

## CONTENT

### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY  
IN HRADEC KRALOVE BY PROJEKTIL  
ARCHITEKTI  
CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES  
AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY  
OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES



.:TRILLIUM GROUP:.

CONCRETE RESEARCH ASSIGNMENT

SITE-CAST FLAT SLAB CONSTRUCTION

Team Members.:  
Paula Damasceno  
Irelis Pimentel  
Nwaram-Billi Ugbo

## CONTENT

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#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

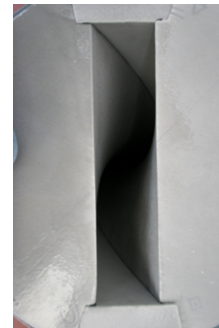
#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### SITE CAST FLAT SLAB CONSTRUCTION

#### OVERVIEW

- Cast-in-place or In-Situ concrete is deposited in *forms* on site, where it remains.
- Cast-in-place concrete is an intuitive solution for free forming concrete into a variety of shapes, spans and forms.



## CONTENT

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#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### SITE CAST FLAT SLAB CONSTRUCTION

#### OVERVIEW

Fresh, fluid concrete is transported as a ready mix product, or concrete is mixed on site.



## CONTENT

### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

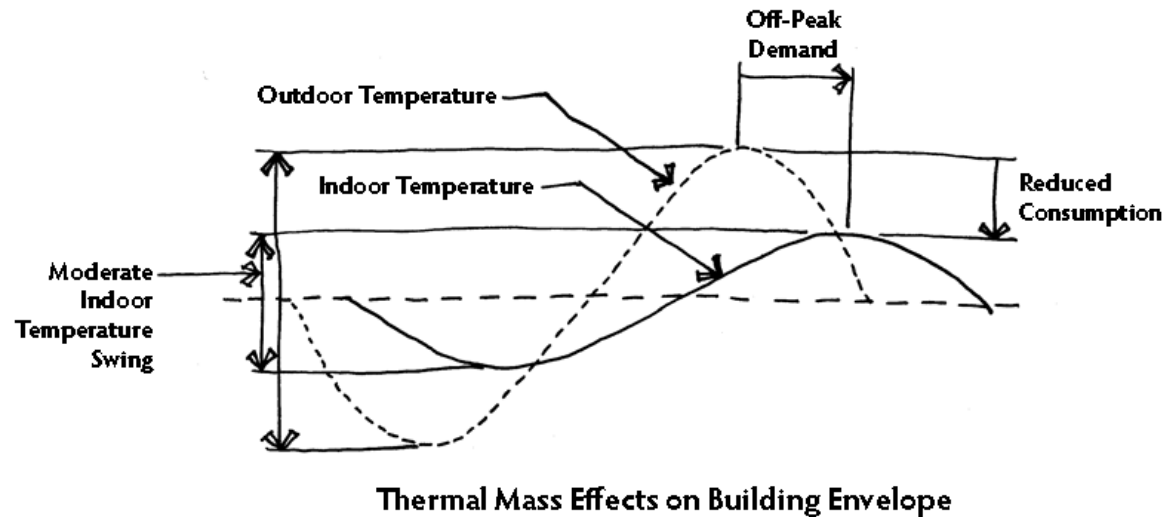
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- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
  - SYSTEM STRENGTHS & WEAKNESSES
  - CONNECTION DETAILS
- CASE STUDY III:
  - GLOSSARY
  - SOURCES

### SITE CAST FLAT SLAB CONSTRUCTION

#### OVERVIEW

Advantages associated with in-situ concrete system:

- Durability and resilience to disaster and the use of recycled materials.
- Thermal mass*, wherein a building with a high thermal mass reduces the transfer of heat through a high thermal mass wall, resulting in lower energy usage for heating and cooling the interior space. The thermal mass of a material such as concrete delays peak temperatures, and reduces peak loads which in essence shifts the energy demand of the building to 'off peak' periods, when utility rates may be lower.



## CONTENT

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#### SITE-CAST FLAT SLAB CONSTRUCTION

- **OVERVIEW**

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### SITE CAST FLAT SLAB CONSTRUCTION

#### OVERVIEW

Advantages associated with in-situ concrete system:

Cast-in-place concrete may be used for nearly all types of concrete elements, including foundations, slab-on-grade, walls, beams, columns, floors and roofs.



## CONTENT

### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

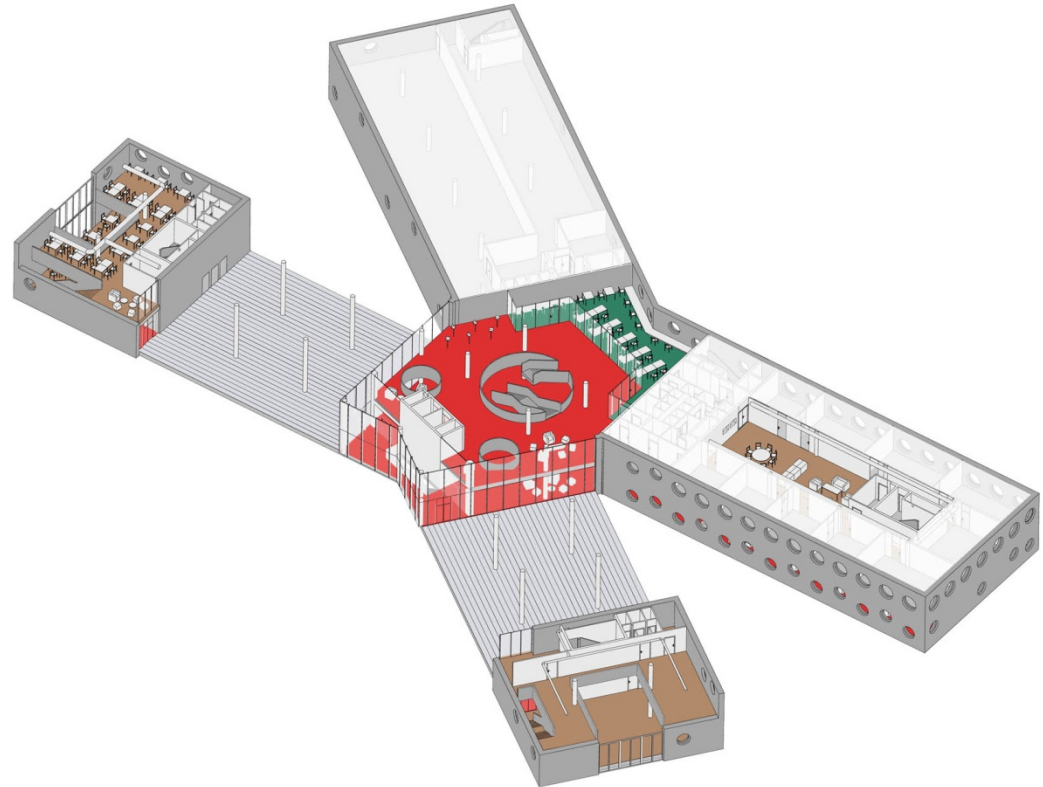
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- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)

In the U.S., approximately 75% of the concrete used is cast-in-place concrete made in ready mixed concrete plants and delivered in concrete trucks to the construction site. This is due in part to the availability of the material and cost efficiency.

The five-story building represents a concrete construction with the final visual in the form of a monolithic concrete façade. The original shape of the building is the precast concrete letter “X”.



## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
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- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

#### RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)

The structure is made from in situ cast concrete – both inside and outside. For heating we use the BKT system (radiant/ concealed heating/cooling inside the concrete construction).



## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

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## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

#### RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)

The interior is also made from concrete.



## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

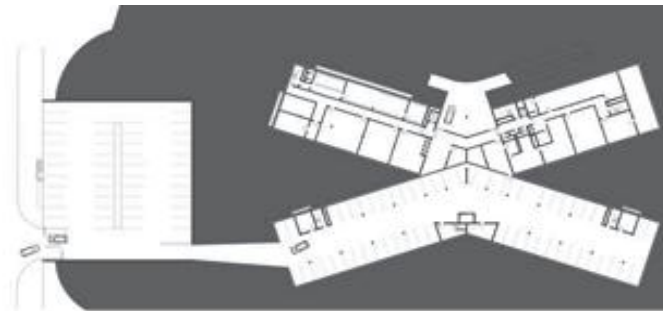
#### CONSTRUCTION TIME & COST

Construction time : 2004 – 2008

Construction cost : 394,500,000 CZK or \$204,268,150 USD

#### RESEARCH TOPICS

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- **CONSTRUCTION TIME & COST**
- ARCHITECTURAL FINISHES AVAILABLE
  
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
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- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
  
- GLOSSARY
- SOURCES



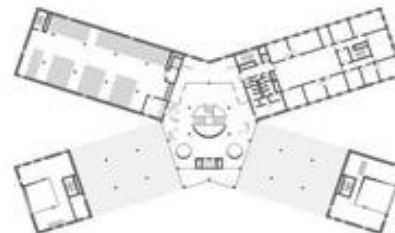
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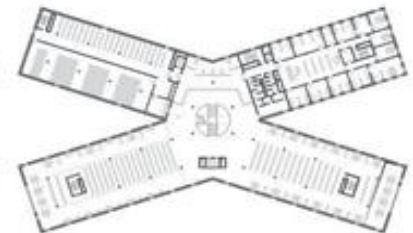
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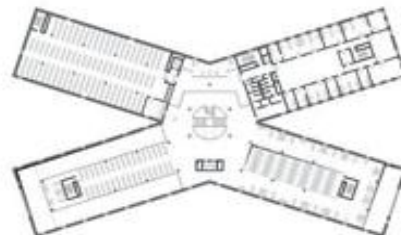
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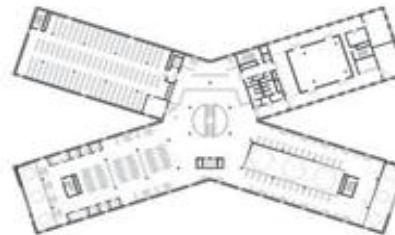
půdorys 2. NP



půdorys 3. NP



půdorys 4. NP



půdorys 5. NP

## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

#### RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)

Interior finishes are made from exposed concrete, colored floors, colored doors, white or maple acoustic panels, wooden tables and chairs, and galvanized sheets.



# TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

## CONTENT

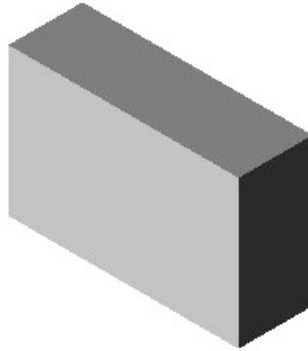
### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

### RESEARCH TOPICS

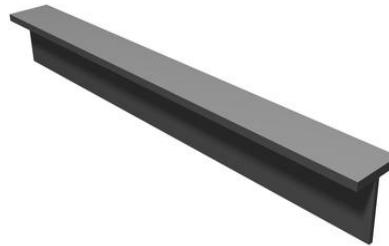
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- ARCHITECTURAL FINISHES AVAILABLE
- **SYSTEM SPANS & EFFECTIVE SPANS**
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES



CONVENTIONAL BEAM



WIDE BEAM



T- BEAM



L- BEAM

CONTENT

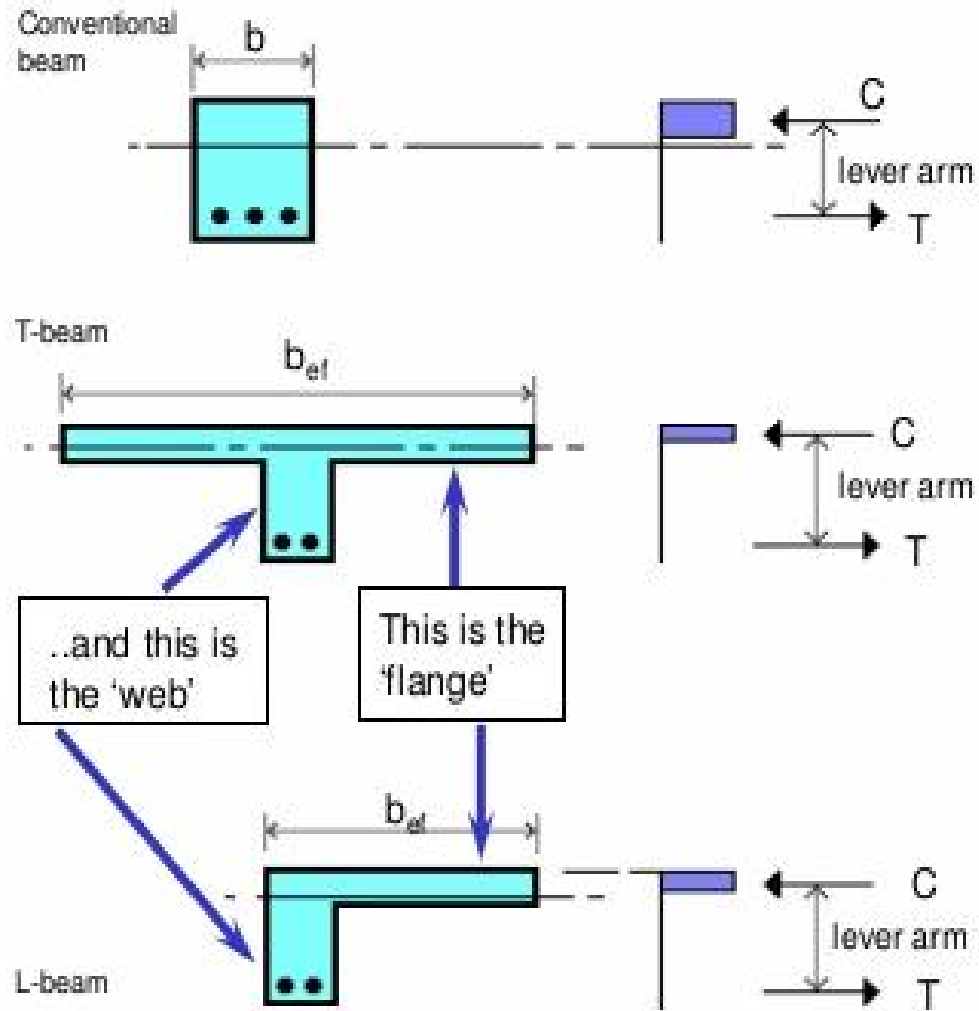
CONCRETE SYSTEM

SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- **SYSTEM SPANS & EFFECTIVE SPANS**
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES



THE T-BEAM AND L- BEAM ARE THE MOST EFFECTIVE WIDTH OF COMPRESSION FLANGE, DUE TO THEIR GREATER LEVER ARM THAT ARE AVAILABLE.

T-BEAM ARE ALSO HAVE THE STONGEST BENDING CAPABILITY.

# TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

## CONTENT

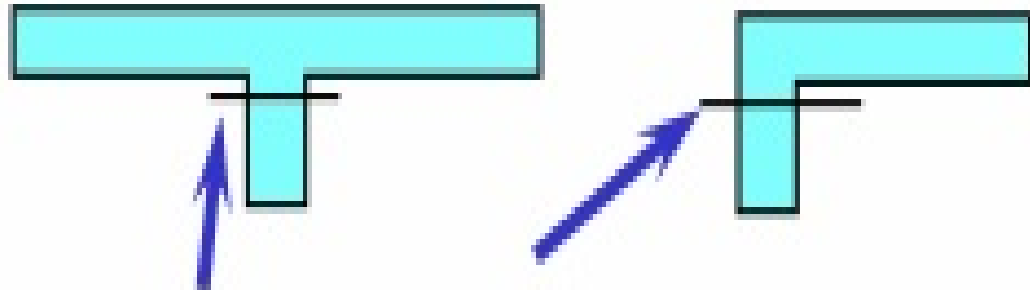
### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES



WHERE THE SHEAR FORCE THAT NEED TO BE RESISTED



MAIN AREA WHERE SHEAR FORCE TO BE RESISTED

## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
  - SYSTEM STRENGTHS & WEAKNESSES
  - CONNECTION DETAILS
  - CASE STUDY III:
- GLOSSARY
- SOURCES

##### MARCEL BREUER'S NYU HEIGHTS CAMPAUS LOCATION: BRONX, NEW YORK



# TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

## CONTENT

MADU MUSEUM LOCATION: MEXICO CITY, MEXICO ARCHITECT: FERNANDO ROMERO

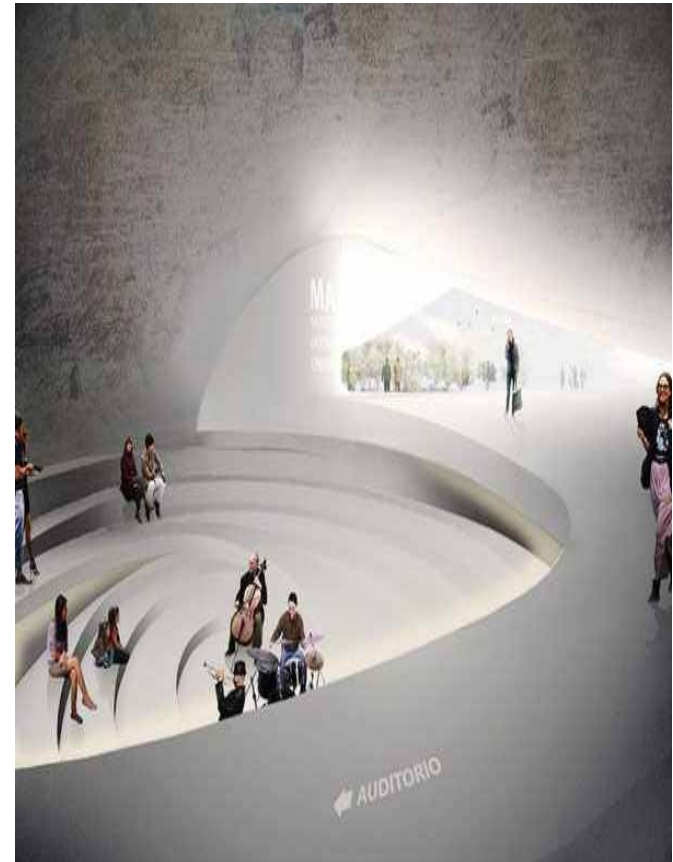
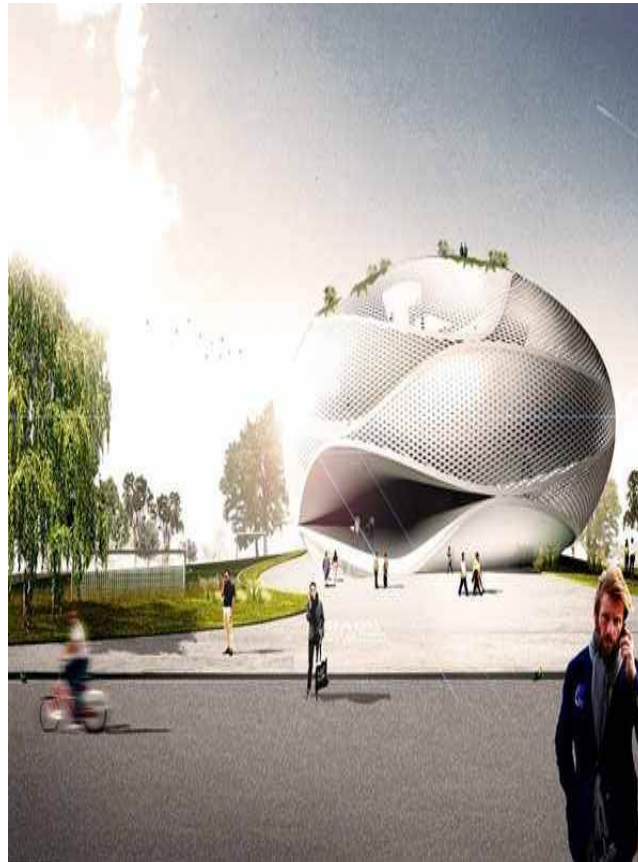
### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
  - SYSTEM STRENGTHS & WEAKNESSES
  - CONNECTION DETAILS
  - CASE STUDY III:
- GLOSSARY
- SOURCES





## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI  
CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
  - SYSTEM STRENGTHS & WEAKNESSES
  - CONNECTION DETAILS
  - CASE STUDY III:
- GLOSSARY
- SOURCES



## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

SHELL HOUSE LOCATION: KARUIZAWA, NAGANO / JAPAN ARCHITECT: KOTARO IDE



## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI  
CZECH REPUBLIC (2008)
- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
  - SYSTEM STRENGTHS & WEAKNESSES
  - CONNECTION DETAILS
  - CASE STUDY III:
- GLOSSARY
- SOURCES

LOCATION: OPORTO, SPAIN ARCHITECT: PAULO FERNANDES DA SILVIA  
BALCONY UNIQUE ASYMMETRICAL DESIGN IN APARTMENT BUILDINGS



## CONTENT

### CONCRETE SYSTEM

#### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

### RESEARCH TOPICS

- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### GLOSSARY

**Formwork:** Is the term given to either temporary or permanent moulds into which concrete or similar materials are poured.

**Thermal mass:** Thermal mass is the term used to describe a material that absorbs and stores heat energy. In a building system it is the mass of the building element that stores heat during the hottest periods of the day and releases the heat during cooler periods.

## TRILLIUM GROUP – RESEARCH ASSIGNMENT (CONCRETE)

### CONTENT

#### CONCRETE SYSTEM

##### SITE-CAST FLAT SLAB CONSTRUCTION

- OVERVIEW

#### RESEARCH TOPICS

- CONSTRUCTION TIME & COST
- ARCHITECTURAL FINISHES AVAILABLE
- CASE STUDY I: RESEARCH LIBRARY IN HRADEC KRALOVE BY PROJEKTIL ARCHITEKTI CZECH REPUBLIC (2008)
- SYSTEM SPANS & EFFECTIVE SPANS
- FLEXIBILITY OF SYSTEM & DIVERSITY OF FORMS
- CASE STUDY II:
- SYSTEM STRENGTHS & WEAKNESSES
- CONNECTION DETAILS
- CASE STUDY III:
- GLOSSARY
- SOURCES

### SOURCES

#### Images

<http://www.arbloc.com/>

[http://www.constructionweekonline.com/article-8165-board-meeting/#.Uje6OT\\_zrHA](http://www.constructionweekonline.com/article-8165-board-meeting/#.Uje6OT_zrHA)

<http://inplacearchitecture.com/blog/?cat=10>

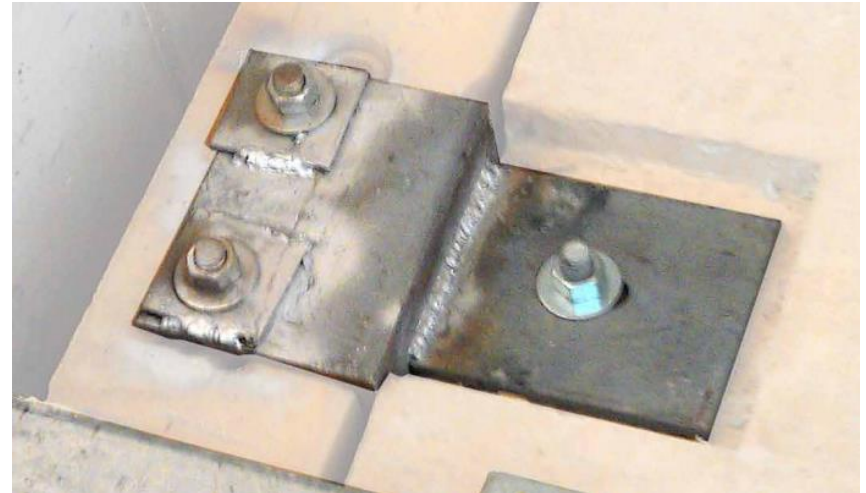
#### Case Study I

<http://www.archdaily.com/23731/research-library-in-hradec-kralove-projektil-architekti/>

# Connections Details

## **Bolted Connections:**

Bolted connections simplify and speed-up the erection operation, because the connection is positive immediately. Final alignment and adjustment can be made later without tying up crane time. Bolting should be in accordance with the erection drawings, using material specified by the designer.



# Connections Details

## Welded Connections:

Welded connections are the most common and typical connection used in the erection of precast concrete. These connections are structurally efficient and adjust easily to varying field conditions.

The connections are usually made by placing a loose plate between two structural steel plates that are embedded both in the cast-in-place or the precast concrete panel and welded together. Some connections are designed to bend and yield in one direction while remaining rigid in all other directions. Welded connections should be installed exactly as shown on the erection drawings and details.

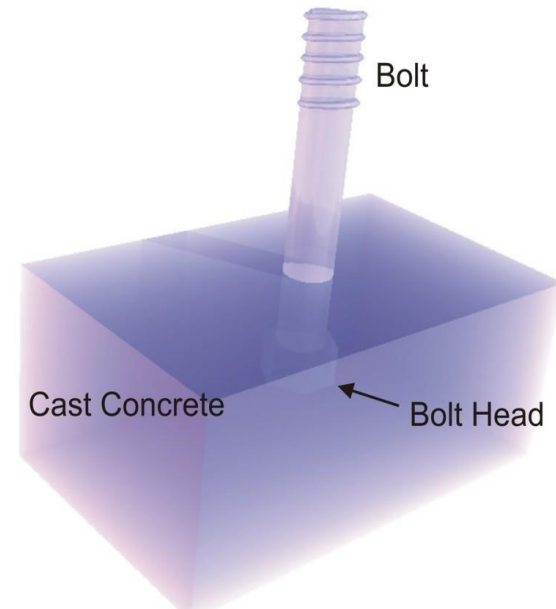


# Connections Details

## Dowel/Anchor Bolt Connections:

In a dowel connection, the strength of dowels in tension or shear depends on dowel diameter, embedded length and the bond developed. Good practice is to provide sufficient embedment to develop the full dowel strength.

Threaded anchor bolts and rebar anchor dowels that protrude from the foundation are the critical first connection to precast members. Usually, this work is performed by a subcontractor not responsible to the erector. It is important that these items be placed accurately in both plan and vertical alignment.





# Systems strengths and weaknesses

- **Advantages of Pre-cast Concrete:**
  - Pre-cast concrete slabs are usually the correct size as it is manufactured off site.
  - Pre-cast concrete saves a lot of time on site as it is manufactured off site.
  - Pre-cast concrete also saves a lot of space on site as pre-cast concrete is usually on site when required.
  - Pre-cast concrete saves money in terms of labour on site as pre-cast concrete can usually be assembled by semi skilled operatives.



# Systems strengths and weaknesses

- **Disadvantages of Pre-cast Concrete:**
  - Pre-cast concrete lacks design and dimension flexibility as the manufacturers may only have fixed shapes and sizes.
  - Pre-cast concrete may affect the construction programme as the delivery on site may not always be on time.
  - Pre-cast concrete may incur additional financial costs as delivery on site may not always be on time.
  - Pre-cast concrete allows for a very small margin for error as the incorrect dimensions of pre-cast concrete may result in changing the entire design.

