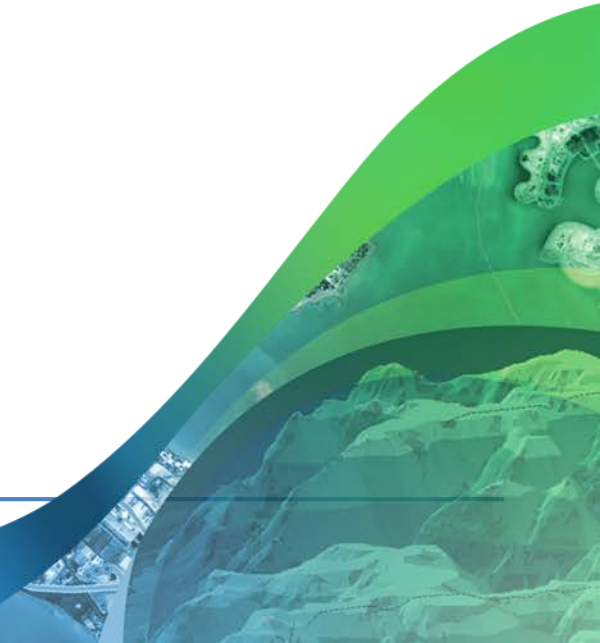

EARTH SC/ENVIR SC/GEOG 2GI3

Exercise 4: Overview

Dr. Darren M. Scott



Learning Objectives

- Learning how to georeference a satellite image
- Learning how to digitize and edit spatial features
- Learning how to incorporate GPS data into ArcMap

Details About Part A

- You are given the following shapefiles for McMaster campus:
 - CampusBuildings
 - RoadCurbs
- You are also given a satellite image of McMaster campus that has not been georeferenced

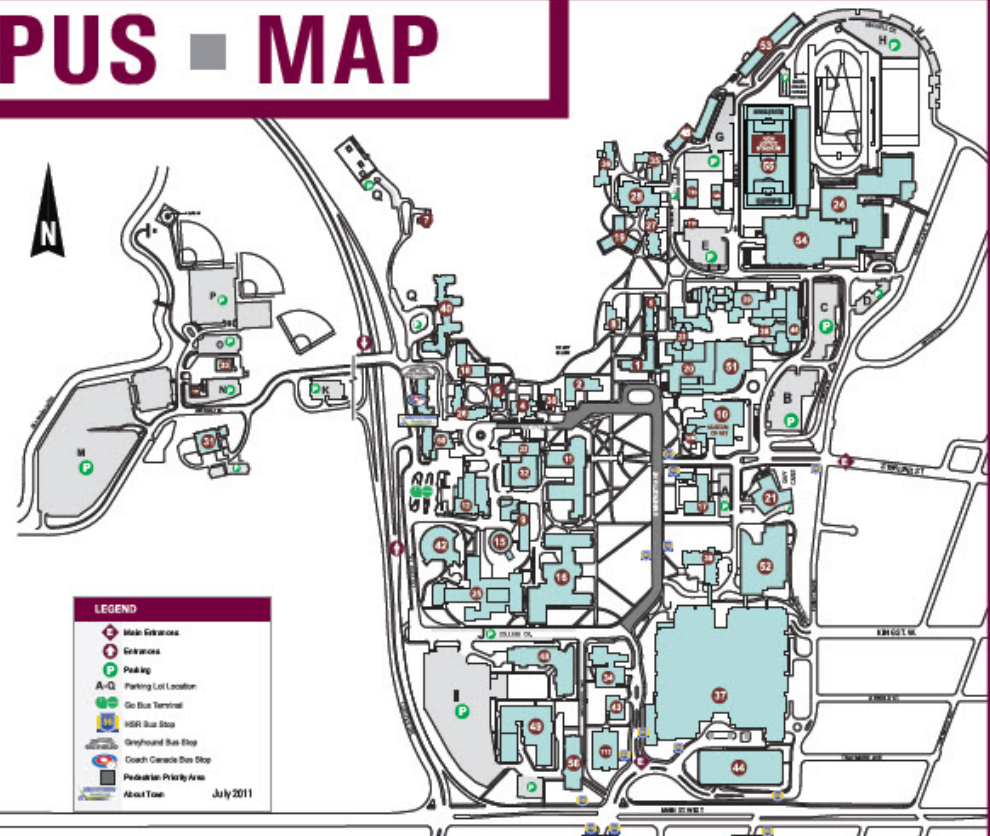
McMaster Campus Map



CAMPUS MAP

CAMPUS BUILDINGS INDEX

A.N. Burns Science Building (ABB)	25	Engineering Technology Building (ETB)	56	McMaster University Student Centre (MUSC)	51
Alumni House	7	General Sciences Building (GSB)	22	Michael G. DeGroote Centre for Learning and Discovery (MDCL)	52
Alumni Memorial Hall	8	Gilmour Hall (GH)	20	Mills Memorial Library Building (MML)	10
Applied Dynamics Laboratory (ADL)	33	H.B. Thode Library of Science & Engineering (TL)	42	McMaster Museum of Art (Alvin. A. Lee Building) (MMA)	10b
Bates Residence	40	Hamilton Hall (HH)	2	Moulton Hall	18
Biology Greenhouse	30	Health Sciences Centre (HSC)	37	Nuclear Reactor (REAC)	15
Brandon Hall	36	Health Sciences Centre Parking Structure	44	Nuclear Research Building (NRB)	9
Building T-13	T13	Hedden Hall	45	Psychology Building (PC)	34
Building T-18	T18	Information Technology Building (ITB)	49	Refectory	4
Building T-26	T26	Institute for Applied Health Sciences Building (IAHS)	46	Ron Joyce Stadium (RJS)	55
Building T-28	T28	Ivor Wynne Centre (IWC)	24	Tandem Accelerator Building (TA)	32
Building T-29	T29	John Hodgins Engineering Building (JHE)	16	Togo Salmon Hall (TSH)	29
Burke Science Building (BSB)	11	Kenneth Taylor Hall (KTH)	38	University Hall (UH)	1
Campus Services Building (CSB)	31	Lee Prince Hall	53	Wallingford Hall	6
Chester New Hall (CNH)	23	Life Sciences Building (LS)	39	Wentworth House (WH)	21
Commons Building (C)	28	Mary E. Keyes Residence (MEK)	50	Whidden Hall	19
Communications Research Laboratory (CRL)	43	Matthews Hall	26	Woodstock Hall	35
David Bailey Athletic Centre (DBAC)	54	McKay Hall	27		
DeGroote School of Business (DSB)	46				
Divinity College	17				
E.T. Clarke Centre (CUC)	12				
Edwards Hall	5				

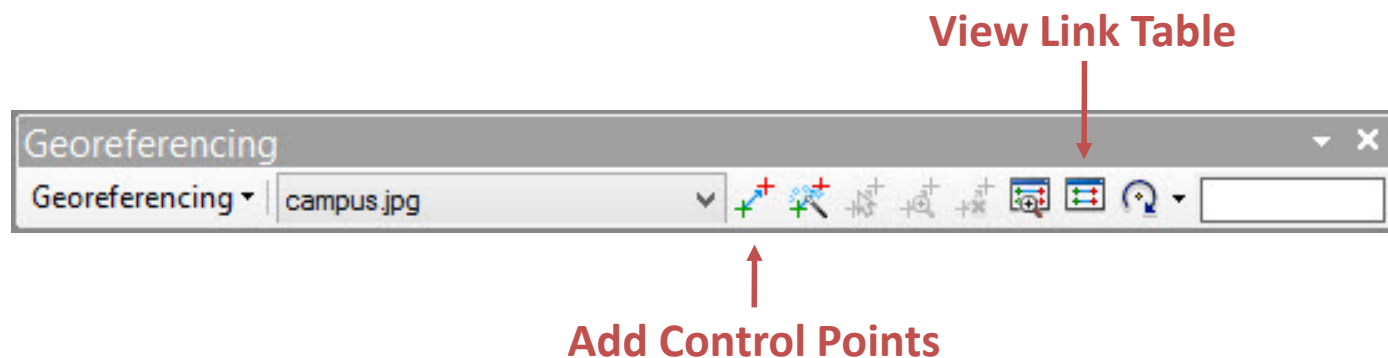


Satellite Image of McMaster Campus



Georeferencing: Major Steps (1)

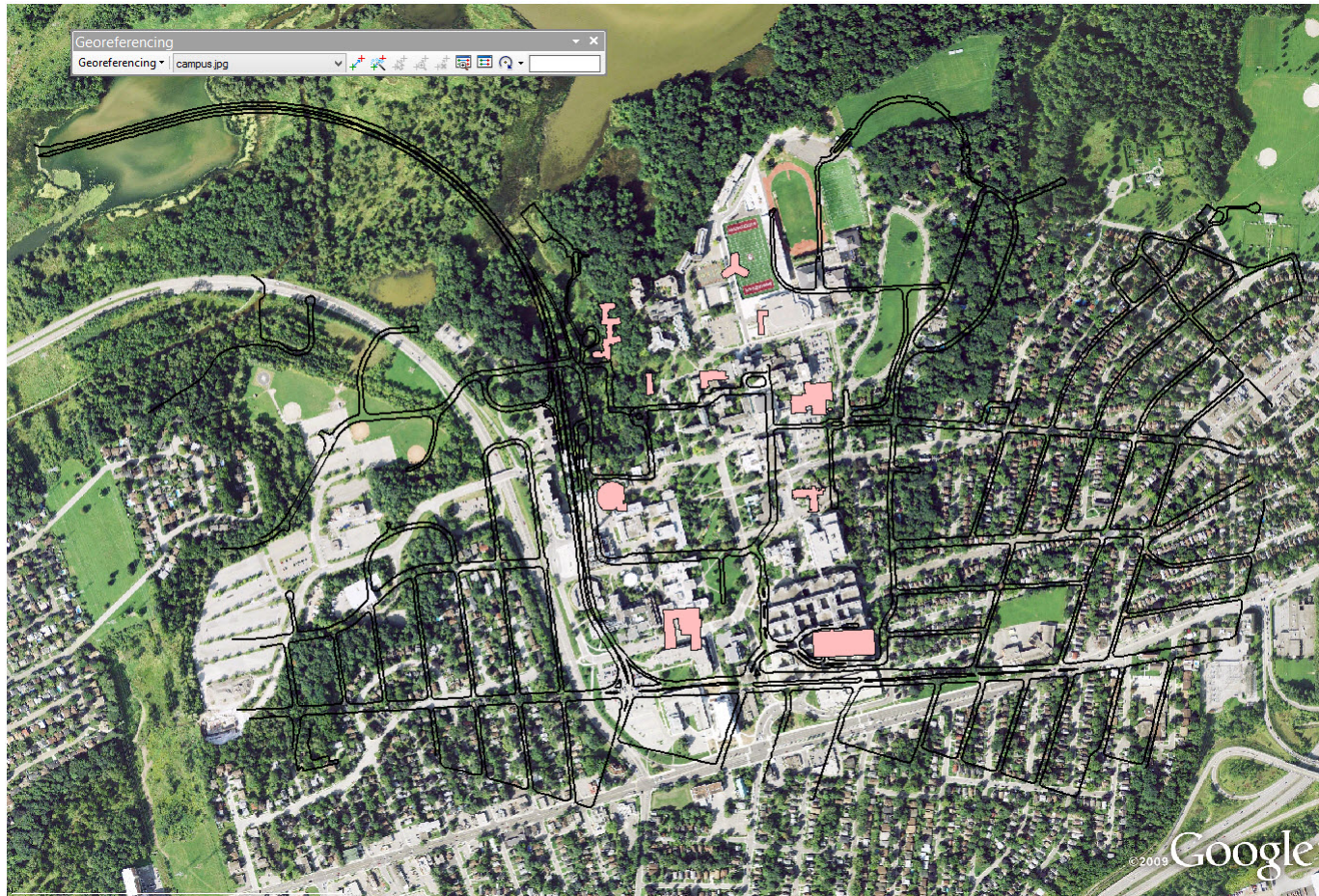
- Load shapefiles first
- Load satellite image next
- Make sure that the data frame has the same coordinate system as that of the shapefiles
- Load the Georeferencing toolbar



Georeferencing: Major Steps (2)

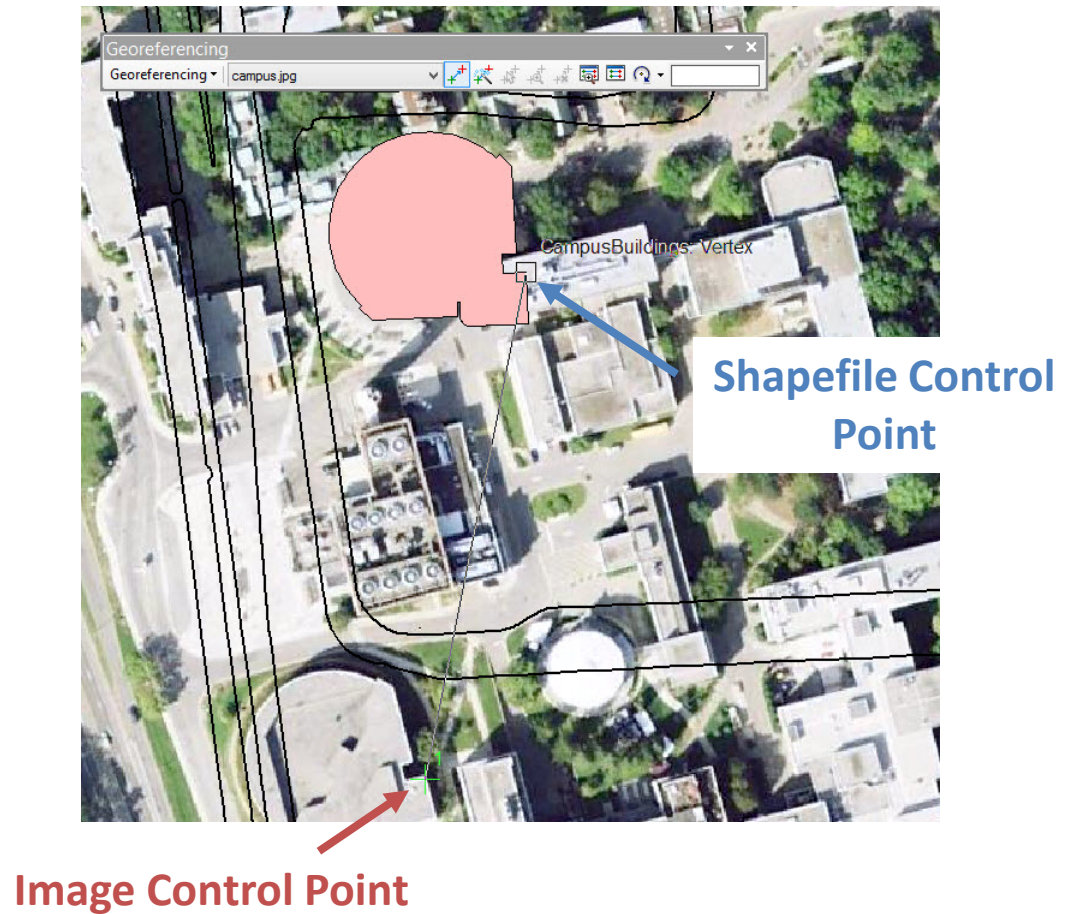
- Display satellite image in the same area as the shapefiles
 - ❑ Right click on a shapefile and Zoom to Layer
 - ❑ Click Georeferencing | Fit to Display

Georeferencing: Major Steps (3)



Georeferencing: Major Steps (4)

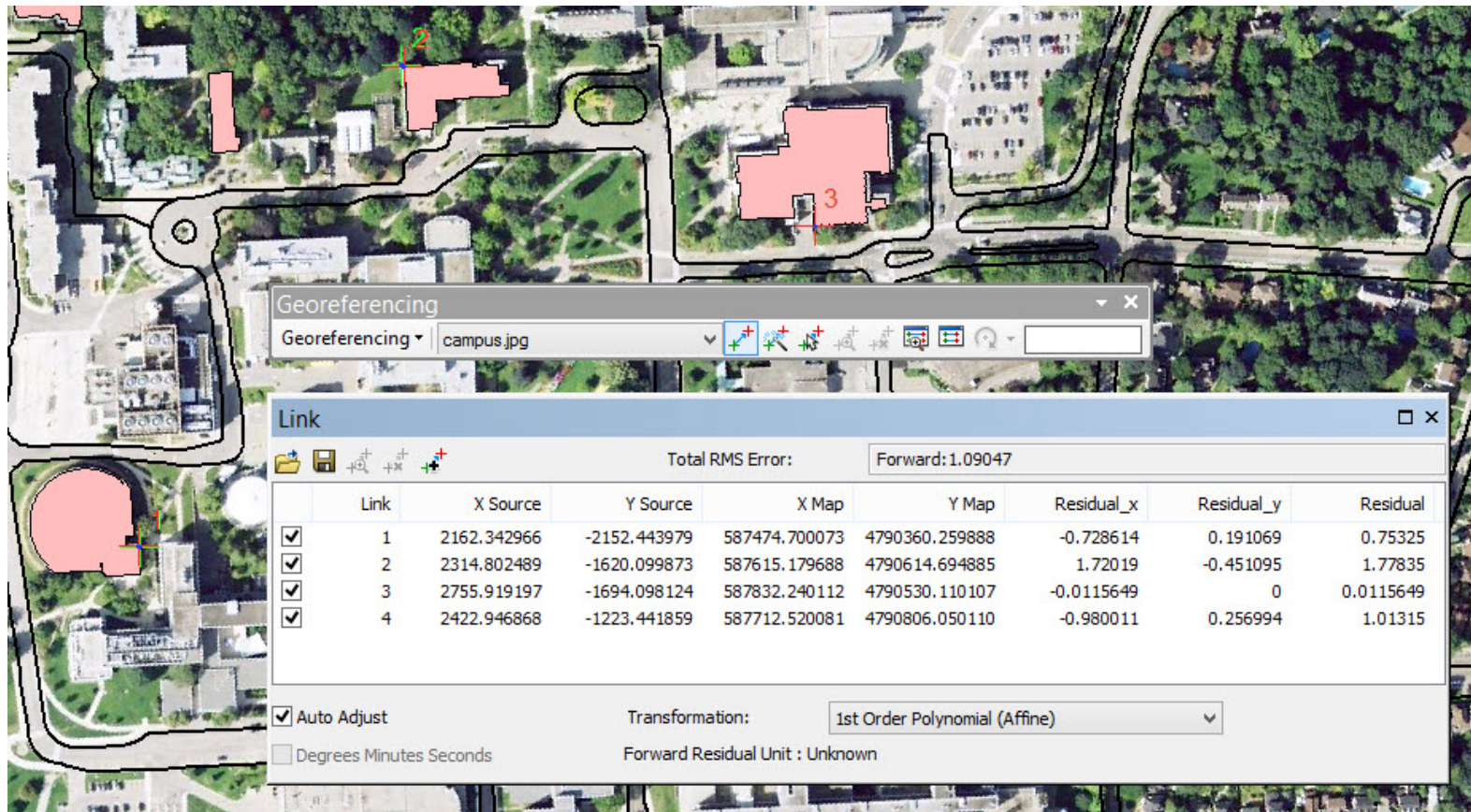
- Establish ground control points between image and shapefiles using identifiable features



Georeferencing: Major Steps (5)

- View Link Table
 - ❑ Can delete control points from this table (click on point and hit DELETE on your keyboard)
 - ❑ Review Total RMS error and determine whether the error is within a tolerance level you establish
- Save image with coordinate system
 - ❑ Two options: Update Georeferencing, Rectify
- Save map document

Georeferencing: Major Steps (6)

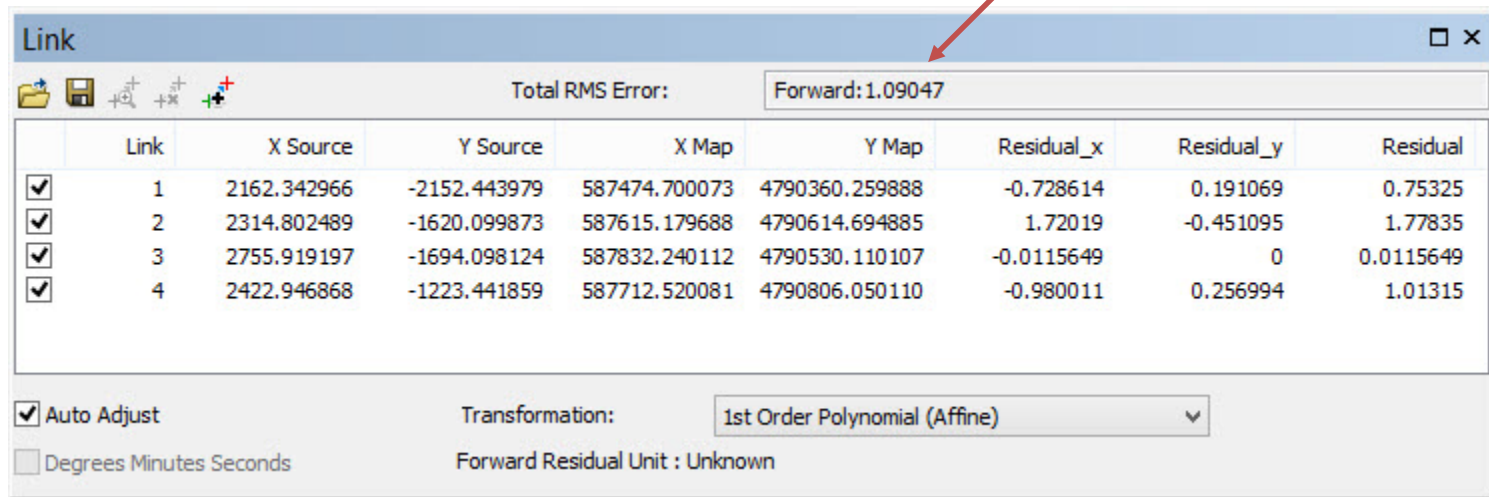


The screenshot displays a georeferencing software interface. The background is an aerial photograph of a campus area. Overlaid on the map are several red-shaded polygons representing buildings or structures. Some of these polygons are labeled with red numbers: '1' on a small building, '2' on a larger building, and '3' on a large, complex building. A 'Georeferencing' window is open, showing a toolbar with various icons for manipulation and a dropdown menu set to 'campus.jpg'. Below this, a 'Link' window is open, displaying a table of control points used for georeferencing. The table includes columns for Link ID, Source coordinates (X Source, Y Source), Map coordinates (X Map, Y Map), and Residuals (Residual_x, Residual_y, Residual). The 'Link' window also shows a 'Total RMS Error' of 1.09047 and a 'Forward' value of 1.09047. At the bottom, there are checkboxes for 'Auto Adjust' and 'Degrees Minutes Seconds', a 'Transformation' dropdown set to '1st Order Polynomial (Affine)', and a 'Forward Residual Unit' set to 'Unknown'.

	Link	X Source	Y Source	X Map	Y Map	Residual_x	Residual_y	Residual
<input checked="" type="checkbox"/>	1	2162.342966	-2152.443979	587474.700073	4790360.259888	-0.728614	0.191069	0.75325
<input checked="" type="checkbox"/>	2	2314.802489	-1620.099873	587615.179688	4790614.694885	1.72019	-0.451095	1.77835
<input checked="" type="checkbox"/>	3	2755.919197	-1694.098124	587832.240112	4790530.110107	-0.0115649	0	0.0115649
<input checked="" type="checkbox"/>	4	2422.946868	-1223.441859	587712.520081	4790806.050110	-0.980011	0.256994	1.01315

Georeferencing: Major Steps (7)

RMS Error in Meters



The 'Link' dialog box displays the following information:

Total RMS Error: Forward: 1.09047

Link	X Source	Y Source	X Map	Y Map	Residual_x	Residual_y	Residual
<input checked="" type="checkbox"/> 1	2162.342966	-2152.443979	587474.700073	4790360.259888	-0.728614	0.191069	0.75325
<input checked="" type="checkbox"/> 2	2314.802489	-1620.099873	587615.179688	4790614.694885	1.72019	-0.451095	1.77835
<input checked="" type="checkbox"/> 3	2755.919197	-1694.098124	587832.240112	4790530.110107	-0.0115649	0	0.0115649
<input checked="" type="checkbox"/> 4	2422.946868	-1223.441859	587712.520081	4790806.050110	-0.980011	0.256994	1.01315

☒ Auto Adjust Transformation: 1st Order Polynomial (Affine) Forward Residual Unit : Unknown

☐ Degrees Minutes Seconds

Details About Part B

- Compare the CampusBuildings shapefile to the buildings shown on the satellite image
 - Identify and digitize eight missing buildings
- Update the attribute table of the CampusBuildings shapefile
 - New fields for building numbers and building abbreviations (abbreviations must be unique)
 - Add names of buildings to Name field
 - Delete ID, Code, and Category fields

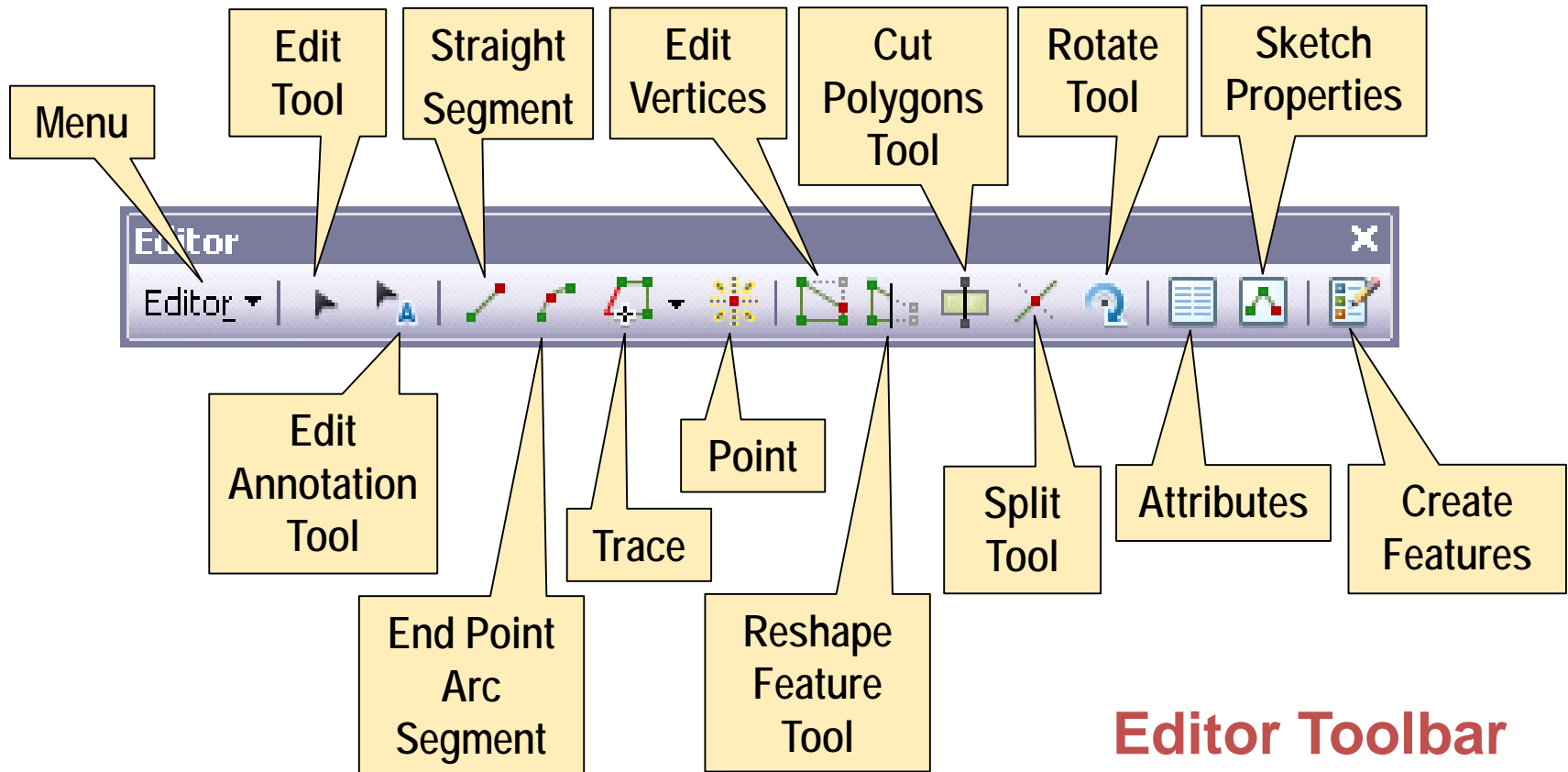
Feature-based Editing (1)

- The process of creating features and correcting feature errors in a vector data set
- Editing is feature specific
 - You must tell the software the feature type that is to be changed; then proceed with editing

Feature-based Editing (2)

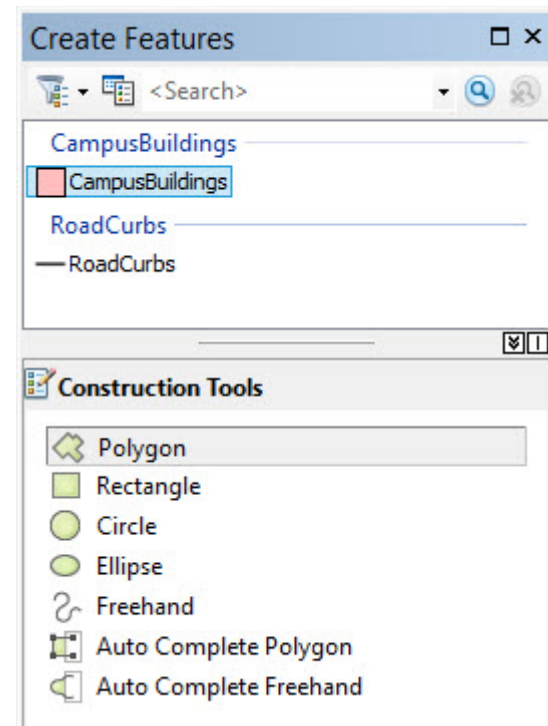
- Load Editor toolbar by right clicking on Campus Buildings shapefile followed by Edit Features | Start Editing
- Remember to Save Edits periodically and Stop Editing when task is completed

Feature-based Editing (3)



Feature-based Editing (4)

- Construction Tools for digitizing new features are accessed through Create Features
- Attributes can be added and updated in two ways:
 - ❑ Attributes button
 - ❑ Buildings attribute table



Details About Part C

- Record locations of all entrances to three buildings using a Garmin eTrex Legend H GPS receiver
- Record whether an entrance is wheelchair accessible (1) or not (0) on a sheet of paper (field notes)
- Download GPS data using the GPS Utility and export the data as a shapefile
- Add a new field to the shapefile called ACCESS for recording the accessibility of the entrance from your field notes
- A different colored icon must be used to distinguish between accessible and non-accessible entrances (e.g., a blue point for accessible, a red point for non-accessible)

Style and Format Guidelines (1)

- Answers must be typed using MS Word, OpenOffice, or some other word-processing package; otherwise your grade = 0
- Style and format is worth 20% of your mark or 7 marks out of 37 for this exercise
- 1 mark is deducted for each unique mistake

Style and Format Guidelines (2)

- To avoid losing marks, ensure the following:
 - ❑ Title page contains the exercise number and name (Exercise 4: Georeferencing, On-screen Digitizing, and GPS), your name and lab section, submission date, and your TA's name
 - ❑ Staple your submission in the upper left-hand corner
 - ❑ Use 12 point font
 - ❑ Use 1.5 spacing between lines
 - ❑ Use 1 inch borders
 - ❑ Pages must be numbered in the bottom right-hand corner
 - ❑ Correct all spelling and grammatical mistakes
 - ❑ Do not use ink or pen on the submission