



International Quarter-Scale Tractor Student Design Competition

2022 Handbook

Initial Release

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1.0 Welcome

Welcome to the Official Handbook for the ASABE International Quarter-Scale Tractor Student Design Competition. The official copy of this handbook will be kept on the ASABE Website at the following location: <https://www.asabe.org/Awards-Competitions/Student-Awards-Competitions-Scholarships/International-1-4-Scale-Tractor-Student-Design-Competition>

Any information presented in this handbook may change at any time at the discretion of the organizing committee. The final revision of this handbook will be made available in May.

2.0 Design Competition

2.1 Objective

As participants in this competition, you are acting as engineers employed by a leading agricultural machinery company. This particular corporation is rather progressive and has embarked on a development program to address the needs of an emerging specialty market. The goal is to develop a machine, which is compact in size, relatively inexpensive, and can harness the power of a specific engine to achieve maximum pulling performance for short periods of time. This product would be intended for the recreational tractor puller; however it may have additional uses in the commercial market (small farms, municipalities, businesses, homeowners, etc.). **It is the responsibility of each team to define the target market(s) for which they will be designing.**

Assume the company will be introducing a tractor to a general market with total sales of 20,000 units per year for an average sales price of \$6050. There are currently 20 manufacturers serving this market with several different configurations of tractors. Assume that the baseline for the company is 3,000 units per year.

There are several different variations of tractors serving this market, but each has two common points. They each use one 31-horsepower engine and the exact same rear drive tires, although some may use an additional set of drive tires of the same size or smaller.

This company feels this market may have incredible potential, and they have decided that they are willing to take a major risk with this project. They want fresh ideas and they want them fast! As new engineers in the company, you have been split off into separate teams, each with the goal of developing a prototype of the optimal design. There isn't much time.... the upper management has announced that they will choose the winning design in the 2nd Quarter of this year and they expect the design to be placed into production shortly thereafter.

If your team is successful in this, sales may exceed 3,000 units per year. This is dependent on the configuration the team selects and the features the team intends to bring to market in the tractor design. The team must market the concept selected to the company and will have to justify the cost of production against the features that the tractor brings to the market. It is estimated that the leading manufacturer serving the market today is selling 6,500 units per year at a total production cost of \$5,490 and a sales price of \$6,210. This leading manufacturer has a tractor that features one engine and four driven wheels.

The company needs to maintain a total production cost close to this \$5,490 at the initial volume projected of 3,000 units, but is willing to pursue a higher production cost if the volumes that can be attained with the tractor concept will support higher sales. However, the team is not expected to achieve as high of profit margin in the first years of production. The team needs to build a business case to make the most money on the project by taking market share at a calculated cost or by matching the demand of the market with basic features and work on reducing the cost of production to make a profitable business case at the volume specified.

As part of the decision, the upper management has stated that they want a full design report with a cost analysis of the design. They also want you to prove the design in a pulling contest against the other teams, and finally, the team must be able to convince them in a formal presentation as to why they should choose the design to be the best overall.

Good Luck! Remember - not only will the winning team be showered with the praises of the company executives and receive generous amounts of company stock & options, promotions, bonuses and awards... All of the teams will gain an engineering experience of a lifetime!

2.2 Rules and Regulations

2.2.1 Configuration

All rules regarding tractor configuration can be found in the Rules and Regulations Document on the ASABE website ([link](#)).

2.2.2 Competition Rules

Event specific rules can be found throughout individual sections in this handbook. This section contains generic event rules.

All team members must have been enrolled during at least one semester or one quarter of the design contest school year and have a National ASABE Student Membership.

Team drivers must meet above qualifications and must be enrolled at the school for which they are representing.

The vehicle must be designed entirely by the student team members, without direct involvement from outside professionals or faculty. However, as with any design project - faculty, vendor technical support or other professionals may be consulted for advice in selecting and designing specific components. In addition, although not always possible, it is encouraged that the students perform the majority of the fabrication themselves, because this is an important part of the learning process.

A second team per school will be allowed. Schools with two teams must have two significantly different designs; schools that come with multiple teams, with similar vehicles, will not be allowed to compete. The school must have two independent teams with different advisors and may not have members participating on both teams. Any second teams wishing to compete will be decided by a lottery selection. The second main teams will need to purchase their own engines and tires. New schools will have priority over second teams to enter the contest.

2.2.3 Supplied Components

As part of the design competition, certain components are provided or offered to schools.

All vehicles must use a Briggs & Stratton 31-hp Vanguard engine (model specified in Rules & Regulations Document, section 6.0). Teams must purchase engines directly through ASABE.

All vehicles must use at least one set of Titan 26 x 12.00 – 12 tires. Based on quantities available, and team participation, these will be supplied by ASABE.

For additional information, contact Rules Chair listed in section 11.0. If a team withdraws from competition, they must return the engine and tires to ASABE.

3.0 Differentiation Between A-Team and X-Team

There are two types of teams involved in the Design Competition.

- A-Teams are defined as teams that have built a new tractor for the Competition and are competing with this tractor for the first time.
- X-Teams are defined as teams that have reworked, rebuilt, or modified a tractor that has been previously entered in the competition. An X-Team tractor may only be entered in the X-Team competition once. The tractor must also meet the current X-Team rules, no matter how “old” the tractor is.

The X-Team Competition is held in conjunction with the A-Team Competition and is designed for team members to gain experience in the project without having to build a completely new tractor.

4.0 A-Team Points Breakdown

4.1 Defense of Design (85pts)

The ability to make sound engineering decisions and articulate those decisions to technical experts who are only familiar with the project at a macro level is critical to your success within industry. In this portion of the competition, you will be asked to hold a design review with technical lead(s), to inspire confidence with senior management in the progression of the design. The meeting will start with the technical lead asking the following question.

Why did you choose “this design aspect variable” for your design?

The design aspect of inquiry will be selected from the information your team provides in the design overview video. Details on the video provided below. If a team does not submit a video, they cannot participate in the Defense of Design event. The specific design aspect will only be made known during the meeting with the technical lead. Teams must answer this provided question and any other follow-up questions that the technical lead(s) ask and will be scored based on the criteria below.

- 1) Design Aspects Ability to Aid in Achieving Goals – 20 points
 - i) Satisfaction of system requirements
 - ii) Understanding of customer needs
 - iii) Market position
- 2) Design Considerations - 20 points
 - i) Pro's/Con's
 - ii) Alternate considerations
 - iii) Benchmarking
- 3) Consideration of Company/Project Limitations – 15 points
 - i) Budget
 - ii) Manufacturing/supply chain core competency
 - iii) Available resources
- 4) Judge's Discretion – 15 points
 - a) Professionalism
 - b) Desire to learn
 - c) Other

This event will occur virtually this year via a private breakout room using Microsoft Teams. The event will be held between January 16th- 23rd, 2022. (See section 9 for schedule). A maximum of three team members will be allowed to participate in the defense of design presentations. If the moderator perceives that the 3 presenters are getting “help” from another person or if someone else answers a judge's question, the points for this area will be forfeited. No spectators will be allowed for Defense of Design judging. A meeting invite will be sent to the team captain and advisor. This link should only be shared with the team members presenting for Defense of Design judging. Teams will be permitted to join this meeting no more than 10min before their assign time slot and the moderator will move the team and the judges to the private breakout room at the assigned time.

Office hours will be held the week of January 9th, 2022 and you can use this time to practice sharing screens, turning video on and off, testing connections, etc. More information will be sent directly to team captains and advisors regarding the schedule for office hours and meeting link to join.

- The defense of design judging schedule is listed in section 9.
- 10 minutes will be permitted for each team with the judges.
- A warning will be given at 8 minutes to allow for the team to wrap up the discussion.
- DO NOT MISS YOUR TIME SLOT!

The questions will NOT be sent to teams ahead of time. The teams should be prepared at the start of the meeting time to share models, sketches, physical parts, design logs, etc. in support of the judges questions.

4.1.1 Design Overview Video (15 pts)

All videos must be shared with the official ASABE IQS Google account (asabe.iqs@gmail.com) through Google Drive by 5:00 P.M. Central Time on the video due date listed in Section 9.

The purpose of the video is to provide a means for your team to communicate the intended design of your tractor. It is acceptable to share models, sketches, animations, test benches, physical components, etc within your video. The design overview video will not be seen by the judges of the Defense of Design event; it will be used by the organizing committee to prepare the questions for the event. The design overview video is worth 15pts. Videos which are submitted on time and follow the procedures outlined here will receive the full 15pts.

It is understood that the design process is iterative and new information may require a change to the plan. The video should be considered a snapshot in time. No penalty will be given if a design changes between video submission and the judging event. In addition, there is no penalty for changing the design anytime after the judging event.

4.1.1.1 Video Contents

The video should include an overview of the vehicle specifications and an overview of the marketing position for the tractor. The specifications listed below are the minimum and teams can elaborate on any aspect they choose. Teams may add content above and beyond what is listed below.

Specifications:

- 2WD/MFWD/4WD
- Ackerman steer, skid steer, crab steer, etc
- Frame material
- Drivetrain layout – transmission type, gearboxes, chains, belts, fluid, etc
- Vehicle weight and weight split
- Make vs buy analysis (Will the major components be built or bought)

Marketing Position:

- High performance puller, excellent reliability, best-in-class maneuverability, etc.

4.1.1.2 Video Format

All videos must be shared with the official ASABE IQS Google account (asabe.iqs@gmail.com) through Google Drive by 5:00 P.M. Central Time on the video due date listed in Section 9 to receive full credit. Videos received after this time but before 5:00 P.M. Central time 1 week

later will not receive the 15 points for video submission, but the teams will be allowed to participate in the judging event. Submission time will be determined by the time stamp in Google Drive.

Video formatting rules are as follows:

- Length: Target 5 minutes in length – anything between 4-6min is acceptable
- Size: Must be less than 1500MB
- Type: File type must be .mp4 or .pptx (with voice recording)
- Name: Follow the naming convention [School Name]_[Team designation: either X or A]_[DesignOverview].[FileType]
 - Examples:
 - South_Harmin_Institute_of_Technology_A_Design Overview.mp4
 - South_Harmin_Institute_of_Technology_A_DesignOverview.pptx
- Team name and competition year should be spoken or visual to start

Once you have shared your video with the official Google account please send a confirmation email to asabe.iqs@gmail.com to confirm that your video has been received.

Once the reports are shared with the official Google account and a confirmation email has been received schools cannot unshare or modify their video until after the closure of the competition awards banquet.

Teams that are unable to meet the final deadline for video submission will receive no score for this portion of the competition. They are encouraged to continue working on their tractor, come to competition, and compete in all other aspects of the competition.

Written Design Reports (500 pts)

All reports must be shared with the official ASABE IQS Google account (asabe.iqs@gmail.com) through Google Drive by 5:00 P.M. Central Time on the report due date listed in Section 9. See Section 7.1 for submission information.

Three separate electronic reports are submitted as part of the Written Design Reports.

- Design Report (380 pts.)
- Design Log (20 pts.)
- Cost Analysis Report (100 pts.)

Review Section 7 for details regarding formatting and report submission.

4.1.2 Design Report (380 pts.)

The Design Report describes the team's design from conceptual stage, through fabrication, testing and development. Design reports should discuss the present design and clearly reference any design concepts taken from previous team(s)' design reports. Please refer to Sections 7.4 and 7.5 for a copy of the Proper Credit and Plagiarizing Statements.

The Design Report is limited to a maximum of 25 (8 ½" by 11") pages (minimum font = 10pt and recommend double spaced). The title page (as described in Section 4.1) does not count toward the page limit, so long as it only contains the information required. All content not otherwise specified will count toward the 25 page limit.

Design Criteria & Objectives = 5 pts.

Customer Requirements (Who is the 'target' customer & what are his/her requirements)

Format = 15 pts.

The layout of the report should be clean and easy to follow. Attention should be given to proper spelling and grammar. Font selection and spacing should allow text to be easily readable. Report must follow requirements for length, naming, and submission.

Design Details = 250 pts.

The Design Report is the main document being judged by the "fictional upper management." It should contain any details that the team feels are important to document. For instance, the report could include conceptual details on the tractor design, design analysis performed on major components, or it might include a description of the power train system chosen and the reasons behind the decision.

Any original or innovative ideas should be clearly stated and explained. The Design Report should include important assembly and detail drawings. The report should include details of the development process. The report should describe how the design meets the needs/requirements of the 'target' customer and maximizes customer value.

The Design Report should include information on the tractor configuration including general arrangement & location of components, physical dimensions of tractor, and static weight distribution etc.

Note: The Design Report and Cost Estimate Reports are graded by two separate sets of judges. It is strongly suggested that you include the overall cost reporting sheet (section 4.2.3.4) and a brief description of the cost strategy in the design report (although the topic should be covered in greater detail in the Cost Estimate Report).

Failure Modes and Effects Analysis = 20 pts.

A system level Failure Modes and Effects Analysis (FMEA) should be conducted on the tractor ***electric kill switch***. This should include all of the components that encompass the kill switch, any electric circuits, adjustments, or interchangeability of the subsystem.

Failure modes can cover design flaws to manufacturing flaws and anything in between. A summary of the FMEA should be included in the Design Report with special attention brought to high RPN values and what, if any, mitigation measures were taken with the design or in the design process.

There is a lot of information available on various sources that will give instructions on how to conduct an FMEA. We have provided a template that will be linked on the ¼-Scale Website ([link](#)) that we ask all schools to use for consistency.

Testing & Development = 70 pts.

Design Reports should include both testing details and general concepts gained from testing. Development can be directly related to experiences gained during the previous year's competition.

Judges Discretion = 20 pts.

Points may be gained at the judges' discretion for exceptional efforts, innovation, educational experience or other miscellaneous categories.

Please note – It is required that teams include a picture or conceptual drawing of their tractor (any medium - solid model or hand sketch) with the report.

4.1.3 Design Log (20 pts.)

The Design Log describes the team's design concept formation, development process & team activities during the course of development.

The Design Log is limited to a maximum of 150 (8 ½" by 11") pages (minimum font = 10pt). The title page (as described in Section 7.0) does not count toward the page limit, so long as it only contains the information required. All content not otherwise specified will count toward the 150 page limit. Exceeding the page limit will result in a 2 point deduction.

Items to consider including in this log include concept generation notes (whether on napkins, graph paper, or other medium), brainstorming notes, calculations, team notes from meetings, emails, etc. Anything and everything used to develop the tractor can be put into the design log.

4.1.4 Cost Estimate Report (100 pts.)

4.1.4.1 Overview

For this competition, teams must be able to justify their designs in terms of the cost involved in producing the machines in their intended market. The goal of the Cost Estimate Report is to produce an estimate of the total manufacturing cost of the tractor for the production volume. The intention is not to report the actual cost of the particular entry, but to give the team experience in preparing an engineering cost analysis for the proposed design.

There is no limit to the length of the Cost Estimate Report. The cost estimate report must contain a titled page as described in Section 7.0.

The total manufacturing cost is comprised of three different costs. They are manufacturing variable cost, period manufacturing cost, and research & development cost. They are summed together for the total cost. The period manufacturing and research & development costs are calculated as a percentage of the manufacturing variable cost.

The manufacturing variable cost is largest of the three and is calculated using the worksheets shown below. This cost includes the labor, materials, and other variable costs in the manufacturing process.

The period manufacturing costs represent overhead and other capital expenses for manufacturing. Examples are tooling, buildings, and other manufacturing technology required to produce the product. It also includes general administrative, sales, and product support expenses. Period mfg. cost is calculated as a percent of the manufacturing variable cost. The range is 14% to 21% of the manufacturing variable cost. It's the responsibility of the team to choose a number from that range which best represents the mfg. requirements for their tractor design.

Examples:

- High period manufacturing cost
 - Proprietary design or design with complex or precise geometry. It would be built in house or with a single partner manufacturer.
 - Significant new design technology requiring different mfg. processes different than prior art.
 - Large amount of service tool development and service training.
- Low period manufacturing cost
 - Design uses commonly available mfg. process
 - Similar design used in the industry with the ability to easily outsource components to the lowest bidder.
 - Simple overall design with fewer parts and features to manufacture.
 - Uses existing service tools and doesn't require advanced training for technicians.

The research and development cost is the expense required to engineer, design, build prototypes, and test them. It represents the expense necessary take an idea to a product that is ready for manufacture. The range is 3% to 6% of the manufacturing variable cost. It's the responsibility of the team to choose a number from that range which best represents the research and development expenses for their tractor design.

Examples:

- High research and development cost

- Large amount of new content significantly different than previous designs or the industry standard.
- Designs requiring extensive testing and validation to prove performance.
- Low research and development cost
 - Designs using existing components that have already been validated on similar machines.
 - Simple overall design with few parts and features.

Teams should not choose a high or low period manufacturing cost or research and development cost based on whether they consider their calculated manufacturing variable cost as high or low. They are all independent and it's possible to have any combination of high or low between the three.

The cost estimate is based on the company's expected production rate of 3000 units per year with a sales price to compete against the market leader, but will consider higher production volumes if the team can justify them with the concept and compare the business case against the base of 3,000 units per year. In other words, management is looking for the best business case, and not necessarily the lowest-cost tractor or the tractor with the most features. The company will not accept any concepts that do not have a profit margin above 7%. Profit margin in this scenario is defined as (Sales Price minus Total Cost to Produce) divided by Sales Price. All components, including the Briggs & Stratton engine and Titan tires must be accounted for in the report.

The number of pages is unlimited. The Cost Estimate Report must be submitted at the same time as the Design Report. It is required that each report have an overall picture or 3-D model of the tractor design in order to have a reference for the concept of the tractor. It is also required that each cost analysis feature a summary page showing the following:

- Profit margin
- Manufacturing Variable Cost
- Period Manufacturing Cost
- Research and Development Cost
- Suggested sales price
- Total number of parts
- Tractor weight
- Available options

In general, the cost analysis portion of the competition is judged based on the following criteria:

- Is the cost estimate accurate and honest?
- Is the cost estimate thorough?
 - Are all parts accounted for properly?
 - Are all parts supported with drawings, quotes?
 - Are overheads such as equipment and facilities accounted for?
- Are the period mfg. cost and R&D cost in the correct area of the specified range for the tractor design?
- Is the cost estimate organized for proper reference?

Details on various sections of the cost analysis are as follows:

Cost Strategy Section = 50 pts.

The Cost Strategy Section is a written essay in which the team is asked to explain their design concept and decisions with regards to cost. They are asked to explain the compromises they were required to make in their design in order to achieve the cost level. They are also asked to propose additional steps, which could be taken to reduce cost if their design was to be actually manufactured as a real product.

Cost Analysis Section = 50 pts.

The Cost Analysis Section is comprised of standard worksheets to determine the estimated “manufacturing variable cost” of the tractor based upon a sales volume defined by the target market share. Cost Analysis worksheet formats and examples are given in the following sections of this document.

The cost analysis section must have the following information:

- Complete bill of materials
- Component/Part/Assembly prints (any medium- solid model or hand sketch). Every part, weldment, and sub assembly must have either a picture or print for clarification.
- Price Quote (Every component used in the design must have a quotation or receipt. Weldments and fabricated parts can be calculated using the data referenced further in the handbook)
- Prices for all attachments, accessories, and add-on devices. This price must be included in the overall cost of the tractor for production as they will be used to market the product to drive higher sales.

The manufactured cost of the tractor will be composed of the following specifications:

1. All costs are to be given in US dollars. For any other currency - you may use a recent exchange rate (no earlier than March 1 of the year of the Competition). Please note the date and value of the exchange rates chosen in the report.
2. Briggs and Stratton 31-horsepower engine is given a set cost of \$1360. One set of Titan 26-12-12 tires is \$75 for this analysis.
3. All purchased parts shall be estimated at 40 percent of retail cost ($0.40 \times \text{retail price}$). NOTE: If you buy a part from a junkyard you may not use the actual price you paid. You must determine the retail cost of a new component and then take 40%.
4. All raw materials are to be considered wholesale. If only retail prices for raw material are available the wholesale price of 70 percent of retail may be used ($0.70 \times \text{retail price}$).
5. The Cost Reporting Sheet (an example is found in the following sections) is broken down into sub-categories. All components required for the construction of the tractor should be accounted for in one of the sub-categories. A suggested breakdown of the sub-categories follows.
6. All *Purchased* and *Fabricated* parts making up a sub-category must be itemized in Form A. A separate Form A should be made for each sub-category such as “Frame” or “Safety Equipment” found on the Cost Reporting Sheet.

7. Any fabricated part itemized in a Form A should also have a Form B accompanying it. Form B itemizes the raw materials as well as the labor and machining costs associated with the fabricated part. The Operations Cost Table should be used when assigning cost values to manufacturing operations. Samples of Form A and Form B have been included in the handbook. As a reminder – when choosing the intended operation – the production units should be based on the production volumes– not just the operation you would use for producing one prototype.

4.1.4.2 Cost Estimate Component Breakdown

The following categories are to be used when itemizing parts in the cost sheet. If you have any additional parts, either place them under the most logical category or put them in the Misc. section.

- | | |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Engine System | Fuel Tank, Fuel Line, Throttle Lever/Pedal, Fuel Filters, Fuel Pumps, Throttle Linkages, Exhaust System |
| 2. Transmission /Transaxle | Clutches, Torque Converter, Drive Engagement Mechanisms, Gearboxes, Hydraulic/Mechanical Transaxle Unit |
| 3. Drive Train | Gears, Sprockets, Pulleys, Chains, Belts, Drive Shafts, Bearings, U-Joints, Drive Axles, Hydraulic Motors, Hydraulic Pumps, Seals |
| 4. Tires & Wheels | Lug nuts, etc. |
| 5. Steering | Steering Wheel, Supports/Brackets, Shafts, Gears, Bearings, Tie Rod Ends, Rack & Pinion Gears/Units, Knuckles, Bushings, Joints, Etc. |
| 6. Frame | Structural Members, Engine Mounts, Brake Mounts, Steering and Drive Line Supports, Hitch, Wheelie Bars, Throttle Lever Mounts, Fuel System Components, Mounts, Ballast Mounting Supports, Sled Bump Stops |
| 7. Body | Hood, Grille, Fenders, Engine Covers, Seat, Sponsor Plates, Etc. |
| 8. Brake System | Mechanical/Hydraulic Axle Brakes, Master Cylinders, Pedals, Lines, Cable, Fittings, Etc. |
| 9. Electrical System | Starter Switch, Battery, Cables, Wiring, Breakaway Switch, Lights, Gauges |
| 10. Fasteners | Nuts, Bolts, Rivets, Screws, Etc. |
| 11. Safety Equipment | Guards, Shields, Drive Shaft Loops, Fire Extinguisher |
| 12. Trim | Paint (Primer, Gel Coat), Emblems, Etc. Includes work time. |
| 13. Miscellaneous | Gearbox Oil, Hydraulic Oil, Other |
| 14. Final Assembly | Cost for the final assembly of the tractor |

4.1.4.3 Operation Cost Table

Operations Cost Table	
Operation	Cost (in U.S. Dollars)
CNC Machining	70.00/hr
Weld	0.06/cm (0.15/inch)
Saw cut	0.15/cm (0.38/inch)
Tube Bends	0.75/bend
Pre-welding preparation for tube ends	0.75/end
Drilled hole smaller than 1" dia., any depth	0.35/hole
Drilled hole larger than 1" dia.	0.35/inch greater than 1" per hole
Tapped Hole	0.35/hole
Sheet metal shearing	0.20/cut
Sheet metal bends (under 3/8 inch thickness)	0.05/bend
Plate bends (material over 3/8 inch thickness)	0.10/bend
Sheet metal punching	0.20/hole
Plasma cutting/ Lazer cutting	0.10 /inch
Fiberglass	\$9.00/sq ft
*Powder coating	\$55.00/hr
Chromeplating/anodizing/phosphate coating	\$2.00/foot
**Painting	\$50.00/hr
Assembly of nut,bolt, and washer	0.10/per
Component assembly (Time)	35.00/hr
Labor (machine set-up, load, unload)	45.00/hr
Miscellaneous operations	Obtain quote on 3000 pieces
* Does not include painting.	

4.1.4.4 Cost Reporting Sheet

Cost Reporting Sheet Example						
Section	Category	Purchased	Fabricated	Cost / Unit	Quantity	Total Cost
1	Engine System	\$706	\$53	\$759	2	\$1,517.20
2	Transmission / Transaxle	\$850	\$170	\$1,020	1	\$1,020.00
3	Drivetrain	\$80	\$100	\$180	1	\$180.00
4	Tires & Wheels	\$200	\$50	\$250	2	\$500.00
5	Steering	\$20	\$15	\$35	1	\$35.00
6	Frame	\$50	\$500	\$550	1	\$550.00
7	Body	\$100	\$200	\$300	1	\$300.00
8	Brake System	\$0	\$25	\$25	1	\$25.00
9	Electrical System	\$30	\$0	\$30	1	\$30.00
10	Fasteners	\$9	\$0	\$9	1	\$9.00
11	Safety Equipment	\$25	\$50	\$75	1	\$75.00
12	Trim	\$100	\$200	\$300	1	\$300.00
13	Miscellaneous	\$10	\$0	\$10	1	\$10.00
14	Final Assembly	N/A	\$200	\$200	1	\$200.00
TOTAL		\$2,180	\$1,563			\$4,751.20
TOTAL VEHICLE COST			\$4,751			
(Parts and Labor)						
Team Captain		(Signature)				
Faculty Advisor		(Signature)				
Professional Engineer						

4.1.4.5 Form A Example

Subassembly Name: Engine System						
P/N	Part Name	Purchased	Fabricated*	Vendor	Qty	Cost
U-001	31 hp Vanguard Engine	\$1,360.00		Briggs & Stratton	1	\$1,360.00
U-002	Fuel Tank	\$35		Jegs	1	\$35.00
U-002a	Fuel Tank Bracket		\$17.05		1	\$17.05
U-003	Shut-off valve	\$3		Midwest Super Cub	1	\$3.00
U-004	Throttle Pedal	\$15		Jegs	1	\$15.00
U-005	Exhaust Pipe		\$39.75		1	\$39.75
	Totals	\$653.00	\$56.80			\$1,469.80
* Form B must be filled out for each fabricated part						

4.1.4.6 Form B Example (Fabrication Sheet)

[illegible]

4.2 Team Presentation (500 pts.)

Please Note: The use of cameras is allowed in the presentation rooms only. Cameras are not allowed in any other parts of the building. Teams must remain in designated areas when not presenting.

Purpose Statement:

Launching a new product is one of the highest risks that a company takes. Senior management must commit approval to fund the expense of the launch and to accept the consequences of success or failure. To ensure the best decision is made, the development team must inform management of readiness of the product for market. As with all products, there are many unknowns. Your job is to provide management an assessment of design concept, design verification, manufacturing cost, market position, and known areas of risk. The senior management will ultimately decide if this project offers an adequate opportunity for profit with an acceptable level of risk. It is required that the presentation at least has an overall picture or 3-D model of the tractor design in order to have a reference for the concept of the tractor.

Teams will be asked to give a 15 minute (max) presentation (including time for questions) to a panel of judges on the development and advantages of their machine. The time limit will be strictly enforced. The breakdown of points is shown below with a list of suggested 'talking points.' After the 15 minute presentation, there will be a short discussion period (3-5 min) where the judges will provide feedback to the individual team.

Design Concept/Customer Focus = 125 pts.

- Design Concept – Overview of Design
 - Specifications / Performance/ Design Details / Assumptions
 - Benchmarking (previous technical solutions and/or outside designs)
 - Decision Process (i.e. for important areas of design) / What are the Alternatives/Compromises?
- Who is the 'target' customer? (Teams must address this question)
- What does the customer want? How does the design meet the customer's needs? (Must address question)
- Market Position (High End vs. Low End Customer, Multi use vs. specialized, etc).
- Ingenuity / Innovation / Technical Creativity

Readiness for Market = 125 pts.

- (100 pts) Design Verification - Will the Product Work? How do you know?
 - Design Analysis – Performance/ Stress/ Simulation
 - Test program – Appropriate Data & Corrective Action
 - Technical Defense of Design Decisions
- (15 pts) Risk Assessment - What are the Known Areas of Risk? What are the Alternatives/Compromises?
- (10 pts) Failure Modes and Effect Analysis (FMEA) – See section 4.1.1 for FMEA topic. What did the FMEA show, and how did the analysis impact the final product?

User Safety = 50 pts.

- Safety Features (highlight those that are above and beyond competition requirements)
- Product Liability Assessment
 - Explain how the product/design addresses customer safety

- Known Areas of Risk / Proposed Corrective Action

Product Cost = 75 pts.

- Expected Profit Margin / Cost Breakdown
- Design/ Process Strategy in terms of Maximizing Customer Value
- Manufacturing Strategy / Impact of Manufacturing Strategy on Design & Cost
- Cost Decisions in terms of Maximizing Customer Value

Team Organization / Planning = 15 pts.

- Team Organization / Planning
- Simultaneous Product / Process Development

Presentation = 50 pts.

- Communication - Effectiveness & Clarity
- Visual Aids
- Handouts

Question & Answer = 45 pts.

Judge's Discretion = 15 pts.

Points may be gained at the judge's discretion for exceptional efforts, innovations, educational experience, and other miscellaneous categories.

Formal presentations will take place indoors before a panel of judges. Each team will have access to the same electronic projector and screen. Tractors will NOT be allowed at the Team Presentations. Presentations will take place in a room that can be dimmed for slide presentations. Each team is required to bring their own laptop computer.

The majority of the Team Presentation judges will be professional engineers (either senior design engineers or technical managers). Each panel of judges will also include one representative from sales/marketing. The judges will be reviewing both the design and the design process from an industry standpoint.

Team presentations will be conducted in semi-private audiences with the judges. Members of OTHER teams are NOT allowed to view the presentations in order to ensure fairness for all groups. However, competition staff, team supporters and team members of the presenting team are allowed in the room. It is the responsibility of the presenting team to inform the officials if there is an unknown/unwanted spectator in the room at the time of their presentation.

4.3 Design Judging (420 pts.)

4.3.1 Panel Judging (350 pts.)

Design Judging will take place in conjunction with Technical Inspections. Design Judging is an interactive portion of the competition where teams present their design's attributes in the particular category to the panel of judges. The judges may then ask questions for further details or provide comments for development of the team's next model. Individual judges will be reviewing the tractor design for the following attributes.

- **Manufacturability = 70 pts.**
- **Serviceability = 70 pts.**
- **Ergonomics = 70 pts.**
- **Safety = 70 pts.**
- **Test & Development = 70 pts.**

Judges for Serviceability, Manufacturability, Safety, Ergonomics, and Test & Development events will be professional engineers, technicians, and or operators from industry. Judges have requested a maximum one-page single sided reference sheet, including picture to summarize the tractor for each area judged. This document is not required and will not be judged. A maximum of three team members will be allowed to participate in the Design Judging presentations. Additional team members may be present, but must be seated alongside the presentation area and cannot participate in the presentation.

- The design judging schedule is listed in section 9.
- 10 minutes will be permitted for each tractor in each judging area.
- A warning will be given at 8 minutes of each segment to allow for questions from judges.
- Be at the staging area by the building at least 10 minutes before the scheduled time.
- The technical inspection schedule is more flexible. Design judging takes the priority!
- Judges will be leaving at 3:30pm. DO NOT MISS YOUR TIME SLOT!

4.4 Technical Inspection (Pass/Fail)

All teams are required to pass a full technical inspection prior to participating in practicing or competing in any Performance Competition. This process is broken into two portions: Initial Weigh-in and a Detailed Technical Inspection. Teams will have until the start of the Tractor Pull to correct any non-compliance.

Technical Inspections for A-Teams will verify compliance to the 2020 competition rules for A-Teams. IF THERE ARE ANY QUESTIONS OR CONCERNS ON THE RULING OF A TECHNICAL INSPECTOR, PLEASE STATE YOUR CONCERNS TO THE LEAD TECHNICAL INSPECTOR OR THE RULES CHAIR.

4.4.1 Initial Weigh-in

All A-Teams that have their tractors in the Tech (Sheep) Barn by the specified time in the Technical Inspection Schedule and meet the following five conditions **will receive a bonus of 100 points**:

- Tractor must be able to start and operate under its own power
- Only one driver and one assistant are allowed to be with the tractor at the Initial Weigh-in
- All shielding must be in place as best as possible to make the tractor safe to operate.
- Team must make it to Tech Inspections for their scheduled time by the end of their scheduled teching time slot.
- Team must be complete with Tech Inspections 24 hours after the end of their scheduled teching time slot. (ex. a team in the 2:00 – 2:30 slot needs to complete all inspections and have the final “tech inspection complete” sticker by 2:30 on Friday)

All tractors will then be required to pass over the official scale, at which time they will be checked against item 2.3 in the Rules document regarding maximum gross vehicle weight. Teams not meeting the weight requirement during this measurement will not be eligible for the *First Time Through Award*, but will have still met the requirements of the Initial Weigh-in. Teams must meet weight as specified by item 2.3 in the Rules document before proceeding into the detailed technical inspection.

After the Initial Weigh-in, the first group will proceed directly to technical inspections (after they’ve properly ballasted their tractor according to rule 10.3). All other teams are allowed to leave.

4.4.2 Detailed Technical Inspection

Teams are required to pass through different Technical Inspection Stations, each manned with a group of inspectors. **Teams are assigned a time to report to Technical Inspections.** Only the driver and one other team member will be allowed into the Technical Inspection Area with each tractor. All others must be outside of the building or in the designated spectator area.

With the exception of the initial weigh-in, all inspection stations must be completed with the tractor ballasted per rule 10.3. Once completing all stations, machines will need to be weighed again to verify that they still meet base weight with any modifications that were required in the technical inspection process. Tech inspections are complete once a team passes the final base weight check after all other inspection stations are finished.

Teams will have all components intended for different configurations available during tech inspections for the tech inspectors to view. This will allow them to verify that each change still

meets all requirements of the rules, including the same base weight requirement with all alternate configuration components.

As outlined by the Competition Rules, teams are required to display sponsor decals on their tractor; they may be mounted on magnetic strips if desired (teams must provide their own magnetic strips if desired). NOTE: All of the decals must be displayed on the tractor throughout the entire competition. **Decals must be displayed in original form, no cutting or trimming of sponsor logos.** Sponsor decals will be provided to each school two weeks before competition.

4.4.1 Sound Judging (Pass/Fail)

All team must record a sound level lower than 91dB(A) in the sound level tech inspection station to compete in performance events. Points will not be awarded.

4.5 Performance Events (900 pts.)

4.5.1 Maneuverability Event (100 pts.)

The Maneuverability Course Event is held to encourage consideration for maneuverability in tractor design. The team(s) with the lowest number of overall 'course demarcations' will receive a maximum of 100 points (course demarcations indicate number of direction changes, distance traveled, and number of collisions). Teams will receive points using the following ratio:

$$(100 - \text{Individual Demarcation}) / (100 - \text{Lowest Demarcation}) \times 100$$

The course will NOT be shown to teams until the start of the Maneuverability Event. With this, we request that rough forms of the actual course not be setup for practice, since the event has already started. The purpose of this event is to evaluate the maneuverability of the tractor, not to train operators to run the course.

In the event of a first place tie, the Maneuverability Award will go to the team with the lowest course completion time.

4.5.1.1 Maneuverability Rules

1. Time limit is 8 minutes. However, one point will be awarded for each 15 seconds exceeding 5 minutes. If the time limit of 8 minutes is reached, the result will be disqualification. A clock will be placed at the course for observation.
2. Only one attempt per school is allowed during the maneuverability event.
3. No spotters are allowed.
4. The course will be outlined with stands with a golf ball will be placed on top of each stand. The vehicle must drive through the entrance and must contact all red stands and knock the ball off each one.
5. Operator must remain on tractor seat at all times during the event.
6. Inadvertent wheel hop or lift is permitted; however, any drive tires that leave the ground due to the actions of the operator will result in disqualification. (i.e. no bouncing the tractor to assist in turning by sliding the wheels)
7. Additionally, disqualification may occur as a result of the following events:
 - The tractor fully leaves the course (no wheels in contact with the ground inside the course area) prior to knocking all red balls off the stands.
 - A driver receives assistance from anyone outside the course, verbal or likewise.
 - A driver leaves their seat, intentionally or not, anytime throughout the event.
 - If any fluid leaks from the tractor in a steady stream or an intermittent discharge equivalent to an 8 inch diameter circle.
 - Any part falls from the tractor during the event, including ballast.
 - At the judge's discretion.

4.5.1.2 Maneuverability Points Breakdown

- One demarcation will be given for each change in direction of the vehicle, except for the initial direction change after contacting each red stand.
- One demarcation will be given for each red stand knocked over or moved completely from its original position.
- One demarcation will be given for each golf ball that falls off a yellow stand.
- One demarcation will be given for each yellow stand that is tipped over.
- One demarcation will be given for each yellow stand that is moved completely from its original position. Judges will remove a stand to protect the equipment.

- Five demarcations will be given for each yellow stand that a team requests a judge to remove.

Note: Maneuverability Course and Rules subject to change as determined by the Organizing Committee.

4.5.2 **Tractor Pull (600 pts.)**

The pull performance event is comprised of a multi-stage tractor pull using a progressive sled. Points are gained by the number of feet the sled is pulled by the respective tractor. Each team will be allowed one scored pull in three separate heats. Each of the 3 pulls will be worth 200 points and will be calculated as follows:

$((\text{Individual Team Tractor Pull Distance in ft}) / (\text{Maximum Team Tractor Pull Distance in ft})) \times 200$

Thus the team that has the highest overall tractor pull distance for each pull will earn the entire 200 points. The overall Tractor Pull score will be the sum of the points for all 3 pulls, for a maximum of 600 points. It is the discretion of the track officials to determine whether a heat is to be restarted.

In the event a floating finish is NOT used, rankings for multiple full pulls within a heat, will be determined by a pull off – however, each team will retain the full pull point score (200 points).

Pulling weight classes are 1100 lbs. maximum and 1600 lbs. maximum. Weight classes include weight of vehicle, driver, and ballast. The chain angle will be adjusted by varying the attachment point on the sled between ground level, and 10" from the ground. A lottery will be used to determine the weight and chain angle for each of the pulls. The lottery for both the weight and chain angle will be conducted at the initial tractor weigh-in.

Upon completion of the Final Quarantine, the engines from the overall top three finishers of the Tractor Pull Event will be collected by the Brigg's and Stratton representative to be inspected and returned to the schools at a later date.

Rules for the Tractor Pull Event are listed in the section titled Performance Event Regulations (Section 6.0).

4.5.3 Durability Event (200 pts.)

The Durability event is designed to encourage teams to focus on tractor performance in off-road environments and machine reliability. The team(s) completing the highest number of laps within the allotted time and rules will receive the maximum of 200 points. Durability event weight class is 1600 lbs. maximum. Weight classes include weight of vehicle, driver, and ballast.

The Durability event will be conducted on an oval course setup on the pulling track that consists of bumps and flat areas. The bumps will be of varying height, no taller than 4 inches and will be set up in an undisclosed array of variable height and spacing. Teams will be required to tow an implement weighing up to 4000 lbs (with 0%-20% tongue weight) through the entire course. The cart will provide a draft load to the tractor. The draft load imparted will be directly related to ground speed, where a higher speed will produce a higher draft load. The cart will attach to the rear hitch of the tractor. A drivers meeting will be held ahead of the event to explain event logistics and execution.

Teams will receive points using the following calculation:

$$\left(\frac{Lap_{comp}}{Lap_{max}} * 200\right)$$

Where:

Lap_{comp} = Total Laps Completed (measured in single laps based on crossing the finish lines; no partial laps will be counted)

Lap_{max} = Maximum Laps Completed (by winning school)

4.5.3.1 Durability Event Rules

1. The total time limit for the event is 20 minutes. Time begins when any part of the tractor crosses the start line.
2. Only one attempt per school is allowed during the event, with the exception of the 1st school. The 1st competitor is considered the test competitor, and upon conclusion of their first run, they have the following options:
 - a. Accept the score
 - b. Refuse the score and immediately run again for another attempt
 - c. Refuse the score and run again in the 6th position
3. No spotters are allowed.
4. The course is outlined with a chalk line on either side. No part of the tractor or trailer can contact the chalk during the event. If a machine drives outside the course boundary, the event ends and points are calculated based on the distance completed.
5. The operator must remain on the tractor seat with at least one hand gripping the steering wheel or grab handle at all times during the event. If either of these conditions isn't met, the event ends and the points are calculated based on the distance completed.
6. No parts can fall from the tractor during the event, including ballast. If any parts fall from the tractor, the event ends and points are calculated based on the distance completed.
7. A speed limit of 5 miles/hour (8.0 kilometers/hour) will be enforced continuously throughout the event. If a competitor is caught speeding, a warning will be given to notify the driver to reduce the speed under the limit. Failure to do so within 3 seconds of the warning being given will result in the black flag penalty (see below). Penalties for speeding are as follows:
 - a. 1st offense: 10 seconds removed from total time available
 - b. 2nd offense: 20 seconds removed from total time available
 - c. 3rd offense: event ends, points are calculated based on the distance completed
8. If a tractor is "stuck" and is unable to produce measurable forward progress within 4 minutes, the event ends and points are calculated based on the distance completed.
9. If the course judges observe anything they deem a potential safety issue during the event, the competitor will be black flagged, and required to return to the course pit for a minimum 10 second run-off (time is counted when the tractor is stopped in the pit). During this time the safety issue will be explained to the competitor. A 2nd occurrence of the same safety issue will end the event for the team and the points will be calculated based on the distance completed.

4.6 Summary of A-Team Points Distribution

Category	Sub-Category	Sub-Area Points	Major Area Points	% of Total Score
Defense of Design			85	3.5
	Design Ability to Aid in Achieving Goals	20		
	Design Consideration	20		
	Consideration of Company Limitations	15		
	Judges' Discretion	15		
Written Design Report			500	20.7
Design Report		380		
	Design Criteria and Objectives	5		
	Format	15		
	Design Details	250		
	Failure Modes and Effects Analysis (FMEA)	20		
	Testing and Development	70		
	Judges Discretion	20		
Cost Estimate Report		100		
	Cost Strategy	50		
	Cost Analysis	50		
Design Log		20		
Team Presentations			500	20.7
	Design Concept/Customer Focus	125		
	Readiness for Market	125		
	- Design Verification	100		
	- Risk Assessment	15		
	- Failure Modes and Effects Analysis (FMEA)	10		
	User Safety	50		
	Product Cost	75		
	Team Organization and Planning	15		
	Presentation	50		
	Question and Answer	45		
	Judges' Discretion	15		
Design Judging			350	14.5
	Serviceability	70		
	Maneuverability	70		
	Safety	70		
	Ergonomics	70		
	Test & Development	70		
Technical Inspections	Pass/Fail		P/F	
	Sound Level		P/F	
Performance Competition- Pulls			600	24.8
Performance Competition - Durability			200	8.2
Maneuverability Course			100	4.1
Initial Weigh-In Bonus			85	3.5
		Total	2420	100%

5.0 X-Team Requirements and Points Breakdown

Most engineering departments in industry have a current-product engineering department and a new-product engineering department. Usually the new-product engineering department is responsible for the development of new concepts and the first market version of a machine. Once the product is released to the market, the current-product engineering department is responsible for improvements made during the production life of the machine. For the purpose of the competition the X-Teams are simulating what current-product engineers are responsible for.

The X-Team participants have the opportunity to take/borrow a tractor used in previous years and update the machine in order to improve the performance. The participants need to analyze previous data (from the competition, previous tests, previous performances, failures etc....) and modify parts of the design for improvement. The main goal here is to improve the overall performance of the machine.

By participating in this project the X-Team is able to gain an introduction into the real world of engineering. It is important that the X-Team participants use this opportunity to work with the more experienced students who have designed the tractor in the previous year. The participants have to be prepared to answer any questions that the judges may have in regards of the tractor design, from concept phase through production. X-Team events are as follows.

5.1 X-Team Written Report (1000 pts.)

All reports must be shared with the official ASABE IQS Google account (asabe.iqs@gmail.com) through Google Drive by 5:00 P.M. Central Time on the report due date listed in Section 9. See Section 7.1 for submission information.

In order to better prepare students for the world of engineering, a written report is required. This written portion will simulate the tasks of engineers in today's workplace. The report must have a title page that contains the school name and the team captain and advisor's names with signatures. Report should be in PDF format with commenting privileges enabled.

All submitted materials must only include printable information. No links to external sites, videos, etc. shall be included. A good rule of thumb is that any material that would not function should the materials be printed must be excluded.

Situation:

One year after the introduction of a new tractor to the market, the engineering manager asks your team to review the product. Your task is to find ways to improve the design while trying to maintain or reduce the cost of the product. You must use facts and data to prove that the changes will improve the product. Finally, you must write a short report convince the management group that the team's updates have given them a better product to market. Report should be no more than 5 pages in length, not including the cover page described in Section 7.0.

It is required that each report have an overall picture or 3-D model of the tractor design in order to have a reference for the concept of the tractor.

Presentation = 100 pts.

- Overall report presentation

Data = 200 pts.

- How data was gathered
- What method was used

Arguments = 300 pts.

- Reasons for the changes

New Design = 400 pts.

- Description of changes
- Comparison of performance enhancement

The team that has the highest overall design report score will earn the entire 1000 points.

5.2 X-Team Presentation (1000 pts.)

Please Note: The use of cameras is allowed in the presentation rooms only. Cameras are not allowed in any other parts of the building. Teams must remain in designated areas when not presenting.

Teams will be asked to give a 15-minute (max) presentation (including time for questions) to a panel of judges on the development and advantages of their machine. Tractors will not be allowed at the team presentations. The time limit will be strictly enforced. The breakdown of points is shown below with a list of suggested ‘talking points.’ After the 15-minute presentation, there will be a short discussion period (3-5 min) where the judges will provide feedback to the individual team. No written comments will be given. It is required that the presentation has at least an overall picture or 3-D model of the tractor design in order to have a reference for the concept of the tractor.

5.2.1 Technical Content = 200 pts.

Identification of flaws from previous design and opportunity to improve = 200 pts.

- Justification of changes.

Description of Achievement = 100 pts.

- Testing procedures and end results.

Presentation Delivery = 50 pts.

Team Communication = 50 pts.

- Relation between past team and X-team.
- Transfer of information

Use of Visuals = 100 pts.

Question and Answers = 100 pts.

Improvements/Ownership = 200 pts.

- Improvements and modifications performed by the team and the degree to which the team has assumed ownership of the tractor.

- **Example 1:** Team returns to competition with last years' version of the tractor and are unfamiliar with its features, fabrication methods, etc. And has no efforts to improve upon the design. (0 pts.)
- **Example 2:** Team presents tractor with major structural modifications resulting in enhanced performance and/or significant cost reductions. Team is extremely knowledgeable about the reasons for the modifications and has demonstrated a solid understanding of the basics of the original design. (200 pts.).

The team that has the highest overall team presentation score will earn the entire 1000 points.

5.3 X-Team Technical Inspection (Pass/Fail)

All teams are required to pass a full technical inspection prior to participating in practice pulls or competing in the Performance Event. Teams will have until the start of the Tractor Pull to correct any non-compliance.

The tractors must meet the 2020 competition year X-Team Rules and Regulations, which are posted on the ASABE Web page. The X-Team tractors will have to pass Technical Inspection, as the A-Teams do. IF THERE ARE ANY QUESTIONS OR CONCERNS ON THE RULING OF A TECHNICAL INSPECTOR - PLEASE STATE YOUR CONCERNS TO THE LEAD TECHNICAL INSPECTOR OR THE RULES CHAIR:

Teams are required to pass through different Technical Inspection Stations, each manned with a group of inspectors. **Teams are assigned a time to report to Technical Inspections.** Only the team captain and two other team members will be allowed into the Technical Inspection Area with each tractor. All others must be outside of the building or in the designated spectator area.

To begin technical inspections, teams must meet rule 2.3 (base weight check). Upon completion of the initial weigh-in, all inspection stations must be completed with the tractor ballasted per rule 10.3. Once completing all stations, machines will need to be weighed again to verify that they still meet base weight with any modifications that were required in the technical inspection process. Tech inspections are complete once a team passes the final base weight check after all other inspection stations are finished.

Teams will have all components intended for different configurations available during tech inspections for the tech inspectors to view. This will allow them to verify that each change still meets all requirements of the rules, including the same base weight requirement with all alternate configuration components.

As outlined by the Competition Rules, teams are required to display sponsor decals on their tractor; they may be mounted on magnetic strips if desired (teams must provide their own magnetic strips if desired). NOTE: All of the decals must be displayed on the tractor throughout the entire competition. **Decals must be displayed in original form, no cutting or trimming of sponsor logos.** Sponsor decals will be provided to each school two weeks before competition.

5.4 X-Team Performance Event (800 pts.)

The performance event is comprised of a multi-stage tractor pull using a progressive sled. Points are gained by the number of feet the sled is pulled by the respective tractor. The event will consist of two pulls at 1600 lbs. Each of the 2 pulls will be worth 400 points and will be calculated as follows:

$$((\text{Individual Team Tractor Pull Distance in ft}) / (\text{Maximum Team Tractor Pull Distance in ft})) \times 400$$

Thus the team that has the highest overall tractor pull distance for each pull will earn the entire 400 points. The overall Tractor Pull score will be the sum of the points for all pulls, for a maximum of 800 points.

In the event a floating finish is NOT used, rankings for multiple full pulls within a heat, will be determined by a pull off – however, each team will retain the full pull point score (400 points). It is the discretion of the track officials to determine whether a heat is to be restarted.

Rules for the Tractor Pull Event are listed in the Section titled Performance Event Regulations (Section 6.0).

5.5 Summary of X-Team Points Distribution

Category	Sub-Category	Sub-Area Points	Major Area Points	% of Total Score
Written Design Report			1000	35.7
	Presentation	100		
	Data	200		
	Arguments	300		
	New Design	400		
Team Presentations			1000	35.7
	Technical Content	200		
	Identification of Flaws	200		
	Description of Achievements	100		
	Presentation Delivery	50		
	Team Communication	50		
	Use of Visuals	100		
	Question and Answer	100		
	Improvements/Ownership	100		
Technical Inspections	Pass/Fail		P/F	
Performance Competition			800	28.6
		Total	2800	100%

6.0 Performance Event Regulations

6.1 Team Member Eligibility and Conduct

- 6.1.0 All drivers must be at least 18 years of age.
- 6.1.1 All tractors must pass a safety inspection in order to participate.
- 6.1.2 All team members must sign a waiver form at the time of entry and have proof of individual medical insurance.
- 6.1.3 Team captains and advisors must sign a document that confirms they have read the 2020 Competition Year Rules and Regulations, and the 2020 Handbook. This document is located at the end of the Competition Handbook.
- 6.1.4 All communication from the team must be done through the team captain to the Competition Chair, Co-Chair, or Rules Chair identified in section 10.0. Advisors cannot speak on behalf of the team members.
- 6.1.5 **NO** consumption of alcohol and/or drugs (other than medication) is allowed during the competition. If a team member is found to be under the influence of alcohol and/or drugs (other than medication), that team will be asked to forfeit the competition. The person under the influence will be asked to leave immediately under the escort of the school advisor. The team can then appeal the forfeit to the Competition Committee and continue the event still under the forfeit status.
 - If the Competition Committee finds in their favor, they will maintain their standing.
 - If the Competition Committee finds they are at fault, the school will be dropped from the competition and their results will not be displayed.
 - The team in question will not receive any awards until after the Competition Committee has reviewed the case. Again, if the Competition Committee rules against the school, they will not receive any awards and will be dropped from the event.
 - If the team has more than one person under the influence, they cannot appeal the forfeit and will be asked to leave immediately with a capable escort (school advisor). Also, the school will not receive any awards and their ranking will be dropped from the event.
- 6.1.6 Drag racing and excessive speed will not be tolerated. Teams found in violation of this safety issue will be disqualified.

6.2 Driver Requirements and Safety Equipment

- 6.2.1 A capable person,
 - One that can operate the tractor in a safe manner,
 - Must be on the tractor and in control of the tractor at all times when the engine is running.
- 6.2.2 Drivers must remain seated whenever operating the tractor.
- 6.2.3 Drivers are required to provide and use the following safety equipment:
 - A helmet with a SNELL rating, (helmets with only DOT ratings are not acceptable)
 - Eye protection (safety glasses, goggles, or face shield)
 - Cotton clothing or a fire jacket with a SFI rating.
 - All drivers must wear a long-sleeved shirt and long-legged pants.
 - Clothing must be completely buttoned or zipped.

- Closed-toed shoes must be worn.

6.2.4 All drivers must have at least one hand on the steering wheel or grab handle (if using steer by wire) at all times.

- Repositioning hands on the steering wheel and/or grab handle will not be grounds for disqualification as long as the flag-person feels it is a safe distance away from the steering wheel (i.e., a judgment call, but must stay within 3 inches of the steering wheel)

6.3 Protests

6.3.1 All protests from the team must be done through the team captain to the Competition Committee Chair or Co-Chair identified in section 10.0. Advisors cannot speak on behalf of the team members.

6.3.2 Any team wishing to file a protest against another team may do so by using the following procedure:

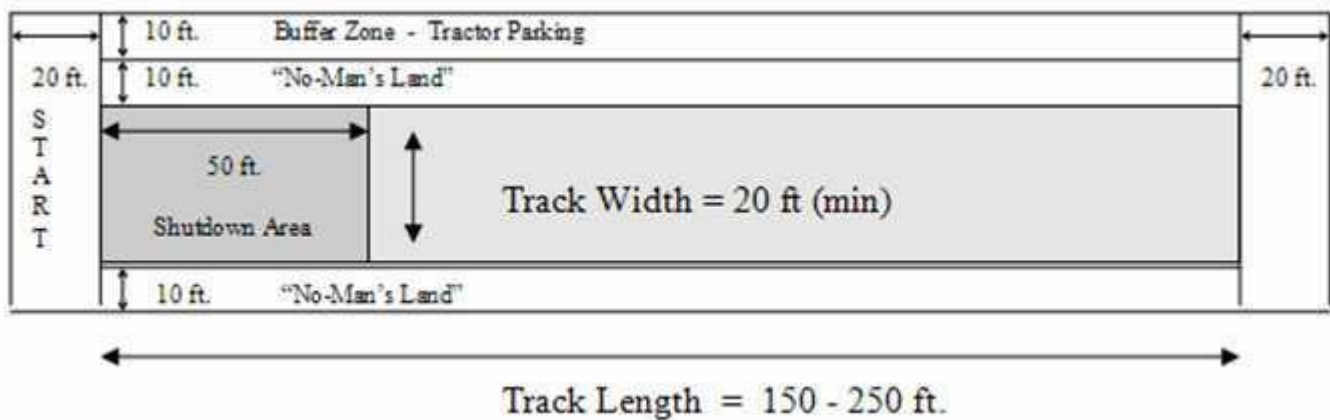
- 6.3.2.1 The protesting team's captain must contact either of the Competition Committee Chairs to identify the protest.
- 6.3.2.2 If the Competition Committee Chairs feel that the protest is valid, a meeting will be held between the said Chairs and both team's captains and advisors to resolve the situation.
- 6.3.2.3 If a team does not have an advisor present, the team captain and co-captain only may file or defend the protest.
- 6.3.2.4 The Competition Committee Chairs reserve the right to seek guidance in a protest issue from any member of the Competition Committee.
- 6.3.2.5 If the protest is deemed to be unfounded, a 25-point deduction will be placed on the protesting team's score.
- 6.3.2.6 Chairs' decisions are final and cannot be protested by a team.
- 6.3.2.7 If a team is found to be in violation of a rule during a stage of the event, disqualification applies only to the specific event in which the incident took place.

6.4 Disqualifications

All disqualifications of any team from any events or from the competition will be communicated to the captain and advisor of the team by the Competition Committee Chair and Co-Chair identified in section 10.0.

6.5 Track Layout

- 6.5.1 Barrier distance from barrier to crowd will be a minimum of 10 feet, which may include the required 10 feet "no-man's-land."
- 6.5.2 During active competition, the only people allowed inside of the "no-man's-land" shall be track officials, the active competitor and the sled operator.
- 6.5.3 Anyone assigned to an operation position shall remain on that duty for the entire class (i.e., flag-person, measuring crew, sled operator, scale operator).



6.6 Pulling Procedures

- 6.6.1 All tractors must be weighed, hitch height checked, engine speed checked, and fuel checked before each pull for certification. Additionally, maximum hitch height will be checked at suspension limits (if equipped) to ensure that the hitch will never exceed the regulated hitch height.
- 6.6.2 Contestants must pull in the position drawn.
- If breakage is not evident, puller may drop down six positions – this will constitute the pullers first attempt to pull and therefore the puller will only have one remaining attempt to compete.
- 6.6.3 A flag-person is on the track for safety reasons.
- Tractor operators are to watch and obey the flag-person.
 - A green flag signals that the puller may start and/or continue pulling.
 - A red flag means "STOP IMMEDIATELY in a controlled manner." If the tractor operator does not stop when signaled, he/she will be disqualified for that pull.
- 6.6.4 The only team member allowed on the track at any given time is the tractor operator.
- When hooking to the sled, the operator will be guided by the flag-person as the tractor is driven onto the track and backed up to the sled.
 - After the tractor pulls off the scale, the only member allowed with the tractor is the operator. Additionally, no adjustments to the tractor can be made after it rolls off the scale, unless the operator, while seated, can perform the adjustment (i.e. locking hubs).
 - In case of breakage, the flag-person may ask the team to assist in the removal of the vehicle from the track
- 6.6.5 Each driver has the right to have the sled spotted to a particular location on the starting line.
- The driver or assigned crewmember is responsible to clearly request the location before the sled is returned to the starting line.
 - The crewmember must spot the sled from the area behind the track so as to not enter the track area.
 - In the case of a second attempt, a second location may be requested.
 - The entire sled must be within the chalk lines at the start of pull attempt.
 - No official pull may be started beyond the starting line or in back of the starting line.

6.6.6 Upon sled readiness, the next puller must, at a minimum, be ready for engine teching. After engine teching, the tractor will have 3 minutes on the scales to make adjustments and 4 minutes to get hooked to the sled and start the pull

- If the tractor is broke or will not start, verified by a track official, you will be given the option to drop to last. You will have this option only once before making the first attempt on the track.
- A second drop can be taken after the first attempt, if the puller is allowed a second attempt. If a second drop is needed before the puller's first attempt, he/she will be granted a drop, but loses an attempt.
- If a puller drops and there are fewer than 3 tractors remaining in the heat, they will have until the end of the heat, plus an additional 10 minutes.

6.6.7 The false start line shall be 50 feet down the track from the start line.

6.6.8 Each competitor will be allowed two attempts to make a measurable pull.

- An attempt is defined as moving the sled one-inch or further.
 - On the first attempt, if the competitor lets off on the throttle before reaching the false start line, the competitor will get a second attempt even if he/she went beyond the false start line.
 - If no attempt is made to back off the throttle, a second attempt will NOT be granted.
- Note: The intent is not to slam on the brakes in order to stop before the false start line (or any time), but to come to a smooth safe stop.

6.6.9 On any re-pull caused by contest malfunction, the competitor may either re-hook immediately or drop six positions.

6.6.10 If laser measuring system malfunctions,

- The laser will be re-zeroed at the final pull position
- The sled will be moved back to the original starting position for re-measurement.
- Re-measurement will stand without appeal option.

6.6.11 Competitor will be able to drop to last if breakage occurs on his/her first attempt and he/she has let off the throttle previous to crossing the false start line. The puller will be eligible for one more attempt.

6.6.12 Any disqualification on first attempt bars a second attempt (see Test Puller section).

- Should the class be restarted, the competitor disqualified during the course of competition will be allowed to re-pull in the position drawn.

6.6.13 Loss of anything from the tractor, which interferes with the sled to provide a pulling advantage, will result in disqualification.

- Reminder: Flagmen and Rules Chair have the final call for any infraction of the rules for the pull.

6.6.14 If the tractor goes out of bounds, the pull will be immediately stopped, and distance will be measured. School will be awarded this distance minus 20%. Going out of bounds is defined as any tire of the tractor that touches the chalk lines. This will be a judgment call by the flag-person.

6.6.15 If any fluid leaks from the tractor in a steady stream or an intermittent discharge equivalent to an 8-inch diameter circle, the pull will be immediately stopped, and distance will be measured.

- 6.6.16 If a vehicle is hooked to a sled and breakage occurs while under the green flag, the pull will be measured with the exception of previously mentioned conditions of going out of bounds, parts falling off and providing a pulling advantage, or fluid leaks.
- 6.6.17 All vehicles must be in neutral/park while being hitched and unhitched to/from sled.
- During this time, the puller will show hands in clear view as proof of safety to the “hooker.”
- 6.6.18 All pulls are to start with a tight chain.
- 6.6.19 No jerking the chain at the starting line.
- 6.6.20 The sled operator has the option to restart the class and re-weight the sled.
- 6.6.21 The pull will be considered over when the forward motion of the sled stops. Determination of the forward motion of the sled is to be called by the flag-person only.
- 6.6.22 The pull length will be measured where the front of the sled stops (except where electronic measuring devices are used).
- 6.6.23 Tractors involved in a pull-off have **one attempt only**.
- 6.6.24 Any contestants attempting to start his/her pull under the red flag will be disqualified.
- 6.6.25 Unsportsmanlike conduct may result in disqualification.
- 6.6.26 Following each team’s last scored pull, their tractor will be placed in quarantine so the committee can accurately address any potential protests following the last scored event. Drivers may not stay with the tractors once they are parked in quarantine until the period has concluded. See section regarding Quarantine.
- 6.6.27 No headlights can be turned on during the pull
- 6.6.28 The chain length of the sled will be 36 inches.
- The height of the chain attachment point on the sled for each pull can vary between 0 and 10 inches (254 mm) from the ground. A lottery will be used to determine the chain attachment height for the pulls during the initial weigh in.
- 6.6.29 **Test Puller:** The competitor pulling in first position of each class is the test puller. This puller will be considered the test puller if the sled crew and track officials deem the weight transfer correct. This puller has the options of:
- Accepting his/her distance
 - Refusing his/her distance and immediately hook again for another attempt
 - Refuse his/her distance and pull again in the sixth position
- Note: Sixth position is defined as the position immediately following the next five competitors and their attempts.*
- 6.6.30 If the test puller has mechanical problems during his/her test pull (before first official pull), the track official may grant the competitor the option of:
- dropping to sixth position

- dropping to last position.

Note: This would mean that the test puller has dropped his/her test pull and will have a potential of two upcoming attempts.

6.6.31 Only the test puller on his/her test pull will have the option of dropping an out of bounds disqualification.

- All other reasons for disqualification apply.
- On all subsequent attempts the out of bounds rule will apply to him/her.

6.6.32 It is the test puller's responsibility to inform the flag-person of his/her decision to take or drop the test pull.

- Leaving the track without informing the official(s) of his/her decision forces the assumption that the puller wishes to keep the hook.

6.7 Quarantine

6.7.1 Teams will have the option of placing their tractors in a quarantine area between pulling heats, allowing them to bypass engine teching for the next heat. Teams are allowed to have 2 people in the area making any adjustments necessary. Teams will have the option to go back to the pits with the tractor, but must go through engine teching before second heat.

6.7.2 A quarantine area will be setup during the last pull on Sunday for Final Quarantine. Team Captains will be given 10 minutes from the time of the last pull to file any protests or questions with the Rules Chair regarding any of the tractors in the tractor pull event.

7.0 General Competition Information

The 2020 competition will be held at the Expo Gardens in Peoria, IL, with exception of the presentations, which will be in the Peoria area. All information regarding the area and miscellaneous information regarding the competition are presented in the following sections.

Team Pictures

We will be taking the Team Pictures on Friday. These will be the pictures used in the awards and for future publications. It is suggested that you bring team shirts (or uniforms) for this picture

GSI Pork Fry and Sponsor Mixer

After the group picture on Friday evening we will be having our annual Pork Fry dinner which is sponsored by GSI. After dinner we invite all students to stick around and spend some time talking with employees from some of our sponsors. This will be a good time to make contacts with each of the companies and learn more about our sponsors.

Competition Merchandise Items

There will be competition t-shirts for sale at registration with the team names on the back. We will have other competition items available for sale as well.

Banquet Details

There is an awards banquet on Sunday evening at the hotel. Dress for the Awards Banquet is “business casual” – so in other words no jeans (polo shirt and khakis are fine).

If anyone on the team requires a special diet, please let us know ahead of time.

You may bring extra guests to the banquet (but please RSVP ahead of time with the number of people). The additional cost for guests is outlined in section 8.3.

Rap Session

There will be a RAP Session for all teams to share opinions and concerns with the Competition Organizing Committee at the time/location listed in section 9.

Advisor Meeting Forum

There will be an advisor only meeting for all school advisors to share opinions, concerns, and share ideas about the competition at the time/location listed in section 9. There will not be committee members on hand as this is intended to be a forum where the advisors can communicate amongst themselves.

Drone/UAV Usage

Use of drones at competition is permissible; however, all pilots must be certified/licensed and obey all FAA, Local, State, and Federal laws. ASABE accepts no liability for loss, theft, damage, or legal violations. We ask pilots to be respectful and do not fly drones in the pit area, during group photo, or anywhere an ASABE employed drone is flying. If a team chooses to fly during a performance event, they may do so for only their own teams' event. If the drone touches down in the track area or interferes with a performance event it will be considered a part of the tractor and penalties will be applied per the rules of the event outlined in the respective event section. The committee reserves the right to ask for a cease flight if the pilot's/drone's actions are deemed inappropriate.



Miscellaneous Information

A limited number of fire suits and helmets will be available for those who cannot bring their own.

We WILL have a ramp to unload tractors from pick-up trucks or high trailers at the event.

Shipping Information

Please send all tractor shipments to one of the following destinations, depending on arrival date:

Delivery on or before Tuesday, May 28, ship to:

Precision Planting LLC
23333 Townline Rd
Tremont, IL 61568
Attn: Ian Radtke
(309) 397-8372

Delivery on or after Wednesday, May 29, ship to:

Exposition Gardens
1601 W Northmoor Rd,
Peoria, IL 61614
(309) 397-8372

Please note that no shipments can be received from Saturday, May 25 through Monday, May 27. All deliveries will need to be scheduled either before or after those dates, during normal business hours.

Return shipment pickup from the Expo Gardens after the competition must be arranged in advance by the team, and scheduled for Monday, June 3 between 9:00 AM and 4:00 PM . Equipment and personnel will not be available at the Expo Gardens to assist in loading after this time window. If pickup within this time window cannot be met, it will be the responsibility of the team to arrange for loading through the freight company or other third-party. The Expo Gardens staff is not equipped to assist with loading.

When arranging return shipment pickup, a lift-gate truck must be requested. Any physical paper work required for pickup must be provided to the competition committee in advance , or a representative of the team should be present at pickup to provide paperwork to the driver.

Please communicate the following information to the competition committee as soon as it is known:

Approximate dimensions of container(s)
Approximate weight of container(s)
Number of containers that will be sent
Anticipated shipment delivery date
Team arrival date / date that team would like access to the tractor at the Expo Gardens

7.0 Written Design Report Submission Information (A-Team & X-Team)

The Written Design Reports are due before the event. All reports must be shared with the official ASABE IQS Google account (asabe.iqs@gmail.com) through Google Drive by 5:00 P.M. Central time on the date listed in Section 9 in order to receive full credit. Reports received after this time but before 5:00 P.M. Central time 1 week later will receive half credit. Reports received after 5:00 P.M. Central Time 1 week later will receive no credit. Submission time will be determined by the time stamp shown in Google Drive.

Design Reports, Design Logs and Cost Estimate reports are to be uploaded and shared with the official competition Google account and shall meet the following requirements:

1. Format:
 - a. PDF documents only with commenting enabled.
 - b. Each report must have a title page that contains the school name, team name, and advisors name. Captain and Advisor must sign the title page.
 - c. No links to external sites, videos, etc. shall be included. A good rule of thumb is that any material that would not function should the materials be printed must be excluded
2. Size: All of the documents submitted to the committee from a specific team for scoring shall not exceed a combined 700MB of file size.
3. Name: following the naming convention [School Name]_[Team designation: either X or A]_[Report type: either "Design_Report", "Design_Log", or "Cost_Estimate_Report"].pdf
 - a. Examples: South_Harmin_Institute_of_Engineering_X_Design_Report.pdf
South_Harmin_Institute_of_Engineering_A_Design_Log.pdf
South_Harmin_Institute_of_Engineering_A_Cost_Estimate_Report.pdf
 - b. The competition year may be added to the end of the naming convention.
4. Sharing settings: the schools must provide the report with the Google Drive share settings that allow editors to add people and change the permissions.
5. Downloading settings: the schools must provide the report with the default Google Drive share settings that will allow the P-126 Committee to download the documents.

Once you have shared your reports with the official Google account please send a confirmation email to asabe.iqs@gmail.com to confirm that your documents have been received. Please allow some time before the due date for you to correct any issues that have been found during the sharing process.

Because of the new scoring process, schools are encouraged to test the sharing of documents with the official Google account at least a week before the deadline. You will receive confirmation that the documents were created and shared successfully.

Once the reports are shared with the official Google account and a confirmation email has been received schools cannot unshare or modify their reports until after the closure of the competition awards banquet.

Teams (A & X) that are unable to meet the final deadline for Written Design Report submission will receive no score for this portion of the competition. They are encouraged to continue working on their tractor, come to competition, and compete in all other aspects of the competition.

7.1 Hotel Information

Embassy Suites East Peoria Hotel and Conference Center (Competition Hotel)

100 Conference Center Dr.

East Peoria, IL 61611

(309) 694-0200

www.embassysuiteseastpeoria.com

To make reservations on-line:

Visit www.embassysuiteseastpeoria.com

Select check in date and check out date

Click the blue link that reads “Add special rate codes”

Group Code: ABE

Select Check Availability

To make reservations by phone:

Call 1-800-EMBASSY

Ask for Global Reservations

State your check in and checkout date

Mention the block “2020 ASABE Design Competition” and code ABE

Group Rates (based on occupancy and room type)

Room Type	1-2 occupants	3-4 occupants	5-6 occupants
Two-Room King Suites	\$121	\$131	N/A
Two-Room Suites with Two Double Beds	\$131	\$141	\$141

Check in time = 3pm

Check Out time = 12pm Noon.

- You are responsible for making your own reservations.
- You must reserve your rooms by May 1, 2020, **but it is highly recommended you reserve your rooms ASAP, as only a limited number of rooms are available to the competition this year.** After this date we cannot guarantee rooms or this special rate will be available.
- The hotel will bill for no-show reservations/guests. Guest rooms which are not guaranteed with a credit card by 6:00 pm on the day of arrival may be released for sale.

The hotel offers the following amenities:

- Features Caffaina’s Internet Café
- RiverSide Café
- Complimentary Hot Breakfast Buffet (served in the main reception area)
- Complimentary, nightly, evening reception featuring drinks and light snacks
- Complimentary High Speed Wireless Internet
- Indoor Swimming Pool and sundeck
- Fitness center featuring Precor equipment

- Close proximity to area restaurants
- Complimentary shuttle to Expo Gardens

Breakfast will also be available for purchase each day at the Expo Gardens.

7.2 Competition Awards

7.2.1 Overall Competition

Cash prizes and plaques will be awarded as follows based on overall cumulative point totals:

- 1st Place - \$1500 + Traveling Trophy
- 2nd Place - \$1200 + Plaque
- 3rd Place - \$900 + Plaque
- 4th Place \$700 + Plaque
- 5th Place \$500 + Plaque

7.2.2 Area Specific Awards

The following various awards are given for specific areas of the competition. They will be judged by various individuals involved with the competition. These awards do not count toward overall team score, but are to recognize teams for outstanding results in the different areas.

Awards will be in the form of a plaque or certificate. Some award area winners may also receive additional tires or other items as prizes. All awards and prizes will be announced at the banquet.

7.2.2.1 Campbell Scientific Award

This award is for the Best Use of Test Methods or Data Acquisition in the Development of a Prototype. It is judged by representatives of Campbell Scientific during the Test & Development design judging portion of the competition.

- To be considered for this award, a 1-4 page report must be submitted with details on the test methods, including use of data acquisition. This report will be submitted during the Test & Development portion of Design Judging.
- The winner of the Campbell Scientific Award will be given the choice of one of the following prizes. If choosing
 1. Model CR3000-Xt-SW-RC-CC datalogger with AC charger, DCDC18R charger, carrying case, and RTDAQ support software.
 2. A \$2500 Certificate for any Campbell Scientific manufactured good(s). It will have an expiration date of 1 year after the pull.

7.2.2.2 Craftsmanship Award

This award area is judged by Manufacturability judges during the manufacturability judging portion of the competition and is based on the craftsmanship of the tractor fabrication.

7.2.2.3 Sound Level Award

This award is determined by sound level measurements taken during the sound level technical inspection station and was incorporated into the competition to encourage teams to “get their feet wet” in this area of increasing regulatory control.

7.2.2.4 Innovation Award

This award area is judged by Design judges during the design judging portion of the competition and is based on the innovative concepts incorporated into the tractor. The winning innovation must meet the following criteria:

1. Tractor (component, machine, structure, system, end product, procedure) must embody the application of new technology or the innovative application of an older technology.
2. Each development must have the potential for broad impact on the competition, an application area, or on the industries served by the engineering of food and agriculture.
3. Innovative merit to be deemed a worthwhile contribution by the competition judges. Hence, the award will only be granted when the design judges feel a tractor demonstrates that students have developed an innovative concept.
4. The winning development is only eligible to win in one year; the same innovative feature cannot win in multiple years. The development will be judged on its originality and uniqueness.

7.2.2.5 Appearance Award

This award area is judged by the field of competitors & committee members and is awarded to the team that is voted to have the best overall tractor appearance.

7.2.2.6 Sportsmanship Award

This award area is judged by the field of competitors & committee members and is awarded to the team that is voted to have exhibited the greatest sportsmanship in all events and with other teams.

7.2.2.7 Jim & Darcy Schmidt Family Teamwork Award

This award area is judged by the field of competitors & committee members and is awarded to the team that is voted to have worked the best together under difficult circumstances or in exhibiting the greatest teamwork in how the team handles different aspects of the competition.

7.2.2.8 First-Time-Through Award

This award is presented to the team or teams that meets the maximum gross vehicle weight specified in the rules document (Rule 2.3) during the initial quarantine and passes through technical inspection with no required rework/modification/additions.

7.2.2.9 Rookie of the Year Award

This award is available to a school competing for the first time, or returning after an extended absence. The award recipient is determined based on a combination of point total and is voted on by the organizing committee.

7.2.3 Top Presentations

The top three presentation winners are requested to give their presentation again at the following ASABE Annual International Meeting (AIM) held July 12 – July 15, 2020 in Omaha, NE. These presentations are the cornerstone of the ¼ Scale Tractor Info Session held each year at that meeting. At the meeting following the presentations there will be an informal discussion where students are encouraged to give your thoughts on the current state of the competition as well as what you would like to see in the future from the organizing committee. All are welcome to attend.

7.3 Proper Given Credit

Proper Credit Given for Other's Work (Mandatory)

The Design Report is an electronic document that describes the team's design from conceptual stage, through fabrication, testing and development. Design Reports should discuss the present design and clearly reference any design concepts taken from previous team(s)' design reports.

All of the judges for this competition are from industry and they all realize the value in reusing previously acquired knowledge/ design. Tractors do not have to be completely redesigned each year in order to be successful. However, it is important to detail why you carried on a particular design or concept. What were the advantages/disadvantages? What other options were investigated? What compromises were encountered by carrying on the design/concept?

To reiterate - it is fully acceptable (and expected) for teams to use and build upon information and ideas, which were developed by other individuals (such as prior teams). HOWEVER, PROPER CREDIT MUST BE GIVEN TO THE TEAM OR INDIVIDUAL WHICH PRODUCED THE ORIGINAL CONCEPT, INFORMATION OR DESIGN.

Example 1) If a team plans to reuse the transmission design from the previous year and would like to include development data in their report such as performance calculations, graphs, test data, and or drawings, which were produced by the previous year's team - this is acceptable - as long as the report gives credit to the previous team's work. This should be done by means of a footnote under all graphs, spreadsheets, drawings, and the like. Directly reusing, or rewording text from a previous report shall not be acceptable, and considered plagiarism.

Example 2) A team submits a design report for a competition year, but does not complete a tractor or participate in any of the performance events for that year. The submitted report can be used for a following year so long as no scores or comments for the report are received by the team.

Example 3) A team uses pages or paragraphs of text directly from a previous report. This shall be considered plagiarizing, even if the copied text is cited.

7.4 Plagiarizing

Each report, presentation and cost analysis will be reviewed and compared to prior teams' reports. If a report is deemed to be substantially equivalent in text or content by the initial censor, two additional staff members will review the report (at least one of which will have written design report judging experience). If all three reviewers agree that the report is a direct or veiled attempt to pass off a prior team's work as original, the report will be given ZERO points.

Please be certain that this action will only apply to serious offenses. If a team makes a clear and good faith effort to create an original document and gives credit to previous work – there is no concern. (NOTE: Directly copying text or any pages from a previous year's report, even with citing – will not be considered "good faith" and will be dealt with accordingly).

Please note that section 7.5 and 7.6 apply to teams that submitted a design report in one year and were not able to compete with their physical tractor and return the next year of the competition with the same tractor. The design reports between these two years will be applied to the same standard as schools competing entirely in two consecutive competitions.

7.5 Sponsor Offers

Various sponsors and companies offer discounts and services to teams participating in the Competition. Information for these offers is listed below.

SolidWorks Corporation

SolidWorks Corporation is offering to provide each team member with a donated version of its software to help in the design of the tractor. The SolidWorks Student Edition w/COSMOS is a 2-year license that contains the 3D modeling software as well as the COSMOS Analysis Suite for FEA, Thermal and Fluid Flow analysis. For additional information and a description of what is included please visit:

<http://www.solidworks.com/pages/products/edu/studenteditionsoftware.html>

Please go to the following link, to request copies:

www.solidworks.com/sponsoredesigncontest

Gasoline for the competition will be supplied by the Kentucky Corn Growers Association.

This includes gasoline for tractors for all events including technical inspections, maneuverability, practice tractor pulls, and the scored tractor pulls.

Igus Inc.

We're pleased to report that igus Inc. has signed on as a sponsor of the 2020 1/4 Scale Competition. igus offers students free samples of Energy Chain® cable carriers to guide and protect moving cables and hoses, Chainflex® continuous-flex cables, iglide® plain plastic bearings, igubal® spherical bearings and DryLin® linear bearings and guide systems.

Igus' Y.E.S. (Young Engineers Support) Program was created to foster the mechanical design ideas of students and educate them on the merits and benefits of plastic components. Through Y.E.S., students like you can receive FREE product donations! Please visit the Y.E.S. Program website at www.igus.com/yesprogram to learn more.

If you are interested in receiving catalogs or samples, navigate to the "Request Info/Parts" page and fill out the Student Sample Request Form. Free standard shipping applies to all requests, so please allow seven to 10 business days for delivery.

If you have questions on Igus' generous offer, please contact the following:

Courtney Toomey
(800) 521-2747
ctoomey@igus.com

Danfoss

Danfoss Power Solutions is a sponsor of the 2020 ¼ Scale Competition. Danfoss offers students access to hydraulic and electronic components, in addition to their Plus +1 Guide Software development platform.

Contact Wyatt Hall at whall@danfoss.com

Thomson Linear

Thomson is a proud sponsor of the 2020 ASABE ¼ Scale Competition, as we have been since 2015. Thomson offer students access to a wide range of industrial motion product, including their industry leading, electro-mechanical linear actuators. These are the same actuators used by major manufacturers of harvesters, balers, and a variety of construction equipment.

Students can find product selection resources at <https://www.thomsonlinear.com/en/products/linear-actuators-products>.

To order their complimentary product, they should email Jeremy.Gong@thomsonlinear.com. Please include “ASABE” in the subject of the email.

Electrex Inc.

All vehicles are required to use a standard interface electrical connector. The necessary components can be purchased from numerous online vendors. As an alternative, Electrex Inc. (<https://www.electrexinc.com/>) has offered to donate pre-populated connectors to teams who request them. There is a 6-week lead time to receive these, so teams are responsible for planning accordingly. Teams can contact Kent Thoreson (kthoreson@vermeer.com) for more details and to order.

7.5.1 Manufacturing Plant Tour Contacts

Many of the competition sponsors, as well as other companies in the industry, have facilities located within relatively easy driving distance of Peoria. Contact info is provided for teams to arrange their own tours of the facilities as desired.

Briggs & Stratton Corp.

While there are no Briggs & Stratton facilities in the immediate Central Illinois vicinity, there are some in surrounding states. Please see

<http://www.basco.com/Company%20Profile/Corporate%20and%20Plant%20Locations/>, which locates our manufacturing facilities. If anyone is interested in a tour, Tom Frederickson (fredrickson.tom@basco.com) can make arrangements for personal or group tours.

Caterpillar

Caterpillar has several facilities in the Peoria area or within a two-hour drive. These facilities regularly have tours scheduled for CAT dealers and customers, so **please call/email as soon as possible**.

Peoria Area

For the following facilities please send an email to corporate_tours@cat.com. Please include your contact information, number of attendees for the tour, and a brief description about the group. Tour availability for each of the facilities can change so please check with Caterpillar Corporate Tours group for availability.

Downtown Peoria

Caterpillar Visitors Center (<http://www.caterpillar.com/visitors-center>)

(Free if booked through Corporate tours email; otherwise \$7 charge per person)

East Peoria

Drive Train Systems Business Unit – Transmissions and Final

Track-Type Tractors Division - D6 thru D11 dozers and pipelayers

Mapleton

Foundry - Casting of engine blocks

Morton

Logistics Division - parts distribution

Outside Peoria

Aurora (approx. 130 mi. NE)

Wheel Loaders & Excavators Division - wheel loaders, hydraulic excavators, and compactors

Contact Dean Caho (630) 859-5579

Decatur (approx. 85 mi. SE)

Mining & Construction Equipment Division - large mining trucks, quarry & construction trucks, wheel tractor-scrapers

Contact Stacy Daugherty (217) 475-4448

GSI

The GSI Group has several manufacturing facilities located throughout Illinois. A tour of any of the facilities listed below can be arranged by contacting Jonathan Waits at jwaits@gsiag.com or 217-226-5479

Assumption, IL – Corporate Headquarters

- Corrugated Steel Grain Bins and Accessories, Unloading Equipment, and Tower Dryers

Paris, IL

- Bucket Elevators, Chain Conveyors, and Enclosed Belt Conveyors

Flora, IL

- Portable Dryers

Omaha, NE (formerly Intersystems)

- Bucket elevators, Chain conveyors, Belt conveyors, and Accessories

John Deere

A tour of any John Deere facility that allows tours in the US can be arranged by calling 800-765-9588. Specific Plant information for those in the Midwest are listed below.

Harvester Works

- Assembly of S Series combines and related front end equipment. 1 ½ hour riding tour.

1100 13th Avenue

East Moline, IL 61244

Contact: 800-765-9588

Tour Times: (M-F) 8:00 A.M., 10:00 A.M., 12:30 P.M.

Booking: Up to 3 months in advance.

Tractor Cab Assembly Operations

- Assembly of 6R, 7R, 8R/8RT, 9R/9RT Series Tractors. 1 ½ hour riding tour.

3500 East Donald Street

Waterloo, IA 50704

Contact: 888-453-5804

Times: (M-F) 8:00 A.M., 10:00 A.M., 1:00 P.M.

Engine Works

- Assembly of 200-600HP Engines. 1 ½ hour riding tour.

3801 Ridgeway Avenue

Waterloo, Iowa 50704

Contact: 319-292-5347

Times: (M-F) 9:30 A.M., 1:00 P.M.

Des Moines Works

- Self-propelled Sprayers, Cotton Pickers, Tillage Equipment, and Grain Drills. 1 ½ hour riding tour

825 SW Irvinedale Drive

Ankeny, IA 50023

Contact: 800-450-2670

Times: (M-F) 10:00 A.M., 1:00 P.M.

CNH Industrial

CNH has several facilities within a few hours of Peoria. Please contact the appropriate representative listed below to arrange a tour.

Burr Ridge – Technology Center

Lidia Ramos Wiederhold (630) 887-5464 lidia.ramoswiederhold@cnh.com

Fargo, North Dakota – Steiger Tractors and Wheel Loader Plant (Assembly and Manufacturing)

Jan Elton (701) 293-4666 jan.elton@cnh.com

Racine, Wisconsin – Magnum Tractors Plant (Assembly and Machining)

Nicole Sweet (262) 636-7273

Goodfield, Illinois – Tillage Tools Plant

Brandy Dyer brandy.dyer@cnh.com 309-965-3140

AGCO Corporation

AGCO has three North American factories, though not in the immediate Peoria area, these factories may be on the way to the competition for some schools.

AGCO - Jackson Operations

Jackson, MN

Track Tractors, Sprayers, 4WD and High HP Tractors

Contact: Billie McClellan

507-847-7881

AGCO – Beloit Operations

Beloit, KS

Tillage, Seeding Frames

Contact: Tina Eck

785-738-6213

AGCO - Hesston Operations

Hesston, KS

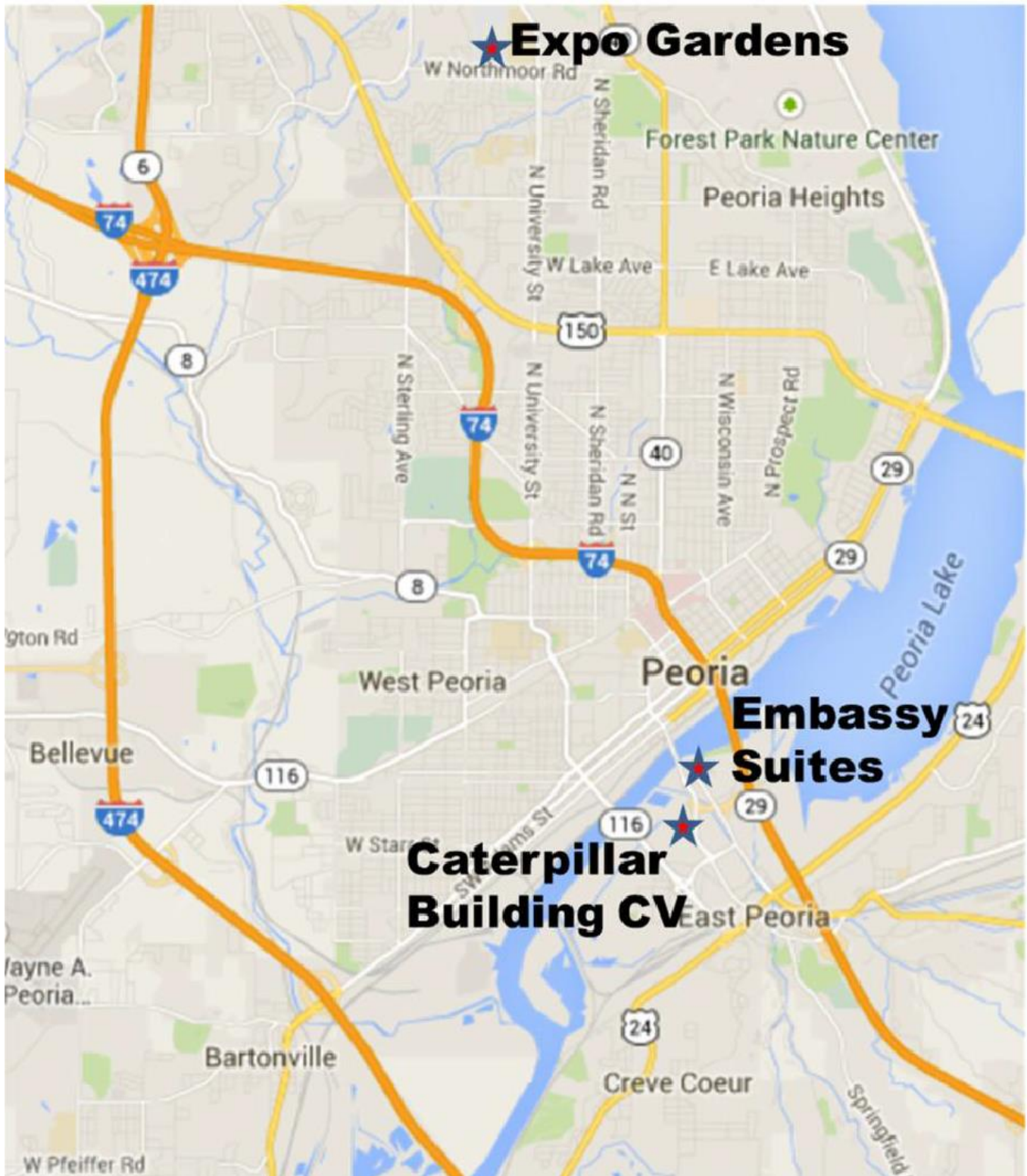
Combines, Hay Equipment, Seeding

Contact: Cindi Roth

620-327-5610

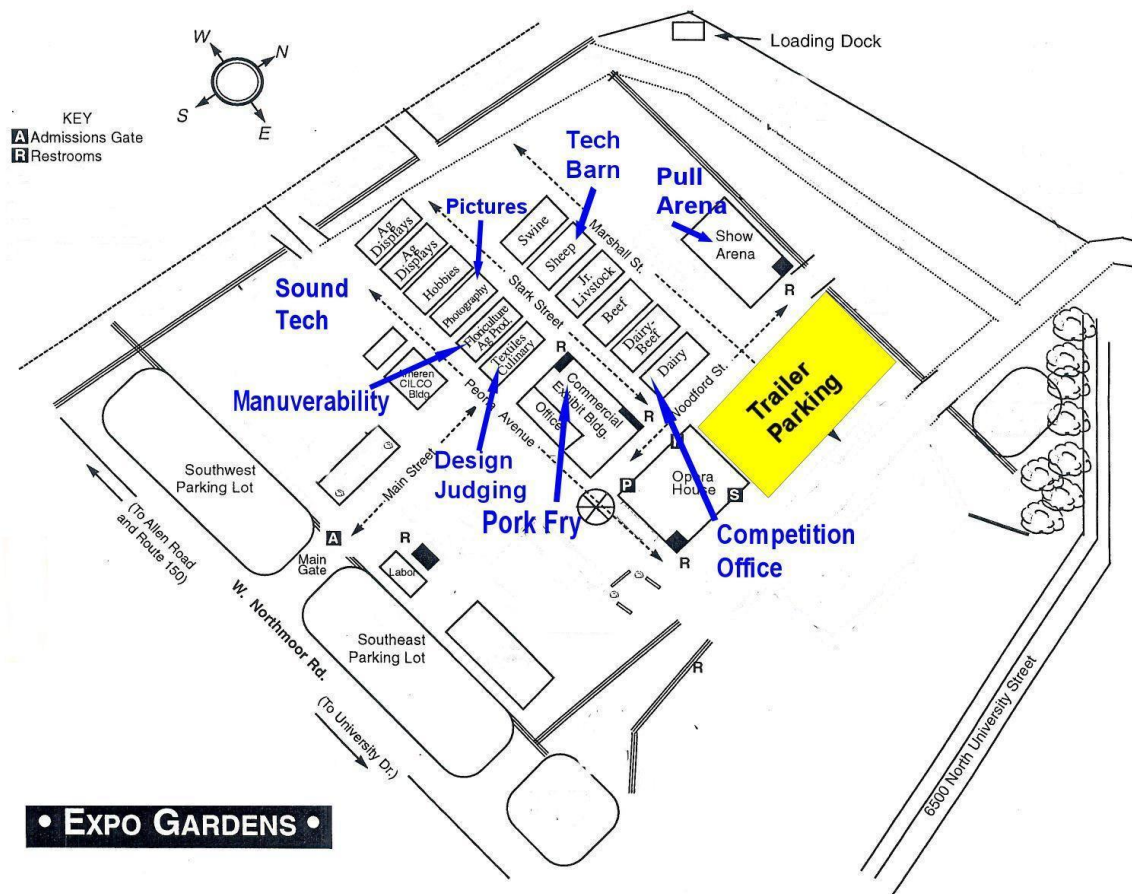
8.0 Maps and Directions

8.1 Map of Peoria



8.2 Map of the Expo Gardens

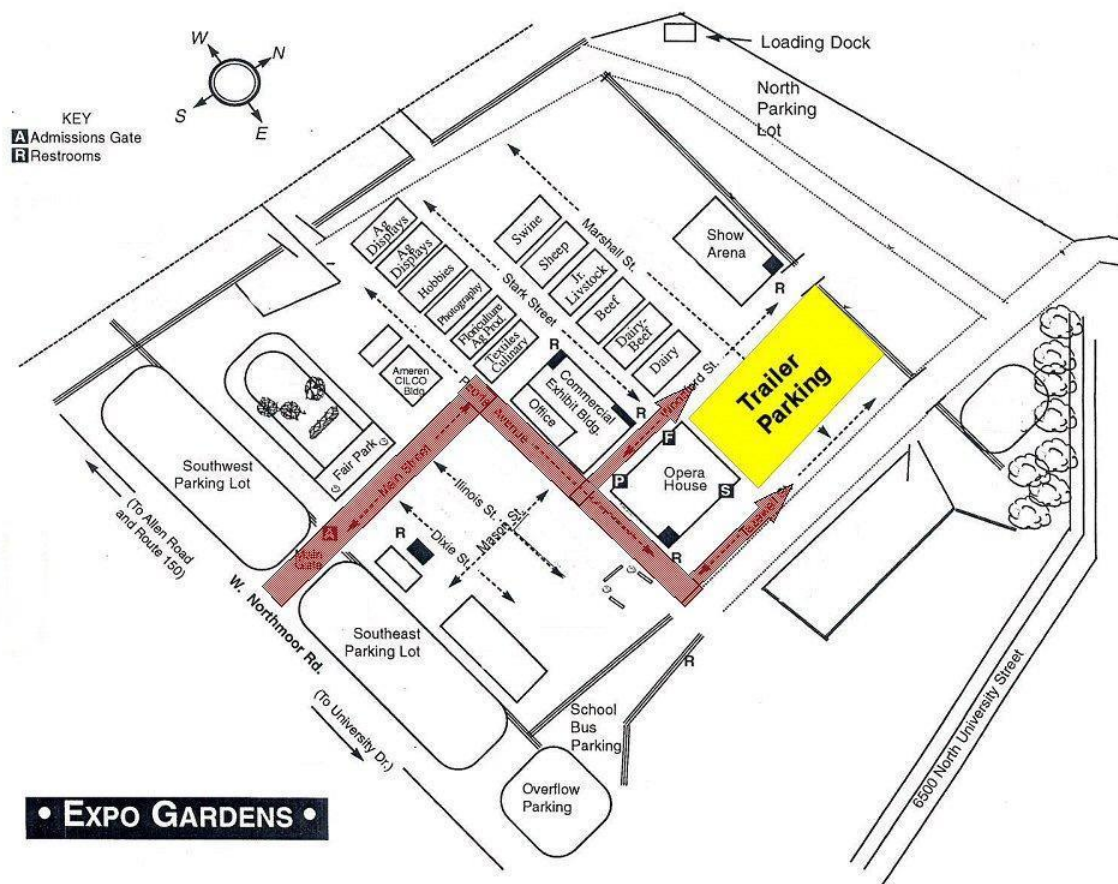
The Expo Gardens will be open to teams from 7:00 am to 10:00 pm, Thursday through Sunday.



Locations for different events

- Competition Office will be at the Southwest corner of the Dairy Barn next to the designated trailer parking area.
- Tech inspections will take place in the Sheep barn; start on North end.
- Design judging will be in the Textiles barn.
- Pulling will take place in the Main Show arena.

8.3 Expo Gardens Parking Layout



When entering the main entrance, turn right when you get to the office buildings and follow the road around the Opera House. Parking will be in the limestone area behind the Opera House. Schools will park in the spot labeled with their number.

8.4 Tractor Numbers & Pit Assignments

Note: Pit area is a limestone surface. If a hard surface is needed, an area in one of the adjacent barns can be used for a short period of time.

The team number is based off of the placing from the previous year. At the event, parking for pits will be as follows

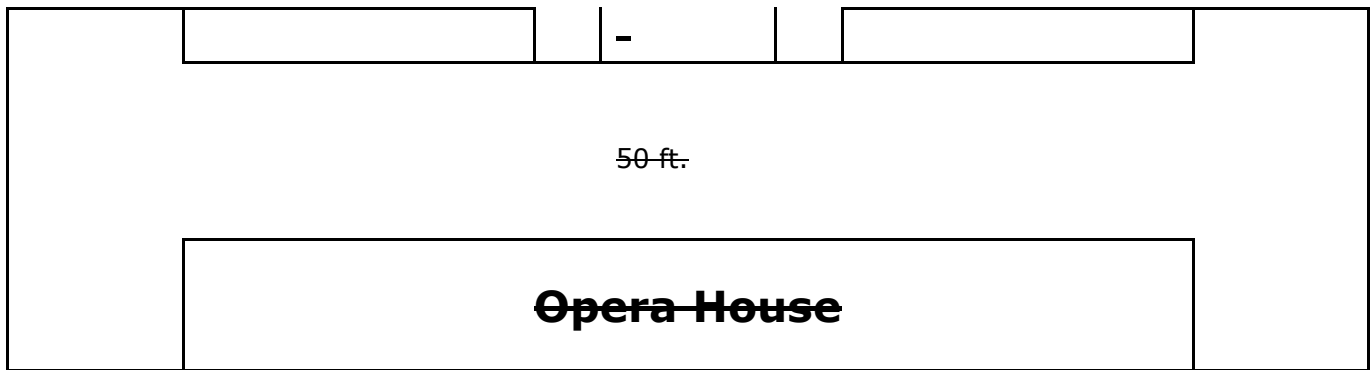
~~2019 ASABE 1/4 SCALE TRACTOR INTERNATIONAL STUDENT DESIGN COMPETITION~~

~~Tractor Numbers and Parking Assignments for Trailers
Please see parking diagram for parking location~~

Tractor Numbers		
A-Team	X-Team	School
1	1X	South Dakota State University
2	-	Kansas State University
3	-	University of Kentucky
4	-	University of Manitoba
5	5X	Iowa State University
6	6X	University of Missouri
7	7X	North Dakota State University
8	8X	Ohio State University
9	-	University of Saskatchewan
10	10X	University of Nebraska
11	-	University of Wisconsin-River Falls
12	-	Université Laval
13	-	Purdue University
14	-	Ariel University
15	15X	University of Wisconsin-Madison
16	16X	University of Illinois
17	-	University of Tennessee-Martin
18	-	McGill University
19	-	CalPoly State University
	20X	Texas Tech University
	21X	University of Northern Iowa
22	22X	Texas A&M Univ
23	-	Oklahoma State Univ
24	-	North Carolina State University
27	-	University of Wisconsin-Platteville
28	-	Minnesota State University

Parking spots are 20' wide by 40' long. Courtyard area is approximately 60' wide by 360' long. Specific parking locations are identified on the layout below.

<div>← Woodford St. ➔</div>	South Dakota State University	1	60 ft.	2	Kansas State	<div>← Tazewell St. ➔</div>	
	University of Kentucky	3		4	University of Manitoba		
	Iowa State University	5		6	University of Missouri		
	North Dakota State University	7		8	Ohio State University		
	← Marshall St. ➔						
	University of Saskatchewan	9	60 ft.	10	University of Nebraska		
	University of Wisconsin River Falls	11		12	Université Laval		
	Purdue University	13					
	University of Wisconsin Madison	15		16	University of Illinois		
	University of Tennessee Martin	17		18	McGill University		
	CalPoly State University	19		20	Texas Tech University		
	University of Northern Iowa	21		22	Texas A&M Univ		
	Oklahoma State Univ	23		24	North Carolina State University		
	University of Wisconsin Platteville	27		28	Minnesota State University		
	Open for Scale	-		14	Ariel University		



8.5 Driving Directions (2020 construction will change these recommended routes...stay tuned)

To Peoria in General

If traveling from Chicago, take I-55 South to Hwy 150 West.

If traveling from the Quad Cities, take I-74.

Reminder: Peoria is only 90 miles from the Quad Cities (interstate). There are large airports in Moline, Chicago. Peoria has a regional airport, as well as Bloomington, which is approximately 45 minutes driving time.

To Expo Gardens *1601 West Northmoor Road, Peoria, IL 61614*

Note: There is a loading dock available at the Expo Gardens available to unload / load tractors.

Directions to Peoria Expo Gardens from Interstate

From East or West, take Interstate 74 into Peoria, IL.

Take Exit 88, Sterling Avenue and travel North.

Continue on Sterling to intersection with War Memorial.

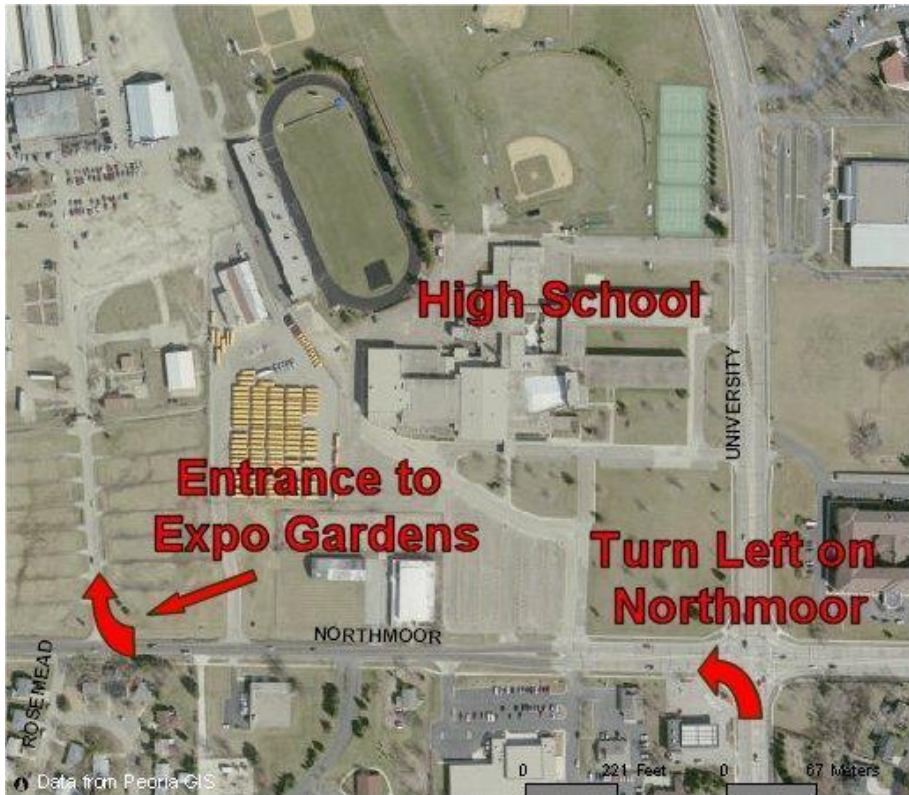
At traffic light, continue straight as street becomes Glen Ave.

Continue on Glen Ave to University St. and turn Left.

Continue on University and turn Left onto Northmoor.

Expo Gardens is on the Right.





To Hotel 100 Conference Center Drive, East Peoria, IL 61611

8.6 Directions to the Embassy Suites from Interstate

From East or West, take Interstate 74 into East Peoria, IL.

Take Exit 94, Riverfront Dr. / Downtown Peoria.

Keep to the right and merge onto West Washington Street.

At traffic light, turn left onto Tractor Drive (**NO LEFT TURN FROM RIVER ROAD**) going towards Logan's Roadhouse.

Take immediate right on Conference Center Drive and follow street to hotel.

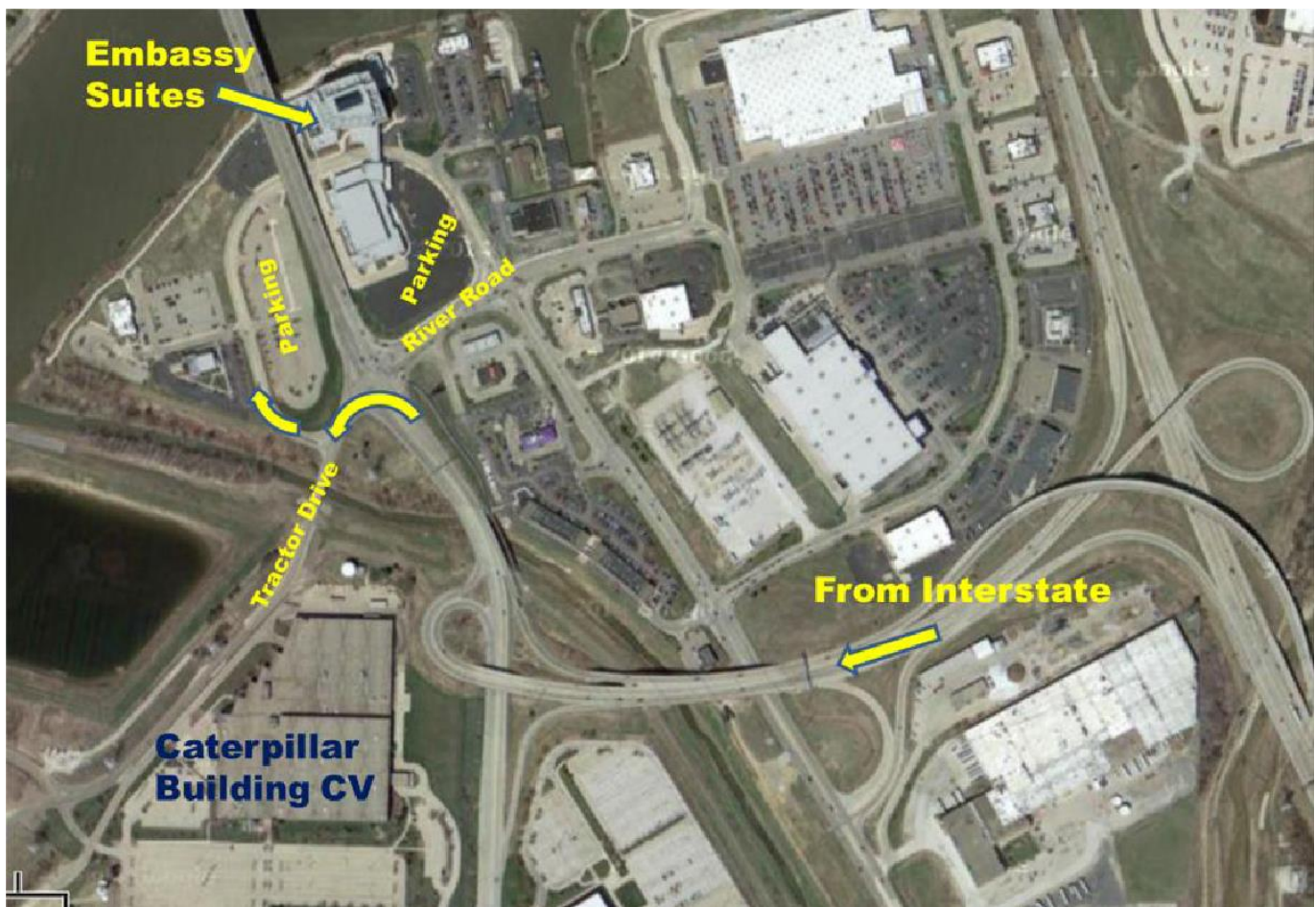
Directions to Embassy Suites from Expo Gardens

Exit main entrance, turn left onto Northmoor, and right onto University

Take University to War Memorial and turn right.

In about a ¼ mile, turn Left for entrance to I-74 East towards Bloomington.

Follow directions above to the Embassy Suites



Directions to CAT Location for Presentations

Directions to Caterpillar Building CV for Presentations from the Embassy Suites

Exit Embassy Suites by River Road or Tractor Drive and travel south on Washington Street.

Caterpillar Building CV will be on the right.

Enter Building CV through main entrance in the circle drive

Directions to Caterpillar Building CV for Presentations from Expo Gardens

Exit main entrance of Expo Gardens and turn Left

Turn Right onto University and Right onto Glen towards the hotel.

Cross War Memorial and continue on Sterling until I-74.

Continue on Sterling and Turn Left on the I-74 East ramp toward Bloomington.

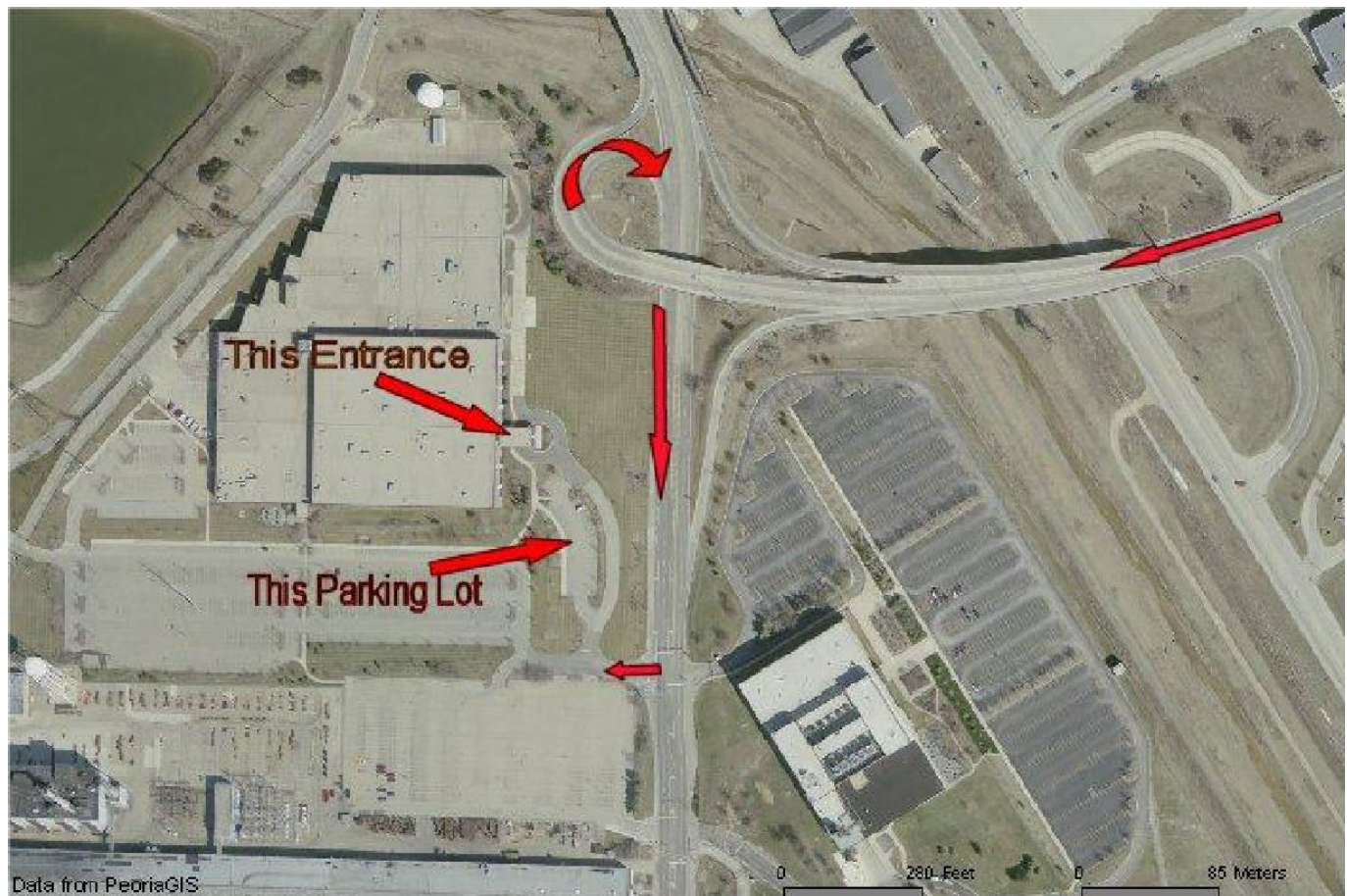
Follow I-74 through downtown and over the Illinois River.

After crossing the bridge, take Exit 94, Riverfront Drive

Take the East Washington Street ramp and stay to the left to loop onto Washington St.

Take first right into the Parking Lot of Building CV

Enter Building CV through main entrance in the circle drive



8.7 Area Businesses

There are many area businesses that offer parts and service to suit your needs. If you need a service that is not listed here, please contact a Committee Member at Registration for further assistance.

1) 14th Street Hardware & Steel
1315 Derby Street, Pekin, IL
309-347-1683

2) Advance Auto Parts
4809 N. University St., Peoria, IL
309-693-0366

3) Altorfer CAT
#1 Capitol Dr., East Peoria, IL
309-694-1234

4) Auto Zone
3109 N. University St., Peoria, IL
309-685-1868

5) BDI Bearing Dist.
1123 NE Adams, Peoria, IL
309-673-3666

6) MFC Hydraulics
817 NE Adams, Peoria, IL 309-685-3011

7) Farm and Fleet
180 S. Detroit St., Morton, IL
309-263-0232

8) German Bliss Kubota
215 Fairlane Dr., East Peoria, IL
309-694-3700

9) Home Depot
5026 W Holiday Dr, Peoria, IL
309-693-3819

10) Kelly Sauder Rupiper John Deere
1501 5th St., Lacon, IL
309-246-2645

11) Lowes
501 N. Big Hallow Rd., Peoria, IL
309-692-1900

12) Menards
N. Allen Rd. @ Rt.6, Peoria, IL
309-693-0416

13) Midwest Super Cub

Dewitt, IA, 563-659-5276

14) Motion Industries
3113 N. Main St., East Peoria, IL
309-694-6214

15) Napa
3016 N. University St., Peoria, IL
309-682-6163

16) Nena's Hardware
1415 W. Forest Hill Ave, Peoria, IL
309-688-9700

17) Nott Company Hydraulics
125 Thunderbird Lane, East Peoria, IL
309-699-4673

18) SJ Smith Welding
2430 N. Main St., East Peoria, IL
309-698-4433

19) Tim's Ace Hardware
8903 N. Knoxville, Peoria, IL
309-689-1133

20) Tractor Supply Company
2115 SW Washington St., Peoria, IL
309-676-6323

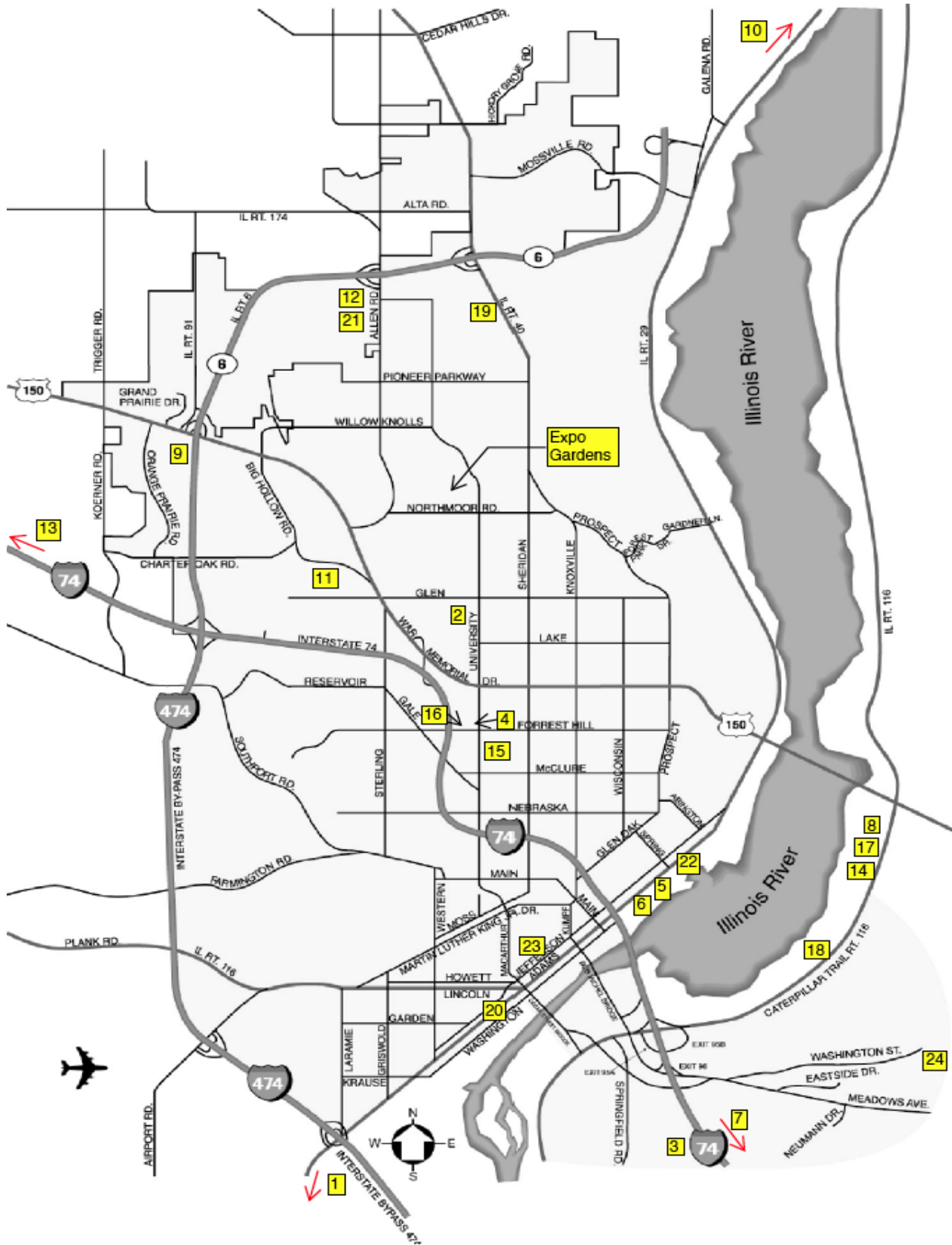
21) Wal-Mart
N. Allen Rd., Peoria, IL

22) Peoria Bearing Company
1515 NE Adams Street, Peoria, IL.

23) Grainger Industrial Supply
1017 SW Jefferson Avenue, Peoria, IL.
309-672-2900

24) Hagerty Industrial Supply
240 Farmdale Road, East Peoria, IL.

25) Du-Mont Steel Company
7800 North Pioneer Ct.
Peoria, IL 309-692-7240



9.0 Event Schedules and Checklists

Thursday, May 30st

8:00 a.m. – 12:00 p.m. All schools must register by 12:00 p.m.
10:00 a.m. – 12:00 p.m. X Team Technical Inspections (See section 9.1 for your scheduled time)
12:30 p.m. Initial Weigh-in
1:00 p.m. – 6:00 p.m. A Team Technical Inspections (See section 9.0 for your scheduled time)

Friday, May 31st

8:00 a.m. – 5:00 p.m. A Team technical inspection completion. (No brake checks will be done after 5:00 p.m. Friday)
8:00 a.m. – 3:00 p.m. A Team and X team sound teching.
8:00 a.m. Advisor Meeting – Baker Room @ Embassy Suites Hotel
8:30 a.m. – 4:10 p.m. Design Judging (serviceability, manufacturing, safety, ergonomics and test & development; see section 9.2 for your scheduled time)
Official team photo (Floriculture/Ag. Products Building) immediately following completion of design judging
12:00 p.m. – 5:00 p.m. Maneuverability Course: (See section 9.3 for your scheduled time)
12:00 p.m. – 5:00 p.m. Durability event practice laps
5:30 p.m. Group photo
6:30 p.m. Pork fry dinner

Saturday, June 1st

8:00 a.m. – 1:15 p.m. X Team oral presentations – Caterpillar Building CV (See section 9.5 for your scheduled time)
8:00 a.m. – 3:30 p.m. A Team oral presentations – Caterpillar Building CV (See section 9.4 for your scheduled time)
7:45 a.m. – 8:00 a.m. Durability Course Driver's Meeting (In Pulling Arena)
8:00 a.m. – 3:00 p.m. Durability Course (See section 9.6 for your scheduled time)
3:30 p.m. – 5:00 p.m. X team practice pulls
5:00 p.m. – 5:15 p.m. X team Drivers meeting and National anthems
5:30 p.m. – 7:00 p.m. X team competition pulls (1500 lb weight class, see section 9.7 for the pulling order)
7:00 p.m. – 9:00 p.m. A team practice pulls (Will start upon completion of X team class)

Sunday, June 2nd

8:00 a.m. – 9:00 a.m. A Team practice pulls
9:45 a.m. – 10:00 a.m. A Team Drivers meeting and National anthems
10:00 a.m. – 3:00 p.m. A Team pulls (All weight classes, see section 9.8 for the pulling order)
3:00 p.m. – 3:30 p.m. Special activities
6:00 p.m. – 9:00 p.m. Banquet – Embassy Suites Hotel

Monday, June 3rd

8:00 a.m. Rap Session – Team Captain & Advisor Meeting – Grandview Room @ Embassy Suites Hotel

Events will try to be run as scheduled, but weather, track conditions, etc. may necessitate adjusting the schedule to allow the students to get the best experience possible from the competition.

9.0 Defense of Design Judging Schedule

- A meeting link will be sent to team captains and advisors one week prior to the event. If you did not receive a link, please reach out to the contacts listed in section 11.
- Join the meeting link 10min before you scheduled time.
- Schedule TBD

9.1 -A-Team Technical Inspection Schedule

- ~~Technical inspection will be held in the Tech (Sheep) Barn~~
- ~~Be in the staging area (North end of Sheep Barn) 10 minutes before your scheduled time.~~
- ~~Visit each station of technical inspection before leaving the technical inspection area unless told to do otherwise by another technical inspector.~~
- ~~If in conflict, Design Judging takes priority.~~

A-Team Tech Inspection Schedule

~~12:30 PM~~ Initial Weigh-In (All A-Teams)

~~1:00 PM~~ University of Illinois
Minnesota State University
Ariel University
University of Wisconsin-Platteville

~~3:30 PM~~ University of Missouri
University of Wisconsin-Madison
South Dakota State University

~~1:30 PM~~ University of Tennessee-Martin
Texas A&M Univ
Purdue University

~~4:00 PM~~ University of Manitoba
Iowa State University
North Dakota State University

~~2:00 PM~~ University of Nebraska
CalPoly State University
Oklahoma State Univ

~~4:30 PM~~ University of Saskatchewan
University of Wisconsin River Falls

~~2:30 PM~~ Ohio State University
Kansas State University
Université Laval

~~3:00 PM~~ North Carolina State University
McGill University
University of Kentucky

9.2 X-Team Technical Inspection Schedule

- ~~Technical inspection will be held in the Tech (Sheep) Barn~~
- ~~Be in the staging area (North end of Sheep Barn) 10 minutes before your scheduled time.~~
- ~~Visit each station of technical inspection before leaving the technical inspection area unless told to do otherwise by another technical inspector.~~

X-Team Tech Inspection Schedule

9:30 AM ~~Ohio State University
North Dakota State University
South Dakota State University
Texas Tech University~~

10:00 AM ~~Iowa State University
University of Missouri
University of Nebraska
Texas A&M University~~

10:30 AM ~~University of Northern Iowa
University of Illinois at Urbana-Champaign
University of Wisconsin-Madison~~

9.3 Design Judging Schedule

- Judging will occur in the Design Judging (Textiles and Culinary) Barn.

Design Judging Schedule

8:30 – 9:30 AM	University of Illinois Minnesota State University Ariel University University of Wisconsin-Platteville University of Tennessee-Martin	12:50 – 1:50 PM	University of Kentucky University of Missouri University of Wisconsin-Madison South Dakota State University University of Manitoba
9:40 – 10:40 AM	Texas A&M Univ Purdue University University of Nebraska CalPoly State University Oklahoma State University	2:00 – 2:50 PM	Iowa State University North Dakota State University University of Saskatchewan University of Wisconsin-River Falls
10:50 – 11:50 AM	Ohio State University Kansas State University Université Laval North Carolina State University McGill University		

Please note: Team photos will be taken IMMEDIATELY following your teams Design Judging time slot. Make sure your entire team (dressed appropriately) is with your tractor at the end of your scheduled time.

9.4 Maneuverability Event Schedule

- The Maneuverability course will be held the pulling arena
- DO NOT MISS YOUR SCHEDULED TIME! YOU WILL NOT BE ALLOWED TO RUN AT A LATER TIME!

Maneuverability Schedule

1:00 PM	University of Illinois Minnesota State University Ariel University University of Wisconsin-Platteville	3:30 PM	University of Missouri University of Wisconsin-Madison South Dakota State University
1:30 PM	University of Tennessee-Martin Texas A&M Univ Purdue University	4:00 PM	University of Manitoba Iowa State University North Dakota State University
2:00 PM	University of Nebraska CalPoly State University Oklahoma State Univ	4:30 PM	University of Saskatchewan University of Wisconsin-River Falls
2:30 PM	Ohio State University Kansas State University Université Laval		
3:00 PM	North Carolina State University McGill University University of Kentucky		

9.5 A-Team Presentation Schedule

- Presentations will be held at Caterpillar's Building CV in East Peoria
- Teams are requested to be onsite and ready to enter the room 10 minutes prior to their scheduled presentation time.

Time	Auditorium	Conference Room F103
8:15 – 8:35 AM	Kansas State	University of Wisconsin-Madison
8:40 – 9:00 AM	Texas A&M Univ	University of Wisconsin River Falls
9:05 – 9:25 AM	University of Missouri	
9:25 – 9:35 AM	Break	
9:35 – 9:55 AM	Université Laval	
10:00 – 10:20 AM	Minnesota State University	University of Saskatchewan
10:25 – 10:45 AM	South Dakota State University	University of Tennessee Martin
10:50 – 11:10 AM	Iowa State University	University of Nebraska
11:15 – 11:35 AM	McGill University	Ohio State University
11:40 – 12:00 PM	Purdue University	Ariel University
12:00 – 12:45 PM	Lunch	
12:45 – 1:05 PM	North Carolina State University	University of Manitoba
1:10 – 1:30 PM	North Dakota State University	University of Wisconsin Platteville
1:35 – 1:55 PM	Oklahoma State Univ	

9.6 X-Team Presentation Schedule

- Presentations will be held at Caterpillar's Building CV in East Peoria
- Teams are requested to be onsite and ready to enter the room 10 minutes prior to their scheduled presentation time.

X-Team Presentation Schedule	
Time	Conference Room F106
8:15 – 8:35 AM	University of Wisconsin-Madison
8:40 – 9:00 AM	Texas A&M University
9:05 – 9:25 AM	University of Missouri
9:30 – 9:50 AM	University of Illinois
9:55 – 10:05 AM	Break
10:05 – 10:25 AM	South Dakota State University
10:30 – 10:50 AM	Texas Tech University
10:55 – 11:15 AM	Iowa State University
11:20 – 11:40 AM	University of Nebraska
12:10 – 12:30 PM	University of Northern Iowa

9.7 Durability Event Schedule

- The Durability Event will be held at the pulling arena.
- DO NOT MISS YOUR SCHEDULED TIME! YOU WILL NOT BE ALLOWED TO RUN AT A LATER TIME!

Durability Schedule

8:15 – 9:15 AM	North Carolina State University University of Manitoba University of Wisconsin Platteville North Dakota State University	11:45 AM – 12:45 PM	University of Missouri Université Laval Minnesota State University University of Saskatchewan
9:15 – 10:15 AM	Oklahoma State University	12:45 – 1:45 PM	South Dakota State University University of Tennessee – Martin University of Nebraska Iowa State University
10:15 – 11:15 AM	Kansas State University University of Wisconsin – Madison Texas A&M Univ University of Wisconsin – River Falls	1:45 – 2:45 PM	McGill University Ohio State University Purdue University Ariel University

9.8 X-Team Tractor Pull Order

1600 lbs Hook 1			1600 lbs Hook 2		
		Distance			Distance
1	University of Illinois	-	1	University of Missouri	-
2	Texas A&M University	-	2	North Dakota State University	-
3	Texas Tech University	-	3	University of Illinois	-
4	South Dakota State University	-	4	Ohio State University	-
5	North Dakota State University	-	5	University of Nebraska	-
6	University of Missouri	-	6	University of Wisconsin-Madison	-
7	Iowa State University	-	7	South Dakota State University	-
8	Ohio State University	-	8	Iowa State University	-
9	University of Nebraska	-	9	Texas A&M University	-
10	University of Northern Iowa		10	Texas Tech University	
11	University of Wisconsin-Madison		11	University of Northern Iowa	

9.9 A-Team Tractor Pull Order

1100 lbs – Hook 1 (3.75" Chain Height on Sled)

	<u>Distance</u>
1 University of Illinois	-
2 CalPoly State University	-
3 Université Laval	-
4 Texas A&M Univ	-
5 University of Missouri	-
6 McGill University	-
7 North Carolina State University	-
8 Ohio State University	-
9 North Dakota State University	-
10 Kansas State University	-
11 University of Manitoba	-
12 University of Nebraska	-
13 University of Wisconsin-River Falls	-
14 University of Kentucky	-
15 Minnesota State University	-
16 Ariel University	-
17 Oklahoma State University	-
18 Purdue University	-
19 University of Saskatchewan	-
20 University of Wisconsin-Platteville	-
21 Iowa State University	-
22 University of Wisconsin-Madison	-
23 South Dakota State University	-
24 University of Tennessee Martin	-

1600 lbs – Hook 2 (3.75" Chain Height on Sled)

	<u>Distance</u>
1 University of Nebraska	-
2 Oklahoma State University	-
3 Ohio State University	-
4 North Dakota State University	-
5 University of Wisconsin-River Falls	-
6 North Carolina State University	-
7 McGill University	-
8 Iowa State University	-
9 CalPoly State University	-
10 University of Wisconsin-Madison	-
11 University of Saskatchewan	-
12 Texas A&M Univ	-
13 Kansas State University	-
14 University of Tennessee Martin	-
15 University of Illinois	-
16 Minnesota State University	-
17 Université Laval	-
18 South Dakota State University	-
19 University of Missouri	-
20 Ariel University	-
21 University of Wisconsin-Platteville	-
22 University of Kentucky	-
23 University of Manitoba	-
24 Purdue University	-

Hook 3 – Weight 1600 lbs (8.75” Sled Chain Height)

		<u>Distance</u>
1	University of Tennessee Martin	-
2	North Carolina State University	-
3	Université Laval	-
4	Minnesota State University	-
5	University of Kentucky	-
6	University of Wisconsin-Madison	-
7	University of Manitoba	-
8	University of Nebraska	-
9	University of Saskatchewan	-
10	CalPoly State University	-
11	University of Missouri	-
12	University of Wisconsin-River Falls	-
13	Ariel University	-
14	Iowa State University	-
15	South Dakota State University	-
16	McGill University	-
17	Ohio State University	-
18	University of Illinois	-
19	Texas A&M Univ	-
20	Kansas State University	-
21	Purdue University	-
22	University of Wisconsin-Platteville	-
23	North Dakota State University	-
24	Oklahoma State University	-

9.10 A-Team Checklist

The following is a checklist for A-Teams that can be used to ensure that all parts of the competition are completed on time.

Task	Due Date	Time	Completed
Pre-Registration	ASAP		
Design Overview Video Due	10-December		
Defense of Design Office Hours	9-13 January		
Defense of Design Judging	16-23 January		
Design Report Due	22-April	5:00 pm	
Cost Analysis Due	22-April	5:00 pm	
Design Log Due	22-April	5:00 pm	
Hotel Reservation	1-May		
Registration	23-May		
Final Team Roster	23-May		
Names for Certificates	23-May		
Registration Fees	23-May		
Final Counts for Pork Fry	23-May		
Final Counts for Banquet	23-May		
Verification of Accountability	23-May		
Team Information Form	23-May		
Arrive at Contest	1-2 June		
Initial Weigh-in (Unballasted)	2-June (Thurs)	12:30 pm	
Technical Inspections (Ballasted)	2-June (Thurs)	Sec 4.4.3	
Design Judging	3-June (Fri)	Sec 4.3.3	
Safety	3-June (Fri)		
Manufacturability	3-June (Fri)		
Serviceability	3-June (Fri)		
Ergonomics	3-June (Fri)		
Test & Development	3-June (Fri)		
Pork Fry	3-June (Fri)	6:30 pm	
Team Presentations	4-June (Sat)	Sec 4.2.1	
Durability Event	4-June (Sat)	8:00 am	
Maneuverability Course	4-June (Sat)	Sec 4.5.1.3	
Practice Pulls	4-June (Sat)	7:00 pm	
Practice Pulls	5-June (Sun)	8:00 am	
Tractor Pulls	5-June (Sun)		
Banquet	5-June (Sun)	6 pm	
RAP Session	6-Jun (Mon)	8 am	

9.11 X-Team Checklist

The following is a checklist for X-Teams that can be used to ensure that all parts of the competition are completed on time.

Task	Due Date	Time	Completed
Pre-Registration	ASAP		
Design Reports Due	22- April		
Hotel Reservation	1-May		
Registration	23-May		
Final Team Roster	23-May		
Names for Certificates	23-May		
Registration Fees	23-May		
Final Counts for Pork Fry	23-May		
Final Counts for Banquet	23-May		
Verification of Accountability	23-May		
Team Information Form	23-May		
Arrive at Contest	1-2 June		
Technical Inspections	2-June (Thurs)	Sec 5.3	
Practice Pulls	4-June (Sat)	3:30 pm	
Tractor Pulls (one weight class)	4-June (Sat)	5:30 pm	
Pork Fry	3-June (Fri)	6:30 pm	
Team Presentations	4-June (Sat)	Sec 5.2.1	
Banquet	5-June (Sun)	6 pm	
RAP Session	6-Jun (Mon)	8 am	

10.0 Registration

10.0 Registration Form

Registrations will be made through Tina Schultz at ASABE Headquarters. The following information is needed. Further information may be posted on the competition website or communicated via email.

Fall Pre-registration (email will be sent to teams in the fall)

Team Name:

Advisor Name:

Advisor Phone Number:

Advisor E-mail Address:

Advisor Shipping Address for Documents:

Team Captain's Name:

Team Captain's Phone Number:

Team Captain's E-mail Address:

Team Captain's Cell Phone at the Contest (or other contact member):

Shipping Address for Tires & Engine (if different than Advisor's address) - must be a University Address

Final Registration (email will be sent to teams 1-2 months prior to competition)

To officially register for the competition, we will need the following information from each team **NO LATER THAN 5/18/2019**:

1. Final team roster including names of team members, advisors and guests.
2. List of team members who would like to receive ¼ Scale Competition participation certificates.
3. Registration Fees
4. Final counts for cookout (Pork Fry) and banquet. Please include guests in these counts.
5. Copy of drivers' and pit-crew members' Medical Insurance Cards. Send a copy only, not the original.
You will not be allowed to participate if we do not have proof of medical insurance.
6. Completed Verification of Accountability Form (Section 8.4)
7. Completed Team Information Form (Section 8.5) NOTE: This form is being updated and will be sent to teams as soon as it is available.

Registration Fees are \$45 per team member per school. Guest meal tickets are available individually - \$10 for the cookout (Pork Fry) and \$45 for the awards banquet.

Please email #1, 2, 4, 6 & 7 and mail #3 & 5 to Tina Schultz (contact information in section 10.0).

To complete the registration process, the Team Captain must check-in at the registration office at competition by 12:00pm (noon) on Thursday, May 28th.

10.1 Verification of Accountability Form

As a requirement of the _____ Student Tractor Design Team
(School Name)
Participating in the 2020 ASABE International Quarter-Scale Tractor Student Design Competition,
I, _____
(Print Name of Team Captain(s)),
and I, _____
(Print Name of Team Advisor(s)),
have read and understood the *Rules and Regulations* and *2020 Handbook* documents that are the
governing set of laws for this year's competition.

(Signature of Team Captain)

(Signature of Team Captain)

(Signature of Team Captain)

(Signature of Team Captain)

(Signature of Team Advisor)

(Signature of Team Advisor)

10.2 Team Information Form

School Name_____Team/Tractor Name_____

Advisor's Name_____Team Captain's Name_____

Drivers _____

What are the specifications of your teams tractor? (i.e. Type of Drivetrain, Steering System)

What was/is the most challenging part of designing and/or building the tractor?

What was/is the best part of designing and/or building the tractor or this competition?

How long (weeks or hours) did it take to build the tractor?

How many years has your school competed in the competition?

If your team chose a theme song, what would it be?

What 5 words would you use to describe your tractor?

What is one unique thing about your tractor or team that people would be surprised to hear?

If your advisor was a superhero, who would he/she be, and why?

10.3 Voted Awards Form



Each of the following awards is voted on by each team as a whole, as well as judges and the competition committee. Please indicate which team you feel deserves the award and a brief reason why. Please return this form to the registration desk no later than Saturday afternoon.

TEAMWORK

BEST APPEARANCE

SPORTSMANSHIP

11.0 Event Contacts

Contact Information is given for various areas of the competition. Do not hesitate to contact any committee member if further information or explanation is needed.

Competition Website:

<http://www.asabe.org/membership/preprofessionalsstudents/14-scale-comp.aspx>

Competition Chair:

Ashley Johnson

johnsonashley@johndeere.com

Competition Co-Chair:

Jarret Ceglinski

jarret.ceglinski@bayer.com

Rules and Engine Questions:

Chance Corum

CorumChanceM@johndeere.com

Lead Tech Inspector:

Robert Marker

rmmark1230@gmail.com

Overall Competition:

Tina Schultz – ASABE

schultz@asabe.org

Mailing Info: Tina Schultz

2950 Niles Road

St. Joseph, MI 49085-9659

Shipping Address for Expo Gardens (Pull Site)

Expo Gardens

1601 W. Northmoor Rd.

Peoria, IL 61614

Telegram App Information

We will be using an app called Telegram to supplement communication at the Expo Gardens. To set this up, download the Telegram app onto your Android, iOS, or Windows smart phone. Next, search for the groups below by their name or link and join.

Announcement Thread:

Group Name: Announcements - ASABE Quarter Scale

Link: https://t.me/asabeiqs_announcements

General Communication Thread:

Group Name: General - ASABE Quarter Scale

Link: <https://t.me/asabeiqs>

12.0 CAN Specification

As part of the competition, teams have the option of interfacing their vehicles with the durability cart via a CANbus network. The rules document outlines the physical requirements for this system, should a team decide to take advantage of it. Here, we outline the message structure that needs to be followed.

CAN Specification

Protocol	J1939
Source Address (static)	0xC2
Baud Rate	250kbps

Broadcast Messages from Durability Cart:

PGN	0xFF0A	
Priority	6	
Reserved	0	
Data Page	0	
Rep Rate	100mS	
Data Length	8 bytes	
Bit Start/Byte	Length	Description
1.1	16 bits	Ground Speed (0.125 fpm/bit)
3.1	16 bits	Ground Drive Pressure (1 psi/bit)

Broadcast Message from Vehicle:

Note: If a team wishes to interface with the durability cart, it is required that they send this message. This will be tested during technical inspections.

PGN	0xFF0B	
Priority	6	
Reserved	0	
Data Page	0	
Rep Rate	100mS	
Data Length	8 bytes	
Bit Start/Byte	Length	Description
1.1	8 bits	Tractor Number (Defined in section 8.4)