

**1. A particular type of piling rig is shown - why is it appropriate and what sort of safety issues are there when creating the foundations?**

Peter: I had a photo of a piling rig at Twickenham - it was short and it was facing perpendicular to the tracks and both of those are intended to reduce the risks associated with the rig falling over sideways. It's a safety thing.

**2. What actions are being taken to get engineers and architects to understand the benefits of offsite methods?**

Nick: This is a focus for us as the Buildoffsite group, to promote MMC of all forms. It's about risk and awareness of that risk - a lot of clients are still nervous about supply chains and being restricted to supply chains. As we see the industry mature the risk is starting to dispel. We see a lot more talk around it. There are more manufacturers in the market and hopefully this will increase appetite to get onboard. You have to be committed from the start and we engineers and architects can describe benefits.

Bill: These projects are a rather unique combination of property with infrastructure - with property we associate architectural design but here, to enable it, we need to create a deck, and a platform above the infrastructure. There's a process aspect that brings diverse sides to it - you need people with broad understanding of the skills required for these projects and that's what gets me excited.

Nigel: The Linear Infrastructure Overbuild Guide illustrates how offsite can be beneficial in terms of delivering this kind of project.

**3. Design life of overbuild and how do we prove durability if it's not been done before?**

Peter: Modular technologies are well established we're just bringing them together with rail building expertise. In terms of durability, the procedures are well established.

Nigel - The Innovation chapter of the guide also looks at how one can protect these structures.

Bill - In the development of these solutions, durability remains in the list of concerns - when we were working on the Chelsea Stadium overbuild project the way the decking was owned and maintained was different between two stakeholders, for the Network Rail deck it was going to be owned by Chelsea and they would pay Network Rail to maintain it. For the District Line it was going to be owned by TfL. Different methodologies don't prevent things progressing to a larger extent. Different ways of tackling that aspect - as Network Rail and TfL say "the door is open for discussions".

#### **4. Who pays for foundations (including box/deck)? Council, developer?**

Bill: The developer would pay for all that. One of the things we talked about with TfL and Network Rail was that the cost of the land and ability to develop over a piece of infrastructure, especially for homes - if stakeholders can take credit for providing homes, the customer deck is potentially balanced against housing provision targets (or other station improvements) rather than paying for the land.

#### **5. In your experience is it difficult to engage with Network Rail when building above rail?**

Nigel - We've got another webinar that's actually around project managing this type of thing and Mace will be leading on that and using the Twickenham example. It's complicated working with Network Rail because of safety considerations but they are proactively finding ways to facilitate that.

Peter: It hinges around whether there are stakeholders in the project or not - in projects like this there will be and they will be keen to find solutions around this. Have them engaged within the project so that you can find solutions with them.

Bill: Begin dialogue as early as you can.

#### **6. Is noise mitigation always handled at the superstructure - would sound proofing be better handled at the rail box level?**

Peter: We've started from saying the box should be simple - as a result of that strategy it should be dealt within the superstructure.

Bill: As I understand it Twickenham is not isolated at all – that's because every train stops at Twickenham and trains are moving slowly - that was the view taken. At Royal Mint Gardens - the entire building above is truly isolated to avoid noise and vibration. I think site conditions need to be measured and the use of the building above taken into account with residential being the most critical. It's better to isolate building from the deck rather than deck from the railway because it puts isolation in control of the building on top of the deck and that tends to be the way these things are done.

#### **7. Are current modular building technologies appropriate for building over decks? What are the technical shortcomings?**

Nick: More appropriate than alternatives - what we've explored is a metal frame modular system - the weight reduction is significant on concrete and it has major carbon savings. Shortcomings: restrictive to design - it is suited to hotels and student living which are straightforward. When you get to a mix of housing types that becomes complicated; the smaller and more repetitive modules the better.

Nigel: Consider modularity before planning permission is obtained to maximise opportunities - there are panelised systems, (e.g. floor cassettes, walls, roofs etc.) and other more serviced aspects that can be packaged (e.g. bathrooms, kitchens, heating/air conditioning). It is key to look at opportunities to vertically stack similar service areas and a lot of those factors need to be thought through earlier than in a traditional project. Once they are addressed it opens opportunities to manufacture and assemble.