

Creating Geological Field Trips with the Google Earth Creation Tools

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Abstract

Streetcar2Subduction (<https://www.agu.org/streetcar2subduction>) was launched in December 2019 as a digital update and extension of the timeless 1984 classic field trip guide “Streetcar to Subduction” by Clyde Wahrhaftig¹. Supported by the American Geophysical Union, we were given early access to the Google Earth Creation Tools in order to build and launch several geology and tectonics field trips in the San Francisco Bay Area. In this contribution, we share some advice and suggestions for students and instructors building their own field trip guides in Google Earth Creation Tools.

Introduction

In 2019 Google launched a new set of content creation tools in the web browser version of Google Earth, supported by the Chrome browser only (other browsers won't work as of this writing). The content creation tools (www.earth.google.com) allow users with a Google account to use Google Earth and Streetview to describe a geographic location with text, photo, video media content, or lines and polygons draped onto Google Earth. We used these tools to develop a set of geological field trips centered on the San Francisco Bay Area, the “Streetcar 2 Subduction” field trips (<https://www.agu.org/streetcar2subduction>). Developed in collaboration with the American Geophysical Union, these field trips were intended to be used by geoscientists and the general public as an introductory guide to the geology of the site by highlighting and explaining some of the special geological features of the area. This document is a brief instruction manual for creating geological field trips in Google Earth using the creation tools. We also include suggestions for best practices based on lessons learned during production of the Streetcar 2 Subduction suite of trips. This project was inspired by, and many of the trips adapted from, Clyde Wahrhaftig's wonderful 1984 field trip guide of the same name. To find out more about Clyde, read this article in EOS: <https://eos.org/articles/the-layered->

¹ Wahrhaftig, Clyde. *A streetcar to subduction and other plate tectonic trips by public transport in San Francisco*. American Geophysical Union, 1984.

[legacy-of-clyde-wahrhaftig](https://agupubs.onlinelibrary.wiley.com/doi/book/10.1029/SP022). The original is paywalled but available through AGU publications: <https://agupubs.onlinelibrary.wiley.com/doi/book/10.1029/SP022>.²

This document is meant for learners and teachers of geology who want to create a field trip guide somewhat similar to ours – but we think our instructions should be easy to adapt for other subjects as well. There are many online resources for use of the Creation Tools (and they will likely be updated with time), which are a better source for technical support, but please do feel free to contact us with questions about Streetcar2Subduction and the design choices we made along the way.

Getting started: what you should know before you start Creation Tools

The Google Earth Creation Tools can be used to create one or more “projects”, which can encompass multiple places. We created one project for each trip. Projects contain features, which can take several forms (e.g. pins), but are associated with a specific position in Google Earth. In the following, we refer to projects as “trips” because that is what we were building.

One of the primary considerations for any trip is the intended audience. This is important for two aspects of trip creation. First, the technical content of the text, photo annotations, and video should be created with the audience in mind (e.g., using appropriate levels of technical jargon, highlighting relevant features for topics of interest). Second, users can interact with the trips either by browsing Google Earth from a desktop computer or by downloading or streaming the trip onto a mobile device and using the device’s location services to navigate from feature to feature in the field. Accessibility may therefore be an issue if the trip is created with the goal of users working in the field. Formatting the features for small screens rather than desktop computer monitors should also be prioritized (more details below).

Things to consider:

- What is the objective of the trip?
 - Is it a general guide?
 - Or a teaching resource with specific learning objectives?
- What is your “route” through the geology? – e.g., will it be linear through the stratigraphy (pedagogical) vs. logistical (shortest distance between outcrops, thus minimizing walking back and forth). This may affect where you choose to introduce supporting information, explain jargon, etc.
- If you are doing a set of field trips, as we did, you may wish to consider the perspective of users that would do only one trip vs. users that would view several trips. It is not currently possible to overlap trips (e.g. use one stop in multiple trips) or to combine stops that are in different trips.

If your project is a group effort, we recommend collaborative work on a trip in a Google doc or similar prior to visiting locations or creating content in Google Earth (see Appendices at the end

² If you can’t access the original Streetcar to Subduction field trip guide, email Christie.rowe@mcgill.ca and ask her to email the pdf. She has convinced herself that Clyde would not have wanted it to be paywalled.

of this document). This is a useful way to share ideas, choose formatting and style, and standardize the language/approach/theme. If edits are made to text and other content in the Creation Tools, previous versions are overwritten (lost) so an independent repository for content is useful, especially one with word counter, commenting, etc.

Explanatory Text worked best when focused on one learning objective for each feature. As a rough guide, we found that around 150 words is a good limit for the text accompanying each feature to fit on the screen and to keep users focused. We defaulted to the “large info box” format, for its greater capacity for supplementary text and imagery and because it is better suited to screens of mobile devices.

Media can include a video hosted on YouTube or a gallery of photos. Images in the image gallery are static (gif animations do not work). YouTube videos appear as a still “screenshot” which then will launch the actual video fullscreen once clicked. Media such as 3D models or gigapixel panoramas that can be embedded in other websites will not work in the media space of a Google Earth project, though the project/trip author can provide links to those resources (*i.e.*, the link would open in a separate tab or in the web browser on a phone).

Geological maps cannot be embedded (as kml). It is currently impossible to import an existing kml/kmz into the creation tools environment. As an alternative, an overview could be created separately and hosted elsewhere on the web. We created polygons and polylines in some of our tours that approximated the more precise shapes from published geologic maps but these are time consuming to make and can suffer from display issues.

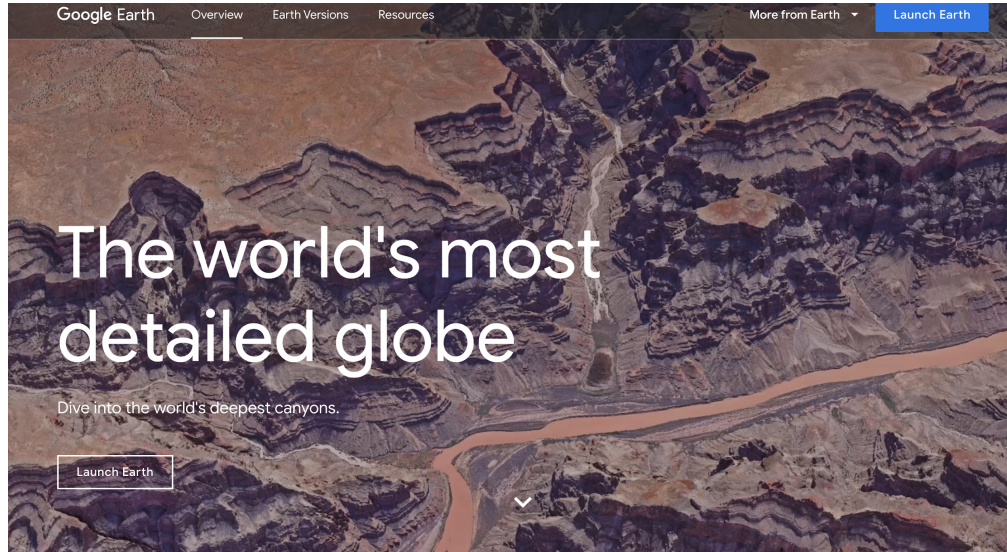
Cross sections (or any diagram with a high aspect ratio) are difficult to view in the media gallery, particularly because the screens are small on hand-held devices.

Links to external sites can be included. Wikipedia is a great resource. Wikipedia articles could be improved as a project in parallel to creation of new trips.

Storage of content in Google Drive or the cloud is required. You will want to store all files, images, media in one location for accessibility, especially if multiple instructors are working on content for a trip.

How it works

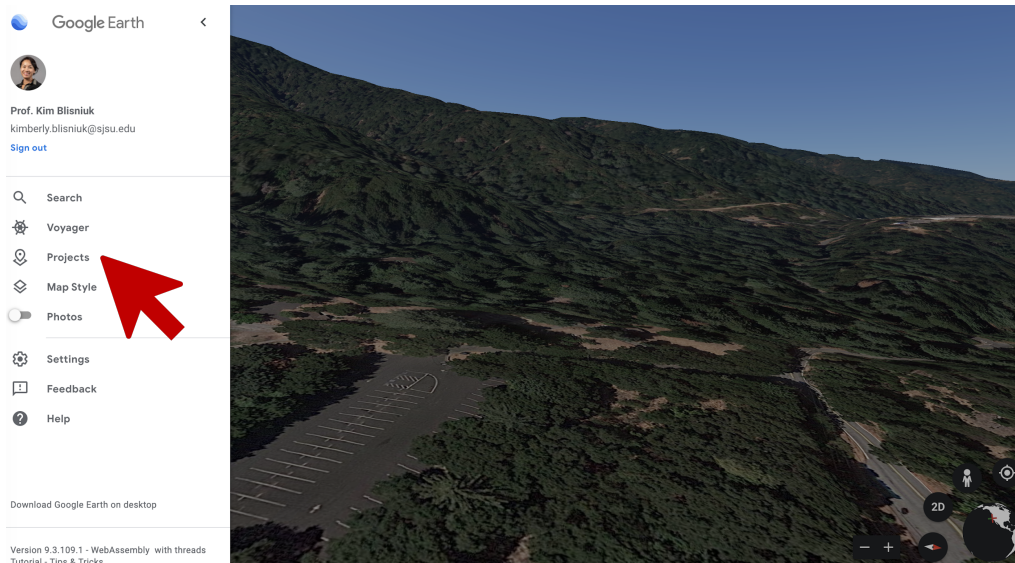
The creation tools can be found at: Earth.google.com, click on **launch Earth** (make sure to sign out of chrome and/or into the google account where media is stored)



On the Smartphone, use the Google Earth app.

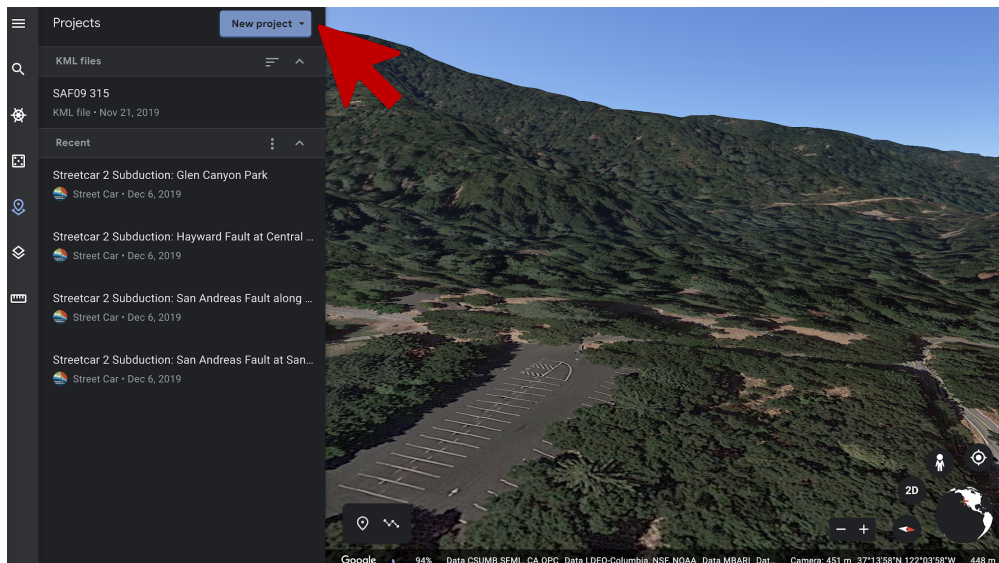
If you have access to more than one Google account, make sure you are logged into the one where you want the field trip to be saved. Since these tools are used in the Chrome browser, which also remembers your logins to Google, you may need to log out of one account on the web AND in the browser settings to log into the correct account. This is somewhat cumbersome.

Once Google Earth is launched, click on the menu bar and then click on Projects.

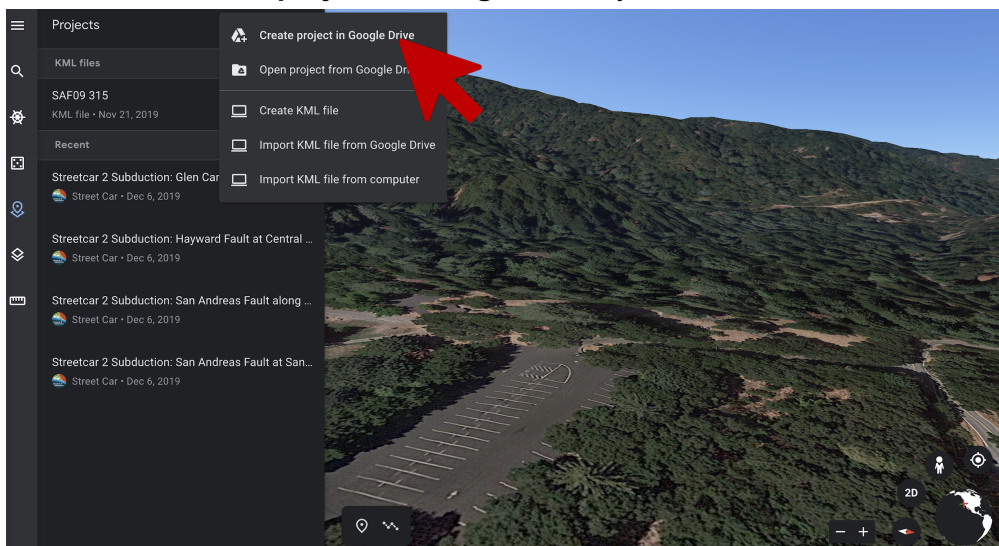


The Projects tab is on the left menu bar => once in the Projects menu, go to **New project**. It is important when creating a project to select “project” and **NOT** the traditional KMZ/KML file

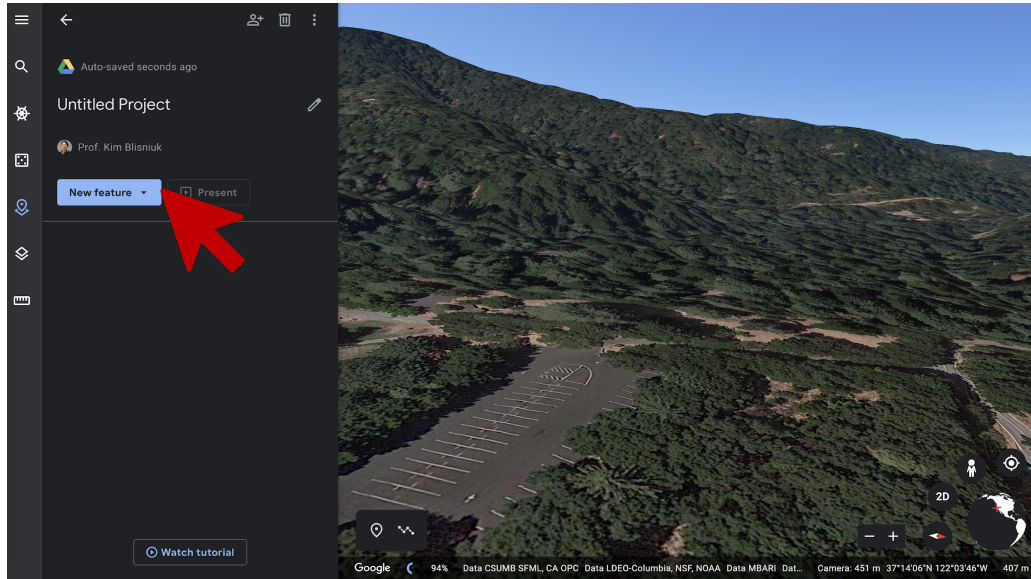
option. (Traditional KMZ/KML files work fine in desktop Google Earth, but are not sharable in browser-based Google Earth.)



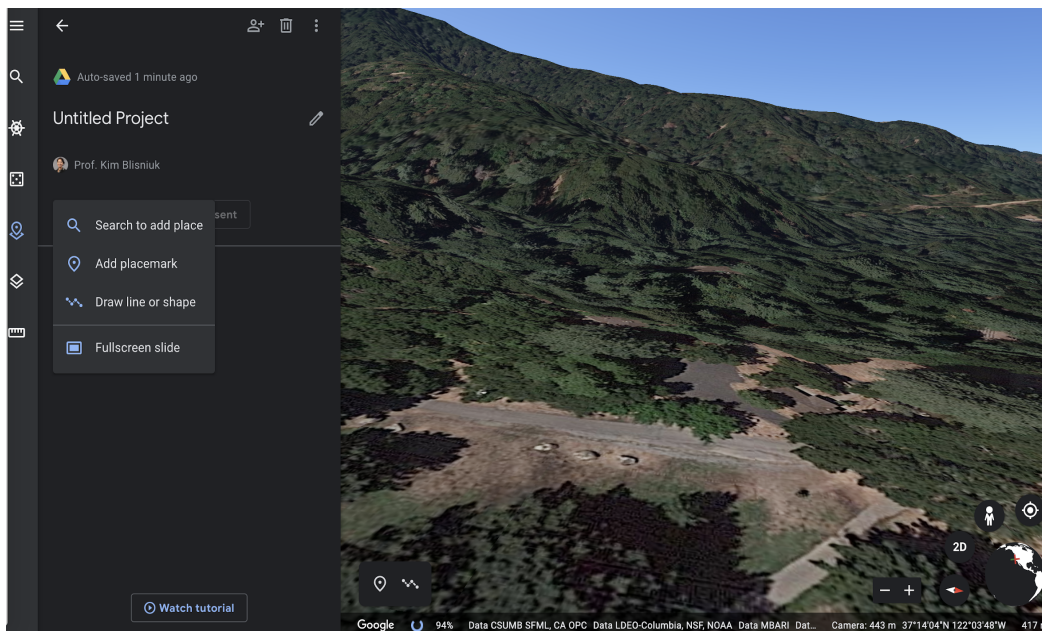
The click on **Create project in Google Drive** in Google Drive, you'll enter the creation tools.



Provide a **title and brief description**. There's a link to a short video tutorial at the bottom of the menu.



Create a new feature by searching or navigating to a place of interest. Click ‘add new feature.’ You will need to decide your preference for the feature, you may want to add a placemark, a line, a polygon, slide etc.



Add and create as many features for your trip. You can always go back to edit these features by clicking on the pencil next to the Project name.

Features are listed in a table of contents (they can be reordered). The presentation mode in Google Earth progresses from one feature to the next in the order they are listed on the table of contents. Trips with different themes in the same area could be shown with different symbols or symbol colors, but probably creating multiple separate trips (separate Google Earth projects)

might be the best solution. The TOC can be used to guide the user along a certain path, but the user can skip to other features using the menu bar at the lower left, or explore the landscape.

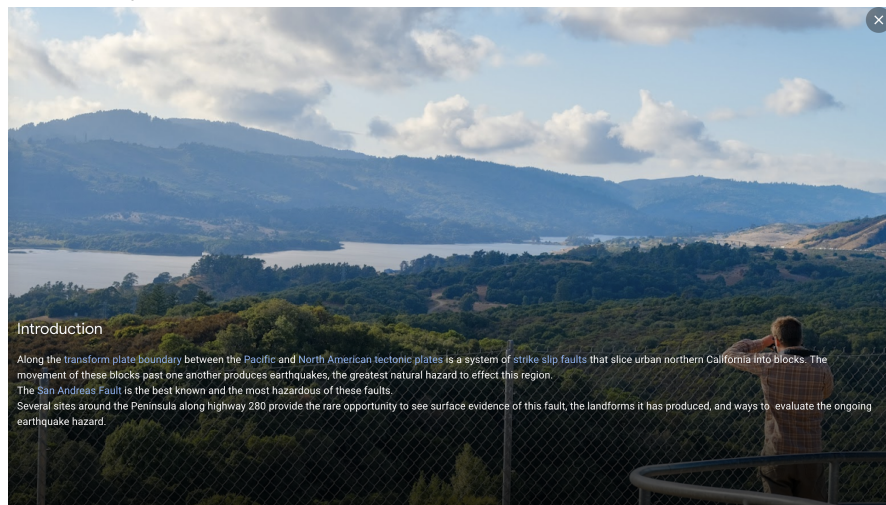
Everything is saved as you work. There is no need to hit “save” or backup anything (it's on the cloud). Everything is saved in google drive.

Google creates a Google Earth folder in the home directory of the Google account used to create content. Trips, including media and text content, are saved in a proprietary format that as far as we know is only opened by Google Earth, and are automatically backed up to that folder. The kml files can be accessed here and exported for sharing.

The trips are set as “private” so that only you are able to view them. Before releasing your new trip to a wider audience, **check** the presentation on a desktop computer screen, on a cell phone and on a tablet screen to make sure there are no formatting issues. Consider seeking a round of critique/feedback from trusted colleagues too, to make sure there is good flow and no technical issues. When you are ready, you can set the project to “visible” and generate a link to send to viewers or post on a website. The small person+ icon will allow you to share only to specified google accounts, or to get a link that allows anybody to view the trip.

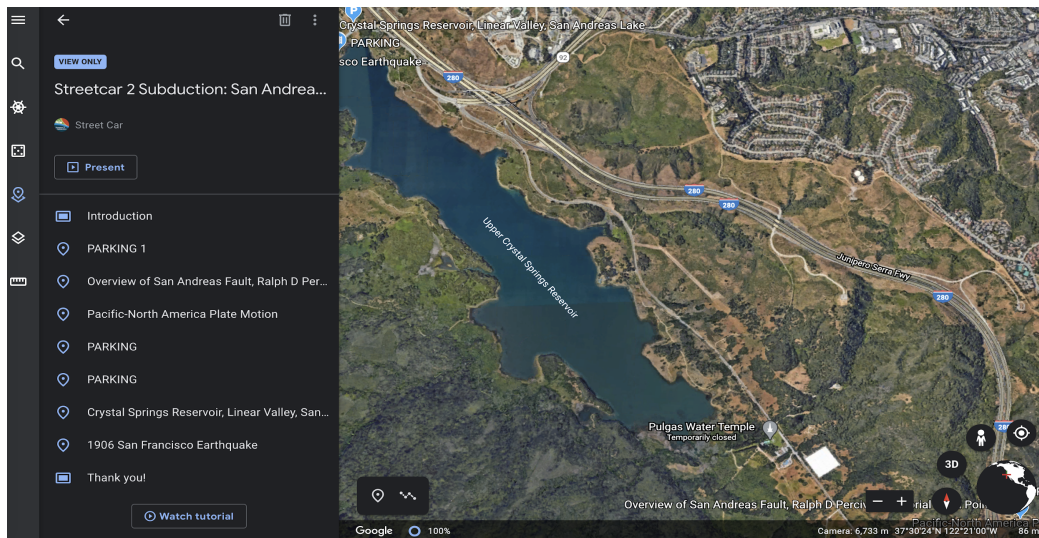
Designing a trip

In Streetcar 2 Subduction, we defaulted to our first feature in each trip being a full screen slide with a brief introduction. Choose a photo with a relatively homogenous region at the bottom where the text will overly the picture.



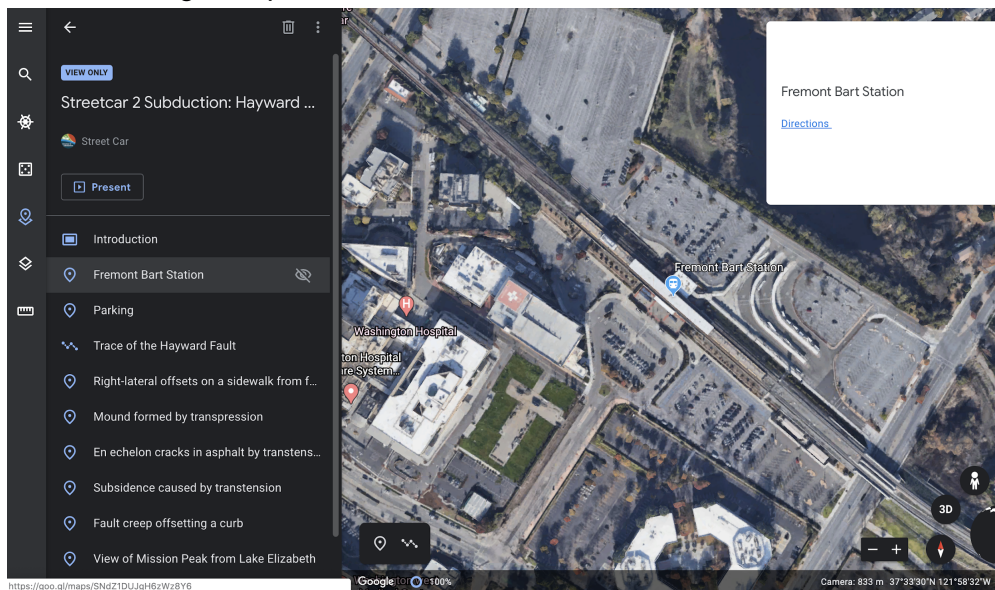
This is a “Welcome” feature that lists things to know before you go. Safety, logistical, permission issues can be summarized here to inform the user. For example, coastal trips should include links to tide tables.

The next location we chose was a stop for logistics (access by road or public transport, parking options, *etc.*).



You may drag and drop to re-order the stops. Use the **Present** button to view the trip, as your users will see it.

Static links to the location of the first feature in Google Maps can be embedded so that users can use the link to navigate to the first feature location. In other words, they click on the link in Google Earth, and it launches the Google Map app with the usual navigation/directions options. For instance in the screen below a static link to The Fremont Bart Station was provided that takes the “user” to Google Maps.

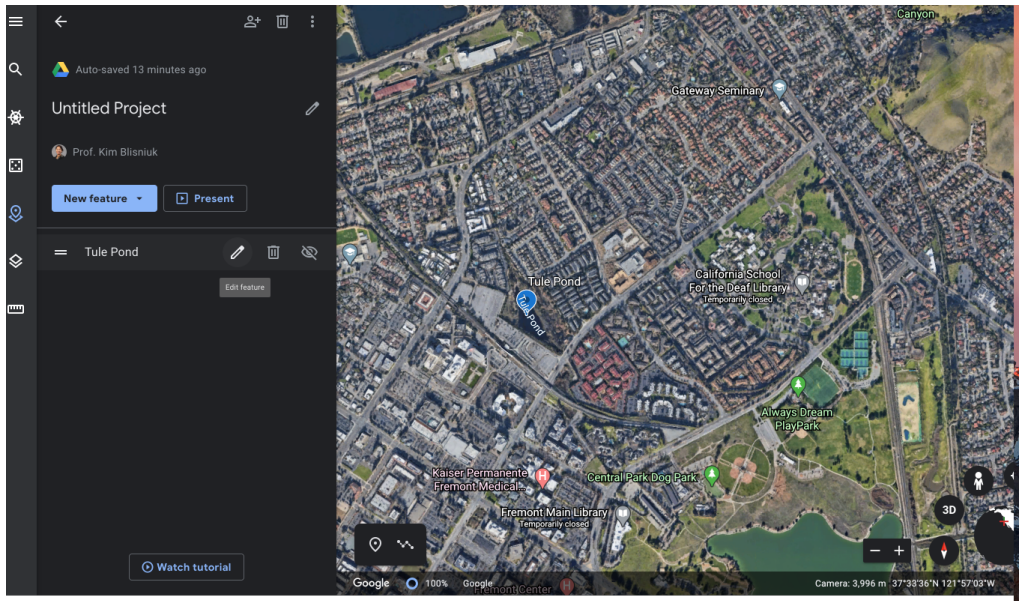


Setting up a feature:

New feature button offers you:

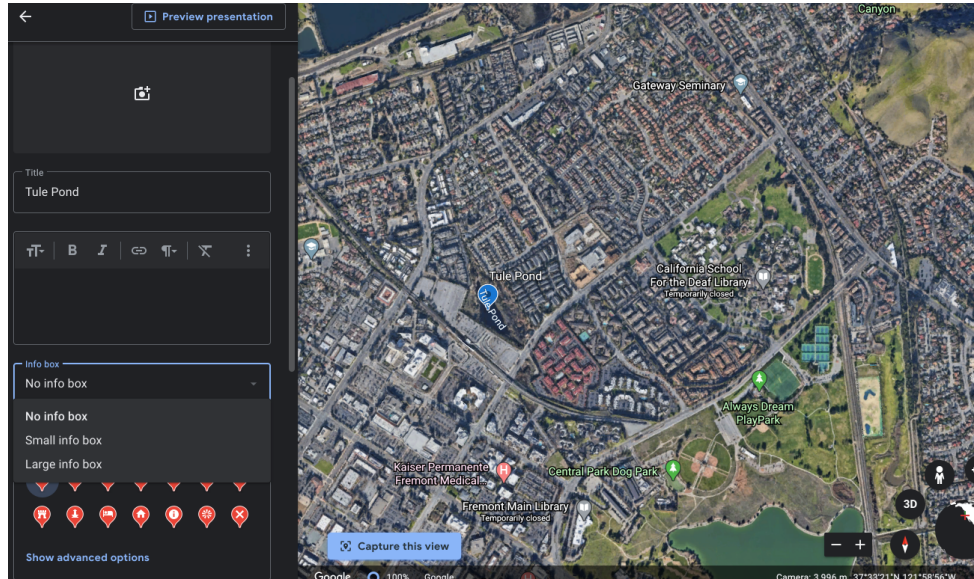
- Search to add place

- Add placemark (just navigate to your preferred view in the big window and click to place the placemark). Once the feature is added, you may edit the feature by clicking on the feature and the pencil to edit



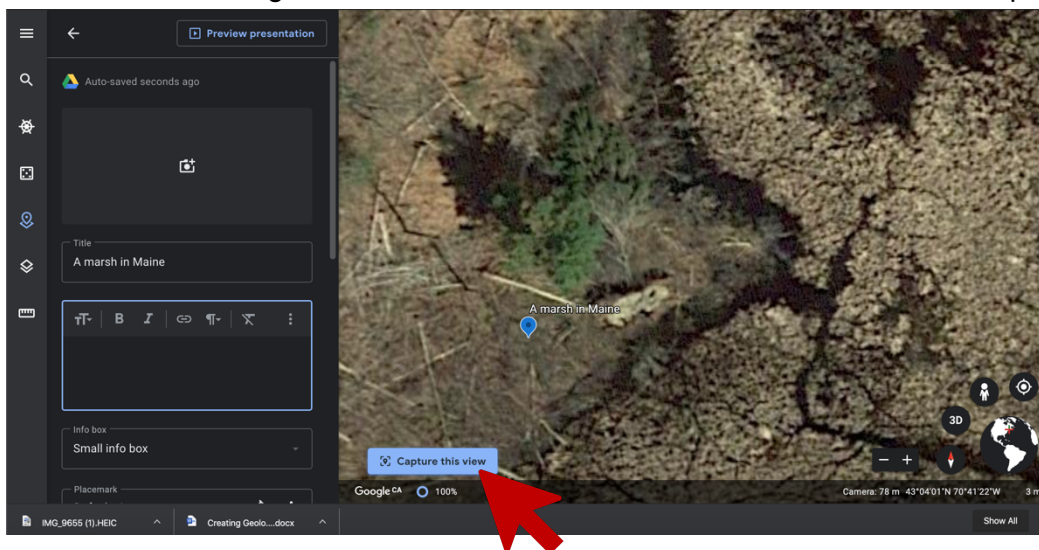
To add Text, you have three options:

1. **No info box** – just shows the location in google earth or Google StreetView imagery (ground level 360° spherical photo w/ navigation arrows; integrated with Google Maps).
2. **Small info box** – small box hovers over the Google Earth or Google StreetView imagery
3. **Large info box** – right portion of the screen dedicated to text and images. We used this option the most frequently because it worked best on a cell phone screen. (We used the “small info box” for logistical information, as a way of making it visually distinct from the geological content.)

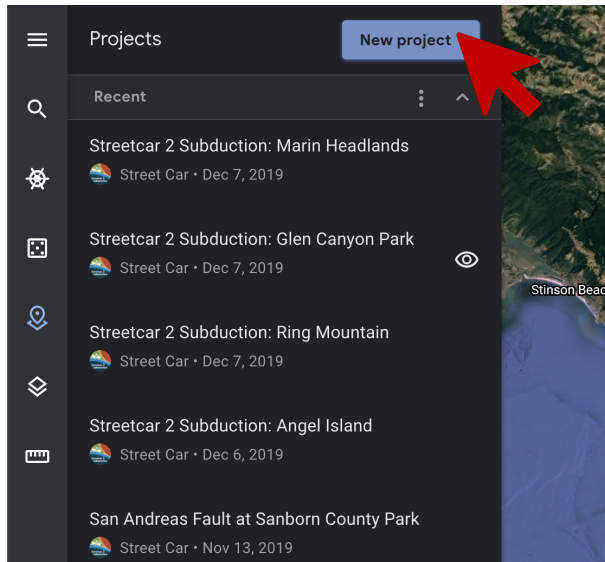


- Draw line or shape (click to draw line or outline shape). A major limitation with lines and shapes is that each feature (as listed in the TOC) can only have one line or polygon. There is no way to upload data or display a draped geologic map etc. There are several awkward work-arounds in Streetcar2Subduction trips, for example, the two klippe of serpentinized peridotite on Ring Mountain are in two successive features instead of being combined as one polygon. You can decide whether your line/polygon will be always visible, or only while the user is viewing that particular stop.
- Fullscreen slide (you upload a photo or find one on your google drive or the web, add text over it). There isn't much control of photo transparency or anything so images should be prepared before uploading to the project to make sure that text will be clear.

The initial view (that Google Earth “flies” to) when someone clicks the feature is set with the “Set view” controls. Rotate Google Earth to the desired view, then make sure to click “Capture this



view” at lower left of the Google Earth screen. Photospheres can be created by users then uploaded in google’s StreetView app, then used as the initial view.



When you come back to work on your previously created “projects”, launch earth.google.com, make sure that you are logged in with the google account you used to create the project, and click on the fourth icon on the menu (placemark on a map sort of icon, see below). The recently edited projects show up, you can also click on the New Project button to open a different (screengrab of menu at left) project from your google drive. Here you can also toggle projects to “visible” or “invisible” by clicking the Eye icon next to their names. “Invisible” projects cannot be loaded except by viewers logged into the google account that created them. Once you load a project, you can also export the whole thing as a kml file via the

three dots at the upper right of the menu bar.

Creating media in the field

Preparing for shooting videos

Videos are content-rich and engage users in a different way to photos. However, a challenge with video is that it may tax a user’s streaming data allotment for phone plans if viewing the field trip on a mobile device in the field (this isn’t an issue w/ a wi-fi connection or desktop tours.)

Video captured on a cell phone is high enough resolution for the media as it is ultimately hosted on youtube and downsized to a phone screen. Audio is more of a challenge and a small microphone, ideally with a wind baffle (a “fur cover” or “kitty” - it looks like a pom-pom) significantly improves the quality of the audio. Wind and wave noise can ruin otherwise top-notch video footage. Also, a gimbal that can hold a phone helps remove much of the wobble/shake that characterizes phone videos.

We recommend thinking through your videos in advance - “storyboarding” them so you know what shots you need when you get on-site. For instance:

“The video opens with our logo. Fade into Kim at the park entrance sign, saying where we are. She turns and walks to the boulder. Closer-up at the boulder, Kim on left hand of screen (upper torso and head) with boulder expanse making up right $\frac{2}{3}$ of screen. She explains cosmogenic isotopes. Halfway through the explanation, cut to a close-up of her hand running over the boulder’s surface. Back to the upper torso in front of boulder shot.

She ends the explanation with the teaser, “let’s go up the hill and find out!” Fade into new scene of hiking up the trail to the debris flow deposits. Close up of Kim describing debris flows and explaining their source area. Cut to closing image/credits.”

Editing and post-production is time consuming (and expensive if outsourced to a professional).

Interview-style videos are best if the presenter uses minimal jargon or explains jargon as they go. The presenter can move around an outcrop but the camera needs to be stable to follow. Shoot several takes from different angles and perspectives; this gives the video editor more options.

The on-camera speaker should endeavor to allow themselves a pause of a second or so between sentences or “paragraphs” to make it easier for clean editing breaks.

Collect lots of photographs of the subject that you can use over audio, show more detail of what the speaker describes in the video, and to cover transitions in the video between clips. It is also useful to shoot “b-roll” video that can be spliced into the “interview” while the “interview” audio continues to break up the talking head, which can be a bit boring if watching for too long (e.g. different video clips for different perspectives, or for streetcar, broader views of the scene or geologists looking at rocks.)

We had standard “intro” and “outro” video that formed the ‘head’ and ‘tail’ of each video, giving the whole package an internal consistency despite variation in on-screen speakers and subject matter. Consider the scope of your project and what image/text you want to start and end each of the videos in your series.

Taking photos for Google Earth

Photos are best in **landscape** orientation in the large info box within a feature. The shape of the large info box will not change with a “portrait” orientation image, which creates a dead zone of wasted space on either side of the image.

If there is one feature of interest at a placemark, then photos with a range of magnification are useful to help a user on the ground get oriented and then focus in on the feature of interest. Photos can be annotated in a separate software (e.g., Notability, Google Drawing) then exported as a jpg at the same size and resolution as the original and posted adjacent in the photo browser gallery. Users are then able to move back and forth in the gallery to turn on and off the labels.

User experience

Whether on a computer or mobile device, users will click on a link that you provide them, which will launch Google Earth or open Earth in Chrome. It will default to an overview map showing locations of your features and your project title and introductory text. The user will have to click

the button that says “Present” to go to the first stop (or introductory slide if you have started with one).

Cell phones with location services enabled may show a blue dot in Google Earth app which is the location of the phone. Users can identify their location and move around on the ground by following the location of the blue dot (some have reported that they needed to relaunch app to refresh position within field trip). Be sure to try your field trip on a lot of different devices so you understand what users will see in the field or on their desktop.

For Streetcar2Subduction, we wanted our many trips to be part of a collection so we built a “launch page” on the AGU website (<https://www.agu.org/streetcar2subduction>) that includes contextual information and a brief description of all the trips.

Some Google Earth Creation Tools resources

- <https://www.blog.google/products/earth/new-google-earth-creation-tools/>
- <https://www.google.com/earth/education/tools/tour-builder/>
- <https://support.google.com/earth/thread/20601582?hl=en>

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APPENDIX A: Example of google doc used to record work progress and upcoming tasks for Metro@Monteregie (in prep for Montreal Area and greater Quebec)

Title of Field Trip - Project Log

Person Responsible

Other people involved with contact details

Instructions: Update the record as you make progress and modify the to-do list as necessary. This document will help keep all collaborators up-to-date and clear on what needs to be done next. Add things to Upcoming Tasks list and when they are done, move them to the Record of Progress.

Upcoming tasks:

1. Plan individual stops and decide on the order
2. Choose stops for video and outline content of video

3. Build list of photos needed for all stops
4. Access requests or drone photography permits needed?
5. Make list of contacts for experts/land owners etc.

Record of progress

February 5, 2020: Steering committee first meeting, designation of trips to build, assignment of some trips to individuals to take responsibility.

APPENDIX B: Example of Google Spreadsheet used to plan a field trip for Metro@Monteregie (in prep for Montreal Area and greater Quebec)

Trip title		Title of field trip
Person responsible		Your name
		Your email address
Other personnel	translation	person's name
	other job	person's name
	other job	person's name
Milestones	Feb 10, 2020	Start scripting field trip (person responsible's name)
	other date	other goals/thinks accomplished
	other date	
Splash Page	Title/Nom	TITLE OF FIELD TRIP (fr + en)
	Location	LAT/LONG OF PIN FOR STARTING TRIP
	Image	FILE NAME OF WALLPAPER IMAGE
	English	200 words (en) with introductory information about the trip, including weather and safety warnings, info about washrooms and food/water if it is a field trip. Include costs if any. Recommended transportation. Brief statement of what trip will cover.
	Français	250 words (fr) with introductory information about the trip, including weather and safety warnings, info about washrooms and food/water if it is a field trip. Include costs if any. Recommended transportation. Brief

		statement of what trip will cover.
Stop 1	Title	TITLE OF STOP
	Location	LAT/LONG OF PIN
	Type of pin	One photo+text? Photo Gallery? Google map image? or video?
	Media	name of image or media files, or links to online resources such as photospheres
	English	200 words (en) description of what to see at the stop, how it formed, supporting information etc.
	Français	250 words (fr) escription of what to see at the stop, how it formed, supporting information etc.
	Notes	
Stop 2	Title	TITLE OF STOP
	Location	LAT/LONG OF PIN
	Type of pin	One photo+text? Photo Gallery? Google map image? or video?
	Media	name of image or media files, or links to online resources such as photospheres
	English	200 words (en) description of what to see at the stop, how it formed, supporting information etc.
	Français	250 words (fr) escription of what to see at the stop, how it formed, supporting information etc.
	Notes	