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Guidelines for Choosing Wall Thickness for HDPE Conduit Based on "Mini-HDD" (Horizontal Directional Drilling)

TN-48/2013

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Foreword

This technical note was developed and published with the technical help and financial support of the members of the Plastics Pipe Institute. The members have shown their interest in quality products by assisting independent standard-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

This technical note has been prepared to provide those responsible for the maintenance of existing HDPE pipelines with suggested general guidelines for the repair of those lines that have been subjected to third party or other unforeseen damage. These guidelines constitute a set of basic operations that have been demonstrated by test and experience to produce satisfactory repairs with commercially available materials. Each specific procedure must be acceptable to, and qualified by, the operator having legal responsibility for the performance of the piping system. This document was not intended to provide system design information. Go to the PPI website at www.plasticpipe.org for different system design documents.

The Plastics Pipe Institute, Inc. has prepared this technical note as a service to the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered “as is” without any express or implied warranty, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Additional information may be needed in some areas, especially with regard to unusual or special applications. Consult the manufacturer or material supplier for more detailed information. A list of member manufacturers is available from PPI. PPI does not endorse the proprietary products or processes of any manufacturer, and assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this report from time to time, in response to comments and suggestions from users of this note. Please send suggestions for improvements to PPI. Information on other publications can be obtained by contacting PPI directly or visiting the web site.

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Guidelines for Choosing Wall Thickness for HDPE Conduit Based on “Mini-HDD” (Horizontal Directional Drilling) from PPI TR-46

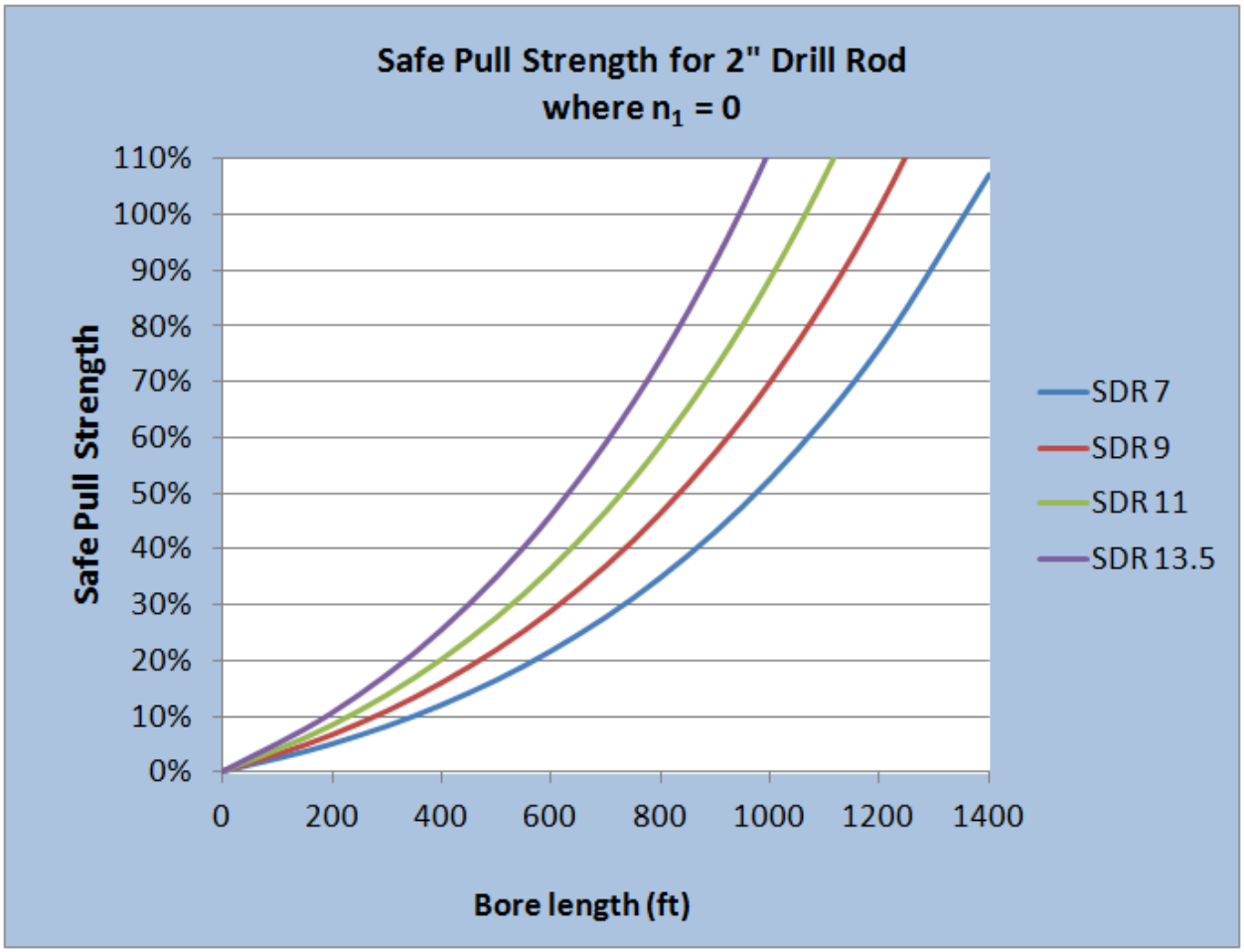
PPI Technical Report 46 (http://plasticpipe.org/pdf/tr-46-hdd-guidelines.pdf) describes the design, selection considerations, and installation procedures for the placement of HDPE Conduit pipe using "mini-HDD" equipment. A section of the report provides a methodology to calculate the "safe pipe pull tension". A range of "wall thicknesses" can then be determined from the "safe pull tension".

The formulas start on page 27 of the report.

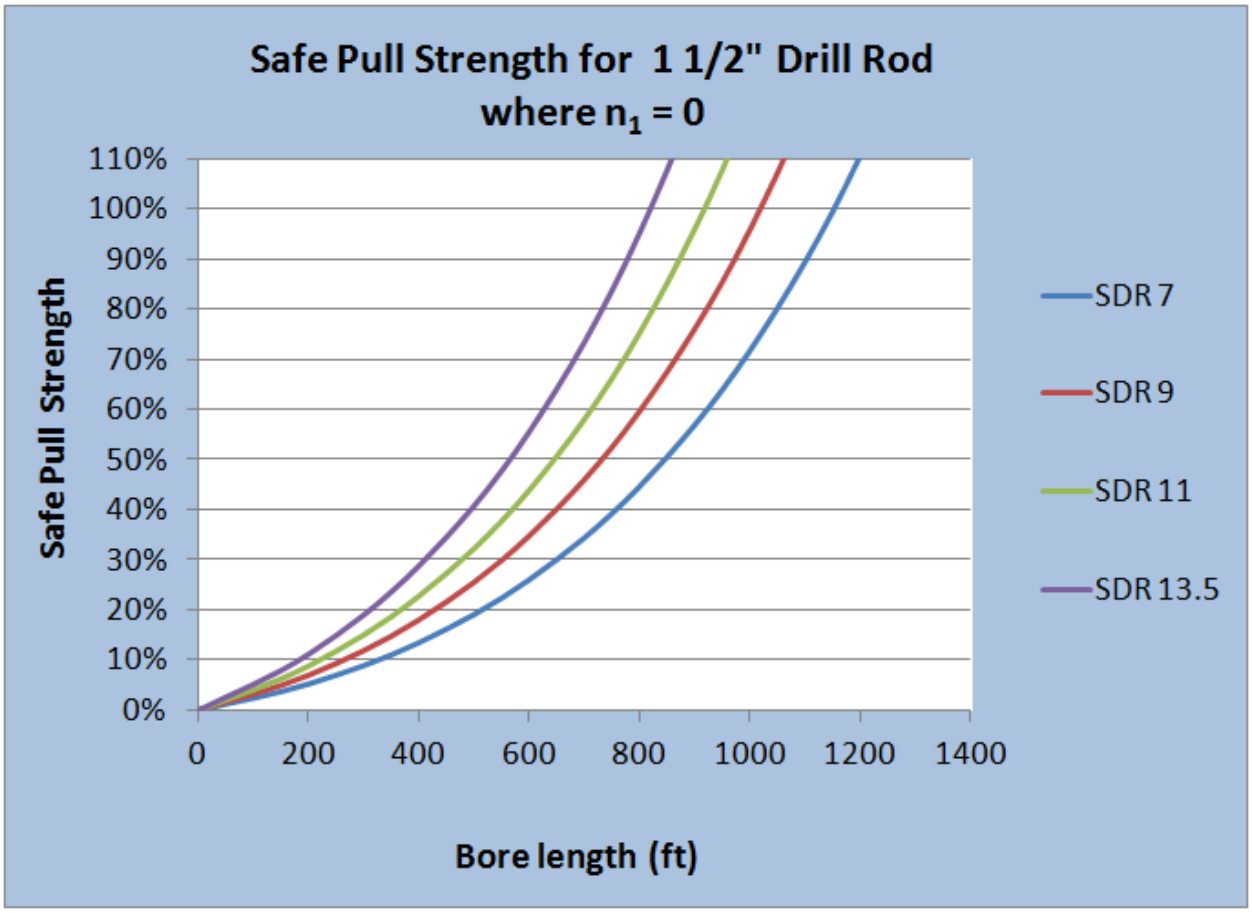
1. Calculate the Peak Tension:
    a. Tension (lbs) = [Bore Length (ft) X Buoyant Weight (lbs/ft) X 1/3] X $(1.6)^n$
        i. Buoyant Weight (lbs/ft)=1/2[Pipe Diameter (in)]^2-Pipe Weight (lbs/ft)
    b. Calculate $n=n_1+n_2$, where:
        i. n_1 is the effective number of deliberate/planned 90^0 route bends. (n_1 may be a fraction; see page 28)
        ii. n_2 is the effective unplanned curvatures, due to typical path corrections, where:
            1. n_2=Bore length (ft) /500 for a 2-in diameter drill rod
            2. For other drill rod diameters:
               n_2=[Bore length (ft) /500] X [2/Rod Diameter(in)]

2. The resulting peak tension is then compared to the safe pull tension
    a. Tension (above equation)<Safe Pull Tension (Table 2 page 27)
    b. Safe Pull Tension is based on:
        i. Safe tensile stress of 1350 psi.
        ii. HDPE Conduit with raw material tensile strength of 3000-3500 psi
        iii. Minimum cell classification of PE 334480C or E per ASTM D3350

The Graph below illustrates the wall thickness selection (compared to the fraction of safe pull strength) appropriate for various bore lengths, based on drill diameter of 2-in and no deliberate turns (n_1=0).



Caution is urged regarding assumptions for the variables used in the calculations, namely drill rod size and number of planned bends. For example, the Graph below illustrates the wall thickness selection for the parameters above, but only changing the drill size to 1.5-in (instead of 2-in).



A 1000' bore with a 2-in drill rod is 70% of the safe pull strength of a SDR 9 pipe. If you drop the drill rod to 1 ½-in, the safe pull is at 100% and it may be prudent to use a SDR 7 pipe wall thickness. Although the TR-46 methodology is generally a conservative approach to mini-HDD, accounting for such effects as additional route curvature due to typical path corrections, care should be taken if the variables (e.g., material properties or path geometry) are significantly different than assumed in the above examples.

Although the safe pull tension for SDR 15.5 and SDR 17 may be applicable for short bores, the PPI Conduit Division does not recommend their use in HDD without detailed engineering calculations including consideration of estimated pulling tension and maximum allowable depth (see TR-46, Sections 7.2 and 7.3).

For further design information, refer to PPI TR-46 Section 7, pages 24-32. See:
http://plasticpipe.org/pdf/tr-46-hdd-guidelines.pdf

For larger diameter installations and longer bore lengths, a more detailed design methodology can be found in ASTM F1962 or Chapter 12 of the PPI Handbook of Polyethylene pipe (http://plasticpipe.org/pdf/chapter12.pdf), and through PPI BoreAid software, (http://plasticpipe.org/publications/software-boreaid.html)