THE STUDY OF DISASTER PREVENTION OF TOWER CRANE OPERATION IN THE CONSTRUCTION SITE

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ABSTRACT

TOWER CRANE IS AN IMPORTANT LIFTING MACHINE AND IS VERY COMMONLY USED IN CONSTRUCTION SITES. HOWEVER DUE TO ITS INHERENT HAZARDS AND TENDENCY TO CAUSE THE POWER LINE CONTACT, CRUSH, FLYING OBJECTS AND ETC. DURING THE LIFTING OPERATION, IT LEADS TO ENDANGER THE WORKERS. CONSEQUENTLY, IT IS RECOGNIZED AS A DANGEROUS MACHINE BY THE GOVERNMENT REGULATIONS. IN FACT TOWER CRANE IS MORE DANGEROUS WHEN IT IS IN CLIMBING OPERATION. THERE HAVE BEEN SEVERAL TOWER CRANE DISASTERS OCCURRED RECENTLY IN TAIWAN. MOST OF THEM WERE HAPPENED WHILE CRANES WERE IN CLIMBING OPERATION. IN THIS THESIS, WE INVESTIGATED THE TOWER CRANE'S USAGE STATUS IN TAIWAN, INCLUDING BRANDS, QUANTITIES, TRAINING/EDUCATIONS FOR THE USERS AND ETC. THE REPRESENTED MODEL FOR THE FLOOR CLIMBING TYPE AND THE STATIONARY TYPE TOWER CRANES WERE CHOSEN TO ANALYSIS ITS CLIMBING PROCEDURES BY FAILURE MODE & EFFECT ANALYSIS (FMEA) AND FAULT TREE ANALYSIS (FTA) TECHNIQUES. THE FMEA WAS USED TO PREDICT THE CRANE TOWER DISASTERS WHEN A HUMAN ERROR OR MACHINE ELEMENT FAILURE HAPPENED. THE FTA WAS USED TO ANALYSIS THE HUMAN ERROR OR MACHINE ELEMENT FAILURE AFTER A CRANE TOWER DISASTER HAPPENED. BY INTERACTING WITH FMEA AND FTA METHODS, THE CAUSES OF CRANE TOWER DISASTERS AND CLIMBING PROCEDURES COULD BE SHOWN CORRECTLY AND CLEARLY. IN THIS THESIS, THERE ARE THREE MAJOR CONTRIBUTIONS TO THE TOWER CRANE CLIMBING PROCEDURES: 1. IN FMEA, A STRUCTURED ACTIVITY APPROACH (SUBJECT + VERB + OBJECT + ADVERB) IS DEVELOPED TO PREDICT THE DISASTER FOR EACH CLIMBING STEP. 2. BASED ON THE FMEA AND FTA, THERE ARE TWO CATEGORIES, TOTAL NINE HUMAN ERRORS, AND FIVE MACHINE FAILURE MODES. 3. EACH CLIMBING STEP WAS EVALUATED AND GRADED INTO ONE OF THE FIVE FAILURE CATEGORIES. THE IMPROVEMENT RECOMMENDATIONS FOR THOSE STEPS LOCATED ON THE FIRST AND SECOND FAILURE CATEGORIES WERE PROPOSED TO ENHANCE THE SAFETY IN THE TOWER CRANE CLIMBING OPERATIONS.

Keywords : TOWER CRANE, FMEA, FTA

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