International Journal of Scientific Multidisciplinary Research (IJSMR)
Vol. 4, No. 5, 2026: 691 - 700

Risks Left Unchecked : Legal and Policy Analysis on Crossing A plot Without Security

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A R T I CLEINFO

Keywords: Crossing One Plot, Safety Transportation, Legal Responsibility

Received : 12, March
Revised : 13, April
Accepted: 30, May

A B STR A CT

This study examines legal and policy gaps in managing unprotected railway level crossings amid increasing train frequency and rising road traffic in Indonesia. It aims to assess risk exposure and clarify institutional responsibility, contributing a legal-risk integration framework. Using a mixed-method approach, the study analyzes statutory regulations, accident data, and field observations across selected crossings, with interviews of stakeholders conducted over a six-month period. Key variables include train frequency, traffic volume, safety infrastructure, and regulatory compliance. Findings reveal a significant gap between legal norms and on-ground implementation, resulting in systemic safety risks. The study recommends regulatory reinforcement, clear allocation of authority, and technology based safety interventions to reduce accidents and improve public protection.

INTRODUCTION

Improvement frequency journey train fire reflect acceleration development transportation national . Intensity increasingly operational tall strengthen role train fire as fashion strategic in mobility passengers and distribution logistics . Conditions the No accompanied with strengthening system safety at crossings a plot . Existence crossing without cross Still found in various regions with level density Then continuous traffic increase .

Vulnerability safety appears at the crossing in the area settlements , centers activity economy , as well as track distribution main . Interaction between current vehicles and frequencies journey train create conflict Then repeated crossing . Events accidents at crossings without security show consistent pattern , in the form of collision between trains and vehicles motorized with fatal impact on safety loss of life and material loss .

Foundation normative safety transportation has confirmed in Constitution Number 23 of 2007 concerning Railways and the Law Number 22 of 2009 concerning Road Traffic and Transportation . Principles safety placed as priority main in organization transportation . The norm contain state obligation to ensure protection to users road . Reality empirical show mismatch between norm law and implementation policy . Crossing without cross still operate without system adequate security .

Frequency journey rising train cause duration closing crossing the more often . Time gap between journey become more short . Pressure to users road increased , especially during peak hours . Growth amount vehicle make things worse condition said . Density Then cross trigger behavior No discipline , including violation to obligation prioritize train fire . Risk accident increase in a way significant at the crossing without security .

Phenomenon the reflect risks that are not managed in a way systemic . Absence cross door , signal warning , and guard active show limitations intervention policy . Capacity supervision and enforcement law Not yet capable reach all over crossing . Pattern of neglect form conditions in which safety depends on awareness individuals , not in a structured system .

Ambiguity authority strengthen complexity problems . Involvement government central government regions and organizers railways No accompanied by clarity distribution not quite enough answer operational and financing . Fragmentation authority produce weakness coordination as well as delay in provision facility safety . Impact direct seen in the low protection law to users road .

Perspective law look at condition This as indication negligence in fulfillment state obligation to ensure safety public . Principles not quite enough state responsibility demands presence system prevention effective risk . Crossing without security show existence gap between obligation law and realization policies in the field . Analysis comprehensive required For study connection between norm law , implementation policies , and levels risk accident .

THEORETICAL REVIEW

Theory Negligence

Theory negligence explain that something party can asked accountability law if No operate obligation caution (duty of care) so cause loss for party other. In context transportation, obligations the attached to the state and organizers system transportation For provide secure infrastructure.

Crossing a plot without security reflect potential violation to principlec aution. Absence cross door, signal warning, as well as guard active increase possibility occurrence accident. Condition the can categorized as form negligence structural if risk has known However No responded to through adequate policies.

A number of study show that accidents at crossings a plot dominated by a combination factor humans and failure system . Study empirical in the sector transportation conclude that low level security infrastructure correlated significant with improvement number accident.

H1: Frequency journey train fire and vehicle volume influential positive to level risk accidents at crossings a plot without security.

Theory State Responsibility

Theory not quite enough the state's responsibility is emphasized state obligations in protect safety public through regulation, supervision, and provision proper infrastructure. The country does not only play a role as a regulator, but also as guarantor safety in system transportation . In context crossing one plot , responsibility answer the covers provision facility security , enforcement law , as well as coordination between institutions . Ambiguity authority between government central government regions and organizers railways can cause failure in fulfillment obligation the .

Study previously show that weakness coordination institutional and not to be clear distribution not quite enough answer contribute to low level safety transportation . The system is not integrated produce gap policies that lead to increased risk accident.

H2: Clarity not quite enough answer law and effectiveness policy influential negative to level risk accidents at crossings a plot.

Theory System Transportation

Theory system transportation look at transportation as something a system consisting of from interaction between humans , vehicles , infrastructure , and regulations . Imbalance in one of these component will influence performance overall system .

Improvement frequency train and vehicle volume without balanced improvement quality infrastructure safety show existence imbalance system . Crossing a plot without security become point weak in system integrated transportation .

Studies previously show that implementation system safety based technology , such as cross automatic and system warning early , capable lower level accident in a way significant .
H3: Availability system security (bar automatic , signal , and technology warning early) has an effect negative to risk accident at a crossing a plot .

Framework Conceptual

Study This study connection between variables independent and dependent in context safety crossing plot :

a. Variables Independent : Frequency journey train fire .
b. Vehicle volume Clarity not quite enough answer law Availability system security .
c. Variables Dependent : Risk level accidents at crossings a plot .

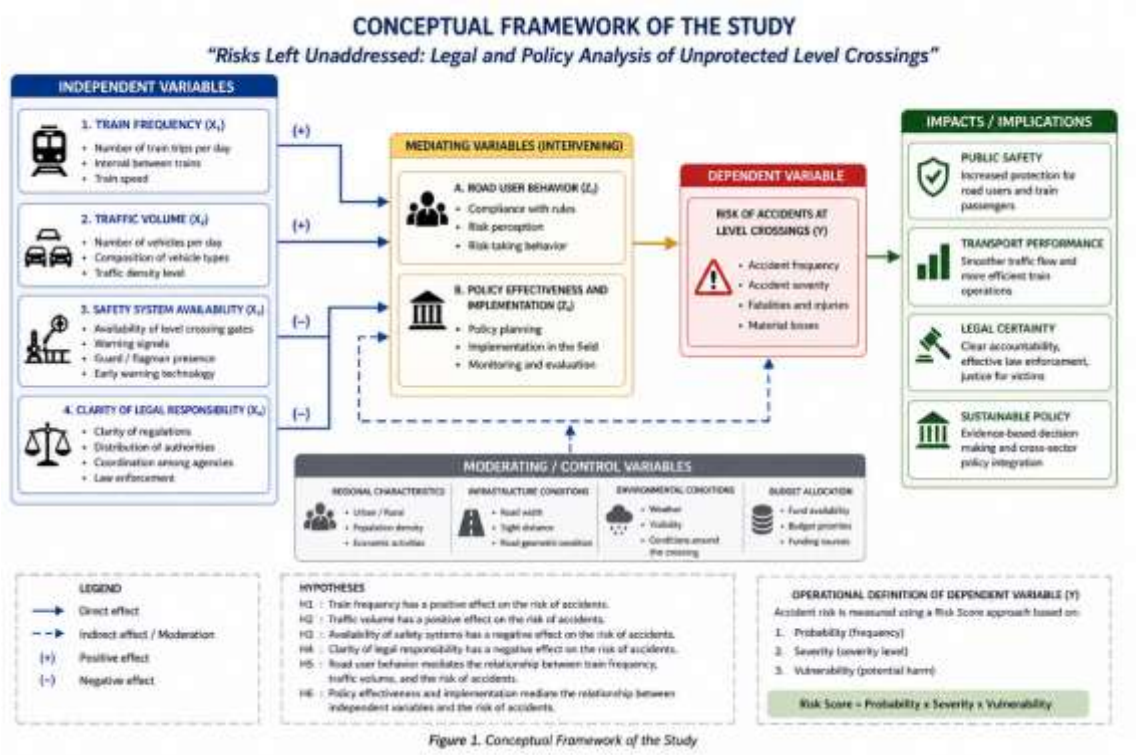

Figure. 1 Framework Conceptual

METHODOLOGY

This study employs a quantitative approach supported by empirical juridical analysis to examine the relationship between train frequency, traffic volume, safety systems, and legal responsibility on accident risk at unprotected level crossings. The population consists of level crossings without safety gates, with samples selected using purposive sampling based on high train frequency and traffic density criteria.

Data were collected through field observations, questionnaires to road users, and secondary data on accidents and regulations over a six-month period. Variables include independent variables (train frequency, traffic volume, safety systems, legal responsibility), dependent variable (accident risk), and mediating variables (road user behavior and policy effectiveness).

Data analysis was conducted using descriptive statistics, multiple regression analysis, and mediation analysis, complemented by risk assessment (Probability × Severity × Vulnerability) and qualitative legal analysis to assess regulatory gaps.

RESULTS

Data Analysis Stages

Analysis started with data quality testing through **validity and reliability tests** . All indicator variables show mark correlation > 0.30 and Cronbach Alpha value > 0.70, so that instrument declared valid and reliable . Stage next done **analysis descriptive** For give description general variables research , which is presented in form summary score use method *Three Box Method* .

Table 1. Three Box Method

Scores	Criteria
50.00 – 100.00	Low
100.01 – 150.00	Medium
150.01 – 200.00	High

Descriptive results show that variables frequency train and vehicle volume is in the category high , whereas system security and clarity not quite enough answer law is in the category currently until low .

Analysis Multiple Linear Regression

Testing hypothesis done use multiple linear regression For measure influence variables independent to risk accident . Equation regression formulated as following :

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 - \beta_3 X_3 - \beta_4 X_4 + \varepsilon \ldots\ldots\ldots\ldots\ldots\ (1)}$$

Description :

Y = Risk accident

X_1 = Frequency train

X_2 = Vehicle volume

X_3 = System security

X_4 = Clarity not quite enough answer law

Table 2. Regression Test Results

Variables	Coefficient	Sig.	Information
Frequency Train (X_1)	+0.45	0.001	Significant (+)
Vehicle Volume (X_2)	+0.38	0.003	Significant (+)
System Security (X_3)	-0.41	0.002	Significant (-)
Liability (X_4)	-0.36	0.005	Significant (-)

The results show that frequency train and vehicle volume influential positive significant to risk accident . System security and clarity not quite enough answer law influential negative significant .

Analysis Mediation

Testing mediation done For know role behavior users path and effectiveness policy . The results show that :

a. Behavior users road mediate connection between frequency train and risk accident
b. Effectiveness policy mediate connection between system security and risk accident

Analysis Risk

Calculation risk done use approach :

Risk = Probability × Severity × Vulnerability …… (2)

Analysis results show that crossing without security is in the category **risk high** , marked with height probability events and levels severity accident .

Summary Findings

a. Improvement frequency train and vehicle volume increase risk accident
b. Absence system security enlarge level severity risk
c. Clarity not quite enough answer law play a role in lower risk
d. Behavior users path and effectiveness policy become factor mediation important

DISCUSSION

Findings study show that increasing frequency journey train and vehicle volume create pressure Then cross that is not can balanced by conditions crossings that still have minimal security . The situation This No only anomaly technical , but reflect failure systemic in governance safety transportation . Conditions empirical on the Island Java as center Then cross train the most populous in Indonesia shows pattern accident repeated at crossings a plot without cross . Various incident on the crossing main such as Jakarta–Bogor, Bekasi –Karawang , to Madiun – Surabaya shows characteristics similar : user road forced to take decision risky Because absence protection physique and information early about arrival train .

Research result This confirm that variables frequency train and vehicle volume play a role significant in increase risk accidents . The more congested timetable journey and more tall current vehicles , increasingly big opportunity occurrence interaction dangerous at the point crossing . Interaction This is what forms a unique hazard landscape at crossings in Indonesia—a landscape that is "high exposure" but left alone without equivalence intervention safety . Research previously in studies safety transportation also shows that exposure Then high traffic without mitigation structural trigger improvement risk accident in a way exponential .

Absence crossbar , alarm, or guard active make things worse vulnerability users road . In various accident big in Java , investigation field show that Lots users

road experiencing a "false safety perception" because used to passing by without obstacles , so that reflex vigilance decreased . Findings This in line with literature behavior man in context transportation , which emphasizes that consistency environment physical is very important quality taking decision in condition risky .

Aspect law participate strengthen findings empirical . Although framework Indonesian regulations in general normative has set safety as principle main , its implementation No consistent . Ambiguity not quite enough answer between government central government regions and organizers railways create room empty in handling dot, dot, dot vulnerable . Many crossings left alone is at in "no clear ownership" condition , so that No There is the party taking action corrective . In developing country context , situation like This often categorized as regulatory drift, namely condition when regulations No capable follow dynamics changing operations fast .

Behavior users road appear as an important mediator . Pressure time , queue long Because often train through , and lack of information make part rider choose breaking through . Phenomenon This often seen in cases accidents in Cibitung , Banyumas , to Kediri, where the decision risky happen Because combination stress Then cross and absence barrier physical . In traffic psychology literature , conditions This known as risk compensation, namely when individual add risk For overcome discomfort situational .

Effectiveness policies also show influence mediative . Closing program crossing one plot and the construction of a flyover/underpass is underway slow compared to growth mobility . On the island Java , partly big point priority Not yet resolved , causing burden risk still high . When the policy No supported allocation budget and coordination cross agencies , gaps implementation become significant and influential straight to safety users road .

Findings This strengthen urgency improvement comprehensive . Risks at crossings a plot without security No It's just a technical problem , however signal that architecture safety transportation Not yet in harmony with intensity mobility moment this . Improvement security physical , digitalization information arrival trains , and sharpening not quite enough answer law become element critical For prevent accident repeating .

CONCLUSIONS AND RECOMMENDATIONS

Improvement frequency journey train fire and growth in vehicle volume No balanced with strengthening system safety at crossings a plot . Condition This produce room real and recurring risks , especially at crossings without security . Risk accident No appear in a way random , but rather formed from interaction between pressure Then cross , absence system protection , as well as weakness clarity not quite enough answer law .

Framework regulations national has put safety as principle main , but implementation in the field show significant gap . Crossing without cross reflect form negligence structural , where the risk has known but No handled in a way systematic . Ambiguity authority make things worse condition , resulting in fragmentation not quite enough response and delay intervention .

Findings study confirm that risks at crossings a plot is consequence from failure integration between system transportation , policy , and enforcement law . Without change approach , accident will Keep going repetitive as pattern , not as incident .

Recommendations

Approach policy must shift from reactive become preventive and systemic . Elimination gradually crossing a plot through construction of flyovers and underpasses is necessary made into priority national at the point with intensity Then cross tall .

Provision system mandatory minimum safeguards applied to all crossing active , covering cross automatic , visual and audio signals , and technology warning early sensor- based . Standard safety No may nature optional . Affirmation not quite enough answer law required through determination authority single in management crossing . Fragmentation authority must ended For ensure clear accountability .

Strengthening enforcement law based technology , such as CCTV and systems traffic ticket electronics , need implemented For form discipline users road . Approach educative must combined with mechanism strict sanctions . System integration transportation through the implementation of the Intelligent Transportation System (ITS) becomes step strategic For align current vehicles and operations train in real-time. Safety at crossings a plot No can Again viewed as issue technical local . He is indicator state capacity in protect its citizens . Every crossing without security is known risks and any risks left unaddressed is deliberate failure .

FURTHER STUDY

Study This own limitations on coverage locations that focus on crossings a plot without security in certain areas , so that generalization results on a scale national need caution . Limited accident data that is not fully documented in a way integrated also affects depth analysis empirical . Variable behavior users path and effectiveness policy measured in framework limited , so that Not yet fully catch dynamics more psychological and social complex .

Study furthermore recommended expand coverage area in general national with longitudinal approach to see trend risk in term length . Usage method advanced such as Structural Equation Modeling (SEM) or approach big data and sensor based transportation can increase accuracy analysis . In-depth aspect law is also necessary directed at studies comparative international For identify practice best in management crossing a plot .

Exploration integration technology , such as system warning based on the Internet of Things (IoT) and intelligence artificial , become direction important For develop an adaptive safety model . Without expansion perspective and innovation methodological , research in the field This risky stop at diagnosis when that is what is needed is transformation system safety in a way comprehensive .

ACKNOWLEDGMENT

Writer convey appreciation to the lecturers supervisors and academic community Doctoral Program Academics Faculty of Law, University of August 17, 1945 Semarang support academic , direction , and discussion constructive and enriching substance study this . Contribution thinking from various party become element important in sharpen analysis laws and policies raised .

Saying accept love is also conveyed to agency related parties and parties the field that has been give access to data and information about crossing a plot as well as dynamics safety transportation . Support the allows study This own base relevant empirics .

Study This arranged as part from development study law transportation that is oriented towards improvement safety public and strengthening not quite enough state responsibility in organization system railways .

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