Mobile Solutions for Capturing Electrical Assets of Municipalities

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Overview

• Challenges facing municipalities
• What is actually required & what is the problem?
• Solution overview & walk through
• What are the outputs?
• What has been achieved?
• Job creation
• Summary
Challenges facing Municipalities

• Compiling **Asset Registers** for the purpose of **Asset Management** (NRS 093-1:2009, GRAP 17)

• Lack of up to date as-built technical drawings of all networks

• Ability to accurately simulate network performance

• Ensure public safety (OHS Act)

Municipalities have IT systems such as GIS, ERP, CRM, power simulation, financial systems, etc, **but**

• they all lack extensive, detailed and accurate network data from HV through to LV
What “data” is actually required?

• A full **audit** of **Asset & Customer data** (as per GRAP, NRS, etc):-
  – Precise geographical location (GPS coordinate)
  – Technical data (eg date of commission, type, classification, ratings, etc)
  – Present condition of equipment (level of impairment)
  – Network interconnectivity data (how each node connects to others)

• Data of peripheral assets that could affect network:-
  – servitudes, fencing, vegetation, terrain (roads, rivers, …)
  – structures (buildings, etc)
What is the problem?

- Data collection is an expensive exercise and is generally avoided.
- Data collected on an urgency basis is expensive.
- High-end skilled resources are required to manage the volume and quality of data (paid on an attribute by attribute basis).
- Several pockets of data capturing done in isolation with duplication (unconsolidated work).
- End result: only partial data is being captured at exorbitant costs.
Solution Overview

Hardware:
- Rugged mobile device with built-in GPS
- Supplied by authorised dealer for Sub-Saharan Africa
- Con: built-in camera is limited

Mobile Software Applications:
- Uses simple screen layout (technician level)
- Systematically prompt the user for comprehensive information (customisable)
- Documents the network interconnectivity
- Use external zoom camera for high quality images
What is the user required to input?

1. Compulsory electrical data sufficient for simulation purposes
2. Specify the different types of assets / equipment at this node (pole/pylon/etc)
3. Fill out questionnaires corresponding to each piece of asset / equipment: GPS coordinates are recorded in the background without concerning the user.

[Image of a software interface with fields for transformer details like type, brand, S/N, kVA, MV Phase, PV[kV], etc.]
Overview of the Workflow

- Compile Asset Registers with images
- Conduct Power Simulation studies
- Proceed with Asset Management strategy
• Asset Management enables municipalities to:
  – Address maintenance issues with prioritisation
  – Identify root cause of recurring problems
  – Use all the data above to develop accurate business plans

Other outputs (Desktop)
• Generate as-built drawings to be used for:
  – Archival (record storage)
  – Extension of existing networks, in-fills, etc
• Detailed report on the data collected for analysis
• Provide an environment for interactive analysis of network in detail (see example)
1. Is the Installation height correct? Correct
2. What is the Transformer installation? Out of line
3. The Transformer condition - rust / oil leaks? Good
4. Is the transformer mounting brackets / platform in order - bolt through pole? Good
5. Tap changer position set? 3
6. Is MV Jumper clearances in order / covered with pipe? Good
7. Is MV bushing connections in order? Good
8. What type of MV bushing? porcelain
9. Is LV bushing connections in order? Good
10. What type of connection to LV bushing? ABC
11. Is LV fuse unit in order? Good
12. Is distributor neutrals directly to bushing in a pipe? Correct
13. Is MV Surge arrestors in order? Good
14. Is MV Surge arrester connected to the tank? Correct
15. Is LV surge arrester connections correct & & in order? Correct
16. Is MV Links in order? Good
17. MV Links Type? Solid
18. What is Conductor size from LV bushings to fuse unit? >35mm
19. What is the LV fuse unit rating? 80A
20. Is MV Earthing in order? Good
21. Is LV earthing in order? Good
22. What is MV / LV earthing method? Separated 5m
23. Is Earth connections in general in order? Good
24. Trfr Label installed? Good
25. Max fuse label installed? Good
26. LV feeder label installed? Good
27. Danger sign installed? Good
28. Anti climbing device installed - type? Good
29. Fault Comments none
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airdac Overhead or Underground?</td>
<td>Overhead</td>
</tr>
<tr>
<td>Airdac clearance in order - road</td>
<td></td>
</tr>
<tr>
<td>Is an additional kicker pole needed</td>
<td>Yes - 5m</td>
</tr>
<tr>
<td>Airdac tension in order (spring tension test)?</td>
<td>Retension</td>
</tr>
<tr>
<td>Is Airdac damaged / joints - Replace (JR)?</td>
<td>Good</td>
</tr>
<tr>
<td>Is Airdac touching tinned roof - possible damage?</td>
<td>Touching-Rectify</td>
</tr>
<tr>
<td>Is Airdac through wall or roof sealed?</td>
<td>Not sealed</td>
</tr>
<tr>
<td>Is Airdac Drip loop in order?</td>
<td>Redo drip loop</td>
</tr>
<tr>
<td>Is Strain clamp at house in order?</td>
<td>Replace</td>
</tr>
<tr>
<td>Is Pigtail Screw or Bolt type?</td>
<td>Pigtail bolt</td>
</tr>
<tr>
<td>Type of Roof entry?</td>
<td>Tm</td>
</tr>
<tr>
<td>Is Airdac secured inside house?</td>
<td>Good</td>
</tr>
<tr>
<td>Passive Base or Readyboard Installation?</td>
<td>Passive Base</td>
</tr>
<tr>
<td>Is Passive Base/Readyboard Installation in order?</td>
<td>Good</td>
</tr>
<tr>
<td>Is Ready board Connections in order?</td>
<td>Good</td>
</tr>
<tr>
<td>Is Meter in order - testing procedure - Earth leakage?</td>
<td>Good; 0168580; kiosk-meter 16kva spu 1ph o/d d3185</td>
</tr>
<tr>
<td>What is the Meter size?</td>
<td>20A</td>
</tr>
<tr>
<td>Is COC with customer?</td>
<td>No</td>
</tr>
<tr>
<td>Is the Meter sealed?</td>
<td>Not sealed</td>
</tr>
<tr>
<td>Is Labelling done- house number</td>
<td></td>
</tr>
<tr>
<td>Are there suspect ready board connections / tampering?</td>
<td>Good</td>
</tr>
<tr>
<td>Is wiring practice unsafe?</td>
<td>Unsafe</td>
</tr>
<tr>
<td>Is Service Connection valid or to be Removed?</td>
<td>Valid</td>
</tr>
<tr>
<td>Fault Comments</td>
<td>no pigtail at house</td>
</tr>
</tbody>
</table>
Analysing a Network in Detail

0163791; bolt.pigtail assy m10x280mm d3003

Clean up this mess
What has been achieved?

• Developed a mobile solution in collaboration with Eskom and consultants to streamline asset data capturing to:-
  – Eliminate onerous paperwork on site and back at the office
  – Not concern the user about GPS readings
  – Reduce the skill level of users to clerks-of-works/technicians
  – Capture ALL the required data in one go (consolidation)
  – Document the network interconnectivity
  – Increases speed and accuracy to obtain data, supported by images
  – Standardise the way in which data is captured by configuring the questionnaires for each piece of equipment
  – Rapidly produce as-built drawings (time saved)
  – Reduce capturing costs by over 70% (outsourced)

• Eskom used this tool on a research project to gather data on the condition of existing networks
How can we create jobs?

- Ideal skill level: clerks-of-works (for accountability)
- Skilled technicians can also undertake the work (it will require both internal skills and outsourcing)
- Redeployment creates vacancies that will be addressed by promoting / training internal staff
- This in turn will create opportunities at the bottom for the employment of graduates / youth

**Working with electricity is dangerous!!!**

- Therefore entrants must be formally trained with apprenticeship for establish lifelong careers.
Summary

• Created mobile software specifically for capturing electrical assets, interconnectivity & peripheral data
• The solution is designed to be compact and easy to use in the field (limited computer literacy and technician level)
• Customised to comply with data standard (content)
• Compile Asset Registers as part of the Asset Management strategy – needs to be done on an on-going basis
• Reduce operating costs by over 70% for data capturing while improving data quality & accuracy
• Technology is an enabler in tackling “costly” inevitable work → create new job opportunities
Thank you

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References

- “Mobile and Desktop Solutions for Capturing and Maintaining MV and LV Networks”, by Rajakanthan T, McLaren B, Dwolatzky B, National Planners Conference 2010,
- NRS 093:2008 Asset Management Presentation to the ESLC (Electricity Suppliers Liaison Committee) by André Bekker, 21 Feb 2008.
- AMEU: Asset Management Regulatory Compliance Challenges, AG Booyzen, SE Fourie, Directors, Bigen Africa Services (Pty) Ltd.
- AMEU: Asset Management: An Executive Perspective, Dr. Willie de Beer and Nigel Waters, EDI Holdings
- AMEU: Benchmarking in the South African EDI context, Dr. Willie de Beer, Nigel Waters and Lee Annamalai, 29 September 2010.