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Operations and Maintenance (O&M): A Comparative Analysis of the Cost-Efficiency of Public Private Partnerships (P3s) and Conventional Project Delivery Models

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Prepared for The 71st North American Meetings of the Regional Science Association International
November 2024 – New Orleans, Louisiana

Agenda

- Introduction
- Research Motivation
- Research Objectives
- Challenges
- Methodology
- Findings
- Conclusions
- Recommendations

Introduction

Conventional "Design-Bid-Build" Model vs. Public-Private Partnership (P3) “Design-Build-Finance-Operate-Maintain” Model

Operation & Maintenance (O&M) is generally the longest and costliest phase of infrastructure management.

Design and Construction phases are significantly shorter than the O&M phase which usually lasts at least 20 years for relevant stakeholders.

Research Motivation

1. Previous research and academic literature show governments across the U.S. have struggled to keep up with the maintenance of infrastructure.

2. There is little available research on whether and how the P3 and conventional project delivery models affect the long-term operations and maintenance (O&M) costs of road projects.

Research Question & Objectives

Research Question: Do P3s deliver infrastructure at a lower lifecycle cost than conventional delivery?

Research Objectives:

1. Understand the existing evidence on long-term O&M periods of large transportation infrastructure projects,

2. Investigate and compare the operations and maintenance costs of selected mature projects,

3. Identify possible determinants and consequences of P3 and conventional projects' long-term O&M performance

Challenges

- Lack of previous literature
  - While this strengthens the motivation for the paper, any additional sources would have been helpful for data collection
- Access to data
  - Data for O&M costs for both traditional projects and P3s are not easily accessible
- Comparison between traditional projects and P3s
  - Not comparing apples to apples, P3s have KPIs they need to meet; states and localities can defer maintenance when required
  - States' data systems do not necessarily monitor specific facilities but rather focus on roadway systems (i.e., interstates, primary, secondary)

Methodology

- Literature review;
- Analysis of the financial statements of public and private highway operating organizations;
- Case studies of selected facilities and systems; and
- Interviews with subject matter experts (SMEs).

Findings: Key Performance Indicators (KPIs)

- Comprehensive Literature Review:
  - Identified relevant journals and meticulously selected papers crucial to the study.
- Systematic Analysis:
  - Conducted a systematic and in-depth examination of the chosen papers to extract valuable insights.
- KPI Selection Criteria:
  - Employed specific criteria outlined in the Table to carefully select a set of O&M KPIs.

Findings: KPIs

KPI	Unit of Measurement	Sources
Structural Condition	Number of deficient bridges	(Shaw, 2003); (Garvin et al., 2011), (FHWA, 2016)
Pavement Condition	International Roughness Index	(Shaw, 2003); (Garvin et al., 2011), (FHWA, 2016); (Lima & Cruz, 2019)
Operations and Maintenance Costs	**Operation and Maintenance Expenditure per Lane Mile**	**(Shaw, 2003); (Yuan et al., 2009); (Adams, 2011); (Lima & Cruz, 2019)**
Traffic Volume	Annual Average Daily Traffic	(Shaw, 2003); (Garvin et al., 2011); (Mladenovic et al., 2013); (FHWA, 2016)
Incidents	Fatal Incidents per Million Vehicle-Miles	(Shaw, 2003); (Garvin et al., 2011); (Yuan et al., 2009); (Mladenovic et al., 2013); (FHWA, 2016)
Speed/Reliability	Roadway Clearance Time	(Shaw, 2003); (Garvin et al., 2011); (FHWA, 2016)

Table 1 - Identified O&M KPIs After a Systematic Review of the Literature

Findings: Database Analysis

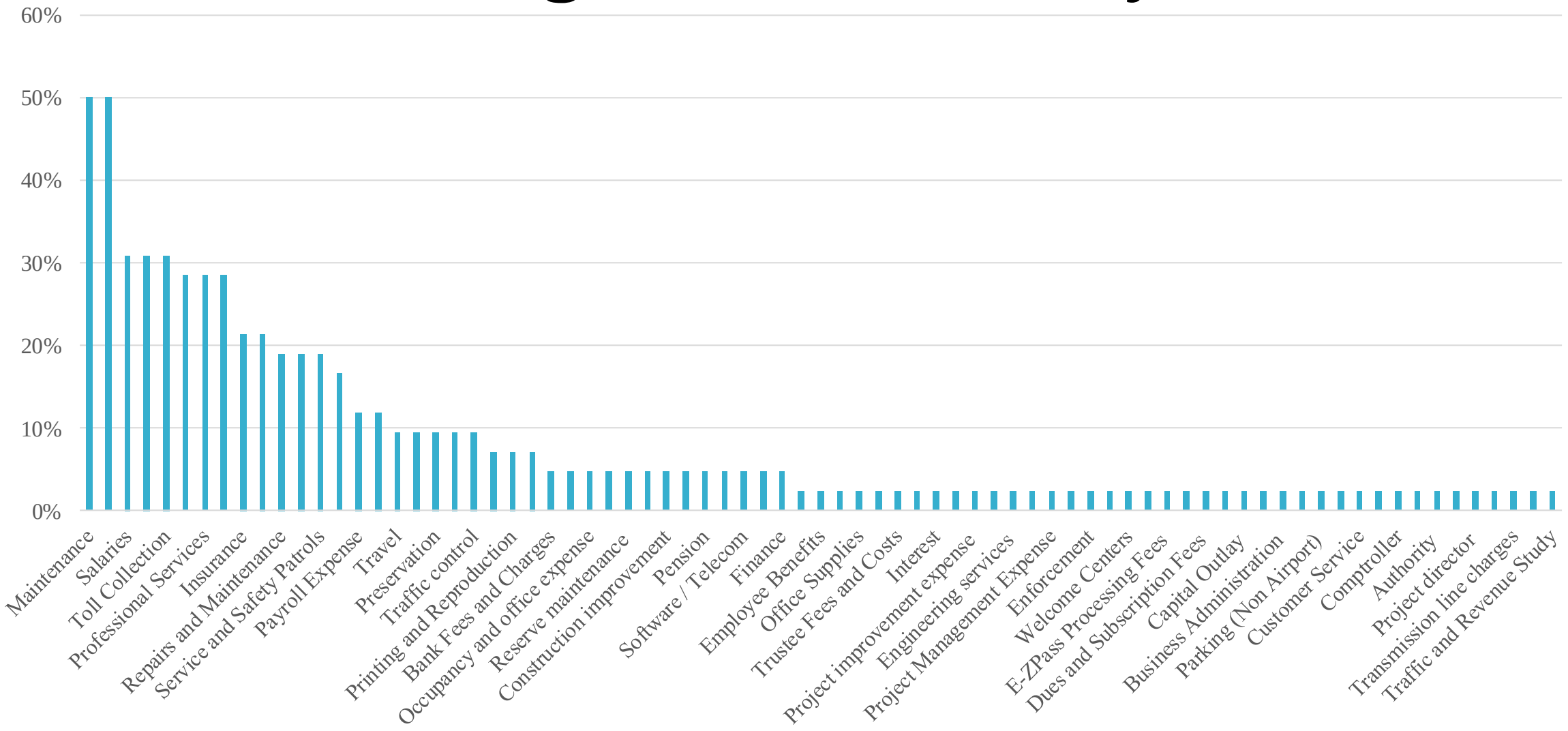

Figure 1 - Frequency of Reported O&M Expense Categories

Case Study: Dulles Greenway vs. Dulles Toll Road

Figure 2 - Dulles Greenway Map

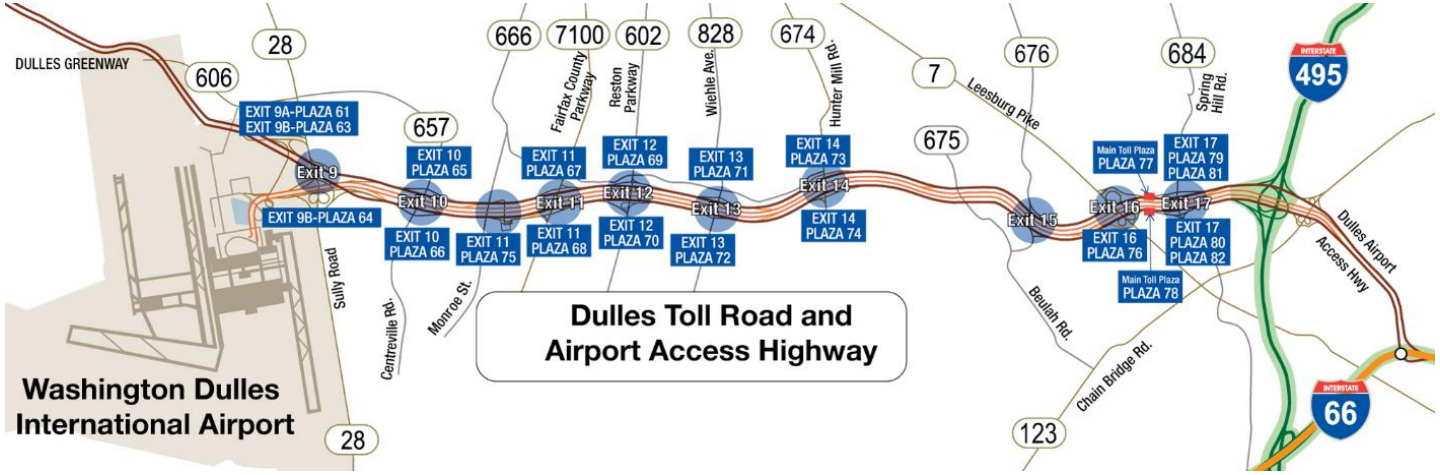

Figure 3 - Dulles Toll Road and Airport Access Highway Course

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Case Study: Dulles Greenway vs. Dulles Toll Road

Project Name	State	Delivery Model	Length (Miles)	Lane Miles	OpEX	OpEX / Lane Miles
Dulles Greenway	Virginia	DBFOM - P3*	14	84	$15,182,643	$180,745.75
Dulles Toll Road	Virginia	Design-Build	14	112	$28,981,600	$258,764.285

Source: Compilations by the authors. *The roadway assets and right-of-way are privately owned and are subject to property taxes paid to Loudoun County.

TABLE 2 - OPEX PERFORMANCE OF DULLES GREENWAY & DULLES TOLL ROAD

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Case Study: Dallas/Ft. Worth TEXpress vs. NTTA Systems

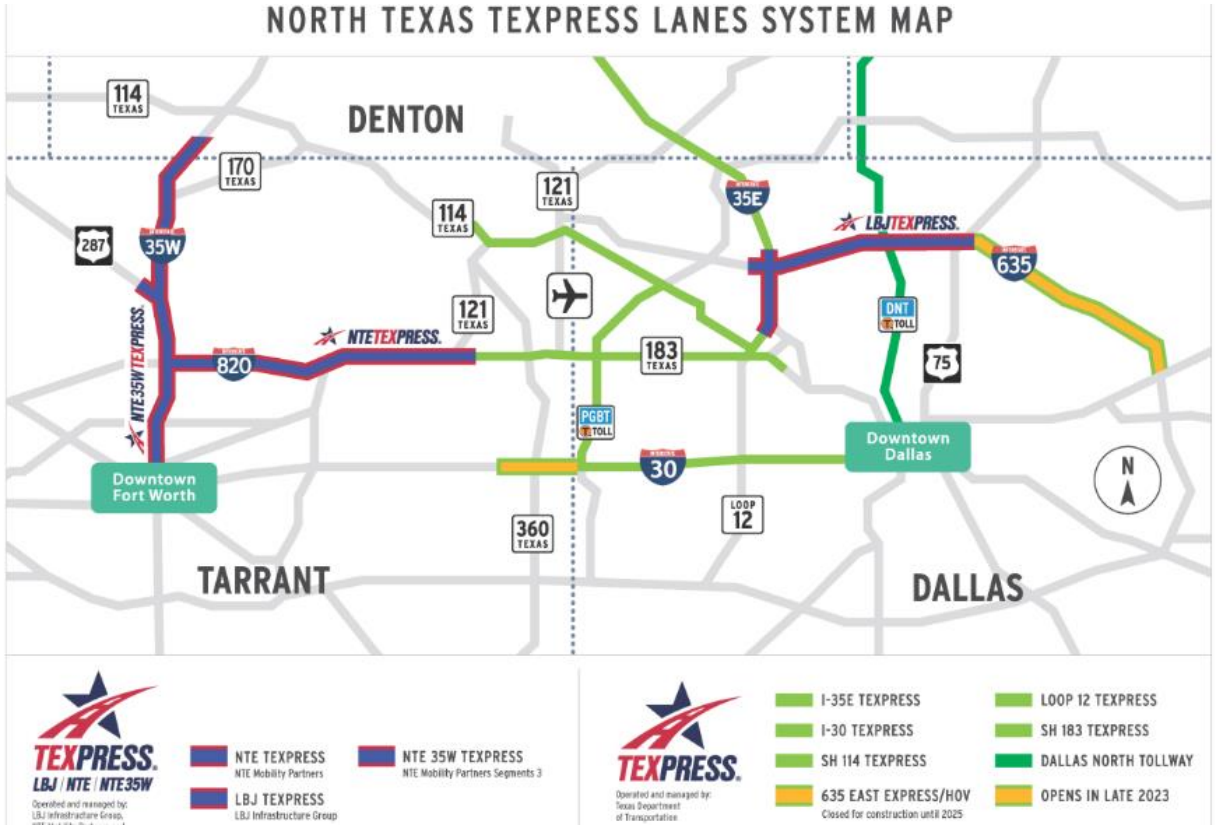

Figure 4 - TEXPRESS Lanes System Map

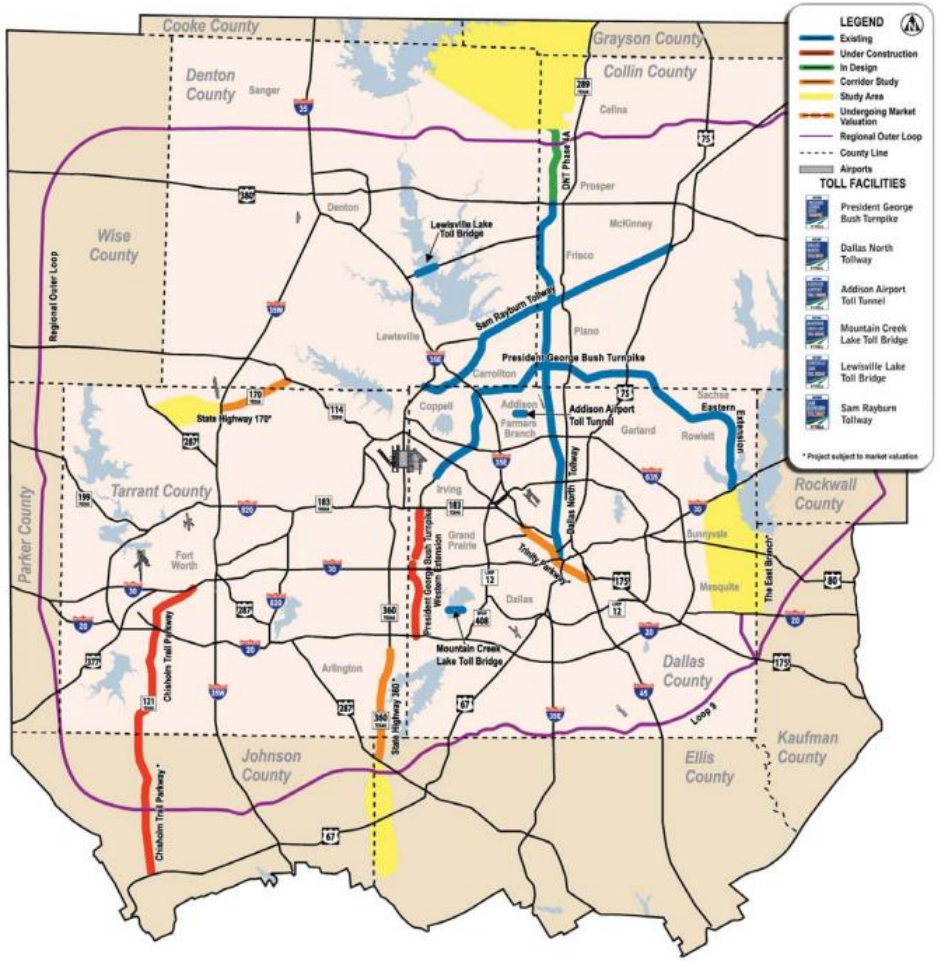

Figure 5 - Map of the NTTA System

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Case Study: Dulles Greenway vs. Dulles Toll Road

System Name	State	Delivery Model	Centerline Miles	Lane Miles	OpEX	OpEX / Lane Miles
Private TEXpress	Texas	DBFOM - P3	36.7	173.4	$69,948,000	$403,391
NTTS	Texas	Design-Build	151	1145	$277,565,495	$242,415

Source: authors' compilations.

TABLE 2 - OPEX PERFORMANCE OF DULLES GREENWAY & DULLES TOLL ROAD

Findings from Interviews: Hidden Differences Approach

A multifaceted KPI approach is essential but may still miss "hidden differences" between projects due to:

- **Stakeholder Preferences**: Different priorities (cost, safety, satisfaction) may not align with standard metrics.
- **Contractual Agreements**: Specifics can affect resource allocation and measurement.
- **Project Characteristics**: Unique factors like size and complexity can influence performance.

Conclusion

- **Inconsistency in Reporting:** The presence of 77 different elements under OpEX highlights challenges for meaningful comparisons.
- **Diverse Evaluation Criteria:** Utilizing multiple key performance indicators is essential for a comprehensive evaluation of O&M performance.
- **However,** Even multifaceted KPIs might not fully capture "hidden differences" between projects.

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Recommendations

1

Explore reasons behind varying O&M expenditure reporting practices across agencies.

2

Adopt a Three-Category Reporting Framework:

- Operating Fees
- Preservation Fees
- General/Administrative Fees

3

Investigate high-level criteria for comparing infrastructure delivery models.

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Thank you!

QUESTIONS

COMMENTS

FEEDBACK