A GIS-based analysis of the status of streetlighting on the WCG road network: Towards a spatial asset repository to guide decision making and asset management

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SUMMARY

Summary of "GIS-Based Streetlight Asset Management for WCG Roads Infrastructure" (400 words)

The Western Cape Government (WCG) Roads Infrastructure Directorate manages its road network assets, including streetlights, through the Road Network Information System (RNIS). However, incomplete, unverified, and unconsolidated streetlight data within RNIS limits its effectiveness for asset management and strategic planning. This deficiency hinders initiatives like the Green Lighting program, which aims to retrofit streetlights with LEDs to improve quality, reduce energy use, and lower costs, especially amid South Africa's rising electricity prices and supply challenges. Geographic Information Systems (GIS) offer robust spatial data management, analysis, and visualization capabilities, making them ideal for addressing these issues. The lack of accurate spatial data and GIS tools, however, impedes decision-making. This study seeks to overcome these gaps by capturing, formalizing, and transforming streetlight data into an actionable format to enhance infrastructure management.

The study's aim is to develop a comprehensive spatial dataset of WCG-maintained streetlight assets using GIS, with objectives to create a verified dataset, compile a visual streetlight repository, apply GIS analysis for resource prioritization, and assess GIS tools for strategic planning. It employs geomatics methods within the Esri environment, utilizing consumer-grade smartphones with GNSS capabilities and Esri Field Maps for field data collection. This approach, conducted over two years, achieved 4-meter accuracy and integrated data into the WCG ArcGIS Online environment via a Spatial Database Engine (SDE) geodatabase. A master feature class guided data collection and verification, addressing challenges like GNSS accuracy through remote sensing and manual

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Spatial analysis was structured into three components: associating streetlight attributes with the road network, mapping light distribution and coverage, and analyzing road illumination and density. This resulted in a dataset of over 9,300 streetlights and 900 traffic light sets, supporting strategic planning and optimized lighting management.

Results show the successful creation of a GIS-based system that centralizes and verifies streetlight data, improving infrastructure management despite challenges like offline functionality and GNSS limitations. The methodology proved cost-effective and scalable, with analysis tools identifying areas needing attention and a web application enabling data visualization alongside road infrastructure layers.

Conclusions affirm GIS as a vital tool for decision-making, asset visualization, and long-term planning in the WCG Roads Directorate. The study provides a replicable model for integrating GIS into road asset management, enhancing data-driven decisions and resource allocation, and laying a foundation for future advancements in infrastructure management.