



6-8TH GRADE: 3-D BIKE MAPS

GREEN GUIDE TRANSPORTATION UNITS

Transportation Location: three lessons, history/science (3-6)

Pollution and Evolution: one lesson, science (6-8)

3-D Bike Maps: one lesson, science (6-8)

Marketing Strategy and Transportation: two lessons, health/art (6-12)

The Cost of Transportation: one lesson, science (6-12)

What Do I Stand For?: one lesson (6-12)

Travel Journal: three lessons (6-12)

History of Transportation: two lessons (9-12)



SAFE ROUTES TO SCHOOLS
CURRICULUM

Find our curriculum online at : http://www.saferoutestoschools.org/green_curriculum.html

TEENS GO GREEN



www.saferoutestoschools.org



Safe Routes to Schools is a program of the Transportation Authority of Marin.

Part of the *Marin Safe Routes to Schools Curriculum*. Engaging lessons K thru 12 that include applicable state educational standards.

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LESSON PLAN

3-D BIKE MAPS

6–8th Grades. 45 minutes. Classroom setting.

After an introduction to reading topographic maps, two fun activities allow students to practice using their topographic map skills. First students follow topographic lines to cut foam layers that stack to construct a 3-D elevation map depicting their region of Marin. Next, each student uses the Marin County Bike Map and 3-D map to find their optimum route from their home (or drop-off location) to the school.

OBJECTIVES

Students will be able to:

- **Recall two benefits of bicycling.**
- **Explain that the topographic lines represent changes in elevation.**
- **Read a topographic map to identify elevation change.**
- **Construct a 3-D map from a 2-D topographic map.**
- **Map the best route for biking to school based upon a bike and topographic map.**

CA 6th Grade Science Standards

- 7f. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.**
- 7d. Communicate the steps and results from an investigation in an oral presentation, with their route data as a visual aide.**

MATERIALS

Paper maps are becoming less available as handheld GPS units increase in popularity. The best solution is to purchase the State Digital maps through National Geographic. Simply zoom in on the area you would like to study and print them yourself.

3-D Bike Map Making Activity

- Class set of local topographic maps
- Adhesive paper
- Scissors
- Glue sticks
- Foam squares (thin enough to cut with scissors)
- Pencils
- Dry-erase board or other large writing surface
- “Transportation Cards”
 - four images: clean air, exercise, no traffic, and fun for bikes
 - four images: air pollution, sedentary lifestyle, traffic jams and road rage for cars.

Topographic Bike Map Activity

- 3D model from 1st activity
- Local bike map.
- Paper road map of the area per student.



VOCABULARY

Topographic Map: A type of map with lines representing different levels of elevation.

Elevation: Distance above or below “sea level” or the height of the oceans.

RESOURCES:

California digital topographic maps at REI: <http://www.rei.com/product/737657/national-geographic-topo-outdoor-recreation-mapping-software-california>

Google-Maps with “Terrain” option shows topographic lines when zoomed in, and “Bicycling” option highlights bike paths and routes. <http://maps.google.com>



PROCEDURE

Making the Map

The 3-D map can be done easy or elaborate depending on how many foam layers are used. Some preparation prior to the lesson cuts down on time constructing the layers during class.

Foam layers can be prepared by:

- a. Printing the topo map on adhesive paper, adhering to foam squares
- b. Printing the topo map on regular paper, glue sticking to foam squares

Students can each create a small scale map of the region to keep, or work collaboratively to create a much larger class map. This decides the scale of the maps you will print.

Each stacked layer of topographic foam represents an elevation range. The map should include at least three layers (low-med-high) but could include many layers of foam. Consider purchasing different colored foam to represent the different elevations. Each student will need one foam map for each level of elevation.

To find the elevation range for each layer of foam either:

- a. Find clear, easy to read topographic lines and designate a low-mid-high range.
- b. Find the exact elevation range by using the following formula.

Elevation range per foam layer:

Subtract the lowest elevation from the highest elevation to find the elevation change.

Divide the elevation change by the number of foam layers you plan to use to find the topographic range each layer represents.

EXAMPLE

Maximum elevation: 910 ft.

Minimum elevation: 10 ft.

$910 - 10 = 900$ ft. elevation change.

$900 \text{ ft.} \div 3 \text{ layers} = 300 \text{ ft. per layer.}$

Layers:

1. 10-310 ft.

2. 310-610 ft.

3. 610-910 ft.

PROCEDURE CONT.

1. Introduce yourself as an instructor for the Teens Go Green program.

- Briefly highlight your relevant background and experience.
- Teens Go Green is the Middle/High School program for Safe Routes to Schools (SR2S). SR2S teaches classes in over 50 Marin schools K thru 12.
SR2S is a program of Transportation Authority of Marin.
- Thank the class/teacher for having you as a guest.
- Use “Transportation Cards” to briefly discuss the benefits of biking.
- Briefly overview the rest of the lesson.

2. Topographic maps show lines of elevation.

- A topographic line is like a line painted around a hill at a certain height.
Draw an example from the side and the top view.
- Each line might represent one or hundreds of feet.
- Lines close together indicate steep while lines far apart show flat areas





ACTIVITY: MAP A BIKE ROUTE TO SCHOOL

To begin, show an example of a finished 3-D foam topographic map.

- Explain that students will cut and glue layers of foam to create their own map.
- Write on the board the elevation range for each layer of foam.
- Distribute the layers of foam maps to each student.
 - i. Find or designate the foam map representing the lowest elevation range.
- To add the next layer: find the foam map representing the medium elevation range.
 - i. With pencil, gently shade any part of the map in the first elevation range.
 - ii. Compare with someone near you to check that the correct portion is shaded.
 - iii. Use scissors to cut off all the shaded parts of the foam map. This may result in multiple pieces of map. Discard shaded pieces.
 - iv. Use glue-sticks to glue the remaining foam map directly above the corresponding section on the low elevation foam map.
- Repeat previous step with each next layer of foam, shading everything below.
- After a few layers of foam, a 3-D map should rise!
- Check with someone nearby to ensure your map is correct.





ACTIVITY: MAP A BIKE ROUTE TO SCHOOL

Using the new 3-D map and local bike map, create a map of the best bike route to school from your home or a nearby drop-off point.

- Distribute blank local road map to each student.
- Students mark the location of their house or drop-off point and the school.
 - i. Any start point is fine. Suggest drop-off locations for those who do not live nearby.
 - ii. Mark the school's location on the map.
- Students share the 3-D map and Marin bike map to find the best route to school.
 - i. Bike map shows recommended bike routes (on street) or bike paths (off street).
 - ii. 3-D topographic maps show elevation change.
 - iii. Most bikers prefer a low-traffic route with little elevation change.
- After finding the optimal route, draw the route on your map.
 - i. Consider noting areas of interest or hazards along the way.
- **Conclusion:** Using maps depicting roads, bike routes, and elevation can help us select the best route. Topographic maps use lines to designate elevations.



3. Conclude the lesson. Review the key concepts and thank the class for having you as a guest.

- Topographic lines represent changes in elevation.
- By reading the topographic and bike map, we could map our best route to school.