Modelling weather effects on construction operations in Oman

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Abstract

The construction industry is recognized as one of the most industries exposed to climatic conditions. Construction projects are mainly executed in an outdoor environment by manual labours and, therefore, its activities are considered as weather-sensitive activities that are affected by various weather conditions. Severe weather conditions can directly affect the productivity and efficiency of construction projects operations. In addition, weather impact on the construction industry is known to be one of the main factors that decrease labour productivity, causing project delays, cost overruns, and contractual claims between contractors and project holders. Therefore, it is important to understand the inclement weather influence on any construction projects to avoid and reduce claims and arguments caused by delays. A construction labours productivity and efficiency are affected by various weather conditions. Examples of weather variables that influence construction labours in hot and dry regions are heatwaves, high temperature, high relative humidity and ultraviolet radiation. Construction labours may suffer heat injuries due to the heat stress, which include sunburn, cramps, heat exhaustion and heatstroke. As a result, this will lower the performance of construction labours and can cause a temporary work stoppage. Consequently, the construction process work will slow down, and the schedule of the project will be affected, which in turn will result in a considerable delay of the project and deviation from the project schedule baseline.

Oman climate is dry and hot climate with very high temperatures in summer, warm winters and low annual rainfall. Therefore, during extremely hot weather events, construction labours productivity may significantly decrease, as construction work may stop partially or completely. Furthermore, labours have reduced working hours in summer. The Ministry of Manpower in Oman has issued an instruction to all construction companies, to stop work at all sites between 12.30pm and 3.30pm, from June to August when the weather is extremely hot and humid. The effect of such low productivity and shorter working hours during the hot summer months in Oman may cause project delays and cost overruns. In this research, the hot weather effects on construction projects activities in Oman were modelled and integrated. A construction productivity black box model was developed using the work/rest schedule proposed by the National Institute for Occupational Safety and Health (NIOSH). The daily weather temperature and relative humidity of Muscat were input into the model and the expected productivity in terms of working hours is expected to perform were the output of the model. The model was applied in real case studies, which involved three real-life completed construction projects in Muscat. Results indicate that implementing the influence of hot and humid weather can lead to an extension of 3-38% longer project duration compared to the planned schedule. Therefore, it is important to understand and take special attention on the impact of extreme weather conditions on construction projects productivity.

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