

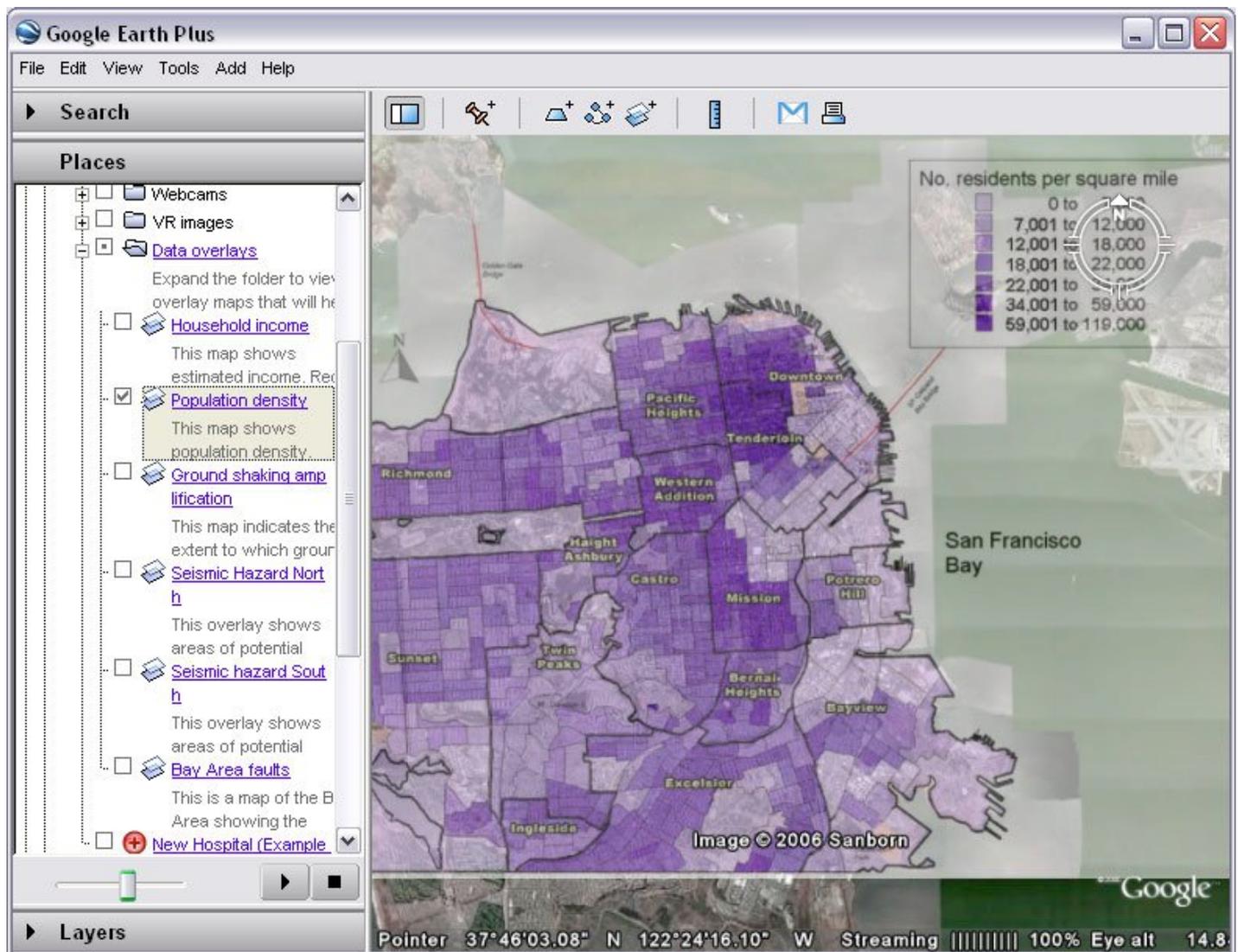
San Francisco: Visualizing a Safer City

(Screenshots are from Google Earth 4 beta)

Introduction and background

This is a tried and tested decision making exercise that requires students to decide on a location for a new building in San Francisco. They utilize a variety of spatial information to minimize the earthquake risk to the chosen site. I show how Google Earth¹ can be employed to underpin the decision-making process, acting as a comprehensive GIS that allows students of all abilities to analyse real spatial data with ease. Overlays provide detailed information on population density, household income, liquefaction and landslide potential as well as underlying geology.

Image: screenshot of population density overlay



In addition, students can draw on the native Google Earth layers such as 3D buildings, roads, railways, terrain and public buildings, to inform their decisions. There is plenty of scope for independent research, and students should be able to access the highest levels of achievement in both Geography and ICT.

The activity represents something of a personal Holy Grail. For several years I've got students to carry out a planning exercise to make San Francisco safer during major earthquakes. I used an excellent resource by John Widdowson in the Earthworks 3 textbook² which essentially gets students to compare maps of seismic hazards and major roads and buildings. Using tracing paper, they plan some new buildings, taking into account the existing infrastructure and potential seismic hazard. For a while I tentatively worked on replacing the tracing paper with ICT and explored the various online GIS viewers that serve data for the San Francisco region, for example Shaking Maps on the ABAG site.³ I found that these interactive websites, while interesting, were often too slow or unpredictable in the classroom and students were not sufficiently engaged. The advent of Google Earth meant that the exercise could be transformed into a simple but absorbing decision making exercise. There are infinite possible variations to the lesson, which takes inspiration from the original ideas in the Earthworks 3 text.

The learning activity

Considerations

I would suggest that students work in small groups, each having access to a computer with a Google Earth installation.

A small file (2.6mb) needs to be downloaded from the Juicy Geography website⁴ and opened in Google Earth.

Students need to be taught some basic Google Earth skills. I have prepared some

¹ Google Earth <http://earth.google.com/>

² Earthworks 3, p19, John Widdowson 2000, John Murray (Publishers) Ltd.

³ Association of Bay Area Governments <http://gis.abag.ca.gov/website/Shaking-Maps/viewer.htm>

⁴ Juicy Geography <http://www.juicygeography.co.uk/googleearthsanfran.htm>

colourful visual user guides that can be printed off and laminated. These are available from the Digital Geography blog.⁵ Essentially students need to be able to organize the contents of the My Places and Layers panels, as well as the basics of creating and editing placemarks.



Image: My Places and the slider screenshot

They should know how to turn overlays on and off and adjust the transparency. Familiarity with the measuring tool would also be useful. I find that these skills can be taught fairly easily within a single lesson, and recommend the use of the home town as the exemplar area.

Possible starter

A number of activities could introduce the task. (1) Show students a picture of earthquake damage. Discuss the idea that planners try to minimise the worst effects of earthquakes by designing safer cities. How might they do this? The BBC film

⁵ Google Earth user guides:
Version 4 at Digital Geography
<http://www.digitalgeography.co.uk/archives/2006/08/simple-guides-to-google-earth-version-4/>
Version 3 at Digital Geography
<http://www.digitalgeography.co.uk/archives/2006/03/google-earth-visual-guide/>

Tokyo Earthquake⁶ (QED series) is a great introduction as well.

IMAGE: Earthquake freeway (public domain Wikipedia)



(2) I have prepared a page about building an earthquake shaking table here, which could make a good precursor, or follow-up activity.⁷

(3) Look at the real time seismograph displays produced by the USGS⁸ or real-time earthquake data on a virtual globe such as Earth Browser⁹, World Wind¹⁰ or Google Earth.¹¹ Incorporating one of these resources into the lesson will lend extra credibility.

(4) Use the video *Visualizing a Safer City Introduction* to create a sense of place. This is included on the CD.

⁶ BBC film Tokyo earthquake can be ordered via <http://www.bbcactive.com/BroadCastLearning/asp/catalogue/productdetail.asp?productcode=21714>

⁷ Juicy Geography Make a Shaker Maker <http://www.juicygeography.co.uk/shaker.htm>

⁸ USGS seismogram data <http://quake.usgs.gov/recent/helicorders/index.html>

⁹ Earth Browser Interactive Earth Globe <http://www.earthbrowser.com/>

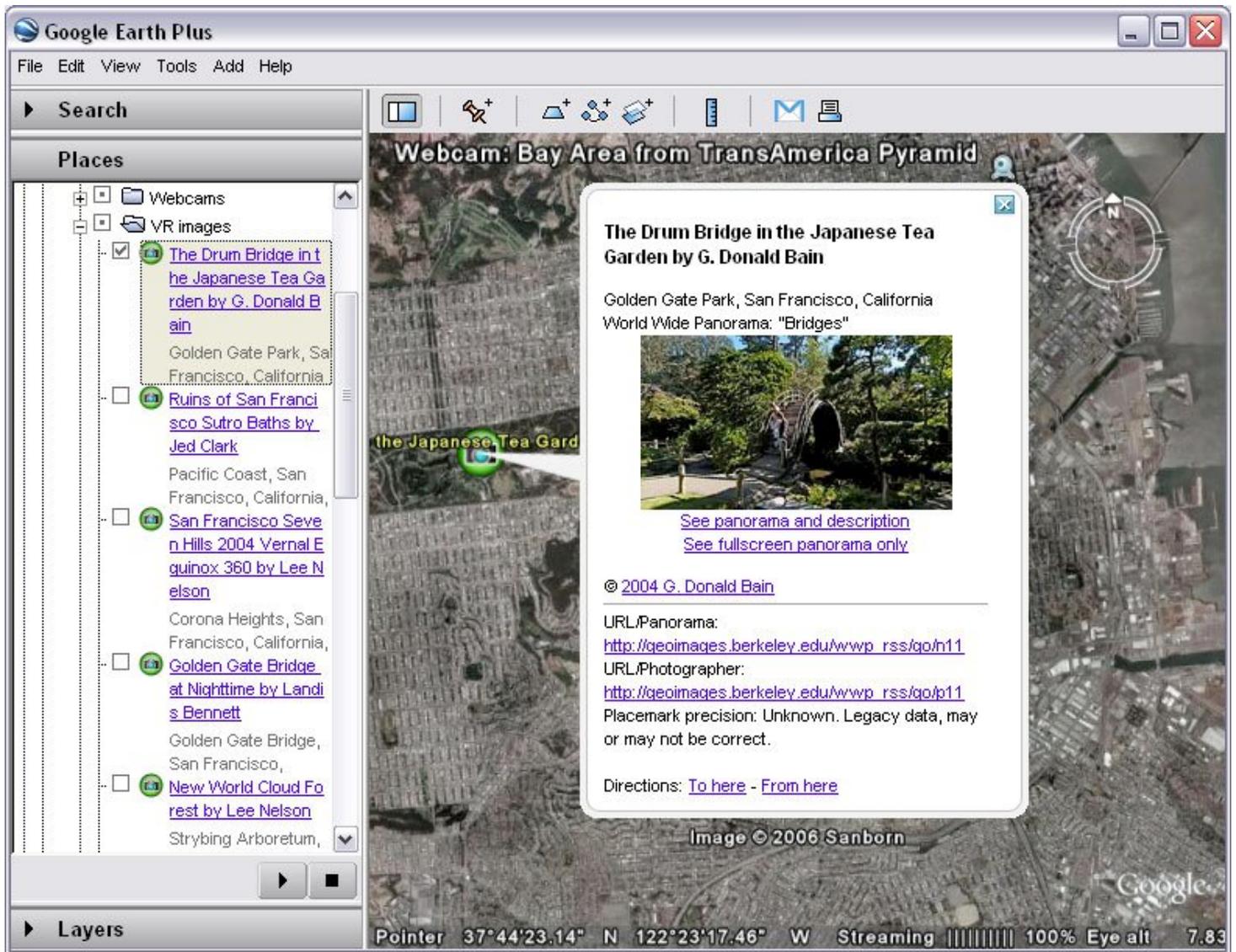
¹⁰ World Wind a virtual globe from NASA <http://worldwind.arc.nasa.gov/>

¹¹ Real time earthquakes network link for Google Earth published by the USGS <http://earthquake.usgs.gov/regional/nca/virtualtour/global.php>

Introduction to the Google Earth files

Clicking on the San Francisco project folder zooms the Google Earth window to an overview of the Bay Area. I recommend allowing students to spend time exploring the city using the panoramas and webcams, together with features such as the 3D buildings and terrain from the Layers window.

Image: web cams and images screenshot



Students should be guided to look at each of the project layers in turn, possibly starting with the one showing the Bay Area faults. This can be zoomed out considerably, in order to show the situation of San Francisco in relation to the major California fault zones.

The map showing underlying geology and shaking potential should be examined in conjunction with the very detailed layers showing the areas at risk of liquefaction and landslides.

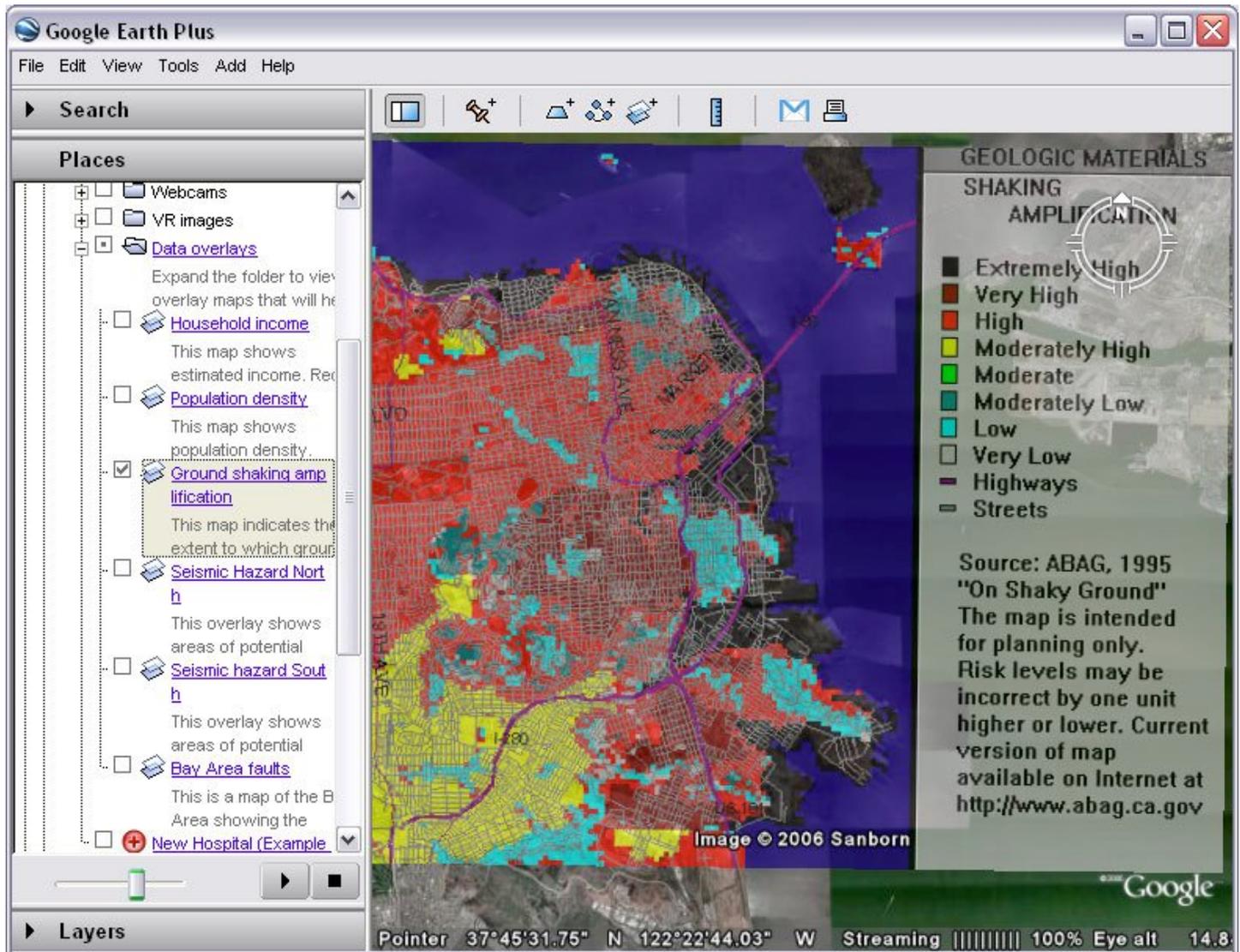


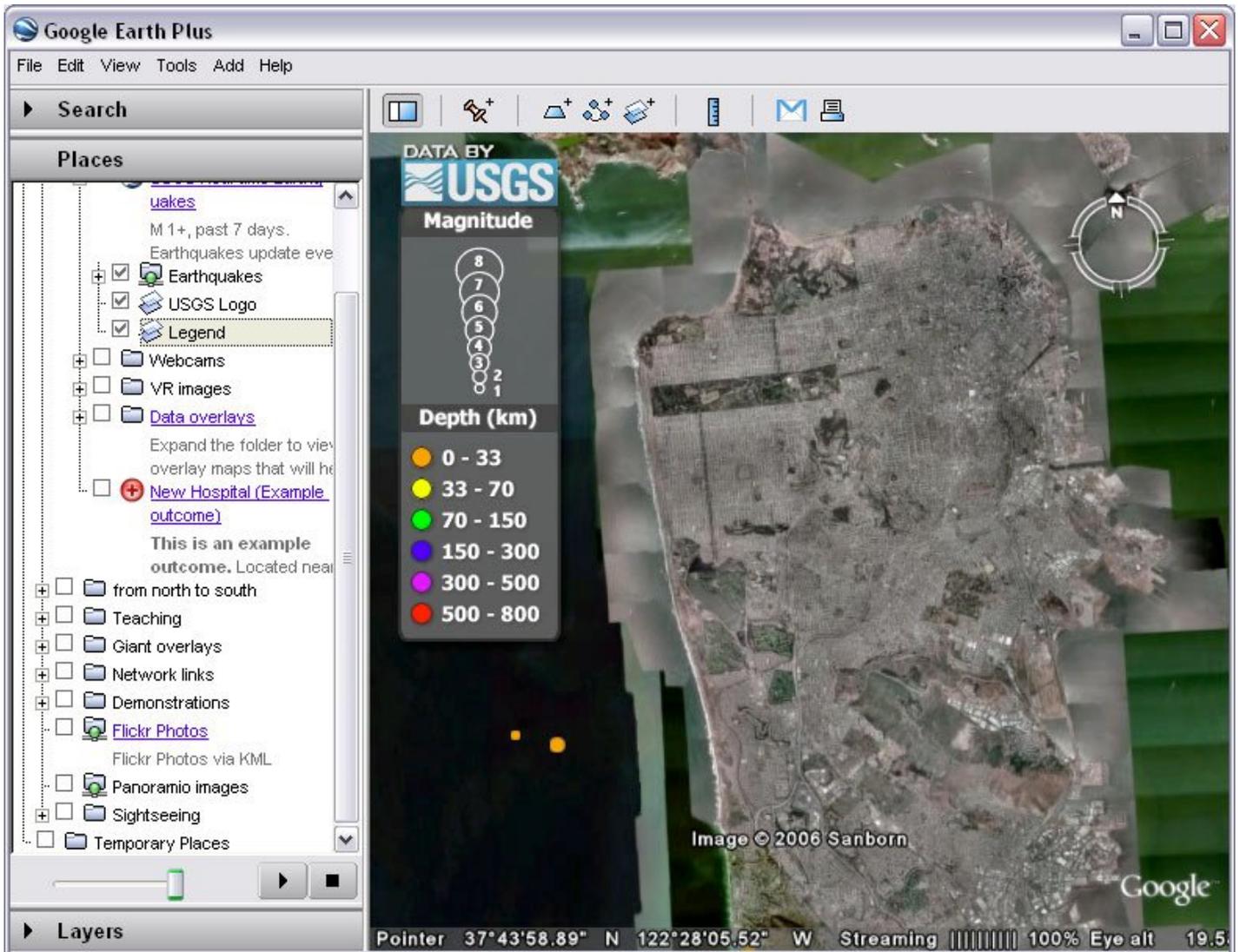
Image: ground shaking screenshot

The slider widget that varies the transparency of overlays is a crucial function!

The teacher should demonstrate this, as well as the technique for turning layers on and off.

There is a dynamic network link to the locations of recent earthquakes which might correlate well with the Bay Area faults map.

Image: Real time earthquake network link



Students also need to understand how to make use of the data from the Layers panel within Google Earth.

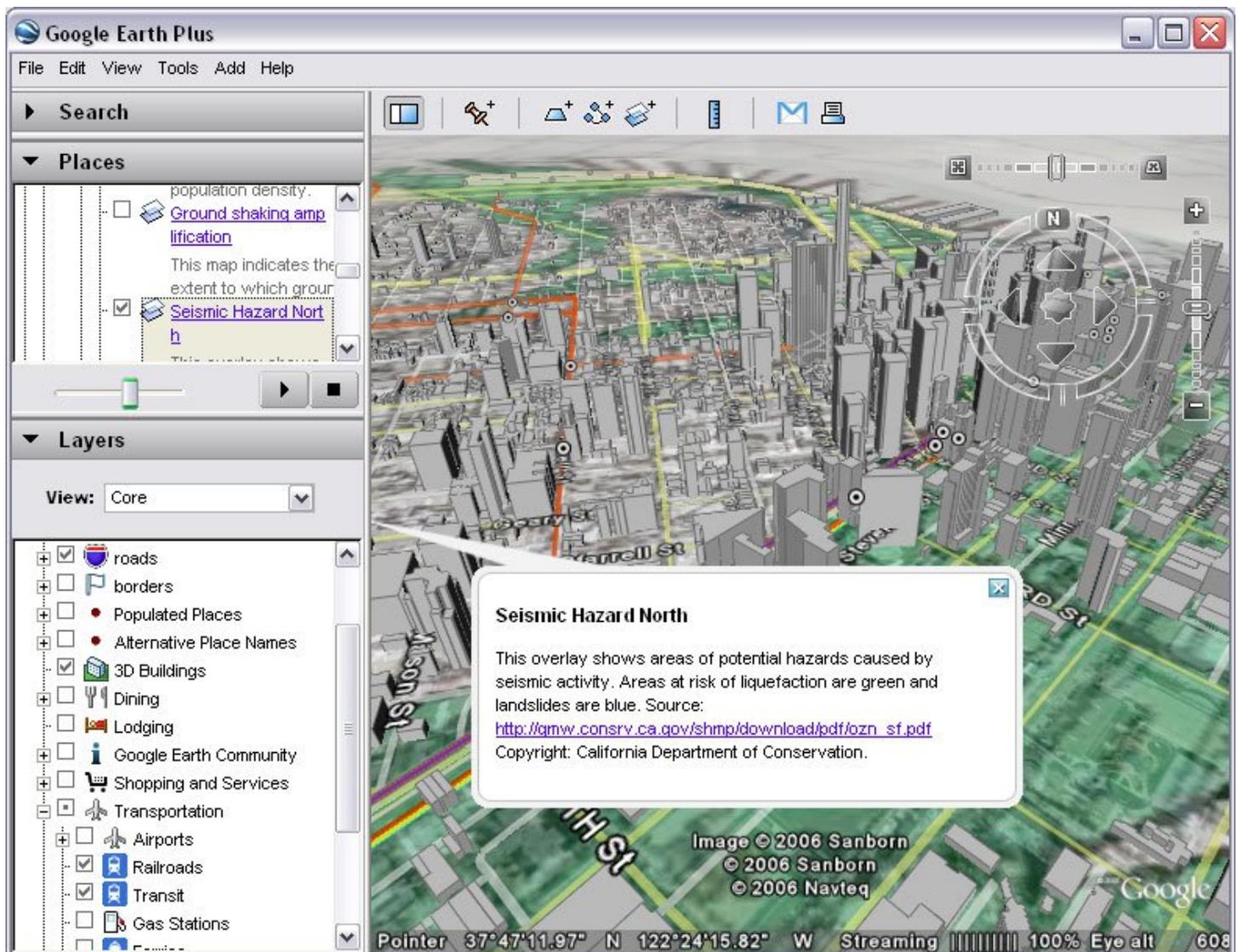
A tutorial with flash animations is available from Juicy Geography to demonstrate the project file.¹²

¹² Juicy Geography Flash based tutorial <http://www.juicygeography.co.uk/sanfran%20tutorial.htm>

The task: Visualizing a Safer City

The students could then be directed to think about the requirements for a new hospital building. They can locate existing hospitals by activating the appropriate layer in Google Earth, and consider what other information might be relevant, for example population density and infrastructure such as roads and rail. They consider the risk from seismically-induced hazards and if they have access to a Pro version of Google Earth, they could draw simple polygons to identify and annotate areas of the city that would be suitable for the new hospital. With the free version, annotated placemarks are just as effective.

Image: seismic hazards and data from layers



Extension and independent study

The task can be extended to challenge the whole ability range. Students could be asked to locate a variety of other features with different location requirements, for example a new sports stadium, or residential area with carefully annotated placemarks. The placemarks, and the text descriptions accompanying them, can form the basis for an assessment.

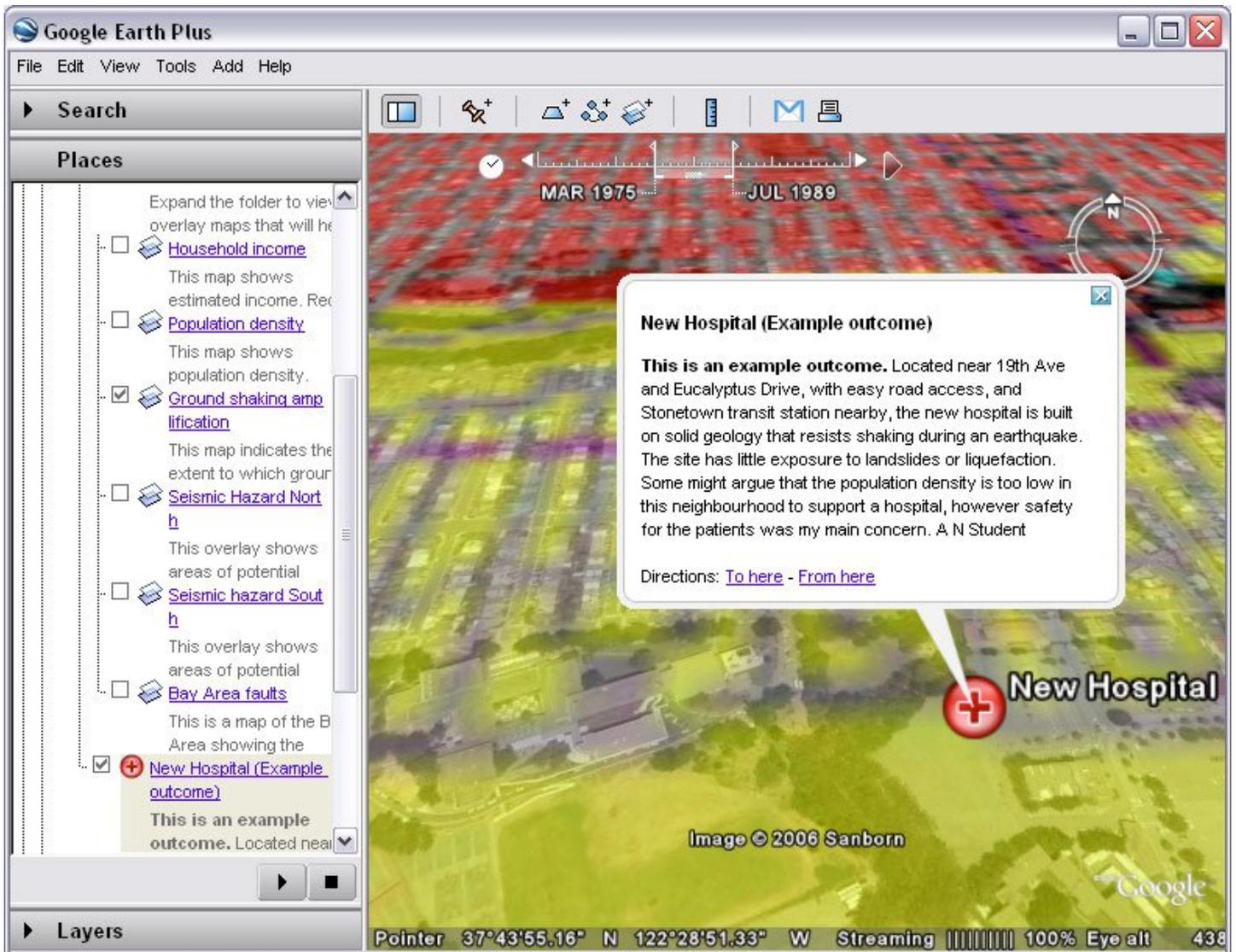


IMAGE outcome screenshot

Using the drawing tools in the Google Earth Plus/Pro, they can design and locate features using the drawing tools, for example new roads or railways, and as I show on the Digital Geography blog, ambitious visions of 3D buildings can be realized

with software such as SketchUp¹³, or buildings could be downloaded from 3D Warehouse and added to Google Earth.¹⁴ Some students might progress to the stage where they add their own overlays, for example a map to show the risk from dam inundation.¹⁵

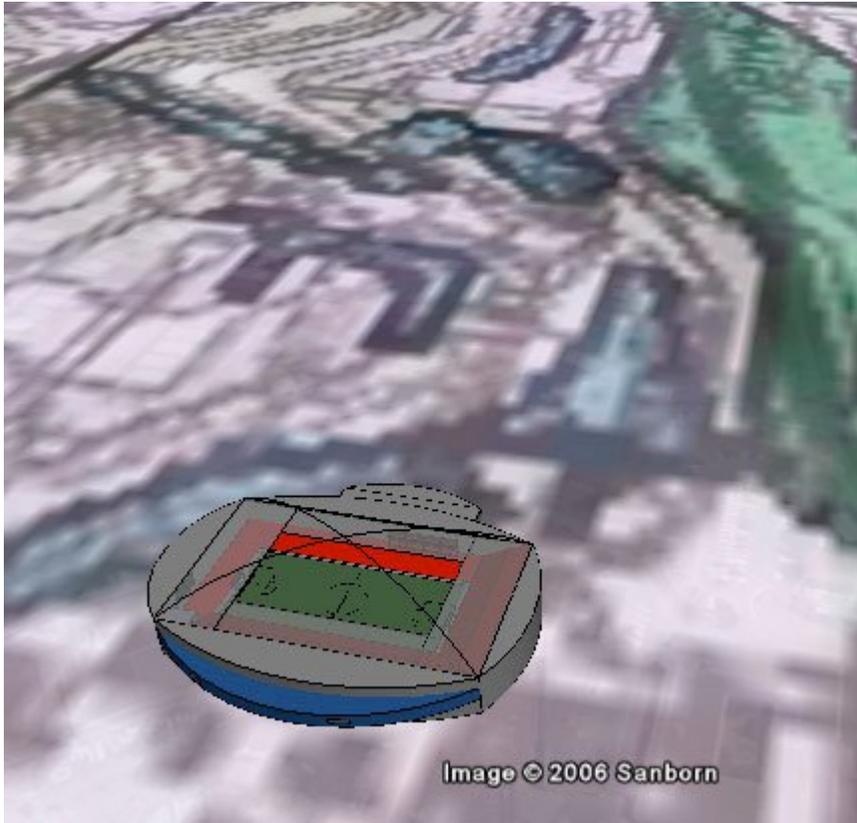


IMAGE: 3d building screenshot

Assessment

Students should be taught to manage and save their work using Google Earth's My Places folder structure. It is a simple matter to save work in progress, including any new polygons or placemark information in a new folder which can then be exported from My Places to another location, for example My Documents, or to removable media for homework.

Peer assessment can be usefully employed once the task is complete, especially if a digital projector is available. Groups can present their plans to the rest of the class

¹³ SketchUp software <http://www.sketchup.com/>

¹⁴ Digital Geography Using 3D Warehouse in the classroom
<http://www.digitalgeography.co.uk/archives/2006/08/using-3d-warehouse-in-the-classroom-short-notes/>

¹⁵ Bay Area Dam Failure Inundation Maps
<http://www.abag.ca.gov/bayarea/eqmaps/damfailure/dfpickc.html>

and the teacher may wish to explore the possibilities for role-play.

Conclusion

Visualizing a Safer City offers students the opportunity to understand the principles behind GIS. The visual nature of the activity appeals to all types of learners and the students will appreciate that city planners in San Francisco will be doing an identical task using similar data sets. The task demonstrates the extraordinary potential of applications such as Google Earth to achieve real and meaningful outcomes without the “tech subverting the teach”

Resources:

The task:

The San Francisco project file can be downloaded here (about 2.7mb)

<http://www.juicygeography.co.uk/googleearthsanfran.htm>

The USGS has just published a superb new resource on the earthquake hazard in San Francisco. A wide range of data is available as Google Earth files, some of these complement, or even replace the files included in the project folder.

<http://earthquake.usgs.gov/regional/nca/virtualtour/global.php>

San Francisco:

San Francisco Chronicle earthquakes page

<http://www.sfgate.com/earthquakes/>

San Francisco Virtual Reality panoramas from Zurdo Go

<http://www.zurdogo.com/panos/index.html>

Google Earth in the classroom:

Juicy Geography has a geography teacher's guide to Google Earth

<http://www.juicygeography.co.uk/googleearth.htm>

Alan Parkinson has produced a comprehensive Users Guide on his Geography

Pages site <http://www.geographypages.co.uk/googleearth.htm>

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