An Empirical Consideration on Drag Coefficient of Flared Silt Curtain

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ABSTRACT

The field measurements on the behavior of silt curtain were conducted under stormy waves and currents. The field measurements were successfully completed and supplied the data required to estimate the drag coefficient of flared curtain structures. Each of the drag coefficients for both stormy waves and currents was predicted to be 1.0. Since the large velocities of wave and current are induced at the same time by storm, the estimated drag coefficient of 1.0 is reasonable for that designed under wave and current.

KEY WORDS: Drag coefficient, field measurements, silt curtain, tension, wave and current.

INTRODUCTION

The silt curtain is very popular in Japan to prevent the pollution due to spoiling or dredging accompanied by coastal zone development. The silt curtain is normally applied to inner bay with high tranquillity. Extension of construction area causes the increase of importance to investigate the applicability and the responsibility of silt curtain to the stormy wave and current. Because of the lack of information on the behavior of silt curtain under storm the silt curtain is sunk into sea water during stormy wave condition. Since the construction is suspended through storm, this procedure is reasonable but costs a lot.

When designing the silt curtain the drag force due to wave or current is estimated by the drag coefficient for the resting body such as a sphere or a rectangular prism. Japan Sea Pollution Prevention Association(JSPPA) employs the drag coefficients of 1.2 for both wave and current. The silt curtain is often flared by current. The treatment of silt curtain as a resting body has to be examined by physical modeling or field confirmation. To obtain the drag coefficient of flared silt curtain both the drag force and the deformation due to wave and current are required. The pioneering research for designing the floating silt curtain was done by Milgram(1971). He conducted the analytical investigation and the field measurements, and derived the formulae for estimating the drag coefficient of silt curtain due to each of wave and current. Thereafter in Japan Sawaragi et al.(1987, 1988, 1989) and Tsuruya et al.(1991) have investigated the drag force and the deformation of the floating silt curtain(the hanging type) and the submerged one which skirt end is fixed at sea bottom. Although these research brought the fruitful results, those researches were based on the laboratory experiments and had the difficulty for applying their results to the practical design method of silt curtain. Thus the field measurements on the behavior of silt curtain are expected to be conducted under storm condition. Maeno et al.(1994) observed the tension fluctuation acting on the mooring wire of the flared silt curtain under the coexistence of wave and current. Maeno et al.(1995a, 1995b, 1996) conducted the field measurement of the tension acting on the mooring wire and wave conditions under more severe storm, and investigated the responses of the various anchors for silt curtain to the wave and current. In this study, the drag coefficient of the flared curtain structure was predicted by measuring the tension acting on the mooring wire and the deformation of the floating silt curtain under wave and current coexist condition.

FIELD MEASUREMENTS

Tension Exerted on Mooring Wire

The measurement of tension exerted on the mooring wires that held the silt curtain were measured for approximately one month from November 9 to December 13, 1994 in the reclamation area in the district "K" of Tokyo Bay, Japan.

The views of the measurement setup are outlined by the Figure 1. Two tension meters were attached to the Silt Protector that were installed in the depth of 42 m from the sea surface, one at the upper part of the curtain and the other at its lower part. The tension meter used here is able to