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# Manual for **DRUK CORSNet** **DATA SHARING**

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National Land Commission Secretariat

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## **Foreword**

Continuously Operating Reference Station (CORS) was first initiated in 2004 with technical assistance from SwedeSurvey. The only CORS station was then established in Thimphu. Subsequently, six additional stations, spanning across Bhutan, were established during the year 2016 with the technical support of a geodesist from Portugal. Bhutan now has 9 stations in the DRUK CORSNet network, fully configured to provide RTK corrections to the end users.

DRUK CORSNet forms the bedrock of our national positioning system. It provides surveyors in geodesy, cadastral, engineering, topographical, and other fields of surveying with a very reliable, efficient, and smart infrastructure. With the existing constellation of 9 CORS stations, coupled with a continued supply of power and network established by installing redundant power and network supply, it is able to provide 24/7 coverage to most parts of the country to any number of end-users concurrently.

The manual sets the procedure for availing CORS services. It also stipulates the roles and responsibilities of the service provider and the clients. With an objective to sustain and enhance the CORS facility and facilitate access to CORS, the manual also provides an affordable pricing modality.

DRUK CORSNet will bring about profound advantages to the surveying communities through efficiency gains, quality control and assurance, and ease of use. I would like to encourage users to subscribe to this service and reap the tremendous benefits.



**(Dasho Pema Chewang)**  
**Secretary**

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## 1. Introduction

Continuously Operating Reference Station (CORS) refers to a set of ground-based GNSS stations used to provide a reference framework for GNSS surveys. A CORS network can provide both static as well as Real-Time Kinematic (RTK) correction signals. It serves as an effective carrier of national geodetic datum through provision of coordinates both in the static as well as RTK modes. CORS forms a dynamic and an active control system for surveying using GNSS technologies.

Bhutan currently has 9 stations in our CORS Network fully equipped for RTK corrections via NTRIP to the end users. The stations are geographically well-distributed to provide a nation-wide coverage. Investments will continue in enhancing the density of the stations. As the use of GNSS continues to gather pace, the CORS network will increasingly play a vital role in providing a national infrastructure for surveying.

The current profile of the users indicate that the CORS Network is being used for cadastral, topographical, mining, engineering and other fields of surveying. It is preferred to conventional ground control networks, sometimes referred to as a passive control system on the grounds of efficiency and quality assurance. As the density as well as the specifications of the CORS network continue to improve, the network will find a useful application in geodynamics as well.

As the name suggests, CORS relies on an uninterrupted power supply and internet connection. A robust power backup plan is installed at all the stations. A high-end GNSS equipment capable of tracking all available constellations on various frequencies is also used at the CORS station to ensure that quality data is collected at every station. A nominal fee is being charged to the users in order to help meet the maintenance expenses.

## 2. Objectives

This Manual aims to:

1. Provide the procedure for availing services
2. Create awareness on the roles and responsibilities of the service provider and the user
3. Define a pricing modality for the services provided

## 4. Services

The CORS Network will cater the following services to the user community:

### 1. Static Data and ephemeris files

Users will be able to download Re-Processed Raw static data of their desired CORS station on a daily and hourly basis. The format of these data will be in RINEX Version 2.11 and Version 3.00. Further, users can also download the available ephemeris files.

The received RAW GNSS data are stored in the MiraNet server and are automatically put in queue, for being processed into RINEX and ephemeris files. After this conversion the quality assurance component determines the quality of the data processed before. This action allows the users to know how much data they are downloading for a file, even before the download starts. After the quality check, a backup is made in order to prevent any data loss, or a double backup, if the CLOUD package was the one purchased.

### **2. Differential data for RTK survey**

A differential correction for carrying out RTK surveys, provided via the NTRIP solution.

1. The message formats available for positioning in RTK mode are RTCM 3.3 (Radio Technical Commission for Maritime Services).
2. The reference system used by the network is Drukref03 which is derived from the International Terrestrial Reference Frame 2000 (ITRF2000) of the 2003 epoch.
3. The height components provided are ellipsoidal and MSL height are computed based on Geoid model installed in the receiver.

### **4. Procedure for availing CORS services**

1. The applicant shall submit the application via prescribed form (Annexure 1) to access the services.
2. The cost for the services shall be calculated based on the Application form submitted by the applicant.
3. The amount shall be deposited in favor of the Director, Department of Survey and Mapping, NLCS.
4. After the payment, the users will be given a credential (Username and Password) wherein users can log in to the portal ([miranet.druknet.net](http://miranet.druknet.net)) and access the data they intended for.
5. Subscription requests shall be made on the miranet website <https://miranet.druknet.net/pre-registration/form>.
6. After users logged in to the platform, they would be able to change the basic information, like name and password.
7. At the end of the service their credentials will be disabled.
8. Subscription is non-transferable.
9. Simultaneous connections to the network are not allowed, that is, each subscription can only make one connection to the network at the same time.



## 5. Pricing Modality

Although the National Land Commission is a not-for-profit organization with a fundamental mandate to provide public service, a nominal fee is applied to help sustain the CORS network. Besides the initial set-up cost of the infrastructure and the equipment by the government, some recurrent expenditure includes:

1. Charges incurred for remote assistance from external sources
2. Monthly rental expenses for internet and other utilities

The subscription fee for CORS Network is as follows:

1. Government agencies including Dzongkhags and four Gelyong Thromdes shall pay a lump sum of Nu. 10,000 a year for unlimited users.
2. As for the corporation and private firms or entities, following schemes shall be adopted; basic subscription @ Nu.10,000/- annually, standard subscription @ Nu.17,500/- and premium subscription @ Nu.22,500/- with 1 user, 2 users and 3 users respectively. For use of static data charges shall be applied to non-subscriber to any of the scheme.
3. Users requesting for educational purposes shall be provided free of charge; however, an official document that proves the use of the Network for teaching/research purposes should be submitted.

The NLCS reserves the right to revise the pricing from time to time.

## 6. Responsibilities

NLCS is responsible for:

1. Keeping the CORS functional 24/7
2. Informing users via email in the following situation:
  - Periods when the network, or part of it, is turned off
  - Changes in the framework used
  - Changes in the device of the stations
  - Any updates made.

NLCS is not responsible for:

1. Breaks in the services provided by the CORS service whose cause is foreign to its structure
2. Breakage of services provided by the CORS service due to failure of the mobile network
3. Breakage of services provided by the CORS Service due to failures or errors in the satellite constellations

4. Specific settings and misuse of GNSS equipment by the user

Responsibility of the users:

1. Have a GNSS equipment that meets the necessary requirements to access the CORS service namely connection to the GPRS and/or GSM protocol;
2. Ensure that the subscription data are for the exclusive use of the user who requested it;
3. The abusive use of the subscription data is the sole responsibility of the user who requested it;
4. The user of theCORS Service undertakes to reserve the information that he/she accesses, and shall not disclose it to third parties, either onerous or free of charge.
5. Failure by the user of the network to comply with all of the above conditions (2-4) gives NLCS the right, upon notice of five (5) working days, by email, to deactivate their access to the CORS Service, nor there is any obligation for NLCS to return any amount received by it.
6. The user, upon requesting a subscription, under the conditions referred to above, declares that he has read, understood and fully and unreservedly accepts all the conditions defined herein for the use of the service.

## 7. Annexure 1: Application form

Date: ...../...../.....

1. Organisation/Department/Individual :

2. Location/Village/Geog/Dzongkhag :

3. Service Type (Static Data/RTK correction)

In case of Static data

a. Station(s) to avail service:

b. Duration of services intended to avail:

In case of RTK services

a. Mount Point to avail:

b. Duration of services (Scheme: Basic/Standard/Premium) intended to avail (in days):

4. Special requirement if any :

Note:-

1. Once the indent form is accepted, it is binding to both the Service Provider and Users.

4. Payment for the Services should be advanced by Bank draft/cheque in favour of the Director, Department of Survey and Mapping, NLCS, Thimphu.

5. Services will be made available after receiving the payment in advance only.

6. In case of dispute, the decision of the National Land commission will be final and binding.

I accept the above conditions.

Signature:

Indendor's name : .....

Address : .....

Mobile No.....

Fax No.....Phone : .....

Email: .....

## 10. Acronyms and Definitions

NLCS – National Land Commission Secretariat

DoSAM – Department of Survey and Mapping

AFD – Administrative and Finance Division

SFA – Survey Field Assistant

TSFA – Temporary Survey Field Assistant

GNSS - Global Navigation Satellite System

TOR - Terms of Reference

QA – Quality Assurance

QC – Quality Control

BM – Benchmark

PRR – Procurement Rules and Regulation

RINEX – Receiver Independent Exchange

RTK – Real Time Kinematics

CORS – Continuously Operating Reference Station

NTRIP – Networked Transport RTCM via Internet Protocol

**RTCM** - Radio Technical Commission for Maritime Services