

MYANMAR GEOSCIENCE SOCIETY



Post-Earthquake Resilient Housing Reconstruction In Myanmar

Date: 4-4-2026

Venue – Function
Hall, Federation of
Myanmar
Engineering
Societies

1. INTRODUCTION

- "It was on the date of 28 March on fifty two minutes pass noon, a massive earthquake struck. Everyone in some part of Asia and Southeast Asia felt the earthquake. It was the quake located at 10 km west of Mandalay at YeKhar Inn in Sagaing Division, and the Hopocenter was at 10km related to the famous strikslip Sagaing fault in Myanmar that triggered most of the past large magnitude quake of Myanmar.“
- The earthquake registered a magnitude of 7.7. The force was catastrophic, inflicting severe damage on Myanmar's second-largest city, Mandalay; the capital, Nay Pyi Taw; and the entire Sagaing Region. Critical infrastructure, including major highways and reservoirs, was also devastated.“
- The quake's power was so immense that its effects crossed international borders. Most strikingly, a 33-story skyscraper collapsed in Bangkok, Thailand, hundreds of kilometers away.
- This event is a stark reminder that earthquakes are a perpetual threat to our nation. This is not a matter of if, but when, due to Myanmar's complex and active tectonic setting.“
- After reviewing all available information, facts and data from the 28 March Mandalay Earthquake, two urgent issues demand serious action.
- (1) **Reconstruction of resilient housings** where and how?
- (2) **The locked section of the Sagaing Fault:** A ticking clock for the next major event

2. PRIMARY CONTRIBUTING FACTORS TO BUILDING COLLAPSE

The following tables summarizes the building collapse rates and primary contributing factors across the affected regions, based on post-earthquake assessments:

Location	Total Building Collapse Rate	Primary Contributing Factors
Sagaing (West of Irrawaddy)	>90%	Proximity to fault rupture + liquefaction-prone river sediments+ poor construction quality
Sagaing (Overall)	~80%	Severe ground shaking + liquefaction + construction deficiencies
Mandalay	~60%	Basin amplification effects + liquefaction + poor construction practices+ insufficient building spacing
Nay Pyi Taw	Extensive (10,000+ buildings)	Ground shaking + structural vulnerabilities

Liquefaction Contribution: The academic investigation confirm that **liquefaction was a major contributor** to building damage across the affected regions, with ground fissures tearing apart houses and loss bearing capacity causing subsidence and tilting.

Construction Quality Contribution:

- **Improper foundation work** (deviation from standard construction protocol) ,
- **Cost cutting practices** (influenced material selection and quality),
- **Deviation from construction protocols,**
- **Absence of earthquake resistant design guidelines;**
- **Lack of adequate urban planning,**

3. THE SAGAING FAULT AND THE "LOCKED" BAGO SECTION

This grand tectonic history brings us to the specific source of our seismic risk: the Sagaing Fault. This major, right-lateral strike-slip fault runs north-to-south for over 1,400 kilometers through the heart of Myanmar. It is the defining tectonic feature of our country and is responsible for most of our historical major earthquakes. Not all segments of a long fault behave uniformly.

- Some sections creep slowly and steadily, releasing energy through aseismic slip without generating major earthquakes.
- Other sections, however, can become "locked".

A locked segment is a portion of the fault where the opposing sides are stuck. The tectonic plates continue to move, but friction prevents the rocks from slipping. A useful analogy is bending a stick—stress and strain build up, and energy accumulates... until it can no longer be contained. When a locked fault finally ruptures, it releases that pent-up energy catastrophically, generating a significant earthquake.

3.1 Evidence for the locked Bago Section

- Current research, including international studies and our own investigations at the Myanmar Geosciences Society, strongly indicates that the Bago Section of the Sagaing Fault is locked. This section has not experienced a major rupture since the great Bago earthquake of 1930 (Mw 7.4) which seismic cycle studies suggest has a recurrence interval of approximately 100 years. This implies the segment is now under **immense and growing strain**.
- It is precisely in these locked sections that tectonic stress is not released through gradual motion. Instead, it accumulates relentlessly, building elastic strain energy. These locked sections are the **primary potential sources for future, damaging earthquakes**.
- Our focus since the 2025 earthquake has been to identify the segment with the highest potential for a major rupture. Multiple lines of evidence point compellingly to the **Bago section**:

Data Source	Key finding	Implication
Kyoto University / EOS GNSS Study (2022)	Bago segment slip rate: ~16 mm/yr vs. 23–24 mm/yr elsewhere; locking depth 10 km	Active strain accumulation confirmed; potential magnitude Mw ~7.3 as of 2021
Chinese Journal of Geophysics (2026)	GNSS velocities 1991–2023 show complex strain patterns	Regional stress field validated with long-term data
This Study (InSAR time series 2012–2025 & MGS, 2026)	Bago creep rate: <1 mm/yr post-2025	Segment remains effectively locked; high strain accumulation confirmed

4. MITIGATING THE FUTURE EARTHQUAKE RISKS

To reduce seismic risk and build resilience, three post-earthquake essential measures must be prioritized.

Priority Action	Purpose
(a) Mandate and enforce modern Building code	Ensure all new construction meets seismic safety standards; retrofit existing vulnerable structures.
(b) Invest a national earthquake early warning system	Provide seconds to minutes of advance warning before strong shaking arrives, enabling protective actions
(c) Launch a public education campaign on earthquake safety	Empower communities with knowledge on preparedness safe construction practices

These three pillars – regulation, technology, and education – form the foundation of a comprehensive disaster risk reduction strategy

5. MONITORING THE THREAT

The quantified risk from this locked section is underscored by history. The great 1930 Bago earthquake (Mw 7.4) suggests a seismic recurrence interval of roughly 100 years—a timeline that brings sobering urgency to our work today

- In response, the Myanmar Geosciences Society has initiated a comprehensive, multi-disciplinary monitoring program focused specifically on the Bago section.

5.1. Paleoseismic Investigation^{[P]_{SEP}}

We are conducting a detailed paleoseismic study to understand the long-term earthquake behavior of the Bago segment. As shown in Figures [5,6], we have excavated two strategic trenches across the fault trace. These exposures allow us to identify and date evidence of past surface-rupturing earthquakes preserved in the stratigraphic record.

- Soil and carbon samples have been carefully collected from distinct event horizons within the trench walls. We are currently awaiting **accelerator mass spectrometry (AMS) radiocarbon dating** results, which will provide absolute ages for past rupture events. This analysis will allow us to:
 - Reconstruct the fault's earthquake history over centuries to millennia
 - Establish a reliable **paleoseismic chronology** for the Bago section

- Determine the **average recurrence interval** of major earthquakes
- Assess whether the segment exhibits **characteristic earthquake behavior**
- This work will answer not just if, but how often major earthquakes have occurred here, providing essential data for long-term seismic hazard assessment.



Figure (5) Paleoseismology Trench (2) at the Payagyi offset ,Bago Payagyi Ancient City



Figure (6) Digital Elevation Model of Bago segment (Payagyi area) and location of paleoseismology trenches

5.2. Continuous GPS Monitoring

- A network of **continuous GPS stations** has been deployed across the Bago section. These instruments provide millimeter-precision measurements of crustal deformation, enabling real-time monitoring of strain accumulation. We have established two key transects perpendicular to the fault: (1) Southern line: Located near Yangon, monitoring the southern portion of the Bago segment. (2) Northern line: Located near Phyu Town, monitoring the southern portion.
- Each transect comprises multiple stations on both sides of the fault, allowing us to precisely measure:
 - (1) The slip deficit (the amount of accumulated strain not released by creep)
 - (2) The strain accumulation field across the fault zone
 - (3) The locking depth and degree of coupling along the segment
- By tracking these stations continuously, we obtain a real-time gauge of the building stress, providing early warning of changing hazard conditions.

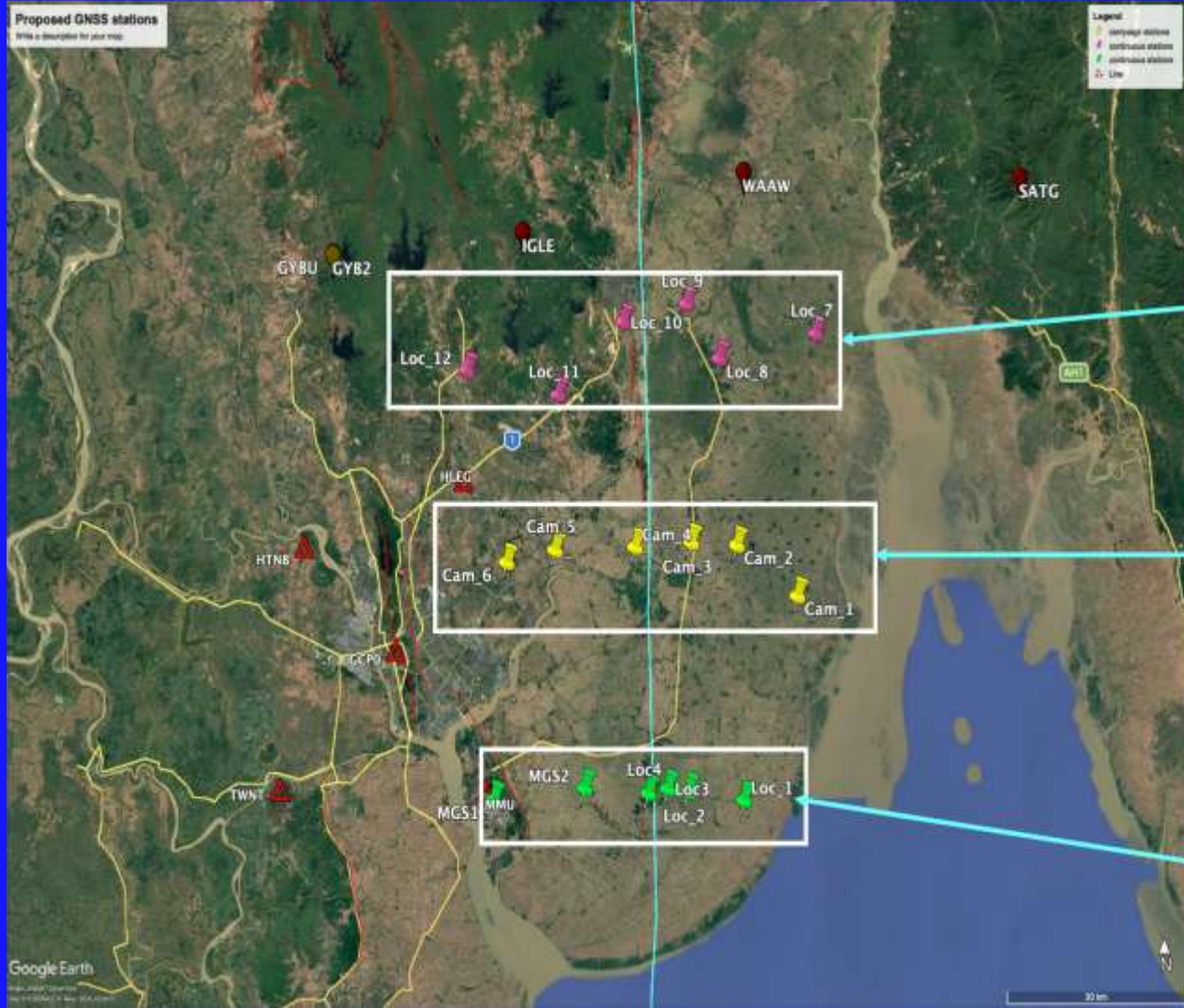


Figure (7) A network of continuous GPS stations has been deployed across the Bago section, laid by the Myanmar Geoscience Society

Southern line: Located near Yangon, monitoring the southern portion of the Bago segment (Permanent stations)

Northern line: Located near Phyu Town, monitoring the northern portion (Permanent stations)

Middle line: Permanent location for campaign surveys



**Inn Ta Kaw – Bago - Ka Mar Se
Transect**

**Ledaunggan – Hlegu – Chan
Thar Gyi – Zee Phyu Pin Transect**

**Thilawa – Kanbyaung–
Kadatpana- Mayanbay Transect**



Fig. 8: Installed continuous GPS station

5.3. Seismic Microzonation for Urban Resilience

Recognizing the profound risk posed to Myanmar's largest population centers, we are undertaking a comprehensive seismic microzonation survey of Bago and Yangon cities. Using dense arrays of microtremor meters, we are measuring site-specific ground response characteristics—how the underlying soils and geology amplify or attenuate seismic waves.

This work will produce not a single hazard map, but a suite of detailed zoning maps that identify neighborhoods most vulnerable to strong shaking. Based on the microtremor survey, we are preparing the following products for both cities:



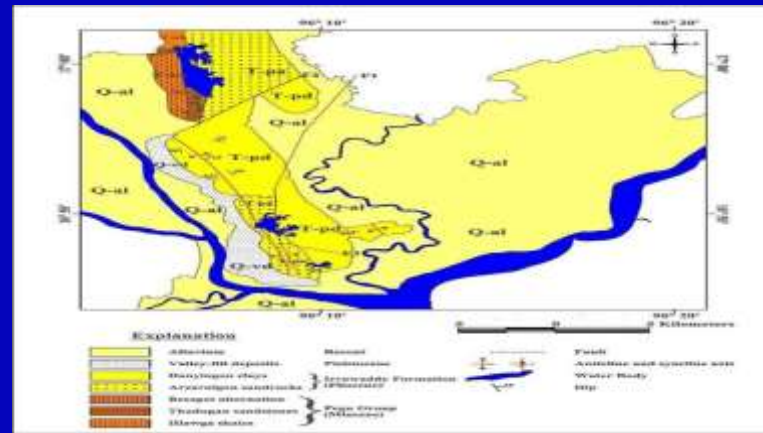
Microtremor survey (array) at FMI City



Survey location: FMI City, Hlaing Thayar



Microtremor survey (single) at FMI City



Yangon Geological Map

Fig. 9: Microtremor survey conducting at FMI City Hlaing Thayar, Yangon

- Ground classification map: Categorizes sites by soil type and engineering properties
- Bedrock acceleration distribution: Defines input motion at engineering bedrock depth
- Bedrock velocity distribution: Maps shear-wave velocity (V_s) at depth
- Peak ground acceleration (PGA) distribution: Predicts maximum ground shaking intensity
- Peak ground velocity (PGV) distribution: Assesses ground motion energy content
- Acceleration response spectrum (0.2 sec): Evaluates hazard for short-period structures
- Acceleration response spectrum (1.0 sec): Evaluates hazard for medium-period structures
- Liquefaction potential map: Identifies areas susceptible to soil liquefaction during shaking
- Slope stability risk map: Delineates zones prone to landslides triggered by earthquakes

6. TRANSLATING SCIENCE INTO PRACTICE

Our seismic microzonation maps for Yangon and Bago will identify:

- (a) Zones of amplification (where ground shaking is intensified)
- (b) Liquefaction risk areas (where soils may lose bearing capacity)
- (c) Proximity to fault rupture (where surface displacement may occur)

This is not just academic data; it is a planning tool. It can dictate.

- (a) Where to rebuild and where to relocate.
- (b) What level of seismic design is required in different parts of the City
- (c) How to prioritize retrofitting investments

These data products will serve as the essential scientific foundation for:

- Updating and enforcing seismic building codes
- Guiding targeted retrofitting of existing vulnerable structures
- Informing land-use planning and urban development
- Prioritizing emergency response and preparedness resources

6.1. Location: Science Based Siting

We must mandate that reconstruction is guided by seismic microzonation maps. This means siting new shelters:

- A safe distance from active fault traces
- Avoiding liquefaction-prone saturated soils.
- Steering clear of unstable slopes.

Science must dictate the 'where' before we even discuss the 'how'.

6.2 Construction: Proven Resilient Method

My experience with low-rise, affordable housing up to eight stories aligns well with this need for speed and resilience. We have successfully used precast panel systems with load-bearing walls.

The key engineering advantage here is **ductility**. Compared to more rigid concrete frame structures, a well-designed precast system can

- Absorb and dissipate seismic energy through flexing,

- Provide greater resistance to lateral forces.

Furthermore, in soft soil conditions common in many of our affected areas, the use of pile foundations is absolutely essential to transfer the loads safely to stable strata.

7. RESULTS AND FINDINGS

Key finding from the study include:

1. Seismic Hazard: The Bago segment of Sagaing fault is locked, with a slip rate of ~ 16 mm/year compared to 23-24 mm/year elsewhere, confirming active strain accumulation. Potential magnitude for a future rupture is $M_w \sim 7.3-7.4$.
2. Building Vulnerability: Collapse rates exceeded 90% in areas west of Irrawaddy river in Sagaing Region. Liquefaction and poor construction quality were primary contributors.
3. Monitoring Network: Six continuous GPS stations are operational on each transect, providing real strain data. Paleoseismic samples are undergoing AMS dating. Microtremor surveys have been completed at 150+ locations across Yangon and Bago.
4. Microzonation products: Maps are under preparation, including ground classification.
5. Paleoseismic studies have been conducted with two trenches across sagaing fault Bago section.

ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့

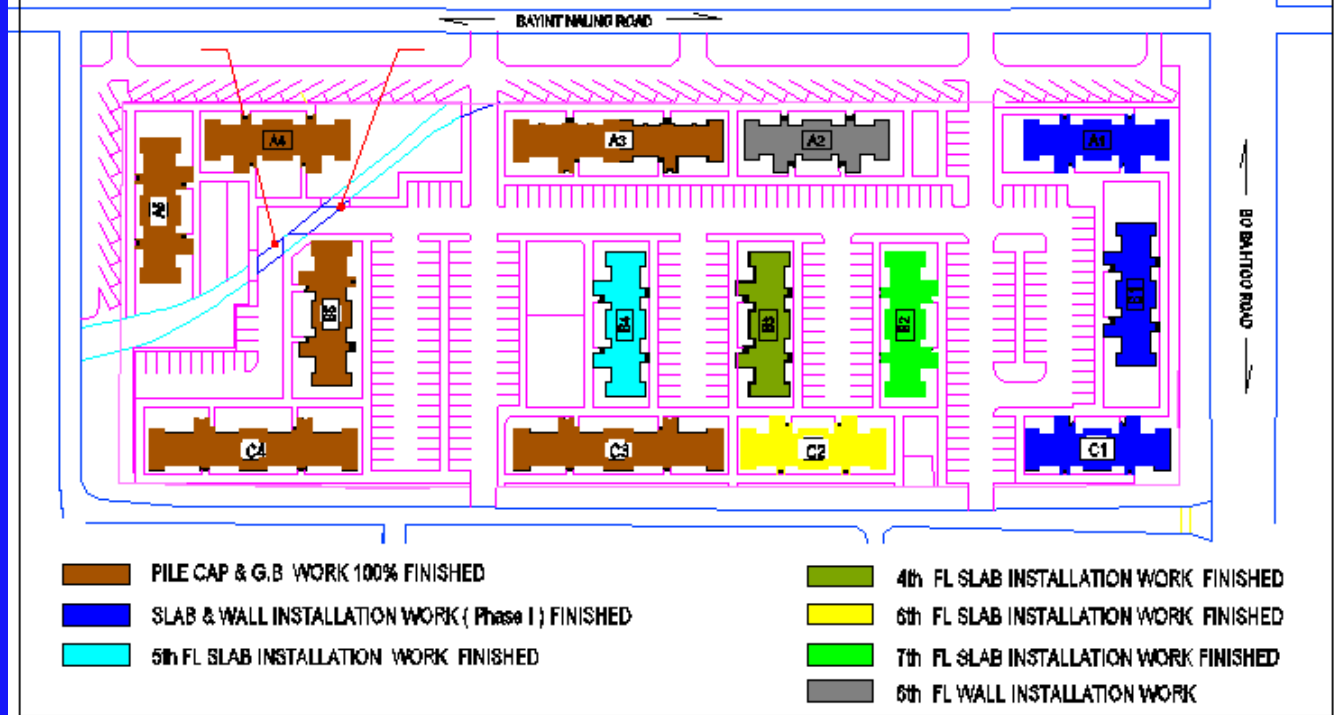
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

ပိုလ်ပထူးတန်ဖိုးမျှတအိမ်ရာစီမံကိန်း



SITE PLAN

BO BAHTOO HOUSING PROJECT (NORTH DAGON) MASTER LAYOUT (PILOT PROJECT OPTION 1) PROGRESS



Bobahtoo affordable housing project

(1) Phase one	Eight Stories	4 rooms/floor	14 Buildings	448 rooms
(2) Phase two	Eight Stories	4 rooms/floor	8 Buildings	256 rooms
(3) Phase three	Eight Stories	4 rooms/floor	19 Buildings	608 rooms
			Total =	<hr/> 41 Buildings 1312 rooms

Construction Method

Foundation - Pile foundation

Super structure - Load bearing wall system

PRECAST FACTORY



FORMWORK SETTING



03 02 2014

BED + MOLO CLEANING



14 02 2014

PAINTING MOLD RELEASE AGENT



SETTING OPENING & ACCESSORY



16 09 2014

SETTING OPENING



REBAR SETTING FOR WALL



REBAR SETTING FOR WALL



REBAR SETTING FOR SLAB



M&E BOX + CONDUIT SETTING FOR SLAB



M&E BOX + CONDUIT SETTING FOR SLAB



REBAR SETTING FOR STAIR



SLUMP TEST



QC WORK



CONCRETING WORK



WAITING FOR FINAL FINISHING WORK



11 02 2014

FINAL FINISHING WORK



14 01 2014

AFTER FINAL FINISHING WORK



AFTER FINAL FINISHING WORK



AFTER DEMOLDING



20 01 2014

AFTER DEMOLDING



DEMOLDING & LIFTING



PC WALL PANEL LIFTING



PC WALL PANEL LIFTING



PC SLAB PANEL LIFTING



PC WALL PANEL STOCKING



PC SLAB PANEL STOCKING



PC STAIR STOCKING



SLAB PANEL DELIVERY TO SITE



WALL PANEL DELIVERY



WALL PANEL DELIVERY



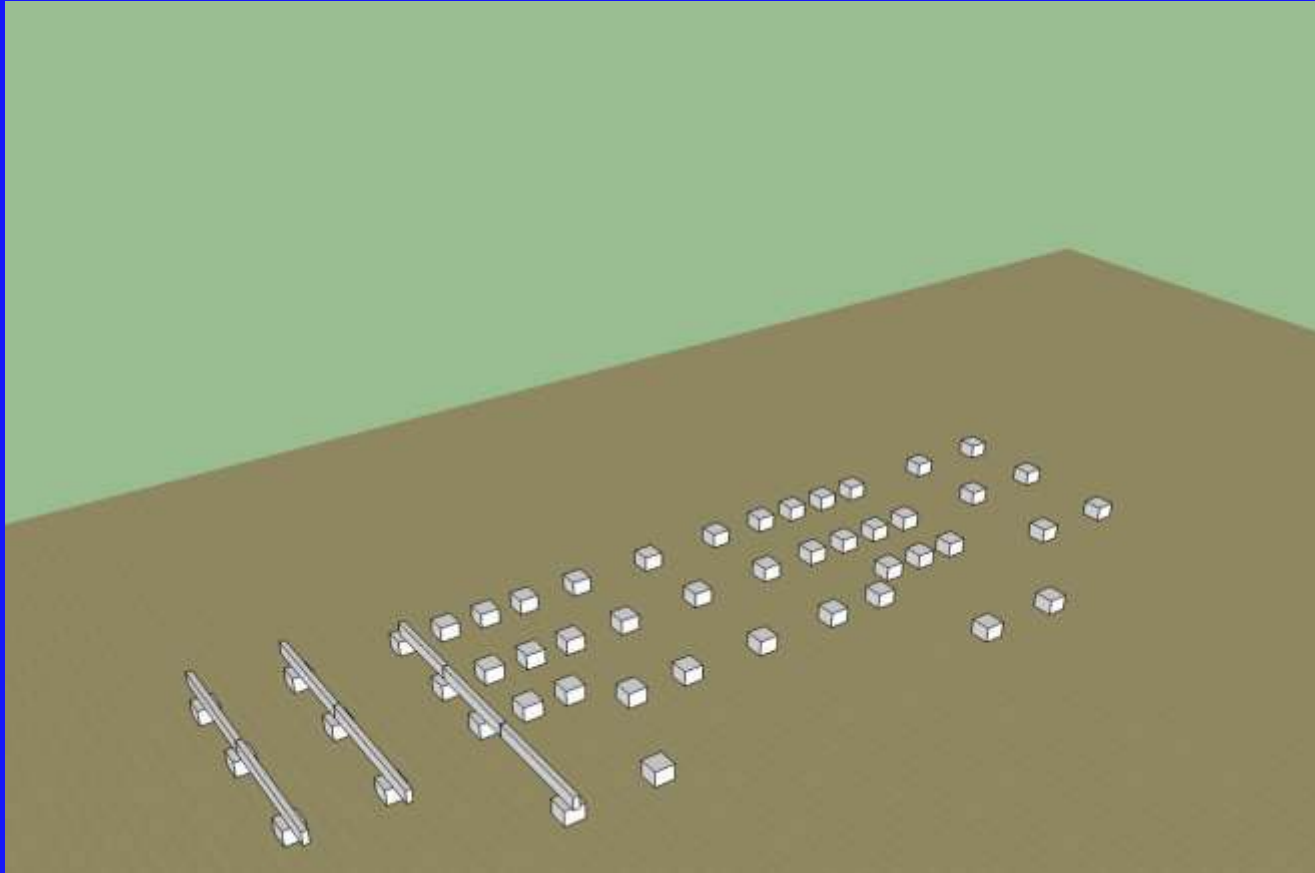
Wall & Stair Panels Delivery with Supervisor



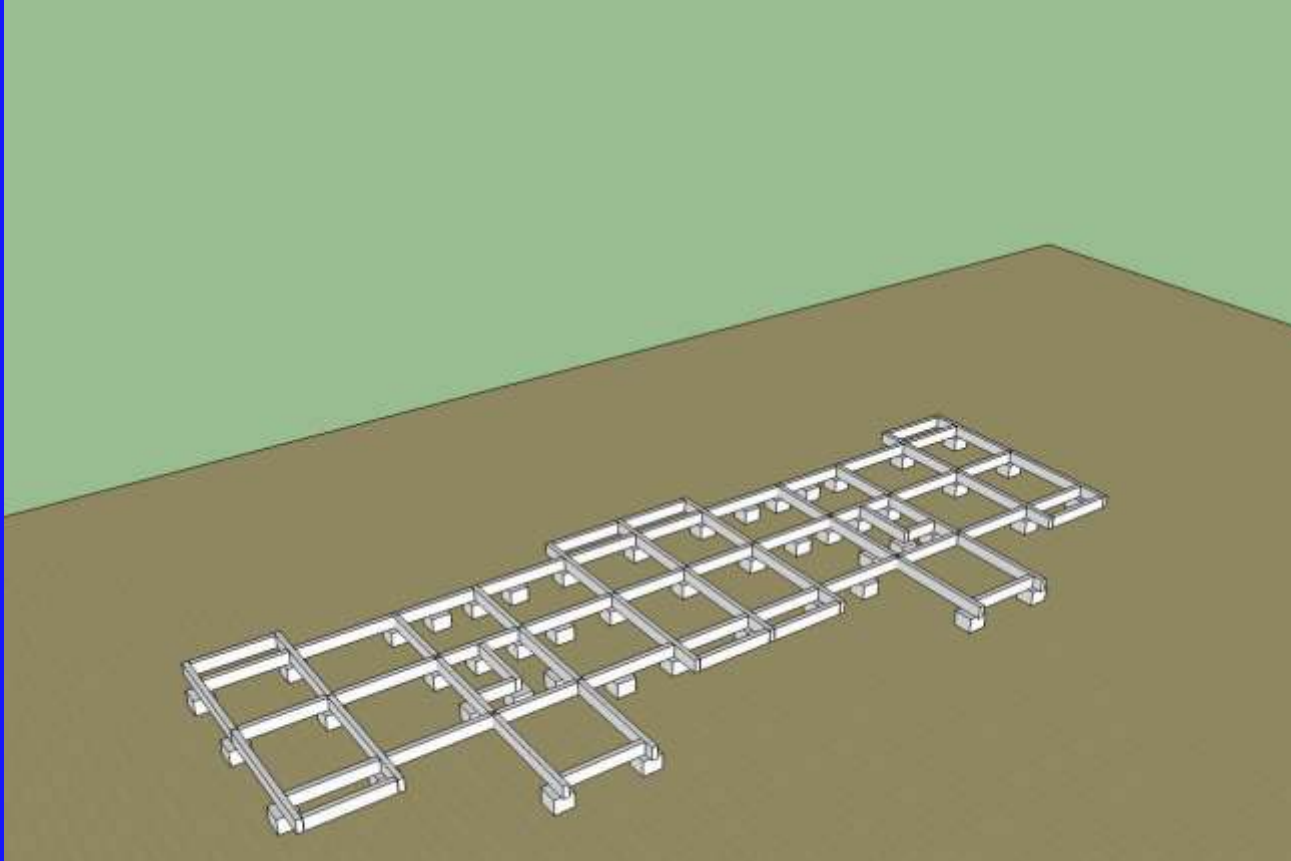
**INSTALLATION PROCESS OF LOAD
BEARING WALL SYSTEM
PRECAST CONCRETE BUILDING**



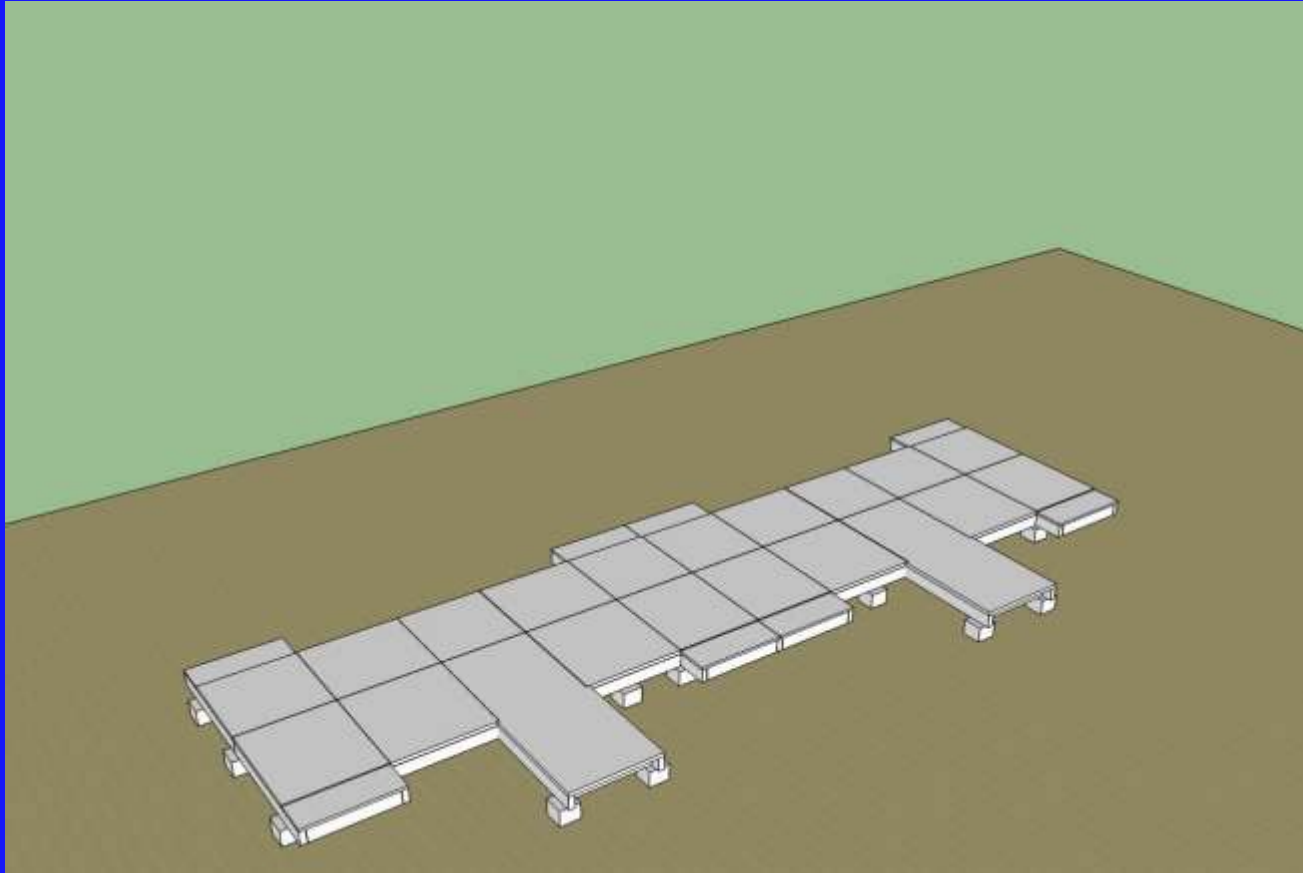
PILE CAP CONSTRUCTION



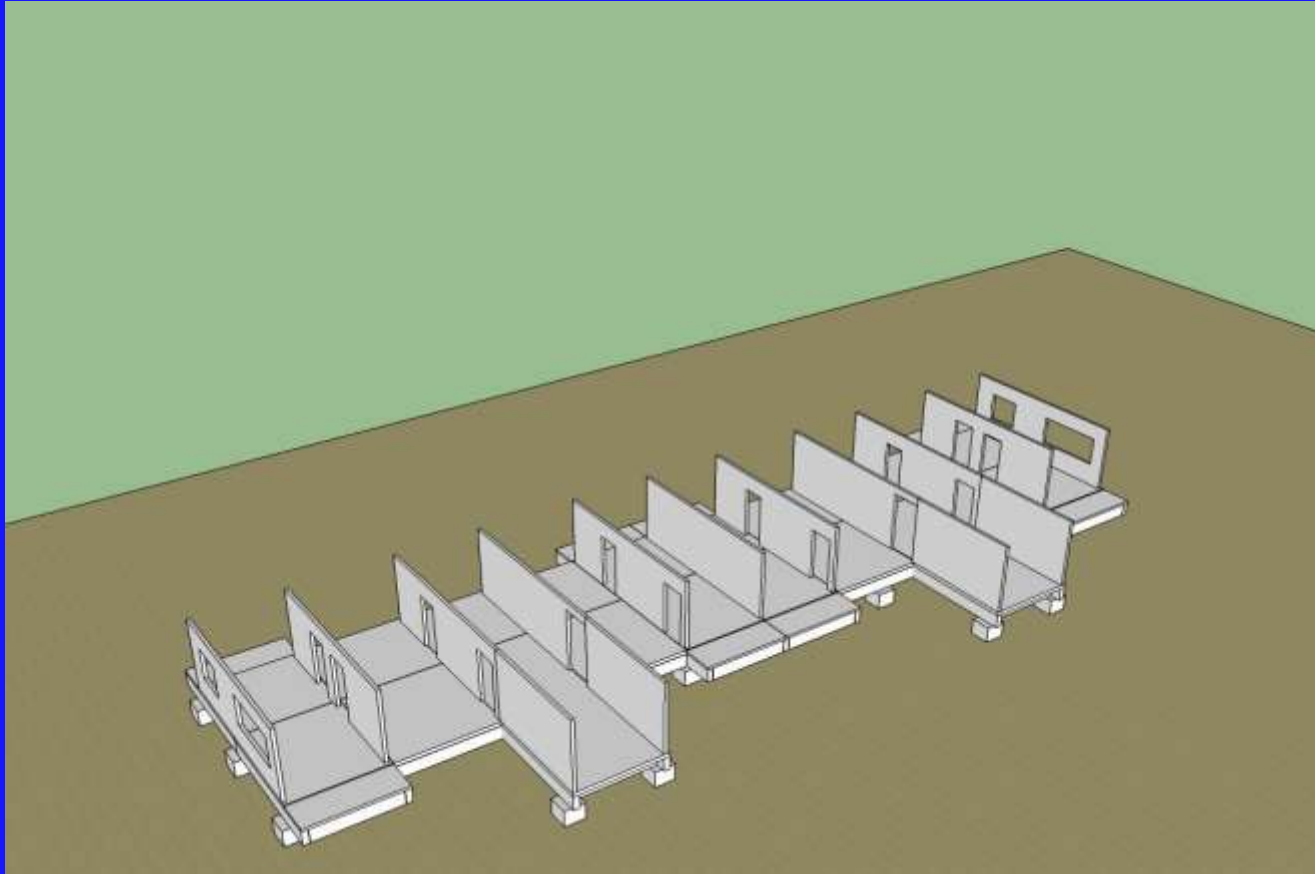
GROUND BEAM CONSTRUCTION



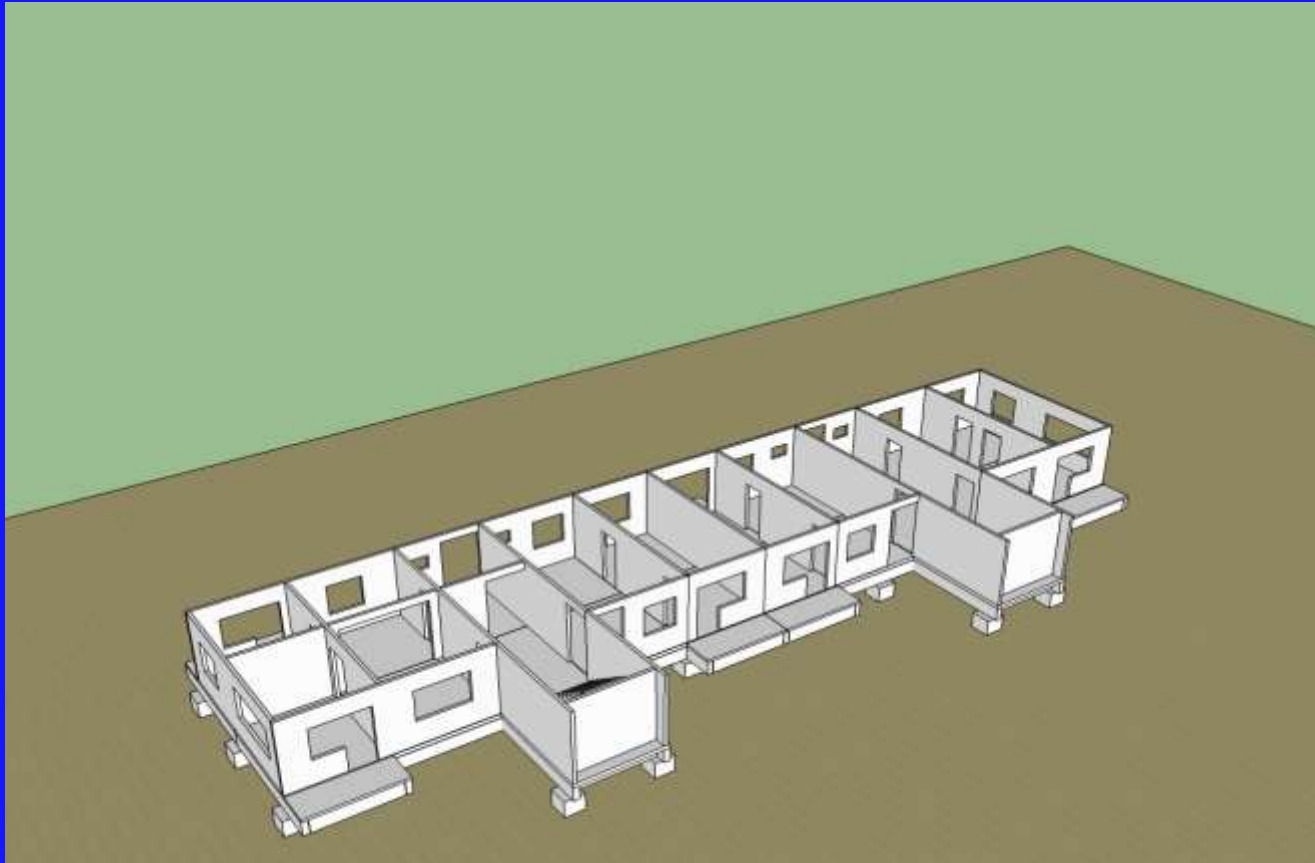
PRE-CAST SLAB INSTALLATION



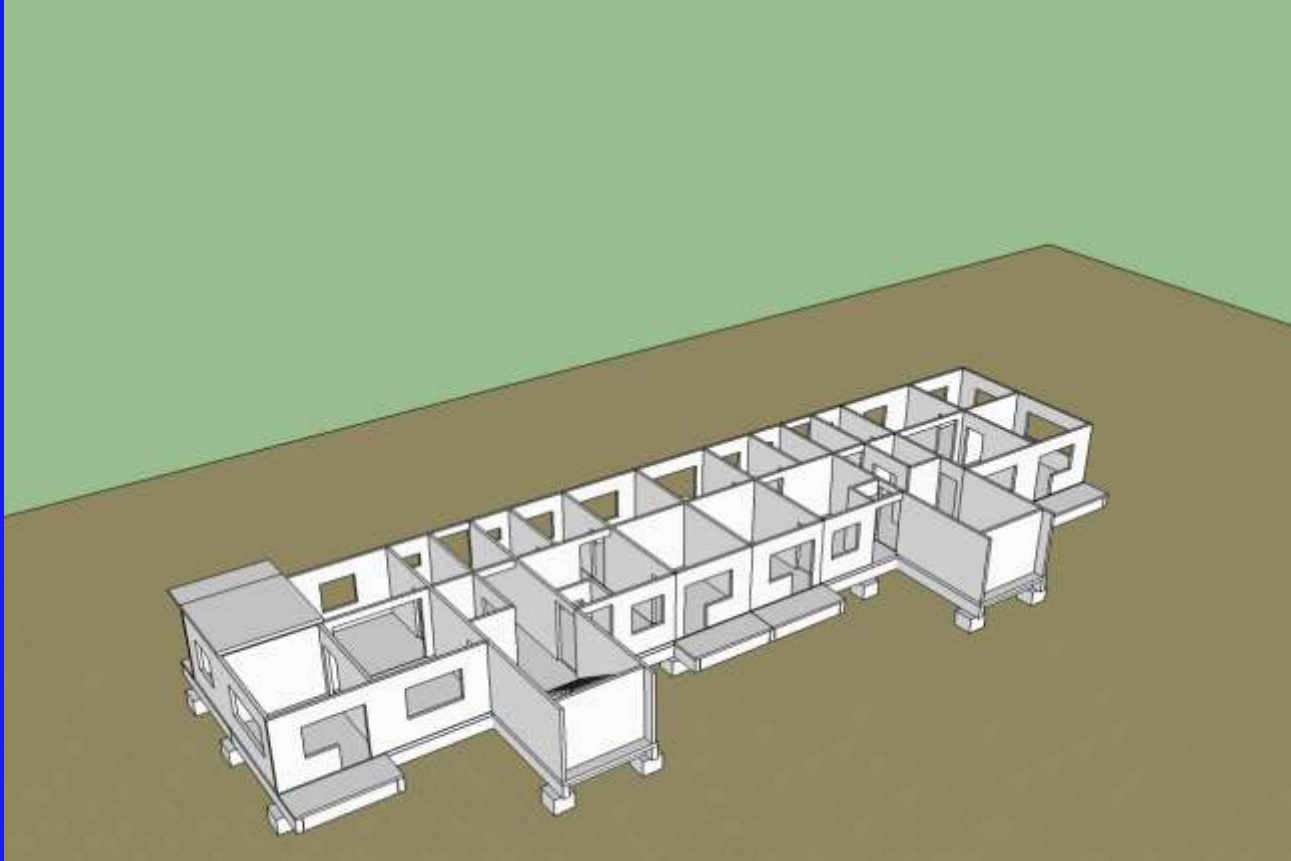
PRE-CAST WALL PANEL INSTALLATION



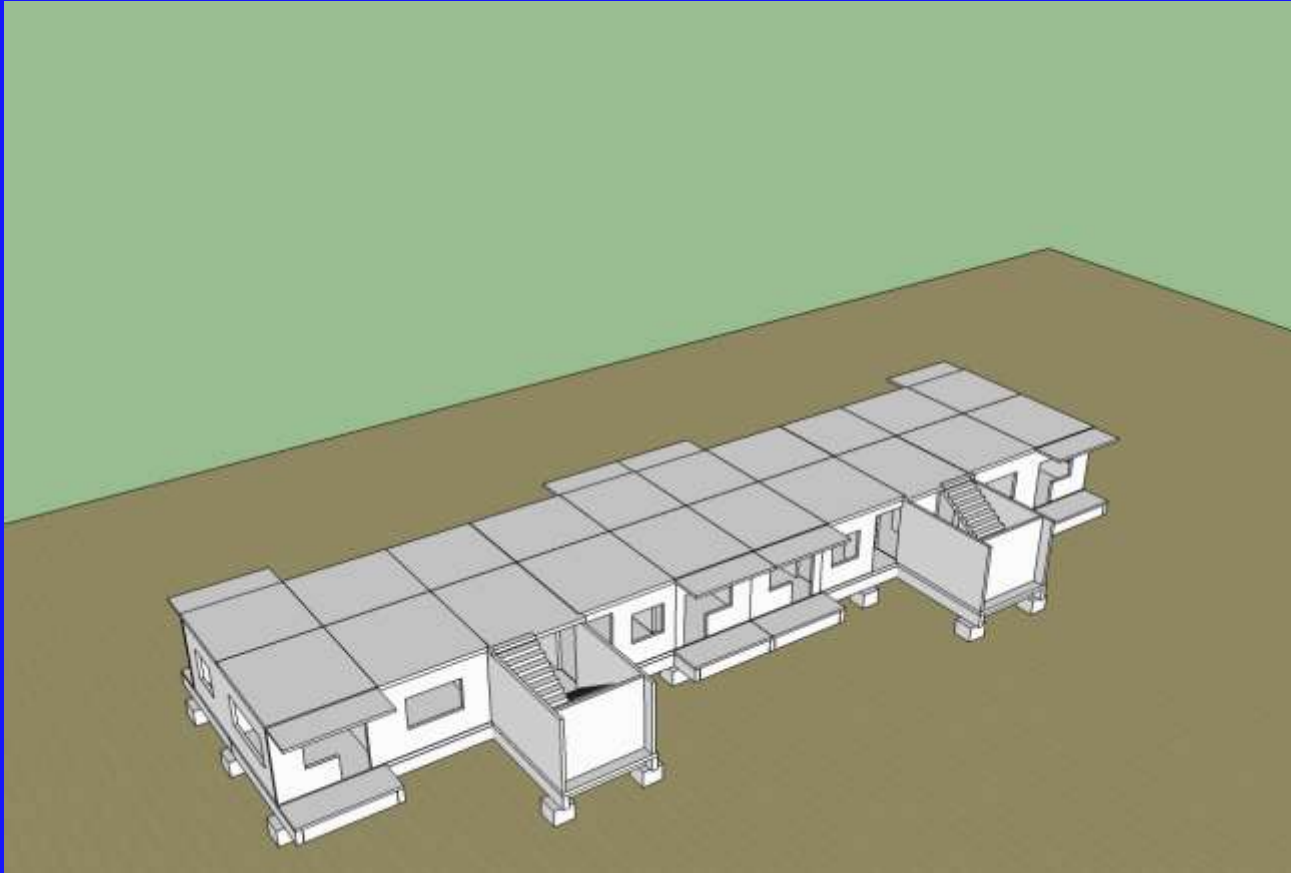
PRE-CAST WALL PANEL INSTALLATION



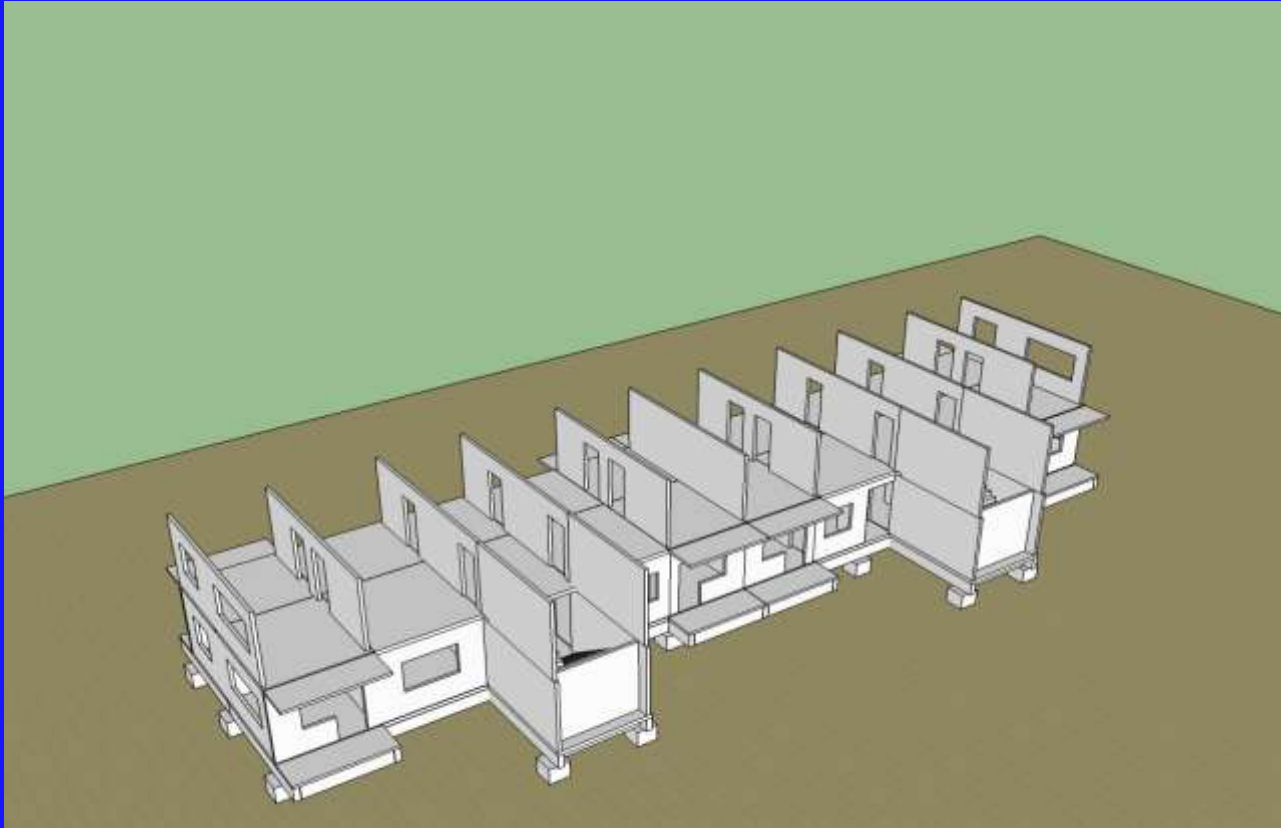
PRE-CAST WALL PANEL INSTALLATION



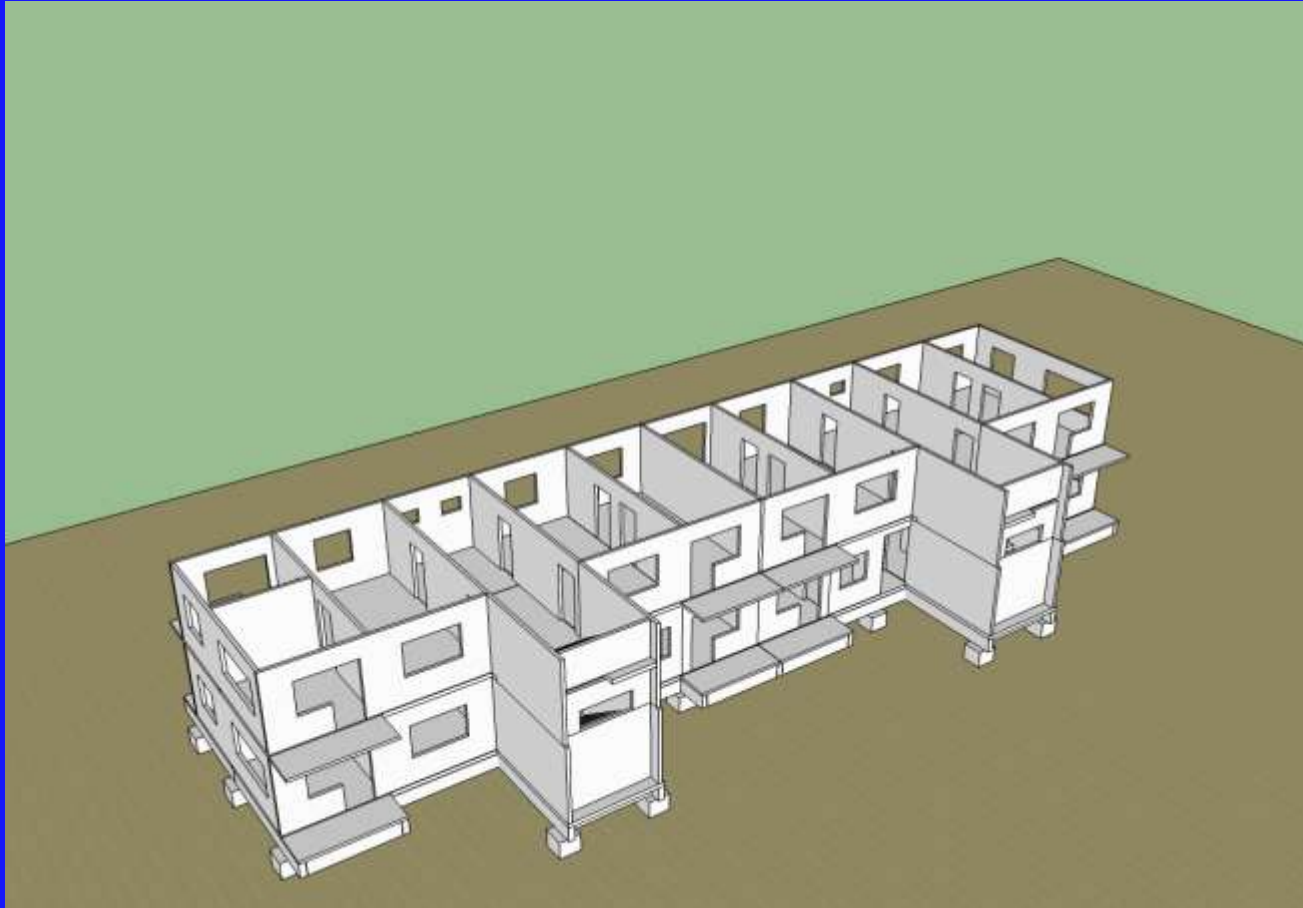
PRE-CAST SLAB INSTALLATION



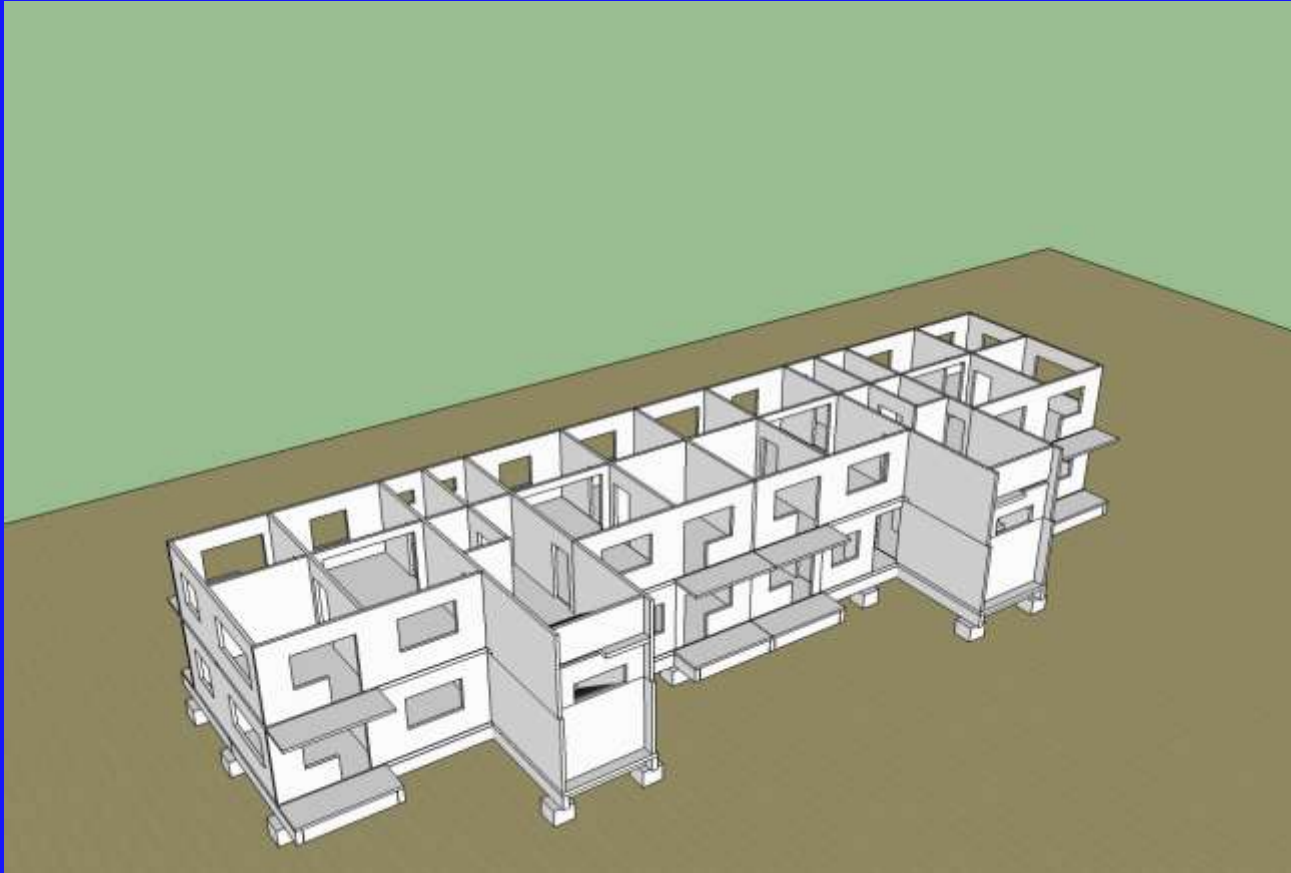
PRE-CAST WALL PANEL INSTALLATION



PRE-CAST WALL PANEL INSTALLATION



PRE-CAST WALL PANEL INSTALLATION



PRE-CAST WALL PANEL INSTALLATION





Bldg-B5 Pile ဆက်ခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ



Pile Cap မြေတူးခြင်းလုပ်ငန်းဆောင်ရွက်ထားပုံ



Pile Hacking လုပ်ငန်းဆောင်ရွက်နေပုံ



Pile Cap ကွန်ကရစ်လောင်းရန်စစ်ဆေးနေပုံ



Pile Cap ကွန်ကရစ်လောင်းရန်ပြင်ဆင်ထားပုံ



Pile Cap ကွန်ကရစ်လောင်းနေပုံ



Pile Cap ကွန်ကရစ်လောင်းခြင်းလုပ်ငန်းဆောင်ရွက်ထားပုံ



Bldg-C1 Pile Cap လောင်းခြင်း
လုပ်ငန်းဆောင်ရွက်ထားပုံ



Bldg-C1 Pile Cap လောင်းခြင်း
လုပ်ငန်းဆောင်ရွက်ထားပုံ



Pile Cap တည်ဆောက်ခြင်းလုပ်ငန်းဆောင်ရွက်ထားပုံ



Bldg C4 ပိုင်ကပ်နှင့် Ground Beam လုပ်ငန်းဆောင်ရွက်ပြီးစီးမှုအခြေအနေပြပုံ



Bldg-B1 GB အတွက် lean
လောင်းခြင်းလုပ်ငန်းဆောင်ရွက်ထားပုံ



Bldg C4 ပိုင်ကပ်နှင့် Ground Beam လုပ်ငန်းဆောင်ရွက်ပြီးစီးမှုအခြေအနေပြပုံ



Bldg-C2 GroundTank အတွက် Lean concret
လောင်းနေပုံ



Bldg-C2 GroundTank အတွက်Lean
လောင်းရန်ပြင်ဆင်နေပုံ



20/07/2013

Bldg-C2 GroundTank-1 အတွက်
သံဆင်ခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ



Bldg-C2 GroundTank-2 အတွက်
သံဆင်ခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ



Bldg B1 ပိုင်ကပ်နှင့် Ground Beam လုပ်ငန်းဆောင်ရွက်ပြီးစီးမှုအခြေအနေပြပုံ



Bldg B1 ပိုင်ကပ်နှင့် Ground Beam လုပ်ငန်းဆောင်ရွက်ပြီးစီးမှုအခြေအနေပြပုံ



Bldg B1 ပိုင်ကပ်နှင့် Ground Beam
လုပ်ငန်းဆောင်ရွက်ပြီးစီးမှုအခြေအနေပြပုံ



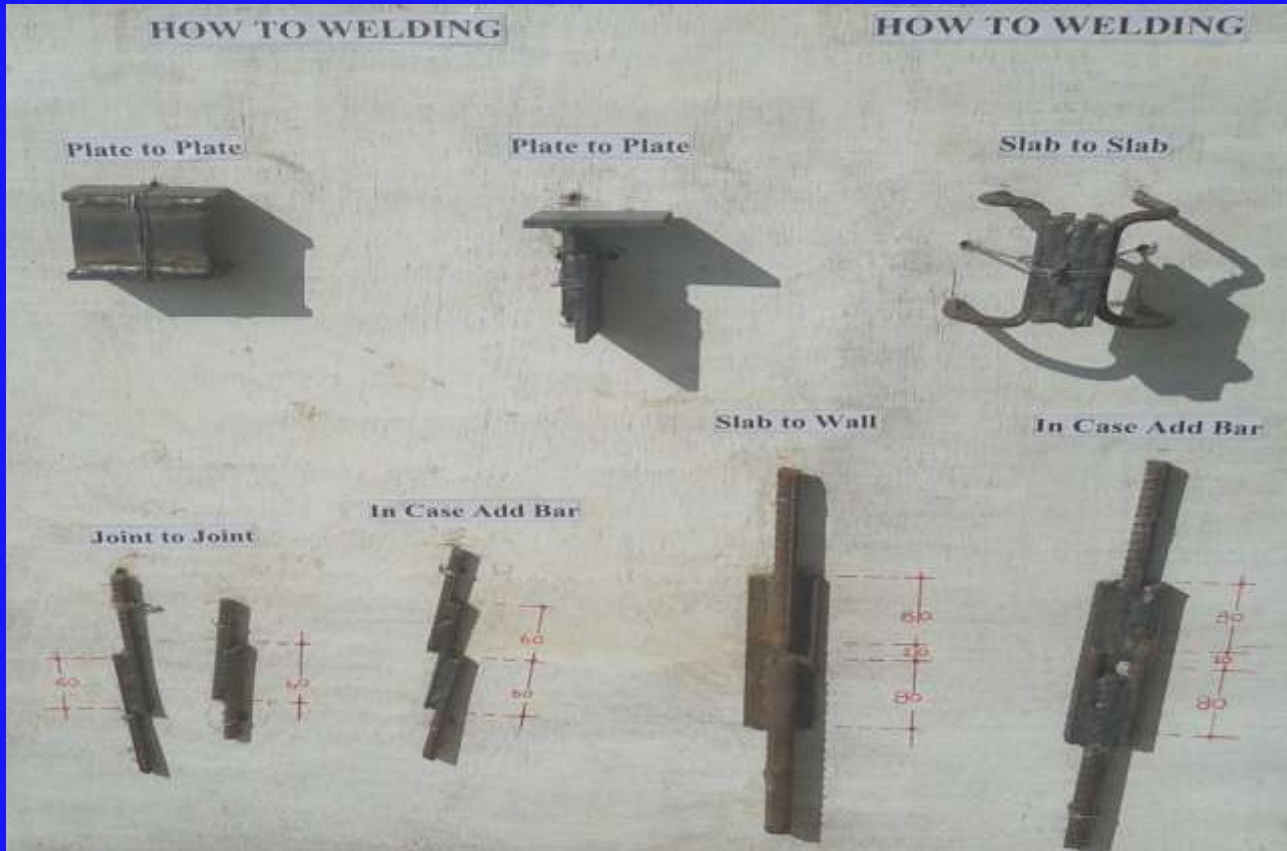
Slab Installation လုပ်ငန်းဆောင်ရွက်နေပုံ ။



Slab Joint Welding လုပ်ငန်းဆောင်ရွက်ထားပုံ ။



Welding Samples များ။



Wall Level & Alignment အတွက် Survey လုပ်ငန်းဆောင်ရွက်နေပုံ။



Wall Installation လုပ်ငန်းဆောင်ရွက်နေပုံ ။



Wall Vertical Joint Welding



Horizontal Joint Welding

Wall Joint Grouting လုပ်ငန်းဆောင်ရွက်ထားပုံ ။



Building A-2 7th FL Wall Installation လုပ်ငန်းဆောင်ရွက်နေပုံ ။



Building A-2 လုပ်ငန်းပြီးစီးမှုပုံ ။



Building B-2 လုပ်ငန်းပြီးစီးပုံ မြင်ကွင်း။



Building B-2 လုပ်ငန်းပြီးစီးပုံ မြင်ကွင်း။



6th FL Slab လုပ်ငန်းဆောင်ရွက်ပြီးစီးပုံ။



8th FL Slab Installation ဆောင်ရွက်နေပုံ ။



Building C-2 6th FL Wall Insallation လုပ်ငန်းဆောင်ရွက်နေပုံ ။



Building C-2 လုပ်ငန်းပြီးစီးမှုပုံ ။



Building B-3 လုပ်ငန်းပြီးစီးမှုပုံ ။



Building B-4 လုပ်ငန်းပြီးစီးမှုပုံ ။



Building B-4 6th FL Slab Installation လုပ်ငန်းဆောင်ရွက်နေပုံ ။



Over View မြင်ကွင်းပုံ။



Over View မြင်ကွင်းပုံ။



8th FL Wall Installation လုပ်ငန်းဆောင်ရွက်နေပုံ။



Machine Room Wall Installation လုပ်ငန်းဆောင်ရွက်နေပုံ။



Installation လုပ်ငန်း အားလုံးပြီးစီးပုံ။



Installation လုပ်ငန်း အားလုံးပြီးစီးပုံ။



Over View မြင်ကွင်းပုံ။



Over View မြင်ကွင်းပုံ။



Over View မြင်ကွင်းပုံ။



Over View မြင်ကွင်းပုံ။



Bldg A1 Front View



Bldg A1 Front View



Bldg A1 Back View



Bldg B1 လုပ်ငန်းပြီးစီးမှုပုံ။



Building C-1 လုပ်ငန်းပြီးစီးမှုပုံ ။



Building C-1 လုပ်ငန်းပြီးစီးမှုပုံ ။



မိုးကြိုးလွှဲတပ်ဆင်ပြီးပုံ။



မျက်နှာကျက်ဖရိန်များတပ်ဆင်ပြီးပုံ။



ခါတ်လှေခါး ပစ္စည်းများရောက်ရှိထားပုံ ။



အခန်းတံခါးများ တပ်ဆင်ထားပုံ ။

အဝင်တံခါး



အိပ်ခန်းတံခါး



ဝရန်တာတံခါး



ကြမ်းခင်း၊ နံရံ၊ ကြေးပြား၊ မျက်နှာကျက်နှင့် ရေချိုးခန်းပစ္စည်းများ တပ်ဆင်ထားပုံ။



အခန်းများသို့ရေဖြန့်ဝေရေးအတွက်
ပိုက်များတပ်ဆင်ထားပုံ။



ရေပိုက်လိုင်းများသွယ်တန်းထားပုံ



ဆေးသုတ်ခြင်းလုပ်ငန်းဆောင်ရွက်ထားပုံ။



There is often an assumption that resilient building is more expensive and slower. My experience with the 41-building Bobahtoo project proves the opposite. Using our in-house precast panel system was both reasonable and faster than conventional methods. This isn't a theoretical model; it's a completed, large-scale project here in Myanmar.“

THANK YOU