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Effects of Right-of-Way Clearance on Cost and Schedule Performance of Road Construction Projects in Ethiopia: A Case Study of the Sodo–Tercha Road Project

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Effects of Right-of-Way Clearance on Cost and Schedule Performance of Road Construction Projects in Ethiopia: A Case Study of the Sodo–Tercha Road Project

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Abstract

Right-of-way (ROW) clearance is a critical precondition for uninterrupted road construction, yet land acquisition, compensation, utility relocation, and site handover can delay project delivery. This study assessed the effects of ROW clearance on cost and schedule performance in the 75.72-km Sodo–Tercha Road Upgrading Project, Lot 1 (Sodo–Omo River section), Ethiopia. A mixed-methods case-study design integrated 84 structured questionnaires, 10 key-informant interviews, field observations, and project-document analysis. Quantitative responses were examined using descriptive statistics and the Relative Importance Index (RII), while interview evidence was thematically analyzed. Project records showed that the planned duration of 1,260 days increased to 2,067 days, a delay of 807 days (64.05%). Of the 807-day extension, 642 days were attributed to ROW-related obstructions, equivalent to approximately 79.6%. Utility relocation increased from 2 to 11 months, and compensation payment increased from 2 to 9 months. The contract sum rose from ETB 1,328,412,050 to ETB 1,383,400,809, representing a 4.14% increase; reported price-adjustment payments totaled ETB 129.79 million. Overhead costs (RII = 0.863), contractor claims (0.850), and idle labour/equipment (0.819) were the highest-ranked cost effects. Extension of time (0.975) and out-of-sequence work (0.913) dominated schedule effects. The findings demonstrate the importance of securing land and coordinating utility relocation before construction mobilization.

Keywords: Right-Of-Way Clearance; Land Acquisition; Cost Overrun; Schedule Delay; Road Construction.

1. Introduction

Road transport infrastructure plays a fundamental role in economic development by connecting communities, facilitating trade, improving access to essential services, and supporting regional integration. However, the successful delivery of road projects depends not only on engineering design, construction resources, and financial capacity but also on the timely acquisition and availability of the required right-of-way (ROW) [1, 2]. ROW clearance is a critical project-readiness activity involving corridor identification, land acquisition, property valuation, compensation payment, resettlement, demolition of affected structures, utility relocation, and formal site handover. Delays in these processes can restrict access to construction work fronts, interrupt planned activities, and expose projects to additional costs. Recent systematic evidence identifies land acquisition, ROW constraints, utility relocation, regulatory issues, and inadequate project planning among the recurring risks affecting highway construction time and cost performance [3-5].

In developing countries, ROW clearance is particularly challenging because road corridors frequently cross agricultural land, residential settlements, commercial properties, and existing utility networks. These conditions require coordination among road authorities, local administrations, land valuation institutions, utility providers, contractors, consultants, and project-affected persons [6]. Inadequate institutional coordination, incomplete land records, insufficient compensation budgets, valuation disagreements, and delayed decision-making can consequently affect construction progress. [7], examining ten road infrastructure projects in Uganda, identified inadequate compensation, delayed payments, insufficient community engagement, and livelihood disruption as significant challenges. Their findings further established that unresolved social issues and limited community acceptance can contribute to construction delays and increased project costs. Similarly, [8] demonstrated that delayed land acquisition and unclear compensation procedures can create prolonged livelihood uncertainty and social dissatisfaction among affected communities.

Ethiopia's experience also demonstrates the importance of ROW management in road project implementation. [4], investigating Addis Ababa City Road Authority projects in Lemi-Kura Sub-City, identified inadequate ROW acquisition performance and emphasized public participation, institutional capacity and improved property relocation procedures. [1] identified delayed site

delivery, ROW problems, inadequate community awareness and utility-provider coordination as major factors affecting both time and cost performance of Addis Ababa road construction projects. Furthermore, [9] identified delayed possession of construction sites among the ten most significant risks affecting Ethiopian domestic road contractors. These findings are consistent with [10], whose investigation of Ethiopian infrastructure projects reported average road-project schedule delays of 110% and cost overruns of 18%.

The delayed right-of-way (ROW) clearance disrupts construction sequencing, resource utilization, and contractual completion schedules. Inaccessible work fronts may cause idle labour and equipment, repeated mobilization, reduced productivity and increased site overhead costs. Since earthworks, drainage, bridge construction and pavement activities depend on continuous site access, delays affecting critical-path sections can directly extend project duration. Fragmented site handover may also disrupt work sequencing and increase operational inefficiencies [11-13].

Ethiopian studies identify site-access constraints, inadequate coordination, delayed decisions, and compensation-related disputes as important contributors to construction delays [14, 15]. Beyond project performance, ROW clearance involves legal and social responsibilities concerning land expropriation, compensation, and resettlement. Ethiopia's Proclamation No. 1161/2019, its Amendment Proclamation No. 1336/2024, and Council of Ministers Regulation No. 472/2019 provide the regulatory framework, while the World Bank's Environmental and Social Standard 5 emphasizes fair compensation, minimizing displacement, and restoring affected livelihoods [16, 17].

Against this background, this study investigates the Sodo–Tercha Road Upgrading Project, Lot 1 (Sodo–Omo River section), covering 75.72 km. The project had an original contract value of ETB 1.328 billion and a planned duration of 1,260 calendar days, compared with a revised contract value of ETB 1.383 billion and an actual duration of 2,067 days. Accordingly, the study identifies major ROW-clearance challenges, evaluates their effects on schedule performance, assesses their influence on project costs, and proposes improvement measures. Using stakeholder assessments, interviews, and project records, it provides case-specific evidence while recognizing other potential causes of project time and cost variations.

2. Materials and Methods

2.1 Study Design and Case Selection

The research used a descriptive and explanatory mixed-methods case-study design. The descriptive component documented the ROW clearance process, stakeholder roles, and reported implementation challenges. The explanatory component examined how delays in land acquisition, compensation, utility relocation, and site handover were associated with project cost and schedule outcomes. Quantitative questionnaire results were combined with semi-structured interviews, field observations, and project-document analysis. The case-study approach was appropriate because the research concerned an operating road project with identifiable contractual baselines, recorded extensions, and a defined corridor, as shown in Figure 1.

2.2 Study Area and Project Characteristics

The study covered Lot 1 of the Sodo–Tercha Road Upgrading Project, specifically the Sodo–Omo River section in the South West Ethiopia area. The project corridor extends from Sodo Town towards the Omo River near Tercha and traverses agricultural, residential, commercial and utility-served areas. The diversity of land uses and existing infrastructure makes land acquisition, compensation, utility relocation, and site handover important prerequisites for construction. The road section is reported as 75.72 km long, with an original contract sum of ETB 1,328,412,050 and an original planned duration of 1,260 calendar days.

2.3 Study Population, Sampling and Participants

The target population comprised professionals involved in road construction and ROW management, including client representatives, consultants, contractors, project managers, resident engineers, site supervisors, planners, quantity surveyors, ROW specialists and administrative personnel. Stratified sampling was used to include the three principal organisational groups, while purposive sampling was used to select key informants with direct knowledge of ROW processes and project administration. The questionnaire sample comprised 84 respondents: 28 from the Ethiopian Roads Administration (ERA), 22 from consulting organisations and 34 from contracting organisations. Ten key informants participated in semi-structured interviews using Equation (1).

$$n_{adj} = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \quad (1)$$

2.4 Data Collection

Primary data were collected through a structured questionnaire, semi-structured interviews and direct field observations. The questionnaire asked respondents to assess factors affecting cost and schedule performance using a five-point Likert scale, where 1 represented strongly disagree and 5 represented strongly agree. Questionnaire items addressed cost effects, schedule effects and ROW-related challenges. The ten interviews provided explanatory information about compensation administration, utility relocation, land access, stakeholder coordination, community concerns and the management of contractual time extensions. Field observations were used to examine selected corridor sections and the physical progress of clearance and relocation activities.

Secondary data were obtained from project records, including progress reports, contract documents, financial records, extension-of-time submissions and related claims. Particular attention was given to the original and revised contract values, planned and actual project durations, documented time extensions and the reported 642 days attributed to ROW-related obstructions. The project records also provided the planned and actual durations for four ROW activities: land acquisition, compensation payment, utility relocation and site handover. Document analysis was used to compare these records with questionnaire and interview evidence.

2.5 Data Analysis

Quantitative questionnaire data were coded and analysed using SPSS Version 26 and Microsoft Excel. Frequencies and percentages described the respondent profile. Mean scores and the Relative Importance Index (RII) were used to rank the perceived importance of cost and schedule impact factors. Interview information was reviewed, coded and grouped into recurring themes. The principal themes reported in the study were compensation payment delays, utility relocation challenges, institutional coordination gaps, community resistance and administrative bottlenecks. Findings from the three evidence streams were compared to identify convergence and explain

differences. Percentages were computed to describe the distribution of responses across different categories using Equation (2).

$$P = \frac{f}{N} \times 100 \tag{2}$$

where P represents percentage, f is the frequency of responses, and N is the total number of respondents. This measure was used to present demographic distributions and response patterns across stakeholder groups. The mean score was used to determine the average level of agreement among respondents regarding each identified factor. It was calculated using Equation (3).

$$\bar{x} = \frac{\sum x}{N} \tag{3}$$

where $\bar{x}$is the mean score, $\sum x$is the sum of individual responses, and N is the total number of respondents. This helped in identifying the central tendency of responses for each variable.

To prioritize and rank the relative significance of identified factors affecting project performance, the Relative Importance Index (RII) was applied. The RII was computed using Equation (4).

$$RII = \frac{\sum W}{A \times N} \tag{4}$$

where W represents the weight assigned by respondents, A is the highest possible weight (5 on the Likert scale), and N is the total number of respondents. The RII enabled comparison of multiple variables by converting Likert-scale responses into a standardized index. In addition, project performance indicators were quantified using standard deviation formulas for cost and schedule overruns. Cost overrun was computed using Equation (5).

$$Cost\ Overrun(\%) = \frac{Actual\ Cost - Planned\ Cost}{Planned\ Cost} \times 100 \tag{5}$$

Using project records, the original contract sum was ETB 1,328,412,050, while the revised contract sum reached ETB 1,383,400,809, resulting in a cost overrun of 4.14%. Similarly, schedule delay was calculated using Equation (6).

$$Schedule\ Delay(\%) = \frac{Actual\ Duration - Planned\ Duration}{Planned\ Duration} \times 100 \qquad (6)$$

With a planned duration of 1,260 days and an actual duration of 2,067 days, the project experienced a schedule delay of 64.05%, demonstrating the substantial impact of ROW clearance constraints on overall project performance.

2.6 Reliability, Validity and Triangulation

The questionnaire and interview guide were reviewed by academic supervisors and construction-management professionals to ensure clarity and alignment with the research objectives. A consistent five-point response scale was applied. Content and face validity were established through objective-based instrument design and expert review, while construct measurement was supported by descriptive statistics and RII ranking. As Cronbach's alpha was not reported in the source study, no reliability coefficient is claimed. Triangulation integrated survey rankings, interview findings, and project records, including 642 ROW-attributed delay days.

3. Results and Discussion

3.1 Respondent Profile and Stakeholder Representation

A total of 84 valid questionnaires were collected from professionals involved in the Sodo–Tercha Road Upgrading Project. Respondents comprised 34 contractors (40.5%), 28 Ethiopian Roads Administration (ERA) representatives (33.3%), and 22 consultants (26.2%), accounting for 100% of the sample. Contractors constituted the largest group, reflecting their direct involvement in construction activities, while ERA representatives provided client-side administrative and decision-making perspectives. Consultants contributed technical supervision and project management insights. Additionally, ten semi-structured interviews were conducted with experienced project managers, resident engineers, ROW specialists, and local administrative representatives. This combination of respondents provided diverse professional perspectives and strengthened the depth and credibility of the study findings, as shown in Figure 2.

3.2 ROW Clearance Process and Activity Durations

The documented clearance process involved land acquisition, compensation payment, resettlement and relocation of affected people and utilities, and final site handover. Delays were reported across all four stages. Land acquisition increased from a planned three months to eight

months. Compensation payment increased from two to nine months. Utility relocation increased from two to eleven months, while site handover increased from one to six months. Utility relocation therefore experienced the largest absolute extension among the four activities (nine months), followed by compensation (seven months). The pattern indicates that the availability of a construction corridor depended on several processes that were not completed within their planned periods, as shown in Figure 3.

These activity-level results are consistent with the interview themes. Compensation delays were associated with administrative procedures and limitations in the availability of funds, while utility relocation required coordination with service providers and resolution of technical and mapping issues. The extension in site handover suggests that completion of individual acquisition or compensation tasks did not automatically translate into immediate, continuous access for the contractor. This distinction matters for project programming: a corridor may be legally acquired in parts but remain unavailable for construction until structures are removed, utilities are relocated, and the relevant section is formally handed over.

3.3 Cost Effects of Delayed ROW Clearance

Respondents ranked increased overhead costs as the most important cost impact, with an RII of 0.863. Contractor claims and compensation-related costs followed at 0.850, while idle labour and equipment recorded 0.819. Reduced productivity scored 0.804. The RII for overall cost overrun was 0.681, and delayed compensation costs recorded 0.481. These results suggest that stakeholders perceived the indirect and time-related consequences of ROW delay—particularly overhead, claims, and idle resources as more prominent than the narrowly defined cost of delayed compensation itself, as shown in Figure 4.

Project records show that the original contract sum of ETB 1,328,412,050 increased to ETB 1,383,400,809. The difference is ETB 54,988,759, equivalent to approximately 4.14% of the original contract sum. The study also reports price-adjustment payments of ETB 129.79 million. These amounts should be interpreted carefully: the 4.14% calculation compares the original and revised contract sums, whereas the price-adjustment figure is separately reported and should not be added to the revised contract sum without confirmation of the contract accounting basis. The results point to financial pressure associated with prolonged implementation, including

inflationary adjustments, longer site administration, fuel and maintenance costs, labour expenses and contractor claims.

An important implication is that a relatively moderate percentage increase in the contract sum can coexist with a substantial schedule overrun. Extended duration may generate a stream of indirect costs that is not fully visible in the headline contract variation. The high RII for overhead costs (0.863) supports this interpretation, as does the high ranking of contractor claims (0.850) and idle resources (0.819). These factors are mutually reinforcing: unavailable work fronts can create idle resources, out-of-sequence working can reduce productivity, and longer implementation periods can increase site overhead and the likelihood of claims.

3.4 Schedule Effects

The planned project duration was 1,260 days, while the actual duration reached 2,067 days. The difference was 807 days, equivalent to a 64.05% schedule delay relative to the original duration. Project documents identified 642 days as directly attributable to ROW-related obstructions. Compared with the total 807-day extension, this represents approximately 79.6%, or about four-fifths of the total extension. The source study therefore identifies ROW clearance as a dominant contributor to the project's time extension, while the remaining 165 days are not attributed to ROW in the reported breakdown, as shown in Figure 5.

The project records indicate that the actual construction duration increased from 1,260 to 2,067 days, representing a 64.05% increase over the planned duration. Of the additional 807 days, 642 days (79.6%) were attributed to ROW-related delays, demonstrating the substantial contribution of land acquisition and site clearance challenges to schedule overruns. The RII rankings further identify the major mechanisms underlying these disruptions. Extension of time ranked highest (RII = 0.975), followed by out-of-sequence work (0.913), poor stakeholder coordination (0.813), verification and re-entry issues (0.763), compensation delays (0.694), and delayed structure removal (0.688). The highest ranking for extension of time reinforces the documented evidence of prolonged project completion. Similarly, the high RII for out-of-sequence work suggests that ROW constraints affected not only overall project duration but also the planned sequence of construction activities. Restricted site access forced contractors to modify work schedules, relocate resources, and undertake activities in alternative sections. These findings highlight that

ROW-related challenges generate interconnected disruptions, affecting both construction productivity and overall schedule performance, as shown in Figure 6.

3.5 Institutional, Legal, Social and Technical Challenges

Interview and project-document findings identified five interrelated categories of barriers affecting ROW clearance. Administrative challenges involved lengthy approval procedures and delays in compensation processing. Legal challenges included land ownership disputes and incomplete or unclear property documentation. Social challenges were associated with community resistance and conflicts arising from resettlement activities. Technical constraints primarily concerned difficulties in utility relocation and inaccurate mapping of existing infrastructure. Institutional challenges reflected inadequate coordination among ERA, local administrations, utility agencies, and contractors. These barriers were interconnected rather than isolated. Incomplete land records delayed property verification and valuation, while prolonged valuation processes postponed compensation payments. Subsequently, utility relocation was constrained by technical verification and weak institutional coordination. Consequently, contractors experienced delays in obtaining continuous and accessible work fronts. This interdependence demonstrates how administrative, legal, social, technical, and institutional weaknesses collectively contributed to ROW clearance delays, disrupted construction activities, and adversely affected overall project schedule performance.

4. Conclusions

This study assessed the relationship between ROW clearance and project delivery in Lot 1 of the Sodo–Tercha Road Upgrading Project. Evidence from 84 questionnaire respondents, 10 interviews, and project records indicates that incomplete and delayed corridor clearance was a major contributor to time and cost pressure. The principal conclusions are:

1. Project duration increased from 1,260 to 2,067 days (807 days; 64.05%), of which 642 days were attributed to ROW issues.
2. Utility relocation took 11 months rather than 2, while compensation payment took 9 months rather than 2.
3. The contract sum rose by ETB 54.99 million (4.14%); reported price-adjustment payments were ETB 129.79 million.

4. Overhead costs (RII = 0.863), contractor claims (0.850), and idle resources (0.819) were the leading cost impacts; extension of time (0.975) and out-of-sequence work (0.913) led schedule impacts.
5. Prioritizing corridor readiness, timely compensation, and coordinated utility relocation before mobilization is essential to reduce avoidable delay and cost exposure.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

Availability of Data

This article outlines research that has not used any data.

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Figure 1. Study Area Location Map

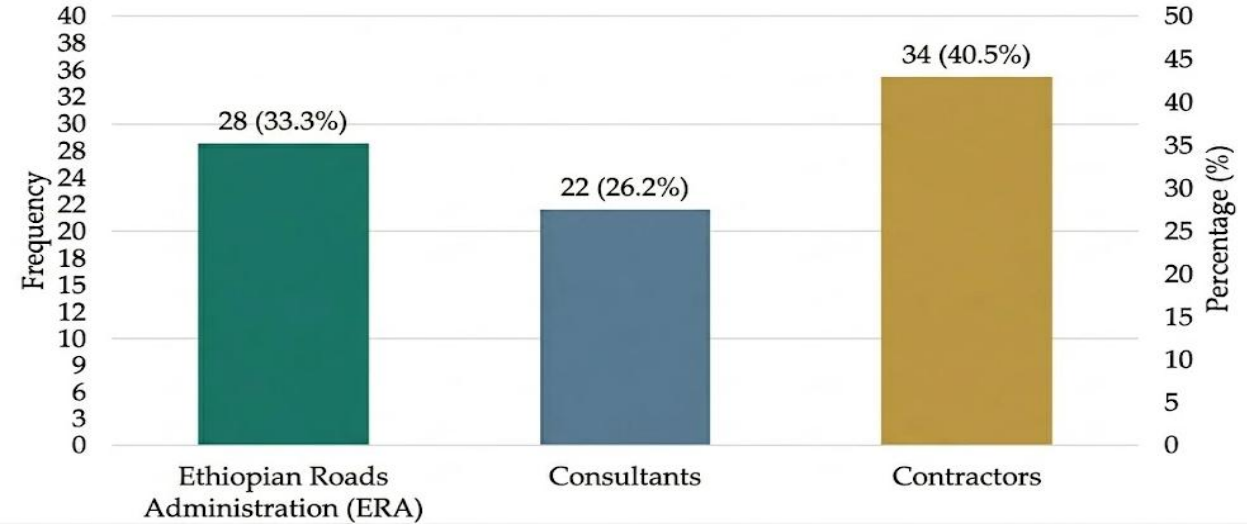


Figure 2. Respondents by Organization

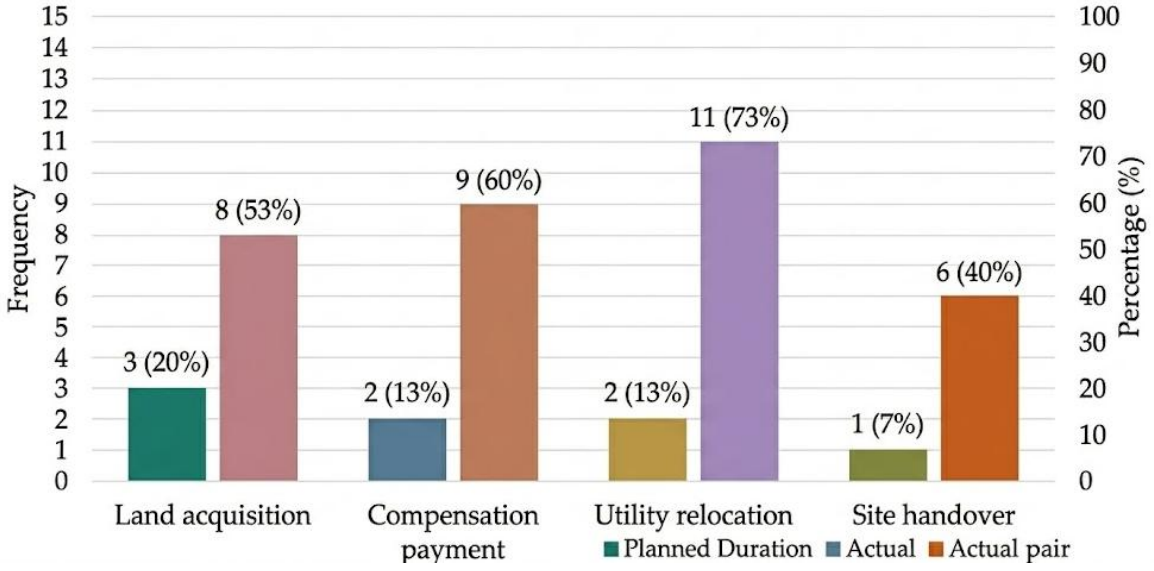


Figure 3. Average Duration of ROW Clearance Activities

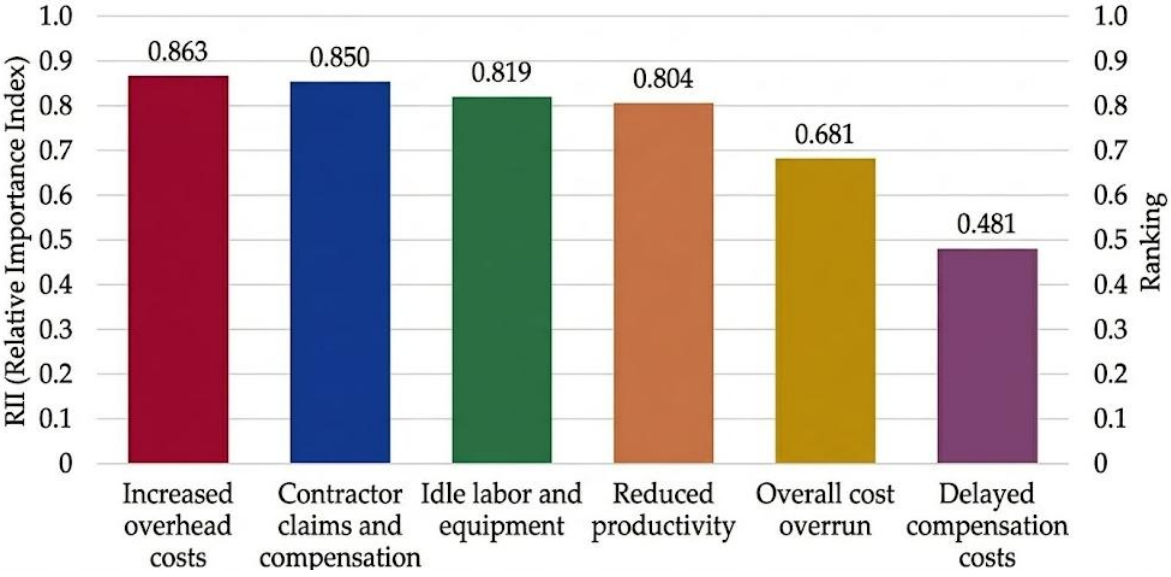


Figure 4. Cost Impact Factors of Delayed ROW Clearance

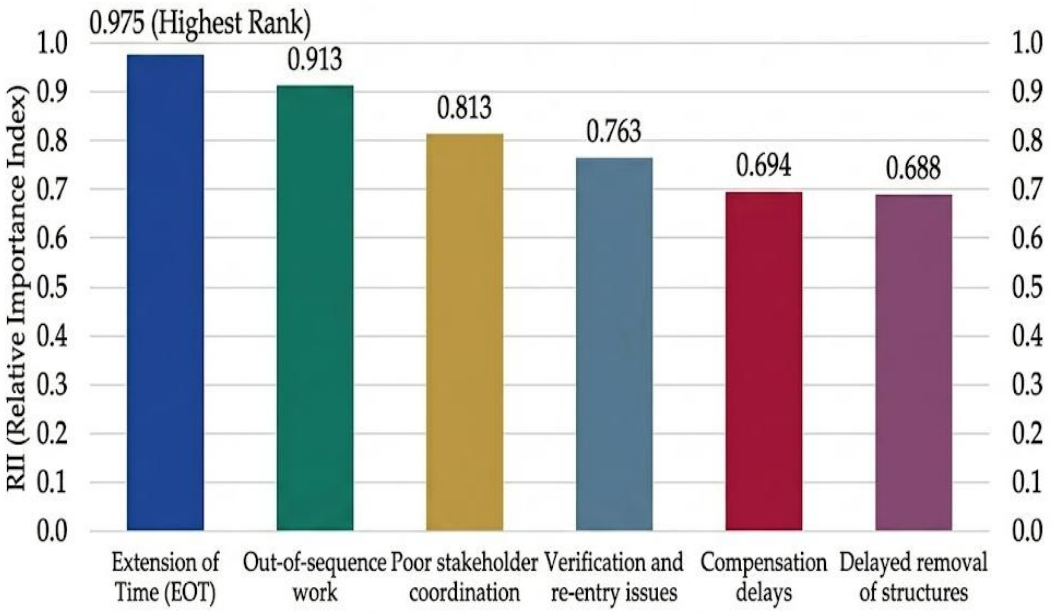


Figure 5. Schedule Impact Factors

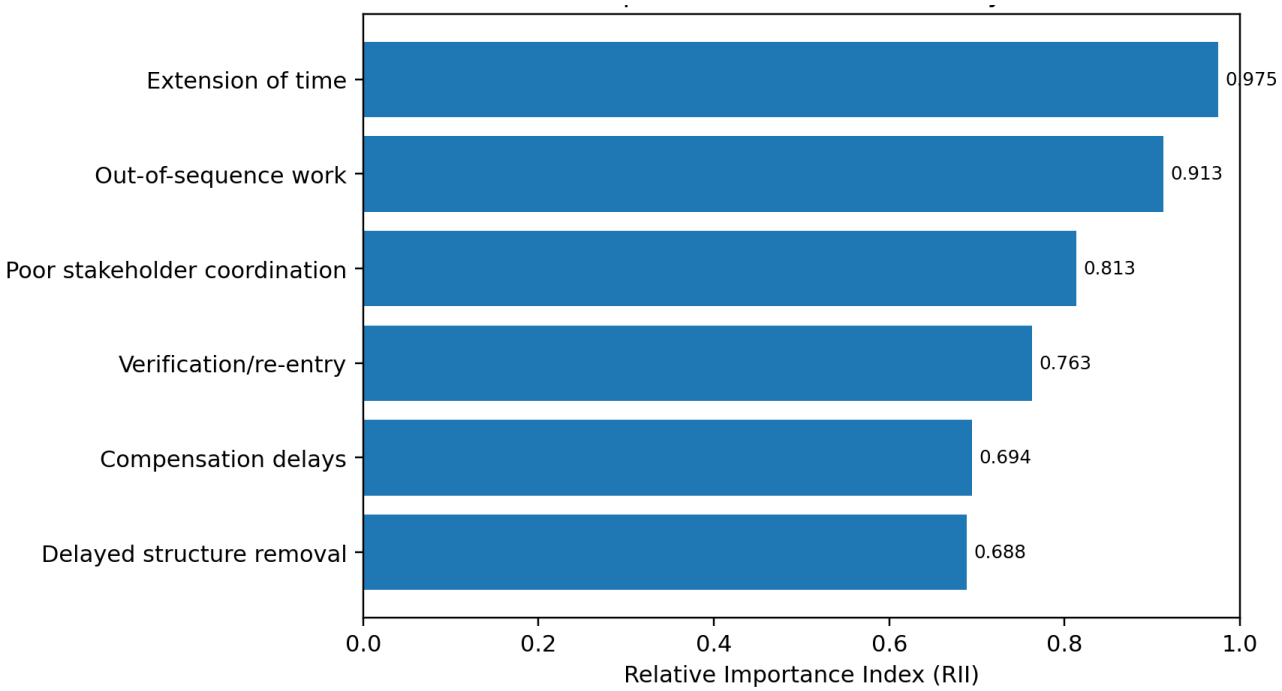


Figure 6. Relative importance of schedule impacts associated with ROW clearance delays