Using Google Earth Pro (and GPS) Elevation Data for Road Race Course Verification

Presentation for Road Running Technical Council – 2020 USATF Annual Meeting
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Google Earth Pro Basics – What you see – Aerial Imagery Series of historical air photos
What you don't see – Underlying grid of elevation data DEM Digital Elevation Model
Original DEMs were digital conversion of USGS maps – with grids of 150, 75, and 25-meter grids.
Current DEMs are LIDAR based – logarithmic improvements –
Early LIDAR 1-meter grid – ground elevations
Present Day LIDAR – sub-meter grid – ground elevations + first surface elevations of trees and buildings = Google Earth 3D Buildings.

Quality of aerials and DEMs vary greatly throughout the world.
How to determine accuracy – zoom in and in an area that is not flat – move the cursor and see how far you have to move for the elevation to change. The elevation is listed at the bottom of the page.

Select Preferences from the Google Earth Pro tab on the top left – on the 3D View tab –
Units of Measurement → select *Meters Kilometers*
Terrain → Leave Elevation Exaggeration at 1 Check on both boxes *Use High Quality Terrain* and Use *3D Buildings*,

Start & Finish Elevations – zoon in a pan start and finish line area – if net difference is between 39 and 45m – switch to feel elevations and convert to meters.
GPS – let GPS warm up 3-5 minutes – avoid laying on ground use meter or yard stick to elevate – take at least 10 positions and average elevations.
Difference between actual elevation and relative elevation. GEOID Use same system for start and finish.

Course elevation profiles – elevation over distance. Bridges are biggest difference between older DEMs and LIDAR – and our current high end lidar.

Elevation readings every 100 meters – and crest and valley points between. Use a graphic program (Illustrator) rather than a graphing program (Excel).

Add other course attributes competitors will encounter – aid stations, turns, chip stations.