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Water Mains & Services

vol. 3 Asset location, customer psychology, DOMS and pipeline innovation

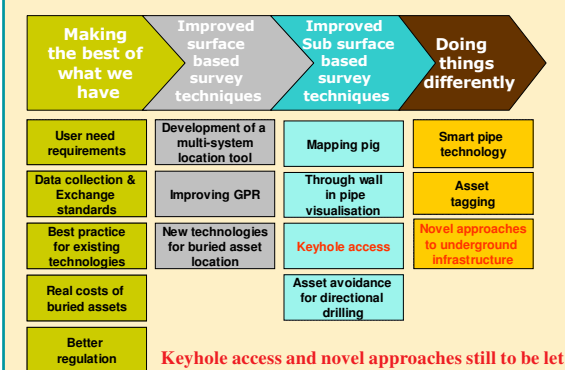
The UKWIR research programme is currently divided into the following topic areas: drinking water quality and health; toxicology; water resources; climate change; wastewater treatment and sewerage; biosolids; water mains and services as well as regulatory and customer issues. This catalogue lists the reports in the **Water Mains & Services Programme Area** on *asset location, customer psychology, DOMS and pipeline innovation*.

Through a series of workshops and collaborations, UKWIR has developed a £10 million programme of work *Minimising Street Works Disruption*. The purpose is to improve our knowledge of underground assets and to improve the efficiency of how we operate in the street.

By finding funders and collaborators in the UK, Europe and internationally and working with electricity, gas and telecoms utilities, nearly all of this £10 million research programme, as shown in figure 1, is now underway.

The UKWIR reports are listed on page 2, under the asset location heading, with the latest report (06/WM/12/13) giving a review of current practice.

Figure 1. UKWIR Minimising Street Works Programme



Volume 1 of the reports catalogue featured the extensive pipeline research programme carried out by Pipeline Developments and this issue includes their extensive work on plastic pipes.

UKWIR reports can only be purchased via the UKWIR website: www.ukwir.org

The website also provides information about current and proposed UKWIR research programmes

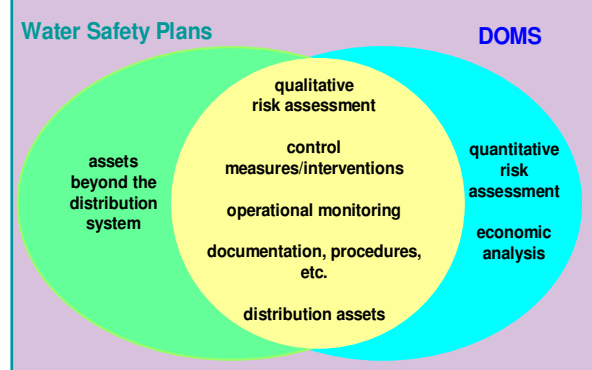
You can also download the latest version of UKWIR NEWS to get an update on recent projects, publications and technology transfer workshops

The concept of Distribution Operation and Maintenance Strategies (DOMS) represents a major change in drinking water regulation. UKWIR research is providing evidence to water companies and Ofwat.

Figure 2 shows the links between DOMS and the forthcoming Water Safety Plans.

DOMS will be a significant part of the next Periodic Review and guidelines (06/WM/18/2) have been issued to assist companies and regulators.

Figure 2. DOMS and Water Safety Plans



UKWIR was set up by the UK water industry in 1993 to provide a framework for the procurement of a common research programme for UK water operators on 'one voice' issues. UKWIR's subscribers comprise 24 water and sewerage undertakers in England and Wales, Scotland and Northern Ireland to whom these publications are freely available.

Work is often carried out in collaboration with government departments and regulators including the Department for Environment, Food and Rural Affairs; the Drinking Water Inspectorate and the Environment Agency. Work is also done in collaboration with research organisations internationally, including the Global Water Research Coalition.

The work is undertaken by a wide range of companies, academic institutions and other organisations in the UK and overseas. Project management is undertaken by both UKWIR members and individuals employed by UKWIR.

Asset location

National Underground Assets Group: Capturing, Recording, Storing and Sharing Underground Asset Information - A Review of Current Practice and Future Requirements

Contractor: Chris Overton, Consultant

Ref: 06/WM/12/13, ISBN 1 84057 422 4, 100pp, £25

The National Underground Assets Group is sponsoring the National Referencing Standards Project, phase 1 of which aims to develop methodologies, standards and best practices that address the short-term standardisation needs to 2008, for capturing, recording, storing and sharing underground asset information. Makes a series of recommendations for a mandatory revised Records Code of Practice, and a mandatory national standard high-level framework to enable effective deployment of the new code, based on a user survey of a representative sample of utilities and highway authorities.

The Implications of the Traffic Management Act

Contractor: WRc plc

Ref: 06/WM/12/12, ISBN 1 84057 413 5, 32pp, £50

Reviews the impact of the Traffic Management Act (TMA) on water companies and identified ways to mitigate its impact and prepare for discussions with Ofwat. Provides an overview of the TMA and its secondary legislation. Identifies a range of measures to mitigate the Act's impact and lays the essential groundwork that will facilitate any approach to regulators. It will allow organisations to make a local assessment of the most serious impacts of the TMA and benchmark themselves against the impact on the water industry nationally.

Minimising Street Works Disruption: Progress 2002-06

Contractor: Watershed Associates

Ref: 06/WM/12/10, ISBN 1 84057 410 0, 22pp, £50

The Minimising Street Works Disruption programme, consisting of fifteen projects valued at £10 million, was developed following a two day seminar attended by representatives from a wide variety of utilities from the UK, US and Netherlands. Details that progress and the status of the different projects.

Minimising Street Works Disruption: Buried Asset Data Collection and Exchange Field Trials

Contractor: Watershed Associates

Ref: 06/WM/12/9, ISBN 1 84057 409 7, 28p, £60

Identifies best practice for existing buried asset location technologies. Details the results of trials in North London and Yorkshire which trialled the various methods of data capture for buried assets including traditional methods such as tape measures and trundle wheels as well as the latest satellite survey equipment. It also looks at the current methods of exchanging and collating utility asset data used by contractors to the water industry.

Minimising Street Works Disruption: The Real Costs of Street Works to the Utility Industry and Society

Contractor: Transport Research Laboratory

Ref: 06/WM/12/8, ISBN 1 84057 408 9, 105pp, £150

Develops a better understanding of what street works cost the utility industry and what they cost society in general. Reviews literature on the subject and endeavours to estimate both the direct cost of street works to utilities and the costs of street works to society. Identifies the ways in which these costs can be minimised as well as gaps in knowledge requiring further research.

Underground Asset Location: Review of Current Technology

Contractor: Institute of Engineering Surveying and Space Geodesy

Ref: 05/WM/12/7, ISBN 1 84057 369 4, 17pp, £25

Presents high-level requirements for underground asset location and summarises the current state of the art in the location of underground assets. It recognises that the majority of effort in this area is focussed on the optimisation of these technologies and that there is little innovation in terms of new sensors and therefore reviews other disciplines as diverse as medicine, defence, archaeology and space to identify a broad spectrum of new technologies which could potentially be harnessed to address this issue.

Minimising Street Works Disruption Stakeholders Forum 21 June 2004

Ref: 04/WM/12/6, ISBN 1 84057 337 6, 32pp, £5

Account of the Second Stakeholder Forum of the Minimising Street Works Disruption Working Group. Presentations from UKWIR, BT, the RAC Foundation, NJUG, the Department of Transport addressing opportunities, covering geographical information, asset location, augmented reality sub-surface visualisation, trenchless techniques and multi-service ducts.

Locating Underground Plant and Equipment - Overview of Proposals for a Research Programme

Ref: 03/WM/12/4, 46pp, £5 or free download

Locating Underground Plant and Equipment - Proposals for a Research Programme

Contractor: Chris Overton, Consultant

Ref: 03/WM/12/3, 14pp, £5 or free download

First report details how the proposals for a research programme were devised, and the second report is a short summary of the final proposed programme that is estimated to be £9.6 million over a five year period.

Multi-Utility Buried Pipes and Appurtenances Location Workshop London 29 - 31 May 2002

Contractor: University of Birmingham

Ref: 02/WM/12/2, ISBN 1 84057 282 5, 74pp, £50

Reports the UKWIR and AwwaRF sponsored workshop. There were delegates from the UK, US and the Netherlands representing research sponsors, users and providers, equipment manufacturers and contractors.

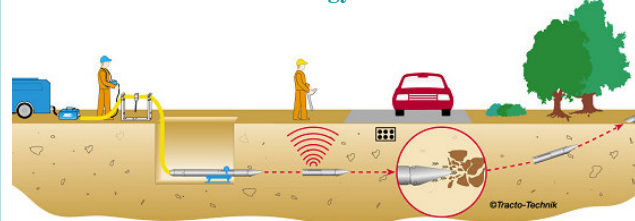
Report on Asset Location and Condition Assessment

Contractor: University of Birmingham

Ref: 02/WM/12/1, ISBN 1 84057 274 4, 36pp, £50

Report on the proceedings at Multi-Utility Buried Pipes and Appurtenances Location Workshop London 29 - 31 May 2002.

Figure 3. Ground Penetrating Radar (GPR) and Trenchless Technology



Customer psychology

Customer Psychology in Relation to Operational Practice 1998/99

Contractor: The Psychology Business

Ref: 99/WM/09/1, ISBN 1 84057 171 3, 74pp, £200

Involving both qualitative and quantitative methodologies, examines how customers determine their levels of satisfaction with the service from their clean water supplier, with specific attention paid to that company's operational practice and the role of its frontline staff. Determines the level of influence, both real and perceived, that network managers and their staff have on their customers' satisfaction with their supply and service. Looks at the practices and procedures that are utilised by network managers and their staff to raise levels of customer satisfaction and those practices that reduce customer satisfaction.

DOMS

DOMS - What Can We Learn? Research Report

Contractor: Tynemarch Systems Engineering
 Ref: 06/WM/18/3, ISBN 1 84057 424 0, 115pp, £200

Existing water company Distribution Operation and Maintenance Strategies (DOMS) have been reviewed in order to identify current best practice and highlight areas where further development would be beneficial. Research has been undertaken covering:

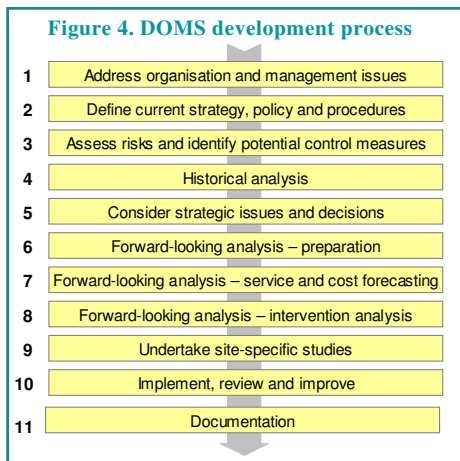
- effect of mains bursts on iron concentrations and customer contacts regarding discolouration
- benefits of interventions such as systematic flushing and mains rehabilitation
- design of cost-effective monitoring programmes
- quantification of costs associated with water quality service failures and capital and operational interventions.

DOMS Guidance Manual Vol. 2: Guidance

Contractor: Tynemarch Systems Engineering
 Ref: 06/WM/18/2, ISBN 1 84057 407 0, 145pp, £130

DOMS Guidance Manual Vol. 1: Non-Technical Overview

Contractor: Tynemarch Systems Engineering
 Ref: 06/WM/18/1, ISBN 1 84057 406 2, 8pp, £50



Pipeline innovation

Strategic Lead Communication Pipe Replacement: Initial Review of Water Company Pilot Trials

Contractor: Kirby Associates
 Ref: 05/WM/02/20, ISBN 1 84057 376 7, 54pp, £100

Summarises results from five pilot studies, in Anglian Water, United Utilities and Yorkshire Water, to develop and test methodologies for strategic lead communication pipe replacement programmes. Aimed at informing the further development of company strategies.

Rehabilitation Strategy

Contractor: Pipeline Developments
 Ref: 01/WM/02/18, ISBN 1 84057 244 2, 52pp, £100

Since 1989, water mains rehabilitation strategy in the UK has been predominantly focussed on meeting regulatory targets in the area of water quality. Renovation technique selection has been driven mainly by price and politics rather than robust engineering.

The Behaviour of Buried Plastic Pipes at Different Depths

Contractor: Pipeline Developments
 Ref: 01/WM/02/17, ISBN 1 84057 243 4, 47pp, £100

Monitoring of buried PVCu and thin wall biaxially oriented pipe at operational sites at Chorley and York has shown that loads and deformations of the pipe are predominately generated during installation and that subsequent transient traffic loads produce no permanent changes. Measurements of backfill temperatures have shown long time lags between changes in surface temperature dominates the pipe environment. The site measurements show no evidence of freezing in mains laid with 750mm cover. Projections from laboratory tests to simulate worst case conditions have shown that prolonged periods of cold weather would be required to freeze water in plastics mains laid with reduced cover of 750mm.

Understanding Burst Rate Patterns of Water Pipes

Contractor: Pipeline Developments
 Ref: 01/WM/02/16, ISBN 1 84057 242 6, 37pp, £100

A range of different water companies have supplied UKWIR with their pipe burst data for the last few years and these have been combined into one 'national' database. Analysis has shown that the newer grades of PVCu (unplasticised poly vinyl chloride) pipes are performing better than pipes made prior to the introduction of new toughness criteria in the 1980s. With polyethylene pipes, the burst problems are largely confined to failure problems with electrofusion joints. Pipes seldom fail. With cast iron pipes, two thirds of failures are due to circumferential fractures of smaller diameter pipes. Larger diameter pipes are more susceptible to longitudinal failures. Corrosion holes only account for 14 per cent of failures. It has been shown that only those pipes which fail by circumferential fractures are susceptible to seasonal effects.

Evaluation of Welding & Jointing of Plastic Pressure Pipes

Contractor: Pipeline Developments
 Ref: 01/WM/02/15, ISBN 1 84057 240 X, 27pp, £100

Welding criteria for PE systems have been evaluated by analysis of thermal data to try to reduce heating/cooling cycles and thus speed up jointing where butt fusion is used. A new harmonised set of welding conditions have been evolved which should allow the same conditions to be used for both gas and water pipe installations. Also, the new 'fastweld' process which allows for reduced has been thoroughly investigated and new conditions devised to allow reduced cycle welds to be made with the same physical conditions as standard joints. A full assessment of the welding properties of 'profuse' PE pipe with an external PP skin has been made. An updated version of the UK national welding specification (WIS 4-32-08) which incorporates the lessons learned here, has been written and circulated for public. For PVC systems, leakage problems have been found with large diameter PVC-A joints.

The Residual Structural Properties of Cast Iron Pipes, Structural and Design Criteria for Linings for Water Mains

Contractor: Pipeline Developments
 Ref: 01/WM/02/14, ISBN 1 84057 239 9, 49pp, £100

The options for relining of old cast iron water mains depend crucially on the perceived condition of the old pipe. All the pipe condition databases which are known to exist in the UK have been combined to give an appreciation of the rates of internal and external corrosion of old cast iron pipes. A major series of mechanical tests have been made of old pipes of various ages and types taken from different utility systems. The variations in strength and fracture toughness have been determined. A master graph of allowable defect size as a function of pipe wall thickness has been produced.

Performance of Access Chambers

Contractor: Pipeline Developments
 Ref: 99/WM/02/13, ISBN 1 84057 156 X, 17pp, £100

Plastic materials are increasingly being offered as alternative materials to concrete for manufacturing chamber units for the installation of valves and hydrants. The units vary in size and construction but ultimately their virtue lies in their lightweight nature and simplicity of installation. An appraisal of the structural integrity of plastic access chambers has been conducted in laboratory and site monitored tests with a view to extend their range of application to highways. The performance of the units to imposed vertical and lateral loadings was evaluated. It was also found that only the stiffest plastic units based on the thicker sections were capable of withstanding the effects of large wheel loads of highway traffic.

Evaluation of Long Term Performance the Behaviour of Buried Pipes

Contractor: Pipeline Developments

Ref: 99/WM/02/12, ISBN 1 84057 155 1, 12pp, £100

Monitoring of buried PVCu and thin wall biaxially oriented pipe at Chorley and York has shown that loads and deformations of the pipe are predominately generated during installation and that subsequent transient traffic loads produce no permanent changes. Measurements of backfill temperatures have shown long time lags between changes in surface temperature and those at pipe depths. Data from monitoring pipe laid at shallow depths and from laboratory tests have demonstrated that water temperature dominates the pipe environment. The site measurements show no evidence of freezing in mains laid with 750mm cover. Projections show that very prolonged periods of cold weather would be required to freeze water in plastics mains. The behaviour of shallow service pipes is being monitored.

Evaluation of the Resistance to Collapse of Thin Walled Liners

Contractor: Pipeline Developments

Ref: 99/WM/02/11, ISBN 1 84057 154 3, 16pp, £100

In the design of thin walled liners, the resistance to external pressure resulting from internal vacuum or external water table must be considered. It is the primary design criterion for thin-wall cured-in-place sewer linings. Laboratory tests on four different types of pipe material have demonstrated that the collapse pressures for unrestrained pipe are accurately predicted by the standard analytical solution. There is considerable enhancement of the collapse pressure in liners constrained from deformation by a host pipe. The degree of enhancement is dependent on the SDR of the pipe and is markedly affected by the presence of small folds or annular gaps between liner and host pipe. Excellent agreement between predictions of the effects of gaps on collapse using a computer model and tests on PVCu and PE liners inside steel pipe. Design tables for common in-service situations have been produced.

Performance of Electrofusion Joints for PE Pipes

Contractor: Pipeline Developments

Ref: 99/WM/02/10, ISBN 1 84057 153 5, 12pp, £100

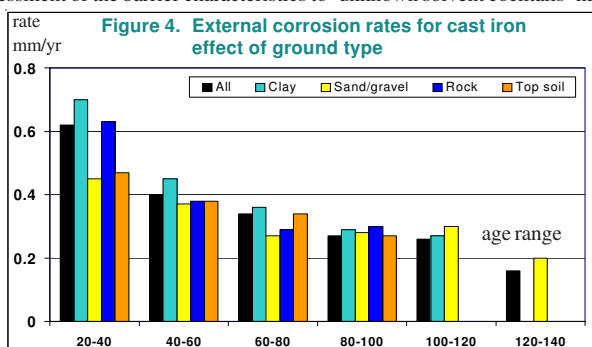
A large number of service failures of electrofusion joints remains of prime concern to UK water industry. This investigation looks at the effects of site conditions, joint preparation and fitting type on joint performance. An exercise was conducted with the involvement of all manufacturers to look at the effects of wet wipes on joint performance. Different wipe formulations were compared and it was found that their effects were negligible relating only to the rate of evaporation from the cleaned surface. The tolerance to contamination test developed for coupling was extended for large diameter couplings and modified for tapping tees. A performance variability between manufactures to overcome the effects of joint contamination clearly exists.

PE Pipes for Contaminated Land

Contractor: Pipeline Developments

Ref: 99/WM/02/9, ISBN 1 84057 152 7, 19pp, £100

The permeation resistance of the new 'twin walled' PE/Aluminium or PE/polyamide pipes and the effect of organics on various rubbers have been investigated. A polyamide outer layer extruded over standard PE pipe can reduce permeation of solvents but will not be effective in all situations. Inclusion of an aluminium layer into the main PE wall structure prevented the permeation of unleaded fuel through the PE pipe. A testing protocol for the assessment of the barrier characteristics to 'unknown solvent cocktails' has



been developed. The behaviour of elastomeric seals for pipes joined by socket and spigot systems needs consideration if pipe is laid in contaminated land. In laboratory tests, Viton rubber has been found to be the most resistant to diesel and unleaded fuels, but nitrile rubber can be effective in some circumstances.

Tapping Tees for PVC Pressure Pipe

Contractor: Pipeline Developments

Ref: 99/WM/02/8, ISBN 1 84057 151 9, 13pp, £100

Failures of PVC pressure pipe when installing self tapping tees, still give cause for concern. These failures appear to centre around fitting design and lack of definitive advice on tapping procedures for PVC materials. An under pressure tapping test has been developed in which most of the variables thought to be significant in field failures can be altered. Failures occur in practice where the tapping tee cutter just breaks through the pipe wall. A razor pendulum test has been developed in order to simulate this. The susceptibility of different PVC materials to tapping tee failure has been examined. It has been definitively shown that reducing both the cutter rotation speed and also the stresses applied to the pipe can dramatically affect the propensity for brittle failures to occur. This is especially true at lower temperatures where all types of PVC are more prone to fail in a brittle manner if a cutter digs into the pipe wall at the time of penetration of the bore.

Performance of Fast Butt Fusion Joining

Contractor: Pipeline Developments

Ref: 99/WM/02/7, ISBN 1 84057 150 0, 10pp, £100

A high productivity butt fusion welding process has been developed by Fusion Group. The process was evaluated on PE80 and PE100 pipe materials in sizes up to 400mm and compared against but fusion joints prepared under conventional water industry conditions. It was found that there was a threefold increase in productivity with all joints failing in a totally acceptable ductile manner. However, the short soak time of the process resulted in significantly reduced weld beads and it was felt there was less scope for pushing out potential contamination from the weld interface.

Plastics Pipeline Systems Evaluation of Long-term Performance - The Behaviour of Buried Pipes

Contractor: Pipeline Developments

Ref: 97/WM/02/5, ISBN 1 84057 038 5, 10pp, £50

Details the loads, temperatures and effects of the soil on two sections of 250mm continuously monitored PVCu pipe and assesses the changes in performance of an exhumed medium density polyethylene pipe. Indicates that design criteria are conservative and recommends that the conclusions should be included in installation specifications.

Plastics Pipeline Systems Analysis of System Failures

Contractor: Pipeline Developments

Ref: 97/WM/02/4, ISBN 1 84057 037 7, 17pp, £50

Incorporates an analysis of various service failure databases, including those compiled by individual water companies and those compiled by PDL from site quality assessment activities and the use of specially designed forms. Amongst the conclusions are that the largest number of plastic pipe failures occur on PVCu pipelines, mostly on the pipe. Most PE failures are due to fittings, with electrofusion tees and couplers failing most often.

Plastics Pipeline Systems Pipeline Innovation

Contractor: Pipeline Developments

Ref: 97/WM/02/3, ISBN 1 84057 031 8, 100pp, £200

Summarises the 1996/97 developments in pipeline innovation.

Pipeline Innovation - Final Report - 1995/96

Contractor: Pipeline Developments

Ref: 96/WM/02/2, ISBN 1 84057 114 4, 50pp, £200

Summarises the annual developments in pipeline innovation.

Pipeline Innovation - Final Report - 1994/95

Contractor: Pipeline Developments

Ref: 95/WM/02/1, ISBN , 73pp, £200

Summarises the annual developments in pipeline innovation.

Statements contained in this UKWIR catalogue do not necessarily represent the views of UKWIR or the Water Industry