FACTORS AFFECTING SOCIAL COST OF PILING IN URBAN CONGESTED AREAS

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Abstract - Adverse impacts that are caused to the neighboring communities due to construction activities are known as the social costs. Piling work is most common scenario in major infrastructure work. It causes serious structural damages to the buildings and utilities in adjacent areas, especially congested urban areas. The major problems caused to the buildings and utilities are due to vibrations, noise and pollutions. This study aims to analyze the social cost occurred to the adjacent structures due to the impact of piling. Based on the study a model can be formed for the incorporation of social cost in building cost estimation. Thus impact can be reduced to some extent. Based on literature review factors and questionnaire survey factors are identified and evaluated.

Keywords: Adverse impacts, Construction Works, Damages, Piling works, Social Cost, Vibrations.

I. INTRODUCTION

Vibrations in the ground caused by pile driving activity seriously affect nearby building and structure. The different pile size and shape as well as installation distances factors are considered for various pile driving impact studies. Cracks, structural damages and settlements are some of the problems caused due to vibrations. Piling also cause traffic, ecological, economical problems and also pollutions. Various scholars had proposed numerous way to quantify the social cost. Identification of the factors is the key step to quantify the social cost.

II. REVIEW ON IMPACTS OF PILING IN URBAN CONGESTED AREAS

Tolga Celik et.al (2017) conducted a study to analyze the social cost in construction project. The objective of the study is to present a state-of-the-art overview of social costs in construction industry in terms of definition, consideration, classification and quantification. The major classifications are traffic, economic, ecological and pollutions. For social cost quantification and to provide strategies author developed a clear understandings. Recommendations for the construction industry for the social cost estimation through a collective and critical review of literature are also done.

Tolga Celik et.al (2016) investigated how the construction operations that are conducted in the residential areas are affected to the residential buildings. By performing a questionnaire survey, study identified the level of effects of each nuisance on the residents. Data obtained by questionnaire survey is analyzed by using descriptive analysis. According to this analysis, loss of peace and quietude of the neighborhood, cleanliness of the house, and degradation of ambient conditions are identified as the most disturbing nuisances. Pollution is perceived as the most disturbing adverse impact by the neighboring community from the analysis.

Andrew Gilchrist and Erez N. Allouche (2005) Identified the adverse impacts related to construction activities in urban environment. According to the study social cost impacts are classified into four categories and each of them have adverse impacts on natural and urban environments. Traffic impacts are prolonged closure of road space, detours, utility cuts and ecological/social impacts are surface/subsurface disruption and damage to recreational facilities. The major pollutions are noise, dust, vibration and air/water pollution. Social cost indicators to these impacts are loss of parking space, additional fuel consumption, travel delay, increased traffic accident rate, accelerated deterioration of road, road rage, loss of income, productivity reduction, loss of tax revenues, property damage, treating compromised physical/mental health, reduced quality of life and restoration cost.

Wen-Der Yu and Shao-Shung Lo(2005) Developed a time dependent construction social costs (COSCO) for quantifying the negative impacts that result from construction operations during the field execution phase. Traffic, environmental and economic impacts are considered for study. Three categories of traffic impact cost considered to develop the model are Daily vehicle delay cost, daily detouring cost and daily traveller's time value.

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Environmental impact costs are daily noise and air pollution cost.

John C. M et.al (2015) conducted a study to identifies eight most important social cost categories, presents mathematical methods for calculating them, and summarizes the social cost impacts for two pipeline construction projects. Eight social cost categories are considered here that are also common to other utility construction project. Those are travel delay, vehicle operating cost, decreased road surface value, loss of business revenue, cost of dust control, noise pollution costs and safety. In dense urban areas the most important social cost factor is travel delay cost, accounting for approximately 55% of the total social costs.

M. Surahyo and T. E Diraby (2005) Proposed a scheme to support interoperable documentation

of relevant knowledge related to the environmental and social costs of highway projects. The research team identified nine major classes of impacts. These are Air pollution impact, Water quality degradation, Hydrological impact, Impact on soil, Impact on biodiversity, Impact on human health, Impact on human comfort, Impact on cultural heritage and Land use impact. There are two impacted entities identified –

1. Direct impact: such as structural damage to buildings or encroachment on/fragmentation of sites; and 2. Indirect impact: impact due to improvement in access to site

Fathi M. Abdrabbo and Khaled E Gaver(2012) conducted a study on installation effects of auger cast-in-place piles (ACIP). Effect of pile installation on the adjacent buildings were discussed. During the construction stage of ACIP, it was noticed that the asphalt level of the side road randomly subsided (250 mm) and existing buildings swayed towards the construction site by about 32 mm, and the wider than the designed space. Cracks were observed inside the basement of the existing building just below the expansion joint. Installing ACIP in saturated loose and medium sandy soil can cause tilt of the nearby structures.

Krzysz C(2016) has done analysis of the vibration propagation induced by pulling out of sheet pile wall in a close neighbourhood of existing buildings. It is founded that pulling out elements of sheet pile wall with the use of vibro hammers is often a source of vibration level comparable and, in some cases, even higher than the level of vibrations generated during the process of driving sheet piles into the ground. This fact is often underestimated and can lead to unexpected structural damages.

III. FACTORS IDENTIFICATION

Based on literature reviews and questionnaire surveys from 50 sites the major factors that are identified due to impact of piling are:

Sl No	Factors	Impacts
1	Traffic	a.)Prolonged closure of road space
		b)Utility cuts
		c) Loss of parking space
		d) Additional fuel consumption,
		e)Travel delay
		f)Increased traffic accident rate
		g)Accelerated deterioration of road
		h)Road rage
		i)Vehicle operating cost
2	Pollution	a)Air/Water
		b) Dust
		c)Noise
		d)Vibration
3	Economic Activities	a)Loss of income
		b)productivity reduction
		c)Loss of tax revenues
		d)Loss of business
4	Ecological /Social activities	a)Loss of peace and quietude of the neighborhood
		b)Cleanliness of house
		c)Surface/subsurface disruption
		d)Impact on physical/mental health
5	Damage to the adjacent structures and utilities	a)Cracks
		b)Structural damage
		c)Tilt
		d)Settlement

IV. CONCLUSION

There had been a surge of complaints from the society about the hazards thrown up to the buildings and structures, in urban congested areas on account of piling works. From the questionnaire surveys it can be concluded that pollutions (dust, noise etc)are the major impacts to the adjacent site caused due to piling works. Other major problem is related to traffic. Traffic delays, loss of parking space, additional fuel consumption, prolonged closure of road space etc. are most common impact to the traffic due to piling works. Loss of business, loss of peace and

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productivity reduction are the indirect and minor problems caused by piling works. Piling works also causes structural damages to the adjacent structures, especially in congested areas.

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