भारतीय प्रौद्योगिकी संस्थान तिरुपति

IIT TIRUPATI

ILCE | INSTITUTE FOR LEAN CONSTRUCTION EXCELLENCE

ILCC 2025

Driving Transformative Change: Lean Construction for Sustainable and Digitalized Project Delivery in India

8th INDIAN LEAN CONSTRUCTION CONFERENCE

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CAMPUS MAP


Visitor Hostel (Guest House)
North Mess
Des Hostel
Malhar Hostel
Lecture Hall Complex (LHC)
South Mess
OAT
Sahana Hostel
Main Gate
SITE FOR RESEARCH PARK
60 Feet Road

Message from Prof. K.N. Satyanarayana, Director, Indian Institute of Technology Tirupati; Academic Patron, ILCC2025

Dear Colleagues, Delegates, and Distinguished Guests,

It is a great honour to welcome you to the 8th Indian Lean Construction Conference (ILCC 2025) at IIT Tirupati. This year's conference, focused on the theme "Driving Transformative Change: Lean Construction for Sustainable and Digitized Project Delivery in India," addresses a critical imperative for our nation – transforming how we conceive, deliver, and sustain infrastructure for a rapidly growing and developing economy.

As India pursues ambitious infrastructure goals amid increasing pressures for sustainability and resource efficiency, the role of Lean Construction has never been more vital. Lean Construction, combined with digital innovation – including Artificial Intelligence, Advanced Analytics, and Automation – empowers us to enhance productivity, minimize resource waste, optimize project delivery timelines, and create infrastructure that serves communities with greater resilience and environmental stewardship.

The theme of this conference speaks to the shared responsibility within our academic, industrial, and government sectors to innovate and build systems that deliver lasting value. By embracing Lean methodologies and digital transformation, we can strengthen our project delivery ecosystems, foster collaboration across the construction value chain, and establish India as a global leader in sustainable, efficient infrastructure development.

IIT Tirupati is honored to host this vibrant gathering of experts from academia, industry, and government. Throughout ILCC 2025, I encourage each of you to engage in deep, meaningful discussions, exchange cutting-edge research and real-world insights, and forge partnerships that will catalyze transformative change in our construction sector. Your collective wisdom and commitment will shape the future of project delivery across India.

Together, let us harness the power of Lean thinking and digital innovation to build smarter, more sustainable infrastructure that strengthens our communities and secures prosperity for generations to come.

Thank you for joining us on this transformative journey. I look forward to the insightful exchanges, collaborative outcomes, and actionable strategies that will emerge from this gathering.

Message from Mr. Anup Mathew, Chairman ILCE & Senior Vice-President & Business Head, Godrej Construction; Industry Patron, ILCC 2025

Opening Statement

"Construction is not merely about building structures; it is about shaping economies, enabling communities, and defining the future of nations." Today, this sector stands as one of the world's largest employers, engaging nearly 7% of the global workforce and contributing significantly to global economic output. The scale of opportunity ahead is extraordinary. Global construction spending is projected to rise from $16 trillion in 2025 to nearly $36 trillion by 2034, driven by urbanization, infrastructure renewal, and sustainability imperatives. This growth will demand innovation, collaboration, and resilience from all of us. (Sources: McKinsey; Global Growth Insights; WifiTalents)

Preface: Construction and Real Estate Industry – Current and Future Perspectives

The global construction and real estate industry is undergoing a period of significant transformation. This change is being driven by structural shifts, rapid technological advancements, and growing sustainability imperatives. According to McKinsey, the industry is currently valued at over $13 trillion, and global construction spending is expected to reach $22 trillion by 2040. This growth will be fueled by urbanization, modernization of infrastructure, and the urgent need to meet decarbonization targets. Real estate continues to be the world's largest asset class, but it is facing significant changes as digitalization, demographic shifts, and hybrid work models redefine how spaces are designed, built, and used. The World Economic Forum emphasizes four guiding principles for future urban development—liveability, sustainability, resilience, and affordability—which highlight the sector's critical role in addressing climate change, public health, and social equity.

Opportunities Ahead

The industry offers immense opportunities for innovation and growth. New asset classes such as data centers, logistics hubs, and green buildings are gaining

prominence, while adaptive reuse of underutilized commercial spaces is creating fresh possibilities. Infrastructure investment needs are enormous—estimated at $106 trillion by 2040—which will foster collaboration between real estate and infrastructure players. Employment prospects remain strong, with millions of skilled workers required globally to meet demand. At the same time, automation and AI are reshaping roles and improving efficiency. Technologies such as AI-driven project management, modular construction, and robotics promise to deliver significant improvements in productivity and safety, addressing decades of stagnation in construction efficiency.

Challenges to Overcome

Despite these opportunities, the industry faces serious challenges. Persistent labour shortages, rising input costs, and regulatory complexity continue to strain margins. Climate risks and geopolitical uncertainties add further complications, while slow adoption of digital tools threatens competitiveness. Sustainability mandates—such as net-zero targets, circular economy practices, and energy efficiency standards—are no longer optional; they are essential for long-term success. Real estate markets are also undergoing structural changes: hybrid work is expected to reduce office space demand by up to 20% by 2030, while retail and hospitality sectors struggle to adapt to changing consumer behaviours.

About Lean Construction

Adopting Lean principles and tools offers the construction industry a powerful pathway to improve operational efficiency, strengthen collaboration across the value chain, and consistently deliver projects on time and within budget. Beyond project-level benefits, Lean adoption enhances overall business performance; creating a culture of continuous improvement and customer-centric delivery. Globally, Lean Construction remains in its early stages compared to Lean Manufacturing, which has transformed industries for decades. Where Lean has been implemented effectively, organizations have achieved significant reductions in time and cost, driven by better resource utilization and elimination of waste. In India, the opportunity is even greater. Most construction sites still present readily achievable improvements, yet many EPC contractors and real estate developers remain either unaware of Lean principles or have not adopted them meaningfully. This gap results in significant inefficiencies and delays, impacting national infrastructure goals and eroding stakeholder confidence. The case for Lean is clear; effective deployment can unlock substantial cost and time savings, improve quality, and enhance predictability. It is not just a set of tools; it is a mindset shift that prioritizes value creation, collaboration, and respect for resources. For an industry under pressure to deliver more with less; Lean is not optional; it is essential.

About ILCE

ILCE is a non-profit organisation formed by a group of reputed like-minded organisations from the Indian Construction and Real Estate sector. The ILCE Board consists of leaders from these organisations, and IIT Madras, who is the knowledge partner. ILCE's Purpose is to help create value for the Construction Industry by enabling its stakeholders to become aware of Lean Principles, develop and internalise Lean Concepts on their projects, and to eventually develop a Lean Culture within their organisations.

The Way Forward

The true success of Lean implementation lies not in isolated tools or techniques, but in a deep cultural transformation across all stakeholders. Lean is fundamentally about people and mindset; creating an environment where collaboration, respect for resources, and continuous improvement become second nature. Such change strengthens team spirit and drives organizational excellence. However, cultural transformation does not happen by chance. It requires unwavering commitment from top leadership, supported by structured initiatives that embed Lean thinking into every function and process. When leadership champions this change, it signals a clear message; Lean is not an option; it is a strategic imperative.

This year's ILCC theme- "Driving Transformative Change: Lean Construction for Sustainable and Digitized Project Delivery in India"- captures the essence of what lies ahead. The industry must move beyond incremental improvements to embrace systemic change, integrating Lean principles with digital technologies and sustainability goals. Digital tools such as BIM, collaborative planning systems, and real-time dashboards can accelerate Lean adoption, while sustainability practices ensure that growth aligns with global climate commitments. A focused approach to cultural transformation, supported by technology and sustainability, will help overcome barriers that have long hindered progress. The reward is significant; predictable project delivery, reduced waste, improved profitability, and a resilient construction ecosystem that serves both business and society.

Indian Lean Construction Conference 2025 (ILCC 2025)

presents

"8th ILCC 2025 – Driving Transformative Change: Lean Construction for Sustainable and Digitized Project Delivery in India"

November 30 – December 3, 2025

Academic Patron: Prof. K.N. Satyanarayana, Director, Indian Institute of Technology Tirupati

Industry Patron: Mr. Anup Mathew, Chairman of the Board of Directors of the Institute for Lean Construction Excellence, Senior Vice President & Business Head – Godrej Construction

National Conference Organizing Committee

1. Prof. Suresh Jain, Professor and HoD, Dept. of Civil and Environmental Engineering, IIT Tirupati, Conference Chair
2. Prof. Koshy Varghese, Director ILCE & Professor IIT Madras
3. Prof. Venkata Santosh Kumar Delhi, Construction Technology and Management, IIT Bombay
4. Prof. Albert Thomas, Construction Technology and Management, IIT Bombay
5. Mr. Kalyan Vaidyanathan, CTO - Construction, Tvasta
6. Dr. Ganesh Devkar, Sr Associate Professor, CEPT University
7. Dr. Laishram Boeing Singh, Professor, IIT Guwahati
8. Dr. Parul Patel, Professor, Nirma University
9. Mr. Kaezad Karanjawala, Secretary General, ILCE; Vice President - Godrej Construction.
10. Dr. Marimuthu K, Technical Secretary, ILCE
11. Board of Directors, Institute for Lean Construction Excellence

Local Conference Organizing Committee

1. Prof. Suresh Jain, Professor and HoD, Dept. of Civil and Environmental Engineering, IIT Tirupati, Conference Chair
2. Dr. Prasanna Kumar Behera, Assistant Professor, Dept. of Civil and Environmental Engineering, IIT Tirupati, Local Organising Committee Chair
3. Dr. A. V. Rahul, Assistant Professor, Dept. of Civil and Environmental Engineering, IIT Tirupati, Local Organising Committee Co-Chair
4. Dr. Santhosh Loganathan, Assistant Professor, Dept. of Civil Engineering, NIT Trichy, Technical Committee Lead - Academia
5. Dr. Marimuthu K, Technical Secretary, ILCE, Technical Committee Lead – Industry
6. Mr. Sreekanth Ramachandran, IIT Tirupati

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Dr. Albert Thomas, Associate Professor, IIT Bombay

Dr. Anandh K S, Assistant Professor, SRM IST

Dr. Ann Francis, Assistant Professor, IIT Delhi

Dr. Aritra Halder, Assistant Professor, NICMAR University

Dr. Aritra Pal, Assistant Professor, IIT Madras

Dr. BB Das, Professor, NIT Karnataka

Dr. Debopam Roy, Faculty, L&T Institute of Project Management

Dr. Dilip Patel, Professor, SVNIT Surat

Dr. Ganesh Devkar, Sr Associate Professor, CEPT University

Dr. Gangadhar Mahesh, Professor, NIT Karnataka, Surathkal

Dr. Guru Raju Pokkunuri, Afcons Infrastructure Ltd

Dr. Jeevan Jacob, Adjunct Faculty Member, APJ Abdul Kalam Technological University (KTU)

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Dr. Murali Jagannathan, Assistant Professor, IIT Madras

Dr. Nikhil Bugalia, Assistant Professor, IIT Madras

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Dr. Venkata Santosh Kumar Delhi, Associate Professor, IIT Bombay

Dr. Venkatesan R, Professor, NICMAR University, Hyderabad

Dr. Vidya Khanapure, Assistant Professor, NICMAR University, Pune

Dr. Vijayeta Malla, Luster National, USA

Dr. Vishal Singh, Associate Professor, IISc

Mr. Jitendra Bhatt, Godrej Construction

Mr. Kalyan Vaidyanathan, CTO, Tvasta

Mr. Thirumalai Rajan, IIT Madras

Mr Tony Jacob, Constask Management Solutions LLP

Mr. Vinay Mathews, Assistant Professor, Carmel College of Engineering and Technology

Ms. Ragavi Prabaharan, URC Construction

With Best Compliments from

the Chairman of Board of Directors, and Directors

of

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(Godrej Construction)

Mr. Akhil Gupta
(Shapoorji Pallonji)

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(Shapoorji Pallonji)

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Mr. Ashutosh Kapoor
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(IIT Madras)

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Secretary General, ILCE

Dr Marimuthu K

Technical Secretary, ILCE

Mr Sankara Vinayagam T

Technical Assistant, ILCE

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Mr. Aritra Roy, Shapoorji Pallonji

Mr. Nilabha Dey, KPMG India

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Ms. Aruna Sandeep, L&T

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Mr. Jayadatta Lad, Afcons

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Ms. Ragavi Prabaharan, URC Construction

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Slomo Anna Daniel, NIT Trichy

Vidya V. Nath, NIT Trichy

Yeddula Ashritha Reddy, NIT Trichy

About the Institute for Lean Construction Excellence (ILCE)

Institute for Lean Construction Excellence (ILCE) is a not-for-profit company established in November 2008 and registered u/s 12AA of the Income Tax Act, 1961, which exists to facilitate the creation of a world-class Indian construction sector and to establish new global benchmarks in the performance of construction projects. It is also the premier Institute in India for Lean Construction, its propagation and application and hence providing a neutral networking platform to all the construction sector stakeholders and academic professionals to discuss, develop & experiment with new ideas.

Lean Construction is an emerging Project Management paradigm derived from the successful practices of Lean Manufacturing developed by Toyota Motors in the 1940s. Lean Construction developed around 1990 and has now become quite popular all over the world. It came to India in 2008 when ILCE (Institute for Lean Construction Excellence) was formed.

ILCE was founded with the help of Mr P. Sampath, who held the Director General position and was instrumental in driving the Lean Philosophy in India. The first company that helped create ILCE was Shapoorji Pallonji under the leadership of Mr Cyrus Mistry, followed by like-minded organisations such as L&T, Tata, Godrej and the other founder companies Afcons, URC, Arcop, KPMG with knowledge partner IIT Madras.

The Role of ILCE

In India, ILCE has taken up the mantle of Lean Construction Management and has been engaged in several ways to popularise the same. ILCE has organised several major Lean Construction Management Conferences, including international events, many webinars and workshops, site-based training programmes, etc., to help construction companies and professionals gain knowledge on Lean concepts and practices. ILCE engages with several international thought leaders in Lean Construction Management and constantly endeavours to enhance the deployment of Lean practices in the country. The ILCE Charter Member organisations lead by setting examples in Lean Construction Management. Several leading technology institutions led by IIT Madras, NICMAR, and CEPT teach graduate and post-graduate levels of Construction Management incorporating Lean Construction Management.

ILCE Developments

Since 2008, ILCE has organised seminars, workshops, and webinars in the country, featuring expert international speakers such as Dr. Lauri Koskela, Gregg

Howell, Dr Glenn Ballard, Dr Iris Tommelein, Dr Tariq Abdelhamid, Alan Mossman and many others.

Lean Construction has also become a part of the curriculum in many leading Project Management institutes in India and worldwide. In 2013, a Lean Training Program was arranged for coaching and training teams from all founding companies and member organisations. IIT-Madras designed the Lean Modules and selected eight pilot projects for the Lean implementation program. The basic Lean philosophy of partnering and collaboration was driven among the project teams and vendors to improve flow and create trust and transparency. At the end of this training, there was a Lean Competition conducted at IIT Madras wherein each of the 8 companies presented their Lean journey, learnings, and results in the form of interesting case studies on Lean implementation in their respective projects.

To popularise the concept of Lean Construction in India, ILCE made a beginning with ILCC 2015 held in Mumbai in 2015. Further to this, ILCC 2017, ILCC 2019 and the international conference IGLC 2018, LIPS 2019 (Lean in Public Sector), ILCC 2021, ILCC 2022, ILCC 2023, and ILCC 2024 were organised.

About the Indian Institute of Technology Tirupati

Indian Institute of Technology Tirupati (IIT Tirupati) is the first among the third generation IITs, announced by the Government of India in 2014, to have its foundation stone laid in March 2015. Initially operating under the mentorship of IIT Madras, IIT Tirupati has emerged as a dynamic and vibrant center of higher education, research, and innovation in southern India.

Institution's Mission and Vision

IIT Tirupati's vision is to become a leading center of higher education with a global outlook and local relevance. The Institute is committed to educating undergraduate and postgraduate students to engage thoughtfully with the social, scientific, economic, and professional challenges of our times. Through rigorous teaching, cutting-edge research, and meaningful industry partnerships, IIT Tirupati strives to generate, preserve, and apply knowledge for the benefit of society and the nation.

Campus and Infrastructure Development

Established on a picturesque 548-acre tract of land near Yerpedu (between Renigunta and Srikalahasti) provided by the Government of Andhra Pradesh, IIT Tirupati's permanent campus represents a carefully planned ecosystem designed to nurture innovation while conserving natural surroundings. The campus master plan caters to an eventual capacity of 12,000 students. The permanent "North Campus" was completed in December 2023, featuring state-of-the-art facilities for academic programs, research laboratories, and student amenities.

Academic Growth and Expansion

The Institute commenced operations in August 2015 with an inaugural cohort of 106 B.Tech students across four engineering disciplines. Since then, IIT Tirupati has systematically expanded its academic portfolio:

- **Undergraduate Programs**: B.Tech in Civil Engineering, Computer Science & Engineering, Electrical Engineering, Engineering Physics, Mechanical Engineering, and Chemical Engineering
- **Postgraduate Programs**: M.Tech in 13 specialized areas; Master's programs in Chemistry, Physics, Mathematics & Statistics, and Public Policy: M.S. (Research) and Ph.D. programs across engineering, humanities and science disciplines

- **Research Initiatives**: Strong emphasis on interdisciplinary research with current student strength of approximately 1,800 (including about 360 Ph.D. students).

Research Excellence and National Initiatives

IIT Tirupati is deeply engaged in transformative national missions and collaborative research ecosystems:

- **National Missions**: Interdisciplinary Cyber-Physical Systems (ICPS), Quantum Technology Applications (QTA), Hydrogen Mission, and India Semiconductor Mission
- **Centers of Excellence**: Centre for Smart Manufacturing and EV Technologies established in partnerships with Siemens and Wipro; Centre for Atomic, Molecular and Optical Sciences and Technologies (CAMOST): a dedicated 5G Use-Case Lab funded by the Department of Telecommunications
- **Cutting-Edge Research Infrastructure**: World-class laboratories and research facilities supporting innovation in emerging technologies, sustainable infrastructure, and digital transformation

Faculty, Culture, and Community

IIT Tirupati is known for maintaining one of the highest faculty-to-student ratios among IITs, fostering close mentorship and research collaboration. The Institute cultivates a vibrant residential campus culture with comprehensive hostels, fostering an environment of academic excellence, innovation, and inclusive growth. Through active industry collaborations, international partnerships, and rigorous research programs, IIT Tirupati nurtures scholars and leaders equipped to address global challenges.

Commitment to Sustainability and Excellence

As a young yet progressive institution, IIT Tirupati embodies the ideals of responsible engineering and technical education. The Institute is committed to producing scientists, technologists, and leaders who not only excel in their disciplines but also contribute meaningfully to society through sustainable practices, ethical innovation, and global engagement.

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PROGRAMME SCHEDULE

WORKSHOP DAY

(Sunday, November 30, 2025)

From	To	Venue: LHC CR 211	
08:30	09:30	***Registration & Networking***	
09:30	10:15	***Inauguration & Welcome Address:*** Prof. Suresh Jain, Conference Chair ILCC2025, IIT Tirupati Prof. K.N. Satyanarayana, Academic Patron ILCC2025, Director IIT Tirupati Prof. Marton Marosszeky, Marosszeky Associates, Australia Prof. Koshy Varghese, Director ILCE; Professor IIT Madras	
10:15	11:00	***Invited Talk***: Prof. Marton Marosszeky, Marosszeky Associates, Australia	
11:00	11:30	***Tea Break & Networking***	
11:30	12:15	***Workshop #1-Conceptual Talk: Lean Construction Implementation: Theory Meets Practice*** Dr. Guru Raju, Afcons Infrastructure Ltd Dr. Murali Jagannathan, Assistant Professor, IIT Madras Dr. Santhosh Loganathan, Assistant Professor, NIT Trichy	
12:15	13:00	***Workshop #2-Conceptual Talk: Artificial Intelligence (AI) at Worksites - Computer Vision for Smart Construction*** Dr. Aritra Pal, Assistant Professor, IIT Madras Dr. Varun Kumar Reja, Assistant Professor, IIT Bombay	
13:00	14:00	***Group Photo & Lunch Break (LHC Ground Floor)***	
14:00	15:30	Workshop#1 - Hands-on - Lean Construction Implementation: Theory Meets Practice Venue: LHC CR 211 Group 1	Workshop#2 - Hands-on - Artificial Intelligence (AI) at Worksites - Computer Vision for Smart Construction Venue: LHC CR 101 Group 2
15:30	16:00	***Tea Break & Session Transition***	
16:00	17:30	Workshop#1 - Hands-on - Lean Construction Implementation: Theory Meets Practice Venue: LHC CR 211 Group 2	Workshop#2 - Hands-on - Artificial Intelligence (AI) at Worksites - Computer Vision for Smart Construction Venue: LHC CR 101 Group 1
17:45	18:45	***Lean Academic Community Meeting*** Venue: LHC CR 211	

INDUSTRY DAY

(Monday, December 1, 2025)

From	To	Venue: LHC CR 211
08:30	09:30	***Registration & Networking***
09:30	10:30	***Extended Tea Break & Networking*** ***Poster Display (Venue: LHC Ground Floor)***
10:30	11:00	***Inauguration:*** Prof. Suresh Jain, Conference Chair ILCC2025, IIT Tirupati Prof. K.N. Satyanarayana, Academic Patron ILCC2025, Director IIT Tirupati Mr. Anup Mathew, Chairman of the Board of Directors of the ILCE; Senior Vice President & Business Head – Godrej Construction ***Chief Guest:*** Mr Ponguru Narayana, Minister of Municipal Administration and Urban Development (MA&UD), Andhra Pradesh Mr. Kaezad Karanjawala, Secretary General, ILCE Prof. Marton Marosszeky, Marosszeky Associates, Australia
11:00	11:30	***Keynote Address by Chief Guest***
11:30	12:00	***Invited Talk 1: Quality and Lean*** Speaker: Prof. Marton Marosszeky, Marosszeky Associates, Australia
12:00	12:20	***Invited Talk 2: Implementing Lean Construction Principles to Reduce Slab Cycle in Residential Buildings*** Speaker(s): Mr. Ashok Kumar, Sr. Vice President - Innovation & Strategy, Kalpataru Projects International Limited Mr. Saurabh Verma, General Manager- Innovation & Strategy, Kalpataru Projects International Limited
12:20	12:40	***Invited Talk 3: Mechanization and Automation in Construction*** Speaker: Mr. Senou K, Head - Technical Services, Larsen & Toubro
12:40	13:00	***Q&A Session: Moderator*** Prof. Ashwin Mahalingam, Professor, IIT Madras
12:55	14:00	***Group Photo & Lunch Break (LHC Ground Floor)***
14:00	15:00	***Panel Discussion #1: Lean Construction Implementation in India: Challenges, Success Stories, and Lessons Learned*** Speakers:

		Mr. Ashok Kumar, Sr. Vice President - Innovation & Strategy, Kalpataru Projects International Limited Mr. Lakshmi Narayanan Sampath, DGM - Strategy and Planning, Larsen & Toubro Mr. Yadhnesh Udas (Afcons), Manager - Quality Excellence Cell, Afcons Infrastructure Ltd Ms. Ragavi Prabaharan, Asst Manager - R&D, URC Construction Pvt Ltd Mr. Ashutosh Kapoor, Director ILCE; Partner, KPMG India Moderator: Mr. Kalyan Vaidyanathan, CTO - Construction, Tvasta
15:00	16:00	***Panel Discussion #2: Digitization in Lean Construction: Leveraging BIM, AI, and Digital Tools for Project Delivery*** Speakers: Mr. Srinivas Bharani N, Engineering Lead, Pathsetter AI Dr. Gaurav Kumar Chawla, Founder and CEO, GKC Consultants Maj Puneet Arora (Retd), Business Development Leader - CMI, vConstruct Mr. Anudeep Ramagiri, Product Owner, KMV Group Mr. Murugesan Muthu, Vice President, URC Moderator: Dr. Nikhil Bugalia, Assistant Professor, IIT Madras
16:00	16:30	***Tea Break & Networking; Poster Display (Venue:*** *LHC 2nd floor)*
16:30	16:55	***ILCE – Journey So Far and Way Forward: Current Initiatives and Support Systems*** Mr. Kaezad Karanjawala, Secretary General, ILCE
16:55	17:25	***Lean Project Competition - Presentation*** Speaker: Finalised Teams
17:25	17:30	Concluding Remarks & Feedback
19:00	20:30	***International Keynote Talk: 5S and Last Planner® System Implementation - Common Pitfalls (virtual)*** Speaker: Mr. David Umstot, PE, DBIA

CONFERENCE DAY#1

(Tuesday, December 2, 2025)

From	To	Venue: LHC CR 211
08:30	09:30	***Registration & Networking***
09:30	10:15	***Inaugural Address & Felicitation of LPC Winners*** Prof. Suresh Jain, Conference Chair ILCC2025, IIT Tirupati Prof. K.N. Satyanarayana, Academic Patron ILCC2025; Director, IIT Tirupati Mr. Anup Mathew, Chairman of the Board of Directors of the ILCE; Senior Vice President & Business Head, Godrej Construction Chief Guest Mr. Kaezad Karanjawala, Secretary General, ILCE
10:15	10:45	***Keynote Address by Chief Guest***
10:45	11:15	***Tea Break & Networking; Poster Display (Venue:*** *LHC 2nd floor)*
11:15	11:45	***Invited Talk 1: Lean Construction Developments - Indonesia*** Speaker: Prof. Muhamad Abduh, Professor, Institut Teknologi Bandung, Indonesia
11:45	12:10	***Invited Talk 2: URC's Lean Journey – Mission 2025*** Speaker(s): Mr. Devarajan C, Director ILCE; MD, URC Construction Pvt Ltd Ms. Ragavi Prabaharan, Asst Manager - R&D, URC Construction Pvt Ltd
12:10	12:30	***Invited Talk 3: How AI Will Transform the Engineering and Management of Construction?*** Speaker: Dr. Subhash Rastogi, Retd Prof IIM Mumbai; Retd Head, Enterprise Solution Academy, Infosys
12:30	13:00	***Q&A Session: Moderator*** Dr. Albert Thomas, Associate Professor, IIT Bombay
13:00	14:00	***Group Photo & Lunch Break (Venue:*** *LHC 2nd floor)*
14:00	15:30	Technical Session A1 (Venue: LHC CR 211) Technical Session A2 (Venue: LHC CR 101) Technical Session A3 (Venue: LHC CR 112)
15:30	16:00	***Tea Break & Networking; Poster Display (Venue:*** *LHC 2nd floor)*

16:00	17:00	***Panel Discussion: Shaping the Future: Impact in Lean Construction Education and Research*** Speakers: Prof. Parul Patel, Professor, Nirma University Dr. Prasanna Venkatesan, Associate Professor, VIT Vellore Prof. Marton Marosszeky, Marosszeky Associates, Australia Prof. Muhamad Abduh, Professor, Institut Teknologi Bandung, Indonesia Prof. Venkatesan R, Professor, NICMAR Hyderabad Moderator: Dr. Murali Jagannathan, Assistant Professor, IIT Madras
17:00	17:15	***Announcement of Next Edition - 9th Indian Lean Construction Conference (ILCC2026)*** Mr. Kaezad Karanjawala, Secretary General ILCE
17:15	18:30	***Poster Presentation Review*** Jury: Dr. Pawan Pandey, Professor of Practice, IIT Delhi Dr. Albert Thomas, Associate Professor, IIT Bombay Dr. Venkata Santosh Kumar Delhi, Associate Professor, IIT Bombay Dr. Senthilkumar V, Associate Professor, IIT Palakkad Venue: LHC Ground Floor
19:00	21:30	***Conference Day Cultural + Gala Dinner*** Venue: OAT South Campus

CONFERENCE DAY#2

(Wednesday, December 3, 2025)

From	To	Venue: LHC CR 211
08:30	09:00	***Registration & Networking***
09:00	10:30	Technical Session B1 (Venue: LHC CR 211) Technical Session B2 (Venue: LHC CR 101) Technical Session B3 (Venue: LHC CR 112)
10:30	10:45	***Tea Break & Networking; Poster Display (Venue:*** *LHC 2nd Floor****)***
10:45	12:15	Technical Session C1 (Venue: LHC CR 211) Technical Session C2 (Venue: LHC CR 101) Technical Session C3 (Venue: LHC CR 112)
12:30	13:30	***Valedictory & Closure*** Plus–Delta Reflection Session (Feedback) Announcement of Best Paper and Poster Re-Announcement of Next ILCC 2026 Venue: LHC CR 211
13:30	14:30	***Lunch Break (Venue:*** *LHC Ground Floor****)***
14:30	16:30	***Tirumala Tirupati Darshan (for Registered Participants)***

Paper Presentation Track A Schedule

Track	Paper ID	Title
A1	12	Implementing Lean Construction: Review Of Contract Drafting Practices and Research Directions
A1	31	Analysis Of Blockwork, Plastering, Reinforcement and Shuttering Activity Through the Lens of Work Sampling
A1	121	Cultivating Lean: A Cultural Shift in Mega Infrastructure Delivery
A1	23	Leveraging Manufacturing Concepts for Managing Multi-Site Public Infrastructure to Achieve Accelerated Progress: A Case Study from Odisha
A1	140	Analyzing Block Work Through the Lens of Value Stream Mapping
A1	30	Lean And Value Engineering Synergy in Construction: The Turner India Model
A1	114	Lean Inventory Management in Indian Linear Pipeline Construction Projects
A1	74	Optimizing Industrial Infrastructure: Transitioning From Cast-In-Situ to Mechanized Precast Systems for Enhanced Efficiency and Workforce Stability
A2	19	Construction Contract Administration (CCA): Review Of Challenges and The Gaps
A2	135	Leveraging Common Data Environment (CDE) For Sustainable Construction Practices
A2	84	BIM – EVM Integration for Enhanced Project Control
A2	85	Why And Wherefore of BIM Enabled Just-In-Time (JIT) Procurement Strategy in Construction Industry: A Review-Based Study
A2	45	Integration of Lean Construction & Building Information Modelling for Enhancing Efficiency: A Case Study
A2	48	From Data to Decisions: A BIM-Enabled Workflow for Visualizing and Validating Structural Point Loads in Renovation Projects
A2	57	Critical Success Factors for Effective Implementation of Visual Planning In Construction: A Multi-Project Analysis
A2	107	Optimising Precast Production Through Lean Engineering and Automation: The Case of a Large-Scale Transportation Infrastructure Project in India
A3	155	Leveraging Lean Practices for Efficient Pile & Diaphragm Wall Planning and Execution

A3	58	Implementing Lean Construction in a Multi-Contractor Fast-Track Healthcare Project: A Case Study of Hospital Project in North India
A3	49	Overcoming Organisational Barriers to Lean Implementation: Changing Waterproofing System in EPC Contract to Reduce Project Timelines
A3	42	Lean-Green Delay Matrix (LGDM) to Measure and Mitigate Environmental Impact of Delays in Construction Projects
A3	111	Bridging The Lifecycle Gap: Embedding Sustainability Through Lean Construction, BIM, and Digital Twin
A3	122	Life Cycle Assessment (LCA) in Built Environment - Synergies with Lean Principles
A3	69	Enhancing Sustainability in Construction Through Lean Practices: A Case of Godrej Vistas
A3	46	Enhancing Construction Quality and Productivity Through The Implementation of Lean Principles and Techniques

Paper Presentation Track B Schedule

B1	2	Integration of Building Information Modelling and Last Planner System for Optimization of Time in High-Rise Project Using MIVAN Technology
B1	125	BIM And Digital Twins in the Construction Industry: A Scientometric Review
B1	89	Lean Construction Meets IOT: Cognitive Perspectives of Integrated Benefits and Challenges
B1	138	Project Controls – The Need for Integrated Visual Production Management Dashboards
B1	100	Extending the Lean Mandate: Why a Facility Space Database Should be a Core Construction Deliverable
B1	55	Lean Construction and Industry 4.0: A Review of Integration Opportunities, Benefits, Challenges and Future Directions
B1	113	Driving Lean in Field Execution of Irrigation Projects: Integration of Geospatially-Enabled Digital Workflows
B1	66	Systematic Assessment of Digital Twin Applications In Linear Infrastructure Projects
B2	1	From Resistance to Rhythm: Field-Led Lean Construction Through 5S and Big Room Implementation
B2	34	Pioneering Monolithic Column Casting: Turner's Achievements in India
B2	33	Linear Scheduling Method (LSM) Using Tilos for Analysing Critical Resource Utilization in Elevated Corridor Projects
B2	137	Towards Leaner Rail Infrastructure: A Theoretical Framework Combining Value Stream Mapping and Last Planner
B2	131	Integrating Lean Principles for Effective Risk Buffering in Project Delivery
B2	87	Delays in Pune Metro Construction: Mapping Risks to Lean Wastes for Improved Project Delivery
B2	51	Study on Labour Productivity in Building Construction
B2	67	Investigating Impact of Small Tools on Rebar-Tying Productivity
B3	105	Ergonomic Factors Influencing the Implementation of Lean Principle in the Construction Industry of North-East India
B3	106	A Review of Smart Infrastructure Solutions for Traffic Congestion and Safety in Construction Work Zones
B3	60	Application of Rapid Lean Construction-Quality Rating (LCR) for a Commercial Building In India
B3	88	Identification and Evaluation of Hazards in Hydrogen Infrastructure: A Lean Construction Perspective

B3	141	Integration of Lean with QMS for its Effective Implementation
B3	127	Optimization in Safety Screen Assembly & Installation Through Lean: Achieving Efficiency, Safety and Sustainability
B3	63	Productivity Improvement Approaches for Linear and Non-Linear Projects Through Lean Construction
B3	50	Work-Life Balance and Its Impacts on Quantity Surveyors in Indian Construction

Paper Presentation Track C Schedule

C1	4	Dimensions of Project Management and Leadership in Linear Megaprojects
C1	10	Innovative Method of Overhead Tank Construction Using the Lean Tools
C1	126	Cycle Time Reduction Through TAKT Planning and PPC Tracking: A Lean Implementation Case Study in High Rise Commercial Project
C1	142	Engineering A Y-Track Rail System to Eliminate Downtime In Tunnel Construction
C1	70	Application of Lean Manufacturing Technique in RMC Plant Using Value Stream Mapping
C1	128	Optimising Construction Processes: A Lean Implementation Approach for Enhanced Efficiency and Sustainability at L&T Innovation Campus
C1	13	Sustainable Use of Steel Slag Aggregate In Road Sub-Base Using CBA Lean Tool
C1	9	Optimizing Joint Sealing in PQC Roads Using Choosing By Advantages (CBA)
C2	76	Integrating Lean Methodologies in Residential Projects: Addressing Delay and Cost Overrun Challenges
C2	7	Lean Construction in Practice: Improving Cycle Time and Workflow in Precast Segment Casting
C2	99	Lean Enabled Construction Workers for Offsite Construction
C2	3	Integrated Real-Time Risk Monitoring Framework for Construction Projects
C2	44	Implementation of Lean Construction in Affordable Housing: A Case Study of MHADA Projects
C2	132	Time and Cost Reduction Using Lean Practices in High-Speed Rail Project
C2	151	Proactive Lean Framework for Efficient Project Scheduling and Risk Mitigation in Power Transmission & Distribution (PT&D) EPC Projects
C2	147	Lean Reservoirs: Prefabrication for Waste-Free, Sustainable, and Rapid Overhead Water Storage
C3	25	Automated Delay Identification and Classification for Construction Projects: A Conceptual Framework
C3	11	Lean Supply Chain Management in Workplace: Garment Industry
C3	68	Supply Chain Management in Indian Construction from Production Theory Perspective

C3	36	Quantifying Material Inefficiencies in Metro Station Construction Using Material Flow Analysis
C3	6	Sustainable Concrete Production: Organizational Strategy for Tracking Carbon Reductions Using SCM's and Admixtures
C3	150	Enhancing Efficiency and Sustainability of Radiant Cooling Systems Through Lean Methodologies
C3	78	Review of Lean Maturity Models: An Indian Context
C3	117	Reverse Tendering as a Lean Enabler: An Indian Case Project

PAPER ID: 12

IMPLEMENTING LEAN CONSTRUCTION: REVIEW OF CONTRACT DRAFTING PRACTICES AND RESEARCH DIRECTIONS

Sarthak Alladwar[1] and Murali Jagannathan[2]

ABSTRACT

The effectiveness of lean construction depends on a collaborative stakeholder mindset, which conflicts with the traditional, silo-based approach enforced by standard contracts. As the main document guiding stakeholder relationships, the contract is a vital tool for encouraging lean behaviors. This study, through a systematic literature review, examines how contracts are currently used for implementing lean and identifies three major research directions based on gaps in the current literature. The review uncovers two predominant pathways proposed by researchers: a radical shift from traditional transactional contracts to unfamiliar relational models, or just adding "lean-friendly" clauses to existing contracts. The adoption of new models requires a mindset change and hence is slow. The latter is especially problematic because it doesn't resolve the conflict with restrictive, non-collaborative ("lean-averse") clauses, creating more confusion instead of promoting true collaboration. Therefore, the solution begins with making a traditional contract more compatible with lean by transforming its "lean-averse" clauses into a "lean-neutral" structure, a route that has yet to be explored. To achieve this, a framework for evaluating the leanness of existing clauses is essential; however, this topic has received little discussion. Finally, the potential of Artificial Intelligence (AI/ML) to automate this complex assessment and restructuring process remains largely unexplored.

KEYWORDS

Lean, construction, contract, drafting, framework

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PAPER ID: 31

ANALYSIS OF BLOCKWORK, PLASTERING, REINFORCEMENT, AND SHUTTERING ACTIVITY THROUGH THE LENS OF WORK SAMPLING

Apoorva Bhamare[1], Ganesh Devkar[2], Jyoti Trivedi[3], Eshani Kothari[4] and Parthiv Pandit[5]

ABSTRACT

The increasing complexity and scale of construction projects have intensified the demand for effective management tools aligned with lean construction principles. Work Sampling provides a subtle, cost-effective means of evaluating labour performance across diverse tasks and environments. This study explores the application of work sampling in identifying and differentiating value-adding (VA), non-value-adding (NVA), and non value-adding but necessary (NVAN) activities. The work sampling study was conducted on an ongoing construction site of a hospital redevelopment project with G+9 floors and two basements to observe and evaluate the efficiency of four construction activities: blockwork, plastering, reinforcement, and shuttering. These activities were tracked across six different work locations. A detailed tour-based work sampling plan was prepared to systematically visit each location with a total of 32 tours conducted at fixed time intervals over two days. The collected data was then analyzed using time-based, activity-based, and location-based methods to identify patterns of productive and unproductive work by categorizing sub-activities as VA, NVA and NVAN. This analysis showed how different factors such as time of day, activity type, and site organization affect overall labour efficiency. The study found that value-adding activities were most frequent during the first two hours of the workday, while non-value adding activities increased after lunch, especially between 13:00 and 16:00. Blockwork and plastering showed consistent patterns; however, helpers experienced considerable idle time due to waiting and poor task allocation, i.e. while skilled workers were engaged, helpers remained unoccupied. Frequent breaks, extreme heat conditions and material shortages further reduced efficiency, particularly in reinforcement and shuttering activities. Activities with better supervision and organised material setup showed up to 9% more productive time than others. The investigation concludes that labour performance on construction sites can be significantly improved through strategic scheduling, efficient material management, structured breaks, and strong on-site supervision, all of which help reduce idle time and enhance value-adding work.

KEYWORDS

Lean Construction, Work Sampling, Analysis, Site Management, Labour Efficiency

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PAPER ID: 121

CULTIVATING LEAN: A CULTURAL SHIFT IN MEGA INFRASTRUCTURE DELIVERY

Kaezad Karanjawala[1], Sagar Karnik[2], Rahul Ruikar[3] Vinayak Salvi[4], Jitendra Bhatt[5]

ABSTRACT

This paper explores the evolution of a Lean-driven culture within the Khalapur North Project, a landmark greenfield initiative in Maharashtra spanning 82 acres with a built-up area of 13.2 lakh square feet. The project includes industrial factory sheds, office buildings, utility structures and advanced infrastructure, executed with a focus on safety, quality and timely delivery. Lean strategies—such as collaborative partnerships and joint problem-solving—have strengthened team resilience and addressed key challenges including workforce shortages, recurring errors, productivity losses and decision-making delays. After completing major PEB structures, the project progressed into extensive RCC Civil and infrastructure works. Lean principles continue to guide stakeholders across Execution, Design, Contracts, Safety, Quality and Supply Chain functions. The team, comprising engineers, supervisors, safety officers and workmen, remains unified in its pursuit of excellence, maintaining zero non-compliances and ensuring customer satisfaction. To eliminate Lean waste and enhance efficiency, tools like the Last Planner System, Value Stream Mapping, Push vs Pull techniques & Work Sampling were deployed. These fostered discipline, improved Safety and Quality and accelerated Timelines. The project also adopted innovative practices: converting cast-in-situ systems to Production System (e.g., Box Culvert installation), using crew work sampling to simplify slab bar designs and pre-fabricating reinforcement cages for faster erection. Modular Sharp Ply formwork enabled sustainable construction of columns, slabs and beams. Mechanized solutions—Boom placers, Excavators and walk-behind tool to offset impact of negative labour fluctuations & aiming towards enhanced Safety and Quality standards. Deployment of these Lean techniques & Collaborative Approach helped in improving the efficiency at the Project.

KEYWORDS

Lean implementation, Stakeholder Commitments, Engineering, Collaborative Planning, Meetings, Last Planner, Value stream mapping

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PAPER ID: 23

LEVERAGING MANUFACTURING CONCEPTS FOR MANAGING MULTI-SITE PUBLIC INFRASTRUCTURE TO ACHIEVE ACCELERATED PROGRESS: A CASE STUDY FROM ODISHA

Dr. Subash Rastogi[1], Manoranjan Misra[2] and Tony Jacob[3]

ABSTRACT

Delivering large-scale, multi-site public infrastructure projects within compressed timelines poses significant management challenges. The Odisha State Government's program to build 89 indoor sports complexes in just 12 months, with an outlay of ₹693.35 crore, demanded a departure from conventional project management. This study presents a novel approach that fuses Lean Construction principles with a manufacturing batch production concept to create a unified and accelerated delivery system. By treating the entire portfolio of projects as a cohesive production shop, following the best standard planning and construction processes at all the locations the project overcame the typical challenges of managing over 70 contractors across a geographically diverse landscape. The methodology, driven by an action-research approach, introduced several key innovations. The adoption of only two standardized architectural designs enabled a replicable "product" for construction. A Collaborative Planning System (CPS) and a centralized "Big Room" were used to establish a uniform execution logic and foster real-time, multi-stakeholder coordination. The concept of batching was applied to site grouping and sharing knowledge among different location teams, creating a predictable workflow similar to a factory floor. Furthermore, a state-level supplier summit was a critical innovation, standardizing materials and pre-emptively solving supply chain bottlenecks. The outcomes were significant: 40 complexes were delivered on time, with another 45 completed within two months of the target. Balance 4 complexes were completed after one year due to other legal nuances. Such results are unusual for the government projects. This approach significantly improved schedule adherence, inter-agency coordination, and procurement efficiency. The Odisha sports complex program offers a powerful, replicable model for governments seeking to implement a manufacturing-inspired production system for the efficient, predictable, and high-quality delivery of public infrastructure.

KEYWORDS

Lean Construction 4.0, Batch Manufacturing in Construction, Multi-site, Infrastructure Projects, Collaborative Planning System, Standardized Designs in Public Works, Construction Best Practices, Government Construction Projects, Action Research in Infrastructure

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PAPER ID: 140

Analyzing Block Work Through the Lens of Value Stream Mapping

Jenish Panchal[1], Ganesh Devkar[2], Jyoti Trivedi[3], Eshani Kothari[4] and Parthiv Pandit[5]

ABSTRACT

The construction industry continues to struggle with inefficiencies such as unnecessary material movement, idle labour time, and disconnected processes. This study investigates the use of Value Stream Mapping (VSM), a lean construction tool, to assess and enhance the AAC blockwork process in a high-rise residential building in Ahmedabad. A current state value stream map was created by combining real-time observation and activity classification. The research study revealed considerable deviations from the expected takt time, as well as high levels of Type-I and Type-II Muda, particularly in material mobilization and alignment activities. To mitigate these inefficiencies, a future-state value stream map was prepared using lean interventions, including 5S, Just-in-Time (JIT) delivery, work cell design, Poka-Yoke, standardised work procedures, and Kanban systems. These strategies led to a measurable reduction in non-value-adding activities, improved takt compliance, and an overall 10% gain in process efficiency. The redesigned workflow demonstrated a 28% reduction in Muda-II, improved resource utilisation, and enhanced coordination among crew members. This paper presents a replicable methodology for implementing lean principles at the task level, bridging the gap between planning and execution. It reinforces the value of VSM not only as a diagnostic tool but as a foundation for continuous improvement in on-site construction activities. The findings contribute practical insights for industry professionals aiming to enhance labour productivity, reduce waste, and achieve more predictable construction outcomes.

KEYWORDS

Lean Construction, Value Stream Mapping (VSM), AAC Blockwork, Takt Time, Waste Reduction, Non-Value-Adding Activities, Construction Efficiency, Workflow Optimization, 5S, Just-in-Time (JIT)

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PAPER ID: 30

LEAN AND VALUE ENGINEERING SYNERGY IN CONSTRUCTION: THE TURNER INDIA MODEL

Suvankar Bhattacharya[1], Yash Saraiya[2] and Ajay Handoo[3]

ABSTRACT

This study highlights Turner India's strategic integration of Lean Principles with Value Engineering across its national project portfolio to enhance contract and cost management. The initiative addresses the need for resource optimization, cost-efficiency, and timely delivery in complex infrastructure projects while maintaining safety, quality, and stakeholder satisfaction. Using Integrated Project Delivery (IPD), open-book frameworks, and cost-led procurement, the methodology re-engineers structural systems, revises execution techniques, and optimizes planning processes. Key innovations include rationalized pile designs, elimination of non-essential PCC layers, sprinkler-based curing, phased elevator installations with crash decks, standardized castellation, and ramp construction using in-situ soil fill. Supported by relational target costing and a Production Pull system, these measures improved collaboration, reduced inventory, and minimized site congestion. A centralized Lean Dashboard tracks interventions, enabling real-time monitoring, cross-project learning, and replication of best practices. Results show measurable improvements in timelines, cost control, and quality. The study demonstrates that Turner India's Lean Value Engineering framework offers a replicable, sustainable model for large-scale construction, with potential application across broader infrastructure projects.

KEYWORDS

Continuous Improvement/Kaizen, Production Pull, cost-led procurement, integrated project delivery (IPD) open book, relational target cost(ing), time compression

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PAPER ID: 114

LEAN INVENTORY MANAGEMENT IN INDIAN LINEAR PIPELINE CONSTRUCTION PROJECTS

Aseem Gupta[1], Aveek Banik[2], and Dr. Santhosh Loganathan[3]

ABSTRACT

Indian construction projects are strained by a demanding mix of tight deadlines, pressure to control costs, scarce on-site storage, and complex day-to-day operations. Traditional practices such as bulk procurement and stockpiling of pipes exacerbate inefficiencies by inflating storage costs, reducing flexibility, and hampering workflow. This research analyses how inventory control can be improved in Indian linear pipeline engineering projects. It employs value stream mapping (VSM) to detect inefficiency, applies inventory theory through safety stock and reorder point determinations, and applies pull-based replenishment policies. Utilising a case study-based approach, daily progress reports and monthly demand data were collected and aggregated to examine and construct current and future state VSM maps of the case project. A periodic review policy with demand-driven replenishment is formulated to examine candidate reductions in average inventory and supply responsiveness increases. Results from the case analysis indicate that the existing system, dependent upon large lot orders of 300 km twice a year, has a high cycle inventory averaging 150 km, subjecting projects to high storage costs and rigidity. Redesign of future state map positions smaller lot sizes of 75 km with an analytically calculated safety stock of 24 km, hence cutting average on-hand inventory to 61.5 km, a reduction of 59%. Pull-based replenishment reduces supply and consumption variability mismatch, while mutual information flows decrease uncertainty and increase reliability. Schedule compliance and obsolescence risk reduction are also modelled to improve supply chain performance. These findings indicate that lean-based interventions can effectively balance holding cost, stockout risk, and demand variability. The research concludes that lean inventory control has theoretical and practical applications by bridging VSM and quantitative inventory modelling. The extension of this lean inventory control approach to applications involving flexible supplier contracts and formalized review policies is implied to achieve sustainable construction supply chain enhancements.

KEYWORDS

Inventory management, Lean construction, Value stream mapping, Pull planning, Inventory control

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PAPER ID: 74

OPTIMIZING INDUSTRIAL INFRASTRUCTUR: TRANSITIONING FROM CAST-IN-SITU CONSTRUCTION TO MECHANIZED PRECAST SYSTEMS FOR ENHANCED EFFICIENCY, SAFETY AND QUALITY

Kaezad Karanjawala[1], Sagar Karnik[2], Awadhoot Sawant[3], Rahul Ruikar[4], Vinayak Salvi[5], Jitendra Bhatt[6]

ABSTRACT

Strategic Decision was taken to Accelerate the construction process at the Naoroji Godrej Khalapur North Campus, an 82-acres industrial development site in Maharashtra. The project encompasses the installation of over 10 km of trenches—both precast and cast-in situ—for critical services including stormwater drainage, electrical and data cabling, fire safety systems, pneumatic pipelines and domestic and effluent water supply. This ensured that there is a Cultural shift resulting in no buried services except Road Crossings thus ensuring ease of access and serviceability for all Utilities installed in the Project. The Precast Technology was further Extended to Main Box Culvert works with usage of Existing Moulds used by CM (Construction Materials) LOB (line of Business) for Mumbai Coastal Road Project. This reuse of Existing Moulds for Box-Culvert segments enhanced Quality in works as well as savings in time. Mechanised Operations using Crane & Coupled with Precast technology countered the effect of negative labour fluctuations. Re-use of existing moulds led to fulfilment of requirement for the Project as well as created a business opportunity for CM which meant Win-Win situation for both Lines of Business (LOBs): RE-D & CM. Given the scale and complexity of trenching across the expansive campus, coupled with the challenges posed by the region's monsoon-prone topography and labour variability, the management opted to transition from predominantly cast-in-situ methods to precast trenching. This strategic shift significantly reduced on-site construction time, mitigated weather-related delays and enhanced overall productivity. The adoption of precast technology also improved quality control, as major inspections were conducted at the casting yard, freeing up site resources for concurrent civil and PEB (Pre-Engineered Building) activities. A GEMBA / Toolbox meeting was conducted to align all stakeholders, ensuring clear communication and collaborative execution. Furthermore, the integration of Lean Design principles during the engineering phase streamlined operations and minimized waste. This case study highlights how innovative construction practices, combined with collaborative planning and Lean methodologies, can deliver rapid, cost-effective and high-quality infrastructure solutions. It serves as a model for future industrial projects Aiming for Efficiency, Safety, Quality and Sustainability.

KEYWORDS

Mechanisation, Lean implementation, Stakeholder Commitments, Engineering, Standardization, Collaborative Planning, Meetings, Cultural Shift

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PAPER ID: 19

CONSTRUCTION CONTRACT ADMINISTRATION (CCA): REVIEW OF CHALLENGES AND THE GAPS

Anushka Patil[1], and Murali Jagannathan[2]

ABSTRACT

Construction contracts are vital in legally binding the signatories to their obligations. What is written and agreed upon in the contract influences the project outcomes, shaping the timely completion and the project budget adherence. However, extant literature indicates that how a contract is administered influences project outcomes. However, the contract administration process, a task undertaken by the parties to the contract, can encounter several issues, ranging from the lack of experience of the contract administrator to the poor quality and inadequate frequency of communication, and the absence of stakeholder collaboration, which deteriorates the working relationship amongst the parties to the contract, promoting claims and disputes. With the advent of Artificial Intelligence (AI), researchers have explored a few contract management tools to mitigate these issues. However, a systematic analysis of Construction Contract Administration (CCA) challenges and the extent to which such challenges result in "wastes" and whether AI tools address the full extent of identified challenges is not evident in the extant literature. By connecting CCA challenges, lean wastes (Muda) and AI solutions, among other things, a key gap that emerges is that although CCA spans across multiple project and construction management domains, the extant AI solutions are very focussed on specific aspects of the domain challenges (like, safety, quality and progress monitoring), and the connection with the CCA is not very evident, preventing CCA from positively influencing the wholistic project outcomes.

KEYWORDS

Construction, Contracts Administration, Challenges, Artificial Intelligence (AI), Lean

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PAPER ID: 135

LEVERAGING COMMON DATA ENVIRONMENT (CDE) FOR SUSTAINABLE CONSTRUCTION PRACTICES

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ABSTRACT

The construction sector is rapidly embracing digital solutions to address sustainability challenges. This paper investigates the integration of Common Data Environment (CDE) as a catalyst for sustainable construction practices, with a specific focus on its alignment with Lean principles. Through a comparative analysis of secondary case studies like The Edge (Amsterdam), London Crossrail, and Bengaluru International Airport Terminal 2, the study explores how CDE facilitates real-time collaboration, reduces rework, and enhances resource efficiency. The methodology involves qualitative assessment of enabling mechanisms and sustainability metrics across projects. Findings reveal that CDE integration supports data-driven decision-making, regulatory compliance, and lifecycle sustainability. The paper proposes a suggestive framework for CDE adoption in Indian construction projects, contributing to future research and practical implementation.

KEYWORDS

Common Data Environment (CDE), Data-driven Decision-making, Lean Construction, Sustainability

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PAPER ID: 84

BIM – EVM INTEGRATION FOR ENHANCED PROJECT CONTROL

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ABSTRACT

The integration of digital technologies in construction management is reshaping project delivery by enhancing efficiency, transparency, and control. This study investigates the integration of Building Information Modelling (BIM) and Earned Value Management (EVM) as a unified framework to support lean construction practices. While BIM improves visualization, coordination, and 4D/5D simulation, it lacks analytical rigor for monitoring cost and schedule performance. Conversely, EVM provides reliable indices such as the Cost Performance Index (CPI) and Schedule Performance Index (SPI) but offers limited visual–spatial integration. To address these gaps, this research develops and demonstrates an integrated BIM–EVM framework through a mixed approach. Data from multiple projects were collected to establish assumptions for cost and schedule estimates. A hypothetical case project was then created, with a detailed Work Breakdown Structure (WBS) validated by industry experts. The validated data were applied within the proposed EVM Web Grid and Decision Support Matrix to demonstrate how the integrated system can monitor deviations, identify critical activities, and support proactive decision-making. Findings confirm that the BIM–EVM framework enhances project control, reduces waste, and strengthens collaboration, offering a scalable pathway for lean construction and digital adoption in the Indian construction industry.

KEYWORDS

Building Information Modelling (BIM), Earned Value Management (EVM), Digital Project Delivery, Performance Monitoring, Decision Support Systems

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PAPER ID: 85

Why and Wherefore of BIM-Enabled Just-in-Time (JIT) Procurement Strategy in Construction Industry: A Review-Based Study

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ABSTRACT

Construction projects are still faced with inefficiencies in procurement and inventory management that have resulted in wastage, congestion and schedule overrun. The traditional approach of bulk buying can also lead to untimely delivery and excessive storage requirements, which is why the increased responsiveness of strategies should be noticed. Just-in-time (JIT) strategies are designed to match the real demand on site, yet their practice in construction is hampered by the disconnective working processes and multi-faceted coordination requirements. The digital planning, visualization, and real time collaboration features of building information modeling (BIM) provides a channel to allay these obstacles. This paper takes the form of systematic literature review (SLR) in order to investigate the role of BIM in enhancing the JIT procurement and delivery plans in the construction industry. Unlike previous narrative or case-based reviews, this study consolidates findings from thirty peer-reviewed papers using a systematic review framework to identify emerging digital synergies and research gaps in BIM-enabled JIT procurement. The review identifies the BIM-enabled capabilities in 4D scheduling of delivery in sync, quantity take-offs to order accurately and collaborative digital tools, which improve communication between all stakeholders. Results show that BIM aids JIT by enhancing demand forecasting, facilitates procurement, shortening lead times and real time tracking of materials. But empirical validation, integration of vendor systems and disruption management gaps still exist. The paper summarizes existing knowledge and outlines the future research agenda, which forms a base of developing data-driven lean based procurement system to minimize waste and enhance project performance.

KEYWORDS

Building Information Modeling (BIM), Just-in-Time (JIT), Procurement, Supply Chain Management, Lean Construction, Systematic Literature Review (SLR)

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INTEGRATION OF LEAN CONSTRUCTION AND BUILDING INFORMATION MODELING (BIM) FOR ENHANCING EFFICIENCY: A CASE STUDY

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ABSTRACT

As the demand for digital, intelligent, and sustainable infrastructure continues to rise, the construction industry must adopt alternatives to traditional methods to enhance on-site efficiency. This paper presents a practical case study that integrates Lean Construction principles with Building Information Modeling (BIM) to optimize slab cycle operations. By applying the Lean tool Value Stream Mapping (VSM) and incorporating its outputs into a 3D Revit model, followed by 4D planning using Synchro, the study enabled real-time progress tracking, which facilitated the identification of wastes and delays. This digital workflow not only improved planning and coordination but also minimized non-value-adding activities, contributing to more effective time and resource management. The results demonstrate how the synergy between Lean methodologies and BIM technology can support smarter decision-making, align project execution with sustainability objectives, and enhance productivity in reinforced concrete construction. The proposed framework offers a scalable strategy to improve workflow reliability and promote continuous improvement across construction projects.

KEYWORDS

Sustainable, building information modelling (BIM), lean construction, value stream mapping (VSM)

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FROM DATA TO DECISIONS: A BIM ENABLED WORKFLOW FOR VISUALIZING AND VALIDATING STRUCTURAL POINT LOADS IN RENOVATION PROJECTS

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ABSTRACT

Renovation projects that involve extensive MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) retrofits often struggle with structural coordination. Verification of point loads from suspended MEPF systems is frequently overlooked until late in the process, leading to overloaded framing, costly rework, and schedule delays. Conventional reliance on uniform code-based loads and fragmented subcontractor data further compounds the problem, resulting in either over-reinforcement (waste) or under-design (risk to safety and performance). This paper introduces a BIM-supported, data-driven workflow that integrates subcontractor load data into structural models through heat map visualization. These heat maps function as a visual management tool, enabling project teams to detect structural "hot spots" early, review constructability with frontline executors, and target reinforcements precisely where needed. By embedding Lean Construction principles— waste reduction, transparency, and continuous learning—the workflow minimizes rework, reduces material use, and preserves flow in project delivery. A case study of a life science renovation project demonstrates measurable benefits, highlighting the workflow's alignment with Lean practices such as the Last Planner System and Target Value Design.

KEYWORDS

BIM-Based Point Load Analysis, Lean Construction Practices, Visual Management System, Structural Risk Management

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CRITICAL SUCCESS FACTORS FOR EFFECTIVE IMPLEMENTATION OF VISUAL PLANNING IN CONSTRUCTION: A MULTI PROJECT ANALYSIS

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ABSTRACT

Visual Planning (VP) implementation in construction faces significant barriers despite proven benefits in advancing Lean Construction practice. This research addresses the gap between VP potential and actual adoption by identifying critical success factors through mixed-methods empirical analysis. The study examines four detailed case studies (one life sciences facility, one hospital, two data centers) across USA and India, plus quantitative portfolio analysis of 140 projects with real-time performance metrics from integrated project management systems. Findings reveal that only 11% of projects achieve full VP adoption. Seven critical success factors emerge in order of priority: High Priority - stakeholder engagement, incorporating local conditions, real-time technology integration, and competency development; Medium Priority - iterative planning and standardization; Low Priority - performance metrics. The proposed framework provides actionable guidance for routine VP adoption, contributing empirically-validated success criteria that advance both Lean Construction theory and industry implementation.

KEYWORDS

Visual planning, lean construction, 4D modeling, critical success factors, BIM

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OPTIMISING PRECAST PRODUCTION THROUGH LEAN ENGINEERING AND AUTOMATION: THE CASE OF A LARGE-SCALE TRANSPORTATION INFRASTRUCTURE PROJECT IN INDIA

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ABSTRACT

In large-scale infrastructure projects, precast yards play a pivotal role in ensuring timely and efficient construction progress. Although prefabrication is increasingly recognised as a sustainable method, the adoption of lean practices in Indian precast operations remains limited. The present research examines the integration of lean engineering and automation within a large-scale Indian infrastructure project, focusing on the dedicated precast track slab (J-Slab) manufacturing unit. The unit utilises 66 high-precision Japanese steel moulds with shutter vibrators, supported by a standardised workflow that spans mould preparation, reinforcement cage fabrication, concrete placement, curing, demoulding, and final storage. Lean-driven process mapping highlighted the cyclic and interdependent nature of slab production, where delays in upstream activities cause downstream disruptions. To address this, takt-based scheduling, pull planning strategies, and just-in-time (JIT) mould reuse cycles were implemented. Automation technologies such as CNC rebar cutting and bending machines enhanced throughput by 8–10 times over manual methods, while steam curing chambers enabled early strength gain for the slab for lifting within a day, accelerating production cycles. A Concrete Distribution System (CDS) reduced transport delays and minimised material wastage to below 0.5%. Complementary lean tools, including 5S practices, visual management systems, and EOT crane handling, further streamlined operations and reduced motion waste. By combining lean engineering with advanced mechanisation, the investigated precast facility achieved its production target of 66 J-slabs per day, meeting stringent quality, safety, and budgetary requirements. The findings demonstrate how lean–automation synergy can optimise high-volume precast production in the Indian large-scale projects.

KEYWORDS

Lean engineering, lean construction, construction automation, takt-time, pull planning, precast production

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PAPER ID: 155

LEVERAGING LEAN PRACTICES FOR EFFICIENT PILE & DIAPHRAGM WALL PLANNING AND EXECUTION

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ABSTRACT

This paper outlines the application of Lean Construction practices in the planning and execution of Pile and Diaphragm wall activities for Peerless Trayam Project in Newtown, Kolkata. Lean Tools such as Last Planner System, Just in Time Delivery, Value Stream Mapping, Root Cause Analysis are employed to address key site challenges with maximum coordination with site team. The adoption of these methods improved productivity and sustainability. A comparative analysis of pre- and post-lean implementation highlights notable reductions in cycle time and improved sustainable outcomes.

KEYWORDS

Lean Construction, Last Planner System, Value Stream Mapping, Root Cause Analysis, Time Motion Analysis

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IMPLEMENTING LEAN CONSTRUCTION IN A MULTI-CONTRACTOR FAST-TRACK HEALTHCARE PROJECT: A CASE STUDY OF A HOSPITAL PROJECT IN NORTH INDIA

Md Asif Akbari[1] and Ajay Handoo[2]

ABSTRACT

This paper outlines the integration of Lean principles in project management and scheduling for the ongoing construction of Hospital Project in North India —a very fast-track and complex healthcare infrastructure project comprising a 400+ bedded hospital and a 400+ capacity multi-level fully automated car parking facility. The project scope includes over 1000+ rooms, high-end interior fit-outs, and a pre-engineered building (PEB) base structure, with an extremely competitive execution timeline. Unlike conventional projects, this development is not managed under a single General Contractor; instead, it involves multiple specialized contractors, making project coordination, sequencing, and communication significantly more complex and challenging. Effective management of interfaces across Civil, MEP, and fit-out contractors became critical to mitigate fragmentation and prevent misalignment. To address these complexities, a Lean construction approach was adopted to ensure efficiency, accountability, and collaboration across all teams. Key Lean tools such as the Last Planner System (LPS), Kanban boards, and pull planning were utilized to support coordinated scheduling, reduce rework, and ensure just-in-time execution. A core control strategy involved maintaining live room-wise completion data using daily real-time updates, validated through joint signoffs by Civil and MEP teams. This allowed the team to monitor micro-level progress while aligning with macro deadlines. Structured Delay Logs and Change Logs were maintained to proactively manage risks. These tools documented deviations, root causes, and facilitated the issuance of delay notices for timely escalations and rapid resolution. Visual management systems, Percent Plan Complete (PPC) tracking, and regular constraint resolution meetings played a pivotal role in enhancing predictability, driving team accountability, and ensuring informed decision-making. Managed by Turner India, the project stands as a benchmark for applying Lean principles in multi contractor, high-speed healthcare construction environments. The Hospital project highlights how real-time data, disciplined planning, and structured escalation protocols can overcome fragmented execution models and deliver successful outcomes in high-stakes infrastructure projects.

KEYWORDS

Lean Construction, Last Planner System, Micro Planning, Visual Management, Healthcare Infrastructure, Fast-Track Projects, Multi-Contractor Coordination, Interior Development, Real-Time Tracking

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OVERCOMING ORGANISATIONAL BARRIERS TO LEAN IMPLEMENTATION: CHANGING WATERPROOFING SYSTEM IN EPC CONTRACT TO REDUCE PROJECT TIMELINES

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ABSTRACT

Every organisation plays a crucial role in ensuring the effective implementation of Lean practices and innovation strategies. However, numerous organisational barriers often hinder progress. These include lack of effective decision making, Insufficient top management support and commitment, limited time allocated for innovation, inadequate organisational structure, weak administration systems, poor communication, prolonged implementation timelines, insufficient preplanning, ineffective procurement and selection strategies, limited resources, lack of Client and supplier engagement. These barriers significantly impact the successful adoption of Lean methodologies. In recent years, many Customers have adopted EPC contracts to mitigate their own risks by transferring responsibilities to the Contractor, who becomes the single point of accountability across the project life cycle. These contracts typically involve fixed pricing and timelines. Despite the risk transfer, large scale projects still face challenges in meeting budget and schedule targets – particularly when strategic decisions are delayed or misaligned. To address delays, one case involved changing the waterproofing system with accepted tolerances. This decision was enabled by overcoming organisational hurdles through the application of Lean tools such as bottleneck analysis, Gemba walk at site, collaborative problem solving with manufacturers, Pull Planning, waste and risk analysis and effective time and cost management. The new waterproofing system offered greater benefits than the original design, contributing to value engineering and aligning with project goals for quality, schedule and cost.

KEYWORDS

Planning, Collaboration, Tolerance, choosing by advantages, huddle, Time, Cost, quality, schedule

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LEAN-GREEN DELAY MATRIX (LGDM) TO MEASURE AND MITIGATE ENVIRONMENTAL IMPACT OF DELAYS IN CONSTRUCTION PROJECTS

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ABSTRACT

Construction delays in India are not only common but also carry significant environmental burdens such as excess fuel consumption, material wastage, and carbon emissions from rework. Traditional planning approaches remain time and cost centric, often neglecting the sustainability consequences of delays. This study proposes a Lean Green Delay Matrix (LGDM), a planning framework that maps real-world construction delay causes to Lean waste categories (e.g., Waiting, Defects, Inventory) and quantifies their environmental impact in terms of material loss and carbon emissions. A case-based methodology is used, drawing from multiple buildings in a high-rise residential project of 3P+G+18 floors in Mumbai, India with available delay logs. The workflow includes Root Cause Analysis (RCA) to classify Lean wastes, and quantitative estimation of waste using historical records on material overuse, idle equipment, and rework events. The CO_2 equivalent impact is calculated through simplified lifecycle assessment (LCA) models using standard emission databases (e.g., ICE). Additionally, semi-structured interviews/questionnaire survey is conducted with planning managers, engineers, and subcontractors to understand the systemic inefficiencies and its influence on construction delays. The outcome is a practical, visual planning tool that helps contractors and planners identify high-impact delay zones and implement targeted preconstruction strategies such as BIM-based design coordination, takt-based labour scheduling, milestone-linked subcontractor payment structures, and early stakeholder involvement. The LGDM aims to strengthen Lean adoption while embedding sustainability metrics directly into construction planning workflows.

KEYWORDS

Lean Construction, Lean and Green, Root cause analysis, Sustainable construction

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PAPER ID: 111

BRIDGING THE LIFECYCLE GAP: EMBEDDING SUSTAINABILITY THROUGH LEAN CONSTRUCTION, BIM, AND DIGITAL TWIN

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ABSTRACT

This position paper advocates for integrating sustainability across the entire lifecycle of built assets through the synergistic application of Lean Construction, Building Information Modeling (BIM), and Digital Twins. While sustainability in construction is often addressed in isolated phases, this paper argues for a systemic, lifecycle-based approach that begins at conceptual design and extends through construction, operation, and eventual decommissioning. Lean principles provide the foundation for value-driven decision-making and the elimination of waste. BIM enables collaborative, data-rich modeling and informed design. Digital Twins offer dynamic, real-time feedback loops for performance monitoring and adaptive management. Together, these approaches enable continuous optimization of material use, energy consumption, and operational efficiency while fostering transparency and stakeholder engagement. The paper presents a framework for embedding sustainability objectives at each stage, demonstrating how integrated Lean-BIM-Digital Twin strategies can transform conventional project delivery models and lead to measurable environmental, economic, and social benefits.

KEYWORDS

Lean construction, Building Information Modeling (BIM), Digital Twins, Sustainability

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PAPER ID: 122

LIFE CYCLE ASSESSMENT (LCA) IN BUILT ENVIRONMENT – SYNERGIES WITH LEAN PRINCIPLES

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ABSTRACT

Life Cycle Assessment (LCA) is a methodology that is generally used to measure the impacts environmentally at each stage of a product or rather a project's life. LCA operates mainly in three categories: Cradle to Gate (From production to Construction Site); Cradle to Grave (from production to demolition/end of life) and finally Cradle to Cradle (from production to end of life and recycled use and purpose). LCA is becoming an effective method of determining carbon emissions, energy emissions and energy consumption of materials, construction systems and projects. The integration of Lean principles with LCA could potentially make possible the systematic elimination of process and material wastes such as overproduction, unnecessary transportation, and excess inventory while being able to measure reductions in embodied carbon and resource consumption. If we can identify every step from material production to the construction site, we can spot where emissions and costs are highest—like heavy materials or long transportation processes and use Lean principles and methods to cut waste, lower carbon footprints, and save money. Through the literature review of close to 40 research papers, the present study has identified carbon as the main central topic, with some papers focusing on a combination of LCA and BIM integration. Research gap pertaining to regional contexts, i.e. the absence of established research on LCA in India, is identified. Our paper's goal is to present the LCA process in an Indian construction context and concentrate on the LCA Lean principles for sustainable project delivery.

KEYWORDS

Life Cycle; Carbon; LCA; Lean Construction; Framework; Synergies

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PAPER ID: 69

ENHANCING SUSTAINABILITY IN CONSTRUCTION THROUGH LEAN PRACTICES: A CASE OF GODREJ VISTAS

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ABSTRACT

The construction industry is a significant contributor to global greenhouse gas emissions and solid waste generation, necessitating a shift toward sustainable practices. Lean Construction (LC) offers a promising approach to address these challenges by reducing waste, improving efficiency, and fostering collaboration. This paper explores the integration of lean tools—Work Sampling, Last Planner System (LPS), Building Information Modeling (BIM), 5S methodology, and Daily Huddles—within the Godrej Vistas project in Mumbai, India, to evaluate their impact on sustainability through the Triple Bottom Line (TBL) framework. The study highlights how these tools collectively enhance economic, environmental, and social outcomes, including cost reduction, waste minimization, and improved worker well-being. While the findings underscore the potential of lean methodologies to drive sustainable construction, the paper identifies gaps in empirical research and standardized metrics for evaluating their effectiveness. Future research directions include quantitative studies and leveraging digital transformation to further optimize lean practices. This case study demonstrates the practical benefits of integrating lean tools to achieve holistic sustainability in real estate development.

KEYWORDS

Lean construction, Sustainability, Triple Bottom Line

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PAPER ID: 46

ENHANCING CONSTRUCTION QUALITY AND PRODUCTIVITY THROUGH THE IMPLEMENTATION OF LEAN PRINCIPLES AND TECHNIQUES

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ABSTRACT

The Indian construction industry, despite contributing nearly 10% to the national GDP, continues to face persistent challenges, including time and cost overruns, inefficient resource utilisation, and inconsistent quality standards. While Lean Construction, a systematic approach to eliminating waste and optimising processes has been successfully implemented in countries such as the USA, Germany, and Japan, its adoption in Indian residential construction remains limited. With mounting regulatory pressures from the Real Estate Regulatory Authority (RERA) and the growing demand for timely, high-quality project delivery, the integration of Lean principles into Indian construction practices is increasingly critical. This study examines the application of Lean methodologies to improve productivity and quality in a large-scale residential development comprising 23 residential towers, 108 villas, three clubhouses, an arts and performance centre, and supporting infrastructure. A customised Lean implementation framework was developed and deployed on-site, integrating tools such as the Last Planner System (LPS), 5S, Kanban boards, identification of the 8 wastes, cycle time analysis, and targeted productivity improvement strategies. Noteworthy improvements were observed, including a significant reduction in slab cycle time across Towers A, B, and C, positively impacting the overall project timeline. Additional Lean interventions such as optimised reinforcement planning, provision of dining facilities near work zones to reduce motion waste, and improved material stacking to minimise transportation waste further contributed to enhanced site efficiency. The implementation led to measurable gains in labour productivity, cycle time reduction, site safety, and operational discipline. The findings confirm that Lean Construction, when contextually adapted and methodically applied, can substantially improve the performance of residential projects in India. This research offers a scalable and replicable Lean framework for broader Lean adoption across the Indian construction sector, fostering improved sustainability, efficiency, and quality outcomes.

KEYWORDS

Integration of Lean tools, waste identification, productivity, Lean framework, and sustainability

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PAPER ID: 2

INTEGRATION OF BUILDING INFORMATION MODELLING AND LAST PLANNER SYSTEM FOR OPTIMIZATION OF TIME IN HIGH-RISE PROJECT USING MIVAN TECHNOLOGY

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ABSTRACT

The construction industry frequently encounters challenges related to schedule delays and workflow inefficiencies, particularly in high-rise residential projects. This study aims to comprehensive integration framework combining Building Information Modeling (BIM), the Last Planner System (LPS), and Mivan formwork technology to address schedule delays and workflow inefficiencies. A case study methodology, a high-rise project in Hyderabad, was selected and analyzed through the development of a BIM model in Autodesk Revit, schedule sequencing via Microsoft Project (MSP), and Lean planning and monitoring using VisiLean. The integration facilitated real-time progress tracking, proactive constraint resolution, and improved collaboration across stakeholders. Findings revealed a 12–15% reduction in formwork cycle time, a significant decrease in labor idle time, and rework.

KEYWORDS

BIM, LPS, Mivan formwork, Lean Construction, High-rise buildings, Time management

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PAPER ID: 125

BIM AND DIGITAL TWINS IN THE CONSTRUCTION INDUSTRY: A SCIENTOMETRIC REVIEW

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ABSTRACT

The Architecture Engineering, and Construction industry has been notoriously known for stagnant productivity owing to substantial dependence on labour intensive operations and continued mundane processes that lacked automation for several decades. With the progression of people, process, and technology-based phenomenon such as 'building information modelling (BIM)', the construction landscape's dearth of technological interventions in improving the productivity has been to some extent fulfilled. BIM transformed the construction operations with visualized outcomes, simulations, and pre-emptive risk identification with information-rich models that facilitated informed decision-making. Gradually, the era of industry 4.0 infused into the construction project operations, and the BIM attributes complimented the digital twin's concept (DT). Digital Twin's simulation analysis and capabilities what-if scenarios of the virtual models of the physical or real-time building / structure became the mainstream phenomenon in the current construction industry. Although, BIM, and digital twins applications percolated in developed nations, the need for exploring the research potential is limited. The current study performs extant research status, and potential areas of research through a scientometric route on BIM, and digital twins in the construction domain. It presents a scientometric study of scholarly articles on BIM, and Digital Twins, and its applications in the built environment domain using VOS viewer. Social network maps of publications of the shortlisted research articles in the construction domain are developed to present a co-occurrence of keywords, and co-authorship (countries, and co-authors) sociogram. This scientometric review presents prospects of research through thematic analysis (TA).

KEYWORDS

Digital twin, Automation, Building Information Modelling (BIM), VOS viewer, Thematic Analysis(TA), Construction

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LEAN CONSTRUCTION MEETS IOT: COGNITIVE PERSPECTIVES OF INTEGRATED BENEFITS AND CHALLENGES

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ABSTRACT

The combined phenomena of Lean Construction (LC) and Internet of Things (IoT) guarantee the foremost benefits in waste reduction and operational profitability. With early focus, construction projects can shape the IoT disruption, while later projects could be forced to react to it. This study reviews the literature related to the applications of combined phenomena of LC-IoT strategies, focusing on the cognitive perspective of benefits and challenges in off-site construction projects. The study methodology is divided into four phases: (1) categorizing the prospective benefits of LC-IoT strategies in off-site construction projects; (2) identifying the typical challenges associated with integrated LC-IoT approaches in off-site construction projects; (3) personnel interviews with industry experts; (4) collection of professional responses using a structured questionnaire; and (5) qualitative and quantitative analysis of the collected data. A total of 33 beneficial factors and 10 key challenges were identified from the literature. These benefits and challenges were analyzed by interviewing 5 subject experts and opinions from 45 respondents with a response rate of 35%. These professionals have experience in construction research and implementation of LC and IoT strategies. A 5-point Likert scale is adopted in understanding the most beneficial areas in optimizing the waste using LC IoT phenomena. ANOVA analysis of each benefit with different respondent demographics is made to understand variation in their opinions towards the benefits of LC-IoT phenomena. The study identified the most challenging factors in adopting LC IoT strategies using ranking analysis. The findings show that implementing LC-IoT greatly benefits offsite construction projects regarding waste minimization and predictive maintenance. IoT applications greatly benefit the LC strategies in optimizing offsite construction processes by automating the workflow data. This study provides valuable insights for off-site construction companies to improve overall project efficiency by adopting the LC-IoT integrated phenomena. The scope of this research is limited to the literature findings and heuristic approach, proving the obvious benefits of emerging technologies integration to the off-site construction community that develops its own significance by including the relevant key experts and those involved in trying to implement these technologies.

KEYWORDS

Lean construction, IoT, off-site, benefits, challenges

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PAPER ID: 138

PROJECT CONTROLS – THE NEED FOR INTEGRATED VISUAL PRODUCTION MANAGEMENT DASHBOARDS

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ABSTRACT

The construction industry is plagued with scattered data and disorganization at each stage. This has not only impacted its growth as an industry but greatly affected its reputation and need to be sustainable in the current global landscape. With each stage introducing new stakeholders, working together in a unified manner towards a common goal becomes extremely difficult and leads to silos both horizontally and vertically – essentially 3D cubes! (Yes, silos doesn't cut it anymore) One of the critical factors for project success is effective project controls. This is a measure that is typically addressed at the end and from a reactive rather than proactive perspective. Project Controls are defined by a carefully interconnected system of people, processes, and tools that work in unison to ensure. This means that each piece, when affected, will cause a knock-on effect that must be absorbed, controlled, and managed by the system without jeopardizing the project overall. The key to having a system that can effectively do this is by ensuring that the people have the right information at the right time by embedded processes and smart-tools that enable them to take proactive decisions and hence, actions to steer the project towards successful delivery. While there is no limit to the technology and process-improvement practices available in the industry today, it is the lack of their connected and systemic deployment that leads to poor management of construction projects. Further, a complete lack of outputs desired or information needed for project controls limits the understanding, need, and development of such systems. This paper aims to address the key factors and components for developing a framework that can help in unifying people through tools and techniques to achieving specific outcomes and objectives that will help drive the project to timely completion, profitability, and eventually a sustainable industry.

KEYWORDS

Construction, BIM, Data, Lean, Project Controls, KPIs

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PAPER ID: 100

EXTENDING THE LEAN MANDATE: WHY A FACILITY SPACE DATABASE SHOULD BE A CORE CONSTRUCTION DELIVERABLE

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ABSTRACT

Lean Construction in India is typically focused on project delivery, concluding with handing over the project back to the clients. This paper argues for extending the Lean mandate into the operational life of the built assets. Following Lean management's goal of maximizing value and eliminating waste across the asset lifecycle, Lean construction must actively enable Lean Facility Management (FM). A foundational step in that direction is delivering an accurate digital facility space database as part of the deliverables at the handover phase, or building new databases for the existing assets and stepping further into operations. Based on our initiative to develop a space database across multiple campus buildings for scheduling, space allocation, and maintenance planning, we illustrate the downstream value of developing such digital storage. Being a single source of truth, this database reduces lifecycle wastes of waiting for space-related information and underutilization. We argue that Lean construction must evolve to deliver not just buildings, but manageable facilities. The space database is a practical, high-impact tool that links Lean Construction to Lean FM, ensuring operational value continuation long after handing over and further into the next stage of planning and construction.

KEYWORDS

Space Database, Lean Facility Management, Digital Construction Deliverables, Institutional Infrastructure

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LEAN CONSTRUCTION AND INDUSTRY 4.0: A REVIEW OF INTEGRATION OPPORTUNITIES, BENEFITS, CHALLENGES, AND FUTURE DIRECTIONS

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ABSTRACT

Historically, the construction industry has lagged behind other industries in terms of technology adoption despite being a major contributor to both the global economy and carbon emissions. In recent years, however, significant progress has prompted a growing body of literature to investigate this shift in greater depth. Nevertheless, the reviews that delve into this are limited. This review aims to aggregate findings from literature on the adoption of Industry 4.0 and 5.0 technologies and tools in Lean Construction. Based on prevailing academic work, it examines the deployment, adoption patterns, and integration strategies across various subfields and organisational contexts, including SMEs and large-scale operations. It focuses on technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), robotics, and Artificial Intelligence (AI), evaluating their reported applications and benefits. Additionally, the paper explores the synergies and integration between Lean Construction and digital tools such as BIM and AI, emphasising how they can enhance practices such as waste minimisation, value generation, and continuous improvement. The paper also presents an indicative framework for integrating Lean Construction with Industry 4.0 and 5.0 innovations, to reinforce construction processes and future research.

KEYWORDS

Construction Automation, Lean Integration, Human Centric Construction, Industry 5.0

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DRIVING LEAN IN FIELD EXECUTION OF IRRIGATION PROJECTS: INTEGRATION OF GEOSPATIALLY-ENABLED DIGITAL WORKFLOWS

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ABSTRACT

Large-scale irrigation pipeline projects, often spanning over 20,000 hectares of Culturable Command Area (CCA) and comprising hundreds of kilometres of pipelines with varying diameters, materials, and fittings, present significant execution challenges. These include difficulty in accurate pipeline laying due to cross-country terrains, inefficiencies in manual progress tracking from centralized offices, and complexity in accessing location specific design data. Conventional methods—such as static engineering drawings and Excel-based data management—lead to delays, data inconsistencies, and redundant manual entries. As-built data, critical for future maintenance and performance validation, is often recorded inconsistently across platforms, further compounding the problem. To address these challenges, a tailored digital workflow has been developed using geospatial technologies and location intelligence through an integrated mobile and web-based application. This unified platform enables precise GPS-based pipeline alignment, real-time access to design data and specifications, GIS-based monitoring of construction progress, and seamless capture of standardized as-built data. By consolidating multiple disjointed processes into a single system, the platform ensures data consistency, reduces duplication, and enhances operational efficiency. The solution has been successfully implemented in two major irrigation projects, streamlining site execution and promoting lean construction practices. It supports gap identification between planned and executed layouts and facilitates as-built validation— particularly important when pipeline routes are altered in the field due to site conditions. Real-time visibility into field progress also enables informed, timely decision-making. This in-house development not only reduces reliance on external vendors and fragmented software tools but also yields substantial cost savings. The approach demonstrates a scalable, field-tested model for digital transformation in infrastructure execution and offers a replicable framework for similar large-scale, geographically dispersed irrigation projects. Overall, the digital workflow enhances accuracy, accountability, and efficiency in the delivery of complex pipeline networks.

KEYWORDS

Lean Management Practices, Geospatial Technologies, Pipeline Execution, Progress Monitoring, As-built Data

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PAPER ID: 66

SYSTEMATIC ASSESSMENT OF DIGITAL TWIN APPLICATIONS IN LINEAR INFRASTRUCTURE CONSTRUCTION

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ABSTRACT

Digital Twin (DT) technology is increasingly recognized for its potential to enhance construction through real-time data integration, simulation, and performance tracking; however, its application in linear infrastructure projects, such as highways, railways, tunnels, and pipelines, remains underexplored. This study presents a systematic literature review, following PRISMA methodology, to evaluate current research on DT in linear construction, focusing on trends, applications, and limitations. Results reveal a growing academic interest, although most studies remain conceptual or framework-based, with limited real-world validation. Key challenges include interoperability, data management, and real-time feedback, while emerging applications—such as progress monitoring, predictive maintenance, and digital visualization—are fragmented and lack standardization. The review concludes that DT offers significant promise for improving planning, monitoring, and lifecycle management in linear projects, but further research and practical implementation are required to develop scalable, interdisciplinary solutions.

KEYWORDS

Digital Twin (DT), Systematic Literature Review, Linear Infrastructure, Construction Projects

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PAPER ID: 1

FROM RESISTANCE TO RHYTHM: FIELD-LED LEAN CONSTRUCTION THROUGH 5S AND BIG ROOM IMPLEMENTATION

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ABSTRACT

India's construction sector is undergoing rapid modernization with increasing emphasis on safety, integration of digital tools, and timely delivery. However, many projects continue to face persistent challenges in achieving consistent productivity and seamless on-site coordination. Common challenges include fragmented subcontracting structures, reactive planning cycles, and inconsistent workface practices that often result in rework, material wastage, and labour inefficiencies. Although Lean Construction has been widely discussed across industry forums, its practical adoption in Indian public-sector projects remains limited and insufficiently undocumented. This paper presents a one-year Lean implementation journey at the "Construction of 400-Bedded Super Specialty ESIC Hospital, Sheela Nagar, Visakhapatnam." Rather than positioning Lean as a rigid framework, the initiative aimed to embed Lean thinking through field-owned, low-barrier interventions, designed to evolve naturally into daily practices, while overcoming cultural resistance and fragmented planning structures. The objective was to assess whether decentralized, behaviourally informed routines could create a sustained transformation in site functioning. Over twelve months, site teams applied Lean principles including 5S, Big Room coordination, visual management, and layout optimization across stores, crane operations, and daily planning. The implementation followed an observation-led, participatory approach that combined site ethnography, real-time syncs, and small experiments involving subcontractors and field engineers. The implementation yielded significant process improvements. Store retrieval time decreased by approximately 30% following the introduction of structured shelving and clear labelling. Crane utilization predictability improved by about 25% through optimized material flow and synchronized lifting windows. Engineers reported smoother task handovers, reduced miscommunication, and organic adoption of Lean terminology such as "sort" and "flow", refelecting gradual cultural integration. Subcontractors benefited from clearer expectations and sequencing, reducing idle time. Although early adoption faced fatigue around the third month, sustained peer engagement and visual nudges helped restore and maintain rhythm. By the sixth month, Lean routines had become normalized site behaviours. This paper does not claim universally replicable productivity gains rather; it offers grounded insights into contextual adaptation of Lean in India. It demonstrates that change is most sustainable when field teams co-create processes, and allow Lean to evolve from lived experience, not by external enforcement. This case contributes to the limited body of literature on behaviour-led Lean adoption in developing construction markets.

KEYWORDS

Lean Construction, 5S, Big Room, Indian Construction Sites, Human-Centered Lean, Field-Driven Change

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PAPER ID: 34

PIONEERING MONOLITHIC COLUMN CASTING: TURNER'S ACHIEVEMENTS IN INDIA

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ABSTRACT

This paper discusses Turner Construction's innovative approach to casting double (8-meter height) and triple-height (12-meter height) reinforced concrete (RCC) columns in a single pour. Implemented on landmark projects in India—Bangalore International Airport Terminal 2, Phase 1, and another high-rise marquee project in Hyderabad—the method demonstrates significant advancements in safety, quality, and project delivery timelines. The paper outlines the methodology, material design, execution strategy, and key benefits achieved.

KEYWORDS

Lean construction, Standardization, Quality, Safety, Architectural Finish, Optimization of activity duration

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PAPER ID: 33

LINEAR SCHEDULING METHOD (LSM) USING TILOS FOR ANALYSING CRITICAL RESOURCE UTILIZATION IN ELEVATED CORRIDOR PROJECTS

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ABSTRACT

Construction of elevated corridor projects involves installation of segmental viaduct and girders using an erection scheme. An effective construction method used in construction of elevated corridors and metro rail viaducts is girder erection with Launching Girder (LG). LGs are used to place precast bridge segments to form viaducts and bridges. LGs are used for the construction of elevated corridors in environments where there is an existing road bridge crossings, railway, and river crossings. Such operations are typically characterized by challenges in project planning & scheduling, leading to traffic congestion, increased waiting times, and inefficient resource usages etc. Extant research points that the Critical Path Method (CPM) and Precedence Diagramming Method (PDM) are inadequate for planning & scheduling elevated corridor projects. The traditional scheduling techniques pose the following challenges for projects that are linear in nature: The currently used planning methods show no spatial overview of erection activities at each moment of time. The methods thus pose challenges in representing both the spatial location and time dimensions of key construction equipment such as LGs and cranes; traditional scheduling methods do not illustrate locations like river crossings, road, and railway crossings. Illustrating such features allows for better planning of construction methods and associated timelines; traditional scheduling methods, do not provide direction of work, and varying rates of productivity of preceding and succeeding activities; clashes between various operational activities cannot be detected; construction logistics (working trains, heavy machinery) cannot be represented with the current methods. With the aid of an elevated corridor project in India, this case demonstrates the application of Linear scheduling (LS) using TILOS software, thereby highlighting the superiority of Location-Based Scheduling (LBS) in projects with repetitive activities.

KEYWORDS

Linear Projects, Linear Scheduling, TILOS, Elevated corridor projects, Lean Construction

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PAPER ID: 137

TOWARDS LEANER RAIL INFRASTRUCTURE: A THEORETICAL FRAMEWORK COMBINING VALUE STREAM MAPPING AND LAST PLANNER

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ABSTRACT

Mega infrastructure projects are inherently complex, involving extensive planning, coordination among multiple stakeholders, and effective use of resources to realize project goals. In such situations, Lean Construction (LC) has emerged as a viable approach for enhancing project delivery by reducing waste and creating value. Among the various Lean tools, the combined use of the Last Planner System (LPS) and Value Stream Mapping (VSM) has shown promise in reducing inefficiencies and improving workflow reliability. The objective of this study is to develop a theoretical framework that integrates Value Stream Mapping (VSM) with the Last Planner System (LPS) to enhance efficiency and waste minimisation in track-laying processes for India's first High Speed Rail (HSR) project. The framework is designed to identify bottlenecks, waste, and process delays while supporting better planning and execution. The findings demonstrate that integrating VSM with LPS provides project teams with clearer insights that improve overall project efficiency by improving workflow reliability and reducing wastage, offering benefits for project managers, contractors, and policymakers. The proposed framework benefits HSR project managers, planners, and policymakers by providing a foundation for applying Lean tools, thereby strengthening construction management practices in India's infrastructure sector.

KEYWORDS

Last Planner System, Value Stream Mapping, High Speed Rail, Lean Construction, Waste Minimisation

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PAPER ID: 131

INTEGRATING LEAN PRINCIPLES FOR EFFECTIVE RISK BUFFERING IN PROJECT DELIVERY

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ABSTRACT

Construction projects face endless uncertainties, including scope and design changes, resource fluctuations, weather disruptions, and evolving stakeholder demands. Traditional risk management typically employs fixed buffers of time, cost, or resources. While these static buffers provide some protection, they are often oversized, poorly positioned, or disconnected from real project conditions. As a result, they can generate inefficiencies, create waste, and reduce overall project competitiveness. Lean construction, with its focus on maximizing value and minimizing waste, provides a strong foundation to rethink how buffers are designed and managed. Yet, lean practices and risk management are usually applied separately, missing opportunities for integration. The concept of dynamic buffer allocation, adjusting buffer sizes and placements in response to actual performance and emerging risks, remains relatively underexplored. The present research proposes a lean-driven risk buffering framework that unites lean tools such as the last planner system, pull planning, constraint analysis, and value stream mapping with adaptive buffer management principles from critical chain project management and production control. The framework emphasizes four steps that includes identifying variability, placing buffers strategically, monitoring collaboratively through visual tools, and dynamically adjusting buffers based on early risk signals. By combining lean thinking with adaptive risk buffering, the proposed approach enhances schedule reliability, improves resource use, strengthens stakeholder collaboration, and delivers more resilient, value-driven project outcomes.

KEYWORDS

Lean construction, Risk management, Dynamic buffer allocation, Pull planning, Real time project monitoring

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PAPER ID: 87

DELAYS IN PUNE METRO CONSTRUCTION: MAPPING RISKS TO LEAN WASTES FOR IMPROVED PROJECT DELIVERY

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ABSTRACT

In rapidly expanding cities such as Pune, urban growth and rising population density have placed immense strain on transport infrastructure, making dependable metro systems vital for mobility and sustainability. The Pune Metro, with its Purple and Aqua lines under Phase 1, has faced an overall delay of approximately 27 months, underscoring the need for systematic approaches to evaluate and mitigate schedule overruns. This research investigates the critical delay factors in the Pune Metro and applies Value Stream Mapping (VSM) to analyze the land acquisition and site handover processes—one of the most significant contributors to project delays. VSM is employed to visualize the current state, identify value-adding versus non-value-adding activities, and design a future state with Lean improvements. The analysis highlights inefficiencies such as sequential approvals, extended negotiations, and redundant verification steps, which collectively prolong lead times. The proposed future-state VSM demonstrates how Lean interventions—including digital land mapping, e-records, standardized negotiations, and parallel approval workflows—can streamline activities, reduce waste, and improve workflow reliability. By showcasing a structured Lean-based approach, this study contributes a practical framework for minimizing delays and enhancing delivery performance in Indian metro rail projects, with broader applicability to large-scale infrastructure development in emerging economies.

KEYWORDS

Construction Delay Analysis, Risk Matrix, Relative Importance Index (RII), Urban Metro Mega Projects, Value Stream Mapping

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PAPER ID: 51

STUDY ON LABOUR PRODUTIVITY IN BUILDING CONSTRUCTION

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ABSTRACT

Construction industry in India is facing with low productivity, low ratio of skilled to unskilled workers, high cost of finance, low technology base which affects the cost and duration of the projects. Therefore, this study aims to address the ways to measure labour producitivy in building construction. The objective of the study is achieved by measuring the productivitiy during building construction using work sampling and foremen delay survey methods. The measured productivity using these methods are used to find the correlation with quantitative productivity values achieved during the same period. This study helps in applying the lean tools to measure the actual productivity achieved during building construction projects.

KEYWORDS

Lean Construction, Productivity, Work sampling, Foreman delay survey

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PAPER ID: 67

INVESTIGATING IMPACT OF SMALL TOOLS ON REBAR-TYING PRODUCTIVITY

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ABSTRACT

Rebar tying is a critical yet labour-intensive activity in reinforced cement concrete (RCC) construction, ensuring structural stability and performance. Traditionally performed manually using pliers and tying wire, workers secure thousands of intersections across dense rebar networks, often in physically demanding postures like bending or squatting for long periods. While accuracy is vital, manual tying is repetitive, slow, and fatigue inducing, limiting productivity and increasing the risk of errors. A skilled worker typically ties only 1,000–1,500 knots per day under site conditions, insufficient for large-scale projects with tight schedules. With reinforcement layouts becoming increasingly complex with dense and congested reinforcement zones, manual tying has become a major bottleneck, driving labour costs and extending timelines. To address this, various solutions have been emerging, from compact hand-held tying tools to fully automated systems. Given their portability and wider availability, this study evaluates the performance of a coil-based hand-tying tool in reinforcement cage fabrication. A field investigation was documented about the production process and conducted a time-motion study of manual tying. Subsequently, an experimental setup tested the tool across three common tie configurations, measuring tying speed, consistency, and worker fatigue. Feedback from workers, engineers, and supervisors was also collected to assess usability and perceived tie quality. Results show that while the tool improved productivity in certain tie types, its effectiveness varied with configuration and operator familiarity. Physical strain during prolonged usage and resistance to adopting new tools were notable challenges. This study highlights the need to reassess low-tech, repetitive tasks within industrialized construction workflows. It emphasises that productivity tools should be evaluated holistically, considering output, ergonomics, and adoption challenges. Future work can explore training strategies, long-term usability, and integration with lean and digital construction frameworks.

KEYWORDS

Rebar-tying, Productivity, Small Tools, Process Improvement, Lean Construction.

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PAPER ID: 105

ERGONOMIC FACTORS INFLUENCING THE IMPLEMENTATION OF LEAN PRINCIPLE IN THE CONSTRUCTION INDUSTRY OF NORTH-EAST INDIA

Ashwini kumar[119] and Sparsh Johari[120]

ABSTRACT

Risk factors related to ergonomics in construction can lead to injuries and even deaths, yet despite their potential to reduce waste, their incorporation into lean procedures remains poorly understood. The northeastern region of India presents challenges in efficiently applying lean concepts due to its steep topography, limited mechanization, harsh weather conditions, and labor-intensive procedures. These circumstances undermine lean goals by posing serious ergonomic concerns that compromise worker productivity, safety, and health. Although lean methods have been extensively studied globally, a significant knowledge gap remains in this area due to the scarcity of studies on the relationship between ergonomics and lean construction. The study's foundation was a literature survey that found nine ergonomic risk factors and ten lean principles. A structured questionnaire survey was administered to 85 participants, including engineers, supervisors, and workers, to collect primary data. The relationship between the identified ergonomic risks and lean principles was then ascertained by analysing the gathered data using descriptive statistics, including mean ranking, standard deviation, and brainstorming for interpretation of the relation. The study found that ergonomic factors, such as manual material handling and repetitive motions, are the most prevalent and frequent in this region, while lean principles, including value generation and flow efficiency, have the most significant impact.

KEYWORDS

Lean construction, Ergonomics, NorthEast India

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PAPER ID: 106

A REVIEW OF SMART INFRASTRUCTURE SOLUTIONS FOR TRAFFIC CONGESTION AND SAFETY IN CONSTRUCTION WORK ZONES

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ABSTRACT

Urbanization in developing countries has increased the complexity of managing traffic congestion and ensuring safety in construction work zones. While essential for improving long-term urban mobility, these projects often disrupt existing traffic networks and pose significant risks to workers, drivers, and pedestrians. This study explores the role of smart infrastructure technologies for enhancing traffic flow and improving safety in construction zones. Smart traffic management systems, IoT-enabled safety devices, predictive data analytics, and autonomous systems are reviewed for effectiveness in urban environments. The review also identifies barriers to adoption, such as infrastructure readiness, financial constraints, and public acceptance, as well as global best practices. It proposes recommendations for policymakers, urban planners, and construction companies. By examining the applicability of these solutions in densely populated urban areas, this study highlights the crucial role of smart infrastructure in mitigating traffic congestion and improving work zone safety. These insights will benefit urban planners and construction firms aiming to implement sustainable and safe infrastructure solutions in rapidly growing Indian cities.

KEYWORDS

Work Zone Safety, Urban Mobility, Emerging Technologies, Smart Infrastructure, Predictive Analytics

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PAPER ID: 60

APPLICATION OF RAPID LEAN CONSTRUCTON-QUALITY RATING (LCR) FOR A COMMERICAL BUILDING IN INDIA

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ABSTRACT

The Quality Rating Model for Rapid Lean Construction (LCR), a simplified framework intended to quickly evaluate the quality and leanness of construction projects, is presented in this study. The model, which was created as part of a global research partnership between Brazil and Germany, combines quantitative analysis and qualitative observation to provide a thorough assessment. Using a standardized questionnaire that covers six crucial areas such as client centeredness, material flow, and waste awareness and pull, organization and information flow, and continuous improvement techniques like the LCR model classifies construction projects according to how much lean construction principles are applied. The model promotes decision-making at the project and organizational levels, makes benchmarking possible, and speeds up improvement planning with its straightforward scoring system and visual results display. Because of its versatility, it may be used in a variety of construction settings and regions, providing a timely and perceptive method for comprehending and improving lean building techniques. The Rapid Lean Construction Quality Rating Model structure, development process, and application for the assessing the Lean Quality Rating of a high rise building commercial building of G+42 Storey located in Hyderabad, India. The project implemented lean practices and completed the bare shell of the structure. The study also shows how LCR can improve project results and promote operational excellence in the construction sector. The LCR model helps businesses benchmark projects, boost performance, and promote lean thinking at all project management levels by providing a quick, standardized method for evaluating lean construction quality.

KEYWORDS

Lean Construction, Quality Rating, Commercial building, Operational excellence, Decision-making

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PAPER ID: 88

IDENTIFICATION AND EVALUATION OF HAZARDS IN HYDROGEN INFRASTRUCTURE: A LEAN CONSTRUCTION PERSPECTIVE

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ABSTRACT

As the global energy sector races toward decarbonisation, green hydrogen has emerged as a transformative clean energy vector projected to account for up to 12% of global energy use by 2050 and attract over 10 trillion USD in investments. In India alone, the National Green Hydrogen Mission (NHM) aims to produce 5 million tonnes of green hydrogen annually by 2030, positioning the country as a major player in the global hydrogen economy. However, integrating hydrogen into existing and new infrastructure introduces complex challenges due to its distinct physical and chemical properties such as low ignition energy, high diffusivity, and embrittlement effects on materials. This study systematically identifies and ranks the hazards associated with hydrogen infrastructure with particular attention to green hydrogen facilities in the Indian context. It adopts a structured, multi-stage methodology grounded in literature review, field investigation, and expert consultation. This study makes a novel contribution by offering one of the first Indian case-based, quantifiable hazard ranking frameworks for hydrogen infrastructure. Unlike existing global studies that focus largely on technical simulations or post-accident investigations, this work integrates on-ground stakeholder feedback, contextualised risk profiles, and a lean-informed hazard evaluation model. The findings support the incorporation of lean construction principles by minimising rework due to failures, enhancing safety-related workflows, and aligning infrastructure development with India's green hydrogen mission goals.

KEYWORDS

Green Hydrogen, Relative Importance Index (RII), Hazard Ranking, Lean Construction, Risk Management

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PAPER ID: 141

INTEGRATION OF LEAN WITH QMS FOR ITS EFFECTIVE IMPLEMENTATION

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ABSTRACT

Lean in Construction has gained widespread recognition in the construction industry that maximizes value, minimizes waste, enhances workflow reliability, and encourages collaborative project delivery. Lean tools and practices align closely with Quality Management System (QMS) principles such as continual improvement, creating evidence-based decision, and engagement of people, making it highly suitable for managing the dynamic and complex nature of infrastructure projects. The seven principles of QMS and their framework, Plan-Do-Check-Act (PDCA) contribute significantly to the improvement in accountability, process discipline, and informed decision-making. Integrating Lean with QMS, improves Lean practices to become more robust and sustainable. The support of QMS ensures consistent performance, standardized procedures, structured documentation and traceability of corrective actions. This paper demonstrates framework for integrating Lean tools such as 5S (Sort, Set in Order, Shine, Standardise, Sustain), 8 Waste, Choosing by Advance (CBA), Value Stream Mapping (VSM), Last Planner System (LPS), and RCA with QMS and their potential benefits. The study highlights that while Lean tools excel at enhancing on-site operations and team efficiency, their strategic utilisation is best realized when combined with the structured support of QMS. Together, Lean and QMS form a powerful, complementary framework that drives sustainable project outcomes, strengthens stakeholder confidence, and cultivates a lasting culture of quality and excellence in infrastructure development.

KEYWORDS

Lean, Construction, QMS, Process approach, PDCA, Waste Reduction, Framework

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PAPER ID: 127

OPTIMIZATION IN SAFETY SCREEN ASSEMBLY & INSTALLATION THROUGH LEAN: ACHIEVING EFFICIENCY, SAFETY AND SUSTAINABILITY

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ABSTRACT

Safety screens are essential vertical fall protection systems mandated in all projects exceeding 10 floors in a leading Indian XYZ Construction firm-Buildings Segment. These systems safeguard workers and prevent debris from falling across three levels: the working floor, one level above and one below. Despite their critical role, the conventional assembly and installation process is fraught with inefficiencies like long transport distances, repeated crane operations, idling of resources and manual bolt tightening resulting in non-value-adding activities (NVAAs), extended cycle times and increased safety risks. This study investigates the application of Lean principles to optimize the safety screen assembly and installation workflow in a high-rise IT building project. A detailed process mapping exercise identified key bottlenecks, followed by targeted interventions including relocation of the assembly yard, Just-in-Time (JIT) staging, standardized work instructions and ergonomic tool deployment. Quantitative metrics were tracked before and after implementation. Findings reveal significant improvements in productivity, safety and sustainability. The introduction of battery-operated bolt-tightening tools reduced man-hours by 93% and eliminated rework cases. These results underscore the transformative potential of Lean methodologies in enhancing operational efficiency and safety in high-rise construction workflows. The study also highlights implementation challenges and proposes future directions for integrating digital and location-based Lean tools.

KEYWORDS

Lean construction, Safety screen assembly, Just-In-Time, Value Stream Mapping

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PAPER ID: 63

PRODUCTIVITY IMPROVEMENT APPROACHES FOR LINEAR AND NON-LINEAR PROJECTS THROUGH LEAN CONSTRUCTION

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ABSTRACT

In the rapidly growing global construction industry, maintaining competitiveness requires delivering greater value for the unit resource deployed on construction. Variability in the construction workflow increases waste, cycle time, and reduces overall system throughput. The application of alternate approaches, such as lean thinking, focuses on optimizing workflow throughput by reducing variability and improving productivity. The present research explores the function of lean construction in improving productivity in two specific types of construction projects: Linear Repetitive Projects (LRP) and Non-Linear Non-Repetitive Projects (NLNRP). LRPs are characterized by a geographically extended scope with sequential and recurring tasks across segments. In contrast, NLNRPs are confined within a bounded site and consist of highly specialized, non-repetitive tasks with varied resource requirements. While LPRs benefit from modular execution and workflow standardization, NLNRPs, constrained by spatial limitations and task disparity, demand intricate coordination, causing productivity challenges. To assess the factors impacting productivity of these projects, expert interviews were conducted with professionals from a large metro construction project (LRP case) and a large steel melting plant project (NLNRP case). The interviews enabled a comparative analysis of productivity factors: in LRPs, terrain variability, crew proficiency, site access, equipment movement, shift delays, standardization, and parallel execution potential; in NLNRPs, spatial congestion, task variability, specialized resources, re-sequencing, inter-trade dependencies, limited standardization, and complex coordination within confined spaces. Analysis from the study indicates that lean construction implementation is more effective in LRPs, owing to its sequential flow and repetitive nature of activities, making it easier to identify wastes, standardise processes, and apply improvement across segments. Consistent data and predictable workflows in LRPs lead to efficient implementation of lean, which helps in bridging the gap between technological advancements and productivity gaps. The study findings provide actionable insights for construction managers seeking to apply lean tools in varied project contexts.

KEYWORDS Lean construction, Productivity improvement, Linear repetitive projects, Non-linear non repetitive projects, Standardization

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PAPER ID: 50

WORK-LIFE BALANCE AND ITS IMPACTS ON QUANTITY SURVEYORS IN INDIAN CONSTRUCTION

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ABSTRACT

Indian professionals are frequently forced to work above their allocated hours due to the demanding nature of the construction sector. There is not enough study on the work-life balance (WLB) of quantity surveyors, who are crucial to project planning and cost control, in the Indian context. It is clear from comparing research conducted in Sri Lanka and Africa that a lack of personal and leisure time contributes to the low job satisfaction of many quantity surveyors. The current study explores the work life balance of quantity surveyors working in the Indian construction sector in order to close this gap. Quantitative data from a questionnaire survey with 30 professionals were examined using RII, with a focus on issues specific to QSs in India. The study found that gender, experience level, and project deadlines (the last being the most important factor have a substantial impact on WLB among QSs in India). High stress levels brought on by poor work life balance (WLB) frequently have a negative effect on organizational effectiveness and professional performance. The study also discovered that fundamental Indian traditions like yoga and meditation are useful techniques for enhancing work life balance (WLB) and managing stress. All factors considered, the elements influencing quantity surveyors work life balance (WLB) have a significant impact on the management and technical cultures of Indian construction companies. In line with the theme of ILCC2025, in this paper, WLB outcomes have been explicitly connected with the concepts of lean construction (value, flow, collaboration, and waste reduction). A better WLB minimizes the variability of workforce availability, decreases the waste of underutilized/overburdened individuals (often discussed within the lean context as the underutilization of human potential), and enables stable, takt-based working processes - enhancing flow and value delivery of projects.

KEYWORDS

Lean Construction, Time Management, Work-life Balance, Employee Well-being, Resource Utilization, Stress, Deadlines, Exhaustion, Professionals, Quantity Surveyors

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PAPER ID: 4

DIMENSIONS OF PROJECT MANAGEMENT AND LEADERSHIP IN LINEAR MEGAPROJECTS

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ABSTRACT

Leadership deficiencies remain a critical and underexplored cause of failure in large-scale linear construction megaprojects, where traditional project management tools often fall short in addressing complex, stakeholder-heavy environments. Despite its recognized influence on project outcomes, leadership in the construction sector lacks structured assessment methods that align with real-world challenges. This study addresses the gap by identifying which leadership quality most significantly influence project success and how they manifest across hierarchical levels in industry settings. Findings indicate that while stakeholder management and vision-setting are relatively well developed among project leaders, transformational leadership, emotional intelligence, and risk-taking remain consistently underperformed despite being highly valued. The results underscore the need for targeted leadership development, offering a data-driven evaluation framework that can be scaled across infrastructure projects. This contributes to enhancing leadership effectiveness and, consequently, improving project outcomes in the construction industry.The study's outcomes also resonate with Lean Construction philosophy, highlighting leadership's role in enabling collaboration, empowerment, and waste reduction.

KEYWORDS

Leadership in Construction, Megaprojects, Analytical Hierarchy Processing (AHP), Leadership Assessment Framework.

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PAPER ID: 10

INNOVATIVE METHOD OF OVERHEAD TANK CONSTRUCTION USING THE LEAN TOOLS

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ABSTRACT

Overhead Water Tanks (OHTs) are an essential part of public water supply systems. Traditionally, they were constructed using the in-situ Intz tank method with raft, columns, bracings, and a dome. Over time, designs shifted to partial in-situ construction, replacing the dome with prefabricated Zincalume tanks on flat slabs. This reduced the challenges of dome construction and improved construction time, but issues such as delays in bottom structure works, weather dependency, complex scaffolding, and inconsistent quality persisted. This study explores precast construction as an alternative, where structural components are manufactured in controlled off-site facilities and then assembled on-site. Precast allows parallel progress of element production and foundation work, while the Zincalume tank installation remains similar to partial in-situ methods. Field data indicates that precast can reduce construction time by nearly 49% compared to partial in-situ, while also improving quality control, safety, aesthetics, weather independence, and reducing labour and maintenance needs. The comparison applies the Lean tool Choosing by Advantages (CBA) to assess both methods, particularly relevant to the Jal Jeevan Mission, where timely delivery, quality, and sustainability are critical. Additionally, the study considers long-term maintenance and environmental performance, showing that precast, though slightly higher in initial cost, offers significant life-cycle savings and a reduced carbon footprint through lower rework and material waste.

KEYWORDS

Lean construction, Lean tool, Choosing by advantage, OHT, Precast, Zincalume, Sustainability

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PAPER ID: 126

CYCLE TIME REDUCTION THROUGH TAKT PLANNING AND PPC TRACKING: A LEAN IMPLEMENTATION CASE STUDY IN HIGH RISE COMMERCIAL PROJECT

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ABSTRACT

In high-rise commercial construction, cycle time is a critical indicator of workflow reliability and activity sequencing. Prolonged or inconsistent cycles often reflect workflow interruptions, resource imbalances and coordination delays, jeopardizing milestones and schedule predictability. To address these issues, a Lean initiative was implemented to reduce the conventional 18–21 days cycle to a consistent 10-day cycle. The approach combined TAKT planning with a Power BI–enabled visual management system to improve flow by balancing workloads, ensuring even task progression and providing transparency. A TAKT sheet integrated with Power BI generated a calendar-style dashboard, displaying daily quantities and workload intensity for reinforcement, shuttering and concreting. Conditional formatting offered instant visual cues, enabling waste reduction through better resource leveling. Plan Percent Complete (PPC) was used to monitor task reliability, supported by structured root-cause analysis. Delays were categorized into prerequisites, manpower, equipment, coordination and other factors. Pareto analysis revealed that early-week disruptions were mainly workmen and equipment intended to cascade into late-week delays. Implementation reduced cycle time from 29 to 10 days. Over six weeks, PPC improved from 37% to 86%. The case demonstrates collaboration-driven, continuous improvement using Lean methods and digital tools, offering a replicable model for sustainable project delivery in India.

KEYWORDS

Lean construction, TAKT, PPC, High Rise Commercial Project

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PAPER ID: 70

APPLICATION OF LEAN MANUFACTURING TECHNIQUE IN RMC PLANT USING VALUE STREAM MAPPING

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ABSTRACT

The main objective of this study is to use a lean principal to the Ready-Mix plant through Value Mapping System (VSM). This technique is used to minimize waste and maximize productivity in the manufacturing process. VSM is a lean tool to visualize and analyze the mapping flow from starting to delivery. This study involved data collection, detailed observation and process analysis to identify the inefficiencies across critical stages such as order placement, batching, mixing and delivery. In this study, the current map identified some inefficiencies, including batching delays, maximum time taken for transit mixture, and delays in the document approval process from application engineer. It is responsible for Non value added (NVA) activities. To reduce the NVA activities, a future map was suggested with the modifications by reducing the overall cycle time across the 10 productions by about 21 minutes, based on quantitative analysis. The suggested map will improve overall material flow, minimize equipment and rearrange transportation paths, and improve operational efficiency. The findings of this study show that implementing Lean Manufacturing and VSM in RMC features can lead to considerable benefits in productivity and process efficiency. The project demonstrates how the usage of VSM can enhance efficiency, reduce non-value-adding activities, and create a streamlined, high-performing RMC production model.

KEYWORDS

Lean construction, Inventory Control, Waste Elimation, Lead Time Reduction

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PAPER ID: 128

OPTIMISING CONSTRUCTION PROCESSES: A LEAN IMPLEMENTATION APPROACH FOR ENHANCED EFFICIENCY AND SUSTAINABILITY AT L&T INNOVATION CAMPUS

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ABSTRACT

This paper presents the successful implementation of Lean Construction tools at the L&T Innovation Campus Project in Chennai, a 40-acre mixed-use development by Larsen & Toubro Construction. Aimed at achieving a 25% productivity increase, the project addressed challenges such as delays, cost overruns, and inefficient resource utilisation through Lean methodologies. Key tools included the Last Planner System (LPS) for collaborative planning, Plan Percentage Complete (PPC) for tracking performance, Root Cause Analysis (RCA) for identifying inefficiencies, and Work Sampling to optimise workforce productivity. Primary research, involving stakeholder interviews and surveys, identified critical bottlenecks like material shortages and poor coordination. Lean interventions resulted in significant improvements: concrete works productivity increased by 34%, blockwork by 29%, and slab cycle time reduced from 15 to 12 days. Material wastage was minimised, with cement waste reduced from 1.79% to 0.54%, reinforcement steel from 2.06% to 0.93%, and concrete from 1.58% to 0.45%. These efforts saved 367 days and reduced project costs by 1.59%, aligning with Environmental, Social, and Governance (ESG) goals through reduced resource consumption. The project established a framework for continuous improvement, enhancing stakeholder collaboration and setting a model for future projects. By integrating Lean principles with digital tools, this initiative demonstrates how sustainable and efficient project delivery can transform India's construction landscape, contributing to the ILCC 2025 theme of sustainable and digitalized project delivery.

KEYWORDS

Lean construction, productivity enhancement, last planner system, waste minimisation, sustainable delivery.

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PAPER ID: 13

SUSTAINABLE USE OF STEEL SLAG AGGREGATE IN ROAD SUB-BASE USING CBA LEAN TOOL

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ABSTRACT

Steel slag is a by-product that is generated during the steel production process. Steel slag offers potential as a substitute for natural crushed aggregates. This study investigated the suitability of steel slag aggregate as a partial replacement for natural crushed aggregates in the sub-base layer using the lean tool Choosing By Advantages (CBA) decision making framework. The objective of this implementation at the Bangladesh road project site was to assess whether incorporating steel slag improves the mechanical performance and cost effectiveness of the sub-base or not. The need for the use of steel slag arises from fulfilling four goals: lack of natural resources in Bangladesh, high transportation cost of aggregate from India, and managing steel industry waste through sustainable reuse. Two alternatives were evaluated: a conventional sub-base using natural aggregates and a modified sub-base containing steel slag aggregate, 20 mm, 10 mm aggregate, and Sylhet sand. The results indicated that the steel slag mix provided several advantages. Subbase mix with steel slag aggregate had 15% higher load-bearing strength as compared to natural aggregate mix. It also showed better compactness & resistance to moisture, which improved durability. Additionally, the modified mix resulted in an 2.1% reduction in material cost per cubic meter.

KEYWORDS

Steel slag, Sustainable, Subbase, Choosing By Advantages (CBA)

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PAPER ID: 9

OPTIMIZING JOINT SEALING IN RIGID PAVEMENT USING CHOOSING BY ADVANTAGES (CBA)

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ABSTRACT

Joint sealing is critical in Rigid Pavement to prevent the ingress of water, debris, and incompressible materials into joints, thereby preserving structural integrity and extending pavement life. Traditional sealants such as hot bitumen and polysulfide, although widely used, are labour-intensive, time-consuming, and require frequent maintenance. This study investigates the use of compression seals as a more efficient, durable, and sustainable alternative. A structured evaluation was conducted using the Lean decision-making framework Choosing by Advantages (CBA), which enables objective comparison across key performance criteria, including installation time, durability, ease of application, maintenance requirements, and cost. The assessment considered practical site constraints and real-world project data to enhance applicability. Results showed that compression seals reduced installation time by up to 85% and lowered the overall joint sealing cost by 10-25%, with an estimated 50% reduction in life cycle cost compared to conventional sealants. These findings emphasize the substantial operational and economic advantages of compression seals. In conclusion, compression seals represent a cost-effective and time-efficient joint sealing solution aligned with Lean construction principles. Their adoption is recommended for future Rigid Pavement projects to improve long-term performance, minimize maintenance, and accelerate project delivery.

KEYWORDS

Rigid Pavement, Joint sealing, Compression seals, Choosing by Advantages (CBA), Lean construction, Sealant evaluation, Lifecycle cost

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PAPER ID: 76

INTEGRATING LEAN METHODOLOGIES IN RESIDENTIAL PROJECTS: ADDRESSING DELAY AND COST OVERRUN CHALLENGES

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ABSTRACT

The Indian construction sector frequently experiences cost and time overruns, particularly in residential projects, leading to reduced profitability, compromised quality, and safety concerns. This study examines the barriers to lean construction adoption and evaluates the potential benefits of lean scheduling through a simulation-based case study. A survey of 113 construction professionals was conducted, and responses were analyzed using IBM SPSS software. Reliability was confirmed through Cronbach's alpha, and descriptive analysis identified five major categories of barriers: general, internal, labour-related, material-related, and exogenous. General barriers such as poor knowledge sharing, low awareness, and resistance to change were found to be most critical. Internal issues included poor planning and weak waste control, while labour barriers highlighted skill shortages and inadequate training. A residential case study in Coimbatore revealed a 54-day (24.77%) time overrun and a cost overrun of ₹510,525 (11.78%), with Pareto analysis showing that five primary causes accounted for nearly 75% of delays. Simulation using the Last Planner System (LPS) demonstrated potential to reduce project duration to 201 days and improve workflow reliability. The study concludes that lean techniques, when adapted to local practices, can improve efficiency, provided challenges are addressed through structured training, phased implementation, and stronger stakeholder engagement.

KEYWORDS

Lean construction, Last Planner System, Project delays, India, Simulation

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PAPER ID: 7

LEAN CONSTRUCTION IN PRACTICE: IMPROVING CYCLE TIME AND WORKFLOW IN PRECAST SEGMENT CASTING

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ABSTRACT

This study examines the application of Lean principles, specifically Value Stream Mapping (VSM), to improve the efficiency of precast ring segment production for the Mumbai–Ahmedabad High-Speed Rail Project (C2 Package). Faced with two key industry challenges—limited manpower and restricted space for segment stacking—the research focuses on optimizing operational workflows at the casting yard in Ghansoli, Navi Mumbai. The primary objective is to reduce the production cycle time, improve workforce deployment, and enhance spatial planning for segment stacking. A comprehensive current state analysis was conducted through site visits, where activities were classified as value-added, non-value-added, or non-value-added but necessary. This analysis enabled the identification of bottlenecks in the casting process and targeted interventions. Pilot strategies implemented include increased manpower allocation, reorganized stacking layouts, and more efficient logistics. Key performance indicators such as cycle time, labour productivity, and space utilization were tracked to evaluate the impact of these changes. The interventions resulted in a 15–20% reduction in casting cycle time and a 25% improvement in workflow efficiency, demonstrating the substantial benefits of Lean thinking. This study validates the practical utility of VSM in the construction industry, particularly in precast production environments that are constrained by labour and space. By systematically eliminating non-value-added activities and improving inter departmental co-ordination, the project achieved significant gains in productivity and resource optimization. The findings offer valuable insights and scalable solutions for similar infrastructure projects. Recommendations include continued Lean training, implementation of modular storage systems, integration of digital tools for logistics management, and replication of Lean strategies across other work fronts. Overall, the study highlights the potential of Lean methodologies to drive continuous improvement, reduce costs, and support timely delivery in large-scale infrastructure projects.

KEYWORDS

Value Stream Mapping (VSM), Cycle Time Reduction, Workflow Optimization, Manpower Efficiency, Operational Efficiency, Waste Elimination, Productivity Improvement.

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PAPER ID: 99

LEAN ENABLED CONSTRUCTION WORKERS FOR OFF SITE CONSTRUCTION

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ABSTRACT

The Indian construction sector, a primary engine of national economic growth, is at a critical juncture. While modern construction philosophies like Lean Construction and innovative methods like Offsite Construction (OSC) are being championed as the future, their successful adoption is contingent upon a skilled and stable workforce. This paper examines the complex challenges hindering this transition. The core of Lean Construction philosophy, particularly the Last Planner System® (LPS), relies on the performance of empowered frontline workers and their supervisors. However, the Indian construction industry is grappling with a severe skill deficit, with an estimated 97% of its workforce lacking formal training. This issue is compounded by the dual migration challenge: the outward flow of skilled labour to international markets and a recent decline in the traditional inter-state migration of workers from states like Uttar Pradesh, Bihar, and Madhya Pradesh, who form the backbone of the industry. Offsite construction, which requires a higher degree of precision and skill, presents both a solution and a challenge. It offers a controlled environment to implement Lean principles and upskill workers effectively, but its success hinges on resolving the current labour crisis. This paper analyses these interconnected issues and explores how government initiatives for skill development and worker retention, coupled with a strategic shift towards OSC, can create a "Lean-enabled" workforce. It argues that the factory-based nature of OSC provides a unique opportunity to institutionalize Lean practices, enhance worker skills, and make construction careers more attractive, thereby addressing the impending skill crunch and paving the way for a more productive and sustainable construction ecosystem in India.

KEYWORDS

Lean construction, skilled workers, off site construction (OSC), Indian construction, BIM

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PAPER ID: 3

INTEGRATED REAL-TIME RISK MONITORING FRAMEWORK FOR CONSTRUCTION PROJECTS

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ABSTRACT

The construction industry is characterized by high complexity and frequent exposure to diverse risks, often resulting in project delays and cost overruns. Traditional risk management methods such as risk registers, checklists and periodic reviews are predominantly reactive and inadequate during the fast-paced execution phase. Recent technological advancements, including real-time analytics, IoT, and machine learning offer potential for continuous risk monitoring, yet their adoption remains fragmented and cost-prohibitive for many firms. This research addresses the critical gap by developing and validating an integrated, real-time risk monitoring framework tailored for construction projects. The proposed system combines lightweight automation, real-time data visualization, and predictive modeling to track five key risk domains: productivity, weather, procurement, worker availability, and site access. Data is collected through custom web forms and stored in Google Sheets, with automated processing and interactive dashboards built in Microsoft Power BI. Field validation was conducted on an active construction site, demonstrating the system's effectiveness in providing actionable insights, timely alerts, and enhanced stakeholder collaboration. By integrating digital tools with lean principles of flow, transparency, and continuous feedback, the research contributes a practical pathway toward proactive, data-driven risk management in construction projects.

KEYWORDS

Lean Construction, Construction Risks, Progress Monitoring and Control, Real-time Monitoring, Construction Productivity

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IMPLEMENTION OF LEAN CONSTRUCTION IN AFFORDABLE HOUSING: A CASE STUDY OF MHADA PROJECTS

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ABSTRACT

India, with its diverse and rapidly growing population, is expected to face a significant housing shortage in the coming years, particularly among middle- and low income groups due to affordability constraints. In response, the Maharashtra state government has introduced the Maharashtra Housing and Area Development Authority (MHADA) lottery scheme as a beacon of hope, offering affordable housing options to various income groups across the state. MHADA plays a key role in delivering affordable housing through its schemes; however, its projects are often impacted by cost escalations, delays, operational inefficiencies, and material wastage, reducing their overall effectiveness. Lean Construction (LC) has proven effective globally in improving productivity and reducing waste; however, its application in India's public sector affordable housing remains underexplored. To address these challenges, a comprehensive case study on MHADA projects has been undertaken. The research follows a systematic approach, beginning with the identification of key challenges affecting project execution, such as cost overruns, delays, inefficiencies, and material wastage. Subsequently, various lean construction principles are explored to assess their applicability to MHADA projects. By understanding these challenges and reviewing current working practices across different life cycle phases, a process map is developed, and appropriate lean tools are suggested to address specific steps in the project life cycle. A strategic model is then formulated by analysing real-time project data and offering tailored solutions to meet the unique demands of MHADA housing projects. The methodology includes semi-structured interviews with project managers, onsite observations to assess workflows, and a review of project documents from both ongoing and completed projects. This multi-dimensional approach helps to understand the current scenario and enables the development of recommendations to improve the existing system. Although the study is limited to MHADA projects, the approach adopted offers broader guidance for addressing challenges in affordable housing across India through the application of lean construction principles. The study proposes a structured framework aimed at enhancing the sustainability and economic viability of MHADA affordable housing projects. The proposed framework can serve as a guideline for different stakeholders facilitating the incorporation of lean philosophy to enhance the outcomes of affordable housing projects in India.

KEYWORDS

Lean Construction, Affordable Housing, Process Mapping, Lean in affordable housing, Sustainable Construction, MHADA Projects

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PAPER ID: 132

TIME AND COST REDUCTION USING LEAN PRACTICES IN HIGH-SPEED RAIL PROJECT

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ABSTRACT

This study outlines the strategic deployment of lean construction methodologies at the MAHSR-C4 project site, a key segment of India's inaugural high-speed rail corridor. A range of lean tools were systematically applied to enhance operational efficiency, minimize waste, and improve workflow reliability. Performance Improvements and Innovations: • Precast Element Erection: Cycle time was reduced from 190 minutes to 70 minutes through the combined use of Work Sampling and VSM, resulting in a two-month reduction in overall activity duration. • Underground MEP Service Encasing: Activity time was reduced by 55 minutes per encasing through coordinated planning using Work Sampling and the Last Planner System. This also mitigated safety risks such as soil collapse. • Recharge Pit Optimization: Introduction of an efficient recharge pit technique reduced the number of pits needed, thereby lowering concrete usage and marginally shortening completion time. • Precast Manhole Innovation: Incorporation of sliding cutouts in precast mould improved Workmen productivity and reduced mould costs. • Digital Documentation Platform: Enabled real-time information flow, reduced paper usage, and improved coordination. This led to lower printing costs and significantly faster submission and approval turnaround times. Impact and Cultural Transformation: The integration of lean tools not only accelerated project timelines but also fostered a culture of continuous improvement, proactive problem-solving, and collaborative engagement across all teams and stakeholders. By promoting open communication, shared accountability, and collective ownership, the initiative strengthened team constructive collaboration and enhanced decision-making efficiency. The outcomes clearly demonstrate that a structured and site-specific application of lean construction principles can yield substantial and sustainable improvements in productivity, resource optimization, cost efficiency, and overall project delivery performance.

KEYWORDS

Lean Construction, Value Stream Mapping (VSM), Work Sampling, High-Speed Rail

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PAPER ID: 151

PROACTIVE LEAN FRAMEWORK FOR EFFICIENT PROJECT SCHEDULING AND RISK MITIGATION IN POWER TRANSMISSION & DISTRIBUTION (PT&D) EPC PROJECTS

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ABSTRACT

Effective project scheduling is fundamental to the successful delivery of complex Engineering, Procurement, and Construction (EPC) infrastructure projects, especially in power transmission and distribution. Despite the adoption of advanced scheduling software such as Primavera and established project management protocols, persistent challenges remain manifested through schedule overruns, inefficiencies, cost escalations, and productivity gaps. Delays in such projects are typically driven not by technological shortcomings, but by workflow disruptions, imbalanced resource distribution, and reactive delay management practices. This paper presents an integrated framework that combines Lean principles (Mura, Muri, Muda) with resource-driven dynamic scheduling and proactive forensic schedule risk management. The framework leverages automation technologies including Python scripting, Visual Basic for Applications, and Primavera Web Services to create adaptable, data-driven scheduling processes that respond to real-time site conditions and stakeholder priorities. Empirical evidence from several large-scale transmission line projects demonstrates the efficacy of this approach in improving schedule reliability, reducing risk exposure, and enhancing productivity through optimized resource flow and early risk detection. Quantitative metrics, such as Schedule Performance Indices, validate performance gains. The framework embodies a paradigm shift from task-centric planning to flow-based, collaborative, and responsive scheduling enabled by digital automation and continuous improvement culture.

KEYWORDS

Lean Scheduling, Mura-Muri-Muda, Resource-Driven Scheduling, Proactive Forensic Analysis, Automation

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LEAN RESERVOIRS: PREFABRICATION FOR WASTE-FREE, SUSTAINABLE, AND RAPID OVERHEAD WATER STORAGE

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ABSTRACT

Project delays and cost overruns remain intrinsic to infrastructure projects across the globe and are extremely consequential in drinking-water supply projects, where delays and cost overruns lead to liquidity damages, service interruptions, and public-related issues that directly affect the status quo, public health and economic activity. Elevated Service reservoirs are critical infrastructure in such drinking water supply projects. In India, most Elevated Service Reservoirs (ESRs) are built using conventional reinforced cement concrete (RCC), adhering to the latest code for water-retaining structures, a conventional approach that is labour-intensive, schedule-sensitive, and frequently exposed to quality and durability problems. By contrast, many developed countries such as the United States, Australia and parts of Europe have progressively adopted factory fabricated steel tanks — bolted or welded modular systems built to standards such as AWWA D103 — to reduce on-site time, improve quality control, and lower lifecycle costs. This paper synthesizes evidence from the boarder project management and lean construction literature, water-supply practice guides, contractual documents, standards, lean construction research and case data to (a) describe contemporary ESR delivery practice in India versus prefabricated practice abroad; (b) make the case that a methodology change must be made in the project conceptualisation phase; (c) map lean waste (TIMWOOD) across the PMBOK project phases for RCC and prefabricated ESRs; (d) present a conservative, evidence-based estimate of time and cost savings achievable by switching to prefabricated steel ESRs; and (e) discuss and Indian case project where prefabricated steel tanks and time and cost tradeoff is evaluated. The conclusion argues that prefabricated tanks provide a scalable, lower-waste solution that India should adopt systematically to meet its water infrastructure goals.

KEYWORDS

Lean Engineering, Lean Construction, Elevated Service Reservoir, Time Delay, Cost Overrun, Lean Methodology

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AUTOMATED DELAY IDENTIFICATION AND CLASSIFICATION FOR CONSTRUCTION PROJECTS: A CONCEPTUAL FRAMEWORK

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ABSTRACT

The construction industry plays a very important role in influencing the economic growth of a nation. Notwithstanding, the industry is witnessing stagnant productivity, time and cost overruns. Delays create waste in the form of idle resources, tied-up capital, and deferred value delivery. Delay analysis is therefore central to project management to predict the impact of delay events and take timely actions to recover project delays. However, there are two issues. First, the extant delay analysis methods are highly dependent on manual data logging and retrospective reconstruction, and such practices constitute wasteful activities that could otherwise be directed toward value-adding tasks like problem-solving and collaboration. Second, irrespective of the chosen method, a fundamental requirement for delay analysis is timely identifying and contemporaneously recording delays, a process often ignored by the parties concerned. With the advent of Artificial Intelligence (AI) and Natural Language Processing (NLP), there is a growing potential to automate delay identification and classification, thereby enabling the proactive identification of delays and the implementation of timely corrective actions. This study proposes to systematically review the extant literature to identify gaps pertaining to schedule management and AI applications, to minimise, improve productivity, and optimize value delivery.

KEYWORDS

Construction, Delay, Artificial Intelligence, Lean, Value Optimization

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PAPER ID: 11

LEAN SUPPLY CHAIN MANAGEMENT IN WORKPLACE: GARMENT INDUSTRY

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ABSTRACT

The competitiveness of the garment industry relies on efficient production systems and waste reduction strategies. This study focuses on the application of two Lean Manufacturing tools—5S and Kanban—in a medium-scale garment industry to improve operational efficiency and reduce inventory costs. The 5S methodology was implemented in the stores department to enhance housekeeping practices, streamline material flow, and foster a clean and organized environment. Comparative analysis before and after 5S implementation revealed significant improvements, including reduced retrieval time, improved material identification through color-coded tagging, and enhanced employee involvement. Furthermore, the existing push production system was replaced with a Kanban-based pull system, incorporating production and withdrawal Kanban cards to synchronize operations across stores, cutting, sewing, inspection, and packing sections. The results demonstrated substantial reductions in work-in-progress (WIP) inventory (up to 73%), inventory costs (up to 67%), and lead times, alongside improved material tracking and flow. Overall, the integration of 5S and Kanban resulted in measurable gains in efficiency, cost savings, and workplace safety, highlighting their potential as practical tools for lean transformation in the garment sector.

KEYWORDS

Lean Manufacturing, 5S, Kanban, Garment Industry, Inventory Reduction, Process Improvement

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PAPER ID: 68

SUPPLY CHAIN MANAGEMENT IN INDIAN CONSTRUCTION FROM PRODUCTION THEORY PERSPECTIVE

Venkatesan Renganaidu[186], Raja Sekhar Mamillapalli[187] and Hemanth Sirige[188]

ABSTRACT

This research investigates how supply chain management (SCM) techniques in the Indian construction sector can be improved using production theory, specifically the Transformation–Flow–Value (TFV) framework, with a focus on cast in-situ (CIS) construction. Fragmented subcontracting in effective material flow, casual labour procedures and poor planning system integration are some of the facing issues in the India construction industry that covered in the study the main goal is to create a framework that improves project efficiency, reduce waste and coordinates in construction process with customer satisfaction by using lean tools like Kaizen for continuous improvement in workflow find visual board for real time workflow communication and forecasting, these two tools creating a conceptual framework for SCM in CIS condition. This framework the results connects SCM operations like labour scheduling, procurement and process tracking by using Kaizen's PDCA cycle and visual board. According to research, CIS sites see better decision making, please delays, and increasing productivity when TFV is integrated with this lean Tools. According to the study findings this strategy not only expedites the construction process but also lies the groundwork of a supply chain that is more cooperative, and client focused. To encourage industry-wide acceptance and ongoing performance improvement, future research may Borden this theory through workforce training programs, digital tool integration and field-based case studies.

KEYWORDS

Supply Chain Management, Production Theory, Kaizen, Visual Board Construction Industry, India, Lean Construction, Efficiency, Cost Reduction

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PAPER ID: 36

QUANTIFYING MATERIAL INEFFICIENCIES IN METRO STATION CONSTRUCTION USING MATERIAL FLOW ANALYSIS

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ABSTRACT

The expansion of metro infrastructure requires the use of a wide range of construction materials, many of which experience inefficiencies during different phases of execution. This study investigates material utilisation across both structural and finishing works in a metro station project, addressing a gap in existing research that often overlooks non structural materials. Material Flow Analysis (MFA) was employed to quantify inputs, actual consumption, and losses by comparing site-level data with Bill of Quantities (BOQ) estimates. The flows were disaggregated by construction activity and material type and visualised using Sankey diagrams to highlight areas of inefficiency. The analysis revealed that structural materials such as cement, sand, aggregate, and steel achieved high levels of efficiency (92–96%), with most losses attributed to handling and placement. In contrast, finishing and masonry materials showed higher inefficiencies: tile works recorded the greatest losses (7%), followed by brick and stone masonry (6%), glass (5.26%), wood (4.43%), and paint (4.82%). These losses were primarily due to breakage, cutting, fitting, and application-related processes. The study emphasises the need for improved practices in material handling, installation accuracy, and workflow coordination, particularly in finishing activities, to minimise inefficiencies and support more effective resource use in metro construction projects.

KEYWORDS

Lean construction, template, formatting, instructions, references

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PAPER ID: 6

SUSTAINABLE CONCRETE PRODUCTION: ORGANIZATIONAL STRATEGY FOR TRACKING CARBON REDUCTIONS USING SCM'S AND ADMIXTURES

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ABSTRACT

The construction industry is a major source of global greenhouse gas emissions, with concrete alone contributing about 11.1% of the total. Since 1950, concrete production has increased 25-fold, making it the second most consumed material after water. Cement, the key binder in concrete, is the main contributor to these emissions. To address this, our organization has adopted a sustainable approach by incorporating Supplementary Cementitious Materials (SCMs) and chemical admixtures into concrete production, reducing both cement and water usage while maintaining quality. Our initiative employs a structured methodology to quantify carbon emission reductions. We first establish a baseline using traditional concrete mix designs (as per IS 10262) that exclude SCMs and admixtures. This is compared to actual site mixes incorporating these materials, allowing us to calculate material savings. Using emission factors from the Inventory of Carbon and Energy (ICE) database, these savings are converted into precise carbon reductions per cubic meter of concrete. To ensure transparency and accountability, a digital dashboard has been developed to monitor and report carbon savings quarterly at both corporate and project levels. This facilitates internal benchmarking, drives continuous improvement, and strengthens the credibility of external sustainability reporting. Moving forward, we plan to formalize our methodology for potential recognition under the United Nations Framework Convention on Climate Change (UNFCCC) and explore monetization of verified carbon savings through carbon credit markets. This initiative reflects our commitment to environmental stewardship, cost efficiency, and leadership in sustainable construction aligned with global climate goals.

KEYWORDS

Carbon Emission Reduction, Supplementary Cementitious Materials (SCMs), Sustainability, Concrete Production, Digital Dashboard.

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ENHANCING EFFICIENCY AND SUSTAINABILITY OF RADIANT COOLING SYSTEMS THROUGH LEAN METHODOLOGIES

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ABSTRACT

This report explores the application of Lean principles to enhance the efficiency and performance of Radiant Cooling Systems within HVAC operations. The primary objective is to identify and eliminate inefficiencies, reduce energy consumption, and improve occupant comfort through streamlined processes and optimized system performance. Using Lean tools such as value stream mapping, root cause analysis, and continuous improvement cycles, the project focuses on minimizing thermal losses, optimizing chilled water flow rates, improving system controls, and reducing maintenance-related downtimes. Data analysis and on-site assessments reveal opportunities to enhance heat transfer efficiency, reduce operational variability, and achieve more consistent indoor thermal comfort. Early results indicate significant energy savings, improved system responsiveness, and reduced maintenance efforts. This Lean initiative demonstrates that targeted process improvements in Radiant Cooling Systems can deliver measurable benefits in sustainability, operational costs, and user satisfaction.

KEYWORDS

Lean Management, Radiant Cooling System, HVAC Optimization, Energy Efficiency, Zero Energy Wastage

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PAPER ID: 78

REVIEW OF LEAN MATURITY MODELS: AN INDIAN CONTEXT

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ABSTRACT

Lean Maturity Models (LMMs) have emerged as essential frameworks to evaluate an organization's progress in adopting Lean Construction principles and to chart pathways for systematic and continuous improvement. This paper presents a detailed review of existing Lean Maturity Models developed globally, drawing from scholarly journals, IGLC proceedings, and established frameworks such as HELMA, LESAT, LCMM, and LCMR. These models are widely adopted across industries to measure Lean capabilities in domains such as leadership commitment, process optimization, stakeholder integration, and cultural transformation. The primary objective is to analyze the origin, foundational structure, assessment mechanisms, and key capabilities of existing LMMs while examining their effectiveness in facilitating Lean transformation of organizations and in helping firms align their Lean practices with strategic goals, improve efficiency, and enhance performance. A comparative analysis reveals the strengths and limitations of each model, particularly in terms of how they assess Lean culture, leadership, processes, and stakeholder integration. A secondary objective is to assess critically the extent to which these models are transferable and effective within the Indian construction industry, characterized by high fragmentation, varied organizational readiness, labor-intensive workflows, and unique regulatory and economic dynamics. The study highlights that while these models provide robust guidance in structured environments, they often fall short in addressing the contextual complexities of Indian construction projects. Findings underscore the need for a context-specific Lean Maturity Model that reflects the unique characteristics of the Indian construction sector. The review concludes with the recommendation that there is a pressing need to develop an India-specific Lean Maturity Model that is rooted in local practices, stakeholder behavior, and project delivery mechanisms. Such a model would offer greater accuracy and practical relevance, enabling more effective Lean implementation strategies. This paper contributes to the body of knowledge by offering a foundation for developing tailored maturity models and fostering more meaningful Lean adoption in India's construction sector.

KEYWORDS

Maturity Model, Lean maturity, Lean construction, Indian construction industry, Context specific frameworks

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PAPER ID: 117

REVERSE TENDERING AS A LEAN ENABLER: AN INDIAN CASE PROJECT

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ABSTRACT

Reverse tendering has become a prominent procurement reform in Indian infrastructure projects, such as the Polavaram Irrigation Project. The Andhra Pradesh government in 2019 cancelled existing contracts and re-awarded remaining works through reverse tendering to reduce cost escalations and delays. According to reports, this action improved financial efficiency and transparency while saving over ₹628 crore. But there were drawbacks as well, such as interrupted processes and project delays brought on by contractor turnover and the requirement to remobilize resources. Analysis of the Polavaram case project through the perspective of lean construction principles reveals its benefits with reverse tendering, which helps eliminate cost inefficiencies, but it lacks systematic value definition, continuous improvement, and stakeholder engagement. It is fundamentally reactive and can undermine steady workflow and reliable planning due to interruptions caused by contractor turnover and scope revalidation. To better align reverse tendering with lean principles, the study proposes introducing a collaborative value definition phase before bidding, such as Target Value Design (TVD), wherein cost and project goals are balanced through stakeholder input. Additionally, planning for smooth contractor transitions from the initial phases should be included to maintain a steady workflow. These changes show the importance of going beyond cost minimisation, aiming for overall value and long-term sustainability in public infrastructure delivery.

KEYWORDS

Reverse tendering, public procurement, Lean Construction, Procurement reform, Target Value Design (TVD)

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POSTER ID: 5

RIGHT THE FIRST TIME : A CASE STUDY ON ELIMINATING DEFECTS BY PROCESS STANDARDIZATION FOR PRECAST SEGMENTS AT MTL MALDIVES PROJECT

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ILCC 2025

AFCONS

ABSTRACT

The primary objective of this study is to enhance the quality, precision, and efficiency of precast bridge superstructure segment production through a structured internal control framework. It focuses on developing and implementing a comprehensive checklist system designed to minimise defects, ensure accountability, and align with lean construction principles to achieve zero-defect outcomes.

A systematic internal checklist system was formulated and integrated into the precast execution workflow to streamline quality control and decision-making. The checklist standardised key operations such as reinforcement placement, formwork preparation, concrete pouring, and dimensional verification. It incorporated mandatory multi-level sign-offs from surveyors, supervisors, engineers, and section heads at each critical stage of casting, ensuring traceability and process discipline.

Grounded in lean construction philosophy, the system emphasised process standardisation, waste reduction, and continuous improvement while promoting collaboration and transparent communication among stakeholders. The structured approach reduced operational variability and established clear checkpoints to detect and correct deviations early. Implementation of this checklist framework demonstrated significant improvements in process reliability and quality assurance. It effectively minimised errors related to dimensional accuracy, alignment, and reinforcement detailing, leading to a substantial reduction in rework and associated financial losses.

Additionally, the system enhanced cross-functional coordination, improved accountability, and strengthened the culture of quality ownership across all operational levels. The outcome provides a scalable and replicable model for achieving consistent, defect-free precast bridge construction under controlled yard conditions, supporting long-term organisational excellence in quality and productivity.

INTRODUCTION

The construction industry faces persistent challenges of low productivity, high variability, and excessive waste compared to manufacturing's standardised efficiency. These inefficiencies drive cost overruns, reduced profitability, and rising quality demands. Adopting manufacturing-inspired principles, especially standardisation, enhances efficiency and minimises waste. Industrialisation emphasises controlled processes and prefabrication, where components are produced off-site and assembled on-site. Prefabrication shifts construction toward standardised, repeatable operations that improve consistency and performance outcomes.

Lean thinking, originating from the Toyota Production System, focuses on eliminating waste and maximising value flow. Prefabrication enables Lean implementation by reducing on-site waste—up to 84.7%—through systematic process control. Its effectiveness relies on process standardisation, ensuring consistency in components and procedures. Standardisation enhances predictability, efficiency, and quality while minimising variability. It also reduces costs, strengthens accountability, and limits unplanned changes during execution.

Lean and standardisation function as complementary drivers for enhancing productivity, quality, and value. Despite their proven synergy, a universally accepted framework for process standardisation in construction is lacking. Existing research remains fragmented, predominantly qualitative, and lacks empirical validation. Human and cultural aspects—such as workforce adaptability and stakeholder engagement are often neglected. Future studies should develop integrated frameworks and measurable indicators for consistent, data-driven implementation.

METHODOLOGY

CASE STUDY: MTL MALDIVES PROJECT

MTL Maldives Project is a 6.7 km long Marine Bridge project connecting four islands from Malè to Thilafushi in the Maldives. The scope includes a total of 1222 nos. of precast segments for the bridge superstructure.

Existing Problems & Need for Implementing Standardisation

Previous projects revealed persistent issues arising from partial standardisation and limited accountability across execution levels. Supervisors, foremen, and subcontractors were often excluded from control systems, leading to gaps in monitoring and planning. Defects such as honeycombs, cracks, and PT duct clashes, along with poor inter-team coordination, caused rework and delays. Informal shift handovers, inadequate checklists, and incomplete design reviews further weakened process ownership. These shortcomings underscore the need for a systematic, accountable, and standardised approach to ensure timely, high-quality project execution.

Identifying Root Causes

Root Cause Identified	Corrective Action Taken	Preventive Measures Implemented
Lack of ownership at field level	Made supervisors responsible signatories	Mandatory involvement in every stage
Poor coordination between precast and launching teams	Regular coordination meetings	Common digital communication platform (WhatsApp group)
Inadequate pre-pour planning	Standby equipment and workforce allocated	Pre-pour checklist covering contingencies
Casual approach during shift changes	Formal handover procedures	Handover sign-off incorporated in checklist
Incomplete design review	Design team included in pre-production sign-off	Periodic design review checkpoints

Waste Types in Precast Construction and Lean Measures

Type of Waste (Lean)	Manifestation in Precast Construction	Lean Measures Implemented
Defects	Honeycombs, cracks, PT duct clashes, misalignments	Comprehensive checklist, supervisor accountability, trial segments
Overproduction	Casting of extra segments due to high rejection rates	Right-first-time approach, better quality control
Waiting	Delays during breakdown of boom placer, weather disruptions	Pre-pour planning, alternate arrangements (bucket pouring, standby pumps)
Transport	Damage during handling and lifting	Standardized lifting protocols, trained rigging teams
Inventory	Overstocking of segments without proper traceability	Segment traceability system, JIT dispatch
Motion	Repeated re-handling due to poor yard layout	Lean 5S for yard organization
Overprocessing	Multiple repairs, extra inspections due to defects	Prevention via detailed root cause analysis
Underutilized Talent	Supervisors & supervisors not involved in decisions	Empowerment by including them as checklist signatories

Implementation of Revised Methodology

Aspect	Initial Process (Kuwait Road Project)	Revised Process (MTL Maldives Project)
Scope of Checklist	Limited, covering only milestone activities (rebar cage, formwork, PT, concreting, dispatch)	Comprehensive, covering micro-level sub-activities of each stage
Stakeholders Signing	Only Engineers & Client	Engineers, Supervisors, Foremen, Surveyors, Specialized PT agency
Accountability	Restricted to site engineers	Shared across field-level staff, promoting ownership
Frequency of Use	Used at final inspection stage only	Used before, during, and after each sub-activity
Communication	Traditional documentation only	WhatsApp group for real-time sharing of signed checklists
Training	Not emphasized	Mandatory periodic training & awareness sessions
Outcome	Frequent defects, repairs, client dissatisfaction	Defect-free segments, improved productivity & client trust

RESULTS

Following the implementation of the revised methodology, defect occurrence in precast bridge segments reduced substantially. Instances of honeycombing, cracking, and surface irregularities became negligible, while traceability, alignment, and dimensional accuracy improved significantly. Post-tensioning (PT) anchor cones, ducts, and blisters were positioned without clashes, minimising rework and associated costs.The standardised workflow streamlined inspections, enhanced productivity, and reduced cycle times. Trial mock-up segments were approved with minimal revisions, reinforcing client confidence in the project team.

Involving supervisors and foremen in the checklist verification process instilled a sense of ownership and accountability across operational levels. This empowerment encouraged proactive quality assurance and improved coordination between design, precast, and launching teams, thereby reducing communication gaps and eliminating blame culture.

Process effectiveness was evaluated through expert observations, weekly stakeholder interviews involving four gangs (six members each) over a month, and document reviews, rated on a 1–5 scale. Comparative analysis revealed marked improvements: defect elimination, stakeholder ownership, and client satisfaction increased from 2/5 to 5/5; productivity improved from 3/5 to 5/5; and cost efficiency rose from 2/5 to 4/5. These outcomes confirm that the structured checklist-based approach significantly enhanced quality, accountability, and resource utilisation, validating the effectiveness of standardised internal control mechanisms in precast production.

Factor	Initial Process	Revised Process
Defect Elimination	2/5	5/5
Stakeholder Ownership	2/5	5/5
Client Satisfaction	2/5	5/5
Productivity	3/5	5/5
Cost Savings	2/5	4/5

CONCLUSION

Implementation of the revised processes in the MTL Maldives Project yielded notable performance improvements across key indicators. Defect elimination, stakeholder ownership, and client satisfaction increased substantially, demonstrating that standardisation and micro-level process control effectively address quality challenges. Productivity gains reflected enhanced execution efficiency and optimised resource utilisation, while cost savings confirmed the financial viability of structured internal control mechanisms. The integration of Lean tools, comprehensive checklists, and stakeholder participation established a "Right the First Time" culture, validating the efficacy of standardised processes in precast segment production.

Although the outcomes were positive, certain limitations constrain the generalizability of findings. Results are project-specific and may not directly apply to other contexts without customisation of checklists and controls. Implementation required intensive supervision, workforce training, and continuous monitoring, factors challenging for smaller-scale projects. Furthermore, sustained success relies heavily on consistent stakeholder engagement; limited participation could diminish outcomes. Despite measurable cost efficiencies, additional optimisation opportunities remain.

The demonstrated methodology holds strong potential for wider adoption in precast and modular infrastructure projects. Future studies should explore integration with digital technologies such as BIM, IoT, and AI-driven analytics to enhance quality and process transparency. Extending Lean principles to encompass design, logistics, and site assembly could yield holistic improvements. Incorporating sustainability frameworks alongside Lean methodologies can further reduce waste and environmental impact. Cultivating a culture of continuous improvement and accountability remains essential for achieving durable, scalable performance enhancement in the construction industry.

POSTER ID: 8

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TERNARY BLENDED GREEN READY-MIX CONCRETE FOR AGGRESSIVE ENVIRONMENTS : A LEAN APPROACH TOWARDS SUSTAINABLE DEVELOPMENT

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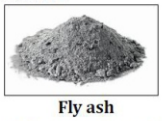
ABSTRACT

- Economic growth increased concrete use worldwide.
- Environmental concerns push use of industrial waste in concrete.
- Study uses GGBFS and Fly Ash in ternary blended concrete.

GGBS

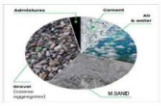


Fly ash

- Results show good strength and better workability.
- Reduces virgin material use, promotes sustainability, and lowers carbon emissions.

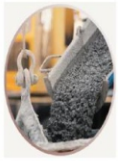
INTRODUCTION

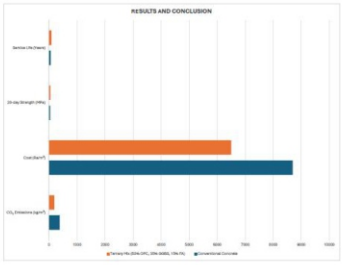
- High concrete demand impacts environment and natural resources.
- SCMs like GGBS and Fly Ash reduce cement use and CO_2 emissions foot prints
- Ternary blends show good strength, workability, and durability.
- Effective in sulfate/chloride-rich conditions, comparable to SRC.
- Promotes sustainable, cost-effective, and lean construction practices.



METHODOLOGY

- Material Selection
- Mix Design
- Concrete Preparation
- Casting & Curing
- Testing
- Results
- Alignment with Lean Construction & Sustainability
- Conclusion





RESULTS

CONVENTIONAL VS 50% INDUSTRIAL BY-PRODUCT

- Cost: Rs.8700 → Rs.6500 per m^3 → 25% savings
- Carbon Emissions: 330–400 → 160–200 kg CO_2/m^3 → 50% reduction
- Slump: 110–125 → 160–180 mm → better workability & placement

- 28-day Strength: 42.42 → 45.55 MPa → denser, less permeable
- Heat of Hydration: High → Low → reduced thermal cracking

CONCLUSION

- Strength: better early & 28-day strength → suitable for harsh environments.
- Workability: High slump retention → reduced effort & easier placement.
- Durability: Denser mix → less pores → less sulfate/chloride ingress → less maintenance → longer service life.
- Eco-friendly: Lower CO_2 emissions and reduced OPC use → greener construction.
- Cost-efficient: bulk industrial waste usage → lower lifecycle cost.
- Lean & Efficient: Less waste, better quality, improved workflow → supports continuous improvement.

POSTER ID: 20

BIDDING CHALLENGES IN INNOVATIVE AND COMPLEX PROJECTS: AN ANALYSIS FROM THE CONTRACTOR PERSPECTIVE

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ILCC 2025

ABSTRACT

- Innovative and complex construction projects face inherent uncertainties, non-clarity in scope and price due to novel materials, methods and technology.
- Traditional contracting models struggle to accommodate these uncertainties, causing inefficiencies and disputes.
- This study performs a systematic literature review on existing contact models, followed by a contractor-centric survey to understand bidding challenges.
- Findings indicate the trust deficits, inadequacy of Lump-sum and item-rate model and complications in cost verification for innovative projects.
- Literature review and Survey results reinforces the need for flexible, trust-based contracts aligned with lean construction principles.

INTRODUCTION

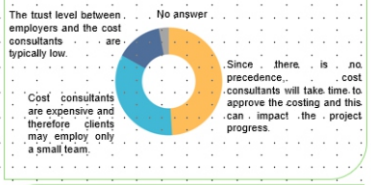
- Construction projects with innovative and complex scopes (e.g., novel technologies, state-of-the-art methods) are increasingly common, but their management poses significant challenges.
- Historically, the construction industry has relied heavily on traditional procurement and contract models that assume a clear, stable scope—a condition rarely met in innovative projects.
- This misalignment results in systemic inefficiencies: wasted time and resources, distrust among stakeholders, and poor project outcomes.
- Lean construction philosophy reframes delivery as an integrated, collaborative system focused on value maximization and waste reduction; however, traditional contracts often contradict this approach by fostering adversarial, transactional relationships.
- This study explores how contractual structures can be redesigned to support the lean principles needed for successful innovation and complexity management

METHODOLOGY

Review of Existing Contract models	Systematic literature review on existing contracting models focused on trust and collaboration, uncertainty.
Survey questionnaire Design	Preparing a contractor focused survey questionnaire. Demographics, 11 Hypothesis based on existing models trust and collaboration.
Conducting Pilot Survey	Getting responses from contractors across varied roles and experience levels
Analysis of Data	Use of parametric and non-parametric tests for validation of hypothesis on trust, collaboration and contract effectiveness using Likert scale.
Insights and Future Directions	Identify key challenges in project scope, price, trust and collaboration. Recommendations for future works on developing contract models integrating lean principles.

RESULTS

Feasibility of Contractor Involvement



The Extent of Trust Between the Employer and the Cost Consultants

DISCUSSION

Feasibility of Contractor Involvement

- Rising innovation increases uncertainty, making firm pricing difficult for bidders.
- Lump-sum or item-rate contracts often unsuitable; cost-plus contracts introduce trust and cashflow issues.
- Moderate trust exists between employers and cost consultants, but ratification delays due to lack of precedents.

Early contractor involvement seen as beneficial but challenging in cost-focused public sector projects

CONCLUSION

- The success in complex projects requires alternative delivery models integrating lean principles.
- Current models fail to manage uncertainty and build trust for collaboration, all contributing to lean waste such as waiting, rework, and excess overhead.
- Need for lean-aligned contracts balancing flexibility with cost accountability is established.

FUTURE DIRECTIONS

Expand survey to other stakeholders (clients, consultants) for broader insights.

Develop and empirically test a new contracting model with lean mechanisms: integrated governance, open-book transparency, joint performance evaluation.

Aim to reduce waste, foster trust, and enhance innovation and collaboration in construction projects.

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LARSEN & TOUBRO

POSTER ID: 22

Behaviour of Partially Concrete Filled Steel Tubular Beams Using Light Weight Concrete

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ILCC 2025

ABSTRACT

- The study numerically investigates the flexural behavior of Partially Concrete-Filled Steel Tubular (PCFST) beams using Lightweight Concrete (LWC) to enhance material efficiency and sustainability under lean construction principles.
- A detailed finite element model in ABAQUS simulates the response of PCFST beams under four-point bending, analyzing parameters like flexural capacity, stiffness, ductility, and failure modes.
- Comparative analysis between LWC and normal-weight concrete infills reveals that LWC substantially reduces self-weight without compromising essential flexural performance.
- The numerically derived moment capacities are benchmarked against international design codes to assess structural adequacy, identifying both conservative tendencies and code limitations.
- The results establish LWC-filled PCFST beams as a viable, sustainable solution for lightweight structural applications, supporting innovations and future updates in composite design codes.

INTRODUCTION

- In bridges, plate girders are the most preferred cross-sections.
- Susceptible to local buckling and lateral torsional buckling (LTB).
- Cross-bracings intensify the constructional efforts and also develop multiple stress concentration zones within the plate girder.

Flyover collapse (Kolkata, India), 2016
Source: National Disaster Response Force

LTB of plate girder during construction stage
Source: Ferris et al. (2015)

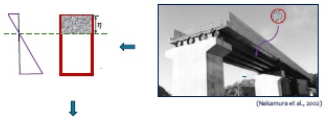
Open deck
Source: IRCON

- Concrete filled tubular flange girders, in which the compression flange of the I section is replaced with CFST, can improve the resistance against LTB.
- Additional stiffeners are required to prevent local instabilities.

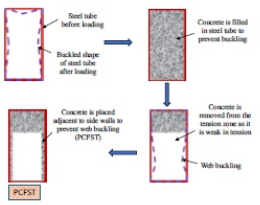
(Sause et al., 2008)

Concrete filled tubular flange girder

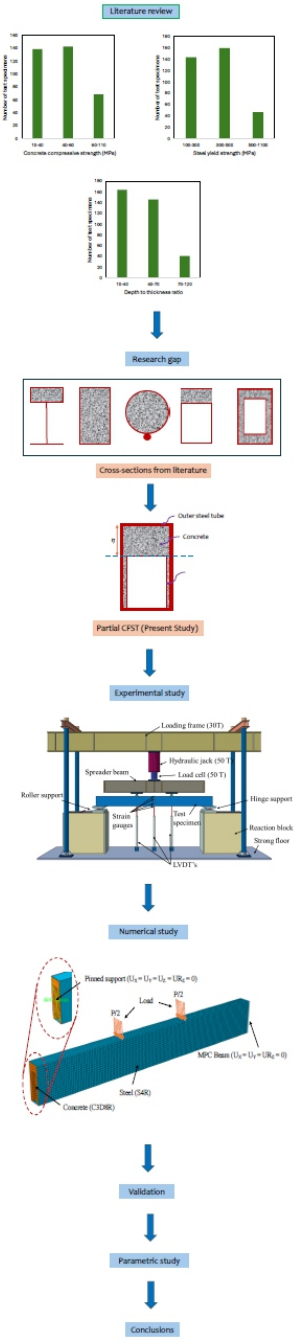
- Concrete filled steel tubular beams, where the empty steel tube is filled with concrete to prevent its local buckling.
- The infill concrete in CFST cannot be utilized completely as the concrete in the tension zone is not effective under flexure.



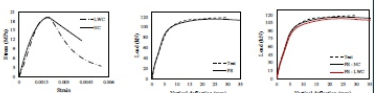
(Nakamura et al., 2005)

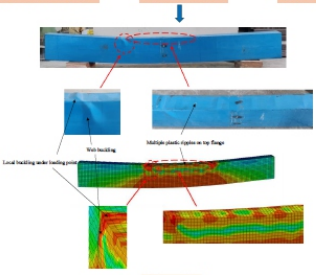


METHODOLOGY



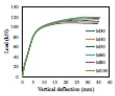
RESULTS





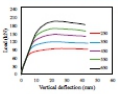
Failure modes

Effect of concrete strength



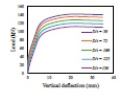
- Variation in concrete strength has low significance on the flexural behaviour of specimens.
- Concrete filling benefits slender steel tubes rather than compact tubes.

Effect of steel yield strength



- No significant change is observed in the initial stiffness of PCFST for various yield strengths of the steel tube.
- An increase in the yield strength of steel reduces the ductility of the PCFST beam.

Effect of D/t ratio



- Increasing the D/t ratio of the steel tube decreases the initial stiffness of PCFST.
- Multiple plastic ripples were observed for higher D/t ratios.

Comparison of Moment Capacities from Existing Codes

S.No	D/t	f_{ck} (MPa)	f_y (MPa)	P_u (kN)	Moment (kNm)				
					M_{exp}	M_{ACI}	M_{AISC}	M_{ACI}/M_{exp}	M_{AISC}/M_{exp}
1	156	30	316	108	37.8	36.56	34.78	0.94	0.79
2	156	40	316	111	38.85	36.66	30.15	0.94	0.78
3	156	80	316	114	39.9	37.49	30.46	0.94	0.76
4	156	80	316	117	40.95	38.55	30.83	0.93	0.75
5	156	80	316	119	41.65	39.09	31.23	0.94	0.75
6	156	100	316	122	42.7	39.73	31.39	0.93	0.73
7	156	45.5	280	90	31.5	31.11	29.44	0.97	0.93
8	156	45.5	350	120	42	40.87	33.05	0.97	0.79
9	156	45.5	420	150	52.5	51.11	40.47	0.97	0.76
10	156	45.5	560	175	61.25	61.12	46.86	1.00	0.80
11	156	45.5	630	205	71.75	70.93	56.81	0.99	0.79
12	80	40	316	141	49.35	47.66	38.38	0.96	0.78
13	72	40	316	151	47.35	45.74	37.26	0.96	0.79
14	100	40	316	127	44.45	42.35	35.03	0.95	0.80
15	125	40	316	114	43.65	39.82	32.13	0.91	0.77
16	156	40	316	111	38.85	36.66	30.15	0.94	0.78
Mean								0.96	0.77
Standard Deviation								0.03	0.02

The moment capacity obtained from the finite element analysis are compared with the EC4 and AISC 360-22, and found that the code predictions are conservative. This indicates that the existing codes are applicable for PCFST beams with light weight concrete.

CONCLUSIONS

- Comparison between normal-weight and lightweight concrete infill indicated that the use of lightweight concrete led to a slight reduction in stiffness and ultimate load, with the decrease being less than 5 %.
- For lightweight concrete infill, increasing the concrete compressive strength from 30 MPa to 100 MPa produced negligible changes in stiffness and only marginal gains in ultimate load capacity.
- The parametric study confirmed that steel yield strength plays a more significant role than concrete compressive strength in enhancing the flexural capacity of PCFST beams.
- Lightweight concrete reduces self-weight and embodied energy. Hence, policymakers should integrate it into sustainability standards and green building rating systems to encourage adoption.

Thank You!

POSTER ID: 24

ILCC 2025

Lean and green construction -sustainable lean: building green with less waste

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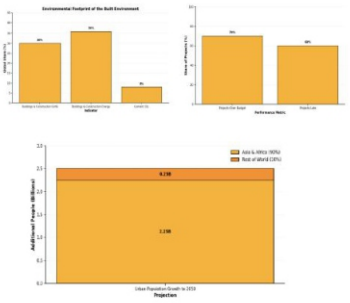
ABSTRACT

- The construction industry faces inefficiency and sustainability challenges, including delays, cost overruns, and high environmental impact (40% carbon emissions, 36% energy use).
- Lean construction, adapted from Toyota's production methods, focuses on reducing waste, maximizing value, and promoting just-in-time resource allocation.
- Integrating lean practices with green building unlocks greater efficiency and advances sustainability goals.
- Case studies from UK, USA, India, Singapore demonstrate significant improvements in cost, scheduling, quality, and ecological outcomes through lean-green synergy.
- Persistent barriers include cultural resistance, lack of training, and technology gaps, with digital innovations like BIM and circular economy practices providing future opportunities.

INTRODUCTION

- The industry faces chronic delays, budget overruns, and excessive waste in projects.
- Construction is a major contributor to global carbon emissions and energy use.
- Lean construction eliminates non-value tasks, optimizes flow, and reduces resource waste.
- Green building embeds sustainability and resource efficiency in all project stages.
- Combining lean and green strategies delivers better cost control, faster schedules, quality improvement, and lower environmental impact.
- Case studies from the UK, US, India, and Singapore confirm these measurable benefits.
- Adoption obstacles include cultural resistance, workforce training needs, and technology limitations, addressed by digital solutions like BIM and advanced analytics

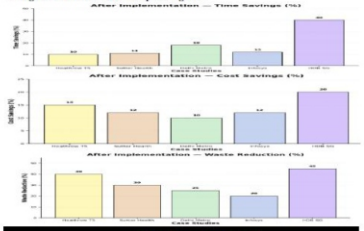


METHODOLOGY

The methodology of this study includes a systematic review of literature on lean construction and green building principles, focusing on their integration throughout all project stages for sustainable development. It analyzes key lean tools such as Just-in-Time delivery, waste reduction, continuous improvement, and Integrated Project Delivery alongside green building practices emphasizing resource efficiency and life cycle sustainability. Multiple international case studies are evaluated to assess practical benefits and challenges. Data is gathered from expert surveys, project metrics, and observations, analyzed via frameworks like fuzzy logic and importance-performance analysis. Barriers such as cultural resistance and skill gaps are identified through stakeholder inputs. The study also explores digital technologies including BIM and AI as enablers of lean-green integration, enabling enhanced coordination and performance monitoring. This holistic approach demonstrates how lean and green strategies together optimize project outcomes with measurable cost, schedule, quality, and environmental improvements.

RESULTS

Lean and green construction combine to address inefficiencies and environmental impacts in the building industry. Lean construction focuses on eliminating waste, improving workflow, and delivering value efficiently through principles like just-in-time delivery and continuous improvement. Green construction emphasizes sustainable resource use, minimizing environmental footprint, and promoting life-cycle sustainability. Together, these approaches integrate tools such as BIM, prefabrication, and integrated project delivery to enhance project outcomes—reducing costs, time, waste, and carbon emissions—while improving quality and collaboration. Despite challenges like cultural resistance and upfront costs, this synergy offers a transformative framework for sustainable, efficient construction aligned with global climate and development goals.



CONCLUSION

The paper concludes that the integration of lean construction and green building creates strong synergies that enhance sustainable development across all phases of construction projects. By combining lean principles, which minimize waste and improve efficiency, with green building practices focused on sustainability and resource conservation, the construction industry can achieve more cost-effective, timely, and environmentally responsible outcomes. Tools like Building Information Modelling (BIM) and prefabrication play a vital role in enabling this synergy. Despite challenges such as cultural resistance and the need for practical implementation strategies, the combined lean-green approach offers significant promise for advancing sustainable construction practices effectively.

POSTER ID: 27

Prefabrication and Modular Construction: A Lean Approach to Faster and Smarter Buildings

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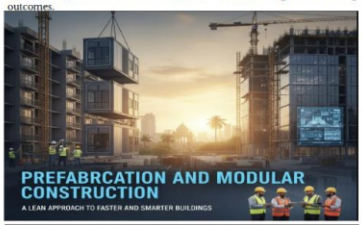
ILCC 2025

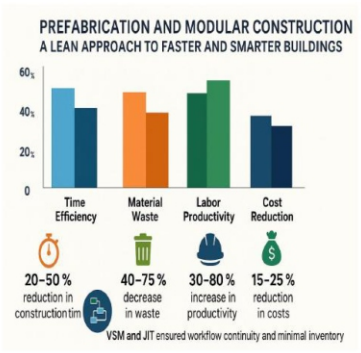
ABSTRACT

The research examines how prefabrication and modular construction methods, based on lean construction principles, can help the Indian construction industry deliver projects more quickly, cost-effectively, and sustainably. By employing case studies and interviews with industry professionals, the study demonstrates that combining lean tools with modular techniques significantly reduces project durations, material waste, and labor inefficiencies. The findings highlight not just the operational and environmental benefits, such as 25–35% faster timelines and nearly 50% less waste, but also underscore challenges like limited industry awareness and fragmented supply chains. The study concludes that widespread adoption of lean modular techniques, supported by digital modeling and early collaboration, can transform the sector toward smarter and greener building outcomes.



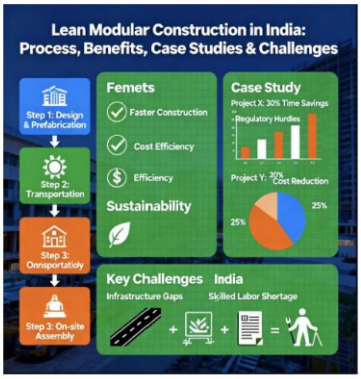
INTRODUCTION

The introduction explains that the Indian construction industry is under pressure to deliver projects faster, with better cost efficiency, quality, and sustainability, but faces challenges like fragmented supply chains, labor shortages, and environmental concerns. Prefabrication and modular construction—where building parts are produced off-site and then assembled on-site—offer practical solutions aligned with lean principles to eliminate waste and maximize value. Driven by urban growth, regulatory pushes for green practices, and the need for predictability, the integration of lean and modular methods is enabling significant gains in timeline compression, efficiency, and sustainability for Indian projects.



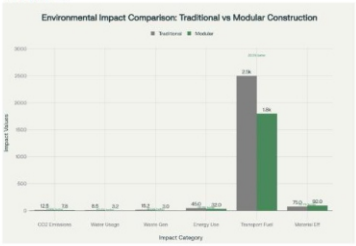
METHODOLOGY

- The study uses a mixed-methods approach, combining both quantitative and qualitative data to analyze outcomes and challenges in modular construction projects.
- Quantitative data was gathered from three modular construction sites in India, focusing on project timelines, labor usage, cost variance, and material efficiency.
- Qualitative insights were collected through structured interviews with project managers, engineers, contractors, and modular fabricators.
- Lean construction tools such as value stream mapping were applied to visualize processes, identify non-value steps, and optimize workflow.
- Additional lean strategies, including just-in-time delivery and pull planning, were implemented for efficient scheduling and process improvement.
- This comprehensive approach allowed the researchers to evaluate how integrating lean principles with modular construction can minimize waste and enhance project delivery in the Indian context.



RESULTS

The results show that lean modular construction outperforms traditional methods in several key areas: project durations were reduced by 25–50%, material waste decreased by up to 80–90%, and labor productivity saw a substantial boost due to off-site standardization and streamlined workflows. Modular systems also improved site safety, ensured better environmental compliance, and contributed to greater predictability in project outcomes. Despite these advances, challenges remain, such as limited industry awareness, fragmented supply chains, and the necessity for early design coordination.



CONCLUSION

- Lean modular construction enables faster project delivery, with timelines shortened by up to 50% compared to traditional methods.
- Material waste and resource consumption are significantly reduced, promoting sustainable and environmentally friendly practices.
- Labor productivity and quality improve due to off-site standardization and efficient workflow management.
- Adoption challenges remain, including limited industry awareness, fragmented supply chains, and lack of collaboration and digital tools.

POSTER ID: 32

INTEGRATION OF DIGITIZATION IN LEAN PRACTICES FOR HIGH-RISE BUILDING CONSTRUCTI

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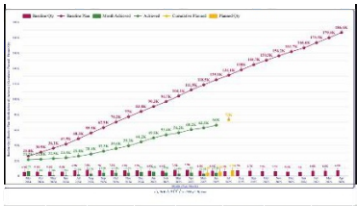
ABSTRACT

Blending Lean methodologies with digital technologies like BIM, Power BI, and DMS drives efficiency, transparency, and waste reduction in high-rise construction. This poster presents a strategic model validated on a 23-acre SEZ project in Hyderabad. The integrated Lean-Digital framework achieved measurable safety, cost, and productivity improvements—highlighting how continuous innovation, visual management, and training are essential for large-scale construction success.



INTRODUCTION

Blending Lean methodologies with digital technologies like BIM, Power BI, and DMS drives efficiency, transparency, and waste reduction in high-rise construction. This poster presents a strategic model validated on a 23-acre SEZ project in Hyderabad. The integrated Lean-Digital framework achieved measurable safety, cost, and productivity improvements—highlighting how continuous innovation, visual management, and training are essential for large-scale construction success.

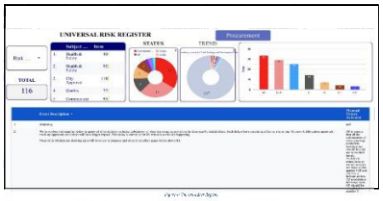
METHODOLOGY

1. Digital Tools
BIM: Clash detection, trade coordination, and schedule alignment.
BI Tools (Power BI, Looker Studio): Real-time dashboards for progress, safety, and risk management.
Document Management (Autodesk ACC): Single source of truth reducing waiting waste.
Drones + HOLOBUILDER: 360° photo capture, snag tracking, and visual validation.

2. Lean Practices
Last Planner System: Enhances reliability of weekly plans.
Pull Planning: Minimizes overproduction and waiting.
Visual Management + Daily Huddles: Continuous feedback and issue resolution.

RESULTS

Quantitative Outcomes
zero major incidents.
RCC S-curve closely tracked baseline → improved schedule reliability (High PPC).
Reduced rework & NCR closure delay through BI dashboards.
Waste reduction: Faster issue closure (Figures 3 & 4 in original).
Qualitative Outcomes
Transparent communication across all stakeholders.
Enhanced quality and snag management.
Sustained culture of accountability and innovation.



CONCLUSION

Integration of digitization with Lean principles revolutionizes project delivery in large-scale construction.
Turner Construction's case demonstrates measurable efficiency, transparency, and safety gains.
Key takeaways:
Digital tools enable Lean efficiency.
Continuous training + leadership commitment = sustainable change.
Model scalable to other high-rise or infrastructure projects.

POSTER ID: 52

Streamlining Construction Supply chains through Lean Thinking

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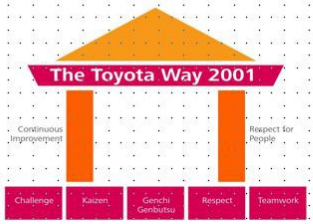
ILCC 2025

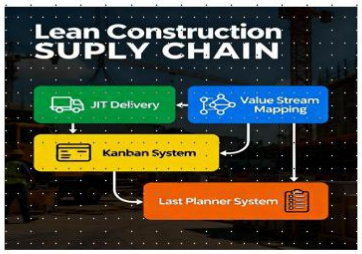
ABSTRACT

This study shows how Lean Thinking, borrowed from Toyota's manufacturing, can fix common construction supply chain problems like delays and waste. Using tools such as Just-in-Time delivery and Value Stream Mapping helps projects run smoother, cut costs, and boost teamwork. While adopting Lean needs cultural change, and training, it leads to faster, more efficient construction projects.



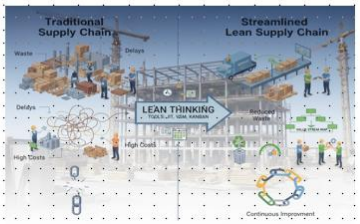
METHODOLOGY

Just-in-Time Delivery (JIT): Materials arrive as needed, reducing stock.
Value Stream Mapping (VSM): Mapping processes to identify waste and bottlenecks.
Kanban System: Visual signals to manage inventory and material flow.
Last Planner System (LPS): Collaborative scheduling to enhance workflow reliability.



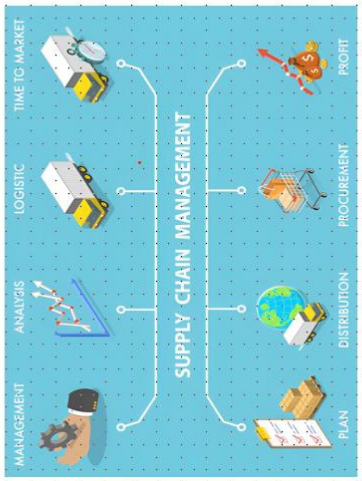
RESULTS

Implementing Lean principles in construction supply chains resulted in better synchronization of materials, significant waste reduction, lower costs, and faster project delivery. Enhanced collaboration among stakeholders improved scheduling reliability and overall efficiency, demonstrating that Lean methods effectively optimize construction logistics and processes for improved project outcomes.



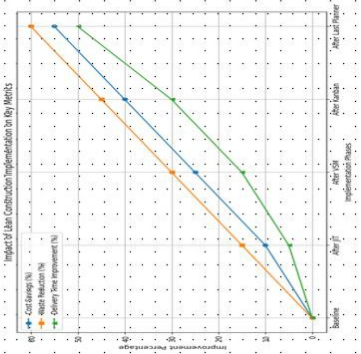
INTRODUCTION

Construction projects often face challenges such as delays, high costs, inefficient resource use, and fragmented supply chains due to weak coordination among participants. Traditional supply chain approaches in construction rely heavily on forecasts and rigid planning, which makes adapting to real-time changes difficult. Lean Thinking, derived from successful manufacturing methods, offers a way to reimagine these processes by focusing on improving flow, reducing unnecessary tasks, and continuously seeking improvements. Applying Lean principles to construction aims to create a more responsive, efficient supply chain that supports smoother project delivery and better collaboration among all involved parties.



CONCLUSION

Lean Thinking effectively transforms construction supply chains by reducing waste, improving delivery speed, and enhancing stakeholder collaboration. By shifting to demand-driven processes and embracing continuous improvement, projects benefit from lower costs and increased efficiency. While successful adoption requires cultural changes and training, Lean principles provide a practical roadmap for streamlining construction logistics and achieving better project outcomes.



POSTER ID: 61

NAVIGATING ORGANIZATIONAL BARRIERS TO ACHIEVE SUSTAINABLE LEAN TRANSFORMATION

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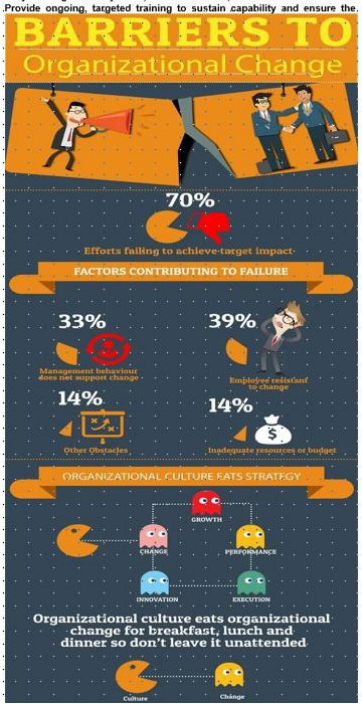
ILCC 2025

ABSTRACT

Many organizations adopt Lean principles to improve efficiency, reduce waste, and increase value. However, successful implementation often faces significant organizational roadblocks. This study explores these challenges and offers practical solutions. Key hurdles include resistance to change, limited employee training, weak communication, and a lack of consistent leadership support. To overcome these barriers, organizations must foster a culture of continuous improvement by involving employees at all levels. Strong leadership must consistently champion and exemplify Lean principles. Open communication builds trust and aligns teams. Targeted training helps employees support initiatives. Starting with small pilot projects can demonstrate quick wins.

METHODOLOGY

1. Establish Urgency and Vision (Kotter's Steps 1-3): Conduct a comprehensive cultural and readiness assessment (surveys, interviews, value stream mapping) to diagnose waste and highlight the urgent need for change. Develop a clear, compelling strategic vision linking Lean directly to organizational goals (e.g., customer value, profitability).
2. Build and Empower Coalition (Kotter's Steps 2 & 4): Form a powerful, cross-functional Guiding Coalition that includes senior leaders and influential employees. Communicate the vision frequently and openly to gain buy-in and address resistance proactively. Empower employees to take ownership and remove initial roadblocks.
3. Implement, Track, and Scale (Kotter's Steps 5-7): Launch small, visible pilot projects ("quick wins") in select areas to demonstrate early success and build momentum. Establish meaningful performance metrics (e.g., lead time, quality) to track progress. Continuously learn, refine the approach, and systematically scale successful pilots across the organization.
4. Institutionalize Change (Kotter's Step 8): Integrate Lean principles into daily management systems, standard work, and reward structures. Provide ongoing, targeted training to sustain capability and ensure the

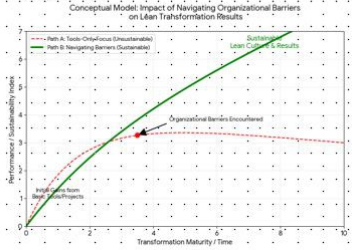


RESULTS

Achieving sustainable Lean transformation requires navigating significant organizational barriers, often rooted in culture and leadership. Key obstacles include resistance to change from employees fearing job loss or increased workload, and a lack of genuine, visible management commitment. Without leadership actively championing the change and removing roadblocks, initiatives stall.

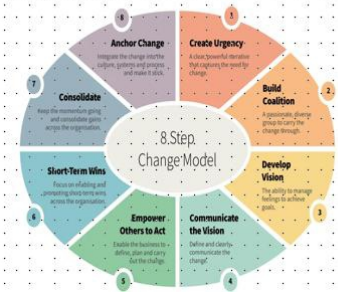
To overcome these, organizations must;

- Secure Top-Down Commitment
- Empower Employees



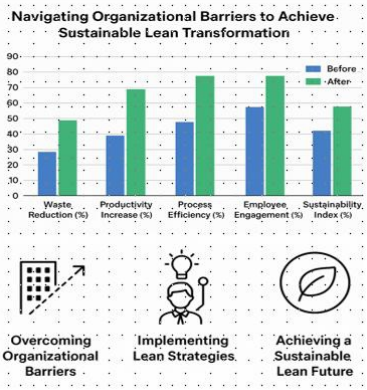
INTRODUCTION

Many organizations pursue Lean transformation intending to boost efficiency and deliver increased customer value. While the benefits—like waste reduction and improved flow—are significant, achieving a truly sustainable transformation remains a substantial challenge. This process extends beyond simply adopting tools; it requires deep-seated cultural and operational change. The journey is often complicated by a variety of internal organizational barriers, including employee resistance, ineffective leadership support, and cultural norms that favor status quo over continuous improvement. Without effectively addressing these roadblocks, Lean initiatives frequently stall, revert, or fail to deliver long-term results. This paper explores the crucial strategies for navigating these organizational barriers to ensure Lean principles become permanently embedded in the corporate DNA, fostering ongoing success.



CONCLUSION

Achieving sustainable Lean transformation hinges on proactively navigating organizational barriers. Simply implementing tools leads to short-lived gains, as cultural resistance, leadership gaps, and structural issues inevitably halt progress. True, lasting success requires deep employee engagement, leadership commitment to coaching, and systemic training to build a continuous improvement culture. This strategic approach ensures long-term growth and resilience, transforming temporary fixes into enduring operational excellence.



POSTER ID: 62

Modular and Off-Site Construction in the AEC Industry: Advancing Efficiency, Sustainability, and Innovation

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ILCC 2025

ABSTRACT

Modular and off-site construction represent a transformative shift in the architecture, engineering, and construction (AEC) industry. By moving major building processes to controlled factory environments, these methods enable precise fabrication, improved quality control, and reduced material waste. On-site assembly of prefabricated modules accelerates project timelines while minimizing disruptions and environmental impacts. The integration of lean construction principles and advanced digital tools such as Building Information Modelling (BIM) further enhances coordination, efficiency, and sustainability. This innovative approach not only ensures faster delivery and cost-effectiveness but also promotes safer, cleaner, and more resilient construction practices, redefining how modern infrastructure is developed.

INTRODUCTION

The global AEC industry faces growing pressure to deliver faster, cheaper, and more sustainable infrastructure. Modular and off-site construction have emerged as innovative solutions, producing building components in controlled factory environments for on-site assembly. These methods improve efficiency, reduce delays, cut costs, and enhance sustainability through optimized material use and minimal site disruption. Advanced technologies like BIM, LiDAR, automation, and robotics boost precision, productivity, and safety. However, challenges such as logistics, design limits, outdated regulations, and the need for skilled digital professionals persist. Integrating automation, digital tools, and lean construction principles focused on value, flow, and waste reduction can make modular and off-site systems key to sustainable, high-performance construction especially in countries like India that prioritize efficiency and sustainability.

METHODOLOGY

- The study on Modular and Off-Site Construction (MOSC) in the AEC industry adopted both qualitative and quantitative research approaches to evaluate its impact on efficiency, sustainability, and innovation.
- A comprehensive literature review was carried out using research papers, industry reports, and case studies to identify current practices, technologies, and trends.
- Data collection involved both primary sources, such as interviews and questionnaires, and secondary sources, including journals and project reports.
- Case studies from healthcare, education, and residential sectors were analysed to assess cost efficiency, construction time, material usage, and sustainability outcomes.
- A comparative analysis was conducted between modular/off-site and traditional construction methods to highlight differences in project duration, quality, and environmental impact.
- The application of digital tools, particularly Building Information Modelling (BIM), was examined for its role in design optimization, project coordination, and real-time monitoring.
- Key performance indicators (KPIs) such as time reduction, waste minimization, energy efficiency, and cost-effectiveness were used to evaluate performance.
- Finally, the findings and recommendations summarized the major benefits, challenges, and best practices to promote the adoption of modular and off-site construction in future projects.

RESULTS

The study shows that modular and off-site construction greatly improve efficiency, sustainability, and quality in the AEC industry. Factory-based production shortens project timelines, ensures cost control, and enhances precision while reducing waste, emissions, and site disruption. Advanced technologies like BIM, LiDAR, and robotics further boost accuracy, productivity, and safety. However, challenges such as regulatory gaps, transport issues, and skill shortages limit wider adoption. Addressing these through policy support, standardization, and workforce training can unlock the full potential of modular construction, making it key to building faster, greener, and more resilient infrastructure for the future.

CONCLUSION

Modular and off-site construction are revolutionizing the AEC industry by improving efficiency, sustainability, and quality. Factory-based production shortens timelines, ensures cost control, and enhances quality while reducing waste and emissions. Technologies like BIM, LiDAR, and robotics boost precision and safety. However, regulatory issues, transport limits, and skill shortages hinder widespread use. With policy support, standardization, and training, these methods can fully realize their potential. As urbanization and sustainability needs rise, modular and off-site construction offer a faster, greener, and more resilient future for the built environment.

POSTER ID: 64

ILCC 2025

BIM as an enabler for Lean Construction in Godrej Vistas Godrej Constructions

ABSTRACT

This paper investigate how Building Information Modelling (BIM) acts as a significant technical cost for Lean construction for the Godrej Vistas Project. BIM's usage has improved the project efficiency and streamlined the processes across the construction lifecycle. The coordination and communication among the stakeholders has improved in particular between the architect, client, and contractor, in turn reducing conflicts and response times to RFIs supporting effective decision making and project advancement. BIM's clash detection capabilities have reduced challenges in design conflicts prior to construction thereby saving time and associated costs. BIM's functionality has enhanced visualization for problem solving during meetings while also allowing effective scheduling efficiency and resource allocation. In addition, enhanced visualization with BIM has supported a particular focus on rendering complex designs clear, as well as minimizing material flow and site logistics issues. Overall, utilizing BIM has demonstrated the ability to contribute to the larger objectives of Lean Construction, which focus on maximizing value and minimizing waste within large scale building projects.

INTRODUCTION

"Value and waste are directly correlated in construction projects" (Salem et al., 2006) for which Lean Construction techniques are devised. Building Information Modeling (BIM) is one of the most important technologies supporting these techniques because it creates digital models that capture the physical and functional aspects of a facility. This case study examines the application of BIM within a Lean Construction system on the Godrej Vistas project and shows how it improved collaborative efforts, conflict avoidance, and workflow enhancement during various project phases.

METHODOLOGY

This research used a case study approach concentrating on the Godrej Vistas construction project. The focus of the research was on a qualitative and quantitative evaluation of project data pertaining to the period the data was collected and after the implementation of BIM. The work included the following:

Architectural and engineering 3D BIM model design of structures and construction systems.

Custom BIM software designed for clash detection and detection resolution within a 3D environment.

Using the implementation of a Common Data Environment (CDE) as a system for the collaboration and information exchange of all participants (Sacks et al., 2018).

4D scheduling through BIM for construction and logistics to achieve the model integration with the working schedule to the optimize material circulation and site organization.

Request for information (RFI) resolution periods and the number of active clashes on site tracked as key performance indicators.

Fig 1. Godrej Vistas Coordinated BIM Model

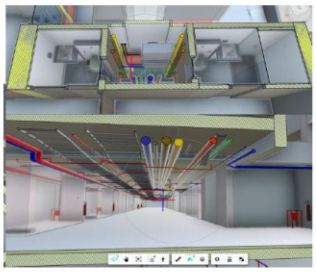

Fig 2. Using BIM in Design meeting for RFI

RESULTS

As stated before, the tangible measurable benefits of BIM deployment hinges on the Lean Principles:

Communication and Coordination: BIM has transformed coordination between stakeholders and has eliminated gaps and disputes in communications(Azhar, 2011).

RFI Processing Times: One of the major accomplishments was the drastic decline in RFI processing times, which enabled quicker decisions and reduced project delays.

Clash Detection: Advanced clash detection capabilities resolved structural design conflicts before construction, thus preventing costly rework and streamlined construction (Kymmell, 2008).

Visualization & Planning: The ability to visualize in BIM improved understanding of complicated designs and assisted in the preparation of advance logistics plans which improved material flow and site organization.

Work in aerial support and planning: Base BIM models could allocate works pending with soft sheets to pending works according to specific parameters which improved resource and time utilization.

CONCLUSION

The Godrej Vistas Project showcases the use of BIM in transitioning to Lean Construction. BIM has added value and performed waste reduction by streamlining collaborative workflows and addressing potential issues in advance. BIM has proven that it goes beyond simply being a modelling tool; it serves as the technology base for the defining elements of today's complicated construction undertakings – versatility, transparency, and predictability. More attention in the future should focus on how to determine the cost savings versus return on investment of the integration thereof BIM and Lean methodologies.

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POSTER ID: 65

Empowering the Frontline: Unpacking the Impact of Immediate Supervisors on Safety Climate in Indian Construction Sites

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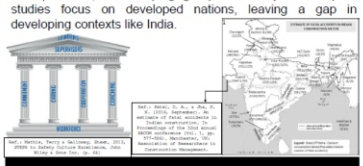
INTRODUCTION

•The **construction industry (CI)** is vital for economic growth but is highly prone to accidents and fatalities, with human error responsible for nearly 90% of incidents.
•Despite global progress, **workplace accidents remain critical**, with ILO estimating 2.3 million occupational deaths annually; India's CI suffers from weak safety standards, poor enforcement, and inadequate reporting.
•Earlier research mainly emphasized **unsafe worker behavior**, but focus has shifted toward **organizational factors** like *safety climate*, which strongly shapes safety behavior and outcomes.
•**Leadership**, especially immediate superiors (ISs), plays a decisive role in influencing perceptions of safety, enforcing safe practices, and shaping group culture—yet most prior studies focus on developed nations, leaving a gap in developing contexts like India.



OBJECTIVE & HYPOTHESES

Objective: Test how immediate superiors' safety leadership predicts key safety climate dimensions on Indian construction sites.

Research Question: Do immediate superiors' safety leadership behaviors predict professionals' perceptions of safety climate?

Hypotheses:
H1: Safety leadership → Management's commitment to safety (MCS).
H2: Safety leadership → Safety equipment and procedures (SEP).
H3: Safety leadership → Safety training (ST).
H4: Safety leadership → Communication and openness (CO).
H5: Safety leadership → Group dynamics and safety culture (GDSC).

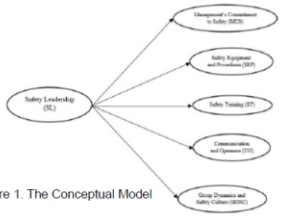


Figure 1. The Conceptual Model

METHODOLOGY

Design: Cross-sectional survey; Quantitative Correlation, CFA & SEM.
Context: Southern India construction projects; white-collar site professionals.
Sample: Convenient Sampling; 279 valid responses. Power analysis indicated minimum N=276.

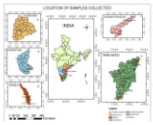


Table 1. Demographic details of respondents.

Demographic Variable	Frequency	(%)
Gender		
Female	21	7.5
Male	258	92.5
Age (in years)		
20-25	117	41.9
26-30	116	41.5
31-40	39	14
41-50	6	2.2
Above 50	1	0.4
Work Experience		
<2 years	45	16.1
2-5 years	76	27.2
6-10 years	110	39.4
>10 years	48	17.2

Instruments:
- Safety leadership (12 items; adapted from Barling et al., Wu et al.; α=0.93).
- Safety climate: MCS (6; α=0.916), SEP (3; α=0.842), ST (4; α=0.867), CO (4; α=0.883), GDSC (9; α=0.877) from established scales.

Key measures (examples):
- SL items spanned: encouragement/satisfaction, rules/accountability, safety vision/innovation, participation, care, onsite focus, impartiality, proactivity, reward/discipline, training, listening.
- MCS examples: prioritization, prompt risk response, safety in planning, data-driven rule improvement.
- SEP examples: adequate PPE, effective rules, enforcement of procedures.
- ST examples: universal H&S education, onboarding, safety emphasis in training, encouragement to attend.
- CO examples: openness to discuss safety, goal communication, meeting opportunities.
- GDSC examples: shared responsibility, proactive risk seeking, JSA participation, mutual help.

RESULTS

Table 2. Correlations among variables.

Scale	MCS	SEP	ST	CO	GDSC	SL
MCS	1	0.763 **	0.802 **	0.758 **	0.587 **	0.651 **
SEP	0.763 **	1	0.809 **	0.720 **	0.518 **	0.600 **
ST	0.802 **	0.809 **	1	0.773 **	0.631 **	0.614 **
CO	0.758 **	0.720 **	0.773 **	1	0.600 **	0.604 **
GDSC	0.587 **	0.518 **	0.631 **	0.600 **	1	0.580 **
SL	0.651 **	0.600 **	0.614 **	0.604 **	0.580 **	1

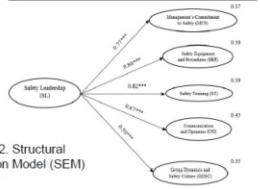


Figure 2. Structural Equation Model (SEM)

RESULTS

•The correlation analysis (Table 2), indicates that stronger safety leadership behaviours consistently align with more positive perceptions of safety climate components.
•No multicollinearity observed among variables (correlations < 0.9).
•All five hypotheses statistically supported with strong positive relationships.

DISCUSSION

•**MCS:** Strongly influenced by SL (β = 0.77). ISs' visible commitment reassures workers about top management's dedication.
•**SEP:** Positive effect (β = 0.80). SL reinforces adherence to PPE use and procedures.
•**ST:** Strongest predictor (β = 0.82). Leaders' participation in training enhances workers' perception of its value.
•**CO:** Moderately strong influence (β = 0.67). SL fosters open reporting of hazards and collaborative problem solving.
•**GDSC:** Positive but relatively weaker effect (β = 0.59). SL helps build teamwork and shared safety responsibility.

Theoretical Insights
•Confirms that safety climate is not static but dynamic, shaped continuously through IS–worker interactions.
•Extends the leader–member exchange (LMX) theory by showing how frontline leaders' actions translate organizational safety vision into practice.

Practical Implications
•ISs serve as a *bridge* between top management and frontline workers, mediating safety climate perceptions.
•Organizations should invest in SL development (training, mentoring, participative leadership).
•Stronger SL can minimize accidents, enhance regulatory compliance, and improve overall project safety performance.

Limitations
•Southern India context; cross-sectional self-report design; additional predictors (culture, broader practices) merit testing; longitudinal dynamics to be explored.

CONCLUSION & LEAN INTEGRATION

- IS' SL is a powerful predictor of professionals' perceptions across five SC factors.
- Investing in frontline SL can tangibly improve SC and, by extension, safety outcomes in Indian construction.

Lean Integration
- **Respect for People**: SL empowers frontline workers and values their well-being; echoing Lean's core pillar.
- **Waste Reduction**: SL minimizes accidents & disruptions.
- **Continuous Improvement (Kaizen)**: Open communication by SL enables learning, hazard reporting, & enhancement.
- **Collaborative Culture**: SL strengthens teamwork (GDSC), aligning Lean's: shared responsibility & reliable workflows.

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POSTER ID: 73

ACCELERATIING COMPLETION of India's LONGEST SEA BRIDGE thru' LEAN CONTRUCTION

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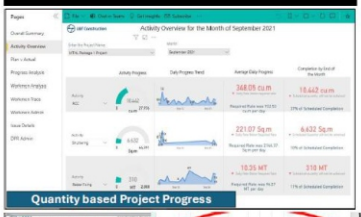
ILCC 2025

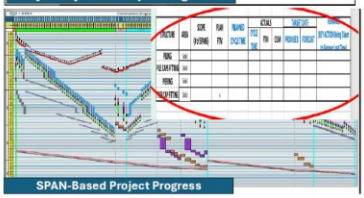
ABSTRACT

This poster presents a Lean Construction-based intervention in India's longest sea bridge project (22 km), designed to connect Mumbai and Navi Mumbai. The project faced a 10-month delay within 20 months of commencement, risking further overrun. A novel span-wise progress review and Lean-driven process improvement were introduced to recover the schedule. Using Value Stream Mapping, collaborative planning, and visual management, the team reduced piling cycle time from 23 to 13 days per 60-meter span. This intervention nearly doubled execution speed. The case demonstrates how redefining project tracking and leveraging Lean tools can improve productivity in complex infrastructure projects.

METHODOLOGY



Quantity based Project Progress



SPAN-Based Project Progress

RESULTS

RESULTS OBTAINED in 6 Months:

- Piling Cycle time per span reduced: 23 → 13 days
- Almost doubling of execution rate, despite very high complexities
- More focus on Management Solution, than Engineering Solution
- Project back on track to meet base target completion date
- Improved stakeholders communications & coordination significantly

LESSONS LEARNT:

- Track 'visible' completion units (Span), not Material quantities
- Find 'Repetitive' work & treat it as mini-project, deep-drive in it
- Visual planning + short cycle collaborative reviews are effective
- Lean tools (Big Room, Collaborative Planning, VSM) accelerate recovery
- Convert Threat (Monsoon work stoppages) into Opportunities (Work improvements)

INTRODUCTION

PROJECT DETAILS :

- 22 km sea bridge connecting Mumbai and Navi Mumbai
- Project value: ₹16,000 Cr (~$2B)
- Travel time reduction for public: 150 mins → 20 mins
- 2 main EPC contractors involved (L&T handling 2/3rd length)
- Very complex Construction in the middle of sea , involving extensive marine piling, piling capping, piers and piers capping and Girder segments.
- Very Complex and expensive Equipment involved
- 20 months into execution: 10 months delay, so, LEAN used
- Some 200 spans of 60M Span lengths involved which constitute 85% of all spans. Another 10% spans are of 90 M lengths, rest of different sizes.

KEY ISSUES ADDRESSED:

- Traditional quantity-based review ineffective
- Engineering redesign not feasible at this stage
- Need for accelerate the project to make is MUCH faster, also recovery of 'lost time' to meet Base Target Date.
- Use LEAN CONSTRUCTION to maximum possible way

INITIAL PROCESS REVIEW

- Monthly progress tables masked real risks
- FTD, FTM, CUM Piles/ Pile Caps etc. metrics ineffective
- Stakeholders unable to visualize actionable delays

LEAN CONSTRUCTION INTERVENTION

- Span-wise review (physical 'VISIBLE' deliverable focus)- SPAN : Earlier ISSUES on this!
- Visual Gantt charts for planned vs. actual progress
- Daily stand-ups (15 min) + weekly "Make Ready" (60 min)
- Mini-project approach for each span: PERT/ Overlapping/ Parallel / VSM

FOCUSSED EFFORTS & RESOURCES ON CYCLE TIME:

- **Whole Project broken into 200 + mini but repetitive Projects; with Target Cycle Time of 13 days**
- **Each Mini-repetitive Project, was Deep-Drive for minimum Process Cycle Time. Old Cycle Times were found, Critically Analyzed, RCA for Variations done.**
- Root Cause Analysis for delays
- **New PERT charts with more overlapping activities & resolving new issues identified. + very critical application of VSM + Many Innovative Changes + Minimizing the Variation thru' simplified CPS**
- **Each Mini-repetitive Project, was Deep-Drive for minimum Process Cycle Time.**
- **Special Focus on Process Improvements for Heavy Equipment by minimizing non-Value Adding activities; Make-Ready Meetings and Constraints resolution**

IMPLEMENTATION STEPS

1. Leverage Monsoon (Converted this 'Threat' into 'Opportunity' for process improvements & far deeper risk management)
2. Detailed mini-project schedule
3. Critical path adjustments
4. Daily & weekly collaborative meetings

CONCLUSION

- Lean principles can drastically improve schedule recovery
- Physical, span-wise tracking and mini-project approach is practical
- Approach is replicable for similar projects across India
- Apply this approach for other Linear infrastructure projects
- Daily/weekly review cycles for real-time responsiveness
- Use Lean tools for process improvement without redesigning engineering (VSM, Waste Elimination/ Kaisen, Big Room, TLP/ CPS)
- Use LEAN in DESIGN also , specially when multi-main Contractors are involved, if possible

POSTER ID: 77

A REVIEW OF VISUAL INSPECTION TECHNIQUES FOR LOCALIZED CONSTRUCTION AND DEMOLITION WASTE MATERIAL COMPOSITION

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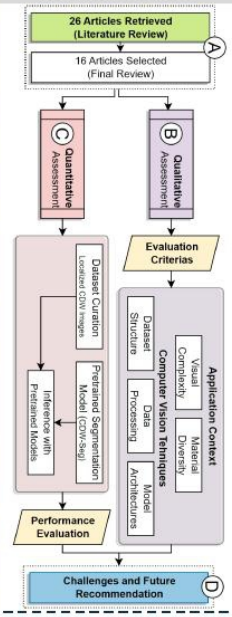
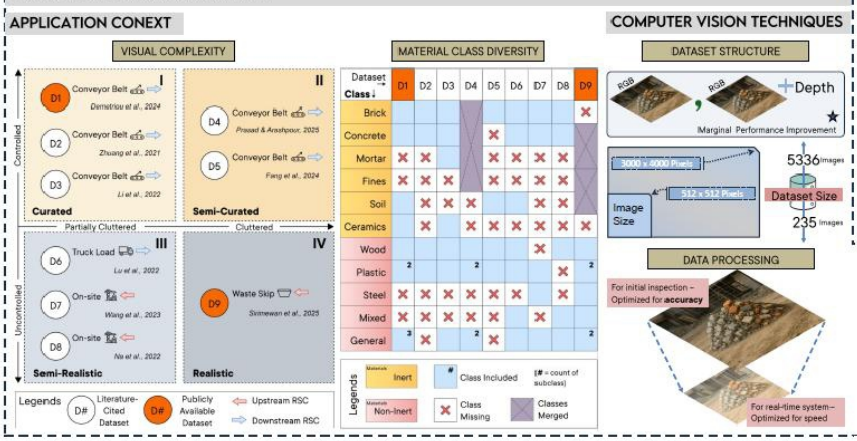
EXISITNG CDW REVERSE SUPPLY CHAIN

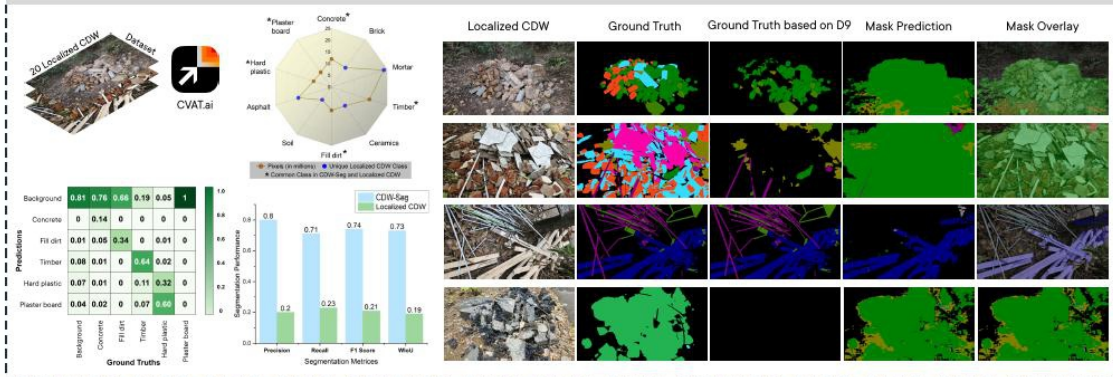
METHODOLOGY



QUALITATIVE ASSESMENT



QUANTITATIVE ASSESMENT



CONCLUSION

- The qualitative findings – Research advance conveyor-belt research but lack the robustness and granularity required for localized CDW.
- Quantitative results confirmed that the current state-of-the-art model (CDW-Seg) struggles with fine-grained segmentation and requires improvement.
- Most existing research focuses on distinguishing visually distinct materials (e.g., inert vs. non-inert), with limited attention to visually similar inert materials.
- CV applications for localized CDW remain in early stage. Continued development is required.
- Expanding dataset scope and leveraging domain adaptation techniques will be essential for improving generalizability to localized waste contexts.
- Future work should explore instance segmentation for localized CDW inspection, as it can offer more detailed insights than semantic segmentation.

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POSTER ID: 80

Lean-Driven Cost Benchmarking & Block Estimation: A Collaborative Framework for Greenfield Projects

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ILCC 2025

ABSTRACT

Cost benchmarking for greenfield projects is often a time-consuming and fragmented process due to the absence of structured historical data, lack of standardization, and the scattered nature of information across multiple teams. These challenges lead to inefficiencies, repeated iterations, and delays in early-stage decision-making.

This poster introduces a lean-driven, collaborative framework that streamlines cost benchmarking & block estimation during the inception phase of greenfield projects. The framework is built on a structured spreadsheet model designed to capture, organize, and align historical cost data across major work packages in Industrial & Residential projects.

Ultimately, this framework empowers project teams to make informed decisions early in the project lifecycle, reducing risk and improving overall project performance.

INTRODUCTION

The motivation for this research stems from persistent challenges in preparing cost benchmarks for greenfield projects. Historical benchmark data is rarely available in a structured form and is often not collated after project completion, leaving information fragmented across multiple teams and difficult to retrieve.

Adding to this complexity, each project generates an enormous volume of data throughout its lifecycle. Retrospectively collating and analyzing this information is not only tedious but also inefficient, leading to delays in proposal preparation. The absence of a standardized process or template to identify and prioritize critical benchmarking data further compounds the problem.

To address these issues, this research proposes a lean-based cost benchmarking & block estimation framework that emphasizes three core principles:

- Collaboration across functions to ensure comprehensive data collation and validation.
- Standardization of cost attributes and normalizing historical data across projects to enable consistent benchmarking.
- Integration of lean principles such as waste reduction, continuous improvement, and pull-based planning to streamline processes.

The goal is to develop a dynamic, reusable, and transparent estimation model that accelerates proposal preparation, enhances accuracy, and promotes a culture of knowledge sharing and continuous improvement.

METHODOLOGY

The research began with a comprehensive data collation exercise involving marketing, project, contracts, finance, and cost monitoring teams to compile cost information from recently completed, ongoing, and upcoming projects. This data was organized into a standardized template covering various specifications of the project:

- Residential- all offerings like amenities, interior finishes, location, floors, number of towers etc.
- Industrial,- all major work packages, including PEB, Civil Works, MEP, Ancillary Structures, and Infrastructure.

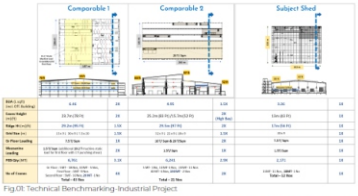

Fig.01: Technical Benchmarking-Industrial Project

Internal benchmarking was then carried out to analyze cost parameters, activity rates, and material consumption patterns, while design elements and specifications were mapped to identify opportunities for optimization and standardization across projects. Comparative analysis was performed on total project costs and high-value activities such as PEB, where steel tonnage per square foot and associated costs were evaluated. Additional analysis focused on infrastructure components such as roads, parking areas, and utility buildings to derive meaningful insights for future designs

Developers Name	Comparable 1	Comparable 2	Comparable 3	Comparable 4	Subject Project
Project Name	xyz	xyz	xyz	xyz	xyz
Location	Powai	Vikhroli West	Kanjurmarg West	Kanjurmarg	Vikhroli East
Residential Land Parcel	11 Acres	8.52 Acres	9.28 Acres	3.91 Acres	2.06 Acres
Phasing of the Project	Phase 1+Phase 2+Phase 3	Phase 1+Phase 2+Phase 3	Phase 1+ Phase 2	Single Phase	Single Phase
No of Towers	3 Towers +4 Towers +3 Towers	3 Towers+2 Towers	2 Towers (T1 & T4)+ 2 Towers	2 Towers	2 Towers
Floor	3B /G+1 Retail Plaza/Podium 1 Parking + 22 Typical Floor + Terrace	GF + 31 Typ Floors (A2 1B /G Plaza/Podium 1 Parking + 34 Typ Floors (A6) + Terrace	G + 1st Floor-Retail + 2nd & 3rd Floor-Office, +28 Typ Floors + Terrace	4B + GF (Incl. Retail) + Service floor + Amenity/Podium Floor + 31 Typ Floor + Terrace	
Flat Configuration	2, 3 & 4 BHK	2, 3 & 4 BHK	1, 2 & 3 BHK	2,3 & 3.5, 4 BHK	2, 2.5, 3, 3.5 & 4BHK
Approx. Clubhouse Area	40,000 Sqft	60,000 Sqft	28,000 Sqft	30,000 Sqft	50,000 Sqft
Amenities	50+	40+	30+	40+	40+
Flooring Living Room / Dining / Passage	Italian Marble- 3 BHK & above	Italian Marble	Vitrified	Italian Marble	Italian Marble
Flooring Master Bedroom	Italian Marble	Vitrified	Vitrified	Italian Marble	Italian Marble
Flooring Other Bedrooms	Italian Marble	Vitrified	Vitrified	Italian Marble	Italian Marble
Flooring Kitchen	Vitrified				
Dado Kitchen	Vitrified	Vitrified	Vitrified	Vitrified	Quartz Stone
Flooring & Dado - Toilets	Vitrified	Vitrified	Vitrified	Vitrified	Porcelain Tiles
Flooring & Dado-Typical Lobby	Vitrified				
Shower Enclosure /Partition	Provided	Provided	Not Provided	Provided	Provided
Modular Kitchen	Provided- 3 BHK & above	Not provided	Not Provided	Not provided	Provided
Main Door	Fire rated door /Hardwood Frame	Fire rated door /Hardwood Frame	Fire rated door /Hardwood Frame	Fire rated door /Hardwood Frame	Fire rated door /Burma Teak Wood Frame
Internal Doors	Hardwood Frame	Hardwood Frame	Hardwood Frame	Hardwood Frame	African Teak Wood Frame
Aluminium Windows	DGU System Windows	DGU System Windows	DGU System Windows	DGU System Windows	DGU System Windows
Internal Paint	Acrylic Emulsion	Acrylic Emulsion	Acrylic Emulsion	Acrylic Emulsion	Lustre

Fig.02: Technical Benchmarking-Residential Project

To ensure reliability, internal benchmarks were validated through collaboration with an external agency, aligning the framework with industry standards.

		SHED 1	SHED 2	Major Impact (approx) (Rs/sqft)	
Civil	Rebar works	2.62 kg/sqft	3.45 kg/sqft	70	*
	Total difference in civil			74	
Peb	Primary & secondary members	8.13 kg/sqft	13.17 kg/sqft	613	*
	Painting thickness (epoxy coating)	120 dft epoxy coating	300dft epoxy coating	47	*
	Wall cladding coverage / BUA	0.34	0.43	7	*
	Wall insulation	Na	60KG/sqft ROCK WOOL	35	*
	Others			94	*
	Total difference in PEB			796	
Mep	Hvac	Na	Airconditioned area in shopfloor	82	*
	Total difference in MEP			82	

Fig.03: Cost Benchmarking-Industrial Project

RESULTS

Lean principles were integrated throughout the process, incorporating Target Value Design (TVD) for cost alignment, Just-In-Time (JIT) procurement for waste reduction, and resource leveling to improve forecasting accuracy. Coefficient analysis and time-adjusted interpolation techniques were applied to normalize data across different project timelines and uncover variance patterns.

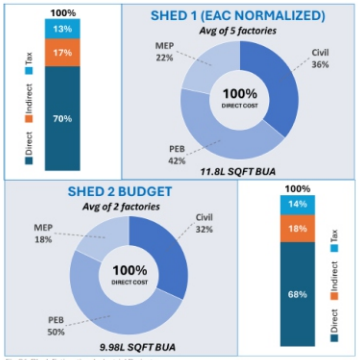

Fig.04: Block Estimation-Industrial Project.

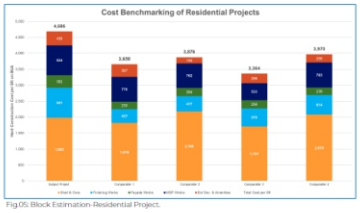

Fig.05: Block Estimation-Residential Project.

CONCLUSION

This research demonstrates that applying lean principles to block estimation can transform the cost benchmarking process for greenfield projects. By embedding collaboration, standardization, and pull-based planning through tools such as the Last Planner System (LPS), the proposed framework ensures greater efficiency, transparency, and reliability from the earliest design stages. The model is practical, scalable, and capable of driving significant value in organizations seeking to improve cost estimation practices. Future enhancements may include the integration of digital tools and predictive analytics to further strengthen adaptability and accuracy.

POSTER ID: 81

IMPACT OF AI-INTERACTION MODALITIES ON COGNITIVE LOAD IN VR-BASED CONSTRUCTION QUALITY CONTROL

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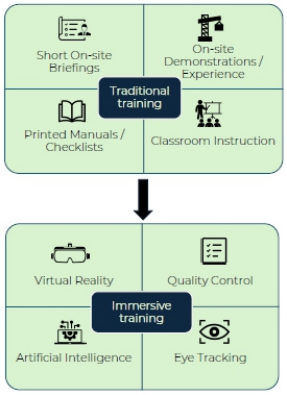
ILCC 2025

ABSTRACT

This study examines the impact of various instructional modes in a VR-based training system on construction workers' ability to identify defects. A virtual site built in Unity 3D with eye tracking tested four groups: text-only, audio-only, text + audio, and a control without AI. Twenty civil engineering students participated, with cognitive load measured via blink rate, pupil size, and pre-/post-tests. Results showed that text-only instructions yielded the best learning and lowest cognitive load, while combining text and audio caused distraction. The findings suggest that simple text-based VR instruction enhances focus and understanding, and that eye-tracking can support the development of adaptive, efficient training systems.

INTRODUCTON



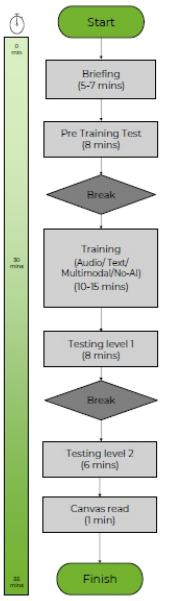
METHODOLOGY

Demonstration

Figure: HTC Vive Focus 3 VR headset with integrated eye-tracking

Figure: Unity-based VR simulation of a construction site with embedded defects

Experimental Work-Flow Diagram

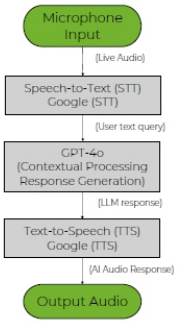


Demographics of Participants

Demographics of Participants		
Category	**Distribution**	**Count**
Age	20-22 years	9
	23-25 years	8
	26+ years	3
Gender	Male	16
	Female	4
Experience in Civil Engineering (Study + Work)	0-2 years	0
	3-4 years	10
	5-6 years	6
	7+ years	4
Expreince in Virtual Reality	0 times	15
	1 times	2
	2 times	1
	3+ times	2

Table: Civil Engineering participants (n=20), randomly assigned into 4 training groups (n=5 each)

AI Work-Flow Diagram



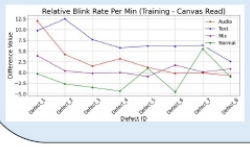
RESULTS

Training Models Tested: Normal (No AI) | Text-Only AI | Audio-Only AI | Mix (Text +Audio)

Eye Tracking Analysis

Blink Rate Difference value = Blinks/min (Training – Baseline)

Blinking changes with mental effort. When people concentrate more, they blink less. When the task is easier, they blink more. So blink rate tells us how much mental effort a training method requires



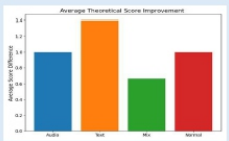
Pupil Diameter Difference = Avg pupil size (Training – Baseline)

Pupils get bigger when the brain works harder and smaller when it's easier. Measuring pupil size shows how much mental strain participants felt

Theoretical Test Analysis

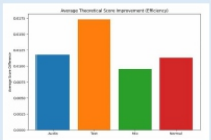
Score Improvement = Post-training score – Pre-training score

To see how much participants learned after the training. The higher the score increase, the more knowledge they gained



Efficiency = Score improvement ÷ Time taken

To see how fast participants learned per second. It shows which training method gave more learning in less time



CONCLUSION

Different AI interaction methods affect VR construction training in unexpected ways: text-only works best for theory while higher mental effort improves practical skills. VR training systems should match presentation style to specific learning goals and adapt in real-time to optimize both theoretical understanding and practical skill development.

Future research should expand this study with diverse participants and adaptive VR systems that dynamically switch interaction modalities based on real-time cognitive load. Incorporating additional physiological measurements beyond eye-tracking. Longitudinal studies are needed to evaluate knowledge retention across different modalities over time.

POSTER ID: 91

GREEN BUILDING THROUGH 3D PRINTING

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ILCC 2025

ABSTRACT

Infrastructural growth and construction industry contribution is played a vital role to the development countries like India. The modern technologies used for time reduction and precisenss but also for the next level to maintain the environment and improve sustainability. The 3D printing technology in construction can improve the quality and minimize the waste and time by using robotic arms for laying the desired structure at a provided layout drawing which is commended. The traditional technologies and locally available material usage like clay, natural fibers, lime will be considered for sustainable and green building development to minimise the carbon footprint in the environment and also can be launched through 3D printing by following the lean construction concepts. This technology can enhance the environment without any changes and provide a better tomorrow in a sustainable manner for the development of infrastructure.

Keywords: 3D printing, sustainability, lean concepts, green building

INTRODUCTION

Traditional construction techniques often involve high energy use, excesive material consumption, and significant greenhouse gas emissions.

Since buildings use around 40% of the world's energy and produce more than a third of CO_2 emissions, it is imperative that sustainable practices be incorporated into the industry.

Additive manufacturing, also known as 3D printing, has become a game-changing technology that provides creative ways to promote green building concepts.

3D printing creates structures layer by layer, allowing for more precise material placement, less waste, and more flexible design than traditional subtractive manufacturing.

This technology facilitates the use of optimal material compositions, including low-carbon substitutes, bio-based binders, and recycled aggregates.

Additionally, its ability to produce complex geometries without the need of formwork encourages innovative structural and architectural concepts that are both resource-efficient and aesthetically pleasing.

3D printing provides more environmental benefits when compared to material efficiency, which encourages domestic production, which reduces transportation-related emissions and enhance the just-in-time concepts in building approaches.

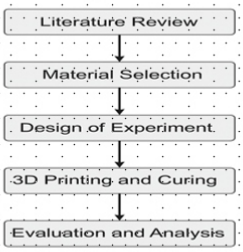
Moreover, automation in the printing process reduces the need of manual labor, increases consistency and improves safety in building.

As working towards ambitious climate objectives like net-zero emissions by 2050 the countries need to positioned as 3D printing a critical tool for the construction sector to acheive sustainability goals.

Assessing recent research and material advancements, the study helps in finding on how 3D printing may integrated into green building practices and identifies potential opportunities for the future development of sustainable built environments.

METHODOLOGY

Methodological Framework



Materials Used in Sustainable 3D Printing:

- Recycled Concrete Aggregates (RCA)
- Geopolymer Binders
- Bio-Based Polymers
- Salt-Based Composites
- PLA and Biodegradable Plastics

Detailed Material Selection Criteria: Embodied Energy, Printability, Structural Performance, Thermal Properties, Moisture Resistance, Recyclability

The Lean process can be adopted in the following process into our building with 3D printing:

Identification of Value:

Lean principle: The building must be value added to the client by the process of applying safety, adopt to the climate, Sustainable built environment. By Using soil, clay, laterite, or locally sourced aggregates blended with binders (like lime, geopolymer, or cement) instead of importing materials. Thrugh this cost, delay in supply of materials and waste recycling process can be reduced and carbon foot print also get reduced.

Value Stream Mapping:

Lean principle: Effective Process planning which may reduce the ineffective workflow and to implement the better cycle of process.

In 3 D printing, the process may like, Mapping material supply chain (quarry → processing → mixing → printer) and waste recycling process.

Identify wastes like unnecessary material transportation, double handling, or excess storage taken place in water recycling process. Use on-site material preparation units to streamline the flow produce better efficiency in process.

Pull:

Lean principle: The need of the client arid planned process to be matched and avoid the additional changes in site to increase the productivity. The mixtures should be ready as per the plan and it can be utilized by the printer Just – in – time to improve the process. The integrated model needed by using software like BIM with the 3D printing impact the productivity much more

RESULTS

The integration of 3D printing in green construction demonstrates measurable improvements in sustainability metrics:

Material Efficiency: Concrete usage can be decreased by up to 60% with hollow structural designs.

Waste Minimization: The forming material is eliminated by the additive process, which also drastically lowers material loss.

Energy Savings: Direct digital-to-physical manufacturing reduces energy usage by reducing construction and machine idle time.

Carbon Footprint: Lower emissions of carbon and reducing the need for transportation.

Design Flexibility: It is possible to create intricate geometries and multipurpose parts without the need for additional materials or components.

Social Impact: Decentralized fabrication allows for community-level construction solutions, while reduced labor needs improve safety.

CONCLUSION

There is a lot of potential for 3D printing to change the building sector toward more efficient and environmentally friendly methods.

Because it promotes creative use of sustainable resources, increases energy efficiency, and reduces waste, it is consistent with the fundamental ideas of green building. While technological, regulatory, and economic barriers still exist, the ongoing research and cross-sector collaboration between academia and industry will be instrumental in realizing its full potential.

Integrating life-cycle assessment practices and promoting the development of low-impact materials are essential next steps.

By using Lean principles and adoption of the same in for making Green Building through 3D Printing provide better result compare to conventional process.

POSTER ID: 101

LEAN INTEGRATED BIM BASED ENERGY ANALYSIS TOWARDS SUSTAINABLE CONSTRUCTION

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ILCC 2025

ABSTRACT

This study presents a novel integration of Lean construction principles with Building Information Modeling (BIM), aimed at promoting sustainability through real-time energy feedback. A dynamic system termed "Lean-Energy Loops" is proposed, where design and construction teams collaborate to optimize the energy efficiency during both design and execution phases. The BIM platform facilitates live energy simulations, enabling early identification of energy-intensive processes and allowing teams to implement corrective actions in real-time. To support this framework, energy analysis is embedded into Value Stream Mapping (VSM), allowing for systematic identification and elimination of energy-related waste throughout the value chain. It's expected to not only enhance energy-conscious planning but also improve construction efficiency. This approach would demonstrate the leveraging of BIM-based energy insights, supported by Lean methodology that can significantly reduce resource consumption, improve workflow reliability, and achieve better sustainability outcomes.

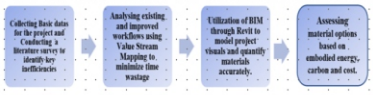
KEYWORDS

Lean construction,Value Stream Mapping, Building Information Modeling (BIM), Project inefficiency, Sustainable construction.

INTRODUCTION

The construction sector is increasingly challenged by inefficiencies, cost escalations, and environmental pressures, demanding innovative strategies that enhance performance and sustainability.**Lean Construction** emphasizes the delivery of maximum project value through the systematic elimination of waste and improvement of workflow efficiency. By applying Lean techniques such as **Value Stream Mapping (VSM)**, project teams can streamline processes, reduce idle time, and promote continuous improvement. **Building Information Modelling (BIM)** complements Lean by offering an intelligent digital platform for precise design visualization, material estimation, and interdisciplinary coordination. Together, Lean and BIM create a powerful synergy that drives data-informed decision-making, improves project transparency, and supports sustainable outcomes. This study integrates Lean and BIM methodologies with **energy performance analysis** to optimize both process and environmental efficiency. VSM was applied to brick masonry and roofing works within a live placement hall project to identify and minimize non-value-adding activities. Subsequently, BIM modelling in Autodesk Revit was used to extract quantities of materials such as AAC blocks and GI sheets whose embodied energy and carbon were evaluated using the **Inventory of Carbon and Energy (ICE, 2006)** database.Based on the assessment, alternative materials with lower carbon intensity and cost were proposed, showcasing how Lean–BIM integration can serve as a pathway toward **efficient, low-carbon, and resource-conscious construction practices**.

METHODOLOGY



This research employed an integrated **analytical and empirical approach** to explore how Lean Construction and Building Information Modelling (BIM) can collectively enhance energy efficiency and sustainability in modern construction. The study was structured to ensure both **technical precision and field relevance**, progressing through literature exploration, data acquisition, process observation, digital modelling, and performance evaluation.

A **live placement hall project** served as the case study to practically demonstrate the synergy between Lean and BIM tools. The workflow of **brick masonry** and **structural roofing** activities was systematically mapped using **Value Stream Mapping (VSM)** to identify process inefficiencies, categorize value-adding and non-value-adding actions, and optimize task sequences. This on-site assessment provided a foundation for improving workflow reliability and resource utilization.

Subsequently, the optimized process was modelled in **Autodesk Revit**, enabling precise quantity take-offs for critical materials such as **AAC blocks** and **GI sheets**. The extracted data were used to assess the **embodied energy** and **carbon footprint** of materials through reference factors from the **Inventory of Carbon and Energy (ICE, 2006)** database. To strengthen the sustainability dimension, **alternative materials** with lower environmental impact, **limestone blocks** and **steel sheets**,were evaluated for both ecological and economic performance.

The integration of Lean principles streamlined site operations, reducing **non-value-adding time** by approximately **27.8%**, while BIM ensured accuracy in design coordination and material estimation. Sustainability analysis revealed a **47% reduction in embodied energy**, **48% reduction in carbon emissions**, and **28% cost savings** through material substitution and process optimization.

Collectively, these results confirm that **Lean–BIM integration** can significantly enhance **workflow efficiency, cost control, and environmental responsibility**. The approach provides a replicable framework for future construction projects aiming to achieve **data-driven efficiency, resource-conscious design, and low-carbon development** within the Indian construction context.

RESULTS

By integrating **Lean principles** through **Value Stream Mapping (VSM)**, **BIM-based quantity extraction**, and **sustainability evaluation** using the **ICE database**, this study achieved measurable performance gains. The **Lean intervention** reduced **Non-Value-Added Time (NVAT)** from **7.20 hr** to **5.20 hr (-27.8%)**, while **Value-Added Time (VAT)** increased from 126.80 hr to 128.82 hr (+16%).

BIM-driven quantity take-off provided accurate material data: **10,000 kg of AAC blocks** and **6,000 kg of GI sheets**, enabling reliable sustainability assessment. Material substitution based on verified quantities resulted in:

- Embodied Energy (EE): 249,800 MJ → 132,400 MJ (-47%)
- Embodied Carbon (EC): 19,720 kg CO_2e → 10,240 kg CO_2e (-48%)
- Cost: ₹177,180 → ₹127,250 (-28%)

The integration of **Lean, BIM, and sustainability evaluation** delivered **simultaneous operational efficiency** and **environmental and economic improvements**, providing a **data-driven, repeatable, and actionable pathway** for enhanced construction performance.

CONCLUSION

This study establishes that the combined application of Lean Construction through **Value Stream Mapping (VSM)** and BIM-based modelling in **Autodesk Revit** enables accurate assessment of material quantities, embodied energy (EE), and embodied carbon (EC), thereby enhancing **sustainability** performance. The integrated approach effectively identified and minimized process inefficiencies, optimized resource utilization, and supported data-driven material selection. The findings revealed substantial reductions in non-value-adding time, energy consumption, carbon emissions, and project costs.

Beyond measurable improvements, the synergy between Lean and BIM promotes better collaboration, design accuracy, workflow reliability, and informed decision-making throughout the project life cycle. Overall, this integration provides a replicable and practical framework for achieving **efficient, cost-effective,** and **low-carbon construction** aligned with sustainable development goals.

POSTER ID: 102

LEAN INTEGRATED INVENTORY MANAGEMENT

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ABSTRACT

This project titled "Lean Integrated Inventory Management" evaluates the factors occurs in the construction of Library building of Thiagarajar College of Engineering (TCE), Madurai. This study explores practical approaches for implementing Lean principles in inventory management to minimize waste, optimize stock levels and enhance overall supply chain performance. Lean can be applied through several strategies. 'Just-In-Time (JIT) inventory, Kanban systems for demand-driven replenishment, ABC analysis for prioritization, and Lean Six Sigma (DMAIC) for problem-solving and process control. These methods help reduce overstocking, eliminate idle inventory, and improve order fulfilment rates. The work involves identifying key inventory inefficiencies using Pareto and Ishikawa tools, classifying items based consumption, and designing a lean based control model integrated with real-time demand tracking. Implementation is expected to result in lower transportation costs, improved warehouse space utilization, faster response to customer needs & to show financial performances. The work aims to present 'lean integrated inventory' framework applicable to various industries seeking cost-effective, agile, & sustainable inventory management solutions.

KEYWORDS
ABC Analysis, Material Requirement Planning, Ishikawa tool, Lean Integrated Inventory, Last Planner System(LPS

INTRODUCTION

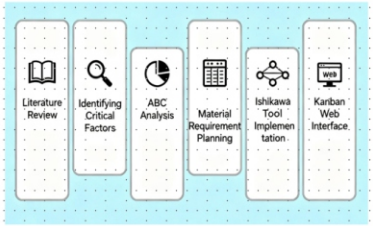
Lean Integrated Inventory Management combines lean principles with modern inventory control techniques to minimize waste and improve efficiency. It focuses on stock level optimization to balance inventory costs and service levels while preventing shortages and excesses. The use of a Kanban web interface enhances real-time visibility and automates material replenishment. Tools like the Ishikawa (Fishbone) diagram help identify root causes of inefficiencies, while Material Requirements Planning (MRP) aligns production with demand forecasts. ABC analysis classifies inventory by importance to prioritize control efforts. Together, these methods create a lean, responsive, and cost-effective inventory system that supports continuous improvement and competitiveness.

A Python-based Kanban web interface can directly support stock level optimization by visually tracking inventory in real-time and signaling when replenishment is needed. Each item or component is represented as a Kanban card that moves through stages such as "In Stock," "Low Stock," and "Reorder," allowing teams to maintain optimal inventory without overstocking. Automated alerts and updates ensure materials are replenished precisely when required, reducing waste and preventing shortages. By continuously monitoring consumption patterns, the system helps balance inventory costs with service levels, making the supply chain more responsive and efficient.

METHODOLOGY

The research methodology employs a structured, data-driven framework to develop a Lean Integrated Inventory Management system for construction projects. It begins with a real-time case study to capture operational inefficiencies in material procurement, stock monitoring, and site logistics. A comprehensive literature review establishes the theoretical foundation, identifying key determinants influencing inventory performance. To validate these determinants, a questionnaire survey is administered to industry professionals, and the results are analyzed to isolate critical factors affecting material flow. Using ABC analysis, materials are classified based on consumption value and criticality, wherein steel emerges as the primary control item. To trace the root causes of inefficiencies, an Ishikawa (Fishbone) analysis is performed, revealing systemic issues such as inaccurate MRP interpretation, unskilled planning, poor communication, and absence of Lean inventory practices like Kanban and JIT. This rigorous methodological approach provides a technically grounded foundation for optimizing procurement accuracy, enhancing material flow reliability, and strengthening data-driven decision-making in construction inventory management.

The research further proposes the integration of Lean principles with digital tools, such as real-time inventory tracking systems and predictive analytics, to create a dynamic and responsive inventory management framework. By combining process optimization techniques with technology-enabled monitoring, the system aims to minimize stockouts, reduce waste, and improve overall project efficiency. This approach not only addresses the identified inefficiencies but also fosters a culture of continuous improvement, enabling construction projects to achieve cost savings, timely deliveries, and enhanced resource utilization.



RESULTS

The study successfully implemented a Lean Integrated Inventory Management framework using a real-time case study to minimize waste and optimize stock levels in construction. Through a questionnaire survey and Relative Importance Index (RII), the research identified critical factors affecting inventory, such as inaccuracy of demand predictions and improper stock level optimization. ABC analysis of 203 materials at the site revealed that a small portion of items, the Class A materials (20.19% of inventory), accounted for the vast majority (90.95%) of the annual consumption value, with steel being one of the top critical materials. The importance of integration was highlighted by a Material Requirements Planning (MRP) analysis for steel, which showed that a misprocurement led to ₹18,190 in additional transportation costs and a 15-day project delay. The root causes of these inefficiencies were analyzed using an Ishikawa (Fishbone) diagram, pointing to systemic issues like lack of skilled planners and inaccurate MRP process. To resolve the issue of improper stock level optimization, a Kanban-based web interface was developed using Python, which provides real-time material tracking, visual alerts when stock falls below safety levels, and automated replenishment triggers, ensuring a more agile and cost-effective system. Overall, the integration of lean tools like Kanban and analytical methods like ABC and Ishikawa with MRP demonstrated a measurable improvement in material planning and execution efficiency.

CONCLUSION

The study establishes a lean-integrated, data-driven framework for improving construction inventory management. Through RII and ABC analysis, steel was identified as a critical A-class material requiring precise control. MRP findings revealed planning inefficiencies that caused a 15-day delay and increased transportation costs. Fishbone analysis further highlighted systemic issues in communication and process accuracy. The proposed web-based system with integrated Kanban cards ensures real-time tracking and just-in-time replenishment, reducing waste and enhancing material flow. Overall, the approach improves reliability, cost efficiency, and project performance.

The framework also emphasizes continuous monitoring and data-driven decision-making, enabling proactive adjustments to inventory levels based on real-time usage and project demands. By combining lean principles with automated tracking through the Kanban web interface, the system minimize stockout and overstock situation, streamline procurement, and enhances coordination among teams. This integrated approach not only optimizes resource utilization but also supports timely project completion and overall operational efficiency, the system enables real-time visibility and proactive inventory control, reducing delays and excess stock. By integrating lean practices with Kanban tracking, it ensures efficient material flow.

POSTER ID: 108

LEAN-DRIVEN AI SAFETY ASSURANCE AT RMC PLANT: A PULL-BASED MONITORING APPROACH

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CONSTRUCTION BUSINESS OF GODREJ ENTERPRISES GROUP

ILCC 2025

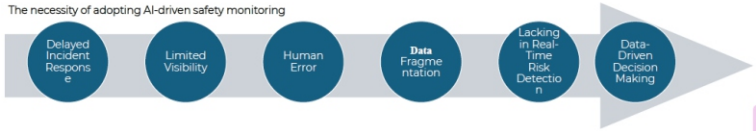
ABSTRACT

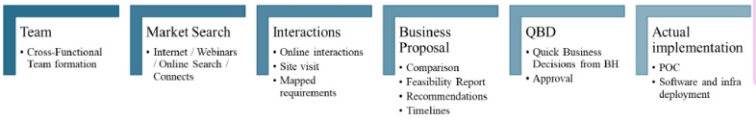
a) General Overview
→ AI integration in CCTV enables real-time intelligent surveillance.
→ Uses computer vision and deep learning for anomaly detection, face recognition, object tracking, and suspicious behavior identification.
→ Minimizes human intervention while enhancing monitoring capabilities.
b) Applications
→ Public safety
→ Industrial safety and security
→ Workplace behavioral analysis
c) System Capabilities
→ Detects unsafe practices and PPE violations.
→ Monitors fatigue and restricted area breaches.
→ Improves situational awareness and response time.
→ Supports proactive safety management.
d) Technical Architecture
→ Includes data acquisition, model training, and alert mechanisms.
e) Benefits
→ Enhanced hazard detection
→ Faster response times
→ Improved operational efficiency
→ Safer and smarter environments
f) Challenges & Considerations
→ Ethical concerns and privacy issues
→ Behavioral monitoring when no supervision is present

INTRODUCTION

- During recent long-range planning sessions, a strategic need was identified to enhance workplace safety culture using advanced technologies.
- AI-based real-time monitoring systems were recognized as transformative tools for elevating safety standards and aligning with industry trends.
- These systems offer proactive safety management and data-driven insights, proving valuable across various sectors.
- The Business Head emphasized shifting from traditional safety practices to technology-driven approaches.
- A pilot initiative was proposed to evaluate the effectiveness of AI-based monitoring systems in a manufacturing setting.
- A cross-functional team was formed, including members from safety, central monitoring, IT, procurement, and manufacturing.
- The team conducted a comprehensive market study and engaged with three reputed vendors specializing in AI-driven safety solutions.
- Key evaluation criteria included infrastructure requirements, software capabilities, and system feasibility.
- One vendor was selected for a three-month proof-of-concept (POC) trial.
- The POC will be implemented at the Recycled Concrete Plant.

The necessity of adopting AI-driven safety monitoring

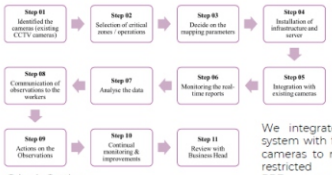




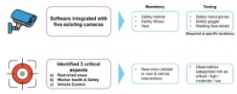
METHODOLOGY

Strategic Implementation Approach

To drive digital transformation in workplace safety, the initiative was strategically guided by our Business Head. The implementation began with a Proof-of-Concept (PoC) at one of our manufacturing units, in collaboration with a renowned AI solution provider. The following key strategic steps were adopted to ensure effective and efficient deployment:



Criteria Setting



We integrated the system with five key cameras to monitor restricted zones, PPE compliance, vehicle-man interactions, and safety behaviors, categorizing observations by severity: high, medium, and low.

RESULTS

Video-Based Observation
12-second clips captured and uploaded instantly upon detecting safety deviations.

Data-Driven Layout Improvements
- Redesigned layouts based on risk patterns.
- Clear floor markings for pedestrian and vehicle

Access Control Enhancements
- Mapped authorization for restricted zones.
- Improved personnel movement control in high-risk areas.

PPE Compliance Enforcement
- Achieved 100% PPE compliance.
- Monitored PPE usage at entry/exit points.

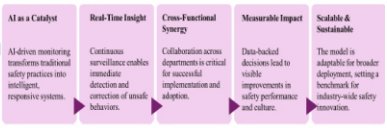
Physical Safety Measures
- Upgraded fencing and railing near machinery.
- Isolated hazardous equipment to prevent contact.

Consequence Management System
- Defined roles and corrective actions.
- Workers informed of strict actions for safety violations.

CONCLUSION

- The deployment of an AI-based CCTV safety monitoring system represents a pivotal step in embedding Lean principles and digital transformation into the organization's safety culture.
- Seamless integration with existing infrastructure has enabled real-time visibility, enhanced accountability, and proactive risk mitigation across critical operational zones.
- Cross-functional collaboration, supported by leadership vision and data-driven insights, has led to tangible safety improvements—such as:
  1) Optimized layout designs
  2) Improved PPE compliance
  3) Controlled access to restricted areas
  4) Strengthened consequence management
- The initiative marks a paradigm shift from reactive safety practices to a proactive, behavior-based approach.
- Encouraged by the success of the pilot, the organization is scaling the solution across multiple units and project sites, reinforcing its commitment to continuous improvement and sustainable safety excellence.

Key-takeaways



POSTER ID: 110

BUILDING COMMITMENT: LEAN TOOLS AND SCENARIO PLANNING FOR TIMELY HIGH-RISE EXECUTION

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ILCC 2025

ABSTRACT

The construction industry continues to face persistent challenges, particularly in delivering high-rise residential projects within the stipulated timelines. Research has shown that High rise residential projects often experience delays when measured against their ambitious schedules. A key contributor to these delays is the difficulty in improving labour productivity across various construction trades and dynamic environment where predictability is hard to achieve.

To address these challenges and enhance project delivery, Godrej Construction adopted Lean Construction principles combined with Scenario-Based Lookahead Planning. This strategic shift aimed to foster a commitment-based planning culture, improve coordination among stakeholders, and reduce variability in execution.

This poster presents the practical application of Lean tools such as the scenario planning , visual controls, constraint analysis, and collaborative planning sessions, demonstrating how these approaches contributed to measurable improvements in project performance. The findings underscore the importance of cultural transformation and structured planning in achieving predictable outcomes.

INTRODUCTIONz

This poster depicts how Godrej Construction effectively deployed a collaborative approach toward Planning and monitoring of Godrej Vistas Project using Lean methodologies, Weekly Big room meetings, Work sampling etc. to understand the challenges and Bottlenecks for seamless project delivery to achieve Super-stretched timeline commitment.

Need For Study:

- On-time delivery of Godrej Vistas Project meeting Stakeholder delight.
- To track Productivity & Resource deployment planned vs actual.

Objectives :

To Implement a standardized weekly productivity tracking system to measure actual vs. committed performance with labour deployment to take corrective action immediately to help in achieve committed milestone completion date.

Figure 01- Work done of Steel & Formwork (Planned vs. Actual)

METHODOLOGY

- Lean tools - Work sampling was been implemented in Project for eliminating Non-value-added activities and minimizing non-value-added but necessary activities so waste can be removed in Project and productivity can be enhanced.

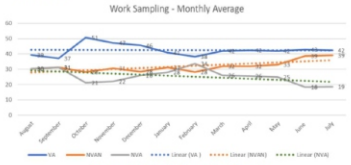

Figure 02- Work Sampling Sheet

- Weekly Big room meeting for collaboration and to address bottlenecks for smother execution of work in the processes using PPC analysis.

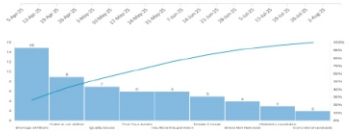

Figure 03- PPC Analysis

- Visual control charts and scenario planning used for monitoring project progress and resource optimization.

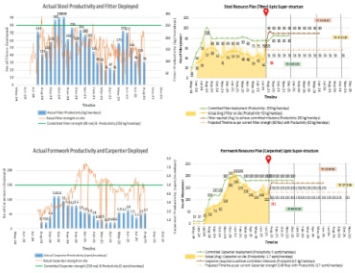

Figure 04- Productivity & Resource Deployment Analysis

RESULTS

By implementing a structured productivity tracking system and optimized resource plan on weekly basis resulting measurable outcome which is shared with contractor in meetings to achieve committed milestones:

1. Productivity graph helps in identifying trends, inefficiencies, improvement areas which improved overall productivity by 20%.
2. Resource planning ensures manpower fluctuation and to minimize unskilled labour deployment which affecting productivity and by deploying adequate manpower productivity increased by 15%.
3. Faster decision-making through real-time monitoring and corrective actions taken in Big Room meetings more then 150+ key issues.

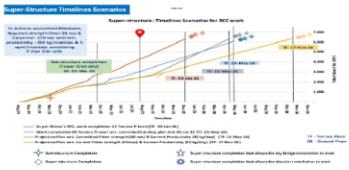

Figure 05- Estimated Projection wrt to Productivity & Catchup plan

CONCLUSION

The implementation of Lean Construction has helped in the successful execution and adherence of delivery on time Partnering:

- Creation of better relationships with our stakeholders.
- Identification of constraints and non-value-adding activities.
- Trust & Transparency.
- Open communication.

Resource optimization:

- Waste minimization
- Smooth process flow for efficient project delivery.
- Better monitoring and controlling using the "productivity" mechanism.

We have created Power BI dashboard providing a clear, color-coded visual representation of RCC slab completion incorporated with LAP, Productivity, Resource deployment trend which gives early flag off to arrest the potential delays.

Figure 06 – Dynamic Power BI Dashboard of Project Progress

POSTER ID: 119

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TURNING WAVES INTO WINS: LEAN-DRIVEN PRECAST INNOVATION FOR MARINE FOUNDATIONS"

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GODREJ CONSTRUCTION

ABSTRACT

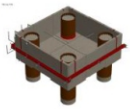
Unpredictable marine conditions in the Versova Bandra Sea Link project led to chronic delays in conventional pile-cap construction. Applying Lean Construction philosophy, the team identified shuttering over water as a non-value-adding activity and replaced it with a precast, seven-segment concrete TUB slab system. These modules, fabricated off-site and delivered just-in-time, acted as sacrificial formwork, enabling continuous workflow and reducing pile cap cycle time from 45 to 10 days—a 77% improvement. The approach significantly cut labour hours, scaffolding, and material waste, while enhancing safety and environmental performance through recycled aggregates. Supported by rapid prototyping, client collaboration, and iterative PDCA cycles, the innovation is now patent-pending. This integration of Lean principles and precast technology transformed a high-risk marine task into a predictable, sustainable, and replicable process, offering valuable insights for future coastal megaprojects.

INTRODUCTION

The Versova Bandra Sea Link (VBSL) project, a critical infrastructure initiative along Mumbai's western coastline, faced significant delays due to unpredictable marine conditions during conventional pile-cap construction. To overcome these challenges, the project team adopted Lean Construction principles, aiming to streamline processes, eliminate waste, and enhance safety and sustainability in a high-risk marine environment.

METHODOLOGY

1. **Identify value**: Versova Bandra sea link project is an important infrastructure facing time and cost challenges. The contractor is losing money, time and reputation for delays.
2. **Value stream mapping**: The conventional way of casting pile-caps using steel or plywood shuttering was a bottleneck and due to challenging marine conditions, it was resulting in wastages.
3. **Just in time**: With client co-creation an innovative solve which could enable use of readymade formwork was brainstormed.
4. **Continuous improvement**: Initially with single precast concrete slab as base for shuttering to 7 segment precast floor-wall units which would nest over 4 piles to form a sacrificial TUB formwork for pile caps., were designed, using recycled concrete for improved sustainability. Rapid prototyping, and iterative Plan-Do-Check-Act loops helped us improvise the solution for practical purpose.



Before

After

RESULTS

1. **Waste reduction and process efficiency**: 77% wastage reduced in Pilecap cycle time, from 45 days to 10 days.
2. **Customer and stakeholder satisfaction**: This solution helped client save cost and simultaneously yielded us order of 93 Cr.
3. Respect for people - Safety: The prefabricated TUB provided safer platforms to workers.
4. **Respect for planet**: Carbon footprint reduced by using recycled aggregates (Approx 20,000 MT) in mass scale. The sacrificial concrete formwork helps in improving life of the pile cap.
5. Sustenance: Integrating precast technology with Lean principles of prefabrication, flow, pull scheduling and relentless waste elimination, the project converted a high-risk marine activity into a predictable, sustainable, and value-rich process. Its success offers replicable insights for future coastal megaprojects across India and worldwide. The novel system is now progressing toward patent protection.

CONCLUSION

From 45 days to 10 — our Lean-driven precast TUB turned a high-risk marine challenge into a safe, sustainable, and repeatable success for India's coastal megaprojects. Off-site fabrication, just-in-time delivery, and PDCA loops reduced labour, scaffolding, and waste, while safer platforms and recycled aggregates lowered risk and carbon. Co-created with the client and now patent-pending, this approach turns a high-risk task into a repeatable, sustainable standard for India's coastal megaprojects.

POSTER ID: 120

MAXIMIZING GREEN CREDENTIALS THROUGH LEAN PROCESSES AND SUSTAINABLE STRATEGIES FOR INDUSTRIAL PROJECT AT KHALAPUR .

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ILCC 2025

ABSTRACT

The objective of this poster is to present a methodology for aligning Lean construction targets with IGBC ratings in construction planning and monitoring in the development of industrial project campuses. This poster also discusses the integration of new technologies in project without disrupting the environmental ecosystem. Furthermore, it outlines the current planning and progress update processes that serve as a foundation for Green along with Lean Strategy implementation. The paper examines how the Company's vision and management's decision on green rating levels, gets implemented with the help Lean principles. Godrej Construction conducted feasibility studies that align Lean construction targets with IGBC criteria. The target was to achieve top-tier green ratings by minimizing natural resource use, water, energy, and high embodied materials for reducing our carbon footprint, reducing construction waste, and safeguarding flora and fauna. Lean principles underpin every step, streamlining processes and eliminating non-value-adding activities.

INTRODUCTION

Godrej Construction (GC) is developing an industrial township at Khalapur in the state of Maharashtra for its internal divisions of Aerospace and Precision Engineering divisions. The Khalapur North Campus spans 90 acres and has a built-up area (BUA) of 1.4 million square feet. Our project has received IGBC Pre-certified Platinum rated green factory award in last financial year.

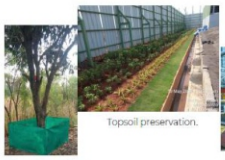
We have adopted the Lean strategies like Waste Reduction (Material, Time, and Energy), Just-In-Time (JIT) Delivery, Improved Resource Efficiency, Prefabrication and Modular Construction, Enhanced Collaboration and Communication, Continuous Improvement (Kaizen), Better Lifecycle Thinking, Reduced Carbon Emissions etc. with the green strategies like Waste management, use of Sustainable regional and recycled materials, tree preservation, natural topography preservation, water management, energy conservation, Rainwater harvesting etc.

Collaborating both technology principles together we Godrej Constructions are creating Sustainable structures with advance technologies.

Fig.01 - Naoroji Godrej Industrial Park at Khalapur.

METHODOLOGY

During construction, we preserved existing trees and topsoil, managed stormwater to protect soil, and enforced rigorous waste segregation—metal, wood, cardboard, plastic, glass- with detailed records and recycler declarations. Material selection prioritized regional sourcing within 400 km and high recycled content, all specified in the BOQ and vetted through RFPs, vendor presentations, and IGBC consultant expert reviews.



Tree preservation. Topsoil preservation. Construction waste management .

Fig.02 - Naoroji Godrej Industrial Park at Khalapur.

Godrej Construction collaborated with our design partners and consultants on rainwater harvesting, and other design modifications as per green principles. Floated IGBC-aligned RFPs to prospective vendors, and used technical data-sheet reviews to confirm compliance before procurement.

Our project, procurement, and contracts teams coordinated vendor engagement, while design requirements are discussed directly with consultants.

Our target was to achieve top-tier green ratings by minimizing,

- Natural resource use,
- Minimize water & Energy requirement ,
- Avoiding high embodied materials to reduce our carbon footprint reducing construction waste,
- Safeguarding flora and fauna.

Lean principles underpin every step, streamlining processes and eliminating non-value-adding activities.

Vendor's engagement .

Use of Sustainable materials

Fig.03 – Lean & Green.

RESULTS

By applying Lean & Green principles we will be achieving in project

- Soil erosion control with natural topography preservation 30%
- Rain water harvesting by 50%
- Domestic Water harvesting by 30%
- Water savings in landscaping by 20%
- Waste water treatment by 95%
- Overall energy savings by 40%
- Renewable power generation by 15%
- Construction waste reduction by 75%
- Recycled and reused material roughly around 10%

Indian Green Building Council (IGBC)

Naoroji Godrej Industrial Park- North Campus, Khalapur

Khalapur Taluka, Raigad District, Maharashtra State

IGBC Green Factory Building Rating System

Precertified Platinum

December 2024

Result after achieving Lean and Green Strategies together .

Fig.04 – CII Certificate for Khalapur North Campus

CONCLUSION

By embedding Lean thinking into construction projects, firms can significantly reduce environmental impacts, improve economic performance, and create more socially responsible outcomes.

Lean and sustainability are not parallel efforts—they are deeply complementary.

Lean focuses on process efficiency, while Green focuses on environmental performance. Together, they drive smart, sustainable, and competitive construction projects.

Adopting these Lean-green strategies enhances the general contractor's brand as a sustainability leader.

Empowers vendors to certify and test their products in authorized labs,
and delivers commercial benefits through stronger market positioning and green credentials.

POSTER ID: 123

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Material Efficiency and Sustainability Value: Organizational Challenges

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Abstract

The construction sector is one of the largest consumers of material resources, with profound implications for both economic costs and environmental impacts. Despite the disproportionate share of environmental degradation, the construction sector is exceptionally slow in adopting innovations, including for material efficiency. This study utilizes a qualitative approach to examine the opportunities and challenges to material efficiency, considering an organizational perspective. Semi-structured interviews and secondary data sources serve as a dataset to explore the phenomenon. The analysis highlights that although organizations attempt, institutionalized practices at the organizational and field-level impede organizations from delivering the 'sustainable value proposition' towards material efficiency.

Conceptual Framing

- Learning disability of project-based organisations (Will et al, 2008)
- Project-level solutions are more ad-hoc; organisational changes are more effective and create long-term impacts (Glass & Dainty, 2011)
- Sustainable Value Proposition (Schaltegger, 2014): Integrating sustainability into the core values of the organisation.

Research Question

How do organisations experience challenges when integrating 'material efficiency' into their value proposition?

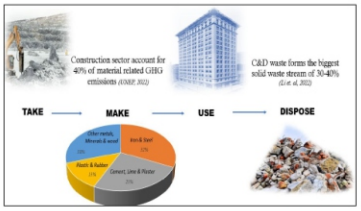
Methodology

- **Primary data:** Qualitative interviews with organisations representing manufacturers, developers, contractors, and consulting firms.
- **Supplementary dataset:** Sources such as panel discussions available in the online domains.
  - Naturalistic *(Ninan et al., 2023)* & openness of information
  - Sustainability is a topic of debate in open forums, thus plentiful and easy to access
  - Help overcome the geographical bias of information
- **Data analysis:** Open coding, categorizing, and thematic analysis.

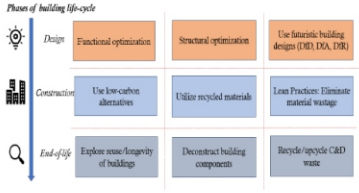
Material Efficiency

"Using less new materials to achieve the same goals"
(Allwood, 2012)

The Need For Material Efficiency In Construction:



Strategies for Material Efficiency:



Environmentally sustainable, Lean & Optimal in Design, Construction & End-of-life

Findings: Organizational Challenges to Material Efficiency

Illustrative Quotes & Categories

Conservative and overdesigned structural components:

"Our entire construction industry is slowly moving from brick to lightweight concrete blocks. But for the dead load calculations, the structural consultant always considers bricks as the default value and arrives at the total load factor for the building. The moment we change from a brick into a lightweight concrete block, your dead load will automatically come down. But still, most of the clients always want to calculate the entire dead load by considering the brick as the baseline. "

Missing metrics and quantification of material efficiency:

"Carbon is a useful metric... but I would caution about it being the only metric because it doesn't capture the full aspects of material efficiency and circularity. We should use it, but we should have a separate metric or a couple of metrics for circularity ambitions."

Delay in onboarding sustainability consultants

"Whether it is the LCA or the energy modeling, all these happen after everything is finalized. They finalize the procurement with the suppliers. They might even order it, but after that, they will send the BOQ to analyze the efficiency. There is no meaning in that, right? Everything is ordered, and then it's more like a formality. Now I need to do a post-mortem and demonstrate that the design is great. That is the reality."

Layer	Institutionalized practices resisting material efficiency in construction
Organizational	• Competing organizational and project goals: Sustainability vs. Cost & Time • Sustainability elements not included in the tender, BOQ, and contract documents • Unsupportive structure and capabilities
Field-level	• Delay in onboarding sustainability consultants • Consultants uninvolved in end-of-life decisions • Conservative and overdesigned structural components • Hierarchical configuration of stakeholders • Missing life cycle perspectives in design and construction • Missing metrics for material efficiency

Conclusion

- **Change in Value Proposition:** Need for AEC organisations to integrate 'sustainability' into their existing value proposition.
- **Institutional resistance:** Organisations face challenges in advancing material efficiency in construction due to the routinized practices.
- **Navigating the resistance:** Organisations need to navigate the resistance to achieve better material efficiency.
- **Institutional work:** Challenging the status quo of focus on cost and time to material efficiency and sustainability.

POSTER ID: 136

COLLABORATIVE SUSTAINABILITY: GODREJ'S LEAN MODEL FOR SUPPLY CHAIN EVOLUTION

GODREJ CONSTRUCTION
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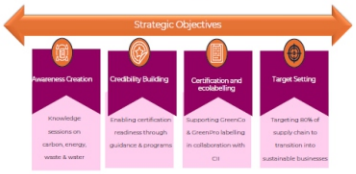
ILCC 2025

ABSTRACT

- In a fragmented market and construction industry which is notorious for Environmental damages , Godrej Construction is pioneering a sustainability-first approach in India's construction ecosystem. Grounded in Lean construction principles—waste minimization, continuous improvement, collaboration, and value-driven engagement—the initiative reimagines supply chains for efficiency and environmental impact.
- Rather than imposing mandates, the program inspires change through voluntary engagement, shared learning, and practical support. It builds awareness, develops business partner capabilities, and guides participants toward green certifications that signal genuine progress.
- Targeting A-type and critical business partners, which account for over 80% of supplies and services, the effort spans procurement, sustainability, finance, and leadership teams. Together, they're addressing priority ESG areas: cutting carbon emissions, conserving water, boosting energy efficiency, and slashing waste.
- Godrej Construction fosters long-term shifts in mindset and operations via structured dialogues, shared values, and partnerships with eco-label certifiers. This Lean-driven model emphasizes collaborative planning, transparent practices, and continuous learning.
- Aiming for 80% sustainable procurement by FY2028-29, the initiative has already secured multiple business partner sustainability certification enrolments. Its scalable, adaptable framework provides a clear roadmap for replicable supply-chain transformation. More than a corporate program, it showcases how purposeful leadership, and genuine collaboration can reshape an entire industry—one relationship at a time.

INTRODUCTION

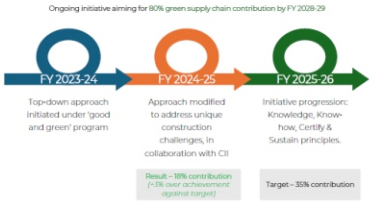
- Practice: Conscious and deliberate efforts to bring SUSTAINABILITY AWARENESS and develop SUSTAINABLE PRACTICES in our supply chain partners in unregulated constriction industry in India.
- Process emphasis - Development of SUSTAINABILITY CONSIOUSNESS instead of exclusive strategy to keep supply chains green



Initiative trajectory:

- Start: FY 2023-24
- End: FY 2028-2029
- Initiation stage – Business partners are selected in manner of clusters for a particular financial year, for which we initiate with the awareness sessions
- Concluding stage – a particular business partner case is considered as concluded, at the point when a validdated proof of sustainability of the business is produced by supplier. In case of voluntary regret from business partner from cluster selection, a valid alternative is to be developed by the team, which becomes part of the next cluster selection.
  - The outcomes of conclusion: (whichever is applicable):
  - Sustainability certification GreenCo or
  - Sustainability commitments like Sbti or
  - Ecolabels, EPD for the products or
  - evaluating their carbon footprint or sustainability key performance indicators (KPIs),

Deployment & Implementation:



Key achievements and recognition

CONCLUSION

METHODOLOGY

Objective:

Under our Good & Green initiative, Godrej Construction is building a sustainable supply chain by enabling vendors to adopt eco-friendly practices, gain certifications, and reduce their carbon footprint. Our target is to make 80% of the supply chain sustainable with support from CII, SBTI, Eco Vadis, and others.

Approach:

Awareness: Vendor sessions on carbon, energy, waste, water.

Certifications: Support for CII GreenCo, Green Pro, and global standards.

Integration: Embedding sustainability into supplier deliverables and service provider practices.

Scope:

Suppliers: Cement, steel, admixtures, chemicals + Green certifications.

Service Providers: Logistics, maintenance, consultants, architects + Sustainable design and compliance.

Stakeholders: Purchase & Contracts teams, business verticals.

Boundaries:

Due to industry-level data challenges, progress is tracked via certifications and % of sustainable spend rather than micro-parameters

RESULTS

Profit centre	Supplier business name	Awareness (Y / N)	GreenCo certification commitment (Y / N)	Status Converted (Y / N)
CM	CONCRETE ADDITIVES & CHEMICALS PVT LTD	Yes	Yes	Yes
CM	KAMERA PLAST PVT LTD	Yes	Yes	No
CM	KALBURGI CEMENT PVT LTD	Yes	Yes	Yes
CM	ASL LOGISTICS PRIVATE LIMITED	Yes	No	No
RE-D	TOTO INDIA INDUSTRIES PVT LTD	Yes	Yes	Yes
RE-D	SAFETY PROJECT PVT LTD	Yes	No	No
RE-D	DOORS & DOORS	Yes	Yes	Yes
RE-D	KIRBY BUILDING SYSTEMS STRUCTURES INDIA (GUJARAT) PVT LTD	Yes	Yes	Yes
RE-D	PENWAR INDUSTRIES LTD	Yes	Yes	Yes
RE-D	AVIANS INNOVATIONS TECHNOLOGY PVT LTD	Yes	Yes	Yes

80% of the initiated suppliers considering for making their business

70% of the initiated suppliers opted for GreenCO certification

Benefits to Godrej Construction

- 30-35% of supply of green nature achievement (forecasted)
- Critical categories (Cement and Chemicals) strategically benchmarked to drive higher adoption
- Improved Green quotient across material sourcing and project execution

Benefits to Business Partners

- Energy and resource savings validated and monitored by CII
- Reduction of Waste and material inefficiencies
- Improved brand positioning
- Future preparedness for NET ZERO (government mandate)

Continuity Plan

Transforming supply chain initiative into 'sustainable procurement policy' to provide basis for 'sustainability guidelines' for business partners

Customized sustainability framework for business partners and industry categories to be developed in assistance with CII

Review Frequency - Continue quarterly cadence of monitoring 'Green conversion' basis spend analysis' and 'business partner certifications' metrices

Next steps and future outlook

Year	Green suppliers' contribution to total spend (cumulative %)	Short-term and long-term milestones	Anticipated expansion plan
FY 25-26	25%	Kalburgi Cement (0% spend share) identified for inclusion in the green supply chain to enhance sustainability impact	Leverage the learnings and finalized sprint framework for broader engagement with cement manufacturers
FY 26-27	50%	Green criteria based vendor shortlisting implemented for key projects like Vistas, HEIRL and ONE	Integrate into upcoming development project procurement strategies
FY 27-28	65%	Category level consolidation focus to boost volumes with sustainable suppliers, moving beyond short-term, micro level optimization	Deployment of category-level business partners across multiple business units
FY 28-29	80%	7% vendors contribute to 80% of spend, highlighting past focus on low-impact interactions - now evolving towards engaging strategic and sustainability-ready partners	Strategic shift in approach through category consolidation and long-term supplier partnerships

Learnings & improvement plans

Sustainability starts with transforming mindsets - Workforce & Leadership alike

Impact areas vary across businesses; tailored action are a must

Collaborate with CII and develop construction-specific rating checklists including previously unaddressed business models in the sustainability scope

POSTER ID: 153

ANALYSIS OF ACTUAL COSTS INCURRED DURING PROJECT LIFECYCLE

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ILCC 2025

ABSTRACT

Cost control in construction is rarely straightforward. Budgets look very neat when written down on paper, but as soon as work commences, a difference between budgets and actual costs starts becoming visible, which often becomes greater than anticipated. In this paper, two large projects, Project XXXX and Project AAAA, are examined to see how the costs behaved with time. The data were gathered from an SAP-based system and consisted of actual costs, revenues and budgets. The aim was to see how closely the limits of the budgets had been adhered to and what factors were most responsible for the results. Whilst both projects were examined by the same method, this paper will concentrate mainly on Project AAAA which will be gone into detail. The same will apply to Project XXXX but results were of a similar nature to those obtained from Project AAAA.
A data-driven approach was employed, involving systematic extraction and categorization of direct and indirect costs, followed by time-series and ratio-based analysis. Microsoft Power BI dashboards were used to visualize monthly trends, variances, and performance metrics, enabling dynamic and interactive monitoring.
Findings reveal that cost-to-revenue ratios provide a more accurate measure of financial health than absolute costs, while rate trend analyses highlight inefficiencies and productivity variations. Integrating SAP data with Power BI enhanced transparency and real-time decision-making. The study recommends implementing rolling budget reviews, closely tracking material and subcontractor costs, and institutionalizing digital dashboards for continuous cost control and improved project governance.
Additionally, the study highlights the importance of integrating predictive analytics with dashboard tools to anticipate cost deviations early. Such integration supports proactive decision-making, enabling project managers to prevent overruns and improve financial sustainability.

INTRODUCTION

Actual construction costs include expenses for materials, labor, equipment, subcontractors, and overheads. These costs are affected by changes in prices, design, market conditions, and project delays. Using real-time tracking and predictive analytics can improve cost control and reduce financial risks (Zhang & Mo, 2024). Key Performance Indicators (KPIs) identified from research studies are defined in the dashboard to analyze and manage both direct and indirect costs. This study uses interactive dashboards Power BI to monitor and analyze cost data. The approach combines cost control and data analytics to support better budgeting, financial decisions, and project performance.

Key Performing Indicators

- **Cost Variance** (Montero, 2015) — Measures the difference between the planned budget and the actual expenditure for the project.
- **Cost per Unit** (KPI, 1999); (Cleary & Lamanna, 2022) — Measures the cost efficiency of the project by calculating the cost for each unit (square meter, Ton, etc) of construction.
- **Material Cost Variations** (Phakoe et al., 2023) — Tracks the price changes in materials over the course of the project, affecting the overall budget.
- **Labour Cost Variations** (Cleary & Lamanna, 2022) — Monitors variations in labour costs, which can be influenced by inefficiencies or changes in labour rates.
- **Margin fluctuations (%)** Primary reference — Measures the profitability of the project or activity phase; indicates how much cost was saved or overspent relative to expected earnings.
- **Actual cost / Revenue quantity** Primary reference — Measures the cost incurred per unit of output delivered (billed quantity) (e.g., per sq. m or per unit).
- **Actual cost as % of revenue** Primary reference — Indicates the proportion of project revenue consumed by actual costs; helps assess cost efficiency and resource management.

METHODOLOGY

Costs in the project are categorized into Direct Costs (formwork, material, labour, plant and machinery, sub-contractor, other) and Indirect Costs (variable overheads and fixed overheads). Each prime activity is linked to specific resource types, with costs incurred for resources like formwork, material, labour, plant, and sub-contractors.

- Data Collection — Gathering raw data from primary & secondary sources
- Ensuring data quality and consistency — Data Standardization
- Defining KPIs & Metrics — Assess Cost Trends & Project Performance
- Applying statistical methods to analyze data — Power Bi Dashboard
- Conclusion & Recommendations — Summarizing findings and providing recommendations

Input Data

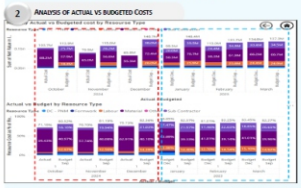
- Actual Costs & Revenue (1st April 2024 to 31st December 2024)
- Budget (September) Costs (1st October 2024 to 31st March 2024)
- Budget (December-revised) Costs (1st January 2025 to 30st June 2025)
- Budgeted Revenue (1st October 2024 to 31st March 2024)

Data Standardization in Excel

Project	Cost Category	Resource type	Posting Date	PA No	PA Description	Net Value in INR

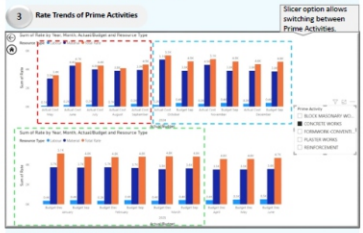
Power BI Dashboard (Project AAAA)

Note: Cost as a percentage of revenue shows the cost efficiency of each resource, with actual costs expressed as a proportion of the revenue generated.



Upper chart shows monthly Budgeted costs, while the **lower chart** illustrates resource costs as a percentage of revenue.
Red : Compares actuals with the September budget
Blue : Compares the revised Dec. revised budget with Sept. estimates.

RESULTS



Red - Shows actual rate trends.
Blue - Compares actual rates with the Sept. budget (Oct–Dec 2024).
Green - Compares revised Dec. budgets with the original Sept. budgets (Q1 2025).

Observation:

- October 2024 had the highest rate at ₹5.5K, exceeding the budgeted ₹4.9K, due to higher material cost (₹5.1K vs. ₹3.8K).
- November 2024 showed a similar overspend, with an actual rate of ₹5.1K.
- December 2024 saw improvement: the actual rate was ₹4.6K, below the budgeted ₹4.8K, indicating better control or reduced activity.

CONCLUSION

1 Analysis of Actual Costs

1c The large negative margins in June and July, especially -14.47% in June, show significant losses from costs exceeding revenue. This likely results from unexpected expenses, delays, or missed revenue targets. Consistently lower actual revenue versus budget suggests overestimated forecasts or project setbacks.

1d On selecting a resource in **1b**, such as Material (blue), which contributes the highest costs from April to December, the month-wise actual cost graph displays the distribution of incurred costs by resource type for each month.

1e The cost-to-revenue ratio exceeded 100% in October and December, indicating that project expenditures during these months surpassed the revenue generated, mainly due to increased material costs in high-expenditure activities. The stacked column chart shows the proportion of resource costs against revenue, indicating how much of the revenue is consumed by each cost component. For better profitability, actual resource costs should remain lower than actual revenue. The lower the cost percentage, the higher the positive influence on profitability.

2 Analysis of Actual vs Budgeted Costs

- It is observed that subcontracting was not provided with materials as initially planned during budgeting, or that certain activities have not commenced where higher subcontracting costs were originally considered. In the December revised budget, the proportions of subcontractor and material costs is expected to be adjusted based on the margin of each activity.
- Remaining within or below the **budget** does not necessarily indicate better cost performance, it may reflect a shortfall in the **execution of planned activities**. When certain works are delayed or incomplete, the corresponding budgeted costs are not incurred, resulting in lower actual spending.

3 Rate Trends of Prime Activities

- The rate analysis indicates significant fluctuations, particularly in the Concrete activity, where budgeted rates are consistently lower than the actual incurred rates. This indicates the need to adjust budgeted material rates to better match market conditions and improve future cost estimates.
- Slight upward budget revisions for Jan '25 suggest a responsive and refined planning approach, while stable projections for later months reflect controlled cost expectations.

POSTER ID: 156

ILCC 2025

LEVERAGING LEAN PRACTICES FOR EFFICIENT PILE & DIAPHRAGM WALL PLANNING AND EXECUTION

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L&T CONSTRUCTION

ABSTRACT

This paper presents the application of Lean Construction practices in Pile and Diaphragm Wall Execution for the Peerless Trayam Project, Newtown, Kolkata. Usage of tools like Last Planner System, Just-in-Time, and Value Stream Mapping enhanced productivity, reducing cycle time and improving sustainability.

INTRODUCTION

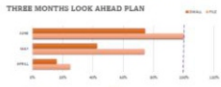
Project Name: Peerless Trayam Project (Mixed Use Development)
Project Location: BG Block (Newtown), Street No. 97, Action Area 1, Newtown, Kolkata -700156, West Bengal
Connectivity:
Railway: Sealdah South Suburban Section (12 km)
Metro: Salt Lake Sector 5 (3.8 km)
Road/Flyover: Biswa Bangla Sarani
Airport: Netaji Subhash Chandra Bose International Airport (11 km)

Sl. No	Description	Stakeholders Details
1	Owner/Client	M/s. Peerless General Finance and Investment Co. Ltd.
2	Contractor	M/s. Larsen & Toubro Limited – L&T Construction, Building & Factories IC
3	Design Consultant	L&T Engineering Design & Research Centre, Chennai
4	Principal Architect	M/s. HB Design Co. Ltd
5	Structural Consultant	L&T Engineering Design & Research Centre, Chennai
6	MEP Consultant	L&T Engineering Design & Research Centre, Chennai

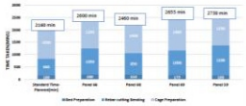
Lean construction, derived from Lean manufacturing principles, provides a structured approach to address the challenges during project life cycle by minimizing waste, improving coordination and enhancing reliability. Lean emphasizes collaboration, short-term predictability and continuous improvement.

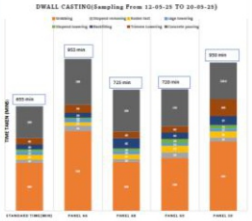
METHODOLOGY

- **Three Months Look Ahead**

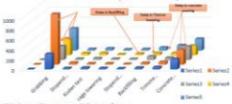


- **Time Motion Analysis**





- **Root cause analysis**



- **Value Stream Mapping**

- **Lean Tool Implemented**
- **Last planner system** : The Last Planner System (LPS) was implemented in the piling and diaphragm wall (D-Wall) execution to improve reliability and flow of activities under site constraints.

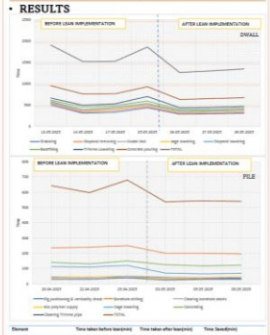
- **Zone Wise Planning:**

- **Digitalization:**

- **Sustainability:**

- **Constraints & Root cause Mitigation**

- **RESULTS**



- Conclusion: The project's success underscores the need for wider Lean adoption in urban construction with future scope in digital integration, real-time monitoring and advanced analytics for stronger execution.

LEAN PROJECT COMPETITION

AURA : An Automated Uncertainty and Risk Analyzer for Lean Construction Planning

Dhyey Gondalia[a], Bhairavi Valodara[a], Nirali Mistri[a], Yayin Parmar[a], Harshit Jhaveri[a]

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ABSTRACT

The Last Planner® System's look-ahead planning is critical for creating reliable workflow, yet it is often undermined by unforeseen risks. Project teams typically rely on experience and intuition to identify constraints, frequently missing complex risks related to weather, supply chain disruptions, and trade interactions. This reactive approach leads to low Percent Plan Complete (PPC), schedule delays, and significant process waste. We propose the development of an "AI-Powered Look-Ahead Risk Predictor," a digital tool designed to proactively identify and score risks within a construction look-ahead plan. The tool will allow a user to upload a standard look-ahead schedule and will analyse it against multiple data sources, including historical weather patterns, supplier lead-time data, and trade-specific productivity rates. Using a predictive model, it will assign a "Risk Score" to each activity. This project will be executed in four stages: (1) Research and Data Curation: We will identify key construction risk factors and curate relevant datasets. (2) Predictive Model Development: A risk-scoring engine will be developed, starting with a robust rule-based system. (3) Tool and Interface Development: A web-based digital dashboard will be created. (4) Validation and Case Study. This tool will shift look-ahead planning from a reactive exercise to a data-driven, proactive strategy. We anticipate it will directly contribute to a significant increase in PPC, a reduction in schedule variability, and the minimization of waste, strengthening the entire Last Planner® System.

LEAN PROJECT COMPETITION

Propose a Lean Framework for Enhancing Site Logistics and Waste Minimization for Sustainable Construction Projects

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ABSTRACT

The construction industry is often challenged by inefficiencies that lead to significant waste generation, affecting project timelines, costs, and resource utilization. Lean construction is a smarter way of building things. Borrowing ideas from the manufacturing industry, especially the Toyota Production System, it focuses on getting maximum value from every step while cutting down on anything that doesn't add value, like wasted materials, time delays, and inefficiencies. The old construction approach where the waste was often overlooked. The lean construction is all about being efficient, well-planned, and always improving. The idea is simple: do more with less: less time, less material, less effort, without compromising on quality. The lean principles emphasize on eight types of waste, namely Defects, Overproduction, Waiting, Non-utilized talent, Transportation, Inventory, Motion, and Extra Processing are identified, which are commonly found on construction sites. In the proposed project, an extensive literature review will be carried out to identify the various waste proposed by different authors. The identified wastes will then be prioritized based on frequency and impact on the construction project, based on expert opinion. Subsequently, a real-time assessment of waste will be done for construction sites in progress. The collected waste will be verified with the literature-based waste. A comparative analysis will be done to identify overlaps and gaps between theoretical and practical waste instances. Using root cause analysis, the underlying factors contributing to each major waste will be explored. Finally, the research proposes an innovative lean-based framework aimed at minimizing construction waste, particularly focusing on reducing all types of waste and improving site logistics. This framework is designed to enhance productivity, optimize resource use, and support sustainable construction practices.

This Project directly contributes to the United Nations Sustainable Development Goals SDGs 9, 11, and 12. Furthermore, the integration of circular economy principles within the proposed framework encourages the reuse of materials, reduction of environmental impact, and development of a more sustainable and resilient construction industry.

LEAN PROJECT COMPETITION

Synergistic Integration of Lean Construction, BIM, and Sustainability for Optimized Project Delivery

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ABSTRACT

The evolving demands of the construction industry necessitate innovative strategies that balance efficiency, collaboration, and environmental responsibility. This study investigates the integrated application of Lean Construction principles, Building Information Modeling (BIM), and sustainability to enhance project performance across the construction lifecycle. Individually, Lean reduces process inefficiencies, BIM enables data-driven collaboration and visualization, and sustainability ensures long-term environmental and economic viability. Their integration presents a transformative approach to project delivery. This is achieved by proposing a comprehensive framework aligning Lean tools—such as the Last Planner System and Value Stream Mapping—with BIM capabilities, including 4D/5D modeling and clash detection, while embedding sustainability metrics like embodied carbon, energy consumption, and material lifecycle impact. This framework is validated through selected case studies, demonstrating measurable improvements in resource optimization, waste reduction, project coordination, and environmental performance. This study underscores the synergistic potential of this triad to drive value-based outcomes, foster stakeholder engagement, and support India's transition toward sustainable infrastructure. By bridging process innovation with digital transformation and ecological consciousness, the integration of Lean, BIM, and sustainability offers a strategic pathway for modernizing construction practices.

Lean Integrated BIM based Energy Analysis towards Sustainable Construction

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Thiagarajar College of Engineering, Civil Engineering Department, Madurai , India

ABSTRACT

This study presents a novel integration of Lean construction principles with Building Information Modeling (BIM), aimed at promoting sustainability through real-time energy feedback. A dynamic system termed "Lean-Energy Loops" is proposed, where design and construction teams collaborate to optimize the energy efficiency during both design and execution phases. The BIM platform facilitates live energy simulations, enabling early identification of energy-intensive processes and allowing teams to implement corrective actions in real-time. To support this framework, energy analysis is embedded into Value Stream Mapping (VSM), allowing for systematic identification and elimination of energy-related waste throughout the value chain. It's expected to not only enhance energy-conscious planning but also improve construction efficiency. This approach would demonstrate the leveraging of BIM-based energy insights, supported by Lean methodology that can significantly reduce resource consumption, improve workflow reliability, and achieve better sustainability outcomes.

Framework for Integrating Lean Principles to Drive Sustainability through Lean Tools and Techniques

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NICMAR University of Construction Studies, Hyderabad, India

ABSTRACT

The construction industry plays a vital role in driving national economic growth but continues to grapple with persistent challenges such as cost and time overruns. Lean construction principles have emerged as a strategic approach to minimize waste and enhance value delivery to customers in addition to meeting project objectives i.e., completing within time and budget. However, increasing regulatory pressures and market competition are compelling stakeholders to align construction practices with sustainability imperatives. While prior research has highlighted the benefits of lean implementation in promoting sustainable construction, there remains a lack of structured guidance for integrating lean tools with sustainability goals. Addressing this gap, the present study proposes a conceptual framework titled "Embrace Sustainability through Lean Lever (ESL^2)," which systematically maps the shared goals and individual principles of lean and sustainability. The ESL^2 framework integrates five lean principles, eight types of construction waste, seventeen United Nations Sustainable Development Goals (SDGs), and relevant lean tools and techniques to create a comprehensive roadmap for sustainable lean construction. This framework not only provides researchers with a foundation for further exploration but also offers construction professionals a practical guide to transform conventional processes into sustainable practices. By aligning lean efficiency with sustainable development, ESL^2 empowers the industry to deliver long-term value to stakeholders while minimizing environmental impact and resource consumption.

A GIS-Driven Lean Approach for Sustainable Pipeline Design in Irrigation Projects

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ABSTRACT

In irrigation EPC projects, underground pipelines contribute significantly to both project scope and cost. Traditional design methods involve multiple manual steps—such as irrigation Chak planning, outlet placement, and pipeline routing—often executed through CAD drafting. These workflows are linear, iterative, time-consuming, and prone to human error, with limited capacity for optimization. For a typical 20,000-hectare command area, finalizing a pipeline design can take over five months, affecting project delivery and cost efficiency.

This paper presents a GIS-based approach that inherently embodies Lean principles by streamlining design workflows, eliminating non-value-adding steps, and enabling rapid, data-driven decision-making. Techniques such as genetic algorithm clustering, least cost path analysis, raster zonal statistics, and spatial analytics are combined within ArcGIS to automate and optimize pipeline routing. Object-oriented programming and rule-based logic are used to integrate these modules into a continuous and intelligent design flow.

The GIS environment acts as a Lean enabler by minimizing rework, reducing manual interventions, and aligning design outputs with real-world constraints like terrain, land use, and infrastructure crossings. A case study from a Mega Lift Irrigation Project in Odisha demonstrated over 80 percent improvement in productivity, significant reduction in pipeline length, and minimized linear infrastructure conflicts. Eight scheme designs were completed in just 10 days—a task that conventionally demands several months.

This GIS based lean approach transforms pipeline design from a fragmented drafting task into a value-driven, automated process. It not only accelerates project timelines but also supports sustainability goals by reducing material use and environmental impact by choosing the eco-friendly alignments and crossings reduction. This GIS-driven methodology sets a new benchmark for smart, efficient, and responsible infrastructure planning.

Lean Implementation in Khalapur North Campus

Jitendra Bhatt, Vinayak Salvi, and Sagar Karnik

Godrej Construction

ABSTRACT

Implementation of Lean tools sets the evolution of a Lean-driven culture at the Khalapur North Campus, an 82-acre greenfield development in Maharashtra with a built-up area of 13.2 lakh square feet. The project comprises industrial sheds, office buildings, utility structures, and infrastructure facilities, executed with a strong emphasis on safety, quality, and timely delivery.

Faced with challenges such as workforce shortages, recurring execution errors, productivity losses, and decision-making delays, the project team adopted Lean construction principles to drive operational excellence. Lean strategies—such as collaborative partnerships, joint problem-solving, and cross-functional alignment—enabled the team to overcome constraints and maintain resilience.

Key Lean tools deployed include the Last Planner System, Value Stream Mapping, Push vs Pull techniques, Poka-Yoke, SMED, Work Sampling, and 5S Audits. These tools helped eliminate waste, improve safety and quality, and accelerate construction timelines.

Innovative practices such as converting cast-in-situ systems to production systems (e.g., Box Culvert installation), Dry Premix Concrete Bags, Plaster machines, pre-fabricated reinforcement cages, and modular Sharp Ply formwork further enhanced efficiency. Mechanized solutions—boom placers, excavators, and walk-behind tools—were introduced to mitigate labor fluctuations and uphold safety standards.

The project team, comprising engineers, supervisors, safety officers, and workmen, remained unified in its pursuit of zero non-compliances and customer satisfaction. This case study demonstrates how Lean implementation, combined with mechanization and innovation, can transform construction delivery and foster a culture of continuous improvement.

Optimizing Tunnel Rings Storage Using Lean Principles : The Vertical Stacking Solution

Shubham Singh[a], Yadhnesh Rajendra Udas[b], Onkar Nath Sharma[b], Ajeet Kumar Kohli[b] and Abhijeet Siddappa Gandage[a]

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[b]AFCONS Infrastructure Ltd., Mumbai, India

ABSTRACT

Purpose- This study aims to address the challenge of limited land availability in precast casting yards by implementing a lean construction-based approach for vertical stacking of precast tunnel segments. The objective is to improve space utilization, reduce handling delays, and enhance operational efficiency.

Design/methodology/approach- In an Underground high speed rail project with a production volume of 7,690 rings (76,900 precast segments), conventional horizontal stacking led to excessive space usage and inefficient material handling. A transition to vertical stacking in three layers was proposed and implemented. The solution was guided by lean tools identified through a functionality-based framework, including first run studies (FRS), visual management (VM), and failure mode and effect analysis (FMEA)-based Risk Assessment. The implementation process involved site visits, workflow analysis, and collaborative planning.

Findings- FRS helped identify the space constraints. VM provided clear operational guidance and FMEA ensured safety in multi-level storage. The lean-based vertical stacking system led to a 30% reduction in space required for segment storage.

Research limitations/implications- The study is based on a single infrastructure project, and specific outcomes may vary depending on segment design, crane capacity, and site layout. Further studies could explore long-term structural impacts or scalability in diverse geographies.

Originality/value- This research presents a novel application of integrated lean tools to solve spatial challenges in segment casting yards. It contributes practical insights into space optimization, safety assurance, and workflow efficiency in high-volume precast environments, providing a replicable model for similar urban infrastructure projects.

Engineering Change for a Sustainable Tomorrow

At Larsen & Toubro, we believe that transformation begins with innovation rooted in purpose: to build smarter, greener, and leaner. Our projects and technologies exemplify this commitment to driving sustainable growth through digital integration and process efficiency.

A shining example of this vision is the **Technology Centre-IV (TC-IV)** at our headquarters, a landmark project that has earned prestigious recognitions from the Indian Green Building Council (IGBC) for *Net Zero Energy (Design)*, *Near Net Zero Water (Design)*, and *Net Zero Waste (Design & Construction)*. TC-IV stands as a testament to how lean principles and advanced digital tools can harmonize to achieve sustainability at scale.

Equally pathbreaking is our foray into **3D Concrete Printing (3DCP)**, a digital construction innovation where automated robotic printers build concrete structures layer by layer, eliminating the need for traditional formwork. The result is *greater design flexibility*, *enhanced safety*, *higher productivity*, and *minimal material waste*. With its automation-driven workflow and reduced CO_2 footprint, 3DCP perfectly aligns with our lean and sustainable project delivery model.

Through initiatives like TC-IV and 3DCP, L&T Construction continues to redefine India's engineering landscape, integrating *lean thinking*, *digital technologies*, and *sustainability* to deliver transformative impact for a resilient future.

Figure 1: Technology Centre-IV

Figure 2: Prestige City Villas

Figure 3: 3D printed post office at Bengaluru

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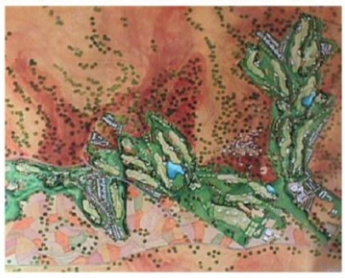
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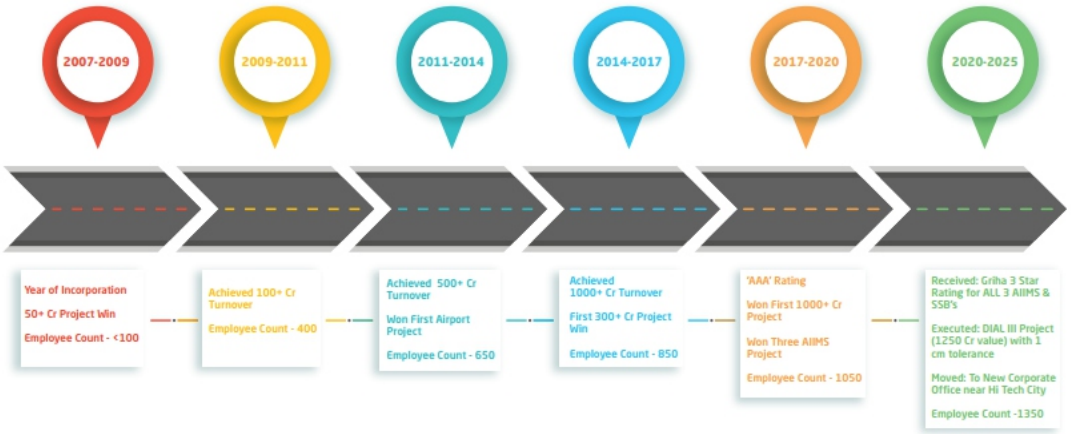

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