On the Use of GPS CORS for Cadastral Survey in Indonesia

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** The National Land Agency of Indonesia (BPN), Jakarta, Indonesia
**IPGSN : National GPS CORS of Indonesia**

- **The Indonesian Permanent GPS Station Network (IPGSN)**
- **Maintained and operated by Bakosurtanal (the National Coordinating Agency for Surveys and Mapping)**
- **All stations of IPGSN use the high precision L1/L2 geodetic type GPS receivers with choke ring antennas and radomes.**
- **GPS data is recorded at 1Hz rate and streamed in real time or near real time of 1 hour latency to the data processing center at Bakosurtanal office in Cibinong, West Java.**

Abidin et al. (2010)
Current Status of IPGSN (99 stations)
April 2011

C. Subarya @ Bakosurtanal
GPS for Cadastral Surveys in Indonesia

(1) establishment of the cadastral control network, 
(2) determination of parcel boundary coordinates, and 
(3) reconstruction of parcel boundary points.

Although GPS CORS are starting to be established, GPS is usually implemented in GPS survey static or in a single station GPS RTK modes.

National Cadastral Reference Networks (NCRNs)

- Established and maintained by BPN
- Connected to 0th and 1st order NGRN

Hasanuddin Z. Abidin, 2010
Examples of 2nd and 3rd order NCRN realization

Typical relative accuracy of 2nd and 3rd order NCRNs
These results are associated with the networks shown in previous slide
Realization of NCRNs

- **2nd Order**:  
  - 10 km interval  
  - 9,000 GPS points  
  - Realization up to 2010: 70% (6,699 points)

- **3rd Order**:  
  - 2 km interval  
  - 200,000 GPS points  
  - Realization up to 2010: 7% (14,085 points)

GPS CORS System is urgently needed to speed up land registration process in Indonesia.

Up to 2010, from about 87 million land parcels in Indonesia, only about 46% has been registered.

BPN GPS CORS Plan in 2009

- To speed up the land administration process in Indonesia.
- GPS CORS of BPN consisting of Class-A and Class-B type stations.
- The Class-A type stations will be established on the ground and have specification and performance comparable to the IPGSN stations.
- The Class-B type stations will usually installed on the building, preferably in the land office building in the corresponding areas.

Ref: F. H. Adyanto (2009)
GPS CORS of BPN (National Land Agency)

- All stations of BPN GPS CORS will be equipped with dual-frequency geodetic-type GPS receivers.
- 3 stations around the capital city of Jakarta, i.e. Tangerang, Bekasi and Bogor, have been established and tested.
- In 2010, other 33 CORS stations will be established in Java and Bali and other strategic areas outside Java and Bali.

Ref: F. H. Adiyanto (2009)

BPN GPS CORS Status in 2010

Up to the end of 2010, 40 GPS CORS stations have been established in Java and Bali

Hasanuddin Z. Abidin, 2011
BPN GPS CORS Plan for 2011

(1) Establishment of other 30 CORS stations in Java,
(2) Establishment of 23 CORS stations outside Java, i.e. Sumatera, Nusa Tenggara, Kalimantan and Sulawesi;
(3) Development of BPN GPS CORS website;
(4) Development of web-based CORS data processing system,
(5) Determination of new national reference system for cadastral applications (in cooperation with Bakosutanal), and
(6) Cooperation with CORS users.

Determination of Parcel Boundary Coordinates

**Direct Method**

- GPS Rover
- GPS satellites
- GPS Reference
- Parcel
- GPS observation route
- 3rd Order of NCRN (can be replaced by GPS CORS Station)
Determination of Parcel Boundary Coordinates

Indirect Method

Results of Determination of Parcel Boundary Coordinates

from test cases in Jakarta and Bali involving 40 land parcels with areas less than 10,000 m²

<table>
<thead>
<tr>
<th>Method</th>
<th>Urban Areas (distance to NCRN benchmark &lt; 5 km)</th>
<th>Rural Areas (distance to NCRN benchmark &lt; 13 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parcels per day</td>
<td>Relative Accuracy</td>
</tr>
<tr>
<td>CORS-RTK</td>
<td>30</td>
<td>1.5 cm</td>
</tr>
<tr>
<td>GPS rapid static</td>
<td>5</td>
<td>1.5 cm</td>
</tr>
<tr>
<td>GPS rapid static + ETS measurement</td>
<td>6</td>
<td>1.5 cm</td>
</tr>
</tbody>
</table>

Hasanuddin Z. Abidin, 2010
Reconstruction of Parcel Boundary Points

**Direct Method**

- GPS Satellites
- GPS Rover
- Display
- GPS Reference
- 3rd Order of NCRN (can be replaced by GPS CORS Station)

Hasanuddin Z. Abidin, 2010

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Reconstruction of Parcel Boundary Points

**Indirect Method**

- GPS temporary Benchmark #1
- GPS temporary Benchmark #2
- GPS Baseline Observation
- Terrestrial measurements

Hasanuddin Z. Abidin, 2010
BPN GPS CORS in Indonesia: Challenges and Limitations

1. Communication Link and Infrastructure
2. Continuous Support for Maintenance and Operation
3. Working Culture & Human Resources
4. Capacity Building and Human Resource Development
5. Multi Purpose Utilization

Closing Remarks

1. Up to 2010, from about 87 million land parcels in Indonesia, only about 46% has been registered. In order to speed up this land registration process, BPN should established as soon as possible the GPS CORS system that can fully support the cadastral surveys all over Indonesian region. 
(Speeding up the land registration process)

2. The synergism of this BPN GPS CORS system with the Bakosurtanal IPGSN system should also be realized, both in conceptual and operational domains. 
(National Geodetic and Cadastral GPS CORS)
GPS = Great Places to Smoke

Thank you very much for your attention