





Project Description



Research



Cabrini-Green



Concrete Dismantle



Joints and Connections



Cabrini-Green Youth Center

Project Description

In 2000, the demands of the world population was equal to **1.2 times** the Earth's biocapacity. The world's buildings use **40%** of the world's energy and emit up to **50%** of its green house gases. Construction waste fills **25%** of the world's landfills. Much of the construction 'waste' or material that lies in landfills was designed for a long life span, yet it has been discarded long before it's time. Adopting sustainable alternatives is not only a matter of progress; it's a matter of survival.

The embodied energy of a building can make up between **6 to 25 percent** of the total energy consumption for a building over the first **50 years**. The cement industry produces **8 to 10 percent** of carbon dioxide pollution globally, making its embodied energy higher than most all other building materials. If, however, the concrete structure of that building was dismantled and the parts were used in another building, the embodied energy of the concrete material used in the second building would be virtually eliminated, save for the energy used to transport the material and set it into place. And if well built and well maintained, taking into account that concrete hardens over time, the original concrete panels will have a lifespan of several hundred years.

Along with the outstanding ecological benefits, there are also financial benefits for in the reusing of concrete and other construction material. The ecological benefits are mainly related to energy savings, especially when referring to concrete. One important factor in the ecological benefits is the distance between the existing site and new site for the material use. While the financial benefits include the saving in the disposal fee for the construction material as well as the cost for pouring concrete for the new building. This lends well to both the stakeholders of the existing building and the stakeholders of the new building - the existing building does not need to be demolished and disposed of, while new building materials do not need to be purchased for the new building. The financial benefits of concrete reuse are a very optimal attribute in a project designed for a non-profit organization.

The existing, or parent, building is the last remaining building high-rise of the infamous Cabrini-Green public housing development. It is a 15-story poured-in-place concrete structure slated for demolition. The purpose for the newly designed building is proposed to be a youth center next to the existing Francis Cabrini Rowhomes, which continue to be used as a public housing development. The youth center will house three organizations

Project Description

that are currently working in the Cabrini-Green area to tutor and mentor children and young adults. Each organization is currently housed in basements or spare spaces of other organizations and it is believed that their work would be more effective and beneficial to the community if they had their own spaces.

My main objective throughout the life of the masters project, is to research and develop a prototypical strategy for the efficient dismantle of concrete structures and effective reuse of the dismantled parts. My focus is mainly with structures that are slated for demolition and not so much with structures that have the possibility for adaptive reuse.

Project Description

goals



research and develop a prototypical strategy for efficiently dismantling a concrete structure with the purpose reusing the material for a new building



develop a prototypical strategy to reassemble dismantled pieces in new building, as well as creating mechanical joints and connections that allow for further reuse of material



design facilities to house three existing youth tutoring and mentoring organizations with three main programs: office and mentoring spaces for each organization, tutoring spaces and indoor and outdoor recreational spaces



guiding principles



MATERIAL REUSE: dismantle an existing concrete structure in the Cabrini-Green Public Housing Development area, which is slated for demolition, and reassemble pieces on a site that is 0.6 miles away with the purpose of a youth tutoring and mentoring center

DISMANTLE STRATEGY: develop a prototypical strategy for concrete dismantle with the ability to adapt to the dismantle of any other concrete structure, with the lowest possible overall financial, environmental and energy costs

NATURAL RESOURCES: use sustainable strategies in the design of the new building to capitalize on the natural resources available such as natural light exposure and thermal mass capabilities of the concrete material

SITE PRESERVATION: preserve, maintain and utilize the natural resources on the new site by designing around the mature trees currently growing on the site, using their summer shading capabilities in courtyards and outdoor gathering spaces

EXPOSE MATERIAL: make design decisions that expose the use of dismantled concrete pieces in new building as both a way to capitalize on structural capabilities of pieces and to attract youth by establishing connection between the new facilities and fond memories of childhood homes

Project Description

program

interior spaces

gym / event space	1	15600	15600 sq. ft.
educational (tutoring) space	10	800	8000 sq. ft.
foyer	1	4000	4000 sq. ft.
offices	9	400	3600 sq. ft.
mentoring spaces	12	250	3000 sq. ft.
volunteer meeting space	3	1000	3000 sq. ft.
bathroom	6	250	1500 sq. ft.
			<hr/>
			38700 sq. ft.

exterior spaces

ball playing field	1	12500	12500 sq. ft.
enclosed courtyard	1	4500	4500 sq. ft.
playground	1	4500	4500 sq. ft.
parking	1	800	800 sq. ft.
			<hr/>
			22300 sq. ft.

total 61000 sq. ft.

precedent: big dig house_single speed design

Research

As a prototype building that demonstrates how infrastructural refuse can be salvaged and reused, the structural system for this house is comprised of steel and concrete discarded from Boston's Big Dig utilizing over 600,000 lbs of salvaged materials from elevated portions of the dismantled I-93 highway. Planning the reassembly of the materials in as if it were a pre-fab system, subtle spatial arrangements are created. These materials however are capable of carrying much higher loads than standard structure, easily allowing the integration of large scale roof gardens. Most importantly, the project demonstrates an untapped potential for the public realm: with strategic front-end planning, much needed community programs including schools, libraries, and housing could be constructed whenever infrastructure is deconstructed, saving valuable resources, embodied energy, and taxpayer dollars.



Within 2 days, the house is framed: reusing steel structure and roadway panels from the big dig has sped up this phase of construction from 2 weeks to 12 hours.

To minimize fabrication time and expense, the structural pieces were reused as-is.

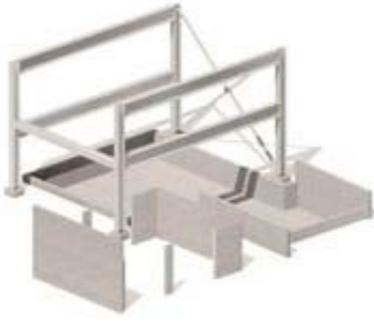


precedent: big dig house_single speed design

Research



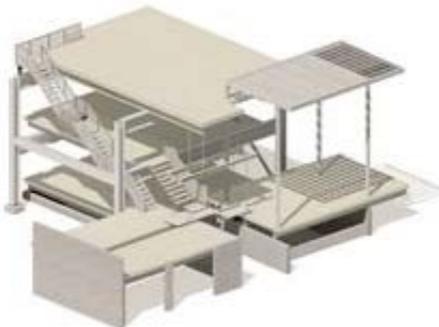
1. foundation walls with recycled aggre



2. salvaged steel framing



3. reclaimed inset panels



4. light steel framing and stairs



5. root gardens and water reclamation



6. exterior rainscreen and windows



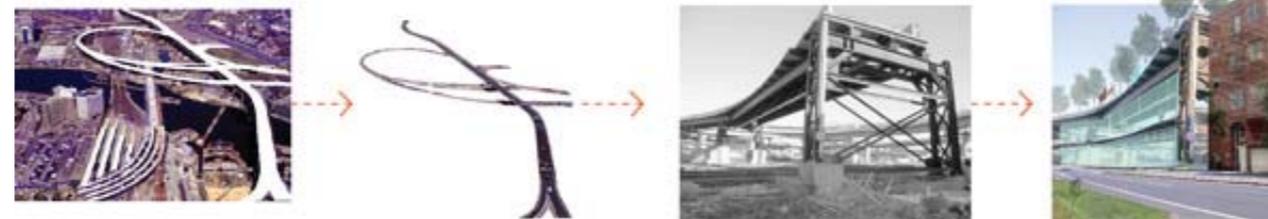
precedent: big dig building_single speed design

Research

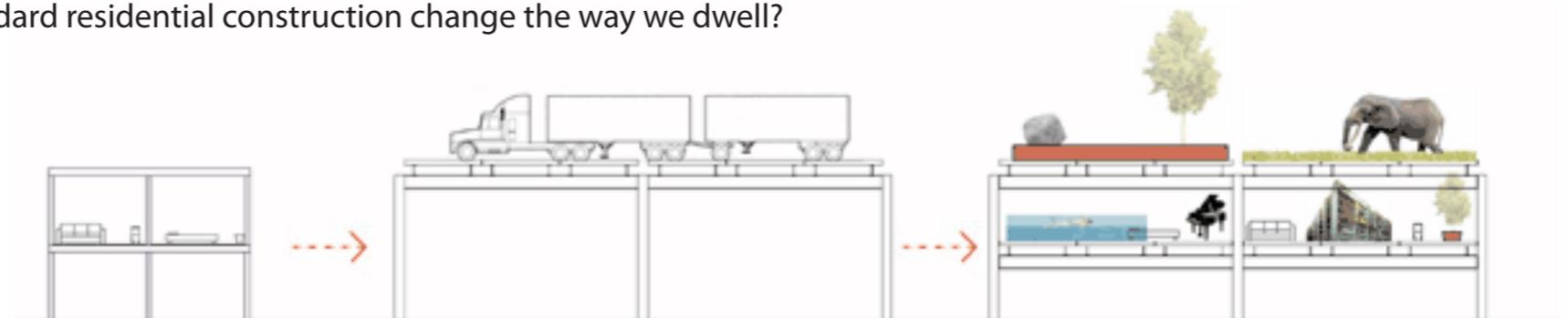
Most are familiar with Boston's ongoing "Big Dig." Few, however, give thought to the massive amount of waste that accompanies construction on this scale, namely the dismantling of the existing and temporary roadways. The Big Dig Building proposes to relocate and recycle these infrastructural materials as building components, adapting them to uses ranging from structural members to cladding. Furthermore, as these reused materials can withstand much higher loads than conventional building elements, the social ramifications of "heavy" in relation to "dwelling" can produce new and innovative results.



From Highway to Housing: What happens to the millions of tons of discarded materials from obsolete infrastructures like Boston's Big Dig? Destroying it costs millions to tax payers as well as wastes the embodied energy already stored in the materials. Dismantled and relocated, concrete and steel sections can become structural building modules adaptable to a variety of sites and programs.



Load Comparisons: Standard framing (left) can withstand 40 psf – only standard residential objects and programs can be accommodated. The existing highway overpass (middle) is designed for HS20-44 military loading and can withstand 250 psf. The Big Dig Building using salvaged materials could withstand 200psf – How might a structure that can sustain 4x the load of standard residential construction change the way we dwell?



precedent: big dig house_single speed design

Research

FROM INFRASTRUCTURE TO ARCHITECTURE

1. The site is partially excavated and perimeter wall poured - an abundance of marine grade formwork is reused.



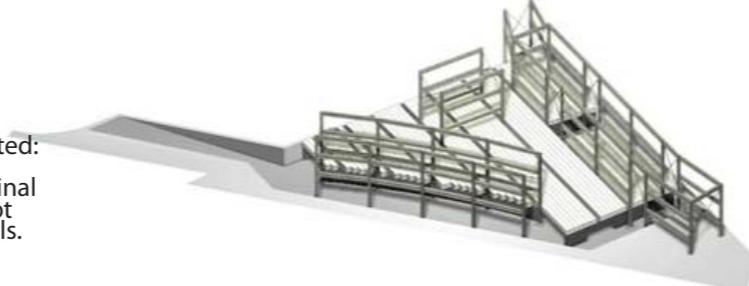
2. Bearing walls & column footings are poured - recycled aggregate from demolished Big Dig concrete is used.



3. Recycled box beams from a 'columb-free' roof over sub-grade parking and a new ground plane.



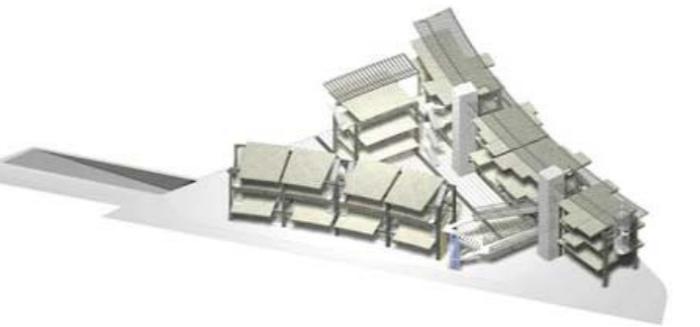
4. Recycled steel framing is erected: Construction resembles original offramps except with multi-levels.



5. Reused invert panels are set on steel framing and welded in place.



6. Lighter roof structures are connected to invert sets & vertical circulation is installed.



7. The building is clad with a rainscreen envelope made of recycled piers and pre-cast panels made from recycled aggregate.



Cross section: The assembly of infrastructural materials provides advantages such as long span underground parking, the integration of water filled trombe walls, and the ability to incorporate full scale landscapes on roofs and balconies.



precedent: benchmade knife company_dan ciorba

Research

In 2010, Benchmade Knife Company (BMK) started an expansion project at their headquarters and manufacturing plant in Oregon City, Oregon. In order to create a connection between the existing building and the new addition, 80 feet of the southeast wall had to be removed and discarded. With the help of DHR Construction, the 80 feet of the existing southwest wall that needed to be removed to make way for the new addition was removed and cut in strips of 5 feet by 20 feet.

The existing wall was tilt-up construction utilizing pre-cast concrete. The parts of the wall that were removed were dismantled cleanly to allow for further reuse. With the dismantled strips of pre-cast concrete that were removed, BMK wanted to build a retaining wall 300 foot retaining wall on the southern border of the property. There were two chief reasons that BMK wanted to reuse the concrete, rather than pouring brand newly mixed concrete. Their biggest goal was to use sustainable practices to be environmentally conscious. And by reusing materials, rather than discarding them, they achieved their biggest goal. Their second goal, one that most owners seek to achieve, was to save as much money on the project as possible. By only having to use new concrete for the foundation of the retaining wall, the project was able to save just over 1000 cubic feet of concrete, which meant saving a great deal of money. They were also able to save money on the fee that would have been charged in order to transport the discarded concrete wall to a local dump and the fee to actually dump it.



precedent: benchmade knife company_dan ciorba

Research



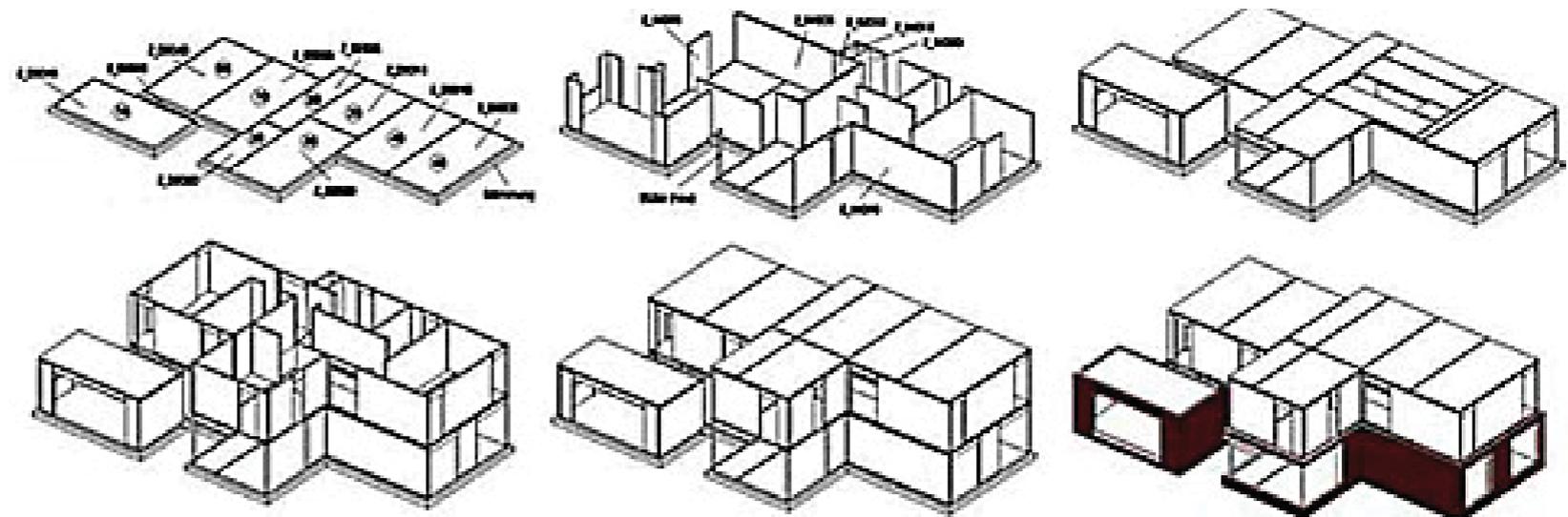
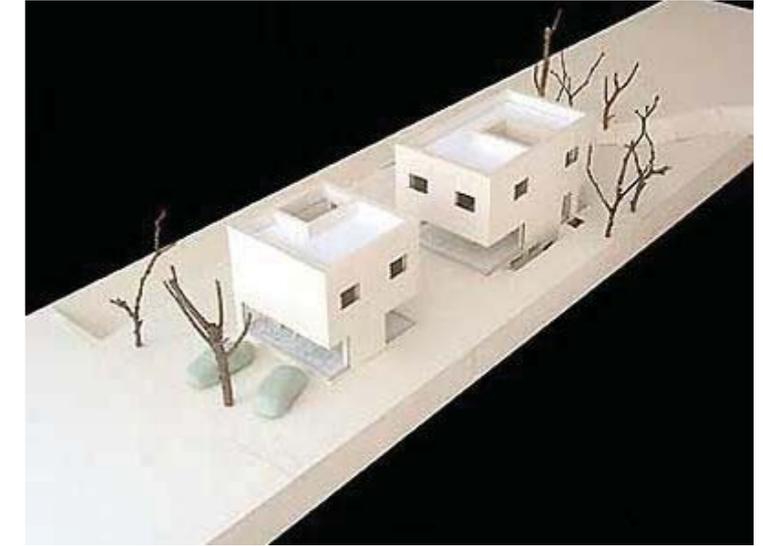
precedent: Institute for the Conservation and Modernization of Buildings

Research

In 2000, the German government announced that 350,000 Cold War era apartments would be torn down. Architect Herve Biele salvaged much of the concrete material and put it in use for building single family homes. Not only was the material free, but the company initially in charge with the demolition gave its services for free to help dismantle the concrete panels.

The concrete panels used to build the new homes are cut with a circular saw, transported to the site, and raised in place by a crane. The panels are then bolted together and adjoining panels are occasionally stabilized with steel strips while the joints between panels are filled with cement for greater stability. The panels used as floors in the new project were originally 5.5 inches thick and measured 10 by 20 feet in dimension. The exterior panels of the buildings were deemed unusable because of the amount of the harmful chemical treatment it had received along the years but the interior wall panels were used as walls in the new construction.

Biele found that the benefits were countless - for the owner, design team and the environment. Using the reused components in a new structure is 30 to 40 percent cheaper and goes up much faster than building an entirely new structural frame. If concrete panels are not reused, they are typically crushed into gravel or aggregate to create new concrete. Avoiding the dumping of the concrete panels was fiscally responsible, avoiding an expensive disposal fee, but also environmentally responsible, the (approximately) 400 liters of oil saved by reusing the concrete panels could heat an entire single family home for 20 years.



precedent: big dig house_single speed design

Research



Cabrini-Green Public Housing Development

Cabrini-Green



The Cabrini-Green Public Housing Development was built over a twenty-year period: the Frances Cabrini Rowhomes, which are currently being remodeled and will continue to serve the same purpose, began construction in 1942, the Francis Cabrini Extension began construction in 1958, and the William Green Homes began construction in 1962. The construction reflected the "urban renewal" approach to United States city planning in the mid-twentieth century. The Cabrini Extension buildings were known as the "reds," for their red brick exteriors, while the Green Homes, with reinforced concrete exteriors, were known as the "whites."

Despite the good intentions, the housing development and it turned out to be one of the most poorly planned public housing developments in United States history. Poverty and heavy gang presence were the norm throughout the life of Cabrini-Green and it quickly became notorious for gunfire, violence, and drug activity. An attempt was made to heighten security measures by welding the rear doors of each building shut but it only further intensified gang fortification. In 1992, seven-year-old Dantrell Davis was killed by a random gun shot while on his way to school with his mother. In 1997, a nine-year-old girl, known only as "Girl X", was raped and poisoned, left in a stairwell for dead. She miraculously survived the senseless attack but was paralyzed, blind and mute.

Demolition for the last standing Cabrini-Green high-rise building (1230 N. Burling) was began on March 30, 2011 and was completed on May 3, 2011.

Cabrini-Green demolition: September 27, 1995 - May 3, 2011



Cabrini-Green



1230 N. Burling

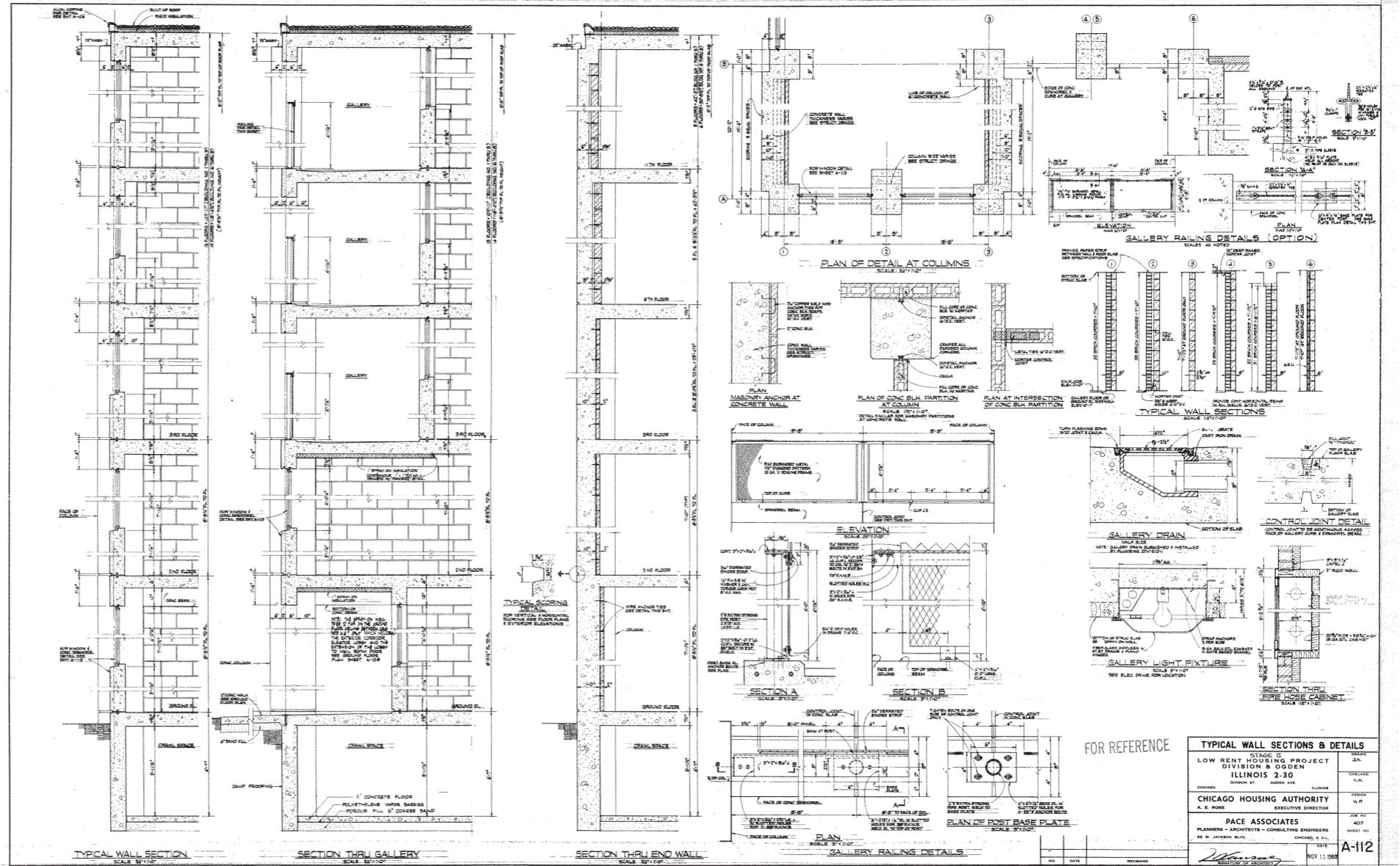


Cabrini-Green



1230 N. Burling

Cabrini-Green

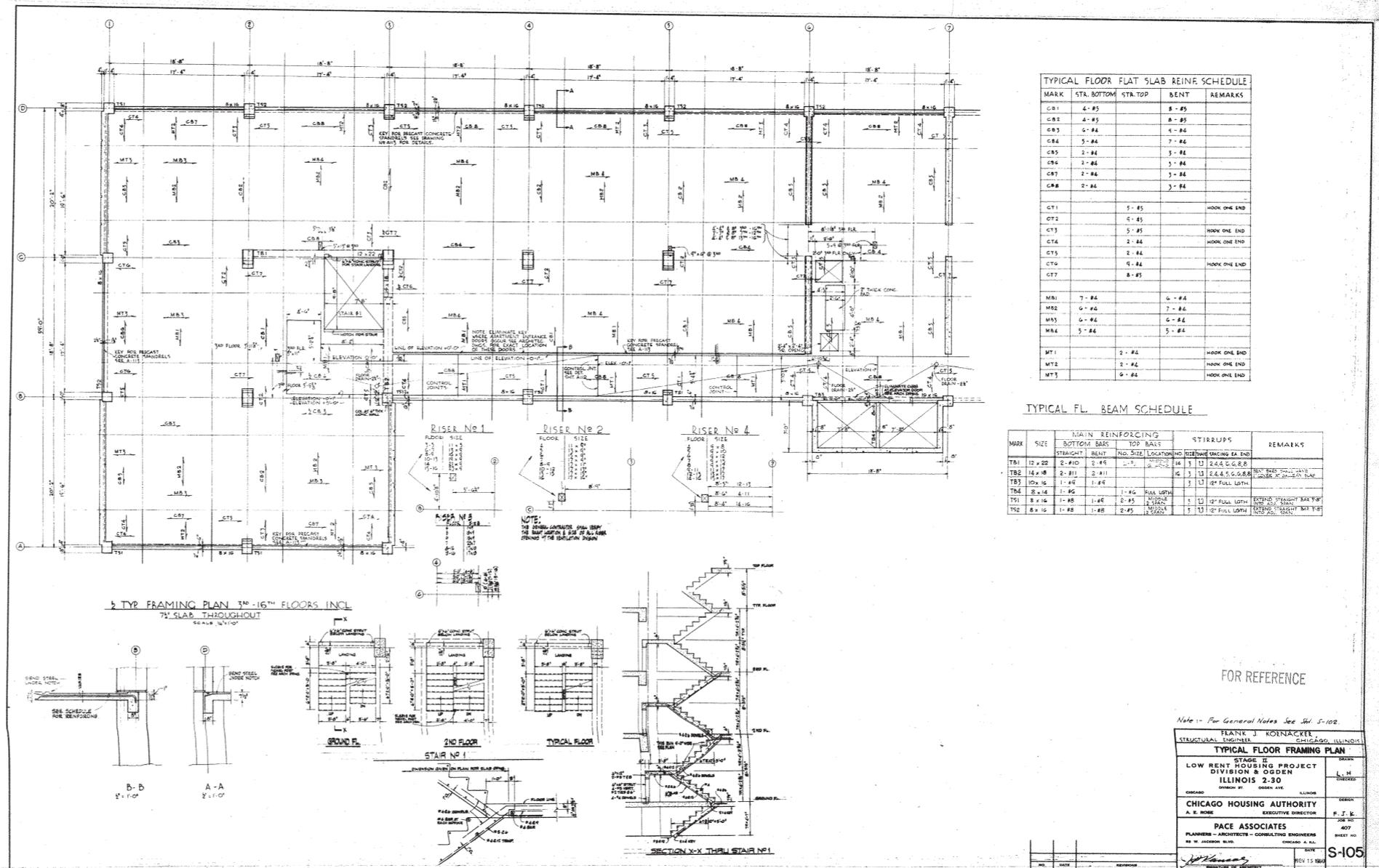


FOR REFERENCE

TYPICAL WALL SECTIONS & DETAILS	
STAGE II	SHEET
LOW RENT HOUSING PROJECT	3A
DIVISION ST. OGDEN	ILLINOIS 2-30
CHICAGO HOUSING AUTHORITY	EXECUTIVE DIRECTOR
A. E. ROSE	EXECUTIVE DIRECTOR
PACE ASSOCIATES	PLANNERS - ARCHITECTS - CONSULTING ENGINEERS
407	407
NOV 15 1968	A-112

1230 N. Burling

Cabrini-Green



TYPICAL FLOOR FLAT SLAB REINFC SCHEDULE

MARK	STA. BOTTOM	STA. TOP	BENT	REMARKS
CB1	4'-#5		8'-#5	
CB2	4'-#5		8'-#5	
CB3	6'-#4		4'-#4	
CB4	5'-#4		7'-#4	
CB5	2'-#4		3'-#4	
CB6	2'-#4		3'-#4	
CB7	2'-#4		3'-#4	
CB8	2'-#4		3'-#4	
CT1		5'-#5		HOOK ONE END
CT2		4'-#5		
CT3		5'-#5		HOOK ONE END
CT4		2'-#4		HOOK ONE END
CT5		2'-#4		
CT6		4'-#4		HOOK ONE END
CT7		8'-#5		
MB1	7'-#4		6'-#4	
MB2	6'-#4		7'-#4	
MB3	6'-#4		6'-#4	
MB4	5'-#4		5'-#4	
MT1		2'-#4		HOOK ONE END
MT2		2'-#4		HOOK ONE END
MT3		6'-#4		HOOK ONE END

TYPICAL FL. BEAM SCHEDULE

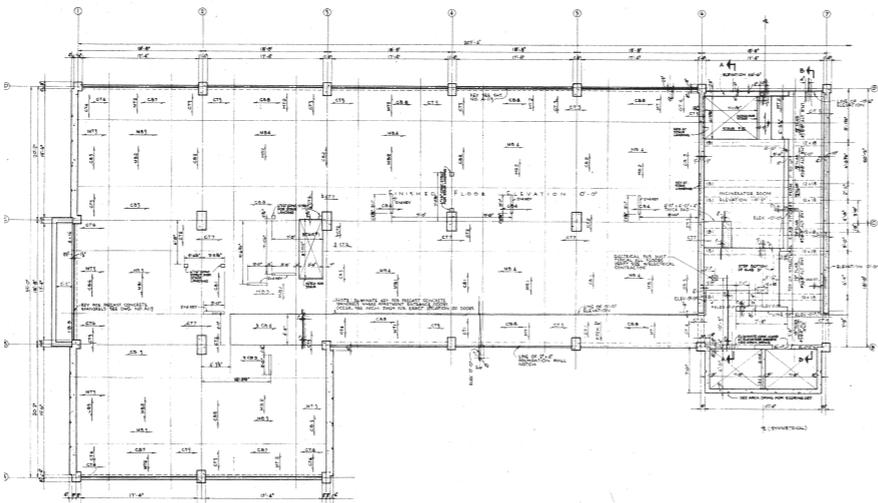
MARK	SIZE	MAIN REINFORCING		STIRRUPS	REMARKS
		BOTTOM BARS	TOP BARS		
TB1	12 x 22	2-#10	2-#8	14 3/4" @ 16"	
TB2	14 x 18	2-#11	2-#11	16 3/4" @ 16"	
TB3	10 x 16	1-#4	1-#4	3 1/2" @ 16"	
TB4	8 x 14	1-#4	1-#4	3 1/2" @ 16"	
TB5	8 x 14	1-#4	2-#5	3 1/2" @ 16"	
TB6	8 x 14	1-#4	2-#5	3 1/2" @ 16"	

FOR REFERENCE

Note: For General Notes See Set S-102.

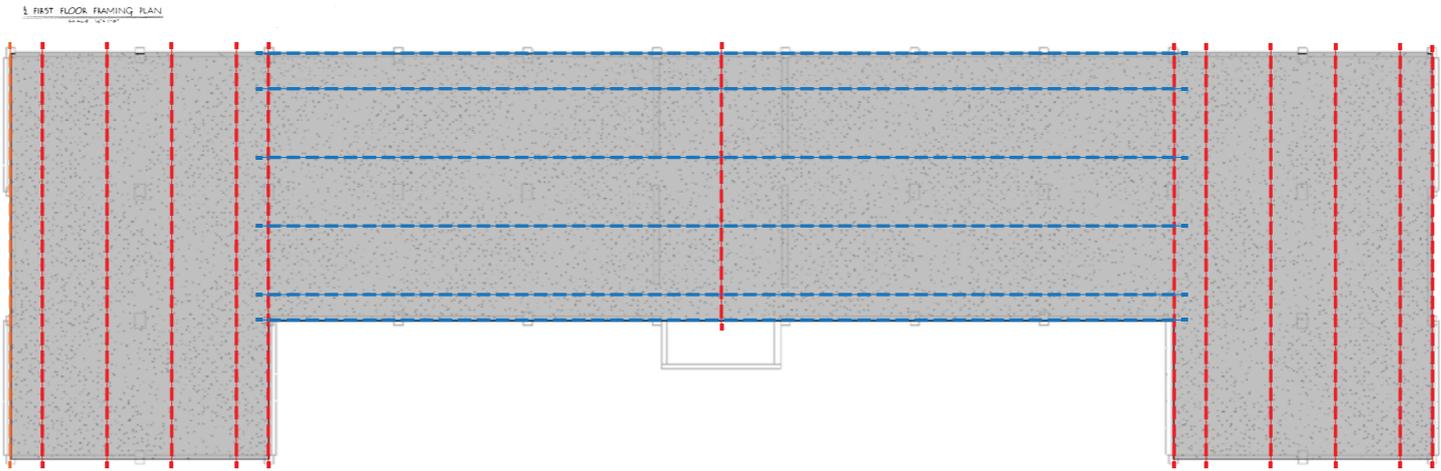
PLANNING ENGINEER FRANK J. KOINACKY, CHICAGO, ILLINOIS	
TYPICAL FLOOR FRAMING PLAN	
STAGE 2 LOW RENT HOUSING PROJECT DIVISION 8 OGDEN ILLINOIS 2-30	DESIGNER L. H. FISHER
CHICAGO HOUSING AUTHORITY EXECUTIVE DIRECTOR A. E. ROBE	DESIGNER P. J. K.
PACE ASSOCIATES PLANNERS - ARCHITECTS - CONSULTING ENGINEERS 40 W. JACKSON STREET, CHICAGO, ILL.	
SHEET NO. S-105	DATE REV 13 1960

Concrete Dismantle

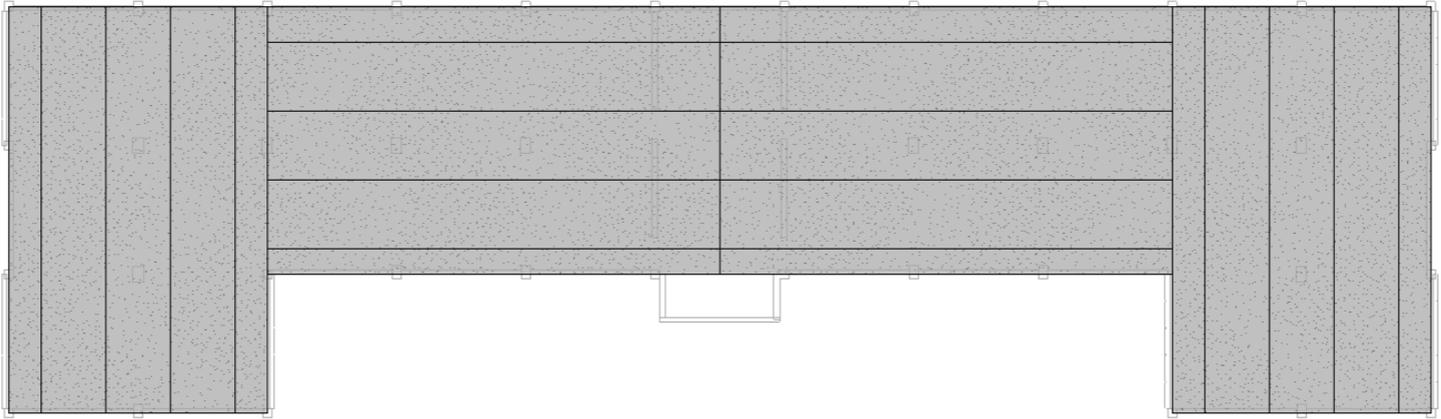


Using the framing plan, cuts are made along the middle and column beam lines

Concrete Dismantle



The red lines are each one single cut in one direction while the blue lines are each a single cut in the perpendicular direction



When dismantled and removed, these are the sizes of each piece: vertical (in the diagram) pieces are 59'0" x 9'4" and 59'0" x 4'8" while horizontal pieces are 65'4" x 10'0", 65'4" x 3'8" and 65'4" x 5'4"

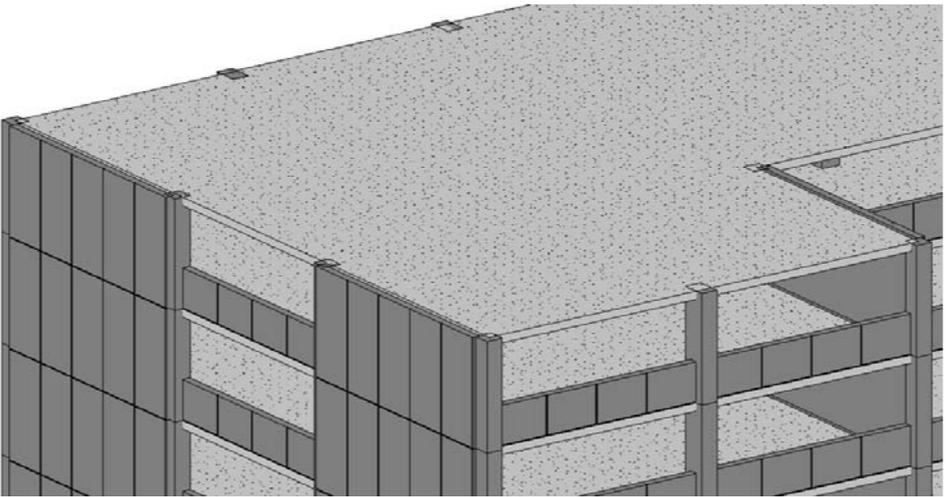
Dismantle Sequence



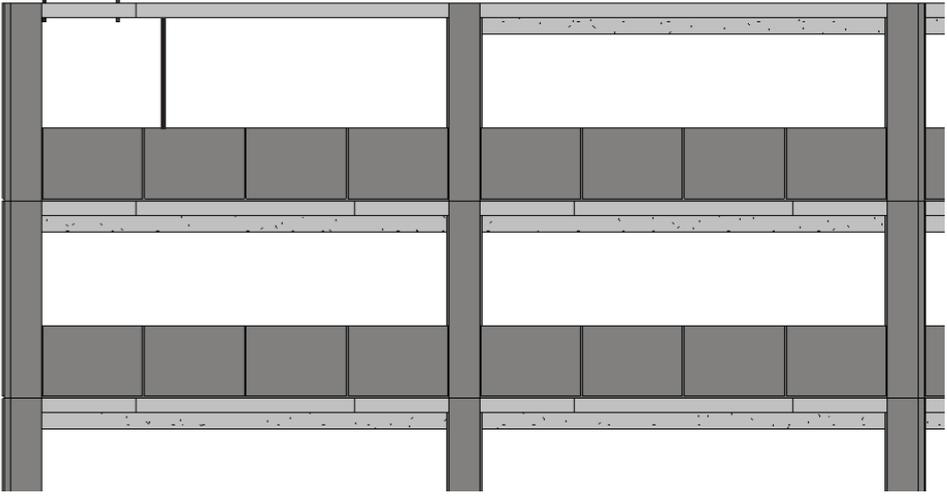
Concrete Dismantle



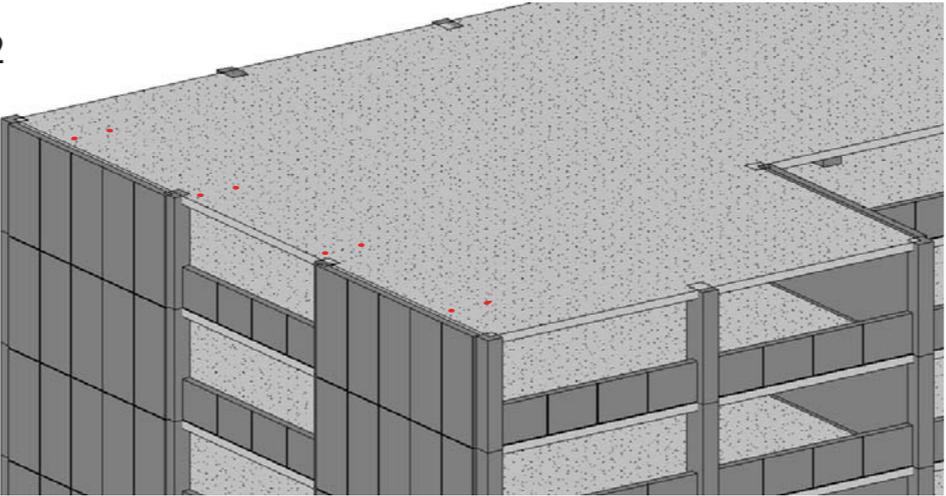
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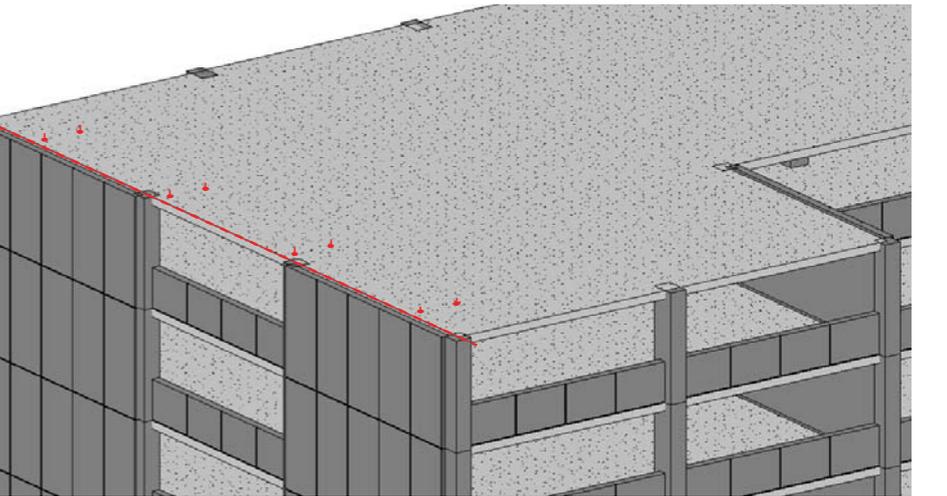
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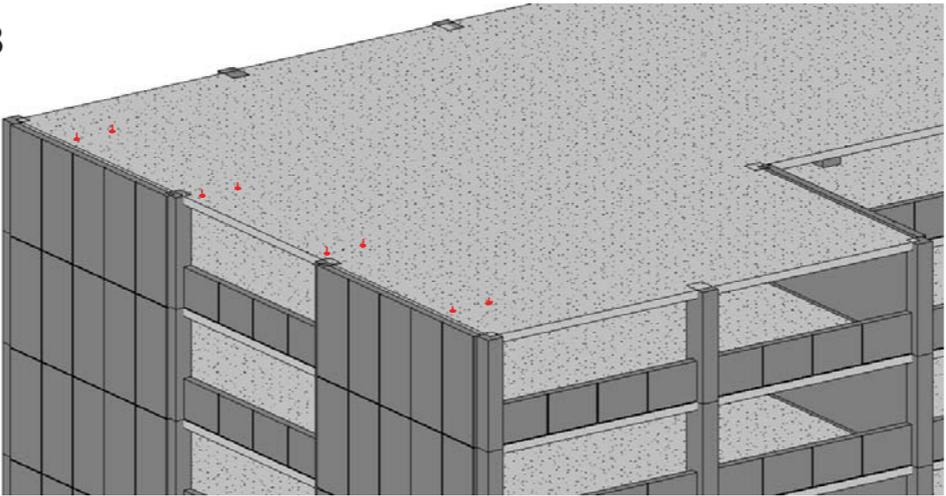
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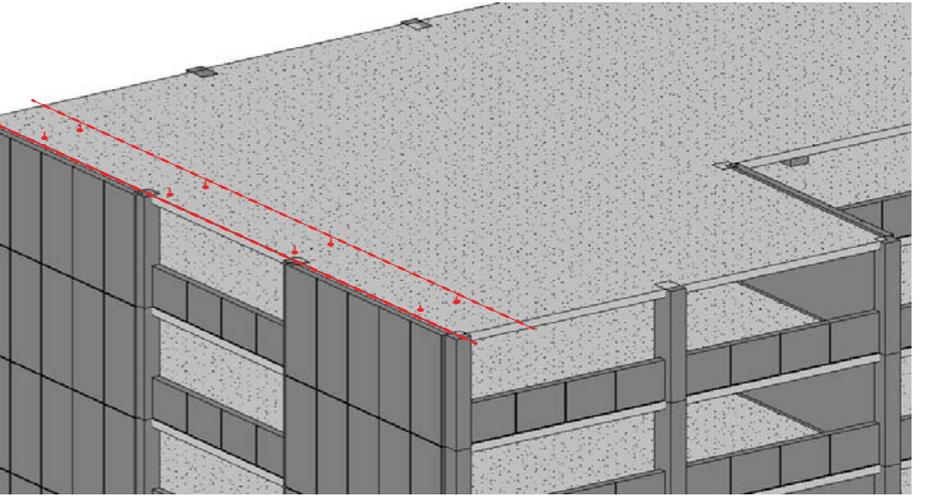
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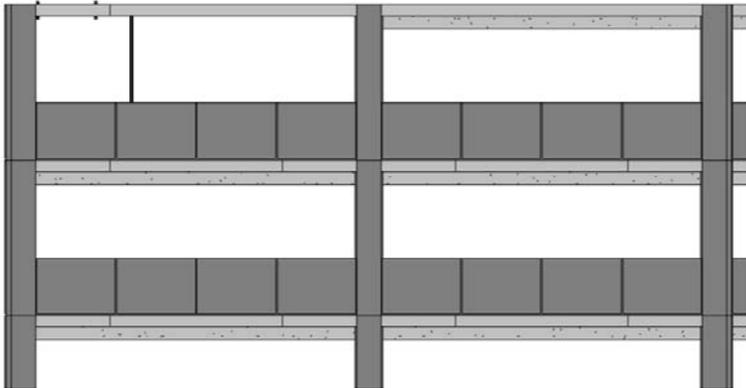


- 1. Original condition of typical floor slab
- 2. Drill two holes ever 15x floor thickness: 15' 7.5"
- 3. Insert pins and cables to handle each piece
- 4. Insert shoring
- 5. Make first cut
- 6. Make second cut

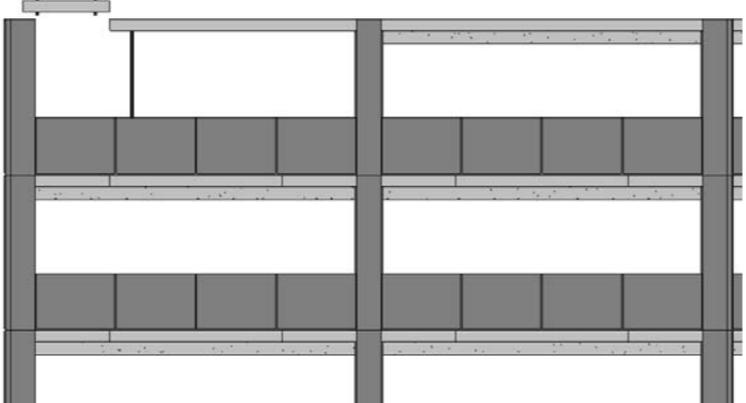
Dismantle Sequence



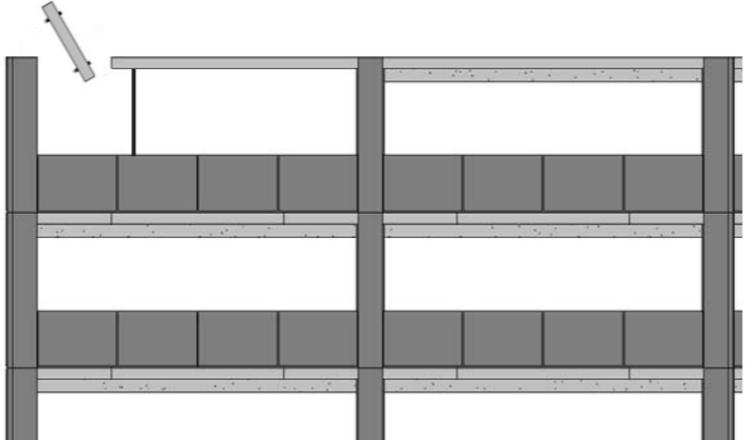
Concrete Dismantle



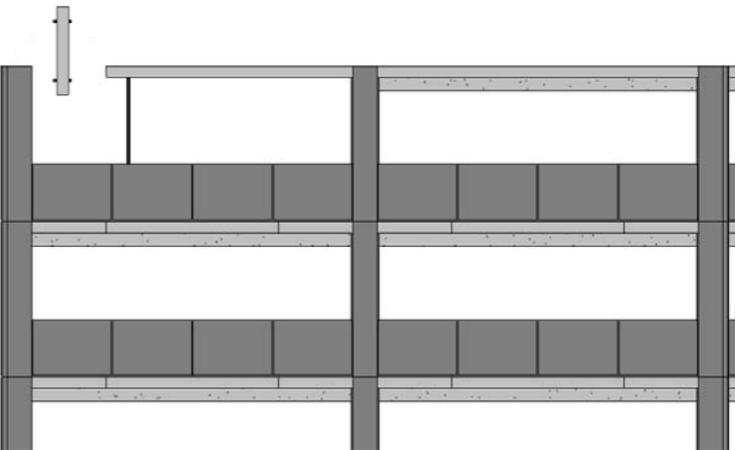
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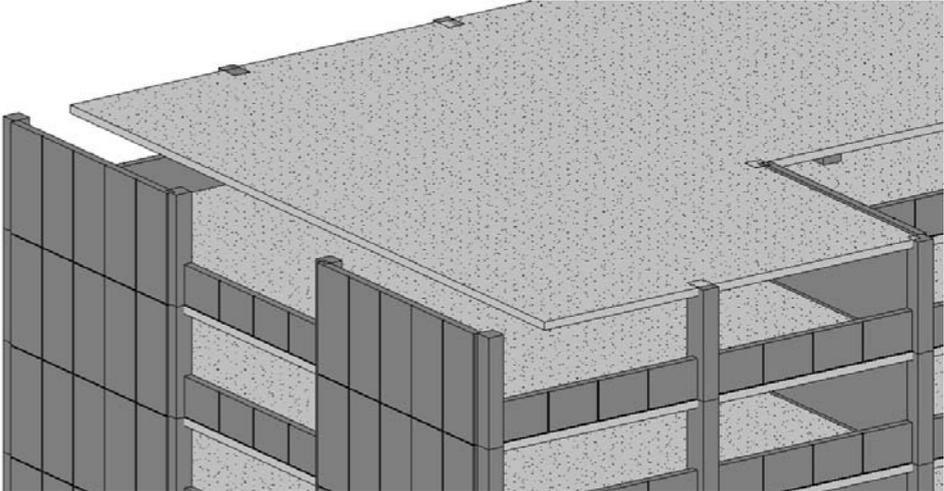
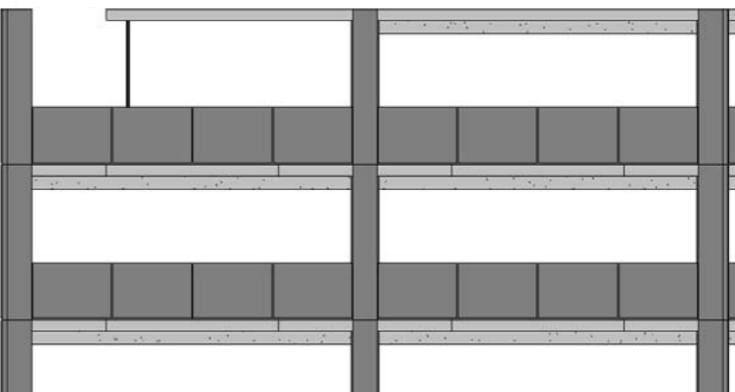
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9



10

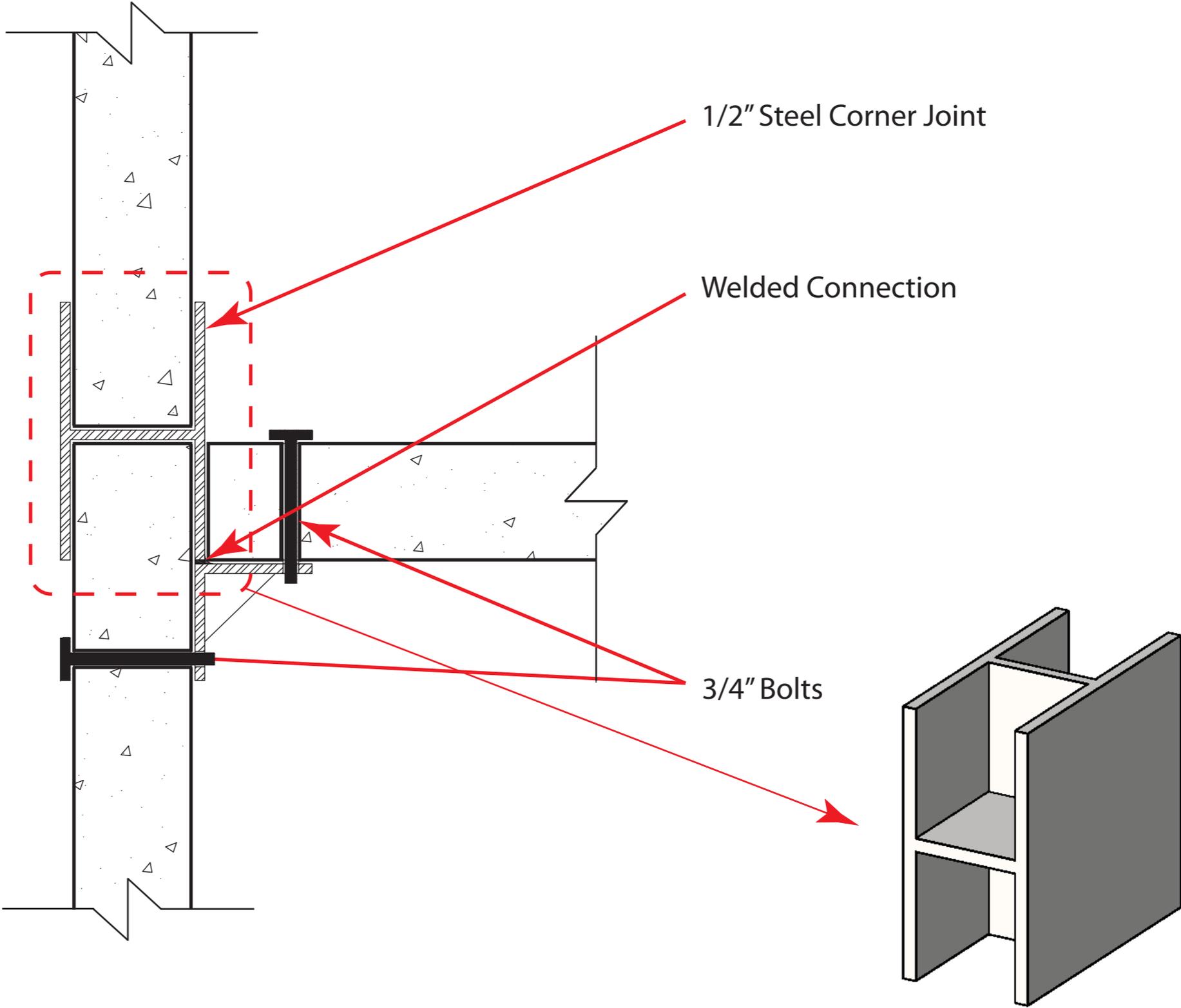


7 . Lift up dismantled piece 8 - 9. Turn dismantled piece into a beam for easier and more secure handling
10. Start with the next piece, securing the shoring as needed

Typical Joint



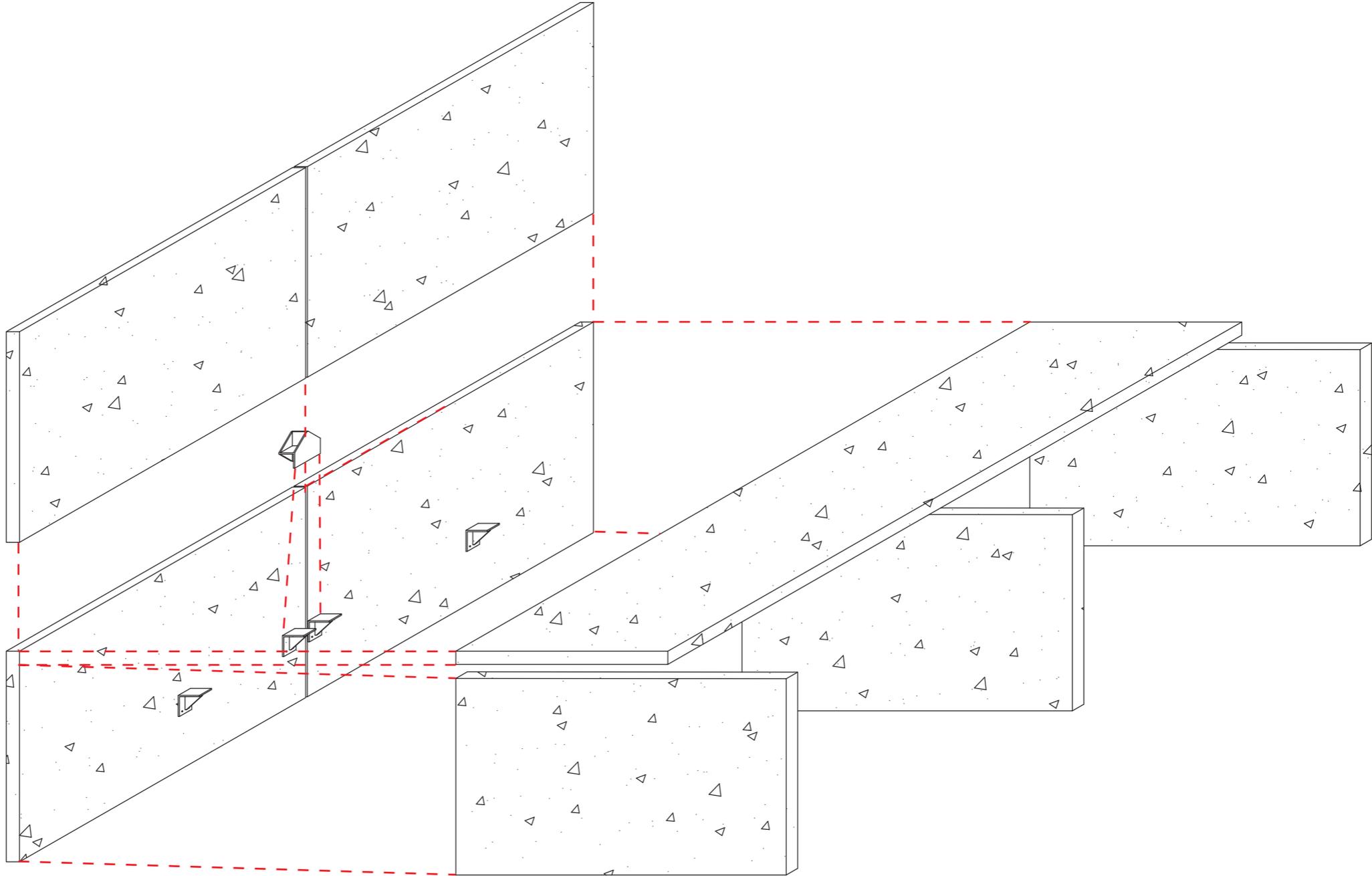
Joints & Connections



Typical Joint



Joints & Connector





Youth Center

site



Distance from 1230 N. Burling to the site where the material will be reused is only 0.6 miles away on (mainly) one residential street.



site



Youth Center



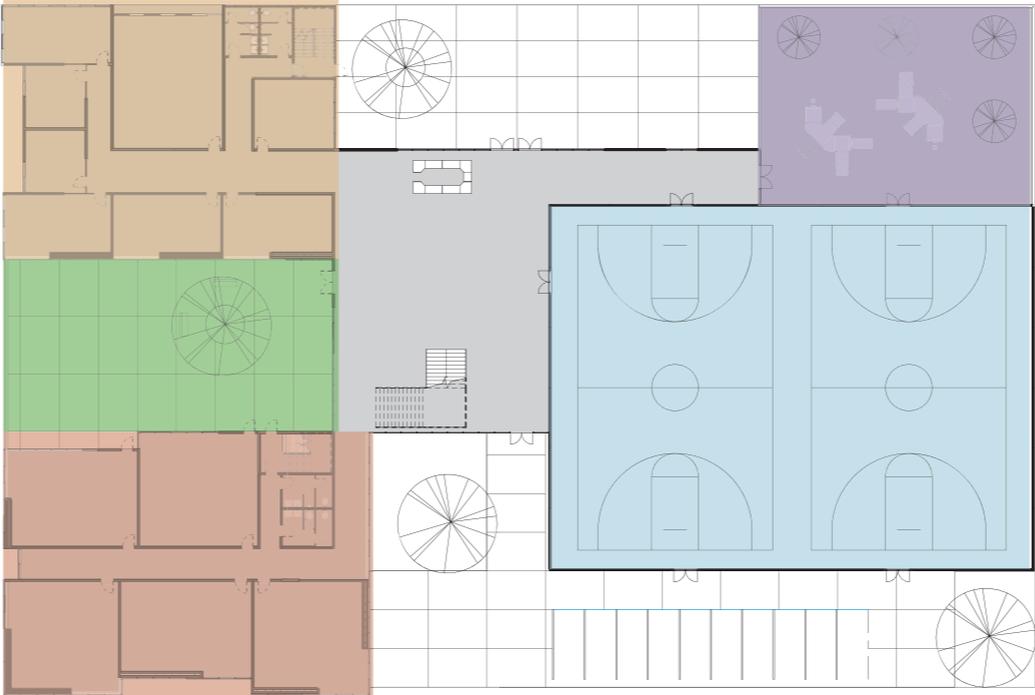
One guiding principle of design was to preserve, maintain and utilize the natural resources on the site of the youth center by designing around the mature trees currently growing on the site, using their summer shading capabilities in courtyards and outdoor gathering space



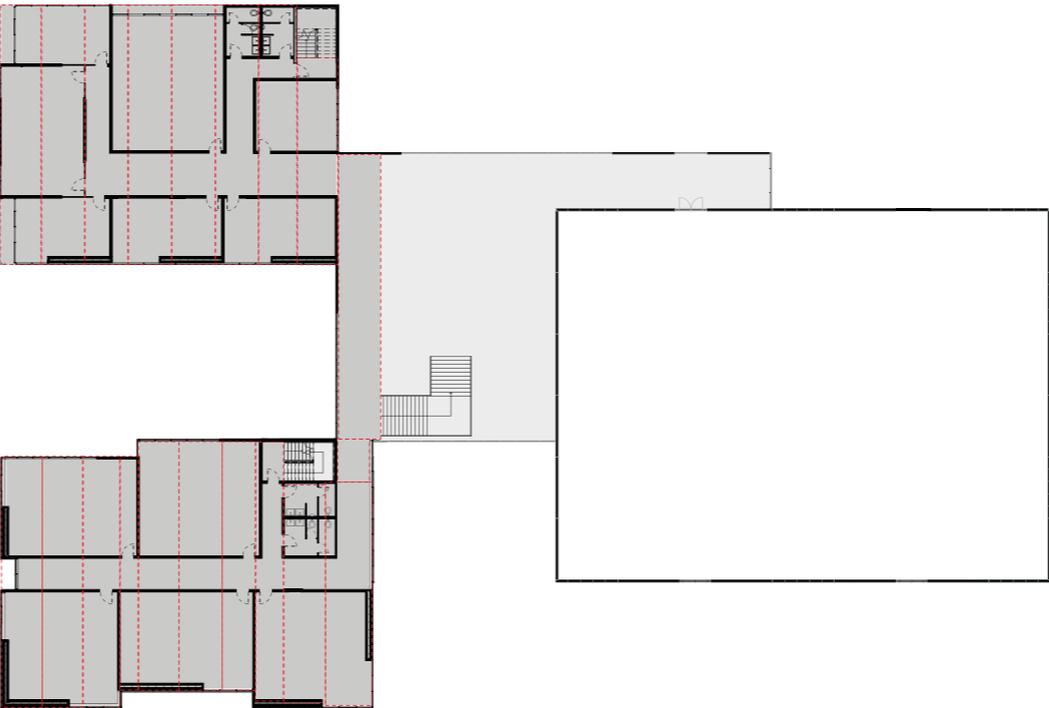
Cabrini-Green Youth Center



Youth Center



-  Offices, mentoring spaces and volunteer gathering
-  Tutoring spaces
-  Gym
-  Enclosed Playground
-  Enclosed Courtyard



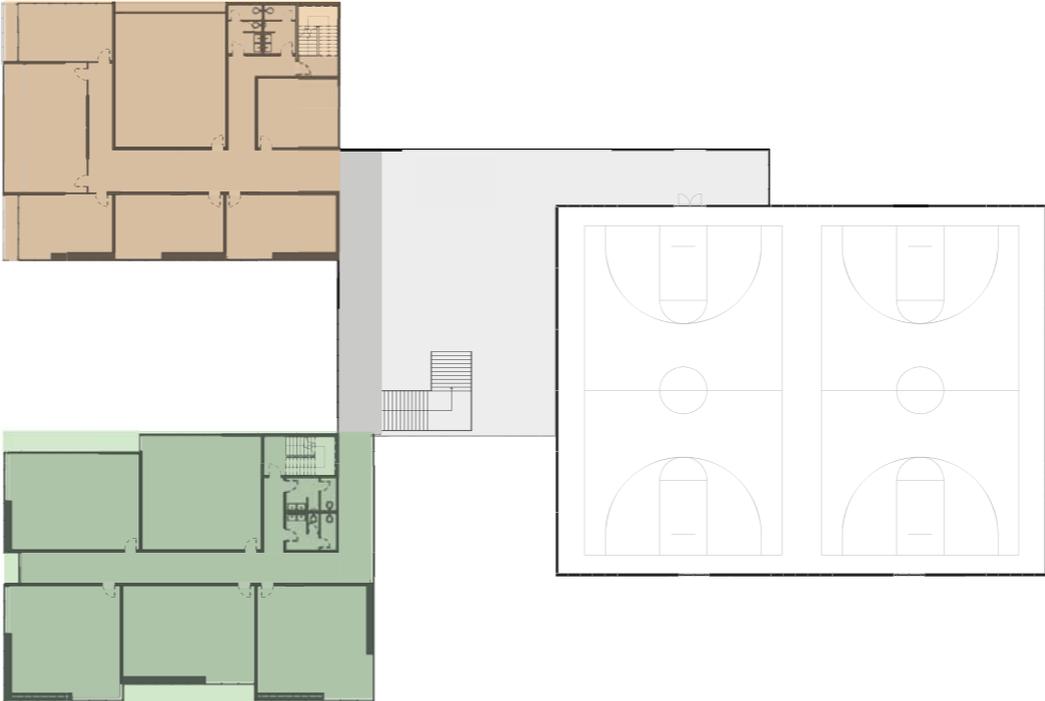
Above: First Floor Plan

Below: Example of how dismantled panels will be assembled as floor slabs in the newly designed building

Cabrini-Green Youth Center



Youth Center



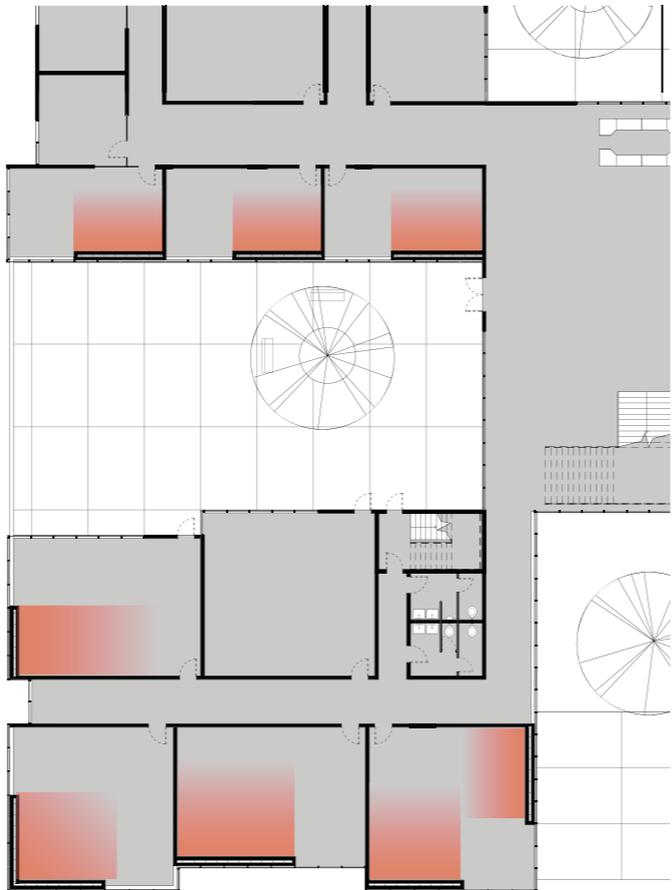
Second Floor Plan

-  Offices, mentoring spaces and volunteer gathering
-  Tutoring spaces

Cabrini-Green Youth Center



Youth Center



Above: use of cantilever structural system to display structural capabilities of dismantled pieces

Below: utilization of a Trombe Wall system on south facing facades to show thermal mass capabilities of material: doubling up two dismantled pieces and using a curtain wall glazing system to seal the material from the exterior

Cabrini-Green Youth Center



Youth Center



View from Southwest



West Perspective



View from Northeast

Cabrini-Green Youth Center



Youth Center



Enclosed courtyard can be used for exterior gathering spaces.

Cabrini-Green Youth Center



Youth Center

