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The Future is Light, the Future is Green, the Future Requires Detailed Design

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Setting aside the significant downturn in passenger rail demand during the pandemic, global demand for transport is growing fast, with passenger and freight activity forecasted to more than double by 2050 in certain regions such as Europe, India and Asia. Such growth is a key indicator of both social and economic progress.



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In a world becoming ever more urbanised, metros, underground and light passenger rail are continually developing their systems to address such needs. In addition, high-speed rail is serving as an alternative to short-distance air travel, whilst upgraded heavy passenger rail and freight rail are continuing to complement other transport modes to collectively provide efficient mobility. To meet this growing demand, new railroads, stations and depots, as well as the modernisation of existing infrastructure, are vital.

The use of rail in place of automotive transport and air travel should place less demand on finite energy resources, although it is acknowledged that increased demand for such transport developments will raise energy consumption and increase CO2 and greenhouse gases emissions. Addressing this issue will require continued innovation in technology such that lighter and greener rolling stock can be manufactured. These demands will inevitably increase the pressure on owners, operators, contractors, manufacturers, and a host of other suppliers within the rail sectors. The net result of such change arising as a result of new technologies being incorporated into designs, in commercial terms, is that it can regrettably lead to disputes and claims between parties.



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To help raise awareness of the sources and means of addressing such disputes, HKA recently published its third annual CRUX report. CRUX draws upon an unprecedented bank of knowledge to provide valuable insights into the most common causes of disputes and commercial claims. The report looks at 1,185 engineering and construction projects from 88 countries where HKA experts have provided claims consulting and dispute resolution services on major capital projects across multiple sectors around the world.

In relation to rail and transit, rolling stock and manufacturing, and signalling and technology, a total of 82 projects were analysed with an average CAPEX of US\$1.58bn. The five most common project issues were identified as:

1. Incomplete design;
2. Changes in scope;
3. Late issue of design information;
4. Incorrect design specification; and
5. Late approval of design.

In view of the geographic coverage provided by CRUX, drawing on Expert input from our teams around the globe, we offer some insights into how such project issues are impacting and can be addressed by stakeholders in the rail industry.

A GLOBAL OVERVIEW INTO RAIL DISPUTES

Owners, operators, contractors and manufacturers alike are having to manage these challenging issues, and more, in the current landscape. This is resulting



in a marked rise in contractual claims and disputes, with parties understandably looking to protect their own commercial interests.

Above all other issues, design problems drive the greatest number of claims and disputes in the rail sector. The root cause of such challenges, however, can often be traced back to failed coordination, rather than poor component design or incompetent designers, whilst pressure on time and the use of lump-sum design commissions also compound problems.

Through early contractor engagement, owners and operators can lead the concerted action needed to pre-empt these problems by:

- actively involving the contractor or manufacturer in the preliminary design; clarifying design requirements and ensuring design maturity before contract award;
- recognising the true capabilities of the supply chain, design teams and contract management; and
- resolving buildability issues ahead of production.

The design failures driving more disputes stem, in large part, from unrealistic project programmes tendered on immature designs. This is of particular pertinence where innovative new technologies, aimed at providing greener solutions, are adopted, as unforeseen challenges can arise during testing, giving rise to elongation of programme timescales. Competition drives prices down as contractors and manufacturers find themselves in a “race to the bottom,” offering value-engineered solutions that they cannot fully develop due to extremely tight programmes. As owners and operators set the timescale, and the open tender price is initially decisive, contractors and manufacturers seek additional time and costs through variation orders, themselves often lodged too late.

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Owner and operators also seek the lowest design price despite the need for the supply chain to explore new innovative solutions, so design consultants operating on slim margins push design detail and associated risk down the supply chain to the contractors and manufacturers. Claims are effectively embedded in contracts at the point of signature when design is incomplete. Yet design represents only a small proportion of the overall capital cost of increasingly large and complex projects.

Owners and operators, contractors and manufacturers would gain from delivering projects on time, to specification and budget, if:

- more time were undertaken to mature design earlier, alongside more detailed early project planning;
- greater emphasis could be placed on engaging supply chain stakeholders earlier, pre-empting latent design issues; and
- design risk was apportioned to the party best equipped to address it.

While these changes would slow the design process, the overall project schedule should not be adversely affected if production proceeds in a more

efficient and effective manner. This would also result in greater price and schedule certainty, fewer defects and less retro-fitment or rework, and a more acceptable risk profile for all parties involved.

Demand for new technologies and sustainable materials on projects is also leading to more late approvals as owner and operator design engineers and regulatory authorities struggle to check compliance. A lack of administrative capacity results in backlogs of the contractor and manufacturers requests. Late approvals could, however, be curbed if:

- contractors and manufacturers took a more proactive approach and submitted requests earlier;
- review points were set in contracts to specify acceptable timelines; and owner and
- operators simplify internal processes and train more administrative and technical staff.

In addition to attending to design issues, changes in scope clearly need to be addressed, which, it is contended, could be facilitated by enhanced supply chain engagement, better communication, and employee training, as follows:

A PERSPECTIVE FROM THE AMERICAS

In the Americas, there is a strong demand to expand the existing rail infrastructure, implement advanced technology, high-speed rail, and automated train control systems to replace outdated systems and rolling stock. Rapid advancements in technology have increased the difficulty for owners (and regulatory agencies) in defining the scope and output requirements for projects. Manufacturers and suppliers are struggling to integrate the technology advancements with existing legacy systems and deliver new infrastructure and rolling stock under fixed price agreements with significant liquidated damages for missing schedule milestones.



Complicating this scenario further, the major rail and transit projects, particularly those for dense urban environments, require extensive interfaces and third-party coordination, and face permitting and stakeholder review challenges. These major projects often include multiple infrastructure and separate rolling stock and systems packages. The contract

packages require interface agreements to coordinate the design, construction, and handover of infrastructure facilities and define liability for cross-impacts. As identified earlier, a key consideration to avoid interface impacts during design development is a greater level of investment in front end scoping and design packaging to support optimal sequencing of procurement, construction, manufacturing, and installation sequencing.

At the systems level, design packages often require a higher level of design development to interface with or replace legacy systems. Systems integration may require coordination of existing systems with new or existing infrastructure for wayside, onboard systems on vehicles, and back office central control servers. Systems integration may also involve interoperability with other railroads on the same or connecting territories. When integrating new systems with advanced technology, the design development, particularly software, may be akin to a research and development process that results in extended review and approvals and multiple iterations of design submittals. Design delays can have a domino effect on downstream procurement, first-

article inspection, manufacturing, installation and testing activities. A careful initial risk assessment of advanced technology and related software design can be beneficial for avoiding delays in systems development, installation and testing.

A PERSPECTIVE FROM ASIA

Asia's presence in railway construction projects grows increasingly fast and benefits the region politically and economically. However, in Asia's price-conscious market, the rail sector, with tight margins and high risks, has really struggled, especially with ever increasing competition. It is common for contractors to chase prices to the bottom to win projects, which erodes what are often already dangerously thin profit margins, which creates a breeding ground for all manner of other issues. The lack of integration between the project teams and other stakeholders creates large backlogs of contractor requests, which tend to lead to project failures that only compounds the other issues.



For Chinese contractors, scope change is still the perennial driver of disputes and claims on large domestic and foreign projects. Over the years, the Chinese state-owned contractors and developers have gained significant industrial capacity and know-how through the construction of China's rail network, and they have increasingly sought to

export this capacity abroad. As contractors take on increasingly challenging and price-conscious projects, bid prices are not often properly and accurately estimated with obvious knock-on consequences. Most often, due to the complex topography and geological locations, pre-bid site visits do little to help contractors price the scopes of work precisely. The awarded contracts are, therefore, based on low price inputs from contractors, which then increases pressure on other suppliers downstream to deliver to the standards expected in the contract, but with insufficient reward.

Furthermore, in relatively small but highly urbanised countries, integration of railway projects and other modes of transport is becoming even more complex and challenging. This requires proper planning, effective management of, and communication with, multiple stakeholders. Large scale cross-border railway projects are directed and implemented by a variety of central governments, regional departments, and public administration, as well as private sector developers and investors. Design change and late approvals further complicates the issues. Effective coordination between the contracts management team and commercial and technical teams is a must, so as to have a positive impact on the management of changes and variations. The challenge is the multi-national effort required to coordinate these projects, as well as to integrate the vast array of differing systems utilised across the region. Again, clear and well-structured control mechanisms and an emphasis on risk management are a pre-requisite.

A PERSPECTIVE FROM UK & CONTINENTAL EUROPE

The idea of a Single European Railway Area is still considered a phenomenon, but is being replicated in other regions, although a single system is far from being realised. Railway infrastructure currently reflects the settlement structure of each individual country. Therefore, the coordination of multi-national organisations, consideration of existing infrastructure and

requirements of passengers and freight must be at the top of any project's agenda.

However, the European Union (EU) has declared 2021 the “European Year of Rail,” and is planning a number of activities to put the benefits of rail transport in the spotlight. The initiative is part of the European Green Deal, which aims to support clean, inexpensive and healthy forms of private and public transport, and achieve a 90-percent reduction in transport emissions by 2050. To boost rail transport, the European Commission has already implemented a number of actions, including 2016's Fourth Railway Package, which begins full implementation in 2021, as well as the Single European Railway Area and the Shift2Rail Joint Undertaking.

The EU motto, *varietate concordia* (unity in diversity), is an apt description of the current landscape of European rail. The EU is addressing the challenges for a unified European Railway Area with its four railway legislative packages, the creation of the European Union Agency for Railways (ERA), and the longstanding development of the European Rail Traffic Management System (ERTMS), among other actions to create consistency. Thus, the focus is on the unity of the entire network by creating consistency across the overall design of the system. Any project undertaking must ensure advances in technology are future proofed and can be implemented with minimal disruption to cross-border travel, and operated for as long as practicable, so that the whole life asset cost is minimised.

In the UK, Network Rail's latest five-year control period (CP6), running from 2019 to 2024, represents a distinct shift from its predecessor. At the end of CP5, Network Rail concluded that it had focused too much on engineering excellence and not enough on outcomes for both passengers and freight. In 2019, Network Rail created five new regions, each overseen by its own managing director, and established 14 new routes, devolving power to help ensure regions play a more active role in decision making.



CP6's aim, therefore, is “Putting Passengers First” with Network Rail focused not just on delivering large-scale infrastructure projects and railway improvements, but also ensuring that rail journeys are made easier and more convenient for passengers.

While engineering excellence, particularly in the pursuit of safety and reliability, remains central to any contractor's offering, this new passenger-centric focus will inevitably impact how the supply chain will engage with Network Rail, and other owners, and operators during CP6, which will require them to further adapt their working practices.

Building on the endeavours of the rail industry supply chain to work in a more integrated manner, collaborative working is being pursued more than ever by all project stakeholders. It has long been recognised that, as projects become ever more complex, there is a need to be more proactive in facilitating solutions that achieve the overall objectives. Greater engagement with the entire supply chain and other stakeholders helps ensure that all participating project stakeholders can contribute something to support Network Rail's goals. Regardless of the works being completed, putting passengers and freight-users first starts with design collaboration and clear lines of communication between owners, operators and all layers of the supply chain.

Without early contractor engagement and the concerted effort needed to actively involve contractors, manufacturers etc., prior to contract award, it is unlikely that we will ever recognise the true capabilities of the supply chain.



SIMPLE ACTIONS TO AVOID DISPUTES – A PARTING SHOT

Pressure is increasing on rail as a mode of transport, driving the need for enhancements in technological innovations to ensure that the scaling up of national and international networks can be achieved in a way that delivers a capable system at the most advantageous whole life cost, whilst simultaneously minimising their ecological impact.

Such innovation and change will inevitably bring unforeseen interface issues within design if historical trends serve as a prediction of the future. By turn, these circumstances are likely to give rise to commercial disputes if left unchecked.

In respect of developing new designs, there is an opportunity to acknowledge that the “long road” is, in fact, the “short road.” Taking the time to mature design prior to contract award will yield better returns by way of reducing exposure to project overrun and unforeseen increases in cost—despite the additional up-front effort required.

To avoid disputes, clarity of communication over end objectives, such that the right technologies and associated interfaces for the end operation of an asset, will help reduce design amendments, retrofitment, re-work and modifications late into the project.

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