Buried Pipe Design

Underground pipelines transporting liquid petroleum products and natural gas are critical components of civil infrastructure, making corrosion prevention an essential part of asset-protection strategy. Underground Pipeline Corrosion provides a basic understanding of the problems associated with corrosion detection and mitigation, and of the state of the art in corrosion prevention. The topics covered in part one include: basic principles for corrosion in underground pipelines, AC-induced corrosion of underground pipelines, significance of corrosion in onshore oil and gas pipelines, numerical simulations for cathodic protection of pipelines, and use of corrosion inhibitors in managing corrosion in underground pipelines. The methods described in part two for detecting corrosion in underground pipelines include: magnetic flux leakage, close interval potential surveys (CIS/CIPS), Pearson surveys, in-line inspection, and use of both electrochemical and optical probes. While the emphasis is on pipelines transporting fossil fuels, the concepts apply as well to metallic pipes for delivery of water and other liquids. Underground Pipeline Corrosion is a comprehensive resource for corrosion, materials, chemical, petroleum, and civil engineers constructing or managing both onshore and offshore pipeline assets; professionals in steel and coating companies; and academic researchers and professors with an interest in corrosion and pipeline engineering. Reviews the causes and considers the detection and prevention of corrosion to underground pipes Addresses a lack of current, readily available information on the subject Case studies demonstrate how corrosion is managed in the underground pipeline industry
This manual describes the design, specification, installation, and maintenance of polyethylene (PE) water pipe.
A collection of papers from the international symposium "Underground Infrastructure Research: Municipal, Industrial and Environmental Applications 2001". It explores materials for buried pipelines, pipeline construction techniques and condition assessment methods, and more.
Annotation Covering both general and technical information related to PVC use, this illustrated manual discusses the properties of the material, its testing and inspection, hydraulics, design factors, pressure capacity, receiving and storage, installation, testing and maintenance, and service connections. Although intended as an aid to the design, procurement, installation, and maintenance of PVC pipe and fittings, its technical information is not directly correlated to AWAA standards. Appendices feature chemical resistance tables and flow friction loss tables. Annotation copyrighted by Book News, Inc., Portland, OR.
Geotechnical and Geoenvironmental Engineering Handbook
Design of Water Supply Pipe Networks
Pipeline Installation
Reliability and Maintainability of In-Service Pipelines
A Manual for Construction of Buried Pipe

The purpose of this guide is to develop design provisions to evaluate the integrity of buried pipefor a range of applied loads. The provisions contained in this guide apply to the following kindsof buried pipe:* New or existing buried pipe, made of carbon or alloy steel, fabricated to ASTM or APImaterial specifications.* Welded pipe, joined by welding techniques permitted by the ASME code or the APIstandards.* Piping designed, fabricated, inspected and tested in accordance with an ASME B3 lpressure piping code. These codes are: B3 l . l power piping, B3 l .3 process piping, B3 l .4liquid hydrocarbon pipelines, 831.5 refrigeration piping, 831.8 gas transmission anddistribution piping, B3 l .9 building services piping, B3 l. l l slurry piping, and ASMEBoiler and Pressure Vessel Code, Section ill, Division 1 nuclear power plant piping.* Buried pipe and its interface with buildings and equipment.
Buried pipes are a highly efficient method of transport. In fact, only open channels are less costly to construct. However, the structural mechanics of buried pipes can be complicated, and imprecisions in the properties of the soil envelope are usually too great to justify lengthy, complicated analyses. Designers and engineers need principles and m
Here is hands-on information for taking measurements and making the calculations necessary for cathodic protection of buried pipe lines.
Pipelines, Pipes, Structural design, Loading, Underground, Imposed loading, Mathematical calculations, Formulae (mathematics), Water supply, Sewers, Sewerage, Drainage, Pressure pipes, Flexible pipes, Rigid pipes, Semi-rigid structures, Pipe laying, Safety measures, Factor of safety, Strength of materials, Physical properties of soils, National standards
Pipeline Corrosion and Cathodic Protection
A Sound Conduit for Sharing Solutions
Design and Installation of Marine Pipelines
Design, Construction, Maintenance, Integrity, and Repair
Piping and Pipeline Engineering

A new, expanded edition of the authoritative handbook now available from Industrial Press for the first time.
Provides practical information about the design and installation of ductile iron pressure piping systems for water utilities. The 12 chapters outlines the procedure for calculating pipe wall thickness and class, and describes the types of joints, fittings, valves, linings, and corrosion protection a
Everything you need to design…install… replace and rehabilitate buried pipe systems Put a single-volume treasury of underground piping solutions at your command! A one-of-a kind resource, Buried Pipe Design, Second Edition, identifies and explains every factor you must know to work competently and confidently with the subsurface infrastructure of distribution systems, including sewer lines, drain lines, water mains, gas lines, telephone and electrical conduits, culverts, oil lines, coal slurry lines, subway tunnels and heat distribution lines. Within the pages of this acclaimed professional tool you'll find space-age remedies for the aging, deteriorating piping beneath America's cities -- and learn how to design long-lived systems capable of delivering vital services and meeting new demands. This comprehensive, state-of-the-art resource shows you how to: * Determine loads on buried pipes * Understand pipe hydraulics * Choose an installation design for buried gravity flow pipes * Design for both rigid pipe and flexible pipe * Select appropriate pipe for your application based on material properties * Work within safety guidelines * Handle soil issues, including pipe embedment and backfill * Employ the powerful tool of finite element analysis (FEA) * Adhere to current standards of the AWWA, ASTM, and other relevant standards organization * Save time with actual design examples * More! This thorough update of A. P. Moser's classic guide is now twice the size of the previous edition -- reflecting the vast progress and changes in the field in mere decade!You'll find enormous amounts of all-new material, including: *External Loads chapter: minimum soil cover, with a discussion of similitude; soil subsidence; load due to temperature rise; seismic loads; and flotation *Design of Gravity Flow Pipes chapter: compaction techniques; E' analysis; parallel pipes and trenches; and analytical methods for predicting performance of buried flexible pipes Design of Pressure Pipes chapter: corrected theory for cyclic life of PVC pipe…strains induced by combined loading in buried pressurized flexible pipe Rigid Pipe Products chapter: the direct method…design strengths for concrete pipe…and SPIDA (Soil-Pipe Interaction Design and

Analysis) *Steel and Ductile Iron Flexible Pipe Products chapter: three-dimensional FEA modeling of a corrugated steel pipe arch…tests on spiral ribbed steel pipe, low-stiffness ribbed steel pipe, and ductile iron pipe *Plastic Flexible Pipe Products chapter: long-term stress relaxation and strain testing of PVC pipes…frozen-in stresses…cyclic pressures and elevated temperatures…the AWWA study on the use of PVC…long-term ductility of PE…the ESCR and NCTL tests for PE…and full-scale testing of HDPE profile-wall pipes *Entirely new chapter! You get new information on pipe handling and trenching as well as safety issues. Here are valuable directions for working with fast-growing trenchless methods for installing and rehabilitating pipelines PLUS: * MORE design examples * THE LATEST ASTM, AWWA, ASHTTO, and TRB standards * NEW DATA ON CUTTING-EDGE PIPE MATERIALS, including profile-wall polyethylene

Trenchless technology allows for the installation or renewal of underground utility systems with minimum disruption of the surface. As water and wastewater systems age or must be redesigned in order to comply with environmental regulations, the demand for this technology has dramatically increased. This is a detailed reference covering construction details, design guidelines, environmental concerns, and the latest advances in equipment, methods, and materials. * Design and analysis procedures * Design equations * Risk assessment * Soil compatibility and more

Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

Design and Repair of Buried Pipe

Handbook of PVC Pipe Design and Construction

Handbook of Polyethylene Pipe

Buried Pipe Design

This revision of the ASCE Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD) is a replacement of ANSI/ASCE 15-93. This Standard focuses on the direct design of buried precast concrete pipe using Standard Installations, and reviews the design and construction of the soil/pipe interaction system that is used for the conveyance of sewage, industrial wastes, storm water, and drainage. To account for the interaction between pipe and soil envelope when determining loads, pressure distributions, moment, thrust and shear, this volume presents the SIDD method for buried precast concrete pipe. Excavation, safety, foundation, bedding, sheathing removal and trench shield advancement are among those construction requirements for precast concrete pipe designed by the SIDD method that are presented here. This standard practice may be used as a reference in preparing project specifications based on the SIDD method. Four types of standard embankment installations and four types of standard trench installations are covered in the standard. The limits state design procedure specified for the design of pipe is consistent with the procedures outlined in the AASHTO Standard Specifications for Highway Bridges. The commentary provides supporting background data.

Proceedings of the Pipelines 2011 Conference, held in Seattle, Washington, July 23-27, 2011. Sponsored by the Pipeline Division of ASCE. This collection contains 135 peer-reviewed technical papers that discuss new solutions to some of the most critical infrastructure issues involving pipelines. The U.S. water and wastewater infrastructure systems are continuing to deteriorate. The recent economic downturn has increased the gap between current and required levels of funding. These serious financial constraints highlight the urgent need for creative and innovative solutions to improve our water and wastewater infrastructure systems. From the technical perspective, cost effective materials, proper planning, new design methods, innovative construction technologies, and advanced condition assessment technologies must be more aggressively developed, tested, and introduced to the industry. From the management perspective, optimal use of financial resources, smart and carefully crafted decision making processes on maintenance, rehabilitation and replacement activities must be made available, applied by and used by water and wastewater infrastructure agencies.

This report explores analytical and design methods for the seismic design of retaining walls, buried structures, slopes, and embankments. The Final Report is organized into two volumes. NCHRP Report 611 is Volume 1 of this study. Volume 2, which is only available online, presents the proposed specifications, commentaries, and example problems for the retaining walls, slopes and embankments, and buried structures.

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. Thus, the report will be of immediate interest to bridge and structural design engineers and materials engineers in state highway agencies, as well as to thermoplastic pipe suppliers.

Ductile-iron Pipe and Fittings

ANALYSIS AND DESIGN OF GRAVITY FLOW CONDUITS.

Design and Structural Analysis

Buried Flexible Steel Pipe

Seismic Analysis and Design of Retaining Walls, Buried Structures, Slopes, and Embankments

Published by the Plastics Pipe Institute (PPI), the Handbook describes how polyethylene piping systems continue to provide utilities with a cost-effective solution to rehabilitate the underground infrastructure. The book will assist in designing and installing PE piping systems that can protect utilities and other end users from corrosion, earthquake damage and water loss due to leaky and corroded pipes and joints.

Design of buried pipeline systems involves solution of geotechnical and structural problems in addition to the hydraulics and mechanical issues. Just like any buried structure, it is of utmost importance to understand how the pipe interacts with the soil when subjected to external and internal loads. Based on the mode of withstanding loads, pipes are classified into two major categories, which are rigid and flexible pipes. Pipe material is the major factor governing the classification of a pipe being rigid or flexible. Rigid pipe is a pipe which is designed to withstand external dead and live loads and internal pressure loads without deformation. Flexible pipe on the other hand is designed with allowance to deform within a specified limit depending upon the pipe material and type of coatings and linings on the pipe. Designs of flexible pipes are generally based on hydraulic criteria of the pipeline, also known as Hydraulic Design Basis (HDB). Side soil column plays a pivotal role in flexible pipe's ability to withstand external loads. Pipe diameters and pipe wall thicknesses of flexible pipes are usually designed as per hydraulic requirements, such as, flow capacity, internal fluid pressure, pipe material strength and elasticity, and so on. Analysis of flexible pipe for response to external loads is commonly carried out with proper embedment rather than to

increase pipe structural capacity. This approach is rightly adopted because it is much more economical to provide good embedment rather than increasing stiffness of the pipe with increased thickness. Most common methods for flexible pipe analyses to predict pipe deflecions include the Modified Iowa and the Bureau of Reclamation equations. The Modified Iowa formula and the Bureau of Reclamation equations are semi-empirical methods to predict flexible pipe deflections. The pipe material properties used in these equations are engineering properties. However, the Modulus of soil reaction (E') which is a key property in determining the predicted long term deflection of pipe is an empirical value. One of the key assumptions in Spangler's (1941) soil pipe interaction model is that the passive soil resistances offered by embedment soil above and below the pipe springline are symmetric. This assumption is addressed in this dissertation, especially for the case of large diameter pipes. It is a widely accepted principle in geotechnical engineering that lateral pressure (active, at-rest or passive) from soil is dependent on depth, with deeper soils with higher lateral forces potential due to greater overburden pressures and also in cases where two different embedment materials are used. The Spangler's model does not consider peaking behavior (increase of vertical diameter) of pipe during embedment construction. There is a need to develop a model to predict pipe behavior due to embedment construction. This model needs to consider the cycle that embedment soil goes through from at-rest conditions (at the time of placement of layer), to active conditions (during peaking deflection), and finally to passive conditions (due to deflection of pipe). The objectives of this research are to consider engineering properties of embedment soils in analysis of flexible pipe-soil system for external load conditions and develop a new model for prediction of deflection of flexible steel pipe. Full scale laboratory tests were perfomed to develop the new model and finite element models were analysed to validate the test results. In this research, finite element method was effectively used to model the soil pipe interaction for five full scale laboratory tests conducted on a steel pipe. Such models can be used for analysis of flexible pipe embedment design for layered embedment conditions. The results of finite element analysis showed that the squaring of the pipe occurs when haunch soil is weak compared to the side column. Another critical observations made during the tests were stresses at the bottom of pipe and bedding angle. It is desirable that the stress due to surcharge load on top of the pipe, weight of the pipe, and water inside the pipe be distributed uniformly across width of the bedding. Best results against peaking deflection were obtained with crushed limestone (Test 3) due to lesser lateral earth pressure coefficient and lesser energy required for compaction. Perhaps, that is the reason why peaking deflections in flexible pipe have not been studied extensively in the past. However, if clayey materials are considered, peaking deflections need to be examined closely. Best results against deflection due to surcharge load were obtained in Test 4 with mixed embedment of crushed limestone and native clay. This was the only case when horizontal deflection due to surcharge load was observed to be approximately equal to vertical deflection in magnitude. This only echoes the importance of haunch area in behavior of pipe. The haunch area consisted of flow-able crushed limestone which was also subjected to compaction energy from compaction of clay embedment above 0.3 diameter. Also, the bedding angle for Test 4 was highest of all tests. The stress at top of pipe was well distributed along the bedding of pipe which is a favorable condition for integrity of bedding.

This authoritative resource consolidates comprehensive information on the analysis and design of water supply systems into one practical, hands-on reference. After an introduction and explanation of the basic principles of pipe flows, it covers topics ranging from cost considerations to optimal water distribution design to various types of systems to writing water distribution programs. With numerous examples and closed-form design equations, this is the definitive reference for civil and environmental engineers, water supply managers and planners, and postgraduate students.

This comprehensive handbook on submarine pipeline systems covers a broad spectrum of topics from planning and site investigations, procurement and design, to installation and commissioning. It considers guidelines for the choice of design parameters, calculation methods and construction procedures. It is based on limit state design with partial safety coefficients.

Pipeline and Utility Design, Construction, and Renewal

Underground Pipeline Corrosion

Design of Buried Steel Pipe

M55 PE Pipe - Design and Installation, Second Edition

Development of a Model for Estimation of Buried Large Diameter Thin-walled Steel Pipe Deflection Due to External Loads

Taking a big-picture approach, Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair elucidates the fundamental steps to any successful piping and pipeline engineering project, whether it is routine maintenance or a new multi-million dollar project. The author explores the qualitative details, calculations, and t

Reliability and Maintainability of In-Service Pipelines helps engineers understand the best structural analysis methods and more accurately predict the life of their pipeline assets. Expanded to cover real case studies from oil and gas, sewer and water pipes, this reference also explains inline inspection and how the practice influences reliability analysis, along with various reliability models beyond the well-known Monte Carlo method. Encompassing both numerical and analytical methods in structural reliability analysis, this book gives engineers a stronger point of reference covering both pipeline maintenance and monitoring techniques in a single resource. Provides tactics on cost-effective pipeline integrity management decisions and strategy for a variety of different pipes Presents readers with rational tools for strengthening and rehabing existing pipelines Teaches how to optimize materials selection and design parameters for designing future pipelines with a longer service life

This collection contains 200 papers presented at the ASCE International Conference on Pipeline Engineering and Construction, held in Baltimore, Maryland, July 13-16, 2003.

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)

Concrete Pressure Pipe, 3rd Ed.

Updated Test and Design Methods for Thermoplastic Drainage Pipe

BURIED PIPE DESIGN 3/E

Guide to the Design of Thrust Blocks for Buried Pressure Pipelines

2nd Volume

MOP 119 offers sound information on the structural design and analysis of buried steel pipe consistent with the latest pipe/soil design concepts of the industry.

Unearth the Secrets of Designing and Building High-Quality Buried Piping Systems This brand-new edition of Buried Pipe Design helps you analyze the performance of a wide range of pipes, so you can determine the proper pipe and installation system for the job. Covering almost every type of rigid and flexible pipe, this unique reference identifies and describes factors involved in working with sewer and drain lines, water and gas mains, subway tunnels, culverts, oil and coals slurry lines, and telephone and electrical conduits. It provides clear examples for designing new municipal drinking and wastewater systems or rehabilitating existing ones that will last for many years on end. Comprehensive in scope and meticulously detailed in content, this is the pipe design book you'll want for a reference. This NEW edition includes: Important data on the newest pipe styles, including profile-wall polyethylene Updated references to ASTM, AWWA, and ASHTTO, standards Numerous examples of specific types of pipe system designs Safety precautions included in installation specifications Greater elaboration on trenchless technology methods New information on the cyclic life of PVC pressure pipe Buried Pipe Design covers the ins and outs of: External Loads Gravity Flow Pipe Design Pressure Pipe Design Rigid Pipe Products Flexible Steel Pipe Flexible Ductile Iron Pipe Flexible Plastic Pipe Pipe Installation Trenchless Technology

Pipelines, Pipes, Structural design, Loading, Underground, Imposed loading, Mathematical calculations, Formulae (mathematics), Water supply, Sewers, Sewerage, Drainage, Pressure pipes, Flexible pipes, Rigid pipes, Semi-rigid structures, Pipe laying, Safety measures, Factor of safety, Strength of materials, Physical properties of soils, Soil mechanics

This one-of-a kind resource touches on everything engineers need to know to work with and design buried piping systems. Discusses all aspects of pipe design, from basic design principles to matters relating to soil. New to this edition: coverage of materials, such as profile-wall polyurethane; new standards from ASTM, AWWA, ASHTTO, and TRB; a new safety section; and more design examples.

Buried Pipe Design, 2nd Edition

PVC Pipe-- Design and Installation

Buried Rigid Pipes

Trenchless Technology

Guide to the Structural Design of Buried Pipelines

This report presents a step-by-step design guide for thrust blocks to restrain the forces generated by changes in direction of fluid flow in jointed buried pressure pipeline networks. It provides a background knowledge to the underlying principles and theory involved with designing thrust blocks for buried pipelines. The guidance given in this report is principally for thrusts up to 1000kN, limiting both the pressure range and pipe diameters and, more importantly, the thrust block sizes.

This comprehensive manual of water supply practices explains the design, selection, specification, installation, transportation, and pressure testing of concrete pressure pipes in potable water service.

Preface. Dedication. List of Figures. List of Tables. List of Contributors. Basic Behavior and Site Characterization. 1. Introduction; R.K. Rowe. 2. Basic Soil Mechanics; P.V. Lade. 3. Engineering Properties of Soils and Typical Correlations; P.V. Lade. 4. Site Characterization; D.E. Becker. 5. Unsaturated Soil Mechanics and Property Assessment; D.G. Fredlund, et al. 6. Basic Rocks Mechanics and Testing; K.Y. Lo, A.M. Hefny. 7. Geosynthetics: Characteristics and Testing; R.M. Koerner, Y.G. Hsuan. 8. Seepage, Drainage and Dewatering; R.W. Loughney. Foundations and Pavements. 9. Shallo.

Fiberglass Pipe Design, 2nd Ed. (M45)

Buried Pipelines

Pipelines 2011

A Practical Manual for Corrosion Engineers, Technicians, and Field Personnel

Proceedings of the ASCE International Conference on Pipeline Engineering and Construction