SOLVING OF SHIPS BERTHING PROBLEM
AT QENA GOVERNORATE, EGYPT

Gamal A. Sallam
Researcher, Nile Research Institute, National Water Research Center, Cairo, Egypt

ABSTRACT
The Governorate of Qena requested the cooperation of the Nile Research Institute (NRI) to study ships berthing problem upstream (Qena Bridge), along the east side of River Nile and at front of Hathor hotel. This area extends from km. 639.350 to km. 640.500 upstream El-Roda Gauge in Cairo.

The information received from the Governorate of Qena indicated that, ships faced difficulties especially during minimum water level period when berthing at the east side of River Nile upstream Qena Bridge, at front of Hathor hotel with total length about 1150 m along the east side of River Nile. A hydrographic survey, bed material samples, velocity measurements and all relevant data were collected from the site.

The objective of this paper is to analyze these collected data, then finding the best solution to overcome this navigational problem.

Key Words: River Nile – Navigation – Berthing - Dredging

INTRODUCTION
The Governorate of Qena requested the cooperation of the Nile Research Institute (NRI) to study a problem concerning navigational draft for ships berthing upstream (Qena Bridge), along the east side of River Nile and at front of Hathor hotel. This area extends from km. 639.350 to km. 640.500 upstream El-Roda Gauge in Cairo. Figure (1) shows the study area. According to that, a field trip team has worked in the site for field data collections. Also, hydrologic, hydrographic and hydraulic data collections have been done for problem definition and to find the best solution to overcome this navigational problem.
The River Nile can be defined by the following characteristics:
- Tendency to meander and migrate.
- Irregularity and changing geometry.
- Varying stage and discharges.
- Variations in the composition of bed and bank materials.

Due to the above-mentioned variations, many related problems to sedimentation process into and within the River Nile are encountered. Consequently, scouring of bed materials, bank erosion, and deposing in critical reaches can affect water depth fulfillment, NRI, [6].

This paper contains the field data measurements which represent the existing situation for river bed level at the site, water current velocity measurements, bed and suspended material collections. Also, water levels data for the last 10 years and comparing the existing river bed levels with the bed levels during the hydrographic survey in 1982 are represented.

These data were used to find navigational draft for ships berthing at the study area especially during minimum water level periods. Also, entrance and exit path of ships from and to the main navigational channel was planned. Finally, dredging areas, dredging volumes and final recommendations are presented.

**SITE DESCRIPTION**

The River Nile survey map of the study area at Qena Governorate is shown in Figure (1). It shows the total surveyed length which is 1,690 km. It extends from upstream Hathor hotel at km. 640,840 to downstream Qena Bridge at km. 639.150. Qena Bridge is located at km. 639,350 upstream El-Roda gauge station.

**DATA COLLECTION**

Field and hydrologic data have been collected; the field data include hydrographic survey and hydraulic measurements (water current velocity measurements, bed and suspended material sample collections).
1. Hydrographic Survey Data

Hydrographic and land survey have been carried out for 1,690 km length. This distance covers 22 cross sections as shown in Figure (1). These sections are illustrated as follow:

- Three cross sections cover about 190 m length of River Nile. They extend from cross section (X-3) to cross-section (X-1) downstream Qena Bridge.
- Nineteen cross sections cover about 1,500 km length of River Nile. They extend from cross section (X0) to cross section (X18), from upstream Qena Bridge to upstream Hathor hotel.

2. Hydraulic Measurements

The measurement of stream flow velocities along the study area have been carried out at the cross-sections no. (X-2, X2, X8, X15), Figure (1). At each one, the stream flow velocities measured at 3 vertical sections (east, west, and middle of the cross-section). At every vertical section the velocity measured at five depths. They are 0.50 m under the surface water, 0.75 m above the river bed and at 25%, 50%, and 75% of the total depth. Also, bed and suspended material samples have been collected at the previous cross sections. Where, three samples have been collected at each cross-section (east, west, and middle of cross-section).
3. Hydrologic Data

It’s well known that solving navigational problems in the River Nile needs to define maximum and minimum of water levels during the last 10 years. And also maximum and minimum discharges downstream of barrages. The collected hydrologic data are:

- Minimum water level at Qena gauge station is (65.25m) MSL.
- Maximum water level at Qena gauge station is (69.40m) MSL.
- Minimum yearly discharge downstream Esna Barrage ranges from 35 mm$^3$/day to 83 mm$^3$/day.
- Maximum yearly discharge downstream Esna Barrage ranges from 217.500 mm$^3$/day to 241.370 mm$^3$/day.
- Minimum yearly discharge downstream Aswan Dam is 60 mm$^3$/day and the maximum yearly discharge is 270 mm$^3$/day.

Figure (2) shows that the minimum water level periods are during October to April yearly. While the maximum water level periods are during May to September, NRI, [1].

![Figure (2) Water levels hydrograph from 1998 to 2002](image-url)

DATA ANALYSIS

1. Hydrographic Data Analysis

The study area can be divided into four parts as follow:
First Part Located Downstream Qena Bridge

This part extends from cross section X-3 to X-1 as shown in Figure (3). The average width of the River Nile in this part is 700 m. The average bed level at the east side is (65.70 m) MSL which is higher than the minimum water level (65.20 m) MSL. The navigational path in this part is close to the west side; its width is about 220 m. The deepest bed level in this part is (60.00 m) MSL, which gives navigational depth about 5.20 m during minimum water level period.

![Figure (3) River Nile bed contour map of the study area in March, 2004](image)

Second Part Located Upstream Qena Bridge

This part extends for a length about 680 m. It includes 9 cross sections (from X0 to X8) as shown in Figure (3). The navigational path in this part is close to the west side. Its width ranges from 170 m at X-0 and decreased in the upstream direction to 120 m at X7. The bed levels of the east side of River Nile in this part are very high. Its average value is (66.00 m) MSL, which is higher than the minimum water level (65.20 m) MSL.

Third Part Located at Front of Hathor Hotel

This part extends from X9 to X14 as shown in Figure (3), its length is about 420 m. The average bed levels in this part is (63.70 m) MSL, it is close to minimum water level (65.20 m) MSL. According to that there is not enough navigational draft for ships