

Traffic Control Management at the Policy Level: A Qualitative Study at the Batam Transportation Agency

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ABSTRACT

Increasingly complex urban mobility demands traffic supervision that is not only effective in the field but also supported by structured and integrated policy management. This study analyzes traffic supervision management at the policy level at the Batam City Transportation Agency, focusing on (1) the formulation of supervision and enforcement policies, (2) structural planning and decision-making, (3) governance of supervision implementation, including coordination, division of authority, and resource readiness; and (4) policy monitoring and evaluation. The study used a qualitative approach, with data collected through in-depth interviews with key traffic supervision actors at the Transportation Agency, observations of supervision activities, and reviews of policy and operational documents. Analysis was conducted thematically using an interactive model and triangulation of sources and techniques to increase the validity of the findings. The results show that the supervision policy framework tends to be responsive to daily issues but is not fully data-driven or systematic in its evaluation; this impacts variations in implementation, limited resource synchronization, inconsistent cross-agency coordination mechanisms, and monitoring and evaluation feedback. This study recommends strengthening oversight governance by standardizing risk-based SOPs, integrating data and performance indicators, institutionalizing coordination, and developing a sustainable monitoring and evaluation system to promote order, safety, and traffic efficiency in Batam City.

Keywords : Traffic control; policy implementation; governance; monitoring and evaluation; Batam, Indonesia

INTRODUCTION

Increasingly complex urban mobility demands traffic governance that goes beyond on-the-ground enforcement and is supported by policy management that can set priorities, integrate actors, and ensure consistent outcomes. The transportation literature emphasizes that urban mobility challenges are not merely technical issues of road networks, but rather policy and governance issues: how cities manage travel demand, reduce congestion externalities, and build more sustainable systems through publicly acceptable and institutionally operational policy instruments (Banister, 2008; Lodan et al., 2023). From this perspective, transportation management and policy studies need to focus on how policy decisions are made, implemented, and evaluated, as the quality of the policy process significantly determines the effectiveness of mobility outcomes (Marsden & Reardon, 2017).

Batam City is a relevant context for examining these issues. As a strategic industrial and logistics hub, Batam experiences high, fluctuating flows of people and goods. Intermodal mobility indicators showed significant intensity in February 2024, with 275,301 domestic air passengers and 305,474 domestic sea passengers (BPS, 2024). The large flow of mobility signals the pressure of travel demand, which requires orchestration of traffic control policies to maintain order, safety, and smooth flow within the dynamics of industrial cities (Khairina et al., 2025; Paselle et al., 2024). In practice, mobility pressure manifests itself in congestion in activity corridors, increased road user violations, and the need for responsive yet consistent intersection and traffic management (Ahsani et al., 2022; Kurniawan et al., 2023).

Efforts to modernize traffic control infrastructure in Batam also demonstrate that traffic oversight is increasingly dependent on systems and policy decisions. The 2024 performance report of the Batam City Transportation Agency recorded traffic light maintenance at 38 intersections; 31 intersections have integrated ATCS (Area Traffic Control System), while 6 intersections still do not. This is important because it confirms two things: (i) there is investment and differentiation in control capacity (ATCS and non-ATCS) across the intersection network; and (ii) the effectiveness of oversight rests not only on field operations but also on policies governing device standardization, resource allocation, decision-making procedures, and data-driven follow-up mechanisms. This means that modernizing equipment demands modernizing governance: without policies that integrate data, SOPs, coordination, and evaluation, technology can become infrastructure without policy levers.

However, strengthening traffic control policies faces classic public-sector implementation challenges: fragmented authority, complex cross-agency coordination, limited resources, and varying policy interpretations at the implementation level (Oktavianti et al., 2025; Tibrani et al., 2024). Policy implementation research confirms that policy outcomes are heavily influenced by implementation design, organizational capacity, and interactions between actors during program execution (Meier & O'Toole, 2006; O'Toole & Meier, 2004). In the transportation sector, governance literature also shows that policies involving multiple actors and objectives are prone to inconsistency if not supported by precise coordination and accountability mechanisms. Therefore, studies that place traffic control at the policy level are crucial: not only for assessing whether operations are running, but also for examining how policies shape operations through planning, authority allocation, procedural standardization, and monitoring and evaluation.

In the Indonesian context, studies of policy implementation in the transportation sector indicate that oversight is often hampered by capacity constraints and inconsistent implementation (Kadarisman et al., 2017). Research by Nursasi & Yenita (2023) on the implementation of overload control and supervision policies in regional transportation agencies indicates that successful oversight requires adequate implementation support—including

resources, work arrangements, and effective control mechanisms. Conversely, Junaid (2019) and Loilatu et al (2020) highlighted ATCS and intersection management as critical issues and emphasize the need for data integration and decision-making in traffic control. However, a notable gap is the limited number of studies that specifically examine traffic oversight management at the policy level in city transportation agencies—particularly in industrial-logistics cities like Batam focusing on the management and policy chain from formulation, decision planning, implementation, governance, to evaluation.

Building on this gap, this study focuses its analysis on traffic oversight management at the policy level in the Batam City Transportation Agency. Substantively, this research examines: (1) how oversight policies are formulated and established as work directions; (2) how planning and decision-making processes are carried out at the structural level; (3) how governance of oversight implementation operates through coordination, division of authority, and resource readiness; and (4) how monitoring and evaluation systems are operationalized as feedback for improvement. Methodologically, the research uses a qualitative case study design to capture the processual, multi-actor, and contextual dynamics of policy, which often cannot be adequately explained by quantitative indicators alone.

This research is expected to contribute in two directions. First, a theoretical contribution: enriching the literature on traffic governance and transportation policy studies by demonstrating how management and governance dimensions operate at the local government organizational level, in line with calls from transportation literature that emphasize the importance of a governance perspective in transportation policy studies (Hasibuan & Mulyani, 2022; Papadakis et al., 2024; Rivera-Coloma et al., 2025). Secondly, a practical contribution: providing recommendations for strengthening policy capacity from standardizing data-driven standard operating procedures (SOPs), institutionalizing cross-agency coordination, to designing ongoing monitoring and evaluation so that traffic supervision is not merely a daily response, but rather a consistent and measurable policy strategy for improving order, safety, and efficiency in urban mobility. In the following sections, this study presents a literature review that positions traffic supervision as a policy and governance problem, explains the qualitative study method, presents findings on supervision management at the policy level, and discusses implications for improving traffic supervision policies and practices.

The literature on urban traffic governance increasingly emphasizes that traffic control is not simply a technical issue, but rather a socio-technical policy regime that links technological tools, institutional design, and data-driven decision-making mechanisms. Within an innovative city framework, the development of smart transportation services is understood as part of an orchestration across technologies, organizations, and services, requiring alignment of strategy, institutional capacity, and implementation architecture (Elassy et al., 2024; Lee et al., 2014).

From a policy design perspective, traffic control can be viewed as a policy mix combining substantive and procedural instruments. Policy design studies emphasize that policy success depends on coherence and consistency across instruments-implementation sequencing, fit with the local context, and the policy's ability to learn from implementation. At this point, the issue is not just the tools used, but also the instruments used to avoid fragmentation and duplication of authority (Howlett & Mukherjee, 2014; Howlett & Rayner, 2007).

Furthermore, the public sector innovation literature views the implementation of traffic monitoring and control systems as a service innovation, heavily influenced by inter-organizational networks and leadership. Innovation capacity grows when public organizations can build functional networks, manage inter-actor dependencies, and overcome coordination barriers, such as differences in mandates, work standards, and incentives. Studies on public

innovation show that networks, collaboration, and operational leadership determine whether innovation becomes an institutional routine or stalls at the project phase (Bekkers & Tummers, 2018; Lewis et al., 2018).

In the context of performance management, traffic monitoring requires indicators that extend beyond the number of monitored points and recorded violations, but also assess improvements in travel time, queue length, safety, and process quality, including data reliability, responsiveness, and consistency of enforcement. This aligns with Nielsen (2014) principle that performance management emphasizes that performance feedback can drive organizational learning, but is only effective when indicators are linked to apparent managerial authority, follow-up mechanisms, and procedural corrections.

Finally, debates emerging in local Indonesian studies also provide important insights. According to Pratiwi et al (2024) and Sholeh et al (2019), innovative city and innovation policy formulation (the smart transportation dimension) tends to be effective when embedded within a broader policy design, rather than as a stand-alone technology package. These findings are relevant to justifying the focus of qualitative research on traffic monitoring policy management, specifically how instrument design, coordination, and data use are implemented as daily institutional practices.

RESEARCH METHOD

This research uses a qualitative case study design to deeply understand how traffic control management at the policy level is formulated, implemented, and evaluated at the Batam City Transportation Agency (Dishub). This case study was chosen because the issue under study is processual, multi-actor, and contextual, requiring an exploration of internal organizational mechanisms (decision-making processes, coordination, standard operating procedures, and monitoring and evaluation systems) that cannot be adequately explained by quantitative indicators alone. The unit of analysis for this research is traffic control management at the policy level at the Batam City Transportation Agency, encompassing four domains: (1) policy formulation and enforcement/supervision; (2) structural planning and decision-making; (3) implementation governance (coordination, division of authority, resource readiness); and (4) policy monitoring-evaluation.

The research location was determined within the Batam City Transportation Agency, with a focus on functions directly related to traffic control and enforcement, including intersection control/ATCC, traffic regulation and engineering, joint enforcement/regulation, and program planning and performance evaluation. Batam was selected based on its industrial-logistics character, with its high mobility dynamics, which require consistent supervisory policies, actor coordination, and the use of data to inform decision-making.

Furthermore, data sources included primary and secondary data. Primary data were obtained through in-depth interviews and observations. Informants were identified through purposive sampling based on their roles and knowledge of supervisory policies, and snowball sampling was used to reach relevant actors in the policy implementation chain. As part of the operational design, the study involved 15 key informants, including heads of relevant divisions, heads of control/supervision sections, operators or coordinators of control centers, field coordinators/supervision officers, program planners, and cross-actor coordination partners. Secondary data were also sourced from documents and work archives to support the accuracy of the primary data and other statements.

Data collection was conducted through three main techniques: semi-structured in-depth interviews to explore the basis for policy considerations; priority-setting processes; task and authority allocation mechanisms; coordination flows; data/information use; and monitoring,

evaluation, monitoring, evaluation, and follow-up practices. The interview guide was developed based on four research focuses and tested with 1–2 initial respondents to ensure clarity.

Observations were conducted on activities reflecting policy in practice, such as coordination meetings, control/monitoring center activities, or the implementation of supervision/enforcement operations at vulnerable points. Observations were recorded in structured field notes: context, actors, decisions, procedures used, and deviations from standard operating procedures (SOPs). Documentation studies were conducted to assess consistency between policy design and activity practices through documented, coordinated implementation aligned with performance indicators.

Finally, data analysis was conducted thematically using an interactive model: data reduction, data presentation, and iterative conclusion drawing. The stages were: (1) transcribing interviews and organizing observation notes; (2) open coding to find initial categories that include policy priorities, resource allocation, coordination, database, SOP compliance, monitoring and evaluation and feedback; (3) axial coding to connect categories to the four research focuses; (4) compilation of key themes that explain the pattern of supervisory policy management; and (5) verification of findings through comparisons between sources and document evidence searches.

RESULTS

This section presents empirical findings regarding how traffic control management at the policy level is implemented at the Batam City Transportation Agency. The findings are organized into four clusters according to the research focus: (1) supervision/regulation policy formulation; (2) planning and decision-making; (3) implementation governance (coordination, division of authority, and resource readiness); and (4) monitoring and evaluation. Data for the findings are summarized from key informant interviews with (structural leaders, field coordinators, system operators/managers, program planners), limited observations of supervision and coordination activities, and a review of internal documents (SOPs, summary work plans, activity reports, and meeting materials).

Policy Formulation Pattern: Responsive, But Not Consistently Data-Based

The findings indicate that traffic control/regulation policies tend to be shaped by a pattern of rapid responses to problems observed in public spaces. In many cases, issues are triggered by a combination of public complaints, local media coverage, increased congestion during peak hours, and incidental events such as accidents or traffic disruptions in specific corridors. Policy formulation in the form of operational directives, the establishment of monitoring points, or temporary engineering adjustments generally arises from the need to maintain traffic stability. Consequently, policies are strong in terms of agility but weak in terms of strategic consistency across periods.

On the other hand, some units have utilized internal data to set priorities. However, the data quality is primarily descriptive and based on field experience, and has not yet been developed into consistent indicators. This often shifts policies from a performance-based analysis to one based on urgency, allowing rapid changes in priorities without a consistent measurement basis.

Planning and Decision-Making: Rapid in Urgent Situations, Multilevel for Structural Change

At the structural level, decision-making is divided into two pathways. First, the tactical-operational pathway for daily needs (personnel assignments, the establishment of monitoring points, temporary enforcement) can be decided relatively quickly through leadership direction and internal coordination. Second, the policy pathway with structural impacts (procedural restructuring, resource allocation adjustments, document standardization, or system integration plans) requires a multi-step process and relies on cross-unit support and budget availability.

Findings show that tactical channels often operate effectively due to established chains of command and coordination practices. However, when fieldwork requires systemic changes, such as standardizing SOPs across activities or improving documentation flows, processes become slower. Delays are primarily related to the need for harmonization between units, the preparation of supporting documents, and adjustments to budget priorities.

Management and Governance of Implementation

In the implementation of supervision, there is a relatively straightforward division of labor in routine activities: field assignments, point management, and response to traffic disruptions. However, governance effectiveness increases significantly when cross-agency coordination is in place, namely, police support for specific enforcement actions or joint arrangements for significant events. A key finding is that cross-agency coordination is often event-driven, intensifying during certain major holidays, city activities, or peak traffic volumes, then decreasing when supervision intensity returns to normal.

Daily coordination is primarily supported by informal communication channels, which help expedite response but have weaknesses in institutional memory: decisions and operational rationales are not always formally documented, making them difficult to trace during evaluations or personnel changes. In some cases, effective coordination relies heavily on a coordinator or experienced officer, so when such a person is not on duty, implementation consistency decreases.

In addition to coordination, resource readiness is a key differentiating factor. Findings indicate a gap between the need for supervision at vulnerable locations and the availability of personnel, operational support for field equipment, data access, and documentation support. This situation encourages officers to prioritize locations with the highest risk or the most frequent complaints, while other locations are monitored on a rotating basis. This prioritization is quite effective in the short term, but it leads to a pattern of moving locations or shifting violations to other locations as supervision intensity decreases.

Standard Operating Procedures and Documentation

Findings indicate that standard operating procedures (SOPs) for supervision and enforcement serve as work guidelines. However, implementation of these SOPs is not always uniform because field conditions require improvisation, particularly when facing high traffic congestion or road user resistance. Variations in implementation are evident in how officers define priority violations, the sequence of warning actions, regulations, enforcement, and the completeness of activity documentation. Activity report documents are generally available, but the recorded details are not always sufficient to provide robust evaluations, resulting in inconsistent recording of event timing, intervention duration, or changes in before-and-after conditions.

This discrepancy in documentation has implications for a weak feedback loop: because input data is not uniform, policy learning is limited. Some units have attempted to develop more standardized formats, but these have not yet become standardized across activities.

Monitoring and Evaluation

Monitoring supervisory activities is relatively straightforward through output indicators such as the number of activities, the number of points supervised, or implementation reports. However, outcome-based evaluations, such as reduced queues, improved traffic flow on specific corridors, or reduced repeat violations, have not been consistently implemented. This finding indicates that the monitoring and evaluation system functions primarily as a means of administrative accountability reporting rather than as a measurable policy-learning instrument.

When evaluations are conducted, they typically take the form of short post-activity meetings that highlight field obstacles and support needs. However, meeting recommendations often remains at the record level and is not translated into changes to standard operating procedures (SOPs), adjustments to the division of labor, or strengthening of indicators. In some cases, evaluations are stronger for large activities or joint operations, while for routine activities, evaluations tend to be minimal. Overall findings are shown in Table 1.

Table 1. Findings, Evidence and Operational Impact of Batam Traffic Governance Management

Impact of Policy Consistency	Impact of Policy Consistency	Impact of Policy Consistency	Impact of Policy Consistency	Impact of Policy Consistency
Lack of stability in the medium-term strategy	Lack of stability in the medium-term strategy	Lack of stability in the medium-term strategy	Lack of stability in the medium-term strategy	Lack of stability in the medium-term strategy
Delayed procedural improvements	Delayed procedural improvements	Delayed procedural improvements	Delayed procedural improvements	Delayed procedural improvements
Dependence on momentum and personal relationships	Dependence on momentum and personal relationships	Dependence on momentum and personal relationships	Dependence on momentum and personal relationships	Dependence on momentum and personal relationships
Data is difficult to provide a solid basis for evaluation	Data is difficult to provide a solid basis for evaluation	Data is difficult to provide a solid basis for evaluation	Data is difficult to provide a solid basis for evaluation	Data is difficult to provide a solid basis for evaluation
Less measurable policy learning	Less measurable policy learning	Less measurable policy learning	Less measurable policy learning	Less measurable policy learning

Overall, traffic oversight management at the policy level in the Batam City Transportation Agency demonstrates an adaptive configuration in responding to field dynamics, but faces three recurring bottlenecks: (1) a database and indicators that have not been standardized to strengthen priority setting; (2) cross-actor coordination that still relies on timing and personal networks; and (3) monitoring and evaluation that prioritizes output reporting over proving outcomes and policy follow-up. These findings provide a direct basis for interpreting why policies tend to be responsive, how variations in SOPs occur, and what institutional consequences weak monitoring and evaluation feedback have on oversight consistency.

Discussion

The findings of this study illustrate the maturity of traffic oversight governance, which is shifting from a rapid-response to a standardized, measurable policy framework. In the policy literature, this condition is common when public organizations face dynamic, multi-actor, and socially sensitive issues, leading day-to-day decisions to be driven by field urgency. Furthermore, from a policy instrumentation perspective, policy has not been fully calibrated as a learning system. The design for the service framework emphasizes the importance of procedural policy instruments so that policies do not stop at programs, but rather function as consistent service designs across situations.

Findings on strong incident response monitoring policies indicate that traffic problems are primarily understood as disruptions that must be addressed immediately, rather than as risk patterns that need to be broken down into indicators and subjected to repeated interventions. The root problem design perspective helps explain this: when the problem definition is predominantly situational, policy design tends to produce situational instruments rather than system-stabilizing ones such as data standards, outcome indicators, and coordination protocols.

The implication is that shifting from responsive to strategic is not simply achieved by increasing operations, but by standardizing how organizations define problems, classify hotspots based on safety risks, congestion, repeat violations, and thresholds for triggering intervention, and set rules of engagement between stakeholders. Here, policy micro-designs must have clear targets, agreed-upon performance measures, and replicable calibrations of warning, engineering, and enforcement actions (Virani et al., 2024; Wellstead & Howlett, 2024).

Furthermore, findings regarding coordination that strengthens at certain moments and then weakens during regular periods indicate a pattern of collaboration that has not yet been fully institutionalized. The literature on performance management in collaborative governance, by Waardenburg et al (2025), emphasizes that collaboration will be fragile if performance is measured only at the output level of each organization, without shared indicators, compatible reporting mechanisms, and evaluation forums that serve as cross-stakeholder decision-making engines.

In other words, the core challenge is not simply a lack of coordination, but rather that coordination has not yet become a shared performance system. This idea aligns with recent studies on the evolution of performance management systems in public sector networks, which view PMS as a socio-technical system: influenced by external triggers, program cycle constraints, and building blocks such as data, standards, roles, and feedback procedures (Kravariti et al., 2023). In traffic monitoring, the most crucial building blocks include the definition of shared indicators, data and evidence protocols, and periodic evaluation forums that inform corrective decisions.

From the perspective of variations in SOP implementation as a symptom of the gap between standards and situations, these findings are interpreted as a gap between formal standards and the need for adaptation in the field. The literature on innovative mobility projects shows that programs involving technology and field operations operate through a policy cycle that demands alignment among procedures, resources, and decision-making governance; otherwise, they tend to rely on key actors and informal practices (Lutfiyya et al., 2026; Simonofski et al., 2023).

This means that variations in SOPs are not simply a matter of individual discipline but a sign that the SOPs are not operationally adequate to address varying situations, such as road user resistance, traffic spikes, and device constraints. In the realm of policy design, this problem is addressed by strengthening procedural instruments, such as minimum-evidence checklists,

formats for action timelines and outcomes, and standards for recording and intervention patterns. This approach maintains flexibility but makes it visible and testable through a documentation trail.

Furthermore, the finding that monitoring is predominantly focused on output is also relevant to the experience of ATCS/ITS implementation in various regions. A study by Aini et al (2024) confirmed that ATCS evaluation in Indonesia showed that ATCS implementation can reduce delays during some peak periods. However, improvements do not necessarily change the overall level of service, indicating the need for outcome-based evaluation and more comprehensive intervention design. On the other hand, ATCS implementation inherently emphasizes typical operational constraints, including funding limitations, equipment failures, and challenges with road user discipline. Therefore, the technology's success is primarily determined by operational capacity and binding policy governance. For the Transportation Agency (Dishub), the policy message is clear: monitoring technology is only effective if supported by data standards, decision-making protocols, and impact evaluations that form the basis for revised SOPs.

Correlating with this, the findings of strong monitoring and evaluation (M&E) on output but weak on outcome can be strengthened by an urban mobility framework that emphasizes that evaluation should track the effectiveness, efficiency, and sustainability of policies, and be tailored to the conditions of the transportation system and the scale of city challenges. In practice, the shift begins with feasible minimum viable metrics, the frequency of repeated violations at vulnerable points, and compliance with documentation procedures. These items constitute a small but consistent set of indicators and are more useful than many indicators that are never used to inform inclusive decisions.

Table 2. Conceptual Realization and Future Policy Emphasis

Focus of Findings	Theoretical Interpretation	Future Management and Policy Directions
Policies tend to be incidental-responsive	Situational problem framing shapes situational instrument design	Risk classification, intervention trigger thresholds, action calibration (micro-design)
Coordination is stronger at specific times	Collaboration has not yet become a shared performance system	Common indicators, cross-stakeholder data protocols, periodic evaluation forums
SOPs and documentation vary	The smart mobility cycle requires alignment of procedures, resources, and decisions	Minimum evidence checklist, standard reporting format, before-after standards
Monev is predominantly output-driven	M&E must be outcome-oriented and policy-learning-oriented	Minimum viable outcome metrics, SOP follow-up, and resource allocation

Conceptually, the findings of this study lead to a discussion conclusion: traffic oversight at the policy level will be more stable if the Transportation Agency (Dishub) establishes three anchors: operational procedural instrument design, cross-agency collaboration based on shared performance, and outcome monitoring and evaluation that results in corrective decisions. This framework is consistent with recent literature that positions policy as a public service design and emphasizes the importance of performance systems within collaborative networks, rather than simply the activities of a single organization.

CONCLUSION

This qualitative research concludes that traffic oversight management at the policy level in the Batam City Transportation Agency has demonstrated a rapid response capacity to mobility dynamics. However, policy consistency is still determined by the strength of procedural instruments, the institutionalization of cross-actor coordination, and the effectiveness of monitoring and evaluation as a learning mechanism. In other words, oversight effectiveness depends not only on operational intensity but also on the policy's ability to transform field information into standardized, replicable, and accountable decisions through indicators and procedural traces. This synthesis emphasizes the importance of root problem design and the integration of procedural and substantive instruments to prevent oversight practices from devolving into repetitive, reactive actions.

Practically, the research findings lead to four policy implications. First, strengthening risk-based prioritization by classifying vulnerable points and setting intervention thresholds to prevent priorities from changing solely due to incidental pressures. Second, strengthening procedural instruments to reduce variation in implementation and strengthen accountability for field decisions. The service framework emphasizes that specifying such procedural instruments is key to ensuring consistent public services, rather than relying solely on informal networks. Third, building a collaborative performance system across agencies to prevent coordination from being event-driven. Fourth, shifting monitoring and evaluation (M&E) from reporting outputs to measuring feasible outcomes aligns with the principles of M&E in sustainable urban mobility planning.

The limitations of the study include the case study design in a single city, which makes generalizations analytical rather than statistical; the scope of observations dependent on access and activities, so not all variations in situations can be observed equally; limited access to sensitive or poorly documented operational data, which limits comprehensive decision-making; and the dominance of informant perception data on several issues that require strengthening quantitative evidence of impact.

Further research is recommended to conduct comparative studies to examine patterns of oversight policy governance; combine qualitative designs with quantitative outcome measures to assess policy impact more measurably; evaluate indicator design and data architecture as the foundation for M&E; and examine the dynamics of stakeholder collaboration using a collaborative performance management framework to create precise recommendations for institutionalizing coordination.

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