Studies Toward the Development of Implementation Plan Of Coordinated Cadastral System for Peninsular Malaysia

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NIKKO HOTEL
22–24 October 2002

SCOPE OF PRESENTATION

• RESEARCH BACKGROUND
• CCS: THE MALAYSIAN PERCEPTION
• DEVELOPMENT OF GEOCENTRIC BASED CADASTRAL CONTROL INFRASTRUCTURE
• REPOPULATING DCDB WITH HOMOGENOUS & SURVEY ACCURATE COORDINATES
• INTEGRATION WITH CAMS DATA
The main objective of this study is:

i. To develop and realize a geocentric based Cadastral Control Infrastructure (CCI)
ii. To establish methodology for the Development of National Digital Cadastral Data Base
iii. To develop techniques for integrating the digital Cadastral Data with Mapping Data
iv. To address the Institutional Issues on the Implementation of CCS.

STUDY FRAMEWORK

IMPLEMENTATION OF CCS

- Development of Geocentric Based Cadastral Control Infrastructure (CCI)
- Development of National Digital Cadastral Data Base (NDCDB)
- Integration of National Digital Cadastral Data Base (NDCDB) & National Digital Topography Data Base (NDTDB)

- Organizational
- Legal
CCS – THE MALAYSIAN PERCEPTION

- COORDINATES
- BEARING & DISTANCE

Coordinated Cadastre as a coordinate-based cadastral system with the coordinates being given greater emphasis. The prominence of measured bearing and distances are reduced whereby they are considered as only a means by which the final adjusted coordinates are derived. The foundation of the concept is the geocentric geodetic datum, a single projection system for the whole country and the application of least-square adjustment technique in the distribution of survey errors.

- PROJECTION SYSTEM
- DATUM
- LEAST SQUARE ADJUSTMENT
CONCEPTUAL MODEL OF CCS FOR PENINSULAR MALAYSIA

Aspects taken into account for the conception are:

- the widely accepted perception of the coordinated cadastre
- the underlying features of a coordinated cadastre as indicated by DSMM
- the future direction of the cadastre
- the existing cadastral system and its needs
- the important elements that should be available in a modern cadastre

Basic CCS Implementation Model for Peninsular Malaysia

- Strengthening PGGN
- Identification of Implementation Areas
- Establishing CCI
- CCSA Proclamation
- Legal-Organizational Related ACTIONS
- New Cadastral Survey
- Adjustment and Re-coordination of Boundary Points in DCDB
- Finalized Geocentric Based RSO Coordinates in DCDB
- DCDB Upgrade and Update

Socio-Economic Related ACTIONS

INTERNATIONAL SYMPOSIUM AND EXHIBITION ON GEOINFORMATION, KL 2002
DEVELOPMENT OF GEOCENTRIC BASED CADAstraL CONTROL INFRASTRUCTURE
Development of A Geocentric-Based Cadastral Control Database

Zero Order Geodetic GPS Network (MASS Stations) → Design & Analysis Of CCDB → Computation of Geocentric Cassini & RSO Coordinates → First Order Geodetic GPS Network (30km Network) → Cadastral Control Infrastructure:
- 10km, 2.5km, 0.5km
- Ties to Cadastral Network

Transformation Parameters from PGGN2000 to PGGN95

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>PARAMETER</th>
<th>STD. DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>DY</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>DZ</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>RX</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>RY</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>RZ</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
<tr>
<td>SCALE</td>
<td>Refer to DSMM</td>
<td></td>
</tr>
</tbody>
</table>
GEOCENTRIC
CASSINI & RSO PROJECTIONS

- Geocentric Cassini coordinate is computed direct from latitude and longitude using exact formulae
- RSO projection parameters have been modified for the computation of RSO coordinate from geocentric latitude and longitude

Remark
Ellipsoid Parameters

<table>
<thead>
<tr>
<th></th>
<th>RSO_{local}</th>
<th>RSO_{geocentric}</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipsoid</td>
<td>Modified Everest</td>
<td>WGS84</td>
<td></td>
</tr>
<tr>
<td>Major axis, a</td>
<td>6377304.063 m</td>
<td>6378137.000 m</td>
<td></td>
</tr>
<tr>
<td>Flattening, 1/f</td>
<td>300.8017</td>
<td>298.25722</td>
<td></td>
</tr>
</tbody>
</table>

Category I – Defined Parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude of Origin, ( \phi_o )</td>
<td>4° 00' 00''</td>
</tr>
<tr>
<td>Longitude of Origin, ( \lambda_o )</td>
<td>102° 15' 00''</td>
</tr>
<tr>
<td>Azimuth, ( \alpha )</td>
<td>(-\sin^{-1}(0.6))</td>
</tr>
<tr>
<td>Scale factor, ( k )</td>
<td>0.99984</td>
</tr>
<tr>
<td>False Origin (Easting)</td>
<td>40,000 Chains E</td>
</tr>
<tr>
<td>False Origin (Northing)</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Category II - Parameters that related to ellipsoid change

| Parameter A | Refer to DSMM |
| Parameter B |              |
| Parameter C | Refer to DSMM |
| Basic Longitude. \( \phi_o \) |
The differences between RSO_{MRT} and RSO_{PGGN2000}

<table>
<thead>
<tr>
<th></th>
<th>$\Delta E$ (m)</th>
<th>$\Delta N$ (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>-193.75</td>
<td>6.09</td>
</tr>
<tr>
<td>Standard Deviation, $\sigma$</td>
<td>0.73</td>
<td>0.47</td>
</tr>
<tr>
<td>RMS</td>
<td>0.72</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Direction = 271° 31' 25''
Magnitude = 193.82 m

ESTABLISHMENT OF CADASTRAL CONTROL INFRASTRUCTURE
ESTABLISHMENT OF CADASTRAL CONTROL INFRASTRUCTURE: MELAKA & JOHOR

GPS Control Station Spacing ~500m

INTERNATIONAL SYMPOSIUM AND EXHIBITION ON GEOFONRICATION, KL 2002
REPOPULATING DCDB WITH HOMOGENOUS & SURVEY ACCURATE COORDINATES

Development of A National Digital Cadastral Database

CCDB : Cadastral Control Database
SDCDB: State Digital Cadastral Database

Automated Database Conversion System

INTERNATIONAL SYMPOSIUM AND EXHIBITION ON GEOPRODUCTS, KL 2002
DIGITAL CADAstral DATABASE FOR STUDY AREA # 1: WILAYAH PERSEKUTUAN KUALA LUMPUR

DIGITAL CADAstral DATABASE FOR STUDY AREA # 2: MELAKA
Digital Cadastral Database for Study Area #2: Johor

GPS Control (2.5 km)  Connection line

Automatic database conversion system

Data selection program
Example: The Residuals And Standard Deviations Of The Melaka Block Adjustment

CASSINI SYSTEM

<table>
<thead>
<tr>
<th>Bearing</th>
<th>Distance (m)</th>
<th>N (m)</th>
<th>E (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1°54&quot;</td>
<td>0.039</td>
<td>0.092</td>
</tr>
<tr>
<td>MIN</td>
<td>-2°00&quot;</td>
<td>-0.040</td>
<td>0</td>
</tr>
<tr>
<td>MEAN</td>
<td>0&quot;</td>
<td>0</td>
<td>0.041</td>
</tr>
<tr>
<td>RMS</td>
<td>21&quot;</td>
<td>0.013</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Statistical Summary

- Number of Stations: 4954
- Error Factor: 1.729 (Standard error factor = 1.00)
- Distance for max bearing residual: 74 m
- Distance for min bearing residual: 43 m
### Error Ellipse for Adjusted Cadastral Network

- **GPS Control Station**
- **Ellipse Scale:** 150

### Summary of The 47 Adjustment Blocks: Melaka (Cassini System)

<table>
<thead>
<tr>
<th></th>
<th>CASE 1</th>
<th>CASE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GEODETIC</td>
<td>GEOCENTRIC</td>
</tr>
<tr>
<td><strong>MAX</strong></td>
<td><strong>MIN</strong></td>
<td><strong>MEAN</strong></td>
</tr>
<tr>
<td><strong>Bearing</strong></td>
<td>`2'03``</td>
<td>`-2'03``</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>0.040</td>
<td>-0.048</td>
</tr>
<tr>
<td>Coordinate ( N/S)</td>
<td>0.151</td>
<td>0</td>
</tr>
<tr>
<td>Coordinate ( E/W)</td>
<td>0.148</td>
<td>0</td>
</tr>
</tbody>
</table>
INTEGRATION WITH CAMS DATA

Techniques For Integrating The Digital Coordinated Cadastral Data With Mapping Data

Integration Issues
- Data Selection
- Datum
- Data Format
- Projection System
- Data Quality And Accuracy
- Software Requirement

Integration Procedures For NSDI

INTERNATIONAL SYMPOSIUM AND EXHIBITION ON G EOINFORMATION, KL 2002
METHODOLOGY OF INTEGRATION

GEO-REFERENCING

CAMS/DTDB
(RSO)LOCAL

GEOCENTRIC NDCDB
(RSO)GEOCENTRIC

INTEGRATION

a. POLYNOMIAL TRANSFORMATION
(by graphic)
b. DATUM TRANSFORMATION
(by point)

ISSUES ANALYSIS

INTEGRATION ISSUES ANALYSIS

DATA STRUCTURE
A. Data Format:
   I) CAMS format need to be converted in to GIS format (GIS Ready)
B. Map Scale
   I) Large scale map give higher geometric accuracy.
   II) Better integration between NDCDB and NDTDB for equivalent scale

REFERENCE SYSTEM
I) Final integration will be in RSO
II) Better integration between NDCDB and NDTDB for equivalent scale

DATA INPUT ACCURACY/QUALITY
A. Absolute Accuracy
   I) Absolute accuracy of CAMS data depends on scale and the degree of
generalisation. Urban area show better absolute accuracy.
B. Relative Accuracy
   I) Subject to graphic presentation and cartographic process.
   II) Relative accuracy effected by generalization and simplification.
   III) Different cartographic level for urban and rural areas.
Example of the National Digital Cadastral Database (NDCDB) and National Digital Topography Database (NDTDB) Overlay Process

NDCDB = 1:8,000
NDCDB = 1:25,000
NDCDB = 1:8,000
NDCDB = 1:5,000

SUMMARY

1. The CCS implementation model has been developed
2. A highly accurate Zero Order Geodetic Network (MASS) and PGGN 2000 defined in ITRF 2000 epoch 00.0 have been established
3. Seven transformation parameters between PGGN 2000 (ITRF 2000) and PGGN95 (WGS84) have been accurately determined
4. Geocentric datum and the associated plane projection (Cassini & RSO) computations have been stated
5. Methodology to repopulate DCDB with new survey accurate and homogenous coordinates has been outlined
6. Integration Issues between NDCDB and NDTDB have been experimented