The Future of Construction in the UK

A WHITE PAPER BASED UPON A ROUND TABLE DISCUSSION

System Solution Providers

Proctor Group

Contents

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Contributors

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Introduction

As part of the Proctor Group Technical presentations, A round table discussion was held with a group of UK Technical professionals, to look at the UK Construction marketplace and have an open and frank discussion on the marketplace as a whole and if possible provide an outlook on the future of the UK construction marketplace.

Executive summary

This report calls upon leading voices from the construction sector, covering housing and construction, manufacturing, and academia to consider the future of construction in the UK. At one of the most pivotal moments for the world, the panel explores the key challenges facing the industry, how these are being addressed, and the critical areas of focus that will be required for success.

The construction sector is facing a transformational future

With 38% of the global emissions for carbon stemming from the construction sector or built environment sector we need to better join up what we are doing. We can no longer produce bespoke one-off singular projects. We need a national retrofit strategy that will combine and bring together so many solutions, evidence based solutions that will allow our architects to deliver.

The future will inspire innovation. We will have gaps in where we are going and that is what spurs innovation.
The industry has done this before on Robust Details. We brought together 119 committee members from all products, housebuilders, and sectors. In just one year they built 1400 homes, all evaluated and tested. We are excited and confident that we will hit net-zero, but we will have to step up the game and deliver in an almost military approach what we need.

A construction sector that is driven by net-zero and decarbonisation

Not just because it is driven by legislation, but because it is right for the world. Clients are already demanding net-zero buildings and net-zero working practices. It would be good to see a focus on long-term value and not the lowest cost which is so common. So, developing a focus on whole life cycle costs and value is critical. In decision making, going forward we need to be thinking about operational carbon as that is key to drive us to net-zero. We require a shift from a sector that has been driven by economic impact to a sector that is driven by environmental, social, and economic impact. Also, we require a focus on upgrading existing buildings. 80% of the buildings today will still be existing in 2045, and so we need a national retrofit programme. With our eye on net zero, going forward, a focus on local materials and local supply chains will become crucial.

A younger and more diverse workforce

We also need to bring in a much younger and more diverse workforce. According to a study Building Skills for Net Zero, published by the Construction Industry Training Board (CITB)[1], 22,500 new roles need to be created in Scotland alone by 2028. This younger workforce is important because they have the digital skills and because they are more carbon literate and so can make a positive contribution to our drive to getting the built environment to net zero.

The demand for more housing

Net-zero is important, with a need for more housing. It is encouraging to see the growth in offsite and MMC. We also require new legislation to help drive CO_2 emissions down. Regarding housing, It would be good to see people buy houses not just on price and features, but on energy efficiency. It would be great at dinner parties to hear people talk more about energy efficiency rather than gold taps, for example.

An excitingly complicated future for housebuilding

Reducing the carbon footprint as a housebuilding industry, combined with educating customers on how they can reduce

carbon is crucial. It is complicated because we have operational energy to deal with, plus embodied carbon from buildings that contain cementitious material and steel. We also have to address biodiversity, with 40% loss of species since the 1970's. Then there is also water reduction, because it takes energy to bring water to a house. Add to this the balance between indoor air quality and overheating. In some ways it can be compared to wrapping a house in a North Face jacket to achieve airtightness. In driving airtightness to a minimum, we still need to ensure homes are healthy to live in.

"Adaptive architecture" [2]

The weather is testing the new designs we put up and the older designs already in place. We need to look at the rest of the world, in terms of how we plan, how we detail and how we reformat our materials to suit the new world. Carbon reduction is very important, but we are stuck with a weather system that will keep on changing for the next 20, 30, 40 years, so we need to do "adaptive architecture", and look at the way we design and bring new materials to the forefront. So, the future is both exciting but worrying.

Learning Points

- What transformational shift is required to get the construction sector to net-zero?
- The need for a national retrofit strategy
- Can the relaxation of regulations support and increase retrofit?
- Passivhaus vs net-zero housing and what determines the best path to follow?
- Outcomes of COP26 and construction
- Why are local materials becoming increasingly important within the building fabric of new or refurbished buildings?
- Embodied carbon and materials selection
- Product development - end of life – circularity
- Can offsite construction play an integral role both for the future of construction, societal housing need and net-zero?
- The future for adaptive architecture & technology
- What are the major opportunities you see for the construction sector coming out of Covid?

What transformational shift is required to get the construction sector to net-zero?

The discussion began by exploring what transformational shift is required to get the construction sector to net zero. One of the critical actions identified is the need for a national retrofit strategy. For example, 80% of our buildings today will still exist in 2045, so there is a clear need for a national retrofit programme focusing on upgrading existing buildings.

Data suggests that 850,000 homes a year in England alone will need to be retrofitted by 2050 (Sarshar, 2022)[3]. This equates to transforming a house a day through retrofit measures leading up to 2050. Achieving this will be a challenging task without a massive shift in terms of productivity. However, it was suggested that as the construction sector transforms its skills base to focusing on offsite manufacturing, there could be a substantial productivity shift. As the construction sector competes with so many other industries for new entrants and skilled workers, the key will also be attracting young people from school and ensuring that people are retained within the sector and upskilled and cross-skilled.

The discussion then moved on to the need for support for retrofit. One of the challenges for the sector in the future will be public engagement; as we engage with the retrofit challenge and this change of focus away from a continual new build. Another crucial area will also be funding, which is a real challenge. It was suggested that there is probably a window of opportunity now where the government can look to those heavy industries, non-construction based, with high emissions and who are in the process of finding solutions for their emissions from industrial processes. Can this knowledge be transferred? One option is to encourage offsetting emissions in the short term whilst the industry is trying to find zero-carbon solutions, and where that offset is then an investment by a carbon tax which then goes into investing into the retrofit of the existing housing stock. In other words, we are not standing still as an industry, but we are getting a carbon reduction via offsetting from the heavy industries.

The need for a national retrofit strategy

In exploring the need for a national retrofit strategy, the panellists considered if the relaxation of regulations could support and increase retrofit? For example, in the acoustics world, you are allowed a relaxation in the sound performance in older buildings to incentivise people to do refurbishments. If we did the same on the thermal aspect of housing, it would encourage people to refurbish existing housing stock.

We have had industry figures asking about removing VAT from home and building refurbishments. If we can refurbish these buildings instead of knocking them down or building new builds, then maybe refurbishment would be encouraged to allow people to upgrade them. There is a lot of technology that can be used to provide a holistic approach in terms of moisture and thermal insulation. Some relaxation in measures would allow more existing buildings to be retrofitted.

Italy introduced the 'super bonus 110' in 2020 to kickstart the economy[4], offering homeowners a tax deduction of 110% on renovation expenses. When someone applies for a grant to retrofit their home it is called the super bonus 110 because they are paid 110%. A 10% bonus is given to the occupant or building owner to encourage them to retrofit. Applying this to every house would result in an enormous cost, but you could do so for difficult or hard to treat homes or in areas with specific difficulty or low incomes. It is an excellent opportunity to accelerate retrofit by looking at the Italian model.

In Germany, they begin by considering the target of 1.5 degrees and then stepping back from the policy of signing up to 1.5 degrees by calculating the energy usage per m2 or cubic metre of the house.

The panellists also considered The LETI Climate Emergency Retrofit Guide[5], but it can work out costly. For example, some of the costs of the remedial works in LETI case studies are as much as the cost of purchasing one or two houses in other parts of the UK. So, if we want to take the public with us, we need cost-effective solutions.

Another approach identified was The ZEST Report – Zero Emissions for Social Housing Task force[6+7].
ZEST proposed a strong fabric first approach, utilising and developing solutions for key archetypes which helps the mass retrofit journey both in known evidence-based performance for energy efficiency and improving productivity outcomes for the whole sector.

Passivhaus vs net-zero housing and what determines the best path to follow?

Another factor discussed by the panellists was the role offered by Passivhaus vs net-zero The difference between Passivhaus and net-zero is that one is a housing standard, and the other isn't. Net-zero is a goal, a guide, it is not a standard.

Passivhaus is a set of rigid standards set out by the Passivhaus Institute[8] that is both measured and certified. In a Passivhaus, heating energy can't exceed 15 kWh per square metre, total household energy can't exceed 60 kWh per square metre, and there are specific airtightness measurements that must be adhered to.

Net-zero homes is about achieving net-zero. In a way it doesn't really care about how you reduce your carbon footprint to zero, it is just about doing it. So, you could have a net-zero home fuelled by fossil fuels but offset it by bringing in other renewable energy sources like solar panels. In net-zero, building materials are also considered key, as well as looking at technologies and equipment. It is all about getting the house offset to net-zero.

The key focus of Passivhaus is all about fabric first. It is about reducing emissions through insulation and airtightness and has a strong materials focus. Passivhaus requires a home to maintain a level of thermal comfort all year. To achieve this level of thermal comfort means wrapping walls, roofs, and floors in insulation. It also requires making sure that you have heat transfer resistant doors, and windows, and importantly ventilation to keep the air from being stale because of the extreme airtightness.

What determines the best path between Passivhaus, and net-zero depends on how far you are trying to reduce emissions in your building? Do you want to get to the level of having your building certified by the Passivhaus Institute and using specialist contractors to work on it?

Passivhaus and net-zero are not exclusive. You could build to Passivhaus, and from there it would be quick and easy to transition to net-zero. In Passivhaus, you are already limiting the amount of energy that you require and can offset this small amount of energy through renewable sources. The best result would probably be to combine Passivhaus and net-zero.

One new innovative approach is the 'Z house' project by Barratt Developments PLC[9]. Net-zero to most people would be defined as regulated and unregulated energy, which can be calculated by software. Zero carbon as defined by English legislation is defined as 75% improvement to regulations.

The 'Z-house' is 125% of regulated energy. So, 100% of lights and items that are identified within regulation, then 25% additional. Viewed in another way, 5-6 days of the week the house will get its energy from renewable heating technologies, and 1 day of the week from the grid. The 'Z house' is 125% of operational energy, but also looked at embodied carbon, so material was taken out of the tiles, and bricks. The 'Z house' considered biodiversity, so included a gold graded RSPB garden, bat houses, swift houses, hedgehog houses, and green walls to entice insects. In the 'Z house' design, Barratt also looked at water, driving past the gold with 105 litres per person per day, and featured atomised showers. In addition, 'Z house' explored different heating solutions, such as air source heat pumps.

Passivhaus is a very good standard and has a cost, but there are many other standards across the world. We should learn from the other standards but set our own that relates to our climate, our skills, and the technology available to us.

Outcomes of COP26 and construction

The value and outcomes of the COP26 conference at the end of 2021 have been much debated. COP26 could be seen as a politician gathering where they are seen to be doing the right things and show that they care. The Politicians claim that getting 2 degrees down to 1.8 and then 1.5 is to be celebrated. Politicians seem to think that getting the value down is the be all and end all. However, it is important to understand the concepts of the whole system because there is a knock on effect and the knock on effect has already taken over.

If you warm the planet, the planets warm air sucks up more moisture from the oceans and the lakes. Not like carbon where carbon stays in the atmosphere for a long time. The water can only stay up there for a limited amount of time, and that is just days and weeks. So, suddenly, the warm atmosphere is sucking up more moisture and it is dropping huge amounts of water out of the atmosphere. Unfortunately, because of the way the planet works, it may suck out moisture in one area and dump water in another area. Like poor northern Germany where suddenly they had huge downpours and virtually two thirds of a small town was washed away. It wasn't their fault, but there was no explanation given as to where the water came from. That is the annoying thing about COP in that they talk politics, trying to get the numbers down, giving big promises, shoving an awful lot of money into a lot of projects without really understanding what they are doing.

There was a little bit of talk about the permafrost. Some years ago, we got involved with permafrost looking at how we could control railway tracks and how some of the houses in the Nordic region were rafted on insulation. At COP26, there was no understanding of what is going on with permafrost as far as the knock on effect is concerned, because it already happened, and the methane that is coming out is unprecedented. Methane is one of the big gases. Water is as bad as carbon in terms of its effect on everything else.

We need to understand this relational link between what is going on in the planet rather than the politics. We need this holistic approach involving all the technical people. We have done it before, we can do it again, where we need to get on board and agree different standards. We have tried to look at the global building regulations and have been doing it for over a year. When you try to read the global building regulations they are misleading, and wrong.

It is good that COP is going ahead but the people who are doing it really don't understand. It wasn't good that the children and youth were shut out. What we are doing now is our grandchildren's legacy.

We can do this, and we will have to stick at it and get together to do this. Overall, COP26 was useful but not very effective.

Why are local materials becoming increasingly important within the building fabric of new or refurbished buildings?

In the transition to net-zero we need to be considering the carbon footprint of the materials that we use. So, their embodied carbon is crucial, and we need to keep these as low as possible. One way of doing that is looking at locally sourced materials to reduce the transport emissions that are involved in importing materials from overseas or even other parts of the UK or non-local sources.

Equally we have seen the challenges of Brexit, and the challenges of Covid, with lorry driver shortages and the impact on construction material supplies. All these challenges have catalysed us to think more about how we source materials and how we can use more local materials. The huge benefit of reducing our reliance on imported material is the economic and social benefits to our communities and to the supply chain. We need to be building much more resilient supply chains. It is all about creating value by using local resources as much as possible. In Scotland for example, looking at new high value applications for Scottish timber for use in more mainstream timber frame. In addition, looking at mass timber, wood fibre insulation, local suppliers, new solutions, and investing in more research and development.

The importance of product passports and Environmental Product Declarations (EPDs)[10] will feature more within procurement models and all aspects of circularity. The use of EPDs at various stages in the building process to determine how products are manufactured. The A. Proctor Group is continually looking at how to responsibly source their products and packaging.

Post Brexit one of the areas we are looking at is the testing and development of products, but also the transition into UK Conformity Assessed (UKCA) marking[11]. The UKCA marking is a new UK product marking that is used for goods being placed on the market in Great Britain. As we head up to the deadline of 31/12/2022 there are still thousands of products that need to be transferred from EU CE marking into UKCA marking in the UK.

Embodied carbon and materials selection

Currently the circular economy attributes aspects of embodied carbon. However, it would be great if embodied carbon came more into our legislative form. It is great to see UK Green Building Council (UKGBC), and the Construction Industry Council (CIC) working on trying to encourage a focus on embodied carbon and how to calculate it. Currently, if you consider the sheer number of products and resources globally we will need to build 2 billion homes in the next 80 years, vis-a-vis existing stock. We should be embedding now that all public procurement and infrastructure, where possible, should be designed for deconstruction. Designing for deconstruction is even more important than embodied carbon right now. We can then encourage how we calculate designing for deconstruction, so that there's an incentive for people for how they declare their buildings. An incentive because of the carbon footprint where they can recover that carbon and reuse those materials in 100 years, 150 years, it doesn't matter, but we have kick-started now that really important factor of material resource going forward.

Product development - end of life - circularity

When we do product development, part of that is what are we going to do with the product when it is finished? It takes a while to reach the product's end of life. So, we might be talking 40-50 years, but we still must consider what you do with the product when it is finished.

A new product that The A. Proctor Group is working on uses the old blades of wind turbines that we can mould into a different shape and use that shape in a building for over 30-40 years, but at the end of its life then we can then do something else with it. Wind turbine blades are not currently recycled, they get put into landfill. So, it's an important element of product development, incorporating design from the outset for circularity and reuse of materials at end-of-life.

Can offsite construction play an integral role both for the future of construction, societal housing need and net-zero?

Offsite construction is not the panacea, but it is a fantastic route towards it. We also need to deliver better offsite for our substructure. In being able to deliver the maximum benefits of offsite, we need our utilities to work at a faster pace. We need to encourage utilities or investment such that we can put the infrastructure up front into the site which then supports the acceleration of the offsite net-zero delivery.

There are solutions in offsite for some of the retrofit measures which are out there and that's why having national retrofit strategy architype solutions for specific buildings could mainstream a lot of the development into offsite for some of the retrofit abilities.

We are seeing in Holland, using the Energiesprong model[12], where they are putting skins on their buildings as part of the entire offsite retrofit, incorporating entire new roofing systems. The technology is there, if we can encourage young people to come through and give their skills. We need to incentivise and encourage the sector to help more people in.

The future for adaptive architecture and technology

The birth to death calculation is not difficult or unknown, it just needs to be done. We started to look at what is called the digital twin. A games company, Epic Games, brought out the Unreal Engine[13], an advanced 3D creation tool. Within that they brought out something called Twin Motion. It is Twin Motion that is becoming incredibly interesting in the way that we can do this, not on one building, but on a city at the same time. Up till now we have not had the computing power to do it, but the cloud is allowing this. We can now model a whole city and calculate what is going on, almost instantly. That is the future as far as looking at new materials and construction. So, if a new housing estate goes up, we can see not only how it's going to work immediately, but we can see 20-30-40 years in the future by simple algorithms. Not on one building, but on the estate in comparison to the rest of the city, which often we have ignored.

So, if you want to know what "adaptive architecture" is, it is all this idea of looking at not just the building, but everything around it, the whole city and we can do that now. We can't yet say that we can do a global approach, because its currently difficult. However, "adaptive architecture" is already happening in New Zealand and Australia. We already have the people now who can do this.

So, if they build on flood plains using adaptative architecture it isn't a problem. For example, design could allow the area to flood if the houses are built up on mounds like the Swiss do and allow the system to work rather than ignore the whole idea of flood plains. Sustainable Urban Drainage (SUDs) is so important. You can't just look at the one building, you must look at the whole area how the SUDs are being used across there.

It's a fascinating area of "adaptive architecture" where we can see not just the one building but a complete city working, and that includes the traffic, and the weather coming in.

What are the major opportunities you see for the construction sector coming out of Covid?

In terms of a post covid world, Local Authorities across the UK and government are looking at 20 minute neighbourhoods[14] as more people are staying at home. People may not always wish to work at home, but they would like to work close to home. We have seen several Local Authorities that had empty premises - office premises which were lying empty which they would normally lease out pre-covid are now full, because some people have decided they don't want to work at home but want to work near to home. So, Local Authorities are leasing out those small offices, which is good. Those neighbourhoods then give an infrastructure to GAP sites of what will be required in terms of amenities and may provide platforms for new community or district heating, but also supporting sustainable communities.

We can't forget rural areas. They are having a tougher time than anyone else. Especially, if they are not on the grid and with the rising costs of energy that are affecting everybody, particularly those on low incomes. Looking ahead to the future of construction in the UK, if rising costs continue as they currently do, and if they go up 5 or 6% per year, the payback period on retrofit really starts to take a different shape. That is on the proviso that material costs do not increase beyond the 5 or 6% per year. We have had a tough time recently with material costs and supply chain issues.

One final thought. Europe is required to retrofit 11 million homes per year. We are all chasing the same technologies and the same processes. Currently, the government spends a minute amount of research funding for the construction sector vis-a-vis any other sector. So, we really need to step up that work so that we can accelerate more of the solutions and work together. It is an exciting time, but we will need everyone to work holistically together to deliver this.

Conclusion

The construction sector has often faced significant challenges and has continued to evolve embracing new methods of design and construction, new materials, new digital technology, new skills, and regulations. Perhaps though, never has the sector faced such a pivotal point that will shape not only the future for the sector, but for us all. The transformational shifts required to achieve net-zero, the need for a national retrofit strategy, how we develop new sustainable products and source materials, whilst addressing embodied carbon, circularity and end-of-life and the impacts of a global pandemic present enormous challenges. At the same time there is a positive hope and excitement at the opportunities presented by "adaptive architecture" and the collective will of an industry working together. This is a critical time, but to quote the panel, we can do this, but we will have to step up the game, must stick at it and get together to make it happen.

Keywords

Global Emissions, Carbon, Carbon Footprint, Construction Sector, Retrofit Strategy, Building Fabric, Architecture, Architect, Architectural Technologist, Robust Details, Net Zero, Decarbonisation, Legislation, National Retrofit Programme, Diverse Workforce, CITB, Digital Skills, Carbon Literate, Housing, Energy Efficiency, Biodiversity, Air Quality, Overheating, Water use, Airtightness, Weather, Retrofit, Government, None Construction Based, Heavy Industry, Holistic Approach, Italian Model, LETI, Passivhaus, net-zero, renewable energy, Solar Panels, Ventilation, Z House, COP26, Knock-on Effect, Methane, Water Vapour, Holistic approach, Transport Emissions, Scottish Timber, Timber Frame, Mass Timber, Wood Fibre Insulation, product passports and Environmental Product Declarations (EPDs, UK Conformity Assessed (UKCA) marking, UK Green Building Council (UKGBC), Construction Industry Council (CIC), offsite construction, "Adaptive Architecture", Digital Twinn, Flood Plain,

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" I believe the success of the A. Proctor Group is down to a solid foundation of innovation backed up by an excellent, loyal and committed team, every one of them playing an important role in our continued success. Scotland provides us with a unique platform to launch our ideas, systems and products. I am fiercely proud of this heritage and our brand."

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