Towards Net zero: Decarbonising the Construction Industry

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COP26 climate summit has accelerated the global market push toward reducing emissions from infrastructure projects and operations Research and innovation are key drivers of a circular economy. Taking a circular economy approach offers the construction industry a major opportunity to deliver decarbonisation targets and whole-life efficiencies. This presentation explored the use of various types of recycled materials, and how they could help to deliver some of those targets especially in the concrete industry. The presenter is a leader in introducing innovative low carbon construction solutions and discussed innovations and challenges in those projects. The use of recycled materials and recovered resources will be included in specifications and therefore will be mandatory in projects in the future. How these materials can be used effectively in construction projects was discussed in the presentation.

The effect of greenhouse gases on the climate is well known. With the increase in global temperatures, the concentration on net zero emissions have gained more prominence. The depletion of the ozone layer, the increased emission of CO2 and global temperature rise have given us much to think about. For example, Australia has come up with a target of 43% reduction in emissions by 2030. Recent increases in draughts, floods and landslide in Sri Lanka have brought the effects of climate change much closer to us. Glasgow summit there has been a lot of discussion on working on de-carbonization. The focus here will be on how the construction and demolition industry could contribute towards achieving sustainability goals.

A comparison was made between linear and circular economy. Three principles of circular economy are driven by design. Elimination of waste generation and pollution gets us to de-carbonization. Circulating materials in use at their highest value is design for reuse. Regenerating natural systems eliminated use of natural resources.

Modular construction done in factories is a great way to reduce demolition cost, and waste material in building sites. Section of buildings are constructed in factories and transported at conveniently to be integrated to building sites. The convenience of prefabricated building construction was illustrated with examples of schools, railway stations, and health care facilities.

Emphasizing of the use of recycle waste materials to elevate circular economy it was highlighted that after water, concrete is the most consumed substance in the world. Waste materials are used as filler in construction materials. Concrete is the most consumed substance in the world, at the same time causing immense pollution. One ton of cement produces one ton of Carbon

Dioxide. 8% of the emissions in the world is produced by the cement production process, where limestone is heated to high temperature to produce lime and carbon dioxide as a byproduct.

We are trying use waste material such as tires and glass in a positive way. We seek methods of reusing waste material by taking advantage of the positive properties. For example, rubber which has an increase tensile strength can be used on roads to get rid of shrinkage cracks and temperature cracks. Further we add value to construction materials. For example, insulation properties can be increased by putting tire crumbs. In the Metro project in Australia, glass waste based concrete is used for temporary concrete elements. Further work is carried out in upcycling plastics and using artificial intelligence for waste identification and creating databases and training.

Graphene oxide based Nano modified high performance concrete is currently being research upon. It consumes 20% less cement and less natural aggregates in concrete. Also it has 25% less embodies carbon in concrete while having enhanced properties such as increased compressive strength, tensile strength and abrasion resistance. Vein graphite, which is the purest form of graphite in the world is produced in Sri Lanka. It has a high carbon purity of 99.5% which significantly reduces the manufacturing cost of graphene products. Graphene enables the use of waste materials in concrete by regaining mechanical strength and durability. For the first time in the world, two columns and slabs were casted using graphene concrete at Design Office of Civil and Structural Engineering Consultants (Pvt) Ltd, Sri Lanka. Blended concrete contains a range of waste material such as graphene oxide, plastic(PHD), rubber, crushed glass, bottom ask, recycled concrete aggregates, textile and hair.

The carbon footprint calculation is a key for any project, in our quest to work towards net zero. Thus the carbon content in concrete will be another parameter which is to be considered, apart from cost and strength, in the choosing the optimum material for a construction. Further work is being carried out in investigating the possibility of introducing paper and textile waste into concrete. These endeavors enhance the properties of the concrete as make a positive impact on the environment in the world.

A couple of few examples were discussed from circular economy. The first was modular construction, where components are dismantled and relocated elsewhere, thereby reducing demolitions and creating versatile connections that can be removed anytime. The second example in circular economy is the use of waste materials in the construction industry, since we are running out of conventional construction materials like sand. Thus we can take care of the environment by using these newer methods and materials in the construction industry