



The Engineers Role in a Collaborative Approach to Lean Design



deliver projects better, faster, together



A targeted and collaborative approach to carbon reduction

The SDG target dates are ambitious...from now and over the next 10 year are critical in negating the tipping point of our planet. As a practice Design ID recognise this and have signed up to Structural Engineers Declare, and are committed to making an impact to reduce climate change...

...as part of this commitment Stephen discusses the SDG's, how material usage in building projects can be measured, monitored and reduced, and how carbon reduction via lean design can be achieved through a collaborative and targeted approach at the earliest project stage.

Lean Design, the UN SDG's and Us...

1. **Introduction**
2. Introduction to The SDG's
3. Carbon in Numbers
4. Carbon Savings & Initiatives
5. Project Examples

What is lean design

- Not new technology. It is a mindset of lean design
- It is border-less, not code restricted
- There are some stumbling blocks
- This is something everyone can do
- These can happen now
- Unlocked by early collaboration

The crises of climate breakdown and biodiversity loss are two of the most serious issues of our time....

"One of our greatest freedoms is how we react to things"



UK Structural
Engineers
Declare Climate
& Biodiversity
Emergency

For everyone working in the construction industry, meeting the needs of our society without breaching the earth's ecological boundaries will demand a paradigm shift in our behaviour. Together with our clients, we will need to commission and design buildings, cities and infrastructures as indivisible components of a larger, constantly regenerating and self-sustaining system in balance with the natural world.

The research and technology exist for us to begin that transformation now, but what has been lacking is collective will. Recognising this, we are committing to strengthen our working practices to create structural engineering outcomes that have more positive impact on the world around us.

UK Structural Engineers Declare Climate & Biodiversity Emergency



STRUCTURAL ENGINEERS DECLARE

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UK Structural Engineers Declare Climate & Biodiversity Emergency

We will seek to:

— Raise awareness of the climate and biodiversity emergencies and the urgent need for action amongst our clients, collaborators and supply chains.

Lean Design, the UN SDG's and Us...

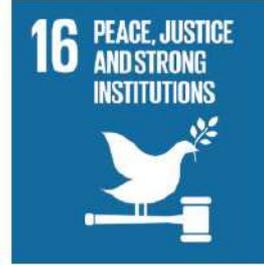
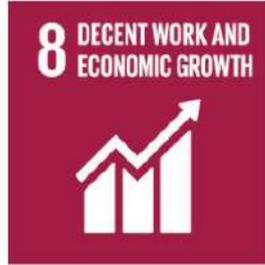
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Familiar with the SDG's before today?



www.SDGsInAction.com

Sustainable Development Goals



1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
8 DECENT WORK AND ECONOMIC GROWTH

IMPROVING LIVES

10 REDUCED INEQUALITIES
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
5 GENDER EQUALITY

FAIRER SOCIETY

17 PARTNERSHIPS FOR THE GOALS

BETTER BUILT ENVIRONMENT

14 LIFE BELOW WATER
13 CLIMATE ACTION
15 LIFE ON LAND

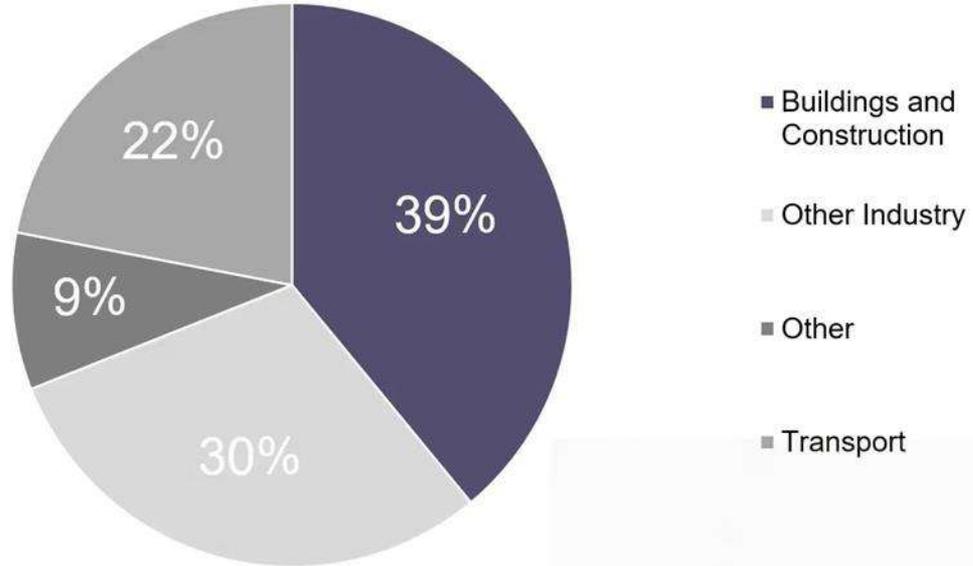
HEALTHIER PLANET

6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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Energy Related CO2 Emissions by Sector



Towards a zero-emission, efficient, and resilient buildings and construction sector, Global Status Report 2017. By International Energy Agency for the Global Alliance for Buildings and Construction, coordinated by United Nations Environment Programme
https://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf

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4. **Carbon Savings & Initiatives**
5. Project Examples

- 1. Don't build - Refurbish**
- 2. Re-Use (Foundations, materials)**
- 3. Design Efficiently – Design for Optimisation**
- 4. Design with Low Carbon Materials**
- 5. Design for Deconstruction / Recycle**
- 6. Produce Detailed and Accurate Handover Information**

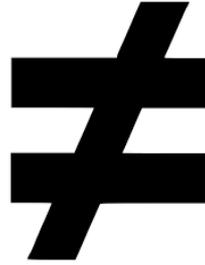


1. **Don't build - Refurbish**
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FLEXIBILITY

ADAPTABILITY



**HIGH DESIGN
LOADS**

**LONG SPAN,
COLUMN FREE**

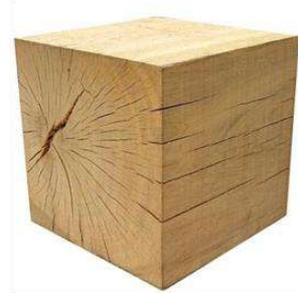
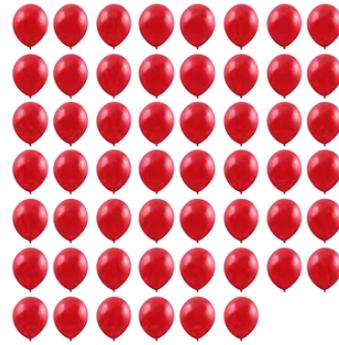
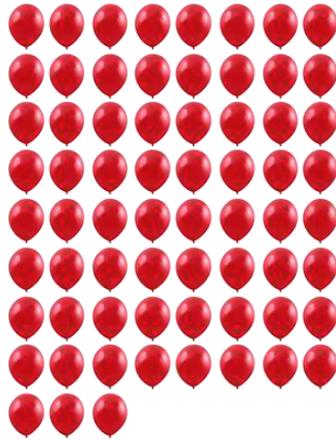
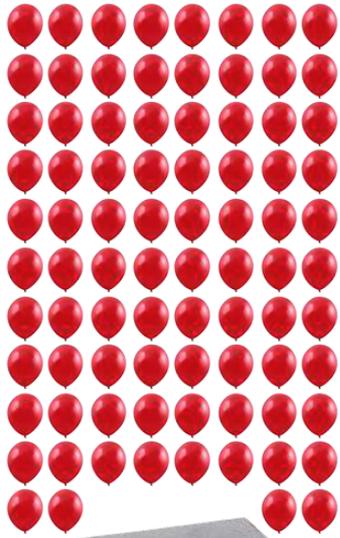
Stumbling blocks...

- Litigious society driving PII higher
- Last minute changes
- Blame Culture
- Lack of collaboration
- Lack of creative/lean thinking....
- Contingency on contingency....

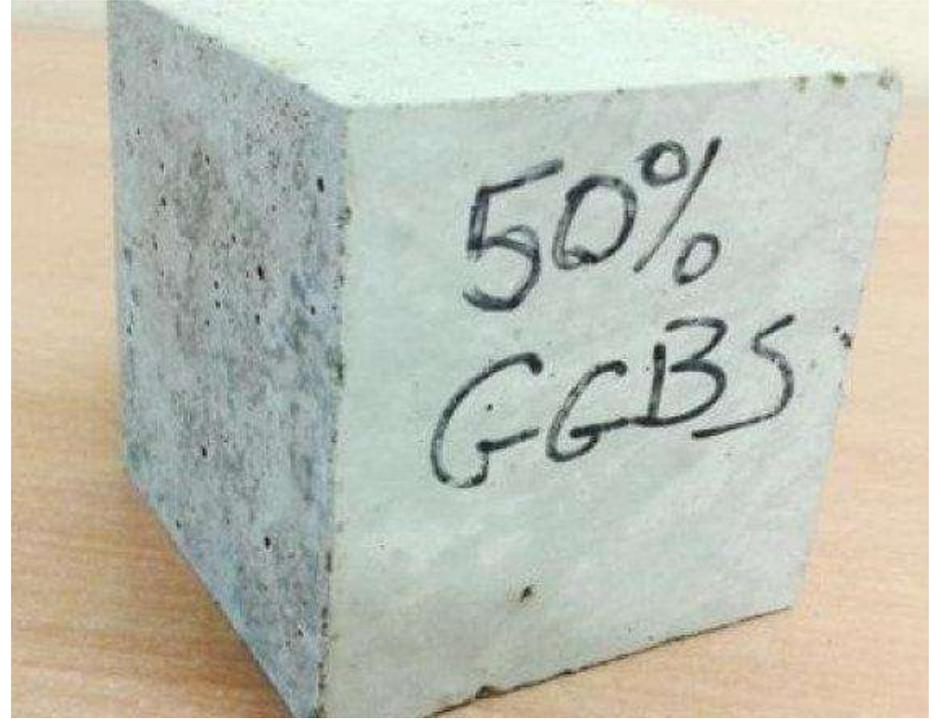


“Average member utilisations
barely reach 50%”

Source: MEICON, from Moynihan, M. and Allwood, J Utilization of structural steel in buildings Proc. R. Soc. A, 2014. 420(20140170)



Stumbling blocks to material replacements...



...Dictate to the supply chain by carbon reduction performance criteria

October 2019

BUILDING REGULATIONS

PART F- Conservation of fuel and power.

NEARLY ZERO-ENERGY BUILDINGS (NZEB) REQUIREMENTS FOR NEW PUBLIC BUILDINGS

BACKGROUND

Regulation 43B of the Building Regulations (Northern Ireland) 2012 (as amended) ("the Building Regulations") requires that where a building is newly erected, it must be a nearly zero-energy building. This regulation implements Article 9(1) of Directive 2010/31/EU on the Energy Performance of Buildings as applicable to Northern Ireland.

PURPOSE

The purpose of this note is to clarify the implementation of the requirements for nearly zero-energy buildings for new public buildings, with respect to regulation 43B as applicable to new buildings occupied and owned by public authorities from 1st January 2019.

REGULATION 43B

Regulation 43B states

- (1) Where a building is erected, it must be a nearly-zero energy building.
- (2) For the purposes of paragraph (1)—
 - (a) in respect of new buildings occupied and owned by public authorities, this regulation shall apply from 1st January 2019; and
 - (b) in respect of all new buildings, this regulation shall apply from 31st December 2020.

COMPLIANCE WITH REGULATION 43B

Meeting the existing Building Regulations guidance and relevant Government procurement policies would be an adequate way to demonstrate compliance with the nearly zero-energy buildings requirement.

The minimum level of energy performance necessary for compliance may be achieved by meeting the Target Emission Rate required under regulation 40. Those carrying out the work should also undertake an analysis of the technical, environmental and economic feasibility of using high efficiency alternative systems, which include decentralised energy supply systems based on energy from renewable sources, and take this into account as required by regulation 43A.

Where an assessment has been undertaken using BREEAM or an equivalent methodology, a demonstration that energy credits have been achieved can be used as further evidence that regulation 43B has been met.

Properties Division, Building Standards Branch
6th Floor Goodwood House
44 May Street, Belfast, BT1 4NN

Tighter Targets not Relaxed
Laws !!!

Include Carbon Benchmark
in Tender Scoring

Introduce Material Use
Carbon Benchmarking at
Design Stages

O&M / HANDOVER MANUALS / BIM

- Accurate As-Built Information
- Clear Design Philosophy / Material Specifications
- Clear Design Loads / Load Plans
- Clear Safety Factors & Utilisation Factors
- Clear Foundation Loading Information
- Clear Statement of Adaptability/Flexibility
- Clear Deconstruction Statements / Potential Recycling



2 tons



200 tons

REFERENCES

A EMBODIED CARBON CALCULATOR

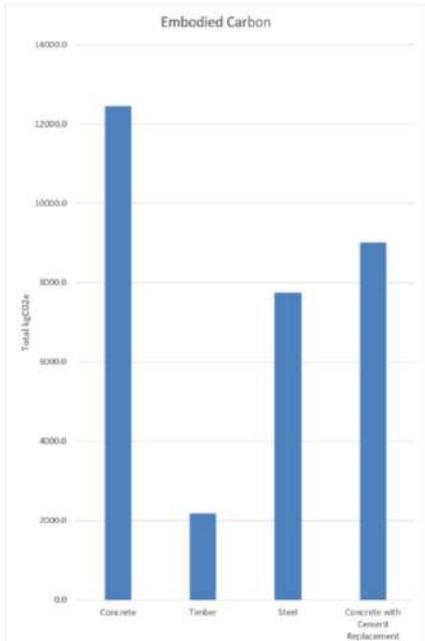
A.1 SUMMARY TABLE

Ref	Material	Amount of material	Embodied Carbon kgCO2e per stated amount	Total kgCO2e
Concrete	Concrete GEN 2 with CEM 1 cement	50.0 m3	248.8	12437.7
Total				12437.7
Timber	Timber (G1) 40% carbon storage	5000.0 kg	0.4	2186.7
Total				2186.7
Steel	Steel Section	5000.0 kg	1.6	7750.0
Total				7750.0
with Cement Repl	Concrete GEN 2 with 40% PFR cement	50.0 m3	180.3	9012.9
Total				9012.9

REFERENCES

A EMBODIED CARBON CALCULATOR

A.2 SUMMARY GRAPH



- Options Appraisal
- Present Comparatively
- Benchmark Design
- Measure 20% Savings

EMBODIED CARBON COMMUNICATOR

Concrete Frame Option

Project X, London, UK – Scheme Design Stage



Total Structural Embodied Carbon =

325,200
kgCO₂e/m²

*Calculated based on user selection below
*Benchmark for similar sized structure = 375,000 kgCO₂e/m²

0%

Reduction From Baseline Scheme



INTERACTIVE OPTIONS

The interface allows users to adjust various parameters to optimize embodied carbon. A vertical axis on the left shows the resulting embodied carbon in kgCO₂e/m², with a green line indicating the current value and a red line for the Provisional Design Baseline.

- COLUMN GRID:** Sliders for 32.1, 32.3, 32.5, 32.7, 32.9, 33.1, 33.3, 33.5.
- FLOOR DEPTH:** Sliders for 400mm, 450mm, 500mm, 550mm.
- CONCRETE GRADE:** Options for C25/30, C30/37, C35/45, C40/50.
- FLOOR SYSTEM:** Options for Cast-in-place, Precast concrete, Precast concrete with steel deck, Precast concrete with composite deck.
- COLUMN RISE:** Options for 1000mm, 1200mm, 1400mm, 1600mm.

The Design ID interface provides a comprehensive overview of the project's carbon footprint and performance. It includes sections for:

- Project Overview:** Client, Project Name, Location, and Design Stage.
- Project Embodied Carbon:** Total embodied carbon (X,000 kgCO₂e/m²) and a comparison to a benchmark (Y kgCO₂e/m²).
- Project Embodied Carbon Per Module:** A bar chart and pie chart showing carbon intensity for different module types.
- Module Embodied Carbon:** A bar chart showing the carbon footprint for each module type.
- SCORS (Structural Provisional Carbon Rating Scheme):** A performance chart showing the project's rating (A) against a target (A+).

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5. **Project Examples**

Client:
Architect:
Structural Engineer:

Weavers Court Business Court
Doherty Architects
Design ID





**Extensive Desk Study
Undertook Load Testing**

WEAVERS COURT, BELFAST





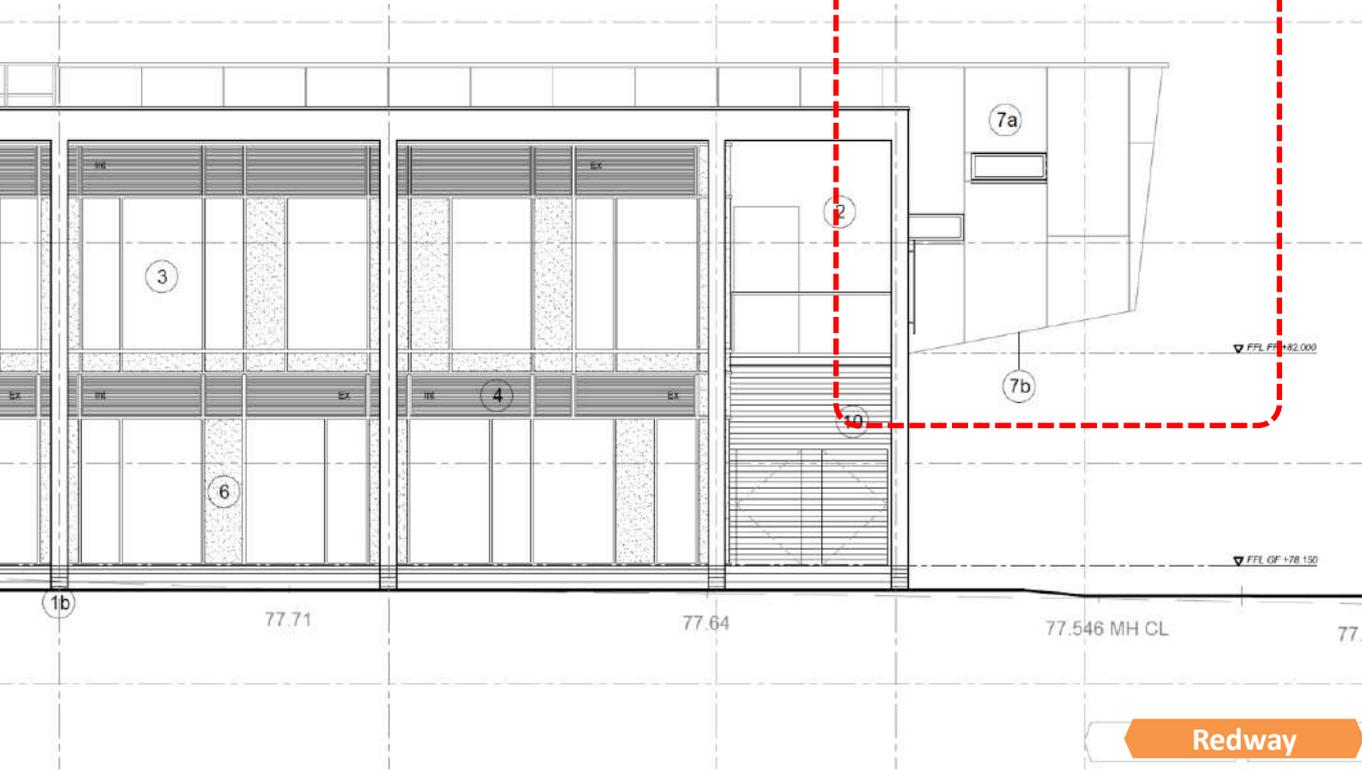
Weavers
Court



Client: University of Buckingham, NHS Trust
Architect: Feilden + Mawson
Structural Engineer: Design ID

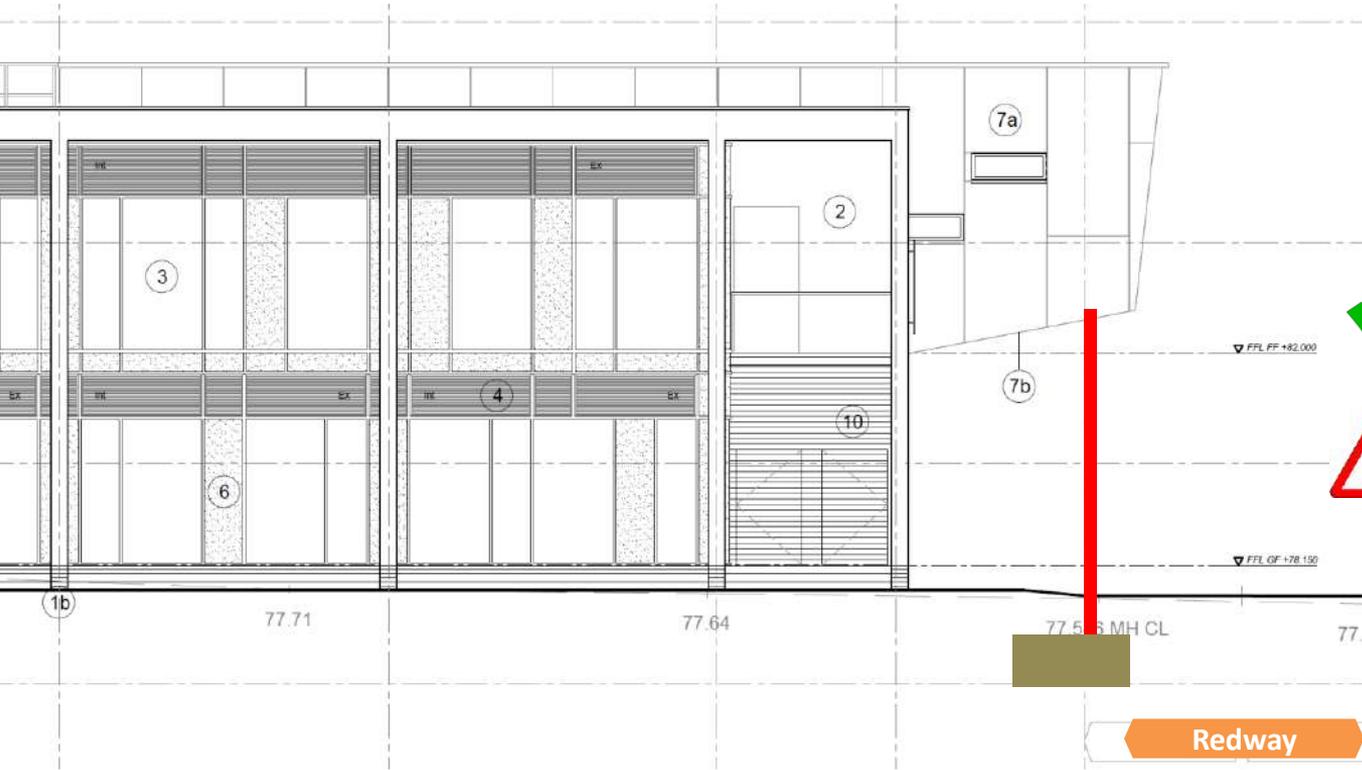


UNIVERSITY OF BUCKINGHAM



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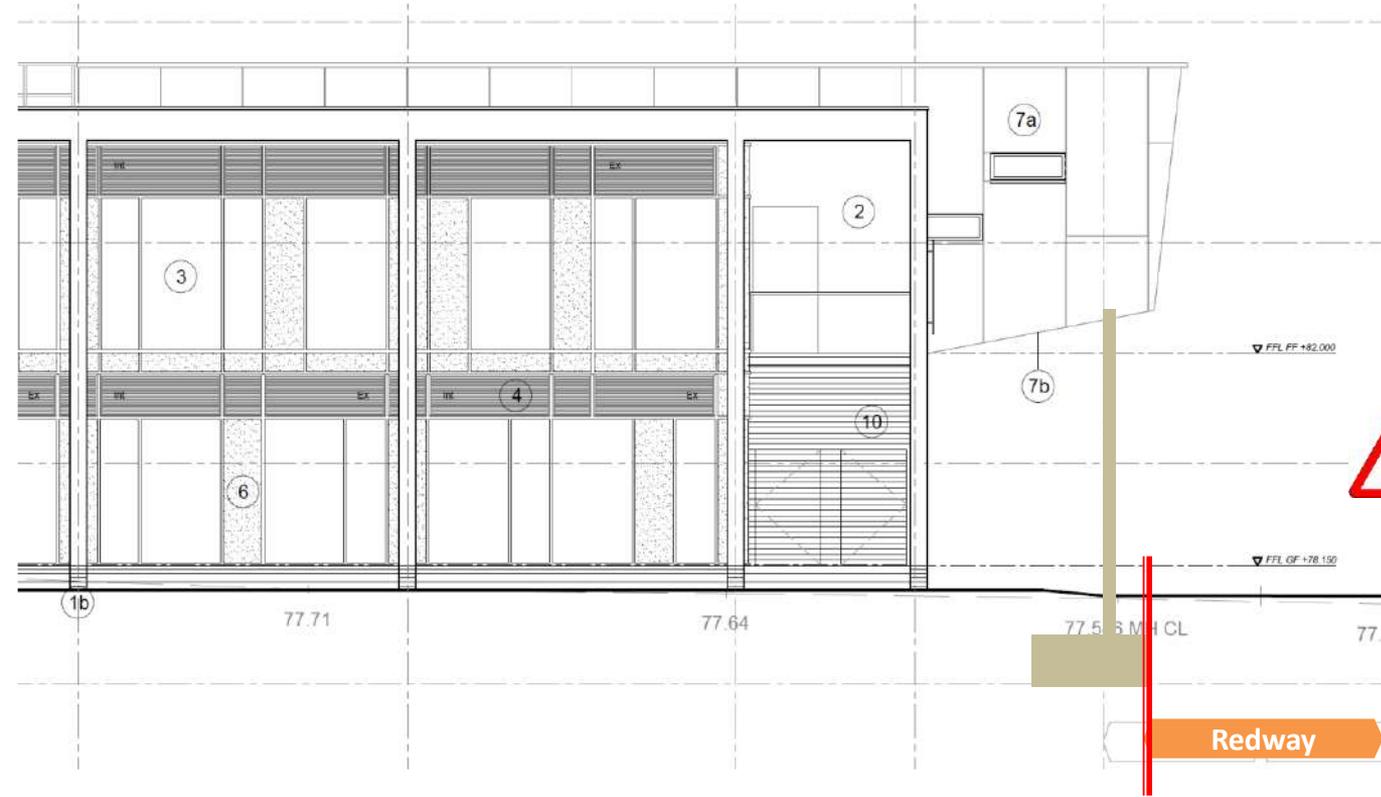




- Perceived Low Cost
- Perceived Ease of Construction



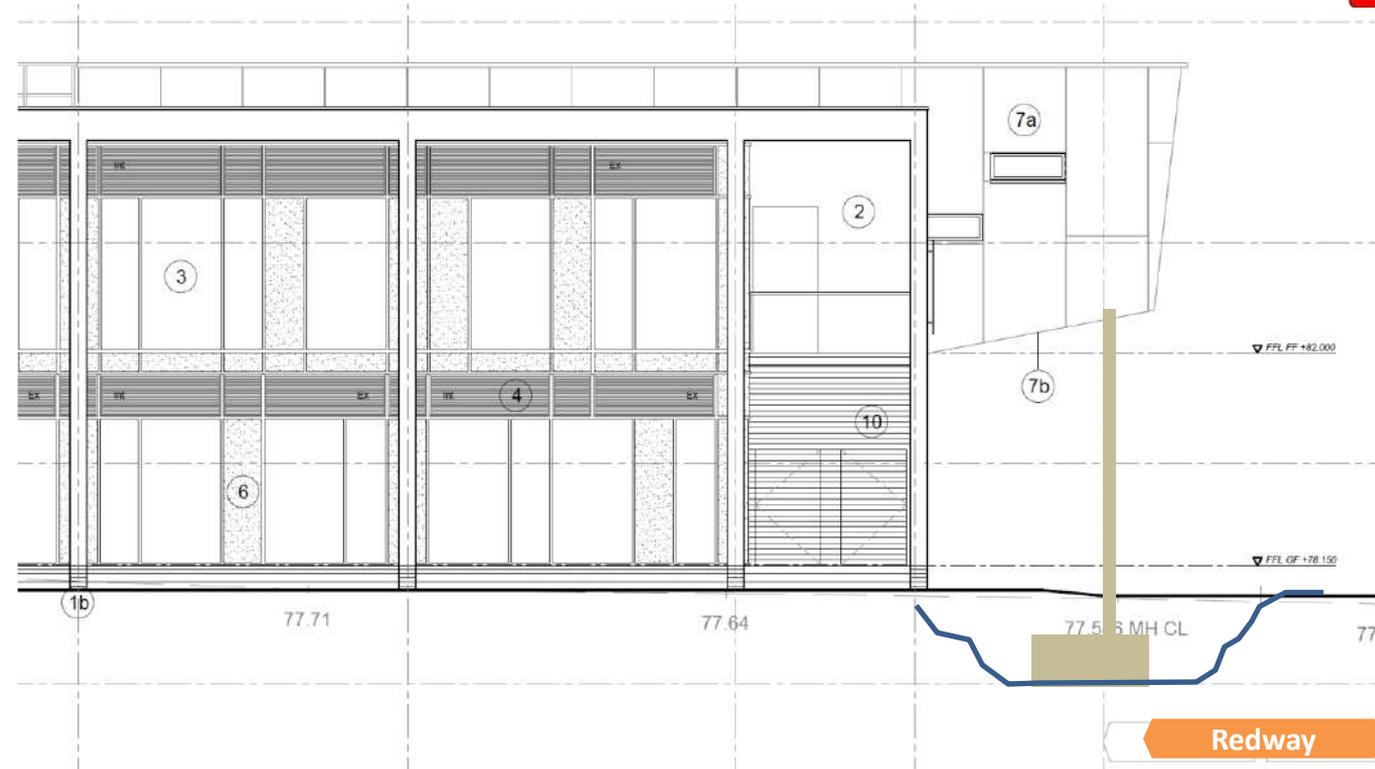
- Architectural Concept
- Environmental Considerations
- Buildability

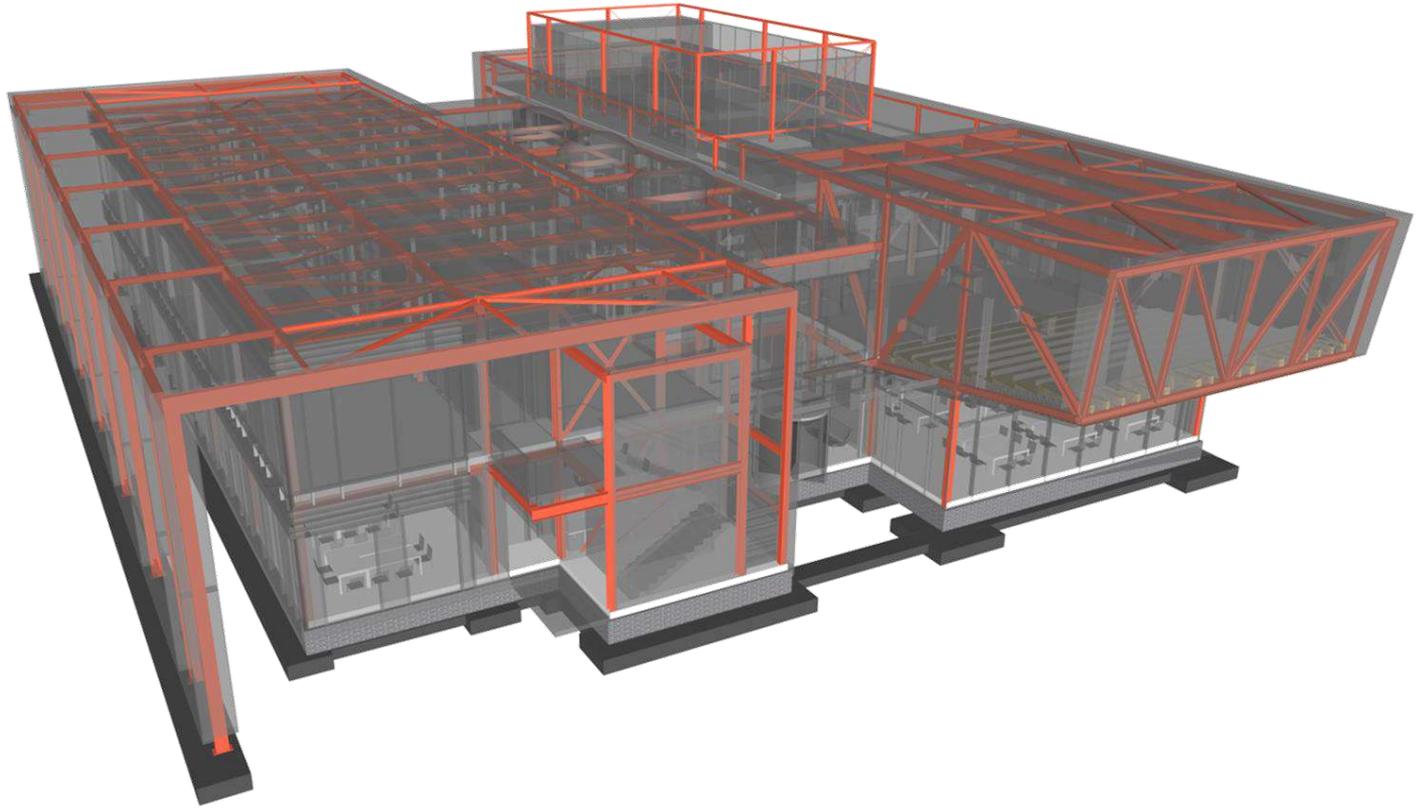


- More Foundations
- More Temporary Works
- More Material Use



- Close the Cycle Path
- Habit takes time – breaking habit could be permanent
- Increasing vehicles on main hospital arterial route







ice



UNIVERSITY OF BUCKINGHAM

Developer: Glenbrook
Funder: Moorfield
D&B Contractor: GRAHAM
Architect: Sheppard Robson
Structural Engineer: Design ID



CORNBROOK, MANCHESTER



By reducing slab thickness, we cut total concrete usage in the build by

291m³

The manufacture of 291m³ of concrete produces the same amount of CO² that a car would produce travelling the distance from

53 times



48 concrete trucks saved

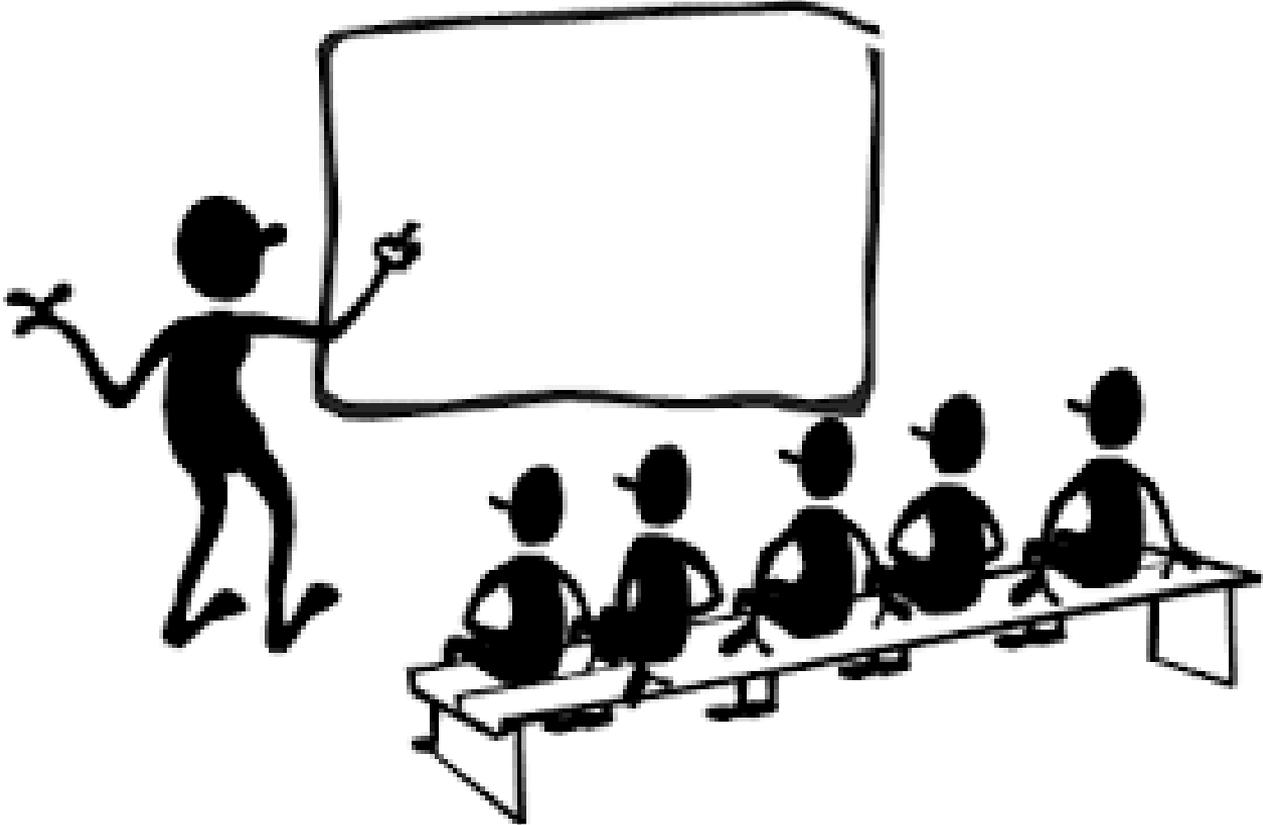


#DesignLean
#EngineersDeclare
#ThinkDesignEngineer

Raising Awareness – Getting Involved



Raising Awareness – Getting Involved



Thank You...
...Any Questions?



www.designid.co.uk



WWW.LEANCONSTRUCTIONIRELAND.IE



INFO@LEANCONSTRUCTIONIRELAND.IE

Should you wish to receive information on the benefits of becoming an LCI Corporate Member, please contact shauna@boxmedia.ie or call + 353 46 9773434



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