The Challenges and Obstacles of Post-Disaster Road Infrastructure Reconstruction in the Pre-Construction Phase

Abstracts

Purpose

The reconstruction of road infrastructure in the post-disaster context require different approach when compared with road projects in the normal development context. Disaster recovery projects are seen as having their own unique identity, particularly due to stakeholder issues, resource challenges, capability issues, and even long-term reliability concerns. This paper invites a discussion regarding the challenges and obstacles identified in the reconstruction of road infrastructure in a post-disaster reconstruction setting, and focuses the discussion on the pre-construction phase.

Design/ Methodology/ Approach

The challenges and obstacles presented in this paper are based on the literature and the empirical evidence collected from the research in three case study districts in Aceh, Indonesia. Twenty-eight face-to-face semi-structured interviews were conducted with stakeholders of road infrastructure at the local, provincial and national level, and represented by respondents from the public works, planning agency, disaster management agency, consultant, contractors, and donor agencies. The findings were triangulated with the literature and consulted with five experts in the road infrastructure and disaster reconstruction area.

Findings

The identified challenges and obstacles are divided into three groups of discussion; planning and programming, road design, and procurement. Whilst some of these challenges are not unique to post-disaster context, the scale of the risks had been undermined.

Originality/ value

This paper identifies the challenges and obstacles of a road project in the post-disaster setting from the pre-construction perspective. Identification of these challenges and obstacles may help improve the implementation of post-disaster road infrastructure reconstruction projects in future recovery projects, particularly in the developing world.

Keywords

Road infrastructure, post-disaster reconstruction, project management

Introduction

Disaster recovery projects are seen as having their own unique identity, particularly due to significant stakeholder issues (Haigh and Sutton, 2012, Baroudi and R. Rapp, 2014), resource challenges (Chang et al., 2010a, Chang et al., 2010b, Chang et al., 2011, Chang et al., 2012), capability issues (Crawford et al., 2012) and even long-term reliability concerns (Hayes and Hammons, 2000). Moreover, the level of success of a project is often reflected from the performance of three indicators: time, cost and quality. This means that successful project is completed within the specified project period, within budget allocation and as intended quality. However, achieving all success factors in a road construction project is not a straightforward effort. Often, at least one of the factors would be compromised to achieve the other performance indicators. In a disaster recovery, the complexity of road construction project is also intensified by the chaotic environment and the high level of uncertainties associated with the post disaster reconstruction context. In turn, these factors result in challenges that are unique, in context and scale, to post disaster reconstruction of road infrastructure.

In major disasters, transport infrastructure appears to be one of the sectors which suffer the most damages and losses. Bappenas (2005) reported that losses and damages in infrastructure sector accounted for 19.7% of the total estimated losses and damages caused by the earthquake and tsunami in Aceh. In Sri Lanka, losses and damages in roads and transportation due to the tsunami accounted for 22% of the total needs (Asian Development Bank et al., 2005). The tsunami disaster in Aceh in 2004 caused damage to more than 2700 km of roads. Within the four year reconstruction period, more than 3600 km of road were reconstructed by the national government and donor agencies working in the reconstruction of road infrastructure in Aceh (Sihombing, 2009). This paper, which is based on the first author's PhD research in three case study districts in Aceh, is focused on the challenges and obstacles identified in the post-disaster reconstruction of the road infrastructure during the pre-construction phase. The identified challenges and obstacles are grouped into three main categories; planning and programming, road design, and procurement. The planning and programming phase refers to the preparation of blueprint of the overall reconstruction and program coordination. The road design phase refers to the process of designing the road technical specification. The procurement phase accordingly refers to challenges and obstacles identified in the procurement process.

Methodology

Twenty-eight face-to-face semi-structured interviews were conducted with the representatives of the road infrastructure stakeholders at the national, provincial and local level. The twenty-eight respondents comprise of eighteen respondents from three case study districts in the west coast area of Aceh province and ten policy makers from the provincial and national level. The basic profile and distribution of the interview respondents is presented in Table 1.

Table 1 – Basic Profile of the Respondents

Institution Types	Total

Public works	**9**
Consultant	**4**
Contractors	**3**
Planning agency	**5**
Disaster management agency	**3**
Donor organisation	**2**
Transport agency	**1**
Secretary of province	**1**
Total	**28**

The respondents for the interviews were selected using a combination of purposive sampling and snowballing method. Semi-structured interviews were conducted in a face-to-face approach. Each of the interviewees was briefed about the objective of the study and was advised to subscribe to the Participant Consent Form. Each interview was conducted for approximately one hour. The interviews were transcribed into NVivo 10, and were coded using multiple stages approach; open coding, axial coding and selective coding process. The data was analysed using content analysis technique with the aid of the same software. The findings of the study were triangulated through consultation with five experts in the subjects of post-disaster reconstruction and road infrastructure management as well as with the literature (the basic profiles of the experts are presented in Table 2).

Table 2 – Profile of respondents for the Expert validation semi-structured interviews

Code	Professional Background
Val01	Academic
Val02	Consultant
Val03	Consultant
Val04	Academic
Val05	Consultant

Discussion

This paper identifies challenges and obstacles of road reconstruction project in the pre-construction phase. The following sections will present the discussions according to the project phase.

Planning and programming

The discussion of the challenges and obstacles in planning and programming process covers the preparation of the blueprint for the overall reconstruction of road infrastructure, as well as the coordination of the reconstruction process. The summary of the challenges and obstacles at the planning and programming process is presented in Table 3.

Table 3 – Challenges and obstacles in the planning and programming process

Project Phase	Challenges and Obstacles
Planning and programming	Fewer aid agencies focused on road infrastructure
	Increased material price
	Project delay
	Blueprint errors
	limited preparation time
	no project prioritisation, inclusion of almost all road networks
	Political pressure
	political pressure affect project location and budget allocation
	Competing donors makes coordinating and project distribution difficult

Hayat and Amaratunga (2011) argue that the reconstruction of road infrastructure in the post-disaster context is immediately challenged by the relatively fewer donor organisations working in the road sector compared with other sector such as housing and livelihood. Even though road infrastructure condition affected the speed and cost of aid distribution and the overall recovery process, very few aid agencies provided sufficient focus and fund allocation for the reconstruction of road infrastructure. Chang et al. (2011) argue that many aid agencies working in the tsunami reconstruction in Aceh undermined the importance of road infrastructure by not including it in their initial recovery plans, which resulted in project delays and increased material price.

Furthermore, the blueprint for the reconstruction of the affected areas was prepared in a very short time (3 months). Accordingly, inaccuracies were found and the blueprint included a number of programs not related to earthquake and tsunami disaster. For instance, almost all national roads and provincial roads were included in the blueprint that it overlapped with those under the responsibility of the Directorate General of Highways and the Aceh administration as part of their regular development programs (Sihombing, 2009). On the other hand, as further explained by Sihombing (2009) there were several most urgent programs excluded from the blueprint, such as the construction of escape airstrips in the remote and strategic locations in Aceh. As a consequence, the disaster reconstruction implementation agency, The Agency for the Rehabilitation and Reconstruction of Aceh Nias (BRR), had to abandon the blueprint and worked based on what they see fit in the actual field condition. Accordingly, in the BRR Mid Term Review report (MTR), adjustments were made in the reconstruction plan, and that the reconstruction projects were grouped into four quadrant of MTR matrix (Subekti, 2009). The MTR matrix is shown in Figure 2

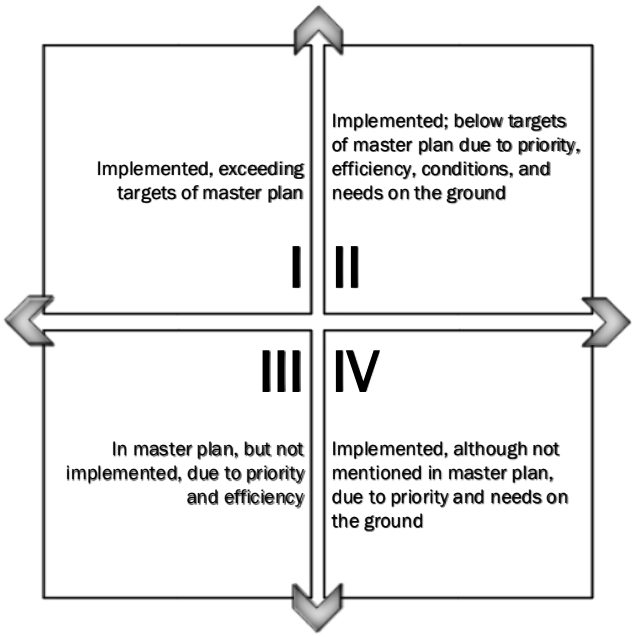

Figure 1 – The four Quadrant of the MTR (Subekti, 2009)

At the programming phase, the study identifies that the distribution of project location and budget allocation was also challenged by the political pressure, conflict of interest, and competition among the donors and stakeholders. It was suggested that political pressure from the parliament member and high-rank officials, for instance, affected the decision-making in determining project location. On the one hand, it was acknowledged that the political pressure to disperse project location was necessary as a means to ensure the distribution of wealth. However, there were cases where such pressure stem from the conflict of interest. As illustrated by CS04

> *"The challenge was that too many road projects were forcefully requested to be done in certain locations… Why do they have to be there? After we did field observations, we found that there was the house of the head of parliament, or it was the Regent's village. That happened." – CS04*

Furthermore, the great number of donors working in the post-disaster reconstruction made coordination and distribution of work areas difficult, particularly when more than one donors interested in working in the same areas and that there were changes of reconstruction coordination authority at the initial reconstruction phase. In the initial period of the reconstruction, Sugiarto (2009) described how the transfer of authority for reconstruction coordination from the National Development Agency to the BRR resulted in a number of projects' postponement, which was due to changes in the reconstruction procurement policy and the reluctance of big donor organisation to coordinate with the BRR for their project implementation. Miscommunication and coordination problem also occurred resulting from the lack of donors' representative offices in Aceh.

With regards to donors' competing interests, Sugiarto (2009) describes a case where the government of Japan insisted to build the whole road network between Banda Aceh, Calang and Meulaboh in the west coast area. However, the request was refused as the road section between Banda Aceh and Calang had been allocated for the USAID. The dispute resulted in project commencement delays, until it was covered by Japan national media and raised the Japanese public's attention.

The reconstruction coordination was also challenged by the various conditions that came with donors' donation. For instance, the Governments of Germany and Japan identified that some of their projects in certain sectors had to be carried out by their own implementing agencies. The disbursement of funds for these projects, even though accounted for in the national budgetary system, were carried out by the particular donors and therefore outside the authority of the coordinating agency, BRR. This scheme was also known as on-budget/ off-treasury projects (Subekti, 2009).

To help with coordination and reporting of project progress, the BRR developed Recovery Aceh-Nias Database (RAND), which registered all projects carried out in Aceh and Nias. The database was accessible for update by the respective NGOs and donor organisations, and was made as one of the requirement for the expatriate personnel to obtain their working permit. In some cases, several NGOs refused to coordinate and report their progress with the BRR by ignoring the need to register and update the RAND database, which affected the overall reconstruction coordination. Consequently, the BRR did not include and acknowledge such projects in the disaster recovery reconstruction progress report. The challenges and obstacles in the planning and programming phase have been discussed in this section. Accordingly, the next section will present issues related to the road design process.

Road design

The summary of challenges and obstacles in the design process is presented in Table 4. Even though the disaster recovery blueprint indicated the list of projects for the post-disaster reconstruction, it did not come with a design plan and inaccuracies were also found. As indicated earlier, the disaster reconstruction resulted in nearly 1000kms more road networks than what was destroyed by the earthquake and tsunami in Aceh. It was suggested that such an extensive number resulted from adopting and implementing the build back better principle where rehabilitation and reconstruction was not only applied to the damaged road section, but also to the connecting network. However, the number was also affected by the inaccuracies of the initial road network length measurement indicated in the blueprint resulting from the limited preparation time as well as the severe condition of the project locations. Accordingly, there were many cases where the project cost escalated and the initial project budget allocation was no longer sufficient to accommodate the actual needs. One of the solutions to deal with the project cost escalation was to reduce the project's scope of work. For instance, many of the World Bank's IRFF road reconstruction projects were long sections of roads that were broken down into smaller packages of road segments. Some packages included the construction of culverts or bridges. Accordingly, to maintain the targeted quality of the road structures within the initial budget ceiling, changes in the scope of works often resulted in the

reduction of the road length or the omission of some project items. The latter option may include the deferral of bridge construction into future projects. Consequently, many of the projects resulted in some sections being left with ‘untouched’ parts at the end of the road segment while some others may have a newly built road with temporary wooden bridges in between. Nevertheless, these gaps were rectified in the next projects.

Table 4 – Challenges and obstacles in the design process

Project Phase	Challenges and Obstacles
Road design	Inaccurate design
	limited time
	harsh working environment
	Land acquisition process
	Customary land title
	Large number of land parcels
	Conflicting donor’s policy
	Over-standard design
	prolong maintenance needs
	donors' pride

With regards to planning and design, Sihombing (2009) acknowledges that providing a design plan in an emergency condition was impossible due to the time constraint and pressure to act quickly. Accordingly, a design review concept was adopted by the BRR, which provided only the basic planning concept, tender documents, and the estimated project value, leaving the details of the design to the awarded party. This was meant to accelerate most of the reconstruction projects, and was claimed to be an effective method (Sihombing, 2009). However, road reconstruction required a different approach and obtaining a ‘final’ design is an urgent priority for the commencement of the land acquisition process. As a result, there were significant delays in the road reconstruction project in Aceh. Some of the main causes of the delay were that road design and implementation plan had not been approved by the time it was needed. Changes to the design and scope of projects are not uncommon in road construction projects, both in the developed and developing countries, which is considered to be one of the most significant causes of project delays (Kaliba et al., 2009). In Aceh, this issue, along with frequent changes to the project scope due to budget thresholds and disagreement over the final road alignment (USAID, 2006) were the additional causes of the project delays.

In many locations, most of the road sections had been submerged under the seawater, requiring changes to the road layout and the need to acquire land. The challenges and obstacles in the land acquisition process are summarised by Hayat and Amaratunga (2011). They describe that the main challenges in the land acquisition process stem from the large number of land parcels to be acquired; more than 3000 land parcels in the west coast alone, and the existence of two types of land title in Indonesia; those formally registered in the

national land agency and those acknowledged by the customary law. While anticipated, the significant amount of time and other difficulties related to acquiring land were underestimated (USAID, 2007). In the tsunami affected areas, many landowners and up to 30% of government personnel as well as offices responsible for the land acquisition process had also been victims of the event (BRR and International Partners, 2005, Fitzpatrick, 2006).

Furthermore, at the project level, the study identified that the use of *over-standard* design consequently gives a long-term impact to the local governments who are responsible to provide the maintenance. The *over-standard* design refers to the higher structural quality pavement standard relative to the local governments' experience and common practice at that time. The *over-standard* design is accordingly more expensive to build. Practically, in Aceh, this refers to the Hot Mix Asphalt pavement type. Respondent Val05 suggested that the use of HMA was affected by 'pride competition' between donor organisations which utilised the reconstruction project as a 'display' of their works and aid donation.

Nevertheless, the use of HMA was also supported by the technical and economic rationale, in that the HMA provides better surface quality and durability which may then prolong the future maintenance needs. In turn, it was expected to help reduce the local governments' maintenance backlog problems. Unfortunately, in the long run, the study identified that the wide application of HMA in the reconstruction process resulted in local governments undermining the various advantages and disadvantages of different road types. The local governments are 'abandoning' the idea of having macadam and gravel roads in their districts, for instance, as they used to have prior to the tsunami reconstruction. Consequently, the annual budget allocation in the road sector was focused and channelled for the new road projects with HMA surface or upgrading the existing macadam and gravel roads to HMA, with little attention given to the maintenance needs.

As the challenges and obstacles in the road design process have been presented, the following section will discuss issues identified in the procurement phase.

Procurement

At the pre-construction phase, the procurement process experienced the greatest number of challenges and obstacles. As shown in Table 5, the challenges and obstacles can be grouped into local resources, bid competition, contractor capacity, and regulatory arrangement.

The procurement process was immediately challenged by the lack of personnel capable and legible for organising and administering the procurement process. As stipulated in the Presidential Decree no 80/2003, the procurement personnel must be civil servant with procurement certification. However, the number of civil servants with procurement certification was very limited. Accordingly, to help solve this issue, BRR regularly and frequently provided training and certification test for their personnel, as well as for the local government personnel.

Table 5 – Challenges and obstacles in the procurement process

Project Phase	Challenges and Obstacles
Procurement.	Local resources availability
	limited personnel with procurement capacity and qualification
	Great numbers of project, limited contractors
	Poor contractor capacity
	seasonal contractor with strong political support
	unfamiliarity with international bidding requirements
	external contractors' reluctance to work in Aceh due to conflict and threats
	Bid competition
	threats and corrupt practices
	unfair competition - collusion among AMP owner
	Regulatory arrangement
	involvement of international consultant in the procurement process against national regulation
	Indigenous people protection
	The absence of post-disaster specific exemption

In addition to procurement personnel capacity issue, the reconstruction was also challenged by the limited capacity of the contractors available locally. This condition was affected by the fact that many construction companies and their personnel were affected and killed by the disaster, and that a great number of reconstruction projects took place within a relatively same period of time. Furthermore, after the tsunami, it was identified that there were many new and seasonal contractors competing for the reconstruction projects through political support. Many of the new contractors were arguably lacked both the skills and experience in construction, and however pushed aside contractors with skills and experience but without political backup. Such a condition was illustrated by respondent CS06,

"Now, fishermen becomes contractors, and contractors go fishing (as there are no jobs)"

The CS06 comment's illustrated his view that inexperienced contractors flooded the industry and pushed aside the existing contractors.

Moreover, Aceh was in a prolonged conflict of nearly 30 years before the peace agreement achieved in 2005. However, the security and safety threats remained on the ground, which hindered the opportunity and willingness of external contractor to work in Aceh. To better ensure the security and safety of project implementation, many of the external contractors established partnerships with the local contractors. The partnership between them occurred in the form of joint-operation scheme, as a contractor and supplier, or as a contractor and subcontractors.

The procurement phase was also challenged by the unfamiliarity of the contractors with the international bidding procedure, which frequently resulted in delays and dispute. As the reconstruction of Aceh involved many international donor organisations, certain projects had to refer to the international bidding procedure. Indonesian procurement regulation (Presidential Decree 80/2003) also stipulates that if any conflicting regulations occur between Indonesia and donor regulations in projects that are partially or fully funded under loan or grant schemes, donor regulation would then prevail. Accordingly, problems due to unfamiliarity with certain procedures and requirements inevitably occurred. For instance, in the initial phase of the USAID project, the implementation plan proposed by the Indonesian contractor, PT Wijaya Karya (WIKA), was not approved due to its non-compliance with the US requirement which caused delays to the project commencement (USAID, 2006). This regulation has been since amended a number of times with the latest being the Presidential Regulation no 54/2010 and its second amendment, Presidential Regulation no 70/2012, where conflicting regulation will now need prior negotiation and agreement.

During the post-disaster reconstruction period, the number of reconstruction projects and the growing number of contractors in the affected areas consequently lead to fierce competition between the contractors in winning the projects. This condition consequently resulted in threats and corrupt practices in the procurement process. As previously discussed, joint-operation scheme was adopted by many contractors working in Aceh. Some of the problems resulted from such collaborations were recorded in details by Sihombing (2009), when a contractor who submitted the most expensive bid was adamant about winning the project and turned into a rage when there seemed to be no chance of winning. In another case, Sihombing (2009) highlights a case where a national company lost a procurement tender due to the local partners' lack of experience in the procurement of heavy vehicle equipment, and forcefully tried to justify their bid position. Accordingly, in order to avoid threats from the bid participants who were eager to win, the procurement committee had to work literally out of the public reach by moving the selection process to another city.

Furthermore, in public procurement, corrupt practices may occur in the form of awarding contracts to the best briber instead of based on the best price-quality value. Such practice may result in higher contract value or purchase of unnecessary items (Søreide, 2005), or fraud resulting from discrepancies between amounts paid to suppliers for goods and the quantity of goods delivered (Oxfam, cited in Schultz and Søreide, 2006). Ewins et al. (2006) suggest that corruption risk in the humanitarian action are among others affected by the existing corruption and transparency level, value of relief activities, and the condition of the affected area. With regard to the transparency level, the Transparency International lists Indonesia as the 114 out of the 117 countries surveyed in its 2013 global corruption perception report (Transparency International, 2013).

After the peace agreement, the ex-combatants returned to the community and formed an association, called Aceh Transition Committee (KPA). At the village level, the KPA is called *Sagoe* (corner). To ensure that the project could be implemented well and without disruption, a personal approach and agreement with the *Sagoe* leaders was frequently required. As a

result, the KPA members would generally be involved in the project as the contractors' personnel or as the suppliers for the project. Respondent CS10 implicitly revealed that this practice was well-coordinated and well-organised by the KPA at the higher level. He said

> *"Since the 'Sagoe' might have been directed by the KPA regarding the project in their village, the contractors would later need to recruit some of the local KPA members in the project. Whether as a night guard... or if they have a business, might also be as the suppliers. So we share (the works)." – CS10*

Whilst CS10's comment above illustrates how the security and safety issue would affect the implementation of a project on the ground, the influences and pressures from the KPA also affected the project tender process. CS10 further described that he had to coordinate with the KPA and distributed the construction work packages between the KPA members. As CS10 explained

> *"We always coordinated with them (KPA). We explained (to the leaders) so that they could convey the message to their members that we are all 'equal' (together). We would distribute (the projects) in the tender process. So there would be no one saying that I have to win such and such project, or this must be mine. What happened was that we arranged them through the (formal) procedure, through tender." CS10*

Another issue identified was with regards to the requirement of having an Asphalt Mixing Plant (AMP), or supported by an AMP company, for a contractor to participate in a road project tender. Whilst such requirement was necessary to ensure that participating contractors were capable of delivering the project, the study identified that the limited number of AMP in the affected areas resulted in at least two consequences. The first consequence was that the requirement of AMP reduced the opportunity for small contractors to participate in a road project tender. On the one hand, this condition helped filter-out contractors with lack of experience or equipment support. On the other hand, however, such requirement did not necessarily resulted as intended. Many contractors who did not have an AMP were able to participate in the project tender, as long as they were supported by AMP companies. Nevertheless, such a support was normally given under a condition that AMP related works (i.e. road pavement) were carried out by the AMP companies, with a price that could be the same with or more than what was included and allocated by the contractors' in their bid. Whilst the price had been normally agreed upon prior to bid submission, there were cases where the AMP companies changed the price after the contractor win the project. The contractors would then need to compensate their loss from the AMP related works by justifying their project budget and specification of other works, often by reducing the quality. The other consequence of the AMP support requirement was that AMP owners were taking turn in winning a project. Such a practice was locally known as *arisan*, where AMP owners formed collusive collaboration by not providing support to contractors without AMPs and distribute the road projects between themselves by pre-arranging the bid price.

The study also identifies that the reconstruction process was also challenged by the regulatory arrangement, which was not suitable and applicable for the post-disaster condition or conflicted with the donor organisations' regulations. For instance, the World Bank required the involvement of international consultant in the procurement of their co-funded projects. Such a requirement was not accommodated and allowed in the Indonesian law, as the law did not even allow any non-civil servant personnel involved in the procurement committee (Presidential Decree, 2003). Furthermore, the World Bank also implemented the indigenous people protection policy. This policy required the assurance that people affected by the project would not be disadvantaged. The policy included paying damages or relocation of the affected communities or businesses. Whilst Indonesian law accommodated the need to pay damages to the affected communities through the land acquisition process, the Indonesian law did not recognise paying damages or relocation of affected people which illegally occupied the land. These condition eventually resulted in disputes and project commencement delays. In many cases, problems occurring from the regulatory arrangement were due to the lack of disaster-specific regulations and laws. Regulations and laws which are produced for normal context cannot be simply applied and implemented in the post-disaster reconstruction context, where the actual field condition is affected by the severe site condition, chaotic environment, and the pressure for a speedy recovery. Some of the problems resulting from conflicting regulations were solved through discussion and amendment of regulation and laws. However, many of the issues resulted in disputes and delays, which were often unnecessary and avoidable should disaster-specific regulations were in place.

Conclusion

This paper presents a discussion on the various challenges and obstacles identified in the reconstruction of road infrastructure during the pre-construction phase. These challenges and obstacles, separated into three main phases – planning and programming, road design, and procurement, are identified from the literature and empirical evidence collected from semi-structured interviews with twenty-eight respondents in three case study districts in Aceh and five experts in the road infrastructure and post-disaster reconstruction subject. At the planning and programming phase, the issues stem to limited number of aid agencies working in the road sector, error in the blueprint preparation, and political pressure in determining project location and budget allocation. From the road design perspective, the study identifies challenges and obstacles resulting from inaccurate design, the extensive land acquisition process, and the wide application of over-standard design. At the procurement phase, the reconstruction of road infrastructure was challenged by the limited local resources availability, poor contractor capacity and unhealthy competition between contractors, as well as issues resulting from conflicting regulation.

The list of challenges and obstacles identified in this paper is not exhaustive and open for discussion. It is acknowledged that each disaster may pose different challenges to its recovery process. Nevertheless, this paper provides a guidance to assist with the implementation of road infrastructure reconstruction project in the future.

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