ABSTRACT

Title of Thesis:	COMPETING FACILITIES PROVISIONS IN PUBLIC-PRIVATE PARTNERSHIP PROJECTS: CURRENT PRACTICE AND VALUATION
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Recently in the US, Public-Private Partnerships (P3) have been increasingly utilized as a mechanism for closing the gap between revenues and expenditures in transportation mega-projects, however public perception remains a major challenge to successful utilization. Recent projects have run into issues with public perception particularly where non-compete provisions are utilized. The conventional wisdom is that non-compete provisions in public-private partnership contracts are a zero-sum game, in which the losses of one party directly balance the gains of the other. However, the design and selection of non-compete provisions can be such that the objectives of the public and private sectors are aligned. This study examines the non-compete provisions in P3 contracts in the US to date and the associated risk. Real options analysis is then utilized to value the flexibility lost to non-compete provisions. The SR 91 Express Lanes in California is used as a case study to illustrate this method.

COMPETING FACILITIES PROVISIONS IN PUBLIC-PRIVATE PARTNERSHIP PROJECTS: CURRENT PRACTICE AND VALUATION

by

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Dedication

To my parents, for their constant love and support.

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Chapter 1: Introduction and Overview

1.1 Background

Public agencies in the U.S. have increasingly considered using public-private partnerships (P3s) as a mechanism for closing the gap between revenues and expenditures in transportation mega-projects. The Federal Highway Administration (FHWA) broadly defines a P3 as "a contractual agreement formed between public and private sector partners, which allows more private sector participation than is traditional. The agreements usually involve a government agency contracting with a private company to renovate, construct, operate, maintain, and/or manage a facility or system." (FHWA, 2004) This definition applies to a wide variety of projects, however P3s most commonly refer to P3 concessions, projects where the private sector assumes some risks and rewards for financing, constructing, and/or operating and maintaining a facility.

Public agencies pursue P3s for several reasons, including expanded financial capacity and optimal risk allocation. However, there are many potential P3 concerns and controversies, including loss of public control and flexibility. Many point to non-compete provisions, which FHWA defines as a clause which prohibits or limits the public sector's ability to improve transportation facilities that compete with a private facility for traffic demand, as evidence of this (FHWA, 2016b). Non-compete provisions are often used to mitigate the private sector risk that traffic volumes will be lower than expected, and are seen as necessary by some to incentivize private

sector interest in a project. Past high profile projects, such as the SR-91 Express Lanes in California, in which the public sector ultimately bought back the facility from the private sector following a violation of the non-compete clause, have contributed to skepticism of non-compete clauses specifically and P3s generally. The conventional wisdom is that non-compete provisions in public-private partnership contracts are a zero-sum game, in which the losses of one party directly balance the gains of the other. However, the design and selection of non-compete provisions can be such that the objectives of the public and private sectors are not in direct conflict with each other. Balancing risks while maximizing the objectives of both parties is key to the successful delivery of any P3 project. To do this, accepted methodologies for evaluating the use of non-compete provisions must be in place, along with best practice for the design and selection of non-compete provisions.

This document aims to give an overview of the use of non-compete provisions in the U.S. from their inception to today, evaluate the associated risk, and estimate the value of non-compete provisions using real options analysis.

The second chapter of this study provides an overview of the use of non-compete provisions in the U.S. from the early 1990s until today and compares the risk associated with each provision type using statistical analysis. The third chapter introduces real options analysis and uses a case study of the SR-91 Express Lanes in California to value the social benefits associated with a competing facility that are lost through the use of a strict non-compete provision.

1.2 Topic Importance

A study of the critical success factors of P3s in the U.S. identified political support, and community support as two of the five most critical factors accounting for the success of a P3 project (Osei-Kyei and Chan, 2015). The public has historically been skeptical of the use of P3 procurement in the US; a reality which can limit public sector flexibility in short and long-range transportation planning. This skepticism is acutely shown in relation to non-compete provisions, as past and current projects have demonstrated. This criticism is not entirely unfounded. A study of early toll concessions in Australia showed that contracts were slightly skewed in favor of the private sector, particularly where revenue risk mitigation strategies such as guarantees were concerned (Alonso-Conde et al., 2007).

Therefore, there is a need to understand the cost of complex contract provisions, such as non-compete provisions to the public sector to ensure that these provisions are in the interest of both parties. Further understanding the trade-offs associated with risk mitigation strategies is also essential to increase political and community support, and ensure the continued progress of P3 projects and programs.

Chapter 2: Non-Compete Provision Evolution & Revenue Risk

2.1 - Introduction

Recently in the US, Public-Private Partnerships (P3) have been increasingly utilized as a mechanism for closing the gap between revenues and expenditures in transportation mega-projects. According to the Federal Highway Administration, there are currently 35 states, the District of Columbia and Puerto Rico which have P3 enabling legislation, while the Build America Transportation Investment Center points out that additional states have P3 activities without P3 enabling legislation, and still more are contemplating P3 enabling legislation currently (FHWA, 2016b; BATIC, 2016). However, as Garvin and Bosso (2008) note, P3 activity is not necessarily an indicator of effectiveness. Major challenges to successful utilization remain, including public perception. Community and political support have been identified as key factors accounting for success in P3 projects, however they are often lacking (Osei-Kyei and Chan, 2015). Mostaan and Ashuri (2017) echo this in identifying turbulent political conditions and lack of political support as a major challenge to P3 development.

Recent projects have run into issues with public perception particularly where non-compete provisions are utilized. The I-77 Expressway in North Carolina is one notable recent example of this negative perception. Several articles in the Charlotte Observer, as well as publications by organizations specifically opposing the project, raised issues with the competing facilities provision specifically. A few general

themes cut across these publications. First, the feeling that the private sector was getting a better deal was pervasive with many parties, specifically noting that the contract was revised to exclude projects from exemption to the compensation clause. Additionally, the length of the concession term was a sticking point for many who felt as though the project would guarantee congestion for decades to come. Lastly, questions of equality were raised as the provision was perceived to easily allow for additional toll lanes, but expressly exclude additional general purpose lanes (Harrison, 2015a, 2015b; Widen I-77, 2017). These same themes were seen in the opposition to non-compete provisions in the Midtown/Downtown Tunnel project in Virginia, with the Washington Post arguing that the non-compete provision combined with the length of the concession period is setting the area up for failure for generations to come (Laris, 2016). These negative feelings are pervasive and tied to historical experience, from past P3 projects, and feelings related to protecting the public good, such as infrastructure.

With the passing of the "Fixing America's Surface Transportation (FAST) Act" by Congress, a clear emphasis has been made on the utilization of public-private partnerships, but also on the need to better understand the non-compete provisions that are often included in P3 contracts; The FAST Act mandates that best practices be developed for non-compete provisions. This development of best practices and dissemination of knowledge regarding non-compete provisions will be critical in balancing the attractiveness of public-private partnerships with protecting the public interest.

There have been several examples of P3 projects in the United States where the inclusion and/or exclusion of a non-compete provision has had unexpected consequences for the public or private sector. On the State Road 91 project in California, the public sector was forced into a buy back of the project in order to expand merge lanes from SR-91 to a competing toll road; this was due to a non-compete provision which prohibited increasing capacity within a 1.5-mile corridor surrounding the project. Conversely, on the Dulles Greenway project in Virginia, the concessionaire began to default shortly after the project opened due in part to lower than anticipated toll revenues. In this project case, no non-compete provision was included in the agreement and Virginia was free to increase capacity on VA Route 7, an un-tolled parallel facility (Persad et al., 2005). As these examples seem to suggest, the conventional wisdom is that non-compete provisions in public-private partnership contracts are a zero-sum game, in which the losses of one party directly balance the gains of the other. However, the design and selection of non-compete provisions can be such that the objectives of the public and private sectors are not in direct conflict with each other. Balancing risks while maximizing the objectives of both parties is key to the successful delivery of any P3 project. To achieve this, as the FAST Act both suggests and mandates, best practices must be developed which help the public-sector in the design and selection of non-compete provisions including caps on compensation and buy-back guidance, among other recommendations. Currently there do not exist widely agreed upon best practices for the design and selection of non-compete provisions, nor methodologies for evaluating past, current, and future use of these and various supporting provisions.

2 – Non-Compete Provision Review

The Federal Highway Administration defines a contract non-compete clause as one that constricts the public sector's ability to improve existing facilities or construct new facilities that compete with the P3 facility for travel demand (FHWA, 2016b). Although these provisions can garner much attention, as seen in the Dulles Greenway and SR-91 cases, as well as in the media coverage of the I-77 Express Lanes and Elizabeth River Tunnels, they do not exist in all toll concession contracts. Several states have prohibited the use of non-compete clauses altogether; one notable example of this is the Texas statute which states that an agreement "may not contain a provision that limits or prohibits the construction, reconstruction, expansion, rehabilitation, operation or maintenance of a highway or other transportation project" (FHWA, 2016b).

In contracts that contain and have contained non-compete provisions, the language referring to competing facilities has taken a variety of forms. Additionally, these non-compete provisions have evolved since their inception in the United States in the early 1990s, a trend that is seen in not only non-compete provisions, but the P3 process generally. Wang (2015) argues that P3 projects have evolved in two phases, from a private development model which maximizes private participation, to a collaborative partnership model in which responsibilities and risks are shared. Wang argues that this evolution has occurred due to lessons learned and implemented risk management strategies on the part of the public sector in contract terms, among other project characteristics. The SR-91 project is cited to demonstrate this change in contract terms following a project that was not seen as serving the public interest. Several studies have evaluated the evolution of non-compete provisions over the

course of this period as well. Buxbaum and Ortiz (2009), and Iseki and Houtman (2012), argue that changes in non-compete provisions have occurred due to lessons learned from past projects, specifically those with restrictive non-compete clauses such as SR-91 in California. From these past projects, lessons learned include the importance of striking a balance between the objectives of the public and private sectors, and the necessity of developing methods for identifying and permitting improvements which may be necessary for achieving the public sector's objectives. These changes have been incorporated into what is deemed the 'second generation' of non-compete clauses, the limited compete clause, which acknowledges some need for public sector improvements.

For this study, an analysis of available toll concession and long term lease contracts was conducted to further explore the state of practice and use of non-compete provisions from their early occurrences in the United States to today. For this analysis 13 contracts dating from 1993 to 2014 were surveyed. This analysis found that only two of the surveyed contracts contained no competing facilities provision, or non-compete language. Additionally, both contracts appeared to be special cases. The first, Dulles Greenway, was one of the first toll-concession contracts in the U.S. and in many ways served as a lesson for future projects. The other, the Chicago Skyway, is a long-term lease concession in a densely-populated area, with little possibility of expansion of existing or new facilities (Buxbaum and Ortiz, 2009). In all other contracts, 85%, competing facilities were regulated in some way. In reviewing these non-compete provisions it became clear that an evolution has occurred from the first agreement surveyed, the SR-91 Express Lanes in California, to

the most recent, the I-77 Express Lanes in North Carolina. This analysis observed the shift from strict non-compete provisions to limited compete provisions, however an additional distinct provision type was observed. In more recent contracts, those which reached financial close within the past 10 years, there appears to be a trend toward competing facilities compensation clauses, those which specify no restrictions based on geography or existing transportation plans.

In general, these provisions have changed from ones which expressly acknowledged the negative impact of competing facilities on the toll revenue of the concessionaire, and limited the government's ability to construct competing facilities in the 1990s, what will be referred to as strict non-compete provisions, to contracts in the 2010s which grant the State Departments of Transportation an unfettered right to construct and improve facilities, regardless of their impact on the private facility, while setting up a compensation structure for the impact on toll revenue from competing facilities if and when they occur. This explicit acknowledgement of the rights of the State are seen in both the limited compete clauses and competing facilities compensation clauses; a specific compensation structure related to competing facilities is seen in many, but not all of the contracts containing limited compete clauses as well. The table below shows this distribution:

Project	**Provision Type**	**Financial Close**
Pocahontas 895	Non-Compete	1998
SR-91	Non-Compete	7/20/1993
Dulles Greenway	No Provision	9/30/1993

Chicago Skyway	No Provision	8/1/2005
Indiana Toll road	Non-Compete	6/29/2006
I-495 HOT Lanes	Limited Compete	12/20/2007
SH 130	Limited Compete	3/7/2008
North Tarrant Express	Competing Facilities Compensation	12/17/2009
Midtown/Downtown Tunnel	Competing Facilities Compensation	4/12/2010
IH 635 Managed Lanes (LBJ Expressway)	Limited Compete	6/22/2010
I-95 Express Lanes	Competing Facilities Compensation	7/1/2012
US-36	Competing Facilities Compensation	2/26/2014
I-77 Express Lanes	Competing Facilities Compensation	5/20/2015

Table 2.1 – Non-compete provision type & date of financial close

The contracts executed in the 1990s include projects which have become notable and controversial due to issues relating to competing facilities. These include the Dulles Greenway project in Virginia and State Road 91 in California. As discussed, the Dulles Greenway example is notable as there was no non-compete language present in the contract and due in part to a competing facility, VA Route 7, the concessionaire began to default shortly after the project opened. Conversely, the

State Road 91 contract did contain non-compete language outlining the concessionaire's "Exclusivity of Rights". Article 3.2 – Exclusivity of Rights states that:

"…*Caltrans shall not during the term of this Agreement grant or convey any franchise or other similar regulatory or contract rights to any party other than CPTC in connection with, and will not finance with public funds within Caltrans' discretionary control (either directly or by provision of governmental guarantees of a financial or commercial nature) the design, financing, construction or operation within the Absolution Protection Zone of any public transportation facility, project or program"* (Caltrans, 1993).

The contract outlines a few exceptions to this covenant, but also provides sweeping, general rules for determining if a proposed facility presents economic competition to the toll facility. These guidelines state that a facility will be considered to present economic competition if it is designed to Expressway or higher specifications and if it facilitates transportation movements to the east and west.

2.2.1 Strict Non-Compete Clauses

The Pocahontas 895 in Virginia is the only other contract surveyed which was executed in the 1990s. This contract takes a similar approach to that of the State Route 91 contract in prohibiting the State from pursuing competing facilities. In this contract, it is stated that the Department will not pursue competing facilities, and will even actively discourage their implementation. In Section 12.1 – Competitive Transportation Facilities, the contract states:

*"(a) The Department acknowledges that Competitive Transportation Facilities may adversely affect Toll Revenues and materially impede the repayment of the Bonds, and that Operator may be unable to finance the Project if there is a significant risk that Competitive Transportation Facilities will adversely affect Toll Revenues or impede repayment of the Bonds without Operator having certain rights to receive compensation for proven economic impacts. In consideration thereof, for a period commencing on the Agreement Date and ending on the expiration or earlier termination of this Agreement, the Department shall not, except as permitted in subsection (b) below: (i) initiate, authorize, franchise or finance private Competitive Transportation Facilities; (ii) open any Department owned or operated Competitive Transportation Facilities; and (iii) fail to exercise all discretionary authority available to it under Laws, Regulations and Ordinances to prevent any other governmental or private entity from developing Competitive Transportation facilities, including but not limited to connections to State Highways." (*VDOT, 1998*)*

Although some consider the Pocahontas 895 concession to be an example of a limited compete provision, because it expressly acknowledges the adverse impact of competing facilities on toll revenues and makes no reference to the rights of the State it is considered a non-compete provision in this analysis. Qualifications do exist which allow for distribution of federally mandated funds and permit the State Department of Transportation to provide advice that it deems to be in the best interest of the state. Additionally, this contract does not include terms of compensation or resolution for when a situation arises where the construction or improvement of a competing facility is unavoidable. In fact, the contracts state that this situation cannot

and will not occur. However, the SR-91 case shows that it can, and in doing so can create major issues for the State actors.

The only contract containing a non-compete provision that did not reach financial close in the 1990s was the Indiana Toll Road; it reached financial close in June of 2006. This project is unique in that it does not include a specific competing facilities provision, but does define "Competing Highway" and sets up a compensation structure. This agreement does define competing facilities more narrowly, as comparable facilities (limited access roads), and does allow for improvements to existing facilities within the specified geographic zone (Buxbaum and Ortiz, 2007). As with the case of the Pocahontas 895 concession, its specification of a non-compete zone and failure to acknowledge the rights of the State lead to its consideration as a non-compete clause. Table 2.2 includes the key components and language of the non-compete provisions included in this analysis, SR-91 and Pocahontas 895:

Project	**Non-Compete Provision - Unifying Language**
SR-91	Article 3.2 - Exclusivity of Rights: "Caltrans shall not during the term of this Agreement grant or convey any franchise or other similar regulatory or contract rights to any party other than CPTC in connection with, and will not finance with public funds within Caltrans' discretionary control (either directly or by provision of governmental guarantees of a financial or commercial nature) the design, financing,

	construction or operation within the Absolution Protection Zone of any public transportation facility, project or program" (Caltrans, 1993)
Pocahontas 895	Section 12.1: "(a) The Department acknowledges that Competitive Transportation Facilities may adversely affect Toll Revenues and materially impede the repayment of the Bonds, and that Operator may be unable to finance the Project if there is a significant risk that Competitive Transportation Facilities will adversely affect Toll Revenues...The Department shall not, except as permitted in subsection b: (i) initiate, authorize, franchise or finance private Competitive Transportation facilities; (ii) open any Department owned or operated Competitive Transportation Facilities; and (iii) fail to exercise all discretionary authority available to it under Laws, Regulations and Ordinances to prevent any other governmental or private entity from developing Competitive Transportation Facilities, including but not limited to connections to State Highways." (VDOT, 1998)

Table 2.2 – Non-Compete Clause Unifying Language

2.2.2 Limited Compete Provisions

The lessons learned from the projects of the 1990s resulted in a wide variety of mechanisms for addressing competing facilities. Collectively, these provisions are often referred to as limited compete provisions (Buxbaum and Ortiz, 2009). The majority of projects utilizing this type of provisions reached financial close in the

early 2000s, with one reaching financial close in 2010. All projects which fall under this category recognize the "unfettered right" and responsibility the public sector has to develop or expand competing facilities, regardless of the impact these facilities have on the Developer and their revenue stream. Table 2.3 details this similarity in language:

Project	**Limited Compete Provision - Unifying Language**
I-495 HOT Lanes	Section 9.02 - Project Enhancements by the Department: "**The Department shall have unfettered rights** to finance, develop, approve, expand, improve, modify, upgrade, add capacity to, reconstruct, renew and replace any existing and new transportation or other facilities. In no event shall the taking of any such action by the Department constitute a default by the Department under this Agreement. " (VDOT, 2007)
IH 635 Managed Lanes (LBJ Expressway)	Article 11.3.1.1 "Except for the limited rights to compensation provided to Developer under Section 11.3.2, **TxDOT will have the unfettered right** in its sole discretion, at any time and without liability, regardless of impacts on Toll Revenues to finance, develop, approve, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew and replace any existing and new transportation or other facilities." (TXDOT, 2009)
SH 130	11.3.1 - "Except for the limited rights to compensation provided to Developer under Section 11.3.2, **TxDOT will have the unfettered right** in its sole discretion, at any time and without liability, to finance, develop, approve, construct, expand, improve, modify, upgrade, add capacity to, reconstruct,

	rehabilitate, restore, renew and replace any existing and new transportation or other facilities." (TXDOT, 2007)

Table 2.3 – Limited Compete Clause Unifying Language

These provisions limit the facilities that can be considered competing in a variety of ways. Each is unique, but approaches generally include a geographic exclusion zone, or the exclusion of projects already present in various planning documents. Excerpts from the contract documents showing this range are included in the table below:

Project	**Limited Compete Provision - Unifying Language**
I-495 HOT Lanes	Section 9.02 (f) -"The parties agree that the Department may, at its sole cost and discretion, develop, design, finance, construct, operate, and maintain the following improvements: (i) a flyover ramp from the northbound GP Lanes to westbound lanes along I-66; (ii) improvements to I-66 outside the Capital Beltway Corridor; (iii) improvements to the interchange of the GP Lanes and the Dulles Toll Road (the "DTR"); (iv) right hand ramps and flyovers from the northbound GP Lanes to the westbound lanes of the DTR; (v) ramps or flyovers from southbound GP Lanes to eastbound along the DTR; (vi) connections from DTR/Dulles Airport Access Road (the "DAAR") westbound to the northbound and southbound HOT Lanes; and (vii) connections from the southbound HOT Lanes to the eastbound and westbound lanes of the DTR/DAAR." (VDOT, 2007)

IH 635 Managed Lanes (LBJ Expressway)	Exhibit 18 - "Unplanned Revenue Impacting Facilities exclude all projects included in any of the following long range transportation plans and programs: 206-208 Statewide Transportation Improvement Program (STIP); Unified Transportation Program (UTP) (2006), 2006 Statewide Preservation Program (SPP), 2006 Statewide Mobility Program (SMP); Mobility 2025 Plan, Amended Paril 2006 by the Regional Transportation Council, the MPO for the Dallas Forth Worth Metropolitan region; Mobility 2030 Plan, adopted by the Regional Transportation Council on January 11, 2007" (TXDOT, 2009)
SH 130	Exhibit 17 - "Competing Facilities exclude all highway projects located outside of the following Competing Facilities Zone [see included map]...Competing Facilities exclude all highway projects included in any of the following long range transportation plans and programs: (see list) as in existence at the effective date"; Also excluded: frontage roads except where adding a 3rd lane in segment 5, all I-35" (TXDOT, 2007)

Table 2.4 – Limited Compete Clause Unifying Language

2.3 Competing Facilities Compensation Provisions

As mentioned previously, in the contracts executed in the last 10 years, especially the contracts executed after 2010, there appears to be a trend toward exclusively including competing facilities compensation provisions without limiting the facilities that may be considered competing. As with limited compete provisions, these provisions still explicitly state that the State is given an unfettered right to pursue competing facilities, regardless of the revenue impact to the Developer; this language is shown in the table below:

Project	Competing Facilities Compensation Provision - Unifying Language
I-77 Express Lanes	Article 11.3.1 "Except for the limited rights to compensation provided to the Developer under Section 11.3.2 **NCDOT will have the unfettered right** in its sole discretion, at any time and without liability, regardless of impacts on Toll Revenues, to finance, develop, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew and replace any existing and new transportation or other facilities...Such rights extends to facilities...whether identified or not identified in transportation plans, and whether adjacent to, nearby or otherwise located as to affect the Project" (NCDOT, 2014)
Midtown/Downtown Tunnel	12.04 - Development of Other Facilities: "Except for the right of the Concessionaire to receive compensation set forth in Section 12.05 with respect to Alternative Facilities, **the State Parties will have the unlimited right**, each in its sole discretion, at any time and without liability, to finance, develop, approve, construct, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew and replace any existing and new transportation or other facilities other than the Project outside of the Project Right of Way... whether adjacent to, nearby or otherwise located as to affect the Project...its vehicular traffic and/or its revenues" (VDOT, 2011)
North Tarrant Express	Article 11.3.1 "Except for the limited rights to compensation provided to Developer under Section 11.3.2, **TxDOT will have the right** in its sole discretion, at any time and without liability, regardless of impacts

	on Toll Revenues, to finance, develop, approve, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew and replace any existing and new transportation or other facilities" (TXDOT, 2009)
US-36	Article 29.8: "Without prejudice to the Concessionaire's rights arising out of any Compensation Event in relation to an Unplanned Revenue Impacting Facility, **HPTE and any HPTE Related Party will have the unfettered right** in its or their sole discretion and at any time and from time to time, without liability to the Concessionaire, regardless of impacts on Toll Revenues, to develop, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew replace or close any existing or new transportation or other facilities of any type whatsoever." (HPTE, 2014)
I-95 Express Lanes	12.04 - Development of Other Facilities: "Except for the right of the Concessionaire to receive compensation set forth in Section 12.02, 12.04 (d), 12.05 and 12.06**, the State Parties will have the unlimited right**, each in its sole discretion, at any time and without liability, to finance, develop, approve, construct, expand, improve, modify, upgrade, add capacity to, reconstruct, rehabilitate, restore, renew and replace any existing and new transportation or other facilities other than the Project, ... , and to otherwise improve the GP Lanes and other roadways and structures within or adjacent to the I-95 Corridor (collectively, the "Department Projects") outside the HOT Lanes, and

	whether nearby or otherwise located as to affect the Project, its operation and maintenance, ... , its vehiclular traffic and/or its revenues" (VDOT, 2012)

Table 2.5 – Competing Facilities Compensation Clause Unifying Language

These contracts outline compensation procedures for when competing facilities affect the toll revenue of the private project; many, but not all, of the limited compete provisions outline similar compensation provisions as well. Additionally, in this provision type if a competing facility results in an increase in revenue for the concessionaire, the concessionaire would typically be responsible for compensating the State DOT for the increase in revenue associated with the competing facility; US-36 however does not contain a specific compensation provision, but does treat revenue impacting competing facilities as compensation events. While these provisions are detailed, generally, the compensation amount is equal to the net increase or decrease in revenue that can be directly attributable to the revenue impacting facility or facilities. However, the method for calculating this amount is slightly varied and often complex.

A major difference between these contracts and contracts with limited compete provisions is that generally, competing facilities are defined broadly as any facility which would directly impact the net revenue of the private facility, and do not assign any location specific criteria or limitations; it is only required that the impact

can be directly attributable to that specific facility. The I-95 case is the only one which qualifies competing facilities further. In the case of the I-95 Express Lanes, the contract specifically identifies planned facilities that would trigger a compensation event if they were implemented. The specific contract language which refers to these compensation events is included in Section 12.05 – Alternative Facilities, and is as follows:

"…(b) Route One Improvements. The Route One Improvements will be treated as a Compensation Event unless the Highest Revenue Share IRR has been reached as of the Commencement of Use of the Route One Improvements. (c) Occoquan Bridge Improvements. The Occoquan Bridge Improvements will be treated as a Compensation Event unless the Highest Revenue Share IRR has been reached as of the Commencement of Use of the Occoquan Bridge Improvements. (d) Southern HOT Lanes. The Southern HOT Lanes will be treated as a Compensation Event unless (i) the Highest Revenue Share IRR has been reached as of the Commencement of Use of the Southern HOT Lanes or (ii) the Concessionaire develops and constructs the Southern HOT Lanes as a Concessionaire Project Enhancement." (VDOT, 2012)

This continuity in competing facilities provisions, and how these recent examples differ from previous examples of the same type, suggests learning and growth on the part of the private sector, the public sector or both. The above analysis of toll concession contracts in the U.S. over approximately 20 years demonstrates a trend toward uniformity and flexibility. The recent toll concession contracts acknowledge the right and need of the public sector to improve and maintain the transportation network, while also acknowledging the impact, negative or positive,

that these actions can have on the revenues of the private transportation facility. Additionally, recent contracts attempt to establish procedures for addressing claims relating specifically to competing facilities when they arise.

2.3 –Non-Compete Provision and Revenue Risk

As discussed, the above analysis of toll concession contracts suggests an evolution of non-compete provisions in the U.S. from the early 1990s to today. This analysis shows that on the whole there has been a movement toward acknowledging the right and obligation of the State to expand and improve upon the transportation network, crafting specific compensation procedures to address the impact of competing facilities on the concessionaire, and a move away from strict non-compete provisions. Especially given this shift across the board, it is important to understand the ways in which different non-compete provision models utilized in the United States affect revenue risk.

In this analysis of 13 toll concession contracts, the approaches utilized to address competing facilities have fallen into four general categories; contracts which contain no competing facilities provision or reference to competing facilities, contracts with strict non-compete provisions, contracts containing limited compete provisions, and contracts containing competing facilities compensation provisions. The last two categories are similar in that they both explicitly acknowledge the rights of the State relating to competing facilities. As mentioned previously, the evolution of competing facilities provisions in the United States has generally been from strict competing facilities provisions, to competing facilities compensation provisions.

To determine the revenue risk in each project case two markers were used, the debt risk spread, measured in terms of basic points (BPS) and the equity risk premium. For this analysis, the debt risk spread is defined as the bond yield minus the risk-free 20-year of 30-year Treasury bond rate; the difference between these two values then represents the risk premiums associated with debt financing. Similarly, the equity risk premium is equal to the equity return minus the 20-year or 30-year Treasury bond rate; the difference in this case indicating the risk premium associated with equity investment. Figure 2.1 shows both the debt risk spread and the equity risk premium for each toll concession analyzed:

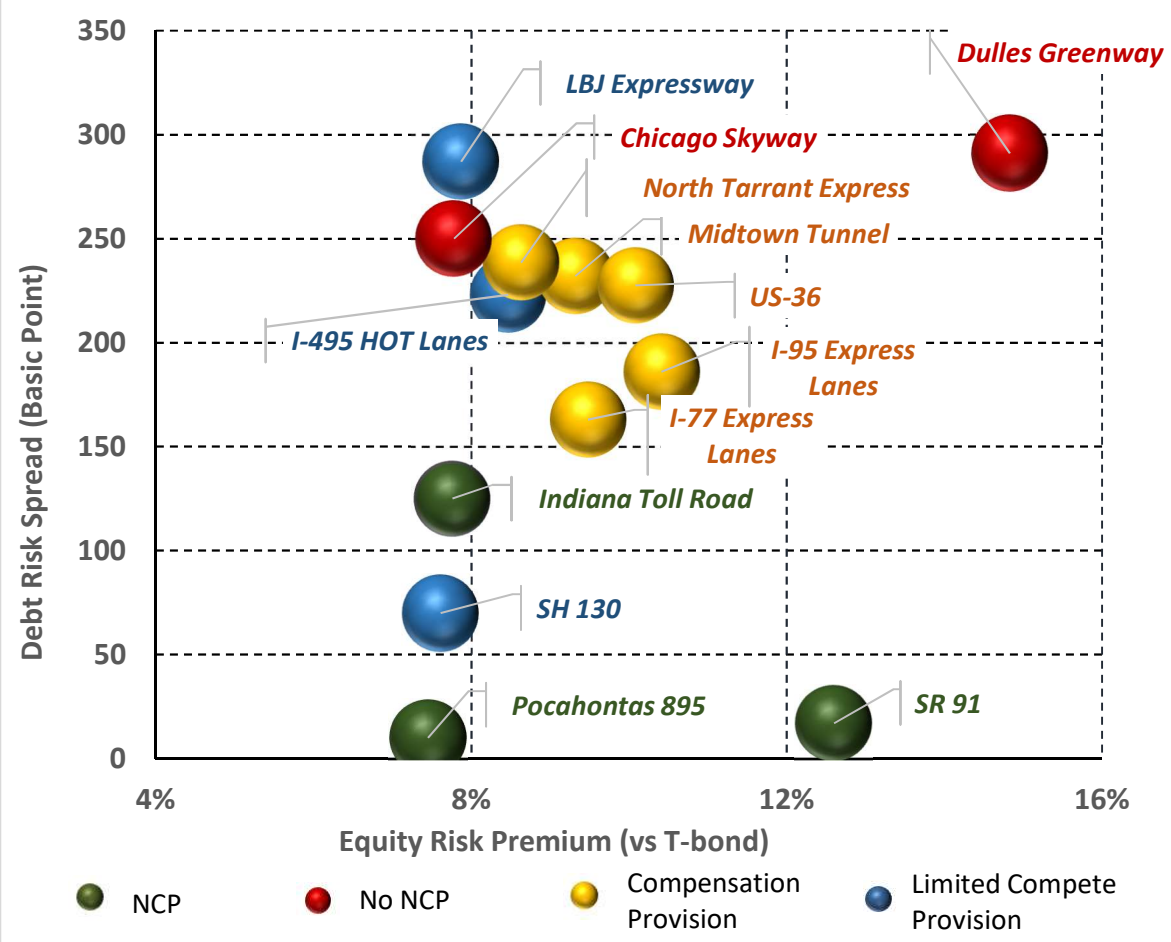

Figure 2.1 – Debt Risk Spread & Equity Risk Spread by Non-Compete Provision Type

The figure appears to show that the model utilized to address non-compete provisions has an insignificant impact on equity return; however, there appear to be clear differences in debt risk spread among the models. As this figure demonstrates, the non-compete provision case is associated with lower risk for the private sector, as seen by the debt risk spread. The low debt risk suggests that non-compete provisions can reduce the exposure to revenue risk caused by actions taken by the public sector, such as developing competing facilities. Therefore, strict non-compete provisions are the most effective for the private sector due to the low revenue risk associated with these provisions. All contracts surveyed that contain a strict non-compete provision, SR-91, the Indiana Toll Road and Pocahontas 895, have debt risk spreads that are lower than 150 BPS; only SH 130, which utilizes a limited compete provision with a Competing Facilities Zone used to exclude competing projects has a debt risk spread below this threshold, all others are above 150 BPS. The project with both the lowest debt risk spread at 10 BPS and the lowest equity risk premium at 7.45%, Pocahontas 895 Concession in Virginia, is significantly lower than that of any other project utilizing a different competing facilities approach.

On the opposite end of the spectrum, contracts which include no competing facilities language, provide no protection to the private sector from actions taken by the public sector; in this case the private sector is left exposed to this revenue risk. The debt risk spread shows this as all projects with no provision are 250 BPS or higher. Arguably the most notable example of this model, The Dulles Greenway, has both the highest debt risk spread, at 290 BPS, and the highest equity risk premium, at 14.83%, of any project surveyed.

The final two models for addressing competing facilities, the limited compete provision and competing facilities compensation provision approach provide flexibility for the public sector while still providing some protection for the private sector, but as the figure shows not as much protection is provided as in the non-compete provision case. This is shown by the higher debt risk spread across the board in both cases. However, it is also important to note the range of debt risk spreads seen in the limited competed case. The highest debt risk spread seen in this category is that of the LBJ Expressway at 287 BPS, which is on par with that of the Dulles Greenway. Conversely the lowest debt risk spread is that of SH 130 at just 70 BPS, lower than the Indiana Toll Road which utilizes a strict non-compete provision. Contracts which contain competing facilities compensation provisions are more closely clustered. This range could be due in part to the varying contract language within the limited compete. Other factors associated with project risk could account for these differences as well.

2.3.1 - Statistical Analysis of Provisions and Revenue Risk

The figure in the above section appears to show that the model utilized to address non-compete provisions has an insignificant impact on equity return. Statistical analysis of the equity risk premiums appears to confirm this assumption. To analyze the differences among the equity risk premiums, one-way between subjects ANOVA analyses were conducted to determine if the differences displayed above were significant. This analysis indicated there were no significant differences between the equity risk premiums of groups of projects with non-compete provisions, without non-compete provisions, with limited compete provisions, and those with

competing facilities compensation provisions at the p<.05 level [F (3,9) = 0.924, p = 0.468]. These results confirm the assumption stated in the previous section, that non-compete provisions appear to have an insignificant effect on equity returns, and were not explored further.

For the debt risk spread, the figure in the above section appeared to show distinct differences between the various types of non-compete provisions. One-way between subjects ANOVA analyses were conducted to determine if the differences displayed above were significant. This analysis indicated that there were significant differences between the debt risk spread of projects with non-compete provisions, without non-compete provisions, with limited compete provisions, and those with competing facilities compensation provisions at the p<.05 level [F (3,9) = 5.574), p = 0.019]. To explore these results further, independent samples t-tests were conducted individually to see between which groups differences occur.

	NCP		**No NCP**		**Limited Compete**		**Compensation**	
	t	df	t	df	t	df	t	df
NCP	-		4.36*	3			4.72**	6
No NCP	4.36*	3	-		.91	3	2.24	5
Limited Compete	1.92	4	.913	3	-		-.25	2.22
Compensation	4.72**	6	2.24	5	-.25	2.22	-	
n	3		2		3		5	
M	50.67		270.5		193.33		209.60	
SD	64.47		28.99		111.5		33.29	

* p<.05, **p<.01

Table 2.6 – Independent Sample t-test of Debt Risk Spread by Provision Type

The above table suggests that significant differences in debt risk spread exist, but not between all groups. Contracts containing strict non-compete provisions had debt risk spreads that were significantly different from almost all other groups;

significant differences did not exist between contracts with strict non-compete provisions and contracts with limited compete provisions. These results suggest that the evolution of non-compete provisions in the U.S., from strict non-compete clauses to competing facilities compensation provisions, represents a move toward a more balanced approach to dealing with competing facilities. The explicit acknowledgement of public sector priorities and responsibilities in the newer generation of P3 contracts supports this conclusion as well. However, it is unclear what differences exist between competing facilities compensation provisions and limited compete provisions. Perhaps more importantly, it is unclear what differences exist between limited compete provisions and strict non-compete provisions.

2.4 – Conclusions

P3 projects are still relatively new in the U.S., however there has been an evolution in contract non-compete provisions at least in part in response to lessons learned from completed projects. Contracts in newer P3 projects explicitly acknowledge the rights and responsibilities of the public sector relating to competing facilities. They appear to strive toward a more balanced approach to dealing with competing facilities and the associated revenue risk. A comparison of the debt risk spread and equity return across all non-compete provision types suggests that the non-compete provision model used influences the risk from the perspective of the debt holder, but not necessarily the perspective of the equity holder.

Further, statistical analysis showed that there are significant differences between the debt risk spread in contracts that have strict non-compete provisions and most others; significant differences did not exist between strict non-compete

provisions and limited compete provisions. Like the acknowledgement of public sector rights and responsibilities, this suggests that competing facilities provisions represent a move toward a more balanced approach to dealing with competing facilities than strict provisions used in early P3 contracts. However, there were not significant differences among limited compete and competing facilities compensation provisions, and between these provision types and contracts which contain no provision. This raises questions about the protections that limited compete provisions and competing facilities compensation provisions provide, and the advantages and disadvantages between the two. Perhaps more importantly, there were not significant differences between the debt risk spread in strict non-compete provisions and limited compete provisions, calling into question the additional protections this provision type provides.

As noted previously, there are many other aspects that are factored into overall project risk, none of which were examined in this study. Additionally, the language in compensation provisions, and their specific requirements were not examined in detail. The requirements associated with the compensation provisions can often be restrictive, a fact which was not measured. Both should be considered in detail in future studies. Additionally, all projects containing competing facilities compensation provisions are relatively new. It remains to be seen how effective these clauses are, and whether they protect the public's interest while still incentivizing P3 investment.

Chapter 3: Valuing Non-Compete Provisions in Public-Private Partnerships with Real Options Analysis

3.1 – Introduction

In the US, Public-Private Partnerships (P3) are increasingly utilized to close the gap between revenues and expenditures in transportation mega-projects. According to the Federal Highway Administration, there are currently 35 states, the District of Columbia and Puerto Rico which have P3 enabling legislation, while the Build America Transportation Investment Center points out that additional states have P3 activities without P3 enabling legislation, and still more are contemplating P3 enabling legislation currently (FHWA, 2016b; BATIC, 2016). Although P3 procurement can be a valuable tool, there exist several challenges to successful utilization. The public has historically been skeptical of the use of P3 procurement in the US; a reality which can limit public sector flexibility in short and long-range transportation planning. This skepticism is acutely shown in relation to non-compete provisions. The I-77 Expressway in North Carolina is one recent example of these negative sentiments. Several articles in the Charlotte Observer, as well as other publications, detailed concerns related to the competing facilities provision specifically (Harrison, 2015a, 2015b; Widen I-77, 2017). These articles generally argued that the private sector was getting a better deal than the public sector, and that the non-compete provision was not in the public's best interest. Additionally, questions of equality were raised as the contract was perceived to easily allow for additional toll lanes, but expressly exclude additional general purpose lanes. These

concerns are hardly new. The SR-91 project in California, one of the first P3 procurements in the US, encountered this negative public perception as well. One study showed that during the first four years the SR-91 Express Lanes (91X) were open, approval of private organizations operating toll roads for profit dropped from 50-75% to 30-45% approval; this trend was not seen in approval of publicly run toll roads (Sullivan, 2000). As with recent projects, the 91X project was often strongly condemned by the press. The non-compete provision was described as giving the concessionaire, California Private Transportation Company (CPTC), a monopoly over the SR 91 freeway. CPTC was also accused of favoring profit over public safety, even sacrificing safety for profit, and repeatedly raising toll rates (Sullivan, 2000). However, it could be argued that this criticism ignored the public benefits the 91X project provided; the project had a positive impact on congestion in the overall corridor and was procured as a P3 because the region was unable to fund the necessary improvement (Sullivan, 2000).

In some ways, the public and private sectors have the same goals in any P3 project, specifically to deliver a successful project. However, in other ways priorities are competing, with the private sector looking to maximize profit and the public sector to provide socio-economic benefits. The conventional wisdom is that P3s generally, and non-compete provisions in P3 contracts specifically, are a zero-sum game, in which the losses of one party directly balance the gains of the other. Arguments for non-compete provisions include that they are necessary to protect the private party and help to encourage private sector investment in toll roads. However, the public sector has a responsibility to maintain and improve transportation facilities

when needed. The design and selection of non-compete provisions can and must be such that the objectives of the public and private sectors are not in direct conflict with each other. Balancing risks while maximizing the objectives of both parties is key to the successful delivery of any P3 project.

In recent years, non-compete provisions in the US have evolved, at least partially in response to lessons learned from previous projects such as the 91X project. These lessons include the importance of striking a balance between public and private sector objectives, and the need to develop methods for identifying and permitting improvements that align with the public sector's objectives (Persad et al., 2005). These changes have been incorporated into what is deemed the 'second generation' of non-compete clauses, the limited compete clause, which acknowledges the responsibility of the State to act in the public interest and pursue improvements when necessary (Buxbaum and Ortiz, 2009; Iseki and Houtman, 2012). This public-sector flexibility increases the private sector revenue risk by some amount, presumably reflected in project costs. As such, it is important that the public-sector be able to value this flexibility.

This flexibility in contract design has been analyzed using real options theory by many researchers (Wang and de Neufville, 2005; Ford et al, 2010; Chiara et al, 2007; Alonso-Conde et al, 2007; Xiong and Zhang, 2016; Liu et al, 2014). Wang and de Neufville (2005) clarified real options theory to include real options "in" projects, which includes flexibility in design, and not just real options "on" projects, which largely consists of the valuation of investment opportunities. Ford et al. (2010) demonstrated how real options can be used in pre-project planning, showing that

considering and evaluating dynamic uncertainty is critical, and under investigated through a case study of a BOT toll road project. Both Chiara et al. (2007), and Alonso-Conde et al. (2007) apply real options to revenue guarantees in BOT projects. Alonso-Conde et al. (2007) use a case study of the Melbourne City Link to analyze two embedded real options included in the project; the ability of the private sector to defer contractual payments to the public sector and the ability of the public sector to terminate the contract early. This study found that the net value of these embedded options to the concessionaire totaled 10% of the value of the company, showing the significance of the value transferred. Chiara et al. (2007) uncovered similar results that suggest that real options analysis should be conducted before utilizing revenue guarantees as they might not be the ideal strategy for mitigating revenue risk from the public sectors perspective. Xiong and Zhang (2016) consider renegotiations as real options in a concession, noting as other have that the option value can be quite large, increasing in value with uncertainty. Liu et al. (2014) model the "guarantee of restrictive competition", also known as non-compete, as an American put option. In this study, the asset is the right of the private sector to make claims to the government when competition is damaging. This study found that the value of restrictive competition can be significant, 10% of the project NPV in the presented case study.

The intent of this paper is to demonstrate the cost of non-compete provisions from the public sector's perspective in terms of the loss of flexibility to pursue transportation projects, and the loss of associated benefits. The SR-91 Express Lane project in California will be used as a simple case study to show the potential value of the option to pursue a comparable, parallel facility. The valuation methodology

utilized is more appropriate than traditional methodologies, as it is more flexible and can help the public-sector value this often-used revenue risk mitigation strategy.

3.2 – Real Options Background

To understand real options analysis, it is helpful to first understand financial options theory, from which real options theory evolved. A financial option is a right, but not an obligation to take an action on an underlying asset at a previously agreed upon price on or prior to a previously agreed upon date (Kodukula and Papudesu, 2006; Mun, 2002). There exist a wide range of options, but the most common are call and put options. A call option, gives the holder of the option the right, but not the obligation to buy an underlying asset for an agreed upon price on or prior to an agreed upon date. Conversely, a put option gives the option holder the right to sell that asset. European options are those that require the holder of the option to exercise their right at a single point in time, while American options allow the holder to exercise their right at any point in the predetermined period.

As real options are an extension of financial options, this basic framework and set of principles remains. The definition of a real option is the same as that for a financial option, with the caveat that real options apply to non-financial assets. There are many common real options including the option to expand, which typically involves scaling up a project, moving into new markets, products, or strategies, or expanding operations (Kodukula and Papudesu, 2006; Mun, 2002). This option is common in situations where standard valuation methodologies, such as net present value (NPV) are inappropriate due to high levels of uncertainty. In typical applications of the option to expand, NPV could be marginal or negative, but

significant value could exist in future opportunities that may be ignored by a short-term outlook, utilizing standard valuation methods. These high levels of uncertainty exist in the case of highway improvements. In a concession with a long concession period, future traffic volumes are a major source of uncertainty. From the private sector perspective, this impacts the revenue risk, or the risk that project revenues are insufficient to cover costs and debt while producing an adequate return on investment (Chiara et al., 2007). From the public sector perspective, this uncertainty impacts their ability to provide a minimum level of service, or the quality of traffic service provided relating to speed, travel time, and traffic interruptions among other factors (AASHTO, 2001). Benefits associated with improved level of service include travel time savings, emissions reductions, and reductions in accident costs among others. As such, the value associated with the option to expand from the public sector perspective can be significant, depending on the uncertainty.

In the case of non-compete provisions in P3 projects, the underlying asset is the social benefits associated with transportation improvements that would have been possible if not for the contractual restriction. The ability to value these potential future social benefits, this public-sector flexibility is what sets real options analysis apart from traditional valuation methodologies. This flexibility can be modelled as a call option, as without the restriction of a non-compete provision, the public sector would have the option to "purchase" the social benefits associated with roadway improvements through initiating a project. This is an American option, as the social benefits associated with the transportation improvements could be realized at any point during the concession period. The payoff to the holder of the option in this case

would be $\mathrm{Max}[(\mathrm{S}_n - \mathrm{K}), 0]$, the maximum of the difference between the underlying asset value and the strike price, or the price at which the asset can be bought, and zero. This is true as it is assumed that the holder of the option will only exercise that option if it is beneficial to do so. This relationship is illustrated in the figure below; In the P3 case, the strike price would be the cost of the transportation improvements; construction costs.

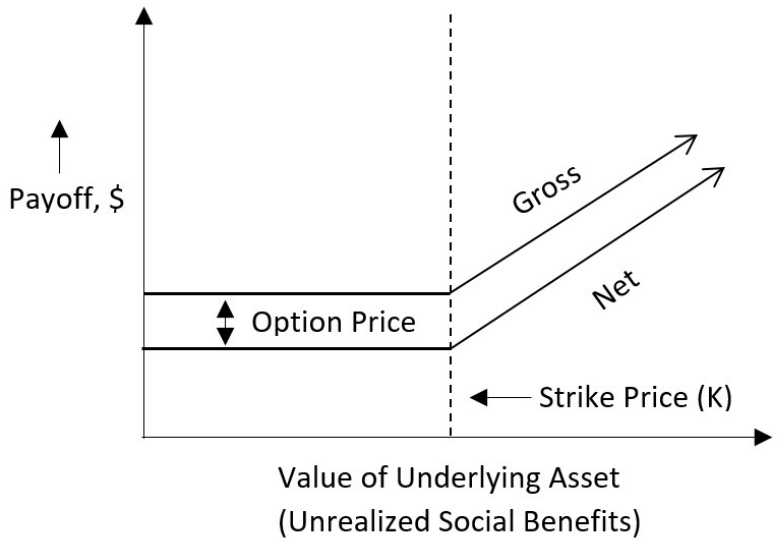

Figure 3.1 – Payoff Diagram for a Call Option. Adapted from *Project Valuation Using Real Options: A Practitioners Guide*, by P. Kodukula and C. Papudesu, 2006. Copyright 2006 by J. Ross Publishing, Inc.

There are two major assumptions behind options pricing models that are important to note. The first is the no arbitrage assumption. In short, assuming that no arbitrage opportunities exist means that it is impossible to purchase an asset at one price and simultaneously sell that asset at a higher price; this is the principle that there is no "free lunch" in an efficient market. The other important assumption or concept is that

of replicating portfolios. A replicating portfolio is a portfolio of other traded assets that has the same payoff as the option. Critics argue that these assumptions don't hold true in the case of real assets. Some argue that the replicating portfolios assumption is invalid as most real assets are not traded assets. However, Kodukula and Papudesu (2006) note that it has been argued that being able to create a replicating portfolio on paper for the real option in question should suffice. Critics also question the no arbitrage assumption, arguing that real assets are not as liquid as financial assets and thus the no arbitrage assumption does not hold. To address this assumption, practitioners use several types of adjustments, including utilizing an interest rate that is slightly higher than the riskless rate, in order to account for any resulting overvaluation (Kodukula and Papudesu, 2006). This approach has been utilized in this study.

Although typically used to value investment in terms of some form of currency, real options have been used to value assets where currency is not a relevant measure, and where markets for an option do not exist. Knight (2014) utilized real options based on prospect theory to value flexibility in naval ship design. Knight's framework utilizes utility theory to express the option value, then prospect theory as a risk adjustment mechanism. A central tenet of prospect theory is that individuals tend to view risk in terms of gains and losses rather than total value (Kahneman and Tversky, 1983). Additionally, Kahneman and Tversky (1979) observe that individuals are loss averse. Significantly, Knight (2014) observes that this conclusion that individuals weight outcomes by non-linear decision weights is similar to the non-linear risk-neutral probability measure from options theory.

3.2.1 Binomial Tree Method

There are many ways to model the underlying asset when pricing an option. One common method is utilizing a discrete time model such as recombining binomial trees. This method is generally accepted in practice as it is simpler to explain and understand, allows for transparency, and provides simple solutions for an option price (Mun, 2006). For the problem analyzed in this paper, the binomial tree depicted in Figure 2 will be utilized.

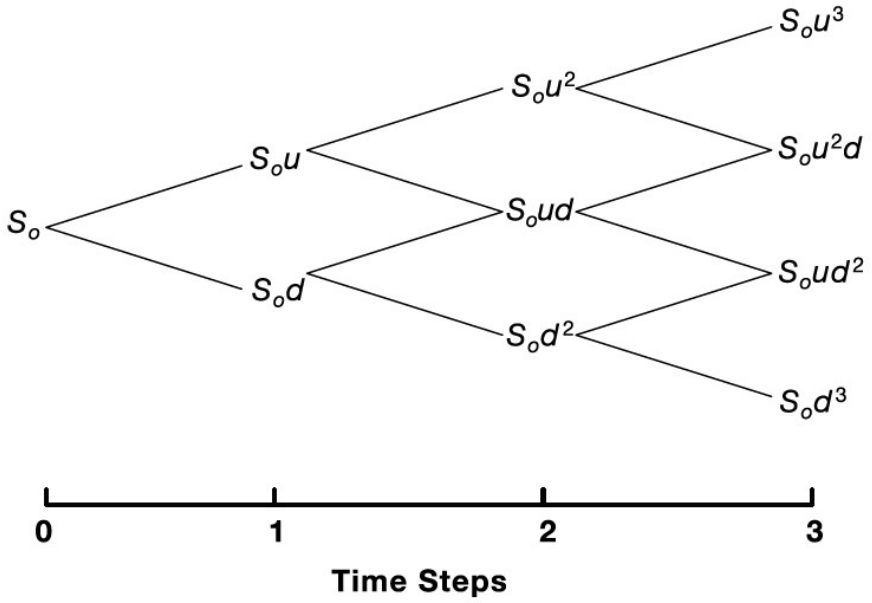

Figure 3.2 – Recombining Binomial Tree. Reprinted from *Real Options Analysis: Tolls and Techniques for Valuing Strategic Investments and Decisions*, by J. Mun, 2002. Copyright 2002 by J. Ross Publishing, Inc.

In this model, the underlying asset is S_0, the value of which is the social benefits associated with a competing facility. As Figure 2 depicts, with each step the asset either increases or decreases, by an up factor (u) or down factor (d), and follows this pattern with each time increment. The up and down factors depend on the volatility of the asset and are calculated using the equations below:

$$u = e^{\delta\sqrt{\Delta t}}$$

$$d = e^{-\delta\sqrt{\Delta t}} = \frac{1}{u}$$

where:

Δt is the time duration of each step;

δ is the underlying volatility of the asset.

The remaining key equation in this framework is that for risk-neutral probability, used to calculate the option value. Using risk neutral probabilities as discussed in *Tools and Techniques for Valuing Strategic Investment Decisions*, involves adjusting the probabilities which lead to the option value throughout the binomial tree, and then discounting these at the risk-free rate (p. 163). This risk-neutral probability measure is defined below:

$$p = \frac{e^{r\Delta t} - d}{u - d}$$

where r is the risk-free interest rate, and u, d and Δt are as defined previously.

The binomial tree structure is created by starting with the value of the underlying asset, S_0, and multiplying it by the up and down factors, as illustrated in Figure 2. As the figure suggests, the first and nth values of the underlying asset are as shown below:

$$S_1 = S_0 \times u \text{ or } S_1 = S_0 \times d$$

$$S_N = S_0 \times u^{Nu - Nd}$$

where Nu is the number of up movements and N_d is the number of down movements.

After the binomial tree is created, the value of the option at the terminal nodes must be calculated. This value is calculated through the maximization of exercising the option and letting it expire, as depicted in the equation below:

$$\text{Call Option Value} = \text{Max}[(\text{S}_n - \text{K}), 0]$$

The call option value at earlier nodes is then calculated through backwards induction, using the risk-neutral probability calculated previously, and the equation below:

$$C_{t-\Delta t,i} = e^{-r\Delta t}(pC_{t,i+1} + qC_{t,i-1})$$

This process is conducted back to the starting period, calculating the option value at time zero, which represents the value of the option.

The SR-91 Express Lane project in California is utilized as a simplified example to demonstrate how real options analysis could be used in valuing a non-compete provision from the public-sector perspective using a single, isolated option. As mentioned, in this case the option value is equal to the social benefits lost through the inclusion of a non-compete provision in a particular case.

3.3 – Case Study: SR-91

The 91 Express Lanes (91X) are four express toll lanes located in the median of California State Route 91, stretching for 10-miles between Anaheim and the Orange/Riverside County line. The project was one of the first public-private partnerships (P3) in the state of California and was procured using a design-build-finance-operate-maintain (DBFOM) model; it was one of the pilot projects approved under the P3 enabling legislation, California Assembly Bill 680 in 1989. Not only was the project one of the first P3 projects in both California and the US, it was the

first practical application of value pricing in the US, and the first toll facility with 100% electronic toll collection (FHWA, 2017a). The state of California elected to pursue the capacity improvements on SR-91 as a P3 due to the lack of available funding needed to pursue this project in a reasonable period (Sullivan, 2000). The project opened in 1995 and was constructed for $135 million. California Private Transportation Company (CPTC), was responsible for financing and building the facility, as well as operating and maintaining it for a 35-year concession period. CPTC was also responsible for toll collection, although Caltrans was contractually able to limit the rate of return. The contract between CPTC and Caltrans also contained a non-compete provision, which restricted the ability of Caltrans to construct competing facilities within an Absolute Protection Zone covering a 1.5-mile corridor around the facility. These restrictions included preventing Caltrans from adding capacity to the general purpose lanes on SR-91.

Several years into the operation of the 91X lanes, Caltrans began planning to add an outer lane to the SR-91 general purpose lanes at the intersection with the Eastern Toll Road, also the entry/exit point to the toll facility, citing safety concerns due to bottlenecks at this point. CPTC viewed this action as a violation of the non-compete clause, as it would add capacity to the general purpose lanes, and sued Caltrans. Ultimately this dispute was settled for $12 million, which allowed Caltrans to continue plans to add capacity at this location. However, after this settlement, Caltrans purchased the 91X lanes from CPTC for $207.5 million in 2003(Persad et al., 2005).

3.3.1 – Eastern Toll Road

The Eastern Toll Road is a 16-mile, 8-lane highway which runs parallel to SR-91 in Orange County, California. It opened to traffic in October 1998 and was built by the public-sector, fully publicly funded and is operated by the Orange County Transportation Agency (TCA). The total cost of construction was $850 Million. According to the Final Environmental Impact Statement, the Eastern Toll Road was proposed to accommodate traffic growth in the region due to planned growth, specifically to relieve congestion on existing roadways, improve traffic flow and mitigate emissions impacts. These improvements were considered essential even considering planned and ongoing improvements to adjacent freeways including SR-91, SR-55, SR-57 and I-5. The FEIS published in 1994 cites traffic studies which estimate traffic volumes on the Eastern Toll Road at 77,000 to 108,000 vehicles per day (p. S-3).

Prior to the completion of the Eastern Toll Road in 1998, the 91X lanes saw a steady increase in traffic reaching a peak of 33,000 vehicles per day. A case study of the 91X lanes reported that the project appeared to be maintaining acceptable financial performance, stating that it was anticipated to yield a favorable rate of return over the concession period regardless of the potential impacts of the Eastern Toll Road. However, the opening of the Eastern Toll Road did lead to a drop in traffic on the 91X facility during the initial 6-8 months it was open, stabilizing at 24,000 vehicles per day; these facilities directly compete for commute travel into the Irvine area (Sullivan, 2000).

The Eastern Toll Road utilizes fixed price tolls, as opposed to the variable pricing that was utilized on the 91X lanes; tolls on the Eastern Toll Road did vary

with distance, but not with traffic volumes like the 91X lanes. At the opening of the project, the average toll on the Eastern Toll Road was $3.25, slightly less than that for peak traffic in the 91X case. However, a study conducted for Caltrans showed that during the first four years 91X was open, approval of private organizations operating toll roads for profit dropped from 50-75% to 30-45%; this trend was not seen in approval of public run toll roads (Sullivan, 2000). As the Eastern Toll Road was the option operated by the public sector at the time, this trend in public opinion favored using the Eastern Toll Road over the 91X lanes.

3.3.2 – Analysis

As mentioned previously, in the case of non-compete provisions in public-private partnership projects there is value lost from the public-sector's perspective due to the restrictions associated with non-compete or competing facilities provisions. This value is equal to the social benefits associated with transportation improvements that are not possible due to the non-compete provision and the specific restrictions the provision imposes. As these social benefits are associated with public sector flexibility, the flexibility to pursue transportation improvements if and/or when they become necessary, real options analysis is more appropriate than traditional valuation methodologies in determining their value.

The SR-91 project is a notable example as the contract contained a strict non-compete provision which prevented the public sector from pursuing any transportation improvements within an Absolute Protection Zone, a 1.5-mile corridor surrounding the project. This Absolute Protection Zone prohibited Caltrans from pursuing improvements to the general purpose lanes at the interchange with the

Eastern Toll Road, and ultimately led to Caltrans buying the facility back from the California Private Transportation Company (CPTC). The non-compete provision included in the SR-91 Express Lanes project did not affect the Eastern Toll Road, it was already underway prior to the completion of the 91X project. However, the Eastern Toll Road project is an ideal candidate for this analysis for several reasons. The Eastern Toll Road is a comparable, parallel, competing facility. A case study of the SR 91 Express Lanes completed for Caltrans showed that this facility negatively impacted the traffic on the SR 91 Express Lanes. A review of toll concession in the US showed that all projects which contained a non-compete, limited compete or competing facilities compensation provision had at least one parallel facility in the National Highway System, as shown in Table 1 below. This shows the importance of modeling a simple parallel facility scenario.

Project Name	**Parallel Roadways**	**Provision Type**
I-495 HOT Lanes	VA-7, VA-120	Limited Compete
I-77 Express Lanes	NC-115, NC-16	Compensation Provision
I-95 Express Lanes	US-1	Compensation Provision
IH 635 Managed Lanes (LBJ Expressway)	President George Bush Turnpike, SH-12, I-30	Limited Compete

Elizabeth River Tunnels (Midtown & Downtown Tunnels)	US-460, I-64	Compensation Provision
North Tarrant Express	US-377, SH-287, SH-199, US-287, I-820	Compensation Provision
SH 130	I-35	Limited Compete
SR-91	SR-60	Non-Compete
US-36	I-25, SH-121, US-278, SH-93	Compensation Provision
Pocahontas Parkway 895	I-64, VA-10	Non-Compete
Indiana Toll road	US-20, US-12, SR-2	Non-Compete

Table 3.1 – Parallel National Highway System Roadways by Provision Type

The interchange connecting the SR-91 Express Lanes to the Eastern Toll Road is at an entrance point to the toll facility, making it simple to bypass the 91X lanes using the Eastern Toll Road if desired. Improvements to the general purpose lanes at this interchange is what triggered the non-compete provision violation and ultimate sale of the SR-91 Express Lanes back to the public-sector. These factors, including data availability, make the Eastern Toll Road an idea candidate for valuing the option to build a comparable, parallel facility.

In this case, the option to construct a parallel facility is “in the money” when the social benefits associated with constructing a facility are greater than the cost of

constructing a project. The strike price, K at which the option of constructing the Eastern Toll Road becomes valuable is $850 Million.

The underlying asset is the social benefits associated with constructing the Eastern Toll Road. According to the Final Environmental Impact Statement for this facility, the roadway was considered necessary to decrease current and future congestion in a heavily trafficked corridor, and provide relief to surrounding facilities, even given planned improvements to facilities such as SR 91. It was pursued in part to achieve goals outlined in the Regional Mobility Plan, such as decreasing emissions and increasing mobility, along with other social benefits (FHWA, 1994). To estimate these benefits, the US Federal Highway Administration's (FHWA) P3-VALUE Analytical Tool was used. This tool includes project delivery benefit cost analysis (PDBCA) which evaluates the economic efficiencies, and the societal costs and benefits, associated with a particular delivery method. This model uses standard benefit-cost analysis (BCA) methodologies and considers factors such as travel time costs, fuel costs, emissions costs, and accident costs among others are used to generate total benefits outputs (FHWA, 2016a). These are typical measures of the economic efficiency impact of a project accrued to both users and non-users of a facility. According to FHWA, BCA is one of many methodologies currently used for project prioritization and selection by State DOTs, and is an important tool that can be used to quantify economic impacts and better target transportation funding (FHWA, 2017b).

The NPV of the benefits under Conventional Delivery was utilized to represent the underlying asset value as the Eastern Toll Road was procured utilizing

conventional delivery. However, the model suggests that pursuing this project as a P3 would result in total additional benefits. The output summary generated by the P3-VALUE Tool for conventional delivery benefits is shown below.

Benefits & costs under Conventional Delivery Units >>	**NPV @ 3.00% USD m**	**Real total USD m**
Δ Travel time cost	1,176	2,326
Δ Delays due to construction	(6)	(6)
Δ Delays due to O&M	4	7
Δ Delays due to incidents	499	964
Δ Non-fuel costs	32	60
Δ Fuel costs	(33)	(53)
Δ Accident costs	83	156
Δ Emissions cost	(38)	(82)
O&M No Build cost savings	197	350
Real construction costs	(804)	(850)
Real operations costs	(100)	(180)
Real base variability	(144)	(160)
Real pure risks	(64)	(83)
Lifecycle performance risk	(304)	(518)
Total benefits / (costs) under Conventional Delivery	***499***	***1,931***
Benefit cost ratio under Conventional Delivery	***1.4101***	***N/A***

Table 3.2 – P3-VALUE Tool PDBCA Output Summary (FHWA, 2016c)

For the real options analysis, the 35-year concession period for the SR-91 Express Lanes project was utilized for the time to maturity of the option. The underlying volatility of the asset was estimated to be 15%. The risk-free rate was estimated using the 30-year treasury rate for 1998, the year the Eastern Toll Road opened to traffic.

All analysis parameters are summarized in the table below:

Parameters	
Asset Value S ($m)	499
P	0.65314199
1-P	0.34685801
Volatility	15.00%
Risk-free rate r	5.58%

Exercise Price X ($m)	850
Time to Maturity	35
Periods	35
Time Interval	1
Discount Factor	0.945728263
Up	1.161834
Down	0.860708

Table 3.3 – Real Options Analysis Parameters

3.3.3 – Results

An excel-based model was used to calculate the value of the call option, by first building the binomial tree, as shown in Figure 3.3 below.

								110482
							…	
						1227		81847
					1056		…	
				909		909		…
			783		783		…	
		674		674		674		674
	580		580		580		…	
499		499		499		499		499
	429		429		429		…	
		370		370		370		370
			318		318		…	
				274		274		…
					236		…	
						203		3
							…	
								2
1	2	3	4	5	6	7	…	35

Figure 3.3 – Binomial Lattice Evolution of Social Benefits

After that the option value at the terminal nodes was calculated, and then at the intermediate notes using backward induction, as explained in Section 2. This analysis was performed using the inputs shown in Table 3 above. The results of this analysis show that the call option value, the value of government sector flexibility

inhibited by the non-compete provision in the Eastern Toll Road case, is $405,500,244.

This value is significant and shows the importance of the social benefits that a parallel, comparable facility could provide. This value is greater than the price at which Caltrans purchases the 91X facility from CPTC and the price of the original settlement for the violation of the non-compete provision, triggered by plans to widen general purpose lanes on SR 91, combined. However, the Eastern Toll Road was already built when this settlement and sale took place, and associated future social benefits could be realized without the purchase of the 91X facility. Previous studies using real options to value other revenue risk mitigation strategies, such as revenue guarantees, produced similar results, with the option value being significant. Taken together, these results suggest that a non-compete provision has great value and should be carefully considered prior to implementation.

Sensitivity analysis was conducted to explore the effect of traffic volatility on the real option value of social benefits. As Figure 3.4 demonstrates, the value of the option increases rapidly with the increased uncertainty, as suggested by previous studies.

Figure 3.4 – Sensitivity Analysis

These results demonstrate that the higher uncertainty, the higher the value associated with a non-compete provision. From a managerial standpoint, this suggests that real options analysis is most appropriate for projects with a high degree of uncertainty in estimates of future traffic volumes. Particularly for these projects, it is important for the public sector to perform real options analysis to understand the value of the flexibility lost through non-compete provisions and determine if they are the most appropriate strategy for mitigating revenue risk from the private sector perspective.

3.4 – Conclusions

Contract provisions designed to mitigate some revenue risk for the private sector, such as non-compete provisions and others, are often included to generate private sector interest in a project among other reasons. However, the literature suggests that not enough is known about the value of these provisions, or about the value that the public sector is sacrificing through their inclusion. In this paper, the

SR-91 Express Lanes and the Eastern Toll Road, a comparable, parallel facility were used to show how real options analysis can be used to value the social benefits lost through the inclusion of a non-compete provision. This analysis suggests that there is significant value associated with public-sector flexibility. Additionally, sensitivity analysis demonstrates that the option value increases rapidly with the increase in traffic volatility. This suggests that not only are non-compete provisions valuable, but they become more valuable with increased uncertainty in future traffic volumes. As previous work has suggested with revenue guarantees, this work suggests that real options analysis should be conducted by the public-sector prior to inclusion of a non-compete provision in a P3 contract, particularly in cases where future traffic volumes are uncertain.

Chapter 4: Conclusions and Recommendations

4.1 Summary and Discussion

In this study, the language 13 P3 contracts containing non-compete provisions were analyzed. This analysis demonstrated an evolution in non-compete provision type from earlier contracts through today. Contracts in newer P3 projects explicitly acknowledge the rights and responsibilities of the public sector relating to competing facilities. They appear to strive toward a more balanced approach to dealing with competing facilities and the associated revenue risk. A comparison of the debt risk spread and equity return across all non-compete provision types suggests that the non-compete provision model used influences the risk from the perspective of the debt holder, but not necessarily the perspective of the equity holder.

Further, statistical analysis showed that there are significant differences between the debt risk spread in contracts that have strict non-compete provisions and most others; significant differences did not exist between strict non-compete provisions and limited compete provisions. Like the acknowledgement of public sector rights and responsibilities, this suggests that competing facilities provisions represent a move toward a more balanced approach to dealing with competing facilities than strict provisions used in early P3 contracts. However, there were not significant differences among limited compete and competing facilities compensation provisions, and between these provision types and contracts which contain no provision. This raises questions about the protections that limited compete provisions

and competing facilities compensation provisions provide, and the advantages and disadvantages between the two. Perhaps more importantly, there were not significant differences between the debt risk spread in strict non-compete provisions and limited compete provisions, calling into question the additional protections this provision type provides.

After analyzing the evolution of non-compete provisions in U.S. P3 contracts, this study focused on valuing a non-compete provision from the public-sector point of view. A case study of the SR-91 Express Lanes and the Eastern Toll Road, a comparable, parallel facility were used to show how real options analysis can be used to value the social benefits lost through the inclusion of a non-compete provision. This analysis suggests that there is significant value associated with public-sector flexibility. As previous work has suggested with revenue guarantees, this work suggests that real options analysis should be conducted by the public-sector prior to inclusion of a non-compete provision in a P3 contract.

Study Limitations and Future Work

There are many other contract provisions, or project aspects that are factored into overall project risk, none of which were examined in this study. Additionally, the language in compensation provisions, and their specific requirements were not examined in detail. These provisions are often lengthy and complex, and have not been tested to date. The requirements associated with the compensation provisions can often be restrictive, a fact which was not measured. These factors should be considered in detail in future studies. Additionally, all projects containing competing facilities compensation provisions are relatively new. It remains to be seen how

effective these clauses are, and whether they protect the public's interest while still incentivizing P3 investment.

Additionally, the real options calculations are based on an isolated case; in reality there may be multiple, interacting options. The Eastern Toll Road was already built when this settlement and sale took place, and associated social benefits could be realized without the purchase of the 91X facility. Regardless, the large value associated with this option illustrates the importance of flexibility in the public-sector case.

This study suggests that the value associated with public-sector flexibility can be significant. Movement has been made toward a more balanced approach to addressing competing facilities, however the more recent generation of provisions have not been analyzed in detail. Future work is needed in analyzing the compensation details in competing facilities compensation provisions. Additionally, more complex real options models should be utilized to more accurately measure the value of non-compete provisions from the public-sector perspective.

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