

Surveying and Land Registration Standards for Tourist Properties of the Maldives

Technical Brief

July 2012

Abbreviations

DWG - AutoCAD drawing format
HWL - High Water Level
LWL - Low Water Level
MLSA - Maldives Land Survey Authority
MoTCA - Ministry of Tourism, Arts and Culture
MSL - Mean Sea Level
PDF - Adobe Portable Document format
PSM - Permanent Station Mark
UTM - Universal Transverse Mercator
WGS - World Geodetic System

Table of Content

1	Introduction.....	4
2	Objectives and Purpose of the survey	4
3	Summary of Requirements	4
4	Grid and Height Datum.....	5
5	Horizontal and Vertical Control (PSM).....	5
5.1	Horizontal Control.....	5
5.2	Vertical Control.....	5
6	Topographic Surveying.....	6
6.1	<i>Scale</i>	6
6.2	<i>Horizontal Accuracy</i>	6
6.3	<i>Features to be Map</i>	6
6.4	Land Area of Island Calculation	6
7	Final Surveyed Map.....	6
8	AutoCAD Guide Line	7
9	Digital Data.....	8
10	Health and Safety.....	8
11	Management.....	8
12	Deliverables	8
13	Appendix.....	9
	APPENDIX 1: Structure of the Survey Report.....	10
	APPENDIX 2: Control Station Description	11
	APPENDIX 3: Survey Control Stations Guideline	11

1 Introduction

The new land rent regulation implemented by the MoTCA requires the land area of all tourist properties to be registered at MoTCA by 31st December 2012. For the existing resorts, the land area of the resorts would be determined from an existing surveyed drawing by a Registered Surveyor. For the new development, the land area would be surveyed and registered before the concept for the development is approved.

2 Objectives and Purpose of the survey

Due to the change in Tourism Act and regulations of the Maldives, it had become very important to provide reliable land information for fiscal purposes. According to the new regulation the rent of the tourist property is based on its land area. Defining the land area of the dynamic shoreline in terms of surveying and cadastral is a challenge.

In order to fulfil the requirements of the fiscal purpose and minimise errors, minimum survey standards need to be adopted to maintain high quality and reliable survey information. The survey standards in the documents are developed to fulfil multiple applications of the developer and government authorities. Some of these applications include:

- Control survey
- Monitoring and deformation
- Cadastral survey (land registration)

During the development of these standards, it was very clear that verification and checking mechanisms needs to be in-place to prevent conflicts arising and also a framework that will eventually support to resolve these matters.

3 Summary of Requirements

All the Surveys should be carried out by a registered surveyor at Ministry of Housing and Infrastructure.

The Registered Surveyor shall:

- Establish Primary Control Network for the island.
- Supply Survey Maps in AutoCAD .dwg file format and .pdf file format
- The data in ASCII file contain all points RAW and Processed points.
- Survey Report.

The Registered Surveyors shall implement quality management procedures to ensure that the data conforms to specification. This shall include thorough checking of quality of deliverables products prior to delivery.

Surveyor shall include his/her declaration and Project Managers declaration. Also there should be a declaration on informing resort owner about the importance and safety of the PSM.

4 Grid and Height Datum

The Survey shall be related to:

Projection: Universal Transverse Mercator (UTM), Zone 43, North/South Hemisphere

Ellipsoid: WGS 84

Vertical Datum: Local Mean Sea level (MSL) ortho-height derived from predicted tide provided by Department of Meteorology. Method of calculation should be shown in the Report.

5 Horizontal and Vertical Control (PSM)

The Registered Surveyor shall perform pre-network analysis to investigate expected accuracy before any Permanent Station Marks (PSM) is established.

The Registered Surveyor shall provide detail station description and photographic evidence of the PSM's established on the island. The station description shall be submitted in the format provided in the APPENDIX 2 and APPENDIX 3.

5.1 Horizontal Control

The PSM's marker shall be established on location where there is good view of the sky and on stable soil. At least 2 PSM should be inter-visible or should be visible to one Station Mark (type A monument) with known coordinates. For horizontal accuracy of PSM or Station marks please refer to Survey Control Stations guideline.

In case of GNSS System

The Registered Surveyor shall position all PSM using high-precision Static GNSS surveying method. All PSMs shall be position relative to the datum point in WGS84 with sufficient accuracy to meet specified accuracy.

In case of Total Station

The registered surveyor shall at least geo-referenced one PSM and a closed traverse between three PSM should be carried out.

- Traverse shall show all field data used to determine directions, distance and azimuths, the adjustment calculations shall be submitted along with name of the software used in adjustments. The data submitted shall show the final results of the adjustment and the error analysis.
- Method used to derive orientation must be shown. For orientation either prismatic compass or astronomical observation should be used or observed.

5.2 Vertical Control

The Vertical control of the PSM should be done by using auto or electronic level. Double run levelling should be carried out and presented in the Survey Report. If GNSS levelling is done, the registered surveyor should provide sufficient evidence to show that the surveyor's methodology complies with the required specification. For vertical accuracy of PSM or Station marks please refer to Survey Control Stations guideline.

6 Topographic Surveying

6.1 Scale

The Registered Surveyor shall map all required topographic features at a scale of 1:1000.

Unit used for this survey should be in meters.

6.2 Horizontal Accuracy

The relative accuracy of permanent structures shall not exceed $\pm 0.030\text{m}$.

Vegetation line accuracy 0.5m

High tide line accuracy 0.25m

Low tide line accuracy 0.25m

6.3 Features to be Map

The registered surveyor shall survey the following features:

The limits of the island or plot of land: The High tide line, Low tide line shall be surveyed (this includes any coastal features which would have an effect on the boundary line (for example groynes, jetties, quay wall, inlets, etc). All data shall be represented as a closed polygon.

- Any uncertainty regarding collecting features should be clarified by MLSA.

Limits of vegetation: The extent of the vegetation canopy, except fallen or dead trees. all data shall be represented as a closed polygon. Area of vegetation line should be mentioned in the survey report.

6.4 Land Area of Island Calculation

Land area of the island should be calculated using the following formula.

Land Area = (LWL Area + HWL area)/2

Calculations and surveyors recommendation should be included in the survey report.

7 Final Surveyed Map

The Registered Surveyor shall supply following maps to be used for land registration purpose.

All the Maps to printed in A3 paper size

- PSM Map (and Traverse Map in case of Total Station Survey)
Shall include bearing and distance to each PSM/Control Station
- Final Survey Map
 - An Index Map (This map should fit in one A3 paper)
 - Maps in 1:1000 scale with Grid lines and if tiled with joint lines.

All the Maps shall include

- Grid Information (grid intervals at 50m)
- Survey date and time and shorelines surveyed date
- Administrative information: Atoll , island name, resort name
- Name of the surveyor, surveyor registration number
- HWL, LWL, Vegetation line and MSL. Land Area in square meters (to nearest square meter).
- Site map showing
 - High tide line
 - Low tide line
 - Vegetation line
 - North Arrow
 - Scale
 - Legend

8 AutoCAD Guide Line

Follow these guidelines for mapping purpose

Paper space text height	2mm	Normal Text
	4mm	Highlighted Text
	5mm	Headline Text

Description	Layer	Colour	Line Type	Line Weight
High Water Line	HWL	30 (Orange)	Continuous	0.30mm
Low Water Line	LWL	4 (Cyan)	Continuous	0.50mm
Vegetation Line	VEG	3 (Green)	Continuous	0.20mm
PSM	PSM	1 (Red)		0.18mm
Joint Line	JOINT	9 (Grey)	Hidden	0.18mm
Grid Line	GRID	8 (Grey)	Hidden	0.09mm
Traverse Line	TRV	11	Hidden	0.18mm
Other Features *	Relevant Name	6 (Magenta)	Continuous	0.20mm

* These are mainly revetments, groynes and Jetties. However surveyor is not restricted from differentiating these features with different pen and colour settings.

* All features shall be drawn as 2 dimensional polylines and should not be smoothened.

9 Digital Data

The Registered Surveyor shall supply Surveyed Maps in AutoCAD DWG format (version 2012 or less), also all the Maps should be combined to one .pdf file. The digital raw files from the survey also should be submitted for the review. Final processed data in .csv file format (Point ID, Easting, Northing, and Description).

Survey Report should be combined to one .pdf along with other data.

All data collected and final deliverables shall be supplied in CD-ROMs as two copies.

10 Health and Safety

The registered surveyor shall use safety equipment such as appropriate clothing and procedures to personal to undertake the work safe and safety for others. The Client shall provide first aid facilities for technical contractor.

11 Management

The Registered Surveyor shall adopt appropriate quality management procedures to ensure that the information and material produced and supplied shall comply with the specifications and fitness for the purpose in the quality, completeness, standard of presentation and timely delivery.

The results of any analyses, tests and audits carried out shall be supplied as part of the survey report.

Also included in the part of the survey report shall be co-ordinates of PSM's, and station descriptions.

12 Deliverables

The Registered Surveyor shall supply following information, data and deliverables after undertaking the survey.

3 sets of printed Survey Reports with Maps and completed PSM information forms.

2 CD-ROM with Digital AutoCAD .dwg, .pdf files and RAW data

13 Appendix

APPENDIX 1: Structure of the Survey Report

APPENDIX 2: Control Station Description

APPENDIX 3: Survey Control Stations Guidelines

APPENDIX 1: Structure of the Survey Report

1. Cover Page
 - Atoll and Island Name:
 - Resort Name:
 - Project Manager:
 - Registered Surveyor: (registration number)
 - Date prepared:
2. Surveyors Declaration, Project Managers Declaration and Resort Owner Declaration
3. General Information
 - a. Purpose
 - b. Location
 - c. Registered Surveyor Contact Information
4. Methodology
 - a. Methodology adopted for the survey
 - b. List of equipments used for the survey
 - c. The Survey Team
5. Horizontal Control
 - a. Pre network design and analysis
 - b. Final Coordinates (WGS 84, UTM Zone 43N/S)
 - c. Control network diagram
6. Vertical Control
7. Shoreline Survey
8. Processing and final data
9. Appendix
 - a. PSM Map
 - b. Index Map
 - c. Final Map in 1:1000 scale
 - d. Station description of all PSM
 - e. Daily Site Logs

APPENDIX 2: Control Station Description

APPENDIX 3: Survey Control Stations Guideline