Plan and Design a City

Project Based Learning
For Middle School
(Grades 6-8)

Research
CAD design
Hands-on building

Created by: Innovations in Technology
Design a City
Unit Overview and Teacher Resources

Unit Contents

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2. Expectations and Overview of the Unit
3. Introduction to City Planning (research and vocabulary) – includes key
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7. Building the City Information (hands on construction)
8. Student Team Work Log
9. Student Daily Work Log
10. Building scale information and examples
11. Sketchup and Building Examples
12. Project Written Reflection

Materials Needed

1. Student computer access
2. Sketchup (CAD) – free download (or another CAD program
3. Chipboard (available through Blick Art Supply http://www.dickblick.com/ or poster board, cardboard, etc.
4. White glue
5. Hot glue/glue guns
6. Paint, markers, etc.
7. Other recycled materials such as bottle caps, paper towel tubes, wood scraps, cotton balls, popsicle sticks, paper, etc. for building

Teacher and Student Resources

Tutorials

Basic Sketchup Tutorials: http://www.sketchup.com/learn/videos/58

Create a City Sketchup Tutorials:
Part 1: https://www.youtube.com/watch?v=dVU6-w97vk0
Part 2: https://www.youtube.com/watch?v=wqNGwfEf6Jg
Part 3: https://www.youtube.com/watch?v=EtS6GR8hVh0
Part 4: https://www.youtube.com/watch?v=C7RDE1Fta90
Part 5: https://www.youtube.com/watch?v=FkPS6lymI44

City Planning and Research

City Planning: https://www.planning.org/aboutplanning/whatisplanning.htm
More about City Planning: https://www.planning.org/kidsandcommunity/moreplanning/
Creating a City Project
Overview and Expectations

As a class, we will be creating a city, first by designing it in Google Sketchup. Then, you’ll be building parts of it from chipboard and other materials. Each group will create a section of the city and at the end we will put it together. You will be provided with some resources, but you will also need to do research on your own. As with all group projects, you will receive an individual grade for your contribution and the effort you make in being a group member (see the rules below).

Choose your group carefully – you will be working with them for over a month! Groups should be 3-4 people.

Follow these steps:

1. Complete all preliminary assignments which will include terminology, research and planning. Some will be individual; others you will do with your group.
2. Complete your group’s proposal sheet and submit (prior to starting work on Sketchup/building).
3. Determine who will maintain the work log for your group – it needs to be completed daily.
4. Use any tutorials, videos, etc. you need to help familiarize yourself with Sketchup. EACH person in the group needs to work on creating buildings for a COMPLETE section of their city’s zone. You may use the 3D Warehouse for no more than 50% of the project (in other words, you need to actually create half or more of the project by drawing it yourself). I suggest using the 3D warehouse for things like landscaping, cars, etc. that are more difficult to draw and draw the buildings yourself.
5. Review your Sketchup drawings to make sure your city is to scale. Scale for your buildings for this part of the project ONLY is 1:100.
6. Determine which building(s) you want to build from chipboard and other materials. All group members need to contribute to this part of the project as well and each person will build one (or more) buildings. The scale you choose for your building when you build will be different than what you used in the city drawing (we will discuss this in class).
7. Assist with putting all the sections together to create a town in Sketchup by creating a new file and importing each block of the city. The class will determine a name for the new town by majority vote.
8. Assist with assembling the city that was built.

Basic rules of the project:

1. I am grading you individually on three things: (1) your projects (2) how you work with your team (3) being on task. There are NO times during this project that you are “finished”, “have your part done”, “have nothing to do”, “are ahead so you’re taking a break”, etc. Expect a significant reduction in grade if you are off task.

2. Your group will not build until ALL MEMBERS complete ALL research and Sketchup drawings.

4. It is up to you how you divide the work and assign tasks, unless it is not working. If I have to intervene, expect a deduction in your grade.

5. This is a “real world” project – there are limited resources (time, materials, etc.)

6. Your group is responsible to clean up your own mess, put your project away, etc. I will deduct points from ALL group members if this is not done.

You will be provided with additional information for each part of the project as we progress.
Introduction to City Planning

This first research assignment is an individual project (each person does the work independently). Make sure you are reading the instructions for each section and completely answering the questions.

Part 1: What do People Need to Live?
For this section, use the city you live in as you consider your answers.

1. What things do you need to live day-to-day that must be provided for you in a city?
2. How are these needs met in your city? Who provides them?
3. Could the day-to-day items provided by the government be obtained without the government being involved? What problems would that create?
4. Does distance from the needed resource create difficulties?

Part 2: What Makes Up a City?
This section applies to all cities. Research using the Internet to find the answers.

1. What are the important elements/features of a city?
2. How do those elements/features relate to each other and determine the others’ importance?
3. Why are cities arranged in zones? What are some of the problems that could be associated with not arranging cities in this way?
4. McKinney has been named as the #1 Place to Live (2014). Why do you think that is? Did the planning of the city have an impact on this? Why or why not?

Part 3: Thinking about Planning
This section applies to a city you might create.

1. When planning a new town or city, what are some things you should definitely include? Why?
2. Where should schools be located? Why?
3. Where should shopping and entertainment centers be located? Why?
4. Where should services such as fire departments and police stations be located? Why?

Part 4: Locating Things in Your City

1. What city services are necessary for your residential areas?
2. What city services are necessary for business areas?
3. What city services are needed for industrial zones?
4. Think about the location of things in your city. What areas of the city would you like to have located near your home? What areas would you like as far away as possible?
5. In what way are necessary city services connected to each other? (Example: how do the things you buy from the store get to your house? From where does your electricity come?)
Part 5: Vocabulary
Define ALL the following terms (as they relate to cities) AND give an example.

1. City zone
2. Industrial zone
3. Residential zone
4. Commercial zone
5. Zoning density
6. Infrastructure
7. Transportations systems
8. Utilities
9. Water sanitations systems
10. High tech industrial
11. Municipality
12. Landfill
13. Power plant
14. Geothermal energy
15. Retail establishment
16. Government facility
17. Cultural and entertainment facility
18. Service Industry
19. Proportion
20. Inter-relationships
21. City connectivity
This first research assignment is an individual project (each person does the work independently). Make sure you are reading the instructions for each section and completely answering the questions.

**Part 1: What do People Need to Live?**
For this section, use the city you live in as you consider your answers.

1. What things do you need to live day-to-day that must be provided for you in a city? **Answers vary.**
2. How are these needs met in your city? Who provides them? **Answers vary.**
3. Could the day-to-day items provided by the government be obtained without the government being involved? What problems would that create? **Answers vary.**
4. Does distance from the needed resource create difficulties? **Answers vary.**

**Part 2: What Makes Up a City?**
This section applies to all cities. Research using the Internet to find the answers.

1. What are the important elements/features of a city? **Well designed buildings, streets, transportation, public spaces, and landscaping that work together to form a pleasant living environment.**
2. How do those elements/features relate to each other and determine the others’ importance? **Each element needs to work together to provide an aesthetically pleasing unity, allowing for easy access between each of the zones of the city.**
3. Why are cities arranged in zones? What are some of the problems that could be associated with not arranging cities in this way? **Cities are arranged in zones to group specific types of buildings together and keep noise and pollution away from certain areas. For example, placing large factories near a residential area would make living in that residential area undesirable.**
4. McKinney, Texas has been named as the #1 Place to Live (2014). Why do you think that is? Did the planning of the city have an impact on this? Why or why not? **McKinney offers a well planned community with a high focus on education, a variety of affordable housing and numerous business establishments, along with cultural and entertainment facilities. City planning allowed appropriate arrangement of the city zones, provisions for transportation, etc. to accommodate growth in the community.**

**Part 3: Thinking about Planning**
This section applies to a city you might create.

1. When planning a new town or city, what are some things you should definitely include? Why? **Answers vary.**
2. Where should schools be located? Why? **Answers vary.**
3. Where should shopping and entertainment centers be located? Why? **Answers vary.**
4. Where should services such as fire departments and police stations be located? Why? **Answers vary.**

**Part 4: Locating Things in Your City**
1. What city services are necessary for your residential areas? *Answers vary and could include houses, apartments, condos, townhomes, etc.*
2. What city services are necessary for business areas? *Answers vary and could include office buildings, retail stores, restaurants, etc.*
3. What city services are needed for industrial zones? *Answers vary and could include water purification plants, electric companies, sewage treatment plants, warehouses, city dump, etc.*
4. Think about the location of things in your city. What areas of the city would you like to have located near your home? What areas would you like as far away as possible? *Answers vary.*
5. In what way are necessary city services connected to each other? (Example: how do the things you buy from the store get to your house? From where does your electricity come?) *Answers vary and include things like trucking companies located in industrial zones would transport groceries to supermarkets in business zones, people who live in residential zones would need to travel to business zones to work, etc.*

### Part 5: Vocabulary
Define ALL the following terms (as they relate to cities) AND give an example.

1. City zone - *dividing an area into zones or sections reserved for different purposes such as residence and business and manufacturing etc.* Examples vary.
2. Industrial zone - *a location of land at a distance from city center that is designed for a cluster of businesses, factories and industry.* Examples vary.
3. Residential zone - *any part of a city or town in which the primary land use is commercial activities (shops, offices, and so on).* Examples vary.
4. Commercial zone - *the part of a city where people live.* Examples vary.
5. Zoning density - *Zoning ordinances that restrict the maximum average number of houses per acre that may be built within a particular area, generally in a subdivision.* Examples vary.
6. Infrastructure - *Fundamental facilities and systems serving a country, city, or area, as transportation and communication systems, power plants, and schools.* Examples vary.
7. Transportation systems - *something that serves as a means of transportation.* Examples vary.
8. Utilities - *Items and services needed to make a house or apartment functional such as hot water, electricity, natural gas, phone service, and cable service.* Examples vary.
9. Water sanitation systems - *a facility that cleans water for a city.* Examples vary.
10. High tech industrial - *industrial businesses that use the latest technology.* Examples vary.
11. Municipality - *people living in a town or city having local self-government.* Examples vary.
12. Landfill - *a place were solid waste is buried.* Examples vary.
15. Retail establishment - *a business that sells merchandise or goods to individuals.* Examples vary.
16. Government facility - *A place that houses government services such as a courthouse or government offices.* Examples vary.
17. Cultural and entertainment facility – *Buildings that provide entertainment and cultural needs of the city such as a football field, museum or a park.* Examples vary.
19. Proportion - *A relation between one object another usually in size.* Examples vary.
20. Inter-relationships - *The mutual or reciprocal way in which each of two or more things is related to the other(s).* Examples vary.
21. City connectivity - *The degree of direct linkage between one particular location and other locations in a transport network.* Examples vary.
Complete the chart below with your partner. You should have at least 10 in each zone; and at least 40 total. Make sure you have EVERYTHING a city needs. You may add more lines if you need to.

<table>
<thead>
<tr>
<th>Type of Business</th>
<th>Zone it would be in</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>EX.</td>
<td>Residential</td>
<td>Commercial</td>
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<tr>
<td>Restaurant</td>
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Design a City ~ Project Proposal

Class Period

Circle One: Residential  Commercial  Industrial

Group Members: __________________________________     __________________________________
                                                      __________________________________

Complete this section for your drawing in SketchUp. Think about what buildings would be in the portion of the city you chose above. You need a minimum of **16 DIFFERENT buildings**. (Example: a house would count as one of the 16, but you might want 30 houses in your zone). You will draw ALL of them in Sketchup (so all 30 houses for example).

<table>
<thead>
<tr>
<th>Building Type</th>
<th># needed</th>
<th>Person(s) Responsible</th>
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</table>

Decide which building(s) you want to build out of materials. Each person must build one. You may build more if you want to and there is enough time and material, but make sure to do a good job on the first one, don’t rush! List your name and the building number (from the chart above) that you are building.

<table>
<thead>
<tr>
<th>Name</th>
<th>Building #</th>
<th>Building Description</th>
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</table>
Creating Your City using SketchUp

For this part of the project, you will be creating your buildings in Sketchup that you identified for the zone you chose in our planning project.

1. Use any tutorials, videos, etc. you need to help familiarize yourself with Sketchup. Use these FIRST before you ask me.
2. “Divide” your zone so that each team member is working on a contiguous piece of it. I will give you a demonstration of this in class. See the visual in #8 below.
3. EACH person in the group needs to work on creating buildings. If you are “done” – add more buildings, landscaping, detail, etc.
4. You may use the 3D Warehouse for no more than 50% of the project (in other words, you need to actually create half or more of the project by drawing it yourself). I suggest using the 3D warehouse for things like landscaping, cars, etc. that are more difficult to draw and draw the buildings yourself.
5. You MAY use copy/paste to duplicate buildings, especially in your residential zones. Copy basic houses and then change them slightly to create neighborhoods more quickly.
6. Complete all of your individual drawings in ONE file. Arrange them appropriately and add streets, landscaping, etc. Identify your building(s) (the ones you build) on the map. This should be done to the scale we choose for the city: 1:100.
7. Make sure to save frequently. This will be a larger file, so you may need to use a flash drive to save as you go along and/or erase files we have finished with.
8. Your group’s portion of the city zone should “fit together” to complete your zone. Each person should be creating a section that could be attached to the other sections. For example, four people’s sections could fit together as below:

```
+----------------+----------------+
| Person #1's zone | Person #2's zone |
+----------------+----------------+
| Person #3's zone | Person #4's zone |
```

9. Make sure you are taking your time and creating DETAIL in your buildings. They should look like real buildings, not boxes.
10. Do not copy large models of other cities from 3D warehouse. You may use it for INDIVIDUAL items such as a tree, a car, a person, etc. and place those throughout the city you created. I will return your project to be redone if you don’t follow this.

**Grading**

<table>
<thead>
<tr>
<th>Expectations</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing shows adequate effort, is original work and to scale</td>
<td>60</td>
</tr>
<tr>
<td>On task, working to improve the project</td>
<td>20</td>
</tr>
<tr>
<td>Cooperating with team</td>
<td>20</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
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Building the City

These expectations are for the building part of this project. ALL your team members must have completed the Sketchup portion of the project to my satisfaction PRIOR to ANYONE on your team building. If you are finished, you need to be helping your team finish.

Expectations:
1. Use the information in the scale document to create paper patterns for your building FIRST. Bring them to me for approval before you start using the chipboard.

2. Make sure you are keeping the work log updated DAILY (part of your grade). One per group.

3. You will make AT LEAST ONE daily entry in every INDIVIDUAL Daily Work Log. It can be:
   a. A sketch of a building you are working on
   b. An idea for something you are working on
   c. Something you still need to do (a reminder)
   d. Something you learned

4. If you finish the buildings you listed on your planning sheet, build more or start on the decorations for the city (trees, etc.)

5. Do not waste materials.

6. If you are off task, expect a 20% deduction from your grade for each day you are off task. If you are disrupting others’ learning, you will be removed from building and work out of a book instead.

7. Any safety violations and you will be removed from the project and work out of a book for this portion of the project.

8. You need to be working at the correct location with your group and using the materials that are labeled for your group. “Visiting” other groups is considered being off task.

9. Taking other people’s projects, damaging them, etc. will result in a zero for the project and working from a book for the remainder of the assignment.

Grading on this portion of the project, as always, is for your INDIVIDUAL contribution and includes utilizing the Engineering Design Process, appropriate documentation, teamwork, participation, effort, following safety rules and being on task.
For your patterns:

1. Assume that the average height of ONE floor of a building is between 10 and 15 feet. (closer to 10 for residential; 15 for commercial/industrial). For multiple story buildings, use the lower number (10).

2. Scale for this part of the project is:

   1 INCH : 5 FEET

   Example: A one story house (10 feet) would be 2” tall.  
   Example: A restaurant (15 feet) would be 3” tall.  
   Example: An 8 story hotel (10 feet per floor) 10/5 = 2;  
   2*8=16; would be 16” tall.

   Everything needs to be LESS THAN 24” tall
Sample Complete City Zones (Sketchup)
Sample Completed Cities (Building Portion):
Design a City
Daily Work Log

Name: ________________________________________
Class Period: _________
<table>
<thead>
<tr>
<th>Date</th>
<th>Name:</th>
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</table>
Design a City Project Reflection

Answer the questions about the city building project we just completed. Save your file as LastFirstCity and submit your assignment (example: Jane Jones saves her file as JonesJaneCity).

Think about how your group worked together on the portions of the project that were group work. I am the only one who will see your answers and no one’s grade will be impacted by your answers (I already know who worked hard and who didn’t!).

1. How do you think your group could have worked better together?
2. If you were choosing a group again, would you choose the same people? Why or why not?
3. Who was the “leader” of your group? Why do you consider them to be the leader?
4. What did you learn about working in a group from this project?
5. How would you contribute to the group if you did the project again? Would you do the same things you did or something else? Why?

Now think about the project itself and answer these questions:

6. Did you change your city or building designs as you went along? Why?
7. How did you decide on the design for your city?
8. Why did you choose to build the building you did?
9. What challenges did you have with the actual construction and how did you overcome those?
10. Are you happy with the final project? How would you change it if you did it again (or would you change it?)
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  - Download: $5.00

- **Exploring the Road to College**
  - Download: $3.00

- **Build Your Own Computer**
  - Download: $4.50

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