



CIRIA WORK ON URBAN DRAINAGE

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Introduction

CIRIA, the Construction Industry Research and Information Association, is an independent, non-profit distributing organisation which initiates and manages research and provides information on topics of concern to professionals in the construction industry. The results of CIRIA research projects are published in books, reports and technical notes.

CIRIA is controlled by its member organisations which cover all disciplines and sectors of construction. All CIRIA research projects are guided by steering groups of experienced and knowledgeable practitioners, who ensure that the results meet the needs of the industry.

CIRIA's Core Programme of research is divided into five areas. Urban drainage is one of the topics most strongly supported by CIRIA members in the Water Engineering programme, reflecting major investment in this field. This paper will review recently completed, present and future urban drainage research projects managed by CIRIA, with emphasis on current work.

Recently completed urban drainage projects

The following list of selected projects is intended to illustrate the wide range of urban drainage topics covered by CIRIA. Projects have also been carried out on grit and grease in sewage and on sewage treatment.

Supervision of sewers for adoption was published in 1989. The report describes a National survey undertaken by CIRIA on the nature and extent of problems occurring during the course of S.18 work and the supervision practices presently being undertaken. The report sets out a basic level of supervision to minimise costs to the adopting authority and recommends that the cost of additional visits to inspect remedial works should be recoverable from the developer. Many of the reports recommendations have since been incorporated into *Sewers for adoption*. A follow-up project is planned to include more detail on quality management and CCTV surveys.

Sediment movement in combined sewerage and stormwater drainage systems was published in 1987. The report describes sediment problems in UK sewers and reviews current analysis, design, operation and maintenance practices. One of the recommendations of the report was that sediment deposits and sediment transport modelling should be added to WASSP. Since the report was published, sediment depth modelling has been included in WALLRUS and a sediment transport model has been developed for MOSQUITO. Some of the other recommendations are the subject of current and proposed CIRIA projects.

Design of low-lift pumping stations is due to be published. The report will provide guidance on the planning and design of low-lift pumping stations with particular attention to pumping wastewater. The report emphasises the multi-disciplinary nature of pumping station design and draws together mechanical and civil engineering knowledge.

Design of flood storage reservoirs is an update of *TN100 - Guide to the design of storage ponds for flood control in partly urbanised catchment areas*. The original methods have been enhanced to include recent developments in small catchment hydrology so they are applicable to smaller areas. Water quality has been added by consideration of sediment, including typical sediment loads in runoff and levels of pollutants attached to these sediments. Sections have also been added on nature conservation and operation and maintenance of storage ponds. The report is being finalised ready for publication in 1992.

Scope for control of urban runoff has just been completed and is now ready for publication. The report, in four volumes, covers technical and administrative aspects and includes a review of present methods and practice, guidelines for increased runoff control using infiltration and storage at various points in the system, and a review of legislative and economic issues. The report's recommendations include increased application of catchment-wide planning, and simplification of the existing administrative system for urban drainage under which responsibilities are fragmented. One of the research requirements identified by the report (and by HR Wallingford's soakaways study) is the need for a manual of good practice for on-site disposal of surface water. This has been followed up by CIRIA and HR and is described below. *Scope for control* will be published early in 1992.

Current urban drainage projects

CIRIA is currently managing two major drainage projects, the *Infiltration Manual* described above, and a study of sediment cleaning practices for whole drainage catchments.

Manual on infiltration methods for stormwater source control

The objective of this project is to produce a manual of good practice for the design, installation and maintenance of a wide range of infiltration systems. The project started in October 1991 and will run for two years at a total cost of over £180,000. The study is funded primarily by DoE, the NRA and the WSPLC's, with HR Wallingford as the main research contractor.

The project consists of a number of related modules:

- * A structured survey to identify the use of infiltration systems in the UK, supplemented with available information from overseas.
- * A review of published information and current research on infiltration drainage, with particular emphasis on water quality and geotechnical aspects which can be included in the manual.
- * Case studies of existing infiltration systems, for detailed investigation of the benefits and shortcomings of different methods and designs. Suggestions for case studies are invited from WaPUG members.
- * A study of water quality aspects of infiltration drainage, including identification of pollutants, categorisation of runoff from different sources by quality, and

investigation of various pollution control measures. This work will include liaison with the NRA to ensure that the study's recommendations are compatible with their forthcoming Groundwater Protection Policy.

- * Investigation of geotechnical aspects, with emphasis on the maintenance of infiltration systems and ways in which their lifespan can be extended.
- * A study of the hydraulic aspects of different types of infiltration system. This will be carried out by extending HR Wallingford's existing hydraulic model for cylindrical soakaways. The new models will be used to test and refine site investigation procedures, and a method will be developed for the hydraulic design of new systems.
- * A cost module, in which methods are developed for the whole-life cost estimation of infiltration systems for comparison with piped drainage systems.
- * A review of relevant legislation, the regulatory system relating to drainage, and the ways in which these affect the viability of infiltration methods. Particular emphasis will be placed on the division of responsibilities between different authorities.

The results from these modules will be drawn together to produce a manual of good practice. Details of the hydraulic and other modules will be published separately. It is hoped that the provision of the manual will promote wider appreciation and use of infiltration systems as an alternative to more traditional piped systems in the UK.

Cleaning sediments from drainage systems and above ground areas

This project started in December 1990, and has a further year to run. The objective is to develop guidelines for the exclusion or removal of sediments which cause problems in drainage systems, both below- and above-ground. The project is funded by DTp and the WSPLC's and CIRIA's research contractor is Binnie & Partners in association with South Bank Polytechnic.

The project is studying sediment buildup and cleaning methods for catchment surfaces, gully pots, sewers, drains and sewer ancillaries. Particular emphasis is being placed on the relationships between these so that recommendations can be made on co-ordinating cleaning activities for more efficient operation of the whole system.

An initial estimate of the costs of removing sediments at various stages (from streets, gully pots, sewers and at treatment works) reveals that the cheapest place for removal is at treatment works. This does not take account of the problems caused by the sediment before it reaches the bottom of the system, however, and in practice the most efficient way to prevent problems is to remove sediment from catchment surfaces and gullies.

This is complicated by the fact that sediment problems are not fully understood by the authorities responsible for cleaning different parts of the system. The main reason for street sweeping, for example, is to improve the appearance of catchment surfaces, not to prevent sediment from building up in gullies, and sweeping operations are scheduled accordingly.

Field work is being carried out in Lambeth, Shropshire and Rotherham to monitor sediment accumulation in gully pots and in Lambeth to monitor sediment accumulation on catchment surfaces. Surface sediment samples have been analysed and grading curves produced for comparison with similar data from gullies. Rainfall, street sweeping and gully emptying data is

also being collected. The project will draw on results of other studies for data on sediment accumulation and cleaning below-ground. In Rotherham, street sweeping frequencies are being varied so that the effects on sediment buildup in gullies can be observed.

The results of the project will be published as guidelines describing sediment problems, the current management framework for cleaning operations, costs and techniques for cleaning catchment surfaces, gully pots and sewers, and the relationships between these cleaning operations. A new management framework will be produced, including recommendations on how to select cleaning methods, identification of key locations in the system, scheduling and monitoring of operations, the role of co-ordination and costs. Recommendations will be made on any necessary changes to legislation and for further research.

Future urban drainage projects

Urban drainage has been identified by CIRIA members as one of the areas of high priority for further research. Three proposals have been developed for future projects:

- * *Guidance relating to sewers for adoption* will build on CIRIA's previous *Supervision* project, with more work on quality management in construction and on CCTV surveys.
- * *Design of sewers to control sediment problems* will produce a handbook for engineers on the design of sewers in the UK and overseas to reduce sediment problems. This will draw on recent research at HR Wallingford, and simple methods for predicting sediment movement developed by consultants for use with simulation models.
- * *Control of pollution from surface water drainage systems* will determine the impact of runoff discharges on receiving water quality and produce practical guidelines on measures which can be taken to reduce pollution. This proposal has been developed in conjunction with WRc.

Many more ideas for new urban drainage research projects are needed. Suggestions for projects to provide guidance for drainage engineers are invited from WaPUG members.

WaPUG AUTUMN MEETING 1991 - DISCUSSION

Paper 1: Control Of Urban Run-Off (J Payne - CIRIA)

D Walters, M Barber & Co. : Have you considered putting CIRIA publications on the Barber Index?

Ans : It is normal practise for all CIRIA publications to be added to the index.

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D Walters, M Barber & Co. : Could you consider the movement of sediments in large diameter sewers during cleaning operations?

Ans : The CIRIA study on cleaning sediments from drainage systems and catchment surfaces is concentrating on above-ground areas because of the large amount of work being carried out elsewhere on sewer sediments. Guidance on the choice of cleaning methods will be included in the final report provided CIRIA can obtain information in the effectiveness of different methods. Wrc are managing a project which looks at sewer cleaning in more detail. General information on sediment movement and the effectiveness of cleaning techniques is given in an earlier CIRIA publication, Sediment Movement in Combined Sewerage and Storm Water Drainage Systems (CIRIA PR1).

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D Walters, M Barber & Co. : Has CIRIA investigated the effects on the structural fabric of the sewer, especially brick sewers, of very high pressure jetting?

Ans: As far as I am aware, this subject has not been addressed in detail by CIRIA. PR1 (see above) states that jetting will not damage sound pipes.

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Andrew Herbert, Travers Morgan : Will the publication on the design of low lift pumping stations include consideration of hazard zone design?

Ans: The publication will include a section on health and safety which covers hazard zones.

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David Balmforth, Sheffield City Polytechnic : Development of infiltration methods for drainage and control of surface sediments very much depends on ownership and legislation. Could the author comment on this and discuss how recent environmental legislation may influence this issue?

Ans: One of the strongest messages to emerge from all CIRIA's recent urban drainage projects is that existing administrative and legislative framework needs to be simplified. The current framework and fragmented responsibilities for urban drainage networks discourage authorities from seeking the best overall solution to urban drainage problems. I am not sure whether recent and planned legislation will improve the situation. The Steering Group for the CIRIA sediment cleaning project has already identified several potential problems arising from the Environmental Protection Act, including the possible classification of materials collected from streets and gullies as industrial waste.