

JUNK DRAWER RACES

HYDRAULICS CRANE CHALLENGE

Grade 8

Competition Guideline and Overview 2021-22

Last Updated: September 2021

TABLE OF CONTENTS

Program Overview	Page 2
Program Registration Information	Page 2
Regional Divisions	Page 3
Contest Overview	Page 5
Challenge Overview and Judging Requirements	
Part 1: Planning and Design Package	Page 5
Part 2: Construction	Page 6
Part 3: Load Test	Page 8
Part 4: Skilled Trades Test	Page 9
BONUS: Visual Appeal	Page 9
Scoring	Page 12
Submission Package	Page 13
Submitting to Dropbox	Page 14
Important Dates	Page 14
Provincial Championships	Page 15
Resources	Page 15
Questions	Page 16

If you require assistance or have any questions about the contest, please consult the **Junk Drawer Races Frequently Asked Questions** located on our website at www.skillsontario.com/junk-drawer-races or you may contact the Competition Coordinator at junkraces@skillsontario.com.

PROGRAM OVERVIEW

Introducing the first-ever Skills Ontario's Junk Drawer Races! The contests under this program are open to students from Grades 2 - 12 within Ontario. Last year we launched Paper Glider Competition for grades 7-12 and this year we are announcing new competitions for different grades. Please refer to table below for these competitions.

Competition	Grades	Related Topics from Curriculum
Gravity Powered Robot Walker Race	2-3	Simple Machines Movement Strong and Stable Structures Forces Causing Movement
Cardboard Car Race	4-5	Wheels Forces Acting on Structures and Mechanisms
Paper Glider Competition	6-7	Flight Technology Designing Building Testing Centre of Gravity
Hydraulic Crane Challenge	8	Hydraulics Fluids Systems in Action
Cardboard Hovercraft Race	9-12	Manufacturing Technology Technological Design Transportation Technology

Number of Teams and its size:

One team of up to four (4) students can participate from every school for every contest. To ensure fairness and access to programs across the province, each school board is entitled to spaces at Elementary, Sr. Elementary and Secondary levels for both their online and in-person learning streams.

Virtual schools/hubs can register one team per contest just like in-person schools. Virtual class/es of a school that also has in-person classes can only register one team per contest which can be either from an in-person class, virtual class, or a collaboration of both. This competition is also open to private schools.

If you have any questions or concerns about registration spaces for your school board, please contact the Competitions Coordinator at junkraces@skillsontario.com.

Teams can register by visiting www.skillsontario.com/junk-drawer-races. A registration confirmation email will be sent to the registering email address within five business days.

PROGRAM REGISTRATION INFORMATION

Registration for all contests open on Tuesday, October 12th at 9:00 am! Please visit www.skillsontario.com/junk-drawer-races to begin the registration process.

Every school must register for all the contests separately by selecting the correct drop down from the registration form. If schools have more teams wishing to compete for a contest, they are

encouraged to host a competition at school level to decide the team that represents the school. This competition could be held within a Gymnasium if permitted.

Teachers can email junkraces@skillsontario.com regarding any questions to hosting an internal school competition.

Registration Confirmation Email

A confirmation email will be sent to the registering email. This confirmation email will be sent within 5 business days of registering. A team is not registered for the program until a confirmation email is sent. If the confirmation email is not received within 5 business days, please contact Skills Ontario at junkraces@skillsontario.com. Please be sure to check spam folders. It is important that all teachers at the school coordinate which team will represent the school. If a school has a second team who registered, Skills Ontario will notify both registered teams and advise them that they must select only one team to participate.

Registration closes Tuesday, November 16th at 4:00 PM. No exceptions.

REGIONAL DIVISIONS

For the purpose of this competition, Skills Ontario has divided the 76 public school boards across Ontario into regional divisions as per their geographic location. Similar to the regional divisions of the Qualifying Competition that leads to the Skills Ontario Provincial Competition. There are 7 regional divisions.

A team must place within the top 3 of their regional division during the Regional Competition that concludes on January 12th to be eligible for the Provincial Championships.

Refer to the table below to review which Regional Division your School Board belongs to. This is the division in which your team will compete within during the Regional Competition.

Central Ontario	Far Northern Ontario
Durham Catholic District School Board	Conseil scolaire de district catholique des Aurores boréales
Durham District School Board	Keewatin-Patricia District School Board
Dufferin-Peel Catholic District School Board	Kenora Catholic District School Board
Peel District School Board	Lakehead Public Schools
Toronto Catholic District School Board	Northwest Catholic District School Board
Toronto District School Board (All Quadrants)	Rainy River District School Board
York Catholic District School Board	Superior North Catholic District School Board
York Region District School Board	Superior-Greenstone District School Board
	Thunder Bay Catholic District School Board

Eastern Ontario	
Algonquin and Lakeshore Catholic District School Board	Northern Ontario
Catholic District School Board of Eastern Ontario	Algoma District School Board
Conseil des écoles catholiques du Centre-Est	Conseil scolaire catholique du Nouvel-Ontario
Conseil scolaire de district catholique de l'Est ontarien	Conseil scolaire catholique de district des Grand Rivières
Conseil des écoles publiques de l'Est de l'Ontario	Conseil scolaire de district catholique Franco-Nord
Hastings and Prince Edward District School Board	Conseil scolaire public du Grand Nord de l'Ontario
Limestone District School Board	Conseil scolaire public du Nord-Est de l'Ontario
Ottawa Catholic School Board	District School Board of Ontario North East
Ottawa-Carleton District School Board	Huron-Superior Catholic District School Board
Renfrew County Catholic District School Board	Near North District School Board
Renfrew County District School Board	Nipissing-Parry Sound Catholic District School Board
Upper Canada District School Board	Northeastern Catholic District School Board
	Rainbow District School Board
Southern Ontario	Sudbury Catholic District School Board
Brant Haldimand-Norfolk Catholic District School Board	Near Northern Ontario
Conseil scolaire catholique MonAvenir	Bluewater District School Board
Conseil scolaire Viamonde	Bruce-Grey Catholic District School Board
District School Board of Niagara	Kawartha Pine Ridge District School Board
Grand Erie District School Board	Peterborough Victoria Northumberland and Clarington Catholic District School Board
Halton Catholic District School Board	Simcoe County District School Board
Halton District School Board	Simcoe Muskoka Catholic District School Board
Hamilton-Wentworth Catholic District School Board	Trillium Lakelands District School Board
Hamilton-Wentworth District School Board	Upper Grand District School Board
Niagara Catholic District School Board	Wellington Catholic District School Board
Western Ontario	
Avon Maitland District School Board	
Conseil scolaire catholique Providence	
Greater Essex Country District School Board	
London District Catholic School Board	
Lambton Kent District School Board	
St. Clair Catholic District School Board	
Thames Valley District School Board	
Waterloo Catholic District School Board	
Waterloo Region District School Board	
Windsor-Essex Catholic District School Board	

If your school board is not listed, or if you notice an error, please contact the Competitions Coordinator at junkraces@skillsontario.com

CONTEST OVERVIEW

Teams of up to four (4) students from grades 8 are to design and build a **Hydraulics Crane** made from fluids, paper products, syringes, plastic tube/pipe and toothpicks or wood skewer sticks. Once the cranes are built, the teams are to then test their capabilities by lifting a load of 25gm from **Pickup point 1** and drop it at **Drop Point 1/Pickup Point 2** and then lift it from the same point and drop it off at **Drop Point 2**. Please print the last two pages of the scope for the purpose of competition. Image of how the crane is to be placed and the load test is to be conducted, is also attached for reference. Teams are required to video record their load tests.

CHALLENGE OVERVIEW AND JUDGING REQUIREMENTS

Below you will find the description and judging requirements for each section of the Hydraulics Crane Challenge.

PART 1: PLANNING & DESIGN

There are three components to the Students' Planning and Design. All three components must be handed in to receive full marks. Submissions will **not be accepted** if students do not include their Mandatory Safety Checklist. All students **MUST** complete the Mandatory Safety Checklist **PRIOR** to beginning their Hydraulics Crane project, however the checklist only needs to be submitted with the rest of the project files.

Mandatory Safety Checklist

Teams must complete the Mandatory Safety Checklist, which is a full project safety checklist that all entries must submit in order to be eligible to compete. Visit the Resources section of the Junk Drawer Races webpage to download the Mandatory Safety Checklist in .PDF format, located here: www.skillsontario.com/junk-drawer-races.

Design Plan

In teams, students are to create a Design Plan of their Crane and submit their designs within their submission package. Design Plan should be neat, easy-to-read, and should clearly show the design of the Crane. Teams are welcome to create their designs by hand or by computer. Teams will be marked on their abilities to build according to their design plans.

Materials List

Teams must include, on a separate piece of paper, a full list of the materials used. This document can be created and formatted however the Team wishes. Teams will be marked on their ability to include all materials used to build their Crane. They must also provide quantity of materials used and will be marked on the legibility and professionalism of this document.

Your Planning & Design Package should include the following three (3) documents:

- Design Plan – Should include all necessary dimensions are labeled (Frame, width, weight, length). It should also include a legend if necessary
- Mandatory Safety Checklist (Can be found in Junk Drawer Races Resource webpage)
- Materials List - Full list of materials used

Teams will be marked on:

- Materials List– Is it legible? Are all materials used listed? Did they use all approved materials? (Up to 5 marks)
- Design Plan – Does the design plan look neat and organized? Was a straight-edge ruler used? Is it legible? Are all measurements to scale? Does the design reflect the build? (Up to 5 marks)
- Accuracy – Are all measurements to scale? (5 marks)

All components of the Planning & Design section must be included with final submission in Dropbox in order to receive marks.

PART 2: CONSTRUCTION CHALLENGE

Once the Students have completed their mandatory safety checklist, materials list and design plan, they are then to begin constructing their projects according to their design plans. Students will be marked on: their ability to follow their design plans, the quality of the construction and the images provided.

Dimensions –

- Total width of the base of the crane cannot exceed **30 cm**
- Total length of the 1st Boom cannot exceed **18 cm**

Approved Materials:

Approved Paper Products

- Printer paper
- Wrapping paper
- Newspaper
- Tissue Paper
- Toilet Paper or Paper Towel
- Cardboard and other Corrugated materials
- Stiff cardstock
- Any other paper product available – **MUST be a product primarily made of paper**

Other Approved Materials

- Bamboo/wood Skewer Sticks

- Toothpicks
- Popsicle sticks
- 10 ml Syringes *
- Water and colors for fluids
- Plastic/rubberized tubes for syringes*
- Old batteries or coins for counterweights
- Thin wire or craft thread for hook and hoist rope
- The use of other materials, hard plastic, motors or wire will **not be permitted**.

All items listed above can be found at most grocery stores, Dollar Stores, Stationary Stores, Walmart, Canadian Tire or Home Hardware stores across Ontario.

* Syringes can be found at Michaels and Canadian Tire; Tubes can be found at Canadian Tire, Home Depot and other home, hardware, and plumbing stores.

If you are having difficulty finding these items, please contact junkraces@skillsontario.com.

Approved Adhesives & Connectors

Students **may use ANY type of adhesive for their crane** but should take into account the type of materials they are using and if it will restrict movement of the crane.

Recommended adhesive/connector products:

- 3M scotch tape
- 3M masking tape
- Painters tape
- Duct tape
- Super Glue
- Glue stick
- Glue gun
- White glue or carpenter's glue
- Zip Ties

Construction Images for Final Project Submission

Team's construction will be marked upon images submitted and proper materials used. Three (3) pictures of the Crane from different angles is to be included with the project submission. Those picture angles are to be taken of the:

1. front
2. side (either side)
3. Top

Teams will be deducted marks if three images showing three separate views are not included with their submission package.

Teams will be marked on:

- Build Accuracy – Did the student competitors follow their design plans? Are all features in the designs present on the product? (Up to 5 marks)
- Picture Quality – Did the team include 3 images with the required views? Do the pictures clearly show the Crane? (Up to 5 marks)
- Quality of Construction – Does the Crane look like it will function? Is it well built? Is it a creative design? (Up to 5 marks)

SAFETY NOTE:

If using a device that requires an electrical source such as a Hot Glue Gun, please ensure a teacher, parent or guardian is supervising at all times.

PART 3: LOAD TESTS – FASTEST ATTEMPT

Once the Student Competitors have completed constructing their Crane and have taken photographs for their submission entries, students are to *print the test drawings* for the contest and place it like it is in the image below. Students are required to place the crane behind the lines as seen in the picture.

Task

The teams are then to test their capabilities by lifting a load of 25 gm from **Pickup point 1** and drop it at **Drop Point 1/Pickup Point 2** and then lift it from the same point and drop it off at **Drop Point 2**. Teams are required to video record their lifting test attempts.

Students are to perform 3 Load tests, with the goal of fastest attempt. The students are to video record their load tests. Points will be awarded based on the time taken to complete the task. Tiebreakers will be determined to the nearest tenth of a second.

The Load Tests consists of three (3) consecutive tests. In order to ensure that Students are using three consecutive tests, the Load test video must be shot in **ONE CONTINUOUS VIDEO – NO EDITING!**

The video must capture the entire movement of the crane at all times. The Crane must not escape the video at any time. Teams must plan their load tests and video shot carefully in order to ensure the crane, load and the test drawing is in the video frame at all times. The fastest attempt out of the three attempts will be considered as a final submission.

For 25 gm weight, students must use any mix of coins and they are required to specify the coins used in their material list.

Coin	Weight (g)
Toonies	7
Loonies	7
Quarters	5
Dimes	2
Nickels	4

Teams will be marked on:

- Video – has it met all criteria? (Submitted on time and titled in proper format, crane does not leave frame;)
- Time taken by the crane to complete the **task**

SAFETY NOTE:

Students should use a safe indoor area, such as a classroom, school gymnasium or an activity room to perform a ride test.

PART 4: SKILLED TRADES TEST

Teams are to include with their Load test submission, answers to the Junk Drawer Races Skilled Trades Test, which can be downloaded from www.skillsontario.com/junk-drawer-races.

The Junk Drawer Races Skilled Trades Test requires the students to find the answers to 10 multiple choice questions that are based upon the Skills Ontario website, OYAP program website and Skilled Trades within Ontario.

BONUS: VISUAL APPEAL

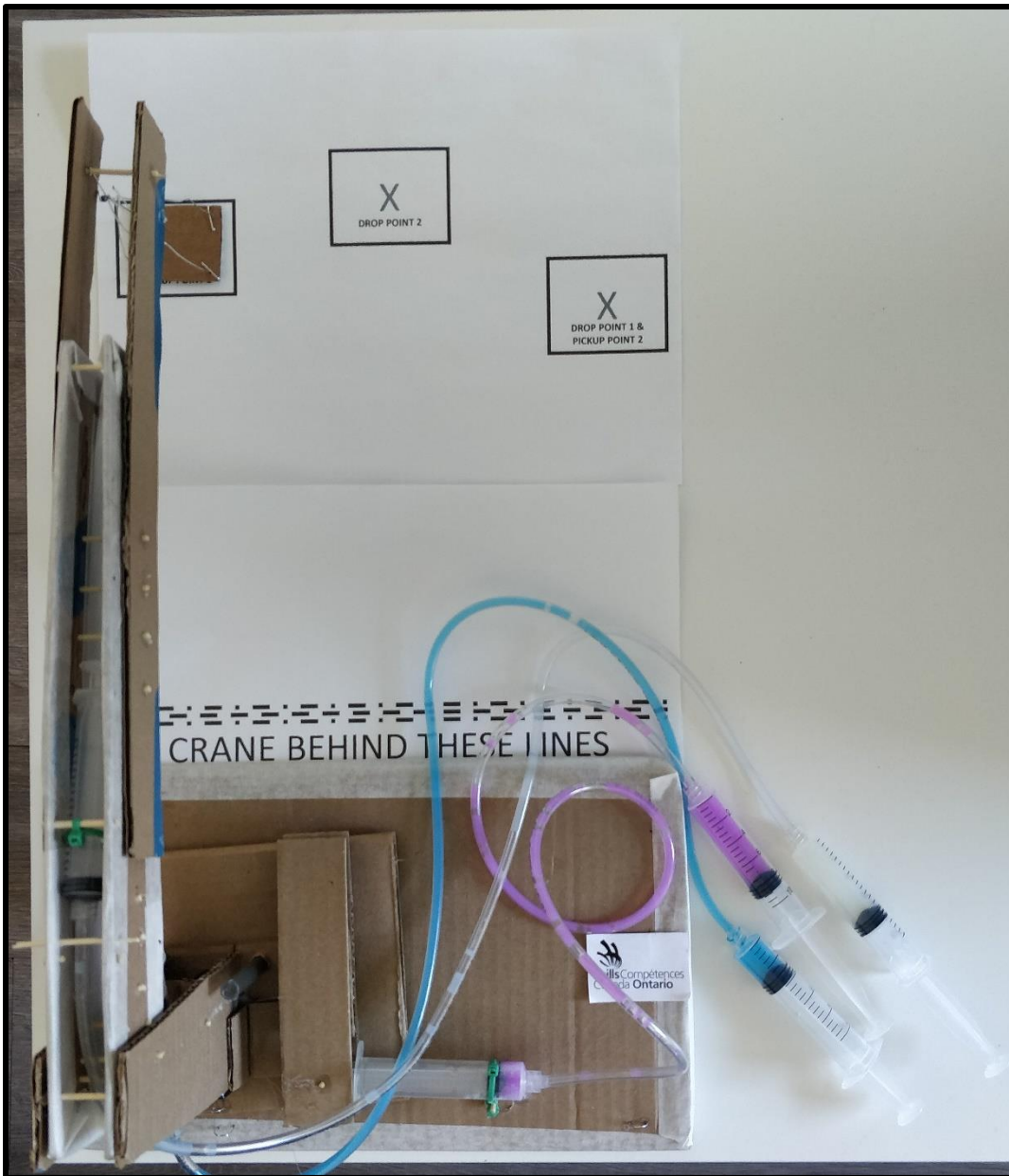
Teams have the option to decorate their Crane projects but must do so using specific materials that do not provide a structural advantage. Students may only use decorations such as colorful construction paper, markers, crayons, paint, glitter, etc.

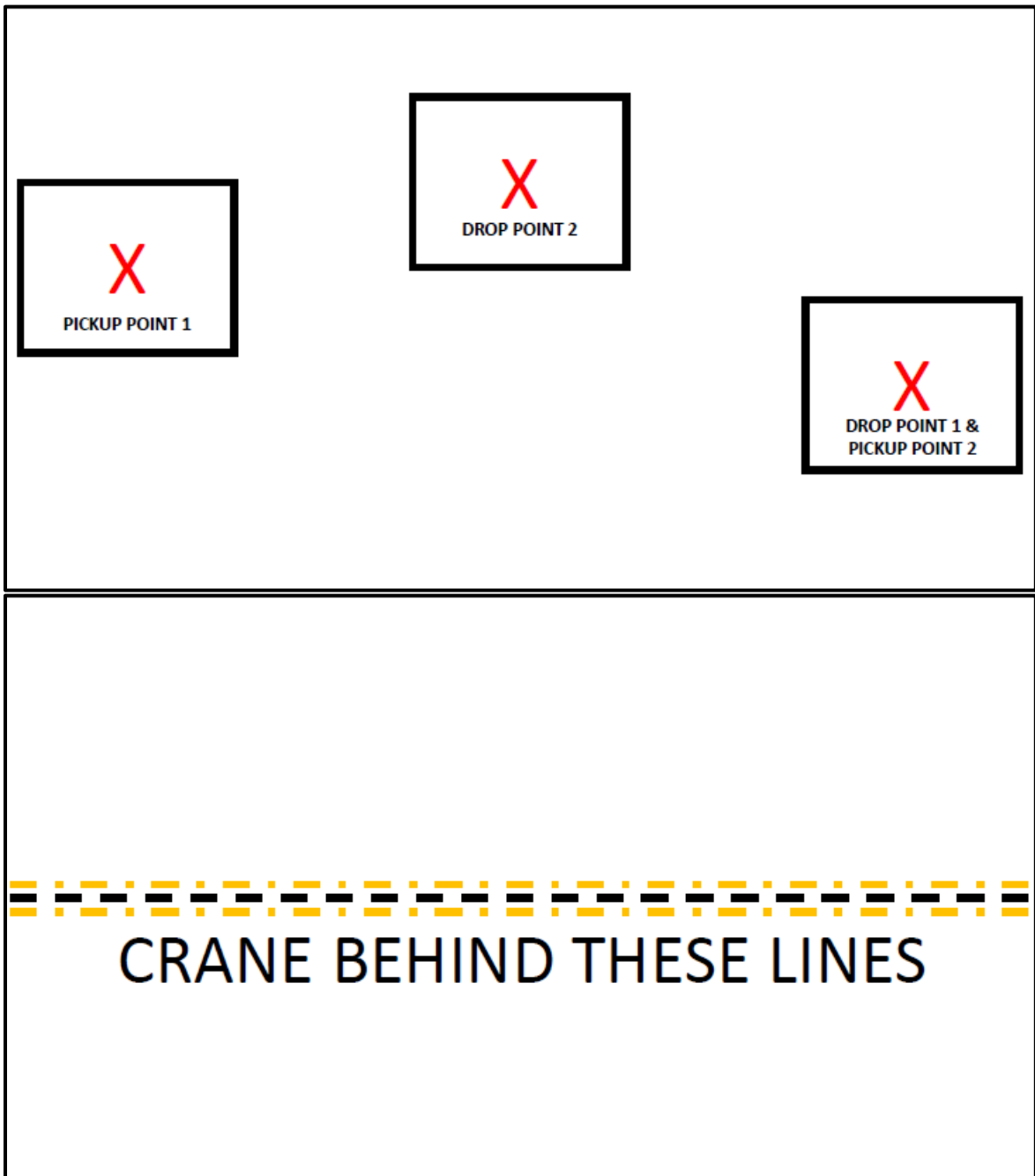
Some examples of decorations that could provide an unfair advantage are:

- Wire
- Pipe Cleaners
- Non-Paper materials, such as aluminum foil, saran wrap or plastic

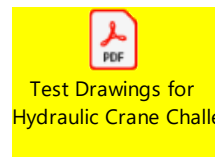
Any decorations that appear to be aiding in the structural integrity of the Crane will result in a 5-point penalty. If a team is unsure if a certain decoration material is allowed to be used, they may email the Competitions Coordinator at junkraces@skillsontario.com.

Placement of Crane





Test Drawing →



SCORING

Category	Maximum Points	
Part 1: Planning & Design package		
Materials List- Is it legible? Are all materials used listed? Did they use all approved materials?	5	
Professionalism – Does the Design Plan look neat and organized? Was a straight-edge ruler used? Is it legible?	5	
Accuracy – Are all measurements to scale?	5	
Mandatory Safety Checklist - submitting this is an automatic 5 points. If an entry does not include a Safety Checklist, the entry will be disqualified	5	
Total Planning and Design	20 points	
Part 2: Construction		
Build Accuracy – Did the Student Competitors follow their design plans? Are all features in the designs present on the product?	5	
Picture Quality – Did the team include 3 images with the required views? Do the pictures clearly show the Crane?	5	
Quality of Construction – Does the crane design look like it will work? Is it well built? Is it a creative design?	5	
Total Construction	15	
Part 3: Load Tests		
3 attempts – Points Breakdown	Time of the fastest attempt will be considered	
Time		Points
Less than 10 seconds		20 points
10 – 11.99 seconds		18 points
12 – 13.99 seconds		15 points
14 – 15.99 seconds		10 points
16 seconds and above		5 points
Quality of Video	10	
<ul style="list-style-type: none"> Was the Crane and load within the frame at all times? Was the test drawing and placement marks in the frames? Was it clear in the video, load was picked up and dropped at right spots? 		
Total Load Test Challenge		
Part 4: Skilled Trades Knowledge		
Questions 1 - 10	10	
Bonus Question	5	
Total Skilled Trades Knowledge	15	

VISUAL APPEAL BONUS MARKS	5
<ul style="list-style-type: none"> • Did the team use approved decoration materials? Is the decoration appropriate? 	
TOTAL MARKS	

Important Points:

1. All judging is final. Individual final scores will not be shared with teams.
2. Students are encouraged to work in a team and every student must have a different responsibility (keeping the time, placing the drawing, helping with the load and recording)

Tiebreaker

In the event of a tie between two or more teams, ties will be broken by using the score from the Load Test.

SUBMISSION PACKAGE

Team’s submissions for the Regional Hydraulic Crane Challenge round are to include the following media in the following formats:

Part 1 – Design Plan Package

- A copy of the Crane Design Plan is required to be submitted. These can be created and submitted in: .PDF, .JPEG, .DOCX (Word or Excel). Any other formats will not be accepted. Must be saved as “Design Plan”
- Material List is required to be created and submitted in: .docx, .xls or .pdf format (MS Word or Excel). Must be saved as “Materials List”
- Mandatory Safety Checklist to be downloaded, answered, and submitted in: .docx, .xls or .pdf format (MS Word or Excel). Must be saved as “Mandatory Safety Checklist – Completed”

Part 2 – Construction Photographs

- Three (3) pictures of the Crane are required to be submitted (Front, Side and Top). These can be received in: .PDF, .JPEG. Any other formats will not be accepted.
- The three (3) pictures must each be saved as: “crane_top”, “crane_side”, “crane_front”.

Part 3 – Load Test

- **Three (3) attempts within 1 continuous video** are required to be submitted. Video submission formats accepted are: .MP4 and .AVI.
- This file must be titled “Load Test”.

Part 4 – Skilled Trades Question Answers

- Answers to the three (3) Skilled Trades Questions are required to be submitted. Submission formats accepted are: .JPEG, .PDF and .DOCX (Word or Excel) and can be no larger than 1GB in size
- This document must be titled "Skilled Trade Test Answers".

The Hydraulic Crane Challenge Submission Package should contain the Team's design plan, materials list, three (3) photographs of the constructed Crane, their written answers to the Skilled Trades Questions, as well as the video recording of their Load test online. **Registered Teams will have until December 1st at 3:00 PM** to submit their Submission Package to the Dropbox folder.

Submitting to Dropbox

Teams are to collect all parts of their submission within a folder and submit their final submission package within the Skills Ontario Junk Drawer Races webpage at www.skillsontario.com/junk-drawer-races by clicking the blue "Submit your Project" button.

Junk Drawer Races project submissions must be submitted in a specific naming format in order to receive marks. If a team does not name their submission package in the following naming convention, their submission may be disqualified from competition.

STUDENTS:

Be sure to have all 6 components of your project saved within a compressed .ZIP file folder. The .ZIP file MUST be titled using your school name and school board initials.

For example, if your school is St. Mary's Elementary School in Waterloo Catholic District School Board, your file must be titled: "stmarys.wcdsb.ZIP".

NOTE: Your full submission package should include a total of 6 documents that is a part of the 4 sections above.

IMPORTANT DATES

Event	Date
Registration for Regional Competitions Opens	Oct. 12 th , 2021, at 9:00 AM
Registration for Regional Competitions Closes	Nov. 16 th , 2021, at 4:00 PM
Submissions for Regional Competitions Due	Dec. 1 st , 2021, at 3:00 PM
Regional Competitions Winners Announced	January 12 th , 2022, VIA Social Media
Championship Round Challenge Announced	January 12 th , 2022
Championship Round Registration Opens	January 12 th , 2022
Championship Round Submissions Due	February 16 th , 2022 at 3:00 PM
Championship Round Winners Announced	March 10 th , 2022, VIA Social Media

*All important dates are subject to change.

PROVINCIAL CHAMPIONSHIPS

The Hydraulic Crane Challenge Championship Round will consist of the top 3 teams from each regional division from the regional competition. The Provincial Championship Round will follow the same rules and guidelines as the regional competition, with the exception of the added Provincial Competition Challenge. **The Provincial Championship Challenge will be revealed when the advancing teams are announced on January 12th, 2022.**

Teams competing within the Provincial Championship round will have until February 16th to review their existing blueprints, potentially modify their designs to meet the provincial challenge and construction requirements while explaining their modifications and submit their new submissions via Dropbox. Provincial submissions follow the same guidelines as the regional competition, but with the addition of the Provincials Challenge. Entries are to be assembled and submitted similar to how they were submitted within the regional competition.

Provincial Submissions will be judged and evaluated by industry volunteers, and the top three teams will be awarded prizes by Skills Ontario. Winning teams will be notified no later than March 10th.

NOTE:

The above Provincial Championship guidelines and dates are subject to change at any time. An official Hydraulic Crane Challenge Championship guideline will be released to advancing teams upon the conclusion of the Regional round.

RESOURCES

To learn how to build this activity and see how it functions, you can refer to the links below:

- <https://www.youtube.com/watch?v=AklAmKKu1y0>
- <https://www.instructables.com/CARDBOARD-Robotic-Hydraulic-Arm/>
- <https://www.youtube.com/watch?v=dYhWg3038rl>

Note: The links are for reference only, you may learn from these, but your submission shouldn't be identical. If it is found to be identical by the judges, your submission may not be considered for marking.

QUESTIONS?

Should you have any questions regarding this competition, please don't hesitate in contacting the Competitions Coordinator at junkraces@skillsontario.com.

Thank you to our Sponsor. Merci à notre commanditaire.



This program is funded by the Government of Ontario. Ce programme est financé par le gouvernement de l'Ontario.