

To: Dan Austin  
From: Will Kwan  
Date: March 11<sup>th</sup>, 2025  
RE: GISC480 Lab #7

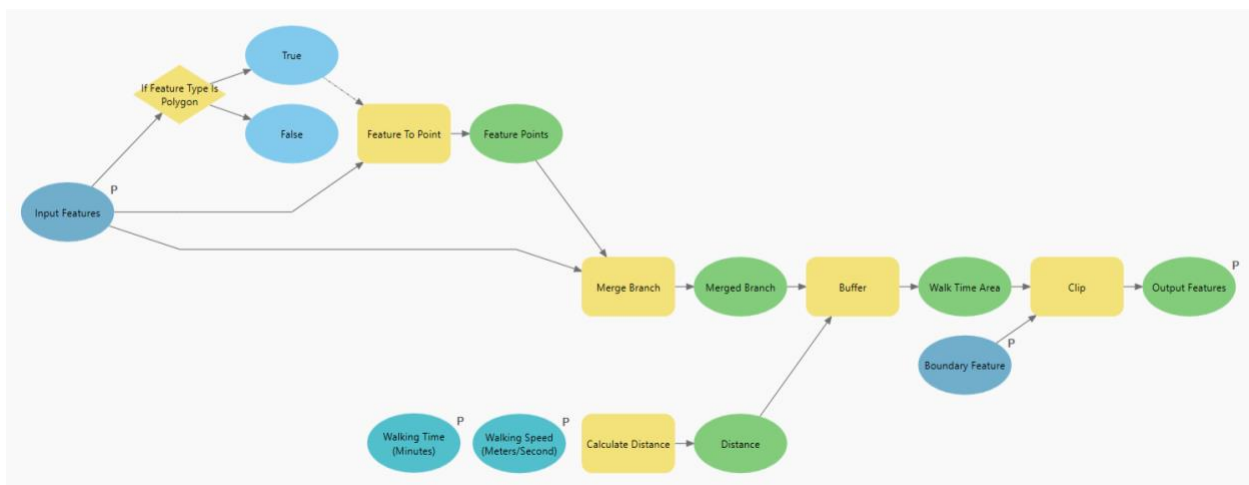
This memo outlines the purpose, required data, and user instructions for the Walk Time Area tool developed in Lab #7. The tool calculates the area surrounding a feature that can be reached within a specified walking time.

## Purpose

The Walk Time Area tool is used to determine the accessible area around a given set of features based on a specific walking time. Rooted in the concept of 15-minute cities—an urban planning concept suggesting essential services like work, education, shopping, and leisure be within a 15-minute walk from anywhere within a city—the tool helps visualize pedestrian accessibility. By mapping walkable areas within a defined timeframe, it visualizes infrastructure access, and, indirectly, walkability.

## Figure 1

*Walk Time Area Tool in Model Builder*



*Note:* Dark blue ovals represent feature variables, while teal ovals indicate double variables. The letter 'P' denotes a parameter. Yellow rectangles represent tools, and green ovals indicate their outputs. A yellow diamond signifies a logical test, with light blue ovals representing its results. Arrows depict the flow of data inputs and outputs between tools, illustrating the sequence of processing steps within the model.

As shown in Figure 1, the tool defines a walk time area by creating a buffer around a set of point features. The resulting dissolved areas represent the regions an individual can reach the input features within the specified time while walking at the given speed. For

polygon features, their centroids are used as reference points to enhance comparability across feature types. The buffer distance is defined by the following formula:

**Formula:**

$$D = \text{Walking Time} \times \text{Walking Speed} \times \frac{1}{\sqrt{2}}$$

Where:

- Walking Time is the time allocated for walking in minutes,
- Walking Speed is the assumed constant walking speed in meters per second,
- $\frac{1}{\sqrt{2}}$  is used to approximate diagonal distance in a grid-like network.

The formula accounts for the fact that walking in a grid-like urban environment typically involves a combination of horizontal and vertical movement rather than the shortest Euclidian distance. By incorporating a factor of  $\frac{1}{\sqrt{2}}$ , the calculation adjusts for the additional distance travelled when following a grid-based street network rather than the direct straight-line path.

This tool has several limitations. It approximates the walk time area using a constant walking speed, but realistically, speed varies throughout a trip. Further, it does not account for physical barriers to movement such as roads, buildings, rivers, disconnected pedestrian networks, or steep slopes. These factors can significantly affect walking time and, consequently, the walk time area. The output walk time areas should be treated as rough estimates.

**Required Data**

To generate a walk time area, the tool requires the following data:

- Input Features (*Point or Polygon*): The starting features from which the walk time area will be calculated (i.e., grocery stores, schools, transit stops).
- Walking Time (*Numerical Value*): The duration an individual is expected to walk, measured in minutes.
- Walking Speed (*Numerical Value*): The assumed constant speed at which an individual is expected to travel, measured in meters per second (m/s).
- Boundary Feature (*Polygon*): The feature bounding the study area.

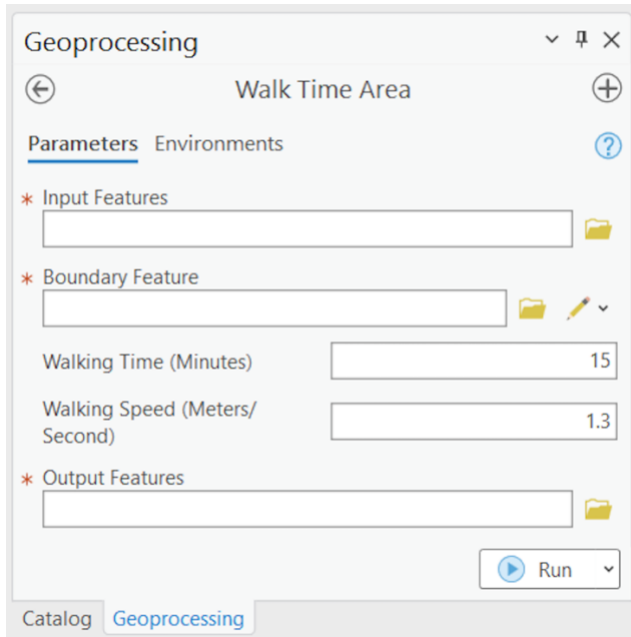
**Users' Manual**

**Step 1: Load the Input Data and Open the Tool**

1. Import the chosen Input Features (point or polygon) and Boundary Feature (polygon) datasets into the GIS.
2. Open ArcGIS Pro and navigate to the Walk Time Area tool.

**Figure 2**

*Walk Time Area Tool Geoprocessing Menu*

The image shows the 'Walk Time Area' tool interface within a 'Geoprocessing' window. The window has a title bar with standard icons. Below the title bar, there are tabs for 'Parameters' (selected) and 'Environments'. A help icon (?) is in the top right. The 'Parameters' section contains several fields: 'Input Features' (marked with a red asterisk), 'Boundary Feature' (marked with a red asterisk), 'Walking Time (Minutes)' (set to 15), 'Walking Speed (Meters/Second)' (set to 1.3), and 'Output Features' (marked with a red asterisk). Each feature field has a folder icon to its right. At the bottom right of the parameters section is a 'Run' button with a play icon. At the very bottom of the window are tabs for 'Catalog' and 'Geoprocessing'.

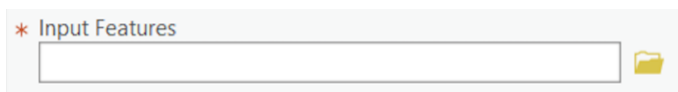
**Note:** the tool requires input features, boundary features, and output features to function. Walking Time (minutes) and Walking Speed (meters/second) are also mandatory; however, default values are provided for convenience.

**Step 2: Populate Feature Parameters**

1. Populate the Input Features parameter (Figure 3) with the chosen point or polygon features from which the walk time area will be calculated (i.e., grocery stores, schools, transit stops).

**Figure 3**

*Input Features Parameter*

The image shows a close-up of the 'Input Features' parameter field. It is marked with a red asterisk. The field is an empty text box with a folder icon to its right.

**Note:** Input Features must be point or polygon.

2. Populate the Boundary Features parameter (Figure 4) with the chosen polygon feature representing the areal extent of the study area.

**Figure 4**

*Boundary Feature Parameter*

The image shows a close-up of the 'Boundary Feature' parameter field. It is marked with a red asterisk. The field is an empty text box with a folder icon and a pencil icon to its right.

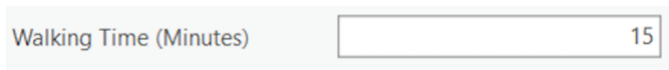
**Note:** Boundary Feature must be a polygon.

### Step 3: Define Walk Parameters

1. Enter the numerical Walking Time (minutes) parameter (Figure 5) in minutes. This is the duration an individual is expected to walk to reach a feature. The default value is 15 minutes, corresponding to the concept of a 15-minute city.

**Figure 5**

*Numerical Walking Time (minutes) Parameter*

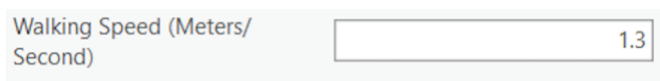


Walking Time (Minutes)

2. Enter the numerical Walking Speed parameter (Figure 6) in meters per second. This is the constant speed an individual is expected to walk. The default value is 1.3m/s, representing the average walking pace of a healthy adult.

**Figure 6**

*Numerical Walking Speed (meters per second) Parameter*



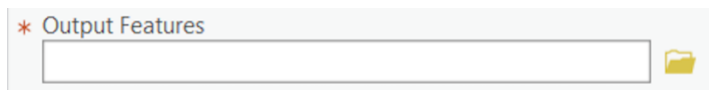
Walking Speed (Meters/Second)


### Step 4: Define Output Features and Run

1. Set the Output Features parameter (Figure 7) to specify the desired location for saving the walk time area feature.

**Figure 7**

*Output Features Parameter*

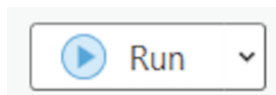




\* Output Features  

2. Click the run button (Figure 8) to run the tool.

**Figure 8**

*Run Button*



 Run 

3. Once the tool has run, the walk time area polygon feature(s) will appear in the display. This marks the completion of the tool process.