

ภาคผนวก ข.
ข้อมูลข้อกำหนดทางเทคนิค

**เอกสารอ้างอิง

ที่มา : ICAO DOC 9881

(Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information)

International Civil Aviation Organization (ICAO)

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ภาคผนวก ข. ข้อมูลประกอบข้อกำหนดทางเทคนิค

TABLE C.1 RECOMMENDED NUMBER OF CHECKPOINTS BASED ON AREA

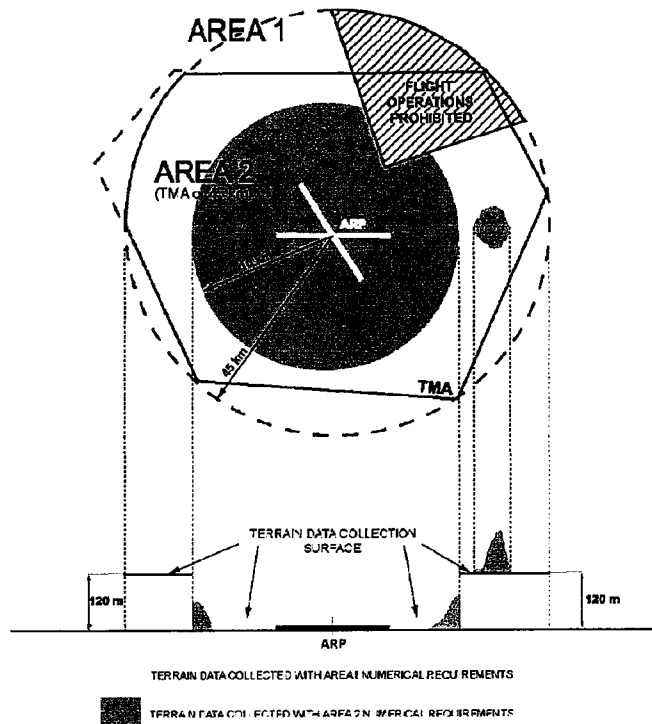
| Project Area (Square Kilometers) | Horizontal Accuracy Testing of Orthomagery and Planimetrics | Vertical and Horizontal Accuracy Testing of Elevation Data sets | | | | | | | | | | | | |
|-------------------------------------|--|---|---|--|-----------|----|----|----|----|-----------|----|----|----|-----|
| | Total Number of Static 2D/3D Checkpoints (clearly-defined points) | Number of Static 3D Checkpoints in NVA ⁵ | Number of Static 3D Checkpoints in VVA | Total Number of Static 3D Checkpoints | | | | | | | | | | |
| ≤500 | 20 | 20 | 5 | 25 | | | | | | | | | | |
| 501-750 | 25 | 20 | 10 | 30 | | | | | | | | | | |
| 751-1000 | 30 | 25 | 15 | 40 | | | | | | | | | | |
| 1001-1250 | 35 | 30 | 20 | 50 | | | | | | | | | | |
| 1251-1500 | 40 | 35 | 25 | 60 | | | | | | | | | | |
| 1501-1750 | 45 | 40 | 30 | 70 | | | | | | | | | | |
| 1751-2000 | 50 | 45 | 35 | 80 </tr <tr> <td>2001-2250</td> <td>55</td> <td>50</td> <td>40</td> <td>90</td> </tr> <tr> <td>2251-2500</td> <td>60</td> <td>55</td> <td>45</td> <td>100</td> </tr> | 2001-2250 | 55 | 50 | 40 | 90 | 2251-2500 | 60 | 55 | 45 | 100 |
| 2001-2250 | 55 | 50 | 40 | 90 | | | | | | | | | | |
| 2251-2500 | 60 | 55 | 45 | 100 | | | | | | | | | | |

⁵Although vertical check points are normally not well defined, where feasible, the horizontal accuracy of lidar data sets should be tested by surveying approximately half of all NVA check points at the ends of paint stripes or other point features that are visible and can be measured on lidar intensity returns.

ภาพที่ ข-1 จำนวนจุดตรวจสอบ

ที่มา: The American Society for Photogrammetry and Remote Sensing (ASPRS), 2014. ASPRS POSITIONAL STANDARDS FOR DIGITAL GEOSPATIAL DATA, *PE&RS Vol.81, No.3, March 2015, pp.*

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ภาพที่ ข-2 พื้นผิว Terrain collection surface

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| Quality attributes | Area 2 — Terminal Airspace |
|--------------------------------|----------------------------|
| Horizontal Accuracy | 5.0 m |
| Data Integrity | Essential (10^{-5}) |
| Vertical Accuracy | 3.0 m |
| Vertical Resolution | 0.1 m |
| Confidence Level (1σ) | 90% |
| Post Spacing | 1.0 arc second (30 m) |

ภาพที่ ข-3 ข้อกำหนดด้านคุณภาพแบบจำลองภูมิประเทศเชิงเลข สำหรับบริเวณ Area 2

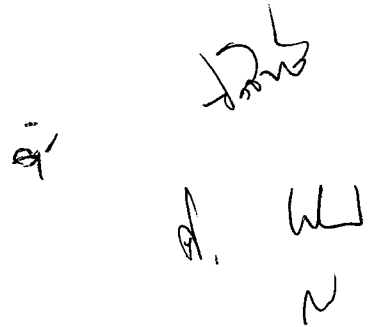
| Quality attributes | Area 3 — Aerodrome Mapping |
|--------------------------------|----------------------------|
| Horizontal Accuracy | 0.5 m |
| Data Integrity | Essential (10^{-5}) |
| Vertical Accuracy | 0.5 m |
| Vertical Resolution | 0.01 m |
| Confidence Level (1σ) | 90% |
| Post Spacing | 0.6 arc second (20 m) |

ภาพที่ ข-4 ข้อกำหนดด้านคุณภาพแบบจำลองภูมิประเทศเชิงเลข สำหรับบริเวณ Area 3

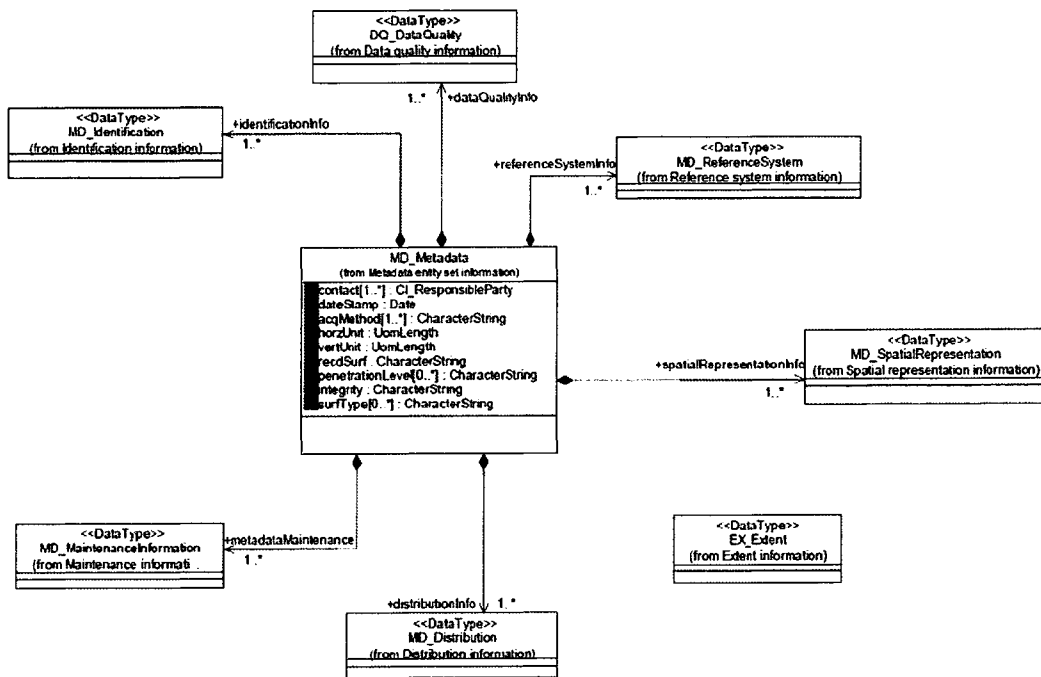
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| Attribute | Mandatory/Optional |
|-----------------------------|--------------------|
| Area of Coverage | Mandatory |
| Data Source Identifier | Mandatory |
| Acquisition Method | Mandatory |
| Post spacing | Mandatory |
| Horizontal Reference System | Mandatory |
| Horizontal Resolution | Mandatory |
| Horizontal Accuracy | Mandatory |
| Horizontal Confidence Level | Mandatory |
| Horizontal Position Data | Mandatory |
| Elevation | Mandatory |
| Database Units | Mandatory |
| Elevation Reference | Mandatory |
| Vertical Reference System | Mandatory |
| Vertical Resolution | Mandatory |
| Vertical Accuracy | Mandatory |
| Vertical Confidence Level | Mandatory |
| Surface Type | Mandatory |
| Recorded Surface | Mandatory |
| Penetration level | Optional |
| Known Variations | Optional |
| Integrity | Mandatory |
| Date and Time Stamp | Mandatory |

ภาพที่ ข-5 ข้อกำหนดส่วนข้อมูลคุณลักษณะ (Attribute) ของแบบจำลองภูมิประเทศเชิงเลข

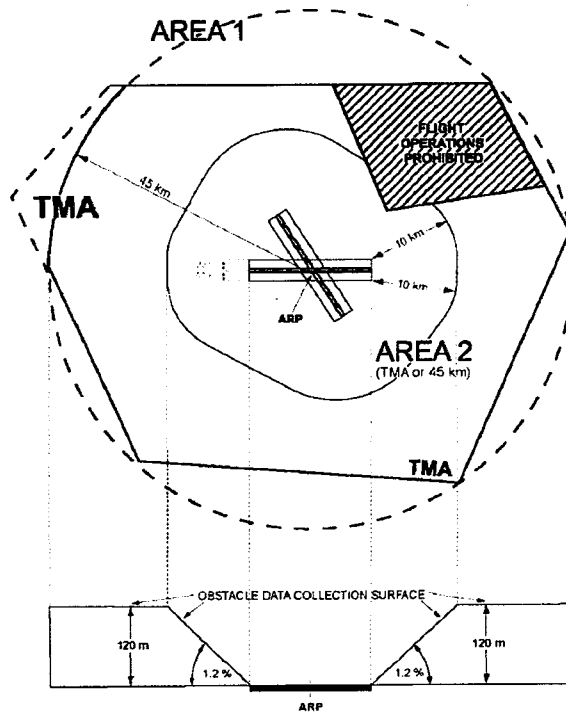


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ภาพที่ ข-6 แสดงภาพรวมของรายการข้อมูล Metadata สำหรับแบบจำลองภูมิประเทศเชิงเลขในรูปแบบ UML

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ภาพที่ ข-7 Obstacle collection surface

| Quality Attributes | Area 2 — Terminal Control Area |
|---|--------------------------------|
| Horizontal Accuracy | 5.0 m |
| Data Classification and Integrity Level | Essential (10^{-5}) |
| Vertical Accuracy | 3.0 m |
| Vertical Resolution | 0.1 m |
| Confidence Level (1σ) | 90% |
| Maintenance period | As required |

ภาพที่ ข-8 ข้อกำหนดด้านคุณภาพสิ่งกีดขวาง สำหรับบริเวณ Area 2

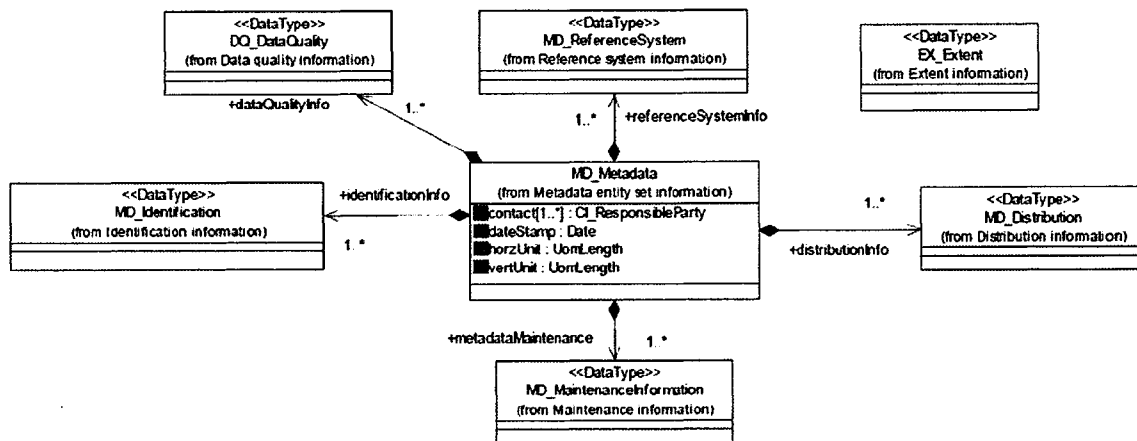
| Quality Attributes | Area 3 — Aerodrome/Heliport Area |
|---|----------------------------------|
| Horizontal Accuracy | 0.5 m |
| Data Classification and Integrity Level | Essential (10^{-5}) |
| Vertical Accuracy | 0.5 m |
| Vertical Resolution | 0.01 m |
| Confidence Level (1σ) | 90% |
| Maintenance period | As required |

ภาพที่ ข-9 ข้อกำหนดด้านคุณภาพสิ่งกีดขวาง สำหรับบริเวณ Area 3

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| Attribute | Mandatory/Optional | Type of attribute |
|-----------------------------|--------------------|-------------------|
| Area of Coverage | Mandatory | Metadata |
| Data Originator Identifier | Mandatory | Feature Attribute |
| Horizontal Position Data | Mandatory | Feature Attribute |
| Horizontal Reference System | Mandatory | Metadata |
| Horizontal Resolution | Mandatory | Metadata |
| Horizontal Extent | Mandatory | Feature Attribute |
| Horizontal Accuracy | Mandatory | Feature Attribute |
| Horizontal Confidence Level | Mandatory | Feature Attribute |
| Elevation | Mandatory | Feature Attribute |
| Height | Mandatory | Feature Attribute |
| Database Units | Mandatory | Metadata |
| Vertical Reference System | Mandatory | Metadata |
| Vertical Resolution | Mandatory | Metadata |
| Vertical Accuracy | Mandatory | Feature Attribute |
| Vertical Confidence Level | Mandatory | Feature Attribute |
| Obstacle Type | Mandatory | Feature Attribute |
| Integrity | Mandatory | Feature Attribute |
| Date and Time Stamps | Mandatory | Feature Attribute |
| Effectivity | Optional | Feature Attribute |
| Status | Mandatory | Feature Attribute |
| Lighting | Mandatory | Feature Attribute |
| Marking | Mandatory | Feature Attribute |
| Geometry | Mandatory | Feature Attribute |

ภาพที่ ข-10 ข้อมูลคุณลักษณะ (Attribute) ของสิ่งกีดขวาง



ภาพที่ ข-11 แสดงภาพรวมของรายละเอียดความเป็นมาของข้อมูล (Metadata)

สำหรับข้อมูลสิ่งกีดขวางในรูปแบบ UML

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Table 4-5. Horizontal data quality requirements
(All values in meters. NS denotes not specified)

| Data Element | Data Derivation | Fine | | | Medium | | | Coarse | | | Max Error |
|------------------------------|-----------------|------|------|---|--------|------|---|--------|-----|---|-----------|
| | | A | R | I | A | R | I | A | R | I | |
| Runway element | S | 1 | 0.1 | C | 5 | 0.1 | - | 30 | 1 | - | - |
| Runway intersection | S | 1 | 0.1 | C | 5 | 0.1 | - | 30 | 1 | - | - |
| Runway threshold | S | 1 | 0.1 | C | 5 | 0.1 | - | NS | NS | - | 3 |
| Painted centerline | S | 0.5 | 0.01 | C | 5 | 0.1 | - | NS | NS | - | 2 |
| LAHSO | S | 1 | 0.1 | R | 5 | 0.1 | - | NS | NS | - | 3 |
| Arresting gear location | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Runway shoulder | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Stopway | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Runway displaced area | S | 1 | 0.1 | C | 5 | 0.1 | - | 30 | 1 | - | - |
| Runway marking | as charted | NS | NS | - | NS | NS | - | NS | NS | - | - |
| FATO | S | 1 | 0.1 | C | 5 | 0.1 | - | 5 | 0.1 | - | - |
| TLOF | S | 1 | 0.1 | C | 5 | 0.1 | - | 5 | 0.1 | - | - |
| Helipad threshold | S | 1 | 0.1 | C | 5 | 0.1 | - | NS | NS | - | - |
| Taxiway element | S | 1 | 0.1 | - | 5 | 0.1 | - | 5 | 0.1 | - | - |
| Taxiway shoulder | S | 1 | 0.1 | - | 5 | 0.1 | - | 5 | 0.1 | - | - |
| Taxiway guidance line | S | 0.5 | 0.01 | C | 5 | 0.1 | - | NS | NS | - | 2 |
| Taxiway intersection marking | S | 0.5 | 0.01 | C | 5 | 0.1 | - | NS | NS | - | - |
| Taxiway holding position | S | 1 | 0.1 | - | 5 | 0.1 | - | NS | NS | - | 3 |
| Runway exit line | S | 0.5 | 0.01 | C | 5 | 0.1 | - | NS | NS | - | 2 |
| Frequency area | C | NS | NS | - | NS | NS | - | NS | NS | - | - |
| Apron | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Stand guidance line | S | 0.5 | 0.01 | E | 5 | 0.1 | - | NS | NS | - | 2 |
| Parking stand location | S | 0.5 | 0.01 | E | 5 | 0.1 | - | 30 | 1 | - | 2 |
| Parking stand area | C | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Deicing area | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Vertical polygonal objects | S | 0.5 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Vertical point objects | S | 0.5 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Vertical line objects | S | 0.5 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Construction area | S | 1 | 0.1 | - | 5 | 0.1 | - | 5 | 0.1 | - | - |
| Aerodrome reference point | C | 30 | 1 | R | 30 | 1 | R | 30 | 1 | R | - |
| Survey control point | S | 0.5 | 0.01 | E | 0.5 | 0.01 | E | NS | NS | - | - |
| Service road | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Aerodrome boundary | C | NS | NS | - | NS | NS | - | NS | NS | - | - |

Table 4-6. Vertical data quality requirements
(All values in meters. NS denotes not specified)

| Data Element | Data Derivation | Fine | | | Medium | | | Coarse | | | Max Error |
|-------------------------------------|-----------------|------|------|---|--------|-----|---|--------|----|---|-----------|
| | | A | R | I | A | R | I | A | R | I | |
| Runway threshold (non-precision) | S | 0.5 | 0.1 | E | NS | NS | - | NS | NS | - | 3 |
| Runway threshold (precision) | S | 0.25 | 0.01 | C | NS | NS | - | NS | NS | - | - |
| Painted centerline | S | 1 | 0.1 | - | NS | NS | - | NS | NS | - | 6 |
| Helipad threshold | S | 0.5 | 0.1 | C | NS | NS | - | NS | NS | - | - |
| Survey control point | S | 0.25 | 0.01 | E | NS | NS | - | NS | NS | - | - |
| Threshold elevation (non-precision) | S | 0.5 | 0.1 | E | NS | NS | - | NS | NS | - | 3 |
| Threshold elevation (precision) | S | 0.25 | 0.01 | C | NS | NS | - | NS | NS | - | - |
| Max height of vertical object | C | 1 | 0.1 | E | 1 | 0.1 | - | NS | NS | - | - |
| Max elevation of vertical object | S | 1 | 0.1 | E | 1 | 0.1 | - | NS | NS | - | - |
| Touchdown zone elevation | S | 1 | 0.1 | - | 1 | 0.1 | - | NS | NS | - | - |

Table 4-7. Angular data quality requirements

| Data Element | Data Derivation | Fine | | | Medium | | | Coarse | | | Max Error |
|-------------------------|-----------------|-------|-------|---|--------|-------|---|--------|------|---|-----------|
| | | A | R | I | A | R | I | A | R | I | |
| True runway bearing | C | 0.01° | 0.01° | R | 0.5° | 0.01° | - | 1.5° | 0.1° | - | - |
| Magnetic runway bearing | S | 0.01° | 0.01° | R | 0.5° | 0.01° | - | 1.5° | 0.1° | - | - |

Table 4-8. Dimensional data quality requirements
(All values in meters unless otherwise stated. NS denotes not specified)

| Data Element | Data Derivation | Fine | | | Medium | | | Coarse | | | Max Error |
|-----------------------------------|-----------------|------|-------|---|--------|-----|---|--------|-----|---|-----------|
| | | A | R | I | A | R | I | A | R | I | |
| Width of runway | C | 0.5 | 0.01 | R | 1 | 0.1 | - | 5 | 0.1 | - | - |
| Length of runway | C | 1 | 0.1 | C | 5 | 0.1 | - | 30 | 1 | - | - |
| Touchdown zone longitudinal slope | C | 0.1% | 0.01% | - | NS | NS | - | NS | NS | - | - |
| Runway slope | C | 0.1% | 0.01% | - | NS | NS | - | NS | NS | - | - |
| Take-off run available | C | 1 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Take-off distance available | C | 1 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Accelerating-stop-distance avail | C | 1 | 0.1 | E | 5 | 0.1 | - | 30 | 1 | - | - |
| Landing distance available | C | 1 | 0.1 | C | 5 | 0.1 | - | 30 | 1 | - | - |
| Radius about center of obstacle | S | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |
| Max height of point structure | C | 1 | 0.1 | - | 5 | 0.1 | - | 30 | 1 | - | - |

ภาพที่ ข-12 ข้อกำหนดเชิงตัวเลข (Numerical requirements) สำหรับการจัดทำข้อมูล AMDB

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