



Agricultural Utilization Research Institute

RENEWABLE MATERIALS IN SUSTAINABLE BUILDING PRODUCTS

August 20, 2020

The Road To
IMPACT
2021



Renewable Materials in Sustainable Building Products

Chat Question

Are you familiar with biobased products in construction?



Renewable Materials in Sustainable Building Products

Course Description

The session is designed to give an understanding of how sustainable and renewable construction materials in the marketplace are used. New products will also be introduced.





Renewable Materials in Sustainable Building Products

Learning Objectives (Intermediate Level):

- **Objective 1:** Upon completion, participant will possess broad category knowledge of sustainable, renewable, and biobased building materials available in the market today.
- **Objective 2:** Upon completion, participant will have knowledge of specific key opportunities to utilize sustainable, renewable and biobased building materials.
- **Objective 3:** Upon completion, participant will understand the benefits of sustainable, renewable and biobased building materials to customers.
- **Objective 4:** Upon completion, participant will understand the improving economics of sustainable, renewable and biobased building materials.

MODERATING TODAY

HAROLD STANISLAWSKI, MS



Business Development Director Agricultural Utilization Research Institute

Stanislawski works with AURI staff and clients to further the development of agricultural commodities, coproducts, renewable energy, food and biobased materials.



Meet the Panel

- **Karen Coble Edwards**, Consultant, United Soybean Board/KCE Public Affairs Associates/USB
- **Brent Aufdembrink, PhD**, Cargill/Global Director of Industrial Applications Technology within Cargill BioIndustrial
- **Todd Mathewson**, Director of Market Development, Just BioFiber
- **Dean Dovolis, MAUD**, DJR Architecture



An aerial photograph of a residential neighborhood. A wide, turquoise-colored canal runs vertically through the center of the image. To the left of the canal, there are several houses with red-tiled roofs and swimming pools. To the right of the canal, there is a paved road with a white dashed line down the center. Further to the right, there are more houses and a small dock with several boats. The water in the canal is very clear and bright green.

Introducing Cargill Bioindustrial

Bioindustrial solutions answer growing demand.

With today's consumers, sustainability
is the status quo.

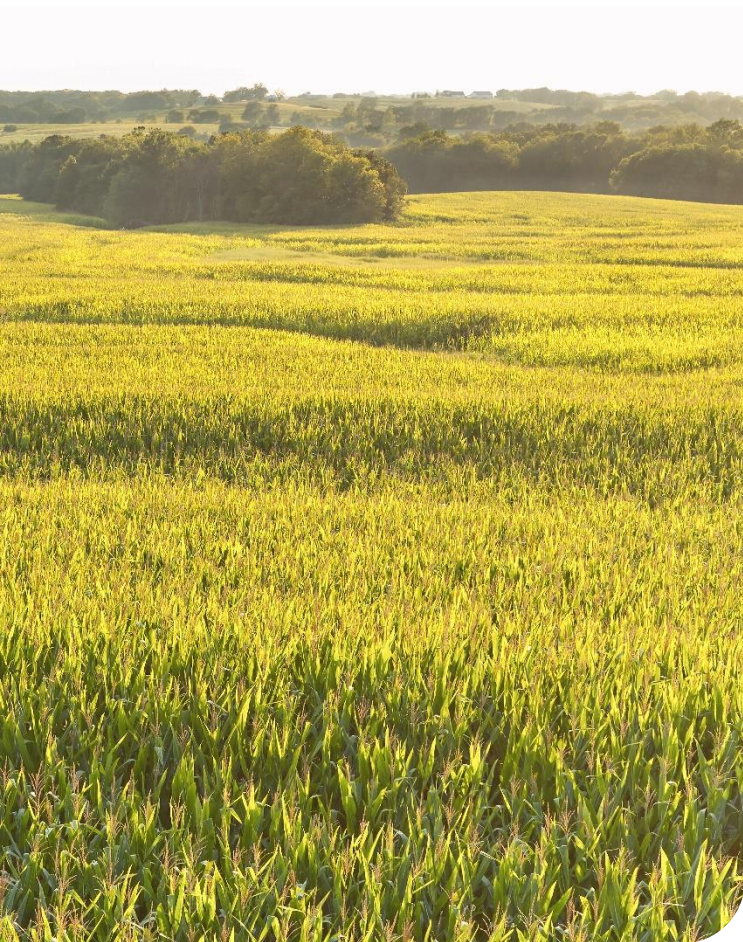




Bioindustrial solutions answer growing demand.

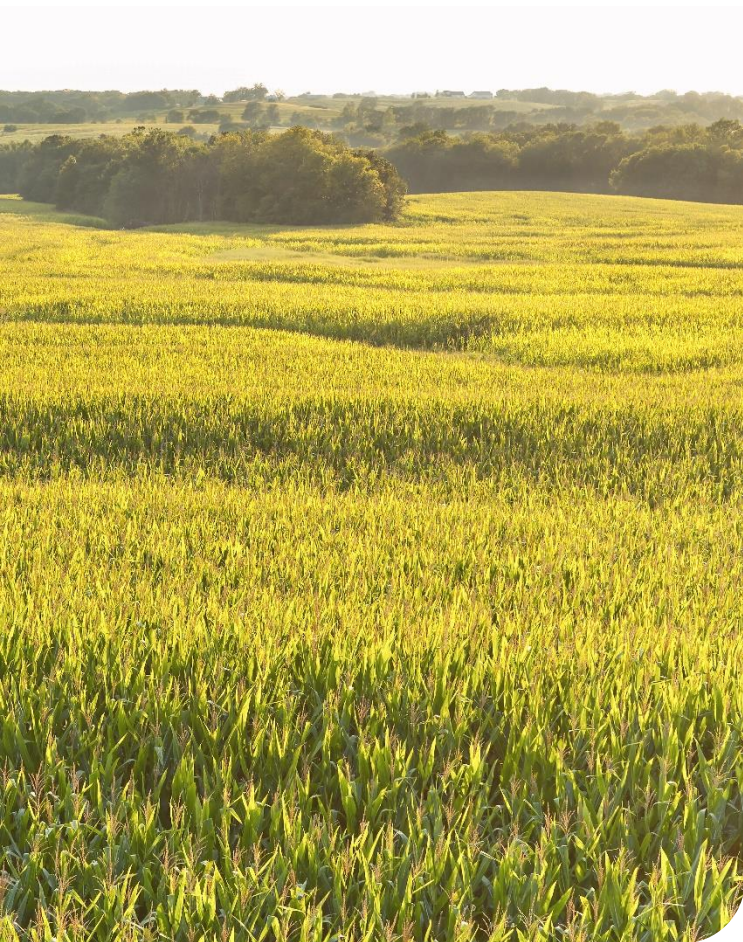
With today's consumers, sustainability is the status quo.

- Heightened consumer awareness of health hazards
- Consumer demand for renewable and biodegradable products
- Regulatory pressure to eliminate toxic or unsafe products
- Increasing viability of bio-based alternatives



**We are bioindustrial.
We are Cargill.**

.



We are bioindustrial. We are Cargill.

Cargill has been innovating in the bioindustrial space for decades.

We leveraged our access to global crops & invested in bioconversion technologies to respond to the global demand for more sustainable solutions.

We're inventing
game-changing
solutions.



We're inventing game-changing solutions.

- **Industrial Solutions**

Road construction

Dielectric Transformer Fluids for power generation

Binders & adhesives

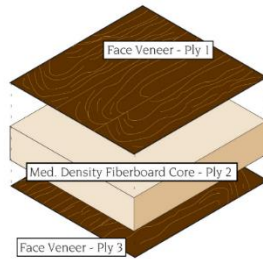
Performance chemicals (e.g. flexible foams, plasticizers & wax)



Pave sustainably.



- Our Anova® asphalt **rejuvenator** empowers customers to pave better-performing roads, campus parking lots and private drives.
- Aged and distressed pavement is milled and stockpiled as Reclaimed Asphalt Pavement (RAP).
- Anova® **rejuvenator** helps reverse the impacts of aging, allowing more RAP to be incorporated into the product, leading to material cost savings and a more sustainable solution.
- Anova® **warm mix additive** allows a safer environment for work crews since its lower temperature reduces the release of fumes during paving.



Adhesives

Removing toxins from insulation and wood

- Our binder & adhesives products make it possible to **replace formaldehyde** in wood and insulation. This chemical is widely used in adhesives but is labeled as a carcinogen.
- Our natural products offers a plant-derived alternative to formaldehyde-based adhesives.

THANK YOU!

For more information on these and other bio-sustainable chemistries, please go to the resources provided in the Chat and visit the Cargill BioIndustrial website:

www.cargill.com/bioindustrial


Brent Aufdembrink

Brent_Aufdembrink@cargill.com

Renewable Materials in Sustainable Building Products

Poll Question #1

What is the primary criterion that would prompt you or your client to build using green technology?

- A.** Acquisition Cost that is the Same or Lower
 - B.** Building Performance - Health, Safety, Comfort and Convenience
 - C.** Lower Long-term Operating Costs
 - D.** Based on Principle Alone
 - E.** Higher Resale Value
- 

The background features abstract, overlapping green geometric shapes in various shades of green, creating a modern and organic feel. The shapes are primarily located on the right side of the frame, with some extending towards the left.

Just BioFiber Structural Solutions

Sustainable Carbon-Negative Building System

The Product

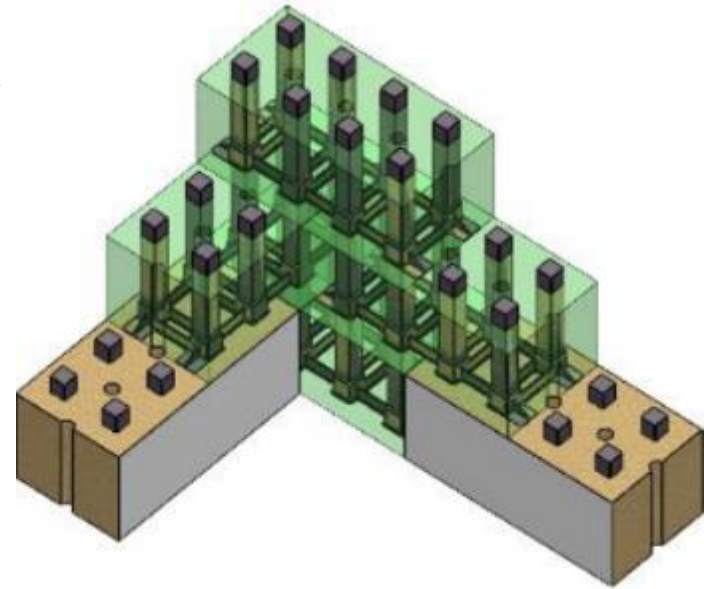
- Modular building block system for fast flexible construction
- Structural load bearing and weather resistant
- Reduces building energy requirements (Heating & Cooling)
- CO2 sequestering Hemp 6 kg biogenic (captured atmospheric CO2) per block
- 7x more efficient at sequestering atmospheric CO2 than wood
- Lime formulation continually absorbs CO2
- Non-Toxic (no volatile organic compounds) and permeable
- Monolithic structure resists seismic and wind loads
- High block alkalinity protects it from mold and insects



JBF Block Innovative Technology

Factory-formed interconnecting blocks:

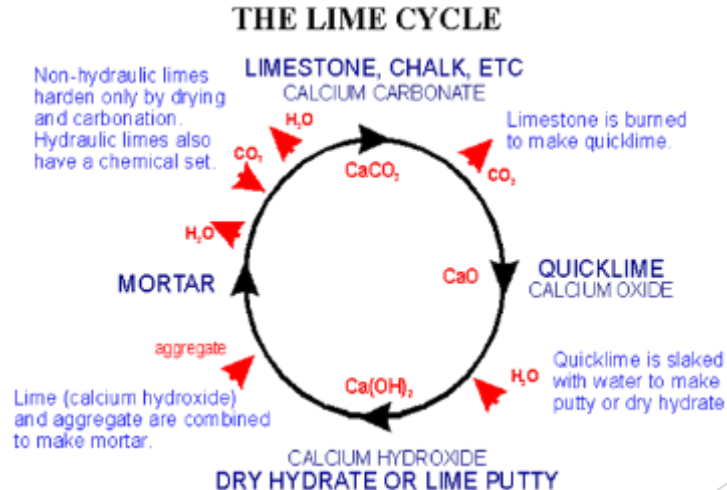
- Integrated internal frame for structural integrity
- Natural materials provide high thermal insulation
- Single modular component to erect a wall
- Combined with adhesives and interior and exterior coatings creates a very strong and durable monolithic structure
- Delivered on-site with all ancillary components ready for assembly
- **Protected by multiple patents, worldwide.**



The JBF Structural Building Block is Comprised of 3 Components

- **Hemp hurd:** Industrial hemp inner core
- **Lime binder:** calcium hydroxide (hydrated lime) absorbs atmospheric CO_2 as it strengthens
- **Structural frame:** engineered for high lateral loading (wind, earthquakes) and tall wall assemblies (up to 8 floors)

Note: Rapidly renewable hemp grows 20 times faster than trees



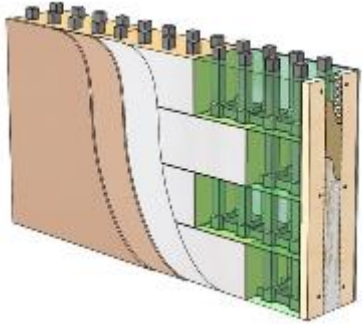
Hemp hurd

The Value Proposition

- ▶ Lower construction cost
- ▶ Fast build times and lower labor costs.
- ▶ R32-40 effective insulation value
- ▶ Safety Fire rating of >2 hour
- ▶ Mold and insect resistant (High Lime Alkalinity)
- ▶ Interior comfort Warm and Quiet
- ▶ Healthy indoor air quality.
- ▶ Longevity over 7 generations



High Performance Attributes



- Sound insulation performance ~.7NRC (47dB)
- Hygro-thermal performance: works without any additional vapor retarder (vapor barrier)
- Vertical load-bearing compression strength 60-95 MPa (8,700-13,800 psi)
- High precision manufacturing achieving a tolerance of 0.63 mm (0.025")
- Minimal material layering requirements, easy to handle and install
- Minimal on-site skill level required

High Performance Attributes

| | JustBioFiber (HD Block) | PreCast Concrete | Concrete Masonry Unit (Cinder Block) |
|--------------------------------------|----------------------------|------------------|-----------------------------------------|
| Compressive Strength | 75 MPa | 27 - 48 MPa | 15 MPa |
| Insulation Value | R32 | R19 | R17 |
| Fire Rating (2 hour) | Passed | Passed | Passed |
| Smoke Development | 0 | 0 | 0 |
| Flame Spread | 0 | 15 | 15 |
| Noise Reduction Coefficient | 0.7 | 0.2 | 0.35 |
| Installed Cost (per m ²) | \$455.51 | \$471.70 | \$706.70 |



Marketing - Market Access

- ▶ Defined target markets:
 - ▶ Industrial
 - ▶ Commercial
 - ▶ Residential
 - ▶ Sound walls
 - ▶ Demising walls (Fire walls between tenants)
 - ▶ Institutional buildings
 - ▶ Fire-rated walls
 - ▶ Barrier walls (Highways, Communities, Rapid Transit Systems)
- ▶ Value proposition established
- ▶ Targeted - early adopters and influencers
- ▶ Demonstration
- ▶ Competitively priced
- ▶ Promotion & Awareness: Global News; Greenbuild; CHTA, IHBA, EIHA, NADC



Market Price Comparison

Higher performance

Lower cost

Quantity Cost Surveyor Report: *“It should be noted that even though the JBF BioFiber SSR Block System is amongst the cheapest methods of construction, it is also likely to soon be recognized as the “best in class”, (or the highest performing building envelope system) in use today.*

QSSI, 2017

| External Wall Assembly Type | Average \$ / ft ² |
|--------------------------------------------|---------------------------------|
| JBF Block R32 (LD) Residential | \$33.54 |
| JBF Block R32 (HD) Commercial | \$42.32 |
| <i>Traditional Residential</i> | |
| AB Nov. 2016 Code / BC Wood Frame | \$30.39 |
| Traditional Concrete Block R17 | \$65.65 |
| <i>Traditional Commercial</i> | |
| Steel Frame (A) Metal Siding R8 | \$34.85 |
| Steel Frame (B) Pre-Insulated Siding R12.3 | \$38.40 |
| Steel Frame (C) Kalzip R10-22 | \$46.19 |
| Precast Concrete Wall R6 | \$44.64 |
| Precast Concrete Wall R19 | \$43.82 |




THANK YOU!

For more information, please refer to
the resources provided in the Chat and
the JustBioFiber website:

www.justbiofiber.com

Todd Mathewson

todddmathewson@gmail.com

A close-up photograph of several green leaves with prominent veins and slightly serrated edges. The leaves are set against a dark, blurred background. Overlaid on the upper left portion of the image is three lines of white, italicized text.

*Together, we can reduce dependence on petroleum.
Together, we can improve air quality for employees.
Together, we can reduce carbon emissions.*

Karen Coble Edwards

UNITED SOYBEAN BOARD









A photograph of a bright sun in a blue sky with wispy clouds, shining over a dense field of green plants. The sun is in the upper right, creating a lens flare effect. The plants are in the foreground, filling the bottom half of the frame.

Plants are nature's way of
capturing solar energy

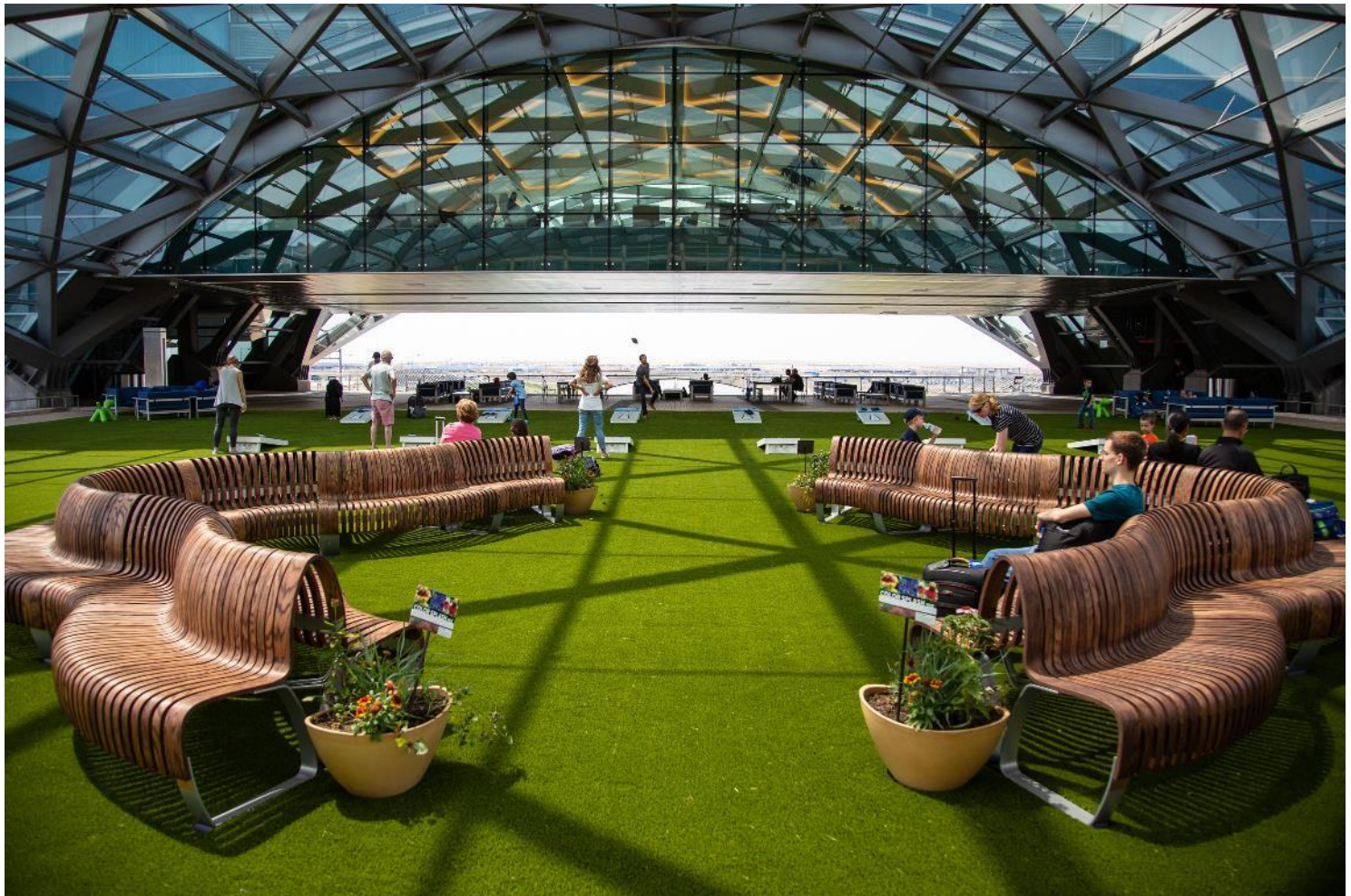












Together,

American Lung Association, City of Moline, U.S. Soybean Growers



Together,

New York City, U.S. Soybean Growers



Together,

DC Water, U.S. Soybean Growers



Together,
What may we do with you
to reduce dependence on
petroleum as we improve air
quality for communities,
employees and families?



Learn more at

WWW.SOYBIOBASED.ORG

WWW.ARCHITECTSGOSUSTAINABLE.COM

@USSOYINTHECITY

THANK YOU!

Karen Coble Edwards

United Soybean Board Consultant

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Modular Building Construction and The Impact on Renewability and Sustainability

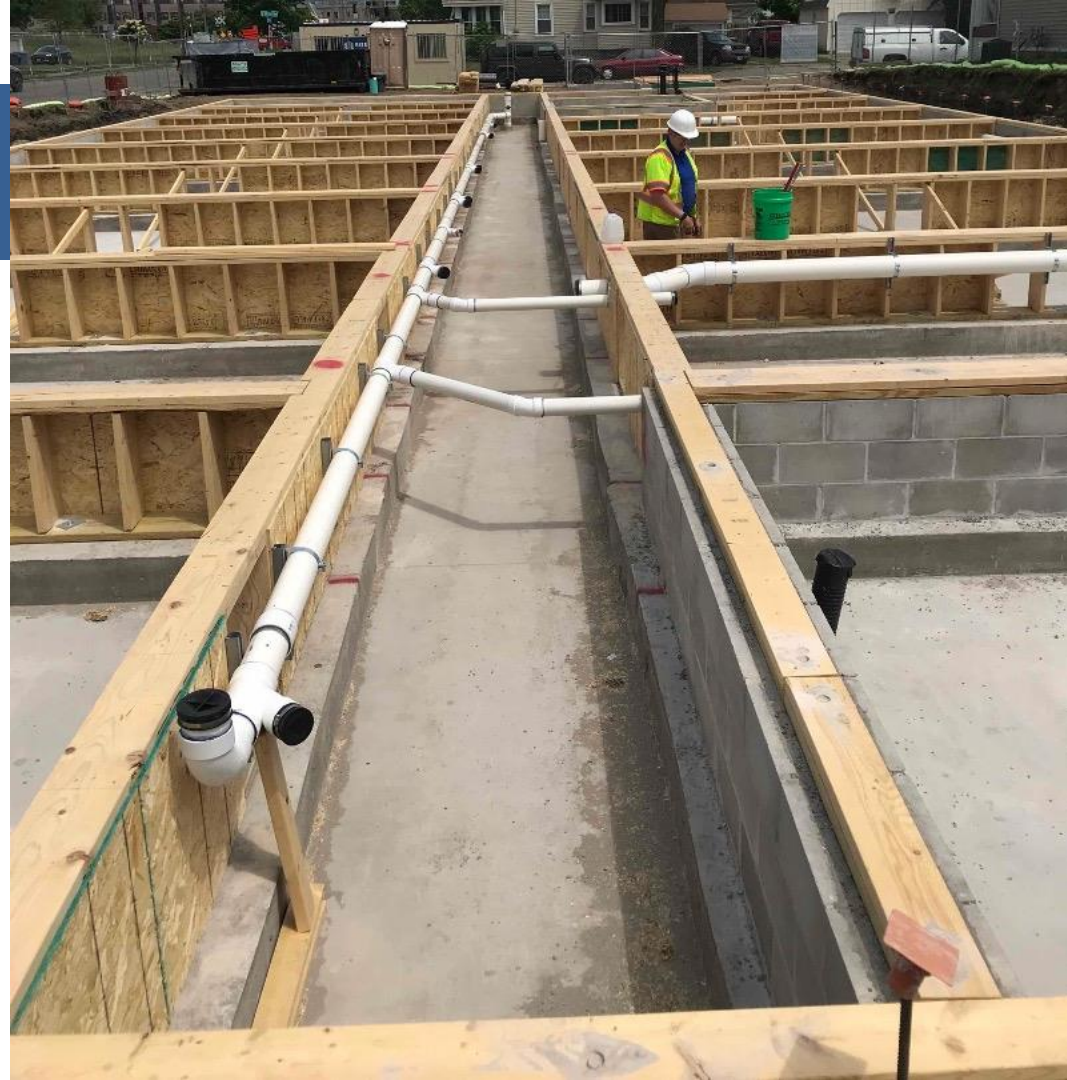


Dean Dovolis

Master in Architecture & Urban Design (MAUD)
Harvard University

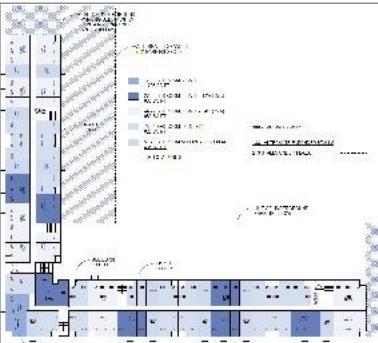
History of The Modular Building Industry

- Modular construction has been in use since the early 1940's yet is not widely accepted in US and European markets. It has been viewed as ugly, cheap and poor quality.
- Modular buildings are very popular in Japan and Scandinavia.
- The industry is adopting new materials and digital technologies that enhance design, improve precision and productivity in manufacturing, and facilitate logistics.
- These new technologies are focusing on sustainability, renewability, aesthetics, and appeal to the higher end of the market.



Supporting Sustainability and Renewability

- Modular construction can speed construction by as much as 50%, resulting in less consumption of materials.
- Modular construction can protect the environment with less than 5% waste compared to 15% in typical stick-built construction, and yield a tighter, more energy-efficient build.
- In the right environment, modular construction can cut costs by as much as 20% by reducing waste.



Project Is Designed Using
Modern Digital Technology



Modular Units are Manufactured
Inside Climate Controlled Factory



Modules Are Transported to
the Construction Site



Modules Are Stacked and Assembled
At The Construction Site



Multi-Family and Hospitality
Buildings Are Finished Onsite

Benefits of Faster Delivery

Construction occurs simultaneously with the site work and foundation, resulting in a 30-50% reduction in the time it takes to complete a project.



Incremental Revenue

| | | Total | Per Unit | Per SF |
|------------------------------|---|-------------|----------|---------|
| Time Savings (Months) | 3 | \$1,000,350 | \$5,002 | \$5.00 |
| | 4 | \$1,333,800 | \$6,669 | \$6.67 |
| | 5 | \$1,667,250 | \$8,336 | \$8.34 |
| | 6 | \$2,000,700 | \$10,004 | \$10.00 |
| | 7 | \$2,334,150 | \$11,671 | \$11.67 |
| | 8 | \$2,667,600 | \$13,338 | \$13.34 |
| | 9 | \$3,001,050 | \$15,005 | \$15.01 |

Incremental Net Operating Income

| | | Total | Per Unit | Per SF |
|------------------------------|---|-------------|----------|--------|
| Time Savings (Months) | 3 | \$650,228 | \$3,251 | \$3.25 |
| | 4 | \$866,970 | \$4,335 | \$4.33 |
| | 5 | \$1,083,713 | \$5,419 | \$5.42 |
| | 6 | \$1,300,455 | \$6,502 | \$6.50 |
| | 7 | \$1,517,198 | \$7,586 | \$7.59 |
| | 8 | \$1,733,940 | \$8,670 | \$8.67 |
| | 9 | \$1,950,683 | \$9,753 | \$9.75 |

Construction Interest Savings

| | | Total | Per Unit | Per SF |
|------------------------------|---|-----------|----------|--------|
| Time Savings (Months) | 3 | \$119,665 | \$598 | \$0.60 |
| | 4 | \$159,100 | \$796 | \$0.80 |
| | 5 | \$198,695 | \$993 | \$0.99 |
| | 6 | \$239,330 | \$1,197 | \$1.20 |
| | 7 | \$279,123 | \$1,396 | \$1.40 |
| | 8 | \$318,201 | \$1,591 | \$1.59 |
| | 9 | \$358,996 | \$1,795 | \$1.79 |

Assumptions

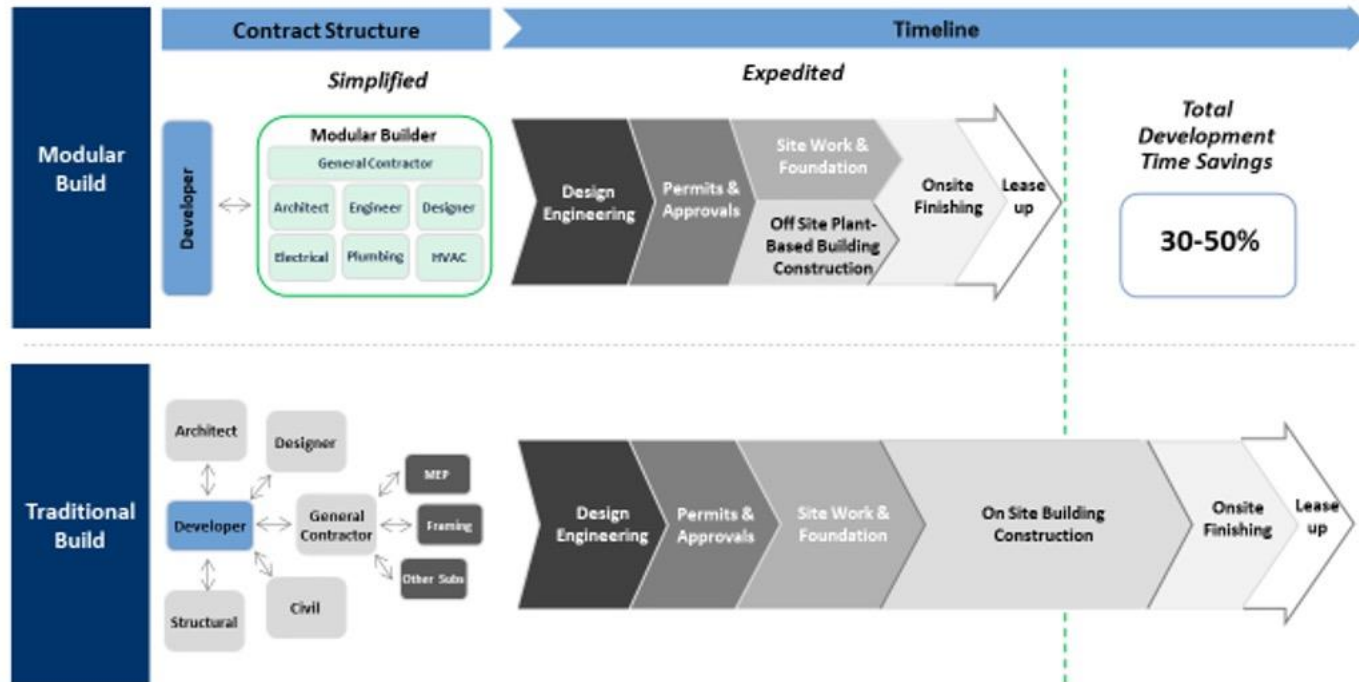
| | | | |
|-------------------------|--------------|-------------------------------------|-------------|
| # of Units | 200 | Stick Construction Period 18 months | |
| Gross Square Ft | 200,000 | Stick Built IRR | 20.0% |
| Total Development Costs | \$39,000,000 | Rent | \$2.25 / SF |
| Cost/Ft | \$195 | Net Margin | 65% |
| Cost/Unit | \$195,000 | Exit 18 months after C.O. | |
| Debt | 70% | | |
| Equity | 30% | | |
| Rate | 5.0% | | |
| Term (mths) | 360 | | |

IRR Impact of Faster Delivery and Cost Savings

| | Cost Savings | | | | |
|---------------|--------------|-------|-------|-------|-------|
| | 0.0% | 2.5% | 5.0% | 7.5% | 10.0% |
| Months | | | | | |
| 3 | 22.2% | 24.2% | 26.1% | 28.0% | 29.9% |
| 4 | 23.0% | 25.1% | 27.1% | 29.1% | 31.0% |
| 5 | 23.9% | 26.0% | 28.1% | 30.2% | 32.2% |
| 6 | 24.9% | 27.0% | 29.2% | 31.3% | 33.4% |
| 7 | 25.9% | 28.2% | 30.4% | 32.6% | 34.8% |
| 8 | 27.0% | 29.3% | 31.7% | 34.0% | 36.2% |
| 9 | 28.2% | 30.6% | 33.0% | 35.4% | 37.7% |



Modular Solutions are Faster



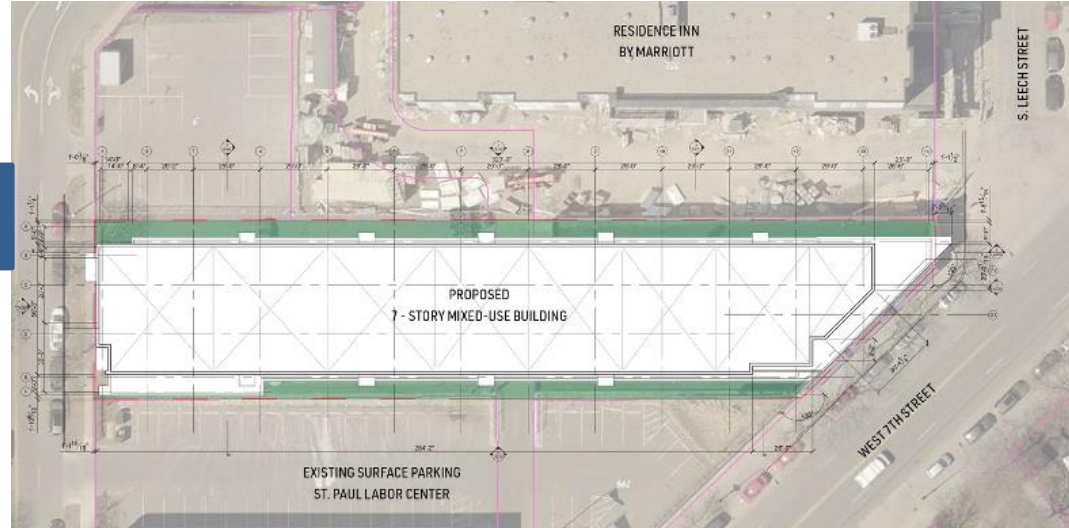
- The modular construction process involves early engagement with design and engineering resources.
- Assembly-line manufacturing process in a controlled environment.
- Site preparation in parallel with the building construction.
- Results are a much faster, cheaper, safer and higher quality process.

Video Showing Modular Construction

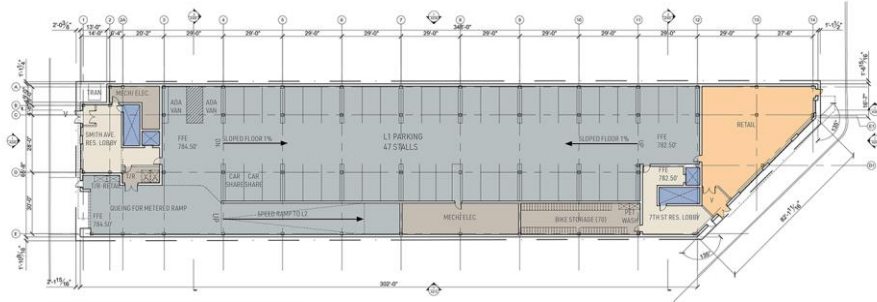


West 7th Street Apartments

- Seven-story, 192 units with modular construction on upper five floors
- 0.61 acres
- 1400 square feet of retail
- 110 parking stalls, 102 of which are semi-automated
- Construction type: Type 3A over Type 1 at 85 feet tall (a first in MN)



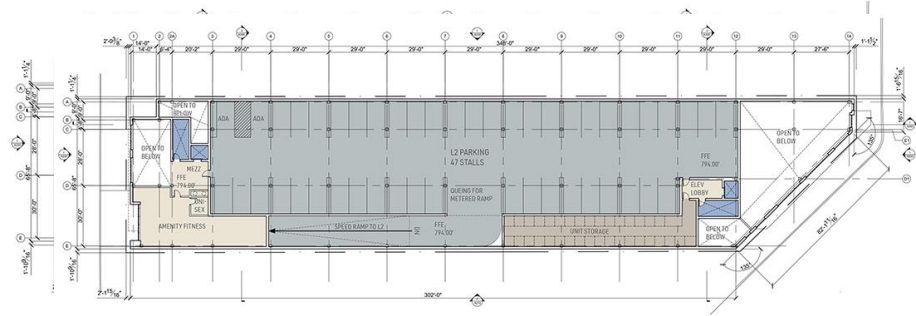
West 7th Street Apartments Typical Floor Plans



LEVEL 1 SUMMARY

Parking - 17,568 sf
Core - 622 sf
Common - 1,672 sf
BOH - 2,639 sf
Retail - 2,499 sf

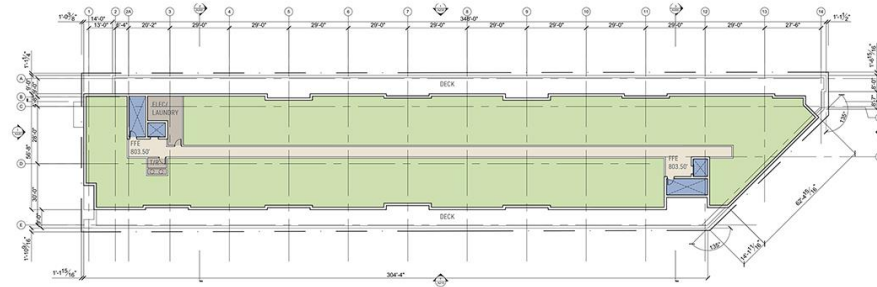
Total - 25,000 GSF



LEVEL 2 SUMMARY

Parking - 165,597 sf
Core - 622 sf
Common - 2,149 sf
BOH - 1754 sf

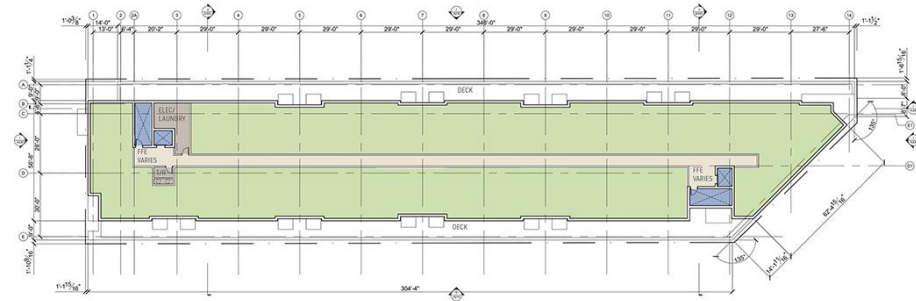
Total - 21,163 GSF



LEVEL 3 SUMMARY

Residential - 15,934 sf
Core - 622 sf
Common - 1,851 sf
BOH - 402 sf

Total - 18,809 GSF



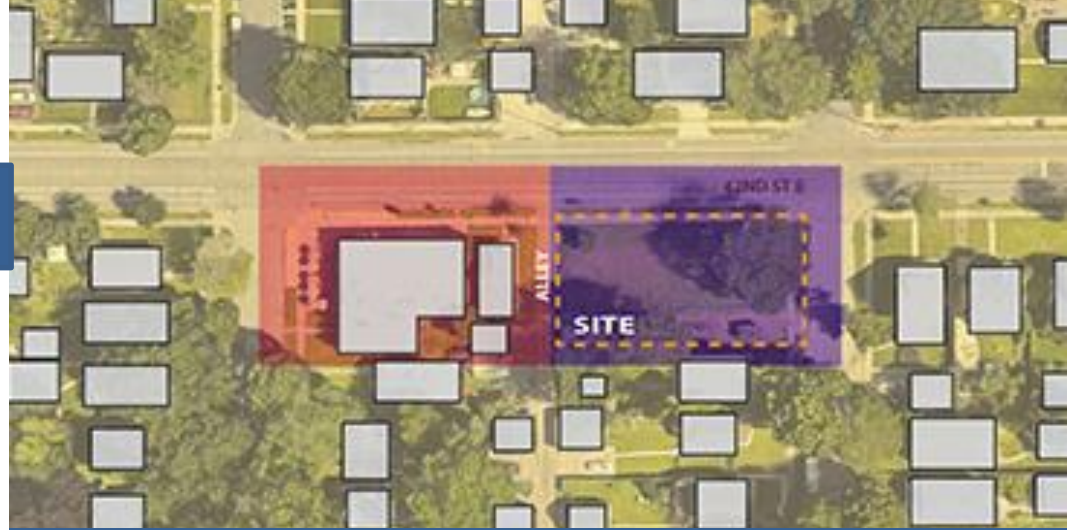
LEVEL 4-6 SUMMARY

Residential - 15,934 sf
Core - 622 sf
Common - 1,851 sf
BOH - 402 sf

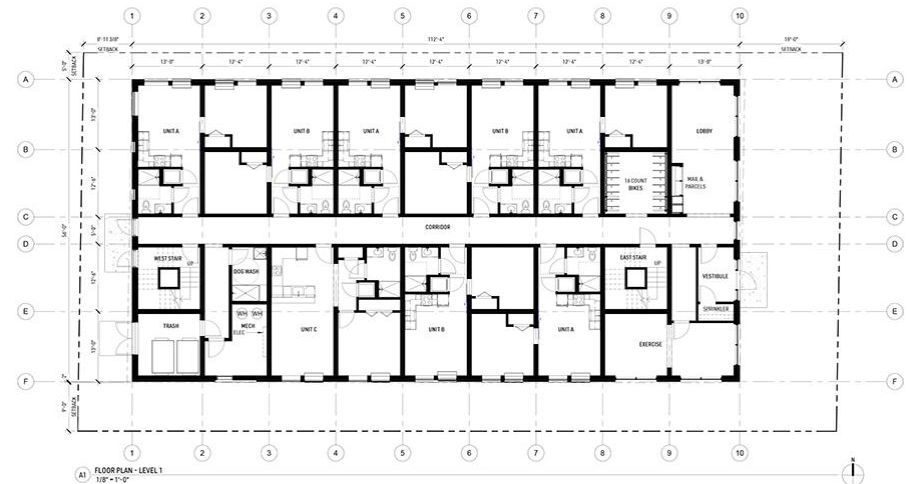
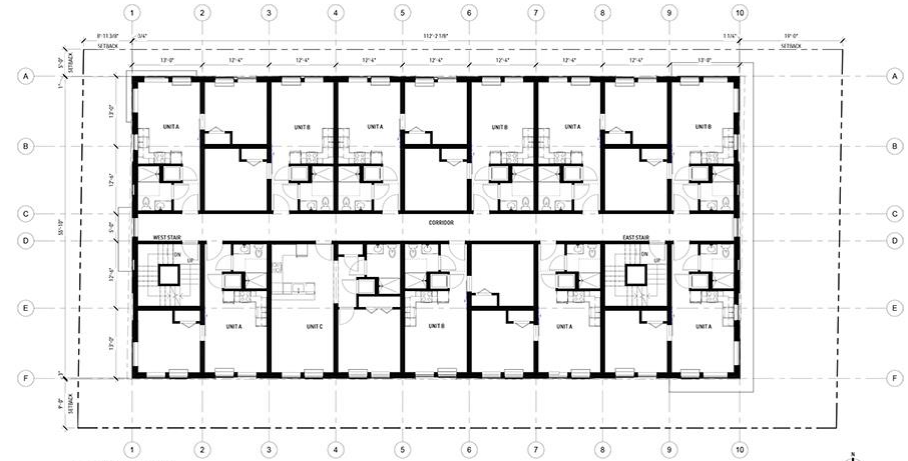
Total - 18,809 GSF

MOD42

- Three-story multi-family residential
- 30 units total
- 0.23 acres
- No vehicle parking
- Sixteen bike racks
- Unit size 414 sf - 567 sf



MOD42 Typical Floor Plans

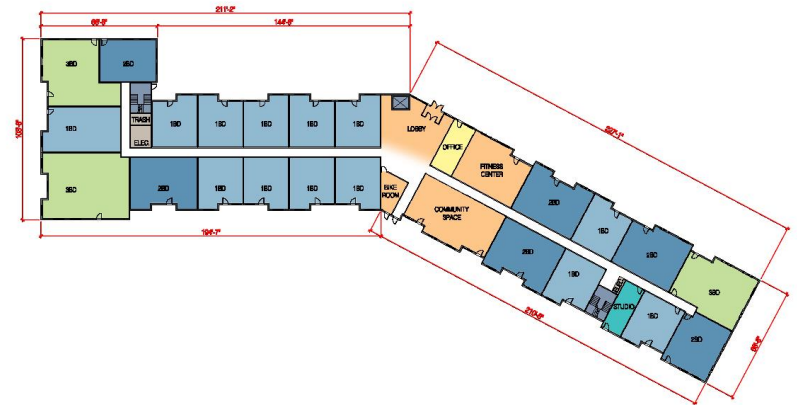
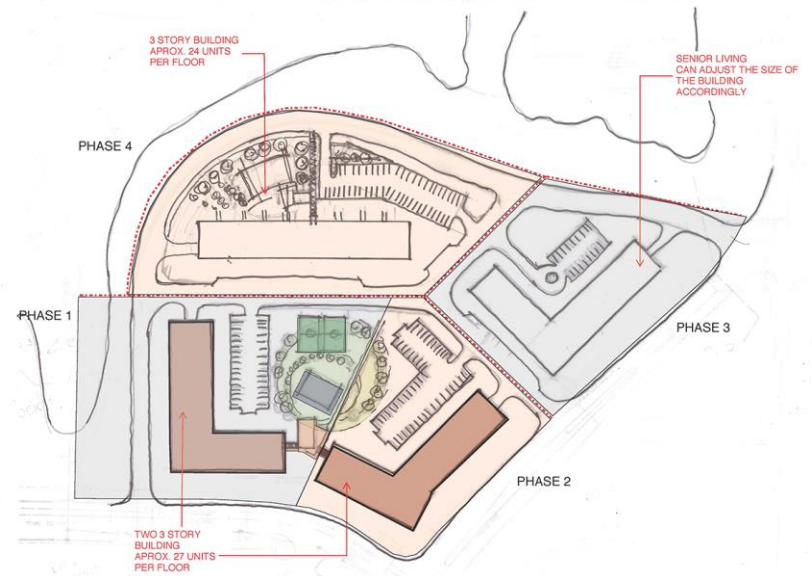


St. Michael

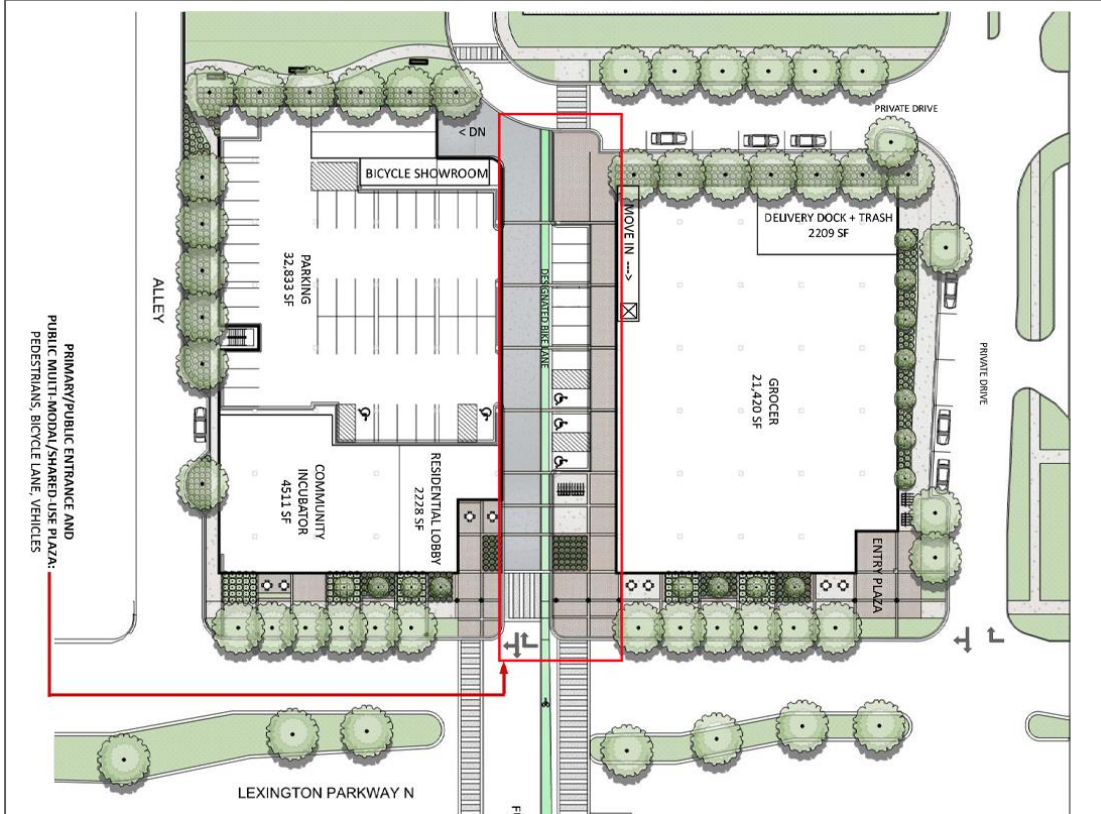
- Three-story multi-family residential
- 90 units, ranging from studio to three-bedroom
- Unit size 484 sf – 1285 sf
- 3.7 acres
- Part of a city masterplan to create housing around the city central park
- 138 parking stalls



St. Michael Site and Floor Plans

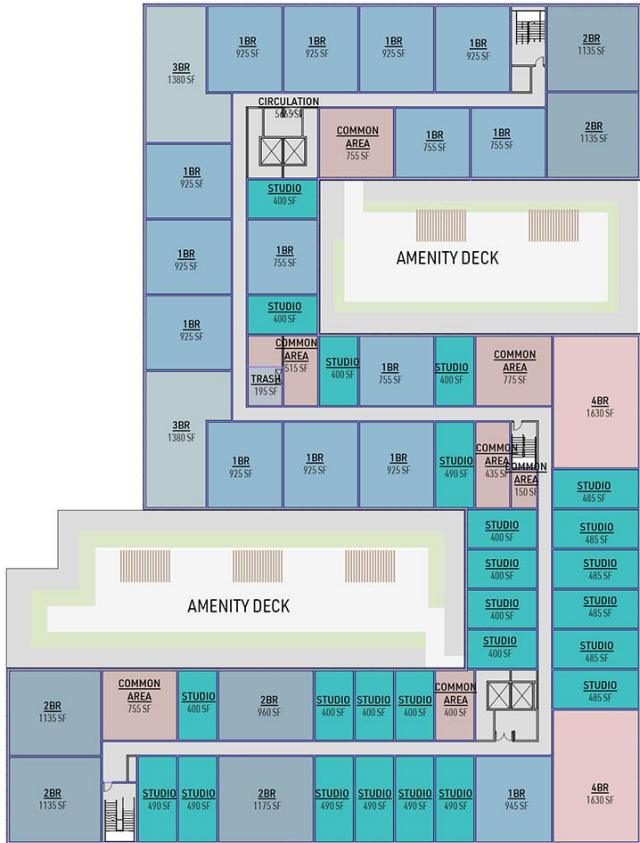


Lexington Apartments Site Plan



- Six-story mixed-use residential
- 272 units, ranging from studio to four-bedroom
- 2.06 acres
- 120 parking stalls

Lexington Apartments Floor Plans



Stinson Apartments



- [illegible]

Stinson Typical Floor Plan



Thank You!

Panel Discussion

Sustainable Materials & Products

The discussion will cover:

- Sustainable materials and renewable materials in the marketplace;
- How sustainable and renewable materials can best be used;
- How sustainable and renewable materials fit into building design; and,
- Information related to economics, health and well-being, and overall purpose in building design.



YOUR THOUGHTS AND QUESTIONS MATTER



Renewable Materials in Sustainable Building Products

Chat Question

Are you now interested in learning more about biobased solutions in constructions?





The Future is Bright


- Less carbon footprint with sustainable building materials
- Creating jobs
- Made from agricultural products in your backyard
- Contributes to LEED credits towards certification



Renewable Materials in Sustainable Building Products

Poll Question #2

What biobased product are you most likely to incorporate into your operation in the coming year?

- A.** Building Materials (foundation, composites, lumber windows, and siding)
 - B.** Interior Construction (adhesives, floorings, paint, cabinets, and insulation)
 - C.** Surface Rejuvenates for Parking Lots and Trails
 - D.** Cleaning Supplies
- 



Call to Action

- Great resources exist and here are a few to get you started in identifying sustainable, renewable and biobased building materials and their uses:
 - USDA BioPreferred Program www.biopREFERRED.gov/BioPreferred
 - United Soybean Board: <https://www.soybiobased.org/> and <http://www.architectsgosustainable.com/>
 - AURI Guides www.auri.org/focus-areas/biobased-products
- To learn more on the many other benefits of sustainable, renewable and biobased building materials, please visit:
 - U.S. Green Building Council www.usgbc.org

Thank You
for joining us!



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