Future Tunnels LCA Study

MEETING MINUTES

LCA PROGRESS MEETING MARCH 2023

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1. ATTENDEES

Arup: Yung Loo, Suzanne Evans, Reihaneh Hafizi, Jin Sasaki, Heleni Pantelidou

CERN: John Osborne, Steinar Stapnes, Benno List, Liam Bromiley, Roberto Losito

2. AGENDA

- Phase 1 LCA progress update.

3. MINUTES

JO: Introduction of Arup members for the benefit of Roberto.

LB: Presented an introduction to the study for Roberto.

RL: Introduced himself and his role as future accelerators sustainability lead at CERN.

SE: Presented slides showing the progress of the phase 1 LCA so far and preliminary results.

A1 – A3 LCA studies so far: raw material extraction, transport and manufacture.

Used Recipe 2016 LCA methodology to assess 18 impact categories.

Projects have been divided into sub-systems, components, and sub-components. To highlight the impact of different components in the tunnel designs.

Presented results at a system level, sub-system level and sub-component level. Providing absolute CO2 values and kgCO2/m of tunnel. Comparing both CLIC and ILC projects.

Comparison between the use of steel and concrete, CLIC 17% steel, ILC 45% steel. Steel more carbon intensive.

Materials baseline, CEM1 concrete and 80% recycled steel, in line with EU standard for CLIC.

Unknown for ILC if Japanese steel is typically 80% recycled.

Steel is more carbon intensive than concrete, therefore the greater proportion of steel in the ILC design leads to the greater CO2 quantity and concentration per m of tunnel.

Preliminary results for CLIC A1 – A5 assessment presented alongside two benchmark projects, Thames Tideway and a railway tunnel.

BL: It would be useful to breakdown the sub-components into functional structures (i.e. tunnels and caverns directly related to the operation of the machine) and access structures (access tunnels, shafts, adits, etc.)

SE: The steel ribs in the ILC design are a significant factor for the greater concentration of CO2 in the ILC design compared to CLIC. A query for ILC is if the steel ribs are definitely required.

HP: However, it’s necessary to look at the whole life carbon of the LC, which includes the operational carbon. For example, the ILC structural design could be a lot more efficient in operation compared to CLIC and therefore the whole life carbon of the two projects could be similar.

JS: Seismic issues are less significant for tunnelling, so use of recycled materials in Japanese ILC design could be improved.

YL: Presented next steps of the LCA study.

Implementation of parametric modelling. Path to net zero may result in a 40% decrease in embodied carbon, to align with the UN breakthrough outcomes for 2030, 100% of projects completed after 2030 to be net zero carbon in operation.

Economic drivers such as carbon pricing will become more important and significant in project decisions.

SS: How would the carbon pricing impact a project?

HP: Carbon pricing is a means of adding the carbon cost to the capital cost of project delivery. Therefore, can be used as a measure of project feasibility and investment decision making.

BL: Carbon cost per metre of structure to be detailed further.

YL: Reduction in the lining thickness provides significant opportunity for reductions. As well as the implementation of composite materials.

4. MAIN ACTIONS

- Meeting to catch up with ILC scheduled March 17th
- Determine if steel ribs in ILC design are critical.
- Arup to detail CO2 impact of functional structures and access structures.
- Carbon cost per metre of structure to be progressed further.

Indico meeting link with slides presented by Arup: https://indico.cern.ch/event/1259275/