

We have compiled all the key documents for this year's challenge into one document.

THIS IS ESSENTIAL INFORMATION AND SHOULD BE READ AND RE-READ BY EVERY MENTOR AND TEAM MEMBER. YOUR SUCCESS IS ALMOST ENTIRELY DEPENDENT ON YOUR COMPREHENSION OF THIS INFORMATION.

ALWAYS CHECK THE FAQ'S ON THE FIRST LEGO LEAGUE SITE. FAQ'S SUPERSEDE ALL INITIALLY PUBLISHED INFORMATION.

Go here for the Game Q&A

<http://www.usfirst.org/roboticsprograms/fll/gameqa1.aspx>

Source documents can be found at:

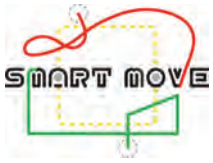
<http://www.usfirst.org/roboticsprograms/fll/smartmove1.aspx>

Go here for TechBrick Worksheets and Guides

<http://www.techbrick.com/resources>

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Robot Game Definitions and Rules

Background Rules and Concepts

Gracious Professionalism

- You are “Gracious Professionals.” This means you are competing hard against PROBLEMS, while treating PEOPLE with respect and kindness - people from your own team as well people from other teams
- You build onto other people’s ideas instead of resisting or defeating them.

[Read more about Gracious Professionalism](#)

Purpose

Interest in engineering innovation...

- FLL is a technical experience so fun, you forget it’s technical. Soon you realize technical is fun - and want more.
- FLL uses competition as an exciting motivator to get you to come up with ideas, solutions, processes, and inventions no one has ever seen before.

Autonomy

- The FLL Robot Game is to be played by an “autonomous” robot. That means you’re not supposed to influence it while it’s doing its work.
- But most teams need to intercept their robot once or more during the match. So you’re allowed to do that, but it always forces a restart from Base, and sometimes, there’s a penalty.

If A Detail Isn’t Mentioned, Then It Doesn’t Matter

Assuming you have read all the missions, rules, and Game Q&A carefully...

- If no particular method is required, then any method is okay.
- If something is not specifically required, then you don’t have to do it.
- If there’s no restriction against something, then it’s allowed.
- There are no hidden requirements or restrictions.
- But there are hidden freedoms - in what the rules do not say.

1 - Participation

- The maximum allowable team size is ten members, not including coaches and mentors.
- See the FIRST LEGO League Coaches’ Handbook for allowable ages.
- At the tournament, only two team members at a time are allowed right up at the competition table except during repair emergencies.
- The rest of the team must stay back from the table, but close enough for different members to tag in or out as desired at any time. Specific positioning is decided by the head officials running each tournament.



2 - Parts

This rule is not only about the robot. It also covers all of the attachments and strategic objects you bring to the competition area...

- Everything you compete with must be made of LEGO elements in original factory condition, except LEGO string and tubing, which you may cut to length. Exception: You can reference a paper list to keep track of programs.
- There are no restrictions on the quantities or sources of non-electric LEGO elements, except that factory-made wind-up/pull-back “motors” are not allowed. Pneumatics are allowed.
- The electric elements used must be the LEGO MINDSTORMS type, and the total number of electric elements you may use in one match is limited as follows:

For RCX users:

RCX controller (1)

motors (3)

touch sensors (2)

light sensors (2)

lamp (1)

rotation sensors (3)

3rd touch OR light sensor (1)

For NXT users:

NXT controller (1)

motors (3)

touch sensors (2)

light sensors (2)

lamp (1)

rotation sensors (3 minus the number of NXT motors present)

ultrasonic sensor (1)

- Example 1: If your robot has three motors, you may not have any other motor in the competition area, even if it's only for weight or decoration; even if it's in a box, off the field.
- Example 2: If your robot has two motors, but you have multiple attachments to motorize, you must design a way to switch the 3rd motor from one attachment to the next.
- LEGO wires and converter cables are allowed as needed.
- Spare/alternate electrical parts are allowed in the pit area.
- Computers are not allowed in the competition area.
- Objects functioning as remote controls are not allowed anywhere.
- Marker may be used for owner identification in hidden areas only.
- Paint, tape, glue, oil, etc. are not allowed.
- Stickers are not allowed except LEGO stickers applied per LEGO instructions.
- You are not allowed to use more than one robot in a single match, but it's okay to use a different robot in a different match.
- If a robot is in violation - of this rule or the SOFTWARE rule - and cannot be corrected, the decision about exactly what to do rests with the head officials at the tournament, but that robot may not win awards.

3 - Software

- Your robot must be programmed using LEGO MINDSTORMS, RoboLab, or NXT software (any release).
- Patches, add-ons, and new versions of the allowable software from the manufacturers (LEGO and National Instruments) are allowed.
- Text-based and/or “outside” software is not allowed.
- The point of this rule is the same as that of the MATERIALS rule: Since we can't ensure equal coaching for all teams, we at least limit this unfairness by capping the power of the tools.

4 - Downloading And Wireless Signals

- Downloading programs to robots must take place in the pits only - never in the competition area.
- Teams downloading to an RCX robot must make sure the process is shielded, that there are no other RCX robots in range, and robots should be turned off when not in use.
- Teams downloading to an NXT robot must do so by cable. Bluetooth must be switched off at all times.

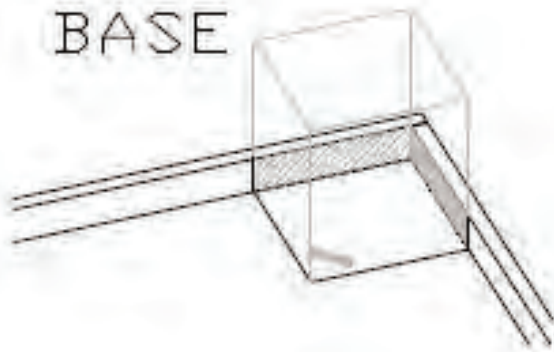


5 - Field

- 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 on a CD which comes in the same box as the LEGO pieces.
- All other field setup instructions are on the Field Setup page.

6 - Base

- Base is a VOLUME. Base is not just an area on the mat.
- Base is an imaginary box formed by vertical walls that rise from the perimeter of the Base area, including the inside surface of the border walls, and by an invisible ceiling 16 in (40 cm) high.
- Base is where your robot is prepared and handled.
- Base is where your robot always starts and restarts from.
- Base is often a scoring target.



7 - Variability

- As you build and program, keep in mind that our suppliers, donors, and volunteers make every effort to ensure that all fields are correct and identical, but you should always expect some variability, such as:
 - flaws in the border walls.
 - variety in lighting conditions.
 - texture/bumps under the mat.
 - waviness in the mat itself - at many tournaments, it is impossible for the mats to be rolled out in time to lose their waviness. Location and severity of waviness varies. You are being warned here. Consider this while designing.
- Two important building techniques you can use to limit the effects of variability are:
 - Avoid steering systems that involve something sliding on the mat.
 - Cover your light sensors from surrounding light.
- Questions about conditions at a particular tournament should be asked of that event's head officials.

8 - Mission

- A mission is defined as a result or action worth points.
- You decide the order you want to try missions in, and you don't have to try them all.
- You're allowed to re-try them, but often it's not possible.



9 - Match

- At a tournament, two Robot Game fields are joined back to back, and you are paired opposite another team to compete in a match. Here's the process:
 - You arrive at the competition table and have at least one minute to prepare your robot.
 - The match starts and you start your robot. Once started, the robot is now "active" and is understood to be working on missions.
 - The robot may get a lot done, or a little, but eventually you are likely to need/want to handle it. For example, it may become stuck, or you may want to add an attachment, or unload some cargo.
 - As soon as you touch it, no matter where it is or what it was doing, it is now "inactive" and must be carried to Base if it's not already there.
 - While the robot is in Base, you prepare it for its next active period, and restart it.
 - These steps repeat (often with music, an announcer, and cheering in the background!), until the 2-1/2 minute match timer sounds (the timer never pauses during a match).
- There are at least three matches at each tournament, and each one is a fresh chance for you to get your best score.
- No match has anything to do with another, and only your best score counts specifically toward the Robot Performance Award.
- If it is known in advance that a team will not have another team opposite them, a volunteer or "house" team should substitute. If you compete against an empty table, you get the points for any interactive missions.

10 - Round

- The process of cycling all teams through one match each is called a round.
- Tournaments run at least three rounds.
- Between your match in one round and the next, you usually have time to go to the pit area and work on your robot and its programs as needed, but this time may be limited, depending on the schedule of other proceedings.

11 - Robot

Your robot is defined as the main body containing the NXT (or RCX) controller and anything that does not fall off when the main body is picked up, turned over (or flipped any way), and/or shaken.

12 - Attachments

Attachments are defined as parts of your robot that are designed to be added and/or removed.

13 - Strategic Objects

- Strategic objects are defined as team-supplied objects which you or your robot may use as tools or aids.
- You may touch or use strategic objects *only in Base, but your robot may touch or use them anywhere.
- *Example: If you're using a device to aim your robot, you need to either pull the device away or let go of it before your robot is allowed to start.

14 - Mission Models

- Mission models are defined as the objects that are already on a competition field when you walk up to it.
- You may not bring duplicate mission models to the table if they could confuse scoring.
- You may not take mission models apart, even temporarily.
- Mission models must be separated from your team-supplied objects quickly after the match.
- Be very careful not to leave the competition area with that field's mission models.



15 - Housekeeping

- After the referee (the “ref”) inspects everything you’ve brought to the competition area, you may store it in Base and/or in a box on a stand where you can get to it quickly while operating your robot.
- Team members other than the two at the table are not allowed to hold anything unless approved by the ref.
- Nothing is allowed on the floor unless approved by the ref.
- Mission models always need to stay in view of the ref.
- In rare situations of crowding at Base, the ref allows you to store objects on the table away from Base, but only if it is obvious their placement is purely for storage.

16 - Robot Preparation and Handling

- Before the match, and whenever else your robot is inactive, you are allowed to handle it and prepare it by hand for its next active period.
- Typical preparations include repairs, switching attachments, loading and unloading objects, selecting programs, resetting features, and manipulating, arranging, and aiming the robot and any objects it will be moving or using.
- This work should be done in or near Base to avoid messing up the field.
- Once your robot and its objects are ready to start, the last thing you must do is to let go of it all.

17 - Muscle Actions

- You may not cause things to extend, leave, or be placed out of Base, even partially, except as described in the START PROCEDURE and HOUSEKEEPING RULES.
- You may not move or “adjust” anything outside of Base.
- In Base, you are allowed to manipulate any objects that have reached Base, even to produce scoring conditions.
- You may place objects completely in Base for an active robot to interact with, but only if you have obviously let go of them before your robot touches them.
- As soon as your robot or anything it’s strategically controlling reaches Base, you may take it all (robot plus objects) into Base.
- Dropping something on your active robot is treated as an active robot touch.

18 - Start Position

- For all starts beginning and during the match, every bit of your robot including its attachments and any objects it is about to move or use must fit completely in Base.
- Nothing is allowed to be poking through the imaginary box.
- Your robot is allowed, but not required, to touch objects it is about to move or use.
- You must not be touching your robot or anything it is about to move or use.
- Everything must be motionless.





19 - Start Procedure

- When it's obvious to the ref that starting position is correct...
 - For the start of the match...
 - The ref asks you if you're ready, then signal your readiness to the announcer.
 - As the countdown starts, you reach in with one hand, ready to either touch a button, or signal a sensor, to start or resume your robot's program.
 - When you hear the sound, you start your robot.
 - For all other starts (restarts)...
 - There's no countdown. The ref sees that you're ready, and you start your robot.
- You may not handle your robot, or anything it's about to move or use, during or after the countdown. If you do, the ref has you restart. The point of this rule is to ensure that your only influence on your robot is to get its program running.
- The exact time to start is at the beginning of the last word in the countdown, such as "Ready, set, GO!"
- If a different signal is used, the start is at the beginning of that signal.

20 - Active Robot <> Inactive Robot

- At the moment your robot is started, it becomes "active" and remains so until the next time you touch it, or anything it is strategically controlling.
- At the moment of that touch, the robot becomes inactive again, and must be carried to Base unless it's already there. There may be additional **consequences.
- The inactive robot in Base may then be handled/prepared and restarted.

21 - Active Robot Touched COMPLETELY Out Of Base

If the robot and **every object** in its strategic control are *completely out* of Base...

- a "touch penalty object" is taken out of play if one is available, as described in the missions.
- objects that were with the robot the last time it left Base go to Base, for scoring or continued use. objects that were not with the robot the last time it left Base are taken out of play (may not be used again).

22 - Active Robot Touched In Base

- If the robot or any objects in its strategic control are at least partially in Base...
- there is no "touch penalty." those objects are placed in Base for scoring or continued use.

23 - Tethers/Leashes

If the only part of your robot in Base at the time of an active robot touch is a cord, hose, wire, tube, chain or string, the robot is treated as if it were completely out of Base.

24 - Loss Of Contact

If an untouched robot loses contact with an object, that object stays where it is unless/until the robot regains contact with it. Such objects may not be recovered by hand.

For exceptions, see the STRAY OBJECTS and ROBOT DAMAGE rules.



25 - Stray Objects

- Objects caused by any robot to be in a non-scoring position may be taken out of play by the ref upon request, or by you if the ref is too far away to act in time. Objects “taken out of play” may not be used again.
- Objects in their original “setup” positions are never considered stray.
- Objects in scoring position are never considered stray.

26 - Robot Damage

At any time, you may recover robot parts that come off as a result of obviously unintentional damage.

- You may do this by hand or request help from the ref.
- Parts planned or designed to come off are strategic objects, and are covered under the LOSS OF CONTACT rule.

27 - Field Damage

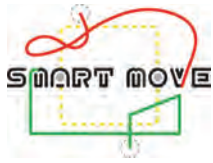
- Field damage is defined as:
 - whenever a mission model is broken or malfunctioning.
 - whenever a Dual Lock connection is separated.
 - any change to your field that is not caused by your robot.
 - any change to your field that is caused by an inactive robot.
 - any change to your field that violates a rule or Game Q&A ruling.
- When field damage occurs, the ref is placed in the difficult position of having to recall the field’s condition right before the damage, and restore it to that condition.
- Field damage too severe to reverse is left as is or swept away.
- If scoring is in question after field damage that was mostly due to faulty model design, construction, or setup, you get the points.
- If scoring is in question after field damage that was mostly due to your robot acting with too much force and/or not enough accuracy (messing up), you are more likely to get the a “benefit of the doubt” call, along with a warning, in Round 1 than in later rounds.
- It is not field damage and the field does not get restored when your robot simply does things you don’t like.

28 - Interference

- Your robot is not allowed to have any effect on the other team’s robot, field, or strategy, except by directly meeting the scoring requirements of missions in areas that are shared between the two sides by design of the Robot Game.
- There is always at least one mission where you and the opposing team are set up to interact in some way, either competitively or cooperatively.
- As a matter of luck, that team may be able to out perform you on that mission or may fail to cooperate with you there. This is not considered interference.

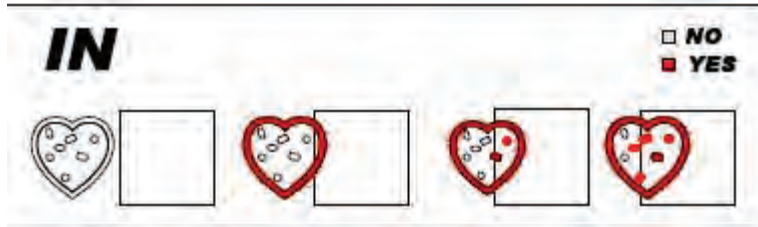
29 - Final Field Condition

- To minimize controversy about what happened during a match, the score is determined at the end of the match, by the SNAPSHOT condition of the field at that EXACT time only.
- This means that points are not given for results your robot gets but then trashes before the match ends.
- This is also why actions that are not allowed (rule violations) are either stopped or reversed as they happen.



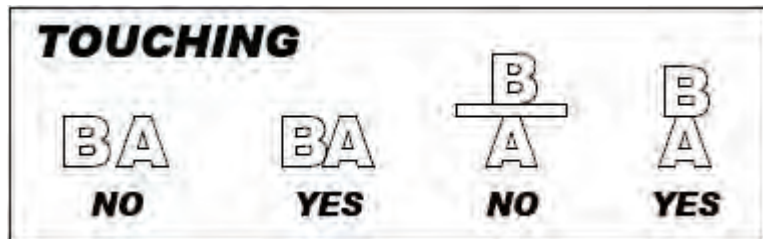
30 - IN

- A is “in” area B if any bit of A is over area B.
- Barely “in” is considered “in” unless the word “completely” is used.
- Direct contact (touching) is not part of the definition of “in.”
- Objects in a container are ruled on individually, and independent of their container.
- Exception: Objects returning to Base with your robot are considered IN as soon as the robot reaches Base.



31 - TOUCHING

- A is “touching” B only if A is making direct contact with B.
- Any amount of direct contact counts as touching.

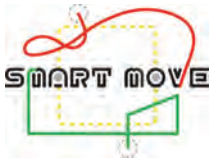


32 - Benefit of the Doubt

- You get the benefit of the doubt when:
 - a split-second or the thickness of a (thin) line is a factor.
 - a situation could “go either way” due to confusing, conflicting, or missing information.
 - anyone other than the challenge designer claims to know the “intent” of a requirement or constraint.
- If you (kids, not coach) disagree with the ref and can respectfully raise sufficient doubt in his/her mind, the ref meets with the head ref, and the resultant decision is final.
- This rule is not an order for the refs to be lenient, but it is a license for them to make judgment calls in your favor when it’s reasonable to do so.

33 - Precedence

- When there is conflict between pictures/videos and text, the text takes precedence.
- When there is conflict between a mission and a rule, the mission takes precedence, but the current Game Q&A page on the web takes overall precedence. MAKE SURE TO CHECK BACK THERE OFTEN.
- The head ref is not obligated to consider calls made at previous tournaments unless those calls have been added to the latest Game Q&A.



34 - After The Match

- No one is allowed to touch anything on the field yet...
- The ref first needs time to record the condition of the field, and come to agreement with you (kids) about what points were scored or missed and why (and to be sure you're not walking away with any of that field's mission models!). Data is marked on a sheet which you initial.
- The scores are tallied by computer, with ties being broken using 2nd and then 3rd highest scores.

Challenge Support

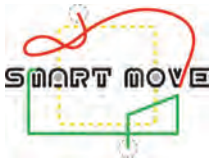
- Official Robot Game support is available through flitech@usfirst.org (usual response in 1-2 business days).
- Before you e-mail, be sure you've read the Field Setup, the Missions, these Rules, and the updated Game Q&A, since flitech refers to these and only these, exactly as you and the refs are supposed to.
- E-mail replies you get are only to guide you. Refs are not obligated to read them.
- When e-mailing, please state your role on the team (member, coach, parent, mentor).
- flitech can help you construct rule-based paths of reason for assessing special strategies or situations.
- flitech may share the answer to your question on the Game Q&A if the question is popular, reveals missing or confusing text, reveals a flaw in the game, reveals an unresolvable conflict, or is amazing or entertaining.
- No new Game Q&A entries are to be posted after 3PM (eastern U.S.) on Fridays.
- flitech does not answer questions about building or programming the robot (that's your challenge).
- flitech can not support LEGO product (RIS, RoboLab, NXT). Instead call 1-866-349-5346.
- flitech does not respond to questions posted in the discussion forum. The forum is great for sharing ideas and getting tips from other teams, but it is NOT AN OFFICIAL SOURCE OF ANSWERS about anything.

Coaches' Meeting

- If a question does come up right before the tournament, your last chance to ask it is at the "Coaches' Meeting" (if there is one) the morning of the tournament.
- The head ref and coaches meet to identify and settle any differences before any matches start.
- For the rest of the day, the ref's calls are final when you leave the table.

Summary Of Significant Content Changes For 2009

- A - The restriction against attaching things to mission models has been removed.
- B - The robot and everything it has, can now be pulled into Base as soon as any of it reaches Base.
- C - Stray objects must now be taken off the table if they're going to be moved at all. Shifting is not allowed.
- D - A tethering rule allows tethering while preventing teams from using it to avoid a touch penalty.
- E - The definition of ON has been removed.



Robot Game Missions

2009-10 FLL Mission Details

Robot Game Overview

The Smart Move Robot Game gives you first-hand experience in getting a sensor-equipped vehicle (your robot) to **gain access to places and things**, while **avoiding or surviving impacts**, all in a test environment...

Imagine if you could program a vehicle to take you places, or even go by itself...

Imagine if each vehicle knew where all the other ones were...

Imagine if vehicles could avoid each other and the things around them...

Imagine if vehicles could be programmed to avoid causing or driving into traffic jams...

Would traffic signals be needed any more?

If these vehicles did hit each other...

How might they be built to really keep passengers safe?

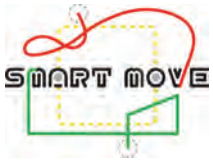
How might they be built to avoid getting stuck or damaged?

Have you noticed that most vehicles near where you live are only used part of the day?

How might the number of vehicles in your area be reduced?

What new technologies could sometimes eliminate your need to travel?

Now in addition to imagining and wondering... Try some of this yourself!



MISSION: GAIN ACCESS TO PLACES (choose one)...

Required Condition: Your vehicle needs to be in one of these positions exactly as the match ends (this mission does not affect others):

TARGET SPOT - Required Condition: Parked with its drive wheels or treads touching the round target.

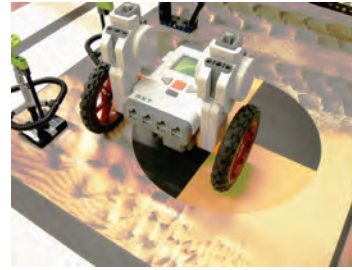
Value: 25 points.



Before



Scoring Example



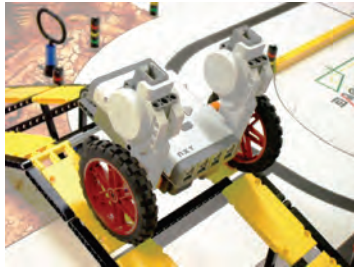
Scoring Example

YELLOW BRIDGE DECK - Required Condition: Parked with its drive wheels or treads touching your yellow bridge decking, but not touching any red decking or the mat.

Value: 20 points.



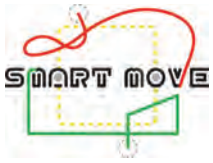
Before



Scoring Example

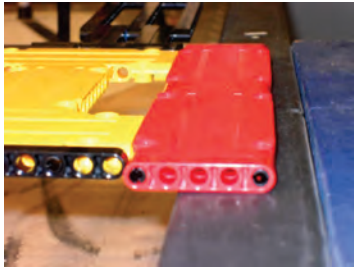


Scoring Example

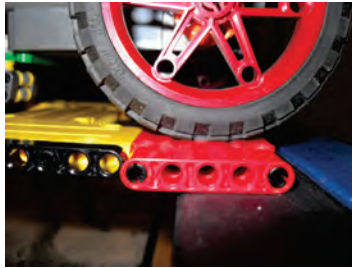


VEHICLE SHARING - Required Condition: Parked with its drive wheels or treads touching your red bridge decking, but not touching the mat.

Value: 25 points.



Before



Scoring Example



Scoring Example

MISSION: GAIN ACCESS TO THINGS...

ACCESS MARKERS - Required Condition: Access markers need to be in their "down" position.

Value: 25 points each.



Before



Scoring Example



Scoring Example

MISSION: GAIN ACCESS TO THINGS...

LOOPS - Required Condition: Loops need to be in Base.

Value: 10 points each.



Before



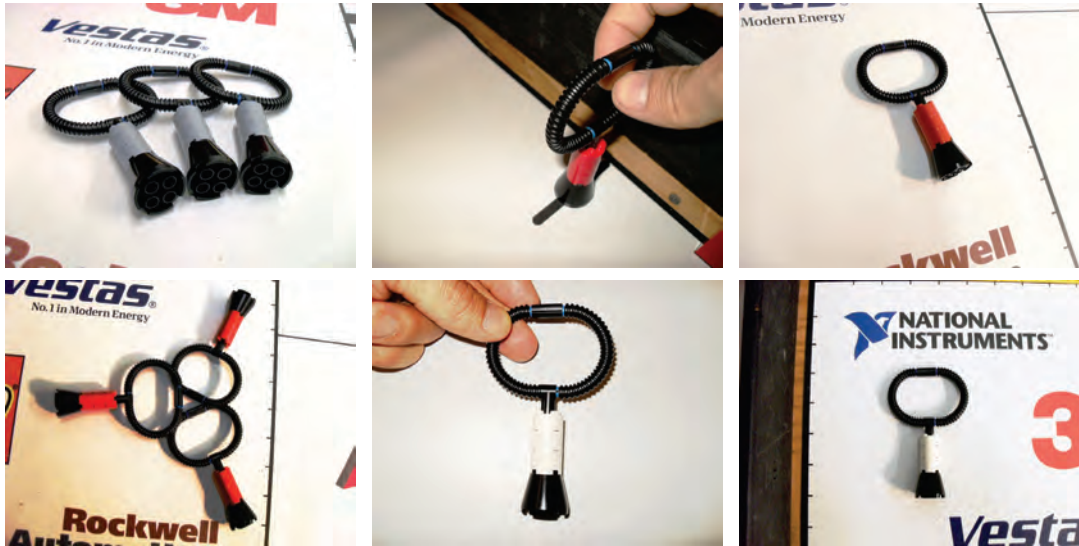
Scoring Example



Scoring Example



BONUS: New technologies can sometimes eliminate your need to travel. They are hard to develop, but each new one makes the next come easier... If all three gray loops have reached Base, you may take one red loop into Base by hand. Independent from that, if all three red loops have reached Base, you may take one loop of any color into Base by hand. Once earned, these hand freedoms (which are a special exception to the rules) may be used any time before the match ends.



MISSION: AVOID IMPACTS...

WARNING BEACONS - Required Condition: Warning beacons need to be upright (square to the mat).

Value: 10 points each.

ALSO: Warning beacons are the touch penalty objects for the Smart Move Robot Game. This means each time you touch your vehicle while it's completely out of Base, the referee removes one upright beacon. The beacons are removed in order from south to north, then from west to east. If there are no upright beacons at the time of the touch, there is no penalty.



Before

Scoring Example

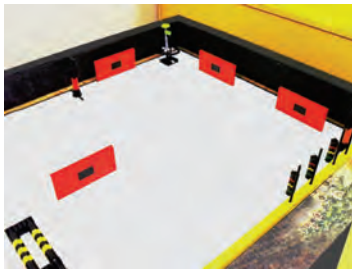
Scoring Example



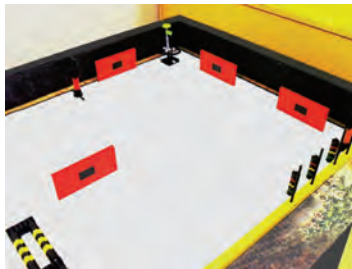
MISSION: AVOID IMPACTS...

SENSOR WALLS (AVOIDANCE OPTION): Required Condition: Sensor walls need to be upright (square to the mat). Any four walls can count. Only four walls can count. Each upright sensor wall also requires a “down” access marker. Example: If there are four upright walls but only three access markers down, only three walls count.

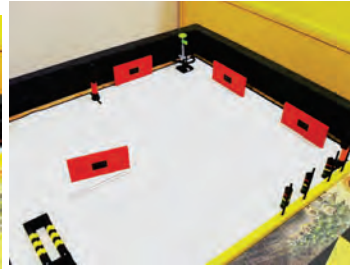
Value: 10 points each, max 40.



Before



Scoring Example

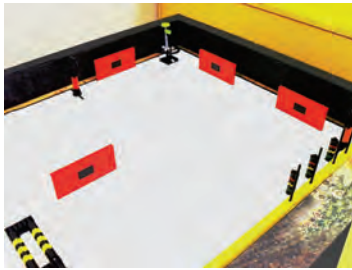


Scoring Example

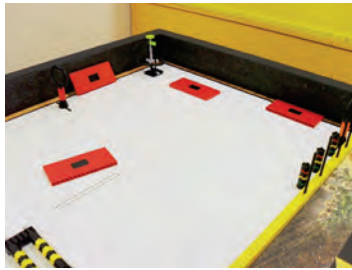
MISSION: SURVIVE IMPACTS...

SENSOR WALLS (IMPACT OPTION): Required Condition: No (zero) sensor walls are upright.

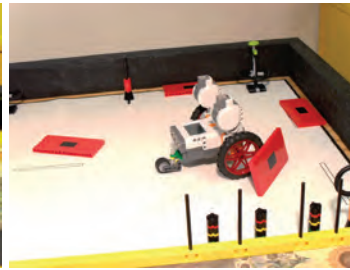
Value: 40 points.



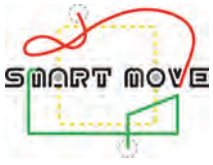
Before



Scoring Example



Scoring Example



MISSION: SURVIVE IMPACTS...

VEHICLE IMPACT TEST: Required Condition: The truck needs to no longer touch the ramp's red stopper beam. Your entire vehicle needs to be completely out of Base when it produces the required condition, otherwise the referee removes two upright warning beacons (in the same manner as two touch penalties).

Value: 20 points.



Before



Scoring Example



Scoring Example

MISSION: SURVIVE IMPACTS...

SINGLE PASSENGER RESTRAINT TEST: Required Conditions: The crash-test figure needs to be aboard your vehicle for the entire match. The first time your vehicle is without the figure, the referee removes the figure. Any constraint system is okay as long as the figure can be separated quickly after the match.

Value: 15 points.



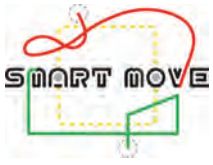
Before



Scoring Example



Scoring Example



MISSION: SURVIVE IMPACTS...

MULTIPLE PASSENGER SAFETY TEST: Required Condition: All four people are sitting or standing in or on a transport device of your design, and some portion of that object is in the round target area.

Value: 10 points.



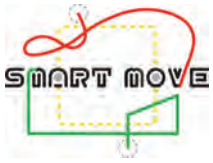
Before



Scoring Example



Scoring Example



Field Setup and Mission Models

OVERVIEW:

- ✓ 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.

TABLE CONSTRUCTION

The Robot Game takes place on a specially designed table, so you'll need to build one to practice on if you don't already have access to one. With safety, weight, height, and cost in mind, a simple design is offered here, but as long as your surface is smooth, and your border walls are located properly, how you build the understructure is up to you. The construction is simple, but does require some wood-working skills.

At a tournament, two tables are placed back to back, but you only operate on one table, so you only need to build one table to practice on. Since a tournament setup has a double wall at the interactive area where the two tables meet, practice tables need an extra wall of type **B** on the corresponding side. So here are the instructions for building one "half-table" including a double north wall:

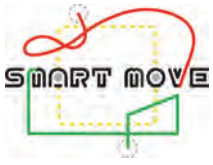
Materials

Material	Quantity
Field Setup Kit (mission model LEGO elements, mat, CD, Dual Lock)	1
sanded plywood (or other very smooth board) 96" X 48" X 3/8" or thicker	1
two-by-four, 8' (actual cross-section = 1-1/2" by 3-1/2")	4
two-by-three, 8' (actual cross-section = 1-1/2" by 2-1/2")	2
flat black paint	1 pt. or spray can
coarse drywall screws, 6 X 2-1/2"	1/2 lb.
saw horses, about 24" high and 36" wide	2

Parts

Part	Make From	Dimensions	Paint	Quantity
table surface (A)	plywood	96" X 48"	no	1
long border wall (B)	two-by-four	96"	yes	3
short border wall (C)	two-by-four	45"	yes	2
stiffener (D)	two-by-three	48"	no	4
saw horse	purchase	H » 24" W » 36"	no	2

Assembly



2009 Smart Moves Rules and Guidelines Nicely Formatted

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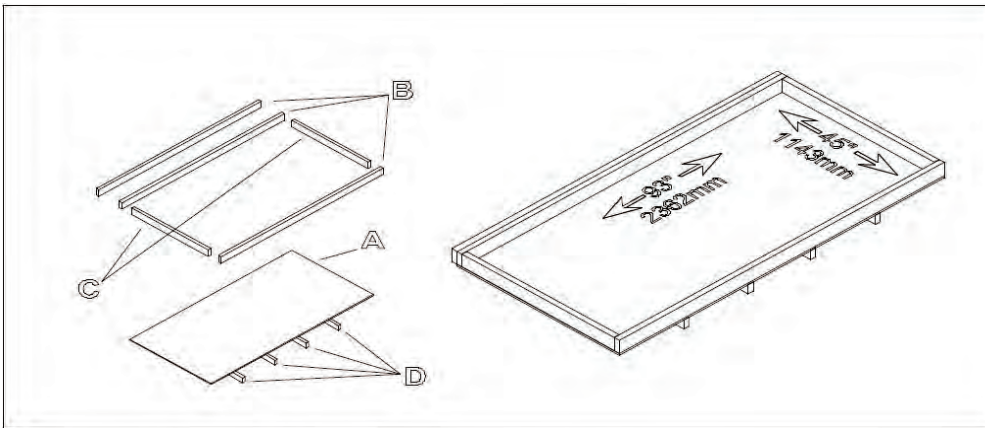


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Step 1 - Determine which face of the plywood (**A**) is least smooth, and consider that the bottom face. On the bottom face, locate, clamp, and screw on the stiffeners (**D**) (about every 18 inches). Be sure screw head tops are flush. Sand any splinters.

Step 2 - On the top face of the plywood, locate, clamp, and screw on the border walls (**B,C**) around the top perimeter. The wall-to-wall dimensions must measure $93\pm 1/8"$ by $45\pm 1/8"$ ($2362\pm 3\text{mm}$ by $1143\pm 3\text{mm}$).

Step 3 - With the help of another person, place this table top on short saw horses (or milk crates, or anything else short and solid).





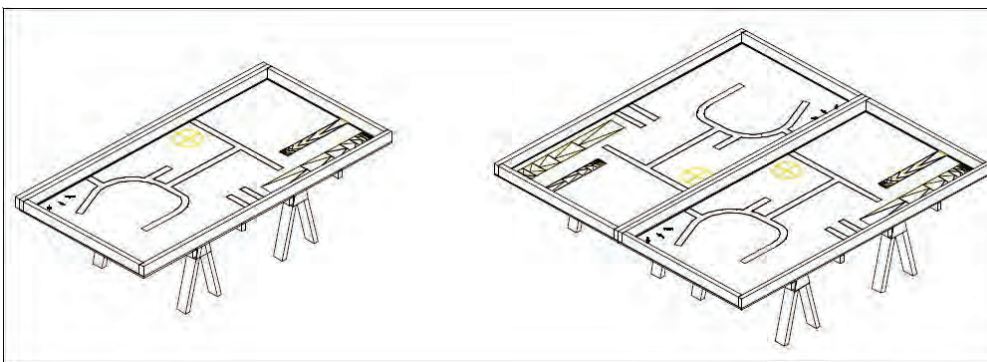
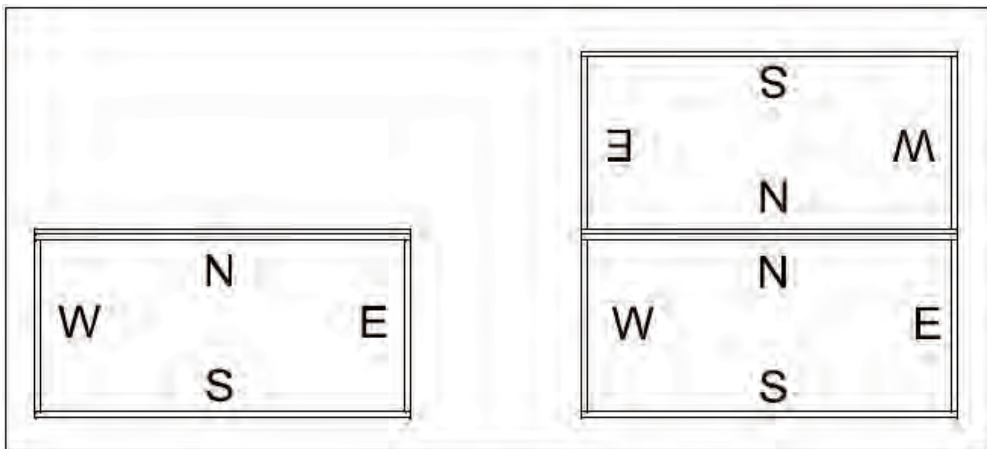
FIELD MAT PLACEMENT

Step 1 - Vacuum the table top. 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).

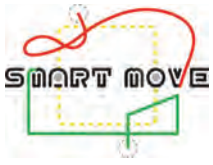
Step 3 - The mat is smaller than the playing surface by design. Slide and align it so that there is no gap between the south edge of the mat and the south border wall. Center the mat in the east-west direction (look for equal gaps at left and right).

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.



MISSION MODEL CONSTRUCTION

Build the mission models - Use the LEGO elements and instruction CD from your Field Setup Kit. It should take a single person between two and three hours to do this, so it's best done in a work party. If there are 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.



MISSION MODEL ARRANGEMENT - DUAL LOCK

Dual Lock

For models where “Dual Lock Needed” appears in the mission model details below, that means the model needs to be secured to the mat during use. 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:

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. TIP: Instead of using your finger, use a bit of the wax paper the squares came on.

Step 3 - Lower the model onto the squares.

CAUTION - Be sure to place each square precisely on its box, and each model precisely over its marks.

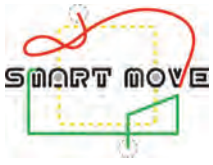
CAUTION - When pressing a model down, press down on its lowest solid structure instead of crushing the whole model. Pull on that same structure if you later need to separating the model from the mat.

TIP: For large/flexible models, apply only one or two sets at a time.

MODEL DETAILS - BRIDGE

Bridge - Dual Lock Needed - Get familiar with the bridge’s exact placement before applying Dual Lock, then apply Dual Lock at one or two locations at a time, from south to north. After the six mat contacts are done, use three Dual Lock pairs to secure the red deck to the border wall (one pair at each end, and one pair at center). Prop up the hinged black deck by standing its swivel beam’s end on the tiny black mark.



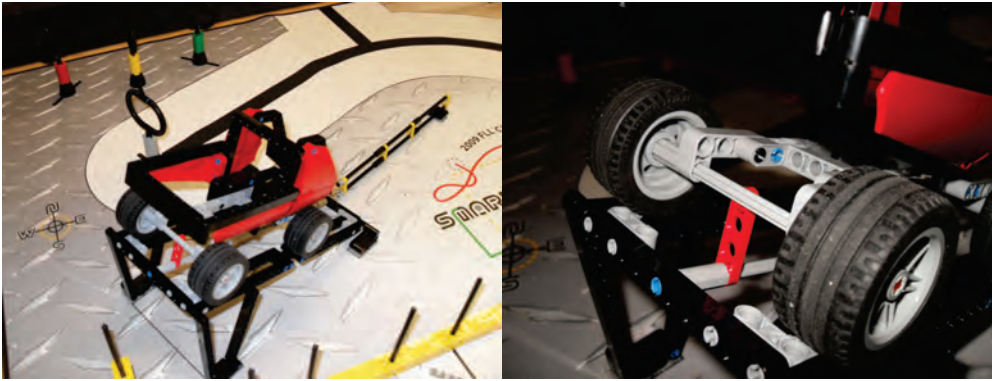


MODEL DETAILS - CRASH-TEST RAMP

Crash-Test Ramp - Dual Lock Needed - CAUTION: Be sure to not distort this model as you secure it. Set the hinged fence-like structure vertical (with the red beam being at its highest point as can be determined by eye).

MODEL DETAILS - TRUCK

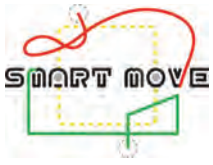
Truck - (NO Dual Lock) - The truck is pointed down the ramp with its rear axle being held by the ramp's red beam. The truck should be centered side-to-side on the ramp, and parallel to it. The truck's centering and parallelism should be as perfect as can be determined by eye, with the understanding that imperfection here adds expected/acceptable variability to the game.



MODEL DETAILS - ACCESS MARKERS

Access Markers - Dual Lock Needed – The access markers are directional. Be sure to place their oval feature over their mark on the mat. Once each model is secured, it needs to be “set.” Pull up on the green wheel, wait a few seconds until the black bumper stops swinging, then lower the wheel. A ball under the center of the bumper will settle into a cup. The exact rotation of the bumper is variable, but be sure there is some free space around the solid post/axle.





MODEL DETAILS - GUIDE WALLS

Guide Walls - Dual Lock Needed - Two guide walls are placed in the southeast, and one is just north of Base. Quite simple!

MODEL DETAILS - DYNAMOMETER

Dynamometer - Dual Lock Needed - This model is in the middle of the east half of the field, and both ends are identical. After pressing it down, test to be sure its rollers spin freely. If they don't, be sure the model is pressed all the way down evenly, be sure there is north-south free-play for the axles, and be sure they're not bent.

MODEL DETAILS - SENSOR WALLS

Sensor Walls - (NO Dual Lock) - Stand four sensor walls on their marks in the northeast, studs up. The last one lies flat across the tops of the three tall black cylindrical columns. Place the square bases of those columns on their marks west of the bridge, toward the north, then carefully balance the sensor wall on top, with its studs facing south.

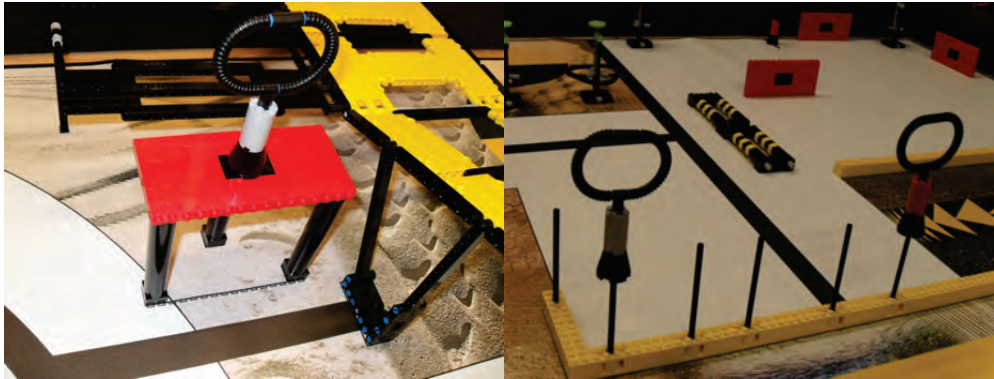
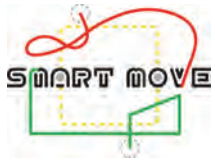


MODEL DETAILS - WARNING BEACONS

Warning Beacons - (NO Dual Lock) - Stand each of the eight warning beacons on its small black circle, studs up. Five go between Base and the bridge, and three are just north of the east guide wall.

MODEL DETAILS - LOOPS

Loops - (NO Dual Lock) - There are eleven loops. Eight of them stand on the mat on their corresponding colored marks with their loops aligned as each mark shows. The remaining two gray and one red are placed on other models, with their loops aligned parallel to the long border walls as follows: Stand one gray loop centered on the sensor wall which is on columns. Stand the other gray loop centered on the southwest axle of the south guide wall. Stand the red loop centered on the east-most axle of the south guide wall. Be sure all loops are vertical.

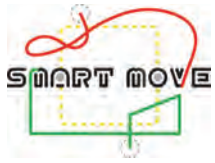


MODEL DETAILS - PEOPLE AND CRASH-TEST FIGURE

People and Crash-Test Figure - (NO Dual Lock) - Place these five models in Base. Their exact position is unimportant.

FIELD MAINTENANCE

- **Border Walls** - Remove any obvious splinters, and cover any obvious holes.
- **Field Mat** - Make sure the mat touches the south border wall, and is centered east to west. Avoid cleaning the mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the robot's performance compared to a new mat (many tournaments use new mats). 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. Tournaments using new mats should unroll the mats as far in advance of the tournament day as possible. For control of extreme curl at the east or west edges of the mat, tape is allowed, with a maximum of ¼" (6 mm) overlap. Foam tape is not allowed.
- **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.



Research Project

Be sure to review the project resources

<http://www.usfirst.org/roboticsprograms/fll/content.aspx?id=15169>

Think About It

Each and every day, transportation touches your lives. Your team travels to the places where they learn, to the places where they play, to visit friends and family. Things we want, clothes we wear, the food we eat, the water we drink, medicines we need—all these travel over highways, on paths and trails, along railroad tracks, up and down rivers, across oceans, over mountains and deserts, along the streets we live on. Information travels to us from experts, teachers, friends, and family. It comes to us by word-of-mouth, over the phone, in books, from websites, in text messages.



Now, consider. A potato chip can travel through a factory—flying from machine-to-machine without being broken—but more than 50,000 kids who traveled on skateboards had to be taken to the hospital. Is all this travel as safe as it could be? Millions of people (and the things they need) get stuck in transit every day. Is all this travel as efficient as it could be?

Your challenge this season is to look at your community and discover how people, animals, information, and things travel. Once you know how people and things move in your community, pick one main mode of transportation and do some research. What kinds of problems keep people and things from getting where they are going safely? What kind of problems keep people and things from moving efficiently, getting where they are going quickly and using the least amount of energy? How could your team help solve one of those problems?



Identify a Problem

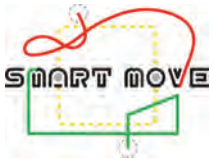
Begin your project by describing your community. This season, it is up to your team to define your community. Is it your school? your neighborhood? your city, village, or town? your country? the world? Be prepared to share how you defined your community.

Next, create a list of the ways that people, animals, information, and things move in, around, to, and through your community. Be creative. Be silly. Be serious. Think about *everything* that gets moved, including yourselves!



Once your list is complete, pick one way that people and things move in your community and learn more about it!

Whether your team chooses planes, boats, trains, cars, trucks, skateboards, rollerblades, bicycles, donkeys, llamas, camels, your feet...it's time to research. What makes your mode of transportation dangerous? What prevents people, information, animals, and things from getting where they need to go? What makes them take longer? What makes them burn more fuel? Search out the problems. Look at reports. Read books. Browse



websites. Conduct a survey. Check with experts who work in and around your community. Use any research tools you have available. Be prepared to share your information sources.

Create an Innovative Solution

Choose one of the problems and suggest a solution. What can be done to fix the problem? What will it take to make your team's solution happen? How will your solution help your community? How can your team make moving from one place to another safer and easier? A great solution might take all the imagination and ingenuity your team can muster. It might seem so obvious that you wonder why the problem even exists. And remember, the most important thing is to have fun while you make a Smart Move.

Share with your Community

Now, tell your community about the problem you researched, and how your solution can help. You choose how to share what you've learned. Give a talk for parents. Create a website. Perform a skit. Make a comic book. Rap. Create a poster. Pass out flyers. Write a poem, song, or story. Present your research and solution to lawmakers.



Your presentation to the judges can be simple or elaborate, serious or designed to make people laugh while they learn—but to be eligible for project awards at tournaments, it must:

- Describe your community, the problem, and your team's solution
- Show that your team did the research and tell about your information sources
- Be shared with someone outside of your team

Note: The total length of your project presentation at a tournament or qualifier should be no more than five minutes, including any setup time.

Need Help Getting Started?



The *2009 Smart Move FLL Coaches' Handbook* contains more information about *FIRST* LEGO® League, the Smart Move Challenge, tournaments, awards, and scoring. Be sure to look at the project rubric.

Information and resources are also available online.

- At www.firstlegoleague.org you will find general information as well as the *2009 Topic Guide* and links to information sources that can help your team start your research.

If you have more questions, email fillprojects@usfirst.org for project support or filltech@usfirst.org for game support.