Buildability & Constructability For Sustainability – With Reference To The CIOB’s Carbon Action Plan 2050

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Introduction

Sustainability In Real-estate Project Development Produces High Performance Building That Reduces Carbon Emission Through Sustainable Site Selection, Conservation Of Energy Resources, While Improving Social & Economic Requirements

Delivering A “Green Building” Requires More Positive & Proactive Actions By All Parties Involved In The Entire Building Process With The Emphasis Of Balancing Amongst Environmental Protection & Sustainability, Social Wellbeing & Economic Development & Prosperity
Purposes & Objectives

1. Promoting The Carbon Action Plan 2050 As Part Of The Institute’s Effort To Achieve A Sustaining Future Worldwide
3. Promoting The Concept Of “Buildability” & “Constructability” To Complement & Facilitate The Implementation Of Carbon Action 2050
4. Highlighting The Potential Of “Buildability” & “Constructability” Assessment As Part Of The Contribution By The Production (Builders) Team For GBI Rating

Sustainability In Construction & Project Development

The CIOB In Its Publication Entitled “Sustainability & Construction” Highlights That,

- Construction, Maintenance & Use Of Buildings Impact Substantially On Our Environment & Is Currently Contributing Significantly To Irreversible Changes In The World’s Climate, Atmosphere & Ecosystem;
- Buildings Are By Far Amongst The Greatest Producers Of Harmful Gases Such As CO₂;
- What 'Sustainability' Means Is Adapting The Ways We All Live & Work Towards "... Meeting Needs, While Minimising The Impacts Of Consumption, Providing For People Of Today & Not Endangering The Generations Of Tomorrow... ."
Sustainability In Construction & Project Development

- Buildings & Structures Enable Mankind To Satisfy
  - Social Needs For Shelter,
  - Economic Needs For Investment &
  - Personal Or Corporate Objectives

Sustainability In Construction & Project Development

- Satisfaction Of These Needs Usually Comes With A High Price – An Irreversible Damage To Our Environment That In Turn Is Affecting The Wellbeing Of Human Habitat
- This Consequently Has Led To A Growing Realisation Around The World To Alter Or Improve Our Conventional Way Of Construction & Project Development Into A More Responsible Approach To Satisfy Our Needs For Development Without Harming The World We Live In
Sustainability In Construction & Project Development

Many Efforts Are Being Directed To Build Sustainably In Construction & The Built Environment

Sustainability Means "Meeting The Needs Of The Present Without Compromising The Ability Of Future Generations To Meet Theirs"

While Sustainability Is About The Future Of Our Society For Today’s Industries & Businesses, It Is Also About Commercial Success

The Mandate To Transform Businesses To Respect Environmental Limits While Fulfilling Social Wants & Needs Has Become An Unparalleled Platform For Innovation On Strategy, Design, Operation, Production & Brand To Benchmark & Compete Or Adapt To The Rapidly Evolving World
Sustainability In Construction & Project Development


Activities Of Construction Industry Must Work & Comply With The Needs To Protect & Sustain The Environment.
The Paradigm Shift

Past
- Environmental Protection
- Construction Development

Present
- Environmental Protection
- Construction Development

The Three Pillars Of Sustainability

A Representation Of Sustainability Shows How Both Economy & Society Are Constrained By Environmental Limits
The Global Construction Industry Context

- The industry uses 32% of the world’s resources in construction
- It generates up to 30% of global greenhouse gas emissions*
- Buildings are responsible for 40% of global energy use
  - 60% of electricity consumption
  - 20% of water consumption
  - 25% of timber consumption

Source: Tackling Global Climate Change – Meeting Local Priorities: A World Green Building Council Special Report, September 2010
The Global Construction Industry Context

Globally, the built environment generates 30% of total greenhouse gas emissions. Construction uses 32% of the world's natural resources.

The UK Construction Industry Context

In the UK, CO₂ emissions relating to the built environment = 45% of the total or 246 million tonnes. This is the single largest contributor to CO₂ emissions and is broken down as:

- 27% from domestic buildings
- 18% from non-domestic buildings
Reducing Carbon In The Built Environment

In May 2010, CIOB Formed The National Specialist Group The Overall Aim Of Reducing Carbon Emission In The Built Environment & Meeting Regulatory Targets Through Innovation & Best Practices In
- Project Design,
- Construction,
- Operation & Maintenance,
- Retrofit & Reuse,
- Waste Management

It Also Recognises That Skills Are Needed To Achieve This & The Vital Requirement To Measure, Manage & Change Environmental Practices Through Effective Leadership

Reducing Carbon In The Built Environment

The CIOB Carbon Action 2050 Toolkit Is An Action Plan Of Simple & Practical Steps That Can Be Taken By The Institute, Its Members & The Wider Construction Industry To Reduce Carbon Emissions From The Built Environment Anywhere In The World
The Carbon Action 2050

One Of The Ways That We Can Be Most Effective For The Public Good Is In The Role The Construction Industry Plays In The Struggle Against Climate Change. It Takes One Third Of The World's Resources To Build Our Homes, Offices & Factories, & The Energy To Run Them Is Responsible For 40% Of Its Greenhouse Gases. The Industry Can Reduce Both These Figures If We Follow Best Practice When We Design & Construct Projects & Clients & Facilities Managers Operate The Finished Building More Efficiently.

The Carbon Action 2050

Carbon Action 2050

Design

- Design For Earlier Connection To The Long-term Energy Source
- Enforce Better Inspection Of Air Conditioning Systems
- Initiate A Comprehensive Retrofit Programme For Residential & Commercial Buildings
- Move To Lifecycle Assessments Of Building Energy Use & Emissions
- Strengthen The Requirements For The Building Regulations
- Strongly Enforce The Building Regulations
Construction

- Adopt Best Practice Energy Use In Corporate Offices
- Adopt Best-practice Energy Management On Site
- Adopt Fuel-efficient Freight Driving & Renewable Transport Fuels
- Connect To The Long-term Energy Source Earlier
- Encourage Subcontractors & The Supply Chain To Reduce Their Own Carbon Footprint
- Promote Greener Business Travel
- Use Energy-efficient Plant, Efficiently
- Use Energy-efficient Site Accommodation

Operation & Maintenance

- Begin A Phased Introduction To Extend Annual Display Energy Certificates (DECS) To All Non-domestic Buildings
- Buildings Should Have A Regularly Updated Operations & Maintenance Manual
- By 2016, Buildings Should Have Insulation Meeting Current Building Regulations Where Feasible
- Introduce A Non-domestic “Code For Sustainable Homes”
- Introduce Smart Metering Technology Within All Buildings
- Provide Training & Skills For All Building Trade Professionals To A Recognised Standard
- Strengthen The Requirements Of The Building Regulations
Retrofit & Re-use

- Create A Knowledge Hub For Retrofit
- Develop A Comprehensive Strategy For The Refurbishment & Retrofit Of The Uk’s Existing Building Stock
- Develop An Education & Skills Programme
- Incentivise Owners/ Occupiers To Improve The Energy Efficiency Of Their Buildings
- Increase The Use & Effectiveness Of Building Performance Tools
- Provide Design Guidance For Refurbishment & Retrofit Works As Part Of Building Regulations

Waste

- Co-ordinate Projects To Allow Surplus Material From One To Be Used On Another
- Continue To Produce Effective Site Waste Management Plans
- Design Out Waste At The Earliest Opportunity
- Enable Early Contractor Involvement In Pre-construction Phase
- Minimise The Waste That Cannot Be Designed Out
**Skills & Education**

- All Courses Should Involve Site-based Experience For The Learner
- Facilitate, Via Accreditation, Greater Interaction Between Academia & The Industry
- Secure Recognition Of The Strategic Value Of Construction Management
- Up-skill Existing Workforce, Including At Trade Level
- Work With Schools & Colleges To Attract More Young People Into The Industry

**Leadership**

- Agree A Structure Of Work With The Government To Redefine Construction & Track Legislation
- Agree Ciob Policy For Common, Ranked, Comparable Reporting
- Develop A Carbon Index
- Enforce Carbon Emission Performance Standards For Coal-fired Power Stations
- Provide Strategic Direction & Share Best Practice
- Standardise The Data, Reporting & Metrics For Carbon Emissions, Greenhouse Gases & Energy
- Undertake CpD Relating To Carbon Reduction
CIOB Action Plan

- Decrease Carbon Emissions In Our Travel By 10% By 2014
- Decrease The Energy Consumed In Our Buildings By 5% By 2013
- Develop A Comprehensive Carbon Management Strategy
- Encourage CIOB Members To Achieve GRI/ GBI Or A Similar Accreditation
- Influence CIOB Accredited Education Programmes & CIOB Awarded Qualifications
- Promote Carbon Action 2050 To Key Stakeholders
- Undertake An Audit Of CIOB Buildings

Design Efficiency & Its Impact On Overall Project Performance & Human Habitat

Buildability & Constructability For Sustainability

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Design Process – Concept & Consideration

- Design is a creative activity by which client’s needs & objectives are collected, interpreted & expressed in three-dimensional physical solutions.
- Design is used not only as a tool to achieve user requirements & fitness for purpose but also to achieve aesthetically pleasing & sustainable solutions for society as a whole.
- Design quality is a critical success factor for projects & requires a balance to be struck between functionality, aesthetic, impact (social, economic & environmental), built quality & value for money.

Design Efficiency – Sustainability & Value for Money

- Clients have the responsibility for commissioning buildings of good design quality at affordable & reasonable cost.
- Good quality buildings have great impact on public behaviour on society as a whole & on the perception of public space & infrastructure.
- General considerations applicable to most projects:
  - Space efficiency;
  - Positive environmental impact;
  - Secure & safe facilities;
  - Energy efficiency;
  - Universal accessibility; &
  - Future-proof design.
Design Efficiency – Sustainability & Value For Money

- **Design Is Essential To Carbon Reduction & Sustainability**
- Adding Value & Reducing Project Life Cycle Cost By Producing Facilities That Are Easy & Cost Effective To Manage, Clean & Maintain To Reduce Carbon Emissions, Reduce Energy & Save Money
- Creating A Flexible, Durable, Sustainable & Ecologically Sound Environment For The Community
- Minimising Pollution, Waste Of Materials & Use Of Energy Both In Construction & In Use

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Design Efficiency – Sustainability & Value For Money

- **Benefit Of Design Efficiency**
- Apart From Its Aesthetic Appeal, Good Design Will Also Consist Of A Number Of Other Qualities
- Contributing To A Construction Process That Is Efficient & Safe;
- Making A Positive Addition To The Project’s Location, Environment & Community By Creating An Attractive & Healthy Environment For Users;
Design Efficiency – Sustainability & Value For Money

Projects Completed With Least Design Changes Are Known To Give Satisfaction To All Parties Of Project – The Client, The Project Consults & The Production Team

The Use Of Expert Construction Knowledge From The Outset To Integrate The Efficient Construction Methodology Into The Design Process Provides Enormous Benefits & Advantages To Achieve The Design Intent In A Cost Effective & Timely Manner

Design Efficiency – Sustainability & Value For Money

Buildings Constructed With The Least Variation To Design Are Known To Give Satisfaction To All The Major Parties Of A Building Project - Client, Design Team & Construction Team

In Situation Where Problems Occurred During Construction When Buildings Or Facilities Could Not Be Built As Designed Or Could Not Be Constructed Efficiently, Particularly In Traditional Contracting System Where The Design & Construction Processes Are Conventionally Separated & Operated Under Different Entity
Design Efficiency – Sustainability & Value For Money

It is believed that the use of experienced construction knowledge from the outset to integrate the method of construction into the design process, provides benefits & solutions to achieve the design intent in a cost-effective & timely manner.

In the construction process, it is used to drive out waste & enhance cost & program certainty through proper project planning & construction logistics, using modern construction techniques that in turn enhance productivity & sustainability.

“Buildability” & “Constructability” are able to overcome these problems in the building process.

Studies have shown that improved buildability & constructability have led to significant improvement in production efficiency & saving in both cost & time required for project completion – production efficiency means less carbon emission – better sustainability.

Buildability & Constructability For Sustainability

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Buildability In Construction

Buildability is a preconstruction exercise that looks at a design from the perspective of those that will manufacture, install components, and carry out the construction works. This should not be confused with value engineering though some processes are common to both activities — “value for money.” Buildability evaluates the effect of design elements to its desired final quality, meeting schedule requirements, avoiding risk & uncertainties while achieving optimum value for money.

Constructability In Construction

Constructability differs from buildability in terms of its much wider boundary. Buildability is design-oriented while constructability is concerned with the whole project process. The construction task force of the construction industry institute (CII) defines constructability as “the optimum use of construction knowledge & experience in planning, design, procurement, & field operations to achieve overall project objectives.”
Constructability In Construction

- Between The Two Concepts Except That Buildability Is Usually Used In The U.K. & Constructability Is Often Used In The U.S.
- Both Concepts Are Generally Are Used Interchangeably In Most Situations & Both Have Been Extensively Developed & Applied In Various Countries Such As The USA, UK & Later In Australia

Buildability & Constructability For Sustainability

- “Buildability”, Is Known In U.K. As An Extent To Which “Design Of A Building Facilitates The Ease Of Construction Subject To The Overall Requirements For The Completed Building”
- In The U.S., It Is Known As “Constructability” That Considers “The Optimum Use Of Construction Knowledge & Experience In Planning, Engineering, Procurement & Field Operations To Achieve Overall Project Objectives”
**Buildability & Constructability Defined**

Several Researchers & Organisations Have Offered Definitions Of Buildability But The Widely Accepted Definition Is That Of The Construction Industry Research & Information Association (CIRIA) That Quite Explicitly States That

'BUILDABILITY IS THE EXTENT TO WHICH THE DESIGN OF A BUILDING FACILITATES EASE OF CONSTRUCTION, SUBJECT TO THE OVERALL REQUIREMENTS FOR THE COMPLETED BUILDING'

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**Buildability & Constructability Defined**

- The CII (Construction Industry Institute) At The University Of Texas Refers To Buildability As

  'THE OPTIMUM INTEGRATION OF CONSTRUCTION KNOWLEDGE & EXPERIENCE .... TO ACHIEVE OVERALL PROJECT OBJECTIVES'

- The CII At The University Of South Australia Defines Buildability As

  'A SYSTEM FOR ACHIEVING OPTIMUM INTEGRATION OF CONSTRUCTION KNOWLEDGE IN THE BUILDING PROCESS ... TO ACHIEVE MAXIMISATION OF PROJECT GOALS'
Buildability & Constructability Defined

**Other Definitions Refer To**

“Building Efficiently... To Agreed Quality Levels”

The Extent To Which Decisions
“Facilitate The Ease Of Construction & The Quality Of The Completed Project”

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Buildability & Constructability Defined

The Construction Industry Institute In Australia (CIIA) Defines Constructability As

“A System For Achieving Optimum Integration Of Construction Knowledge In The Building Process And Balancing The Various Project And Environmental Constraints To Achieve Maximisation Of Project Goals And Building Performance”
Buildability & Constructability Defined

Or More Specifically

“An Important Feature Of A Structural Design And The Construction Project Site Conditions, Which Determines The Level Of Complexity Of Executing The Associated Structural Assembly Tasks”
Carbon Action 2050

Applicable Tools & Practices For Buildability & Constructability

- Legislation & Statutory Regulations
- Project Life Cycle Cost Analysis
- Knowledge Management & Building Information Modelling
- Value Engineering & Management
- Early Contractor Involvement
- Construction Project Management Plan
- Site Waste Management Plan
- Lean Construction
- Poke Yuka
- Kalzen & Total Quality Management
- Just-In-time Supply Chain Management & Industrialised Building System
- 5-S/ 8-S Project Housekeeping
Buildability & Constructability For Sustainability – What Can Be Measured, Can Be Managed

Thank You