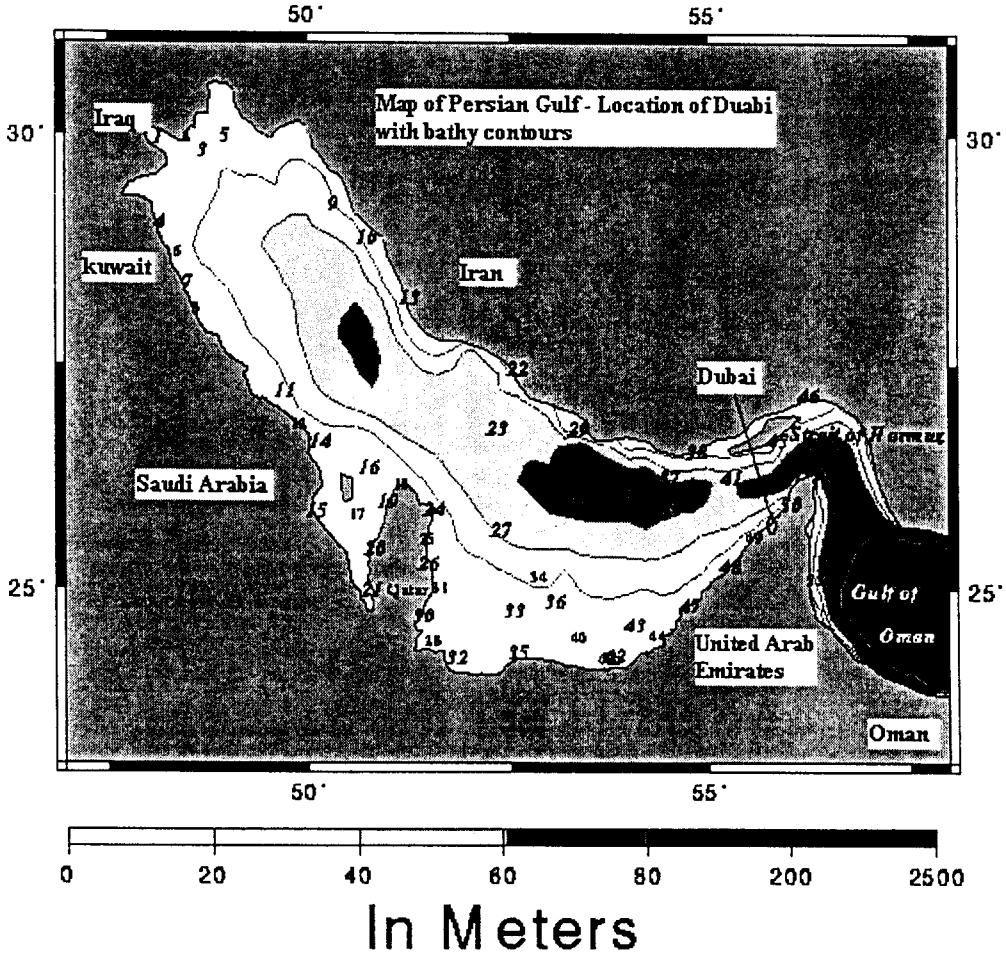
GLOSS Malaysia Training Course Feb 2004 Gulf

Country Report on Sea Level Observation in the Emirate of Dubai, United Arab Emirates

Introduction

Dubai is one of the seven emirates (states) forming the federation of United Arab Emirates. Dubai is located on the Southeastern coast of the Arabian Gulf and has a land area of approximately 4600 sq. km. with a coastline of roughly 67 kms.
It has two major ports and a few minor ports; in addition it also has wharfage along the creek catering to dhows; and marinas along the coast and creek for recreational marine craft.

Map of the Arabian Gulf & Dubai



History of Sea Level Measurements in Dubai

In 1954, Dubai needed to establish a vertical Datum in Creek for development work. It was intended to use the Admiralty Chart Datum in the creek, which was defined at a zero 14.56 ft. below a benchmark in the petroleum development building in Dubai. This Datum was established by British Royal Navy

In 1959, an automatic Tide Recorder was setup on one of the Halcrow stilling wells. The values for this recorder were obtained from benchmark previously mentioned for creek development works. Tidal reading was observed on this recorder from **1959-1961**. Data was forwarded to Admiralty in January **1960** for calculation of the Harmonic Constants.

In **1967** with the start of construction of port Rashid an automatic tide Recorder was set up at a nearby port. The reference level for this Tide Gauge, obtained from existing Creek Benchmark by direct leveling. This recorder was changed in **1968** to a rotary level type. Tidal reading data during that period was sent to the Admiralty.

In **August 1968**, Admiralty approved that datum as an Admiralty tide Datum for open sea in Dubai The Values for Highest Astronomical Tide and Lowest Astronomical Tide was not considered as final.

In 1977, the benchmark was moved to the top of the transshipment berth in Port Rashid due to some development work. Subsequent tidal analysis during the period of **1972 to 1977** indicates that the difference between the Halcrow datum and predicted Lowest Astronomical Tide **is less than 0.1 Meter**.

Halcrow (Consultant Engineer) submitted the **Bench Mark No.001 (Federal Bench Mark)** at port Rashid to Dubai Municipality **dated 1978.**

Survey Section of Dubai Municipality decided to accept that value and a loop of precise leveling was done from Port Rashid in along the whole creek and back to the same Bench Mark **(001)** at Port Rashid with achieving accuracy of 4mm $\sqrt{}$ K, where K is in Kilometers.

About 6000 Bench Marks in whole Emirate of Dubai were interconnected. D.M survey section also transferred the Level from Bench Mark **No.001** at port Rashid to Mina Jebel Ali by direct leveling and established a similar tidal Bench Mark called No. **A100.**

Benchmark **(No.001)** was destroyed in **1979** due to construction work at port Rashid.

During **1978 till 1982,** observed water levels from established tide recorder at Maktom Bridge (On the Creek) was forwarded to Admiralty for analyzing and calculating the Harmonic constants.

In **1986 till 1992**, water levels in Mina Jebel Ali were measured by Local port Authority.

In 1988, Halcrow launched tidal tables for all the U.A.E ports.

In 1991, Tidal data of the Mina Jebel Ali analyzed by WIMPEY Environmental Company based on one-month tide observations.

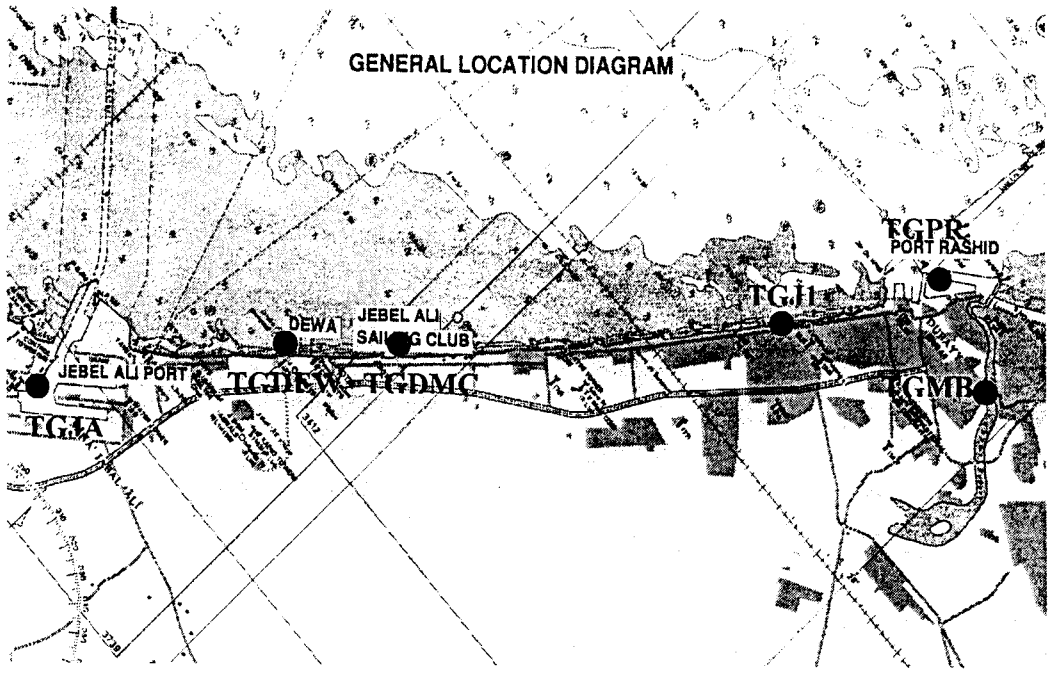
On 22 September 1993 NEDECO (Netherlands Engineering Consultants) carried out Tidal analysis based on one-year observations in Mina Jebel Ali. (A selection of June 1988-October 1989)

In 1994 till 1995, water levels in Mina Jebel Ali observed by Local port Authority and analyzed by Admiralty.

In 1997,Martin Mid East LLC., Contracted by Mouchel International to undertake a tidal monitoring survey over 4 years period along the coast of Dubai.

In Feb.2001, Jebel Ali Tide pole calibrated by local Port Authority and Cowi Almoayed Company.

Map of existing tide gauges in Dubai



1-Mina Rashid Tide Gauge:(TGPR)
Self-Recorder Tide Gauge
Observations available from 1967 till 1978 (Not continuous record)
Reference to the Halcrow report

2-Mina Jebel Ali Tide Gauge:(TGJA)
Self-Recorder Tide Gauge
Observations available from 1979 till now (Not continuous record)
Reference to the Mina Jebel Ali and Halcrow reports

3-AL Maktoum Bridge Tide Gauge:(TGMB)
Observations available from 1978 till 1982
Reference to the Halcrow report

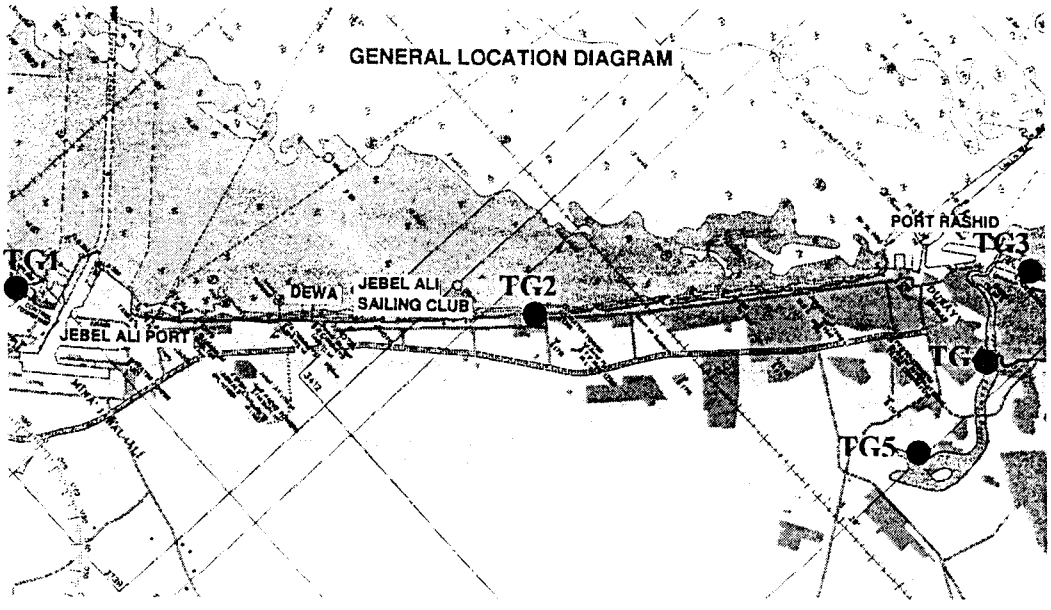
4-DEWA Tide Gauge:(TGDEWA)
Self-Recorder Tide Gauge
Observations available from 1990 (Not continuous record)
Reference to the Mouchel International report

5-DMIC Tide Gauge:(TGDIMC)
Self-Recorder Tide Gauge
Observations available from 1992 (Not continuous record)
Reference to the Mouchel International report

6-Jumeirah 1 Tide Gauge:(TGJ1)
Self-Recorder Tide Gauge
Observations available from 2001 till now (Not continuous record)
Reference to the Dome International report

Dubai Municipality Tide Gauges

Map of DM tide gauges



Dubai Municipality is planning to deploy five Tide Gauges in the coast of Dubai by the end of April 2004.
Three Tide Gauges will be located along the Coast (**TG1, TG2, TG3**) and two in the Creek (**TG4, TG5**).

Conclusion on the Existing Tide Gauges:

Mina Jebel Ali and Port Rashid are major ports in coast of Dubai State. Sea level measurements in these ports are performed by Local port authorities and analyzed by different companies such as: Halcrow, British Admiralty, NEDECO, WIMPEY Environmental and Cowi Almoayed.

The data from these tide gauges are used only as an aid to navigation and sometimes for hydrographic survey of the ports. Generally, hydrographers are using their own Tide gauge for bathymetric surveys.

No continuous record of tide data is available from Port Rashid station for analysis and the vertical datum reference is not fully traceable.

According to the latest reports on the Tidal information, at Mina Jebel Ali the **main port** in Dubai the Admiralty Chart Datum is 1.014 meters below Mean Sea Level in Jebel Ali (1995) and is 1.014 meters above the Zero of Tide pole.

Meanwhile, Port Rashid **(Secondary Port)** datum is Lowest Astronomical Tide at Port Rashid and also called Dubai Municipality Datum **(DMD)** and there is ten centimeter discrepancy between port Rashid Datum and Mina Jebel Ali.

As mentioned before, Vertical Datum is not very accurate which's why Dubai Municipality intends to deploy its own Tide Gauge's in the Coast of Dubai to establish the accurate Chart Datum and also control all the hydrographic survey activity in the area.

Dubai Municipality Tide Gauges and Future Expansion:

D.M decided to remedy the lack of data and work out the relationship between the MSL and CD by setting up permanent tide monitoring stations and a central data collection and analysis center.

The proposed water level stations uses a high accuracy pressure sensor and the data is recorded digitally at site and also sent to a base station in real time using GSM telephone network.

The also have metrological instruments to measure the wind speed, wind direction, barometric pressure, air and water temperature, humidity, and visibility as well.

The goal is to monitor the water level with an accuracy of better than one centimeter. Provisions are made within the data processing system to convert the measured water levels to local tidal datum with reference to the Dubai Municipality Datum (DMD).

The main objective of the project will be to determine the accurate Chart Datum and Mean Sea Level and connect the vertical datum to the land control points and update the complete network in Dubai.

A proposal is also being considered to provide the tidal data on the web page server, which could easily be accessed either internally over an intranet or external public access via the Internet.

Status of Control points in Dubai

Concurrently using GPS and Geoid modeling further densification of the vertical datum network is being carried out. The vertical datum is based on 3rd order leveling; presently precise leveling (4mm square root of K) is being carried out. All these will be tied to the Lowest Astronomical Tide at Port Rashid.

The Geoid model has been computed by observing gravity at 1 km grid spacing, with accuracy of 2-5 cm (Geoid model accuracy).

The GPS based DVRS (Dubai Virtual Reference System) consists of 5 stations giving horizontal accuracy of 1-2 cm in planimetry and 3-5 cm in altimetry.