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Sustaining emergency preparedness maps within facilities allows staff to safely navigate out of their building in a quick and efficient manner during an unexpected situation. The City of San Marcos (CoSM) has used faulty and outdated emergency preparedness maps in their facilities. They have tasked the San Martían Evacuators with creating emergency preparedness maps for their facilities through geographic information system (GIS) techniques like arcPy and Python Toolbox, creating tools like Least cost path and Euclidean distance. Implementing GIS techniques will ensure proper symbology, a clear template layout, high quality exit routes, and proper posting guidelines. With the creation of a fire evacuation standard, this will allow a uniform plan amongst facilities to produce operational efficiency and proper navigation.

- Developing standards ensuring similar data within all locations
- Creating updated and accurate maps and data that are both maintainable and shareable
- Produce static maps to be displayed within three selected buildings for staff/visitor use.

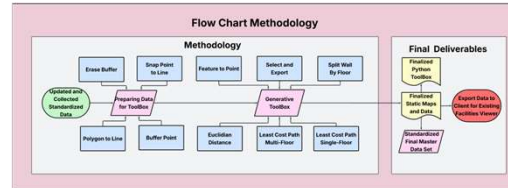


Figure 1. Methodology Workflow

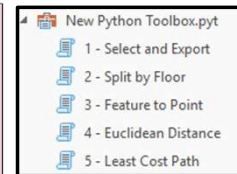


Figure 2. Python Toolbox Tools

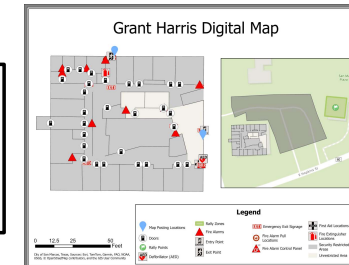


Figure 3. Preview of the Municipal Building seen through San Marcos Facilities Viewer App

The SME successfully created static maps to be placed inside of three select city facilities, digital maps that can be viewed and interacted with through the city Facilities Viewer app, and a Python Toolbox that can be utilized for exit routing using Euclidean Distance and Least Cost Path. The maps created will provide a blueprint for future data collection when conducting site visitations for map implementation. These automated workflows utilized through the Python Toolbox will automate the processes of emergency exit routing and significantly reduce the time needed to create emergency exit routing maps. The implementation of these features will allow for symbology standardization, coherent template layout, and highly efficient exit routing. The implementation of these features and standards will allow for a proper uniform evacuation standard and efficient navigation amongst all CoSM buildings, ensuring proper safety procedures in the case of an emergency and potentially even influencing the creation of exit routing and emergency maps for other private or governmental bodies.

[illegible]

Table 1. Final master data list

Both the CoSM updated data and the data collected by the San Martián Evacuators (SME) was done for the purpose of creating static maps to be placed inside of buildings with different emergency features, the creation of emergency exit routing , and to further submit all features to the CoSM for their existing Facilities Viewer App. Data given by the CoSM are seen in Table 1. The CoSM data had issues that needed to be edited, with the most major issue being the given doorways acting as barriers for exit routing, as they functioned as walls themselves. The SME then collected data at select CoSM buildings via site visitations using the software ArcGIS Field Maps. This application was set up using Map Viewer, where multiple forms were attached to each feature. Seventeen features were collected as seen in Figure 1. After data collection, these features were cleaned up and standardized between attributes. These collected features were then updated with standardized symbology found in either ArcGIS or from online vector sources. Finally, with both updated CoSM provided data and SME collected data, a final master data list was created with twenty-three features.

A methodology workflow was established to highlight the evacuation route process and analysis, as seen in Figure 1. A Python toolbox was required for the process of map route creation, as it needs to run multiple iterations for current and future maps. For the process of route creation, there are specific tools that need to be run before paths are established. This means creating a toolbox with all the required tools within, as seen in Figure 2. With these applications, every possible evacuation route can be generated, and then further compiled all into one geodatabase for easy mapping. After this, the mapping of buildings can commence. For the process of data collection and running the Python toolbox, a Standard Operating Procedure (SOP) document will be given and should be followed for maximum efficiency. If the given steps of data collection and usage of the Python tools are accurately followed, the given processes submitted by the SME can be successfully recreated.

Standardized static maps were produced for usage in the CoSM buildings of Grant Harris, City Hall, and Municipal Building. These maps will be hung up inside of their respective buildings with generalized emergency routing and key emergency features mapped out with appropriate standardized symbology for maximum clarity and conciseness. These maps will be available to CoSM employees via the Map Viewer app with more detail that could be used to path out of any given room. These given maps are now the baseline that the CoSM can use to replicate and produce more evacuation route preparedness maps for current and future buildings. Perhaps more important than the maps created is the implemented Standard Operating Procedure (SOP) set up for future map creation and emergency routing. This document allows any user to input collected data of a given CoSM building into the supplied Python Toolbox and create an emergency exit route for the given building. Through the utilization of updated collected data and proper implementation into the given Python Toolbox, there can be high quality and efficient maps created by the CoSM for current and future city buildings.



Figure 4. Preview of City Hall seen through San Marcos Facilities Viewer App

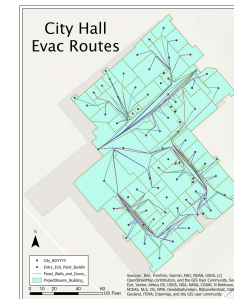


Figure 6. City Hall raw evacuation route data for analysis



Figure 5. Preview of the Municipal Building seen through San Marcos Facilities Viewer App

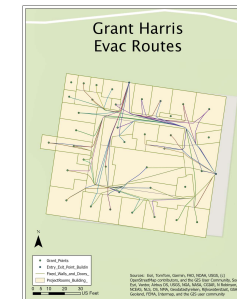


Figure 7. Grant Harris raw evacuation route data for analysis

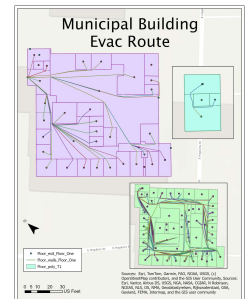


Figure 8. Municipal Building raw evacuation route data for analysis

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