pipe or insulation as appropriate, will be provided within the ROW of public roads.
- Uncased railroad crossings require six feet minimum cover measured from the bottom of the rail to the top of pipe or insulation as appropriate. Under all other surfaces within the ROW or from the bottom of ditches the minimum cover is three feet.
- Cased railroad crossings require five and one halve feet minimum cover measured from bottom of rail to top of pipe. Under all other surfaces within the ROW or from the bottom of ditches the minimum cover is three feet.
- At crossings of public roads and Railroads, design factors of 0.6 and 0.5 will be used for pipe within the ROW in Class 1 and Class 2 locations, respectively.
- The crossing angle between the gas pipeline and a roadway will range from a minimum of 45 degrees to as nearly perpendicular as practical.
- The crossing of railroads will be as nearly perpendicular as possible.
- Reduce visual impacts. Refer to Section 10 for criteria on clearing and buffer zones, and Section 12 for restoration.
- Disruption of existing drainage patterns will be minimized.
- Differential settlement and frost heave effects at the road surface due to thermal disturbance will be minimized.
- Traffic disruption due to construction of the road crossing will be minimized. State Highways traffic interruption will be limited to DOT&PF regulations and procedures. Emergency access where required will be maintained at all times.
- Existing roads will be restored to comparable pre-construction conditions, using comparable materials and construction methods, and where applicable in accordance with DOT&PF regulations and specifications.
- Existing Trans Alaska Pipeline System (TAPS) security gates and barricades may require relocation.
- Railroad crossings design will be site specific and comply with the owning railroad company's specifications, regulations and procedures. API Recommended Practice 1102 will be used as a guide and reference.

15.3 DESIGN PROCEDURES

15.3.1 Classes of Roads

Roads crossed by the gas pipeline are classified as follows:

- Highways – hard surfaced (paved or unpaved) public roads routed within a specified ROW.
- Secondary Roads – all other hard surfaced (paved or unpaved) public roads with only a ditch to ditch ROW.
- Access Roads – generally unpaved restricted use roads as defined in Section 7.
- Trails – trails or unimproved driveways used or with the potential for use by heavy equipment will be located and designed on a site-specific basis. Other crossings of trails and unimproved surface routes will require no special design other than restoration of the traveled surface and the drainage to an acceptable condition.

15.3.2 Crossing Design

- All road and railroad crossings will be designed on a site-specific basis. Site-specific drawings will be prepared for crossings of all highways, secondary roads and railroads (see Figure 15-1 for typical road crossing detail and Figure 15-4 for typical railroad crossing).
- Class locations are to be in accordance with 49 CFR 192.
- Highways and railroad design factors of 0.6 in Class 1 and 0.5 in Class 2 locations inside the limits of the road ROW at the crossing.
- Secondary road design factors of 0.6 in Class 1 and 0.5 in Class 2 locations to a point 5 feet beyond the outside edge of the road ditch, or 10 feet beyond the edge of the traveled way at the crossing.
- For access roads a stress analysis (see Section 20) will be done to determine pipe wall thickness and/or cover requirement except that a design factor of 0.72 will be used for TAPS access roads.
- The need for bypass roads will be evaluated on a site-specific basis. Bypass roads will, where feasible, be approximately the width of the existing road. The grade will be designed to approximate the grade of the existing road and grade of the workpad (see Figure 15-3).
- Highway crossings will be laid out so that there will be minimal direct line-of-sight down a cleared ROW visible to a passing motorist.
- Evaluate each crossing design for geotechnical and geothermal conditions. Items to be evaluated include thermal interaction between the gas pipelines and the road, slope stability, settlement potential, frost heave potential and liquefaction potential (see Section 21).
- The workpad at road crossings will be ramped no steeper than 6:1 on each side of the road (see Figure 15-2)
- The maximum degree of bend in the gas pipeline approaching and leaving the area of a crossing will be determined by the amount of transverse displacement and axial displacement expected at the bend location taking into account the soil conditions

existing at the particular crossing site (see Section 21). The minimum bend radius will be dependent on pigging requirements.

- In general, bends will not be used within the road or railroad ROW at the crossing.
- A minimum radius of curvature will be specified on bypass roads.
- A maximum allowable speed will be specified on bypass roads.
- Any drainage along the existing road will be accommodated by using culverts or low water crossings placed in the workpad and/or bypass road. Drainage analysis will be performed in accordance with the applicable portions of Section 11.
- At each road and railroad crossing there will be a cathodic protection test station. This station will be installed either adjacent to one of the crossing warning signs or at the site of a foreign pipeline crossing, where there is one in conjunction with the road crossing.
- All road and railroad crossings will be identified with warning markers, located over the centerline of the gas pipeline, at each end of the ROW limits, or, where no ROW limits exist, in a conspicuous location in the vicinity and on both sides of the crossing. See Section 25 for design of warning markers.

15.3.3 Construction Aspects

- Road and railroad crossings will be constructed in accordance with approved construction specifications.
- Traffic control and safety will be maintained during construction by the use of warning signs, markers, barricades and flag-persons as necessary, which will be specified and located in conformance with the appropriate state and federal regulations or agreements with private owners or permittees.
- During construction of crossings, where the road is open-cut, controlled traffic will be maintained by the use of a temporary bypass or other means consistent with existing conditions, traffic volumes, and DOT&PF standards. Bypass roads will be designed to provide maximum traffic safety.
- It is planned that most road crossings will be open cut. However, if physical restraints do not permit the provision of temporary bypass during open-cut installation and if soil conditions are suitable, then boring or tunneling of the road crossing may be utilized. If bored or tunneled, the crossing design will be handled on a site-specific basis.
- Road and trail crossings will be constructed so as to minimize the length of time each is out of service.
- Permanent access on roads, temporarily closed or bypassed due to construction operations, will be restored after all construction operations have cleared the area to render the area safe for vehicular passage. The method of restoring access will conform to applicable state and federal regulations or agreements with private owners or permittees.

- Temporary bypass road embankment and structures will be removed and the area restored to pre-construction condition.
- Railroad crossings will be bored or jacked. The crossing will be uncased, unless owning company stipulations or site conditions prevent this.
- Site specific methods will be developed for passage of construction equipment at road and railroad crossings.

15.4 Figures and Tables

LIST OF FIGURES

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15-1	Typical Road Crossing
15-2	Typical Details at Road Crossings
15-3	Typical Bypass
15-4	Typical Uncased Railroad Crossing
15-5	Typical Cased Railroad Crossing

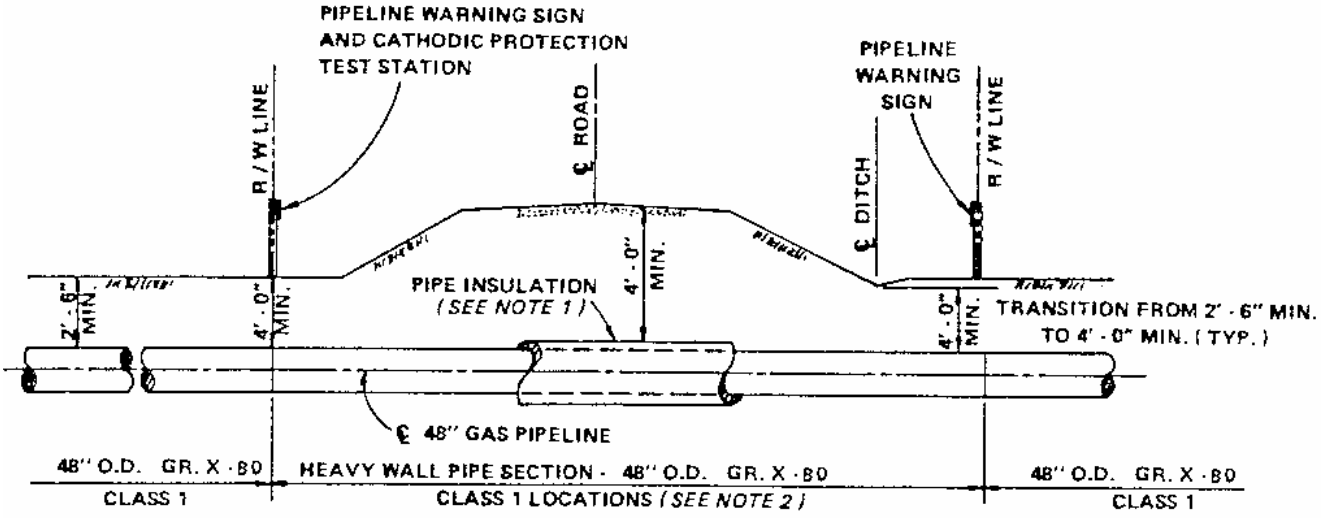
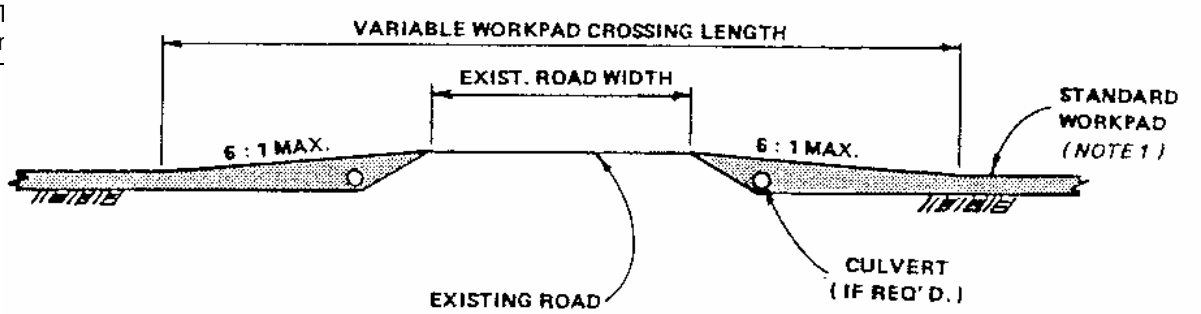
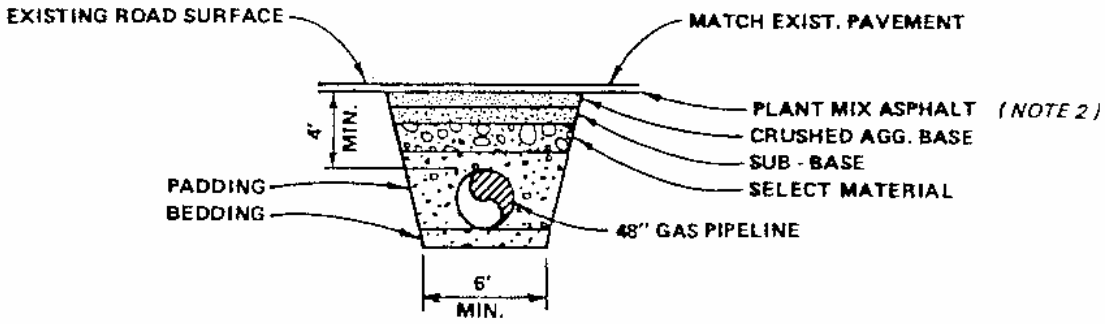


Figure 15-1 Typical Road Crossing

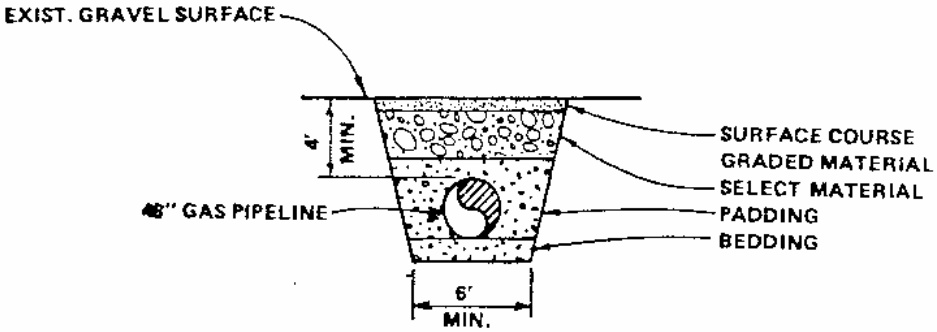
Notes:
1. *For insulated pipe the 4'-0 cover requirement is measured from top of insulation*
2. *Pipe wall thickness in Class 1 locations uses 0.6 design factor. Pipe wall thickness in Class 2 locations uses 0.5 design factor.*
3. *The carrier pipe and appurtenances must be installed with at least 12 inches of clearance from any other underground structure.*
4. *Backfill material in pipe ditch in roadbed shall be placed and compacted in accordance with the standard specifications for backfill at road crossings.*
5. *Traffic disruption during construction of the road crossings will be minimized by the use of a temporary bypass or other means. See Figure 15-3.*



WORKPAD PROFILE



PIPE DITCH SECTION
AT PAVED ROAD CROSSING



PIPE DITCH SECTION
AT UNPAVED ROAD CROSSING

Figure 15-2 Typical Details at Road Crossing

Notes: 1. Workpad side slope will be 6:1 on the side facing on-coming traffic and 3:1 on the other side (applies only if workpad is permanently abutted against road).
2. Surface and subsurface course thickness will match preconstruction thickness.
3. 6:1 ramps to state highway will be temporary and are allowed only during active construction.

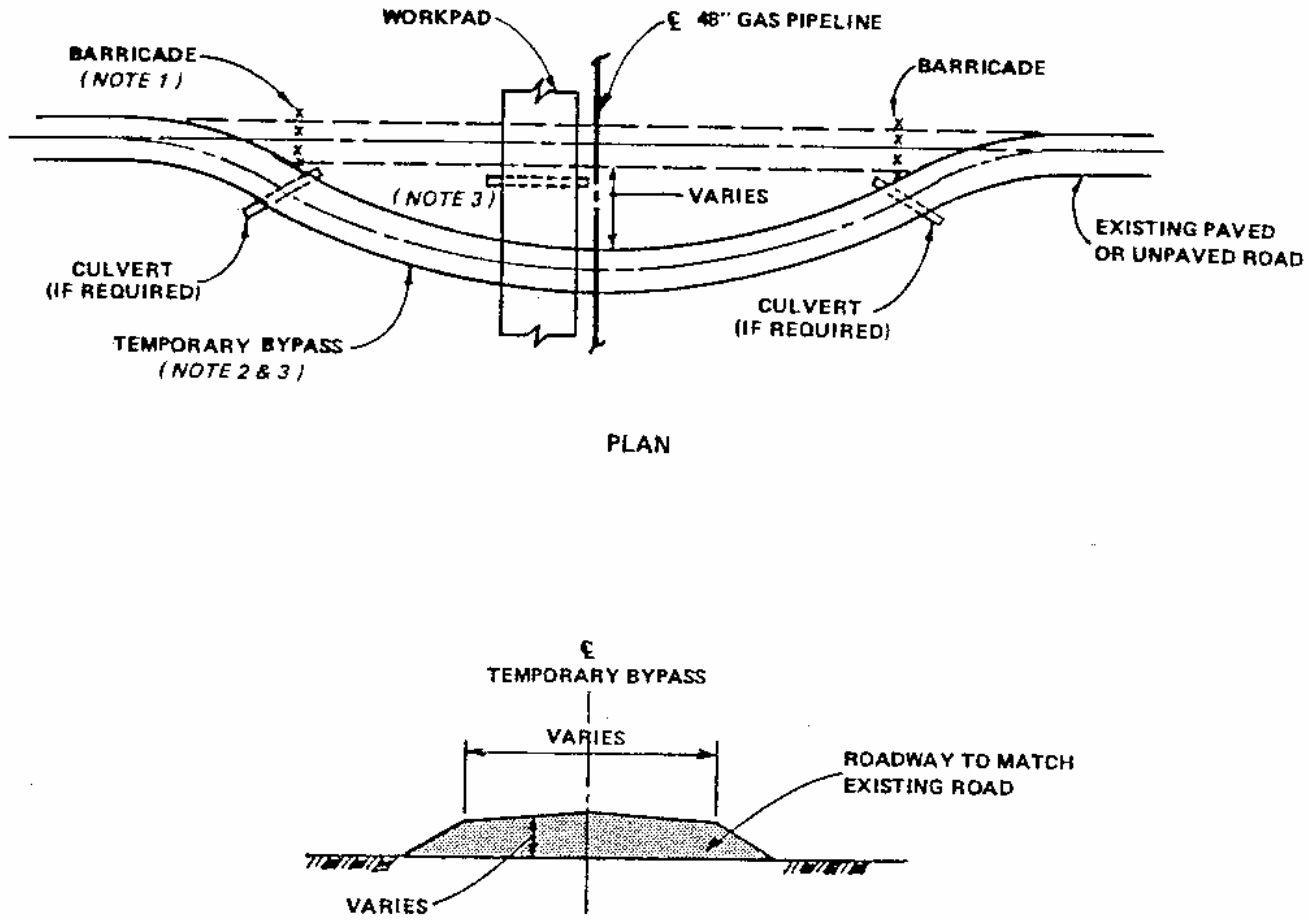


Figure 15-3 Typical Bypass

Notes: *1. Barricades and signs will be in accordance with Alaska Department of Transportation and Public Facilities requirements.*
2. Bypass alignment design will be consistent with topography at the point of road crossing.
3. Clearing to be kept to a minimum between the existing road and the bypass.
4. Minimum design speed and curve radius will be same as for access road (See Section 7)

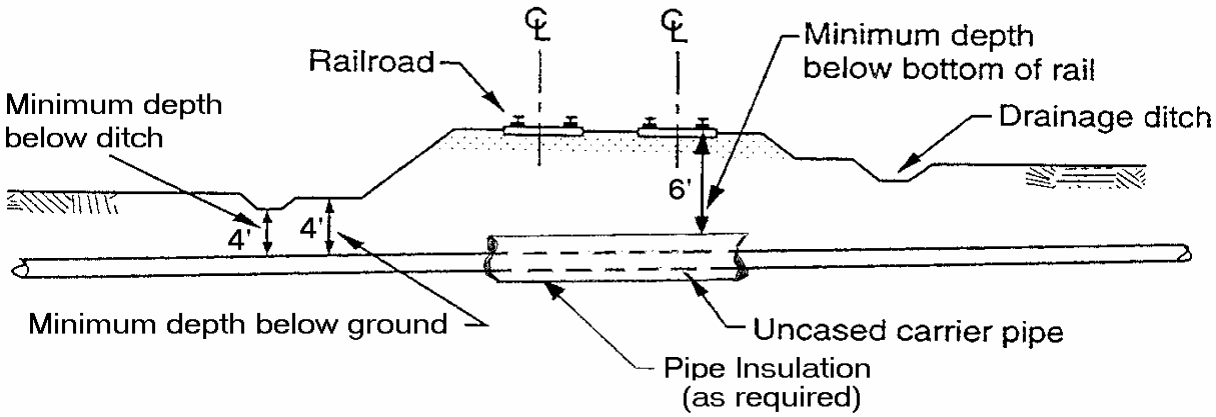


Figure 15-4 Typical Uncased Railroad Crossing

Notes: 1. For insulated pipe the cover requirement is measured from top of the uncased carrier pipe

2. Pipe wall thickness in Class 1 locations uses 0.6 design factor. Pipe wall thickness in Class 2 locations uses 0.5 design factor.

3. The carrier pipe and appurtenances must be installed with at least 12 inches of clearance from any other underground structure.

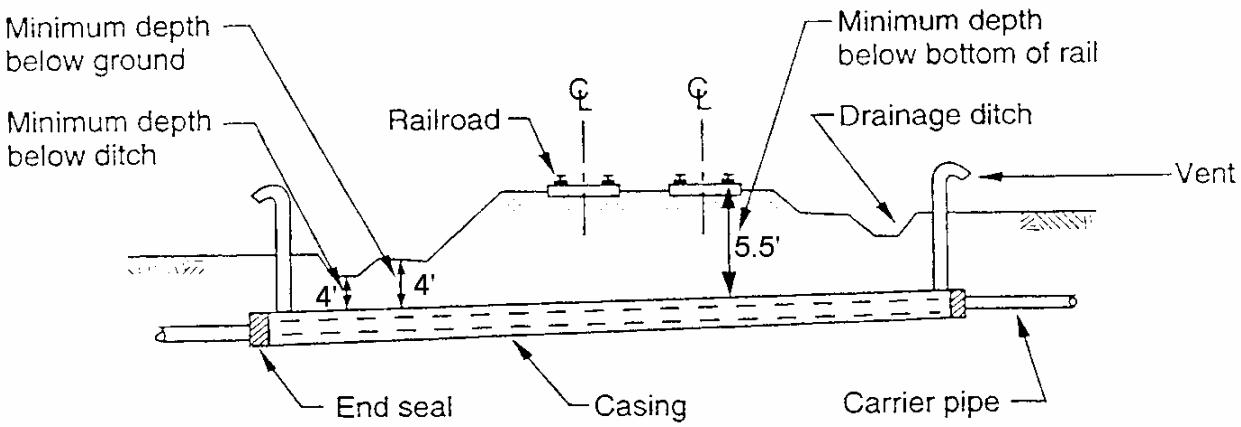


Figure 15-5 Typical Cased Railroad Crossing

Notes: 1. The cover requirement is measured from top of casing
2. Pipe wall thickness in Class 1 locations uses 0.6 design factor. Pipe wall thickness in Class 2 locations uses 0.5 design factor.
3. The carrier pipe and appurtenances must be installed with at least 12 inches of clearance from any other underground structure.