



Integrated services

Providing comprehensive asset condition information and interpretation.



00 Introduction

James Fisher Testing Services (JFTS) can provide asset owners with extensive condition investigations and guidance, by using several infrastructure asset management services together with extensive experience from a team that includes Chartered Civil Engineers.

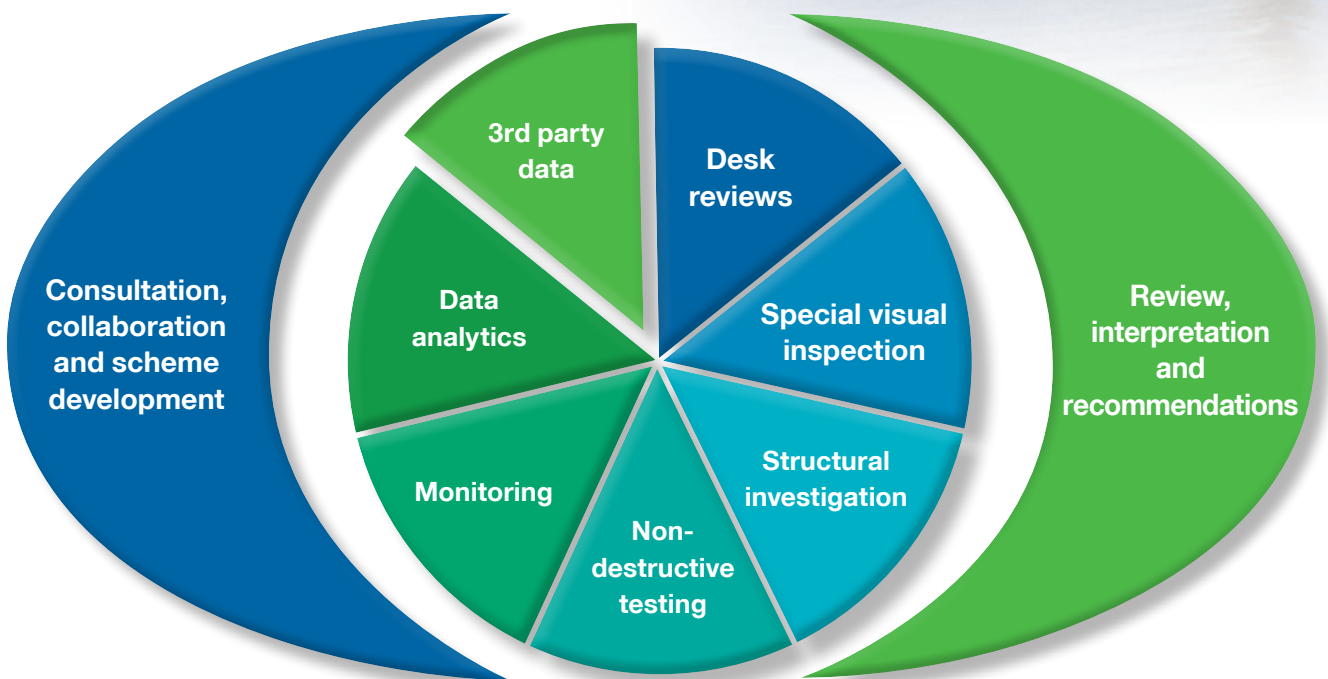
Services range from desk studies to complex data analytics and can include many varieties of inspection and testing.

We are bringing together the breadth of technologies and experience within the James Fisher group to provide comprehensive asset condition information and interpretation.

JFTS capabilities:

- Advise on asset management risks and prioritisation
- Offer an overview of techniques available
- Guide appropriate measures for specific scenarios
- Conduct combined investigations to give complete condition information
- Provide monitoring for future changes
- Factual and interpretive reporting

JFTS Integrated services



01 Bridge bearing condition services

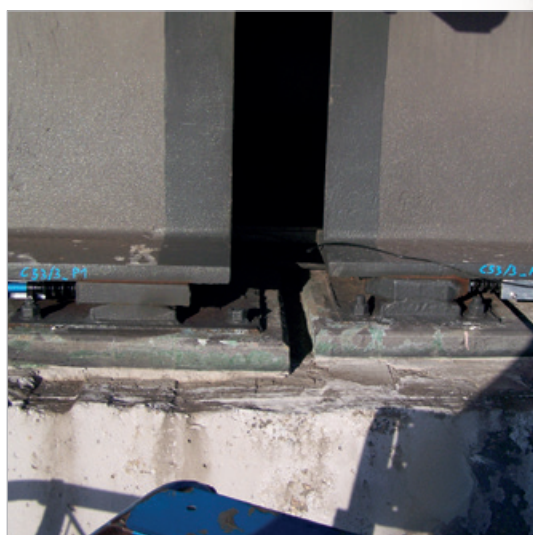
JFTS can provide comprehensive bridge bearing condition investigation and offer data-driven analysis on the remaining life of the bearings.

Bridge bearings are known to deteriorate due to corrosion, debris and wear. Leading to resistance, and numerous other potential future problems. Knowing their condition can provide tell-tale signs of other effects to the bridge and allow future planning for maintenance.

We offer impartial advice through inspection, non-destructive testing and dynamic monitoring. We will review the performance of each bearing individually and collectively, as they respond to a number of investigations.

JFTS offers a range of inspection, investigation and monitoring services, including:

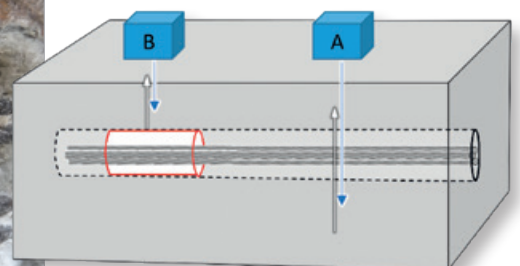
- Detailed visual inspection of bearings
- Inspection of expansion joints, structural components and other influencing parts
- Measurement of bearing displacement offset, mapped throughout the bridge to compare thermal displacement at a point in time
- Ultrasonic investigation for cracking or corrosion
- Investigation of bolts including detection of defects hidden inside joints or concrete
- High-speed monitoring of bearing movements, displaying a response to temperature variation and vehicle loads
- Interpretive review for bearing condition and its effects on the structure
- Recommendations for the longevity of remaining life, maintenance needed or replacement programme




02 Post-tensioned special inspections

JFTS provides consultation and comprehensive post-tensioned concrete bridge special inspections (PTSI). We can examine details, inspect and conduct condition investigations to avoid unnecessary intrusive investigations.

Post-tensioning for concrete structures can vary between simply threaded bars to complex multi-strand arrangements in decks, beams, crossheads or piers. Particularly onerous features include segmental constructions or tensioning at inaccessible locations. Notable failures at Ynys-y-Gwas (1985) and more recently in Genoa (2018) have highlighted the vulnerability of post-tensioned bridges to hidden defects. Ongoing investigations and monitoring schemes are crucial to avoid any repeat occurrences. However, DMRB DB54/15 requires all post-tensioned concrete structures to be managed on a risk basis and conduct investigations where necessary.





JFTS offers a comprehensive PTSI service from risk review to management advice, utilising a broad range of non-destructive techniques. JFTS can select the best suited approach to determine the current condition with minimal detriment to the structure.

Where appropriate, JFTS will conduct intrusive investigations, exposing the tendons for inspection. This is limited in number and optimised to critical locations and areas that have been identified by other means as potentially suffering from defects or deterioration. We can also use this opportunity to conduct in-situ stress measurements.

“ On-going investigations and monitoring schemes are crucial to avoid any repeat occurrences. ”

James Fisher has specialist teams who can provide a number of services, including:

- Desk review of known information, ranking and prioritisation
- Identification of areas optimal for investigation and recommendations
- Detailed visual inspection identifying signs of distress associated with post-tensioning
- Measurement and inspection for assessment
- Radar and/or eddy current scanning for reinforcement and duct locations
- Ultrasonic screening through concrete for detection of voids in grouted ducts
- Radiography for imagery of tendons within concrete and ducts, using gamma or X-ray and film or digital imagery
- Tensioned Cable Anchorage Scan (TCAS™) for the detection of broken wires
- Concrete and grout material condition investigations, including carbonation, chlorination and cement content. Half-cell potential and resistivity for identification of corrosion risk areas
- In-situ stress measurement of concrete, using coring or slotting techniques
- Intrusive investigations for exposure, material sampling and visual inspection
- In-situ tendon load measurement (following tendon exposure)
- Structural monitoring for future condition changes and damage detection
- Interpretive review, categorisation and risk scoring
- Recommendations for bridge management

03 Reinforced concrete half-joints

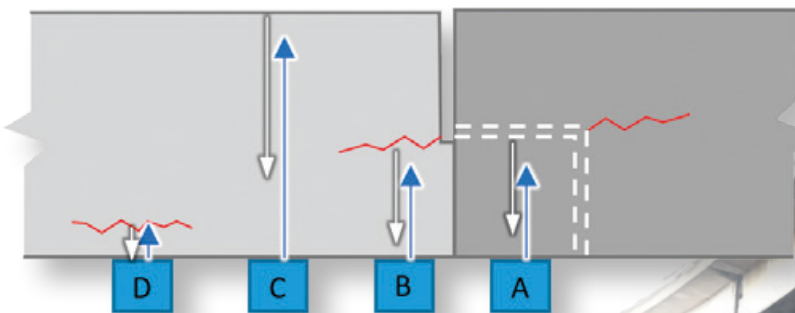
JFTS can provide condition investigation services for bridges with reinforced concrete half-joints. From the initial consultation through to risk review and testing, JFTS seeks to determine the likelihood of serious defects and advise on the structural performance.

Half-joints in reinforced concrete bridge decks and sub-structures are found in a variety of forms, which are often in difficult to inspect places and pose the risk of hidden defects. Common defects start from water leakage through the movement joint, causing corrosion which may go undetected. Visual inspection can find external defects, however, these inspections are frequently insufficient to confirm the internal condition.

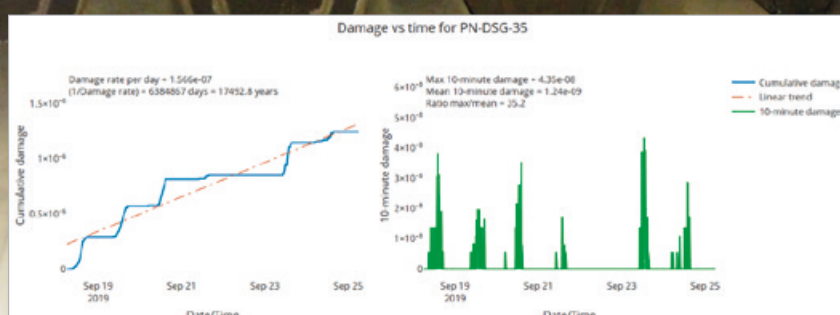
In recent years, notable bridge collapses in Canada and Italy have both involved defects at reinforced concrete half joints in which inspection alone was unable to determine the severity of the prior condition.

JFTS offers a comprehensive service including relevant non-destructive techniques for investigation of internal cracking and corrosion. We can also monitor movements and create warning systems for further deterioration along with the services below:

- Review of available drawings, inspections and past investigations
- Special visual inspections
- Risk scoring and prioritisation
- Radar and eddy current scanning to determine internal reinforcement details, checking bar positioning and anchorage lengths
- Concrete condition investigations for external faces, including carbonation, chlorination and half-cell potential
- Ultrasonic screening through concrete for detection of internal cracking at mid-depth
- Structural monitoring for future condition changes and damage detection
- Interpretive review and recommendations for bridge management



04 Fatigue detection in metallic structures



JFTS can provide inspection and monitoring techniques for fatigue in metallic structures, as well as the monitoring of strains to predict future fatigue. By measuring crack development, measuring stress cycles and counting fatigue damage accumulation, we can monitor remotely for progressions and suggest timescales for intervention.

Fatigue cracks developing in steel bridges are often influenced by localised stress, as well as heat affected zones of welded components. Visual inspection rarely finds the minute cracking, which often develops in areas which are hard to access such as box girders or steel decks making early detection difficult.

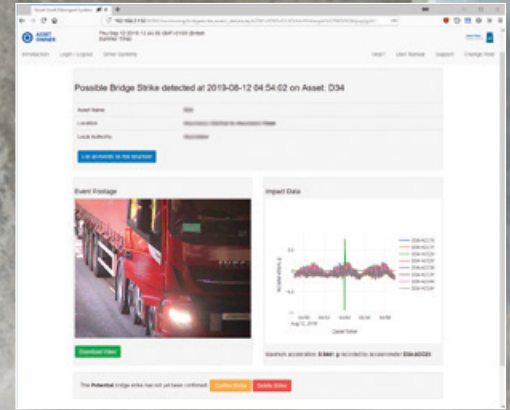
Traditional testing regimes typically require magnetic particle inspection (MPI) to a proportion of weld details suspected at higher risk. JFTS can offer alternative techniques for defect detection, which avoid surface preparation and the associated hazards. These techniques are safer, quicker and avoid environmental contamination; some techniques can even be conducted remotely.

James Fisher can also provide services including:

- Review of available drawings, to comment on stress concentration prone details and fatigue risk
- Strain monitoring
- Fatigue damage calculation and graphical display on SAMST[™]
- Weld visual inspections for construction quality
- Eddy current testing verified locally by MPI or dye penetration
- ACFM for comprehensive investigation and crack depth measurement, without paint removal
- Robotic corrosion mapping
- Phased array ultrasonic weld inspection



05 Response to bridge impact



Collisions to bridges by vehicles cause disruptions and require a swift response to ensure that public safety is maintained and there is minimal road disruption. Damage by floating debris in flood events can be equally damaging and demand similar attention.

For concrete bridges, this can involve hammer tap survey or ultrasonic investigation for crack mapping. For steel or iron structures we recommend ACFM (alternating current field measurement), in which eddy currents are used to measure extents and depth of cracks and laminations without removing paint. Many other techniques are also available and their relevance can be assessed for the specific conditions.

JFTS also has a range of monitoring solutions, known as BridgeStrike, which constantly check in real time the bridge deck for sudden movements that suggest an impact. Our cameras can record images of the vehicle before, during and after impact, which assists with bridge management as well as perpetrator prosecution.

Other monitoring options from JFTS can detect over-height, over-width and/or over-weight vehicles, which then activate warning signs pre-empting and avoiding impact. We can detect even fine over-height aerials which could conflict with electrified railway overhead line equipment (OLE).

Other services available include:

- Review of previous impact damage and testing conducted
- Emergency visual inspections
- Dimension surveys for assessment
- Broad range of non-destructive testing including ultrasonic and ACFM
- Review of impact severity and recommendations
- BridgeStrike monitoring for impact records and imagery
- Impact magnitude recording for future enhanced response
- Over-height, over-width and over-weight vehicle detection to activate warning signs



06 Parapet integrity

Deterioration can occur inside the closed hollow sections and fastening bolts of bridge parapets, due to them often receiving little maintenance after installation. Visual inspection is insufficient to determine the integrity of these hidden features. JFTS offer a comprehensive service for condition investigation on bridge parapets and highway safety fences using several different services.

Though parapets are included in bridge inspections, the detection of their corrosion is incomplete by visual inspection alone. We recommend cursory checks using non-destructive tests at a sample of locations and periodic intervals. Where there are specific concerns of deterioration, more thorough investigation programmes might be appropriate. We can advise on the appropriate extents of testing suitable.

In some instances, vehicles have collided with parapets when attempting to access bridges with height or width restrictions. Undetected defects caused by these collisions lead to bridge parapets not meeting the intended rated resistance. Highways England provides advice on management of parapets, including risk ranking and prioritising upgrades.

James Fisher can, using the breadth of our specialist teams, provide services including:

- Collating and review of record information
- Visual inspection
- Ultrasonic thickness measurements for posts and rails – for which we suggest B-scans to establish both minimum and average thickness
- Bolt scanning by phased array ultrasonic testing
- Weld inspection and testing
- Bolt load testing and certification
- Paint inspection and testing
- Inspection and measurements at zones of impact and use of ACFM technique for damage measurements
- Physical load testing of barrier system (static or dynamic)
- Monitoring for changes in condition or safety fence tension
- Since parapet resistance is reliant on the supporting structural plinth, we can extend investigations into the steel or concrete components around
- Risk rating and recommendations for management programme



07 Load testing of structures



“ A physical test can demonstrate the load capacity that remains, or alternative load paths available. ”

JFTS can provide extensive services associated with the testing of structures and bridges for load capacity. Load testing is used to calibrate theoretical models and calculations.

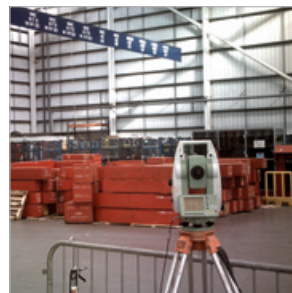
Testing can be conducted in accordance with the ICE Guidelines for the Supplementary Load Testing of Bridges, CS463 Load Testing for Bridge Assessment, or other standards where applicable. Structures that are refurbished or repurposed can benefit from proof load testing to verify the capacity and fitness for purpose.

Load testing is applicable for structures that are subject to deterioration, impact, or environmental damage where the residual strength might not be simple to calculate by theoretical methods. A physical test can demonstrate the load capacity that remains, or alternative load paths available.

Load can be applied to individual components or to complete bridges and buildings. Tensile tests are applicable to discrete hangers of suspension bridges, which can be removed from the structure and tested safely offsite. We recommend comprehensive visual inspection and proportional non-destructive testing before load testing to ascertain the prior condition. Further inspection and non-destructive testing can be applied after load testing to confirm that no defects have been extended by the load applied.

James Fisher has a comprehensive suite of complementary services, including:

- Liaison with structure assessment consultants and collaborative planning
- Visual inspections
- Non-destructive testing for condition before and after load testing
- Controlled progressive load application by moving vehicles or water baths
- High accuracy and sample rate monitoring for loading applied and structure response
- Live data graphical displays and correlation finding
- Review and interpretation



08 Safety critical fixings

In response to several high profile failures, new guidance has been published which calls for a review of the fixings that are relied upon. JFTS can provide a comprehensive review of details and condition to manage the condition of Safety Critical Fixings within assets.

Ciria guidance, 'Management of Safety Critical Fixings C778', calls for a review of bolts which are relied upon for safety to life or which pose significant risk to operation. Such fixings include structural connections, parapet bolts, claddings, suspended ceilings, signs and lighting. Combining extensive experience and non-destructive testing, JFTS can determine and rate risk features.

Some features are installed on a 'fix and forget' basis, with no record of installation details. JFTS can investigate the information available, combining measurements, inspection and testing to suggest the most likely details to evaluate risks.

Other services include:

- Review of structural details and known information
- Detailed visual inspection
- Bolt scanning by phased array ultrasonic testing, to detect corrosion and necking even where hidden within concrete
- Load testing and certification
- Listing and categorisation of all known safety critical fixings
- Risk rating and recommendations for management programme



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