Best Practices, Tools and Techniques
utilised in Geospatial-Utility Projects

by Navayuga

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NAVAYUGA - LEADING ENGINEERING ENTERPRISE

- **NAVAYUGA** - A 30+ YEARS ENGINEERING AND TECHNOLOGY COMPANY COMMITTED TO DEVELOPMENT PROJECTS
- **NAVAYUGA** IS A GLOBAL ENGINEERING AND TECHNOLOGY ENTERPRISE IN INDIA - ENGINEERING AND TECHNOLOGY SOLUTIONS IS OUR BUSINESS
  - 5000+ CRORES REVENUES.
  - CURRENTLY EXECUTING ORDERS WORTH RS 50,000+ CRORE
  - OVER 10,000 EMPLOYEES WORLDWIDE
  - DIVERSIFIED CONGLOMERATE - CIVIL AND MARINE ENGINEERING, PORTS & FACILITIES HANDLED MAJOR PROJECTS IN SURVEYING, MAPPING AND 3D GIS
  - USE OF IT, SURVEYING, MAPPING AND GIS FOR SEVERAL YEARS AS PART OF ENGINEERING ENTERPRISE
  - NAVAYUGA IS A MAJOR PLAYER WITH MANY INTERNATIONAL AND NATIONAL LEVEL IT/ GIS PROJECTS

NAVAYUGA - IT Solutions
- Geomatics
- Exports
- Ports
- SEZ
- Steel
- IT
- Power
- Engineering

NAVAYUGA - LEADING ENGINEERING ENTERPRISE
Aerial – HR satellite data (Visible / IR, Thermal bands)

GPS / Total station

Ground Laser Scanner

Cadastral / Parcel Mapping

Data Inventory Scanning / migration

Field data collection

Image Processing & Thematic Mapping

GPR Surveys

Ortho mosaic

Triangulation

DEM (Photogrammetry / Lidar)

Aerial Survey

3D City Modeling

Enterprise GIS Database & Application Dev

Capacity building & Facility Mgmt

GIS Mapping

CMMI-Level 5 | ISO 9001 : 2008 Company

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MAJOR UTILITY PROJECTS OF NAVAYUGA

- FEWA – Federal Electricity and Water Authority
  - Survey, Mapping and GIS database development of complete Electrical and Water network and its Asset
- Delhi SDI – 30 Depts including water, Gas, Sewer, Power, Telephone utilities
- RAPDRP – 3 states in India
  - TamilNadu,
  - Uttarakhand and
  - Puducherry states of India
- Al Ain Electricity Distribution System
- Publi Authority of Electricity & Water, Oman
  - Survey, Mapping and GIS application database development of complete Electrical and Water network and its Asset
- Ministry of Electricity and Water, Kuwait
- Abudhabi Municipality, RAK Municipality, Ajman Municipality
- Krishnapatnam port – Survey and Mapping
- Reliance Telecom – As built survey and mapping in GIS
Port and Powerplant – detailed survey
POWERLINE ALIGNMENT SURVEYS

• Reconnaissance survey of the existing Transmission Line using GPS, SOI topo sheets and Satellite imagery

• Delineate new transmission-line using the defined parameters and on-site judgment

• Final field survey using Total Station and DGPS for positional accuracy

• Outputs as maps at various scales of (1:250,000, 1:50,000 & 1:25000)
GPS and Total Station

• Dual Frequency GPS for Base Control points
  - Accuracy of less than 5 cm
  - Average of 1 point per 2 km
  - DGPS data processing for manhole / Surface feature identification

• Total Station survey points on urban / Tree covered areas

• GPS Guided Direct Mapping
  - On the mobile mapper units
  - Marking on maps / satellite image prints
GPR SURVEYS: UNDERGROUND ASSET MAPPING

- PROFILING RADAR FOR ASSET MAPPING BELOW GROUND
- DETECTS METAL, CERAMIC MATERIALS ETC
- LINKED TO GPS FOR PRECISE LOCATION
- TRANSFORMED OVER ROADMAP TO MAKE A ASSET GIS

Multichannel cart radar system - Terravision

6 Feet wide coverage
Scan grid geometry 5 inch x 1 inch
UTILITY SURVEY

Collection and Analysis of Existing Utility Maps, Associate Data, and Local Area Knowledge

Survey Planning - Base Line Survey Map Preparation

Segmentation of Roads

Preliminary Survey to fine tune the equipment settings – UtilityScan and Terravision

Utility Survey

Under Ground Survey

Over Ground Survey
UTILITY SURVEY

Under Ground Survey

GPR Survey

Data Processing & Interpretation

Utility Map with all other relevant information

Incorporate Utility Map into Base Map in .dwg format

Attributes from Line Department

Over Ground Survey

Survey of Key over Ground Network Feature by GPS/Total Station

Collection of other non-spatial data / information

Creation of GIS Database and link attribute data
UNDERGROUND UTILITY DETECTION: Equipment and software

- **Utility Scan – SIR** system for real time 2D profiles,
  - Utility Scan-400 MHz for Shallow Penetration-Highest Resolution (0 – 4 m)
  - Utility Scan-270 MHz for Deeper Penetration-High Resolution (0 – 6 m)
    - ideally suited for detection and mapping of utility pipes.
    - can locate buried utilities, drums and underground storage tank.
    - identify depth and location of objects of all metallic and non-metallic pipes.

- **Terravision** system for 3D survey.
  - Records 3D data from 14 hardware channels simultaneously at 400 MHz in 6 feet wide survey swath for automatic pipe recognition.

- **Pipe Locators with signal generators and clamps**
  - DXL, MXL from Stanlay
  - RD 7000 from Sigma, 3M 2250

- **GPR Data Processing Software**
  - identification and data enhancement - Rdx pro
  - Radan will be used for scans collected by Terravision
  - CAD / GIS Software for Data management and attribute attachment
MOBILE DATA ACQUISITION: SURFACE UTILITY MAPPING

[Image of software interface]
MOBILE DATA COLLECTION for RAPDRP

- Good for Surface data extraction, verification and planning, landmark collection

- Guaranteed Accuracy of location and pole info

- Difficult for attribute data updation of wires which was needed
DATA COLLECTION

**Paper Based**

- Easy for data collection
- Low capital investment
- May lead to confusion due to hand writing
  - Avoided as much as possible by form design
- Lot of validation process to be built
- Highly Scalable
- Easy to train for large scale implementation

**PDA / Direct Digital**

- Dependencies
  - Battery backup
- Direct validation
- Takes time during survey
- Security of the instruments on large scale implementation
- Accuracy is more
- Scalability is difficult
Airborne LIDAR: Acquisition and Processing

- Lidar Surveys
- DEM / DTM
- Transmission network mapping
- Orthoimagery
- Vector Map for PLS CADD integration
Terrestrial Laser Scanning

- Surveying, 3D Models for Breakline Detection and Bench Monitoring
- Monitoring of rockfaces and slopes
- Detection of rock- and slope-movements
- Open Pit Mining Monitoring
- Volume Calculation,
- Blast-planning and -supervision

<table>
<thead>
<tr>
<th>Mobile</th>
<th>Fixed - Temp</th>
<th>Fixed - Permanent</th>
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<td>up to 10°</td>
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- Panorama Image
- Textured 3D Model
- Detail of 3D Model
- 3D-Model with truecolor
- 3D-Model showing vegetation
- 3D-Model colored by height
- Contour lines

- Measurement range up to 2000 m
- Laser Class 1
- Laser beam divergence 0.15 mrad
- Measurement rate up to 11000 points/sec.
- Built-in inclination sensors (typ. accuracy 0.008°, tilt range ±10°)
- Accuracy 10 mm
- Field of View 80° x 360°
Power line surveys for inspection

- Corridor Mapping
- LIDAR and Imagery acquisition
- Monitoring of power lines
- Infra red inspection for full evaluation of all detected thermal anomalies
- Asset inspection service
  - Damaged, burned or rotting structures
  - Broken or damaged cross arms and braces
  - Missing aerial markers and FAA warnings
  - Broken or missing guy wires and anchors
  - Broken or damaged insulators Missing structure numbers, or incorrectly numbered structures
  - Determine minimum ROW widths
  - Locate ROW restrictions / encroachments
  - Locate ROW access features, including bridges and gates
  - Erosion near structures

Source: GeoDigital
RAPDRP : Components and Process Flow

<table>
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<th>Main Activities</th>
<th>Sub Activities</th>
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<tr>
<td><strong>1 Base Mapping</strong></td>
<td>Satellite Data Procurement</td>
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<td>GPS Control Point Planning</td>
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<td>GPS Data Processing</td>
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<td>Geo referencing</td>
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<td></td>
<td>Digitisation of base map</td>
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<td>GPS Control Survey</td>
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<td><strong>2 Existing Data usage</strong></td>
<td>Collection of existing data</td>
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<tr>
<td></td>
<td>Review and Planning</td>
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<td></td>
<td>Georeference with base map</td>
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<td>Digitisation as per design</td>
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<td><strong>3 Asset Mapping</strong></td>
<td>Collection of SLD and dept data</td>
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<td>Marking of DT &amp; RFP Location</td>
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<td>Area Demarcation</td>
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<td>AM– attribute collection</td>
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<td>Lin king and Validation</td>
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<tr>
<td><strong>4 Consumer Indexing</strong></td>
<td>Collection of Consumer data</td>
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<td>Survey of HT &amp; LTCT consumers</td>
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<td>Survey of Street Light meters</td>
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<td>Integrated Geodatabase</td>
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<td><strong>5 GIS Data base Generation</strong></td>
<td>QA / QC of Asset data</td>
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<tr>
<td></td>
<td>QA / QC of Consumer data</td>
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<tr>
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<td>QA / QC of Base map database</td>
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<td>Integrated Geodatabase</td>
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<td><strong>6 GIS based Network Analysis - Application</strong></td>
<td>Database &amp; High Level Design</td>
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<td>Functional Design</td>
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<td>Development and Integration</td>
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<td>Testing and Deployment</td>
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RAPDRP – Our Implementation Process

• Use of Geodetic GPS receivers
• Use of Google Data in the initial days
  – Establishment of transformation matrices
• Boundary study
• Clear spatial indexing of the project area
• Paper based data collection process along with GPS data
  – Flexibility in increasing more manpower
  – GPS only for location identification
  – Tools for generation of electrical network
  – Use of open source tool
  – Central Data Validation
  – Colour coding & Unique numbering during the field surveys
  – Predefined building ID’s for ground survey. Quick to link attributes and check for anomalies
• OH and UG based Data collection procedure / forms
• Process of achieving 100% consumer and mapping them to identification
• Duplicate clearance and resolution of mixed numbering scheme
Gridlayout – Sample
1 km grid layout on 1 : 5000 scale – optimised for A3 paper
250 m grid – layout for Asset mapping and consumer indexing
RAPDRP : Our Solution

- ESRI based Solution
- PRDC Mipower based Network Analysis
- Enterprise Service Oriented Architecture
- Data Updation Procedure
  - Complete automation
  - Utility driven approach
- Hardware sizing
  - Load balanced App servers
  - DB servers – 2 nos of IBM P7 6 core processor,
    - 3.72GHz of 416 GB RAM.
- Network Sizing
  - 30 Mbps Network for DC
  - Dedicated 512 kbps network for the section offices
- Lower Time delay / display in webpages
  - Configuration of network parameters and monitoring
  - Database design, dynamic Cache, query / display, Role based data extract and display
- Load flow Analysis
- Fault Analysis
- Contingency Analysis
- Protective Device Coordination
- Line Re-Conductoring
- Network Re-Configuration / Express Feeder
- Cost Estimation
- Cost Benefit Analysis
Integrated Solutions @ Utility Industry

Capture Real World

Accurate – Authoritative – Actionable Information

Desktop  Web  Mobile

Database Server

Geospatial Portfolio

Sensors

Deliver

Process

Store
Geospatial Resource Management (GRM) provides advanced integrated solutions to increase efficiencies, streamline workflows and lower the costs of network operation and maintenance.
Display Main Map, Schematic Map, Substation Map
OMS @ Reporting on Web Portal

- Provide detailed, accurate, and analytical information through timely.
- Allows you to identify and correct trends before they become an issue.
- Industry standard reports and charts
  - System reliability
  - Outage analysis and crew history reports
  - Current workday or historical
Load Flow analysis
3 Query on depth and diameter of the utility pipes of DJB
3 Query for identifying the nearest valves in the vicinity of a gas leak point.
DT Energy Distribution

- HT & LT Network of one town with DT & its network / boundaries
TO CONCLUDE…

- **Navayuga**
  - A one stop solution provider for all ICT-Spatial technology / Geomatic needs
  - Industry best Top Technical and Management team
  - End to End Solution from experienced Geomatic professionals
  - State-of-the-art technology and Infrastructure
  - Best Practices includes not the use of advanced technology but use of judicious use of resources and technology based on the requirements and terrain
  - Success of Projects depends on Proper Planning, Monitoring and Budgets along with educating the clients and training the team on Geospatial technologies

Thank you