Summary
The National Precast Concrete Association (NPCA) Foundation Student Competition provides a unique opportunity to engage students and academia with the precast concrete industry. Under the guidance of an academic advisor/professor and an NPCA member mentor, students compete in teams to solve real-world problems using precast concrete as the solution. After teams submit their entries to a panel of judges for review, the top teams are invited to present their entries to the industry at The Precast Show 2023 in Columbus, Ohio, where a winning team is chosen.

Overview
The NPCA Foundation Student Competition is designed to raise student awareness and experience with precast concrete. Students solve real-world problems faced by precasters and their customers that require them to consider myriad of issues, including: production, delivery, budgeting, timelines, engineering, unexpected problems, last-minute change requests from the customer and more. The goal is to teach future engineers, specifiers and construction management personnel about the many uses, benefits and innovations available from the precast concrete industry.

Students are encouraged to build multi-dimensional teams made up of CIM students, engineering students, construction management students, etc., similar to workgroups used every day within the precast industry. Additionally, teams will have industry liaisons (NPCA members) who can help guide them to resources and other industry experts to assist in the project. The team structure helps familiarize students with the process of involving a precastor in the design/build process in order to make the most of the experience and ingenuity precasters can offer.

Each competition cycle includes a new real-world problem selected by the NPCA Foundation’s Student Competition Task Force. Beyond the precast products used in the solution, teams are reminded that precasters often use outside consultants in planning their projects, including consulting engineers, who can help mitigate any liability issues. Teams are permitted and encouraged to consider the use of outside consultants as part of the project profile. The cost of using such consultants should be incorporated into the final project cost estimates.

Who May Apply
The NPCA Foundation Student Design Competition is open to undergraduate students, including architectural students, CIM students, construction management students and engineering students at two- and four-year universities and colleges.

NPCA and The Precast Show
The National Precast Concrete Association has represented manufacturers precast concrete products and the suppliers of products and services for the industry since 1965. We are dedicated to expanding the use of quality precast concrete and providing members with the programs and information required to operate a successful precast plant.

The Precast Show is the largest trade show dedicated to the manufactured concrete industry. Held annually, The Precast Show draws almost 5,000 attendees for the trade show, education, committee meetings and more. The Precast Show 2023 is Feb. 23-25 at the Greater Columbus Convention Center.
Application for 2023 NPCA Foundation Student Competition

Date _____________________

School Name ___________________________________________________________________________________

Team Members (Up to 5 students per team)

Name ___________________________________________________  Email _____________________________
Name ___________________________________________________  Email _____________________________
Name ___________________________________________________  Email _____________________________
Name ___________________________________________________  Email _____________________________
Name ___________________________________________________  Email _____________________________

Faculty Advisor __________________________________________________________________________________

Address _________________________________  City_____________________  State______  Zip___________
Phone ___________________________________________________
Email ____________________________________________________

Important Dates

Dec. 2, 2022: Initial design due to Foundation.
Dec. 31, 2022: Final design due to Foundation.
Jan. 20, 2023: Webinar presentations from all teams to have been made to judging panel.

Prizes

First place team wins $2,000 (divided equally among the student team members) and $5,000 for the school program.

Second place team wins $1,200 (divided equally among the student team members) and $4,000 for the school program.

Third place team wins $400 (divided equally among the student team members) and $3,000 for the school program.

How to Apply

The completed entry form must be submitted to Marti Harrell by Oct. 14, 2022. Entry forms can be mailed to the Foundation office at 1320 City Center Drive, Suite 200, Carmel, IN 46032 or emailed to mharrell@precast.org.

Release

By entering the NPCA Foundation Student Design Competition, the Team grants permission to use images and descriptions of the entries for promotional purposes.

Signatures

________________________________________________________ ______________________________________
Team Captain Signature  Date

________________________________________________________ ______________________________________
Faculty Advisor Signature  Date
NPCA Foundation Student Design Competition Rules

1. Each team must submit its completed and initial design by Dec. 2, 2022. The design must be done in report format and include the following:
   a. Initial design concept drawing and explanation of strategy.
   b. Initial shear and moment capacity calculations for sample piece.
   c. Initial cost consideration.
   d. Initial timeframe.

2. Each team will be assigned an NPCA member to act as liaison to the team. The team and liaison are responsible for holding calls/virtual meetings as needed.

3. Teams are encouraged to reach out to suppliers, manufacturers and engineers who may be able to provide research, data and recommendations related to the project.

4. Each team must submit its final design by Dec. 31, 2022. The design must be completed in report format and include the following:
   a. Final design concept drawing and explanation of strategy.
   b. Detailed submittal and production drawings.
   c. Final shear and moment capacity calculations for sample piece.
   d. Final costs.
   e. Timeframe.
   f. Project concerns/limitations.

5. Each team will be scored out of 100 possible points. The points will be an aggregate from initial and final submittals. The four highest-scoring teams will be invited to The Precast Show 2023 for a final presentation competition.

6. The final presentation will be scored out of 100 points.

7. The NPCA Foundation will provide up to $1,000 reimbursement to each team member presenting their group Student Competition entry at The Precast Show 2023. This reimbursement is intended to offset costs incurred for round trip coach airfare, meals, lodging for three nights and any other transportation for up to five students and one faculty advisor. The reimbursement is based on IRS per diem rates for Columbus of $64/day for meals, $122/night for hotel/lodging and an average coach airfare cost. Any additional expenses occurred by the team or team members related to this event are the responsibility of the team. The NPCA Foundation will provide this reimbursement no later than April 15, 2023. Detailed receipts with all expenses, fees and taxes must be submitted with the request for reimbursement. Total reimbursement may not exceed $5,000 per school.

8. An overall winner will be selected based on final score of presentation and combined scores of submittals.

Final Presentation Rules

1. Each team will create a presentation based on its final report and present in front of a panel of NPCA members at The Precast Show 2023 in Columbus, Ohio.

2. Each team will present a 15-minute presentation and be available for 10 minutes of Q&A from the panel.

3. Standard AV equipment (projector, screen, laptop, mics) will be made available by the Foundation for presentations. Teams will need to bring their presentations on a flash drive.

4. Final presentation will be scored out of 100 points.
Scoring

Grading Rubric for Initial Report and Final Report

<table>
<thead>
<tr>
<th>5-Point Scale</th>
<th>10-Point Scale</th>
<th>15-Point Scale</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Item is missing from report.</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>Item is present but is incomplete and incorrect.</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>6</td>
<td>Item is present but is incomplete. The components of the item that are</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>present are correct.</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>9</td>
<td>Item is present and complete but partially incorrect.</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>12</td>
<td>Item is present and complete and mostly correct.</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>15</td>
<td>Item is present, complete and correct.</td>
</tr>
</tbody>
</table>

Initial Report (25 Points)

<table>
<thead>
<tr>
<th>Item</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness of Report</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Drawings and Submittals</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Calculations</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Cost Considerations</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Time Frame Considerations</td>
<td>_____ of 5</td>
</tr>
</tbody>
</table>

Final Report (75 Points)

<table>
<thead>
<tr>
<th>Item</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness of Report</td>
<td>_____ of 15</td>
</tr>
<tr>
<td>Concept/Strategy</td>
<td>_____ of 15</td>
</tr>
<tr>
<td>Drawings and Submittals</td>
<td>_____ of 10</td>
</tr>
<tr>
<td>Calculations</td>
<td>_____ of 10</td>
</tr>
<tr>
<td>Cost Considerations</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Time Frame Considerations</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Identification of Limitations</td>
<td>_____ of 5</td>
</tr>
<tr>
<td>Professionalism and Appearance of Report</td>
<td>_____ of 10</td>
</tr>
</tbody>
</table>
## Presentation (100 Points)

<table>
<thead>
<tr>
<th>Item</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professionalism</strong></td>
<td>_____ of 10</td>
</tr>
<tr>
<td>Uniformity of attire among team members, appropriateness of appearance, level of professionalism in demeanor and dialogue.</td>
<td></td>
</tr>
<tr>
<td><strong>Presentation Layout/Flow</strong></td>
<td>_____ of 25</td>
</tr>
<tr>
<td>Logical flow of introduction, problem statement, considerations, issues along the way, solution, costs, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Presentation Content</strong></td>
<td>_____ of 25</td>
</tr>
<tr>
<td>Incorporation and explanation of major items from final report in the presentation.</td>
<td></td>
</tr>
<tr>
<td><strong>Presentation Time</strong></td>
<td>_____ of 20</td>
</tr>
<tr>
<td>(Goal of 20-minute presentation followed by Q&amp;A. Q&amp;A duration is not included in the 20-minute presentation window.)</td>
<td></td>
</tr>
<tr>
<td>Start: Stop:</td>
<td></td>
</tr>
<tr>
<td>Presentation lasting 15-20 minutes: No deduction, still earns full 20 points. After 21 minutes, team loses 2 points per minute (22-minute presentation gets 18 points).</td>
<td></td>
</tr>
<tr>
<td><strong>Use of Handouts as Presentation Aids</strong></td>
<td>_____ of 5</td>
</tr>
<tr>
<td>How well the handout(s) served as aids to the presentation or explanation of a certain topic. No handouts at all results in 0 points.</td>
<td></td>
</tr>
<tr>
<td><strong>Q&amp;A</strong></td>
<td>_____ of 15</td>
</tr>
<tr>
<td>How well Q&amp;A is handled. Ability to provide accurate explanations, justifications, and responses to questions posed by judges. Ability to share answering responsibility rather than one team member responded to all questions. How well team members handle questions to which they don’t know the answer.</td>
<td></td>
</tr>
</tbody>
</table>
**Big Cheese Factory**

Big Cheese Factory located in Davenport, Iowa, is in need of a cheese process water cooling system. This system will have to cool the process water from 180 F to ambient temperatures. The water is also highly acidic entering the system with a pH of 2. This can be done in a series of structures or one structure.

In order to cool the water the system will have to be able to hold at least 8,000 gallons of water per 24-hour period before discharging to the municipal lines. Technicians will need to access the structures in order to monitor the water and adjust the pH for discharge.

The project is set to commence on July 24, 2022. You will have a 4 hour window to install the project in totality before water needs to be turned back on.

Major dates to consider

- Bids due: May 12, 2022
- Award of Bid: May 20, 2022
- Notice to Proceed: July 1, 2022
Your form system capabilities are as follows:

- 4 foot inside diameter manhole
- 5 foot inside diameter manhole
- 6 foot inside diameter manhole
- 1000 gallon tank (See Drawing)
- 2000 gallon tank (See Drawing)
- 3200 gallon tank (See Drawing)
- 5000-10000 gallon tank (17’ x 9’ x 8’ tall 6” Wall Monolithic Wall/Slab connection up to 3’ height. Two Monolithic Sections = 5000 gallons. Riser Sections capability to make more capacity)

**Design requirements**

- Capacity to hold water and cool
- Sampling Structure to hold 500 gallons
- Pumping Station to send cool water to waste station (Capacity 400 gallons)
  - Pumps 2’ in Diameter and weigh 1000 lbs each
- Each structure needs to be detailed on reinforcement, concrete specifications, liners, coatings, and sealants, connections between each structure, and openings for access.
- Production Schedule
• Shipping and Installation Schedule (You will need to assist with the installation. General contractor is not familiar with this type of construction).
• Detailed drawings of how the water will flow from structure to structure if using multiple structures.

**Your Facility**

Located in Fon Du Lac, WI. 5 production employees. 3 delivery drivers. Septic tank forms are busy every day making stock products. Manhole forms are used on a per job basis. Currently not busy

**Equipment.**

- 2000 sqft production space
- 2 Overhead Bridge Cranes 7.5 ton
- 3 Forklifts (1-15000lb, 1 - 6000 lb, 1 - 8000 lb)
- 4 QMC Boom Trucks (40,000 lb capacity cranes)
- 1 Semi Truck with Flatbed
- 3 acres of yard storage space (Currently 80% full)
1. All manholes to comply with ASTM C-476.
2. Concrete to be 4,000 psi minimum at 28 days.
3. Reinforced with 4 bars @ 3" o.c. @ 12" for each panel.
4. Reinforced with 2" o.c. @ 12" for each panel.
5. Masonry coping is cast in place and flat top is 1" diameter.
6. Joints sealed with mastic, GC-150, 1" joint sealant.
7. Steps are reinforced polypropylene @ 12" o.c. Model R-13 by American Step.
8. Cast iron riser and cover to be furnished.
9. Vents shown are in sanitary service only. Storm sewer manholes do not come furnished with vents.
10. Flat top manholes to be 4" @ 12" o.c. each way.
11. Pipe to manhole connection made with press seal psi-50 gaskets.
12. Flat top manholes to be used for all manholes under 6" of invert. Flat-flat top manholes be used for all manholes under 3.5" of invert.

Sections A-A

Precast Grade Rings

CAST IRON RING & COVER

Sanitary Sewer Pipe
Press Seal Gasket

Flat-Flat Top

Section A-A W/ ECC. CONE

48" DIAMETER, PRECAST MANHOLE

1" SEALANT AT JOINTS

Reinforced Polypropylene steps on 12" centers

MONOLITHIC BASE SECTION WITH SECONDARY INVERT. ARRAYS ON SITE WITH GASKETS AND INVERT INSTALLED.

#4 1-BARS (10"x10"") spaced @ 12" O.C.
#4 @ 12" O.C. EACH WAY

6" CRUSHED ROCK BASE COURSE

Section A-A W/ FLAT TOP

48" MANHOLE SUBMITTAL
NOTES:
1. ALL MANHOLES TO CONFORM TO ASTM-C478
2. CONCRETE TO BE 4,500 PSI MINIMUM AT 28 DAYS
3. BASED REINFORCED WITH #4 REBAR @ 12" O.C. EACH WAY
4. RISER AND CONE SECTIONS REINFORCED WITH WELDED WIRE MESH
5. MANHOLE OPENING IN CONE AND FLAT TOP IS 24" DIA.
6. JOINTS SEALED WITH CONSEAL CS-102 1/8" JOINT SEALANT
7. STEPS ARE REINFORCED POLYPROPYLENE @ 12" O.C. MODEL ML-13 BY AMERICAN STEP
8. CAST IRON RING AND COVER TO BE D&B
9. INVERT SHOWN IS IN SANITARY SEWER ONLY, STORM MANHOLES DO NOT COME STANDARD WITH INVERTS
10. FLAT TOP REINFORCING TO BE #5 @ 6" O.C. EACH WAY
11. PIPE TO MANHOLE CONNECTIONS MADE WITH PRESS SEAL PSX-DD GASKET

SECTION A-A
W/ ECC. CONE

SECTION A-A
W/ FLAT TOP
NOTES:
1. ALL MANHOLES TO CONFORM TO ASTM-C478
2. CONCRETE TO BE 4,500 PSI MINIMUM AT 28 DAYS
3. BASED REINFORCED WITH #4 NELSON @ 1/2" O.C. EACH WAY
4. RISER AND CONE SECTIONS REINFORCED WITH WELDED WIRE MESH
5. MANHOLE OPENING IN CONE AND FLAT TOP IS 24" DIA.
6. JOINTS SEALED WITH SEALANT CONSEAL CS-102 1/2" JOINT SEALANT
7. STEPS ARE REINFORCED POLYPROPYLENE @ 1/2" O.C. MODEL ML-13 BY
   AMERICAN STAIR
8. CAST IRON RING AND COVER TO BE DNL
9. INVERT SHOWN IS IN SANITARY SEWER ONLY, STORM MANHOLES
   DO NOT COME STANDARD WITH INVERTS
10. FLAT TOP REINFORCING TO BE #5 @ 6" O.C. EACH WAY
11. PIPE TO MANHOLE CONNECTIONS MADE WITH PRESS SEAL PSX-DO
    GASKET

SECTION A-A
W/ FLAT TOP

SECTION A-A
W/ FLAT FLAT TOP
493 GPD WHEN USED AS A SEPTIC TANK
BASED ON A 3 YR SERVICE INTERVAL

**DIMENSIONS:**
LENGTH - 91"
WIDTH - 78"
HEIGHT - 60"
BELOW INLET - 47"
TANK WEIGHT - 5900 lb.
LID WEIGHT - 3780 lb.
MAX DEPTH OF BURY 108"

42.5” Liquid Depth
24.7 gal/in
Model 2000 Septic, Pump, Siphon, Holding, or Grease Interceptor

2055 gal. septic
2136 gal. holding

984 GPD WHEN USED AS A SEPTIC TANK
BASED ON 3YR SERVICE INTERVAL

**DIMENSIONS:**
LENGTH - 145"
WIDTH - 78"
HEIGHT - 68"
BELOW INLET - 55"
TANK WEIGHT - 9600 lb.
LID WEIGHT - 6000 lb.
MAX DEPTH OF BURY 108"
Model 3200 Septic, Holding, Pump, Grease Interceptor, or Siphon

3232 gal. septic
3356 gal. holding

1549 GPD WHEN USED AS A SEPTIC TANK
BASED ON A 3 YR SERVICE INTERVAL

DIMENSIONS:
LENGTH - 176"
WIDTH - 92"
HEIGHT - 71"
BELOW INLET - 59"
BOTTOM SECTION WEIGHT - 12500 lb.
TOP SECTION WEIGHT - 12500 lb.
MAX DEPTH OF BURY 108"

Optional 4" Inspection In Lieu of Manhole

Baffle
Tongue and Groove Locking Walls

52" Liquid Level
62.2 gal/in
Model 5000 Septic, Holding, or Grease Interceptor

5026 gal septic
5206 gal holding
89.8 gal/in

2407 GPD WHEN USED AS A SEPTIC TANK
BASED ON A 3 YR SERVICE INTERVAL

DIMENSIONS:
LENGTH - 204"
WIDTH - 120"
HEIGHT - 76"
BELOW INLET - 64"
BOTTOM SECTION WEIGHT - 24000 lb.
TOP SECTION WEIGHT - 24000 lb.
MAX DEPTH OF BURY 108"

Tongue and Groove Locking Walls
Baffle

58" Liquid Level
Model 6000 Septic, Holding, or Grease Interceptor

6014 gal septic
6193 gal holding
89.8 gal/in

2880 GPD WHEN USED AS A SEPTIC TANK
BASED ON A 3 YR SERVICE INTERVAL

DIMENSIONS:
LENGTH - 204"
WIDTH - 120"
HEIGHT - 87"
BELOW INLET - 75"
BOTTOM SECTION WEIGHT - 24000 lb.
RISER SECTION WEIGHT - 9950 lb.
TOP SECTION WEIGHT - 19506 lb.
MAX DEPTH OF BURY 108"

Tongue and Groove Locking Walls

Baffle

69.0" Liquid Level