



# **AN INVESTIGATION OF THE CONTRACTUAL ROADWAY SAFETY TERMS IN TRANSPORTATION PPP PROJECTS**

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Roadway safety is an important aspect of all transportation facilities. With operation and maintenance becoming contracted roles under public-private partnerships (PPP), it is expected that safety rates will improve beyond those experienced in traditional delivery. The international experience shows that PPPs experienced mechanisms designed to provide safer roads. In the United States, PPP is gaining momentum and several states initiated PPP projects. While studies show the potential of PPPs for improving cost efficiency and expediting the delivery time, few researches investigated the correlation between PPP and roadway safety. To fill the gap, this study investigated seventeen PPP projects through content analysis of their agreement and procurement documents. The findings show that PPP projects were lacking further consideration toward safety beyond what is normally available in traditional delivery. Safety was an objective in most (76%) of the projects, however, without direct mechanisms to implement such objective. Around half of the projects have mentioned safety as part of proposal evaluation but only two projects have assigned points/weights in the evaluation. None of the projects provided for a direct link between the compensation to the achievement of improvements in the safety rates. Generally, PPPs are meant to provide public agencies with means to achieve particular objectives. It is recommended to use the particulars of PPPs in performance measures and payment mechanisms to enforce roadway safety in highways infrastructure.

*Keywords:* Transportation systems, Evaluation, Accident management, Safety incentives, Documents, Design.

## **1 ROADWAY SAFETY AND PUBLIC-PRIVATE PARTNERSHIP**

Roadway safety is an important aspect of safe and reliable transportation systems. Poor roadway design and poor pavement conditions are among the factors that would render a highway unsafe with an increasing number of accidents, injuries, and fatalities. During the life cycle of a road, from its preliminary design to operation, there are decisions that affect roadway safety. In this respect, the operation stage offers great opportunities to improve roadway safety (Vassallo *et al.* 2009). Well-maintained roads are expected to have lower accident rate than roads with pavement cracks, rutting, potholes and other pavement distresses. Therefore, it is fair to assume that roads with sufficient funding for operation and maintenance would have fewer accidents.

Although state and federal agencies have continuously provided capital for roadway design and construction, funding for operation and maintenance is always in shortage. Innovative procurement approaches are increasingly used to fill the financial gap by involving the private sector in managing and financing infrastructure through Public-Private Partnership (PPP). In

performance-based PPP contracts, road maintenance and financing could be provided as part of the contractual delivery system (Abdel Aziz 2007). While there have been several studies showing the potential of PPPs for improving cost efficiency and expediting the delivery time, research on the relationship between roadway safety and PPP are scarce with regard to the contractual safety terms and safety performance. Geddes (2014) conducted research regarding the effects of PPP on traffic safety based on the Mexico federal toll roads and found that private management of federal roads in Mexico had no improvement on safety performance. In another research, Vassallo *et al.* (2009) concluded that PPPs with safety payments or incentives is effective in encouraging the contractor to implement safety approaches and finally could improve the roadway safety performance.

To fill the research gap between PPP and roadway safety performance in the US, this paper aims to investigate the contractual terms related to roadway safety of transportation PPP projects in the US and to develop recommendations to articulate contractual terms for safety improvement.

## 2 RESEARCH METHODOLOGY

States that have (1) PPP enabling legislation, (2) availability of sufficient number transportation PPP projects, and (3) a wealth of experience and history of using PPPs are identified as targets for the research purpose. Table 1 shows such target states and projects used in this research.

Table 1. The information of the selected PPP projects.

Project	State	PPP Contract Model	Year of Financial Closure	Status
The Port of Miami Tunnel	Florida	DBFOM	2009	In Operation
I-595 Improvement	Florida	DBFOM	2009	In Operation
I-4 Ultimate	Florida	DBFOM	2014	Under Construction
SR125	California	DBFOM	2003	In Operation
The Presidio Parkway	California	DBFOM	2012	In Operation
IH 635 Managed Lanes	Texas	DBFOM	2008	In Operation
North Tarrant Express	Texas	DBFOM	2009	In Operation
SH 183 Managed Lanes	Texas	DBFOM	2014	Under Construction
SH 130 Seg. 5 & 6	Texas	DBFOM	2007	In Operation
Elizabeth River Tunnels	Virginia	DBFOM	2012	Under Construction
I-495	Virginia	DBFOM	2008	In Operation
I-95	Virginia	DBFOM	2012	In Operation
Pocahontas Parkway	Virginia	Lease-Develop-Operate	2007	In Operation
Indiana Toll Road	Indiana	75-year long-term lease	2006	In Operation
PR-22 and PR-5 Toll Road	Puerto Rico	40-year long-term lease	2011	In Operation
Northwest Parkway	Colorado	Long-term lease	2007	In Operation
Chicago Skyway	Illinois	99-year long-term lease	2005	In Operation

A content analysis of the procurement and contract documents is conducted to investigate how traffic safety was managed and accounted for in the target projects. The documents of each project has been divided into four categories, including bidding document, contract document – Part I Design & Operation, contract document – Part II Safety Incentives and Payments, and contract document – Part III Safety Accident Management. A set of questions has been designed for each category to fully explore how roadway safety is managed in these projects.

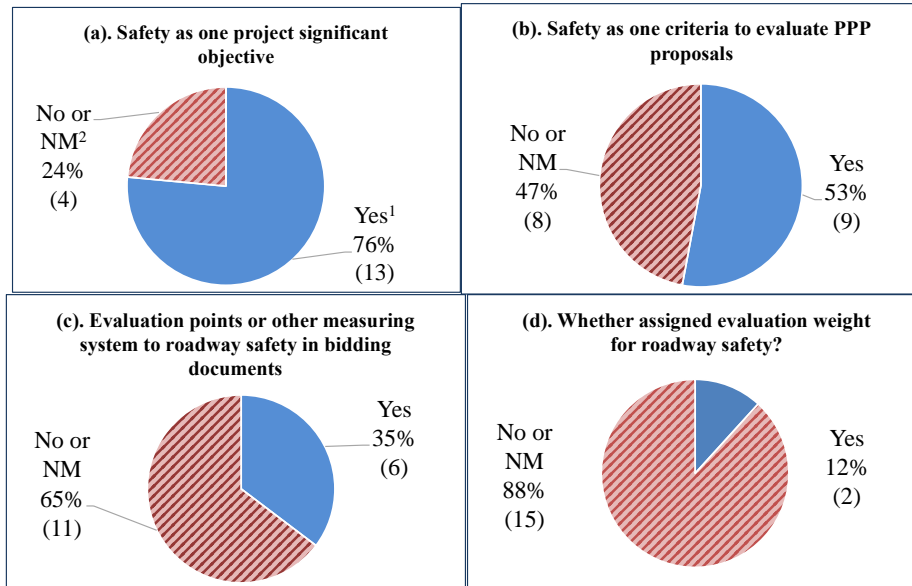
## 3 CONTRACTUAL ANALYSIS

The objective of the content analysis is to establish the understanding of the roadway safety management in current US PPP projects.

### 3.1 Safety Objectives in Procurement Documents

This part aims to answer two questions – 1) whether roadway safety is considered as a significant goal in the project, and 2) how well the safety considerations have been reflected in bidding evaluation criteria. The results of the analysis are in Figure 1.

Regarding the first question, only those projects that explicitly include safety as one of the project objectives are marked as “Yes”. For example, this study marked the I-595 Improvement project as “Yes” since its RFP claimed “*the primary objective throughout the Term of The Project are: ... Maintain a high level of quality and safety provisions in the engineering, construction, maintenance and operations services provided by the Concessionaire.*” A total of 13 projects (76%) included safety in their project objectives, as shown in Figure 1(a).



Notes: <sup>1</sup>Projects marked as “Yes” only if containing certain contractual provisions that can answer the proposed questions; <sup>2</sup>NO or NM (Not Mentioned) for projects not containing any provisions related to the proposed questions.

Figure 1. Safety considerations in the bidding documents.

In terms of the selection criteria, about half of the selected projects (9 out of 17) included safety as one of the project objectives and also contained safety in their Evaluation Criteria, Figure 1(b). In these nine projects, a common method is to include safety management as an element to evaluate the technical capability of the bidding team. In these projects, safety is categorized as part of technical capability, however, a fewer number of projects specifically assigned evaluation points or rating weights to safety; this is presented in Figure 1(c) and Figure 1(d). Usually, the evaluation weights are only assigned for team’s Technical Capability as a whole. Only Pocahontas Parkway and SH 183 assigned evaluating points for safety.

Although most PPP transportation projects considered safety as one of important project goals, there is a much smaller portion that clearly reflected the safety objective on the selection criteria. This is clearly noted where the percentages go down from 76% to 53% to 35% and finally to 12% in Figure 2. For instance, I-595 Improvements, the Presidio Parkway, the Elizabeth River Tunnel, I-495 Express Lanes, Indiana Toll Road, and PR-22 and PR-5 have similar contracts to include safety as part of evaluation criteria for the Technical Capacity, but none of them assigned any weighting points specifically on safety evaluation.

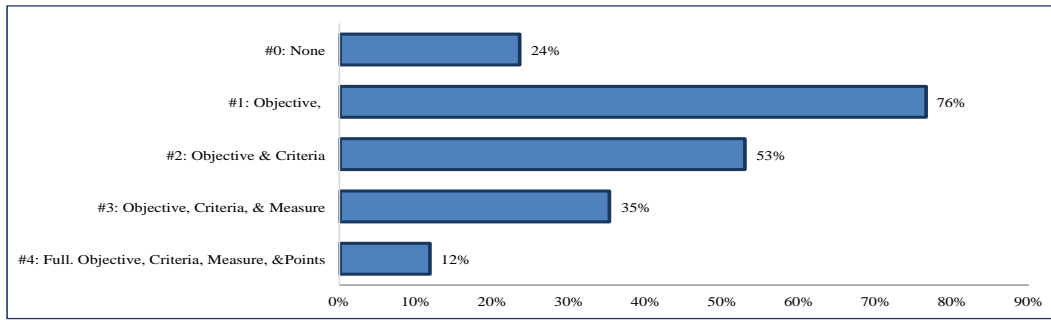


Figure 2. Relative safety considerations.

### 3.2 Contractual Document Part I: Design and Operation

The PPP Technical Requirements commonly contain safety-related contractual terms, such as the road slope, lighting, and materials. Also, the concession agreements require their concessionaires to provide a comprehensive Safety Plan. However, since these safety-related terms are inherited from the traditional project delivery methods, they are considered as traditional terms in this study. This subsection aims to investigate if PPP agreements include any special safety terms, beyond what are included in traditional contracts in terms of structural design and operational requirements.

In terms of special design or extra roadway elements for safety improvement, as shown in Figure 3(a), 8 of the 17 (47%) target projects contain at least one contractual design term that differs from the traditional contractual template. These special design-related provisions are heterogeneous and vary from project to project. For example, I-595 Improvements required a custom design should meet or exceed all of the safety requirements provided by the standard signature gantry, which is a set of particular design requirements in the Agreement; LBJ 635 adopted a geotechnical instrumentation program to monitor the safety and adequacy of the design and construction approach; I-95 Express Lanes required a reliability assessment shall be made for safety purpose, and furthermore, the project also required an operational analysis to demonstrate the concessionaire’s revised design did not have a significant adverse impact on the safety and operation of the existing facility; Indiana Toll Road developed a particular traffic plan, named Safety Initiative, for roadway safety improvement; and PR-5 / PR-22 implemented a program called “the accelerated safety upgrades” to improve the performance and safety conditions.

In terms of operation, as presented in Figure 3(b), 12 of the 17 (71%) projects include special provisions to improve roadway safety in two ways. The first requires the concessionaire to conduct periodic safety inspection to monitor the safety condition. The second strategy includes a requirement for the concessionaire to regularly update the safety plans.

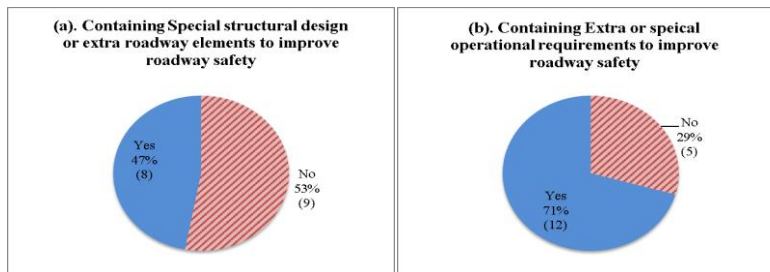


Figure 3. Special design and operation safety terms in target projects.

### 3.3 Contractual Document Part II: Safety Incentives and/or Payments

This part aims to identify the usage, if any, of monetary incentives for managing roadway safety. According to the payment mechanisms, none of the 17 projects contained any payment that links a monetary compensation to the traffic safety performance.

All the selected projects contained traditional provisions regarding roadway safety precautions (Figure 4). Two safety-related contractual chapters, Safety Compliance and Remedies for Failure to Meet Safety Standards or perform Safety Compliance, are widely applied to all PPP projects. In addition, these two chapters also included some terms potentially involved in a safety-related deduction or compensation. For example, I-4 Ultimate required if the concessionaire failed to be compliant with safety standards or any other regulations, the public agency has the right to take actions directly to ensure the safety and quality of the project and the concessionaire is responsible for all the expenses and potential losses due to such actions. However, the safety mentioned in most of the provisions does not clearly refer to the roadway or traffic safety. Although some contracts provided for deductions of the general O&M performance of which safety-related requirements is indirectly included (*e.g.* sealing of pot holes and cracks), none of the 17 projects required the evaluation of any safety performance measure (*e.g.*, number of crashes, injuries, or fatalities). None have provided any safety payment or incentive for a better safety performance.

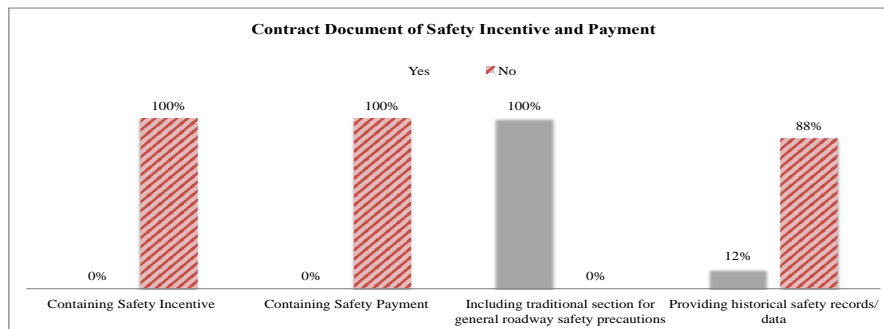


Figure 4. The adoption of safety-related payments and incentives.

Additionally, few projects required the use of historical safety records to assess roadway safety performance. Only two projects (I-4 Ultimate and Port of Miami Tunnel) required in the Technical Requirements utilizing traffic data for project analysis. However, Port of Miami Tunnel only used AADT to establish a revised traffic operational analysis for congestion management rather than for improving traffic safety. I-4 Ultimate is the only one of the 17 projects providing historical traffic safety records in the contract. It adopted a safety ratio to assess roadway safety performance. However, this ratio was only used for identifying the hazard location of the project instead of evaluating the operational performance regarding safety.

### 3.4 Contractual Document Part III: Roadway Accident Management

In terms of traffic accident/incident reporting and management, this research found that collecting and keeping safety data (*e.g.* number of accidents was not a major contractual requirement) which can be seen in Figure 5. The majority of the 17 projects (94%) required their concessionaires to immediately report any safety-related incidents to the public law enforcement agency. There is one project (6%), LBJ 635, allowed an independent agency to do this task. Only four (25%)

projects required the concessionaire to collect safety data and only the Elizabeth River Tunnel) required the concessionaire to manage information identified through incident reports.

While collecting and keeping safety data was not a major requirement for the concessionaire, all of 17 projects required the concessionaire to develop Incident Management/Response Plans.

All of the selected projects required development of an incident management plan to immediately response and manage the roadway incidents. Additionally, most (81%) of the 17 projects required the concessionaires to be responsible for the maintenance and repair, and 11 projects required the concessionaires to pay for the repair works. Some agencies authorized pursuing claims against any responsible third party for reimbursement of expenses incurred.

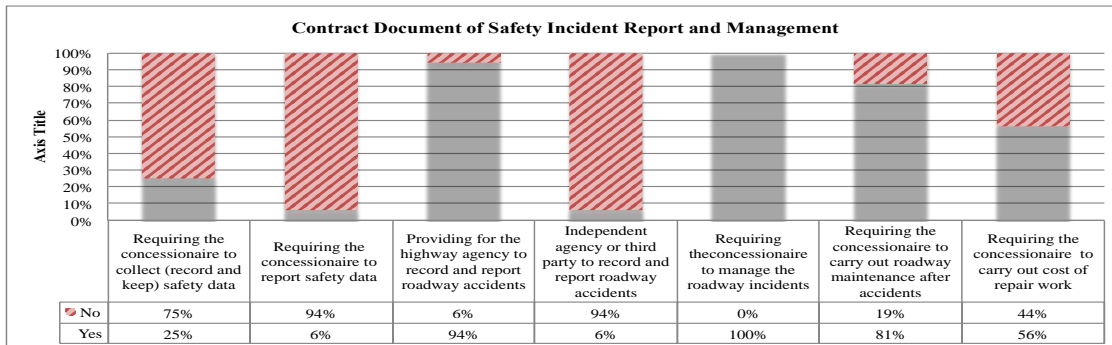


Figure 5. Safety incident report and management.

#### 4 SUMMARY AND CONCLUSIONS

Following to the analysis of the 17 PPP projects, it can be fairly concluded that the US take a lenient stance toward using PPPs to enforce better roadway safety performance. By default, all the selected projects account for the traditional safety requirements as set by the states/federal governments. The analysis shows that safety was an important objective, however, there was no particular mechanism to implement that objective. Half of the projects (53%) include safety in proposal evaluation, but only two projects assigned points/weights to the safety requirements.

All of the agreements required the concessionaire to provide regular safety plans. However, for the operation phase, 12 out of the 17 projects (71%) called for carrying inspections and updating of the roadway safety plans. Only four projects required collect and report traffic and crash data. The PPP projects had no safety incentives, payment, or other mechanism. No provisions were made to assess any safety performance indicators except for one project.

It is suggested that public highway agencies to investigate proactive systems that enforce and incentivize higher roadway safety standards. Along with the traditional contractual safety terms, public agencies would be advised to investigate the broad range of options for proactive systems, e.g. link the concessionaire compensation to the achievement of particular safety objectives.

#### References

- Abdel Aziz, A. M., A Survey of The Payment Mechanisms for Transportation DBFO projects in British Columbia, *Construction Management and Economics*, 25(5), 529-543, 2007.
- Geddes, R., The Effects of Public-Private Partnerships on Traffic Safety: Evidence from Mexico, 2014. Retrieved from <http://www.utrc2.org/sites/default/files/pubs/Final-PPP-Traffic-Safety.pdf> on Jan 2019.
- Vassallo, J. M., Rangel, T., de Vilar, P.P., and Areans, B., Do PPP Contracts Improve Road Safety, *Research Paper, European Investment Bank University Research Sponsorship Program*, European Investment Bank and Universidad Politecnica de Madrid, Madrid, 2009.