



The Association of Surveyors  
of Papua New Guinea inc.

 PAPANUA NEW GUINEA  
UNIVERSITY OF  
TECHNOLOGY



# GEOMATICS INTEGRATION TECHNIQUES; IS IT A PATHWAY FOR DCDB UPDATE ON A GAZETTED DATUM FOR PAPANUA NEW GUINEA?

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## GEOMATICS INTERGRATION

- ✓ This is a proposed technique for DCDB creation and update using an Orthomosaic image
- ✓ This technique is then compared with the existing method of creating and updating a DCDB.
- ✓ This technique's accuracy and precision were evaluated against the linear error limitations outlined in the Urban Class Two of Survey Direction of 1990 and Mapping Standards



## CREATION OF DCDB

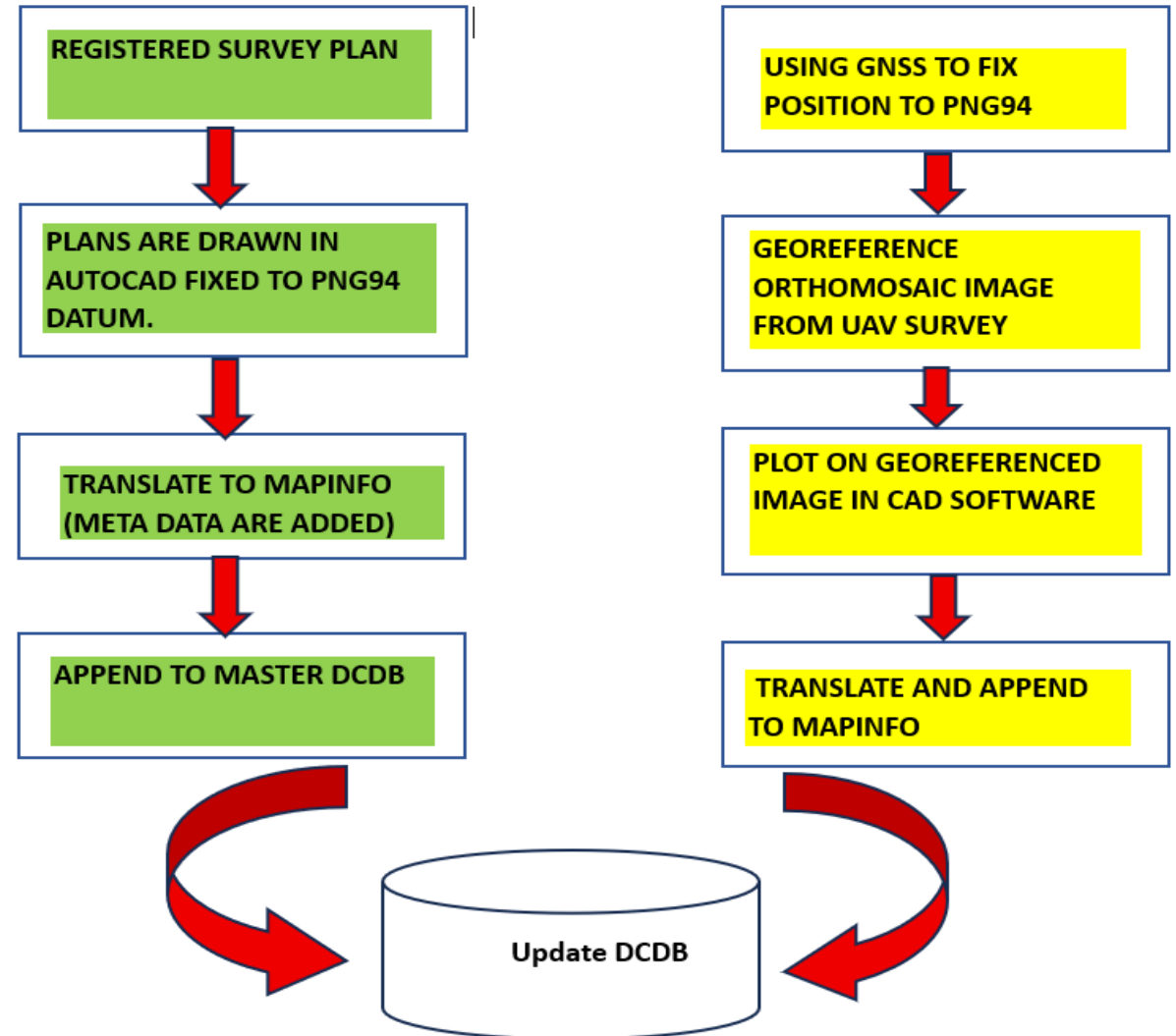
- ✓ Roic(2021) stated that, the digitalization of cadastral map sheet required further technological advancement as the map sheets had to be scanned, georeferenced and then vectorized to be stored into a database.
- ✓ The data that are used to create a typical DCDB based on literature reviewed;
  - ✓ 1. Existing survey plan of the parcel of land. (vector)
  - ✓ 2. Base map (raster image)
- ✓ Typical practices in designing cadaster was done using scanned survey plans and not orthomosaic raster images to visualize the existing layout A0I.



# CREATION OF DCDB

## Main Differences

- ✓ Utilizing orthomosaic image
- ✓ Design was plotted on the image from an orthomosaic georeferenced image
- ✓ Aids in visualization of AOI and positional integrity





# POSITIONAL ACCURACY OF PROPOSED

## Part 3, Part 4 & Part 6 of Survey Direction 1990

Class of Survey	Purpose for Survey	Precision of Survey	Method of Survey
Urban Class 2	Zones for Residential and Public Utilities	- Linear Error: $\pm 0.5\text{m}$	Combination of Aerial Photography, site plans and ground measurements.

## Accuracy Achieved

Method of Survey	Precision
GNSS	Horz RMS = $\pm 0.001\text{mm}$ - $\pm 0.002\text{mm}$ Vert RMS = $\pm 0.001\text{mm}$ - $\pm 0.003\text{mm}$

GPS Observation Residuals

Name	dN (m)	dE (m)	dHt (m)	Horz RMS	Vert RMS
CS 01-CS 02	108.888	-293.347	-0.746	0.001	0.002
CS 01-CS 06	-207.288	-65.225	-1.663	0.001	0.003
CS 01-PSM 9799	-605.545	572.035	-3.072	0.001	0.001
CS 02-CS 03	-165.636	-68.739	-0.817	0.001	0.002
CS 02-PSM 9799	-714.437	865.379	-2.325	0.001	0.002
CS 03-PSM 9799	-548.803	934.109	-1.503	0.001	0.001
CS 04-CS 05	-130.159	354.357	0.223	0.001	0.002
CS 04-CS 06	42.003	408.368	1.780	0.001	0.001
CS 04-PSM 9799	-356.261	1045.631	0.359	0.001	0.001
CS 05-PSM 9799	-226.103	691.275	0.121	0.001	0.002
CS 06-PSM 9799	-398.259	637.262	-1.421	0.001	0.001

GPS Observation Residuals

Name	dN (m)	dE (m)	dHt (m)	Horz RMS	Vert RMS
CS 06-GCP 01	164.387	-6.821	0.897	0.002	0.002
CS 06-GCP 02	100.509	-18.290	0.631	0.001	0.001
CS 06-GCP 03	144.035	-104.232	0.152	0.001	0.002
CS 06-GCP 05	3.365	-222.681	-0.734	0.002	0.003
GCP 02-GCP 03	43.526	-85.946	-0.470	0.001	0.001
GCP 02-GCP 05	-97.149	-204.396	-1.378	0.001	0.002



# POSITIONAL ACCURACY OF PROPOSED

Part 3, Part 4 & Part 6 of Survey Direction 1990

Class of Survey	Purpose for Survey	Precision of Survey	Method of Survey
Urban Class 2	Zones for Residential and Public Utilities	<ul style="list-style-type: none"> <li>- Max flight altitude =109m</li> <li>- 3cm/pix spatial resolution acceptable for ±0.05m accuracy.</li> </ul>	Combination of Aerial Photography, site plans and ground measurements.

Accuracy Achieved

Method of Survey	Precision
UAV	Flight height at 70m GSD= 1.9cm/pix
Georeferenced orthomosaic	±0.032 Horz ± 0.050 Vert

	Absolute	Relative
Horizontal Accuracy CE90 (meters)	0.000	0.032
Vertical Accuracy LE90 (meters)	0.000	0.050

### GPS/GCP/3D Errors Details

GPS	Mean	Standard Deviation	RMS Error
X Error (meters)	1.621	3.913	4.235
Y Error (meters)	-3.040	3.657	4.756
Z Error (meters)	-81.498	6.093	81.725
Total			81.737

GCP	Mean	Standard Deviation	RMS Error
X Error (meters)	-0.000	0.000	0.000
Y Error (meters)	0.000	0.000	0.000
Z Error (meters)	0.000	0.000	0.000
Total			0.000

3D	Mean	Standard Deviation	RMS Error
X Error (meters)	0.009	0.019	0.021
Y Error (meters)	0.012	0.022	0.025
Z Error (meters)	0.022	0.043	0.048
Total			0.028



# DISTORTION

## Why Georeferenced orthomosaic image?

- ✓ At RTK mode error = **81.737m**
- ✓ Georeferenced error = **0.028m**
- ✓ @ 90% certainty = **0.032m** for Horizontal and **0.050m** for Vertical, which was within the allowable accuracy of Urban Class Two Survey **± 0.50 m .**

GPS/GCP/3D Errors Details

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X Error (meters)	1.621	3.913	4.235
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# DISTORTION

Shift applied 210m  
@ 37°00'45"

The transformation  
was done by  
applying shifts in  
Lae at  
Approximately 121m  
E and 160.5m N  
(Stanaway ,2023)



Cadastral  
Boundary on  
PNG94 Datum

Cadastral  
Boundary on  
ADG66 Datum



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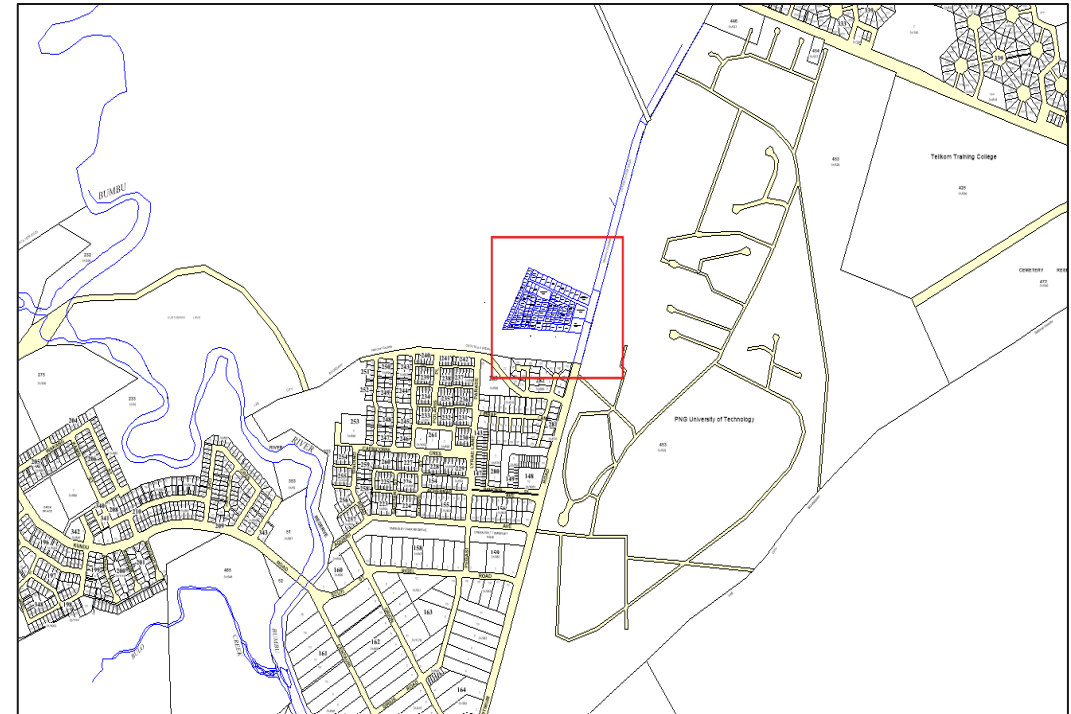
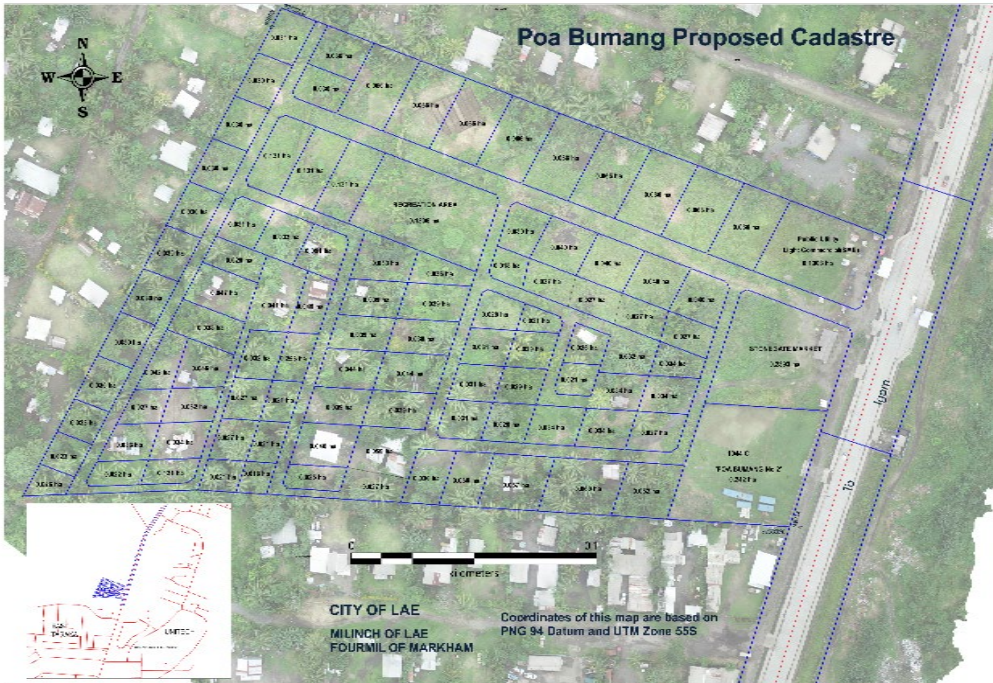


# UPDATING OF DCDB

Subdivision Design



Append to  
Master DCDB





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# Why using Orthomosaic image for DCDB?

- ✓ Accurate Representation
- ✓ Detailed Visualization & Improved Planning
- ✓ Reduced Errors
- ✓ Increased Efficiency
- ✓ Better Stakeholders Engagement
- ✓ Improved Subdivision Planning



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## SIGNIFICANCE OF DCDB

- ✓ Accurate Land Records
- ✓ Improves Land Management and Governance
- ✓ Efficient Land Transaction
- ✓ Effective Land Use Planning
- ✓ Reduced Land Disputes
- ✓ Support for Urban Planning



## Key Highlights

- Fix GNSS control to National Datum to allow for high positional precision that meets the allowable accuracy.
- Accuracy for the Ortho mosaic image is tied to GNSS fixed positions.
- Georeferenced Ortho mosaic image captured by UAVs are encouraged for Cadastral details extraction
- This approach not only satisfied the Urban Class 2 Survey requirements but also established itself as a reliable method for DCDB updates.



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# Reference

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# END OF PRESENTATION!!!!

## ANY QUESTIONS/COMMENTS?