

OFFICIAL ENTRY FORM PART I

This is an application to register for the EPDACI Student BEAM Competition, to be held at Widener University, Chester, PA, on April 1, 2017. This competition is for undergraduate student teams. One form is required for each entry. **Completed Part I must be received no later than March 11, 2017.**

Date of Application: _____
Name of School: _____
Faculty Advisor: _____
Phone: _____ Fax: _____
E-mail _____

Student Team (2 to 5 students) (Please Print)	Email	Phone No.
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

SIGNATURE OF THE FACULTY ADVISOR: _____

PLEASE SUBMIT THIS FORM AS EARLY AS POSSIBLE TO:

Lizanne Pepin, P.E.
EPDACI Student Beam Competition Chairman
Hilti North America.
145 Sharon Lane
Paoli, PA 19301
Tel. (484) 896-8481, Fax (918) 461-7578
E-mail lizanne.pepin@hilti.com

ASSIGNED BEAM MARK: _____

OFFICIAL ENTRY FORM PART II

This form must be submitted after the beam specimen and control cylinders have been cast.
Completed PART II must be received no later than March 27, 2017.

DATE: _____ SCHOOL: _____ ASSIGNED BEAM MARK: _____

Name (Please Print)	Degree/Graduation Date	Signature
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

DATE OF CASTING BEAM & CYLINDERS: _____

Batch weights and estimated yields for concrete used for beam & cylinders. **NOTE: weights reported must be the actual measured batch weights of all materials included in your concrete mix.**

<u>Material</u>	<u>Weight (lbs)</u>	<u>Abs. Vol. (cu. ft.)</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Total Batch Weight	_____	Yield _____

Seven-day cylinder strength test data (psi):
 Cylinder Size Cylinder 1 Cylinder 2 Cylinder 3

Number of steel reinforcing bars used: _____

ESTIMATED LOADS

AN ESTIMATED LOAD OF _____ (LBS) SHOULD RESULT IN A MIDSPAN DEFLECTION OF 1/4". This is $P_{est @ 1/4 \text{ in. midspan deflection}}$

FOR OUR BEAM, THE ESTIMATED ULTIMATE LOAD IS _____ (LBS). This is $P_{est @ ult}$

TO BE SIGNED BY THE FACULTY ADVISOR:

To the best of my knowledge, this information is correct. The students have adhered to the official rules of the contest, and the specimens have been made and cured in compliance with the rules.

Name: _____

Signature _____ Date _____

EPDACI STUDENT COMPETITION

CONTEST RULES - 2017

1. THE CHALLENGE:

- 1.1 Design, construct and test a concrete beam reinforced with steel bars to achieve the optimal ultimate load.
- 1.2 Predict the ultimate load.
- 1.3 Predict the load that will result in a midspan deflection of 1/4 inch.
- 1.4 Comply with the contest rules. **The completed forms Part I and Part II of the Official Entry Form must be received by the dates shown on the forms.**

2. THE STUDENT TEAMS:

- 2.1 Each team must have a faculty advisor who will see that the student team complies with the rules of the contest. The team includes the faculty advisor.
- 2.2 Each team must consist of not less than two and not more than five students currently enrolled in an **undergraduate** program at any college or university worldwide. Although there are no restrictions on the geographical location of the school, all members of a given team must be from the same school. A student may not be a member of more than one team. A faculty member is permitted to advise more than one team.
- 2.3 It is strongly recommended that at least one individual (faculty or student) be designated to represent each team and be present during the testing of specimens at the time and location specified for this competition. Participation by additional team members is both permitted and encouraged.
- 2.4 **Each school will be permitted to send no more than three teams to the competition.** From a specific institution, the first three properly completed applications (**Parts I and II**) will be accepted as the entries from that school. Additional teams will only be accepted if an earlier entry from the same school withdraws from the competition.
- 2.5 Each team must complete and submit Parts I and II of the Official Entry Form.

3. THE MATERIALS AND THE BEAM SPECIMEN:

- 3.1 The beam specimen must fit into a 40" x 5.5" x 2.5" envelope, must have solid ends as shown on the attached sketch, and may have ineffective concrete omitted in the central 36" long, clear span. **NOTE: this is a wide and shallow beam, which is only 2.5" deep.** Except as otherwise noted, the dimensional tolerance is $\pm 1/8$ " for all dimensions. If time permits, beams not meeting this requirement may be tested, but the teams submitting such specimens will not be eligible for the prizes.
- 3.2 The beam specimen must be constructed using a minimum of one and a maximum of two 39" (± 1 ") long #4 steel reinforcing bars conforming to ASTM A 615 as tensile reinforcement. Other reinforcing materials such as wires, fibers of any type, stirrups are not allowed. Reinforcing bars may not be heated, prestressed, or configured with hook ends for developing anchorage.
- 3.3 A NOMINAL MAXIMUM CEMENTITIOUS MATERIALS content of 7 1/2 POUNDS PER BEAM is a key requirement, which must be specifically checked and validated by the faculty advisor. **Cementitious materials include portland cement, ground granulated blast furnace slag, fly ash, and microsilica or silica fume. A "green concrete" bonus will be assigned to beams that contain less than 7.5 lbs of portland cement. The "green concrete" bonus can be earned by using sustainable mix design concepts, such as a leaner concrete mix or through the use of recycled cementitious materials including slag, fly ash, and microsilica or silica fume.** The cementitious materials limit and portland cement content per beam may be verified by either weight or density measurement at the competition. Teams must provide

the actual measured batch weights of all materials included in their concrete mix, as specified on Part II of the Official Entry Form.

- 3.4 Any type of nonmetallic aggregate may be used.
- 3.5 Chemical and mineral admixtures are allowed. Epoxies and other polymers, glue, and binders may NOT be used.
- 3.6 Curing shall be at atmospheric pressure, and the curing temperature must not exceed the boiling point of water at atmospheric temperature.
- 3.7 No beam shall be more than 56 days old at the time of the test.
- 3.8 Reinforcing support wires and/or chairs are not permitted in the clear span area of the beam. Any manner of bar support may be used outside the clear span of the beam, as long as it does not act to anchor the bar in the concrete.
- 3.9 At the center of the beam, a large "X" shall be painted on a flat 5.5" x 5.5" area on the compression side where the concentrated load will be applied. In addition, the Beam Mark must be painted so as to be clearly visible on both sides of the beam. Teams may also apply decals of their school logo. **No other paint or surface treatment shall be permitted.**
- 3.10 The Competition Committee will determine each team's maximum permissible beam weight based on the actual batch weight information submitted on Part II of the Official Entry Form. Note that **the deadline for submitting Part II is March 27, 2017.** Earlier submittals are permitted and encouraged. Beams which are determined to weigh more than their maximum permissible weight at the competition will be tested but will not be eligible for prizes. **MODIFICATION OF BEAMS SHALL NOT BE PERMITTED AT THE COMPETITION SITE.**

4. THE TESTING PROCESS:

- 4.1 The beam specimens judged acceptable by the Competition Committee will be positioned in the testing apparatus, which will apply a midspan concentrated load by means of a loading plate measuring not less than 2" by 2". The clear span is 36" and reaction forces are through bearing surfaces measuring not less than 2" by 2" and providing no restraint against rotation at the ends of the beam specimen.
- 4.2 Once seated in the testing apparatus with a seating load of 200 lbs, additional load will be applied until the beam specimen fails. The loading rate shall be determined by the Competition Committee. In lieu of obvious physical signs of failure, failure will be assumed when total load on the beam has decreased to 75% of the maximum load achieved by that beam specimen. Midspan deflection will be monitored through the loading, which causes a deflection of 1/4". If a beam fails to reach a midspan deflection of 1/4" prior to failure, that beam shall be disqualified for the Most Accurate Prediction prize, but will be permitted to compete for the Highest Ultimate Load prize.
- 4.3 To arrive at the load corresponding to midspan deflection of 1/4", the total load at 1/4" midspan deflection will be reduced by the 200 lb seating load (for which no deflection was measured).
- 4.4 The actual ultimate load, without deduction of the seating load, will be recorded as the maximum load achieved.

5. THE EVALUATION PROCESS:

- 5.1 To receive the prizes for **THE HIGHEST ULTIMATE LOAD TO WEIGHT RATIO**, teams must achieve the highest value for actual ultimate load (P_{ult}) as defined in paragraph 4.4 divided by the **adjusted weight** of the beam. **The adjusted weight will be calculated by subtracting the "green concrete" bonus from the beam's measured weight in lbs. The "green concrete" bonus will be calculated by subtracting the weight in lbs of the portland cement in the beam from the 7.5 lbs per beam limit on cementitious materials.**
- 5.2 To receive the prize for the **MOST ACCURATE PREDICTIONS** of the loads, teams must achieve the smallest absolute values for "D", the estimated percentage difference, computed as follows:

$$D = (100/2) \left[\frac{\Delta P_{1/4}}{P_{1/4}} + \frac{\Delta P_{ult}}{P_{ult}} \right]$$

Where all loads are in pounds and

$\Delta P_{1/4} = (P_{est @ 1/4 \text{ in. midspan deflection}} - P_{1/4})$ = the absolute value of the difference between the estimated 1/4" midspan deflection and the actual load corresponding to 1/4" midspan deflection, where the actual load is defined in paragraph 4.3.

$P_{1/4}$ = the actual load corresponding to 1/4" midspan deflection, as defined in paragraph 4.3.

$\Delta P_{ult} = (P_{est @ ult} - P_{ult})$ = the absolute value of the difference between the estimated ultimate load and the actual ultimate load as defined in paragraph 4.4.

P_{ult} = the actual ultimate load as defined in paragraph 4.4.

5.3 A panel of judges will be appointed by the EPDACI Competition Committee. Interpretations and decisions made by the judges will be final, and appeals will not be considered.

6. THE PRIZES:

6.1 \$1500 for the HIGHEST ULTIMATE LOAD to weight ratio as defined in paragraph 5.1.

6.2 \$1500 for the MOST ACCURATE PREDICTIONS as defined in paragraph 5.2.

6.3 Each team is only eligible for one prize.

6.4 In the event the same team has both the HIGHEST ULTIMATE LOAD to weight ratio and MOST ACCURATE PREDICTION, they will be named the overall first place winner and receive the \$1500 prize. The second \$1500 prize will be split between the two second place teams for each category.

6.5 **No school may enter more than one beam of the same design in the competition. Beams will be considered to be of the same design if they have the same geometry and the same concrete mixture proportions. The judges will not test more than one beam of the same design from any school.**

7. TIME AND LOCATION FOR TESTING:

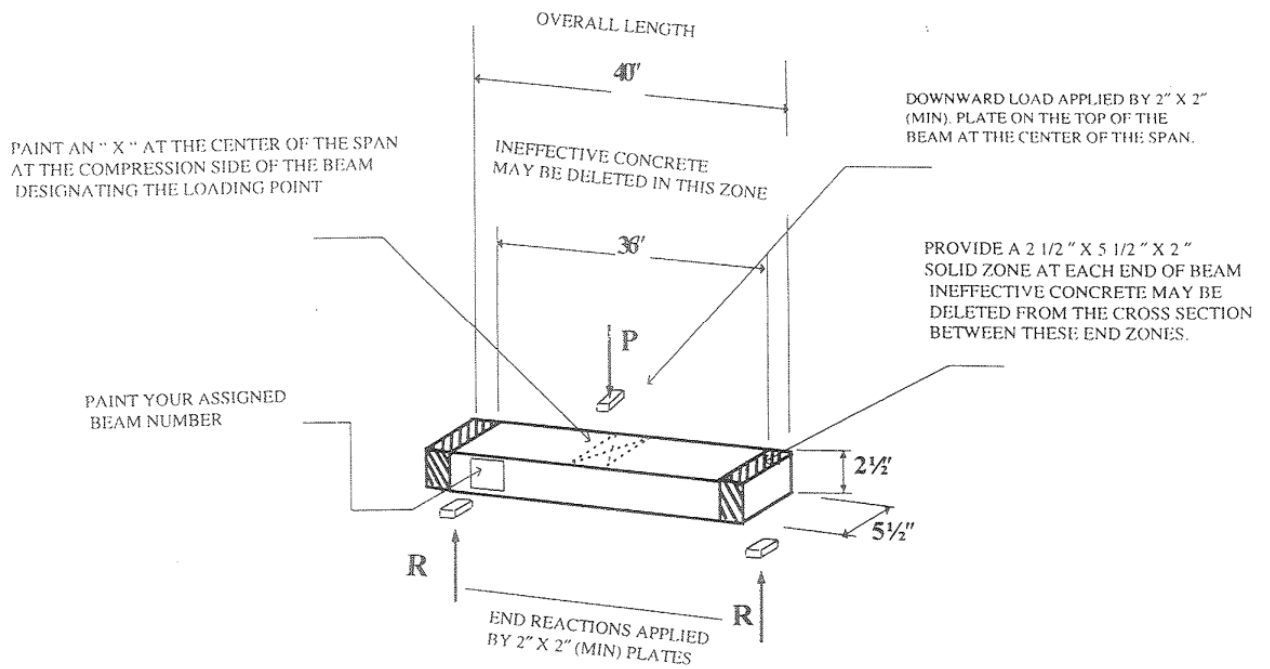
7.1 The beam competition will be held at Structures Lab, Widener University, 17th and Melrose, Chester, PA on April 1, 2017 at 9:30 AM.

8. ADDITIONAL INFORMATION:

8.1 The return mailing address for all entry forms and for additional information is:

Lizanne Pepin, P.E.
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 Hilti North America
 145 Sharon Lane
 Paoli, PA 19301
 Tel. (484)-896-8481, Fax (918)-461-7578
 Email lizanne.pepin@hilti.com

BEAM SPECIMEN



NOTE: TOLERANCE ON ALL DIMENSIONS = 1/8"