GEOGRAFICKÝ ČASOPIS / GEOGRAPHICAL JOURNAL 78 (2026) 4, 241-249
DOI: https://doi.org/10.31577/geogrcas.2026.78.4.05

INSTITUTE OF GEOGRAPHY SLOVAK ACADEMY OF SCIENCES

Geografický časopis
Geographical Journal

A GIS-Based Workflow for Producing and Validating Municipal Tourism Information Plans

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Abstract

Municipal tourism information plans support visitor navigation and destination communication, particularly in compact urban centers where attractions, services, public institutions, and transport routes must fit within a limited printed format. This study presents a theory-informed geographic information system (GIS) workflow for producing and evaulating an A2 printed municipal tourism information plan for Ferizaj, Kosovo, at a scale of 1:8,000. The workflow combines spatial data verification, field checking, coordinate reference system management, constrained scale selection, cartographic generalization, hierarchical symbol design, bilingual toponymy, map composition, and usability evaluation. Scale selection considers the print format, mapped extent, and minimum symbol-separation requirements to limit congestion in dense urban areas. Line simplification and selective feature omission reduce geometric complexity while a structured symbol hierarchy and manually refined Albanian and English labels support visual clarity. The map composition coordinates navigational and descriptive content. Navigation tasks were used to assess effectiveness and efficiency, while the System Usability Scale (SUS) was used to assess perceived usability; together, these methods guided iterative cartographic refinement. The study presents a practical methodological framework for municipal tourism information plans while emphasizing that GIS processing must be combined with cartographic judgment, local tourism expertise, and field verification.

Key words:
cartography, GIS, information plan, generalization, scale optimization, toponymy, usability, semiology, tourism

1 INTRODUCTION

Tourist maps and tourism information plans occupy a distinctive position within cartography as spatial artifacts that simultaneously support wayfinding, structure visitor perception, and communicate destination identity. In this paper, a distinction is made between outdoor tourist maps, which commonly emphasize relief, hiking routes, and natural terrain, and urban tourism information plans, which focus primarily on attractions, services, public institutions, transport access, bilingual names, and visitor-oriented map composition. The Ferizaj case belongs to the second category: it is a printed municipal information plan for urban tourism, not a hiking or mountain tourist map.

The conceptual foundations of tourist cartography are embedded in classical theories of cartographic communication. Bertin's semiology of graphics established that spatial meaning is constructed through controlled manipulation of visual variables, including size, value, orientation, color, and shape (Bertin, 1983). Robinson et al. (1995) further articulated cartography as a communicative process in which abstraction is essential to clarity. MacEachren (1995) expanded this perspective by emphasizing the cognitive dimensions of map use, arguing that map interpretation depends on perceptual structuring and mental model formation. In tourism contexts, these theoretical principles acquire heightened significance because maps are often consulted under dynamic conditions characterized by limited time and unfamiliar surroundings.

Aesthetic judgment is also a component of cartographic theory and design (Kent, 2005). Research on European topographic maps demonstrates stylistic variation among national symbol systems and examines these conventions through the concept of cartographic language (Kent & Vujakovic, 2009, 2011). This wider perspective treats topographic maps as representations with both scientific and cultural dimensions (Kent & Hopfstock, 2018).

Despite extensive theoretical literature on cartographic design, the practical production of city plans and tourism information maps frequently remains heuristic, publisher-driven, and constrained by budget, print format, available data, and local tourism priorities. Earlier work on tourist-map users and GIS-supported tourist-map production indicates that technical processing alone is insufficient unless it is linked with cartographic design, field verification, and user-oriented evaluation (Filippakopoulou

& Nakos, 1995; Medyńska-Gulij, 2003). Related research has also explored automated tourist-map generation based on the salience of landmarks and other map elements (Grabler et al., 2008). This study therefore does not claim that an urban information plan can be produced automatically from orthophotos, LiDAR, or GIS datasets alone. Instead, it formalizes a workflow in which GIS supports data organization, quality control, scale testing, and iterative map refinement.

The rapid expansion of Geographic Information Systems has reshaped cartographic production by enabling structured spatial data integration, projection control, algorithmic generalization, reproducible attribute management, and iterative layout refinement (Longley et al., 2015). Nevertheless, the GIS-based approach is most defensible when it is combined with local field verification and cartographic visualization expertise. In many European contexts, city plans and visitor information maps have historically been produced by private publishers, tourism organizations, or local authorities using national topographic or cadastral sources supplemented by field knowledge. This practical production context is central to the present study, which evaluates GIS as a controlled production environment rather than as a substitute for professional cartographic design.

Tourism geography further complicates the representational task. Maps are not neutral reflections of spatial reality; they influence visitor movement patterns and shape destination image construction (Hall & Page, 2014). Monmonier (2018) underscores that all maps embody selective emphasis and omission, thereby structuring perception. In tourism, this selective emphasis may guide flows toward specific heritage clusters or redistribute attention toward under-visited areas. Consequently, tourist maps can function as subtle instruments of spatial governance.

An additional dimension concerns linguistic representation. Place names carry symbolic, cultural, and political meaning within tourism contexts (Light, 2014). In multilingual or internationally oriented destinations, bilingual toponymy becomes central to accessibility and identity negotiation. International guidelines recommend preserving endonyms while providing accessible exonyms to reduce navigational ambiguity (Stani-Fertl, 2017). However, bilingual representation introduces spatial and typographic constraints that may compromise clarity if not systematically managed. The cartographic literature has not sufficiently addressed operational strategies for balancing multilingual inclusivity with layout optimization in dense urban environments.

A further methodological deficiency in tourist cartography concerns usability assessment. While digital mapping platforms frequently undergo structured user testing, printed tourist maps are rarely evaluated using standardized instruments. Usability concerns effectiveness, efficiency, and satisfaction in a specified context of use (International Organization for Standardization [ISO], 2018). Task-based measures can assess effectiveness and efficiency, while the System Usability Scale (SUS) provides a measure of perceived usability (Brooke, 1996; Bangor et al., 2009). The absence of empirical usability validation in many tourist map projects limits the scientific robustness of such products and constrains their replicability.

For this study, the Municipality of Ferizaj was selected as an appropriate case through which to address these theoretical and practical gaps. The tourism-relevant urban core contains a dense concentration of cultural heritage sites, religious monuments, civic institutions, hospitality services, and public infrastructure within a compact spatial footprint. This spatial density generates significant cartographic challenges, particularly in relation to map-symbol conflict, label congestion, bilingual naming, and hierarchy between primary attractions and secondary services. At the same time, Ferizaj does not require the relief-centered design logic typical of outdoor tourist maps; its principal design problem is the production of a clear urban information plan for visitor orientation.

This study therefore positions itself at the intersection of cartographic theory, GIS-based spatial data processing, local tourism information, bilingual toponymy, and usability engineering. The central research problem is not merely how to design a map, but how to construct a reproducible workflow for an A2 printed municipal tourism information plan that ensures spatial accuracy, visual clarity, linguistic accessibility, practical feasibility, and empirically evaluated usability.

Specifically, the study addresses the following research questions:

- How can the extent, print format, and publication scale of a municipal tourism information plan be selected so that visitor-relevant areas are emphasized while symbol conflict is minimized?
- How can GIS-based spatial data integration, attribute standardization, and cartographic generalization support practical map production without replacing field verification and cartographic judgment?
- How can bilingual toponymy, cartographic symbol hierarchy, and label categorization be implemented without compromising readability in a dense urban map face?
- How can structured usability testing, including task-based assessment and SUS reporting, identify weaknesses before final publication of a printed tourism information plan?

By answering these questions, the study contributes to municipal-level tourism cartography through methodological formalization. It demonstrates that integrating established cartographic theory (Bertin, 1983; Robinson et al., 1995; Slocum et al., 2014), GIScience principles (Longley et al., 2015), data quality frameworks (ISO, 2013), tourist-map user research (Medyńska-Gulij, 2003), early GIS-tourist-map assessment (Filippakopoulou & Nakos, 1995), tourism geography perspectives (Hall & Page, 2014), and usability engineering (Brooke, 1996; ISO, 2018) produces a coherent model for evidence-based tourism information plan development.

The contribution is therefore both theoretical and applied. Theoretically, it operationalizes classical cartographic concepts within contemporary GIS workflows while acknowledging the practical distinction between outdoor tourist maps and urban information plans. Methodologically, it formalizes scale determination, attribute standardization, bilingual labeling, and usability feedback loops. Practically, it provides municipalities and tourism organizations with a structured framework for producing cost-aware, user-centered printed information plans that remain compatible with local field knowledge and professional cartographic design.

2 TERMINOLOGICAL AND PRACTICAL CONTEXT

The term municipal tourist map can imply an outdoor tourist map, often associated with hiking, mountain terrain, relief representation, and recreational infrastructure. The depiction of relief is a distinct cartographic design problem (Collier et al., 2003). In this study, the Ferizaj product is more accurately described as a municipal tourism information plan or urban visitor information plan. Relief depiction is therefore not treated as a primary design variable in this case; the design emphasis is instead placed on point-of-interest hierarchy, transport orientation, bilingual names, visitor services, and the separation of navigational and interpretive content.

This terminological clarification also affects the methodological claims of the paper. The workflow should not be interpreted as a fully automated procedure for producing all types of tourist maps. For true outdoor tourist maps, relief representation, trail verification, terrain interpretation, and extensive fieldwork would be essential. For an urban tourism information plan, GIS contributes most strongly through spatial data management, coordinate consistency, attribute standardization, density analysis, scale testing, and repeatable revision; the final product still requires field verification and cartographic design expertise.

The intended publication format is a printed A2 information plan combining a map face with supporting visitor information. It may also be displayed as a poster, but the printed A2 product is the primary object of design and evaluation. This distinction is important because a wall poster and a hand-held information plan impose different requirements for symbol size, viewing distance, label density, and marginal information.

3 MATERIALS AND METHODS

GIS workflow and spatial data preparation

The production of the municipal tourism information plan for the Municipality of Ferizaj was implemented as a theory-informed GIS workflow designed to support spatial accuracy, cartographic legibility, linguistic accessibility, and usability evaluation. The methodology conceptualized the product as a printed urban information plan rather than as an outdoor relief-centered tourist map. The workflow integrated multi-source spatial data compilation, field and orthophoto verification, coordinate reference system management, attribute-table standardization, constrained scale selection, cartographic generalization, bilingual toponym implementation, hierarchical cartographic symbolization, map composition, and usability evaluation.

The integrated methodological structure is illustrated in Figure 1. The Business Process Model and Notation (BPMN)-style diagram organizes the production process into sequential GIS processing stages, cartographic visualization stages, and validation loops. Within the cartographic visualization stage, symbol design converts categorized points of interest into a perceptual hierarchy, visual hierarchy defines the relative prominence of attractions, services, and transport elements, bilingual labeling assigns primary and secondary typographic roles to Albanian and English names, and map composition organizes the map face and supporting visitor information into a coherent printed product. These visualization decisions depend on the preceding GIS processing stages because feature categories, scale constraints, geometry simplification, and verification status determine what can be shown legibly.

Figure 1 presents the structured methodological architecture underlying the development of the Ferizaj tourism information plan. The BPMN-style representation formalizes the workflow into sequential GIS processing stages and decision gateways, highlighting the integration of spatial data preparation, attribute standardization, scale optimization, cartographic generalization, symbol design, bilingual labeling, map composition, and usability evaluation. The feedback loops from usability testing to symbolization, labeling, and generalization stages demonstrate how empirical evaluation directly influenced cartographic adjustments.

The spatial data framework was defined by the tourism-relevant urban core of Ferizaj, characterized by a dense concentration of cultural landmarks, civic institutions, religious sites, hospitality services, and public infrastructure within a compact urban footprint. The mapping extent was delineated functionally rather than strictly administratively, reflecting the principle that visitor information plans prioritize navigational relevance over exhaustive territorial representation (Jancewicz & Borowicz, 2017). All spatial processing was conducted in EPSG:9140, ETRS89-XKX [KOSOVAREF01] to support metric distance measurement during scale testing, map-symbol separation analysis, and geometry processing.

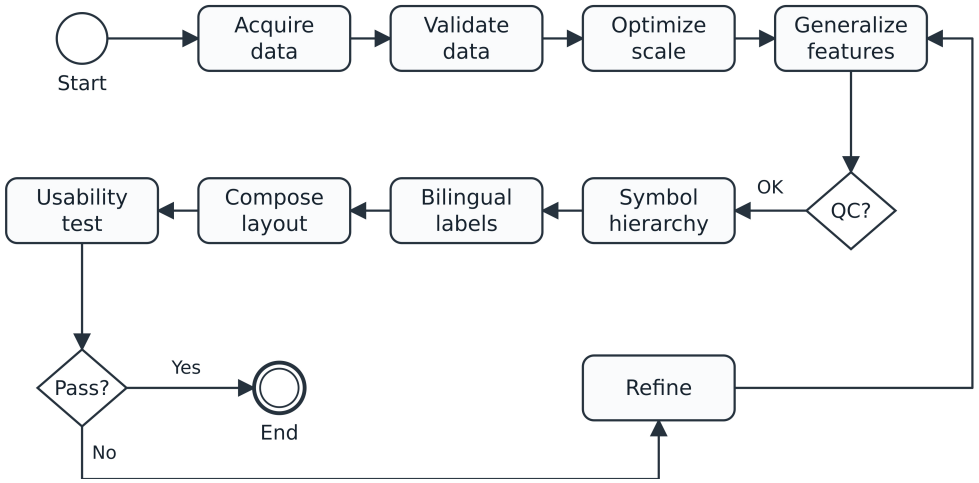


Fig. 1. BPMN-style workflow for GIS-based production and validation of a municipal tourism information plan in Ferizaj, including data validation, cartographic visualization, bilingual labeling, map composition, and usability feedback.

Spatial datasets were compiled from complementary authoritative and open sources: topographic base data for reference structure, recent orthophoto imagery for positional checking, municipal infrastructure records for official public facilities, OpenStreetMap data for transport and service features, and locally verified tourism information for cultural attractions and visitor services. OpenStreetMap is an example of volunteered geographic information (Goodchild, 2007). Each mapped feature was assigned a unique point-of-interest (POI) identifier, thematic and sub-thematic category, Albanian and English name attributes, symbol category, label-priority level, scale-dependent display rule, source dataset, verification status, and date last verified. This functional attribute structure allowed the GIS project to drive symbolization rules, label hierarchy, feature selection, and later updates in a transparent manner.

Scale optimization, cartographic design, and usability evaluation

Earlier experiments in 1:100,000 topographic mapping for tourist and leisure users illustrate the importance of relating design choices to map scale and intended use (Forrest & Kinninment, 2001). Scale determination was treated as a constrained design procedure rather than an arbitrary aesthetic decision. First, the tourism-relevant bounding box was compared with the printable A2 map face after margins, legend, scale bar, north arrow, and locator elements were reserved. Second, the smallest distances between clustered POI symbols in the urban core were measured in projected coordinates and converted to on-paper distances. The target condition was that adjacent priority POI symbols should remain at least 0.5 cm apart at normal hand-held viewing distances of approximately 50-70 cm. When this condition was not met, the workflow tested four corrective actions in sequence: reducing the mapped extent to the visitor-relevant core, increasing the publication scale, displacing lower-priority symbols, and omitting or aggregating secondary services. The final A2 production scale was standardized as 1:8,000.

Cartographic generalization was applied to reduce visual complexity while preserving navigational integrity. Raw GIS datasets often contain geometric detail suitable for large-scale mapping but excessive for city-scale tourist representation. Line simplification was performed using the Douglas–Peucker algorithm, which iteratively removes vertices within a tolerance while preserving overall shape characteristics (Douglas & Peucker, 1973). Complementary evaluation using the Visvalingam–Whyatt method improved perceptual smoothness and reduced angular artifacts in curved street segments (Visvalingam & Whyatt, 1993). These approaches derive from foundational research on polygonal curve approximation (Ramer, 1972) and remain widely implemented due to computational efficiency and predictable behavior. Simplification tolerances were calibrated iteratively to balance vertex reduction against topological preservation. Over-simplification risks distorting intersection geometry and impairing route interpretation, whereas under-simplification increases clutter and contributes to label collision. Selective omission of minor streets was guided by functional relevance to visitor mobility rather than geometric reduction alone, consistent with abstraction principles emphasizing thematic prioritization over exhaustive depiction (Robinson et al., 1995).

Map design guidance relates the selection and visual organization of content to the map‘s purpose and intended audience (Krygier & Wood, 2016). The cartographic symbol system was developed according to hierarchical semiological principles. Points of interest were categorized into primary cultural attractions, secondary attractions, visitor services, transport facilities, and emergency infrastructure. Primary attractions were assigned larger and higher-contrast map symbols; secondary attractions and services were assigned smaller subordinate symbols; emergency and safety-related services retained distinctive iconography because of their functional importance. The legend was organized according to these same categories so that users could interpret symbol meaning without scanning an unstructured list. Bilingual toponymy was implemented through explicit label categorization. Albanian endonyms were retained as primary labels, while English equivalents were presented as secondary labels using smaller size, lighter weight, or subordinate placement. Label rank was assigned by feature class: settlement and district names, primary attractions, transportation corridors, public institutions, secondary services, and descriptive information. Automated label placement was used only as a first pass. Final label placement was manually refined to avoid overlap, preserve road readability, and prevent bilingual labels from competing with primary map symbols. This typographic hierarchy made the bilingual structure visible without treating both languages as visually equivalent layers.

The final map composition coordinated navigational and descriptive content. The map face contained essential marginal elements, including a legend, scale bar, north arrow, map frame, and locator inset. Supporting visitor information included photographs and concise descriptive text for selected attractions. This separation of content was intended to limit overcrowding of the map face while preserving promotional and interpretive value.

Usability evaluation was conducted to assess the functional performance of the printed information plan under realistic use conditions. The evaluation record included participant number, demographic composition, recruitment method, participant selection criteria, familiarity with Ferizaj, visitor/resident status, age group, and language competence. Participants completed structured tasks including landmark identification, route planning, and location of essential services. Following task completion, they completed the SUS questionnaire (Brooke, 1996), and observational notes were used to identify symbol, label, and spacing issues for iterative refinement.

4 RESULTS

The final municipal tourism information plan of Ferizaj was produced at a standardized publication scale of 1:8,000 in A2 format. It combines a map face designed for navigation with supporting photographs and concise descriptive text. The completed product illustrates the integration of cartographic abstraction, field verification, hierarchical symbols, billingual information, and user-centered evaluation within a GIS-supported production workflow.

Figure 1 summarizes the methodological structure that produced the final cartographic product. The BPMN-style representation formalizes map production as a controlled system of GIS processing, cartographic visualization, and validation checkpoints. The diagram highlights iterative feedback loops between usability testing and refinement stages, indicating that the map was optimized through evaluation-driven revision rather than finalized in a single pass.

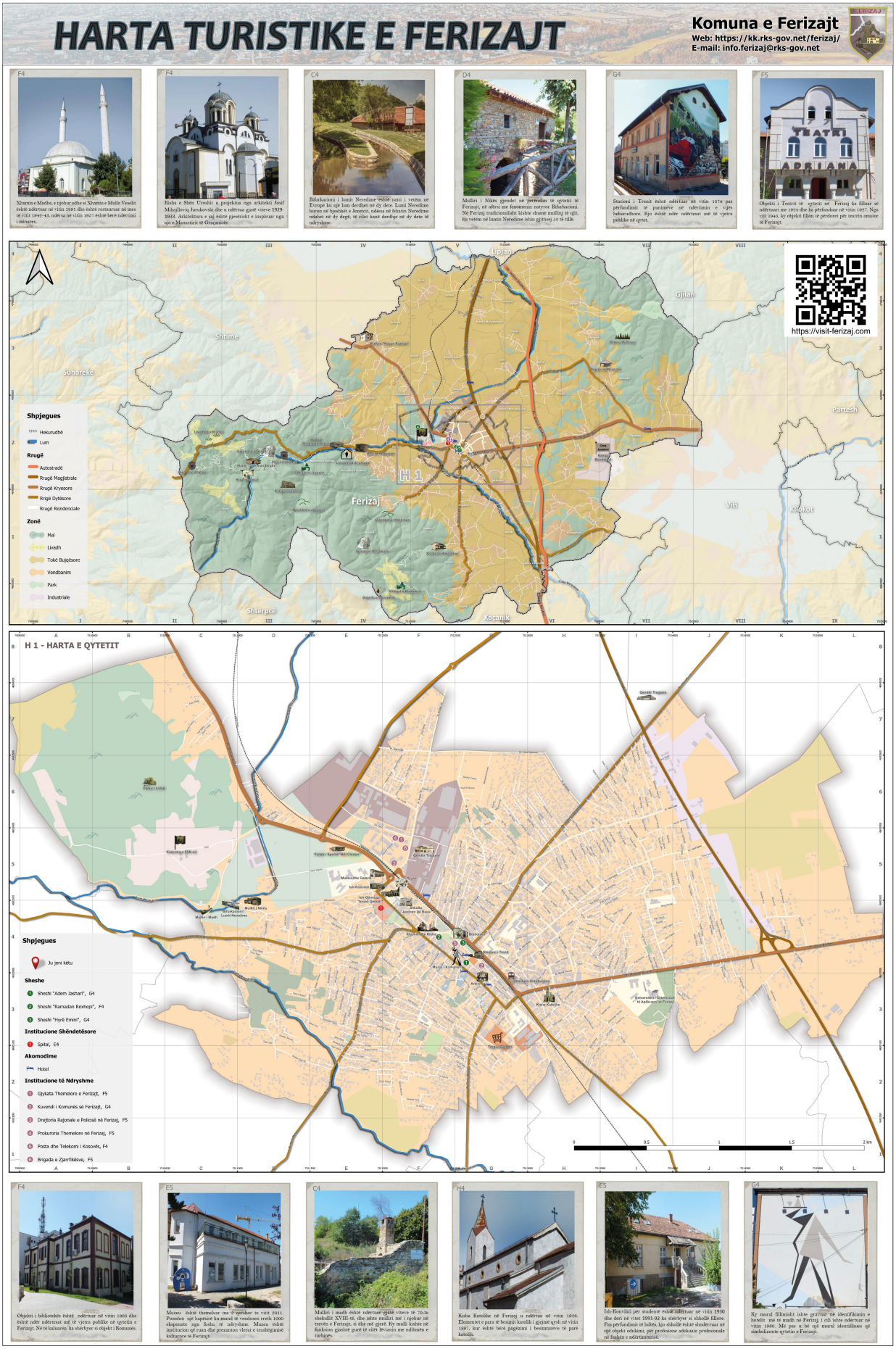


Fig. 2. Final A2 municipal tourism information plan for Ferizaj, showing the main map face and supporting visitor-information content. The figure is reproduced at reduced size.

Figure 2 presents the final information-plan product. The map face demonstrates that the chosen 1:8,000 publication scale, generalization tolerances, symbol hierarchy, and label hierarchy collectively achieved legibility in an urban environment characterized by high feature density.

A key result concerns the effectiveness of the constrained scale-selection approach. The proportionality analysis ensured that the tourism-relevant extent could be represented without excessive spatial compression, while the minimum-distance constraint reduced map-symbol conflict in dense clusters of attractions. In the Ferizaj case, the final 1:8,000 scale enabled clearer separation of proximate points of interest in the historic core, where attraction density is highest. Visual inspection of the final map confirms that symbol overlap was minimized in the most saturated areas, indicating that the minimum-separation criterion successfully translated legibility requirements into a measurable spatial constraint.

The generalization procedures applied to the transportation network and other linear features produced a substantial reduction in visual noise. Raw datasets derived from base map layers and volunteered geographic information contained polyline vertex densities unsuitable for a printed city information plan. Here, vertices refer to the coordinate points composing line geometries, such as street segments and paths. After simplification, the transportation network retained topological continuity and intersection integrity, both of which are essential for tourist wayfinding and route interpretation.

A further outcome of generalization was the improvement of label placement capacity. By reducing geometric irregularity and eliminating excessive minor detail, additional whitespace was created for toponyms and POI labels. This use of simplification follows cartographic principles that relate selective abstraction to interpretive clarity (MacEachren, 1995; Robinson et al., 1995). The resulting network representation supports rapid recognition of major corridors and pedestrian pathways, reinforcing the map's core navigational purpose. In Figure 2, the road hierarchy distinguishes major corridors from subordinate routes, with the aim of making the city structure easier to interpret.

The hierarchical cartographic symbol system performed effectively across thematic categories. Cultural attractions, museums, religious sites, and heritage locations were visually dominant through controlled manipulation of size and contrast. Visitor services such as hotels, restaurants, and transport facilities were represented with smaller, subordinate symbols, allowing them to remain accessible without competing with primary attractions. Emergency services, including hospitals and police stations, were emphasized through distinct iconography consistent with user expectations for safety-related information. This hierarchy aligns with semiological principles that emphasize differentiation through graphic variables (Bertin, 1983) and with contemporary cartographic design guidance advocating strong thematic structuring for tourist map products (Slocum et al., 2014; Brewer, 2016). User observations indicated that participants were able to interpret the legend quickly and identify symbol meaning with minimal hesitation, suggesting that categorical grouping and symbol consistency were successful.

The typographic strategy produced a readable bilingual representation without a substantial increase in clutter. Albanian endonyms were retained as primary labels, while English equivalents were displayed as secondary text. This implementation corresponds with international recommendations for tourist map toponymy, which emphasize the importance of preserving local naming while providing accessible forms for international users (Stani-Fertl, 2017). It also reflects tourism geography findings that place names function as cultural markers and contribute to destination perception and meaning-making (Light, 2014). In the final map (Fig. 2), bilingual labels were successfully integrated through typographic hierarchy and manual refinement. Label collisions were minimized, and the bilingual structure did not generate confusion during usability tasks. Participants noted that bilingual naming improved their ability to match map labels with physical signage and verbal directions, supporting the practical navigational value of multilingual representation.

The map composition distinguished navigational from descriptive content. The map face focused on spatial orientation, while supporting images and concise descriptions provided information about major attractions. Separating these functions was intended to limit the amount of descriptive text within the map frame.

Figure 3 summarizes selected structural indicators and visual comparisons before and after cartographic processing. Panel (a) compares polyline vertex count, the POI density index, and label conflicts. Here, polyline vertices are the coordinate points composing street and path geometries rather than tourist features. Panel (b) compares the displayed point distributions before and after feature selection, while panel (c) illustrates changes in the plotted line profile following simplification. The comparisons indicate reduced complexity in the displayed representations. These structural indicators are interpreted alongside visual inspection of the map and usability observations; they do not, by themselves, establish preservation of network typology or improved navigation performance.

Usability testing examined landmark identification, route planning, and the location of essential services. Task observations, participant feedback, and SUS responses informed the evaulation and subsequent refinement of the printed information plan.

SUS scores are interpreted as measures percieved

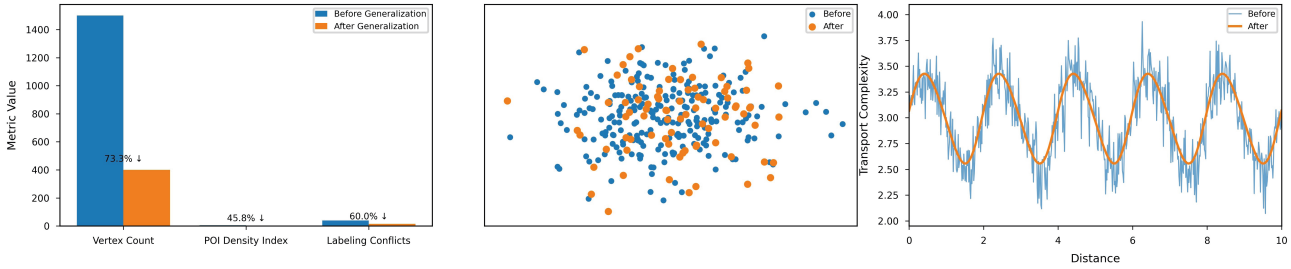


Fig. 3. Cartographic generalization comparisons: (a) vertex count, POI density index, and labeling conflicts, with percentage reductions; (b) point distributions before and after generalization; and (c) transport-complexity profiles before and after generalization.

usability alongside observed task performance and participant feedback (Bangor et al., 2009). Task-based observations address effectiveness and effiiciency, while SUS responses and qualitative feedback contribute to the interpretation of users' experience within the context of use defined in ISO 9241-11 [ISO], 2018).

Qualitative feedback further supported these outcomes. Participants reported that the cartographic symbol system was intuitive, the legend was easy to interpret, and bilingual labeling improved accessibility. Minor issues were primarily related to marginal spacing and the prominence of selected secondary service symbols. These issues were resolved through final refinements, including slight resizing and spacing adjustments. These revisions did not require structural redesign and focused on the symbol sizes and spacing identified during evaluation. This outcome aligns with usability engineering principles that emphasize iterative design, early validation, and refinement based on user performance evidence (Nielsen, 1994; Garrett, 2011; Sauro, 2011).

The final map represents the concetration of cultural heritage sites in the historic core and the distribution of service infrastructure across the broader urban area. These spatial relationships provide context for visitor itinerary planning and movement decisions. The visual hierarchy ensures that key attractions remain focal while secondary services provide contextual support. This outcome reflects cartographic design principles emphasizing the need to structure user attention without suppressing essential reference information (Slocum et al., 2014; Brewer, 2016).

Together, the results illustrate how a GIS workflow can organize scale selection, attribute standardization, cartographic generalization, hierarchical symbols, bilingual toponymy, and usability evaluation within a documented production process. The final information plan combines navigational and promotional content while drawing on field verification and cartographic judgment.

5 DISCUSSIONS

Methodological and cartographic contributions

This study documents a structured workflow for producing a municipal tourism information plan. Many city plans and visitor maps are developed as design-driven products with limited methodological documentation. The workflow formalized in Figure 1 integrates data validation, scale selection, cartographic generalization, semiological design, bilingual labeling, map composition, and usability evaluation in a documented process that can be adapted and evaluated in other municipalities.

A key cartographic contribution concerns the operationalization of scale as a measurable design constraint. Urban tourism information plans are vulnerable to symbol congestion because points of interest cluster in heritage cores and because visitor maps must simultaneously represent attractions, services, and mobility corridors. The constrained approach described in Section 3 and evidenced in Figure 2 demonstrates that scale can be selected through both print-format proportionality and ergonomic separation thresholds, while also allowing practical interventions such as extent reduction, symbol displacement, or omission of lower-priority services.

The generalization results provide further methodological insight. The improvements visible in Figure 2 and quantified in Figure 3 indicate that classical line simplification algorithms remain effective for contemporary municipal tourist cartography. The Douglas–Peucker and Visvalingam–Whyatt methods reduced geometric noise while preserving navigational integrity. Cartographic generalization selectively removes detail to improve legibility while preserving information needed for navigation. The resulting representation trades geometric detail for readability while seeking to preserve navigationally important relationships.

The cartographic symbol hierarchy and legend design also contribute to applied municipal cartography. Semiological structuring ensures that primary attractions dominate visual attention while secondary services remain contextually available. The outcomes support the view that urban tourism information plans function as both navigation tools and curated representations of destination identity. This duality requires design strategies that maintain legibility while still presenting an attractive and meaningful tourism product.

Implications for tourism navigation, accessibility, and destination communication

The workflow has implications for tourism mobility and visitor decision-making. Tourism geography emphasizes that tourist movement is shaped by spatial cues, perceived accessibility, and representational emphasis. Figure 2 illustrates how transport corridors, landmarks, and a structured legend can be organized to support visitor orientation. These design choices are intended to make the map easier to interpret for users unfamiliar with the urban environment; their effects on interpretation speed and independent navigation require direct assessment.

Bilingual labeling is relevant to accessibility in destinations serving heterogeneous visitor groups. Including English alongside local endonyms provides linguistic access for international tourists while retaining local naming. The Ferizaj map illustrates how typographic hierarchy and manual refinement can accommodate two languages within a compact urban map. This implementation offers design choices for other municipalities to adapt, subject to evaluation with their own languages, map content, and user groups.

Coordinating the map face with supporting visitor information contributes to destination communication. Tourism information plans serve as navigation aids and as promotional artifacts that contribute to destination image construction. Separating navigational content from descriptive information can limit overcrowding of the map face while retaining interpretive and promotional value.

Figure 3 complements the visual assessment by describing changes in geometric complexity, point density, and label conflicts. These structural changes can create space for labels and help distinguish map elements. Their effects on navigation time, cognitive load, and user confidence require direct behavioral measurement and cannot be established from cartographic indicators alone.

Comparison with traditional production procedures and practical constraints

Compared with traditional analog or general-purpose graphic workflows, the proposed GIS workflow offers stronger control over data provenance, projection consistency, attribute logic, feature selection, and repeatable revision. Traditional production remains valuable because it incorporates publisher experience, local tourism knowledge, manual design judgment, and field observation. The advantage of the proposed workflow is therefore not automation alone, but the integration of these

practical inputs into a documented spatial database and an iterative validation process.

The workflow is also more transparent for municipal updating. When a new attraction, road change, or service facility is added, the standardized attribute table can be updated and the symbol, label, and legend logic can be regenerated consistently. In a purely graphic workflow, comparable updates may require manual redrawing and may leave fewer traces of source reliability or verification status. For small municipalities, however, the cost-benefit balance remains important: GIS processing is justified when the municipality expects repeated updates, official data integration, or multi-format publication, but it may be excessive for a one-off promotional graphic.

This study therefore frames GIS as a production and validation framework rather than as a universal replacement for traditional cartographic production. The workflow improves methodological transparency and update capacity, but field verification, cartographic aesthetics, and tourism expertise remain necessary to produce a user-friendly public information plan.

Limitations and directions for future research

Several limitations should be acknowledged. First, the usability evaluation was based on a single municipal case and a limited participant group. The absence of participant counts, task-level performance summaries, and SUS descriptive statistics limits the strength and reproducibility of the usability conclusions. Reporting these details, together with recruitment criteria and participant characteristics, is necessary for comparison with other applications.

Second, the study does not yet provide a controlled time-cost comparison with a traditional cartographic or graphic-design production process. Future research should record production time, revision cycles, error rates, update costs, and field-checking effort across GIS-based and conventional workflows.

Third, the present case concerns a compact urban information plan rather than a relief-centered outdoor tourist map; therefore, its findings should not be generalized to hiking or mountain tourist maps without additional work on relief depiction, trail verification, and terrain readability.

Fourth, the study focuses on a printed cartographic product. While printed tourist maps remain valuable for curated representation and offline use, digital mapping environments increasingly dominate tourist navigation. Future work could extend the workflow to interactive web cartography, integrating scale-dependent labeling and user-controlled filtering. However, such extensions require additional usability evaluation because interface complexity introduces new cognitive burdens and changes how users interpret map content.

Fifth, the indicators presented in Figure 3 primarily describe structural aspects of cartographic processing. Direct behavioral evidence is needed to relate these changes to map readability, navigation performance, attraction visitation, route selection, or the spatial distribution of tourist movement. Such studies would enable stronger integration between cartographic design research and tourism management.

Finally, the transferability of the workflow should be considered. The approach is broadly applicable to compact urban tourism environments, yet municipalities with larger extents, greater linguistic diversity, or more complex transportation systems may require additional scale-dependent mapping products or multi-sheet solutions. Future research should therefore explore workflow adaptation for multi-scale tourist cartography, particularly where heritage cores must be represented alongside peripheral attractions.

The Ferizaj case demonstrates the application of a documented production workflow linking data preparation, cartographic design, and evaluation. Figure 1 describes the process, Figure 2 shows the resulting information plan, and Figure 3 presents selected structural comparisons. Together, these components provide a basis for further evaluation of map usability and for adapting the workflow to other municipal settings.

6 CONCLUSIONS

This study presents a theory-informed GIS workflow for producing and evaluating a municipal tourism information plan. The workflow integrates cartographic abstraction, symbol hierarchy, bilingual labeling, field verification, and usability evaluation within a structured spatial communication process. Its application in Ferizaj produced an A2 printed information plan at 1:8,000 through constrained scale selection, cartographic generalization, and user-centered refinement.

The methodological contribution of the study lies in formalizing tourist map production as an iterative workflow rather than a linear sequence. The BPMN-style workflow (Fig. 1) shows how GIS processing stages and validation checkpoints interact through feedback between usability evaluation and cartographic refinement. This workflow structure improves transparency and reproducibility, providing a transferable model for other municipalities seeking to develop official tourism cartography without reliance on heuristic design alone.

From a cartographic perspective, the case illustrates how scale selection can account for both the extent of the mapped area and symbol-separation requirements. These constraints are relevant to urban tourist cartography, where clustered points of interest and limited map space can create clutter. Iteratively calibrated simplification reduced geometric detail and created space for bilingual labeling, with navigational integrity retained as a design requirement.

The final product also illustrates the integration of bilingual toponymy in a compact urban setting through typographic hierarchy and manual refinement. Albanian endonyms were retained and English equivalents were provided as secondary labels. This approach shows how structured abstraction and layout decisions can accommodate multilingual content in a printed municipal tourism information plan.

Practically, the study provides a workflow that municipalities and tourism organizations can adopt to produce cost-aware and high-quality visitor information plans using integrated authoritative and open spatial datasets. The incorporation of usability testing makes navigation performance an explicit part of the evaluation alongside the map's promotional role. Combining cartographic theory, GIS processing, local verification, and user evaluation provides a framework for addressing tourism mobility and destination communication objectives.

Future research should extend this workflow toward multi-scale and interactive tourist cartography, including web-based implementations with dynamic labeling and scale-dependent filtering. Additional evaluation methods such as field observation, eye-tracking, and longitudinal visitor studies would also

strengthen understanding of how printed tourist maps influence real movement patterns, attraction visitation, and spatial distribution of tourism activity. Linking cartographic optimization metrics to behavioral tourism outcomes remains a particularly promising direction for high-impact interdisciplinary research.

The Ferizaj case illustrates how a structured GIS workflow can connect cartographic theory, field verification, and user evaluation in municipal tourism information-plan production. Further applications with fully reported usability measures are needed to assess performance and transferability across municipalities.

Acknowledgements

The authors thank the Municipality of Ferizaj for providing data used in this research.

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Article first received: 14 February 2026
Article accepted: 9 June 2026