



Culvert design and operation guide

Project Summary SC070038/S1

Culverts are one of the most common types of drainage infrastructure and are widely used by many sectors and organisations in the UK. They represent a huge collection of assets, which have to be managed to achieve best value. To aid this process CIRIA and the Environment Agency have developed updated guidance on the design and operation of culverts.

There are tens of thousands of culverts currently in operation in the UK, many of them over 50 years old and requiring significant repairs or replacement. Although the construction of new culverts is discouraged, there are many situations where there is no viable alternative, so significant numbers of new culverts are still being designed and constructed each year.

A culvert provides the means of allowing infrastructure (generally a highway, railway or waterway) to cross a watercourse. Culverts are superficially simple structures, but they have the potential to restrict flow (causing flooding), and to impact adversely on the aquatic environment. Furthermore, assessment of the hydraulic performance of a culvert can be complex.

In service a well-designed culvert may require little attention from an asset manager other than routine inspection and maintenance. However, many of the existing culverts across the UK were designed for conditions which have been significantly altered by urban development, climate change and concern about the quality of the aquatic environment. Problems of decaying structural fabric, sedimentation, blockage by debris and inadequate capacity present an asset manager with a constant demand for assessment, rehabilitation, repair and enhancement. In addition, there are increasing environmental pressures, driven by legislation such as the Water Framework Directive, that require asset managers to examine options for improving the environmental performance of culverts, including restoring the watercourse back to a more natural state.

It is in the above context that the Culvert Design and Operation Guide (CDOG) has been prepared to replace the Culvert Design Guide originally published by CIRIA (Construction Industry Research and Information Association) in 1997.

The CDOG adopts a whole-life approach to the design and operation of culverts, with a focus on asset management, reflecting the significant changes that have occurred in the business of asset management over the past 10 to 15 years.

CDOG addresses the management of culverts in the context of both the drainage basin in which they sit, and the infrastructure that they form part of. The guide questions the need for the culvert, encouraging the user to consider more sustainable alternatives including culvert removal and river restoration. The environmental and legal implications of culverting and culvert removal are explained, including enhancement opportunities and landowner responsibilities. Revised approaches to hydrology and hydraulic assessment are provided, with methods for assessing siltation and debris load, computational methods for hydraulic analysis and advice on allowances for bulking due to debris, sediment and air entrainment.

Good practice examples from the project steering group, comprising asset owners, manufacturers and those engaged in the construction, operation and maintenance of culverts are presented. Advice includes innovative approaches and techniques for inspection, maintenance and repair of culverts.

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