FIELD MONITORING OF SHIP MOORED MOTIONS AND MOORING LOADS AT PUNTA LANGOSTEIRA PORT (A CORUÑA, SPAIN)

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Paper topic: Laboratory and field observations and techniques

1. Introduction

Operation efficiency in ports and harbors may be determined by the motions of the ships moored inside them under different climatic conditions. These motions can exceed certain limits that result in cargo handling or berthing works interruptions. Therefore, it is considered of a great relevance to achieve a detailed knowledge of the ship motions inside the harbor, as well as the characterization of the mooring loads.

This paper present a field campaign carried out by the Water and Environmental Engineering Group (GEAMA, www.geama.org/hidraulica/), in collaboration with Aquatica Ingeniería Civil S.L. and Siport 21, at the new facilities of the Punta Langosteira Port (A Coruña, Spain). The project consists in the characterization of the climatic and hydrodynamic conditions, outside and inside the harbor, and the six degrees of freedom of the ship motions and mooring loads. These results are fundamental to understand the behavior of the moored ships with both low and large frequencies motions.

Moreover, the obtained information where compared with hydrodynamic and ship mooring numerical models available for the Langosteira Port. This study leads to a calibration and validation of these numerical models, in order to use them in future ship operation predictions, which can optimize the efficiency of a port.

Figure 1. Aerial view of the Langosteira Port.

2. Field experiments

The field monitoring of the ship motions was carried out at Langosteira Port. A Coruña Port Authority decided some years ago to build a new harbour in Punta Langosteira, located some

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10 km west from the city centre to improve their facilities and avoid the danger and environmental impact of its main traffics on the city. Currently, the two first phases of the Port are completed, where the main rubble mount breakwater constructed has a length of 3350 meters.

Swell and sea waves were determined both outside and inside the harbor. A direction waverider buoy and a pressure sensor were installed outside the harbor to determine the incident wave conditions. The instrumentation inside the harbor consists in to AWACS velocimeters, to determine the wave and current conditions, three pressure sensors installed to study possible resonation phenomena, and a MIROS Radar. Furthermore, a weather station was installed in the proximity to the ship. The obtained hydrodynamic data was compared with the numerical models developed to predict the wave conditions inside the port, focusing on the possible resonance phenomena.

The instrumented ship was a pollution control vessel, Urania Mella, with 72 meters length and 3.300 DWT. The duration of the field observation was of two months.

Figure 2. Pollution control vessel Urania Mella.

Ship motions were measured with three complementary methods. A GPS system, 3-axis accelerometer and gyroscope, both of them capable of measure the six degree of freedom of a floating body, and complementary visual imaging techniques. The three systems were compared and validated, with a good agreement of the obtained results. Also, the ship motion measuring with visual techniques was analyzed as a non-intrusive method for future ship instrumentations.

Three load cells were installed for the mooring rope tension measuring. They were set in the bow line, in one of the springs, and in stern line.

The motion and load data obtained was compared with the obtained with the Siport21 *ship-moorings* numerical model, in order to achieve an appropriate calibration and validation of the model for similar ship with several external wave conditions.

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