Building Cape Town's 3D City Model: Geospatial Foundations for an Urban Digital Twin

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SUMMARY

Cities are complex and dynamic environments that demand accurate, integrated spatial data to manage growth and infrastructure effectively. The City of Cape Town faces rapid urbanisation and increasing pressure to provide adequate housing, services, and infrastructure. To address these challenges, the City's Geospatial Professionals are leading the development of a 3D City Information Model (3DCIM) that provides a continuously updated, integrated digital representation of Cape Town's natural and built environment. This initiative, seen as the foundation for a future Urban Digital Twin, forms part of the City's commitment to improving data-driven decision-making, sustainable urban management and service delivery through geospatial innovation.

Since 2010, the Geospatial Section has worked to build the 3DCIM from the ground up, establishing accurate, standardised base datasets. The 3D geospatial foundation includes:

(i) annually updated Digital Elevation Models and LiDAR-derived terrain surfaces;

(ii) a 5 m Digital Terrain Model that defines Existing Ground Level for land use applications as per the Municipal Planning By-Law;

(iii) photogrammetrically captured Level of Detail (LoD) 2.2 building models covering key urban areas;

(iv) deep-learning extraction of formal, informal and backyarder buildings into full-metro LoD 1 3D datasets;

and

(v) automated 3D zoning and development envelope models representing volumetric development rights.

Additional datasets include tree classification, 3D engineering structures and annual built-environment change detection.

These datasets already support practical use cases across City departments. Development Management applies 3D zoning and visualisation tools to assess development proposals and mediate disputes, while Heritage and Urban Regeneration use 3D Web Scenes and flyovers to evaluate context and scale in planning precincts. The data is also showing potential in valuations analysis, safety and security operations and environmental modelling.

The next phase of work focuses on expanding 3D coverage, improving interoperability and developing a strategy for serving 3D data across departments. Through its methodical, data-driven approach, the Geospatial Section is laying the groundwork for an Urban Digital Twin that will enhance collaboration, transparency and sustainability, supporting the City's vision for the future we want and advancing Sustainable Development Goals 11 (Sustainable Cities and Communities) and 13 (Climate Action).