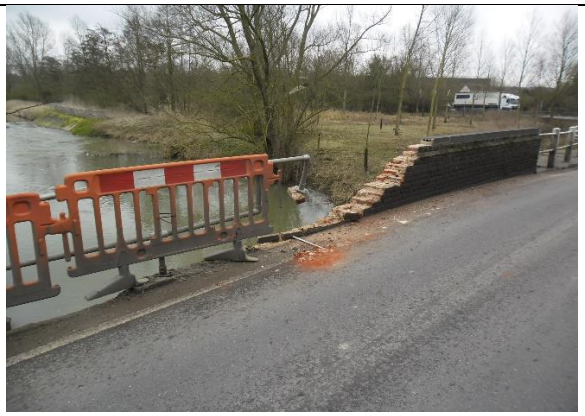
Structures Work

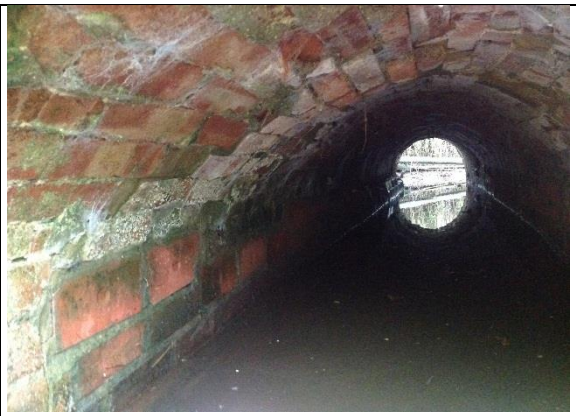
Structures come in different forms and are constructed using different material as detailed below;

Brickwork

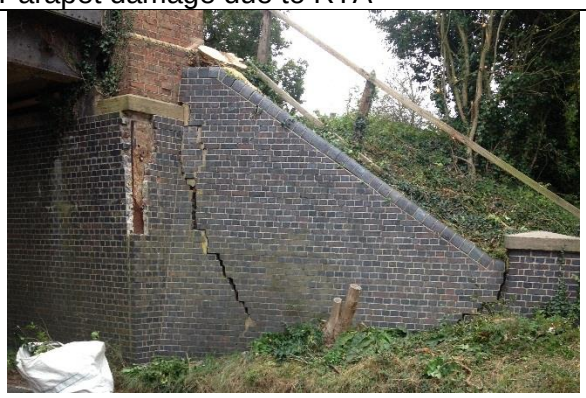
Problems in brickwork usually manifests in the form of cracks, bulging or deformation either within the arch/barrel or spandrel wall and parapet. Some of these defects can be directly related to vehicular impact, however most defects usually relate to general deterioration of the structure, which is picked up during the general inspection every 2 years.



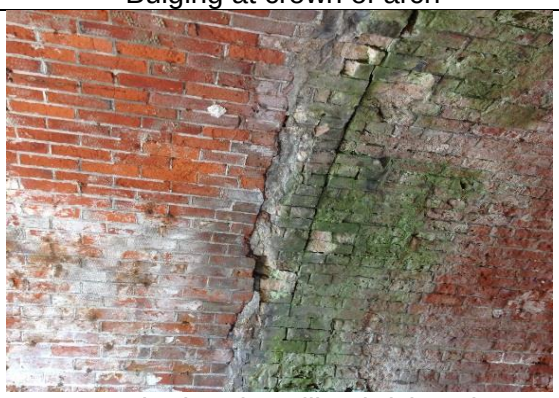
Parapet damage due to RTA



Bulging at crown of arch

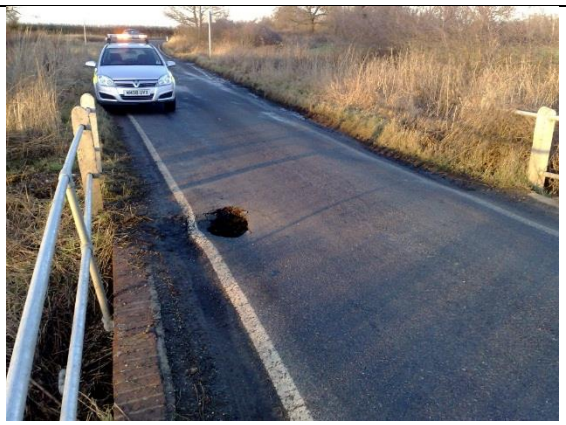


Badly cracked wingwall



Cracked and spalling brickwork

In some instances a problem is only discovered following an emergency call out i.e. when a hole appeared in the carriageway and the backing to the arch had been washed away.

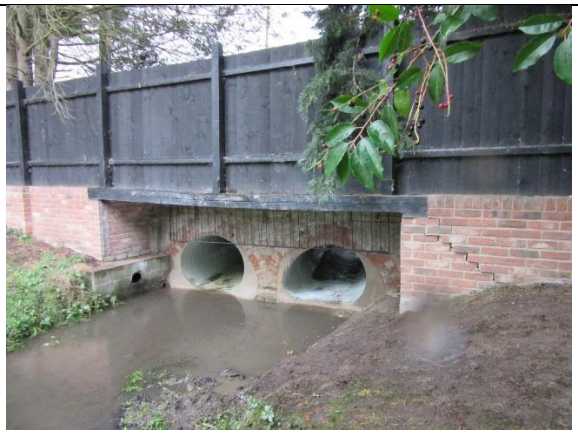


Hole in carriageway

Backfill washed away

Where there is significant deformation in the arch then traditionally the culvert would have been replaced, however a new technique of lining the structure will not only assume the structural strength of the culvert but will also radically speed up the construction time for the scheme.

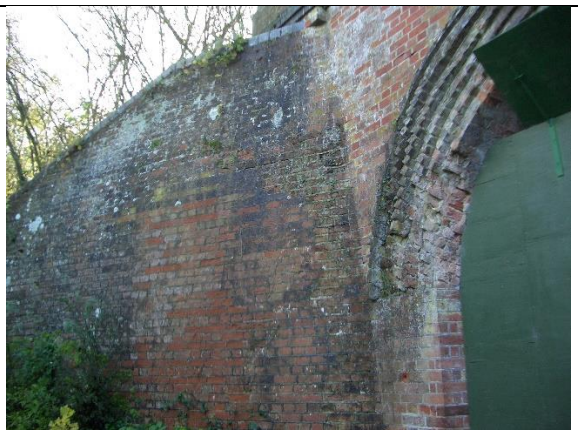
i-lining going in



i-lining complete

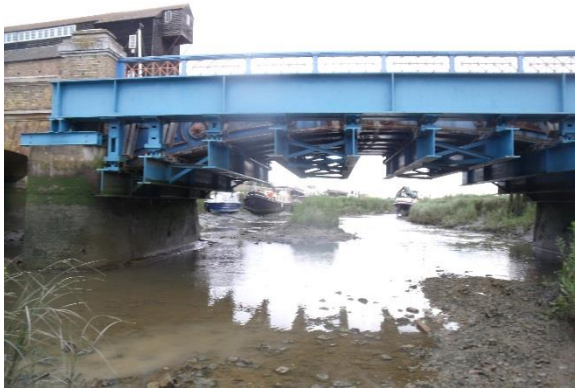
In larger span brick arches, it is possible to install a propping system under the arch in order to maintain the structural integrity. However this is generally only a relatively short term solution.

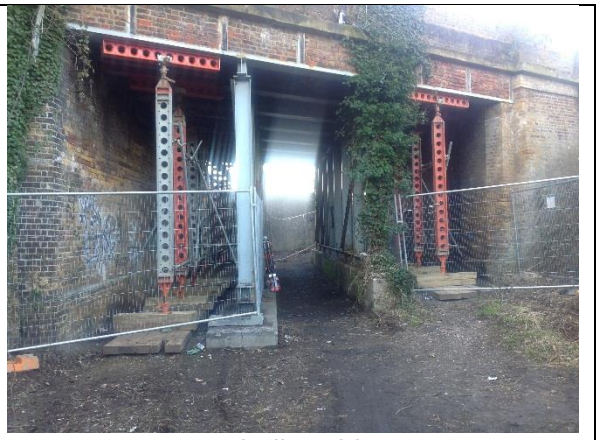

Setting up the propping system under arch


Propping system under arch

Cast Iron

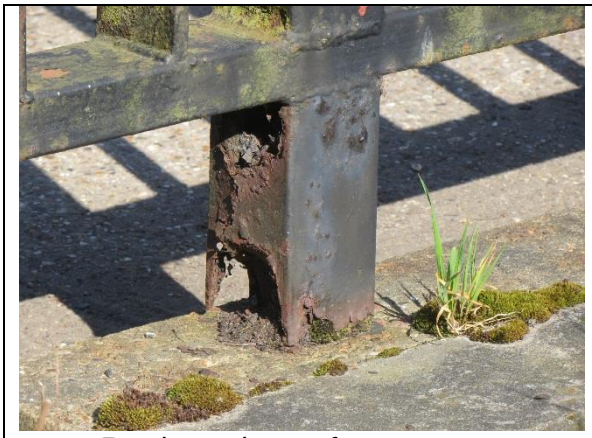
There are 8 bridges with which have had an inspection of the cast iron beams that make the primary deck support. Generally between the cast iron beams are small jack arches which assist in supporting the carriageway above. Cast iron is brittle and is not strong in tension and is therefore subject to cracking particularly evident in the bottom flanges. Currently two bridges have propping systems to support beams which are cracked, Battlesbridge and Catholic Bridge. Catholic Bridge has recently had further props installed as additional cracks were discovered. Cast iron structures will generally need painting every 10-15 years.


Battlesbridge

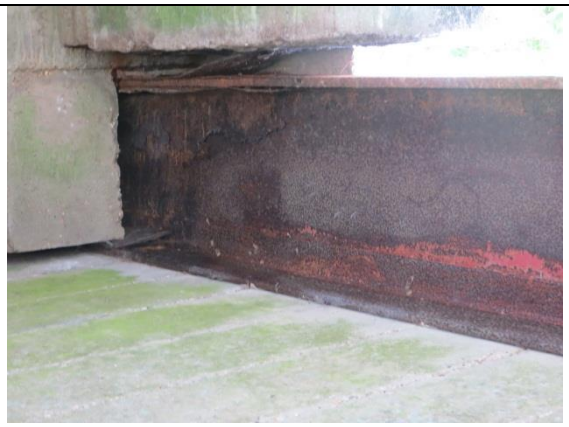

Catholic Bridge

Steel

Steel is used for beams and combined with a reinforced concrete deck to support a carriageway. Steel is also used to manufacture P2 parapets.



Rusting at base of parapet post

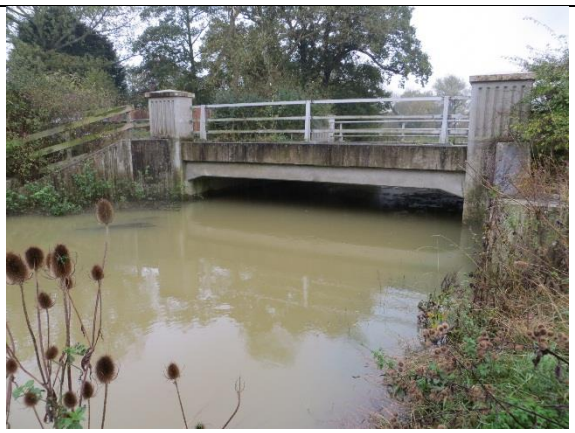


Delamination of beam

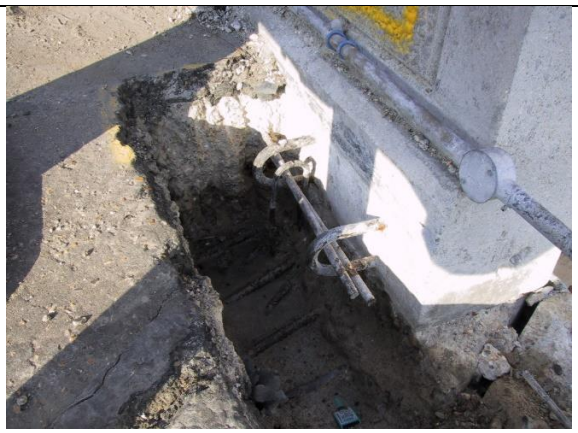
Steel predominantly rusts, even with protective coatings. If the rusting is allowed to continue then delamination and loss of section and hence capacity is possible. Generally these structural elements need painting every 10-15 years. Where loss of section occurs then plating and welding is required.

Concrete

Concrete combined with steel reinforcement is very common in bridge construction. Reinforced concrete can be constructed in-situ or be precast (either pre or post tensioned).



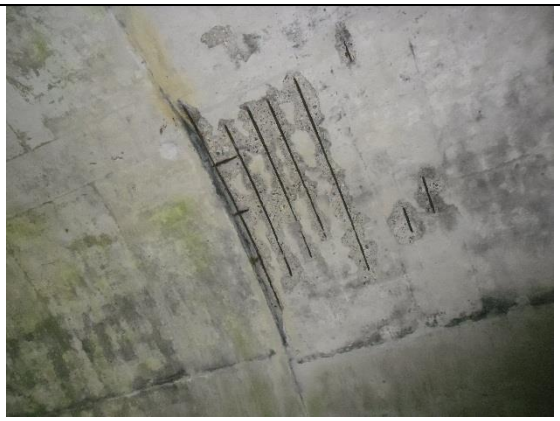
In-situ concrete bridge



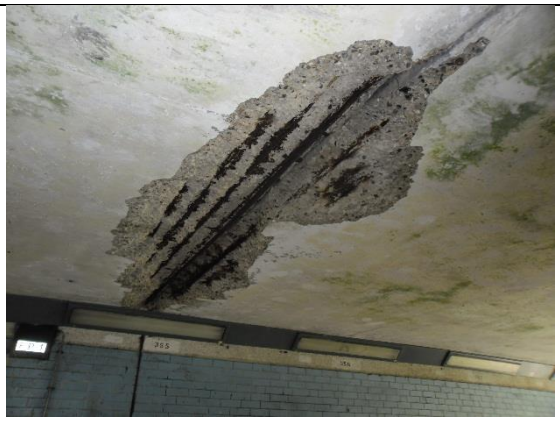
Precast beam deck

One of the main problems with concrete is historical low cover to the reinforcement with means the reinforcement is susceptible to rusting, which results in the concrete spalling around the area of rusted reinforcement.

Other problems with concrete structures are high alumina cement (higher degradation of the cement) and insufficient reinforcement in precast beams (weak structures, particularly edge beams).



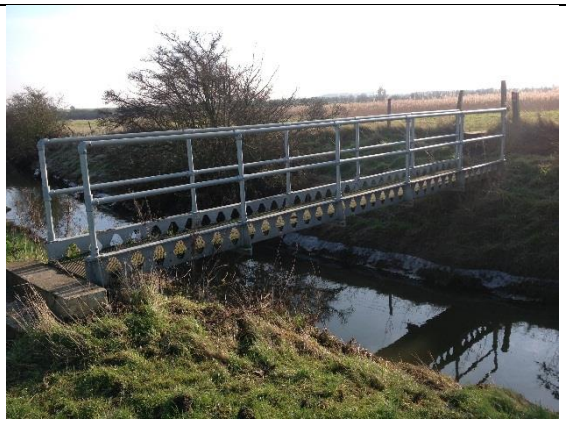
Spalling Concrete



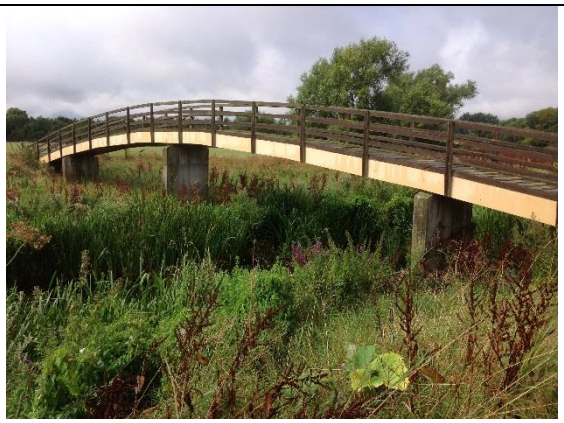
Spalled Concrete

PROW (Public Rights of Way) Bridges

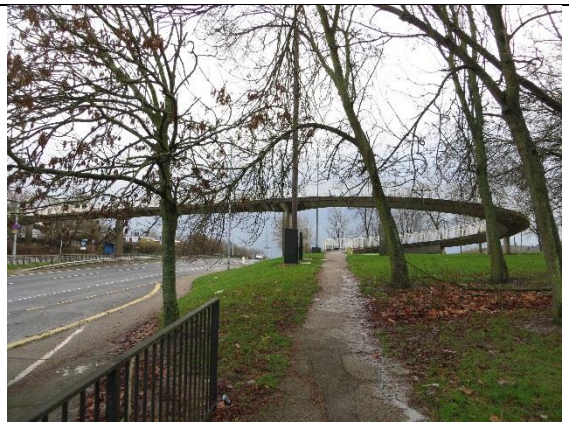
PROW bridges can be come in various sizes from small footbridges to larger urban footbridges and bridleway bridges



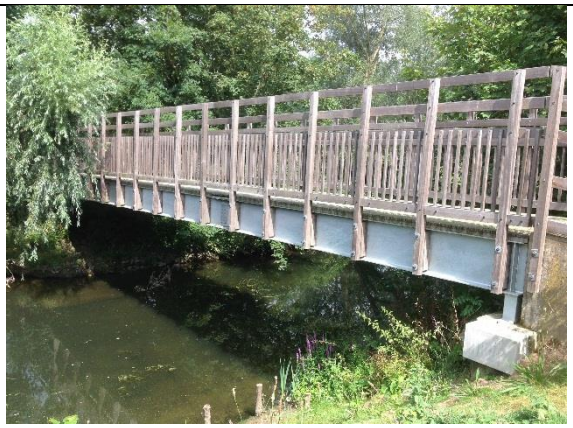
Standard 8m Castellated F/B



Large Rural F/B

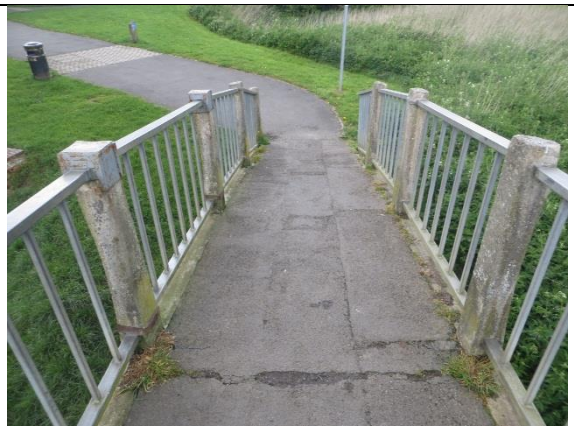


Large Urban F/B

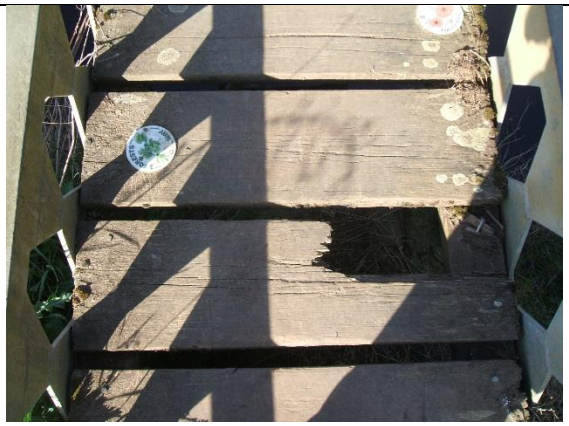


18.5m Bridleway Bridge

PROW bridges require either re-decking in timber incorporating anti-slip grips or having a new resin/bauxite surfacing for urban footbridges. Handrails have to be replaced (timber), repaired and painted (steel).



Footway surfacing and joint issues



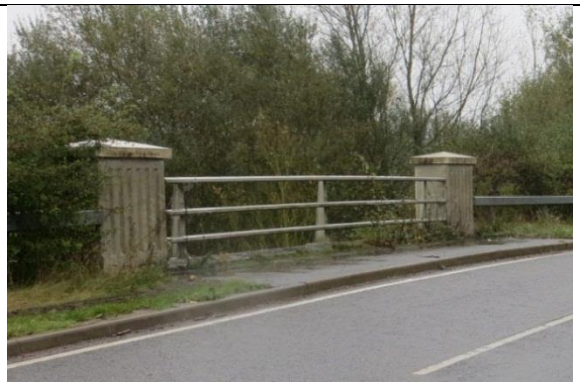
Timber deck problems

Parapets

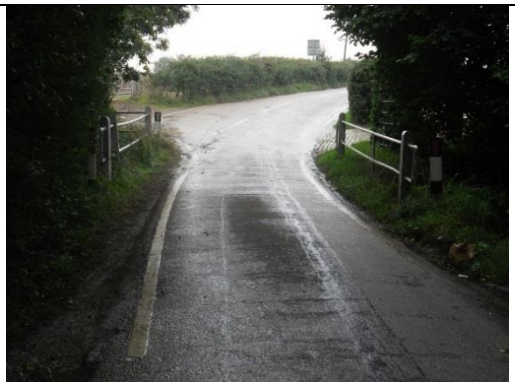
Parapets are generally either brick, Steel or Aluminium P2 type or Post and tubular rail arrangements. The majority of damage to parapets and road restraint systems are from vehicular impacts.

Modern structures will tend to have P2 steel or aluminium parapets with a leading and trailing Road Restraint system. Steel parapets will require painting every 10-15 years.

Brick work parapets will be repaired/re-built.



P2 Parapet



Post and Rail