The precast frame structure, solution to the global housing crisis

Content **Page**

1. THE GLOBAL HOUSING CRISIS IN NUMBERS

UN-Habitat

“Approximately 2.8 billion people worldwide face housing inadequacies, from homelessness to substandard and unaffordable homes."

"A recent study by Habitat for Humanity International shows that equitable access to adequate housing could reduce preventable deaths of 730,000 people annually."

730,000/year means 2,000 preventable deaths/day!

United States

"The United States currently has a housing shortage between 4 and 7 million homes.”

“Nearly 7-in-10 Americans are concerned by rising housing costs."

"We are facing a massive housing deficit”.

“Even if constructions immediately double, which is unlikely, we still need 5 to 10 years just to catch up with the current demand."

“America’s housing crisis, will it be ever fixed?”

India

“India is estimated to have a cumulative affordable housing shortage of 31.2 million units by 2023, with a potential market size of Rs 67 trillion” ± $ 800 billion!

France

« Nearly 15 million people are affected by the housing crisis (health risks, risk of eviction, inadequate comfort, or disruption to their daily environment and family life.”

Germany

“The lack of affordable housing and skyrocketing rents in Germany has become perhaps *the most pressing social issue of the century*. There is a shortage of over 800,000 apartments, according to the Federal Statistical Office.”

Nigeria

“Nigeria faces a severe housing crisis, with a deficit exceeding 17 million units that is projected to grow due to rapid urbanization, with 700,000 new units needed annually.”

United Kingdom

"Right now, there are 8.5 million people in England who can't access the housing they need. This includes two million children in England living in overcrowded, unaffordable or unsuitable homes."

The housing crisis and birth rate decline

“The U.S. birth rate plunged to an all-time low in 2024 after being on a downward trajectory for roughly 20 years, with soaring housing costs widely cited as a major contributing factor.”

2. THE ROOT CAUSE OF THE CRISIS

Facts:

Fact #1. The housing crisis is severe, global, and deepening. Worse, there is no prospect of solution in sight.

Fact #2. Housing is the physical foundation of shelter. Construction methods are therefore a fundamental factor in both the crisis and the solution.

Fact #3. Current construction methods failed to prevent the crisis. They can't stop it either.

Fact #4. The artisanal character of current construction methods is the root cause of the crisis.

Conclusion: The solution to the crisis lies in industrial construction methods.

3. CONDITIONS FOR AN INDUSTRIAL CONSTRUCTION METHOD

Two main requirements for industrial construction method: simplicity and the right material in the right place.

3.1 Simplicity

Industrialization generally refers to mechanized production and automation, at a certain extent.
Mechanized production is technically and economically justified only if production involves a large number of identical units.
Automation is justified only if the production involves units of sufficiently simple shape.
Both result in more or less high production.

Therefore, the first step is to find which construction technique allows an advanced breakdown of buildings in simple components, with appropriate methods of assembly once on construction site.

There are two types of structures:
The structure frame. Simply said, the frame must withstand loads – that's all. Partition walls come as a complement for defining spaces and protecting occupants.

The load-bearing walls.
Walls play two roles simultaneously: supporting all loads, defining spaces, and protecting occupants. This combination of functions makes them less simple to industrialize. Structural and architectural aspects are combined.

Furthermore, load-bearing walls are limited in the number of stories they can support. Urban housing, especially that intended to address the current housing crisis, should not be subject to such limitations.

Off-site production of load-bearing walls in concrete and wood are common. However, they didn't result in a level of industrialization sufficient to stop the crisis.

Conclusion: The frame structure is the most suitable type of structure for industrial-scale approach.

3.2 The right material in the right place

3.2.1 The structure frame

Concrete is unparalleled for underground and on-ground structures. What works for the greater can work for the lesser; its use can easily be extended to the superstructure: columns and beams, slabs and stairs.

3.2.2 Connections

For simple buildings, connections are not stressed at an alarming level. That is why conveniently wood uses wood connections, concrete uses concrete connections, and steel uses steel connections.

However, most wood constructions appropriately shift to steel connections at a certain height of buildings. For example:
. Ascent, USA, a hybrid high-rise apartment building, 25 floors.
. Mjostarnet, Norway, a timber high-rise commercial building, 18 floors.
. Bullitt Center, USA, a five-floors commercial building.

On the other hand, concrete construction didn't, in a similar way, adopt the right joint material for multi-story buildings: steel.
There is no viable alternative to steel for creating moment-resisting connections between structure frame elements.

3.2.2 Conclusion:

Concrete is the dedicated construction material for all foundations independently of the construction material used for the above ground structure. Similarly, steel should be dedicated for all connections, independently of the construction material used elsewhere in the building.

3.2.3 Walls

Walls represent the most significant building component in terms of volume and weight. They should be constructed using locally available materials: bricks, wood, cement blocks, etc.

3.2.4 Conclusion

We took the best from the main construction techniques:

. From wood construction, we took the technology: *posts and beams for structure, and joists floors for slabs*.
. From concrete construction, we took the material: *concrete*.
. From steel construction, we took *connections*.

At this stage, the best choice for an industrial construction approach, is *concrete frame structure with steel connections*, and *walls made of locally available materials*.

3.3 Why not cast-in-place frame structure?

Cast-in-place frame structure was ruled out for several reasons.

3.3.1 Outdoor work

Cast-in-place concrete is performed on construction site, in outdoor conditions. Weather can affect quality, even continuity of operations.
On the other hand, offsite fabrication is performed in controlled environment, with positive effect on quality and continuity of operations.

3.3.2 Problematic sequence of operations

Let's consider the example of a farmer who undertakes to sow five fields of corn.

He has two options:

Option 1: Simultaneous cultivation: planting all 5 fields in parallel.
He gathers enough seeds to plant all five fields at the same time.

Option 2: Sequential cultivation: sow one field after another, in series.
- He sows the first field, then waits for the harvest.
- He sows the second field with the seeds harvested from the first, then waits for the second harvest.
- And so on, up to the fifth field.

The analogy applies to construction. A contractor wishes to construct a five-story building.

Option 1: Prefabrication of all elements in a precast facility.

The contractor purchases all the structural elements needed for the entire building from a factory. He then proceeds with assembly immediately, without interruption, until the project is completed.

Option 2: Sequential construction: building floor by floor, in series.

- Fabrication of foundation beams: reinforcement, formwork, pouring concrete, vibration, deshuttering; watering for curing.
- Fabrication of the ground floor columns: same successive operations as above.
- Fabrication of the ground floor beams: same successive operations as above.
- Fabrication of the ground floor slab: same successive operations as above.

These steps are repeated for each floor, at height.

In total, there will be 5 x 3 = 15 steps, separated by a curing period, which theoretically takes 28 days.

Sequences of operations alone explain the huge difference in construction time between the two methods.

3.3.3 An artisanal method by nature

Let's take the example of a 5-story building with 10 apartments.

It has approximately 200 identical columns.
In cast-in-place concrete, each of these 200 columns is shaped by hand as a unique piece. This includes fabrication of the reinforcement cage, construction and stabilization of the formwork, pouring and vibration of concrete, deshuttering, and watering 28 days for the curing process.
And this is done 200 times!

If in a small city 10 similar buildings are under construction, it means that 2,000 columns will be made by hand, as well as a slightly higher number of beams, for a total of nearly 5,000 elements. Workers can be assisted by huge equipment such as tower cranes, concrete mixers, etc., but the fabrication method its-self remains artisanal.

In contrast, with precast frame construction, a few infinitely reusable metal molds are used, set to the correct dimensions once and for all. This allows for the production of similar, higher-quality elements more quickly, more easily, with greater precision, and at a consistent production rate, completed by an easy assembly once on site.

3.3.4 Working at height
All these thousands of columns and beams are fabricated on average 10 meters above the ground, with adapted logistics and a significant level of discomfort.
Even the ground-floor columns are manufactured in a vertical position and therefore require lateral anchoring until they can stand on their own.

In contrast, with fabrication in factory, all components are manufactured at ground level and in a horizontal position. Operations are easier: reinforcement cage, vibration, handling, etc.

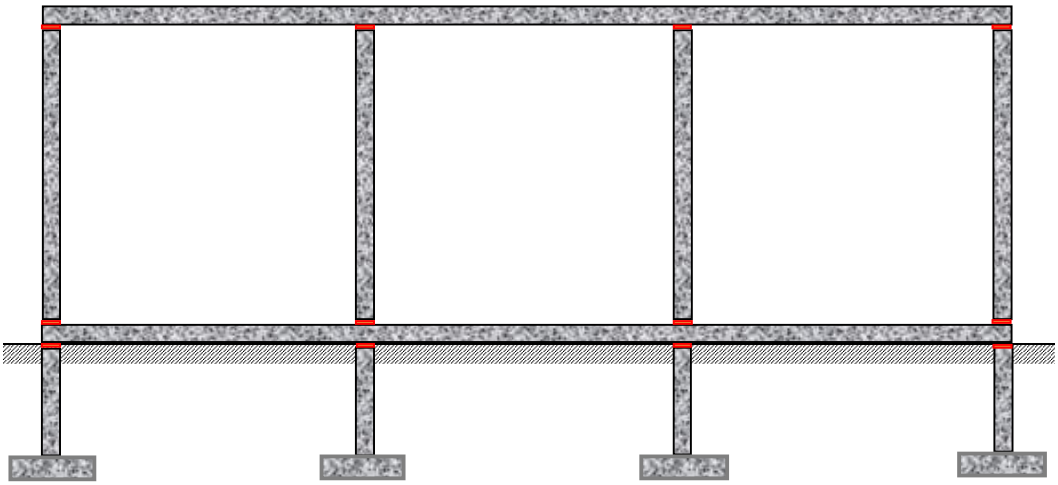
3.3.4 Semi-rigid connections
Buildings must withstand vertical and horizontal loads.
Vertical loads are well known and predictable. It is relatively easy to deal with them.
Horizontal loads, on the other hand, are unpredictable. All structural elements are involved in dealing with them, but joints are on the front line.
However, joints are not specifically designed to meet these challenges. They are just physical intersections between columns and beams, from which they inherit their characteristics. This results in high vulnerability of the entire structure to horizontal loads, particularly in case of earthquake.

https://www.researchgate.net/publication/245378123

The palliative solution generally adopted for lateral stability of buildings: shear walls.

3.3.5 The illusion of monolithic structures: cold joints

One of the weaknesses of cast-in-place concrete construction lies in "cold joints," particularly at the top and bottom of columns. They result from interruptions in pouring concrete. The bond between batches of concrete which were not vibrated together is weak.



Cold joints at tops and bottoms of columns

3.4 Conclusion

Based on objective facts and observations, it successively appeared that in the perspective of industrialized construction:
1° The frame structure is the best option.
2° Using the right material in the right place resulted in the frame structure to be made of concrete, with connections of steel, and infill walls of locally available materials.
3° Off-site fabrication of the structure elements: posts, beams, as well as slabs and stairways components.

Types of structure eligible for industrialization

	On-site	**Off-site**
Load-bearing walls	**No**	**No**
Structure frame	**No**	**YES**

Currently available types of structures

	On-site	**Off-site**
Load-bearing walls	**Yes**	**Yes**
Structure frame	**Yes**	**No**

It turns out that the only type of structure which is eligible for industrialization is not available.
It must therefore be invented.
Concrete posts and beams are common. It is only an effective connection between them that is to be invented.

4. CONNECTION IN THE PRECAST FRAME STRUCTURE

4.1 A wish that remained unfulfilled for a long time

For the precast frame structure to be possible, an effective connection method is required. Specialized literature shows a proliferation of connection methods up until the 1990s, but they performance were low. They have become increasingly rare, but research continues till now.

In 1987, the Precast/Prestressed Concrete Institute funded an evaluation of connection methods which were available precast columns and beam.

https://www.pci.org/PCI/Publications/PCI_Journal/Issues/1987/March April/Moment_Resistant_Connections_and_Simple_Connections.aspx

See especially pages 5 and 6.

It appears that the lack of an efficient connection method is the reason why the precast frame construction system didn't develop significantly.

4.2 The main issue

When considering connecting precast columns and beams, the first idea that comes to mind is to provide starter bars at the end of each element. These starter bars would be inserted into the joint to serve as reinforcement for a reinforced concrete connection.
However, a problem arises with the placement of rigid rebars from columns and beams, in a limited space such as their intersection. Orthogonal rebars for column-to-beam connection are the most problematic. However inline rebars for beam-to-beam connection are easy to arrange.

"The use of precast concrete is known to improve productivity, quality control, and cost efficiency in reinforced concrete structure. *The connection is the most important aspect of precast concrete structures*. The connection transfers force between the precast components, determine strength, stiffness, and ductility of the whole structure.

*Providing joint in the beam-column connection region **always cause difficulties** during the erection stage. Relocation of the connection at a certain distance from the column to the beam span is an alternative solution that creates the beam-to-beam connection.*".

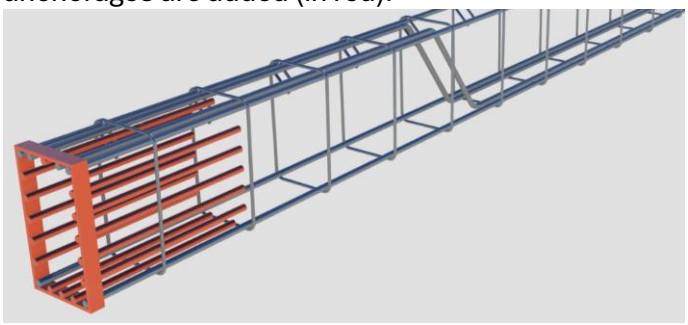
MATEC Web of Conferences SCESCM 2018, 0 40 02 (2019)

4.3 The idea that changes everything

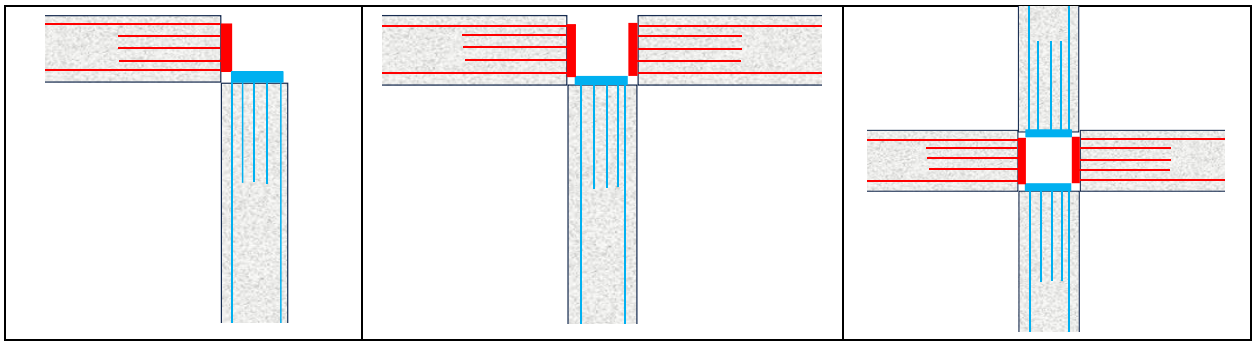
The problem lies in arranging the numerous rebars of beams and columns within the limited space of their intersection.

The solution consists of not entering rebars in the common area, but stopping and fixing them onto a metal frame by welding, **the end frame**.

To ensure the end frame (in red) is perfectly secure to the element to which it is attached, straight anchorages are added (in red).



During assembly, end frames of two perpendicular elements come into contact, and they are joined by welding. And so on.



The end frame allows to achieve post-beam moment resisting connections.
It is a world first, a game-changer in concrete construction.

Once end frames of two columns and four beams have been welded together, a cube is formed.

The photo on the right is how would appear end frames, straight anchorages, and the longitudinal rebars if the joint and its surrounding were “deboned”.

The straight anchorages of end frames are approximately 30 cm long.

This new connection method has two major consequences: structural and industrial.

4.4 An important structural consequence

4.4.1 The connection gets a structural “personality”

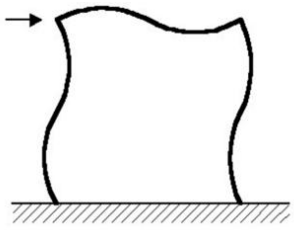
Usually, the parameters of a connection are the “natural” result of the parameters of the adjacent columns and beams. If the characteristics of the columns and beams are known, those of the connection can be deduced. The joint is simply the intersection of the columns and beams.

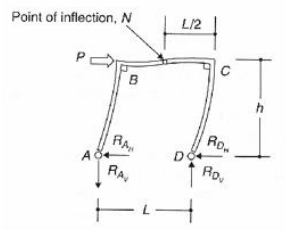
With the new method, the parameters of end frames and their anchorages don’t dependent on the columns and beams design. They depend on their own requirements for specific characteristics of the connection, notably for being or not a moment resisting connection.

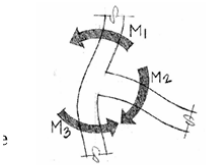
Thus, the connection gets a structural "personality."

4.4.2 Structural personality results in moment-resisting connections

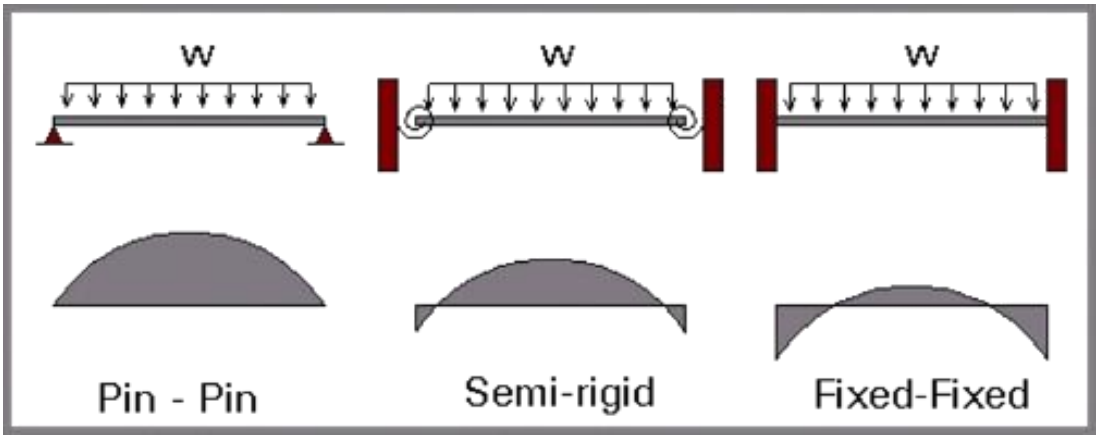
Due to the structural personality of the connection, its parameters can be adjusted to achieve a rigid connection, and therefore a resisting moment connection, for all constructions.
A resisting moment connection is one where the columns and beams maintain a right angle with each other, under all circumstances. Columns and beams may deflect, even break, but the connection itself maintains the angles at 90°.





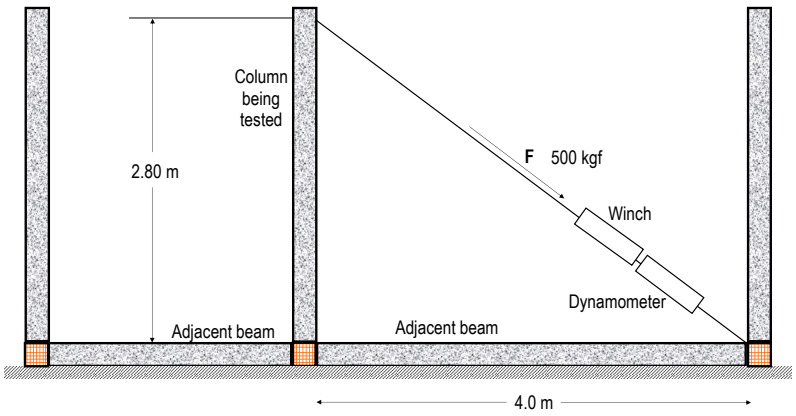


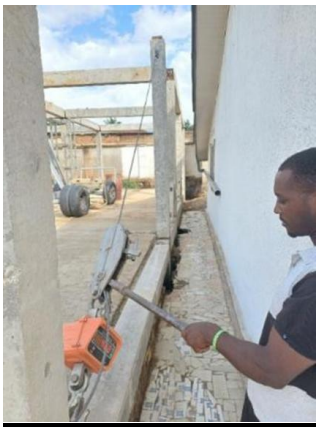
Bending moment diagrams for 3 types of beam connections:
1. Hinged connection: on simple supports.
2. Semi-rigid connection: possesses a certain rigidity but allows slight rotation.
3. Rigid connection: fixed end.



The following non-disruptive test is performed on columns for buildings under construction.

A winch is attached on top of a column and on bottom of the next one, in series with a crane scale. For 20 x 20 x 300 cm column reinforced with four rebars of 12 mm, a tension of 500 kg is applied.





4.5 A major industrial consequence: centralized fabrication

The new connection method allows off-site fabrication. Thus, centralized production of columns and beams, as well as slab and stairways components.
Indeed, with precast columns and beams, it becomes possible to construct joists concrete slabs and stairs, on the model of wood joist floors and stairways.
Beams-and-blocks slabs fit to the structure, as well.


Stair stringers in stock.


Joist slabs based on the model of wood floors

Contractors don't need to fabricate structure components themselves. They can just buy them from a local precast facility, on catalogue.

The low weight (less than 1 ton), and simple rectangular shape of components facilitate fabrication, handling in factory, storage, transport, and assembly.

5. Advantages of the precast frame structure

5.1 Structural stability of constructions

The primary benefit of this method is a moment-resisting connection, which can be made as strong as desired.

Furthermore, the precast frame structure fits for intensive triangulation, both vertically and horizontally.

Some experts are talking about "defeating earthquakes."
https://www.youtube.com/watch?v=Bg4kSIgn67I&t=3s
Min 0-2:45

The two factors, moment resisting connections and intensive triangulation, result in higher lateral resistance, thus allowing construction of higher buildings.

5.2 Easy fabrication

All components are of rectangular shape, which facilitates their fabrication, curing, and storage of large volumes in a small space. Columns and beams for the frame, joists and boards for the slabs, as well as stringers, treads, and risers for the stairways.
Everything is made in simple, rectangular molds, essentially consisting of two metal panels.

5.3 Easy assembly

Handling can be done using manual cranes for small units. After assembling columns, beams, and joists of the ground floor, the crane is dismantled, hoisted onto the slab, and reassembled. Then it repeats the same process as on the ground floor. And so on up to the last floor.

5.4 Moderate investment level

The initial investment level is modest and consists largely of casting and storage areas.
To produce the frame for a 10-apartment building per week, the initial investment is less than USD 300,000.00.

5.5 Sustainable approach

Our complete construction system, including two other innovations not presented here, results in reduction in concrete use of approximately 50%, without compromising on the quality of the structures, but improving it.

Indeed:

- Concrete joists slabs as explained above, use 3 times less concrete than an equivalent conventional solid slab.

- Beams incorporated columns, not presented here, are doubling spans, all other things being equal. The beams are less massive and therefore consume less concrete.

- Two phases concrete mixing method results in using 15% less cement for the same concrete compressive strength. For example, 300 kg instead of 350kg of cement per 1m3 of concrete.

5.6 Precast joint

The precast joint is intensively reinforced and cast using high performance concrete.
Assembly is even faster. Just lifting and tightening bolts and nuts.
Note: Intensive bracing is also applicable here, particularly in seismic zones.

NB: Metal parts (assembly bolts and nuts) can be hot-dip galvanized, and are always covered by a layer of concrete according to the appropriate cover thickness.

5.7 Structure vs architecture

The industrialized construction discussed here is related to structure only. Not to architecture as well.
For the same structure, there is a large number of architectural designs.
The industrialized structure itself does not imply structural monotony. While the height of the columns doesn't change a lot, the length of the beams varies considerably. The precast facility should keep different sizes of beam in stock, in increments of 50 or 25 cm, for example. Other lengths will then be fabricated on order.

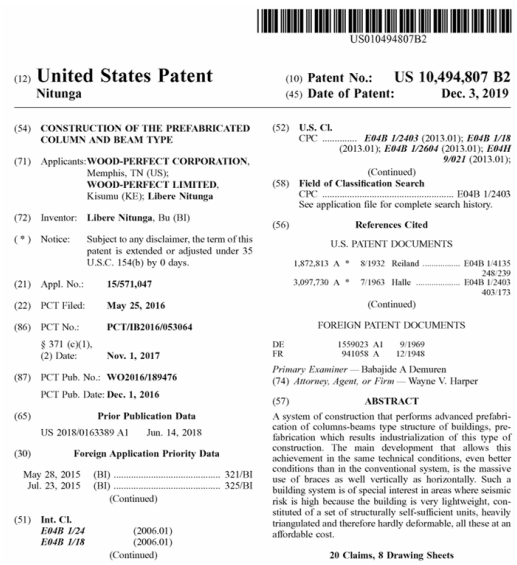
Therefore, there is no risk of structural monotony or architectural similarities.

https://www.instagram.com/p/DZmu7-3msx4/

6. Patents granted

Patents were granted by the following offices:

1. United States Patents and Trademarks Office USPTO: US 10,494,807 B2.
2. European Patent Office EPO: EP 3310973.
3. Burundi Department of Industrial Property: BI 2015/321.
4. Euro-Asian Patent Office EAPO: EA 034805.
5. China National Intellectual Property Administration CNIPA: CN 4328807.
6. Indian Patent Office IPO: IN 471248.



US010494807B2

(12) **United States Patent**
Nitunga

(10) **Patent No.: US 10,494,807 B2**
(45) **Date of Patent: Dec. 3, 2019**

(54) **CONSTRUCTION OF THE PREFABRICATED COLUMN AND BEAM TYPE**

(71) Applicants: **WOOD-PERFECT CORPORATION**, Memphis, TN (US); **WOOD-PERFECT LIMITED**, Kisumu (KE); **Libere Nitunga**, Bu (BI)

(72) Inventor: **Libere Nitunga**, Bu (BI)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/571,047**

(22) PCT Filed: **May 25, 2016**

(86) PCT No.: **PCT/IB2016/053064**
§ 371 (c)(1),
(2) Date: **Nov. 1, 2017**

(87) PCT Pub. No.: **WO2016/189476**
PCT Pub. Date: **Dec. 1, 2016**

(65) **Prior Publication Data**

US 2018/0163389 A1 Jun. 14, 2018

(30) **Foreign Application Priority Data**

May 28, 2015 (BI) 321/BI
Jul. 23, 2015 (BI) 325/BI
(Continued)

(51) **Int. Cl.**
E04B 1/24 (2006.01)
E04B 1/18 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***E04B 1/2403*** (2013.01); ***E04B 1/18*** (2013.01); ***E04B 1/2604*** (2013.01); ***E04H 9/021*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC E04B 1/2403
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,872,813 A * 8/1932 Reiland E04B 1/4135 248/239
3,097,730 A * 7/1963 Halle E04B 1/2403 403/173
(Continued)

FOREIGN PATENT DOCUMENTS

DE 1559023 A1 9/1969
FR 941058 A 12/1948

Primary Examiner — Babajide A Demuren
(74) *Attorney, Agent, or Firm* — Wayne V. Harper

(57) **ABSTRACT**

A system of construction that performs advanced prefabrication of columns-beams type structure of buildings, prefabrication which results industrialization of this type of construction. The main development that allows this achievement in the same technical conditions, even better conditions than in the conventional system, is the massive use of braces as well vertically as horizontally. Such a building system is of special interest in areas where seismic risk is high because the building is very lightweight, constituted of a set of structurally self-sufficient units, heavily triangulated and therefore hardly deformable, all these at an affordable cost.

20 Claims, 8 Drawing Sheets

Europäisches Patentamt
European Patent Office
Office européen des brevets

URKUNDE | **CERTIFICATE** | **CERTIFICAT**

Europäisches Patent | **European patent** | **Brevet européen**

Es wird hiermit bescheinigt, dass für die in der Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist.

It is hereby certified that a European patent has been granted in respect of the invention described in the patent specification for the Contracting States designated in the specification.

Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet, pour les Etats contractants désignés dans le fascicule de brevet.

Europäisches Patent Nr.
European patent No.
Brevet européen n°
3310973

Patentinhaber
Proprietor(s) of the patent
Titulaire(s) du brevet
Nitunga, Libère
8, Ave Nyabitsindu Q10 Ngagara
B.P. 2834 Bujumbura/BI

München, den
Munich,
Munich, le
25.03.20

Antônio Campinos
Präsident des Europäischen Patentamts
President of the European Patent Office
Président de l'Office européen des brevets

REPUBLIQUE DU BURUNDI

Ministère du Commerce, de l'Industrie, des Postes et du Tourisme

Direction de la Propriété Industrielle et de la Documentation

Réf. N° 756/225 /PID/2015

Certification des spécifications de l'invention telles que déposées

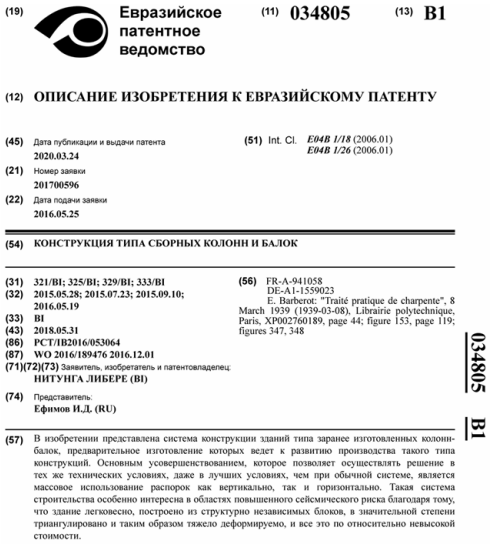
Par la présente, nous certifions que les spécifications ci-jointes sont conformes à celles déposées par Libère NITUNGA en notre office, pour l'obtention d'un brevet d'invention ayant pour titre : Poteaux et poutres en béton armé préfabriqués.

La demande a été enregistrée en date du 28 mai 2015 sous le numéro 321/BI à la Direction de la Propriété Industrielle et de la Documentation, du Ministère du Commerce, de l'Industrie, des Postes et du Tourisme.

Fait à Bujumbura, le 28 mai 2015

Le Directeur de la Propriété Industrielle et de la Documentation

Vianney NIYUKURI



(19) Евразийское патентное ведомство

(11) **034805** (13) **B1**

(12) **ОПИСАНИЕ ИЗОБРЕТЕНИЯ К ЕВРАЗИЙСКОМУ ПАТЕНТУ**

(45) Дата публикации и выдачи патента
2020.03.24
(21) Номер заявки
201700596
(22) Дата подачи заявки
2016.05.25

(51) Int. Cl. ***E04B 1/18*** (2006.01)
E04B 1/26 (2006.01)

(54) **КОНСТРУКЦИЯ ТИПА СБОРНЫХ КОЛОНН И БАЛОК**

(31) **321/BI; 325/BI; 329/BI; 333/BI**
(32) **2015.05.28; 2015.07.23; 2015.09.10; 2016.05.19**
(33) **BI**
(43) **2018.05.31**
(86) **PCT/IB2016/053064**
(87) **WO 2016/189476 2016.12.01**
(71)(72)(73) Заявитель, изобретатель и патентовладелец:
НИТУНГА ЛИБЕРЕ (BI)

(74) Представитель:
Ефимов И.Л (RU)

(56) FR-A-941058
DE-A1-1559023
E. Barberot: "Traité pratique de charpente", 8 March 1939 (1939-03-08), Librairie polytechnique, Paris, XP002760189, page 44; figure 153, page 119; figures 347, 348

(57) В изобретении представлена система конструкции зданий типа заранее изготовленных колонн-балок, предварительное изготовление которых ведет к развитию производства такого типа конструкций. Основным усовершенствованием, которое позволяет осуществлять решение в тех же технических условиях, даже в лучших условиях, чем при обычной системе, является массовое использование распорок как вертикально, так и горизонтально. Такая система строительства особенно интересна в областях повышенного сейсмического риска благодаря тому, что здание легковесно, построено из структурно независимых блоков, в значительной степени триангулировано и таким образом тяжело деформируемо, и все это по относительно невысокой стоимости.

034805 B1

证书号第4238807号

发明专利证书

发明名称：一种预制柱和梁结构类型

发明人：利贝尔·尼活格

专利号：ZL 2016 8 0043406.3

专利申请日：2016年05月25日

专利权人：利贝尔·尼活格

地址：布隆迪布琼布拉市伽倍拉Q10号比森都大街8号

授权公告日：2021年02月05日　　授权公告号：CN 108138481 B

国家知识产权局依照中华人民共和国专利法进行审查，决定授予专利权，颁发发明专利证书并在专利登记簿上予以登记。专利权自授权公告之日起生效。专利权期限为二十年，自申请日起算。

专利证书记载专利权登记时的法律状况。专利权的转移、质押、无效、终止、恢复和专利权人的姓名或名称、国籍、地址变更等事项记载在专利登记簿上。

局长
申长雨

2021年02月05日

第1页(共2页)

INTELLECTUAL PROPERTY INDIA

पेटेंट कार्यालय, भारत सरकार | The Patent Office, Government Of India

पेटेंट प्रमाण पत्र | Patent Certificate

(पेटेंट नियमावली का नियम 74) | (Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No. : 471248

आवेदन सं. / Application No. : 201717046828

फाइल करने की तारीख / Date of Filing : 25/05/2016

पेटेंटी / Patentee : NITUNGA Libere

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाघटित *CONSTRUCTION OF THE PREFABRICATED COLUMN AND BEAM TYPE* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख मई 2016 के पच्चीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *CONSTRUCTION OF THE PREFABRICATED COLUMN AND BEAM TYPE* as disclosed in the above mentioned application for the term of 20 years from the 25th day of May 2016 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख / Date of Grant : 21/11/2023

नियंत्रक पेटेंट
Controller of Patents

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, मई 2018 के पच्चीसवें दिन को और उसके पश्चात प्रत्येक वर्ष के उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 25th day of May 2018 and on the same day in every year thereafter.