DRIVING EXCELLENCE WITH IBS

29 September 2016

Institut Sosial Malaysia

UTM UNIVERSITI TEKNOLOGI MALAYSIA

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What is IBS?

Industrialised Building System:

- Components manufactured in controlled environment (either **on-site** or **off-site**)
- **Rest of the world:** Pre-fabricated/Pre-fab Construction, Modern Method of Construction & Off-site Construction

IBS Types in Malaysia

Precast concrete framing, panel & box systems

Steel formwork systems

Prefabricated timber framing systems

Steel framing systems

Blockwork systems

Advantages of using IBS

- Save construction time
- Quality control
- Optimum use of materials
- Minimal use of workers on-site
- Special texture and design components
- Consistencies in building construction

Advantages of using IBS

- Cost effective
- Structural strength
- Saving in formwork on-site
- Organise, clean and safe construction site
- Minimum environmental impact

IBS Issues

IBS kurangkan harga rumah 20 peratus

ZUNAIDAH ZAINON | 13 April 2016 1:17 AM

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Utusan Malaysia Online

KUALA LUMPUR 12 April - Penggunaan Sistem Bangunan Berindustri (IBS) sepenuhnya dapat membantu mengurangkan harga rumah sekitar 10 hingga 20 peratus.

Ng Seing Liong

Bekas Presiden Persatuan Pemaju Hartanah dan Perumahan Malaysia (REHDA), Datuk Ng Seing Long berkata, bagaimanapun ketika ini penggunaan IBS masih lagi rendah iaitu sekitar 20 peratus dalam kalangan pemaju dan kontraktor.

Beliau berkata, pihaknya mendapati pemaju mempunyai kesedaran terhadap penggunaan IBS dan berharap ia dapat ditingkatkan sehingga 50 peratus menjelang 2020.

“Ini bukannya satu perkara yang mudah untuk dicapai tetapi sekiranya penggunaan IBS dapat ditingkatkan sekitar 40 hingga 50 peratus dalam tempoh empat tahun lagi, ia sudah menunjukkan satu perkembangan yang positif kepada industri,” katanya kepada Utusan Malaysia di sini hari ini.

Beliau berkata demikian selepas majlis perasmian Minggu Pembinaan Antarabangsa (ICW) 2016 yang disempurnakan Menteri Kerja Raya, Datuk Seri

IBS Issues

The Star Online

Business News

Home > Business > Business News

Tuesday, 23 February 2016

CIDB: Low awarness on IBS technology

FACEBOOK TWITTER GOOGLE+ LINKEDIN

KUALA LUMPUR: Although the use of Industrial Building Systems (IBS) is a technological force that has many benefits, there is little acceptance of this form of property construction technology and awareness among property buyers, says Construction Industry Development Board (CIDB) senior general manager Datuk Elias Ismail

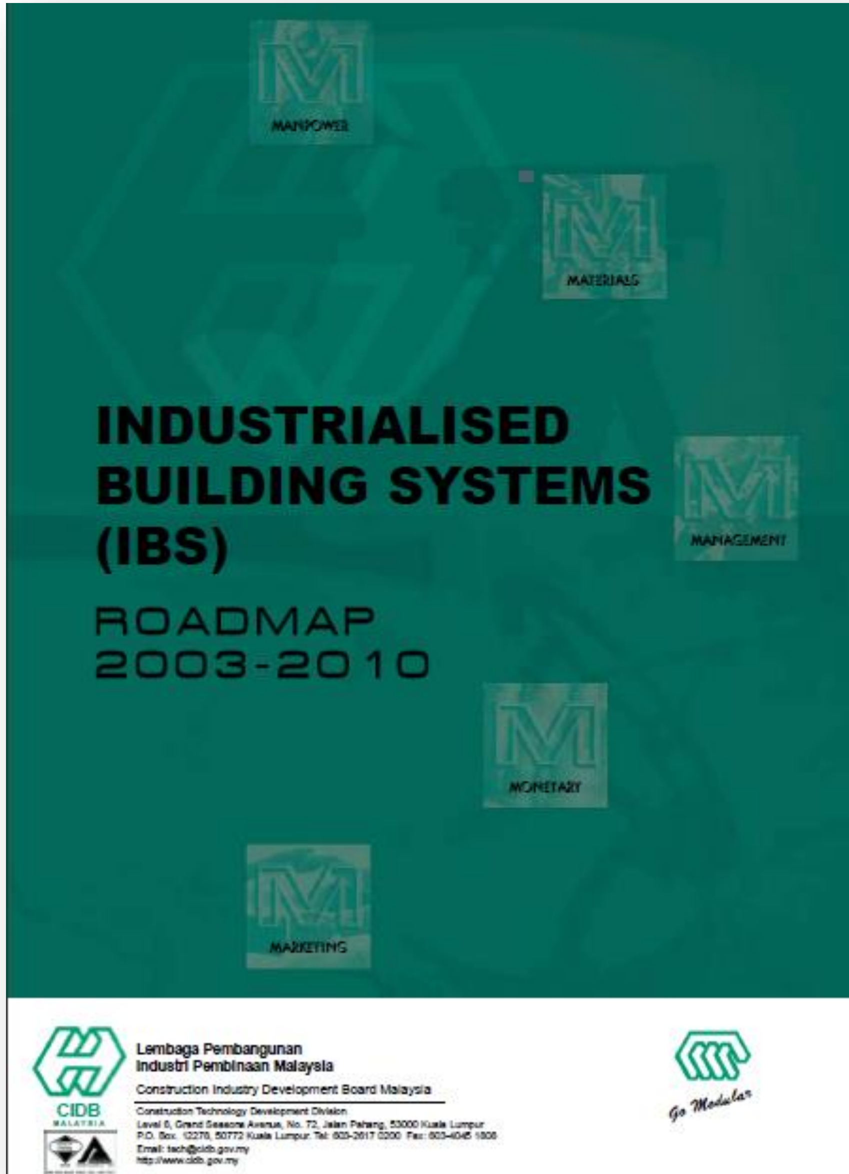
Popular Now in Business

Good demand for SP Setia upcoming residential tower

What if you're not as rich as you think you are?

Fry: Global palm oil output to

IBS Roadmap (2003 – 2010)



IBS Roadmap (2011 – 2015)

IBS Roadmap 2011-2015

The new IBS Roadmap 2011-2015 to replace the current roadmap will be published in late 2010. The policy objective is to impose high level intended outcomes of implementing IBS. The new roadmap will be focusing on private sector adoption of IBS. To remain focus, it has been narrowed down to four policy objectives; which are quality, efficiency, competency and sustainability. A sustainable IBS industry will contribute to the competitiveness of the construction industry. The pillars of the new roadmap are as follows :

- Good quality designs, components and buildings are the desired outcomes of IBS. Aesthetics should be promoted through innovations.
- To ensure that, by using IBS, completion time of a building is speedier, more predictable and well managed.
- To have a ready pool of component IBS professionals and workers throughout the entire project lifecycle : from design, manufacture, build and maintenance.
- To create a financially sustainable IBS industry that balances users affordability and manufacturers viability.

Four workstreams have been established as an action plan to achieve the new roadmap pillars :

- Workstreams 1 : Institutional Strengthening
- Workstreams 2 : Focusing on User
- Workstreams 3 : Product Focus
- Workstreams 4 : Industry Focus

Based on this workstreams, 37 action steps have been recommended to be accomplished by 2015. It is hoped that the roadmap will drive the way forward for sustainable IBS adoptions; both in public and private sector.

The goals for the Roadmap are encapsulated below:

List of Public University

Category	Public University
Research University	Universiti Malaya (UM) Universiti Sains Malaysia (USM) Universiti Kebangsaan Malaysia (UKM) Universiti Putra Malaysia (UPM) Universiti Teknologi Malaysia (UTM)
Comprehensive University	Universiti Teknologi MARA (UiTM) Universiti Islam Antarabangsa Malaysia (UIA) Universiti Malaysia Sabah (UMS) Universiti Malaysia Sarawak (UNIMAS)

List of Public University

Category	Public University
Focusing University	Universiti Utara Malaysia (UUM) Universiti Pendidikan Sultan Idris (UPSI) Universiti Tun Hussein Onn Malaysia (UTHM) Universiti Teknikal Malaysia Melaka (UTeM) Universiti Malaysia Perlis (UniMAP) Universiti Malaysia Terengganu (UMT) Universiti Malaysia Pahang (UMP) Universiti Sains Islam Malaysia (USIM) Universiti Sultan Zainal Abidin (UniSZA) Universiti Malaysia Kelantan (UMK) Universiti Pertahanan Nasional Malaysia (UPNM)

List of Public University

Category	Public University
Public Universities offering Civil Engineering	Universiti Malaya (UM) Universiti Sains Malaysia (USM) Universiti Kebangsaan Malaysia (UKM) Universiti Putra Malaysia (UPM) Universiti Teknologi Malaysia (UTM) Universiti Teknologi MARA (UiTM) Universiti Islam Antarabangsa Malaysia (UIA) Universiti Malaysia Sabah (UMS) Universiti Malaysia Sarawak (UNIMAS)

List of Public University

Category	Public University
Public Universities offering Civil Engineering	Universiti Tun Hussein Onn Malaysia (UTHM) Universiti Malaysia Perlis (UniMAP) Universiti Malaysia Pahang (UMP) Universiti Pertahanan Nasional Malaysia (UPNM)

Public University

Research University

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

UNIVERSITI KEBANGSAAN MALAYSIA
The National University of Malaysia

UNIVERSITI MALAYA

APEX & Research University

USM
KAMI MEMIMPIN
UNIVERSITI SAINS MALAYSIA

Public University

Focusing University

Universiti Malaysia PAHANG
UMP
Engineering • Technology • Creativity

UniMAP

UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI PERTAHANAN NASIONAL MALAYSIA
Kewajipan, Maruah dan Integriti

Comprehensive University

UNIVERSITI TEKNOLOGI MARA

الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

UMS
UNIVERSITI MALAYSIA SABAH

UNIVERSITI MALAYSIA SARAWAK
UNIMAS

Structural Design Courses in University

Course Year		UTM	UKM	UPM	USM	UM
YEAR 2	**Core**	IDP I	-	-	-	RC Design
YEAR 3	**Core**	RC Design I	RC Design	Structural Design I	RC Design I	
	Core	Steel & Timber Design	Steel Design	Structural Design II	RC Design II	Structural Steel Design
	Core	IDP II	-	-	-	IDP II/III
YEAR 4	**Core**	RC Design I	-	Civ. Eng. Design Project	Structural Steel Design	-
	Core	-	IDP I	-	Pre-stressed Conc. Design	Advanced RC Design
	Core	IDP III	IDP II	-	IDP	Capstone Design Project
	Elective	-	**IBS Design**	-	-	-

Structural Design Courses in University

Course Year		UMP	UTHM	UniMAP	UiTM
YEAR 3	**Core**	RC Design I	RC Design I	Concrete Building Design I	RC Design
	Core	RC Design II	RC Design II	Concrete Building Design II	-
	Core	-		Steel Building Design	-
YEAR 4	**Core**	Steel & Timber Design	Structural Steel & Timber Design	-	*Structural Steel Design**
	Core	-	-	**Industrialized Building System**	*Pre-stressed Concrete Design**
	Core	-	IDP	IDP	IDP
	Elective	-	**IBS Design**	-	-

** Majoring in Structure*

Structural Design Courses in University

Course Year		UIAM	UMS	UNIMAS	UPNM
YEAR 3	Core	RC Design I	RC Design I	RC Design	RC Design I
	Core	RC Design II	RC Design II	-	RC Design II
	Core	Steel & Timber Design	Structural Steel & Timber Design	Structural Steel Design	-
YEAR 4	Core	-	-	-	Steel & Timber Structural Design
	Core	-	-	IDP I	Infrastructure Design Project
	Core	IDP	Design Project	IDP II	Structural Design Project
	Elective	IBS	-	-	-

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Summary

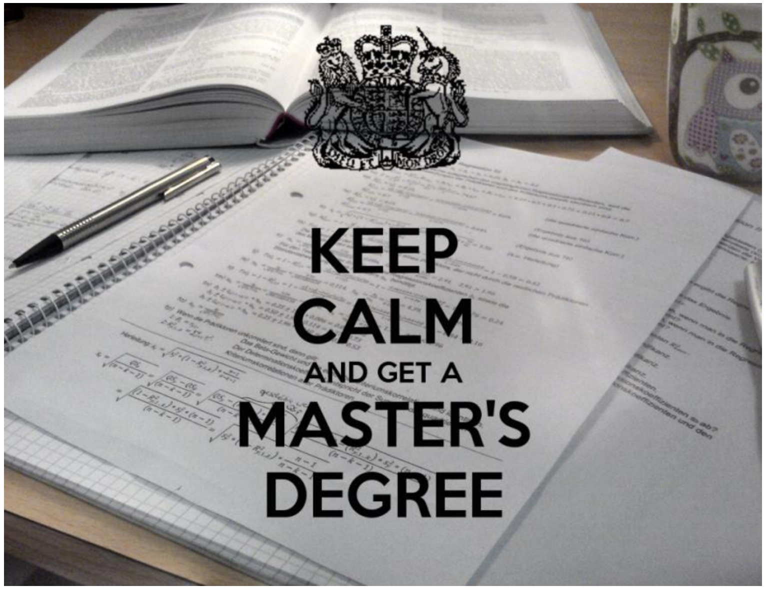
- **All universities** offers RC Design & Structural Steel Design
- **Core** IBS: UniMAP
- **Elective** IBS: UKM, UTHM, UIAM
- These courses are elective, they only provide theoretical and not practical experience
- For **precast concrete design**: Only offers at Masters level

Summary

- **Lack** of **expertise** on IBS Design in universities
- **Lack** of **practical** experience

Why only offer at **Masters** level?

- Needs to complete all **structural analysis** course
- Needs to complete all **RC design** courses
- Needs to complete **steel design** course



Course Outcomes:

1. Identify the structural system of precast concrete structures
2. Understand the design concept of precast concrete structures
3. Design precast concrete components such as slabs, beams, columns and connections
4. Analyse precast concrete frame structure

Main topics covered:

1. Design of Precast Flooring
2. Floor Diaphragm Action in Precast Flooring
3. Precast Frame Analysis
4. Design of Precast Concrete Beam
5. Design of Precast Concrete Column
6. Design of Connections
7. Design of Column-to-Foundation Connections

Activities

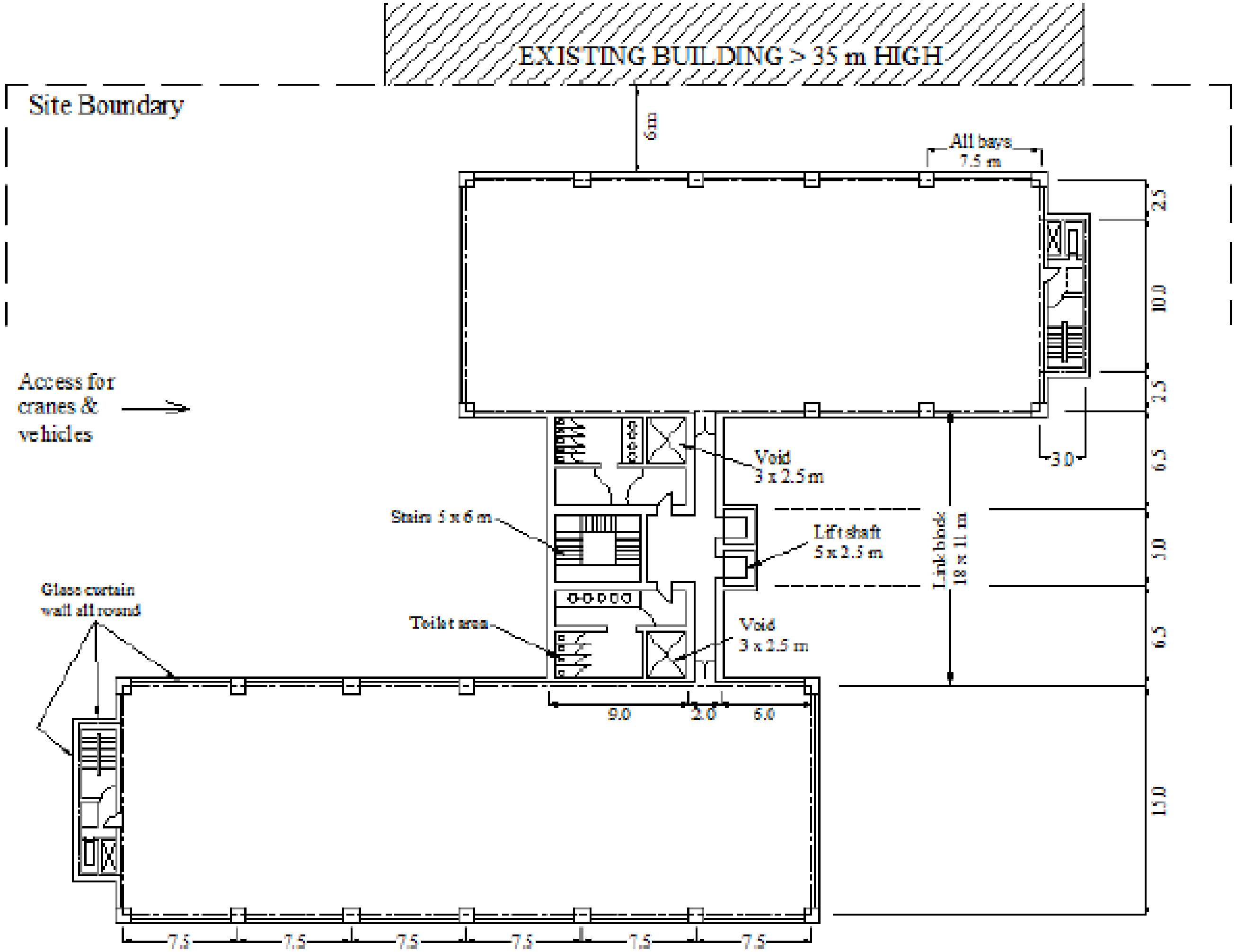
- **Educational** trips
- Carry out **case study**: Bring real-life design and construction problems into the classroom
- **Assignments**: Carry out complicated precast concrete building project

*Gul Polat & Atilla Damci. "Need for Qualified Workforce in Industrialized Building Systems: Case of Turkish Precast Concrete Industry". **Built Environment Education Conference**.*

Site Visit

Site Visit

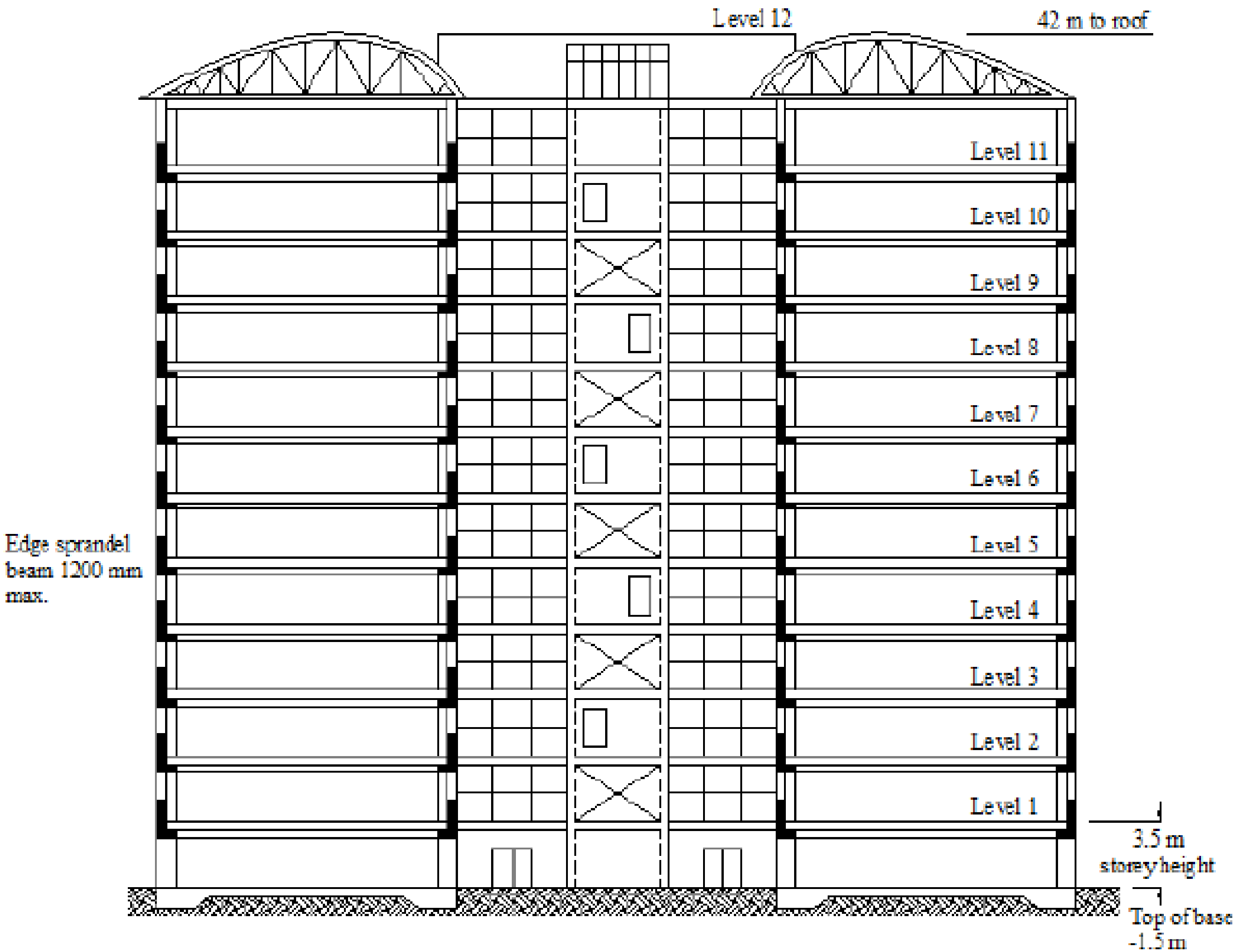
Example of Assignment



PLAN VIEW

(All units are in metres unless stated)

Example of Assignment



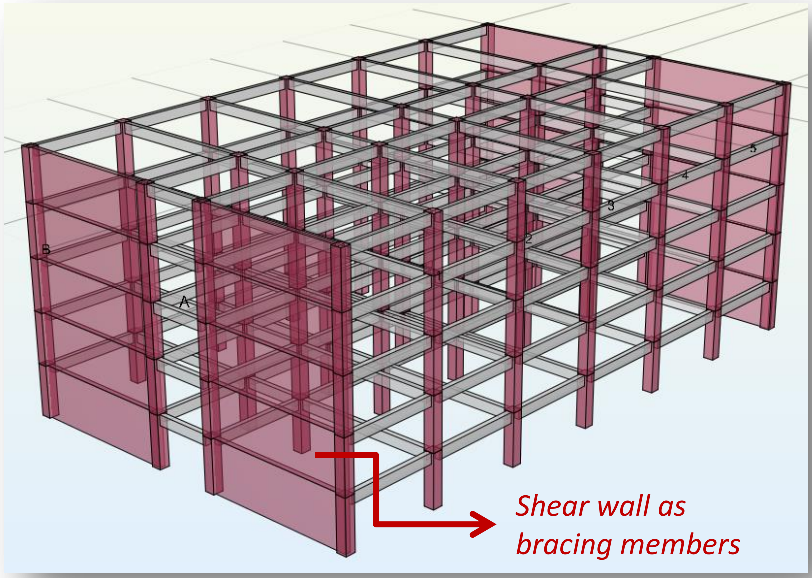
SIDE VIEW

(All units are in metres unless stated)

Planning

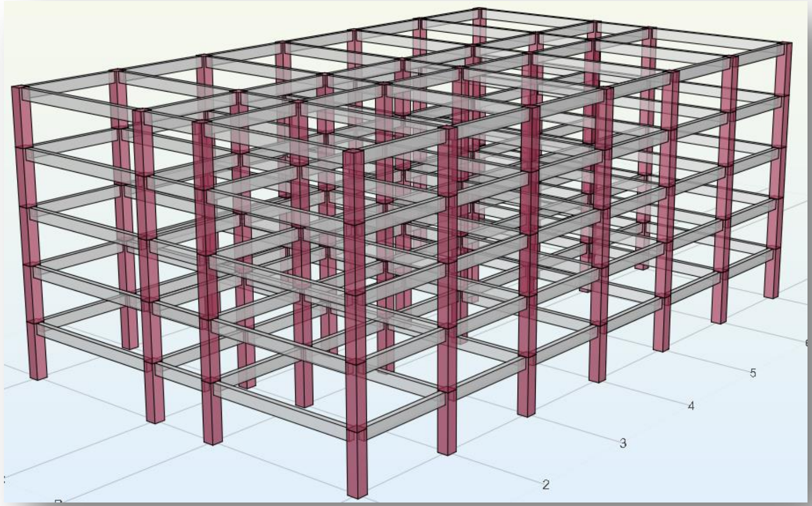
Braced Frame

- **<u>NOT</u>** contribute to the overall structural stability
- None lateral actions are transmitted to columns & beams
- Support **<u>vertical actions</u>** only



Unbraced Frame

- Contribute to the overall structural stability
- All lateral actions are transmitted to columns & beams
- Support **<u>vertical & lateral actions</u>**

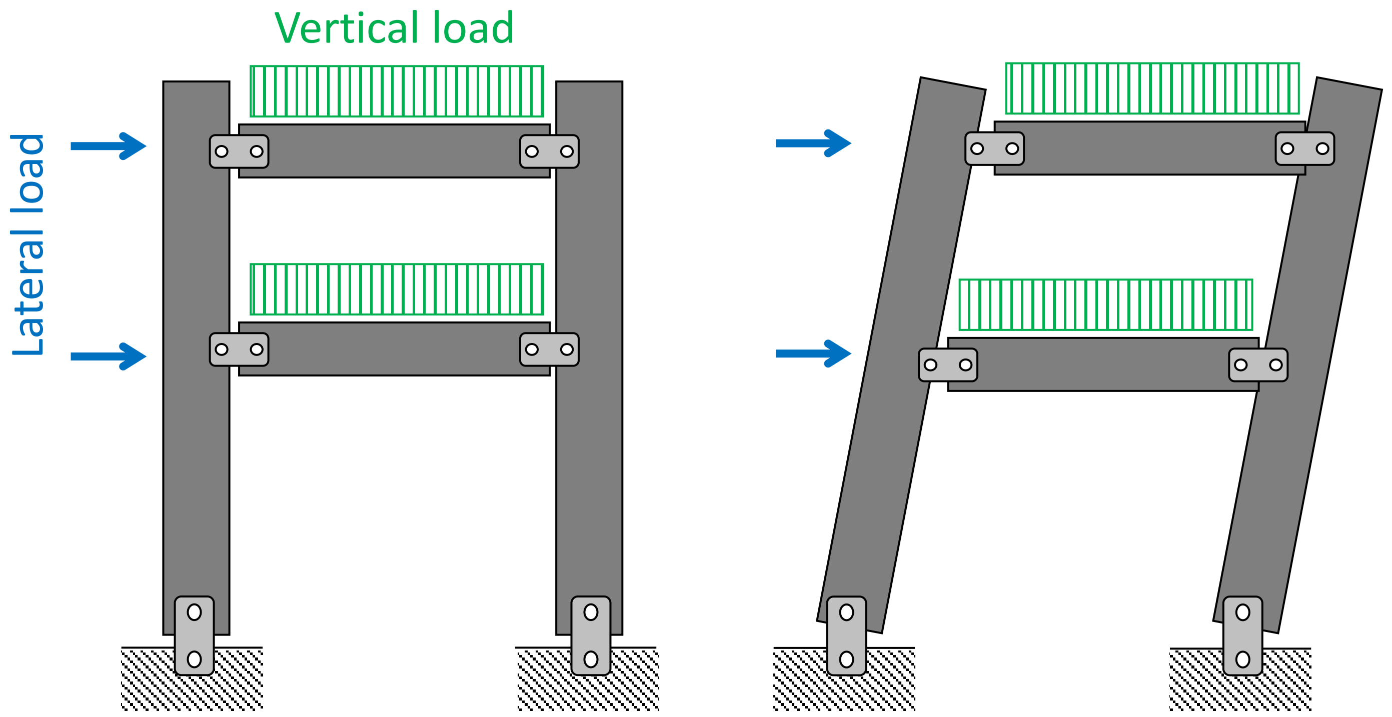


Planning

Number of Storey	Type of Frame	Bracing Elements
2	Unbraced	Cantilevered columns
Up to 3 (small roof load)	Unbraced	Cantilevered columns
Up to 4	Braced	Steel cross bracing
Up to 5	Braced	Precast hollow core infill
3 to 10	Braced	Precast solid infill walls Solid cantilever wall
15 to 20	Braced	In-situ concrete shear core

Planning

Frame Stability

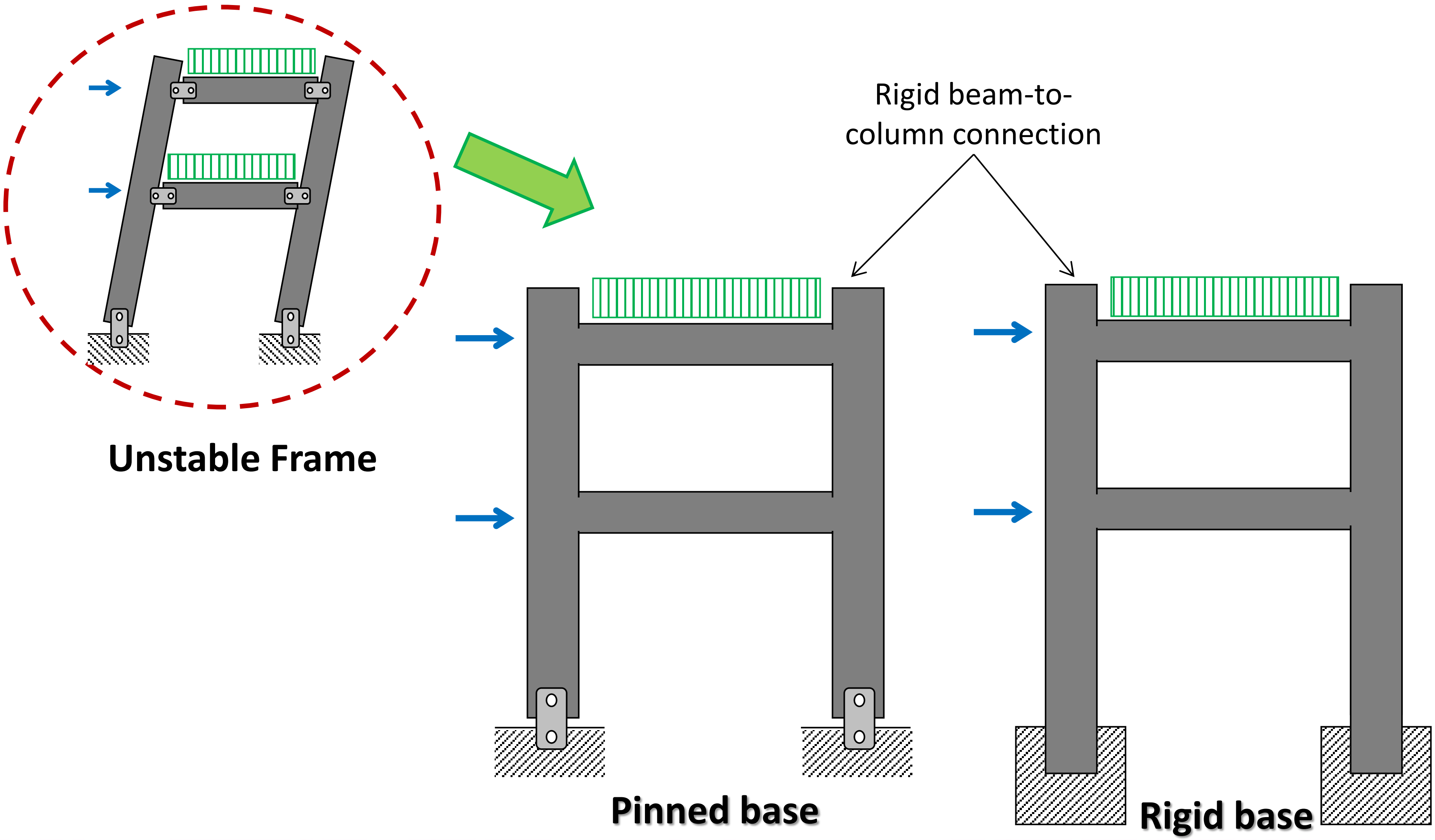


Pinned beam-to-column connections

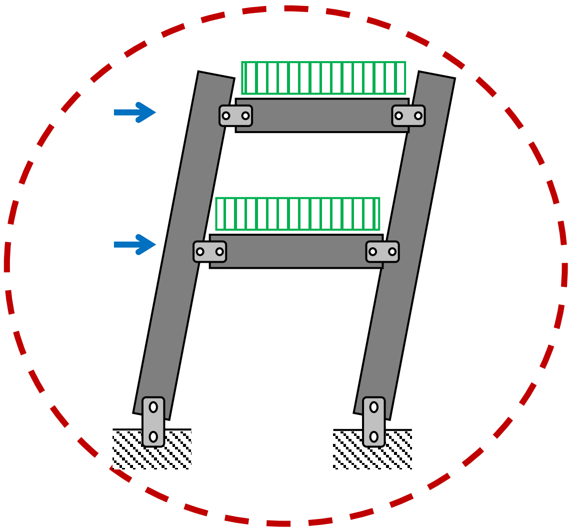
Frame is not stable when subjected to lateral forces

Planning

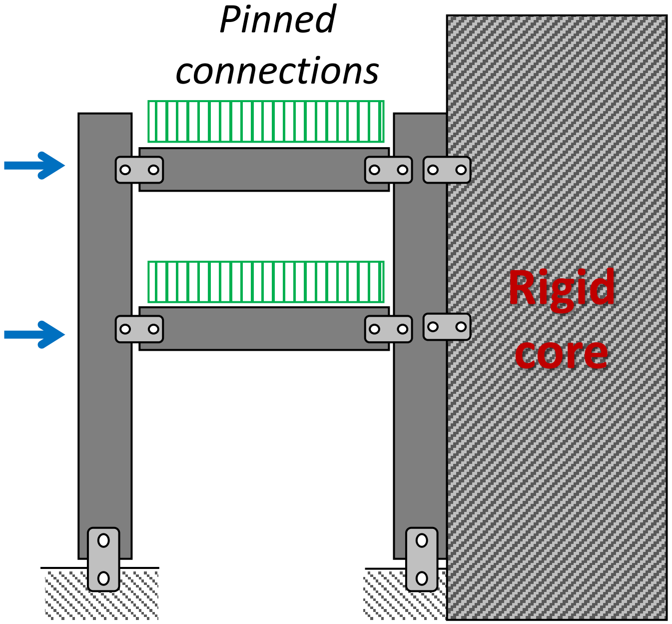
Frame Stability



Frame Stability



Unstable Frame



Stable Frame

Research Centre & Research Group:

PCRG

UTM Precast Concrete Research Group

Research Focus:

- Precast concrete components
- Connections of precast concrete components
- Overall stability and buildability
- Innovative precast concrete products – structural systems, connections and anchorage to concrete for IBS and accelerated construction

Engineering Structures 111 (2016) 285–296

Contents lists available at ScienceDirect

Engineering Structures

journal homepage: www.elsevier.com/locate/engstruct

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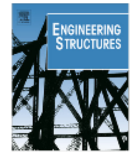

Tensile capacity of grouted splice sleeves

CrossMark

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ARTICLE INFO

Article history:
Received 2 June 2015
Revised 15 December 2015
Accepted 17 December 2015

Keywords:
Grouted splice
Sleeve
Connection
Confinement

ABSTRACT

This study tests grouted splices connected by two types of sleeves, namely Welded Bar Sleeve (WBS) and Tapered Head Sleeve (THS). These sleeves are made from non-proprietary pipe sections, where (a) WBS is fabricated by welding the deformed bars to the inner wall of the pipe, and (b) THS is made tapered with smaller openings at both ends. To study the behavior, the splice specimens were tested under incremental tensile load at various bar embedded lengths and sleeve diameters. The degree of confinement generated in the sleeve is found to increase with decreasing sleeve diameter. This improves the bond strength in sleeve, which subsequently increases the tensile capacity of the splice. THS gives a 30% higher tensile capacity compared with WBS. With the active confinement, the required bar embedded length of the splice can be reduced to 8 times the bar diameter. An analytical model is formulated on the basis of the confinement stress as expressed in a function of sleeve dimensions. The model is used to predict the tensile capacities of the splices at a variation range of ±10% of the experimental results. This verifies the correlations among the sleeve dimensions, the confinement stress and bond strength of the grouted splice.

1. Introduction

Steel bars are usually adjacently lapped in reinforced concrete structures. This method requires long lapping lengths, and it is not practical for connecting precast concrete elements. Due to the simplicity of connecting and short bar embedded length, mechanical and welded splices are commonly used for precast concrete structure [1–4].

There are many mechanical splices [5–7]. Some of these splices may not be easily acquired in certain countries as it is not common. This results in a longer duration and additional cost to acquire them. Additionally, some of the splices require high precision to ensure the alignment of the spliced bars due to tight tolerances.

The idea of using non-proprietary pipes to splice steel bars was proposed by Einea et al. [8] in 1995. Kim [9] adopted the idea and used pipe sections as the beam-column connection. Since then, researchers have developed grouted splices using various non-proprietary materials, such as mild steel pipes [10–14], corrugated aluminum sleeves [15], spirals [16], square hollow sections [17], and glass fiber reinforced polymers [18–21].

These non-proprietary splices are called grouted splice which is a type of mechanical splice consisting of a sleeve, some grout and two spliced bars. The steel bars are spliced and bonded by grout in the sleeve. The grout mechanically interlocks with the ribs on the bars to prevent the bars from slipping out of the sleeve [11,22–24]. The sleeve confines the grout to increase the bond strength,

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Research

Engineering Structures 125 (2016) 80–90

Contents lists available at ScienceDirect

Engineering Structures

journal homepage: www.elsevier.com/locate/engstruct

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Experimental study on the shear behaviour of precast concrete hollow core slabs with concrete topping

CrossMark

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A R T I C L E   I N F O

Article history:
Received 24 July 2014
Revised 2 June 2016
Accepted 6 June 2016

Keywords:
Hollow core unit
Concrete topping
Composite action
Shear-flexure capacity
Interface slip

A B S T R A C T

In typical precast construction practice of floor slabs using precast concrete hollow core unit (HCU), in-situ concrete is cast on top of the HCU to obtain smooth and even floor finish. The surface of the HCU is seldom given proper treatment prior to casting the concrete topping. The texture and surface moisture condition of the HCU just before receiving concrete topping may affect the overall strength of the slabs when the concrete topping and the HCU act compositely during service. This paper presents the experimental study on shear-flexure capacity of composite slabs using HCU and concrete topping. Full scale three point load test are carried out on 14 composite slab specimens with different surface roughness and surface condition of the HCU before casting the concrete topping. The surface roughness considered is smooth and rough, while the moisture conditions are dry, ponded and optimum wet. The effect of the longitudinal joint between the HCU panels is also considered. The experimental results are also compared with predicted values using the available equation in Eurocode 2 and an equation published by a previous researcher. The results of the experiment show that the HCU surface condition and longitudinal joint affect the stiffness and shear-flexure strength of the slabs. The optimum HCU surface condition which can produce highest stiffness and shear strength is rough and wet conditions, while the longitudinal joint between HCU panels reduces the slab shear strength. The interfacial horizontal shear is not the factor that governs the strength and behaviour of the slabs. The equation available in Eurocode 2 gives non-conservative prediction of the shear strength. In contrary, the equation published by the previous researcher gives conservative prediction of the shear strength.

1. Introduction

Precast concrete slab system for buildings that is widely available in the market includes hollow core unit, double-tee, solid composite plank & beam, and composite plank. They offer speedy

concrete toppings are 40–100 mm in thickness, and contain a small amount of steel reinforcement, usually a prefabricated welded mesh to control shrinkage. The concrete topping with the strength ranges from 25 to 40 N/mm^2 are laid onto the aged precast slab units. The most popular precast concrete slab system is the pre-

Research

Construction and Building Materials 75 (2015) 112–120

Contents lists available at ScienceDirect

Construction and Building Materials

journal homepage: www.elsevier.com/locate/conbuildmat

ELSEVIER

Flexural performance of a precast concrete slab with steel fiber concrete topping

CrossMark

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HIGHLIGHTS

- Increasing the flexural capacity of concrete slab by applying a steel fiber topping.
- Try to overcome certain problems by using steel fiber in concrete.
- The mechanism relies on a good bonding between the two layers.
- To provide a better results, roughness for interface has used.
- Flexural performance depends mainly on the type of roughness.

ARTICLE INFO

Article history:
Received 25 February 2014
Received in revised form 30 July 2014
Accepted 27 September 2014
Available online 26 November 2014

Keywords:
Cement-base concrete overlay
Steel fiber reinforced concrete
Flexural capacity
Composite action

ABSTRACT

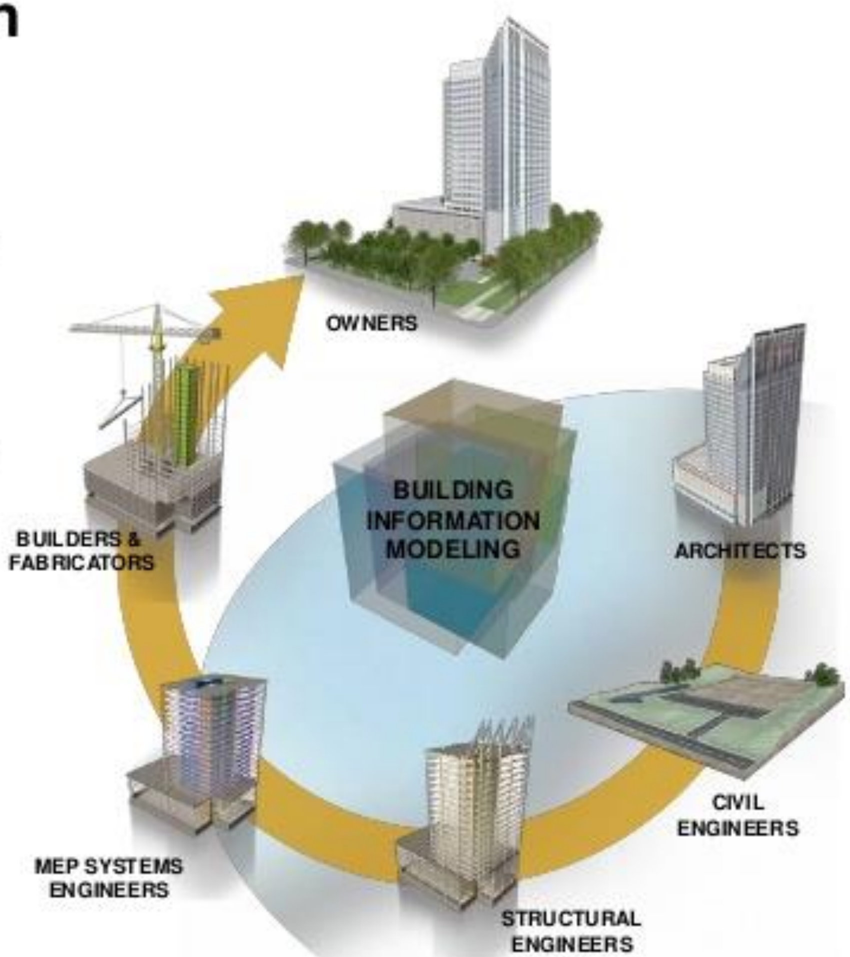
The positive effects of various types of fibers on concrete ductility and other engineering properties, such as the tensile, flexural, fatigue, and load-bearing capacity after cracking and toughness, are well known. Steel fiber-reinforced concrete (SFRC) has been used increasingly in recent years and has been applied to various structural components. Considerable interest has been developed in using steel fibers in concrete to increase the load-carrying capacity of the structural members in service. It has been used recently to increase the flexural capacity of concrete slabs by applying a thin layer of SFRC onto an existing slab, a technique known as cement-base bonded overlay. The objective of this research is the investigation of the flexural behavior of a precast concrete slab with a steel fiber concrete topping. To reinforce the concrete overlay, hooked-end steel fibers with a length of 30 mm and a diameter of 0.75 mm were used. Because the performance of this composite slab depends on the bonding between the old and new concrete, different types of roughness at the interface has used to provide good bonding between the two layers. Based on experimental tests, the flexural performance was shown to depend not only on adding the steel fibers to the topping but also on the type of interface roughness. To examine the composite behavior of the specimens, the interface slip was also measured throughout the test. The results showed a good reliability of roughness in providing bonding strength at the interface. It was also found that roughness in the transverse direction provides the best bonding strength at the interface. Although the results showed interface slip at mid-span, slip was not detected at either end of the specimen.

Future Design & Construction

Future Design & Construction

Building Information Modeling

- BIM is an integrated workflow that allows architects, engineers, and builders to explore a project digitally before it is built. Coordinated, consistent information is used throughout the process to:
  - *Design* innovative projects
  - Accurately *visualize* physical appearance
  - *Simulate* real-world performance



Thank You