KURSUS COORDINATED CADASTRAL SYSTEM (CCS)
INSTITUT TANAH & UKUR NEGARA
BEHRANG, PERAK

METHODOLOGY FOR THE DEVELOPMENT OF NATIONAL DIGITAL CADASTRAL DATABASE (NDCDB)

OLEH:
PROF DR ABD MAJID BIN A KADIR & ABDULLAH HISAM OMAR
Fakulti Kejuruteraan & Sains Geoinformasi
Universiti Teknologi Malaysia
Skudai , Johor.
Email: majid@fksg.utm.my, a.hisham@fksg.utm.my

21st OCTOBER 2003

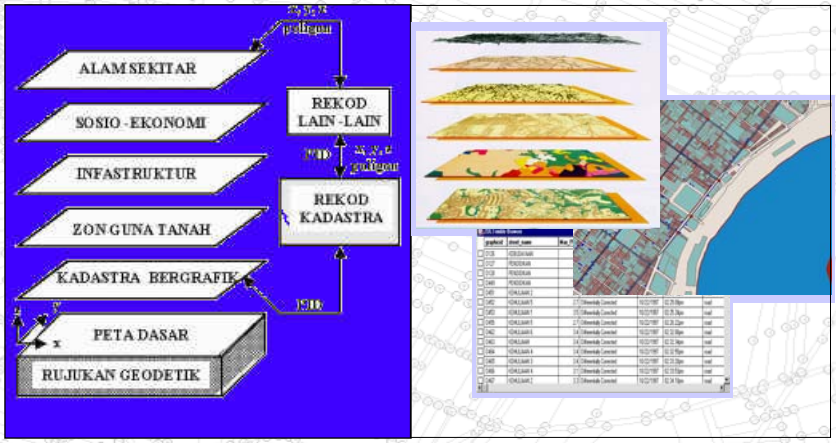
OVERVIEW ON PREVIOUS COORDINATED CADASTRAL SYSTEM RESEARCH PROJECTS

- **PILOT STUDY : 1996**
  - **Pilot study has been conducted in Malaysia with the following objectives**
    - To determine the effectiveness of using Global Positioning System for cadastral control network densification
    - To select most appropriate adjustment method for the large cadastral network
- **FEASIBILITY STUDY: 1997-1999**
  - **Feasibility study has been carried out in the Melaka/Johor border with the following objectives:**
    - To carry out larger cadastral network adjustment
    - To use Rectified Skew Orthomorphic (RSO) projection system in the cadastral network adjustment
    - To use geocentric datum (WGS84) as a National Geodetic Datum
    - To introduce GPS measurement for cadastral application
  - **The outcome of this study are as follows :**
    - RSO projection may be used to replace Cassini for cadastral mapping purposes.
    - Least squares adjustment technique is suitable and practical to be used in the large cadastral network adjustment
    - Potential use of geocentric datum has been realized
    - A guideline for using GPS in Cadastral surveying is produced
- ***It has been realized from the previous studies that Coordinated Cadastral System could potentially be implemented in Peninsular Malaysia***

THE IMPORTANCE OF THE STUDY

- ✓ Coordinated Cadastral System (CCS) – a cadastral reform programme to improve the cadastral survey system. Implementation of CCS – *feasible*, according to results of feasibility study.
- ✓ Long term benefits to be accrued from CCS implementation:
  - Utilizing "Whole to the Part" methodology.
  - Facilitate use of rapid data acquisition, storage, processing & management techniques.
  - Improvement of the cadastral survey system.
  - Provides common reference system.
  - Facilitate data integration.
  - CCS – basis for / underpins a good LIS.

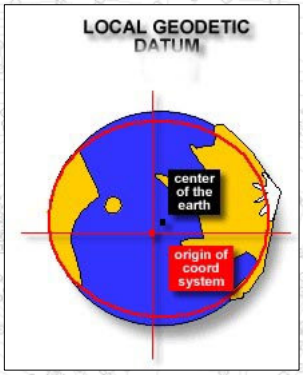
CCS –UNDERPINS A GOOD LAND INFORMATION SYSTEM (LIS)



Coordinate –based LIS facilitate data integration process in GIS Environment

CCS –UNDERPINS A GOOD LAND INFORMATION SYSTEM (LIS)

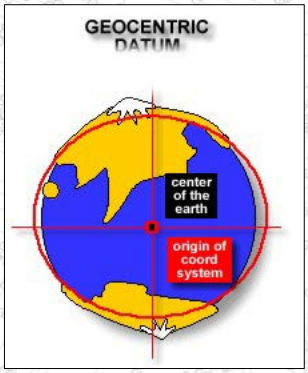
Before CCS



ELIPSOID MODIFIED EVEREST

Datum Origin: Kertau

After CCS

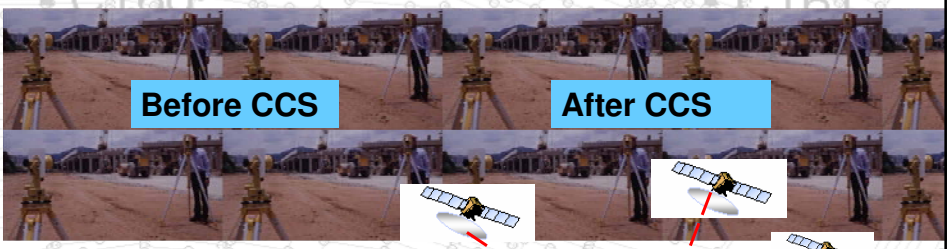


ELIPSOID WGS 84

Datum Origin: Center of the Mass

Data integration can be done globally

CCS –UNDERPINS A GOOD LAND INFORMATION SYSTEM (LIS)



Before CCS

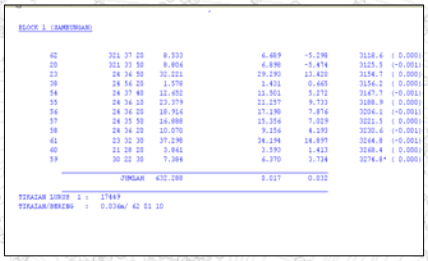
After CCS

Labour Intensive

One man Show

Coordinated Cadastral System: Methodology For The Development of National Digital Cadastral Database

Before CCS



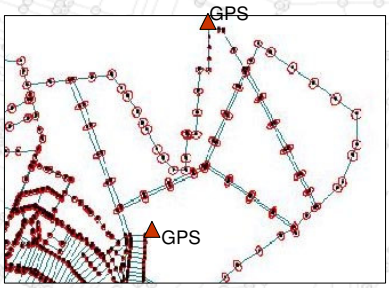
BLOCK 1 (AMPUNGAN)						
42	321 37 20	8.533	6.489	-5.298	3118.6	(0.000)
20	321 33 50	8.804	6.898	-5.474	3125.5	(-0.001)
23	24 34 50	32.221	29.293	13.420	3154.7	(0.000)
39	24 56 20	1.578	1.431	0.665	3156.2	(0.000)
54	24 37 40	12.652	11.501	5.272	3167.7	(-0.001)
55	24 34 10	23.379	21.257	9.733	3188.9	(0.000)
56	24 36 20	18.914	17.198	7.874	3206.1	(-0.001)
57	24 35 50	16.888	15.356	7.029	3221.5	(0.000)
58	24 34 20	10.070	9.156	4.193	3230.6	(-0.001)
61	23 32 30	37.198	34.194	14.897	3244.8	(-0.001)
60	21 28 20	3.841	3.593	1.413	3248.4	(0.000)
59	30 22 30	7.384	6.370	3.734	3274.8*	(0.000)
	JUMLAH	432.288	0.017	0.032		

TIRAIAN LURUS 1 : 17469
TIRAIAN/BEBLENG : 0.036m/ 42 01 10

Network adjustment technique: Transit /Bowditch

Low accuracy and suitable for individual lot

After CCS



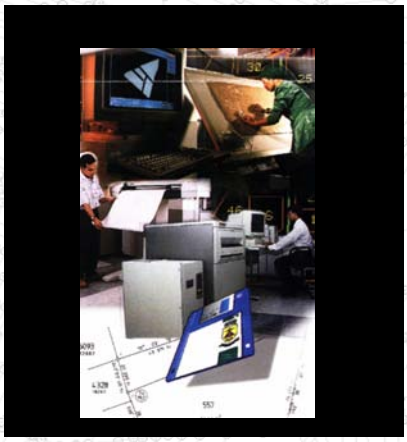
Network adjustment technique: Least Squares
High accuracy and rigorous method

.

Before CCS

Plotting coordinates are not adjusted properly

After CCS



Adjusted coordinates

STUDY FRAMEWORK

IMPLEMENTATION OF CCS

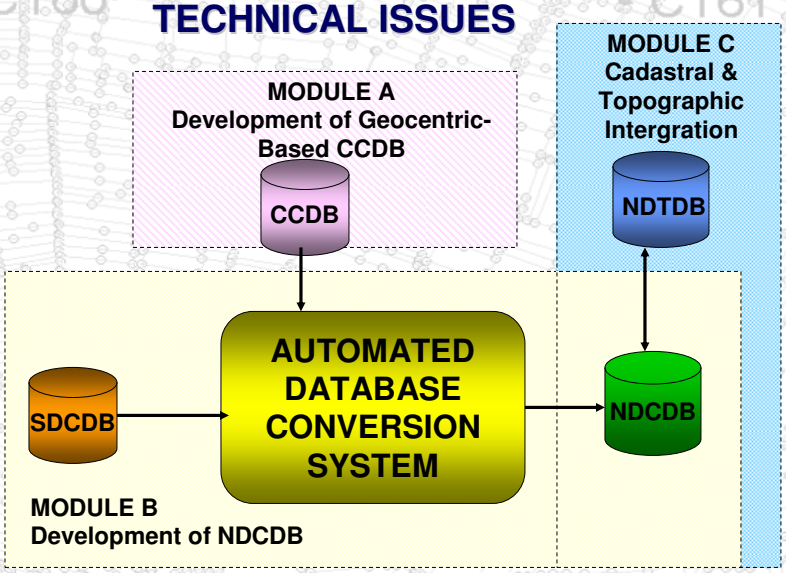
TECHNICAL ISSUES

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

INSTITUTIONAL ISSUES

- Organizational
- Legal
- Economic
- Social

TECHNICAL ISSUES



SDCDB - State Digital Cadastral Data Base
NDCDB - National Digital Cadastral Data Base
CCDB - Cadastral Control Data Base
NDTDB - National Digital Topographic Data Base

MALAYSIAN PERCEPTION OF THE COORDINATED CADASTRE

COORDINATES

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

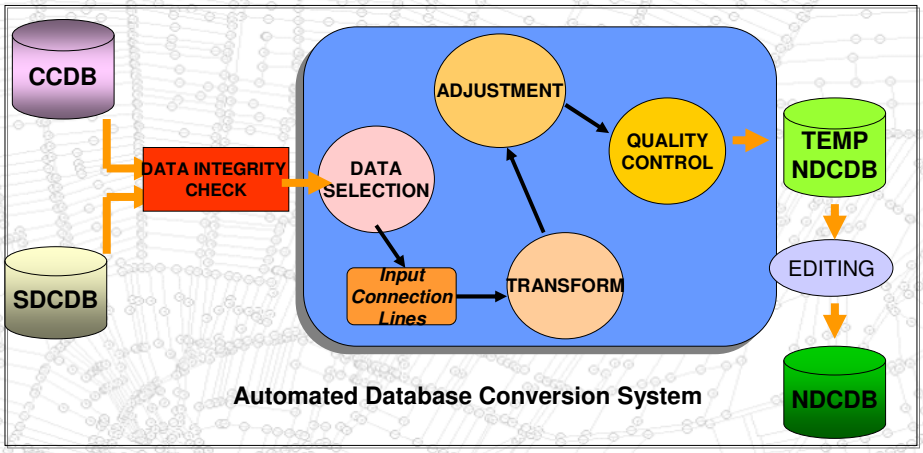
BEARING & DISTANCE

LEAST SQUARES ADJUSTMENT

PROJECTION SYSTEM

DATUM

MODULE B: Development of A National Digital Cadastral Database

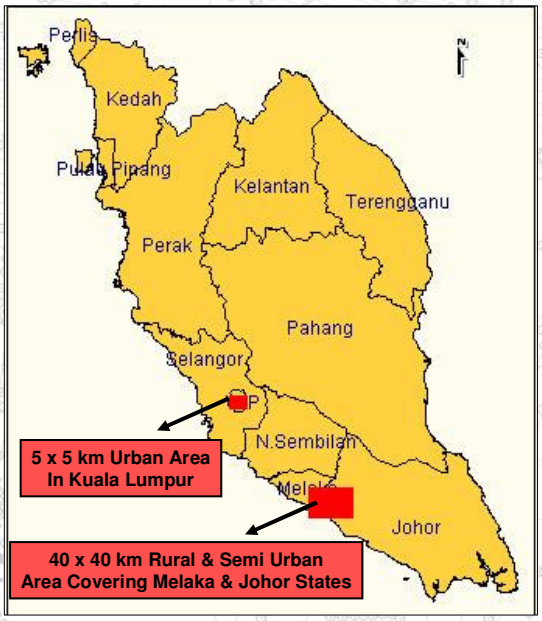


CCDB : Cadastral Control Database
SDCDB : State Digital Cadastral Database
NDCDB : National Digital Cadastral Database

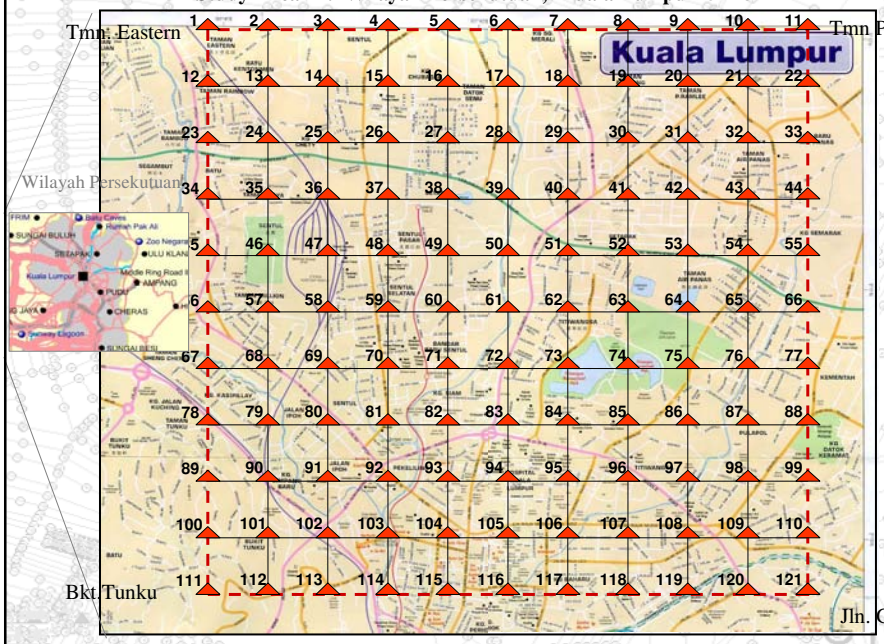
OBJECTIVES
(Modified from original proposal)

- The study objectives of this module are:
  - ✓ To assess and analyze the use of the existing State Digital Cadastral Database (DCDB) as the primary input to Coordinated Cadastral System;
  - ✓ To develop Cadastral Control Infrastructure using GPS technology for both urban and rural areas;
  - ✓ To develop Automated Database Conversion System for the development of National Digital Cadastral Database

STUDY AREA

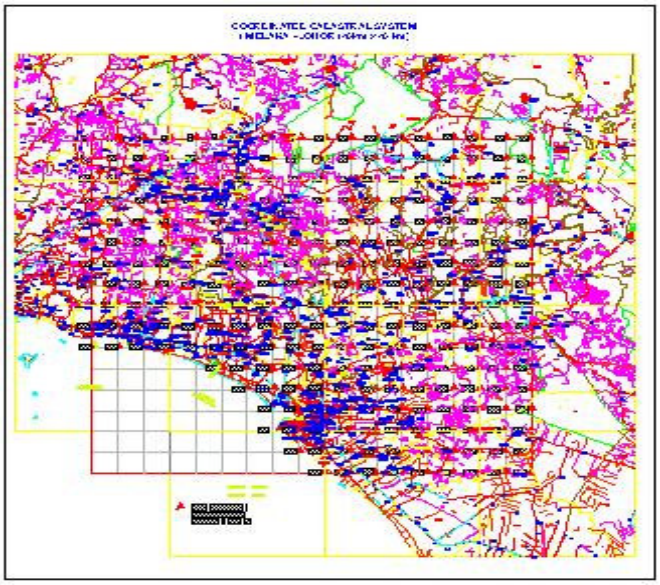


COORDINATED CADASTRAL SYSTEM PROJECT
Study Area #1: Wilayah Persekutuan, Kuala Lumpur 5 X 5 km



▲ GPS Control Station Spacing ~500m

COORDINATED CADASTRAL SYSTEM PROJECT
Study Area #2: Melaka – Johor 40 X 40 km



▲ GPS Control Station Spacing ~2.5 km

Cadastral Control Infrastructure Development

PHASE	MELAKA	REMARKS	JOHOR	REMARKS
Reconnaissance*	Mac 2001	131 of 132 stations have been identified	Mac 2001	89 of 132 stations have been identified
Monumentation*	Mac 2001	Standard Traverse, Pipe and Cadastre mark	Mac 2001	Standard Traverse, Pipe and Cadastre mark
GPS Field Observation *	19 Mac – 7 April	Jasin, Melaka Tengah, Alor Gajah	7 Apr – 14 April	Muar
GPS Processing and Results*	Results Delivered: 3/5/2001			

** Note: Geodesy Section, JUPEM Melaka and JUPEM Johor*

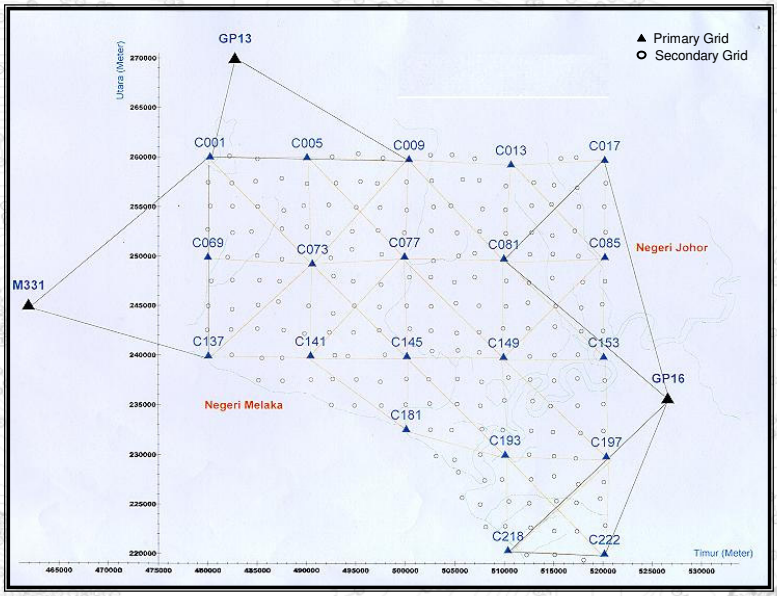
Cont…

GPS Field Observation For Study Area # 2 (Melaka – Johor)

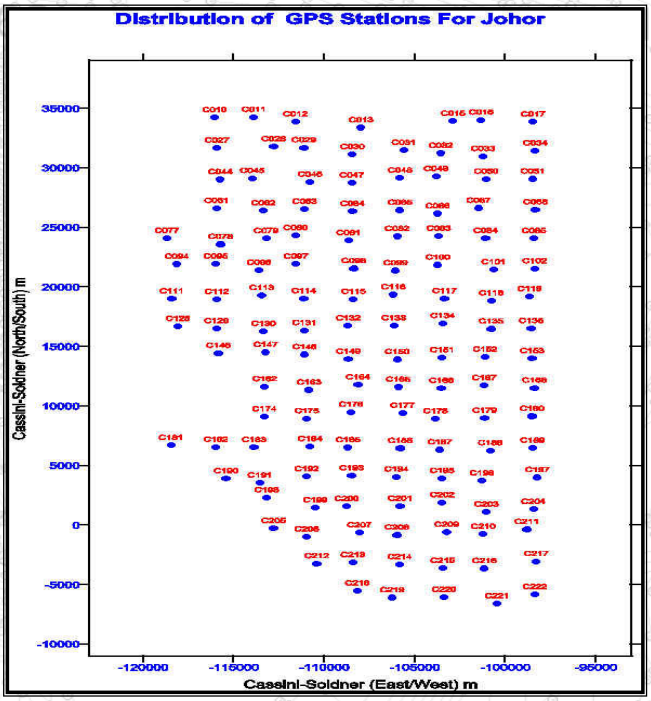
- GPS Network Grid consists of
  - Primary Grid (10 kmx 10 km)
  - Secondary Grid (2.5 km x 2.5 km

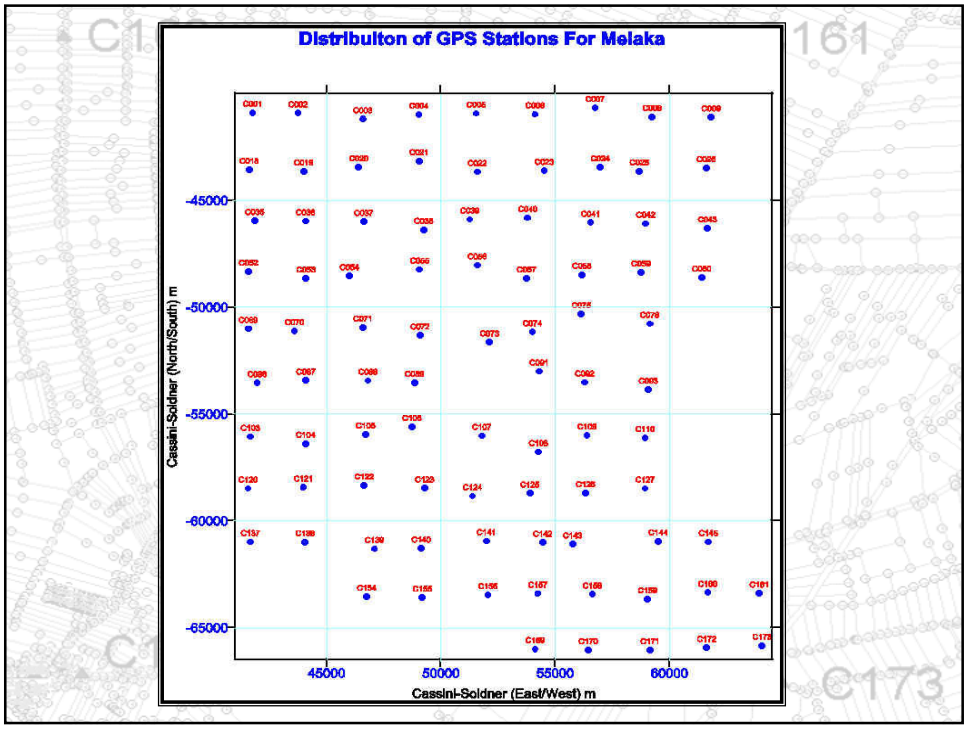
	Primary Grid	Secondary Grid
Observation Technique	Static Reference Stations: M331 (Tg.Keling, Melaka), GP13 (Tebong, Melaka), GP16 (Pagoh, Johor)	Rapid Static : Reference Stations Primary Grid Points
Observation Time	90 minutes	15-30 minutes
Total of Stations	23	197
GPS Processing Software	Trimble Geomatic Office V1.1	Trimble Geomatic Office V1.1
Adjustment Software	Geolab 2.4c	Trimble Geomatic Office V1.1

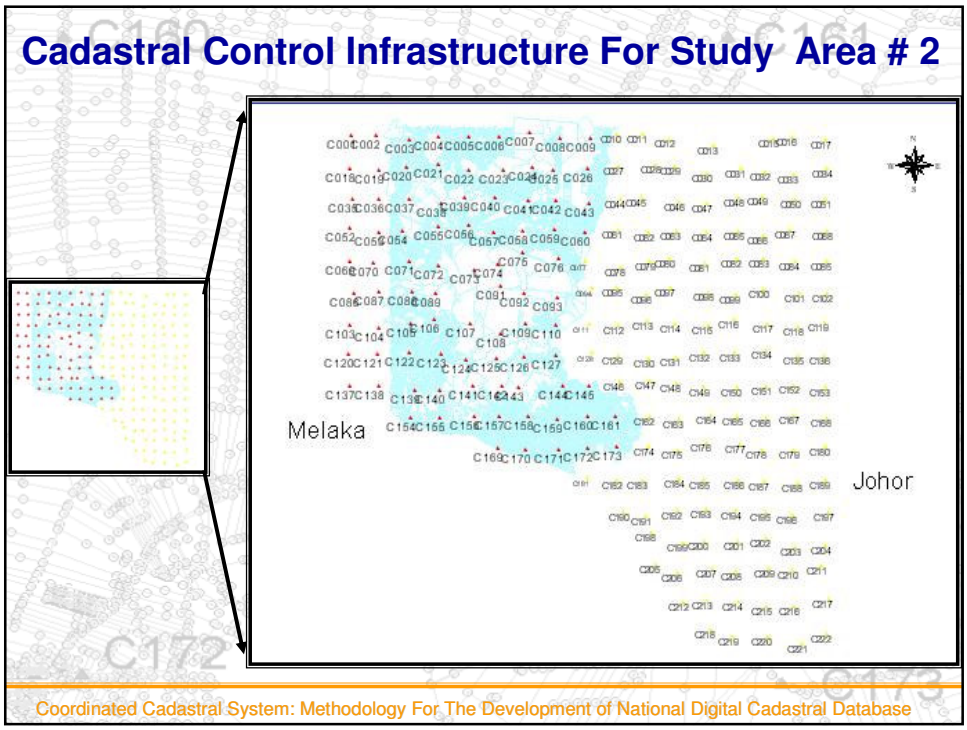
GPS Network Grid For Study Area # 2: Melaka



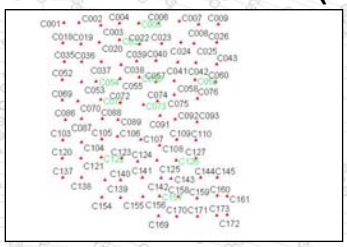
Coordinated Cadastral System: Methodology For The Development of National Digital Cadastral Database




Distribulton of GPS Stations For Melaka
Cassini-Soldner (North/South) m
-45000
-50000
-55000
-60000
-65000
45000
50000
55000
60000
Cassini-Soldner (East/West) m


Cadastral Control Infrastructure For Study Area # 2
Melaka
Johor
Coordinated Cadastral System: Methodology For The Development of National Digital Cadastral Database

Cadastral Control Database (CCDB)



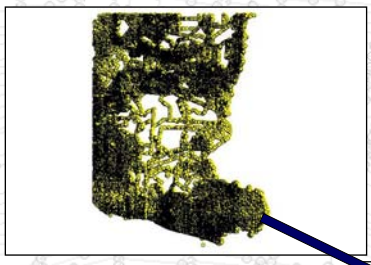
Attributes of Gps.shp

Shape	Name	Geo_zn	N_east	N_north	Rso_x	Rso_y	Wgs84_lat	Wgs84_lon
Point	792020037	CCS154	46749.326	-63575.039	485141.675	237408.741	2.1457302372	102.3621242312
Point	462020620	CCS139	47065.365	-61426.072	485461.497	239557.095	2.1651633328	102.3643706606
Point	7017900	CCS071	46584.652	-50935.386	484999.366	250048.237	2.2600355191	102.3606750721
Point	10PA9232	CCS088	46810.088	-53426.524	485220.365	247556.806	2.2375067100	102.3626956112
Point	108013766	CCS054	45993.213	-48528.110	484412.230	252456.457	2.2818068702	102.3553637384
Point	34PA9268	CCS020	46321.184	-43433.928	484749.356	257549.793	2.3278745590	102.3583250102
Point	45PA24796	CCS037	46501.690	-45966.720	484925.302	255016.012	2.3049691639	102.3599415675
Point	16PA8052	CCS003	46579.768	-41184.775	485011.999	259798.353	2.3492138263	102.3606555261
Point	83172958	CCS140	49133.233	-61279.612	487529.668	239699.933	2.1664827064	102.3835607633
Point	551721516	CCS155	49147.567	-63587.017	487539.956	237392.582	2.1456160132	102.3836836421
Point	5157623	CCS156	51983.498	-63459.761	490376.169	237514.900	2.1467594447	102.4091781655
Point	2191022649	CCS141	51995.255	-60918.021	490392.370	240056.512	2.1697452152	102.4092908209
Point	11PA10928	CCS169	54113.519	-65992.778	492501.822	234978.295	2.1230467309	102.4283132607
Point	10104385	CCS157	54238.849	-63394.050	492631.672	237576.682	2.1473474579	102.4284533289
Point	931020653	CCS142	54453.747	-61008.260	492850.734	239961.993	2.1689223411	102.4313920423
Point	71020653	CCS143	55760.097	-61084.077	494156.964	239883.907	2.1682329774	102.4431357151
Point	35PA23284	CCS170	56564.970	-65990.021	487087.893	245405.661	2.1239646389	102.4503568350
Point	116023939	CCS106	46681.268	-55434.449	487202.439	247481.448	2.2188011155	102.3795125857
Point	30023946	CCS089	46752.335	-53498.376	487556.835	249655.121	2.2368519957	102.3805162657
Point	28019454	CCS072	49142.798	-51319.977	490560.970	249223.907	2.2585511189	102.3806727029
Point	155PA2875	CCS073	52147.681	-51739.891	492851.363	247958.866	2.2527456224	102.4106864721
Point	117PA23249	CCS091	54240.330	-53011.314	492361.060	249769.996	2.2412419030	102.4294364111
Point	128PA23249	CCS074	53946.823	-51200.588	492361.060	249769.996	2.2576177224	102.4268629032
Point	2PA20649	CCS108	54263.375	-56762.278	492667.800	244208.082	2.2073207013	102.4296327934

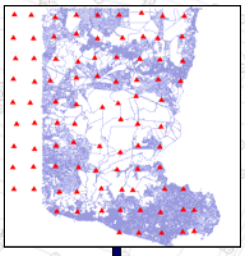
Coordinated Cadastral System: Methodology For The Development of National Digital Cadastral Database

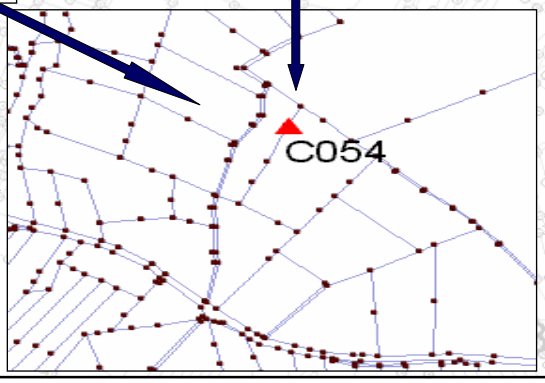
Overlay and Identify Stages

DCDB



CCDB

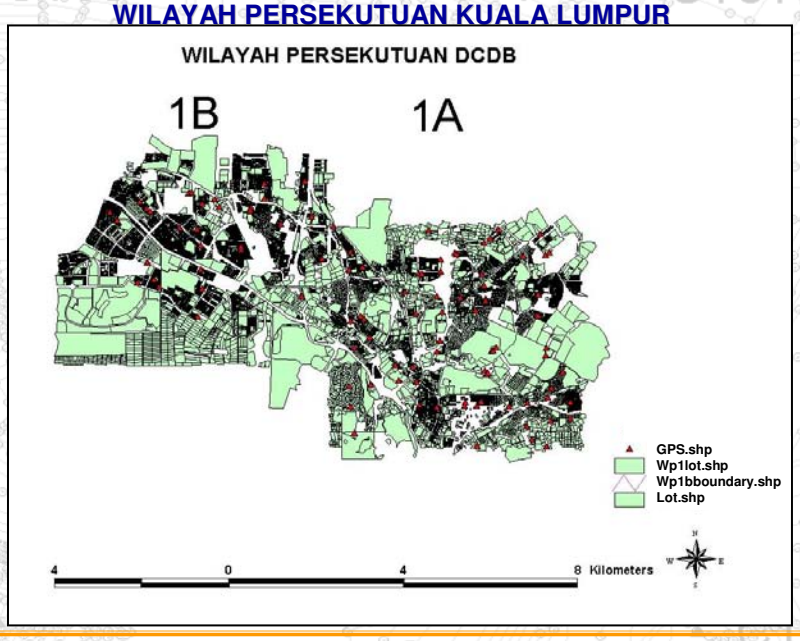


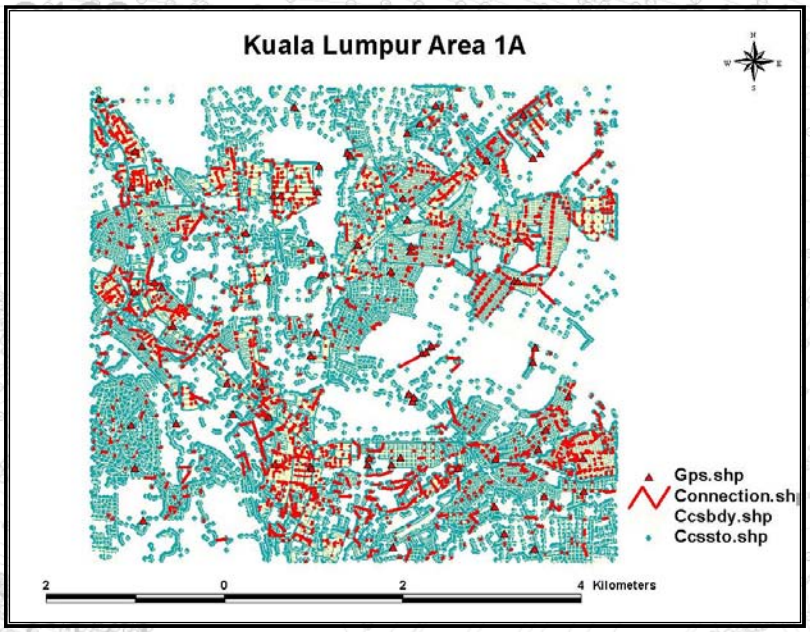


Identify GPS Control Stations in Cadastral Database (DCDB)

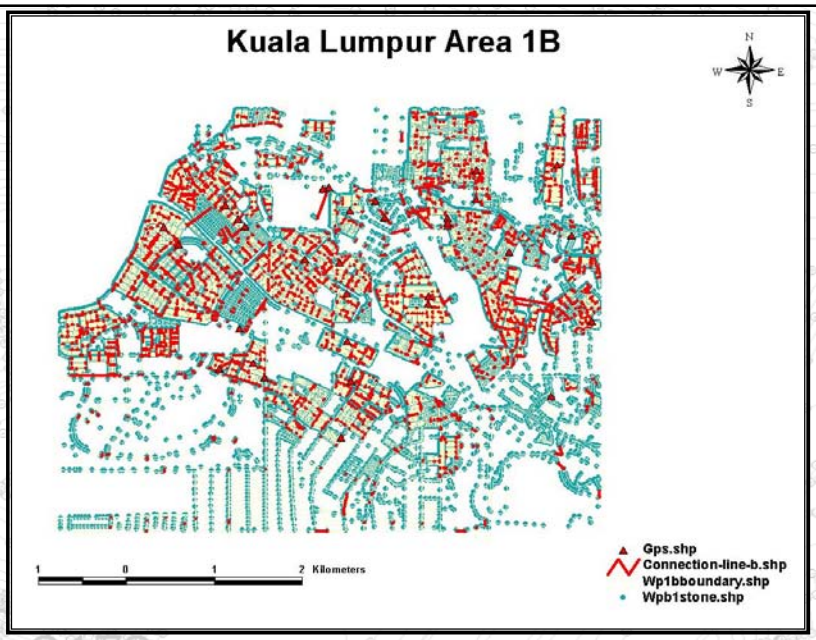
PREPARATION OF DATA INPUT & CONNECTION LINES

DIGITAL CADASTRAL DATABASE FOR STUDY AREA # 1: WILAYAH PERSEKUTUAN KUALA LUMPUR



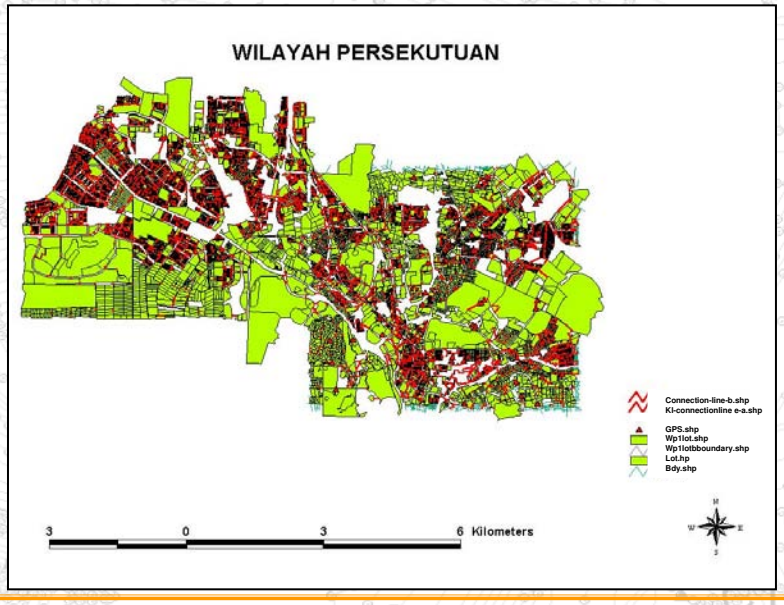


Total of Connection Lines: 2890

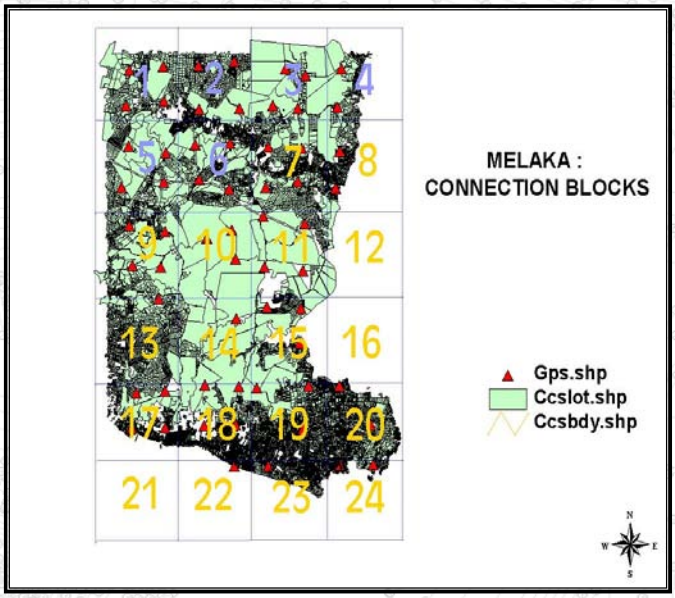


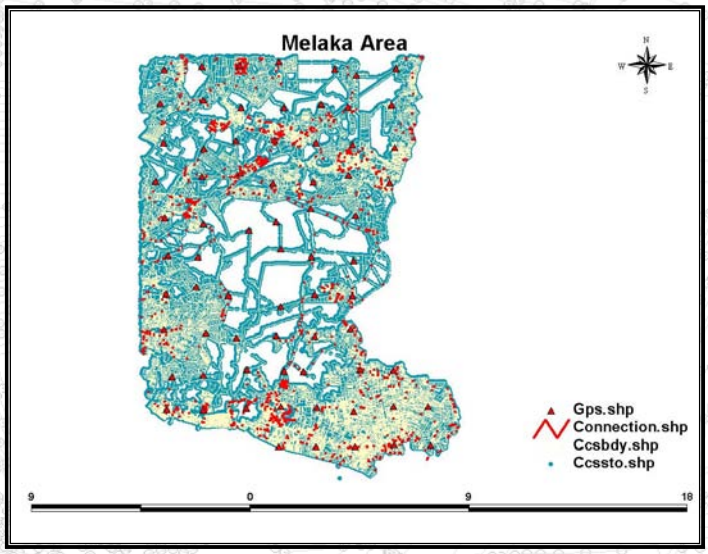
Total of Connection Lines: 3015

CADASTRAL INFRASTRUCTURE FOR STUDY AREA # 1: WILAYAH PERSEKUTUAN KUALA LUMPUR



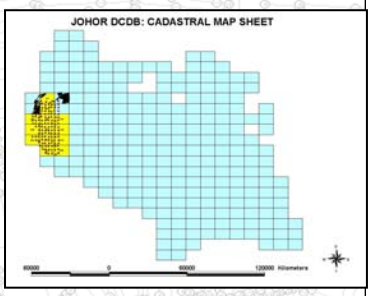
PREPARATION OF DATA INPUT: MELAKA

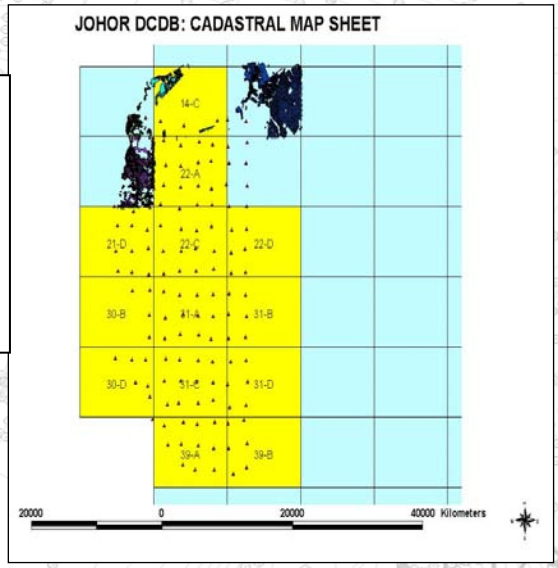




Total of Connection Lines: 4951

PREPARATION OF DATA INPUT: JOHOR





JOHOR DATA INPUT

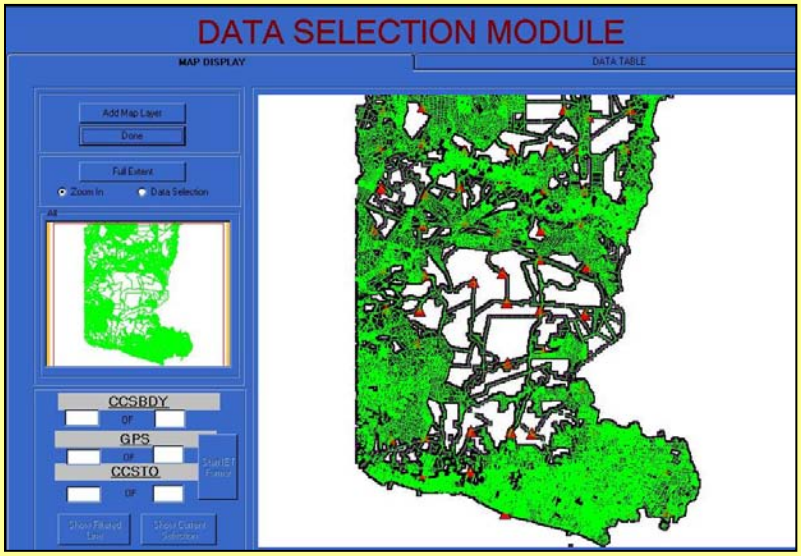
Gps.dbf
Ccs.shp
Ccs(s).shp
Ccs(b).shp

9 0 9 18 Kilometers

N W E S

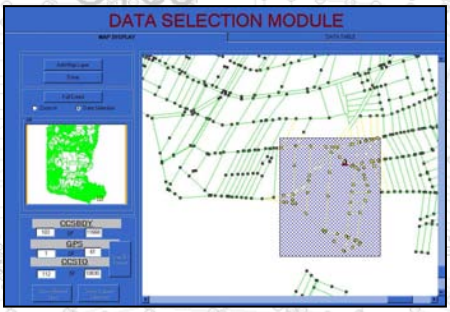
AUTOMATED DATABASE CONVERSION SYSTEM

Data Selection Module

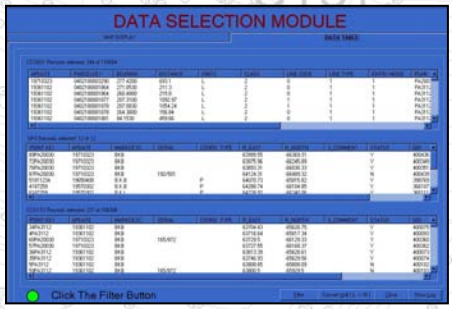


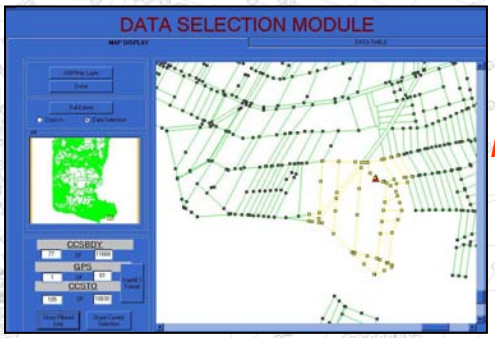
Cont…

Selection Process…



Filtering Process…

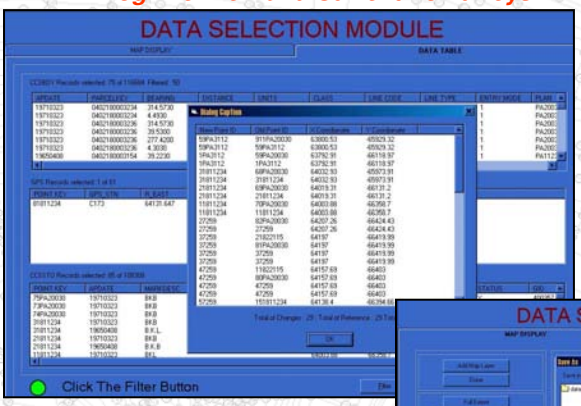




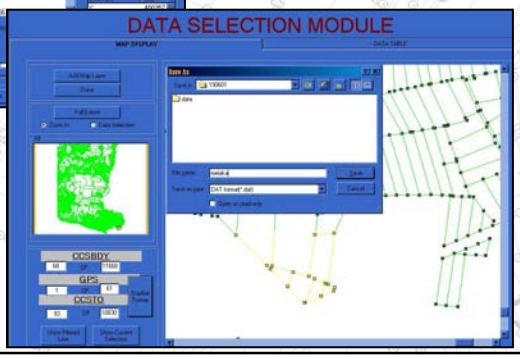
Filtered Zone…

Cont…

Log File: New and Current Point Keys

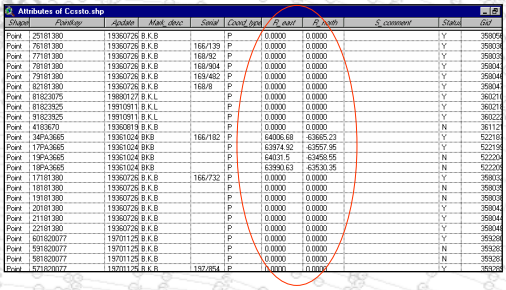


Save to StarNet Format

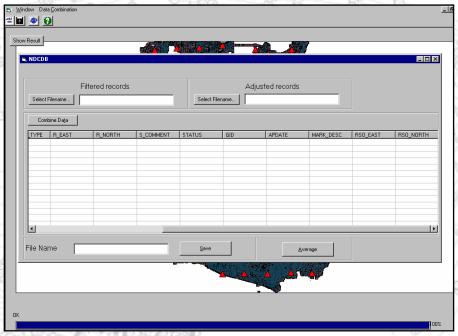


Samb…

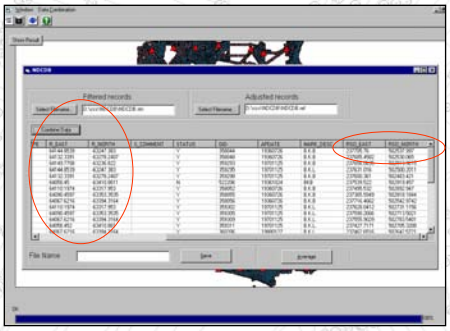
Populasi-PDUK



Original Boundary file
(Cassini coordinate only for selected boundary stones)



Interfacing program for repopulation of DCDB



New attribute:
Two new columns: RSO_EAST & RSO_North and Cassini coordinate

ADJUSTMENT OF TEST AREAS:

i)Melaka -Johor

ii) Wilayah Persekutuan Kuala Lumpur

Statistical Summary for Adjustment:

CASE 1

WGS-MRT-RSO-CASSINI

	(Fixed GPS Control Point at 2.5 km Interval) GPS Control Station:931020653, 10104385, 71020653, 53PA3141, 23PA10920, 5PA13105			
	Residual		Stn.Coord Std.Deviations	
	Bearing	Distance (m)	N (m)	E (m)
MAX	1'54"	0.039	0.092	0.084
MIN	-2'00"	-0.040	0	0
MEAN	0"	0	0.041	0.039
RMS	21"	0.013	0.042	0.041

Statistical Summary for adjustment Block 40-42

Number of Stations : 4954

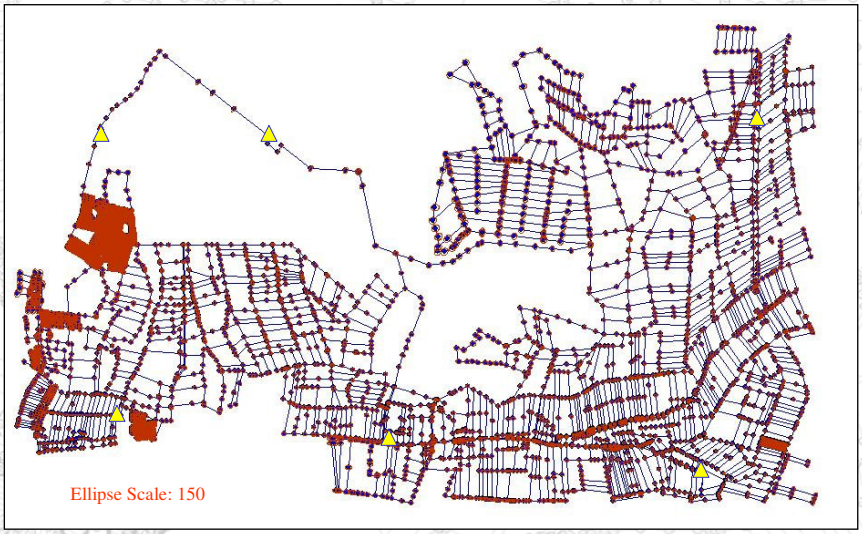
Error Factor : 1.729 (Standard error factor = 1.00)

Distance for max bearing residual : 73.919 m

Distance for min bearing residual : 42.714 m

CASE 1

Error Ellipse for Adjustment: Local Cassini



CASE 2

Statistical Summary for Adjustment:

WGS-CASSINI (GEOCENTRIC)

	(Fixed GPS Control Point at 2.5 km Interval) GPS Control Station:931020653, 10104385, 71020653, 53PA3141, 23PA10920, 5PA13105			
	Residual		Stn.Coord Std.Deviations	
	Bearing	Distance (m)	N (m)	E (m)
MAX	1'56"	0.039	0.092	0.084
MIN	-1'59"	-0.040	0	0
MEAN	0"	0.0003	0.041	0.039
RMS	21"	0.007	0.042	0.041

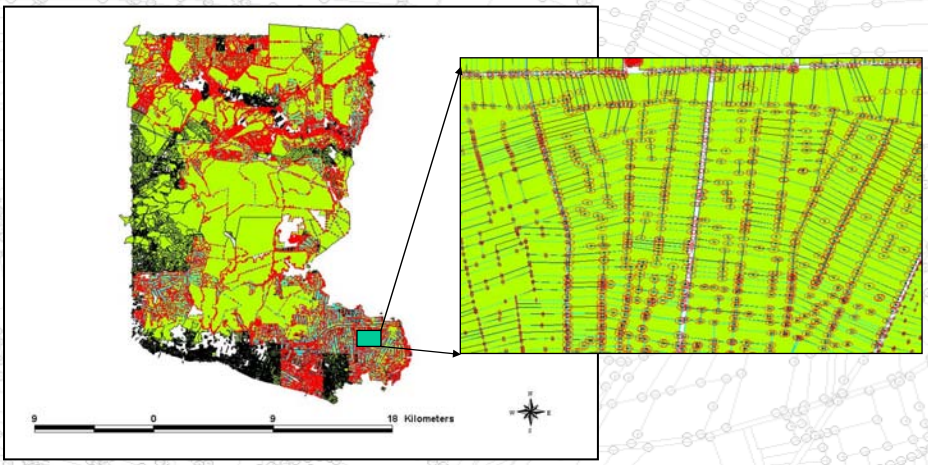
Statistical Summary for adjustment Block 40-42

Number of Stations : 4954
Error Factor : 1.729 (Standard error factor = 1.00)
Distance for max bearing residual : 73.919 m
Distance for min bearing residual : 6.823 m

CASE 2

Error Ellipse for Adjustment: Geocentric Cassini

COMBINED ADJUSTMENT RESULTS OF MELAKA CADASTRAL NETWORK



Total of Adjusted Boundary Marks: 62411

Statistics of the Melaka CCS Adjustment

Blk No.	No. of Stn.	No. of Obs.	No. of Unknowns	No. of Redundant Obs.	No. of GPS Stn.	Error Factor
Blk 1-6	7643	20832	15258	5574	13	1.8
Blk 7-8	3384	8318	6756	1562	6	1.4
Blk 11-12	3741	11007	7470	3537	6	1.7
Blk 15-16	5595	16263	11178	5085	6	1.7
Blk 17	2728	8074	5448	2626	4	1.7
Blk 18	3229	8228	6452	1776	3	1.7
Blk 20-27	3608	9870	7198	2672	9	1.7
Blk 30	1546	4044	3084	960	4	1.7
Blk 32-33	1997	5132	3978	1154	7	1.6
Blk 34-37	8139	24251	16256	7995	11	1.7
Blk 40-42	4954	14405	9896	4506	6	1.7
Blk 43	4510	12699	9010	3689	5	1.8
Blk 45	3698	9583	7392	2191	4	1.8
Blk 47	3034	8388	6062	2326	4	1.7

Note : Standard error factor is 1.0

Comparison Between Two Difference Cassini System

	BEARING RESIDUALS							
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Blk 1-6	2'1"	-2'1"	-1"	22"	2'00"	-2'01"	0"	21"
Blk 7-8	1'46"	-1'34"	0"	14"	1'42"	-1'34"	0	14"
Blk 11-12	2'00"	-1'53"	0"	17"	1'56"	-1'54"	0"	21"
Blk 15-16	1'59"	-1'58"	-1"	16"	2'01"	2'00"	0"	17"
Blk 17	1'57"	-1'59"	-1"	20"	1'57"	-1'56"	1"	19"
Blk 18	2'00"	-1'56"	-1"	20"	1'54"	-1'56"	0"	19"
Blk 20-27	2'02"	-2'03"	-1"	21"	1'59"	-2'00"	0"	21"
Blk 30	1'57"	-2'00"	0"	20"	1' 57"	-2' 00"	0"	20"
Blk 32-33	1'46"	-1'57"	0"	20"	1'44"	-1'57"	0"	19"
Blk 34-37	2'03"	-1'59"	0"	22"	2'01"	-2'01"	0"	21"
Blk 40-42	1'54"	-2'00"	0"	21"	1'56"	-1'59"	0"	21"
Blk 43	2'01"	-2'01"	1"	25"	1'59"	-2'01"	1"	25"
Blk 45	2'00"	-1'55"	0"	28"	1'59"	-1'55"	0"	21"
Blk 47	1'54"	-1'58"	0"	24"	1'52"	-1'57"	0"	24"

Comparison Between Two Difference Cassini System

	DISTANCE RESIDUALS							
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Blk 1-6	0.040	-0.048	0	0.008	0.040	0.040	0	0.008
Blk 7-8	0.033	-0.033	0	0.005	0.033	-0.033	0	0.005
Blk 11-12	0.040	-0.040	0	0.008	0.036	-0.036	0	0.007
Blk 15-16	0.040	-0.039	0	0.007	0.035	0.037	0	0.006
Blk 17	0.038	-0.040	0	0.009	0.039	-0.040	0	0.008
Blk 18	0.036	-0.033	0	0.007	0.046	0.038	0	0.007
Blk 20-27	0.039	-0.040	0	0.007	0. 040	-0.040	0	0.007
Blk 30	0.040	-0.033	0	0.007	0.040	-0.033	0	0.007
Blk 32-33	0.040	-0.041	0	0.007	0.040	-0.040	0	0.007
Blk 34-37	0.037	-0.036	0	0.007	0.040	-0.040	0	0.008
Blk 40-42	0.039	-0.040	0	0.013	0.039	-0.040	0	0.007
Blk 43	0.040	-0.039	0	0.008	0.040	-0.039	0	0.008
Blk 45	0.039	-0.040	0	0.008	0.039	-0.039	0	0.008
Blk 47	0.038	-0.037	0	0.007	0.038	-0.037	0	0.008

Comparison Between Two Difference Cassini System

	STATION COORDINATE STANDARD DEVIATIONS NORTH/SOUTH COMPONENT							
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Blk 1-6	0.150	0	0.070	0.075	0.140	0	0.075	0.083
Blk 7-8	0.151	0	0.076	0.084	0.140	0	0.075	0.083
Blk 11-12	0.103	0	0.044	0.048	0.101	0	0.042	0.046
Blk 15-16	0.139	0	0.065	0.069	0.141	0	0.065	0.069
Blk 17	0.092	0	0.044	0.045	0.086	0	0.039	0.040
Blk 18	0.104	0	0.056	0.059	0.104	0	0.056	0.059
Blk 20-27	0.151	0	0.059	0.062	0.139	0	0.055	0.057
Blk 30	0.120	0	0.064	0.067	0.120	0	0.064	0.067
Blk 32-33	0.150	0	0.048	0.054	0.141	0	0.048	0.053
Blk 34-37	0.141	0	0.046	0.048	0.137	0	0.046	0.049
Blk 40-42	0.092	0	0.041	0.042	0.092	0	0.041	0.042
Blk 43	0.090	0	0.043	0.044	0.090	0	0.042	0.044
Blk 45	0.081	0	0.053	0.054	0.079	0	0.053	0.054
Blk 47	0.093	0	0.044	0.047	0.092	0	0.044	0.047

Comparison Between Two Difference Cassini System

	STATION COORDINATE STANDARD DEVIATIONS EAST/WEST COMPONENT							
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Blk 1-6	0.139	0	0.070	0.063	0.138	0	0.063	0.067
Blk 7-8	0.148	0	0.076	0.086	0.147	0	0.075	0.085
Blk 11-12	0.104	0	0.047	0.050	0.101	0	0.045	0.049
Blk 15-16	0.148	0	0.072	0.076	0.152	0	0.072	0.076
Blk 17	0.084	0	0.042	0.043	0.079	0	0.039	0.040
Blk 18	0.095	0	0.050	0.054	0.095	0	0.050	0.054
Blk 20-27	0.123	0	0.061	0.063	0.147	0	0.055	0.057
Blk 30	0.131	0	0.056	0.059	0.131	0	0.056	0.059
Blk 32-33	0.124	0	0.046	0.050	0.112	0	0.046	0.050
Blk 34-37	0.133	0	0.047	0.049	0.132	0	0.047	0.049
Blk 40-42	0.084	0	0.039	0.041	0.084	0	0.039	0.041
Blk 43	0.113	0	0.049	0.053	0.112	0	0.050	0.055
Blk 45	0.108	0	0.063	0.065	0.106	0	0.063	0.065
Blk47	0.101	0	0.046	0.050	0.101	0	0.045	0.050

Statistical Summary For W.P.K.L Adjustments Results (Control Stations at 500 m spacing)

	Results Statistic							
	CASE 1				CASE 2			
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Bearing	40"	-39"	0"	6"	40"	-39"	0"	6"
Distance (m)	0.004	-0.004	0.001	0.001	0.004	-0.004	0.001	0.001
Std. Dev Coordinate (N/S) (m)	0.021	0.001	0.010	0.011	0.021	0.001	0.010	0.011
Std. Dev Coordinate (E/W) (m)	0.024	0.001	0.010	0.011	0.023	0.001	0.010	0.011

Error Ellipse for Block 1 K.L in Local Cassini System

Error Ellipse for Block 1 K.L in Geocentric Cassini System

Comparison of Adjustment Statistics Between 2.5 km and 0.5 km Control Spacing (Geocentric Case)

	Results Statistic							
	CASE 1				CASE 2			
	GEODETIC				GEOCENTRIC			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Bearing	40"	-39"	0"	6"	40"	-39"	0"	6"
Distance (m)	0.004	-0.004	0.001	0.001	0.004	-0.004	0.001	0.001
Std. Dev Coordinate (N/S) (m)	0.021	0.001	0.010	0.011	0.021	0.001	0.010	0.011
Std. Dev Coordinate (E/W) (m)	0.024	0.001	0.010	0.011	0.023	0.001	0.010	0.011

	2.5 km GPS Control				0.5 km GPS Control			
	MAX	MIN	MEAN	RMS	MAX	MIN	MEAN	RMS
Bearing	2' 01"	-2' 01"	0"	20"	40"	39"	0"	6"
Distance (mm)	40	-40	0	7	4	-4	1	1
Std. Dev. N/S (mm)	147	0	53	56	21	1	10	11
Std. Dev. E/W (mm)	152	0	56	57	23	1	10	11

SUMMARY

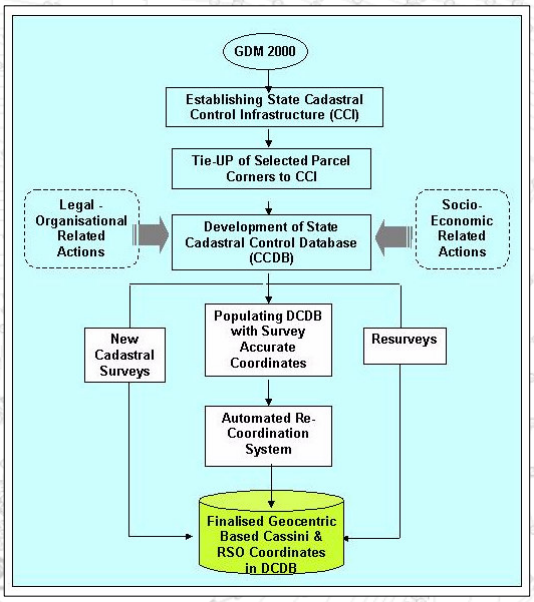
- ✓ Data screening and cleaning is essential since outliers exist in the data input. Manual editing is needed in order to run the adjustment ~ time consuming, tedious and challenging task.
- ✓ Data selection and Adjustment process greatly depend on the " cleanliness" of the data input.
- ✓ For the implementation of CCS, the adjustment progresses coherently with
  - – Outliers encountered during adjustment process
  - – The availability of number of software license
- ✓ The adjustment results depend on several factors:
  - I) Control station
  - ii) Accuracy of the cadastral survey
  - iii) Block size
  - iv) Number of boundary mark
  - v) Density of the cadastral lot
- ✓ Adjustment results show that the residuals and standard deviations for bearing, distance and coordinate are in tolerance.
- ✓ GPS station at 0.5km and 2.5km spacing are sufficient to be used in providing control for urban and rural cadastral networks, respectively.

RECOMMENDATIONS

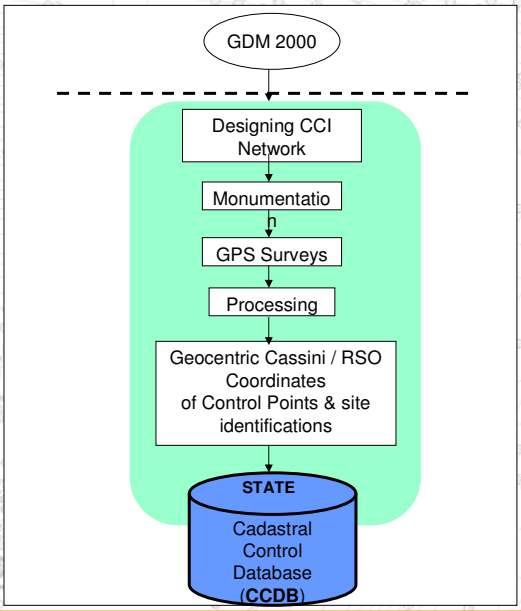
- ✓ To develop a comprehensive data integrity and management module in the existing Cadastral Management System comprising:
  - ▪ Revision of DCDB development process especially during data entry.
  - ▪ The creation of new layer in the DCDB for Cadastral Control and Connection Line
- ✓ To establish Cadastral Control Infrastructure with the following consideration:
  - ▪ GPS control in a grid format for better network geometry during adjustment process.
  - ▪ GPS station at 0.5km and 2.5 km spacing are sufficient to be used in providing control for urban and rural cadastral networks, repestively.
  - ▪ To facilitate the current GPS technologies such as Real-Time Kinematic GPS and Virtual GPS reference System in the Cadastral Control Infrastructure development process
- ✓ To further refine the present Automated Database Conversion System
- ✓ To restructure boundary mark file in order to populate the DCDB with new adjusted survey accurate coordinates

IMPACT OF GDM2000 ON CCS IMPLEMENTATION
(Technical Views)

Basic CCS Implementation Model for Peninsular Malaysia
(Modified Version)

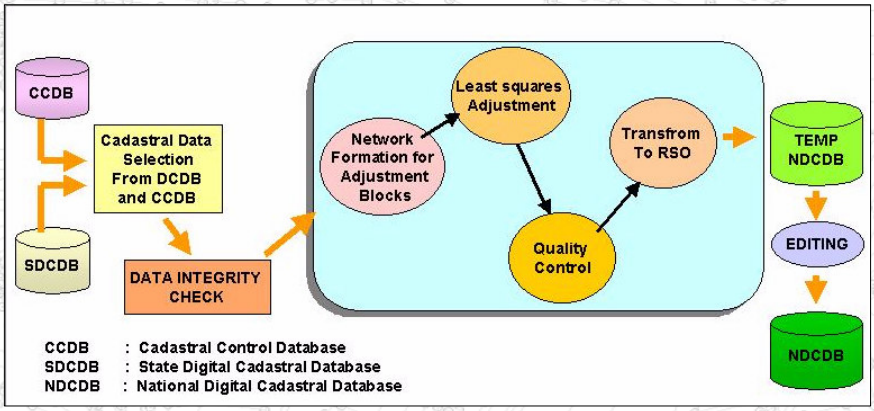


Establishing the State Cadastral Control Infrastructure (CCI) & State Cadastral Control Database (Modified From Original Conceptual Model)



Development of A National Digital Cadastral Database

(Modified From Original Conceptual Model)



CCDB : Cadastral Control Database
SDCDB : State Digital Cadastral Database
NDCDB : National Digital Cadastral Database