

FLL “TRASH TREK” – RULES & ROBOT GAME

At the Robot Game, the teams compete with robots they have built in advance out of LEGO parts and programmed by themselves. Within 2½ minutes they try on the approximately 2m² large playing Field, to get as many points. The robot must act autonomously, all movements must be independently by the program. Remote controls are not allowed.

At all competitions a season the same playing Fields and tasks are used worldwide. The way in which the objects are achieved, and the order in which they are dissolved, are not prescribed. Accordingly, the robots of the team look completely different, even though they are all built from LEGO.

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1. RULES

1.1 Guiding principles

GP1 – Gracious professionalism®

- The FLL tournament should be driven by fairness.
- You compete hard against PROBLEMS, while treating PEOPLE with respect and kindness - people from your own team, as well as other teams.
- Coaches and parents lead by example.
- You build onto other people's ideas instead of resisting or defeating them.
- Everyone running a tournament is a volunteer, including each Referee (Ref). Refs spend hours after work and on weekends to learn the Challenge, but you must expect them to occasionally make calls you disagree with.

GP2 – Interpretation

- Robot Game text means exactly and only what it says. Take it literally whenever possible.
- If a word isn't given a game definition, its common/dictionary meaning applies.
- If a detail isn't mentioned, it doesn't matter.

GP3 – Benefit of the doubt

- You should get the "benefit of the doubt" when...
 - ... the Ref thinks a Mission Model with known faults is a factor.
 - ... the Ref thinks incorrect Table/Field setup or maintenance is a factor.
 - ... the Ref thinks a split-second or the thickness of a line is a factor.
 - ... the Ref thinks a situation could "go either way" due to confusing, conflicting, or missing information.
 - ... the Ref is unable to actually point to decisive and compelling official text against you.
- This good-will courtesy is not to be expected, and not to be used as part of any strategy.

GP4 – Variability

- Our suppliers, donors, and volunteers try very hard to make all Fields correct and identical, but you should always expect some flaws and variability in the...
 - border walls.
 - lighting conditions.
 - Table surface and Mat.
- Questions about conditions at a particular tournament should be directed to that tournament's officials, the contact dates you can find at the [FLL Regional Web-site](#).

GP5 – Precedence

If there is conflict between sources of game info, precedence/authority is in this order...

1. [FLL FAQ](#)
2. [FLL Missions and Field Setup](#)
3. [FLL Rules](#)
4. Local Head Ref decision

Pictures and video have no standing, except as Referenced by Missions, Field Set-up, or Rules text. Emails and forum discussions have no standing - no matter who they are from. Consider their opinion.

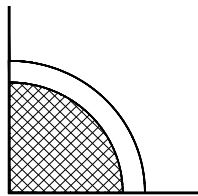
1.2 Definitions

D01 – Autonomous

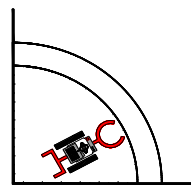
A Launched Robot is said to be “Autonomous” - performing with no help.

D02 – Base

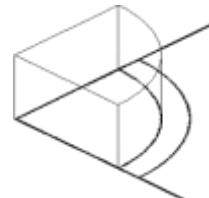
- “Base” is over the Field’s inner quarter-circle.
- It extends to the inner south and west border walls, but no farther, and has an imaginary height of 12 in. ~ 30,5 cm
- Base is important during Robot Start/Re-Start only.



BASE Footprint



Robot „COMPLETELY IN“ Base



High matters during Start

D03 – Equipment

- “Equipment” is everything you bring to a Match for a Mission-related activity.

D04 – Field

- The “Field” is the Robot’s game environment, consisting of LEGO Models on a Mat, surrounded by border walls. The Field is held on a Table. For full details, see the Missions section in this document – for each Mission there is a description of how to set up the Models on the Field or on the FLL website beneath “Field Set Up & Placement”..

D05 – Interruption

- If you interact with an Autonomous Robot, that’s an “Interruption.”
- No longer Autonomous, the interrupted Robot is not allowed to move or do anything.

D06 – Match

- A “Match” is when two teams play opposite each other on two Fields arranged back to back.
- Matches last 2-1/2 minutes.
- Your Robot Launches from Base and tries as many Missions as possible.
- The Field is not reset for the purpose of multiple attempts.
- Re-Launches are allowed during the Match, but the timer doesn't pause.

D07 – Mission

- A “Mission” is one or more objectives worth points.
- Some must be visible at the END of the Match.
- Some must be performed in a particular way, and must be watched by the Ref AS THEY HAPPEN.

D08 – Mission Model

- A “Mission Model” is any LEGO structure already at the Field when you arrive to compete. You don't bring Mission Models to the competition Field - they're already there when you arrive.
- You are not allowed to take Mission Models apart, even temporarily.
- If you combine a Mission Model with something, the combination must be loose enough that if asked to do so, you could pick the Model up and nothing else would come with it.

D09 – Penalties

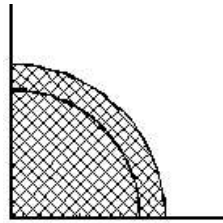
- A “Penalty” is a deduction from your final score due to a specific action that is allowed but discouraged.
- Penalty Points are found in the Missions. There are two types of Penalty:
- INTERRUPTION PENALTY: Caused by you Interrupting the Robot while it's not completely in Safety.
- JUNK PENALTY - Caused...
 - immediately - by each piece of equipment the Robot Strands partly in Safety.
 - at the end of the Match - by each piece of equipment still stranded completely outside Safety.

D10 – Robot

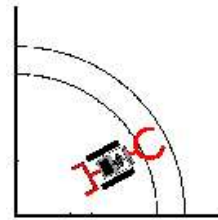
- A “Robot” is a LEGO MINDSTORMS controller and all Equipment currently combined with it.

D11 – Safety

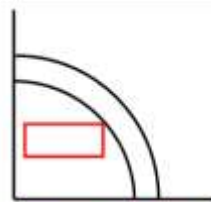
- Safety” contains Base, extends to the outer black arc, and has no ceiling.



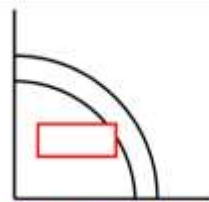
Safety Footprint



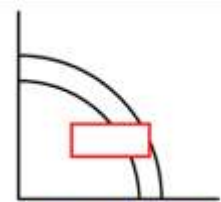
Robot „COMPLETELY IN“ Safety



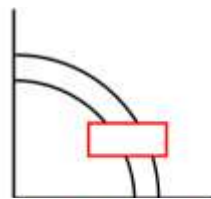
Completely in Base,
completely in Safety



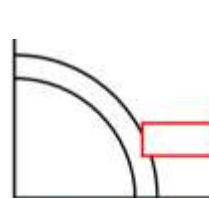
Not completely in Base,
not completely in Safety



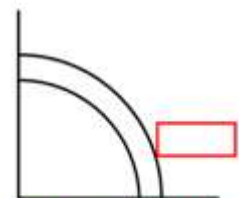
Partly in Safety



Partly in
Safety



Partly in
Safety



Completely outside
Safety

1.3 Equipment, software, and people

R01 – All equipment

All Equipment must be made entirely of LEGO-manufactured building elements in original factory condition. Except:

- LEGO string and tubing may be cut to length.
- Reminders written on paper are okay.
- Marker may be used only in hidden areas, for ownership identification.
- Paint, tape, glue, oil, zip-ties, etc. are not allowed.

R02 – Controllers

Only one individual controller is allowed in any particular Match.

- It must exactly match a type shown below
Except: Special-edition color differences are okay
- All other controllers must be left in the pit area for that Match.

All forms of remote control and/or data/info exchange with Robots (including Bluetooth) in the competition area are illegal.



EV3



NXT



RCX

R03 – Motors

Up to **four** individual motors are allowed in any particular Match, grand total.

- Each one must exactly match a type shown below.
- You may include more than one of a type.
Example: 3 EV3 „LARGE“ + 1 EV3 „MEDIUM“ = 4 motors = OKAY.
- All other motors must be left in the pit area for that Match.



EV3 "LARGE"



EV3 "MEDIUM"



NXT



RCX

R04 – Sensors

Use as many external sensors as you like.

- Each one must exactly match a type shown below.
- You may include more than one of each type.



EV3 TOUCH



EV3 COLOR



EV3 ULTRASONIC



EV3 GYRO/ANGLE



NXT TOUCH



NXT LIGHT



NXT COLOR



NXT ULTRASONIC



RCX TOUCH



RCX LIGHT



RCX ROTATION

R05 – Other electric/electronic things

No other electric/electronic things are allowed in the competition area for Mission-related activity.

Except:

- LEGO wires and converter cables are allowed as needed.
- Allowable power sources are controller's power pack or six AA batteries.

R06 – Non-electric elements

Use as many non-electric LEGO elements as you like.

Except:

- Factory-made wind-up/pull-back "motors" are not allowed.
- Additional/duplicate Models are not allowed if they could confuse scoring.

R07 – Software

- The Robot may only be programmed using LEGO MINDSTORMS RCX, NXT, EV3, or RoboLab software (any release).
- No other software is allowed. Patches, add-ons, and new versions of the allowable software from the manufacturers (LEGO and National Instruments) are allowed, but tool kits, including the LabVIEW tool kit, are not allowed.

R08 – Technicians

- Only two team members, called "Technicians" are allowed at the competition Field at once.

Except:

- Others may be present during preparation.
- Others may step in for honest emergency repairs during the Match, then step away.
- The rest of the team must stand back as directed by tournament officials, with the expectation of fresh Technicians being able to switch places with current Technicians at any time.

1.4 Robot-Game

R09 – Pre-match preparation

After getting to the Field, you have at least one minute to prepare. During this time only, you may...

- ... ask the Ref to confirm that a Model or setup is correct.
- ... calibrate light/color sensors on the Field inside and outside Safety

R10 – Hands off

If something on the Field is not completely in Safety, you are not allowed to touch it except as specifically described in a Mission, Rule, or Update.

R11 – Workspace and storage

- On the Field: Handling and storage of allowable things may extend out of Safety, into adjacent irrelevant Field space only if specific actions and locations are completely non-strategic.
- Off the Field: Equipment and Models are not allowed on the floor.

R12 – Launching

A proper Launch (or re-Launch) goes like this:

- **READY SITUATION**
 - Your Robot and everything related to its next autonomous period are arranged as desired and all completely contained within and under the limits of Base.
 - The Ref can see that nothing in Base is moving, and that you're not touching anything.
- **ACTIVATION METHODS**
 - **ACTIVE:** Reach with one hand and touch a button or signal a sensor to prompt a program.
 - **PASSIVE:** Do nothing and allow a running program to resume.
 - **SPECIAL CASE: Match Start** - In this case, the exact time to Launch is the beginning of the last word/sound in the countdown, such as "Ready, set, GO!" or BEEEEEP!
- The properly Launched/re-Launched Robot is Autonomous until you interrupt it.
- Every change completely outside Safety caused by the Robot stays that way.
Except: The Robot may change its own changes.
- You are not allowed to cause anything to leave or even extend out of Base except by Launching/re-Launching.
- If you accidentally propel something out of Base, that's okay to recover immediately without disturbing the Field.

R13 – Interrupting

If you INTERRUPT the Robot, you must stop it immediately, then calmly pick it up for a re-Launch * if there will be one. Here's what happens to the Robot and any Model it was transporting, depending on where each was at the time...

- **ROBOT – Completely in Safety?**
 - Yes: Re-Launch.
 - No: Re-Launch + Interruption Penalty.
- **MODEL – Completely in Safety?**
 - Yes: Keep it.
 - No: Was it with the Robot during the most recent Launch?
 - Yes: Keep it.
 - No: Give to the Ref (out of play).
- * **LENIENCY:** If there is no re-Launch allowed/intended, leave everything stopped in place, and there's no Penalty or movement of anything. Your Match is considered finished. Use this leniency if your robot has no more to do, especially if it's out of control, or stuck and straining its motors.

R14 – Stranding

If the UNINTERRUPTED Robot loses contact with something it was transporting, that thing must be allowed to come to rest. Once it does, here's what happens, depending on its rest location...

- EQUIPMENT
 - Completely in Safety: Keep it.
 - Partly in Safety: Take it completely into Safety + keep it + Junk Penalty (immediately logged on Refs Sheet).
 - Completely outside Safety: Leave it as is.
- MODEL
 - Completely in Safety: Keep it..
 - Partly in Safety: Give it to the Ref (out of play).
 - Completely outside Safety: Leave it as is.
- You may hand-recover unintended fragments from a truly broken Robot any time, with no Penalty.

R15 – Field damage

- If the Autonomous Robot separates Dual Lock or breaks a Model, Missions obviously made possible or easier by this damage or the action that caused it do not score.

R16 – Interference

- You are not allowed to negatively affect the other team except as described in a Mission.
- Missions the other team tries but fails to get because of illegal or accidental action by you or your robot are given to them.

R17 – End of the Match

- As the Match ends, everything must be preserved exactly as is...
- If your Robot is moving, stop it ASAP and leave it in place.
- After that, hands off everything until after the Ref has given the okay to reset the Table.

R18 – Scoring

- SCORESHEET/ EVALUATION SOFTWARE
 - The Ref recalls action and inspects the Field with you, Mission by Mission...
 - If you agree with the Ref on all facts, you sign the sheet, and the score is final.
 - If you don't agree, tell the Ref nicely. Refs can be wrong, and when they are, they want to know. If there is any lingering disagreement, the Head Ref makes the final decision.
- IMPACT
 - Only your BEST regular Match score counts towards advancement/awards.
 - Playoffs, if held, are just for extra fun.

- TIES
 - Ties are broken using 2nd, then 3rd highest scores.
 - For a rare tie across all three Matches, tournament officials decide what to do.

1.5 Questions regarding Rules, Robot Game & Field Setup

- Important questions are published at the "FAQ" section for all the Teams. It may be that the answers apply to all teams and additional arrangements are in this place for the competition.
- For official answers to questions of any areas of competition including pre - arrangements with special strategies or situations send an Email to HANDS on TECHNOLOGY: fl@hands-on-technology.org or a message via Facebook.
- Questions will be answered as soon as possible.

1.6 Important changes for 2015/2016

- Words have been cut by 60%.
- Remaining rules are simpler and many are VERY different. WARNING to veteran teams! Example: The Rules used to tell you "IN" meant "partly in" was okay. Now that Rule is gone, and "Completely In" is required throughout the Robot game.

2. ROBOT GAME FLL 2015 – “Trash Trek”

The TRASH TREK Challenge is about what happens to things when we **think** we're done with them, or when we **think** they are no good any more. The truth is that with some imagination, we can get much more use out of them or the materials they are made from. A really smart time to think about this is before we even make or buy them! Recycling is great, but that's only one part of a very big picture. As you work on the Missions, imagine how we might be able to innovate our way toward **ZERO WASTE** one day...

2.1 General FLL Field Set up & Placement

Overview



FLL Challenge Field

The Field is where the Robot Game takes place. It consists of a Field Mat, on a Table, with Mission Models arranged on top. The Field Mat and the LEGO® pieces for building the Mission Models are part of your Field Setup Kit. The instructions for building the Mission Models are not part of the Field but available online: www.first-lego-league.org/en/fll/robot-game/buildinginstruction.html.

The instructions how to build the Table is online: www.first-lego-league.org/en/general/participation.html#4. How to arrange the Mission Models on the playing Field is explained in this document.

Field Mat Placement

Step 1: Vacuum the Table top carefully. Even the tiniest particle under the Mat can give the robot trouble. After vacuuming, run your hand over the surface and sand or file down any protruding imperfections you find. Then vacuum again.

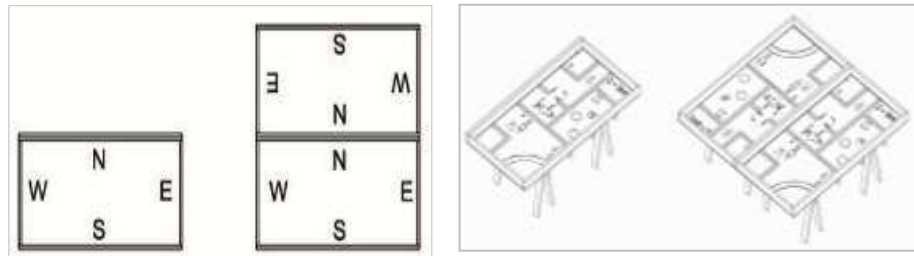
Step 2: On the vacuumed surface (never unroll the Mat in an area where it could pick up particles), unroll the Mat so the image is up and its north edge is near the north/double border wall (note the location of the double wall in each Table sketch below). **BE VERY CAREFUL TO NOT LET THE MAT KINK FROM BENDING IN TWO DIRECTIONS AT ONCE).**

Step 3: The Mat is smaller than the playing surface by design. Slide and align it so that there is no gap between the south edge of the Mat and the south border wall. Center the Mat in the east-west direction (look for equal gaps at left and right).

Step 4: With help from others, pull the Mat at opposite ends and massage out any waviness away from the center and re-check the requirement of Step 3. It is expected that some waviness will persist, but that should relax over time. Some teams use a hair dryer to speed the relaxation of the waviness.

Step 5 - OPTIONAL: To hold the Mat in place, you may use a thin strip of black tape at the east and west ends. Where the tape sticks to the Mat, it may cover the Mat's black border only. Where the tape sticks to the Table, it may stick to the horizontal surface only, and not the walls.

Step 6: For a competition setup, dummy walls are not needed. Secure two Tables north-to-north. The total span of border between two Tables must measure between 3" (76mm) and 4" (100mm).



Pic. 1 and 2 – Alignment of mats on double / single (competition / practice) Field

Mission Model Construction

Build the Mission Models. Use the LEGO elements from your Field Setup Kit, and instructions from this page www.first-lego-league.org/en/fll/robot-game/buildinginstruction.html. It will take a single person four to five hours to do this, so it's best done in a work party. For any team members with little or no experience building with LEGO elements, Mission Model construction is a great way to learn. This step is also a nice time for new team members to get acquainted with each other.

The Models must be built PERFECTLY. "Almost perfect" is NOT good enough. Most teams make several building errors and practice all season with incorrect Models... When these teams later compete on Fields with correct Models, the Robot fails. The team incorrectly blames the Robot, the tournament organizers, or bad luck for the failure.

Dual Lock

Some Models are secured to the Mat, others are simply placed on the Mat. Each place where a Model needs to be secured has a white box with an X in it. The connection is made using the re-usable fastening material from 3M called Dual Lock, which comes in the flat clear Bag with the LEGO elements in your Field Setup Kit. Dual Lock is designed to stick or "lock" to itself when two faces of it are pressed together, but you can unlock it too, for ease of transport and storage. The application process for the Dual Lock is only needed once. Later, the Models can simply be locked onto the Mat or unlocked. To apply Dual Lock proceed one Model at a time as follows:

Step 1: Stick one square, adhesive side down, on each box you see on the Mat with an “X” in it.

Step 2: Press a second square on top of each of those, “Locking” them on, adhesive side up. Instead of using your finger, use a bit of the wax paper the squares came on.

Step 3: Lower the Model onto the squares.

Tips:

Pay attention... Some Models look symmetrical, but do indicate a directional Model feature somewhere. Be sure to place each square precisely on its box, and each Model precisely over its marks. When pressing a Model down, press down on its lowest solid structure instead of crushing the whole Model. Pull on that same structure if later you need to separate the Model from the Mat. For large and/or flexible Models, apply only one or two pairs at a time. There’s no need to do it all at once.

Arrangement of Models and setup

Marks on Mat along with the text and pictures in the Robot Game section give most of the info you need to arrange and set the Models (place/set as pictured). Any details not shown in pictures or mentioned in the text are left to chance and officially don’t matter.

Field Maintenance

Border Walls

Remove any obvious splinters, and cover any obvious holes.

Field Mat

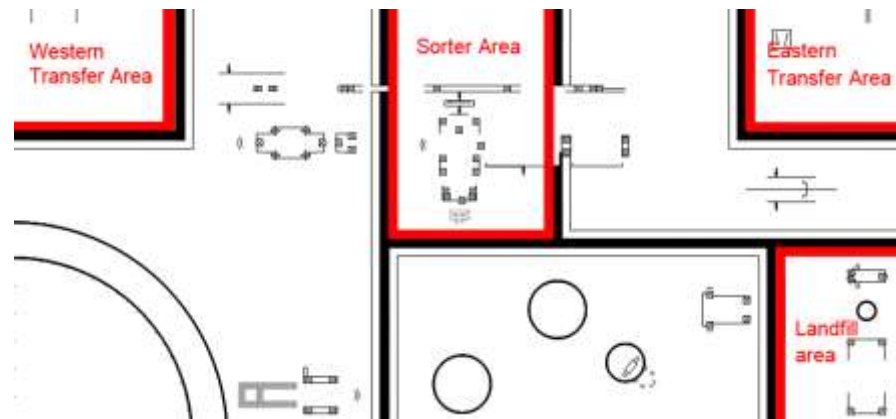
Avoid cleaning the Mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the robot’s performance. Use a vacuum and/or damp cloth for dust and debris (above and below the Mat). When moving the Mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the robot’s movement. Do NOT put Dual Lock under the Mat, or use it in any other than securing Models as described.

Mission Models

Keep the Models in original condition by straightening and tightening solid connections often. Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.

Areas

Where the Missions Refer to the Landfill Area, Sorter Area, East- and West Transfer Area, those areas are defined by the inner white strips, colored red below. Each area is defined as only the space above and inward from those white strips. Everything partially over the adjacent area beyond-projects, counts as not in the zone. Anything still partly above the adjacent thick black line (eg black lines) count as being not in the zone.



2.2 Missions: Field Setup & Placement, Tasks Description, Constraints & Evaluation

1. Base



The following objects are in Base before the start of the match:

- 1 Octopus
- 1 Chicken
- 1 Engine/Windshield
- 2 People
- 2 Yellow bars.

2. Demolition

Compared to the amount of material discarded by a family every week, the amount of material discarded from a demolition site is unbelievable. Where does it all go? Where SHOULD it all go?

Field Set Up & Placement



Secure the building bracket exactly within its marks, red lever at northwest. Then use four of each colored bars to make the Building as shown, with studless plates facing west (see projection on Mat).

Finally, insert the Valuables (see picture) fully onto the ground floor from.



Mission



Start



End

Task Description:

Demolish the Building and decide what to do with the materials.

End of the Match:

None of the Building's twelve beams is left standing in Setup position.

Points: 85

Constraints & Evaluation

- Visible at the End of the Match

3. Salvage

A building being demolished should only be a shell of its former self. Many tons of valuable materials and objects can be salvaged first.

Field Setup & Placement



The setup of the building and valuables is described above in the Mission „Demolition“.

Mission



Start



End

Task Description:

Move the Valuables to Safety.

End of the Match:

The Valuables are completely in Safety.

Points: 60

Constraints & Evaluation

- Visible at the End of the Match

4. Cleanup

For discarded material, the only outcome worse than waste is pollution. Plastic Bags for example, seem to be everywhere, causing a variety of problems - jamming equipment, threatening Animals, etc.

Field Setup & Placement



Place turtle and Plastic Bag on the marks on the beach.



Further Animals (octopus, chicken) are in Base at the start.



Another Plastic Bag (white loop) is in the Sorter.

Mission



Task Description:

Move Bags from the Sorter and/or the Beach, and return Animals to their favorite spots.

End of the Match:

Do either Option or both.

End Option 1



OPTION 1

Plastic bags are completely in Safety.

Points per Bag: 30

OPTION 2

Animals are completely in large circles which are completely empty of Plastic Bags.

Points per Animal: 20



OPTION 3

Chicken is completely in small circle.

Points: 35

Start

End Option 2



End Option 3

Constraints & Evaluation

- Visible at the End of the Match.
- Score any that apply.
- The fish food scrap does not count as an animal.

5. Composting

Discarded organic material doesn't have to become waste. It can be converted into fertilizer.

Field Setup & Placement



Secure exactly on its marks. Be sure the Model is pressed down tightly. The multistep setup for this Model takes a little bit of memory and practice:



Step 1 - Vorher



Nachher

Step 1: Pivot the red lever lock west.



Step 2



Step 3

Step 2: Slide the black rocker arm & rubber tires north to disengage them from the red cross.

Step 3: Raise the food scrap bin gently/slowly all the way up and hold it there...



Step 4

Step 4: While still holding the food scrap bin all the way up, undo Step 2, then undo Step 1.



Step 5



Step 5: Push the rubber tires east out of the way, then slide the yellow plunger west, and let go of the rubber tires.



Step 6



Step 6: Push the green lid west onto the food scrap bin and insert the Compost disc, studs up. This is needed!

Mission



Task Description:

Start the Composting process. After some time, it will eject Compost.

Start



End Option 1



End Option 2

End of the Match:

OPTION 1

The Compost is ejected, but not completely in Safety.

Points: 60

OPTION 2

The Compost is completely in Safety.

Points: 80

Constraints & Evaluation

- Visible at the End of the Match
- Score only one way.

6. Scrap cars

There are hundreds of millions of cars worldwide, made from an enormous variety of materials. Are we making the best use of cars at the end of their lives? How much of a scrapped car really gets re-used?

Field Setup & Placement



Place pointing west, aligned with its marks and arrows at the bottom of the front tires as shown. The engine block with windscreen is located in the base.

Mission



Start

Task Description:

Fix the old Car by installing the engine, or fold the car and sell it for scrap.

End of the Match:

OPTION 1

The windshield and engine are installed in the unfolded Car in the proper space and direction.

Points: 65

OPTION 2

The Car is completely folded and completely in the East Transfer Area.

Points: 50



End Option 1



End Option 2

Constraints & Evaluation

- At the end of the match only one option can be scored
- The Car is never allowed to cross into Safety, even partly.
- Valid for Option 1: Full/exact nesting is not required.

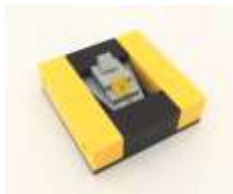
7. Purchasing decisions

Some manufacturers put products in packaging which is hard or impossible to divide into pure sorted recyclables. What choices do you have when you see that?

Field Setup & Placement



Secure the Factory, slide the loop fully in.



Place the Large Package with Toy Plane inside the factory as shown in the picture.



Place the small toy plane package on its mark as shown in the picture.

Mission



Start



End

Task Description:

Decide about buying Toy Planes based on their packaging.

End of the Match:

Toy Planes are completely in Safety.

Points per Airplane: 40

Constraints & Evaluation

- Visible at the End of the Match

8. Methane

We want to avoid Landfills, but existing Landfills do produce Methane, which can be converted into energy.

Field Setup & Placement



Secure the Holder exactly on its marks, then place the two Methane Loops in their holes, aligned as shown.



The setup of the Factory is described in the Mission „Purchasing Decision“ and the truck placement in „Transport“.



Secure the Landfill bin on the Mat as shown in the picture.

Mission



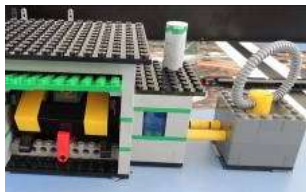
Task Description:

Collect Methane from the Landfill area and use it to help run the Truck and/or the Factory.

End of the Match:

Methane is in the Truck's Engine compartment and/or the Factory's Power Station.

Start



Points: 40 per Methane

End

Constraints & Evaluation

- At the End of the Match.
- LENIENCY: Full/Exact nesting of Methane loops is not required.

9. Careers

Many scientists, engineers, and technicians are needed to keep up with today's trends in waste reduction.

Field Setup & Placement



The 2 people are in Base at the beginning of the Match.

Mission



Start



End

Task Description:

Move at least one person to the Sorter Area to earn a helpful exception to the Rules.

End of the Match:

At least one person is completely in the Sorter Area.

Points: 60 plus Leniency Bonus

Constraints & Evaluation

- Visible during the Match as needed
- Leniency Bonus: Team technicians (and/or the Referee if asked) are allowed to unclog any east chute blockage by hand and/or put missorted bars into their correct bin including bars that didn't land in any bin.
- Definition Sorter Area – see "General FLL Field Set up & Placement" section.

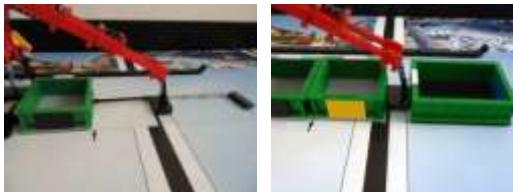
10. Sorting

As we strive toward zero waste, one of the most urgent needs for innovation is in the area of sorting. Current separation technology and processing is difficult, expensive, limited, and error-prone.

Field Setup & Placement



Secure exactly within its marks. Be sure alignment at the end of the arrow is as close as possible.



Secure the Bin Bracket with Dual Lock as shown. Then place Green bins as shown, with the north side of each Green bin resting ON the Bin Bracket's axle.



Make sure the foot of the east chute (black beam with holes) rests between its tabs on the Bin Bracket as shown.



Load two Blue and two Black bars in the red tray as shown, with studless plates up. Bar color order and axle directions are important. Refer to the small reminder on the Mat, south of the Sorter.



Load the Yellow bin containing a Yellow bar as shown, centered east/west, with studless plates down.

Insert a Plastic Bag in its slot fully as shown.



Finally, attach either all white or all black Identification Plates to the Green bins as shown. Color is not important for practice, but will tell your bins apart from the other team's bins at a tournament. The spare set of Identification Plates are not part of the Field and may not be used as Equipment. The Setup of the "Transfer-Mission" is explained at task "Recycling".



Mission



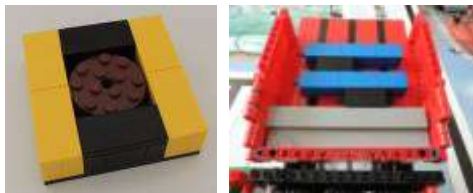
Start



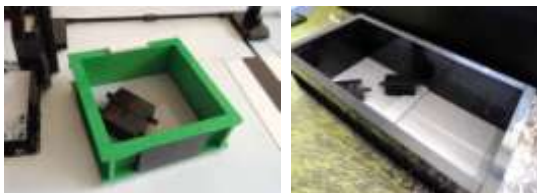
End- Option 1 - Blue/Yellow



End Option 2 - Blue/Yellow (examples)



End Option 1 - Black: Flower box & Example Setup Position



End Option 2 – black (examples)

Task Description:

Yellow and Blue bars are recyclable. Black bars are impurities we have no current way to use.

YELLOW/BLUE BARS ARE IN THEIR MATCHING GREEN BIN AND THE BIN ...

OPTION 1

is completely in the other team's Safety by way of your West Transfer Area.

Points per bin: 60

OPTION 2

is completely in your West Transfer Area and/or completely on the Transfer.

Points per bar: 7

OPTION 3

was never completely in your West Transfer Area.

Points per bar: 6

BLACK BARS ARE (bars score independently) ...

OPTION 1

part of a scoring Flower Box or in their original set up position.

Points per bar: 8

OPTION 2

in their matching Green bin or the Landfill Bin.

Points per bar: 3

OPTION 2

anywhere else on the Mat.

Minus Points per bar: - 8

Constraints & Evaluation

- Visible at the End of the Match
- All bars must enter Green bins directly from the eastern Sorter chute or the Bonus ruling from Mission "Careers".

11. Transport

The distance a discarded material may need to travel is an important part of the equation when deciding what to do with that material.

Field Setup & Placement



Place truck pointing west, aligned with its marks and arrows at the bottom of the front tires as shown.

Secure Truck Guide exactly within its mark, with its tail east.

Mission



Start

Task Description:

Load the all-Yellow Material bin onto the Truck to be transported east and unloaded.



Option 1

End of the Match:

OPTION 1

The Truck supports all of the Yellow bin's weight.

Points: 50

OPTION 2

The Yellow bin is completely east of the Truck's Guide.

Points: 60



Option 2

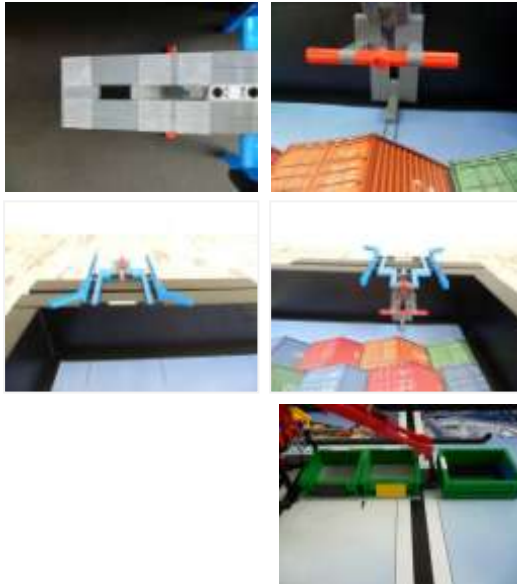
Constraints & Evaluation

- Visible at the End of the Match
- Score one or both options.

12. Recycling

Everything constructed, crafted, or manufactured is made from materials that originally came from nature. But most of those materials are limited, or take decades or even centuries to accumulate.

Field Setup & Placement



EAST TRANSFER - Secure to the inner surface of the north Border Wall. Use the Dual Lock pattern shown here, and align the Model's foot with its marks on the Mat. Be sure the Model is level.

WEST TRANSFER - Secure to the FAR side of a SECOND thickness of north Border Wall, known as a "Dummy Wall." This arrangement is needed to replicate the spacing conditions at a tournament, where the north Border Wall is double-thick (one north wall for your Table, and one for the other team's Table). Use the Dual Lock pattern shown here, and center the Model over its marks on the Mat. Secure the Model so it's level, and the bottom of its foot is at the same height as the Mat.

The Green bin's setup is described in the Mission „Sorting“.

Mission



Start



End

Task Description:

Get material discarded from someone else, but useful for you. You'll avoid taking from nature, and the material won't become waste.

End of the Match:

Green bins containing at least one matching Yellow or Blue bar, all from the other team, is completely in your Safety.

Points per Bin: 60

Constraints & Evaluation

- Visible at the End of the Match
- For each scoring Bin in either Safety the other team gets the points too and this also applies vice versa.

13. Repurposing

Recycling gives new life to the materials an object is made from, but the process does take time and energy. Instead, is there a way to give new life to the object itself?

Field Setup & Placement



The packages with the Toy Planes and the compost are placed on different locations: compost is in the composter, one toy plane has a mark on the Field, the other is in the Factory - see Missions „Purchasing Decision“ and “Composting” for details.

Mission



Start



End



Task Description:

Use the packaging from a Toy Plane as a Flower Box by putting compost in it.

End of the Match:

The Compost is perfectly nested inside one of the packages from which a Toy Plane has been removed. The package is in original condition.

Points: 40

Constraints & Evaluation

- Visible at the End of the Match.

14. Penalties

Field Setup & Placement



Place four Black bars off the Field out of the way. At a tournament, these are in the Ref's control.



Start



End

Description:

For each Penalty as described in Rule D09 the Referee will place one Black bar on the Mat in a „convenient out-of-the-way place“, not to exceed four Penalties.

Penalty Points: -8 per Black bar
(see also Sorting Mission)