Widening and straightening improvements to the navigation channel in Gaillard Cut at the Panama Canal

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EXTENDED ABSTRACT

The commercial and industrial development worldwide during the twentieth-century and part of this century caused the world global merchant fleet to grow, making the vessels that transit the Panama Canal become larger in size and draft. The Panama Canal Authority undertook improvements projects along the navigation channel, particularly at the Pacific and Atlantic entrances and in the sector known as Gaillard Cut, a 14-kilometer-long segment that crosses the continental divide in the Isthmus, which is well-known for its landslide occurrences during and after the construction of the Canal.

In the 104 years of service of the Canal, there have been three significant widening programs along the Gaillard Cut. The first widening program of the Cut, started in 1934, where the width was increased from the original navigation channel of 300 feet to 500 feet, and the program ended in 1971. The second widening program increased the navigation channel width to 630 feet in the straight segments and up to 730 feet in the curves, and it lasted approximately 10 years, between the years 1992 and 2002.

The third widening program increased the navigation channel width to 715 feet in the straight segments and 730 feet in the curves, in addition, the curves of the Gaillard Cut were straightened, and the program lasted 10 years, between the years 2003 and 2013. This program was divided into several phases to ensure slope stability during the excavation process, these phases included dry excavation, land-based drilling and blasting, land-based dredging, underwater drilling and blasting, and conventional dredging. Dry excavation and land-based dredging was carried out by external contractors, and the rest of the phases were carried out internally by the Dredging Division of the Panama Canal Authority.

All the phases are based on excavations that are properly designed to predict the performance of slopes that have not yet been excavated. Geologic models were complemented with various sources of information that provide data that is relevant to the stability of a slope. Such sources include: a testing program with a modern geotechnical laboratory for measuring the shear strength of rock masses, the interpretation of groundwater regime by installing monitoring instruments, the compilation of past movements of surface monuments placed along the slopes of the Cut, and the information of the shear strength of different materials from back-analysis of past landslides. All of the above data provides valuable information used in the design process.

The paper describes the design criteria assumed in the improvement of the navigation channel and the excavation process implemented in the widening and straightening of the Gaillard Cut.