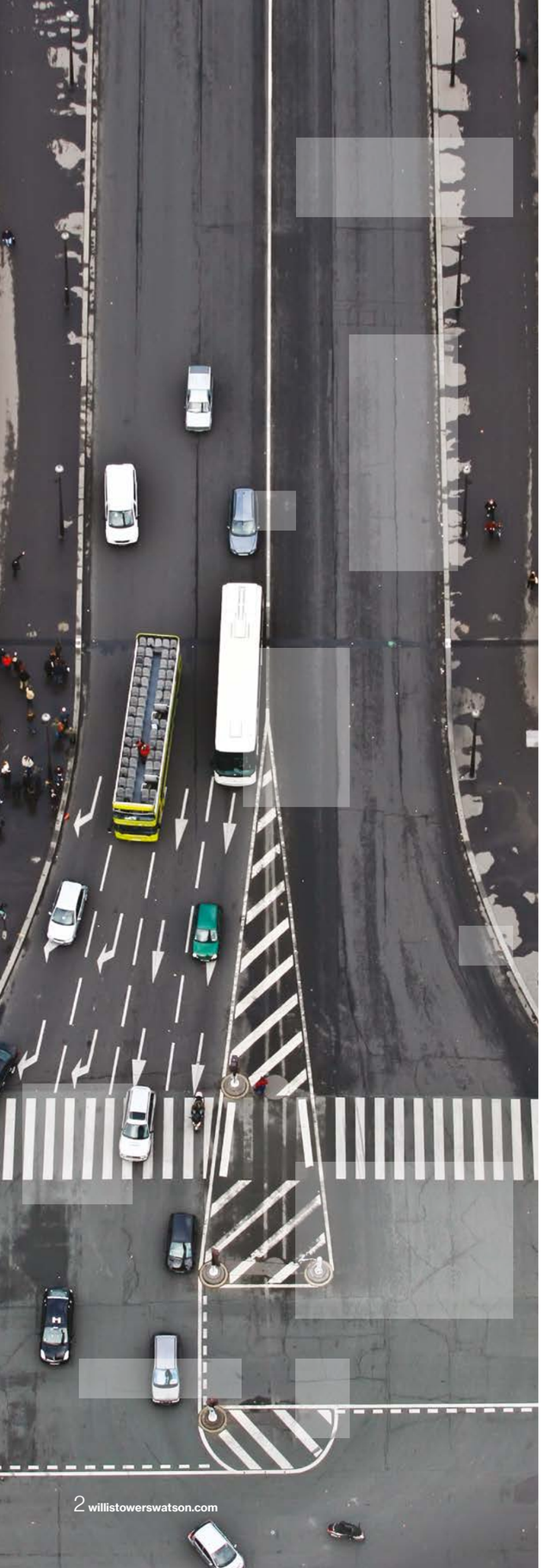
Willis Towers Watson

Ageing Infrastructure – More than a bump in the road

February 2020



Ageing Infrastructure

For over 50 years, the Morandi Bridge carried commuters, families, tourists and freight along the A10 motorway across the Polcevera River in Genoa. On the 14th of August 2018, 43 people tragically lost their lives when a section of the bridge collapsed.

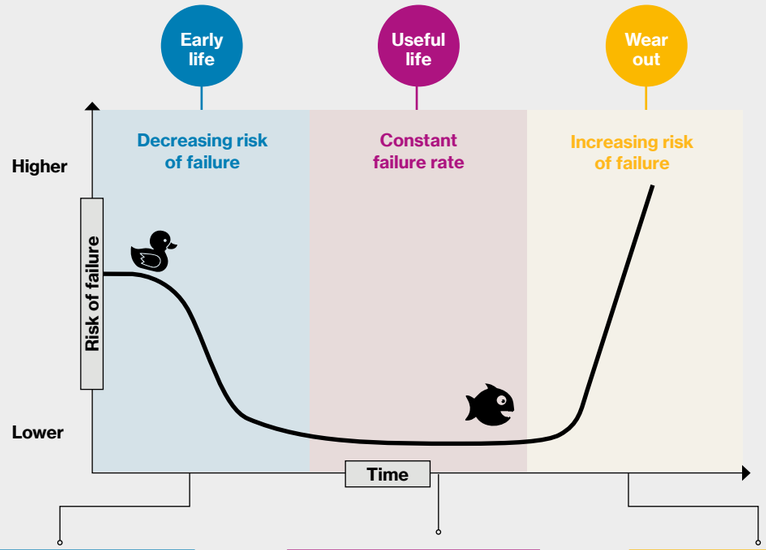
Genoa's disaster is part of a wider trend surrounding ageing global infrastructure.

The tragic loss of life here and at other incidents in recent years, throws a spotlight on the evolving risks and complex liability chains associated with economic infrastructure. These risks stretch beyond business interruption and property damage to legal liabilities, reputational damage and possible corporate manslaughter.

Whether infrastructure forms part of your investment portfolio – or is your responsibility to construct, operate and maintain – it is essential that you fully understand your risks.

In this paper we look at the key issues in risk management and insurance which can assist you in identifying, managing and mitigating your risks.

Where is your asset on the bathtub curve?



Cause of failures early in the life of an asset are dominated by defects in design or construction and errors in commissioning. Good project governance and timely 'Bringing into Use' mitigates the risk here.

Failure during the 'useful life' phase is essentially random. Good controls include inspection and maintenance. It's important to constantly check that the asset is being used in the way in which it was designed.

Risk of failure towards the end of asset life increases. This phase is likely to be dominated by increased inspection and maintenance. Degraded performance or limitations on use may be necessary.

No time to grow old gracefully

In developed economies, most of the economic infrastructure assets have been part of the fabric of everyday life for 40 years or more. The majority of these assets are hiding in plain sight – they are the bridges, tunnels, roads and utility connections we use every day without a second thought.

The average age of a bridge in the U.S. is 40 years and the average age of structurally deficient bridge is 67 years- of which there are more than 54,000[1]. A staggering 188 million trips are made over structurally deficient bridges each day[2]. In the UK a recent study found that over 3,000 bridges were not suitable to carry the heaviest vehicles now permitted on the pubic highway[3].

[1]https://www.artba.org/2018/01/29/54000-american-bridges-structurally-deficient-analysis-new-federal-data-shows
[2]https://www.infrastructurereportcard.org/cat-item/bridges
[3]https://www.racfoundation.org/media-centre/bridge-maintenance-backlog-grows

Built for a different world

It's not just wear and tear that affects the suitability of older infrastructure assets for modern demands. Changing needs place stresses on infrastructure that may not have been considered when they were first designed and built.

Over the last 50 years the permitted weight of goods vehicles on UK roads has increased to 44 tons. Asset deterioration increases with heavier vehicles, increased traffic volumes and higher speeds; trends which we observe globally. In particular, the weight and quantity of commercial vehicles in use have increased significantly. Bridges designed for traffic 40 years ago are now coping with very different loads; one reason why unforeseen use is one of the main causes of bridge failure.

Similarly, assets that were built to comply with less stringent safety standards than we expect today continue to play a fundamental role in our daily lives. Bringing those assets up to date carries inherent risks – both during maintenance and upgrade works and also during the remaining life of the asset.

Under Pressure?

- Heavier use
- Higher expectations
- Funding uncertainties
- Regulatory turmoil
- Extended life aspirations
- Increased intervals between inspections
- Reduced maintenance opportunities
- Litigious environment
- Population increase
- Urbanisation
- Climate change

Private sector engagement

The result is a huge requirement for infrastructure[4] spending. McKinsey have estimated that a $49trn spend will be needed by 2030. That figure includes building new assets, but a significant chunk of it will be required simply to maintain existing infrastructure.

Many economic infrastructure projects are of such scale and complexity that they're beyond the public purse alone. In response, government and regional authorities look to a range of procurement models, such as Public-Private Partnerships (PPPs), to attract private sector investment.

PPP is frequently the preferred model for major economic infrastructure procurement; both maintenance of existing and development of new. These long term contractual agreements facilitate long term maintenance planning through committed future funding – which is a great opportunity to address the problem of uncertain maintenance budgets.

[4] https://en.wikipedia.org/wiki/I-5_Skagit_River_Bridge_collapse

Risk transfer

Whichever procurement model is used, the contractual arrangements will involve transfer of risk from one party to another. Ensuring that the risk is allocated effectively is key to successfully developing and financing projects. Wherever you sit in the procurement chain – government, commissioner, contractor, operator, equity source or lender – it's essential that you understand the nature of the risks you are either transferring or assuming as part of your role.

Even strict compliance with your contract requirements may not be sufficient to mitigate all risks. Your duty of care must be a primary focus.

There are a number of key considerations.

Contractual interface risks

A common feature of asset management and delivery, and particularly PPP, is the large number of contracted organisations involved. An obvious consequence of this is the huge number of contractual, technical, legislative and physical interfaces. And with interfaces, come risks.

It's essential that risk is understood and allocated effectively, leaving all parties with a clear understanding of their obligations.

Transfer of an aged asset as part of a construction contract

Frequently, the operation and management of existing assets may be part of the commission for the replacement. For example, the contract for construction of a new airport may include the operation, maintenance and decommissioning of the existing airport as part of the agreement.

The primary focus is frequently the new-build construction contract. However, it is essential that the winning bidder understands the full nature of risks related to the existing asset. This is particularly critical as any construction delays could prolong the required life of the asset.

It's vital to remember that a very different set of skills are required during 'end of life' maintenance compared to 'new build construction'. Does the team contain this breadth of skills?

A risk-based approach to operation and maintenance of the current asset will ensure accurate costing when bidding and cost-effective maintenance during the asset's remaining lifespan.

Contract length

PPP contracts typically have a duration of twenty five years. Consequently, long-term risk modelling is essential to ensure sufficient lifecycle and maintenance funding is available throughout the duration of the contract.

Handover obligations

It's essential that all parties are clear about handover obligations in relation to the asset at the end of the contract period.

Clear definition and delineation of obligations and responsibilities is essential to ensure a smooth handover.

Who is responsible for what? Who is liable? What are the consequences of failing to meet obligations?

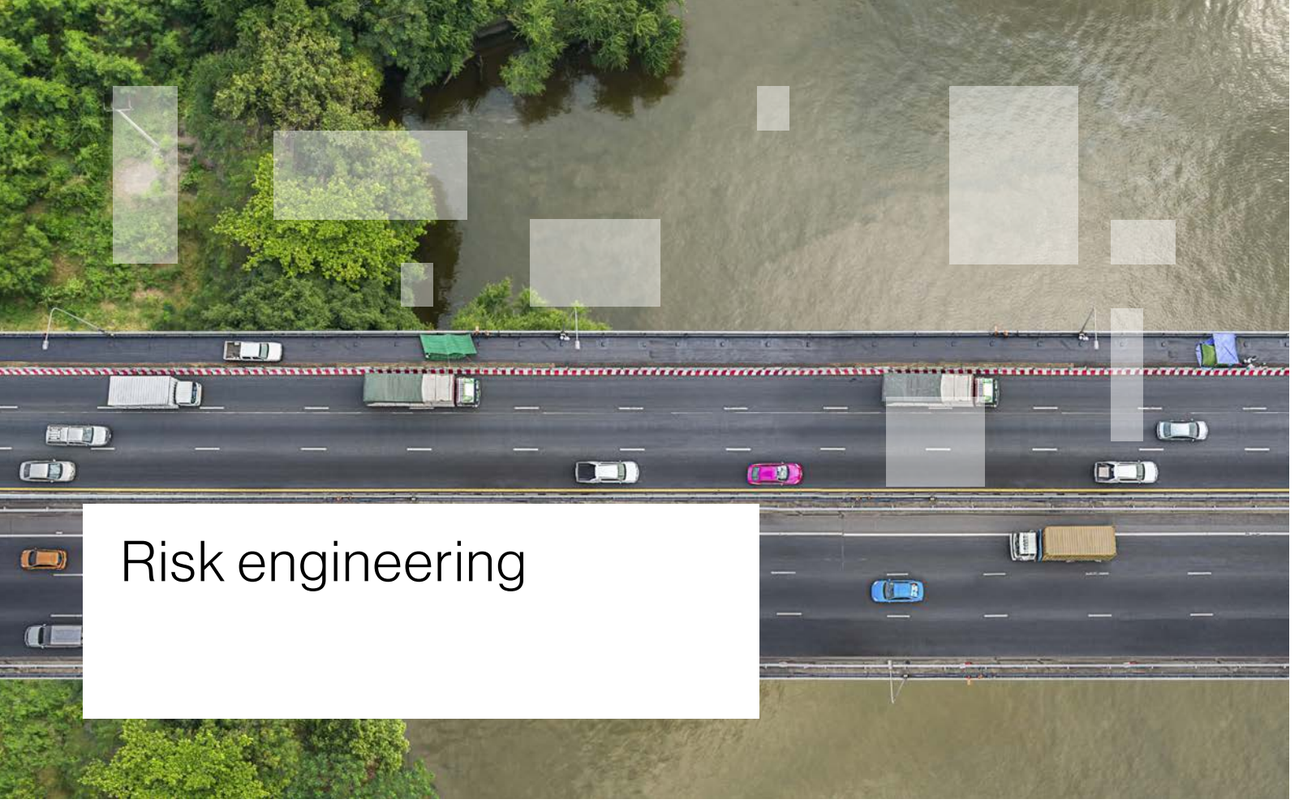
Separation of ownership and operation

There's an inherent risk in the separation of ownership and operation.

You may own an asset, but have very little role in its day-to-day running. Or you may be operating and maintaining an asset on behalf of another party.

Again, it's essential that every party understands who is responsible for what – and again, who is liable should anything go wrong.

Further problems can occur when funding for construction (capital investment) is considered or administered by a separate organisation to that which is responsible for operation and maintenance.



Risk engineering

So how do you manage your exposure to risk and put the appropriate mitigation measures in place? Risk engineering provides a structured framework to achieve this.

The first step is to establish what your risks are – both at the individual asset and portfolio levels. This is achieved through a review of asset stewardship information (such as design details and maintenance records), site surveys and analysis. This can be undertaken for all critical assets or a representative sample for portfolio accounts.

Modes of failure and hazards can then be identified. Following this, a review of control mechanisms can be undertaken. This may include inspection and maintenance activities, opportunities to design out or eliminate hazards and identify possible new control features.

Benefits of risk engineering to managing your total cost of risk

Structured presentation of risk to insurers to ensure that proactive risk mitigation is rewarded through improved terms or reduced premium. We know what underwriters like to see – and we can respond accordingly. Crucially, this enables underwriters to offer premiums that reflect the true level of risk.

Reduction in attritional losses below a deductible (self-insured retention) – with a clear benefit for organisational profitability.

Tailored, site specific and bespoke risk engineering enables you to understand what risks are present and what mitigation measures are appropriate.

Areas of interest to risk engineers

Competency of the organisations involved – their experience of designing, constructing, operating and maintaining complex infrastructure.

Depth and complexity of the supply chain – looking at all parties involved and their physical and contractual relationships.

Long term risk exposure and potential refinancing – considering your risk exposure over time.

Handover clauses – what are the obligations of each party when it's time to hand over the asset. What does 'good' look like?

Maintenance and inspection obligations – are the obligations clear and measurable? Are they achieved?

Standards – what engineering standards are used? Are they minimum statutory or global best practice?

Lifecycle funds – are they sufficient?

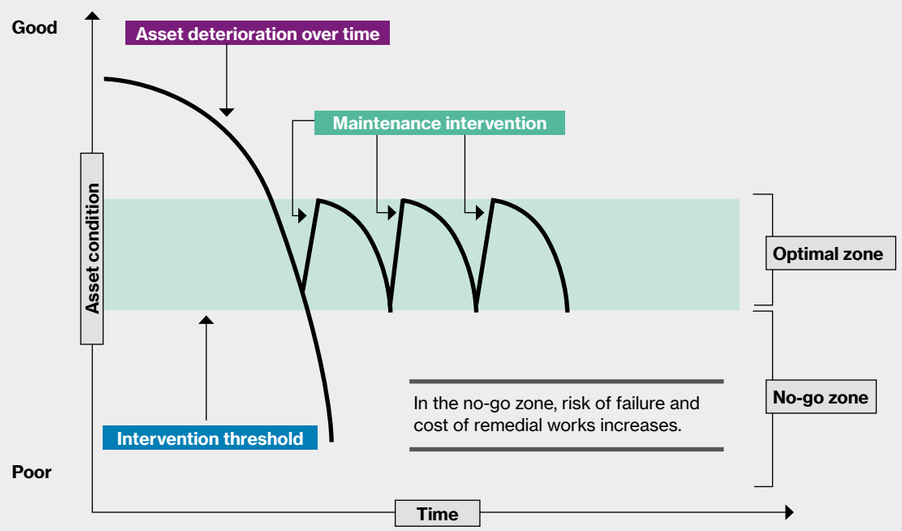
Inspection and maintenance plan

For a single asset, or portfolio of assets, the Inspection and Maintenance Plan, or Asset Management Plan, is a critical document.

An effective plan will detail the required inspection and maintenance activities and ensure that they're budgeted, audited and delivered. As well as protecting against risk of failure, a planned maintenance regime will be more cost-effective than a reactive approach. Maintenance spending should be scheduled to maintain an acceptable asset condition (and hence risk of failure), whilst not intervening too frequently. Logistics and disruption during maintenance and seasonal variations will also inform the optimum intervention strategy.

Saw tooth diagram

Effect of maintenance on asset condition



The plan should be ‘risk-based’ so that efforts are focused on critical areas and respond to changes in asset use, adjacent activities and aspirational lifespan. Particular attention is required if an asset portfolio is geographically distributed or varies in age or type across the portfolio.

Probabilistic modelling can be used to inform inspection regimes – this can be particularly valuable for asset portfolios – but there is no substitute for ‘on-the-ground’ inspection.

Risk-based inspection and maintenance

> “...everybody wants to build and nobody wants to do maintenance.”
>
> **Kurt Vonnegut, American Author**

While everybody wants to be there when the ribbon is cut on a shiny new asset, maintenance is notable only for its lack of glamour.

This means that when budgets are squeezed, inspection and maintenance can become targets for short-term savings. Scrutiny and oversight of inspection and maintenance is therefore essential.

A risk-based inspection regime will ensure that an appropriate maintenance budget is allocated and that the budget reduces the risk of failures. Ideally, this should be undertaken at the tender stage to ensure that sufficient lifecycle funds are available; something for all involved to consider.

Evidence based maintenance planning allows expenditure to be optimally sequenced and planned to minimise disruption and maximise value.

Ensuring that maintenance takes place

Of course, maintenance and inspection plans are only the first step. It’s essential that the correct oversight is in place to ensure that those plans are followed and identified issues addressed.

Risk engineers can help you put the appropriate audit, surveillance and governance processes in place and establish appropriate standards.

Robust records allow you to demonstrate compliance with contractual obligations, demonstrate discharging of duty of care and provide valuable information in the case of an incident.

Designing with inspection and maintenance in mind

Risk is reduced when infrastructure is designed with inspection and maintenance in mind. Current legislation may cover new projects, such as the legal requirements for Construction Design Management in the UK, but ageing assets may not have been designed with the same level of foresight. It’s essential to understand how this will impact on inspection and maintenance activities – and the funds necessary to achieve this.

WTW risk engineering solutions

Some of the ways that Willis Towers Watson Risk engineers help our clients to understand and mitigate infrastructure risk are presented below:

Property Damage/Business Interruption surveys – These surveys identify and document existing hazards & mitigation recommendations.

Construction surveys (for Contractor’s All Risks’ policies) – These document and assess risk for construction projects.

Joint Property Damage/Business Interruption/Contractor’s All Risks surveys – Particularly relevant for private sector engagement contracts where existing assets are maintained whilst new, replacement assets are delivered – often in close proximity.

Document review – Review of corporate policies, competency arrangements, inspection plans and impairment management arrangements.

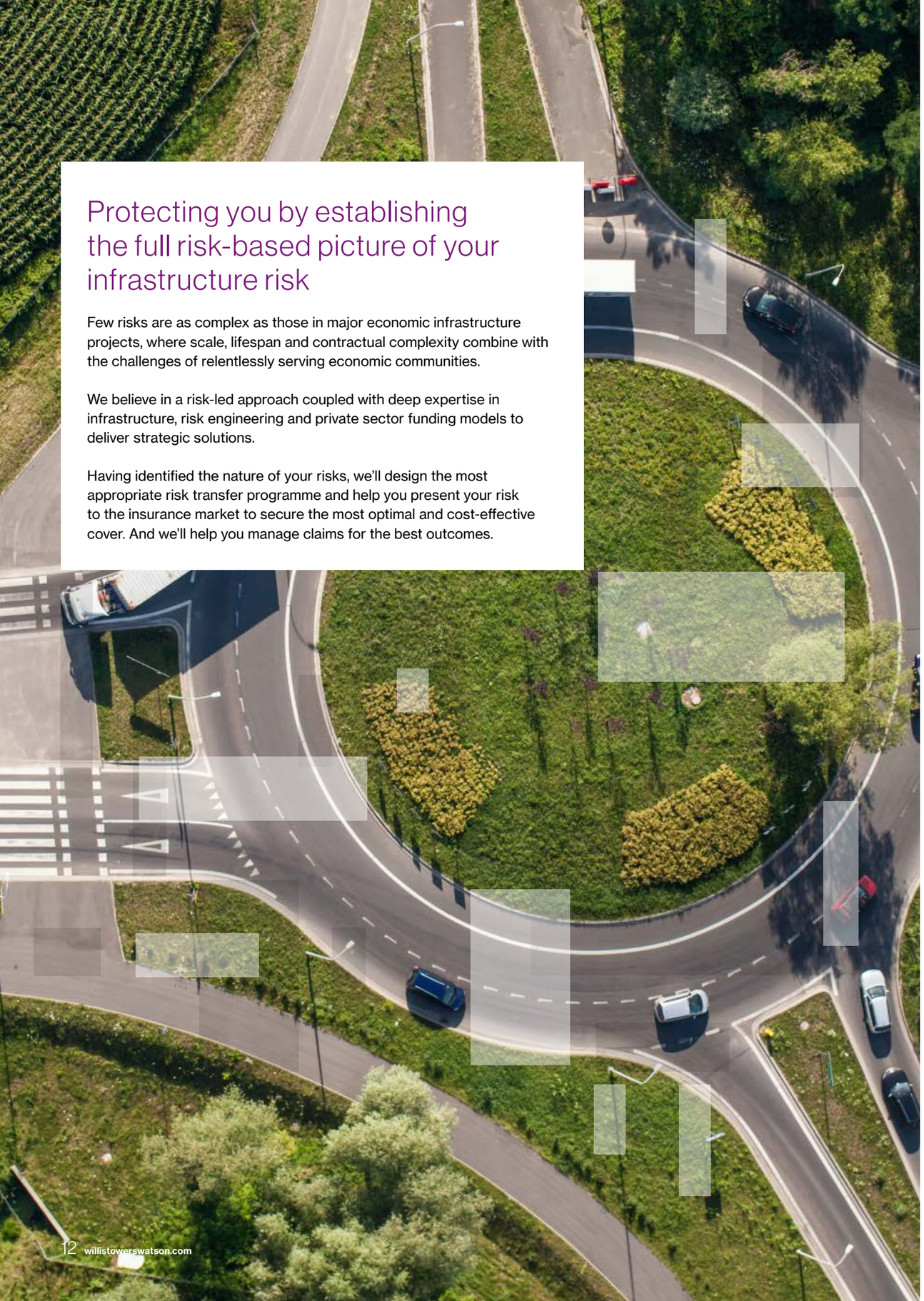
Third party liability assessment – Third party exposure can be significant for economic infrastructure.

Bespoke loss scenario assessment – Quantify the exposure and check coverage. Provide an accurate picture of risk to inform and validate risk transfer decisions.

Natural Catastrophe reviews – To consider the full range of threats.

Analytical assessment – Making best use of available data to make informed decisions.

These surveys are frequently undertaken in conjunction with underwriters to present the risk and share knowledge.



Protecting you by establishing the full risk-based picture of your infrastructure risk

Few risks are as complex as those in major economic infrastructure projects, where scale, lifespan and contractual complexity combine with the challenges of relentlessly serving economic communities.

We believe in a risk-led approach coupled with deep expertise in infrastructure, risk engineering and private sector funding models to deliver strategic solutions.

Having identified the nature of your risks, we'll design the most appropriate risk transfer programme and help you present your risk to the insurance market to secure the most optimal and cost-effective cover. And we'll help you manage claims for the best outcomes.

Our risk focussed approach establishes an understanding which aids structured insurance programme design:

Key benefits will include limits/cover reflecting:

- The full range of risks to which your asset may be exposed. These will be highlighted by a full risk assessment and supporting engineers report to ensure coverage is appropriate.
- The evolving nature of liabilities – An up to date assessment of legal liability exposure including evolving risks such as cyber and corporate manslaughter.
- A bespoke assessment of the quantum of your risks – It's not sufficient simply to base limits on 'what other similar assets are buying' or what your lenders may require.
- Risks transferred to your supply chain – Appropriate pass down requirements to reflect those risks passed down for example professional liability limits for contractors and consultants.

Key Questions

Can you confidently answer yes?

- Do you know and understand your contractual and statutory obligations and responsibilities?
- Do you know who in the contract chain is responsible for what?
- Do you understand your supply chain?
- Are you confident that there are no gaps?
- Have you met your duty of care? Can you demonstrate this?
- Do you know what condition your assets are in? Have they been inspected recently?
- What is your maintenance plan? Is it funded?
- Do you understand the full range of consequences of a failure?
- Do you have the right protection for the nature and level of risk you face?
- Is infrastructure risk given as much attention as financial risk in your organisation?

The Willis Towers Watson Global Infrastructure team delivers a strategic approach to major infrastructure projects and drives excellence and a unified approach to bring optimal risk solutions to our clients in the infrastructure space.

As a leading global risk and insurance advisor with extensive experience across infrastructure, PPP and project financed projects, Willis Towers Watson provides full project lifecycle services to all parties. Our dedicated teams deliver pioneering risk allocation solutions supported by the unparalleled expertise of our construction and operational placement, risk engineering, analytics and claims teams. Our risk-led approach combined with a strong understanding of the requirements of all project parties, makes us a trusted advisor for Project Companies, Equity Providers, Lenders and Financiers as well as Central and Local Governments.

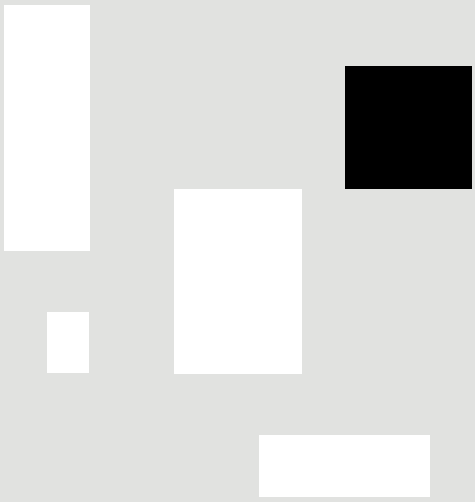
“Decisions based on bad information can lead to poor results and be costly to organisations.
This may culminate in the squandering of opportunities, taking on unnecessary risk, mis-allocating resources, and ultimately not achieving strategic goals or objectives.”

Michael J Keegan, Fiat Chrysler

For further details contact:

Barry Gibbs
Risk Control Engineer
barry.gibbs@WillisTowersWatson.com

Joanne Foley
Director – Global Infrastructure
joanne.foley@WillisTowersWatson.com



About Willis Towers Watson

Willis Towers Watson (NASDAQ: WLTW) is a leading global advisory, broking and solutions company that helps clients around the world turn risk into a path for growth. With roots dating to 1828, Willis Towers Watson has 45,000 employees serving more than 140 countries and markets. We design and deliver solutions that manage risk, optimise benefits, cultivate talent, and expand the power of capital to protect and strengthen institutions and individuals. Our unique perspective allows us to see the critical intersections between talent, assets and ideas – the dynamic formula that drives business performance. Together, we unlock potential. Learn more at willistowerswatson.com.

willistowerswatson.com/social-media

Willis Limited, Registered number: 181116 England and Wales.
Registered address: 51 Lime Street, London, EC3M 7DQ.
A Lloyd's Broker. Authorised and regulated by the Financial Conduct Authority for its general insurance mediation activities only.

FPS154 - WTW393782/01/20

willistowerswatson.com

Willis Towers Watson