

Schedule performance of transport infrastructure projects in Danang City: Situation and influencing factors

Hiệu quả quản lý tiến độ các dự án hạ tầng giao thông tại TP Đà Nẵng: Thực trạng và các nhân tố ảnh hưởng

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ABSTRACT

Schedule is the most important issue today for the management of construction projects using public investment capital in Vietnam. The economic situation had many fluctuations after the Covid-19 pandemic such as the increase in inflation rate, the price of raw materials increased sharply; scarcity of local materials, especially materials that need large quantities such as fill soil, sand, gravel. In addition, unpredictable and increasingly negative impacts caused by climate change is also a challenge for schedule management of transport infrastructure projects. This study aims to find out which factors are strongly affecting the effectiveness of schedule management in the investment implementation phase of transport infrastructure projects in Da Nang city, Vietnam. Besides, the actual situation of transport infrastructure projects in Da Nang city from the year 2016 is reported and analyzed. Consequently, this study reveals 13 top factors affecting to the schedule of the ground clearance phase, 05 most important factors influencing to the schedule of the design-estimating phase, 03 significant impact factors of the bidding-contract signing phase, and 18 leading factors of the construction – acceptance-hand over phase of transport infrastructure projects in Da Nang city. These important factors will help guide strategies and policies to improve the efficiency of the city's transport infrastructure projects in the coming time.

Keywords: Schedule; affecting factor; transport infrastructure; Da Nang city; Vietnam

TÓM TẮT

Hiện nay, tiến độ là vấn đề quan trọng nhất trong quản lý dự án sử dụng vốn đầu tư công tại Việt Nam. Tình hình kinh tế Việt Nam đã và đang có nhiều biến động sau đại dịch Covid-19 như lạm phát tăng, tăng giá cả vật liệu xây dựng, tình trạng khan hiếm nguồn cung vật liệu xây dựng tại địa phương nhất là những vật liệu khối lượng lớn như đất đắp, cát, đá. Bên cạnh đó, những tác động ngày càng tiêu cực và khó tiên lượng gây ra bởi biến đổi khí hậu cũng đang trở thành một thách thức lớn cho việc quản lý tiến độ của các dự án hạ tầng giao thông. Mục tiêu của bài báo là nghiên cứu tìm ra những yếu tố ảnh hưởng mạnh đến tính hiệu quả của công tác quản lý tiến độ trong giai đoạn thực hiện đầu tư của các dự án hạ tầng giao thông tại TP Đà Nẵng, Việt Nam. Nghiên cứu này cũng báo cáo và phân tích thực trạng tiến độ giải ngân của các dự án hạ tầng giao thông tại TP Đà Nẵng từ năm 2016 đến nay. Kết quả, nghiên cứu đã tìm ra 13 nhân tố hàng đầu ảnh hưởng đến tiến độ công tác giải phóng mặt bằng, 05 nhân tố quan trọng nhất tác động đến tiến độ công tác thiết kế - dự toán, 03 nhân tố quan trọng ảnh hưởng đến tiến độ công tác đấu thầu - ký kết hợp đồng, và 18 nhân tố chủ đạo tác động mạnh đến tiến độ công tác thi công - nghiệm thu - bàn giao của các dự án hạ tầng giao thông tại TP Đà Nẵng. Việc nghiên cứu những nhân tố quan trọng này đóng góp vào việc hoạch định chiến lược và chính sách giúp nâng cao hiệu quả quản lý dự án hạ tầng giao thông tại TP Đà Nẵng trong thời gian tới.

Từ khóa: Tiến độ; nhân tố ảnh hưởng; hạ tầng giao thông; TP Đà Nẵng; Việt Nam.

1. INTRODUCTION

Infrastructure, both in its broad sense and with a specific focus on transport infrastructure, stands as the cornerstone upon which a nation's socio-economic development is firmly anchored. Over time, the Party, State, and society as a whole have recognized the paramount importance of investing in and expanding transportation networks. This concerted effort has borne fruit in the form of cutting-edge transportation facilities like state-of-the-art highways, international seaports, and world-class airports. These impressive developments, constructed in adherence to regional and international standards, have ushered in a transformative era for our nation.

Amid the temporary dormancy imposed by the Covid-19 pandemic, the local government of Da Nang City has displayed remarkable adaptability. They have strategically reevaluated and redistributed investment initiatives, directing their energies towards completing projects slated for 2022 and beyond into the 2022-2025 timeframe. These endeavors aim to cultivate a propitious environment for trade and bolster the city's allure for prospective investors. Da Nang City has unequivocally identified "transport infrastructure as a catalyst for urban progress". With unwavering determination, the City's People's Committee has promptly earmarked over VND 7,880 billion in public investment funds for pivotal and incentivizing ventures. Notably, more than VND 1,529 billion has been dedicated to key transportation projects, underlining their pivotal role in propelling Da Nang City's development trajectory.

As per the Da Nang City People's Committee's latest report, it is anticipated that by the close of 2022, the disbursement rate for investment projects geared towards enhancing the city's transportation infrastructure will reach approximately 89% of the annual capital allocation. At present, a concerted effort is being channeled into numerous critical transportation initiatives, with all available resources mobilized to accelerate construction progress, thereby ensuring adherence to the planned project volumes. This underscores the paramount significance of adhering to project timelines, emerging as the foremost concern for the effective management of construction projects financed through public investment capital, both at a national and local level in Vietnam. Da Nang City, in particular, stands at the forefront of this endeavor.

In the contemporary landscape, despite garnering substantial attention and investment from both the Government and the City People's Committee, the construction sector in our nation, and Da Nang City specifically, grapples with an array of formidable challenges and hurdles. The aftermath of the Covid-19 pandemic has ushered in economic fluctuations, marked by surging inflation rates and steep escalations in the cost of raw materials. This predicament is exacerbated by the scarcity of local materials, particularly those in high demand for transport infrastructure undertakings, such as fill soil, sand, and gravel. Furthermore, the increasingly unpredictable and adverse impacts of climate change loom large, presenting a formidable

challenge to the meticulous management of transport infrastructure projects. These multifaceted challenges underscore the need for innovative and resilient strategies to ensure the successful completion of these vital projects.

This study is dedicated to the critical task of identifying and comprehending the key factors exerting a substantial impact on the efficacy of progress management during the implementation phase of investment and construction endeavors in the realm of transport infrastructure, with a specific focus on Da Nang City. The anticipated outcomes of this research endeavor hold significant promise for enhancing the management of investment projects associated with the construction of transport infrastructure, both in the current period and the foreseeable future.

The overarching objectives of this study encompass two pivotal facets: Firstly, a meticulous analysis of the actual timelines and schedules governing investment in transport infrastructure projects within the confines of Da Nang City. Secondly, an exhaustive exploration aimed at deciphering the multifaceted factors that wield influence over the progression of city transport infrastructure projects during their implementation stage.

To realize these research objectives, the study will traverse a systematic and rigorous research journey. Commencing with an in-depth examination of the legal provisions encapsulated within the Law on the Management of Construction Investment Project Progress, the study will embark on an overarching assessment of progress and the management thereof within the realm of transport infrastructure construction investment projects in Da Nang City, spanning the period from 2016 to 2022. Subsequently, a comprehensive review of relevant research sources, encompassing literature, publications, reports, and other pertinent materials, will be undertaken to discern the factors that emerge as potent influencers. The final phase of this investigative process will entail soliciting feedback and insights from the leadership within the city's traffic construction investment management agencies, thereby engendering a collaborative effort to pinpoint and validate the factors that hold relevance and applicability.

2. OVERVIEW OF INVESTMENT AND CONSTRUCTION OF TRANSPORT INFRASTRUCTURE PROJECTS IN DA NANG CITY FROM 2016 TO 2022

In its role as a catalyst for economic development, the swift allocation and utilization of public investment capital stand as a pivotal imperative. This process serves as a cornerstone, significantly bolstering the realization of socio-economic development objectives and tasks within the framework of Da Nang city. The succinct overview presented in Table 2 encapsulates the progress of disbursing public investment capital for transportation projects in Da Nang city, spanning from 2016 to the present day.

Table 1. The disbursement schedule performance of public investment capital of transport infrastructure projects in Da Nang city from 2016 to 2022 (Unit: Million Dongs)

Year	2016	2017	2018	2019	2020	2021	2022
Capital plan value	228,392	589,403	1,232,968	932,094	466,933	2,254,548	1,734,869
In which: - Construction	192,520	419,399	1,186,598	592,664	390,033	1,753,268	1,161,665
In which: - Compensation	35,872	170,004	76,370	339,430	76,900	501,280	573,204
Disbursement value	167,240	136,912	569,039	602,132	311,922	759,441	1,538,072
In which: - Construction	166,064	133,155	527,800	372,050	270,222	24,016	1,106,783
In which: - Compensation	1,176	3,757	40,920	230,082	41,700	60,200	431,289
Disbursement rate (Schedule performance)	73%	23%	46%	65%	67%	34%	89%
In which: - Construction	86%	32%	44%	63%	69%	1%	95%
In which: - Compensation	3%	2%	54%	68%	54%	12%	75%

Table 1 underscores a significant uptick in the allocation of public investment capital towards transport infrastructure projects, particularly in the aftermath of the COVID-19 pandemic. The pandemic's severe impact, notably during the 2020-2021 period, resulted in alarmingly low capital disbursement rates and nearly halted infrastructure construction activities. However, a marked improvement is evident as of 2022. In 2022, the disbursement of public investment funds, specifically for transport infrastructure projects, exhibited a noteworthy resurgence. The disbursement rate reached an impressive 89%, with the construction and installation sector achieving a commendable 95% disbursement rate, and clearance and compensation efforts reaching 75%.

To ensure smooth operations, the City People's Committee has actively regulated disbursement schedules throughout the year for meticulous implementation. Regular reviews are conducted, and necessary adjustments, transfers, and reductions to the 2022 capital plan are made for projects facing sluggish disbursement. Priority is granted to projects demonstrating readiness, capability, and a pressing need for capital allocation, particularly in the domains of compensation, clearance, settlement, and volume payment.

The city's leadership has been assigned specific responsibilities in various areas and sectors, enabling them to expeditiously address difficulties and challenges as they arise. Moreover, investors and project operators are directed to develop comprehensive disbursement plans, commit to monthly disbursement targets, and enhance project management quality. This approach ensures that construction progresses steadily, with ongoing volume assessments and timely payments to the state treasury, thus mitigating the accumulation of funds until year-end.

3. PROPOSING THE INFLUENCING FACTORS TO SCHEDULE PERFORMANCE OF TRANSPORT INFRASTRUCTURE IN DA NANG CITY

This study conducted surveys through direct interviews with 6 experts who are in the Board of Directors of specialized construction investment management agencies assigned to manage the Da Nang city's transport infrastructure projects. A list of influencing factors, compiled from related studies, was included in the survey. Such factors are categorized into 12 groups,

consisting of land policy and legislation group, project finance group, land plot and project area group, project community group, implementation organization group, investor related group, design consultants related group, management related group, project characteristics group, construction consultants related group, contractors related group, and Other factors. Figure 2 illustrates the affecting factors' research framework in this study. The survey content is developed according to each component stage in the investment implementation process, including: site clearance stage, design - costing phase, bidding phase - contract signing, and phase. construction - acceptance - handover. Interviewees were asked whether they agree or disagree about the factors that affect the progress of the component stages. Tables 2, 3, 4, 5 present the factors responded by experts as affecting factors to the schedule performance of transport infrastructure projects in the investment implementation stage.

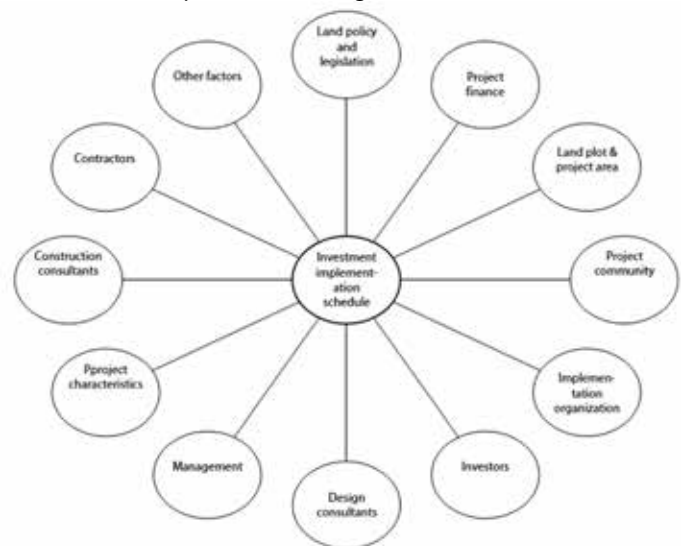


Figure 1. The research framework of affecting factors to investment implementation schedule of transport infrastructure projects

Table 2. Factors affecting the schedule of the ground clearance phase of transport infrastructure projects in Da Nang city

Code	Factors	Freq.	%	Code	Factors	Freq.	%
PLDD	Factor group of Land policy and legislation			TCH2	Deployment of compensation and clearance work	6	100%
PLDD1	Land use planning	6	100%	TCH3	Propagating and disseminating the land legislation	5	83%
PLDD2	Compensation, support, resettlement	6	100%	TCH4	Professional staff's ability to handle work	6	100%
PLDD3	Land registration and Certificates of land use rights	3	50%	TCH5	Transparency	6	100%
PLDD4	Settlement of land complaints and denunciations	5	83%	TCH6	Resolve complaints promptly and thoroughly	6	100%
TCDA	Factor group of project finance			CDT	Factor group of the investors		
TCDA1	Land compensation price	6	100%	CDT1	The investor changes the investment scale	2	33%
TCDA2	Property compensation price	6	100%	CDT2	The investor changes the design	2	33%
TCDA3	Capital	4	67%	CDT5	Investor's capacity in determining project scope	1	17%
TCDA4	Social welfare compensates for affected people (tax exemption, tuition fee, electricity use, etc.)	5	83%	CDT6	Investor's capacity in completing the document	2	33%
KVDA	Factor group of land plot and project area			CDT8	Financial capacity and payment of the Investor	2	33%
KVDA1	Location and profitability	4	67%	CDT9	Competence of specialized personnel of the Investor	4	67%
KVDA2	Acreage	5	83%	CDT12	The Investor closely follows and urges the progress of the project and related works	2	33%
KVDA3	Purpose of using land	5	83%	QLY	Factor group of management		
KVDA4	Legal status of the land plot	5	83%	QLY1	Communication between stakeholders	4	67%
KVDA5	Population density of the project area	5	83%	QLY2	Appropriate management method	2	33%
NDDA	Factor group of project community			DDDA	Factor group of project characteristics		

NDDA1	People's income	6	100%	DDDA1	Project complexity	2	33%
NDDA2	People's intellectual level	6	100%	DDDA2	Project size	2	33%
NDDA3	People's understanding of land legislation	6	100%	YTK	Other factors		
NDDA4	People's customs and habits	6	100%	YTK1	Unpredictable weather conditions	1	17%
NDDA5	People's trust	6	100%	YTK2	Legal regulations and approvals of relevant state management levels	4	67%
TCTH	Factor group of implementation organization			YTK4	Diseases, natural disasters, force majeure	4	67%
TCTH1	Develop compensation and clearance plans	6	100%				

Table 3. Factors affecting the schedule of the design-estimating phase of transport infrastructure projects in Da Nang city

Code	Factors	Freq.	%	Code	Factors	Freq.	%
PLDD	Factor group of Land policy and legislation			CDT8	Financial capacity and payment of the Investor	3	50%
PLDD1	Land use planning	2	33%	CDT9	Competence of specialized personnel of the Investor	5	83%
PLDD2	Compensation, support, resettlement	1	17%	CDT12	The Investor closely follows and urges the progress of the project and related works	3	50%
TCDA	Factor group of project finance			TVTK	Factor group of design consultants		
TCDA2	Property compensation price	1	17%	TVT1	Error in design	5	83%
TCDA3	Capital	3	50%	TVT2	Ability to apply supporting software in design	6	100%
KVDA	Factor group of land plot and project area			TVT3	Designer's experience	6	100%
KVDA1	Location and profitability	1	17%	TVT4	Shortage of design personnel	6	100%
KVDA2	Acreage	1	17%	TVT5	Ability to understand design processes, standards, and standards	5	83%
KVDA3	Purpose of using land	1	17%	QLY	Factor group of management		
NDDA	Factor group of project community			QLY1	Communication between stakeholders	4	67%
NDDA2	People's intellectual level	1	17%	QLY2	Appropriate management method	3	50%
NDDA4	People's customs and habits	1	17%	DDDA	Factor group of project characteristics		
TCTH	Factor group of implementation organization			DDDA1	Project complexity	6	100%
TCTH1	Develop compensation and clearance plans	2	33%	DDD12	Project size	5	83%
TCTH4	Professional staff's ability to handle work	2	33%	TVGS	Factor group of construction consultants		
TCTH5	Transparency	2	33%	TVGS4	An understanding of the supervision consultant's documents, drawings, and project scope	1	17%
CDT	Factor group of the investors			TVGS5	Design change by design consultant	2	33%
CDT1	The investor changes the investment scale	5	83%	TVGS6	Delay in the preparation, review and approval of construction drawings	1	17%
CDT2	The investor changes the design	5	83%	TVGS8	Construction site surveying capacity	2	33%
CDT3	Time to make decisions of investors	3	50%	YTK	Other factors		
CDT4	Investor's approval time	3	50%	YTK1	Unpredictable weather conditions	1	17%
CDT5	Investor's capacity in determining project scope	5	83%	YTK2	Legal regulations and approvals of relevant state management levels	4	67%
CDT6	Investor's capacity in completing the document	6	100%	YTK3	Material price volatility	3	50%
CDT7	Requesting unreasonable progress milestones from the Investor	4	67%	YTK4	Diseases, natural disasters, force majeure	2	33%

Table 4. Factors affecting the schedule of the bidding-contract signing phase of transport infrastructure projects in Da Nang city

Code	Factors	Freq.	%	Code	Factors	Freq.	%
PLDD	Factor group of Land policy and legislation			QLY	Factor group of management		
PLDD2	Compensation, support, resettlement	1	17%	QLY1	Communication between stakeholders	3	50%
TCDA	Factor group of project finance			QLY2	Appropriate management method	3	50%
TCDA3	Capital	4	67%	DDDA	Factor group of project characteristics		
TCTH	Factor group of implementation organization			DDDA1	Project complexity	2	33%

TCTH4	Professional staff's ability to handle work	1	17%	DDDA2	Project size	2	33%
TCTH5	Transparency	2	33%	NTTC	Factor group of contractors		
TCTH6	Resolve complaints promptly and thoroughly	1	17%	NTTC1	Financial capacity	3	50%
CDT	Factor group of the investors			NTTC5	Construction capacity of subcontractors	1	17%
CDT1	The investor changes the investment scale	3	50%	NTTC6	Effectiveness of contractor planning and scheduling	1	17%
CDT2	The investor changes the design	1	17%	NTTC7	Contractor's experience	3	50%
CDT3	Time to make decisions of investors	3	50%	NTTC9	Suitable construction method	1	17%
CDT4	Investor's approval time	3	50%	NTTC10	Competence of the contractor's technical team	1	17%
CDT5	Investor's capacity in determining project scope	2	33%	TVGS	Factor group of construction consultants		
CDT6	Investor's capacity in completing the document	1	17%	TVGS5	Design change by design consultant	2	33%
CDT7	Requesting unreasonable progress milestones from the Investor	2	33%	TVGS6	Delay in the preparation, review and approval of construction drawings	2	33%
CDT9	Competence of specialized personnel of the Investor	4	67%	TVGS7	Contract management capabilities	2	33%
CDT10	Ability to organize contractor selection ensures transparency	5	83%	TVGS8	Construction site surveying capacity	1	17%
CDT11	The ability to draft and manage contracts is tight and clear	3	50%	YTK	Other factors		
CDT12	The Investor closely follows and urges the progress of the project and related works	3	50%	YTK2	Legal regulations and approvals of relevant state management levels	2	33%
TVTK	Factor group of design consultants			YTK3	Material price volatility	2	33%
TVTK1	Error in design	1	17%	YTK4	Diseases, natural disasters, force majeure	2	33%
TVTK5	Ability to understand design processes, standards, and standards	1					

Table 5. Factors affecting the schedule of the construction - acceptance - handover phase of transport infrastructure projects in Da Nang city

Code	Factors	Freq.	%	Code	Factors	Freq.	%
PLDD	Factor group of Land policy and legislation			TVTK3	Designer's experience	2	33%
PLDD1	Land use planning	1	17%	TVTK4	Shortage of design personnel	2	33%
PLDD2	Compensation, support, resettlement	2	33%	TVTK5	Ability to understand design processes, standards, and standards	2	33%
PLDD4	Settlement of land complaints and denunciations	3	50%	QLY	Factor group of management		
TCDA	Factor group of project finance			QLY1	Communication between stakeholders	6	100%
TCDA1	Land compensation price	1	17%	QLY2	Appropriate management method	5	83%
TCDA3	Capital	5	83%	DDDA	Factor group of project characteristics		
TCDA4	Social welfare compensates for affected people (tax exemption, tuition fee, electricity use, etc.)	2	33%	DDDA1	Project complexity	5	83%
KVDA	Factor group of land plot and project area			DDDA2	Project size	4	67%
KVDA2	Acreage	1	17%	NTTC	Factor group of contractors		
KVDA3	Purpose of using land	1	17%	NTTC1	Financial capacity	6	100%
KVDA4	Legality of the land plot	1	17%	NTTC2	Site management and supervision capacity	6	100%
KVDA5	Population density of the project area	3	50%	NTTC3	Ability to mobilize and supply materials	5	83%
NDDA	Factor group of project community			NTTC4	Level of errors and errors in construction	5	83%
NDDA2	People's intellectual level	2	33%	NTTC5	Construction capacity of subcontractors	6	100%
NDDA3	People's understanding of land legislation	1	17%	NTTC6	Effectiveness of contractor planning and scheduling	6	100%
NDDA4	People's customs and habits	4	67%	NTTC7	Contractor's experience	5	83%
NDDA5	People's trust	3	50%	NTTC8	Level of defects, supply and availability of construction machinery	5	83%

Code	Factors	Freq.	%	Code	Factors	Freq.	%
TCTH	Factor group of implementation organization			NTTC9	Suitable construction method	6	100%
TCTH1	Develop compensation and clearance plans	1	17%	NTTC10	Competence of the contractor's technical team	6	100%
TCTH2	Deployment of compensation and clearance work	3	50%	NTTC11	Competence of personnel in charge of as-built documents and contractor's payment	4	67%
TCTH3	Propagating and disseminating the land legislation	1	17%	NTTC12	Ability to ensure construction manpower	5	83%
TCTH4	Professional staff's ability to handle work	2	33%	NTTC13	Skill level of construction workforce	6	100%
TCTH5	Transparency	2	33%	NTTC14	Labor productivity of construction workers	6	100%
TCTH6	Resolve complaints promptly and thoroughly	3	50%	NTTC15	Productivity of machinery and equipment	6	100%
CDT	Factor group of the investors			NTTC16	The level of accuracy of the estimate of materials needed for construction	5	83%
CDT1	The investor changes the investment scale	5	83%	TVGS	Factor group of construction consultants		
CDT2	The investor changes the design	5	83%	TVGS1	Construction supervision capacity	4	67%
CDT3	Time to make decisions of investors	2	33%	TVGS2	Time for decision making, response, guidance of supervision consultant	6	100%
CDT4	Investor's approval time	2	33%	TVGS3	Competence and experience of supervision consultant	6	100%
CDT5	Investor's capacity in determining project scope	1	17%	TVGS4	An understanding of the supervision consultant's documents, drawings, and project scope	5	83%
CDT6	Investor's capacity in completing the document	3	50%	TVGS5	Design change by design consultant	4	67%
CDT7	Requesting unreasonable progress milestones from the Investor	4	67%	TVGS6	Delay in the preparation, review and approval of construction drawings	3	50%
CDT8	Financial capacity and payment of the Investor	6	100%	TVGS7	Contract management capabilities	3	50%
CDT9	Competence of specialized personnel of the Investor	5	83%	TVGS8	Construction site surveying capacity	6	100%
CDT10	Ability to organize contractor selection ensures transparency	1	17%	YTK	Other factors		
CDT11	The ability to draft and manage contracts is tight and clear	3	50%	YTK1	Unpredictable weather conditions	6	100%
CDT12	The Investor closely follows and urges the progress of the project and related works	6	100%	YTK2	Legal regulations and approvals of relevant state management levels	5	83%
TVTK	Factor group of design consultants			YTK3	Material price volatility	6	100%
TVTK1	Error in design	5	83%	YTK4	Diseases, natural disasters, force majeure	6	100%

As the result, there are factors recognized totally by all experts to be top factors affecting to schedule of transportation infrastructure projects in each phase of the investment implementation stage. This demonstrates the absolute consistency of all experts. For the phase of ground clearance, there are 13 top factors, including Land use planning (PLDD1), Compensation, support, resettlement (PLDD2), Land compensation price (TCDA1), Property compensation price (TCDA2), People's income (NDDA1), People's intellectual level (NDDA2), People's understanding of land legislation (NDDA3), People's customs and habits (NDDA4), People's trust (NDDA5), Develop compensation and clearance plans (TCTH1), Professional staff's ability to handle work (TCTH4), Transparency (TCTH5), Resolve complaints promptly and thoroughly (TCTH6). For the phase of design-estimating signing, the top factors are Investor's capacity in completing the document (CDT6), Ability to apply supporting software in design (TVTK2), Designer's experience (TVTK3), Shortage of design personnel (TVTK4), Project complexity (DDDA1). For the phase of bidding-contract signing, there is no top factors, so this shows that there's no totally consistency of senior leaders. However, there are 3 significant factors that agreed by the majority of experts (over 80% of respondents), including Competence of specialized personnel of

the Investor (CDT9), Ability to organize contractor selection ensures transparency (CDT10), and Project Capital (TCDA3). For the construction - acceptance - handover phase, there are 18 top factors, consisting of Communication between stakeholders (QLY1), Financial capacity of contactors (NTTC1), Site management and supervision capacity of contractors (NTTC2), Construction capacity of subcontractors (NTTC5), Effectiveness of contractor planning and scheduling (NTTC6), Suitable construction method (NTTC9), Competence of the contractor's technical team (NTTC10), Skill level of construction workforce (NTTC13), Labor productivity of construction workers (NTTC14), Productivity of machinery and equipment (NTTC15), Financial capacity and payment of the Investor (CDT8), The Investor closely follows and urges the progress of the project and related works (CDT12), Time for decision making, response, guidance of supervision consultant (TVGS2), Competence and experience of supervision consultant (TVGS3), Construction site surveying capacity of construction consultants (TVGS8), Unpredictable weather conditions (YTK1), Material price volatility (YTK3), Diseases, natural disasters, force majeure (YTK4).

The distribution of the top factors within each project phase is shown in Figure 2. Accordingly, the schedule performance of

ground clearance phase could be improved if the subjects related to land policies and legislation, project finance, project community, and implementation organization are focused highly. The role of investors, the capacity of design consultants, and the thoroughly understanding of project characteristics help to enhance the design-estimation phase schedule. Whereas, the capacity of investors and the project finance are two significant factor groups deciding to the schedule of bidding phase. In order to ensure the schedule of construction - acceptance - handover phase, the main stakeholders including the investors, contractors, and supervision consultants, and the external objective factors contributes the key of project schedule success. Overall, this study highly appreciates the role, capacity, and the fierce participation of investors in each project phase as the key for the transport infrastructure project success.

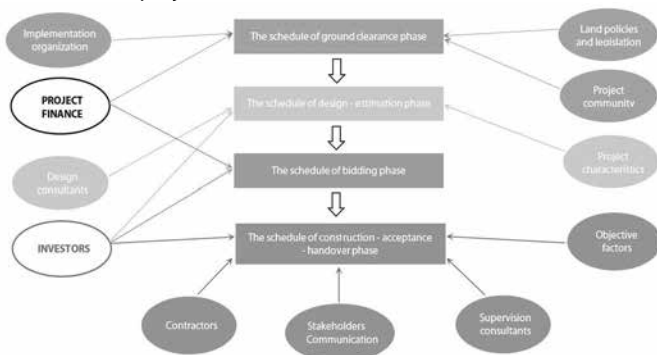


Figure 2. The distribution of the top factors affecting to schedule within each transport infrastructure project phase

4. CONCLUSIONS

This study represents a comprehensive examination and analysis of the actual investment implementation schedules for transport infrastructure projects in Da Nang City spanning from 2016 to the present. Notably, Da Nang City regards the disbursement rate of public investment capital as a pivotal criterion for gauging the success of public investment projects in general, and transport infrastructure projects in particular. During the challenging period characterized by the profound impact of the COVID-19 pandemic, notably from 2020 to 2021, there was a conspicuous decline in capital disbursement rates, almost causing a standstill in infrastructure construction activities. Nevertheless, by the year 2022, a significant improvement was observed. The disbursement rate of public investment, specifically for transport infrastructure projects, surged to 89%, with the construction and installation sector achieving an impressive 95% disbursement rate, while the clearance and compensation efforts reached a commendable 75%.

The methodology employed in this study involved conducting surveys through direct interviews with six experts serving on the Boards of Directors of specialized construction investment management agencies tasked with overseeing Da Nang City's transport infrastructure projects. A meticulously compiled list of influencing factors, drawn from prior research, was incorporated into the survey, categorized into 12 distinct groups. The survey content was meticulously developed to align with each component stage of the investment implementation process, encompassing the site clearance stage, design and costing phase, bidding phase, contract signing, and the construction, acceptance, and handover phases.

As a result of this comprehensive study, a total of 13 paramount factors impacting the schedule of the ground clearance phase, five

pivotal factors significantly influencing the design and estimation phase, three crucial factors with substantial impact on the bidding and contract signing phase, and 18 leading factors impacting the construction, acceptance, and handover phases of transport infrastructure projects in Da Nang City have been identified. These critical factors hold immense potential in guiding the formulation of strategies and policies aimed at enhancing the efficiency of the city's transport infrastructure projects in the foreseeable future.

For future work, the authors will conduct the mass survey to engineers and managers who participated to the schedule management of transportation infrastructure projects in Da Nang city to validate comprehensively as well as to increase the reliability of the study result.

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