

STRESS DESIGN CALCULATIONS FOR FRP UNDERGROUND PIPING TO AWWA M45

1. INPUTS

1.1 Design Conditions

	Calculations as Submitted	Senario 1	Senario 2	Senario 3	Senario 4	
Nominal pipe diameter, mm	3700	3700	3700	3700	3700	3700
Working pressure P_w , Kpa	511	511	511	511	511	511
Surge pressure P_s , Kpa	146	146	146	146	146	146
Vacuum P_v , Kpa	50	50	50	50	50	50
Maximum deflection permitted, δ/D	0.05	0.05	0.05	0.05	0.05	0.05
Cover depth H_{min} , m	1.2	1.2	1.2	1.2	1.2	1.2
Cover depth H_{max} , m	5.7	5.7	5.7	5.7	5.7	5.7
Wheel load P , N	159838	159838	159838	159838	159838	159838
Soil specific weight γ_s , KN/m ³	17	17	17	17	17	17
Service temperature, C°						
Native soil conditions at pipe depth						
Native soil modulus E_s , KPa	20700	20700	20700	30000	30000	10350
Ground water location M						
Maximum $h_{w,max}$	5.2	5.2	1.4	1.4	1.4	1.4
Minimum $h_{w,min}$	0.7	0.7	0	0	0	0
γ_w = specific weight of water, Kg/m ³	1000	1000	1000	1000	1000	1000

1.2 Pipe Properties

Trial pressure class P_r , Kpa	511	511	511	511	511	511
Reinforced wall thickness t , mm	31	31	31	31	31	31
Linear thickness t_{linear}	1.25	1.25	1.25	1.25	1.25	1.25
Total wall thickness t , mm	32.25	32.25	32.25	32.25	32.25	32.25
Minimum pipe stiffness F/Dy , Pa	62000	62000	62000	62000	62000	62000
Hoop tensile modulus E_t , KPa	27390000	27390000	27390000	27390000	27390000	27390000
Hoop flexural modulus E_f , KPa	26000000	26000000	26000000	26000000	26000000	26000000
HDB	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065
S_w	0.013	0.013	0.013	0.013	0.013	0.013
Distance between joins L , mm	12000	12000	12000	12000	12000	12000

Awwa M 45 Design Manual

Dimitrios G. Pavlou



Awwa M 45 Design Manual:

Fiberglass Pipe Design AWWA Staff, 2005 Updated from the 1996 edition this manual provides water supply engineers and operators a single source for information about fiberglass pipe and fittings New in this edition are the addition of metric equivalents an expanded discussion of pipe mechanical properties with stress vs strain curves Buried Pipe Design chapter has expanded discussion of deflections caused by live loads and soil properties a second method of determining pipe stiffness and a new equation for pipe buckling Guidelines for Underground Installation has additional information on soil backfill considerations and minimum trench width new information on angularly deflected pipe joints pressure testing and a new section on trenching on slopes Replaces ISBN 0 89867 889 7

Analysis and Design of Gravity Flow Conduits and Buried Bridges Timothy J. McGrath, 2024-12-20 This book covers the structural analysis and design of buried gravity flow conduits including traditional pipes arches box conduits and buried bridges with spans up to 80 ft 25 m and greater The text primarily covers concrete corrugated metal and plastic conduits but is generally applicable to other materials Applications include culverts storm drains sewers and pedestrian and vehicular crossings The book is intended to introduce the subject to practitioners new to the field as well as provide detailed information for those with prior experience The opening chapter presents historical background and basic design models to introduce important concepts and then follows with chapters devoted to materials soils soil conduit interaction and guidance on the use of finite elements for analysis Then design methods for evaluating soil conduit systems are presented along with guidance on important considerations during installation The book concludes with field experiences of when things went wrong and why Analysis and Design of Gravity Flow Conduits and Buried Bridges offers a unified and comprehensive guide for practicing engineers working on buried pipe design private consultants and product manufacturers as well as researchers in the area

Rehabilitation of Pipelines Using Fiber-reinforced Polymer (FRP) Composites Vistasp M. Karbhari, 2015-05-23 Rehabilitation of Pipelines Using Fibre reinforced Polymer FRP Composites presents information on this critical component of industrial and civil infrastructures also exploring the particular challenges that exist in the monitor and repair of pipeline systems This book reviews key issues and techniques in this important area including general issues such as the range of techniques using FRP composites and how they compare with the use of steel sleeves In addition the book discusses particular techniques such as sleeve repair patching and overwrap systems Reviews key issues and techniques in the use of fiber reinforced polymer FRP composites as a flexible and cost effective means to repair aging corroded or damaged pipelines Examines general issues including the range of techniques using FRP composites and how they compare with the use of steel sleeves Discusses particular techniques such as sleeve repair patching and overwrap systems

Handbook of Structural Engineering W.F. Chen, 1997-10-24 Covering the broad spectrum of modern structural engineering topics the Handbook of Structural Engineering is a complete single volume reference It includes the theoretical practical and computing aspects of the field

providing practicing engineers consultants students and other interested individuals with a reliable easy to use source of information Divided into three sections the handbook covers Water Distribution Operator Training Handbook Third Ed AWWA Staff,2011-01-12 AWWA s most popular handbook for distribution operators this handbook provides a complete introduction to water distribution system operation and equipment Recommended Specifications for Large-span Culverts Timothy J. McGrath,National Cooperative Highway Research Program,2002 **Updated Test and Design Methods for Thermoplastic Drainage Pipe** Timothy J. McGrath,Ian D. Moore,Yick Grace Hsuan,2009 This report contains the findings of research performed to develop a recommended load and resistance factor design LRFD specification for thermoplastic pipe used in culverts and drainage systems for highway structures The report details the research performed and includes a recommended LRFD design specification a quality assurance specification for manufactured thermoplastic pipe and the results of supporting analyses **Recommended LRFD Specifications for Plastic Pipe and Culverts** Timothy J. McGrath,V. E. Sagan,2000 Composite Materials in Piping Applications Dimitrios G. Pavlou,2013 A comprehensive materials science book on the design analysis and performance of composite materials CM in oil gas water and wastewater pipe applications Corrosion in the Petrochemical Industry, Second Edition ,2015-12-01 Originally published in 1994 this second edition of Corrosion in the Petrochemical Industry collects peer reviewed articles written by experts in the field of corrosion that were specifically chosen for this book because of their relevance to the petrochemical industry This edition expands coverage of the different forms of corrosion including the effects of metallurgical variables on the corrosion of several alloys It discusses protection methods including discussion of corrosion inhibitors and corrosion resistance of aluminum magnesium stainless steels and nickels It also includes a section devoted specifically to petroleum and petrochemical industry related issues

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