Cultural routes in the historic city of Lisbon with uneven terrain using ArcGIS

*1. Poloz (Universidade de Lisboa, Faculdade de Arquitetura, Centro de Investigação em Arquitetura, Urbanismo e Design)

SUMMARY

The Geographical Information System (GIS) for a long time was not in the field of architects and restorators. But, since 2015, there has been a greater tendency to use GIS in built heritage issues (Ferreira-Lopes, 2018). For instance, GIS has a great potential in analysis, evaluation and development of route walkability and accessibility for people with different needs (Pires Rosa, 2020). In this paper, the author aims to present an alternative use of GIS in cultural heritage tourism. Author enhances utilization of GIS in cultural heritage by demonstrating the workflow creating pedestrian accessibility routes between touristic attractions in Lisbon historic city core. The path encompasses different variants such as distance, time consumption, angle of the road and the number of religious attractions. It offers the shortest way to the maximum number of attractions considering the complexity of the passage due to the relief of the city to promote tourism, thus to preserve religious heritage.

Keywords: cultural routes, ArcGIS, cultural heritage
Introduction

The Geographical Information System (GIS) for a long time was not in the field of architects and restorators. It was initially used for geological and geographical targets such as automated creation of maps and management of water, plant, and soil resources (Foresman, 1998)). Even recently most published resources are mainly from the field of IT and Computer Science. However, since 2015, there has been a greater tendency to use GIS in built heritage issues (Ferreira-Lopes, 2018). Its use has evolved to address both the new construction and the heritage preservation subjects. Recently, there has been a growing interest in GIS in the field of heritage conservation, creating new branches, such as Historical GIS, 3D GIS heritage and SDI for cultural heritage (Zohar & Ben-Bassat, 2021), (Kuna & Kowalski, 2020), (Pepe, Costantino, Alfio, Restuccia & Papalino, 2021), (Ferreira-Lopes & Molina Rolazem, 2018). However, GIS has not yet been fully explored for use in cultural heritage. Thus, its use is still insufficient and occasional (Santos et al., 2021). GIS in the field of historical heritage is mainly applied for inventory and cataloging (Ferreira-Lopes, 2018). Although it can collect, store, operate, analyze, and demonstrate spatial data to resolve diverse complex issues in cultural heritage and tourism. For instance, GIS has a great potential in analysis, evaluation and development of route walkability and accessibility for people with different needs (Pires Rosa, 2020).

In this paper, the author aims to present an alternative use of GIS in cultural heritage tourism. Author enhances utilization of GIS in cultural heritage by demonstrating the workflow creating pedestrian accessibility routes between tourist attractions in Lisbon historic city core. The path encompasses different variants such as distance, time consumption, angle of the road and the number of religious attractions. It proposes the shortest way to the maximum number of attractions considering the complexity of the passage due to the relief of the city.

Introduction of GIS in the field of culture heritage and tourism is a driving force in their development, improvement and preservation as tourism creates public awareness and this, in turn, contributes to the financial support and preservation of architectural heritage.

Method

Author uses the ArcGIS program to integrate geo-referenced graphical data with information about cultural heritage. All information was taken from open-source data at municipal authorities. The following workflow is proposed to demonstrate the creation of different levels of accessible tourist paths depending on the height of the historic city center terrain. Three main steps were considered.

1. Identification of certain cultural points of attraction,
2. Creation of walking path network,
3. Adjustment of cultural routes altitude.

Example

In this example, tourist routes to religious cultural buildings were created within the historic center of Lisbon.

To create touristic routes, it is necessary to choose the type of historic buildings to which there is a need to produce it. In this case, tourist attractions are religious buildings. Since the municipality did not have a separate file of religious buildings, they were extracted from the common database of all types of buildings in the city of Lisbon.

I. Extraction of the religious buildings:

1.1. Selection – Select by location: -Target layer: Existing Building, Source layer: religious buildings’ points – Apply.
1.2. Tool: Select Features.
1.3. RC - Data – Export data.
Additionally for better perception, all religious buildings were marked with different colors according to their type (monastery, convent, collegium, hospitality, etc.).

  b. Add column “Type”.
  c. RC – Properties – Symbology – Categories – Value field: Typology; Add all values.

The next step is to create a road network based on which the tourist paths to certain objects are produced. The main file of road polylines was obtained from an open resource of the municipality of Lisbon.

2a. Creation of road networks:

  2a.2. Create New Network database in Catalog
  2a.3. Unity Network tool

2b. Creation of walking route:

  2b.1. Create New Shape file with providing a type (polyline) and a coordinate system.
  2b.2. Adjust necessary settings with editing tools.
  2b.3. Data Management tool – Features – Split line in vertices; Input: “Roads …”
  2b.4. Unity Network tools - Create a new route – create network location tools – Solve (run the current analysis)

3. Creation of touristic walk routes altitude based on elevation and slope maps

  3.1 Create elevation map:

    3.1.1. Spatial Analyst Tools – Interpolation – IDW
    3.1.2. Environments – raster analysis – Mask: Limit.

  3.2. Create slope map:


  3.3. Create roads width:

    3.3.1. Conversion tools - To raster – Polyline to raster.

  3.4. Create altitude of roads:

    3.4.1. Spatial analyst tools – Extraction – Extraction by mask

  3.5. Provide altitude to walking paths:

    3.5.1. Spatial analyst tools – Extraction – Extraction by mask

As a result, four different tourist routes to historic religious buildings were created within the relief historical center of Lisbon (Fig.1).
Figure 1 Four tourist routes created in GIS showing 1) the number of covered historical religious buildings; 2) the difficulty of passing the path, which is displayed in green, yellow, and red. Colors show the angle of the road. Green has the angle of the road up to 5 degrees, yellow - from 5 to 15 degrees, red - from 15 to 37 degrees.

Conclusions

The author explains in detail the process of creating cultural routes to religious buildings within the historic relief city of Lisbon. This workflow demonstrated the accessibility of routes based on city elevation terrain. That is, the higher the angle of the terrain, the more difficult access to the religious building. Therefore, the demonstrated path warns the tourist in advance about the increase in time and the difficulty of access to the object by certain groups of people.

For the future application, the demonstrated workflow sequence has all the features be more complex and include other aspects of walkability and safety of cultural routes developing spatial accessibility and access to information required by the World Tourism Organization.

References

Ferreira-Lopes, P. (2018) Achieving the state of research pertaining to GIS applications for cultural heritage by a systematic literature review. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII (4), 169-175. Doi: 10.5194/isprs-archives-XLII-4-169-2018


