

## Analysis of Construction Site Complaints and Their Relationship with Surrounding Spatial Information: A Case Study of Seoul

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**ABSTRACT:** The purposes of this study are to identify the types and numbers of civil complaints raised at construction sites, examine their correlation with the spatial characteristics of the surrounding area, and investigate the impact of these complaints on project schedule performance. The frequency of construction-related complaints has steadily increased, presenting significant challenges for resolution due to the complexity and diversity of construction projects. This research aims to identify the spatial factors influencing the number of complaints related to construction sites and analyze the impact of these complaints on the construction project schedule performance. Geographic Information Systems (GIS) are used to process and visualize complaint data obtained through information disclosure requests from Seoul Metropolitan Districts, along with spatial data and building permit information from Seoul City. To explore the spatial relationship between complaints and surrounding environmental factors, Geographically Weighted Regression (GWR) was applied. In addition, a correlation analysis was conducted to investigate the relationship between complaints and schedule growth, which compares the planned and actual project durations. It was found that the occurrence of complaints at construction sites was influenced by spatial characteristics such as land prices, road length and ratio of residential buildings to buildings of other use. Additionally, the number of complaints was negatively correlated with schedule growth. This study makes three key contributions. First, by providing insights into the underlying causes of construction-related complaints, it enables timely and appropriate responses to various types of complaints. Second, by identifying the correlation between construction complaints and the surrounding environment, it facilitates the preparation for potential complaint risks during construction project planning. Third, in the context of increasing awareness of corporate social responsibility, including sustainability and Environmental, Social, and Governance (ESG), understanding complaint cause helps incorporate the opinions of residents around construction sites, ultimately improving the social image of the construction industry.

### 1. INTRODUCTION

Recently, civil complaints related to construction activities have been increasing as residents seek to protect their rights and enhance their quality of life in response to noise, vibrations, and dust from construction sites (Kwon et al., 2018). Kwon & Son (2001) addressed that civil complaints related to construction activities are increasing and are expected to increase continuously. Due to the increasing trend of civil complaints related to construction activities, such complaints have become a major managerial factor in construction site operations (Jang et al., 2024). Managing complaints is crucial as it not only enables a proactive response to issues but also enhances customer satisfaction by addressing concerns effectively (Goins & Moezzi, 2013; Vairetti et al., 2024).

Due to the nature of being conducted outdoors, construction activities expose various complaint causing discomforts such as noise or dusts (Skvarenina et al., 2024). These complaints result in decreased

productivity due to liquidated damages from construction delays or compensation for damages to nearby residents (Son, 2010). Moreover, they can contribute to a negative perception of the construction industry, further emphasizing the growing importance of effective complaint management (Jang et al., 2024). Furthermore, increasing renewal projects and the rise of skyscrapers to enhance land-use efficiency have led to more frequent and complaints. This growing complexity has resulted in a greater diversity of conflicts and complaints (Ghaleb et al., 2022; Luo et al., 2017), requiring agencies such as construction companies and governments to allocate more capital for management through compensation, change orders, or extensions of the construction duration (Kwon & Son, 2008).

However, Moon & Jo (2018) argued that there is a gap in research regarding construction complaints, and a lack of information on how to address civil complaints during the design and construction phases. As a result, construction companies face challenges in implementing advanced preventive measures to manage complaints. There are some studies that identify civil complaint-raising factors based on spatial characteristics in other sectors, such as transportation or waste management (Liu et al., 2019; Yona et al., 2021). Additionally, some studies suggest qualitative evidence of a relationship between construction delays and civil complaints (Son, 2010; Kwon & Son, 2008). Unfortunately, there is little quantitative evidence on the spatial factors contributing to construction-related complaints.

To overcome these issues, this study aims to address the lack of information related to construction complaints by analyzing the correlation between spatial data around construction sites and the civil complaints raised. Based on this, it seeks to help construction companies and government institutions, such as local authorities, prevent and effectively manage construction-related complaints. Additionally, by examining the correlation between complaints and schedule performance in terms of schedule growth, the study provides quantitative evidence of the correlation between complaints and schedule performance in terms of schedule growth.

This study focuses on construction sites in 12 districts of Seoul, South Korea, where information disclosure was granted. Data collection was conducted at the district level, and the final analysis was performed at the construction site level. The research followed three phases: (1) collecting and processing geographical, administrative, and building-related data using GIS; (2) conducting a geographically weighted regression between spatial factors and civil complaints; and (3) examining the relationship between number of complaints and construction duration to assess the impact of complaints on project timelines.

## **2. LITERATURE REVIEW**

### **2.1 Civil complaints**

The definitions and scope of civil complaints vary, with terms such as ‘civil petition’ and ‘civil appeal’ being commonly used. In general, civil complaints report issues related to the petitioner’s concerns, such as discomfort or dissatisfaction, or problems with the administrative management of government services (Oxford English Dictionary, 2023). According to the “Civil Petitions Treatment Act” of South Korea, which is the focus of this study, civil complaints are defined as requests by a civil petitioner to an administrative agency to take a disposition or other specific action. Han et al. (2017) argue that these complaints vary based on the characteristics of the region or residents, and capital expenditures are inevitable to address them. Additionally, due to their quantitative increase and qualitative complexity, which require specialized knowledge and techniques, cooperation and information sharing between public and private stakeholders have become increasingly important. Furthermore, the increasing awareness of citizens’ rights and the societal recognition of the need for damage compensation have contributed to the rise in civil complaints. New York State operates the 311 service to comprehensively handle civil complaints, with noise-related complaints steadily increasing (DiNapoli, 2018). Other countries, such as Ireland and the UK, also handle general inconvenience complaints through online or phone channels. Similar to South Korea, they proceed to individual lawsuits following government warnings (Department for Environment & Food & Rural Affairs, n.d.; Ireland Government, n.d.).

Among various civil complaints, construction related complaints exhibit several distinct features. Due to the nature of construction activities, which take place outdoors and affect a large and unspecified group of people, multiple stakeholders are involved (Chan & Oppong, 2017). As a result, the types and causes of complaints are highly diverse, making response and resolution more challenging. Despite these challenges, as noted by Lee et al. (2005), complaints do not arise suddenly; rather, they can be detected and addressed

during their latent stage through neighborhood surveys. Additionally, as a construction project progresses, implementing change orders becomes more challenging, and resource allocation increases, making it increasingly risky to accommodate changes prompted by complaints (Ossama, 1996; Perrenoud et al., 2016). Therefore, in construction related complaints, early identification and proactive management of potential issues are crucial to minimizing uncertainties in construction projects. Furthermore, with the growing societal emphasis on corporate social responsibility, driven by the rise of Environmental, Social, and Governance (ESG) principles and sustainability (Liu et al., 2022; Seo et al., 2024), coexistence with local communities has become a critical issue. In this context, this study aims to provide a foundation for effectively addressing construction-related civil complaints raised by residents, offering a strategic direction for achieving corporate social responsibility.

## **2.2 Relationship between complaints and spatial characteristics**

Several previous studies have analyzed the correlation between civil complaints and spatial factors. Özkal & Tecer (2023) analyzed citizen odor complaints using a GIS-integrated public participation platform and found that these complaints were influenced by spatial factors such as wind speed and temperature. Similarly, Benocci et al. (2020) and Zambon et al. (2020) examined noise complaints and discovered that they exhibited spatial characteristics, including distinct regional distributions. Kim & Kim (2024) examined the relationship between traffic complaints and urban characteristics in Seoul using a geographically weighted regression model, identifying correlations between the number of complaints and factors such as residential density, the number of single-person and foreigner households, and land use mix. Similarly, Kim & Kim (2023) applied the same methodology to analyze the correlation between environmental and sanitation complaints and various factors, including demographic, building, transportation, and economic characteristics. Building on previous studies that show a correlation between civil complaints and spatial factors like land use and building characteristics, this study aims to explore the relationship between construction-related complaints and spatial features. Unlike prior research, it specifically examines complaints about construction site discomforts, such as noise and vibrations, and their impact on construction duration. This approach seeks to provide a quantitative understanding of how civil complaints affect project timelines and surrounding spatial factors.

## **2.3 Relationship between complaints and project performance**

Various factors influence construction project performance, including schedule and cost, with complaint-inducing factors such as noise and vibrations having a significant impact. Roberts (2009) noted that construction noise and vibrations can pose a threat to project schedules, particularly in areas near residential communities. Similarly, Babazadeh et al. (2024) emphasized that effective noise management in construction projects can help prevent unexpected legal disputes and ensure the well-being of the workforce. Furthermore, Warriner & Bartley (2006) highlighted that managing customer complaints and maintaining flexibility in addressing such issues can lead to a reduction in administrative costs. Schexnayder (1999) also noted that noise complaints often force engineers to halt construction activities or adjust their working hours, which in turn leads to construction delay claims. In conclusion, various complaints and their underlying causes directly impact on project performance, including schedule and cost. However, limited research has provided quantitative evidence of their effects. To address this gap, this study analyzes project performance in terms of schedule growth to assess the impact of complaints.

# **3. METHODOLOGY**

## **3.1 Research flow**

The research framework is illustrated in Figure 1. This research is structured into three primary stages: First, spatial information and construction site-related data, such as construction duration and site locations, are gathered. These data are sourced from various public databases managed by the Korean government, including the public data portal and the building lifecycle management system. Second, the collected data are processed into an analyzable format using methodologies such as geocoding, which converts text-

based construction site location address into longitude and latitude coordinates. Finally, the processed data are analyzed using GIS to visualize results, such as identifying complaint hotspots. Additionally, correlation analysis and geographically weighted regression (GWR) are employed to investigate the relationship between civil complaints and schedule growth, as well as to determine the key factors influencing complaint occurrences.

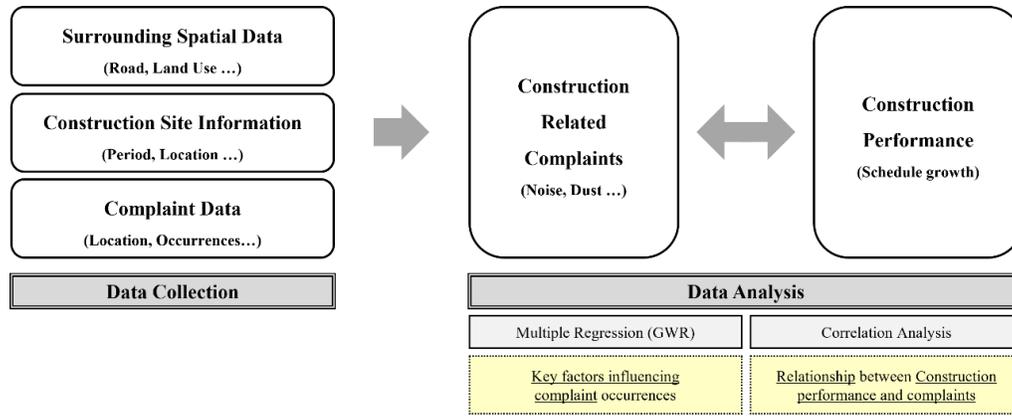


Figure 1. Research Flow

### 3.2 Research scope

The study focuses on construction sites in Seoul, South Korea. Among the 25 districts in Seoul, this research examines construction sites within 12 districts, where civil complaint data were managed and disclosed through an information request. The selected construction sites primarily consist of projects that were ongoing as of 2023, with some cases including sites that commenced construction as early as 2019. However, since this study analyzes the number of complaints and surrounding environmental factors for each project, the temporal variation in the dataset is not considered a significant influencing factor.

### 3.3 Data collection

In this study, various datasets from multiple sources were collected to obtain civil complaint information related to construction sites and their surrounding spatial characteristics. Civil complaint records for construction sites in each district of Seoul were acquired by submitting information disclosure requests through the information disclosure portal provided by the Korean Ministry of the Interior and Safety (MOIS). Since local governments are not required to maintain complaint data at the individual construction site level, discrepancies existed across districts regarding data availability and retention periods. As shown in Table 1, consequently 7,251 complaints data from 1,304 construction sites across 12 districts were obtained.

Table 1. Complaint data description

District	Gwangjin	Guro	Geumcheon	Nowon	Dongdaemun	Secho
Number of sites	377	27	102	10	74	196
Number of complaints	1,466	139	506	73	2,208	1,331
District	Seongdong	Songpa	Yongsan	Eunpyeong	Jongno	Jung
Number of sites	125	87	1	9	11	285
Number of complaints	489	418	18	50	67	486

To examine the impact of civil complaints on construction performance in terms of schedule growth, data on both planned and actual construction duration were collected. The planned construction duration was determined based on construction start and end dates recorded in notifications of dust emission projects, obtained through information disclosure requests. The actual construction duration was derived from open system for building data managed by the Korean Ministry of Land, Infrastructure, and Transport (MOLIT), using the officially reported commencement and occupancy approval dates. Additionally, to analyze spatial characteristics surrounding construction sites, various datasets were utilized. These included building registry information, railway and green space data from the Public Data Portal, urban planning facility spatial

data from the Seoul Open Data, building age and land-use spatial data from the V-WORLD platform provided by the Korean MOLIT, land price data, and road network information from the National Transport Information Center (ITS) through the National Standard Node-Link dataset.

The collected data cover a range of scales, from district-level to nationwide level, so the data scope was adjusted to the construction site level for analysis. This adjustment was carried out using GIS. GIS is a spatial data analysis and visualization tool that allows for the analysis of geospatial information and is advantageous in handling spatial data beyond traditional numerical data used in information systems.

To convert the civil complaint site addresses into spatial coordinates, Geocoding was employed. Geocoding refers to the process of converting non-spatial data, such as addresses, into spatial data by assigning geographic coordinates (latitude and longitude). In this study, address data were refined as formal type and geocoded to generate corresponding location and their coordinates using web-based geocoding program, which were then used to generate construction site point coordinates in the GIS platform. Based on these point coordinates, the surrounding influence zones of the construction sites were set up.

The influence zones of the construction sites were set to two ranges: 100m and 300m from the construction site center, and these areas were spatially defined using buffer function of GIS. Since majority of complaints related to construction sites stem from noise discomfort, this research established the influence zone based on the distance at which noise impacts are felt. The average noise level at a 15m distance from the construction machinery was found to range from 64dB to 106dB (Gannoruwa & Ruwanpura, 2007). Since noise from point sources in free field decreases by about 6dB with each doubling of distance (Dawood et al., 2014; Maekawa, 1970), it drops by 18dB at 120m, averaging 67dB (46–88dB). Given that general conversation is about 60dB, noise complaints are expected to decrease beyond 100m. Therefore, a 100m influence range was selected for analysis. Furthermore, the 300m influence range was based on the provisions of “Noise and Vibration Control Act” in South Korea, which outlines the regulatory scope for managing residential noise and vibration.

After determining the construction site’s impact range, spatial data within this range were extracted. From the spatial data covering a wide range of regions shown in Table 2, only the information corresponding to the impact zones of the construction sites was selected, which helped define the spatial characteristics around the site. For instance, data related to building usage and area from the building’s land-use spatial information were filtered to include only those buildings within the 100m and 300m buffer zones. Additional information was incorporated to specify which construction site’s impact range the data belonged to. This process utilized the GIS Intersect function. Following the same methodology, all collected data were processed at the construction site influence range level. The processed data on surrounding spatial characteristics were then converted into numerical formats suitable for correlation and regression analyses.

### 3.4 Data analysis

Based on processed spatial data, this research analyzed the correlation to identify the spatial factors influencing civil complaints. The preliminary variables selected for this analysis are shown in Table 2. These variables are widely used spatial data to analyze urban phenomena. For example, land price and land use mixes (Kim & Kim, 2023; Kim & Kim, 2024), such as zoning or usage, are commonly used variables to analyze geographical characteristics. Rail and road data (Di et al., 2019), along with the structure of buildings (Cho et al., 2024), are primarily related variables for analyzing noise occurrences. Through a process of removing and adding these variables and combining them iteratively, the independent variables for the linear regression model were determined. However, since the linear regression model does not account for spatial characteristics, geographically weighted regression (GWR) was ultimately applied to incorporate spatial dependence and analyze the data accordingly.

Table 2. Variable list

Category	Subcategory	Item	Source
Construction Site Information	Basic Permit Details	Site Area	Building Permit
		Building Area	
		Total Floor Area	
		Floor Area Ratio (%)	
		Main Use of Building	
Surrounding	Economic Indicators	Average Official Land Price	Official Land Price
	Railway Network Information	Number of Railway Stations	Railway Information

Spatial Information	Road Network Information	Road Length	
		Road Length * Number of Lanes	
		Number of Lanes	Standard Node Link
		Road Hierarchy	
	Zoning	Average Maximum Speed	
		Use District	
		Use Zone	Building Permit
	Building Information	Use Area	
		Average Building Age	Building Age Information
	Building Structure	Ratio of Collective Buildings	
Reinforced Concrete Structure (%)			
Lightweight Steel Structure (%)			
General Wood Structure (%)		Building Age Information	
Steel Reinforced Concrete Structure (%)			
Building Usage	General Steel Structure (%)		
	Educational Use (%)		
	Commercial Use (%)		
	Residential Use (%)	Building Usage Information	
	Industrial Use (%)		
Green Space Information	Public Use (%)		
	Green Area	Green Area Location Information	
	Landscaping Volume		

The estimation method used in the original linear regression model, Ordinary Least Squares (OLS), assumes that the effect of independent variables on the dependent variable is uniform across all spatial regions (Berry & Feldman, 1985). This implies that the regression coefficients for each independent variable are the same regardless of spatial location. However, this assumption of spatial homogeneity cannot account for the individual spatial characteristics of the data. To improve the accuracy of parameter estimation in the presence of spatial heterogeneity and dependency (Brunsdon et al., 1996), geographically weighted regression (GWR) should be applied.

Moreover, to analyze the impact of civil complaints on construction performance, schedule growth was used as an indicator to measure performance. The metric is the ratio of the difference between actual and planned durations to planned duration, which serves as a measure of schedule performance (Shrestha & Maharjan, 2018). Based on the results of the normality test, it was recognized that non-normal estimation was necessary for the distribution of civil complaints. Consequently, Spearman's rank correlation analysis was performed to examine the relationships between the variables.

## 4. RESULT

### 4.1 Key factors influencing complaint occurrence

Table 3 shows the results of conventional linear regression analysis, spatial regression models, and geographically weighted regression models. As shown in the table, the Jarque-Bera test revealed statistically significant results for the OLS model, and the spatial dependency test below also showed statistically significant values for the Spatial Lag model, indicating that considering spatial dependence is appropriate for the estimation of these variables. Based on this, the spatial regression model (Spatial-lag, Spatial-error) was applied to estimate the influence of the variables. However, the Breush-Pagan test results showed that heteroscedasticity had not been resolved, and the explanatory power remained low at 0.101. Therefore, a geographically weighted regression model was applied.

The final geographically weighted regression model showed a relatively high explanatory power of 0.167, and the Log-Likelihood value was also higher compared to the other spatial regression models. As a result, it was determined that the geographically weighted regression model, which had the highest explanatory power and accounted well for heteroscedasticity and spatial dependence, was the most suitable for identifying the spatial characteristics influencing complaints in construction projects. In fact, as shown in Table 4, the results of the geographically weighted regression model indicated that all spatial characteristic variables significantly affected complaint occurrence. Areas with larger road lengths, higher

maximum speeds, and more residential buildings tend to see more complaints. On the other hand, areas with higher public land prices, more road lanes, and larger construction sites tend to have fewer complaints. Some variables, like the general wood structure and industrial ratio, show weak effects.

Table 3. Comparison between regression models

	OLS	Spatial-Lag	Spatial-error	MGWR
<b>Model Fitness</b>				
<b>R2</b>	0.062	0.101	0.099	0.167
<b>AIC</b>	5305.350	5271.750	5272.640	5218.866
<b>Jarque-Bera test</b>	665.604**	-	-	-
<b>Breush-Pagan test</b>	25.839**	27.7359 **	28.3263 **	-
<b>Log-likelihood</b>	-	-2622.870	-2624.320	-2571.427
<b>Spatial Dependence Test</b>				
<b>Moran's I (error)</b>	6.679**	-	-	-
<b>LM test(lag)</b>	43.939**	-	-	-
<b>Robust LM test(lag)</b>	7.918**	-	-	-
<b>LM test(err)</b>	39.101**	-	-	-
<b>Robust LM test(err)</b>	3.079	-	-	-
<b>Likelihood Ratio Test</b>	-	35.6035 **	32.7090 **	-

Table 4. Geographically Weighted Regression (MGWR)

Dep. Var.	Indep. Var.	Mean	STD	Min	Median	Max	t (95%)	p-value
	Intercept	2.358	0.477	1.601	2.472	3.113	2.696	0.0071**
	300M_Avg. Public Land Price	-1.119	1.127	-3.811	-0.879	0.205	2.682	0.0074**
	300M_General Wood Structure	-0.029	0.213	-1.014	-0.013	0.575	2.618	0.0090**
	300M_Collective Building Rate	0.053	0.021	-0.027	0.062	0.065	2.088	0.0370*
	300M_Avg. Max Speed	0.122	0.311	-0.426	0.004	0.684	2.492	0.0128*
Total	300M_Avg. Number of Lanes	-0.145	0.142	-0.233	-0.195	0.292	2.415	0.0159*
Complaints	300M_Road Length	0.164	0.01	0.157	0.16	0.205	2.103	0.0357*
	300M_Railway Station	-0.047	0.008	-0.061	-0.045	-0.023	2.06	0.0396*
	300M_Green Area	0.139	0.042	0	0.159	0.173	2.14	0.0326*
	300M_Industrial Ratio	-0.022	0.009	-0.034	-0.026	0.003	2.095	0.0364*
	300M_Residential Ratio	0.052	0.074	-0.032	0.019	0.25	2.305	0.0213*
	Building Area	-0.14	0.011	-0.169	-0.141	-0.112	2.084	0.0374*
<b>R-squared: 0.167 ** / Adjusted R-squared: 0.140 / AICc: 5221.502 / Log-likelihood: -2571.427</b>								

Several key factors can serve as predictive indicators for the likelihood of complaints. Construction sites in densely populated residential areas with many multi-unit buildings may require increased management resource. In contrast, in industrial-dominated areas, the need for complaint-related management resources may be lower. Additionally, if the construction site is surrounded by numerous narrow roads or alleys, the number of complaints tends to increase. Therefore, effective complaint management in such cases necessitates strategic road occupancy planning and close cooperation with the road management authorities.

In conclusion, although the explanatory power of the regression model developed in this study is relatively low, making it difficult to predict actual number of complaints, statistically significant relationships between each independent variables and number of complaints were identified. Therefore, by considering the influence of these variables, the impact of complaints can be incorporated into construction planning.

#### 4.2 Relationship between project schedule performance and complaint

Table 5 shows the correlation between number of complaints and schedule growth. As shown in the table, the correlation was negative, suggesting that an increase in complaints demonstrates a correlation with the growth of the project schedule. However, this finding contradicts previous studies that indicate complaints tend to worsen project performance (Son, 2010; Jang et al., 2024). Considering both this result and prior research, one possible conjecture is that a higher number of complaints led to the reinforcement of management resources or manpower on-site, ultimately enhancing schedule growth. In practice, construction companies typically address problems only after they are raised (Hinsberg & Lamanna, 2024). For instance, when a noise complaint arises, they assess the actual noise levels and implement appropriate measures, such as installing soundproof walls or providing compensation.

Another possible explanation for the contradictory result is that it is related to data quality. Different authorities manage data in distinct ways, with retention periods varying across districts. Some maintained records for over a decade, while others kept them for less than a year. Additionally, inconsistencies in data formats, complaint classification, and schedule updates across districts may contribute to the differing correlation results compared to previous studies on complaints' negative impact on project performance.

Table 5. Result of spearman correlation analysis

	# of complaints	Schedule growth
# of complaints	1	
Schedule growth	-0.160**	1

Schedule growth: (Final completion duration – Planned duration) / Planned Duration \* 100

\*- Correlation is significant at the 0.05 level (2-tailed). / \*\* - Correlation is significant at the 0.01 level (2-tailed).

## 5. DISCUSSION AND CONCLUSION

Through geographically weighted regression analysis, this study concluded that both the characteristics of the construction site and various spatial factors surrounding it – such as residential area ratio and adjacent road data – have a statistically significant influence on the volume of civil complaints. Moreover, civil complaints were found to exhibit spatial dependence, highlighting the need to consider regional characteristics, such as geographic location, when developing strategies for managing complaints. Based on these findings, companies may employ spatial information as a risk assessment indicator for construction projects, as delays associated with schedule performance can ultimately lead to additional costs in the form of liquidated damages. For example, in projects with a high risk of complaints, engineers should incorporate mitigation measures, such as installing soundproof walls, into their cost estimations to prevent budget overruns. Additionally, the results indicated a negative correlation between the number of complaints and schedule growth. Although the correlation coefficient is not high, it is clear that the number of complaints impacts schedule growth. To ensure the efficient utilization of resources, it is crucial to evaluate the impact of complaints and allocate additional management resources appropriately to enhance project performance.

Even though the relationships investigated in this study showed statistically significant results, power of the model were relatively low. This could be attributed to the limited data processing procedures, such as outlier removal or setting a minimum cutoff. Furthermore, the correlation between complaints and schedule growth appears to contradict previous research suggesting that complaints negatively impact project performance. Additional studies should be conducted to further investigate the inconclusive results.

The contributions of this study can be summarized into three key points. First, by analyzing the correlation between complaints and schedule growth, the finding of this study provides quantitative evidence that construction companies should adequately account for the impact of complaints and allocate additional management resources when operating construction sites. Second, the study identified spatial characteristics that can influence the number of complaints, providing construction companies with insights to formulate more effective strategies for complaint management. By effectively addressing complaints that statistically significantly correlate with construction duration, efficiency of construction projects can be improved. For instance, when construction projects are undertaken in areas that are particularly sensitive to complaints, such as densely populated residential zones, construction managers may adopt a more proactive approach by engaging with local communities in advance to discuss and implement appropriate mitigation strategies, such as the pre-boring method—which involves pre-excitation rather than pile driving—can be employed to reduce noise and vibrations. Finally, by assessing the impact of civil complaints during the construction phase, companies can optimize resource allocation and improve efficiency. In conclusion, the findings of this research underscore the importance of understanding the factors influencing civil complaints and using this knowledge to develop strategies for complaint management, ultimately contributing to more efficient resource utilization in the construction industry.

This study is not free from limitations. First, the analysis was limited to data from only 12 districts within Seoul, resulting in a geographically constrained scope. Consequently, further research to expand the geographical range would be valuable. As mentioned earlier, civil complaints are also being recorded in several countries, including the United States, Ireland, and the United Kingdom. For example, New York provides complaint data through the NYC Open Data platform. Therefore, future research could potentially compare various international examples to gain a broader understanding. Second, the analysis revealed

that the spatial characteristics around construction sites had a minimally statistically significant impact on civil complaints. In other words, the overall significance of the correlation and regression analysis was relatively low, suggesting that the model and variables may not have adequately captured the factors influencing civil complaints. However, the geographically weighted regression analysis identified statistically significant variables, and the explanatory power of the model appeared to increase. By incorporating additional relevant variables such as noise level or traffic flow, and refining the estimation model, it would be possible to improve the accuracy of a complaint prediction model based on factors influencing civil complaints at construction sites. Third, this study focused solely on the schedule performance. To comprehensively assess the impact of complaints in construction projects and to identify potential causal relationships between complaints and construction performance, it is recommended to study the relationship between complaints and various performance dimensions such as cost, safety, and quality, through methodologies that allow for causal inference.

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