

INFLUENCE OF REAL-TIME KINEMATIC NETWORK IN CADASTRAL  
SURVEYING

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## **DEDICATION**

To my beloved my wife, Marlina Binti Abdul Manaf,

**Thank you for your constant support throughout my 2 years here at UTM**

my son, Ahmad Firdaus B. Mohd Zahirudin and Ahmad Solehin B. Mohd Zahirudin

and to my family,

**I Love you All**

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## ABSTRACT

Development of cadastral surveying in Malaysia has showing excellent progress with the application of the latest surveying technology where in the year of 2003 JUPEM has implemented Real-Time Kinematic GNSS Network (MyRTKnet). Currently there are seventy eight (78) GNSS reference stations over the entire country compared with twenty nine (29) a network of Continuously Operating Reference Stations (CORS) in 2003. This study focuses on analyzing the performance of GPS observation using Network based-RTK technique and Virtual Reference Station-RTK technique in conducting cadastral reference mark within a 30 km radius from the existing MyRTKnet Station and also outside a 30 km radius from the existing Reference Station. The test observation carried out on eight Cadastral Reference Mark located at North, Perak. The accuracy of the VRS-RTK in the horizontal component is in the range of 1cm to 2cm. While for the accuracy of N-RTK in horizontal component is in the range 1cm to 2.5cm. Based on the JUPEM circular no. 6/2009 the results acquired are within the tolerance where the coordinate difference between three epochs of observation were less than 3 centimeter for Northing and Easting component.

## ABSTRAK

Perkembangan dalam bidang Ukur Kadaster di Malaysia telah menunjukkan kemajuan yang cemerlang dengan mengaplikasikan teknologi pengukuran yang terkini dimana pada tahun 2003 JUPEM telah melaksanakan Rangkaian Kinematik Masa Hakiki yang dikenali sebagai *MyRTKnet*. Pada masa ini terdapat tujuh puluh stesen lapan (78) rujukan GNSS seluruh negara berbanding dengan dua puluh sembilan (29) rangkaian Stesen Rujukan Beroperasi Berterusan (CORS) pada tahun 2003. Kajian ini memberi tumpuan kepada analisis kualiti cerapan GPS menggunakan Teknik *Network based-RTK* dan Teknik *Virtual Reference Station-RTK* dalam lingkungan 30 km daripada Stesen MyRTKnet yang sedia ada dan juga di luar lingkungan 30 km dari Stesen Rujukan yang sedia ada. Kajian ini dilakukan ke atas lapan (8) *Cadastral Reference Mark* di bahagian Utara negeri Perak. Ketepatan bagi teknik *VRS-RTK* pada paksi ufuk adalah 1cm hingga 2 cm manakala ketepatan bagi *N-RTK* pada paksi ufuk adalah 1cm hingga 2.5cm. Hasil kajian ini masih memenuhi had yang dibenarkan, dimana perbezaan tiga epok cerapan adalah kurang daripada 3 cm bagi komponen Utara dan komponen Timur mengikut pekeliling JUPEM bil 6/2009.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

E-Cadastre is the backbone of sustainability in the cadastral system in Malaysia. This system will can increase land title procedure from two years to 2 month, following the ISO 9000 surveying method can be carried out more quiker and it will be easier to all parties involved mainly because each of the surveying issue whether the surveying, the adjusted misclose, information of data and statement of fieldwork had been linked and fixed immediately from the field to the office.

When it comes to nation's growth, there are lots of challenges and tests that will be taken. In line with the government's effort to boost its distribution process, there are a lot of project created by JUPEM. One of these is the effort created to utilized real-time survey technology with the enchament associated with their product and services as well as dissemination of various geodetic solutions made by JUPEM. Throught 2003, JUPEM provides a real time kinematic network which is referred as MyRTKnet. The system and then features twenty seven (27) RTK stations being created the network in which covering the entire Peninsular Malaysia and two (2) main cities in Sabah as well as Sarawak. In order to offer much better services towards the consumer, the MyRTKnet has been to be widened and improved by JUPEM from 2006 to 2008 where seventy eight (78) MyRTKnet GNSS reference stations have been established throughout the entire region.

## 1.2 Problem Statement

Each and every cadastral survey need to be determined by a satisfactory datum, which is established as outlined by JUPEM circular. Within the establishment associated with Cadastral Reference Mark related with the JUPEM circular no. 6/2009 the tolerance in which the coordinates differences among three epoch observation being below than 3 cm for Nothing and Easting component. In generally it requires a high accuracy and reliability measurements. The technique of Network-Based Real-time Kinematic needs a minimum of three Continiuous Reference Station (CORS) to be able to estimate the actual Virtual Reference Station (VRS) based on the rover location. Real-time corrections received by consumers also refer to the VRS. There are circumstances in which the CORS near the user is maintained or damaged in the case of telecommunications equipment or lines. This leads to a waste of time and money because users cannot use the MyRTKnet service.

The coverage area for real-time services should increase when the telecommunication companies spread its broadband services to a larger area, especially to the inland and the rural, hence the increase the number of reference stations in the network RTK system. MyRTKnet not only to expand the coverage of correction station observations but also can reduce observations errors as the effects of the ionosphere and the troposphere which cause a horizontal position becomes less accurate.

Arising out of awareness and concern among cadastral surveying player as professionals, consultants and the public with regard to the integrity and reliability, thus more research needs to be done outside the area or within 30 kilometers from existing MyRTKnet stations to get the difference and instances of more detailed GPS observation.

### **1.3 Objectives of the Study**

The objectives of this study are as follows:

- i. To conduct N-RTK technique and VRS-RTK technique within a 30 km radius from the existing MyRTKnet Station and outside a 30 km radius from the existing Reference Station.
- ii. To analyze the performance of N-RTK technique and VRS-RTK technique within a 30 km radius from the existing MyRTKnet Station and outside a 30 km radius from the existing Reference Station for cadastral surveying application.

### **1.4 Scopes of the Study**

The scopes of this study are as follows:

- i. The study was execute for the purpose to determine the accuracy of the use N-RTK and VRS-RTK technique within a 30 km radius from the existing MyRTKnet Station and outside a 30 km radius from the existing Reference Station for cadastral surveying application.
- ii. The observation made comparison with the Publish Cadastral Reference Mark. The test were carried out using VRS-RTK with 3 sessions of observation consisting of 10 measurement in each session. Meanwhile, for observation of VRS-RTK period is fifth teen minutes with 3 sessions. After that, the comparisons between two techniques with the publish cadastral reference mark are made.
- iii. The observations tests were conducted on eight (8) Cadastral Reference Mark (CRM) which had been selected in the Lot 22562, Mukim of Bagan Serai, District of Kerian District of Kerian, Lot 130416 Mukim of Batu Kurau, District of Larut & Matang, Lot 311347, Mukim of Asam Kumbang, District of Larut & Matang, Lot 33432, Mukim of Sayung, District of Kuala Kangsar, Lot 7039, Mukim of Bukit Gantang, District of

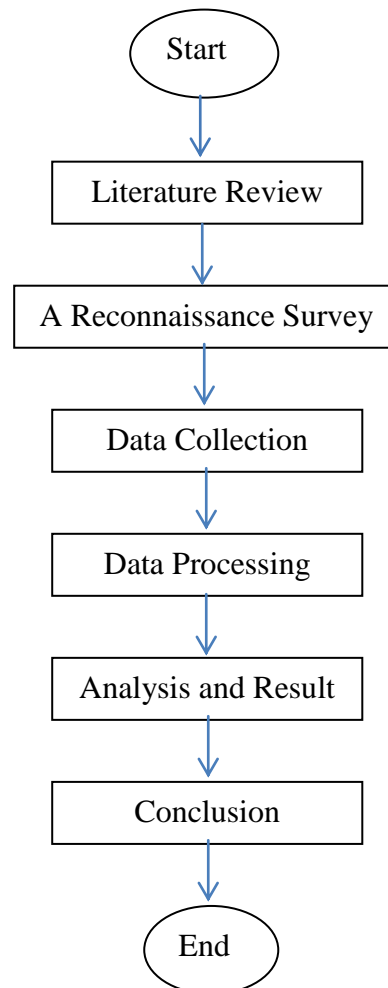
Larut & Matang, lot 60006, Mukim of Sungai Tinggi, District of Larut & Matang, Lot 500, Mukim of Pekan Beruas, District of Manjung, Lot 23788, Mukim of Pengkalan Baharu, District of Manjung. The observations test was carried out using VRS-RTK technique and N-RTK technique.

- iv. The data will be download and processed using Trimble Business Center (TBC) version 2.5 software and Microsoft Excel software. This TBC software is suitable for processing and analyzing satellite data.
- v. Result and analysis for this study is essential to prove the proposed objectives are successfully or otherwise. The observation were conducted in three phase, in the morning at 9.30 am, in the afternoon at 12.00 pm and in the evening at 3.30 pm.
- vi. The analysis will be conducted for this study to compare GPS observation using VRS-RTK technique and N-RTK technique with the published CRM coordinates.



## 1.5 Research Methodology

The research methodology is a series of research activities to find the end result of this study. Figure 1.1 shows a flowchart of research: -



**Figure 1.1:** The process of Research Methodology

## **1.6 Significances of the Study**

The significances of this study are as follows:

- a) This study describes the contribution of N-RTK technique and VRS-RTK technique using MyRTKnet infrastructure in the application of cadastral survey.
- b) This study gives a general idea about the performance expected from using N-RTK technique and VRS-RTK technique compared with the Published Cadastral Reference Mark.
- c) The study contributes to the idea of GPS based to not only government agencies such as JUPEM and property management but also to private agencies and practitioners related to the field of surveying.

## **1.7 Thesis Outline**

Chapter 1 : Describes an overview of the overall background and about the content of the thesis. Including a brief explanation about project overview, the problem faced. The objective, the scope of the study area and the contribution this research to the public.

Chapter 2 : Discusses the concept of Real-Time Kinematic Network System (MyRTKnet), Virtual Reference Station (VRS) and E-Cadastre System.

Chapter 3 : Discusses the research Metodology which is the Literature Review, Planning and A Reconnaissance Survey , Data Preparation, Data Collection and Data Processing.

Chapter 4 : Describe and explain all of the analysis and results of the observation through the form of tables and graphs.

Chapter 5: Conclusion the study and providing finding suggestion and recommendation for further research.

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