hHow to Complete Data Input Documentation for Structural Flood Damage to Historic Unreinforced Masonry Buildings

Introduction

This document provides a detailed, step-by-step guide for completing data input documentation for historic buildings potentially impacted by flood events. The goal of this guide is to ensure consistency in how the information is being sourced, collected, and entered into the dataframe, allowing all team members to follow a standard approach.

Additional Information

- All measurements should be in meters (m)
- Yellow highlighted words indicate the software, websites, or resources used for that step
- Most steps will explain how to find and fill the information for each column in the format:

Column Name (Column)

Note: Columns with ** in front of them in the instruction set need uncertainty highlights that go along with uncertainty columns (to the right of their respective column). These correspond with how certain you are of the input in the cell that you have put. These column headers should also be **highlighted in green in the dataframe.**

Colors and their corresponding certainties:

Green – very certain | >75 % certain (3)
Red – somewhat | 35-50% certainty (2)
Yellow – very uncertain | 0-25% certainty (1)

AH	AI	AJ	AK
construction_type_u	construction_type_u_unc	mwfrs_u_wall	mwfrs_u_wall_unc
masonry_un	2	wall_diaphragm_wood	3
masonry_un	2	wall_diaphragm_mason	2
un	1	wall_diaphragm_stone	3
masonry_un	3	wall_diaphragm_stone	2

Necessary Resources and Documents

- Computer
- Computer Applications/Websites
    - Microsoft Excel
    - Snipping tool/screenshot on your computer
    - Access to project One Drive: 2023_montpelier_noName
    - Google Earth Pro (downloaded to computer)
    - Google Maps online: https://www.google.com/maps
    - Fulcrum online: https://web.fulcrumapp.com/users/sign_in
    - Zillow: https://www.zillow.com/
- Necessary Document
    - "Minimal Building Flood Fragility and Loss Function Portfolio for Resilience Analysis at the Community Level": https://www.mdpi.com/2073-4441/12/8/2277

Troubleshooting and Follow-Up Advice

- **Access Issues:** If you do not have access to the One Drive, contact Yishuang Wang or another research assistant to provide you the access and rights to the One Drive folders.
- **Unclear Information:** If you're uncertain about any data (such as the building's year of construction or the archetype), make a note in the "notes" column. Research may require further investigation or assumptions based on available data. Feel free to ask for any structural clarifications.
- **Missing or Incomplete Data:** In cases where data is unavailable (e.g. year built, occupancy), input "un" as a placeholder, standing for unknown.
- **Photo Documentation:** Ensure that all photos are taken both before and after the tornado to provide clear visual comparison. If you have trouble accessing street view photos from Google Maps, try adjusting the timeline to get a more accurate representation. If any particular view cannot be found in any manner, note this in the "notes" column at the end of the dataframe.

Table of Contents

Opening the Excel document 5
Finding Historic (Masonry) Buildings 6
completed_by 8
fully completed? 8
NRHP_ref_number 8
town 8
flood_height_building 8
distance_from_river_edge 8
distance_from_river_centerline 9
FEMA_floodzone 9
dist_to_culvert 9
dist_to_stormsewer 9
latitude & longitude 9
complete_address 10
building_name_listing & building_name_current 10
archetype 10
located_in_historic_district 10
occupancy_u 10
number_storie 11
year_built_u 11
building_area_m2 12
building_urban_setting 13
building_position_on_street 13
building_height_m 13
first_floor_elevation_ 14
front_elevation_orientation 14
wall_length_sid 14
wall_length_front 14
wall_thickness 14

roof_shape_u 14
roof_slope_u 15
****construction_type_u** 16
Uncertainty columns – unc (give numbers) 16
****mwfrs_u_wall** 16
****mwfrs_u_roof** 17
****mwfrs_u_moment_frame** 17
****masonry_leaves** 17
structural_wall_system_u 17
****foundation_type_u** 17
****wall_anchorage_type_u** 18
****wall_substrate_u** 18
****wall_cladding_u** 19
soffit_type_u 19
soffit_present_u 20
wall_fenestration_per_ 20
wall_fenestration_protection_ 21
fenestration_protection_type_ 21
(large_)door_present_ 21
raised_above_road_level 21
raised_floor_elevation_ft 21
****roof_system_u** 21
r2wall_attachment 22
****roof_substrate_type** 22
****roof_cover_u** 22
overhang_length_u 22
parapet_height_m (CK) 22
retrofit_year_u (CL) 22
retrofit_present_u (CM) 23
retrofit_type_u (CN) 23
Opening Fulcrum to get Damage Information 25
hazards_present_u and status_u 25
rainwater_ingress_damage_rating_u 26

Damage Columns 27
risk_category_16 28
building_low_rise 29
national_register_listing_year 29
existed_during_flood 29
building_use_BLANK_flood 29
demolishing_year 29
single_unit OR multiple_unit 29
National recognized listings 29
const_material_h_ 30
const_material_v_ 30
prop_"classification" 30
prop_val_ 31
owner_ 31
owner_occupied 31
tenant_occupied 31
building_existed_#_years_before_flood 31
building_existed_during_flood 31
building_in_use_during_flood 32
building_use_during_flood 32
damage_status 32
building_demolished_#_yrs_after_event 32
building_abandoned_1_yrs_after_event 32
emergency_measures_only_performed_1_yrs_after_event 32
restoration_in_progress_1_yrs_after_event 32
restoration_completed_building_in_use_1_yrs_after_event 32
notes 32

Opening the Excel document

1. Open the One Drive link: 2023_montpelier_noName
2. You will see various folders.
   2023_montpelier_noName > Montpelier_Flood_DataInput.xlsx

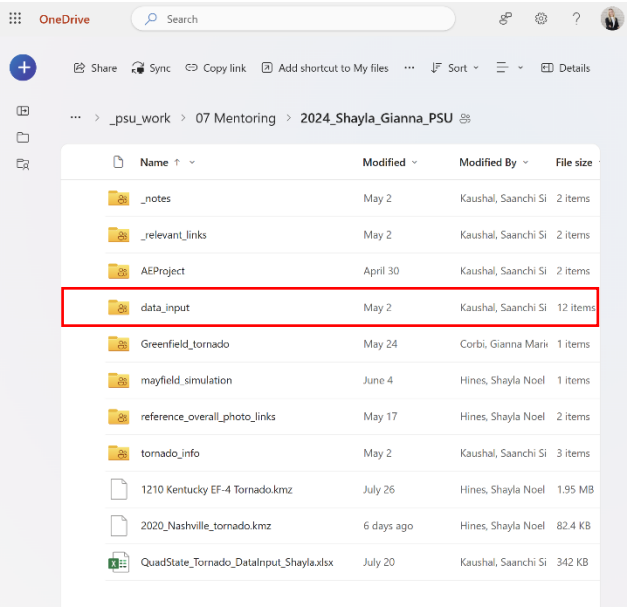


Figure 1

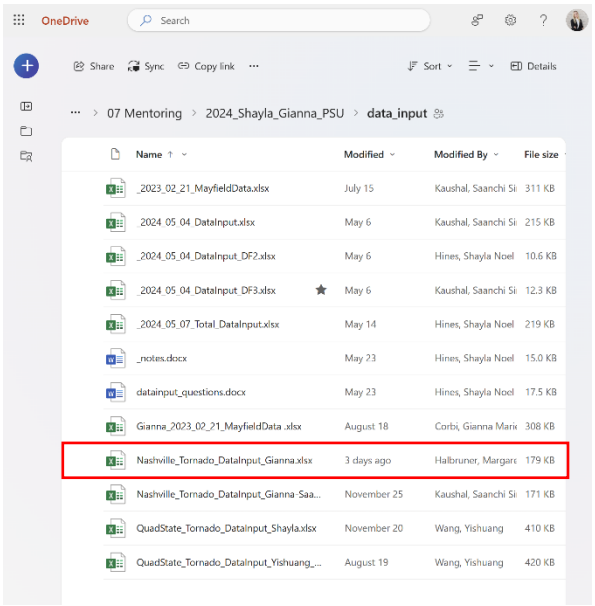
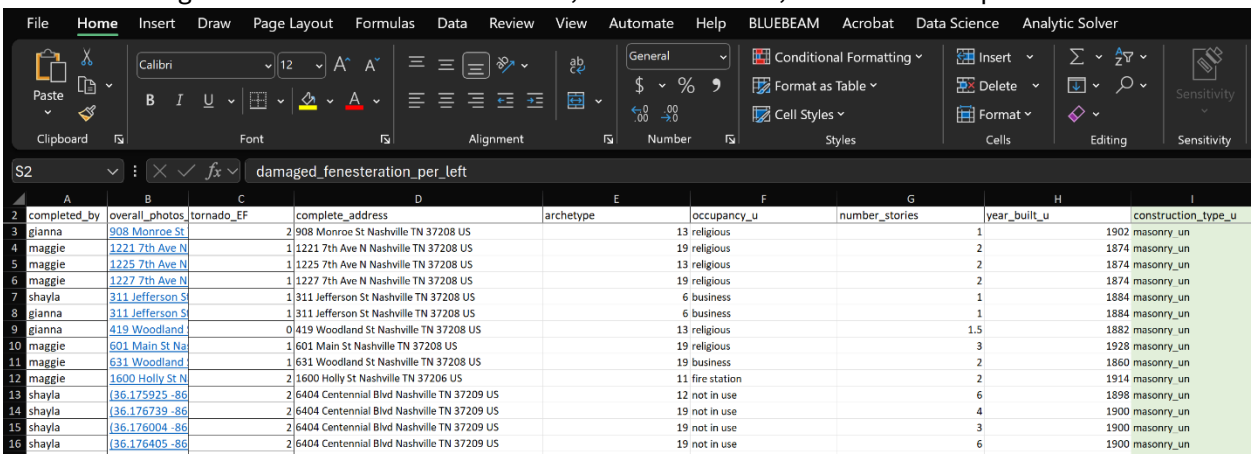


Figure 2

3. This Excel spreadsheet is the main database for the information dataframe. Once you open this file, you will see a list of addresses added by another on the research team. These are all of the buildings which will need data collected, for columns A-U, which will be explained below.



	A	B	C	D	E	F	G	H	I
2	completed_by	overall_photos	tornado_EF	complete_address	archetype	occupancy_u	number_stories	year_built_u	construction_type_u
3	gianna	908 Monroe St	2	908 Monroe St Nashville TN 37208 US	13	religious	1	1902	masonry_un
4	maggie	1221 7th Ave N	1	1221 7th Ave N Nashville TN 37208 US	19	religious	2	1874	masonry_un
5	maggie	1225 7th Ave N	1	1225 7th Ave N Nashville TN 37208 US	13	religious	2	1874	masonry_un
6	maggie	1227 7th Ave N	1	1227 7th Ave N Nashville TN 37208 US	19	religious	2	1874	masonry_un
7	shayla	311 Jefferson S	1	311 Jefferson St Nashville TN 37208 US	6	business	1	1884	masonry_un
8	gianna	311 Jefferson S	1	311 Jefferson St Nashville TN 37208 US	6	business	1	1884	masonry_un
9	gianna	419 Woodland	0	419 Woodland St Nashville TN 37208 US	13	religious	1.5	1882	masonry_un
10	maggie	601 Main St Na	1	601 Main St Nashville TN 37208 US	19	religious	3	1928	masonry_un
11	maggie	631 Woodland	1	631 Woodland St Nashville TN 37208 US	19	business	2	1860	masonry_un
12	maggie	1600 Holly St N	2	1600 Holly St Nashville TN 37206 US	11	fire station	2	1914	masonry_un
13	shayla	(36.175925 -86	2	6404 Centennial Blvd Nashville TN 37209 US	12	not in use	6	1898	masonry_un
14	shayla	(36.176739 -86	2	6404 Centennial Blvd Nashville TN 37209 US	19	not in use	4	1900	masonry_un
15	shayla	(36.176004 -86	2	6404 Centennial Blvd Nashville TN 37209 US	19	not in use	3	1900	masonry_un
16	shayla	(36.176405 -86	2	6404 Centennial Blvd Nashville TN 37209 US	19	not in use	6	1900	masonry_un

Figure 3

CAUTION: Make sure that the Excel document is on AutoSave so that no or minimal data is lost if an error were to occur and close the file

completed_by

All that is needed in this box is your name to indicate who completed the information for this building – e.g. maggie, shayla, gianna.

fully completed?

Complete after everything is completed. Use a “Y” to indicate that the entire row is done for that building, including all information and checking Fulcrum for all damage statuses.

NRHP_ref_number

It is on the National Register of Historic Places? Either “yes” or “no”.

town

Based on the address (e.g. Nashville).

latitude & longitude

These coordinates are based on the Google Earth Pro location of the building location (in decimal form). There are many ways to find the coordinates but here is one easy way.

1. Use the **yellow pin** located in the top left corner of the tool bar on Google Earth Pro.
2. As shown in Figure 12, a box will pop up showing the coordinates in DMS format.

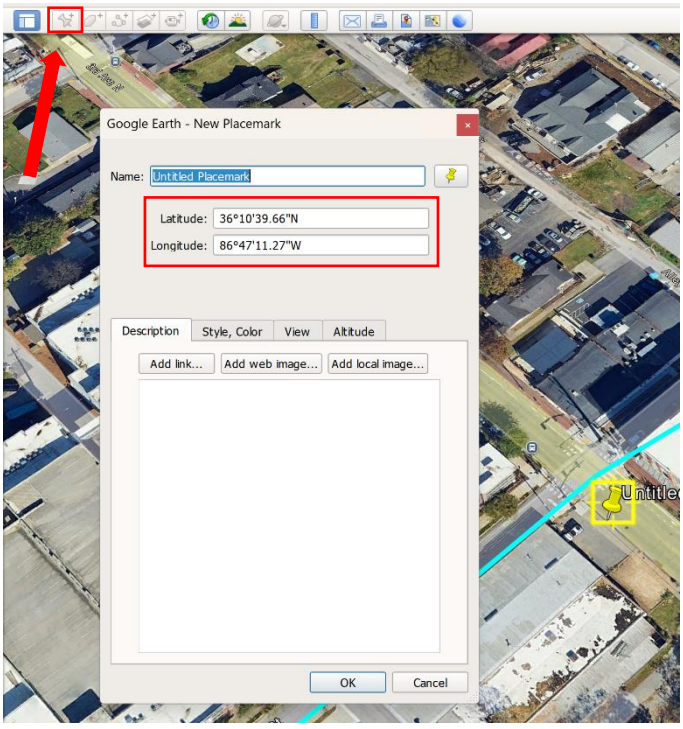


Figure 12

3. To get this number into decimal format, you can use the site Degrees Minutes Seconds to/from Decimal Degrees or any other similar site and input these numbers into the Excel.

Note: North and East will be positive, South and West will be negative

complete_address

Unless already input, address numbers can typically be found on Google Maps. Include no commas in the address.
e.g. 631 Woodland St Nashville TN 37208 US

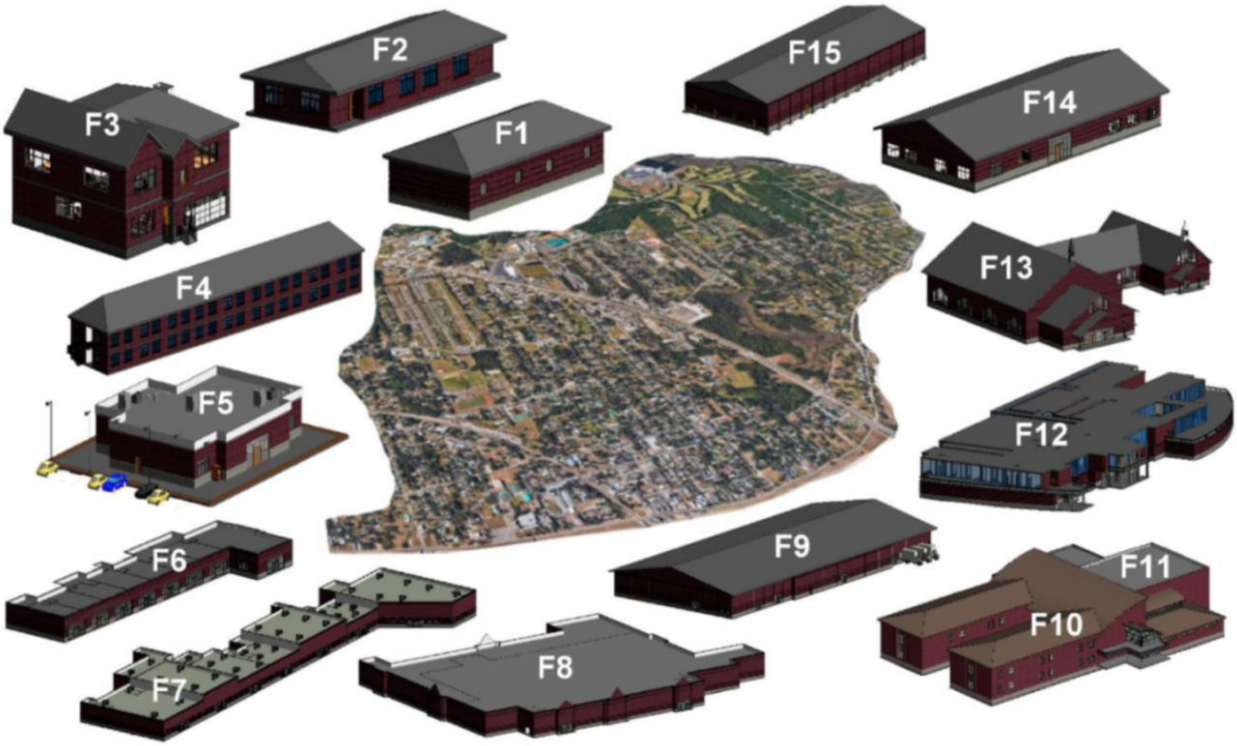
Note: Some addresses may not be completely accurate because quite a few very historic buildings don't have exact addresses (coordinates are always the most accurate location).

building_name_listing & building_name_current

Unless there is a historic AND current name for the building, you can put the name under the "building_name_listing". Some buildings (residential) will not have a name and that is okay. Leave it blank.

archetype

1. Using the table below, match the building to the best of your ability with one of the archetypes based on the structural makeup of the building. Some assumptions may be necessary as not all structural makeups are obvious.
2. If uncertain for any reason, make any necessary notes in the last column, called "notes".



Building Archetype	Building Description
F1	One-story single-family residential building on a crawlspace foundation
F2	One-story multi-family residential building on a slab-on-grade foundation
F3	Two-story single-family residential building on a crawlspace foundation
F4	Two-story multi-family residential building on a slab-on-grade foundation
F5	Small grocery store/Gas station with a convenience store
F6	Multi-unit retail building (strip mall)
F7	Small multi-unit commercial building
F8	Super retail center
F9	Industrial building
F10	One-story school
F11	Two-story school
F12	Hospital/Clinic
F13	Community center (place of worship)
F14	Office building
F15	Warehouse (small/large box)

For more details see this paper: https://www.mdpi.com/2073-4441/12/8/2277

Figure 13

located_in_historic_district

Either “yes” or “no”; typically known when it is a very historically recognized building.

occupancy_u

1. The occupancy entry box is for which occupancy best describes the building in its current use (when the tornado occurred). The following options to choose from are:
    - assembly
    - business
    - educational
    - factory
    - high hazard
    - institutional
    - mercantile
    - residential
    - storage
    - utilities
    - museum
    - not in use

For more information on what each one is, look at the 2021 IBC:
https://codes.iccsafe.org/content/IBC2021P1/chapter-3-occupancy-classification-and-use

Note: You may have to do a few Google searches if the use is not apparent and requires a little more digging online.

number_stories

1. Determining the value for this column will be based on visual inspection of the building from Google Maps. To see the building in street view:
    a. Open Google Maps
    b. Enter the address of the building you are looking at
    c. Click and drag the little blue figure in the bottom right corner to the place where the building is, pictured in Figure 14

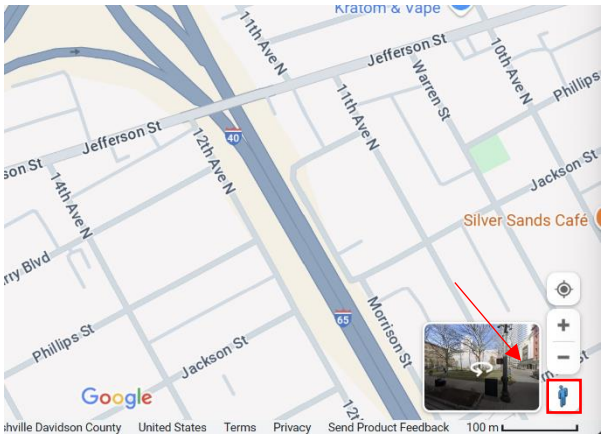


Figure 14

   d. Once on street view, you can move around by clicking on the ground
2. Stories will generally be whole numbers, but some residential buildings are input at 1.5 stories.

year_built_u

There are a few ways to tell when a building was built:

1. If it is historic or well-known, online sources may outright say the year that it was built.
2. Some historic buildings may have the year built on the side of the building, which can be seen in street view (as explained in the previous step).
3. Zillow shows the year built for many residential buildings.
   a. Go to Zillow online
   b. Enter the address
   c. Go to the "Home Details" tab under the general information
   d. Scroll down to "Facts and Features"
   e. Year will be listed next to "Year Built:" if available
4. If no year built can be found, just put "un" in the cell

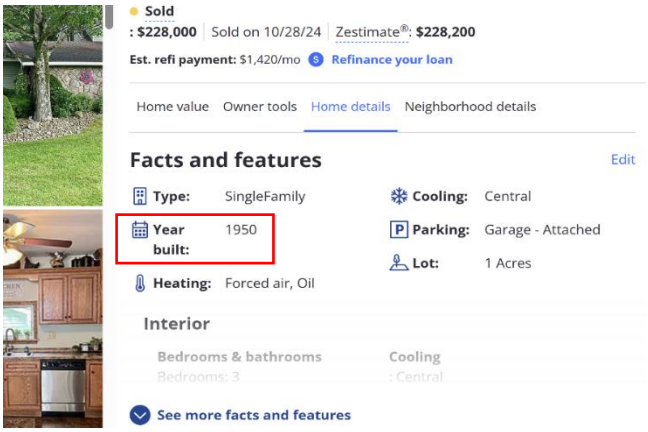


Figure 15

Notes: If given range of years of construction, use the first year; best approximation if ever given a very vague date range.

building_area_m2

Find the approx. area of the building using the **Ruler (Polygon)** tool on Google Earth Pro.

1. Go to the **Ruler tool** on the top tool bar.
2. Click on the **Polygon tab.**
3. Click on each corner of the building to create a polygon for the area, where the area will appear in the Ruler tool box (shown in Figure 16).

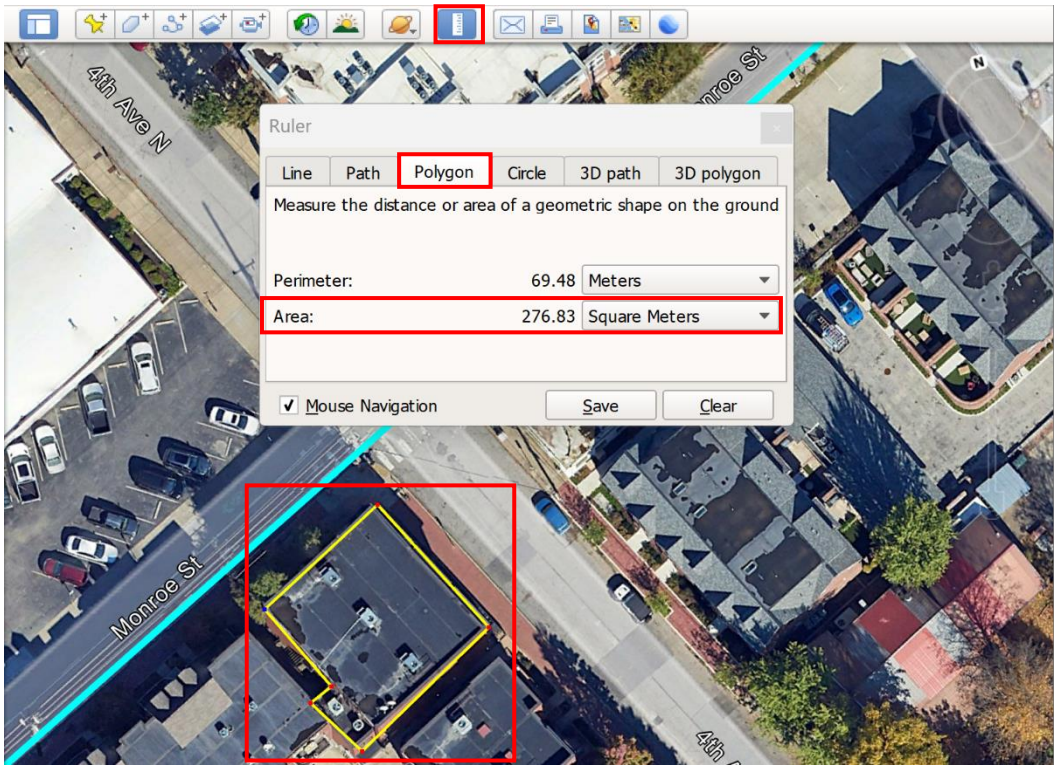


Figure 16

building_urban_setting

Is the building stand alone of connected (like a downtown row building)? Input options are:

- Isolated
- row_middle
- row_end

building_position_on_street

Is the building recessed or right on the street? Recessed would be anything with a yard (more applicable when it is in a row of buildings). Input options:

- recessed
- right_on_street

building_height_m

Best visual approximation upon inspection (on Google Maps/Earth), **in meters**.

Note: It can be helpful to measure based on standard sizes of doors (7') or surrounding buildings.

first_floor_elevation_

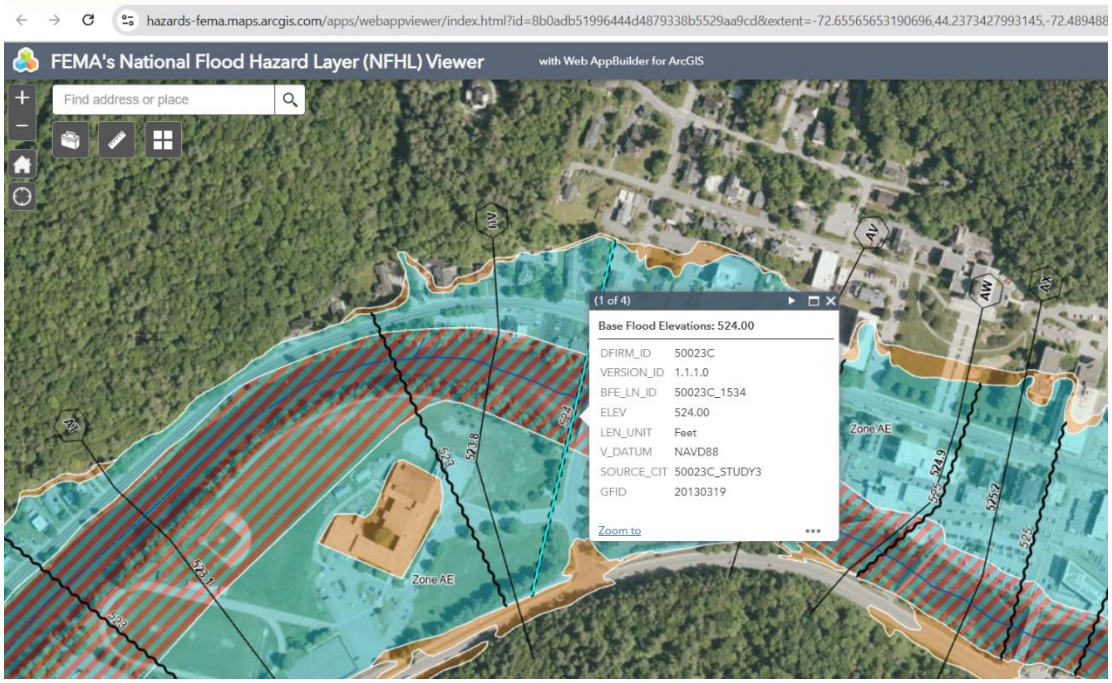
Again, **in meters**, best approximation upon inspection.

front_elevation_orientation

Which direction is the front of the building facing? This will be used throughout rest of the data input, as a reference to different sides of the building. Input options include:

- n, s, e, w

Note: If the building is at a 45^{o} angle or similar (not in one specific direction), use the direction closest to the front face. The most important thing is to remain consistent through the entire data entry process.

- flood_exposure_levels:
  - Base Flood Elevation (BFE): Regulatory flood elevation referenced from FEMA maps or local studies.
  - 

wall_length_side

This measurement is the side of the building which is NOT the front!

From length measurement tool on Google Earth Pro

- Ruler > Line
- Click and drag a line for the side of the building that you are measuring
- Either Map or Ground length can be used (since it's an approximation)

- Add this to the Excel sheet
    - Don’t include units when putting into the data sheet

Note: Many buildings may not be perfectly or simply rectangular, so it is harder to decide which length to measure. This is up to your discretion (I typically choose the longer measurements).

wall_length_front

Same as last step, just for the front face of the building.

flood_height_building

distance_from_river_edge

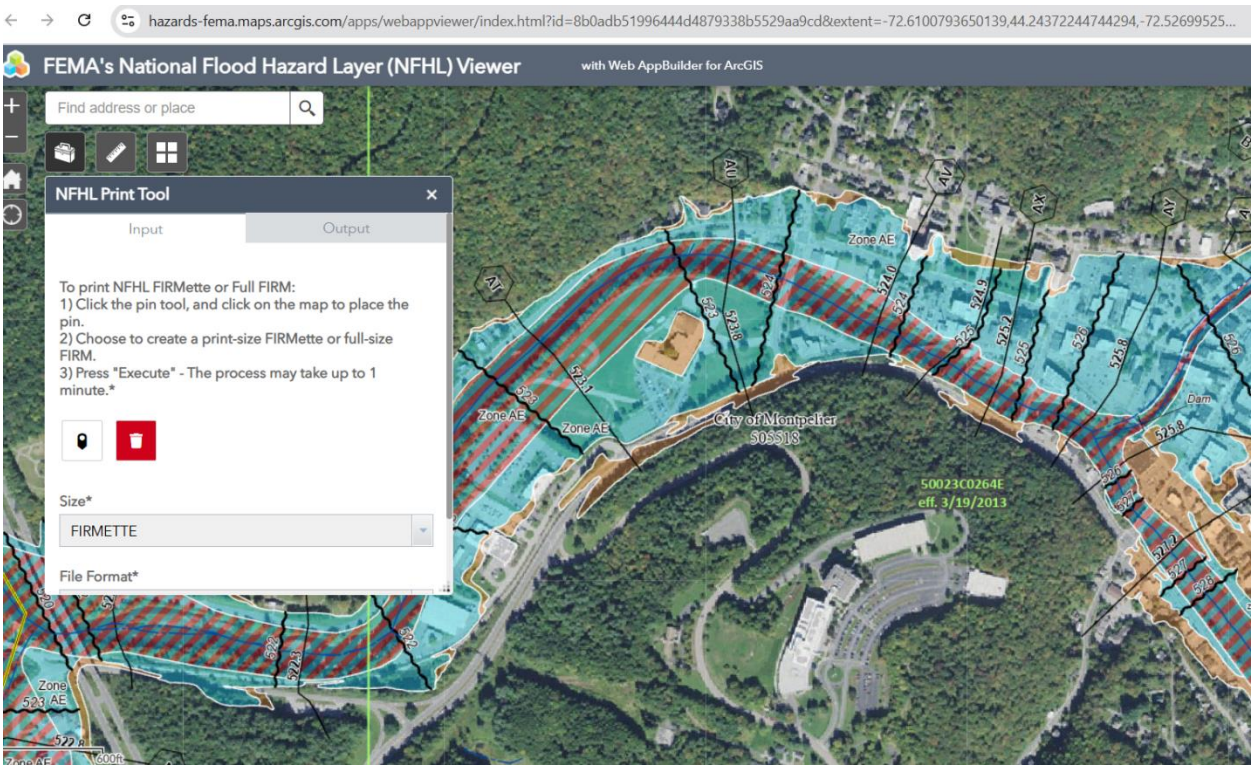
TO BE ADDED LATER PYTHONICALLY, NOT DURING DATA ENTRY

distance_from_river_centerline

TO BE ADDED LATER PYTHONICALLY, NOT DURING DATA ENTRY

FEMA_floodzone

This parameter identifies the flood hazard zone designation based on FEMA’s Flood Insurance Rate Maps (FIRMs) or the National Flood Hazard Layer (NFHL). Flood zones represent areas of varying flood risk, from high-risk Special Flood Hazard Areas (SFHAs) labeled with “A” or “V” zones (e.g., AE, VE), to moderate- or low-risk zones marked as “B,” “C,” or “X.” These zones classify flood hazard levels and help determine flood insurance requirements and floodplain management regulations



wall_thickness

Since we usually can't see the wall thickness (unless very damaged), you have to put in your best approximation for how thick in meters the walls are. **For typical residential or similar buildings, use 0.2 (assumed).**

roof_shape_u

Most roof shapes will fall into these input categories (what should be put in the cell):

- flat
- gable
- hip
- gable-hip_combo

- complex
    - anything that has more than one roof shape or not easily classified

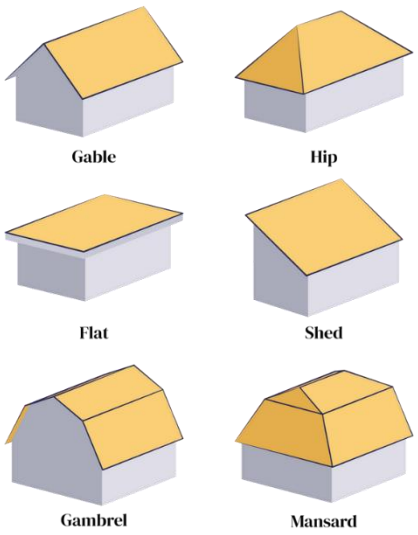


Figure 17

Note: Other shapes are possible, these are just the most common from what we see.

roof_slope_u

Input options: 0, 30, 45

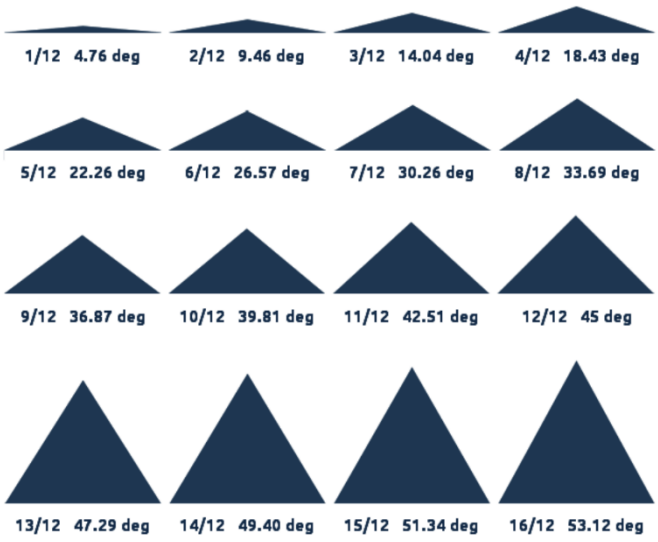


Figure 18

Note: If there are multiple roof slope for the one building, choose which one make up the majority of the building.

**construction_type_u

Filling out this cell will require some understanding of what to look for, determining the construction type of a building. Generally, this can be determined by looking at when the building was built (which decade), the outer structural makeup, and the type/occupancy of the building. Prior knowledge on this will be necessary.

The most common choices for data entry in this cell include:

- wooden_light_frame
- masonry_un
- rf_masonry (reinforced masonry)
- steel_light_frame
- composite (buildings with mixed structural types)
- un (stands for unknown)
- ot (stands for other)

Since we are looking at primarily historic masonry buildings, "masonry_un" will almost always be the entry type.

Note: Other possible input options will be listed in the **final_attribute_division_and_op** tab in the Excel sheet.

Uncertainty columns – unc (give numbers)

These columns can be completed after the entire dataset is completed (it's the easiest). All that needs done is matching the color of the column to the left, to its numerical certainty value 1, 2, or 3 (described in the first page of the document).

The reason for this is to convert the certainty color into a numerical value can be analyzed through code.

**mwfrs_u_wall

MWFRS – Main Wind Force Resisting System

Similar to construction type, but based on each part of the building (wall or roof). What is the main structural system for the WALLS of the building? What is the system made of which is resisting wind forces on the WALLS of the building? Input options:

- wall_diaphragm_masonry
- wall_diaphragm_wood
- wall_diaphragm_steel
- un

Note: Best approximation! If uncertain, you can highlight the cell with its related color.

**mwfrs_u_roof

What is the main structural system for the ROOF of the building? What is the system made of which is resisting wind forces on the ROOF of the building? Input options:

- roof_diaphragm_wood
- roof_diaphragm_steel
- un

**mwfrs_u_moment_frame

Best assumptions of whether the building has a moment frame or not; typically historic buildings so not have a moment frame. Input options:

- no
- yes
- un

**masonry_leaves

Masonry leaves are the number of layers of masonry in the walls of the building. Again, since you can't see the inner wall assembly, input your best guess based on the type of masonry construction (small family home vs. large brick building). Input options:

- double_leaf
- triple_leaf
- not_applicable (for buildings that aren't masonry)

As a rule of thumb, all unreinforced masonry buildings will have a double_leaf assembly (single leaf would be too unsupported if it is truly unreinforced).

structural_wall_system_u

Best approximation from imagery and any official documentation from historic listing (if present). Input option:

- masonry_block_unreinforced

There are other options, but this is what it will be if you are only looking at historic unreinforced masonry buildings.

**foundation_type_u

Knowing the foundation type of a building can be very hard to tell sometimes. The best thing to do is look at street view imagery or any official documentation from historic listings to see what the foundation is. Most likely it will be unknown or very vague. Most common options include:

- slab_on_grade
- stone
- masonry_un (looks like brick)
- unr_masonry_stem_wall
- un

This is definitely an approximate guess for most buildings, unless clearly stated somewhere.

Slab_on-grade	When zooming in, slab can be found	
Masonry_un	Has basement, definitely not slab-on-grade	

**wall_anchorage_type_u

Going to be unknown for almost all buildings, unless you're able to see those small features through the wall assemblies. So far, have been **putting "un" for all.**

**wall_substrate_u

Low certainty levels for most because only exterior cladding can be seen; assuming that there is no wall substrate when looking at historic unreinforced masonry buildings so **put "not_applicable" for all, unless given other information.**

Note: The masonry acts as the substrate in a way.

**wall_cladding_u

What material is used on the siding of the building? Common input options:

- brick
- cmu
- vinyl
- wood
- stone
- stucco

Note: If multiple types of cladding on a singular building, put what was used for the most coverage of the building.

soffit_type_u

Soffit – Cover the underside of the roof overhang and limit the ingress of wind-driven rain

Soffit can be hard to see but do your best to look through all imagery and Google Maps to determine what material it is. This can change over time due to renovations, so make sure you are looking at the latest date. Input options:

- wood
- vinyl
- stone
- un
- not_applicable

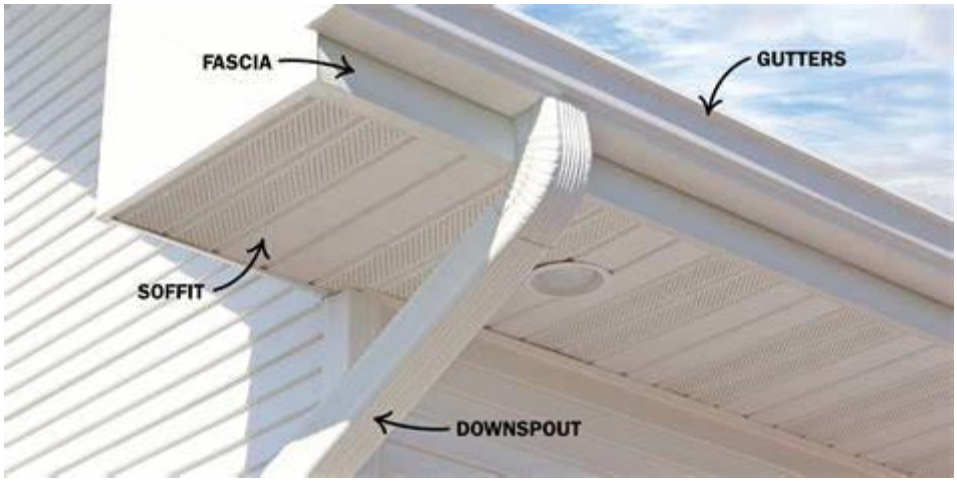


Figure 19

Note: Sometimes it is hard to tell whether an overhang counts as a soffit. Below are some examples of what is and is not soffit on a building.

SOFFIT	 This is considered a soffit due to how far it sticks out and provides covering from rain fall off.	
NOT A SOFFIT	 This covering does not protrude out far enough from the building to perform the function of a proper soffit.	

soffit_present_u

Is there a soffit present on the building or not? Some buildings are built to not have a soffit.

wall_fenestration_per_

This is the percentage of openings in each side of the building; essentially what percent of the entire thing is made up of windows and doors?

Input will just be a number, from 0-100.

Note: Make sure to correctly correlate the side to its direction, based on what you decided in the beginning.

wall_fenestration_protection_

Is there fenestration protection present on the windows/openings? This can include storm shutters or plywood (before the flood, not after!) as well as flood gates or sandbags.

Flood gates can look like this on a building

Sandbags would look like this

fenestration_protection_type_

If the answer was yes to the previous question, you need to say what type of protection. For most, **the input will be not_applicable.** Other inputs, if present, include:

- plywood
-
- FFlood gateood gate
- sandbagsunknown

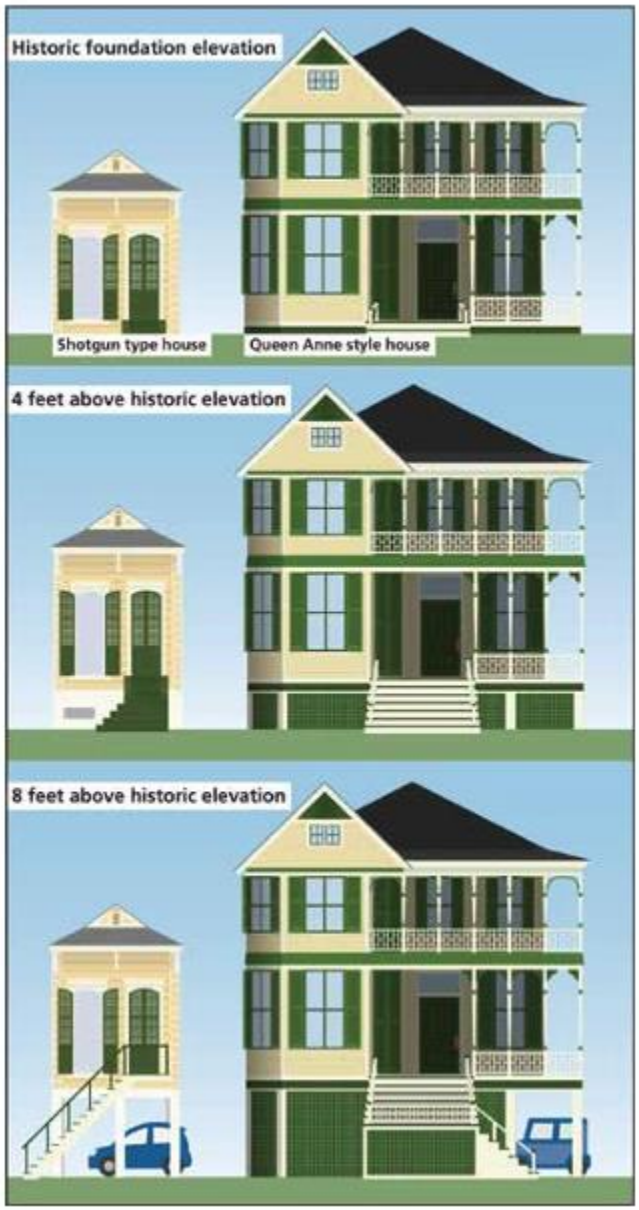
(large_)door_present_

Are there any large doors present on the building? Large doors are only garage doors (you won't find many). For BY-CB, just “door” is still referring to garage doors.

Input options: yes, no, un

raised_above_road_level

[100] Elevating the interior floor level above the established flood risk requires several building alterations, including constructing a new floor, elevating any utilities, and creating access to the new floor level. The original floor to ceiling height must be substantial enough to allow space for the new elevated first floor. *Graphic: Blank Space LLC for NPS*



raised_floor_elevation_ft

(NEW) basement_presence_and_condition ?

Whether building includes basement or crawlspace and its condition (dry, flooded, damaged).

Input options: yes, no, un

**roof_system_u

This is your best approximation of what structural system the roof is; very hard to say for certain from the outside. Input options:

- wooden_un
- wooden_rafters
- wooden_trusses
- open_web_st_joists
- steel_un
- un

r2wall_attachment

Will not be able to see or know this from outer imagery; **put "un" for all.**

**roof_substrate_type

Again, best approximation because you can't actually see the roof substrate. Try to go off of the time it was built and the roof system. Input options:

- dimensional_lumber
- un

**roof_cover_u

Determine this based on imagery, what material is the roof covering? Input options:

- asphalt
- corrugated_steel
- steel_un
- clay_shingles
- asbestos_shingles
- un

If you don't know what each of these looks like, you can Google it and look at the images for each and classify.

overhang_length_u

This overhang length refers to the roof overhang length. Since we obviously can't measure this, it will be your best guess from visual inspection (measured in meters). Make sure that your input seems like a reasonable answer.

parapet_height_m

If the building has a parapet, use context and your own knowledge to create a guess at how high that parapet is (in meters). Keep in mind that the minimum height requirement for a parapet is around 0.75 m.

retrofit_year_u

Were there any major renovations, building additions, or structural retrofits to the building? If so, list them in this cell. If there are multiple retrofit years, list them using commas to separate.

retrofit_present_u

Simple "yes" or "no" is there is a retrofit present.

Note: To help see if there were any building additions, use the history tool on Google Earth Pro to scroll through all of the years available and see if any major additions were added.

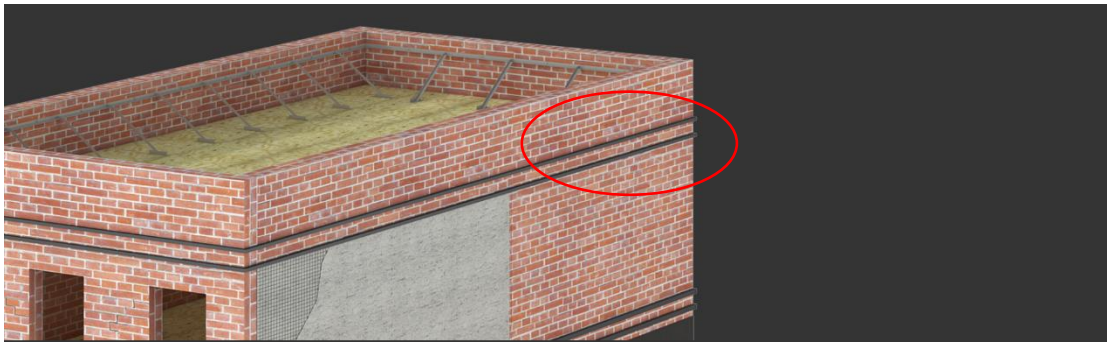
retrofit_type_u (CN)

Most common input options (more explanation at URM Building Seismic Retrofit Applications — Concrete Foundation | Simpson Strong-Tie):

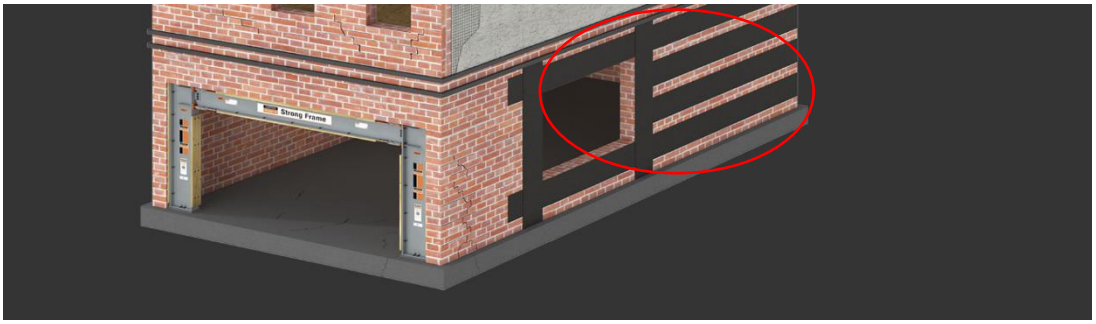
- structural_restoration
- building_addition

- parapet_bracing

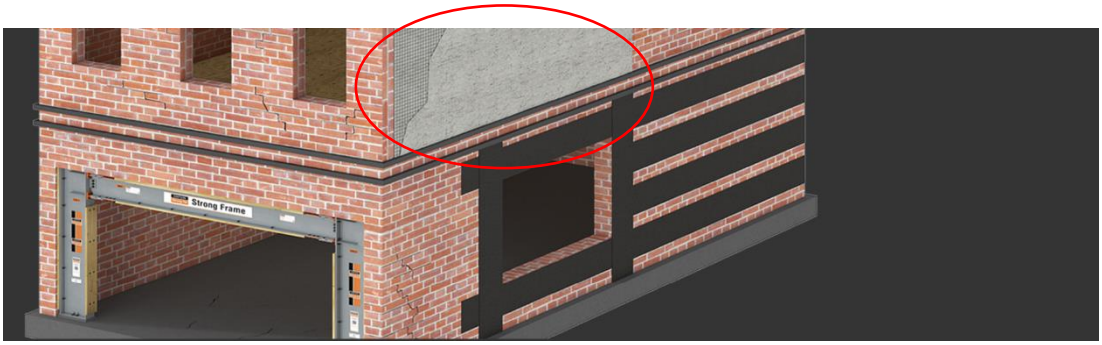
- wall-to-roof_anchorage
- wall-to-floor_anchorage



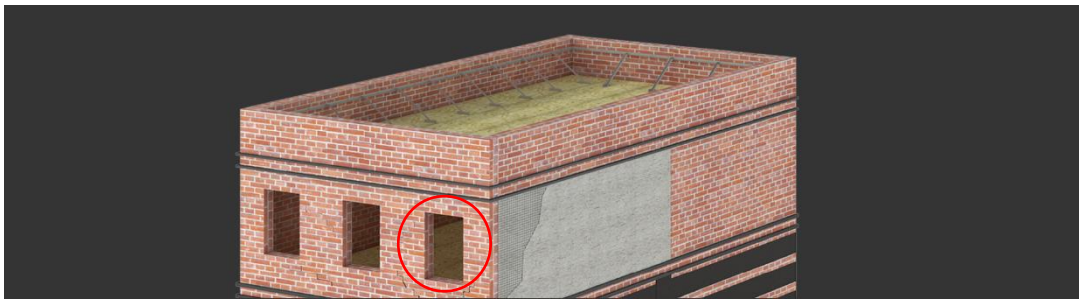
- out-of-plane_wall_bracing



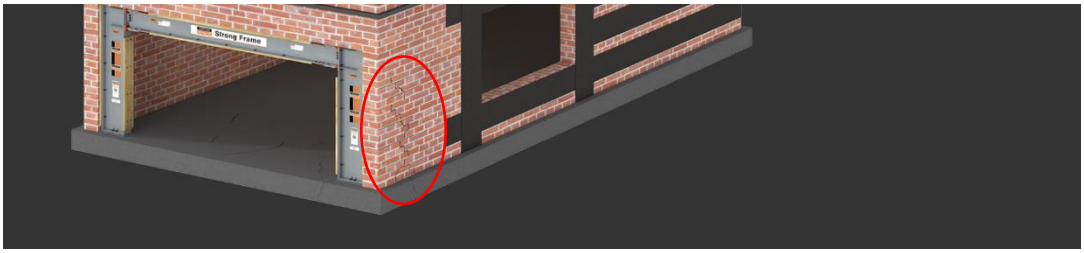
- lateral_shear_resistance



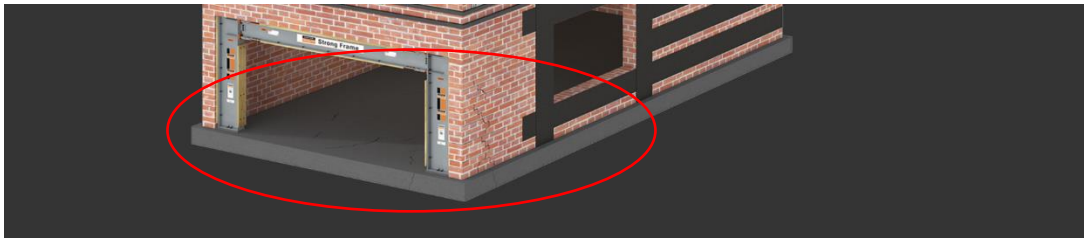
- diaphragm_strengthening



- veneer_anchoring_and_stitching



- concrete_foundation



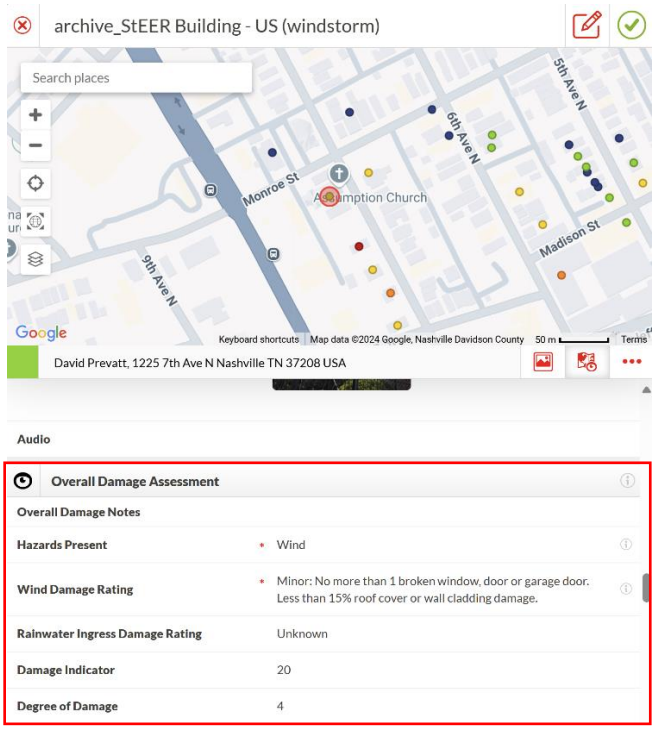
- unknown

hazards_present_u and status_u

Note: If the building is not on Fulcrum (as a lot of buildings won't be), assume wind for everything; tree_fall based on looking at surroundings from aeriel views and seeing if there is any tree fall.

1. Once in the data set for a particular building on Fulcrum, scroll down past the image section to the "Overall Damage Assessment", shown in Figure 21.

Figure 21



2. For the hazards_present_u cell, the data used will be the input for "Hazards Present". Options include:
    a. wind
    b. wind-borne debris
    c. wind, wind-borne debris
    d. tree_fall
3. For the status_u cell, the data used will be the input for "Wind Damage Rating". Options include:
    a. undamaged
    b. minor
    c. moderate
    d. severe
    e. destroyed

Note: If the building isn't in Fulcrum, use your best guess for the damage status from what you can see on any available imagery.

rainwater_ingress_damage_rating_u

- scour_and_erosion_observations (NEW): Visual or recorded evidence of soil scour affecting foundation or terrain stability.

Damage Columns

These columns are used to describe the percent of damage to different parts and sides of the structure. In these columns, we're looking at: roof structure, roof substrate, wall structure, wall cladding, fenestration, soffit, and fascia.

Note: If the building is not in Fulcrum, do your best to fill out this information based on what you can see.

1. Scroll down to the section "Wind-induced Damage Levels"
2. As you can see, there are sections for each of the column inputs, and you can use the values listed. The inputs will range from 0-100% because they are given as percentages. *If no value is listed in Fulcrum, just put 0.*

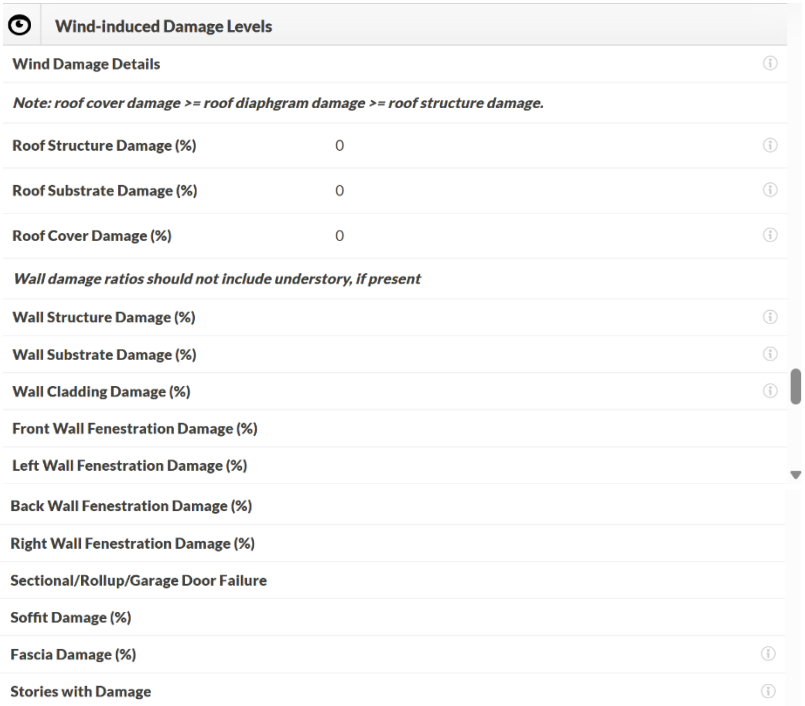


Figure 22

- **wind_damage_rating** – on a scale 0-5 how damaged the building is
- **damage_indicator_u** – same as wind damage rating
- **degree_of_damage** – same as wind damage rating

- **wind_damage_details_u** – in this cell you can write brief notes of the damage to the building (leave the space blank if there is no damage)

After this, then will come each component, with a **_u** and a **_u_per.** The **_u** columns will be on a scale of 0 to 5, while the **_u_per** columns are the same measurement but as a percentage of the overall building front 0 to 100 (what percentage of that specific component is damaged?).

Some may include directional (front, back, left, right AND n, s, e, w) so make sure to pay attention to that. If a building has not been damaged at all, the input for all of these columns will be 0.

- **piles_damage_u** – typically going to be **not_applicable**, unless there is damage to the piles of the building which can only be seen is 1. They are present to begin with and 2. The building is so destroyed that you are able to see themucn
- **foundation_damage_cause** – also have been putting **not_applicable** but if there is evidence of foundation damage, will need to be listed

risk_category_16

Based on IBC Table 1604.5 Risk Category (Figure 23 below), mainly using 2 and 3. Input just the number of the category.

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.a • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the International Fire Code; and Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. • Ambulatory care facilities having emergency surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the International Fire Code; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Figure 23

building_low_rise

Typically anything 4 stories or less is low rise (less than 15 meters).

national_register_listing_year

Most of the buildings you will be looking at are probably not going to be nationally listed. But if the building is on the National Register listing page, there will be a listing year in which it was recognized/listed. Input this year.

existed_during_flood

Did the building exist during the tornado? “yes” or “no”

building_use_BLANK_flood

Using the most current use (not the original historic building use), before and after the tornado. Here you will put the occupancy which was used in the occupancy column at the beginning, with the same options.

Building use plan after tornado is typically the same as the building use after the tornado.

demolishing_year

If it was demolished, in what year? If it was not demolished, just put **not_applicable**

single_unit OR multiple_unit

From this point on, a yes will be input as a 1 and no will be 0.

Single unit – only one building use (e.g. single-family home, regular office buildings)
Multiple unit – multiple building uses/occupancies (e.g. condos, apartments, duplex, office buildings that have apartments on the second floor); singular building with multiple functions

Note: Can only be one or the other

National recognized listings

This is typically only shown for buildings which are on the national registry. When you look them up, it will say either “true” or “false” for each category. If not on the listing, it is up to your discretion, depending on the building, if it is a property of local significance (if so, then it gets a 1).

const_material_h_

Find this based on documentation and visual inspection. Is ___ material used for the foundation, floors, or roof?

KEY (for input): 1 for yes, 0 for no
h is horizontal materials (foundation, floors, roof)
rf means reinforced
rglr means regular
ir means irregular

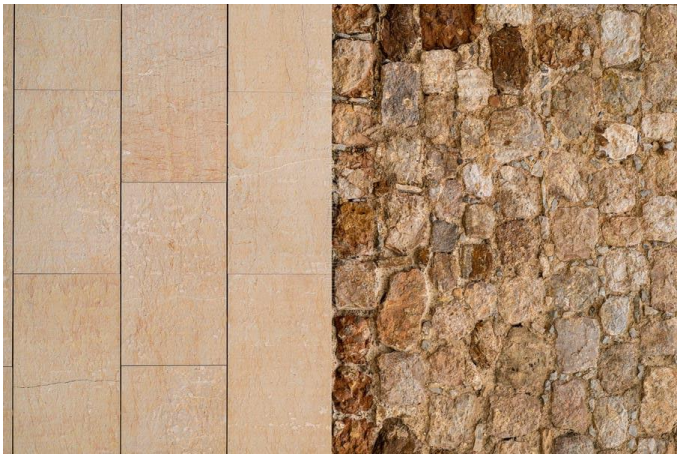


Figure 24: Example of regular vs irregular stone

const_material_v_

Find this based on documentation and visual inspection. Is ___ material used for the walls?

KEY (for input): 1 for yes, 0 for no
v is vertical materials (walls and other vertical members such as columns)
rf means reinforced
rglr means regular
ir means irregular

prop_"classification"

This relates to the original occupancy type, **historically** what was its use? Again, use 1 and 0 to say yes and no respectively (should only be one 1 and the rest should be zeros for each building). The most commonly used classifications:

- prop_religious → churches
- prop_law / government facility → post offices, courthouses, fire stations, etc.
- prop_residential facility → single-family homes, apartment buildings, all lodging
- prop_commercial / exchange facility → all commercial/business buildings
- prop_educational facility → schools

prop_val_

Input options for each column: exceptional, considerable, some, limited, no value

- prop_val_evidential
    - Does the building hold a lot of historical values, belongings wise? Does it show pieces of history that can be used?
- prop_val_historical
    - How important is it in a historical context?
- prop_val_aesthetic
    - How aesthetic is it? Is it kept up?
- prop_val_communal
    - Is the building of local significance? How important is it communally?

owner_

At the time of the natural disaster, who was the owner of the building (may need to make some assumptions)? For this set, use 1 for yes and 0 for no. There should be only one 1 and the rest should be zero.

Note: take private colleges as businesses; public colleges are government; ngo stands for non-government organization

owner_occupied

tenant_occupied

building_existed_#_years_before_flood

Input for each should either be “yes” or “no”.

building_existed_during_flood

Input for each should either be “yes” or “no”.

building_in_use_during_flood

Input for each should either be “yes” or “no”.

building_use_during_flood

Same as the occupancy type.

damage_status

Same as the damage status put prior in the set (severe, moderate, minor, undamaged).

building_demolished_#_yrs_after_event

Input for each should either be “yes” or “no”. Since the columns are in two-year increments, choose which one is closest to real date. For example, when looking at Google Earth Pro at a building, if you see it was demolished in 2022 and the tornado was in 2020, then you can say “yes” for demolished after 3 yrs (round up).

building_abandoned_1_yrs_after_event

emergency_measures_only_performed_1_yrs_after_event

restoration_in_progress_1_yrs_after_event

restoration_completed_building_in_use_1_yrs_after_event

notes

This column is for any notes that need to be made, particularly any uncertainties. Some of the typical things include reasonings for choosing a certain archetype, mixed roof types, exactly when it was demolished, and other information you deem necessary.