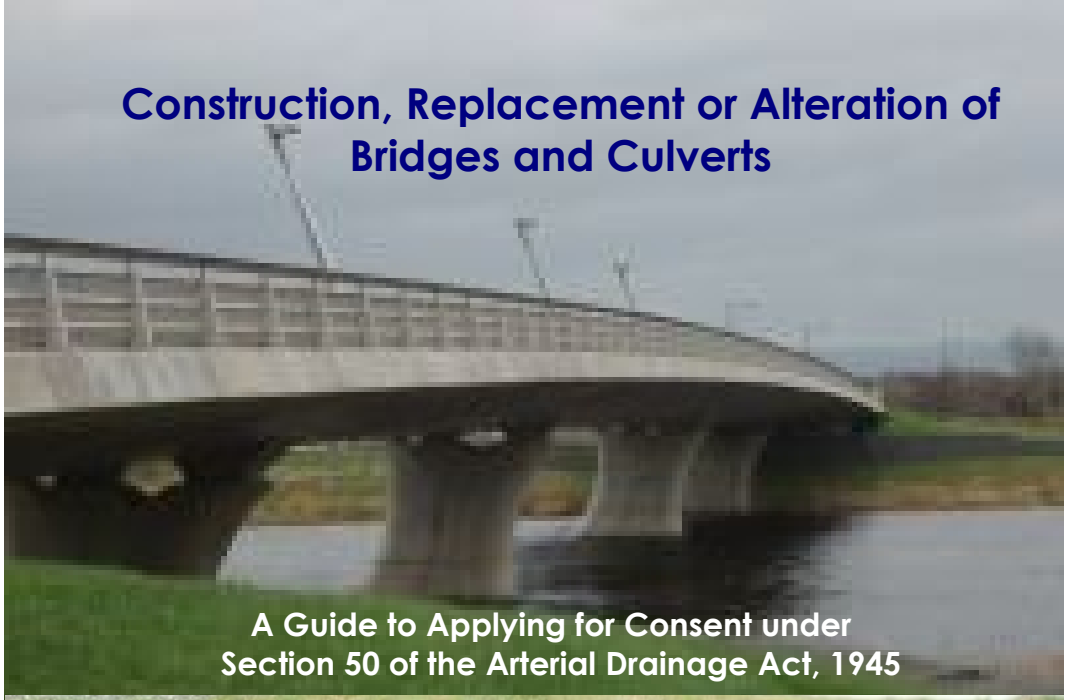
Construction, Replacement or Alteration of Bridges and Culverts



A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945

About this Guide

This guide has been produced by the Office of Public Works (OPW) to assist those applying for consent from the Commissioners of Public Works to construct, replace or alter a bridge or culvert. The issues that this guide addresses include:

-Why is consent required from the OPW?

-How is an application reviewed by the OPW and how long can a review take?

-What information should be submitted in support of an application for consent?

-What are the features of hydraulically efficient and inefficient bridges and culverts?

Within this guide, the following references are used:

-Bridges: This refers to the entire bridge structure, including all ancillary works such as watercourse realignment, erosion control and approach works.

-Culverts: This refers to the entire culvert structure, including all ancillary works such as watercourse realignment, erosion control and approach works.

-Structures: This refers to both bridges and culverts, including all ancillary works such as watercourse realignment, erosion control and approach works.

If further information is required, please refer to the relevant OPW contact details on the back page of this guide.

Introduction to Section 50

Section 50 of the Arterial Drainage Act, 1945 requires that:

> *No local authority, no railway company, canal company or other similar body, and no industrial concern shall construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners.*

The OPW is responsible for the implementation of the regulations in the Arterial Drainage Act, 1945, including Section 50.

! OPW consent does not confer permission to construct and does not absolve the developer from fulfilling any other legal obligations or from third party claims that might arise from the project.

Section 50 and Flood Risk Management in Ireland

The objective of flood risk management is to reduce the impact that flooding has on communities and infrastructure both at present and into the foreseeable future through the implementation of measures such as:

-Planning and development controls.

-Land use management.

-Flood warning systems.

-Flood relief schemes.

The role of the various State Bodies in the management of flood risk in Ireland is defined by the "Report of the Flood Policy Review Group". Of particular relevance to this guide are the roles and responsibilities that are assigned to the OPW, which include taking the lead role in relation to the management of flood risk in Ireland.

The construction, replacement or alteration of a bridge or culvert has the potential to change the hydraulic characteristics of a watercourse. If significant, this change may result in:

-Flood levels upstream of the bridge being increased due to the creation of a restriction in the watercourse.

-Flood levels downstream of the bridge being increased due to the removal of a beneficial restriction from the watercourse.

-Erosion of the watercourse and/or floodplain being initiated or accelerated due to the restriction increasing flow velocities and turbulence.

-Deposition of material in the watercourse or on the floodplain due to a change in flow velocities and turbulence.

-Overland flow paths on the adjacent floodplain being blocked or diverted due to the construction of bridge approaches.

The above changes to the hydraulic characteristics of a watercourse or floodplain may impact on local flood risk management plans. The OPW has a broader interest in ensuring that the adverse hydraulic effects created by new or existing bridges and culverts are avoided, minimised or managed through the process of obtaining consent under Section 50.

! Consent under Section 50 does not confer permission to construct and does not absolve the developer from fulfilling any other legal obligations or from third party claims that might arise from the project.

Hydraulic Design Standards

In general, a proposed bridge or culvert design submitted with an application under Section 50 should demonstrate the achievement of the following design standards:

✓A bridge or culvert must be capable of passing a fluvial flood flow with a 1 % annual exceedance probability (AEP) or 1 in 100 year flow without significantly changing the hydraulic characteristics of the watercourse.

✓In addition to the above fluvial flood flow standard, if a bridge or culvert is located within a tidal zone, it must cater for a tide level with a 0.5 % AEP or 1 in 200 year flow without significantly changing the hydraulic characteristics of the watercourse.

✓A bridge must be capable of operating under the above design conditions while maintaining a freeboard of at least 300 mm.

✓If the land potentially affected does not include dwellings and infrastructure, a culvert must be capable of operating under the above design conditions while causing a hydraulic loss of no more than 300 mm (excluding the culvert gradient).

✓If the land potentially affected includes dwellings and infrastructure, it must be demonstrated that those dwellings and/or infrastructure are not adversely affected by constructing the bridge or culvert.

✓A culvert diameter, height and width must not be less than 900 mm to facilitate maintenance access and reduce the likelihood of debris blockage.

! If the level of risk or uncertainty warrants, a HIGHER design standard may be required.

i A LOWER design standard may be considered by the OPW if there is a sufficiently low risk. In such cases, adequate justification must be provided with the application.

Hydrological Considerations

The hydrological analysis submitted in support of an application should be representative of the rainfall and flood flows that can be expected at the site of the proposed bridge or culvert. It should therefore:

✓Define the hydrological characteristics of the watercourse catchment upstream of the location of the proposed bridge or culvert.

✓Utilise all appropriate and available rainfall and hydrometric data.

✓Where appropriate, use a range of techniques to estimate the design peak flood flow.

✓Incorporate any expected change in the catchment's hydrological characteristics due to "climate change".

Hydraulic Considerations

The hydraulic analysis submitted in support of an application should be representative of the bridge or culvert that will be constructed. It should therefore take into account:

✓All losses associated with the bridge or culvert (e.g. entrance, exit, friction and pier losses).

✓Any ancillary works that may affect the hydraulic performance of the bridge or culvert (e.g. erosion control works and debris screens).

✓The effect of the downstream water level on the hydraulic performance of the bridge or culvert, including tides.

✓The hydraulic implications of any environmental measures incorporated into the bridge or culvert design (e.g. depression of the invert or the installation of baffles).

! If the information required to review your application is not submitted, the OPW will place your application on hold pending the receipt of outstanding or additional information.

! Any change to the hydraulic design of the bridge or culvert made after receipt of consent from the OPW under Section 50 will invalidate that consent.

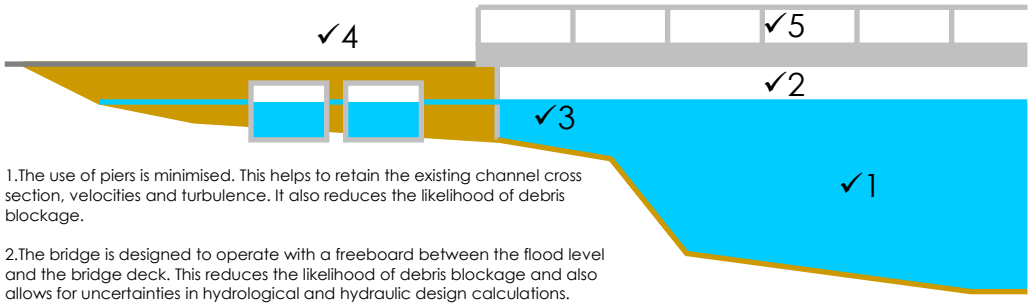
The level of technical analysis that may be required in support of an application is outlined in the following table.

		Information Requirements											
		Impact		Survey Information			Hydrology		Hydraulics			Additional	
		Flood level	Flood extent	Detailed plan of structure and adjacent watercourse	Cross section survey extending over the affected area	Aerial or ground-based contour survey covering the affected area	Estimation of design flood flow	Estimation of design flood hydrograph	Simple hydraulic calculations	Numerical hydraulic model	Flood risk assessment	Analysis of alternative events that may be affected by the structure	Joint probability analysis combining fluvial and tidal events
Affected Land	Undeveloped	✓	-	✓	O	-	✓	-	✓	-	-	-	O
	Rural dwellings and Infrastructure	✓	O	✓	O	O	✓	O	✓	O	O	O	O
	Urban dwellings and infrastructure	✓	✓	✓	✓	O	✓	✓	✓	✓	✓	O	O

✓ Likely to be required
O May be required
- Unlikely to be required

i Please be aware that this information is provided as a guide only, and that additional information may be requested at the discretion of the OPW.

Some features of a Hydraulically **EFFICIENT** Bridge and Culvert



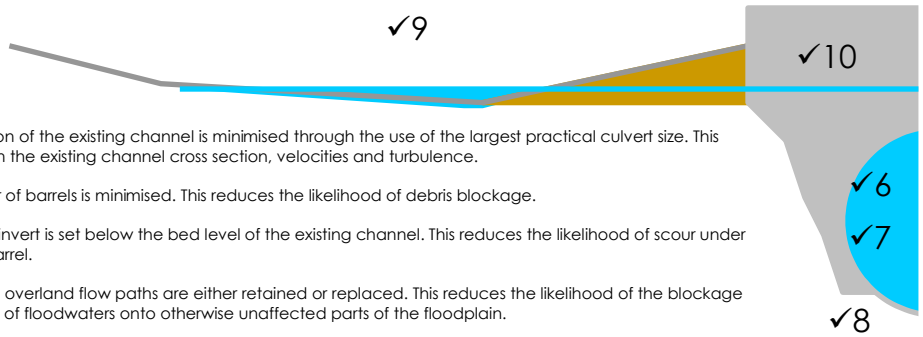
1.The use of piers is minimised. This helps to retain the existing channel cross section, velocities and turbulence. It also reduces the likelihood of debris blockage.

2.The bridge is designed to operate with a freeboard between the flood level and the bridge deck. This reduces the likelihood of debris blockage and also allows for uncertainties in hydrological and hydraulic design calculations.

3.The encroachment of the bridge abutments into the channel is minimised. This helps to retain the existing channel cross section, velocities and turbulence.

4.Any existing overland flow paths are either retained or replaced. This reduces the likelihood of the blockage and diversion of floodwaters onto otherwise unaffected parts of the floodplain.

5.The bridge abutments and any piers are parallel with the existing direction of flow.



6.The restriction of the existing channel is minimised through the use of the largest practical culvert size. This helps to retain the existing channel cross section, velocities and turbulence.

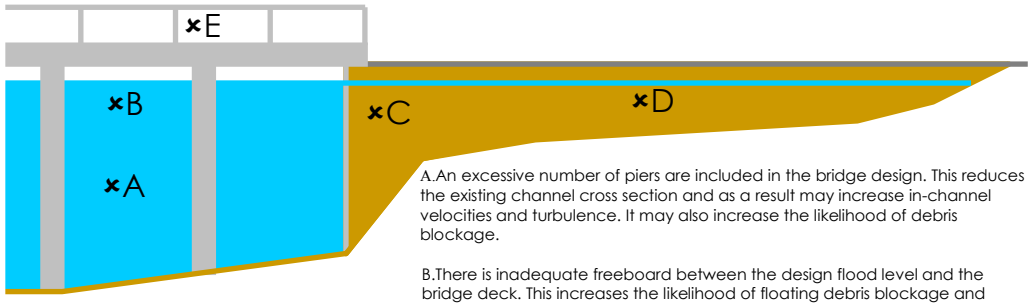
7.The number of barrels is minimised. This reduces the likelihood of debris blockage.

8.The culvert invert is set below the bed level of the existing channel. This reduces the likelihood of scour under the culvert barrel.

9.Any existing overland flow paths are either retained or replaced. This reduces the likelihood of the blockage and diversion of floodwaters onto otherwise unaffected parts of the floodplain.

10.The culvert is designed to operate without a reliance on excessive head loss across the structure. This reduces the likelihood of high velocities and turbulence in the culvert and channel.

Some features of a Hydraulically **INEFFICIENT** Bridge and Culvert



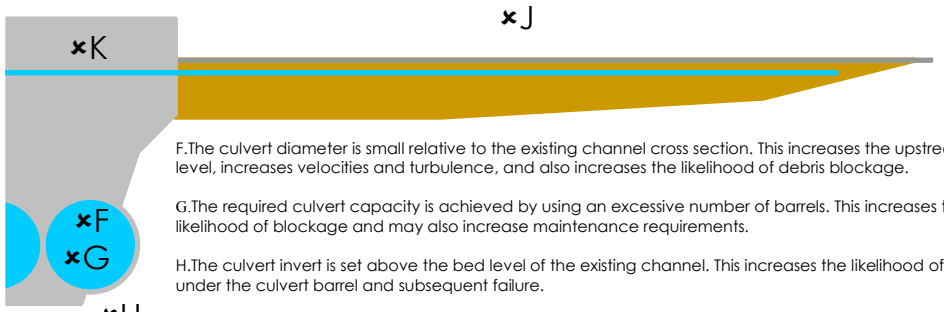
A.An excessive number of piers are included in the bridge design. This reduces the existing channel cross section and as a result may increase in-channel velocities and turbulence. It may also increase the likelihood of debris blockage.

B.There is inadequate freeboard between the design flood level and the bridge deck. This increases the likelihood of floating debris blockage and does not allow for any uncertainties in the hydrological and hydraulic design calculations.

C.The bridge abutments encroach into the existing channel. This reduces the existing channel cross section and as a result may increase in-channel velocities and turbulence.

D.Existing overland flow paths are blocked. This may cause the diversion of flood waters onto otherwise unaffected parts of the floodplain.

E.The bridge abutments and any piers are not aligned parallel to the existing direction of flow. This is likely to decrease the hydraulic performance of the bridge.



F.The culvert diameter is small relative to the existing channel cross section. This increases the upstream water level, increases velocities and turbulence, and also increases the likelihood of debris blockage.

G.The required culvert capacity is achieved by using an excessive number of barrels. This increases the likelihood of blockage and may also increase maintenance requirements.

H.The culvert invert is set above the bed level of the existing channel. This increases the likelihood of scour under the culvert barrel and subsequent failure.

J Existing overland flow paths are blocked. This may cause the diversion of flood waters onto otherwise unaffected parts of the floodplain.

K The culvert is only able to pass the design flow with a significant head loss across the structure. This may result in increased upstream water levels, high velocities and turbulence that may damage the structure and channel.

Information Checklist

To allow us complete a full review of your application, you need to prepare and submit the following information to the OPW:

✓Completed application form.

✓Scaled and annotated location plan (including accurate geographic position).

✓Scaled plan(s) and cross section(s) of all works associated with the bridge or culvert (including the earthworks necessary to form any approaches to the bridge or culvert) referenced to ordnance datum.

✓Annotated photographs of the proposed site, the upstream channel and floodplain, and the downstream channel and floodplain. Details of any existing bridges both upstream and downstream of the proposed site are to be included, if applicable.

✓Technical documentation covering the hydrological and hydraulic analysis completed during the design of the bridge or culvert.

The Review Process

An application for consent under Section 50 is reviewed by the OPW as follows:

a.The application is received, registered and acknowledged by the OPW.

b.The application is checked to ensure that all the information necessary to review it has been submitted.

c.If necessary, a request for any outstanding information is issued.

d.Once all necessary information is received, the application is reviewed. This review includes:

-Examination of the hydrological and hydraulic calculations.

-Review of the basis for the conclusions reached with regard to the impact of application on upstream and downstream flood levels.

-A request is issued if any additional information is required to complete the review of the application.

e.The application for consent under Section 50 is either granted or declined.

i The OPW aims to review applications within 8 weeks of receiving all necessary information.

Further Information

Further information specific to the application for consent under Section 50 is available from:

OPW East Region
Newtown
Trim
Co. Meath
Phone: (046) 943 1352
bridgeseast@opw.ie

OPW South East Region
c/o Templemungret House
Mungret
Co. Limerick
Phone: (061) 227 139
bridgessoutheast@opw.ie

OPW South West Region
Templemungret House
Mungret
Co. Limerick
Phone: (061) 227 139
bridgessouthwest@opw.ie

OPW West Region
Headford
Co. Galway
Phone: (093) 35456
bridgeswest@opw.ie

General information may also be available from the following organisations.

www.opw.ie www.epa.ie www.met.ie

! The OPW accepts no liability for the failure of a bridge of culvert, or the effect of a bridge or culvert on third parties, as a consequence of information contained in this guide.