



## Transportation Challenge | 2019 E-Day Competition Herff College of Engineering | University of Memphis

Student teams will compete with K'NEX vehicles that they bring and submit to the judges on E-Day. Vehicles will be powered by a single “Micro Power Spring Motor” available in the **K'NEX Forces, Energy & Motion** set. See the Materials section below for more information.



K'NEX part  
number 92890

- Teams will submit their vehicles during competition timeslots from 9:00 AM until 3:30 PM in the Engineering Administration Building (first floor) at the University of Memphis.
- Vehicles will be submitted unassembled with all parts contained in a zip-lock bag.
- The bag will be labeled with the submitting organization’s name and with the names of the team members.
- Each team will represent their organization and will consist of four or fewer team members. Organizations may have up to three teams entering the competition.

### 2019 Competition Description

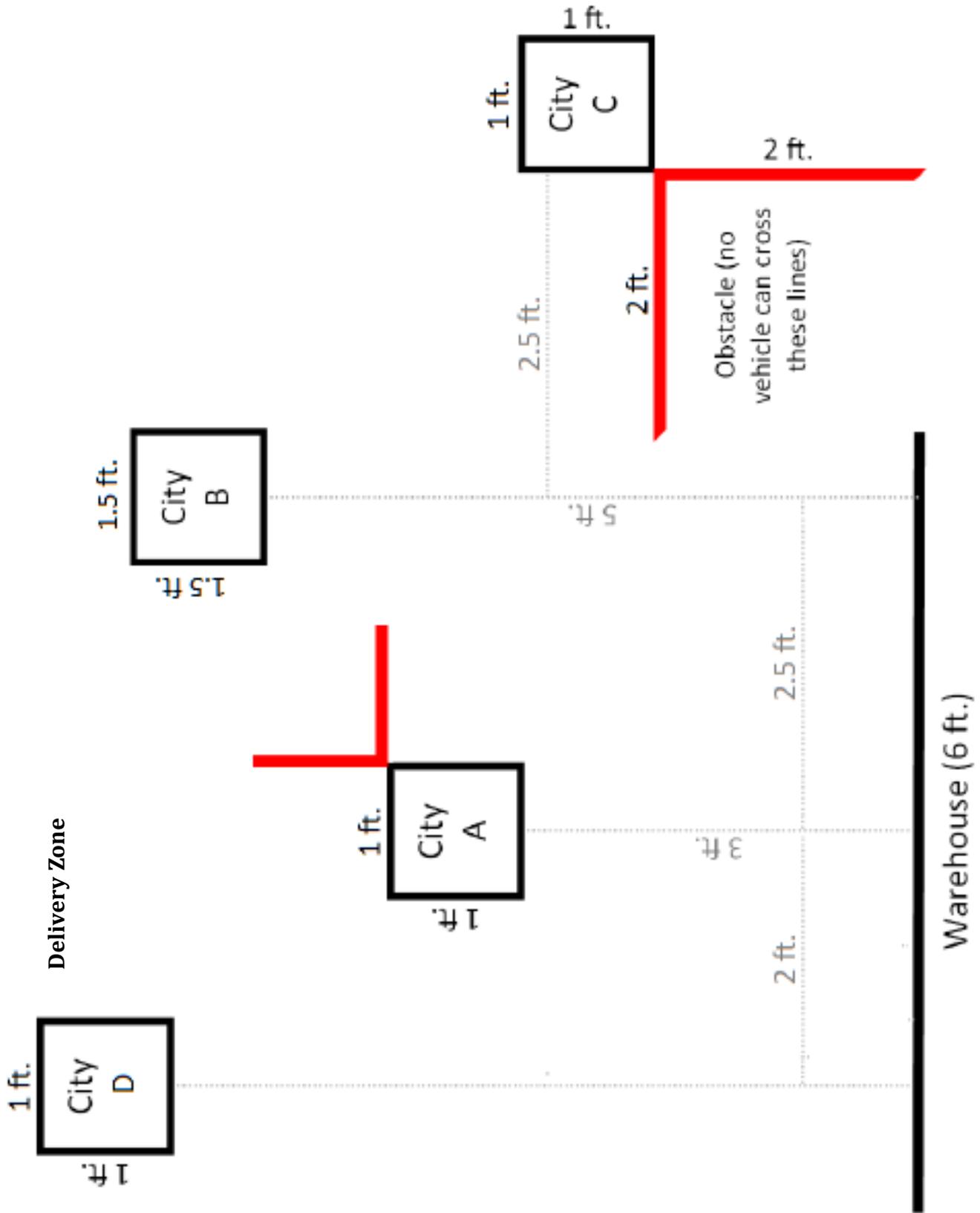
The design goal is to develop a delivery vehicle to achieve the highest income by delivering packages to designated destinations identified as cities A, B, and C. Each of the cities will be located in a different area of the delivery zone (shown below). The vehicle design should allow for the transportation of packages between cities. An additional feature in the judging of the vehicle design will be the speed of construction of the vehicle on competition day. The design goals should be:

- the ability to construct the vehicle quickly and
- the ability to operate the vehicle so that profits are maximized.

More detailed rules for this competition are described in the sections below. Please see the figure below for the exact layout of the Delivery Zone on the day of the competition (drawn to scale). The cities, warehouse, and obstacle will be indicated by tape on a surface floor.

### Materials

Vehicles must be constructed from materials contained in standard K'NEX kits. The motive force for the vehicles will be provided by a single micro power spring motor as shown above. A penny will be used to represent a ‘package’ for the competition. **You must bring the pennies you plan to use in your delivery mission with you on the day of the competition.** The only other materials that may be used are Styrofoam or plastic cups that can be used to hold the packages in the vehicle.



## Total Score for Transportation Challenge

The total score for this competition is composed of two parts:

1. Build time as described in Competition Rules 1 and 2.
2. Profit developed during the delivery mission. The profit is determined by:

*Profit = (# Packages delivered to City A) \*\$50 + (# Packages delivered to City B) \*\$75 + (# Packages delivered to City C) \*\$150 + (# Packages delivered to City D) \*\$200 - (# of refuels)\*\$20 - (# of repairs)\*\$25*

The formula for computing the total score is as follows:

$$\text{Total Score} = \text{Profit} * \frac{(\text{shortest build time})}{(\text{your build time})}$$

## Competition Rules

1. At registration, you will participate in a timed build phase. All the members of the team may participate in the building of the vehicle. Illustrations and drawings may be used during the construction phase but no photos or other instructions that were not drawn by team members may be used.
2. Each team will be assigned a judge to act as a time keeper for their team. The official time is the time as decided by the assigned judge. The longest build time will be 15 minutes. Any time beyond this will not be penalized.
3. Once a vehicle is declared completed, it may not be altered in any way, or else it will be charged a "repair" fee (of \$25, see profit equation). Any time after the build phase is complete that a vehicle is touched (with the exception of "refueling" and picking up/dropping off packages) a repair fee will be charged.
4. The vehicle must be constructed so that it is able to transport packages by placing them in the cup or container that is to be attached or supported by the vehicle. **Teams must provide their own cup or container.** If packages fall off the vehicle, a repair fee will be charged. Packages can be picked up or dropped off while in the warehouse or in any of the cities.
5. After the build phase, the delivery phase will begin. All delivery runs will start in the "warehouse". Teams will have 4 minutes to deliver as many packages to the three cities as possible. Teams may choose to visit the cities in any sequence they choose. Teams do not have to visit all of the cities, but they are not allowed to exit and "re-enter" a city without first returning to the warehouse.
6. During operation, the team may choose how many packages to transport and to which city they will deliver their packages. Once a delivery has been made to a city, the team may return their vehicle to the warehouse square to pick up more packages, or attempt to make another delivery to a different city. Packages can only be picked up by the vehicle at the warehouse. A successful delivery occurs when a vehicle has touched or crossed the city boundary, at which point packages can be dropped off.
7. You incur a fuel cost every time you have to wind your vehicle. The charge is \$20. This includes starting from the warehouse for any delivery and any time that the vehicle must be restarted during a delivery. Repair charges are incurred any time the vehicle is touched (except when picking up/dropping off packages or refueling).