LEGO Activity: Transportation and City Planning

Objective:

To help children discover the effects of transportation planning on the places we live.

Introduction:

The way a city is built is largely impacted by the structure of the transportation network. Networks designed for cars generally have larger roads and allow vehicles to travel at higher speeds. Residential and commercial areas tend to be spread apart, discouraging alternative modes of transportation, like biking and walking. Auto-oriented network make it more difficult to accommodate increases in population density. In contrast, networks designed for bikes, pedestrians, and public transportation tend to have higher population densities, allowing people to live closer to hospitals, schools, and stores. The roads in these networks are designed to feel safer and more convenient for travelers who choose not to use or own cars.

Materials:

- Recommended LEGO Set:

<table>
<thead>
<tr>
<th>Description:</th>
<th>Color</th>
<th>Dimensions</th>
<th>Auto Network</th>
<th>Bike/Ped Network</th>
<th>Transit Network</th>
<th>Total Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Plate</td>
<td>Green</td>
<td>32x32</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Gray</td>
<td>2x4</td>
<td>10</td>
<td>9</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Gray</td>
<td>2x6</td>
<td>-</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Gray</td>
<td>2x16</td>
<td>-</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Gray</td>
<td>4x8</td>
<td>14</td>
<td>-</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Dark Gray</td>
<td>2x16</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Plate (w/o Pegs)</td>
<td>Blue</td>
<td>1x8</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Bricks</td>
<td>Red</td>
<td>2x2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>2x2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fuchsia</td>
<td>2x2</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>2x2</td>
<td>100</td>
<td>150</td>
<td>150</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>White</td>
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<td>30</td>
<td>45</td>
<td>45</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>2x4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>2x4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

- Copies of LEGO Key (see page 5)
- Ziplock bags, or other small containers
Preparation:

- Build the three networks. Pages 6-8 show how to build the networks from the recommended LEGO set.
- Separate the bricks into four Ziplock bags. For the bike/pedestrian network and the transit network, the bricks should be separated as outlined in the table found in the materials section. The bricks for the auto network should be split into two bags as shown in the table below:

<table>
<thead>
<tr>
<th>Brick Color</th>
<th>Auto I</th>
<th>Auto II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Blue</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Green</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Orange</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Yellow</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>White</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

- Print copies of the LEGO key for participants

Activity Instructions:

1. **Introduce the topic to participants.**
   - If this activity is being run by a guest engineer or planner, the guest may want to give a brief description to his or her job. Otherwise, you may want to adapt the written objective and introduction to the age group of the participants.

2. **Create teams.**
   - To encourage participation, we suggest splitting the group into teams of three or four students. Each team will need its own set of LEGOs.

3. **Introduce basic activity guidelines**
   - Use the auto network as an example. Explain that green spaces represent areas where teams can build. Gray plates represent roads. Wider plates represent highways and thinner plates represent smaller roads.
   - Go through the LEGO key (page 5) with the students, make sure they understand what each color represents.
   - Below are some rules that we suggest allowing the students to discover rather than explaining:
     - Bricks can be stacked
     - House/Apartment bricks can be stacked on top of residential bricks.
     - Schools and Hospitals can be oriented in any way.

4. **Build the Auto network.**
   - Give each team an auto network board and the ‘Auto I’ bag of LEGOs. After five minutes or so, hand the students the ‘Auto II’ bag, explaining that the city is getting bigger so you need to plan for more people.
Depending on the age of the participants and how seriously they are taking the activity, you may find the students building in an unrealistic way. We suggest using guiding questions to help the students think through how they build their city. Below are some examples:

- **If they are making large towers:**
  If you lived in a place with roads like this how would you get to the store or to soccer practice? *(Probably a car – it’s not safe to bike or walk on highways)*
  So if everyone needs a car to drive around and you build a huge tower for a lot of people to live in, where are all of their cars going to go? (If participants are still building huge towers, you may just have to impose a 3 brick height limit for the town)

- **If they are not leaving any green space:**
  Where could you play in this neighborhood?
  If you surround your school with houses/stores, where are the students going to have P.E. and play at recess?

- **If they build schools/houses at highway intersections:**
  Do you think it’s safe to put a school directly on two highways? *(Students may come up with ways to make it safe which is fine but it’s an important consideration)*
  Would you like to live at the corner of two highways?

If you have a time constraint, we suggest cutting off the students at fifteen minutes.

(5) **Build the Bike/Pedestrian network.**
Give each team a Bike/Pedestrian network board and the bricks set aside for the Bike/Pedestrian portion of the activity. Ask the students what is different about this network. Hopefully, they’ll point out the smaller streets. This should provide the opportunity to mention that these narrower streets have fewer fast moving cars, making it safe for people to walk or bike.

Examples of additional guiding questions:

- **If they are separating houses/apartments from stores:**
  If you wanted to get something from the store, how far would you have to go? Do you think you would be able to walk or bike that far?

Allow the students fifteen to twenty minutes to work on this network. The way this network is set up should allow the students to fit a lot more bricks onto the board. Because they don’t have to worry about everyone owning cars, they can also build larger buildings.

(6) **Build the Transit network.**
Give each team a Transit network board and the bricks set aside for the Transit portion of the activity. Explain the new elements on this board. The blue represents bus lines where the buses share the road with cars. The dark gray represents rail lines that are not shared with cars.

Examples of some guiding questions:

- **Trains Station placement:**
How would you get the train from a house on the other side of town (opposite of the train line)? If you have to take the bus to get to the train, where might you want to put the train station?

- **Home and store placement:**
  Where would you want to live in this city? Where do you think a store owner would want to set up his or her business in this city? *(There is not necessarily a ‘right’ answer to these questions. These questions are intended to encourage students to really think about how they are laying out their city. They may also come to realize that land near train stations can be very desirable.)*

Allow the students fifteen to twenty minutes to work on this board. Like the bike/pedestrian network, this network should be able to contain more houses/stores than the auto network.

(7) **Wrap up.**
Ask the teams to share their cities with the groups and explain their placement of different types of buildings. After everyone has shared, ask some of the following questions to the group as a whole:

- What were some of the challenges you faced while building your cities?
- Was it more difficult to build on some networks than others? Why? How are the networks different?
- Which of these cities would you most like to live in? Why?
**LEGO Key**

**Buildings:**

- Hospital = 2 Orange Bricks
- School = 2 Green Bricks
- Fire Station = 1 Red Brick
- Police Station = 1 Blue Brick
- Houses/Apartments = 1 Yellow Brick
- Shopping/Restaurants = 1 White Brick
- Train Station = 1 Fuchsia Brick
Auto-Oriented Network

Each square in the grid represents 1 Peg on a 32 x 32 Lego board.

- **Roadway**
- **Free Space**
Pedestrian/Bike Oriented Network

Each square in the grid represents 1 Peg on a 32 x 32 Lego board.

- **Roadway**
- **Free Space**
Transit Oriented Network

*Colored borders included to help differentiate between blocks

Each square in the grid represents 1 Peg on a 32 x 32 Lego board.

- Roadway
- Free Space
- Bus Line (Runs ON Roadway, Bus Line Bricks ON TOP of Roadway Plates)
- Rail Line