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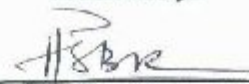
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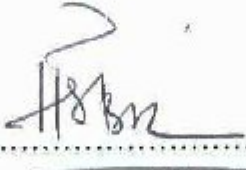
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DESIGN OF A DREDGED NAVIGATION CHANNEL ACROSS AN OFFSHORE
SANDBAR

ORJI KALU UKA

A project report submitted in partial fulfillment of the requirements for the award of
the degree of Master of Engineering (Civil – Hydraulics and Hydrology)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

JULY 2011

I declare that this thesis entitled “Design of a Dredged Navigation Channel across an Offshore Sandbar” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ACKNOWLEDGEMENT

I am heartily thankful to my supervisor, Prof. Hadibah Binti Ismail, whose sage advice, insightful criticisms, encouragement, guidance and support aided the writing of this thesis in innumerable ways. I would also like to thank the staff and members of Coastal and Offshore Engineering Institute (COEI) whose steadfast support of this project was greatly needed and deeply appreciated.

I would like to thank my family members, especially my sister, Mrs Florence Obasi, and my wife Orji Esther for supporting and encouraging me to pursue this degree.

Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the project.

Orji Kalu

ABSTRACT

Pulau Labuan is one of the most accessible islands in the world today. The island is 18km off the mainland coast of Sabah. Ro-Ro ferries are used to transport people and goods from Labuan to Menumbok in Sabah and vice-versa. However, people find it difficult to either export or import goods or other services to Labuan due to an offshore sandbar that is located between the two harbor facilities.

In order to solve the above problem, dredging across the offshore sandbar is required. Various methods were applied in the design of the channel and also in the prediction of sediment transport. The Ro Pax ferry was selected as the designed vessel and used in the calculation of the channel depth. Both the bottom and top width of the channel were also determined. The length of the design channel (about 5km) was divided into several sections. The volume of each section was calculated using trapezoidal and triangular methods. The volume of capital dredging was obtained by the addition of individual volumes of all the sections. The sediment transport rate was predicted using Bijker's formula. The bed roughness was calibrated and used for the Bijker's computation. The sediment rates across the channel were also predicted and dredging interval for maintenance dredging established.

The capital dredging volume was found to be 4326280m^3 and sediment rate within the sandbank was $23,205\text{m}^3/\text{yr}$ from Surfer8 and $23,209\text{m}^3/\text{yr}$ from Bijker's formula. It was estimated that the total sedimentation in one year was $390,388\text{m}^3$. The dredging interval was calculated to be 3.5 years.

It was observed that the highest sedimentation rate occurred during flooding at sector A. Generally, rates of sediment transport were high in the upstream boundary of the channel compared to any other part of the channel. This could be as a result of changes in velocities and water depths observed as the currents moved the suspended sediments across the channel.

ABSTRAK

Pulau Labuan pada masa kini adalah salah satu pulau yang paling mudah dilawati di dunia. Pulau ini terletak kira-kira 18km dari tanah besar di Pantai Sabah. Feri Ro-Ro digunakan untuk membawa penumpang dan barangan berulang-alik dari Labuan ke Menumbuk, Sabah. Walau bagaimanapun, aktiviti mengeksport dan impot barang dagangan dan lain-lain perkhidmatan ke Labuan adalah sukar, kerana terdapatnya beting pasir yang terletak di antara dua pelabuhan ini.

Bagi menyelesaikan masalah ini, pengorekan dikawasan beting pasir ini amat diperlukan. Terdapat pelbagai kaedah yang boleh di lakukan untuk mereka bentuk terusan dan meramalkan pergerakan sedimen. Reka bentuk Feri Ro Pax di pilih untuk proses pengiraan kedalaman terusan tersebut. Lebar bahagian dasar dan permukaan terusan turut dikenalpasti. Panjang reka bentuk terusan (kira-kira 5km) dibahagikan kepada beberapa bahagian. Isipadu setiap bahagian dikira berdasarkan kaedah trapezoid dan segitiga. Isipadu kawasan pengorekan terusan dikira berdasarkan Jumlah isipadu individu pada setiap bahagian. Kadar pergerakan sedimen diramalkan berdasarkan formula Bijker. Kekasaran bahagian dasar dikalibrasikan untuk digunakan di dalam pengiraan Bijker. Kadar pergerakan sedimen yang melintasi terusahjuga telah diramalkar dan sela masa pengorekan untuk tujuan penyenggaraan.

Isipadu pengorekan di jumlahkah sebanyak 4326280m^3 dan kadar enapan sedimen di beting pasir ialah 23205m^3 setahun mengguna sofwer Surfer 8, dan $23,209\text{m}^3$ setahun daripada formula Bijker. Oleh itu, adalah dianggarkan jumlah enapan sedimen dalam tempoh masa setahun ialah $390,388\text{m}^3$. Sela masa pengorekan dianggarkan pada 3.5 tahun.

Melalui pemerhatian, kadar enapan sedimen tertinggi berlaku ketika air pasang di sektor A. Secara amnya kadar pergerakan sedimen adalah lebih tinggi di bahagian hulu terusan berbanding bahagian lain. Ini mungkin disebabkan perubahan kelajuan dan kedalaman air yang diperhatikan apabila arus menggerakkan sedimen sepanjang terusan.

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