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The Changing Role of Public-Private Partnerships in Urban Transportation: A Case Study of the Rise of P3s in Denver, CO

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The purpose of the first study was to examine the recent use of P3s in the Denver Regional Transportation District's (RTD) FasTracks program, a 2004 voter-approved $4.7 billion transit expansion program. After a shortfall in funding, RTD partnered with several private consortia to enable the FasTracks program to move forward. Using in-depth interviews with key stakeholders and policymakers in the Denver region, I found that the Eagle P3 commuter rail project and Union Station redevelopment were the most successful of the Denver P3s, and the FasTrack P3s could serve as a model for transit infrastructure expansion in other metropolitan regions in the U.S.

The opportunity exists to minimize environmental and social impacts of expanding passenger rail transit by sharing existing corridors with freight rail operators. The purpose of the second study was to evaluate existing agreements between freight and passenger rail services and identify issues, challenges, and best practices of shared-use corridors. Through in-depth interviews with local experts in shared-use rail corridors, I found the main issues surrounding FasTrack's Northwest rail line were the absence of accurate and timely cost estimates for the line and changing requirements for the shared track. Overall, the other FasTracks shared-use corridors involved successful negotiations of right-of-way (ROW) acquisitions. Recommendations include taking advantage of corridor banking for future rail expansion when possible.

TNCs and public agencies are starting pilot P3 programs in the U.S., and these new P3s could greatly affect the cost and efficiency of transportation provision. Using interviews with public and private agencies involved in ridesourcing P3s, the third study documents the characteristics of two partnerships in the Denver metro region: Go Centennial and DU Moves. The pilot projects had lower than expected ridership, but the Go Centennial pilot was identified as a strong proof of concept for future partnerships. The most common reasons for public agencies to seek out partnerships with TNCs are to improve first-last mile connections and on-demand services, and reduce single-occupancy vehicle trips in a cost-effective manner. TNCs also benefit from partnerships through increasing their brand awareness and creating positive relationships with cities. The role of the transit agency is changing with the increase in private sector mobility options.

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Sylvia Arriaga Brady

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Chapter One: Introduction to studies in public-private partnerships in U.S. transportation

Introduction

With population and traffic congestion growing in urban areas throughout the United States, the demand for transportation infrastructure and transit service improvements in U.S. cities is growing. However, funding to expand and repair aging infrastructure is falling due to lack of federal funds, the recent economic crisis, and local revenue shortfalls. State and local governments are especially susceptible to funding woes and have increasingly turned to the private sector to fill in funding and service gaps and accelerate project build-outs. Public-private partnerships (PPPs or P3s) have become more widely utilized in recent years throughout the U.S. as a way to expand transportation infrastructure and transit services. More research is needed on the emerging trend of using PPPs in transit infrastructure procurement as well as transit service provision, especially in the U.S. Research is needed to discern the benefits and shortcomings of transit PPPs, as well as analyze cooperation between private and public entities such as transit agencies and local governments, freight rail companies, and ride-sourcing services.

This research study examines the nature of PPPs that have been established to facilitate planning, construction, and operation of several transit and highway projects in

the Denver metropolitan area. In particular, this research focuses on three areas in which the Denver metro area is utilizing public-private partnerships: (1) innovative funding and financing of transit infrastructure projects, (2) the partnerships between freight and passenger rail services, and (3) emerging collaborations of local governments, transit agencies, and ride-sourcing transportation network companies (TNCs).

The studies together will address a common theme of transport PPPs in Denver, and each study will then answer its own research questions and objectives. Overall, the studies will analyze the role of PPPs in transport in Denver, assess their successes and failures, and recommend best practices for other agencies and governments looking to Denver as a potential model for developing transport P3s. The studies utilize in-depth interviews with experts and stakeholders and survey methods.

This introductory chapter provides a discussion of significance of the studies by addressing their intellectual merit and broader impacts. Next, I discuss the theoretical framework of the new mobilities paradigm and neoliberalism that ground each of the studies. Then, I provide a more in-depth discussion of the methods used in the studies. Finally, I provide an outline for the rest of the dissertation.

Intellectual Merit

In a recent commentary in the journal *Nature,* Bruun and Givoni (2015) suggest six research routes to steer future transport research policy. This study addresses several of these research avenues. These papers answer their question, what kinds of governance works for transport systems? Research on the potential of ridesourcing P3s, which are still in the early stages of interaction with public agencies and regulatory issues, is especially relevant. The research on ridesourcing P3s also answers the call by Bruun and

Givoni (2015) for studies of the long-term impacts of new technologies in transport. The policy implications of rapid changes in technologies, such as app-based ride-sourcing, are important to understand. Much of the previous research on transport P3s comes from the international perspective or focuses on roads, bridges, and tunnels. This research advances the limited knowledge of U.S. public-private partnerships in transit and transit-related services.

Broader Impacts

These studies are significant because of the growing involvement of the private sector in public sector transportation service and infrastructure procurement. Research is needed to analyze the financial and social costs and benefits of these partnerships and to provide feedback on the level of success of these P3s for transit agencies to learn from the innovative practices taking place in Denver. Policymakers, government officials, agencies, and private investors can use policy and best practice recommendations from this research to inform their decision-making and policy choices.

Bruun and Givoni (2015) posit the question of how to evaluate the impacts of transport systems, suggesting that researchers should look beyond the typical economic cost-benefit analysis to include evaluation of transportation infrastructure and service based on their impact on social equity, accessibility, and mobility using both quantitative and qualitative methods. The following research seeks to evaluate the impacts of transport systems using both qualitative and quantitative methods. This research is socially relevant because it addresses urban mobility through the lens of social justice and urban sustainable mobility. Improved and expanded transit infrastructure and service

provision addresses some of the social inequalities of urban mobility while also creating more options for reduced carbon emissions from transportation.

Theoretical framework and contribution to the field

Qualitative approach and new mobilities paradigm

This research contributes to the field of transport geography by bridging the divide of quantitative and qualitative methods called out by Goetz et al. (2009). Using in-depth interviews with experts and stakeholders in public-private partnerships, coupled with data driven results of innovative ride-sourcing partnerships, this research answers the call for alternative research approaches in transport-related research, bringing it more in line with other human geography subfields of urban and cultural geography (Goetz et al 2009). In addition, the following papers address the need to focus on critical transport geography by examining public policy, social justice, and environmental issues.

These studies are grounded in the social theories of the new mobilities paradigm and neoliberalism. The field of transport geography has experienced a critical turn, incorporating and adapting the new mobilities paradigm of sociology (Sheller & Urry 2006). As an example of critical geography, the mobilities turn at its core establishes that "no mode of transport, infrastructure, or technology can be understood in isolation of its social and cultural context" (Jensen, 2015, p. 485). The mobilities turn differentiates travel as merely movement from point a to b from travel as movement that has the ability to affect different groups economically and socially. This research recognizes this fundamental concept of the new mobilities paradigm and incorporates the idea that mobility and transportation studies must consider the socio-political context of transport

systems. This research delves into the social, political, and cultural context of transit systems in Denver, Colorado.

Neoliberalism, growth machine, and financialization

According to David Harvey (2007),

> Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade. (p.2)

The theory of neoliberalism underlies the current reductionist government spending and expansion of the private sector in public policy and financing (Springer et al., 2016). Neoliberalism incorporates political and economic practices that support free markets and free trade with privatization and market-driven forces as its bedrocks.

Scholars have articulated the manifestations of neoliberalism in cities through the development of theoretical frameworks and empirical studies of the impacts of neoliberal policies. The growth machine theory of Molotch (1976) and Logan and Molotch (1987) is used to explain both regional cooperation and conflict in seeking economic development in an area. The local urban growth machine is typically made up of a city or region's elites and entrepreneurs, from both the public and private sector. Their goal, which benefits themselves as landed elites or their locality through increases in land values, is to encourage economic growth in a city through land development. Thus, the growth machine theory can explain and interpret both the increasing regional collaboration amongst a mix of local and regional elites to bring development to its region as well as intraregional conflict because of increasing competition between cities for economic development funding and infrastructure provision. In addition, the local growth machine

may also work together to respond to increasing competition from national and global competition to attract development to its locality. The theory of the city as an urban growth machine helps to explain the rise of regionalism and the effects of neoliberalism on local governance in U.S. cities.

Neoliberal policies in urban and transport development have increased the role of global finance markets at the local level. Financialization, the increasing dominance of the financial industry in the economy, is on the rise at the country level, but it increasingly affects local economies. Neoliberalism has been a strong driver of the globalization of economic markets. More and more, local funding and financing of urban and transport infrastructure are influenced by credit-rating agencies and global investors.

Neoliberalism in the highway and automobile sector

Transportation provision in the U.S. has primarily been affected by neoliberal policies through expanded privatization and deregulation. Because of tax revenue shortfalls due to increased fuel efficiency, a recent decrease in the national vehicle miles traveled (VMT), and cost inflation, the traditional funding sources of highways are roads have not met the demand for maintaining and operating the aging road infrastructure. Neoliberal policies of privatization and free market ideologies have begun to change the conventional funding mechanisms, and state DOTS are looking to the private sector to fill in the gap of infrastructure provision. One example of privatization of roads is the propagation of toll lanes on roads, which charge a user fee to drivers to help pay for the building and maintenance of that road. The recent propagation of infrastructure PPPs in the U.S. can be juxtaposed with past public capital infrastructure investments such as the post-WWII Federal Interstate Highway System.

Neoliberalism in the railroad industry

The railroad industry is privatized and has been from its inception, but because railroads created monopolies in the 1800s and were undermining interest of the public good, they were subject to extensive government regulations. After increased competition from trucking and highways diminished the railroad's competitive advantage by the mid-20th century, the industry underwent deregulation through the 1980 passage of the Staggers Rail Act. The railroad network carries both freight and passengers, with the bulk being freight. As a result of the 1970 Rail Passenger Service Act, the railroad industry shed much of its unprofitable passenger service, and Amtrak, a government entity, now provides most of the intercity passenger rail service in the U.S. Because the provision of railroad infrastructure has historically been the responsibility of a private rail company, neoliberalism affected the railroad industry to a lesser degree than other modes. Massive expansion of the current railroad network is not expected in the future because of the high cost of building out new rail lines. Most of the costs of rail infrastructure provision lie in the maintenance of existing lines and the creation of new transit and passenger lines, many within freight rail corridors. Freight rail gets some additional capital through its partnerships with public transit agencies seeking to expand their operations in freight rail rights of ways or on freight rail tracks.

Transit service expansion is traditionally funded through additional taxes levied within the transit district, usually voter-approved. The transit agency, as a public entity, can also sell tax-exempt bonds to pay off interest on loans they take out for infrastructure and capital improvements. One challenge to this type of funding is a limit to the transit agency’s debt capacity. This is where private investor and private equity firms have

stepped in to help take some of the debt off of the accounting sheets of transit agencies, allowing more money to be raised than by the agency alone.

Neoliberalism in public transit

Privatization of transit is not new. The development of the transit industry in the U.S. was led by streetcars, which were typically owned and operated by private investors or industry that wanted to facilitate real estate development further out from the city center (Schweitzer, 2017). These private companies were able to leverage their investment in the capital costs of the infrastructure because they benefited from their other investments in real estate and retail along the streetcar lines. Eventually, competition from the bus and private automobile reduced ridership on streetcars and eventually buses as well, until the transit companies were taken over by public agencies because of the need for subsidies to continue their operation. Neoliberal policies of the 1980s repopularized the concept of private sector involvement in providing public transit, and some agencies began to outsource a portion of their services to private companies. Through neoliberal restructuring by the legislature beginning in 1988, Colorado now requires transit agencies to contract a minimum 35% of its operation to the private sector.

Whereas privatization of service provision has become somewhat commonplace in transit, infrastructure provision is only recently taking advantage of private sector investment. Financing infrastructure through private equity firms and global investment companies is one way that transit is being liberalized. Like toll roads, transit agencies are also experimenting with long-term operation and maintenance agreements with private companies as well. The Eagle P3 project in Denver is currently the only operating example of a private-public partnership in transit that includes private financing and a

long-term operations and maintenance concession agreement. The Federal Transit Administration's (FTA) Penta-P program, which granted funds to the Regional Transportation District Eagle P-3 rail project, specifically rewarded transit infrastructure projects that utilized innovative financing with the private sector and encouraged agencies to explore both disadvantages and advantages of such partnerships. More transit agencies are exploring the benefits of PPPs and private financing of transit expansion projects. Innovative financing is necessary as neoliberal policies continue and the public's tolerance for tax increases wanes.

Increasingly, the private sector is seeing potential profit in a new market of transit and transportation service industry, especially as a new generation of young adults is more interested in alternative transport modes and living car-free. Although contracting by public transit agencies is not new, this arena is expanding as local transit agencies begin to look to the private sector to fulfill new transit demand through partnerships with transportation network companies (TNCs) such as Uber and Lyft. Public-private partnerships in the building of transportation infrastructure as well as providing financing of infrastructure is becoming more common because of lack of federal and state funding and decreased local tax revenue.

Methods

Interviewing as a Methodology

The discipline of geography uses a wide range of methods to answer a wide range of research questions. Geographers' research exists along a spectrum of methodologies utilizing qualitative and quantitative methods, often incorporating multiple or mixed-method approaches. Geographic methods can also be divided into extensive and intensive

methods, the former focusing on breadth of material and subjects versus the latter focusing on depth. Qualitative methods are interdisciplinary and cannot be claimed by any one discipline, but are often used by the social sciences, including political science, sociology, and geography. Qualitative methods are useful for finding out what people think, know or feel (Secor, 2010) and to answer research questions about social structures and individual experiences (Winchester and Rofe, 2010).

Interviewing is considered a qualitative and more intensive method because it involves direct interaction with the research participant (Hoggart, Lees, and Davies, 2002). Interviews have generally been defined as a face-to-face exchange between the interviewer and informant, whereby the interviewer asks questions to seek out information or opinions from someone, although the face-to-face aspect is now not required as some research can be conducted through written email communication or a telephone interview. Dunn (2010) solved the face-to-face issue by defining interviewing as "a data-gathering method in which there is a spoken exchange of information" (p. 101).

Interviews are useful to fill a gap in knowledge, investigate complex behaviors and motivations, collect a diversity of opinion and experiences, and to show respect for and empower the informants (Dunn, 2010). According to Hoggart et al. (2002), interviews are "appropriate when research seeks to unravel complicated relationships or slowly evolving events" (p. 205). In order to reveal these relationships and experiences, interviewers ask open-ended questions to elucidate detailed descriptions and in-depth knowledge of the topic. Interviews are most appropriate for research questions that answer *how* rather than *how many*. Interviews can be divided into several types according

to Winchester and Rofe (2010) that include the unstructured, semi-structured, structured, and open-ended focus groups. I primarily use semi-structured interviews in my research, which allows me to develop open-ended, content-focused questions while still allowing for flexibility and change during the interview (Dunn, 2010).

Conducting research with members of an elite class can provide unique opportunities as well as unique problems to consider when compared to interviewing members of the general population. Sometimes this type of research is also referred to as "studying up" or the corporate interview. Elites can be defined in several ways and the definitions vary based on the research arena, business sector, or corporation being studied. Harvey (2011) defines elites as occupying senior management positions and being influential decision makers in a company or business sector at the time of research. Rice (2010) was more practical about determining an elite for his research on urban regeneration, stating that an elite was someone that has the ability to answer his research questions. Hunter (1995) uses the term "studying up" to describe the often elevated social status of elites. Literature exists on the specific nature of interviewing local elites, especially in policy research, which is what applies to this research (Lancaster, 2017; Cochrane, 1998; Ward and Jones, 1999; Sabot, 1999). Research utilizing local elites and policy elites often addresses local economic development and elites are the people who influence the local decision making processes. In my study, I see an elite as an expert on the research topic with intimate, local knowledge to answer my research questions.

Recruiting and gaining access

Recruiting participants for elite interviews provides another set of challenges that may not exist in non-elite research. Often elites can be hard to locate or establish a time

of communication. Harvey (2011) points out the need to identify gatekeepers to the elites. These gatekeepers may include important people such as personal or administrative assistants who keep the calendars of the elites. In other instances, it is useful to get the blessing of upper management or first interview the head of the company, which can cast the interviewer in a positive light to the underlings (Hoggart et al. 2002). Again, in some cases, it is useful to play up the insider role, while other times the outsider. As Sabot (1999) found, sometimes a foreign national is more likely to receive a response for an interview or be granted more access that a local researcher.

Snowball sampling, whereby previous informants recommend potential interviewees, is often very effective when interviewing elites. It is especially helpful if an informant can vouch for the researcher by sending an email request to other potential interviewees. An experienced researcher who has conducted previous studies on a topic may begin to be seen as an insider by elites and has often developed their own network of informants to draw from, therefore researchers tend to conduct research where they are already considered an insider. This strategy can be useful to reduce the barriers to gaining access to elites. In interviewing local urban elites in politics, transportation, or economic development, geographers and social scientists work side by side with local elites on committees, research teams, or other affiliations which can ease access to informants.

The literature does focus on the relative difficulty in accessing elites compared to the general populations. While it may be true that it is harder to identify people who would be able to answer a particular research question with a certain level of expertise, the barriers to access are often overstated in my opinion, especially when talking about local elites. In particular, politicians who want to show their expertise on a topic are

usually not hard to persuade to sit down to talk. On the other hand, if a politician thinks that your research could be controversial or he or she does not want to take a side, then the interview request can go unanswered. Most responsive are officials in public or civil service, especially those working in roles that use tax-payer funding. These officials often see it as their duty to respond to requests for interview or research and typically are transparent and open to academics in general. They can also be the most helpful in linking the researcher to other potential interviewees in other sectors.

Interviewing and the theoretical framework

I believe that no research, whether quantitative, qualitative, or a mixed-methodology, can be declared objective or without bias. The researcher's positionality influences the questions asked, methods used, and interpretation of the data. Choosing a particular method should not be based on the researcher's affinity for a particular method, but because the method is the best one to answer the questions being asked. My research seeks to answer questions about the perceived success of transit operations and expansions, identify implications and impacts of policy decisions, and ascertain benefits and limitations of such policies. These questions can best be answered by using qualitative methods such as interviewing to delve deeper into people's experiences with and knowledge of such partnerships. Interviews are not intended to generate a representative sample of the general population, but rather to explore the nuances and reasoning behind an informant's responses and ideas. There is not one definition of success or a final determination of the winners and losers of public-private partnerships. We must be critical of such research that claims to provide the definitive answer to such nuanced questions.

The theoretical framework of the new mobilities paradigm supports the use of interviews because it stresses the fundamental concept that mobility and transportation studies must consider the socio-political context of transport systems. In-depth interviews also enable researchers to look beyond the typical economic cost-benefit analysis and ridership revenue to include evaluation of transportation infrastructure and service based on their impact on social equity, accessibility, and mobility, key concepts of the new mobilities paradigm. As a relatively inexperienced researcher who did not have extensive shared affiliations or networks with the respondents, I relied more on colleagues' networks and past research experiences to gain access to the elite informants.

Interpretation of Data: Transcribing and Coding data

Following the preparation and interviewing stage, I began analyzing the interview data. Most researchers agree about the benefits of recording interviews rather than relying solely on handwritten notes (which can, however, be an appropriate back-up method and additional data source). I was able to record all but one interview, since the respondent requested only notes be taken. Recording interviews allow the researcher to focus on the responses and engage in appropriate follow-up questions and prompting for more clarification or elaboration from the interviewee. A written record can be referred back to as often as needed, without the concern of a faulty memory or misremembering getting in the way of accuracy.

I transcribed the interviews myself, which enabled me to experience and engage with data again (often at a slower speed), after the interview (Dunn, 2010). Verbal cues, silences, and other mannerisms are sometimes lost if a transcription service is used. The tone of a response, a pregnant pause, or a nervous laugh can sometimes tell a different

story than the written response would otherwise indicate (Dunn, 2010). On the other hand, if a larger number of interviews had been required or if I conducted each of the studies concurrently, a transcription service would have been vital and may be required on some studies. For example, the additional time it takes for the researchers to transcribe the interviews might cause her to reduce the number of interviews she is willing to conduct because of a research deadline. But all things considered, the value of hearing the interviews again and revisiting the audio exchange far outweighs drawbacks of the time-consuming task of transcription.

When presented with the vast amount of transcribed data, the researcher can sometimes be overwhelmed with words. Systematic coding of the responses allows the researcher to organize and interpret the data. Coding the responses involves labeling sentences or ideas using categories or labels, and usually common themes will emerge from the respondents' answers. This type of coding can be done by hand, using highlighters, scissors, and tape for the more tactile learner, or using basic word processing software to copy, cut, paste, search, and highlight responses. Prior to the advent of powerful software such as NVIVO, most coding was done this way. NVivo is an example of a computer assisted qualitative data analysis software (CAQDAS). CAQDAS allows a researcher to import text and code sections of the text with multiple codes. I utilized word processing and "hands-on" coding. Cutting the coded transcript excerpts allowed me to experiment with different way to combine and frame excerpts and to see the interplay of the themes in new ways. Although I have utilized NVivo in past research, the pen and paper methods to sorting and coding the data worked well for this

project. The interview questions were fairly straightforward and the studying up interviews required less creative interpretation of the data.

Dissertation Organization

The following chapters consist of three distinct research projects regarding public-private partnerships in the Denver, Colorado metropolitan area. Chapter 2 focuses on utilizing public-private partnerships for innovative funding and financing of transit infrastructure projects and is titled *Innovative Approaches to Improved Intermodal Transit Infrastructure Funding and Financing through Public-Private Partnerships: A Denver Case Study*. Chapter 3 looks at the partnerships between freight and passenger rail services, and is titled *Passenger Rail and Freight Rail Partnerships: A Case Study in Denver, CO.* Chapter 4 addresses emerging collaborations of local governments, transit agencies, and ride-sourcing transportation network companies (TNCs) and is titled: *Public-private partnerships with public transit, local government agencies, and ridesourcing in Denver, CO*. Chapter 5 provides a summary of the research projects and a conclusion about public-private partnerships in transportation in general.

Chapter Two: Innovative Approaches to Improved Transit Infrastructure Funding and Financing through Public-Private Partnerships: A Denver Case Study

Introduction

Cities across the United States are grappling with a looming transportation crisis as a result of ever-increasing passenger and freight transport demands and overburdened networks of aging infrastructure. All levels of government, but particularly state and local governments, need to develop innovative funding and financing mechanisms to maintain and enhance transportation infrastructure. Public-private partnerships (PPPs or P3s) have increasingly been utilized in a number of cases to help address ongoing shortfalls in public infrastructure funding, and to accelerate project build-out.

This research analyzes the increasingly important role of PPPs in transit infrastructure provision in the Denver, Colorado, metropolitan region. It examines five PPP projects in the Regional Transportation District (RTD) voter-approved FasTracks program: Eagle P3 commuter rail; Denver Union Station redevelopment; U.S. 36 bus rapid transit; I-225 light rail; and North Metro commuter rail. Each of these transit projects has employed some form of a public-private partnership to facilitate RTD's transit expansion, and I discuss the nature of each P3 agreement. The Denver metro area is seen as a model for regional collaboration and innovation in transit funding and financing through public-private partnerships (Jonas, Goetz, Brady, 2019). The Regional

Transportation District in Denver is the first transit agency in the U.S. to use a full design-build-finance-operate-maintain (DBFOM) P3 contract for transit infrastructure.

Using in-depth interviews and surveys with key stakeholders and decision-makers, I analyze the financial and social benefits of the projects for the public and private partners as well as the Denver community at large. I examine the impact of P3s on regional collaboration and the delivery of public information. I also discuss the benefits and shortcomings of using the P3 delivery method and the extent to which Denver's use of PPPs can serve as a model for other transit agencies seeking alternative procurement methods.

Research Questions

- What is the role of public-private partnerships in transit infrastructure provision in Denver, CO?
- To what degree have the transit PPPs in Denver been successful or not?
- Could the Denver P3s serve as models for other agencies seeking to expand transit infrastructure?

Literature Review

Transport PPPs in the U.S.

Public-private partnerships (PPPs) have been used widely throughout the world to deliver many types of infrastructure. The United States (U.S.) has lagged behind the international community in its use of PPPs. Nevertheless PPPs are becoming increasingly popular in the U.S. as a tool for leveraging funds by cash-strapped state and local transportation agencies. Between 1989 and 2011, 81% of the 104 transportation public-private partnerships in the U.S. were for highways, bridges, and tunnels, and only 19%

of transport PPPs were for rail transit projects (Istrate and Puentes, 2011). Most of the transit PPP research has focused on international transit projects (for a review of international light rail P3[1] projects, see Mandri-Perrott, 2009). The list of transit P3s in the U.S. is small but growing (see a summary of U.S. transit P3s in Thomas, 2014), and more transit and transportation agencies are interested in pursuing them to expand their transit infrastructure. Papajohn et al. (p. 127, 2011) found that of the 32 U.S. states that responded to their survey, 25 had either experienced, were currently adopting or had plans to implement transportation PPPs in the future, while only 7 stated they do not plan to pursue them. With the increasing interest in utilizing the private sector in transit infrastructure delivery, more research is needed on the implementation of transit-specific P3 projects in the U.S, especially long-term concessions (i.e., those typically covering 20 or more years) that include a financing element.[2]

PPPs are defined in different ways by different entities. Typically, PPPs are comprised of a consortium of private sector firms, which is under a contract with a public authority to deliver and/or finance the infrastructure in question. The definition that most applies to transit PPPs discussed in this paper is from the U.S. Department of Transportation (USDOT). The USDOT defines PPPs as a form of procurement. According to the USDOT's 2004 Report to Congress on Public-Private Partnerships (cited in FHWA, 2007)

[1] I use the terms PPPs and P3s interchangeably throughout the chapter but they are referring to the same thing.

[2] DBOM and DBFO(M) contracts, as described in this section, typically include an operating and maintenance agreement of 25 years or more according to USDOT (2004). O'Steen and Jenkins further describe DBOM contracts as averaging between 15-25 years and DBFO averaging about 20 years, with some as long as 50 years (for example the U.S. 36 toll lane project discussed here).

> A public-private partnership is 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.

Private sector financing does not have to be included as a component of the PPP, but innovative financing has become more prevalent in recent years. This research project looks at financing in particular as a component of PPPs in Denver.

PPPs can take several forms and the most common in transit procurement are: design-build (DB) and design-build-operate-maintain (DBOM) (Thomas, 2014). In the U.S., design-build contracts made up 62% of the total transport PPPs from 1989-2011, and DB is also the most common for highway projects (Thomas, 2014). These are considered "alternative methods" of project delivery because they differ significantly from the more traditional design-bid-build method of contracting (Thomas, 2014). In a design-bid-build project, the public agency has more control over the design of the infrastructure. The agency either designs it themselves or contracts out the design according to their precise specifications, then companies bid on the construction of that project. In the DB and DBOM models, the public agency develops certain performance specifications for the project, and the detailed design is left up to the private groups who bid for it. This allows more flexibility for the private sector to utilize efficiencies and develop innovative ways ideally to decrease the cost of the project. DBOM then adds operations and maintenance responsibilities to the contract, which is usually for a longer-term of 15 or more years. One advantage of including operate and maintain (O&M) in the PPP is to incentivize the private sector to produce a high quality project because it

will also be paying for the operating and maintenance costs over time. The Hudson-Bergen light rail system in NJ is an example of the DBOM model.

Financing can also be added to these alternative delivery methods whereby the private sector brings in equity or takes on some of the debt burden of the project. The public entity will use revenue generated from the project (usually farebox or toll revenue) to pay the private sector or issue availability payments over the course of the O&M period. A full design-build-finance-operate-maintain or DBFOM delivery method can further transfer financial risk to the private sector as well as generate life-cycle cost savings (Thomas, 2014). The Denver Eagle P3 project is the first full transit DBFOM in the U.S. The Maryland Purple Line is being modeled after the Eagle P3 project and is in the early stages of development.

The benefits of using P3s to procure new transportation infrastructure have been identified in several research articles and federal publications. P3s are expected to deliver projects faster and at a lower price than traditional methods (see next section) (FHWA, 2007). The on-budget on-time expectation was tested by the National Audit Office of the U.K. (NAO, 2003), which found that only 24% of PPP projects were delivered late compared to 70% of projects delivered by traditional methods. The NAO (2003) study also found that budgets were exceeded in 22% of PPPs versus 73% of traditional procurements.

Increased innovation and expertise from the private sector in the construction and operation phases is another benefit of PPPs. Proponents argue that innovation leads to a better quality product at a lower cost (Thomas, 2014 p. 6; Papajohn et al., 2011, p. 130-131). PPPs can also stretch limited capital funds of an agency by allowing it to finance a

project over a longer period of time, as well as utilize private financing and capital to build more transportation infrastructure than through public financing alone. P3s also have the potential to allocate appropriately some risks to the private sector (FHWA, 2007). Interestingly, Papajohn, et al. (2011) found in their survey that 57% of U.S. states implemented PPPs because of financing reasons, while 21% used PPPs for cost-saving reasons. None of the states identified risk transfer as the reason for setting up a PPP. Measuring and quantifying these benefits is not always easy, and the extent to which a state or agency realizes these benefits is project-specific.

There are also potential drawbacks to consider when it comes to choosing to conduct a transportation project as a P3. The initial costs at the bidding stage and other transaction costs are much higher for a P3 because of the need to hire experts in P3 contracts (Valila, 2005; Vining et al., 2005). Critics of P3s also have concerns about the loss of public accountability when the private sector takes over the operation of a public asset (Siemiatycki, 2006; Forrer et al., 2010). Some people are concerned that profit maximization will come at the expense of the public good. Siemiatycki (2006) analyzed the Canadian Richmond-Airport-Vancouver (RAV) urban rail line PPP and found that it did not deliver on expected benefits such as limiting cost escalations and producing technological innovation. P3s are not a viable alternative of infrastructure delivery in all cases; a cost-benefit analysis should be conducted to assess the viability of a project to be conducted as a P3 (Reinhardt and Utt, 2012).

Much of the research on transport PPPs comes from the evaluation of international projects (e.g. Transport Reviews 2015 special issue on PPPs, Banister, 2016). Previous research on transport PPPs in the U.S. has focused mainly on toll roads

and highway infrastructure (e.g. Van der Hilst, 2012), which is where the majority of P3 funds are spent (Istrate and Puentes, 2011). These studies, however, are somewhat applicable to transit PPPs because the contracts are often modeled after toll road PPP contracts, according to our interviews. Papajohn et al. (2011) stated that innovative financing is usually involved in P3s. According to our research, the experts tended to agree that a "full P3" has to include financing, and DB contracts are becoming the standard procurement method. More research is needed on transit-specific P3 projects in the U.S., especially those that include financing, such as the Eagle P3 transit project in Denver.

Study area and background on Denver's transit PPP projects

In November 2004, voters in the Denver-Aurora and Boulder metropolitan areas approved a 0.4% increase in the regional sales tax to support the FasTracks rail transit program, which would add 122 miles of light and commuter rail transit to Denver's existing 35-mile light rail system. FasTracks would expand rail transit into six new corridors, including a new link to Denver International Airport, extend three existing corridor lines, complete a bus rapid transit line to Boulder, and refurbish Denver Union Station into a multimodal transportation hub for intercity and regional rail and bus service. At an initial cost of $4.7 billion, the FasTracks project was at the time one of the largest urban rail transit construction programs in the U.S.

However, delays in construction soon led to an increase in the costs of the FasTracks projects. Between 2003 and 2008, construction material costs rose much faster than RTD had predicted. The global economic crisis of 2007-2008 greatly affected the regional economy in Denver, and sales tax revenues were not as large as originally

projected. By 2012, the cost estimate for FasTracks completion rose to $7.4 billion. As regional officials looked to the federal government to cover the growing gap in funding, it was clear that further measures were required. In 2007, the FTA had launched its Public Private Partnership Pilot Program (Penta P) to encourage transit agencies to explore how P3s could reduce risk on federally funded projects. Denver RTD was one of three agencies selected for the program and the only one that continued with it. In May of 2011, the FTA awarded a $1.03 billion fully-funded grant to the RTD for the completion of three major corridors in the FasTracks system. A key factor in the FTA's decision was the RTD's commitment to creating a new public-private partnership to deliver the project in a timely and cost effective fashion. In awarding the money to Denver, the head of the FTA, Peter Rogoff, praised the RTD's plans as a "model of private-sector involvement in transportation" (cited in Lieb, 2011). The creation of a P3 having access to non-traditional sources of capital was a centerpiece of the RTD's plan.

The successful completion of the FasTracks system is hindered only by the Northwest rail line. Because of the increased construction and right-of-way costs, decreased sales tax revenue, and lack of a federal funding, the Northwest commuter rail line to Boulder and Longmont was sacrificed to get the rest of the system built. The Eagle P3 agreement did enable the first six miles of the Northwest rail to be built to Westminster. RTD officials have put a date of 2042 on the completion of the Northwest rail line. They are legally bound by the FasTracks legislation to build the line, but they do not have the financial ability to pay for it without a tax increase[3]. This has caused some

[3] For more information about the cost estimates and shared-use agreements for the Northwest rail corridor, see chapter 3.

tension between regional stakeholders in Boulder and Longmont who voted for the sales tax, but who are not getting their rail line. Improvements in the bus service along U.S. 36 were implemented as part of the toll road P3 instead.

Making a P3: The Eagle P3 Project

An example of a new generation P3, the Eagle P3 project in Denver is described as "an innovative financing and project delivery method in which a public entity partners with the private sector on a public infrastructure project" (RTD, 2015a). Central to the Eagle P3 project is the delivery and completion of three key components of the FasTracks project (see Table 1), namely, the East Rail Line (now the A-line) and the Gold Line (now the G-line) (which together comprise the main East-West extension) and the first segment of the Northwest Rail Line (B Line), along with the Commuter Rail Maintenance Facility (a site for storing and maintaining the commuter rail vehicles that serve parts of the FasTracks system). These lines are significant because they connect downtown Denver to major urban edge developments, including Stapleton and Denver International Airport (DIA), as well as the cities of Aurora, Arvada, Wheat Ridge and South Westminster (Figure 1). They are integral to ongoing regional efforts to retrofit mass transit to the new metropolitan geography of urban development, to promote smart growth, and to encourage transit-oriented developments throughout the Denver region.

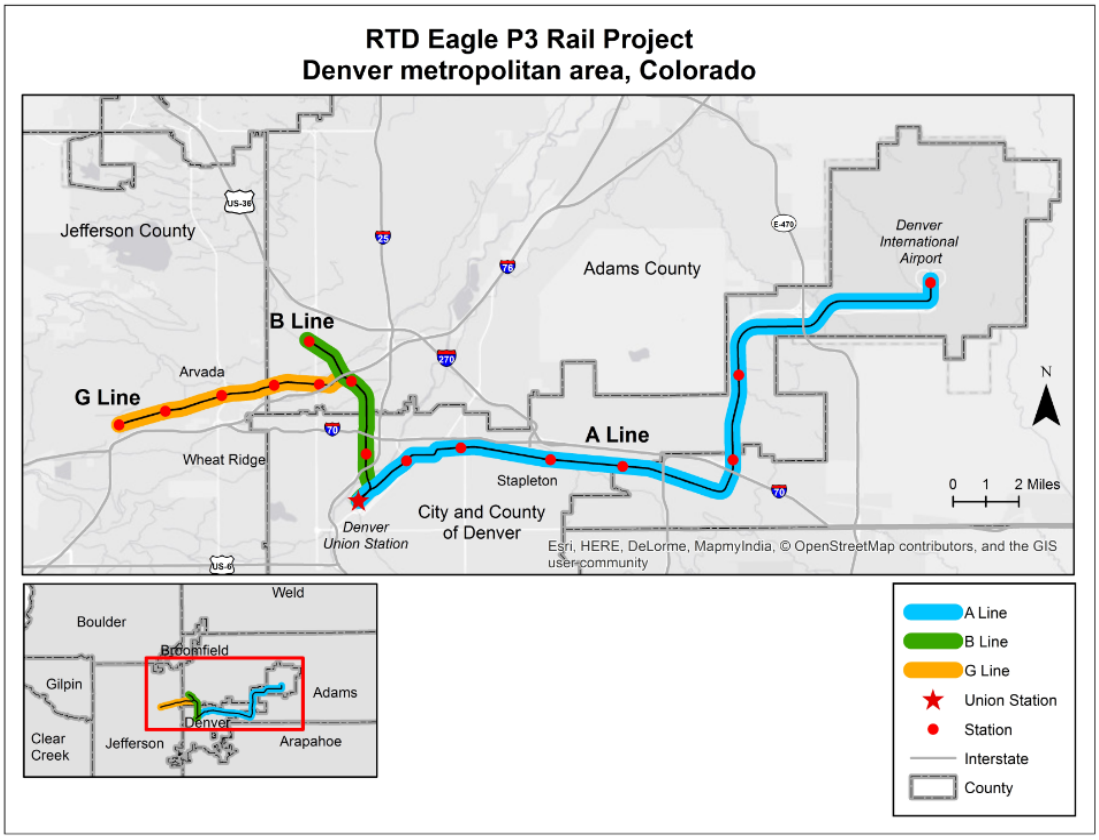


Figure 1: RTD map of Eagle P3 rail project. Author: S. Brady, Source: RTD FasTracks 2015a.

Table 1: Major transit corridors covered by the Eagle P3 PPP project (Source: RTD, 2015c)

Corridor name	Distance (miles)	Corridor description	Local jurisdictions and major developments served
East Rail Line (A Line)	22.8	Electric commuter rail linking Denver Union Station and Denver International Airport (DIA)	City/County of Denver, downtown Denver, DIA
Gold Line (G Line)	11.2	Electric commuter rail linking Denver Union Station and Wheat Ridge	City/County of Denver, Adams County, Arvada, Wheat Ridge
Northwest Line (first segment only) (B Line)	6.2	Electric commuter rail linking Denver Union Station and Westminster	City/County of Denver, Westminster

The Eagle P3 Project is described as a "Design, Build, Finance, Operation and Maintenance (DBFOM) project" (FasTracks 2015c), meaning it involves all stages from project construction to financing and maintenance. Some $2.2 billion in capital has been committed to the project, which is comprised of $1.03 billion in grant funding from the Federal Transit Administration (FTA), regional sales tax bonds, and private equity of at least $450 million raised by the private consortium, Denver Transit Partners [DTP] (see Table 2; RTD FasTracks, 2015a, 2015c). The RTD makes payments to the private partners over the lifetime of the project whilst retaining ownership of all assets relating to the FasTracks system. Phase 1 of the project began in August 2010. The remaining construction phase of the project (Phase 2) was completed in 2016. While the A-line portion of the project opened as scheduled in 2016 and the B Line in July of 2016, the G-line was significantly delayed. The G-line was delayed for over 2 years, until April of 2019, because of crossing-gate issues that also affected the A-line and B-line. DTP (the private consortium) will continue to operate the project thereafter and for the remainder of its contracted lifetime of 29 years.

Who are the partners in the Eagle P3 project? DTP represents a consortium of private concessionaires, including Fluor Enterprises, Inc.,[4] Denver Rail (Eagle) Holdings, which is a subdivision of John Laing PLC,[5] and Aberdeen Infrastructure Investments, a

[4] Fluor Corporation is a Fortune 500 global engineering and construction firm headquartered in Irving, Texas. In 2013, it employed more than 40,000 worldwide and earned revenues of $27.4 billion (Reuters, 2015).

[5] John Laing PLC specializes in raising capital for transportation, renewable energy, and social infrastructure projects involving state-led PPPs in the UK, Europe, Asia, the Pacific, and North America (John Laing, 2015). In the last 30 years, it has invested in more than 100 such projects worldwide, including most recently the I-4 Ultimate Highway project in Florida, which is financed by a combination of debt equity and a loan provided by the US Department of Transportation under its Transportation Infrastructure Finance and

unit of Aberdeen Global Infrastructure Partners LP (DTP, 2015).[6] John Laing and Aberdeen Infrastructure Investments are the majority partners in DTP, each with a 45% interest (John Laing, 2015).[7] Concessionaire arrangements legally bind together the Eagle P3 project into a consortium, but it is important to note that this arrangement has already undergone some significant changes over the course of the project.

Funding source	Amount ($US millions)
Regional: RTD funds including bonds raised against regional sales tax revenue	684
Federal: Federal Transit Administration Grant	1,030
Global: private equities and revenue bonds	486
Total investment in Eagle P3 project	2,200

Table 2: Sources of capital funding for Eagle P3 (data sources: various including RTD FasTracks, 2015a, 2015c).

Other P3 FasTracks Projects

Besides Eagle P3, the FasTracks program is being delivered through four other types of P3 arrangements. I describe and discuss each of these arrangements in turn below.

Innovation Act (TIFIA) program (see http://www.laing.com/project_portfolio/109/145/i-4-ultimate-highway-project-florida-us.html).

[6] Aberdeen Global Infrastructure Partners LP is a collective investment scheme registered in the island of Guernsey, a recognized tax haven for UK-based investors. Aberdeen invests in global infrastructure projects, which are underpinned by long term secure government contracts that generate stable cash flows (The Hedge Fund Journal, 2014).

[7] Other members of the Eagle P3 consortium are Balfour Beatty Rail Inc., ACI, Ames Construction, and HDR.

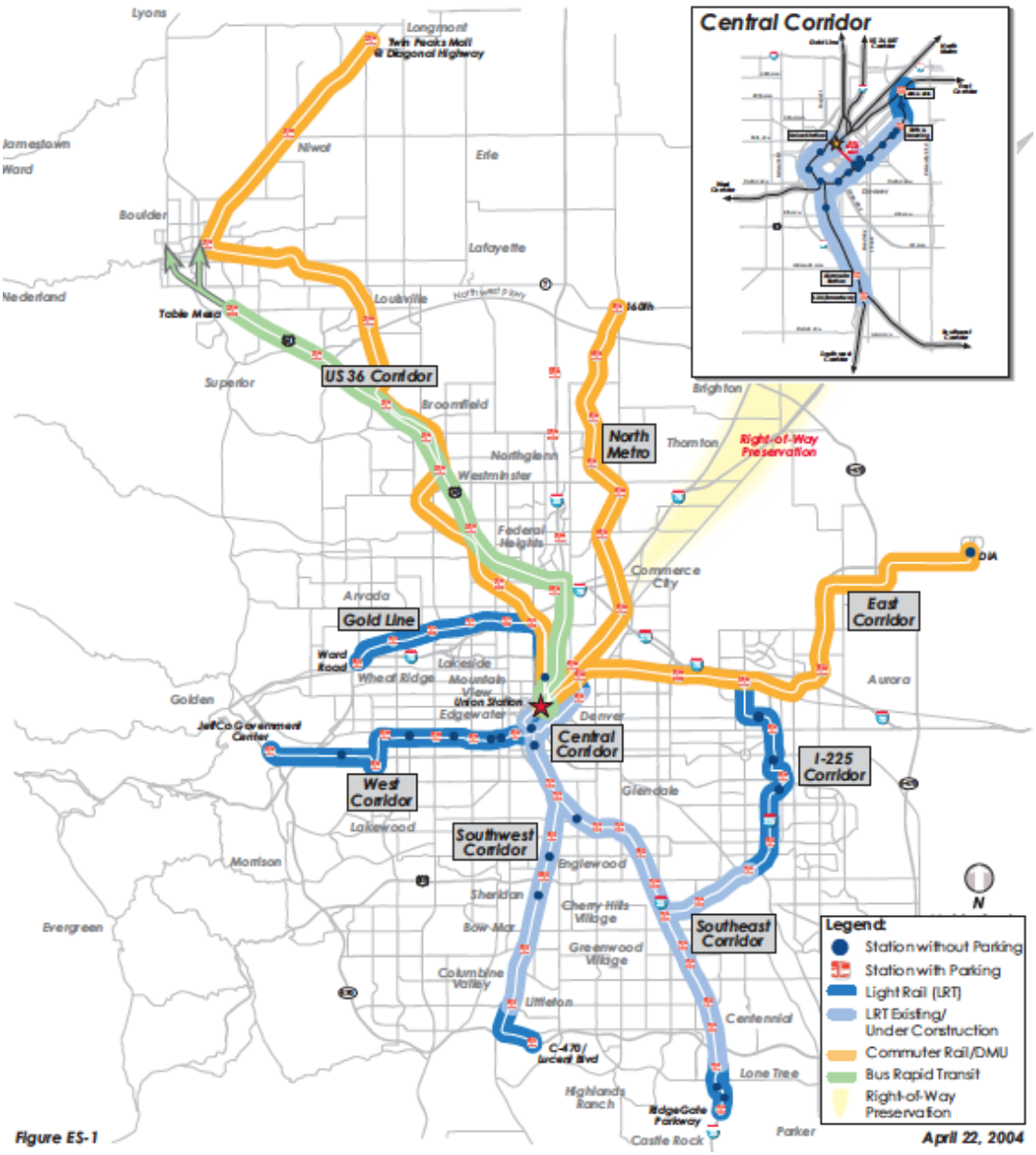


Figure 2: Original FasTracks program map (source RTD, 2004)

P3 project	Aims	Partners	Funding sources	Type of P3
Denver Union Station • Eight-track commuter rail station • Relocation of light rail station • 22-bay underground bus concourse • MetroRide downtown circulator • Renovation of historic Union Station building with hotel, retail, and dining	Create dense, mixed-use transit-oriented development around the station Create an intermodal hub for light rail, commuter rail, Amtrak, bus, taxi, pedestrians, and bikes Renovate historic Union Station building	RTD, DRCOG, CDOT, City and County of Denver, Union Station Neighborhood Company, Kiewit	RRIF and TIFIA loans, FHWA grant, ARRA grant, FTA grant, Senate Bill 1 (CO) funds RTD property sales and FasTrack funds	DBF
U.S. 36 bus rapid transit/ HOT lanes • Bus rapid transit (BRT) Flatiron flyer service • Express HOV and toll lanes • U.S. 36 Bikeway • Intelligent transportation system solutions	To reduce congestion on U.S. 36 corridor Offer transportation choices	CDOT, RTD, HPTE, Plenary Roads, Aims Granite Joint Venture	RTD funds, TIGER grant (USDOT), Colorado Bridge Enterprise funds, DRCOG, TIFIA loans, CDOT funds	DBFOM
I-225 light rail • 10.5 mile light rail line through Aurora	Provide connectivity to major activity and employment centers in Aurora Provide key regional access to East and Southeast rail lines	RTD, Kiewit	RTD FasTrack funds	DB
North Metro commuter rail • 18.5 mile electrified commuter rail from Denver Union Station to Northglenn	Connect downtown to Northglenn in the first segment	RTD, Graham and Balfour Beatty Rail (Regional Rail Partners)	RTD FasTrack funds	DB

Table 3: Overview of P3 projects in the FasTracks program (sources: RTD 2016 a,b,c,d; FHWA 2014, n.d.; CDOT 2012, 2014; Khorkhyrahova 2013; Lien 2014; USDOT 2016)

Denver Union Station

Denver Union Station (DUS) is different from the other FasTrack transit P3 projects because it utilized innovative financing through real estate and development value. The DUS public-private partnership included four public agencies, RTD, Colorado Department of Transportation (CDOT), Denver Regional Council of Governments (DRCOG), the City and County of Denver, and one private group, Union Station Neighborhood Company (USNC), a joint venture of Continuum and East West Partners. The private sector was engaged in the project as a "master developer." DUS is the intermodal hub of the RTD transit network, where light rail, commuter rail, bus operations, and Amtrak service all converge. In addition, the historic union station building and great hall were refurbished, and now house a boutique hotel and very popular retail and dining options.

The financing of DUS came from several sources including federal and state grants, property sale proceeds, and federal TIFIA and Railroad Rehabilitation and Improvement Financing (RRIF) loans. The money to repay these loans came from FasTracks sales tax revenue and TIF revenue. DUS opened the light rail facilities in 2011, the bus concourse and great hall in 2014, and commuter rail service began in 2016.

Funding source	Amount ($US millions)
Federal: Railroad Rehabilitation and Improvement Financing (RRIF) loan	155
Federal: TIFIA loan	145
Federal: FHWA grant (CDOT)	50
Federal: American Recovery and Reinvestment Act funds (ARRA) (DRCOG and RTD)	28.6
Federal: Federal Transit Administration Grant	9.6
Federal: Transportation Improvement Program (TIP) funds (DRCOG and RTD)	2.5
State: Senate Bill 1 (CO)	18.6
Regional: Property sale proceeds (RTD)	37.4
Total investment in Union Station project	446

Table 4: Sources of capital funding sources for Denver Union Station (data sources: FHWA n.d.; Khokhryahova 2013; Lien 2014; USDOT 2016; RTD 2016a).

U.S. 36 Bus Rapid Transit

Also known as the Flatiron Flyer, the bus rapid transit service operated by RTD runs 18 miles between Boulder and Denver Union Station. In conjunction with the BRT expansion, CDOT entered into a PPP agreement with Plenary Roads and the High-Performance Transportation Enterprise[8] (HPTE) within CDOT to expand highway capacity on U.S. 36 by building High-Occupancy Toll (HOT) lanes. The BRT service was included in the original FasTracks plan in conjunction with CDOT's highway improvements. The BRT and toll lanes began service in 2016.

[8] The High-Performance Transportation Enterprise is a government-owned business within CDOT that was formed to pursue innovative means of more efficiently financing important surface transportation infrastructure projects.

Funding source	Amount ($US millions)
Federal: TIGER Grant	4.8
Federal: TIFIA Loan	54
State: CDOT Bridge Enterprise	41.5
State: CDOT federal/ state grant	41.4
Regional: DRCOG federal funds	46.6
Regional: RTD funds	112.1
Local funds and other	12
Total investment in U.S. 36 improvements	312.4

Table 5: Sources of capital funding for U.S. 36 improvements (data sources: FHWA 2014, CDOT 2012, CDOT 2014, RTD 2016d).

I-225 light rail line (R-line)

The I-225 light rail line is 10.5 miles and connects the Southeast and East (A-line) rail lines through Aurora, Colorado. It was built as a design-build agreement with Kiewit, who put in an unsolicited bid in 2012. Kiewit is the same contractor who completed in 2006 the Southeast Corridor light rail line along I-25 and I-225 (up to Parker Road) as part of the $1.7 billion TRansportation EXpansion (T-REX) design-build project that also widened those highways. Because Kiewit had previous experience with building light rail in the same corridor, it was able to generate a bid that was lower than RTD cost estimates for that corridor. The I-225 line opened in 2017.

North Metro commuter rail line (N-line)

The North Metro (N Line) electric commuter rail project is a proposed 18.5 mile line from Denver Union Station to Thornton, Colorado, with 13 miles currently under construction and due to begin service in the early 2020s. In 2013, RTD received an

unsolicited proposal to construct the line, then opened a competitive bidding process and awarded a design-build contract to Regional Rail Partners (RRP) (RTD, 2016b). The private group is a Joint Venture of Graham and Balfour Beatty Rail.

Research methods

This research utilizes multiple methods to accomplish the principal objectives of the study. First, I conducted a desktop analysis of transportation and transit public-private partnerships in the U.S. Second, I conducted a survey and a sample of face-to-face interviews with at least twenty strategic actors and policymakers in Denver to elicit their views on the structure and nature of the transit PPPs in the region. I conducted the surveys face-to-face to control its dissemination and preserve the quality of the data. Interviewees were identified through personal knowledge and snowball sampling. I sought to gather a variety of perspectives in the interviews, with responses from members of the business community, local, state, and federal government, community and advocacy groups, transit agency representatives, and private contractors.

I then input the survey responses into survey analysis software called Qualtrics. I used this software to analyze the survey data and generate summary statistics for the close-ended survey questions. The survey used a Likert-type scale for close-ended questions, and the survey also included several open-ended questions. I report the descriptive statistics, such as mean, maximum, and minimum values on a Likert scale, and the percentage of responses for each choice. I audio recorded, transcribed, and coded the interview responses to identify common themes. The methods and the survey are approved by the University of Denver's Institutional Research Board.

Discussion of Results

Measuring the success of P3 projects in Denver

This section assessed the success of P3 projects in Denver, drawing on the results of the survey and interviews with key stakeholders. I have included brief quotes by interviewees in a fashion that respects the anonymity of respondents.

Effectiveness in addressing transportation needs in the Denver region.

Respondents rated Denver Union Station, US 36 BRT, and the Eagle P-3 projects as the most effective at addressing transportation needs in the region. One interviewee responded that there should be a category for "beyond extremely favorable" for Denver Union Station because of the incredible transformation that has taken place in Lower Downtown around the station. DUS is the multimodal hub of the RTD transit network, with connections to bus, light rail, commuter rail, Amtrak, taxis, and bike and pedestrian routes. The Eagle P-3 is also highly ranked, but with three corridors included in the project, some are better at meeting transportation needs than others. The A-line to Denver International Airport is seen as the most effective line in the Eagle project because of its access to the airport and the ability to bring in economic benefits. US 36 was previously a widely used transit corridor, and the BRT and lane improvements have already produced increases in ridership and reduced travel time along the corridor for both drivers and transit users.

I-225 (R Line) and the North Metro Line (N Line) were also expected to meet transportation needs effectively, but to a lesser degree. Both lines will increase connectivity in the region, however, the I-225 line deviates from a straight alignment with the interstate to serve areas in Aurora's downtown and the Fitzsimmons Medical

Center. These alignment issues will result in increased travel time on the rail, making it tougher to compete with the automobile. The North Metro line is expected to have lower ridership than other corridors with less frequent service, but it will fill a void in the system because there is currently no alternative for people traveling on I-25 to the north. The rail line is also competing with the exclusive bus and HOT lane on I-25, so it may be less effective than that option at meeting transportation needs.

Financial benefit to involved parties

Financial benefit to RTD. The respondents were careful to point out that as a transit agency, RTD does not financially profit from running their services. The financial benefit of a P3 comes in the way of "bang for the buck" in spending on transit projects. All of the P3 projects came in under the internal cost estimates for RTD to complete the projects themselves so they are mostly viewed as financially favorable for RTD. The projects with a full P3 financing structure are viewed as providing the most financial benefit for RTD. The Eagle P3 project came in $300 million below internal cost estimates, and that savings was redirected to other projects, including the I-225 and North Metro lines. The actual debt rates for the private financing were higher than RTD could have raised itself, but the projected savings and benefit come from financing over a longer timeframe, which again allows RTD to fund more projects and accelerate the delivery of the FasTracks program. In addition, the private equity that was used to finance a quarter of the Eagle project reduced the debt burden of RTD so they can complete the other projects. The FTA full-funding grant agreement awarded points for cost effectiveness or "bang-for-buck" efficiency, and the P3 financing structure helped RTD score well on that part of FTA's assessment for federal funding.

Denver Union Station produced the highest return on RTD's investment according to some experts because RTD ended up getting a half a billion-dollar project for half the cost. RTD was able to make use of the real estate value of their property surrounding the station to fund DUS and also make use of federal loans and private sector investment. Therefore RTD had to invest less upfront cash to complete the project. The revenue from DUS tax increment financing (TIF) is already ahead of performance schedule to pay back the TIFIA loans.

A few people saw the US BRT project as financially unfavorable for RTD because it did not add much to the service while sacrificing a lot of political goodwill. Most people, however, recognized its benefit to RTD as favorable because they were able to leverage about $200 million in investments to get $500 million in improvements through the P3. Several interviewees stated that they would not have been able to do the BRT without partnering with CDOT and the private partners. One even saw this as the best financial deal for RTD because of the comparatively low investment in exchange for high quality of service improvements on a much faster timetable than without the P3.

While the I-225 and North Metro lines were not viewed as favorably as the others, they still came in below internal costs through unsolicited bids. The I-225 bid was over $90 million below cost estimates. Any time the transit agency works with the private sector, even on a design-build contract, they should see cost benefits because the private sector is motivated by profits to save money.

Financial benefit to the private consortium. Overall, the financial benefit for the private consortium involved in the P3 projects is generally favorable. Respondents were more conservative in their assessment of the concessionaire's finances because most

respondents (except for representatives from the private consortium) have no real way to know if they are making money, but the general consensus is that they are. The global investment firms involved in the Eagle P3 have experience with these types of long-term infrastructure projects and are looking for a "steady, long stream revenue source with fairly predictable and manageable risk" for investors like the California school board retirement group and the Australia Teachers Union. The consensus is that DTP got "a good deal, but not a smoking deal," and "nobody is walking away broke," even with significant unexpected expenses for the private sector, such as having to rebuild the Jersey Cutoff bridge in the Eagle P3 project at the cost of $10 million.[9]

The most important factor for DTP to make money on the Eagle project was to complete the project on time in order to begin receiving availability payments to service their debt. Although construction was completed on time, all lines were not in service according to the anticipated schedule. Since the interviews for this research were conducted before all of the Eagle P3 lines entered into revenue service, the responses were colored by the assumption that the lines would open on-time. There have since been several battles of the contract agreement and payments because of several issues relating to increased costs of operation and delayed opening of the G line. The A-line and B-line opened on-time in April of 2016 and July of 2016 respectively, but the lines were operating under a waiver from the Federal Railroad Administration (FRA) for safety issues with the crossing gates. The Eagle P3 lines were the first rail transit lines to

[9] This bridge goes over the BNSF railway tracks just south of I-70 along the Gold line/ Northwest line alignment in the Eagle P3 project (Source: Eagle P3 update presented at RTD board update Sept. 2, 2014: http://rtd.iqm2.com/Citizens/Detail_LegiFile.aspx?Frame=&MeetingID=1954&MediaPosition=&ID=2051&CssClass=).

implement wireless signaling to the crossing gates, and it was integrated with the federally mandated positive train control (PTC) technology[10]. As a first of its kind system, there have been glitches. According to the FRA, the crossing arms were going down too soon and staying down too long. The waiver from the FRA requires DTP to station human flaggers at every grade crossing, and DTP has continued to do so on and off for over three years. While the exact cost to station flaggers at road crossings for nearly 24 hours a day for three years is not known, it is estimated that tens of millions of dollars have been spent by DTP to keep the A-line in operation. In addition, RTD has withheld over six million dollars from the availability payments to DTP for failure to meet contract terms in getting the G line open. Because of the issues at the crossing gates, the G line opening was delayed until April of 2019, and it is also operating with flaggers under the FRA waiver. In the fall of 2018, DTP sued RTD for $80 million dollars for reimbursement of the costs of the flaggers and withheld payments, arguing that federal regulations changed, and they should not be liable for the additional costs due to FRA's decision (Minor, 2019). RTD has threatened to end its contract with DTP and countersued DTP for millions of dollars, claiming they have defaulted on their contract and rushed the testing phase of operation. The net effect on the private sector partner's finances is not known, but it is clear that their operation costs have increased and the delayed opening of the G-line has affected their access to the availability payments from RTD, enough to warrant a lawsuit.

[10] Positive Train Control was mandated by Congress in the 2008 Rail Safety Improvement Act. The technology is designed to automatically stop a train to avoid accidents. For more information see: https://www.aar.org/campaigns/ptc/

Denver Union Station was assessed somewhat more favorably for the financial benefit of the private sector because the property values of the real estate that was sold around the station is publicly known and published in the newspapers. The successful and explosive redevelopment of Lower Downtown (LoDo) is evident to everyone. A representative of the private master developer, however, did comment that while the private group ended up averaging out to make a profit, it was only due to market conditions and not from any money that RTD was paying them. The real estate developers had a difficult time early on when the real estate market was still recovering from the 2007-8 financial crisis, and they had to wait until the end of the deal to realize any profits. They assumed a lot of risk, but ended up making money with a combination of historical luck and effective solutions of the transit hub problem.

The US 36 toll lane project financials remain to be seen, and it is really too early to tell what toll revenues will be. Many respondents think this will be one of the last toll road projects that transfers the toll revenue risk to the private sector because toll project revenue projections can be "wildly inaccurate." Recently, several large U.S. toll road projects have gone bankrupt, notably the Indiana Toll Road in 2014 and the Texas Toll Road/ SH 130 in 2016. The private sector is increasingly less likely to bear the toll revenue risk in these arrangements. The I-225 and North Metro lines were seen as typical design-build contracts where the contractor will likely make money as long as they work within their budgets.

Financial and social benefits for the Denver community at-large. The interviewees agree that PPP projects benefit the Denver community financially and socially. Generally speaking, all of the transit projects deliver the social

benefit of providing an alternative to the car and getting drivers off the road. This is truly the mission of transit. The projects facilitate cost-effective mobility and livability in the region. The P3 delivery model has enabled more transit to get built faster, without having to go back to the taxpayers after the funding shortfall. The consensus is that taxpayers are getting a good deal with these P3s and seeing value for their tax dollars. Most people stated that they expect the region as a whole to benefit from future economic development due to investment in transit infrastructure in Denver. The projects for which respondents expected to see the most economic development and financial benefits are the Eagle P3 and Denver Union Station.

The Eagle P3 project is economically important to the region because of the access it provides to the airport. Interstate 70 east of downtown is the major thoroughfare that most travelers use to access the airport, but that highway has been experiencing crippling levels of traffic congestion and substantially increased travel times especially during peak hours. Everyone agreed that the "train to the plane" will bring economic development opportunities to the Denver region, and it has already brought in industry along its corridor, including Panasonic. The A-line provides a certainty of travel time as a social benefit to citizens. Moreover, the "aerotropolis" concept is something that Denver and Adams County hope to further capitalize on to bring more jobs to the region.[11] The cost of the crossing gate flaggers and the delay of the G line revenue service has been born thus far by the private contractor, DTP, but they are suing RTD for

[11] Denver's current mayor, Michael Hancock, has expressed an interest in developing the land around DIA and along the A-line corridor into an 'aerotropolis' or airport city as an engine for regional economic development. The Aerotropolis Regional Transportation Authority (ARTA) has been established to oversee future development and infrastructure improvements on the land surrounding DIA (see https://aerotropolisrta.org/).

reimbursement of these costs and withheld availability payments. This could be considered a financial benefit to the public, since a major benefit of a P3 is shifting some of the financial risk to the private sector. However, RTD is having to expend legal fees to fight and file the lawsuits and may end up paying for some of the expenses, so the true cost of these issues are likely being felt by both the public and private partners.

Redevelopment of Denver Union Station is also credited with the relocation of several national firms' headquarters to downtown Denver. Many companies cite access to transportation options as an amenity they hope to provide their employees. DUS has also reinvigorated the LoDo neighborhood and facilitated higher real estate values in the area. The tax revenues from the redevelopment around the station has been triple the original projections. RTD and the City and County of Denver were able to refinance $300 million in loans, which will enable Denver to pay off their debt in just over eight years while saving over $10 million, and RTD will save up to $134 million over the life of the loan through 2040 (Murray, 2017).

The BRT and HOT lanes on US 36 provide transportation choices in an important highway corridor. The improvements have provided more reliable and faster travel times for the community, and the P3 delivered an "autobahn-like system" decades before it otherwise could have.

Public accountability of P3s

Since P3s are relatively new in both the U.S. and Denver contexts, questions have been raised about matters of public accountability and access to information. Regardless of how much information an agency feels they provide to the public, they know that what matters is how the public views projects like P3s. The agencies most heavily involved in

these projects, namely RTD and CDOT, both felt that they did a good job informing citizens of the impacts of their projects. However, the public did not always agree. RTD's projects in general received higher marks for public information than the CDOT project. Transit agency respondents also gave themselves high marks for public information, citing RTD's philosophy of active transparency.

Every RTD project has a public information team that is responsible for engaging with the community and local stakeholders. For the Eagle P3 project, RTD held a public meeting in a large auditorium downtown for the public to hear presentations from the private groups competing for the contract. People were interested in the high profile A-line to the airport, and the public could see it being built along the airport boulevard. Moreover, quite detailed information about the project and the concessionaire is accessible on RTD and other websites. Nevertheless, the public and even some elected officials still do not know many details about the projects, including the procurement model or even the differences between light rail and commuter rail.

Denver Union Station was seen as "a different animal" because the P3 was more real estate driven. The project had more scrutiny by more people, according to individuals involved in the station redevelopment. The project has had multiple public and private stakeholders involved, so they felt they were always out there explaining the project- to CDOT, RTD, Lower Downtown neighborhood groups, etc. The project also had a citizens group, Union Station Alliance, which has had input into what type of tenants they wanted to see in the station. Although Eagle P3 and Denver Union Station were seen as providing more information to the public, some people were quick to point out that these projects were not controversial. In the end, the public was mostly just glad

the projects were being built, and there was little opposition to them. People were not as concerned about the P3 delivery model being used in transit projects as they were with the highways.

Toll lanes are inherently more controversial according to some interviewees. With the US 36 project, some of the public got the wrong impression that they were going to have to pay to drive on all the lanes on U.S. 36. People were also confusing CDOT and RTD, thinking that RTD was building toll lanes. Some interviewees also attributed the backlash against the US 36 toll lanes and BRT to the failure of the Northwest rail line to get built. People felt they had voted for rail and now all they were getting were buses, even though the BRT had always been a part of the FasTracks plan. The project turned political, and state legislators stepped in questioning the P3 contract with the Plenary Roads group. Some elected officials interviewed cited a "total lack of transparency" from CDOT, stating that the "agreement was negotiated behind closed doors, nobody including legislators, got to see the agreement until it was signed."

An audit of the US 36 project found that CDOT failed to provide enough information to the public, "even though all [of the RTD transit projects] provided much less information- a lot less," according to one interviewee. As a result, a few state legislators sponsored a bill to restrict PPPs for CDOT in the future, but the governor vetoed the bill. The public outreach part of the bill was kept, requiring at least two public meetings if a project is delivered using a P3. In hindsight, a few respondents felt that the private and public partners failed to reach out to key stakeholders, including state legislators, to make sure they understood the procurement process and key contract terms. Interviewees did feel that it is important for the public to understand and be

involved in P3s, but because they are "complex and opaque transactions that are difficult to explain and communicate," it is hard to know how much the public really wants to know.

Regional collaboration

Over the past few decades, the Denver metropolitan region has become known for its strong model of regional collaboration (Jonas, Goetz, and Bhattacharjee, 2014). Most of the interviewees credited regionalism created through the Metro Mayors Caucus, the Metro Denver Chamber of Commerce, and other regional organizations with getting the initial FasTracks ballot initiative passed in 2004. The Metro Mayors Caucus is an informal collaboration between Denver metro area mayors to address issues that cross jurisdictions such as transportation. Denver's mayor at the time, John Hickenlooper, was also a strong regionalist.

After the funding shortfall was discovered, it became evident that not all the rail lines would be built, and there was potential for the strong regional collaboration to become fragmented based on which corridors would move forward. Choices had to be made; however, the decisions were not political, but based on the availability of federal funding and private sector interest in the projects. The lines eligible for federal funding in the PentaP project, the Gold Line, the B line, and the A line, were packaged together as the Eagle P3. After the Eagle P3 project came together, there were some negative sentiments expressed against the core city (Denver), but most people supported the airport line getting built as a benefit to the region. The Eagle P3 also enabled part of the Northwest rail line to get built to Westminster. Communities to the northwest, however, were unhappy that their corridor was not being built. RTD's ability to get the I-225 and

North Metro lines built with savings from Eagle P3 was "brilliant" because it showed a good faith effort to get something built for Adams County and Aurora.

Denver Union Station and the Eagle P3 rated the highest for contributing to stronger regional collaboration. These projects met little opposition, and it was hard to argue that the transit hub and the airport line were not good for the region. Everyone in the region supported the projects, but DUS did not have to deal with multiple jurisdictions- it is located only in the City and County of Denver. The US 36 BRT project required collaboration between CDOT, RTD, and local communities, and ironically the backlash against CDOT and the toll lanes coalesced the region.

The opinions of the P3 contribution to regional collaboration varied. Some experts either thought that the P3 delivery model itself did not hurt regional collaboration or it did not affect it much at all. Others, however, said that a P3 is the very definition of collaboration. It requires government to be more proactive with regional partners and to think about the regional benefit of the transit lines rather than what a certain jurisdiction wants. Another pointed out that RTD is regional by definition and requires strong collaboration between many different government entities. Another felt that the mayors stood by one another and supported each other's projects, not just their own. One respondent spoke about the importance of local match grants in the Southeast corridor, where local government and private groups collaborated to provide matching funds to get the Southeast light rail extension back on the table.

There were a few people who felt that regional collaboration has suffered more recently because of the 'corridor versus corridor' mentality, with the south metro arguably getting everything, or so it has been claimed. The fact that the Northwest rail

project to Boulder and Longmont was being pushed beyond 2042 contributed to this "Mason-Dixon type line." The FasTracks plan was supposed to be funded as a regional system, but instead was being funded, through FTA funding and private money, corridor by corridor.

Overall success of the projects

Denver Union Station stands out among these projects, with 100% of survey respondents rating the success extremely favorable. DUS was assessed by some respondents as "beyond extremely favorable" and an "unmitigated, outstanding super success." It is "hard to find a problem" with the project, and the region and public is already seeing economic and social benefits from it.

Eagle P3 was also highly rated, either extremely favorable or generally favorable by all respondents, because of the economic development and connectivity it will bring to the region. Ridership on the A-line has exceeded expectations, and new cars are being added to the service in 2019 to meet demand (Tinsley, 2018). The ridership has continued to increase since 2016, from 4.1 million boardings in 2016 (from April through December) to 6.6 million in 2017 to 7 million in 2018 (Bosselman, 2019). As of December 2018, total ridership had reached 16 million, which RTD officials did not expect to reach until 2020 (Tinsley, 2018). RTD has expressed their satisfaction with the ridership numbers, as well as their on-time percentage for the A-line of 97%.

The success of the other projects was also favorable. The success of the BRT is attributed to the high ridership and improved travel time in the corridor. In the interviews, the North Metro (N Line) is expected to be successful because it is anticipated to be on-time, on-budget and provide high quality service to customers. The first segment of the

Northwest rail (B line) was completed on-time in July of 2016 and on budget, and it has achieved its expected ridership. The B line is nearing 160 boardings per hour. The R-line along I-225 was stalled for a few months by equipment issues, but opened in February 2017, and it has thus far been the lowest performing FasTracks line. The R line had less than 40 boarding per hour in 2017, well below the next lowest line at 140 boardings per hour (Sachs, 2017). The R line makes significant detours from the most efficient route in order to service the Aurora town center and is not well integrated into the large employment center of the CU Anschutz Medical Campus. The transit oriented development along the R line has also been slow to develop thus far. After considering all of the measures of success, meeting transportation needs, financial success, and public information, the P3 projects overall get high marks from interviewees.

Major Benefits of Private-Public Partnerships

Most of the benefits cited by respondents apply to a full P3, with DBFOM aspects. The two most important and most cited benefits of these PPPs were accelerated delivery of the projects and appropriate allocation of risk. RTD was able to deliver more infrastructure sooner than it could have with traditional revenue streams. The private sector has a better ability to deliver multiple projects on-time and on-budget because of incentives such as availability payments that take effect when the project is complete. Most of the interviewees believe that the private sector is “faster, smarter, and better”, and through their operating efficiencies plus incentives for profit, they can complete projects faster than the transit agency alone. Even a design-build project, without the financing, operating, and maintenance agreements, gets built faster than a traditional

design-bid-build because of private sector efficiencies, such as utilizing the connection between the designer and the contractor for smoother and faster implementation.

A few people named allocation of risk as the primary reason to conduct a project as a P3. The risks must be shifted appropriately, with the private concessionaire (and its constituent firms) assuming those risks that they can manage better and cheaper than RTD. For example, the private sector is much more equipped to assume construction risk or interest rate risk, while the public sector is better equipped to handle risks such as environmental hazards and public utilities. Shifting some of the risk to the private sector is a significant financial advantage in a P3 contract. However, the distribution and allocation of risk should not undermine control of public assets. Most respondents felt that the contracts negotiated in several of the P3s had provisions that allowed the regional public agency to retain or reassume control of strategic assets should the private sector fail to deliver. These provisions are discussed further in section five: the role of the regional transit agency.

A P3 can reduce some costs, as evidenced by the lower cost estimates that came in for all of the projects discussed in this report. For the Eagle project the cost estimate came in $300 million under initial internal projections. This freed up more money for other transit projects, but it is not always cheaper to do a P3 in the long-term. The ability to finance over time gets more infrastructure built faster, but it would have been cheaper for RTD as a government agency to finance the debt than the private sector assuming that bond ratings were strong. There is not really a cost savings through private financing, but if the public sector needs capital from elsewhere because they have reached their debt capacity, as was the case with RTD, then the financing element is a very important

benefit. The financing element is also important because it gives the private sector "skin in the game." For the Eagle P3, the private consortia contributed $54 million to the funding of the infrastructure. If they walk away, they lose the equity they have contributed. One person noted that the financing element of the P3 is overrated, and "if you (the transit agency) are doing it for money, you are doing it for the wrong reasons." Benefits such as allocation of risks and accelerated delivery are the primary reasons for doing a P3 in this respondent's opinion.

Another key to realizing all of the benefits of a P3 is to include financing, operations, and maintenance in the partnership. The public sector benefits by being able to pay for the full life-cycle cost of operations and maintenance. In a DB contract, some construction savings may be reaped but possibly at the expense of operations and maintenance. With a full DBFOM contract, the private sector is incentivized to build a better product that will require less maintenance to increase their profit over the long-term concession lease. There is also a guaranteed condition of the asset in the Eagle P3 that requires the infrastructure to be returned to the agency in a certain condition after the 30 year O&M period. Instead of building a system to last 50 years and using it and abusing it, this contract funds a mid-life overhaul of the system.

Another way the public sector benefits from partnering with the private sector is the expertise that hired consultants and the private consortia bring to the table. These specialized individuals and companies are better at executing projects at a higher level of skill and reliability. The public sector does not have the expertise or experience to negotiate these contracts, so they bring together a group of very sharp legal and financial minds to represent them, resulting in a better deal for the agency. In addition, the

knowledgeable resources that the private consortia contribute during the design, construction, and operation phases also results in a better overall team overseeing the project.

Bringing in the private sector results in more innovation. According to some respondents, the public sector is used to doing things in a certain way, with a "this is the way we have always done it" mentality. A P3 helps "get the bureaucratic bologna out of the way." The public sector provides robust design criteria for the transit infrastructure, but the P3 model provides flexibility for the private sector to find efficiencies and cost savings by building things the way they know how or by coming up with innovative solutions to design or construction issues. In this way they are not hamstrung by the agency's design. One example of an innovation from the private partner in the Eagle P3 was including wireless signaling technology with positive train control. However, in this instance, the innovation has resulted in additional regulatory problems and costs since the technology was relatively untested prior to the opening of the Eagle P3 lines. Neither the public nor private partner has been able to adequately address the technical issues with the crossing gate software.

Major Shortcomings of Public-Private Partnerships

The nature of P3s, at least in the U.S., is that they are "complex and opaque," and difficult to explain to the public because PPPs are misunderstood, unfamiliar, and still novel. From the public perspective, and as evidenced here by reactions to the U.S. 36 project, there is a lack of transparency in P3 agreements and negotiations. The public and private entities must spend a lot of time on public information, in order to ease the increased public suspicion of corruption and uneasiness of the private sector taking over

public assets. Keeping the public informed is even harder with a P3 than with traditional projects because everything moves so much faster.

Changes can also be difficult in a P3. The public agency loses some flexibility and ability to request changes from their original design. For example, the City of Denver and RTD wanted to add another station at 61st and Pena on the A-line to the airport very late in the construction phase. While some change orders can be done, it is not usually in the best interest of the private sector. In this instance, the private side was able to add the station, but everything comes at a cost. Some people view some loss of control by the agency as a shortcoming. The public entity has less control of the design and building specifications compared to a design-bid-build contract, but one response from RTD was "we have plenty of control over what we should worry about." RTD does not need to be concerned about the specific way the contractor builds a bridge or station platform, as long as it is safe, reliable, and produces quality transit service.

The expense to hire private expertise in the negotiation phase can cost millions in upfront soft costs. The public sector does not have the skills to negotiate these complex deals themselves. The risk of ending up with a bad contract is more expensive than the cost of hiring the experts, but there is also a risk that the project will never get to the bid phase and the agency will have spent millions of dollars on lawyers, designers, bankers, consultants, and other experts. There is no standardization of contracts for full DBFOM agreements, so for the Eagle P3, financial and legal experts from Goldman Sachs, JP Morgan, and Freshfields were required to ensure that the public entity was adequately prepared to enter into the P3 arena.

There is also the issue of cost. It is complicated to precisely identify whether P3s provide a cost savings or not. As discussed in the benefit section, P3s can result in a cost savings in the short term and allow projects to get completed that may have had funding issues. However, over the longer term, the agency will end up paying more for a P3 project because they are paying a higher debt rate through the private sector financing. As one expert put it, rarely will the agency's "green-visored accountant" in the back room look at the spreadsheets and say that a P3 makes financial sense, because the agency will pay more over time. But the agency should take into account all of the other benefits of a P3, especially the transfer of risk, which also adds to the increased cost. Experts agreed, financing is not funding, and P3s are not a magic bullet to address the lack of transportation funding in U.S. states and cities.

Using Denver P3s as a Model

Many people stated that the Eagle and Denver Union Station P3s could serve as models for other cities and regions looking to expand their transit infrastructure, especially for transit agencies with constrained revenue streams. In fact, these projects already are serving as models for projects such as the Maryland Purple Line, outside of Washington D.C. RTD has hosted numerous cities that have visited Denver to see how they were able to get these projects done. RTD also produced a "Lessons Learned" document after the procurement phase of Eagle P3 and hope to produce another one after the transition to O&M[12]. They have shared their experiences with others at conferences and shared transit exchanges as well.

[12] See http://www.rtd-fastracks.com/media/uploads/main/Eagle_P3_Procurement_Lessons_Learned_final_with_cover_letter.pdf

The Eagle P3 is considered a good model contractually and financially. The contract was based on toll road and international deals, and the "risk transfer was nearly perfect," according to one expert. The way these projects were financed is also considered a model for future transit PPPs. Denver and RTD were able to maximize all sources of funding including federal funding and grants as well as private equity. Cities looking to replicate Denver Union Station's success are especially interested in how to use TIFIA loans and Certificates of Participation (COPs) to leverage economic development dollars. The Eagle P3 and DUS project are also models of intergovernmental cooperation and regional collaboration. Part of the model of Denver's success is the strong regionalism that has characterized regional governance and economic development for several decades. For instance, the Denver model was cited in an important national study of metro regionalism published by the Brookings Institution (Katz and Bradley, 2013).[13]

The most repeated answer to whether Denver can serve as a model was "yes, but…" Respondents cautioned that Denver and RTD had a special set of circumstances with the Eagle P3 and DUS that might not be replicable in other situations. They stressed that every P3 deal is different, and as former general manager Phil Washington was prone to say, "If you have done one P3, you have done one P3." Perhaps it would be better to call Denver an example, as suggested by some interviewees. As the first full-scale transit PPP (DBFOM) in the United States, the Eagle P3 can serve as a useful example of how a transit PPP can be done. The federal PentaP program was one of a kind, and while other

[13] The Brookings study did discuss the FasTracks vote, but it did not assess the role of P3s in regional collaboration.

agencies can learn from RTD by leveraging as much federal funding as possible, they may not be able to replicate the exact circumstances and funding sources. RTD has produced a checklist of things to address in P3 contracts, but not every agency will have to address the issues in the same way as RTD. No one can pick up RTD's contract and say, in effect, "now we do not have to draft our own". Transit agencies interested in P3s can also learn from Denver how transit can court private investment. Prior to entering into the Eagle P3 agreement, the private sector already viewed RTD as a good business partner based on their experience with DB contracts and contracting out some paratransit and bus operations.

Other regions should consider whether a P3 is even the right delivery model for them. Not every transit agency needs to do their project as a P3. Because of the Colorado Taxpayer Bill of Rights (TABOR) law that requires all new tax requests to go to the voters for approval and revenue shortfalls, RTD had to be innovative with their financing structure. Cities looking to Denver as a P3 model must understand that financing is not funding, and it is not a magic bullet.

The Role of the Regional Transit Agency

The transit agency interviewees were asked additional questions regarding their preference for P3s, the protection of public interests and potential for default from the private sector. These questions address concerns from some legislators and the public about private operators defaulting on public assets.

Should projects be conducted as a P3 or by transit agency alone.

Transit agency representatives were asked if they could choose whether these projects would be conducted as PPPs or conducted by the transit agency alone, which

they would choose. There were two schools of thought. Some people would prefer the transit agency to conduct the projects as design-bid-build because the agency would have more control and involvement over the project, and the agency's ability to control costs is better. Most people, however, said it depends on the project and the circumstances surrounding it. For example, for the Eagle P3, it made sense to do a DBFOM P3 because the agency was short on funding, and electrified commuter rail was a new technology that required coordination with the FRA, which RTD did not have experience operating. Despite the benefit of the private sector's experience with electrified commuter rail, the commuter lines have not been immune to technical issues with the crossing gates and other unlucky events including lightning strikes and power outages. Furthermore, RTD has stated its intention to operate and maintain the yet to be opened North Metro line (N line) itself, rather than use DTP which operates the other commuter lines (Minor, 2019). The I-225 line (R line), however, would not have made sense to do with an operate and maintain component because it is light rail technology, which RTD already runs in several corridors. The takeaway was that each project should be analyzed, and using a P3 as the delivery model should be considered as a part of the cost/ benefit analysis, and if it makes sense, then do it. Construction on toll lanes in the C-470 highway corridor is another example where CDOT decided after analyzing the options, that it would make more sense for the agency to build and operate the lanes rather than a private entity. A full DBFOM agreement does not make sense in every case, but DB agreements also allow the agency to benefit from bringing in the private sector through risk transference, efficiencies, lower cost, and the ability to complete multiple projects at the same time.

Assurances that the public interests are being protected.

I also asked the agency respondents what elements of the PPP contracts provide assurances that the greater public interest is being protected. It all comes down to the contract, according to RTD representatives. The Eagle P3 contract has robust requirements with default provisions and tender provisions should something happen with the private sector's ability to pay for or run the service. The quality of service is also specified in the contract, with penalties that apply if the service is not performing up to required levels. The contract was negotiated by leading financial and legal experts that RTD hired, so the transit agency felt that the contract fully protected the public interests. On the Eagle project, RTD also had an oversight team of more than 60 people overseeing DTP and conducting QA/ QC, as well as four inspectors in the field.

The potential for the PPP being deliberately bankrupted

The transit agency was not concerned about the concessionaire defaulting because of the numerous levels of protection in the contract. First, it would be incredibly unlikely that the private consortium would intentionally bankrupt the project because of the repercussions to the private firm and its parent company, Fluor. If Fluor (or the other partners) were to walk away from the debt of over $400 million in private activity bonds, they would never be allowed to work on a federal contract for the next ten years or borrow money from anyone. In addition, they would lose the equity they previously invested in the project. Secondly, the contract and financing agreement do not allow the private group to foist its project debt on the transit agency. The bonds specifically state that RTD is not responsible for repayment on the offering statement; all of the debt is with the private sector. Thirdly, even in the worst-case scenario, if the private

concessionaire did default or they do not perform up to contract requirements, RTD retains ownership of the infrastructure asset. If they fire the private concessionaire or the private group defaults, RTD has the right to re-tender and sell the lease to someone else or operate the service itself. This is the scenario that would develop if RTD follows through with their threat to terminate its contract with DTP, albeit not without extensive legal wrangling in the courts. The most damaging consequence of such default to the public would be that the trains would not run until RTD or another operator could take over the service. There is really no additional risk to the public compared to the case if RTD owned the bonds.

Conclusion and Recommendations

Public-private partnerships have been utilized for public infrastructure projects throughout the world, but they are relatively underutilized in the United States. Interest in P3s is increasing in the U.S., especially in the transportation sector due to lack of federal, state, and local funding. Denver's RTD agency used P3s to deliver several of their FasTracks projects. FasTracks was a 2004 voter approved ballot measure to increase the regional sales tax by 0.4% to fund a regional light rail and commuter rail system alongside a bus rapid transit system and the redevelopment of Union Station as a transit hub connecting the transit network. FasTracks has thus far cost over $5 billion dollars, and the system has not yet been fully built-out. After a funding shortfall following the wake of the global financial crisis and increasing construction costs, partnering with the private sector to use innovative procurement methods allowed the agency to deliver several of the rail lines that were in jeopardy of not getting built. The Eagle P3 project

included the region's first commuter rail service and was the nation's first full DBFOM transit P3.

This research sought to outline the different transit P3 that were a part of FasTracks and analyze their successes. The research also aimed to answer whether or not the Denver region's approach to P3s and regional collaboration could be seen as a model for other public agencies seeking to use P3s to build transportation infrastructure. The research utilized semi-structured interviews with public and private stakeholders and media and document analysis to answer these questions. This research contributes to the literature by filling in the research gap of transit P3s in the U.S. and provide public agencies interested in implementing P3s with information from a case study about benefits and drawbacks of the P3 approach.

Denver's five PPP projects were rated favorably by nearly all the respondents. Denver Union Station in particular has exceeded expectations in several areas, notably economic development for the city and financial benefit to the private and public partners. Respondents identified the most important benefits of utilizing a P3 delivery model as accelerated delivery of a project and appropriate allocation of risk. In addition, the projects were also able to be delivered at a lower cost than if the transit agency alone had completed them. The incentives for on-time project delivery facilitated faster completion by the private sector. The allocation of risk for maintenance and operations through the use of availability payments incentivized the private partner to build a better, longer-lasting product. The main shortcoming is that P3s can be complex and opaque, especially to the general public. Public accountability and transparency were found to be lacking in the U.S. 36 toll lane and BRT project. Overall, the Denver P3s, especially the

Eagle P-3, can serve as a useful model for other transit agencies seeking to expand their transit infrastructure.

The interests in P3s for transit agencies is growing because of the continuing funding and financing problems that face transit agencies and state DOTs. For public agencies interested in following Denver's P3 example, the Denver P3s can serve as a useful model. Recommendations for future P3s in transit include investing in specialized legal and financial expertise to ensure the inclusion of appropriate safeguards for project quality and to protect the public interest. Agencies should do so in a way that fully integrates P3s within existing structures of regional collaboration.

This research focused on the development of public-private partnerships and their success thus far. This research was limited in scope by the level of completion for each of the P3 projects at the time of the data collection in 2016. In some cases, interviews and surveys were conducted before some of the lines went into service, so the long-term benefits and success cannot be pinpointed from this study. The success of the FasTrack lines were determined in the context of the design-build-finance phases of the partnerships, but the success of the operate-maintain phases is yet to be seen. Recent issues surrounding the contractual agreement and obligations of the public agency and private partner in the Eagle P3 suggest that these partnerships need to continue to be studied over the long-term. Future studies should explore the long-term effects of the Eagle P3 and U.S. 36 toll road project since they are long-term concession agreements that stretch over several decades, and the financial benefit of the partnerships may not be realized at the start of the service phase.

Chapter Three: Passenger Rail and Freight Rail Partnerships: A Case Study in Denver, CO

Introduction

In the U.S., the demand for increased commuter and intercity passenger rail service is increasing due to population growth and traffic congestion. Amtrak service is growing and high-speed rail service is planned in a few major corridors. Locally, transit agencies are looking to expand their light rail and heavy rail service to meet the transportation needs of their region. Because the railroad networks are already built out through densely populated cities, most experts agree that sharing freight rail corridors is one of the least environmentally and socially impactful ways to expand passenger rail services across the country. As plans for shared-use railroad corridors increase, more research is needed to improve, encourage, and sustain the cooperation between freight and passenger rail.

This research examines the use of public-private rail partnerships across the country by identifying and describing existing relationships between freight and passenger rail, analyzing elements of good agreements and bad agreements, and developing best practices in corridor sharing. Commuter rail and Amtrak operations in Colorado and the Denver metropolitan region are also examined in detail. Amtrak, regional and state transit and transportation authorities, and local governments in Denver

have had experience in conducting negotiations with freight railroads concerning the acquisition or use of rail corridors, rights-of-way, or tracks. It is important for public transportation agencies and authorities at all levels—federal, regional, state, and local—as well as the private railroads to learn from these cases and to develop more effective partnerships. In-depth interviews with key participants and stakeholders from the freight and passenger rail industry at the national and local levels yield useful examples of both positive and negative experiences, and best practices in freight and passenger rail partnerships.

Research questions

This research intends to identify, describe, and analyze existing relationships between freight railroads and passenger rail operators in Denver, CO for the purpose of facilitating future public-private partnerships in rail corridor capacity expansion and gaining a better understanding of this major intermodal transportation issue. Building upon the research conducted by Bing et al (2010) in a National Cooperative Highway Research Program (NCHRP) report, this research will use a case study approach to answer the following questions:

- What is the current status of rail corridors in Denver and how have public agencies acquired and/ or shared use of rail corridors with freight railroads?
- How do shared-use rail corridors in Denver impact economic competitiveness for both freight and passenger rail service?
- What are best practices for future shared-use rail agreements?

Background in shared use rail corridors

The Federal Railroad Administration (FRA) provides definitions of different categories of shared-use partnerships between freight railroads and passenger rail agencies (Resor 2003). A shared track is rail line track on which both commuter rail or light rail vehicles and freight railcars operate. A shared right of way (ROW) utilizes different tracks for transit and freight rail, but they both operate within the same 25 foot right of way. In other words, the centerline of the freight and passenger rail tracks is less than 25 feet apart. In a shared corridor, transit and freight rail operate on their own tracks separated by a distance of greater than 25 feet but less than 200 feet. As a federally operated and subsidized service, Amtrak is the only operator that has a statutory right to operate on private railroad property. Amtrak does have to compensate freight railroads for incremental costs associated with operating on freight tracks.

Several key academic papers and industry reports have been published discussing the technical and policy-related issues of shared-use rail corridors. Bing et al. (2010) is the most recent, most comprehensive guidebook for implementing public-private partnerships between freight companies and passenger rail agencies. It describes the present situation of rail corridor sharing in the U.S., the process of negotiations with private freight rail companies, analysis and modeling of cost sharing, and content of operations and maintenance agreements. The guidebook also includes several case studies of implemented shared-use corridor agreements and best practices in negotiations and approaches to fees and incentives. This research will follow-up and update the findings in the guidebook.

From a review of numerous relevant papers and reports, several issue areas emerge as concerns for future shared-use rail agreements: capacity, liability, cost-sharing, and capital constraints. (Bing et al., 2010; FRA 2005; Resor 2003; Prozzi 2006; Dolata et al. 2005; GAO 2004). Preserving capacity for freight rail is a primary concern of private railroads and can be a source of contention in shared-use negotiations. Passenger rail service will not be run at the risk of harming current or future private freight business (Mitchell, 2006). Liability continues to be a concern for freight railroads when entering into shared-use agreements. The $200 million cap on liability for passenger rail operators may not be extended to host freight railroads, so often the host railroads ask passenger agencies to procure at least $500 million in liability insurance. This can greatly raise the cost of transit operation in a corridor.

Cost-sharing is another issue that must be addressed in negotiations. How much the passenger agency is required to pay for the right to run on the private railroad tracks, ROW, or corridor can be especially contentious. Capital constraints are also a concern. Passenger agencies should come to the table with money, since as a private company usually beholden to stockholders, freight railroads are not apt to subsidize public or private passenger rail (Mitchell, 2006). General best practices for agencies entering into shared-use corridor agreements or negotiations are to recognize that each situation is different, the importance of trust and bargaining, and coming to the table with experienced negotiators with a background in passenger and freight rail issues.

A case study approach to studying shared-use rail agreements is found to be effective, since several reports have found that there is no silver bullet or one-size fits all approach to shared-use agreements (Wilcock & Stoetzel 2009; GAO 2004; Prozzi 2006).

Recent economic environments have changed since the reviewed literature was written, such as an increase in freight rail traffic, growth in demand for passenger rail service, and growing interest in expanding mobility options. Adding a Denver case study, which is one of the most recent shared-use agreements between public transit and freight rail, will contribute to the literature informing future shared-use agreements.

Study Area and background

Colorado has a rich history of freight and passenger rail operations. At its peak in the 1930s and 1940s, Denver's Union Station served up to 80 trains a day. The private railroad industry began to drop its less lucrative passenger rail service after competition from air and car travel increased. With the formation of Amtrak in 1971, passenger rail service decreased significantly in the state. Colorado currently has two long distance, intercity passenger rail services operated by Amtrak: the California Zephyr and the Southwest Chief routes. The services operate on shared track with both Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroads. This research will focus on the recent negotiations between BNSF and Amtrak to continue the Southwest Chief service in Colorado.

After private railroad companies stopped operating passenger rail services in Denver, only Amtrak utilized shared use rail corridors, and regional commuter rail service did not exist until a recent rail proposal from Denver's transit agency. The Regional Transportation District (RTD) is the transit agency for the Denver metropolitan area, and in 2004, passed a new regional rail transit system plan called FasTracks. Voters approved the FasTracks plan which proposed six new rail lines in the Denver area, five of which were proposed to be built at least partly within freight rail corridors, with funding

from an increase in sales tax. Most of the FasTracks rail lines have already been built or will open by the early 2020s except the full Northwest rail line[14]. This research will analyze the nature of the FasTracks sharing agreements and acquisitions as well as the major impediments to reaching a public-private rail partnership agreement on the Northwest line.

Research methods

The research utilizes multiple methods to answer the research questions of the study. First, literature on public-private partnerships between freight rail and passenger rail operators across the US was collected and analyzed. The literature review includes public and private reports as well as scholarly articles. The 2010 TRB *Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors* (Bing et al 2010) provided an excellent background into the many issues related to public-private rail partnerships. It has appendices on applicable acts of congress and federal government regulations, capacity and cost analyses, legal and institutional arrangements, safety regulations, and an appendix with several limited case study descriptions of passenger rail development on freight lines.

Secondly, an in-depth case study of public-private rail partnerships in the Denver metropolitan area was developed. Key decision-makers and policy officials for both the freight railroads and the public agencies that operate rail transportation services in Denver were identified through personal knowledge and snowball sampling. Face-to-face, in-depth interviews were conducted with these key participants and stakeholders in order to elicit their perspectives and viewpoints concerning the nature of these public-

[14] Find more information at www.rtd-fastracks.com.

private rail partnerships. Interviewees include representatives from transit agencies, state DOTs, passenger rail advocates, freight rail representatives, consultants, and local officials who have experience concerning the acquisition or use of rail corridors, rights-of-way, or tracks. The case study interviews were audio recorded, transcribed, and coded to reveal common themes from the interview questions.

The Denver metropolitan region was chosen as a case study due to its long and significant history of railroads, and its current effort to build a regional rail transit system through its 2004 FasTracks transit and land use plan. Of the six new rail lines proposed in the FasTracks plan, five were scheduled to be built at least partly within freight rail corridors. While access to the rail corridors has been acquired on four of these lines, negotiations over the proposed Northwest Corridor line have stalled, thus placing that line's completion in serious jeopardy. It is especially important to analyze the major impediments to a public-private rail partnership in this case.

Denver Case Study

Amtrak

Amtrak operates along two routes in Colorado: The California Zephyr, connecting Chicago and San Francisco, and the Southwest Chief, connecting Chicago and Los Angeles. The California Zephyr operates along shared tracks with BNSF and UP from the northeast into Denver, and along the Union Pacific tracks west of Denver to Salt Lake City. The Southwest Chief operates primarily over BNSF track in the southeast corner of Colorado. Although Amtrak has legal right to operate over any freight or passenger rail track and priority is given to Amtrak trains by law, as one interviewee put it, "whoever controls the switches, controls the railroad; the reality is [Amtrak] can't move until

whoever owns the switches gives them permission." This reality can lead to contentious agreement negotiations and ongoing operations if there is not a partnership mindset between the parties.

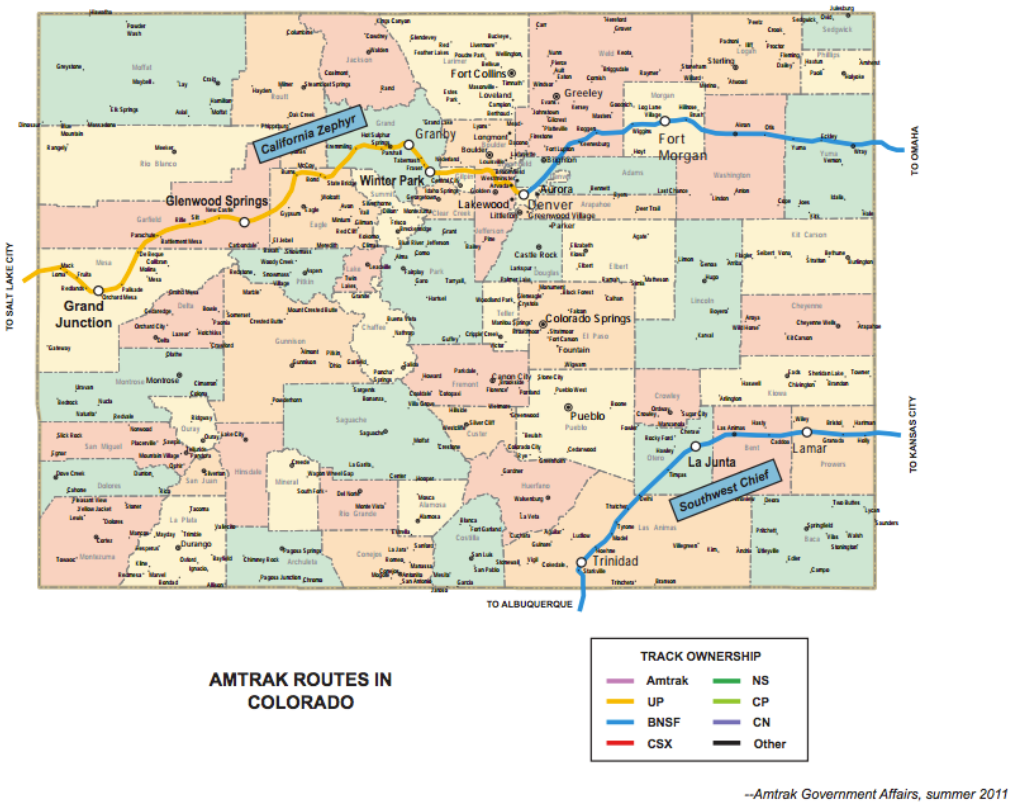


Figure 3: Amtrak routes and stations (Amtrak 2015)

In 2010, the future of the Southwest Chief in Colorado seemed to be in jeopardy. According to the Colorado State Freight and Passenger Rail plan (CDOT 2012), BNSF announced to Amtrak that it would no longer maintain the tracks between Hutchison, KS and La Junta, CO to speeds of 79 mph, and if Amtrak wanted to run its trains at speeds higher than 60 mph, Amtrak would have to pay for the increased maintenance cost. BNSF also stated that Amtrak would be responsible for all maintenance costs for the track between La Junta, CO and Lamy, NM. Amtrak continued to run the service and bear the additional maintenance costs for several years. Later, BNSF further reduced the

speed to 30 mph for safety on some segments of track because of the track's poor condition, and their argument was since their freight does not need to run at higher than 30 mph, Amtrak should pay to run at a higher speed. Amtrak and BNSF had discussions about rerouting the Southwest Chief out of Colorado altogether through Kansas, Oklahoma, Texas, and New Mexico, but several communities in Southeast Colorado that would lose Amtrak service banded together to "Save the Chief."

The response to the efforts to continue the Southwest Chief service in Colorado is a good example of cooperation and partnerships. The process of renegotiating Amtrak's contract with BNSF started off as contentious, with BNSF levying demands. Amtrak alone did not have the funds to continue to pay additional maintenance costs or to improve the track. Through a partnership of federal Transportation Investment Generating Economic Recovery (TIGER) grants and matching funds from state and local governments, BNSF, and Amtrak, an agreement was reached that benefited all the stakeholders. In total, TIGER grants of over 48 million dollars were awarded to allow Amtrak to maintain the line as well as replace decaying tracks. BNSF has pledged to pick up the cost to maintain any portions of the track that are improved for the next 20 years. The value of BNSF's contribution is over 111 million dollars over the 20 years, saving Amtrak and the states future maintenance costs. The funding package reflects cooperation amongst the BNSF, Amtrak, local communities, and state governments. Since improving the line, Amtrak has improved their on-time performance and improved the run time by over 90 minutes along this segment. BNSF has also experienced improved quality of service.

Regional Transportation District (RTD)

The first RTD rail line to use a shared freight corridor was the Southwest light rail. This line was built in 2000 and shares 11.8 miles of right of way (ROW) with both BNSF and the UP railroads in their consolidated main line corridor. This is a true shared corridor where BNSF, UP, and RTD own different portions of the corridor, and everyone has tracks on each other's property. RTD bought fee interest from Denver Rio Grande, which after multiple mergers in the 1990s, became Union Pacific by the time of closing. On BNSF property, RTD purchased a passenger easement.

The West rail line was the first FasTracks line to be opened in 2013 and operates light rail within an abandoned consolidated freight rail corridor that RTD acquired through an outright purchase in the 1980s from the Colorado and Southern, a predecessor to Burlington Northern. Freight no longer operates in this corridor.

The Gold line (G line) corridor is an electrified commuter rail line that opened in 2019 and includes two sections of shared corridor. From Pecos Street to Sheridan Boulevard, RTD bought two miles of forty foot wide right of way from Union Pacific, and from Sheridan Blvd to Golden and the Coors property, RTD owns the entire corridor and grants an operating easement to BNSF. The current Gold line does not run all the way to Golden, but there is potential for future expansion because of the purchase of the additional property.

In the summer of 2016, the B line opened as an electrified commuter rail line and is the first six miles of the Northwest Rail line. It currently runs on portions of right of way purchased from BNSF from Pecos Junction to Westminster Station.

The North Metro line is an electrified commuter rail along the Boulder Industrial Lead (BIL), which is former UP right of way. RTD purchased the entire corridor right of way, which extends 33 miles north to Erie, although only the first 13 mile segment of the proposed 18.5 mile line identified in FasTracks is currently under construction. The Union Pacific no longer operates in this corridor. The 13-mile North Metro line is scheduled to be opened in the early 2020s.

The A-line along the east corridor to Denver International Airport is one of the more complicated shared corridors. From Denver Union Station to York St., RTD bought all required right of way adjacent to either the BNSF or UP. From York to Airport Blvd, RTD bought a forty-foot wide right of way from UP. In practice, the UP and RTD operations exist as independent corridors because the UP operates on their own property while RTD operates on their own property, but in reality, they are only separated by a fence so it is a shared corridor in practice.

Northwest rail line is the only one of the FasTracks lines where the freight railroad and transit agency could not reach an agreement for shared use, although that is not the only reason the line is stalled. Lack of funding for RTD was a major issue that required the agency to prioritize the FasTracks build out based on availability of federal funds, cost, and ridership benefits. The proposed commuter rail line would go over BNSF right of way, and it is the only RTD rail line that would involve shared track for portions of the corridor. Further discussion of the Northwest Rail line issues follows in the next sections.

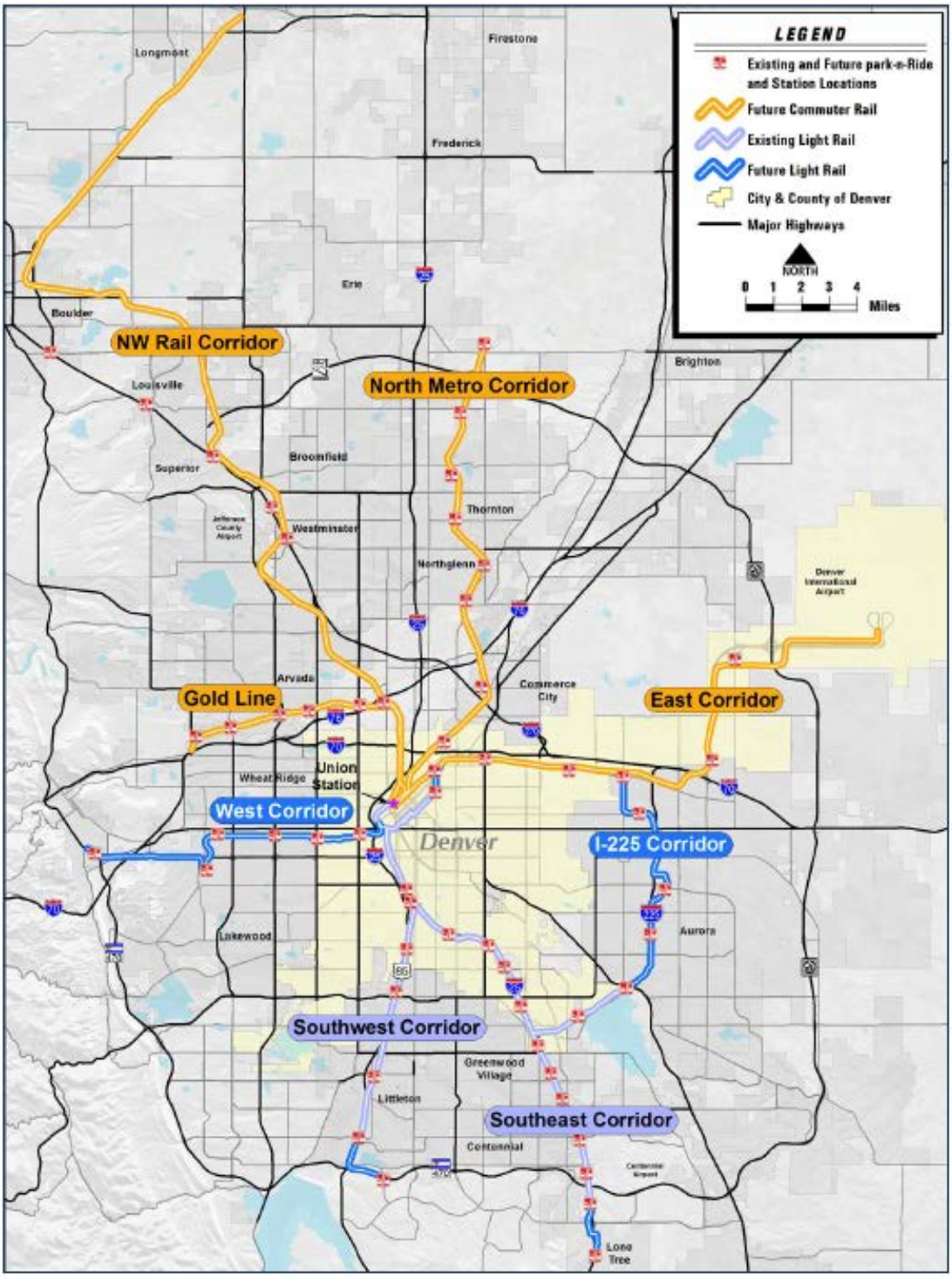


Figure 4: FasTracks corridors (CDOT 2012)

Agreements and corridor sharing development process

Recent FasTracks corridor sharing deals involved three basic parts: (1) purchase of the real estate interest, (2) relocation of freight rail and construction of passenger line, and (3) ongoing operation and maintenance and shared corridor use agreements.

Real estate interests

The process of developing a corridor sharing agreement begins by approaching the freight railroad with a general plan for rail development to see if the railroad would be willing to sell or share part of their right of way, corridor, or track. These "feasibility discussions" for the FasTracks plan with BNSF and UP took place prior to the 2004 vote on the sales tax increase. These discussions are very general and meant to determine whether or not the freight railroads would be willing to participate in further negotiations, and if there is even a right of way or corridor that could be shared. The freight railroads will not engage in detailed engineering until there is a sure source of funding and detailed plans from the transit agency emerge. When RTD approached the railroads about options for corridor sharing, it became clear early on that shared track would not work in most cases because of the time sensitive nature of the passenger rail service that RTD and the community desired.

In addition, for the transit agency to receive federal funding for a project, the agency is not allowed to enter into a legal contract to purchase or share the rail corridor until the federal environmental impact assessment (EIA) is completed. The environmental process for some of the corridors began prior to the 2004 vote and others after, and the process is meant to rule out other alternatives to the planned construction in the rail corridors. Before and during the environmental process, the transit agency is not

able to engage with interested third parties or private property owners such as the railroads, other than basic feasibility discussions. After the EIA, plans for construction and realignment may change based on community input and environmental factors, and the best situation/ alternative is chosen. The environmental impact statement (EIS) is then publicly available for everyone, including the freight railroads, to view, and only then can the right of way be purchased with funds designated under the plan. A transit agency could, however, use other funds proactively to secure access to freight rail corridors for proposed passenger operations as part of a "landbanking" strategy.

The limitations on private railroad involvement prior to environmental assessment have a significant impact on the ability of the freight railroads and the transit agency to reach an agreement. It makes it very hard to negotiate with the railroads when there is a document stating what type of service the transit agency has decided to provide. One respondent said that RTD would have been able to negotiate better agreements if they had not had a document that already identified their intended plans to the railroads. The railroads knew that RTD had committed the rail lines to the voters, and that they intended to build in the freight right of way, thus providing the railroads with the upper hand in negotiations. An alternative approach would be to amend the environmental process to allow the freight railroad to be a participant from the beginning, to allow negotiations and establish realistic cost estimates for access to the right of way first, and then continue with the environmental assessment process.

In recognition of the unfortunate paradox that often exists in the timing of cooperation, some flexibility in implementing regulations for NEPA has been introduced. Implementing regulations allow for ‘categorical exclusions,' i.e. actions that have been

presumed, based on history and frequency of occurrence, to have no significant impact on the environment. Furthermore, in 2012 the FTA introduced a change in their implementing legislation that provides for corridor preservation before completion of NEPA. Specifically, 49 USC 5323 states:

> (q) Corridor preservation.--
>
> > (1) In general.--The Secretary may assist a recipient in acquiring right-of-way before the completion of the environmental reviews for any project that may use the right-of-way if the acquisition is otherwise permitted under Federal law.
> >
> > (2) Environmental reviews.--Right-of-way acquired under this subsection may not be developed in anticipation of the project until all required environmental reviews for the project have been completed.
>
> Passenger agencies should always seek the advice of their regional FTA, FRA, and/or other relevant federal offices before pursuing this course of action. There can be no development of the corridor property, only the acquisition. Compliance with NEPA is paramount and non-compliance could kill a project, so passenger agencies must be careful in how they proceed with corridor preservation. Nevertheless, these approaches can be useful in addressing corridor access issues.

There are a few corridors where RTD was able to buy the right of way or corridor prior to construction and the environmental process. The West line was purchased during the 1980s as corridor preservation, but it was bought from base RTD funds. The Gold line runs from Denver Union Station to Wheat Ridge at Ward Road. RTD was able to purchase an additional six-mile long property along the BNSF corridor beyond Ward Road all the way to Golden at the Coors Brewery. In addition, RTD is only building the first 13 miles along the UP corridor of the North Metro line, but purchased 33 miles of the corridor up to Erie. These landbanking acquisitions will enable RTD to expand the lines in the future if population growth demands it. In the future, corridor preservation purchases would make sense and prevent negotiations with railroads from stalling rail

lines, but the funding issues are the problem. Future sales tax revenue from the FasTracks funds cannot be used to purchase property not included in the FasTracks plan, and federal funds cannot be used to purchase corridor property unless the federal environmental review process is followed.

Relocation and construction.

The freight railroad and the transit agency must also reach agreement on where and how some of the freight facilities will be relocated. The original plan for the A-line to the airport was to relocate UP totally out of the corridor that RTD purchased, but after the EIS, it became cost-prohibitive to rebuild facilities up to new code and technologies. RTD and the Union Pacific reexamined the design and ended up with a different alignment that still worked. The needs of both the freight and passenger agencies must be taken into consideration for relocation and during construction, and everything comes at a price.

Operation and maintenance agreements

The BNSF calls these agreements "joint corridor agreements" and the Union Pacific calls them "O & M agreements," and both provide for ongoing operations and maintenance issues that arise such as insurance, drainage, indemnity, emergency coordinations, and the construction of future additional facilities in the right of way. Previous agreements or acquisitions made in the 1990s did not involve all of these elements. Operations and maintenance were not discussed with Union Pacific in the Southwest light rail corridor deal. It was a "we take care of ours, you take care of yours" situation that was not formally agreed to in a contract. At the time, there were not as

many freight and passenger rail shared use agreements, but today, the freight railroads have seen the value of including operations and maintenance terms in their agreements.

The Contentious Process of Developing a Shared-Use Agreement

When asked whether the development of corridor sharing agreements were contentious, the general consensus was yes, all agreements were contentious but most were ultimately successful. None of the corridors were described as easy negotiations where everything fell into place, but agreements were reached in all corridors except the Northwest, which had a variety of issues that prevented the passenger rail from being implemented. In order to be successful in negotiating an agreement, the transit agency needs staff members who understand the operations and infrastructure requirements of freight rail. The passenger agency lays out the plan for what they want to do in the freight corridor, shows how it will not affect the freight and if it does, how to mitigate the impact on them. Having someone at the table that speaks the railroad's language, knows the business, and realizes that the freight railroad is there to make money will create a more cooperative relationship. Dealing with freight in an honest, one-on-one basis with good interpersonal skills makes a big difference in reaching an agreement.

Cost is generally the main sticking point in negotiations. Everyone comes to the table needing things, RTD has a limited amount of funds, and the goal is to reach a deal. Prior to the 2004 FasTracks vote, RTD generated a cost estimate for all the corridors based on preliminary design plans and a rough 10-20% estimate, usually a gross cost per mile. Prior to meeting with freight railroads to negotiate a price for property acquisitions, the agency only knows the cost of their own facilities, but not of relocating freight facilities, upgrading technology or track that must be moved. The price of the real estate

can be determined, but other factors can affect the cost that RTD originally estimates for a corridor or for an acquisition. Another contentious issue in agreement negotiations is how to preserve service to local freight rail customers. This is sometimes done by relocating the customer, building a flyover to retain freight access, or other creative solutions, but it must be addressed and paid for in the negotiations.

Northwest rail line

The public saw the Northwest rail line negotiations as especially contentious because of rising cost estimates for sharing the corridor, but RTD points out that cost changes came about on their side of the negotiations as well. The Northwest rail line is proposed to run from Denver Union Station to Boulder and Longmont northwest of Denver along a BNSF freight corridor. The line was included in the FasTracks plan, some argue, to get the votes needed in the jurisdictions to the north to pass FasTracks. Even before the recession of 2008, several factors affected the cost estimates and funding sources for the Northwest rail. A combination of a shortfall in sales tax revenue and increased costs for construction commodities jeopardized all of the proposed FasTracks lines, but innovative financing structures through public-private partnerships and federal funding enabled the other lines to move forward. The ridership in the Northwest corridor was always projected to be low, and because of the low ridership, low population density, and competition from RTD's bus rapid transit (BRT) service to Boulder, the line was not eligible for federal funding. This left some people in the northern communities to feel that they were paying for FasTracks, but getting no rail in return.

RTD approached BNSF to design a system that could handle projected RTD operations in the BNSF corridor. Unlike other corridors in the FasTracks plan, RTD

could not acquire the entire right of way or corridor because there is barely room for two tracks, and BNSF still needed to move freight in the corridor. RTD was negotiating for time slots on the freight tracks where the railroad would retain the infrastructure and guarantee RTD could move their trains. RTD says that BNSF came back with a fair number, but that the number kept changing over time. Some of the cost increases came from changes requested by RTD in the original design after the 2004 vote and after the EIS. Communities wanted more stations, quiet zones, grade separations, and bigger Park and Rides, and the level of service was changed to 55 trains a day. The equipment was changed from diesel locomotive-hauled coaches to electrified commuter rail, which also required a different type of maintenance facility.

In addition, the freight traffic on the line had nearly doubled since 2004, so additional capacity improvements that the freight railroad needed would cost much more than RTD had anticipated. Additional right of way would be needed for more sidings and more overpasses to maintain capacity for freight trains that were as long as two miles. Positive train control (PTC) was a new safety technology that needed to be implemented but was not previously figured into the cost estimates. When original estimates were derived more than five years before, there were different economic conditions, different capacity needs for the freight, technology changes, and operational changes. All of this contributed to rising costs in the corridor.

RTD says the biggest challenge with this corridor is its length. The Northwest corridor is over 40 miles long, much longer than most of the other corridors, and an increase in the cost per mile is compounded over 40 miles of track. In 2004 RTD initially budgeted $66 million for access to the corridor, but by 2012 BNSF announced that it

would cost $535 million. With other operational and technology changes, the total cost for the Northwest rail line jumped from $461 million in 2004 to $1.7 billion by 2012 (Migoya 2012). A railroad representative stated that their cost estimates for sharing corridors are generally good for only one year, and after that, new costs need to be determined in order to reflect changes in capacity, freight flows, and other economic determinants. In order to reach a successful agreement, the railroads need to know that the transit agency has a committed, reliable source of funding. When the sales tax revenue fell short of projection, RTD was uncertain of the time frame in which the Northwest line would be built. RTD says it needed to know the costs from the railroads before it could determine when the line can be built and if it had funding. BNSF said that they could not produce detailed engineering plans and negotiate an agreement until RTD had certainty in funding and a short to medium time frame to ensure that the railroad protected its interests for future capacity needs. RTD blamed BNSF and BNSF blamed RTD, and they went in circles. This then spilled over into the newspapers, where the "dirty laundry" from the discussions was aired out in public. When parties do not protect each other's reputations in the media, it hurts future negotiations and ends the partnership mentality of agreement discussions.

To add to the situation, the communities along the corridor could not agree on what made sense in the corridor. Some of the mayors and elected officials were committed to BRT rather than rail, while other communities dug in their heels for a rail line. One elected official in the corridor stated that he felt BNSF could see the disagreement among local governments, and that Boulder, the largest city in the corridor,

was not really interested in completing the Northwest line, so they determined there was not really a serious effort to complete the rail line.

Economic competitiveness

Nearly everyone agreed that bringing passenger rail to the Denver metropolitan region keeps Denver economically competitive with other cities. They believe that it brings development and employers to the region, citing the relocation of several national headquarters of companies to downtown Denver near the Denver Union Station transit hub and DIA. The value of fewer people on the highways and less congestion also increases economic productivity and competitiveness for the region. One passenger rail advocate even stated that freight rail does not drive economic development, it is passengers that do, and the service must be at least every fifteen minutes for economic development to occur.

The interviewees did not think that sharing rail corridors has a negative effect on freight railroads. By law, Amtrak is not allowed to impede freight traffic, and if it does, railroads can petition the Surface Transportation Board. The consensus is that when negotiating agreements with passenger rail agencies, the freight railroads look out for their core business, moving freight, and they will not do anything that will detrimentally affect their ability to serve their customers. While some relocation or buy out of customers is necessary during relocation or construction, it is up to the railroads to ensure that their ability to run their service is not reduced. For example, in the east corridor of FasTracks, when RTD tracks went in on the south side of the corridor, it blocked access to a few direct freight shippers who had to make alternative transportation arrangements or use relocation money to relocate elsewhere along the railroad. However, it was

stressed that the railroads would not have agreed to these terms if they thought it would make them suffer. RTD has tried to negotiate fairly with both railroads, the BNSF and UP, to keep the railroads whole, and not give either railroad any advantage over the other. These deals are voluntary for the railroads and they enter into the deals only if they can maintain their capacity. In the past, they have entered into agreements where they have curtailed their service, such as in Chicago when they allowed absolute curfews whereby the freight railroads could not run their trains during certain peak commuter hours. The railroads have learned from these past agreements that this does not work for future capacity concerns. There are also some positive impacts to economic competitiveness to the railroads sharing their corridors because such agreements can include eliminating or improving at-grade crossings. These types of operational advantages are good for everyone, as they help car traffic flow easier and the freight traffic move smoother through town without as much stopping and downtime.

Best Practices

The experts agree that it is important for the passenger agency to have the most accurate cost estimate possible, and to try to keep the costs from escalating too much. If costs change substantially, people get angry, and it causes concern for the passenger agency, the freight railroad, and the public.

One way to keep cost estimates more accurate is for the transit agency (RTD) to have an Intergovernmental Agreement (IGA) with every community along a corridor before entering into negotiations with the freight railroad. This helps to define what RTD is doing on the project, and what the community is doing on the project. For example, if a community wants sidewalk near the track and station, RTD may think it is the

community's responsibility, the community thinks it is RTD's responsibility. Additional ROW may need to be purchased, and then costs go up. RTD learned from previous experiences, and they were able to negotiate IGAs for the North Metro line before issuing a RFP for that line. This helps keep cost estimates more accurate.

Think ahead about everything the agency might need from the railroad, and tie it all into one package. For example, the freight railroad may not be willing to negotiate small issues like grade separations and crossings or to sell smaller corridor segments unless it is tied to a larger deal. It is not worth the price to the railroads to process such small deals (the cost of paperwork, lawyers, etc.). RTD was able to get things packaged together that they otherwise would not have been able to get, while they had them at the table for larger acquisition deals.

The passenger agency needs to show how the railroad will come out ahead even before beginning discussions. They also need to show that they know what they are doing and what they are talking about in negotiations. The transit agency needs to employ staff members who understand the operations and infrastructure requirements of the freight railroad, either as consultants or in-house employees. Passenger rail agencies must be able to see things from the freight perspective as a business with stakeholders who need to make money. Approaching the railroad with honesty and good faith is the way to achieve good agreements.

Both the freight and passenger rail sides must have people who know the local rail issues, and not just send people from the headquarters, Fort Worth (BNSF) or Omaha (UP), to negotiate. The freight railroads benefit the most when the transit agency can help address local rail issues that the higher ups may not be aware of.

It is incredibly important for the passenger agency to be able to show that they have a secure source of funding and feasible time frame for project completion. The freight operations need to see that passenger rail is committed to completing the project in a short to medium timeframe to ensure that the costs are accurate.

One best practice for both the freight and passenger agencies is to not air out "dirty laundry" from negotiations. The two sides should be partners and strive to protect the reputations of both entities in the public eye. Pointing fingers or assigning blame for failures in negotiation talks can quickly sour any working or future relationship.

One expert suggested that all successful agreements are where the agency buys the ROW, as RTD did for all of its corridors except the Northwest line. He stated, “It is not a good agreement if you don’t control the switches.”

Several people suggested that incrementally adding capacity is the way to get good commuter service. Examples they pointed to were the Minneapolis North Star and Seattle Sounder services. Starting a high level of service, such as 55 trains a day, can disrupt the freight operations significantly and require much higher capital contributions for improvements.

The planning process should not take place in isolation, and the process needs to address passenger rail needs, highway needs, and freight flow needs. Collaborative planning can accomplish a win-win-win scenario, for example improved grade crossings. Freight rail and passenger rail need combined solutions, not one at the expense of another.

Future shared use corridors and future of agreements

Most people agreed that the most feasible and probable location for future shared corridors is along the Front Range running north and south of Denver. The interviewees had varying opinions of the breadth of a potential Front Range rail system, but it could generally span from as far south as Albuquerque, NM to as far north as Cheyenne, WY, closely paralleling Interstate 25. The more likely scenario is within 20-25 years, building Front Range Rail north from Pueblo to Colorado Springs to Denver and on to Fort Collins, mostly along BNSF track with some UP trackage rights. This corridor would be suitable for passenger rail because population is expected to grow along the Front Range by over two million people in the next 25 years, from four million to six million. There is little room to expand the highway in key highway corridors in the region. Several Colorado Department of Transportation (CDOT) studies supported the feasibility of either commuter rail or high-speed rail along the Front Range corridor. The CDOT North I-25 Environmental Impact Statement (2011) recommended commuter rail as the Preferred Alternative along the northern section of I-25 from Denver to Fort Collins. An update to the I-25 commuter rail study was published in 2015 to update the right-of-way needs of such a project and provide better cost estimates due to relationships with the freight and passenger rail service and changes in the economy (CDOT 2015b). The Rocky Mountain Rail Authority (RMRA) completed a High-speed Intercity Passenger Rail (HSIPR) Feasibility Study in 2010, which analyzed a high-speed rail corridor from Cheyenne, WY to Trinidad, CO as well as along the I-70 corridor from Denver to Grand Junction, CO. It concluded that HSIPR is feasible along shorter sections of these corridors, from Fort Collins to Pueblo and from DIA to Eagle County Regional Airport

near Vail, Colorado (CDOT 2015a). The RMRA recommended a follow-up study called the Interregional Connectivity Study (ICS), which was completed in 2014. The ICS found HSIPR to be most feasible along the I-25 corridor because it would connect the most dense areas of population. Another study, Advance Guideway Feasibility Study (AGS) looked at HSIPR along the I-70 corridor from Golden, CO to Eagle County Regional Airport. The AGS and ICS recommended two levels of phasing to implement the HSIPR vision and did not identify specific sources of funding (CDOT, 2015a).

According to RTD, Northwest commuter rail is still going to be built as part of FasTracks, when RTD has the money. Current estimates peg completion of the Northwest rail line sometime in the early 2040s. Additional corridor sharing projects beyond FasTracks are not on the horizon for RTD. Amtrak is considering expanding service from La Junta to Pueblo as part of a reconfigured Southwest Chief route, with current plans to begin thru car service to Pueblo in anticipation of this expansion. While some rail options exist to share track along Interstate 70 with UP running west from Denver, few people mentioned this as a likely option in the near future.

One recommendation from RTD staff was to preserve as much corridor as possible to avoid having to deal with negotiating these types of deals in the future, even though expanded rail service will likely not be needed for the next 20-25 years. The Northwest rail corridor was offered to RTD in the 1990s for “peanuts” when freight traffic was waning, but RTD did not have cash to buy it then. If they had, they would have been able to avoid the contentious negotiations for later acquisition of access to the corridor. The transit agency has tried to learn from this, and would hope to buy additional ROW along the corridors for future expansion.

Discussion of an eastern freight bypass to move freight rail activity out of downtown Denver waxes and wanes with the volume of freight flows. It could free up more capacity for passenger rail and more land downtown for redevelopment. The North I-25 EIS decision was based on the assumption that as eastern bypass would be built, but the 2015 I-25 commuter rail update study was needed since it does not look like the bypass is a feasible alternative. Is there a cooperative solution for moving freight that can benefit both parties? The local experts see more cooperation in the future for freight and passenger rail because of pressure on both sides.

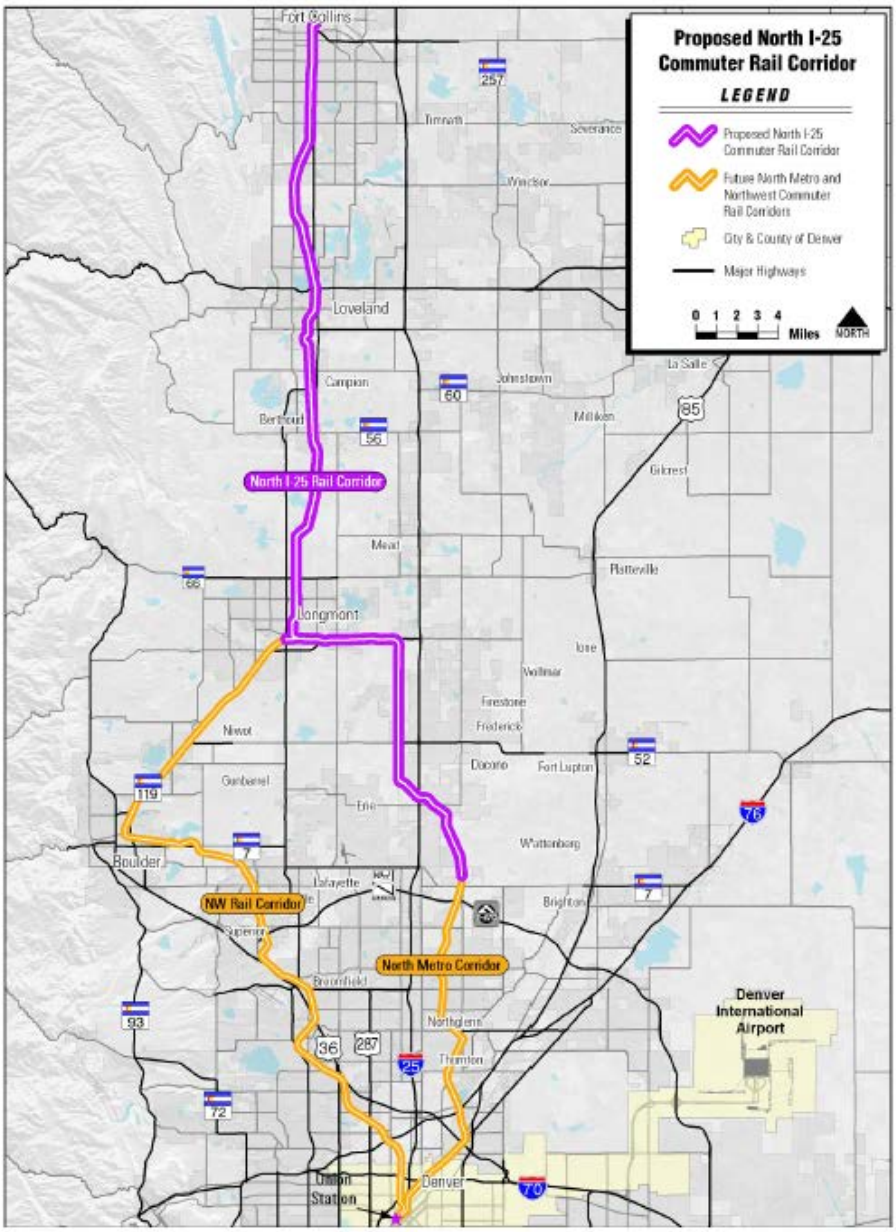


Figure 5: Proposed I-25 commuter rail, Northwest Area Mobility Study (CDOT 2012)

Government policy for Shared-Use Corridors

Most passenger representatives view more government intervention as positive, but they do not necessarily think the federal government should mandate policy for shared-use corridors. Shared-use corridors should be looked at on a case-by-case basis

because shared-use does not make sense in all situations- it is only one tool in the toolbox for expanding passenger rail.

One way the government can support shared-use is through the continuation of federal grant and loan programs such as TIFIA, RRIF, and TIGER programs. The feds can also help by integrating services and facilitating cooperation and collaboration among agencies like the EPA, HUD, and USDOT to improve innovation. The federal government should not intervene and dictate, but instead should facilitate cooperation amongst passenger and rail operations.

A few people had specific suggestions for how the government could get more involved in shared-use agreements. Passenger rail is not currently subject to the STB's jurisdiction (except for Amtrak interactions with railroads), but the STB or another national body could act as an oversight body to allow disputes or stalled negotiations between passenger and freight operations to come before them. Currently, if an agreement cannot be reached, then the passenger agency is the one that has to walk away. On the other hand, the general feeling is that the freight rail operators are smart people who will figure out a way to work with passengers to prevent the feds from getting involved. Another suggestion is for the federal government to amend the environmental process to allow railroads to be at the table during the EIA, so the passenger agency could have the ability to acquire ROW before the environmental process is completed.

Figure 6: Light rail and CML Lower Downtown, Denver. Photo Credit: Julie Cidell

Conclusion and recommendations

Demand for passenger rail service within and between cities in the U.S. will increase the need to develop shared use rail corridors. As local transit and state agencies seek to expand their commuter rail service, freight rail corridors are often the most feasible locations for expansion or development within an already built-up city. Shared-use corridors include shared track, shared right-of-way, or shared corridors. Amtrak is the only entity that has the legal right to operate on private freight railroads. All other entities must negotiate an agreement with a host railroad to operate on their tracks or within the railroad right of way.

This study sought to examine the public-private partnership aspect of passenger rail agencies sharing rail corridors with private freight rail companies. The case study approach was applied to the Denver metropolitan area and the state of Colorado. After the 2004 FasTracks ballot measure was passed to expand RTD's rail network, the transit agency looked to freight corridors to build out the rail lines. This study described and

analyzed shared corridors in the FasTracks system. In addition, this study describes how the threat of moving the Amtrak's Southwest Chief out of Colorado prompted a collaborative effort between public and private agencies to raise capital to invest in upgrading tracks and technology to keep the line moving through southeast Colorado. The study used in-depth interviews with railroad personnel, transit agency representatives, and rail advocates to answer the following research questions: What is the current status of rail corridors in Denver and how have public agencies acquired and/ or shared use of rail corridors with freight railroads? How do shared-use rail corridors in Denver impact economic competitiveness for both freight and passenger rail service? What are best practices for future shared-use rail agreements? This study is significant since Denver and Colorado provide a recent case study on shared-use agreements that have been both collaborative and contentious, resulting in examples of both successful and unsuccessful shared use agreements.

The response to the threat of discontinuing Amtrak's Southwest Chief service through Colorado is seen as a successful example of cooperation between public-private partners. The renegotiation of Amtrak's contract with BNSF resulted in benefits for all stakeholders through contributions from federal, state, and private funding to improve track and contribute to additional maintenance costs. RTD currently operates light rail and commuter rail service and entered into several shared-use agreements with both Union Pacific and Burlington Northern Santa Fe. Most of the agreements were negotiated as outright purchases of right of way. The Northwest Rail is not built yet, partly because of escalating costs to share the corridor and tracks from the host railroad, BNSF, because of increased freight traffic along the corridor. The shared-use of a rail corridor involves

agreements being reached in three areas: the purchase of the real estate, relocation of freight rail and construction of passenger rail, and ongoing operation and maintenance agreements or shared-use agreements.

Private freight railroads are not obligated to share their corridors with public agencies other than Amtrak. Negotiations can be contentious, as was the general consensus of interviewees involved in RTD negotiations. Cost is often a major obstacle in negotiations, and inaccurate cost estimates or out of date estimates can result in major sticker shock when it comes time to approach the host railroad. The Northwest rail line is an example of a corridor where costs increased over time since the passage of the FasTracks ballot measure. Negotiations involving shared track are often more difficult than acquiring right of way within a corridor. Economic competitiveness for the freight rail industry is not affected by entering into shared-use agreements, otherwise, the private companies would not do it. That is part of the negotiation process, making the railroads whole.

The research on Denver's shared-use corridors revealed several lessons learned and best practices for future shared-use agreements. Passenger agencies should attempt to establish the most accurate and timely cost estimate as possible. Creating intergovernmental agreements (IGA) is one strategy to lessen the escalation of costs during the planning process. Another way to ensure accurate estimates from the freight side is to be sure the passenger agency has a secure source of funding and that the project can be completed in the short to medium timeframe. Packaging smaller acquisitions into a larger corridor negotiation is a good practice to limit the costs to the railroad company of negotiations. It is imperative that the passenger agency knows the railroad business

and employs people who know the infrastructure and operation needs of the freight business. Beginning early in the planning process for potential rail service is key, and collaborative planning can result in benefits to the public and private partners. Corridor banking is another successful strategy for passenger agencies to reduce the contentious negotiations with freight rail when the money is available. RTD has moved forward with this strategy to purchase additional ROW on the G-line and North Metro Line, even though there is not an immediate plan to build in those corridors. Finally, keep negotiations and "dirty laundry" out of the media because this can adversely affect the relationship between host railroad and passenger agency.

Future growth in shared-use corridors is likely to increase. Several CDOT studies point to the Front Range corridor as the next feasible expansion of rail in Colorado, followed by the I-70 corridor west of Denver. These corridors will require close collaboration and planning with the host railroads in each case. Most interviewees did not see the need for federally mandated shared-use policies, but the role of the federal government is important for grant and loan programs to support shared-use cooperation. Amending the federal environmental process to allow host railroads to be involved during the assessment could help smooth the process of acquiring ROW.

Chapter Four: Public-private partnerships with public transit, local government agencies, and ridesourcing in Denver, CO

Introduction

In recent years, there has been an explosion in the shared economy that has brought innovation and efficiency to many sectors, from buying and selling goods, to renting new forms of lodging accommodations, to transportation provision. Shared mobility in particular has boomed since the introduction of bikesharing, carsharing, and ridesourcing and their interaction with the on-demand economy that utilizes smart-phone application technologies to provide mobility options on demand. The use of shared mobility has the potential to reduce car ownership, expand mobility options, and generate higher utilization of public transit services. Ridesourcing, the use of private vehicles and drivers summoned by smartphone apps such as Lyft and Uber, along with the entrance of autonomous vehicles (AVs), is seen as potentially contributing to the end of private vehicle ownership. The co-owner of Lyft, John Zimmer, has proclaimed that "by 2025, private car ownerships will all but end in major U.S. cities" (Zimmer, 2016). However, legal issues surrounding employment designations, privacy issues, and regulation by public agencies have tempered innovation in the ridesourcing arena. In addition, some are concerned about the impact of ridesourcing on the public transit network. Still others see ridesourcing as an answer to the first/ last mile conundrum of transit and the easy and

cheap way to expand mobility options for many. Public-private partnerships between ridesourcing companies and public agencies are just getting off the ground around the U.S., with pilot programs between local governments and transit agencies and several of the largest ridesourcing companies, Uber and Lyft. With proper integration of ridesourcing with public transit and local municipalities, these new P3s could greatly affect the cost and efficiency of transportation provision across the U.S. The full benefits and shortcomings of utilizing ridesourcing as a partner to provide services or integrate with public transit have not yet been fully researched.

Using interviews with public and private agencies involved in ridesourcing P3s and desktop analysis, this research seeks to address the gap in the literature of P3s and ridesourcing by documenting the characteristics of pilot programs across the U.S, and addressing two specific partnerships in the Denver metropolitan region. This research identifies how transit agencies and local governments are partnering with ridesourcing companies to enhance their mobility offerings through improved first-last mile connections and on-demand services, document the pilot programs produced thus far, and measure their success in achieving the goals of both the private and public sector partners. Finally, the research addresses the benefits and drawbacks of contracting out services to ridesourcing companies and suggests recommendations for agencies seeking to enter into public-private partnerships.

Research questions

- *How are transit agencies and local governments partnering with ride-sourcing companies, both locally and nationally, to address mobility goals? (first-last mile connections, use during off-peak transit hours, paratransit substitute)*

- *How successful have Denver area pilot partnership programs been in addressing their mobility goals?*
- *What are the benefits and drawbacks of public private partnerships between public agencies and ridesourcing companies?*

Background

Facilitated by recent advances in technology, the sharing economy/ collaborative consumption has exploded in recent years. The on-demand environment enabled by smartphone technology as well as an increased focus on sustainability has fueled the explosion in many sectors (Nadler 2014). Rachel Botsman, the author of *What's Mine is Yours: The Rise of Collaborative Consumption* (2011), recently clarified some of the key definitions in the collaborative consumption movement. The sharing economy is used to describe "an economic system based on sharing underused assets or services, for free or for a fee, from individuals" (Botsman, 2015). Collaborative consumption is "the reinvention of traditional market behaviors- renting, sharing, bartering, gifting- through technology and on a scale not possible before the internet" (Botsman, 2015). The ridesourcing services described in this research are facilitated by the expansion of on-demand services- "platforms that directly match customer needs with providers to immediately deliver goods and services" (Botsman, 2015).

On-demand technology has facilitated the development of shared mobility services as people search for alternatives to the single-occupancy vehicle (SOV). Shared mobility encompasses several different mobility services including car sharing, bike sharing, ridesharing, and ridesourcing. (Kodransky and Lewenstein, 2014). Bike sharing allows individuals to rent a bike for a fee or membership cost for short point to point trips

usually less than five miles. Many cities in the U.S. now operate or contract with private companies to run bike sharing systems. Examples of bike sharing systems include Denver Bcycle, Chicago Citibikes, and New York City bikes. Car sharing refers to a system where users can rent a car for short to medium distances for occasional trips. Car sharing may utilize several forms, for example round-trip service that requires the user to return the car to the same location, one-way service that enables users to return the car to a different destination than origin, and peer-to-peer car sharing where individual car owners rent their cars to fellow drivers when not in use (Kodransky and Lewenstein, p. 7, 2014). Companies that operate car shares include Zipcar and Car2Go.

Ridesharing is differentiated from car sharing in that multiple people share the ride to a common origin or destination. Ridesharing includes vanpool, carpool, microbus, and demand-responsive transit or paratransit. Paratransit is most often used by older adults or people with disabilities who cannot use the fixed-route public transit. These systems are usually very expensive per rider, rising from $14 per ride to $33 on average from 1999 to 2012, a 138% increase, and are generally operated by public transit agencies (FTA report 0081 cited in Feigon and Murphy, 2016).

Transportation network companies (TNCs) are “app-enabled chauffer services that match drivers to passengers (Kodransky and Lewenstein, p. 11, 2014).” Uber and Lyft are the two largest TNCs in the U.S. The term ridesharing is commonly used to describe the services offered by TNCs, but ridesourcing and ridehailing are more appropriate terms to differentiate between carpool or vanpool and Uber and Lyft. The main difference is that ridesourcing does not use the rider(s) own vehicles. TNCs now offer a form of ridesharing through services such as UberPool and Lyft Line that match

passengers with other riders and drivers going in the same direction. This research discusses the impact of ridesourcing on urban areas and focuses on partnerships between TNCs and public agencies.

Literature Review

The research on ridesourcing is limited because of its relatively recent and quick adoption. Privacy and data sharing issues for users of the app-based technology have also held back extensive research into the efficiencies and bottom lines of private TNCs. Unlike public transit agency data, which is more widely shared, private, for-profit companies with competitors keep their data close to the vest. A few prominent data sharing agreements have been reached, such as a partnership between Uber and the city of Boston, which has been more hospitable to TNCs than other cities (Dungca, 2015). The limited previous research conducted on ridesourcing spans a breadth of issues, from legal issues to quantitative methods of ridematching, to comparisons of taxis and ridesourcing efficiency. Many questions remain unanswered, and this area is ripe for research as TNCs are quickly expanding their modal share in urban centers throughout the world.

Oversight of ridesourcing TNCs also generates issues around collaborating with public agencies. Taxi cab companies have long been regulated and subject to oversight by government, while TNCs' recent arrival on the transport scene has managed to skirt many of those regulations and employment practices. Cab companies have filed lawsuits against Uber, upset over the taxi companies' loss of revenue, higher operating costs due to compliance with regulations, and more extensive and expensive background checks. Lyft and Uber have also been involved in litigation about whether their employees are

independent contractors or employees, which greatly affects the tax burden and costs of TNCs based on the designation (Lichten & Liss-Riordan, 2017). Each state, region, and city has treated the TNCs differently, some fostering a friendlier atmosphere of cooperation, while others push an atmosphere of regulation.

Cramer and Krueger (2016) found that TNCs are more efficient than taxis in terms of the amount of time the driver spends with a passenger in the car, known as the capacity utilization rate. They found that it was 50% for Uber and between 30-50% for taxis depending on the city. The authors point out the inefficient taxi licensing regulations and Uber's flexible labor supply model which can better match supply of and demand for drivers as reasons for the differences. Utilization of technology is also seen as an important factor in higher capacity utilization rates. Rayle et al. (2016) found that ridesourcing trips had a higher vehicle occupancy rate than taxis, and this may be due to the social nature of most ridesourcing trips. Ridesourcing trips had an average of 2.1 passengers compared to an average of 1.1 for taxi trips.

Both Lyft and Uber tout their abilities to keep drunk drivers off the road. Greenwood and Wattal (2015) found that the presence of ridesharing in a city decreased rates of alcohol related car fatalities, but that this effect is diminished with "surge pricing[15]" in effect. Dills and Mulholland (2016) found a reduction in fatal crashes and DUIs in over 150 cities with ridesharing. Through an analysis of transportation survey data, Young and Farber (2019) found that in Toronto, 20-29 year olds use ride-hailing services at the highest rates and between the hours of 11pm and 5 am for "other purpose

[15] "Surge pricing" is a term used by Uber to describe an increase in the price of a ride based on high-demand. Lyft uses the same strategy and calls it "prime-time" pricing.

trips" (not commuting, household trips, etc.), therefore suggesting, but not proving, that these ride-hailing trips are likely helping users to avoid drunk-driving. Brazil and Kirk (2016), however, found no association with the availability of Uber and drunk-driving related fatalities in 100 of the largest U.S. metro areas.

Some studies have focused on the effects of ridesourcing on traffic volume and congestion. There are mixed results on whether they increase or decrease traffic. Li et al. (2016) found that after Uber enters a market, traffic congestion goes down, and Alexander and Gonzalez (2015) found similar results with high to moderate adoption of ridesourcing in an area. A traffic study by Fischerbaum and Bialik (2015) of the site *FiveThirtyEight* based only on number of pickups stated that Uber vehicles were merely replacing taxis, as the number of Ubers in the street increased by 3.82 million and taxis decreased by 3.83 million. Others question the assertion that ridesourcing does not impact congestion levels, pointing out that it is based on assumptions that ridesourcing is replacing drive-alone personal car trips and not transit or active transport trips. Most Uber and Lyft trips still only carry one passenger. Henao (2017) found that ridesourcing increases VMT by 185%, which can clearly impact congestion levels. More research is needed on the question of how ridesourcing affects traffic or if it can lead to fewer people owning cars in the future.

Many have wondered if the increase in ridesourcing means the end of public transit. Kuhr et al. (2017) does note the potential for widespread ridesourcing to eliminate transit, especially if integrated with autonomous vehicles, but only if the price of the service drops very low. Many studies looking at the effects of ridesourcing on public transit have found that the services complement public transit rather than threaten it.

TNCs could complement and enhance public transit by addressing problems that have long plagued transit, including the first and last mile connection, expensive paratransit and call-n-ride services, and filling in geographic and time gaps in the network. A 2016 survey by APTA reported that users of shared mobility services are more likely to use transit and own fewer cars than the general population (Feigon and Murphy, 2016; Rayle et.al., 2016). Several studies have found that people most frequently use ridesourcing for social and recreation purposes (Feigon and Murphy, 2016; Young and Farber, 2019; Rayle et al., 2016). These social/ leisure trips are usually during late night hours when public transit operates at lower frequencies, and the ridesourcing trips more likely substitute for car trips rather than public transit trips (Feigon and Murphy, 2016; Young and Farber, 2019). Hall et al. (2018) found that Uber was more likely to complement transit in cities with low transit ridership and substitute for transit trips in cities that had already high public transit ridership. A 2015 study by fivethirtyeight.com (Silver & Fischer-Baum, 2015) notes that in New York City, Uber combined with public transit trips becomes cost-competitive to car-ownership much more quickly than ridesourcing alone. People who combine Uber trips and public transportation can go carless and achieve higher mobility than with either mode alone. Young and Farber (2019) concluded, however, that the mode share of ride-hailing trips is too inconsequential to influence the mode share or ridership of either public transit or cars, but as the share of ridehailing trips grows, it will become an issue especially for the younger generation (below 40), which had the highest rates of ridehailing use.

Zimmer's proclamation of the end of the private vehicle raises some concerns for lower-income populations and suburban areas if private vehicles are replaced solely by

ridesourcing and AVs rather than enhancing public transit. One obstacle to public transit collaboration with the private sector is the differing goals of the two sectors. In a recent paper for the Transportation Research Board, Kuhr et al. (2017) point out the potential challenges of relying too heavily on private ridesourcing companies. There is the potential for service disruption, monopolistic practices, and revenue changes to the public sector from falling parking and traffic violations. They also note the social inequity of such services because of price and the private companies' ability to refuse service. TNCs are for-profit companies that have no obligation to serve certain geographic areas or socio-economic levels or even less-abled passengers. There have been instances where Lyft or Uber drivers have refused to pick up blind passengers with service dogs or disabled people who require additional time for the service.

Public agencies have the opportunity to engage with shared-modes, including TNCs, to ensure that the benefits of ridesourcing are shared widely and equitably with all potential users (Feigon and Murphy, 2016). Collaboration through public-private partnerships can steer for-profit companies to connect with lower-income users and in less-dense areas that they might not otherwise choose to service. Government officials in some cities have experience collaborating with bikesharing and carsharing companies and can build off these partnerships to enhance shared-use mobility. Feigon and Murphy (2016) suggest transforming public transit agencies into mobility agencies that oversee multiple modes with the goal to maintain accessibility, equity, and expand mobility options. If public agencies engage with ridesourcing through P3s, they can supplement or encourage transit rather than threaten it and address the challenges of increased transportation via TNCs if the collaboration is negotiated properly (Kuhr, 2017).

There is promising potential for collaborative P3s in multiple areas, including in the integration of ridesourcing technologies with already established public transit services. For example, the app-based technology could improve paratransit and demand responsive services that can cost public agencies up to $33 per ride. By either contracting with TNCs to directly provide transportation or using their customer technology interfacing and ridematching, these services could be provided more inexpensively and with improved quality (Feigon and Murphy, 2016). Kuhr et al. (2017) presents a framework for P3s in ridesourcing, based on contracts with other transit projects, including Denver's Eagle P3 project to expand commuter rail infrastructure. They remark on both public and private sector benefits to ridesourcing P3 and offer P3s as a potential solution to the some of the pitfalls of private transportation provision through TNCs.

Ridesourcing P3 pilot programs in the Denver Metro Area

In 2014, the state of Colorado was the first to pass statewide legislation to regulate TNCs. In some ways, this legislation has made it harder for TNCs to operate in the state, especially in rural areas of the state, because of the strict regulations for drivers regarding background checks, vehicle inspections, and prohibiting felony convictions. Despite this early regulation, the Denver metropolitan region of Colorado is a good study area because of the atmosphere of partnership thus far by the state and region. TNCs have used Denver as a testing ground for several programs, including being one of the first cities where TNCs introduced their ridesharing programs including UberPool and LyftLine. UberPool and LyftLine allow users to choose an option to share their ride with another passenger for a reduced fare. The city of Centennial, a suburb of Denver, recently operated a P3 pilot program with Lyft and other private and public partners to

provide transportation between the Dry Creek Regional Transportation District (RTD) light rail station and its nearby service area. This pilot program used the TNC model in place of paratransit and call and ride services to facilitate the first-last mile connection to transit. The University of Denver entered into a pilot program with Lyft as well, utilizing Lyft as a test for a campus shuttle, safe ride home for students, and a first-last mile connection to the University of Denver light rail station. The results of these innovative pilot programs will serve to inform future ridesourcing collaborations and how to best integrate public transit and TNCs in the future.

Research methods

In this research, I use multiple methods to address the research questions in the study. First, I conducted an analysis of newspaper articles, academic literature, and interviews with experts in public transit, ride-sharing, and local government to develop an overview of public-private partnerships with TNCs that have developed in various cities. Then I focused on the pilot programs in the Denver metro area. I used semi-structured interviews and analysis of data and reports to investigate the success of the partnerships of public agencies with ridesourcing companies in the Denver metropolitan area, how these partnerships have addressed the mobility needs in the region, and the costs and benefits of contracting with ride-hailing companies.

I audio recorded most interviews, transcribed the recordings and notes, and then coded the interviews to identify common themes. I use semi-structured interviews in this research, which allowed me to develop open-ended, content-focused questions while still allowing for flexibility and change during the interview (Dunn, 2010). The interviews provide a variety of perspectives from both private and public sector actors, including

representatives from Lyft and Uber, the City of Centennial, the City and County of Denver, the University of Denver, and the Regional Transportation District (RTD).

The next section provides a discussion of the results of the research, beginning with how different actors in the public and private sector define a partnership. Then I provide an overview of P3 pilot programs from the Denver metropolitan region, including their goals and purposes. The themes that emerged from the interviews and document analysis are discussed next, including the benefits and difficulties of P3s with TNCs, the changing role of the transit agency, recommendations for agencies seeking out P3s, and the future of such partnerships.

Discussion of results

Defining a partnership

The term public-private partnership is sometimes used to describe the contractual relationship between a transportation network company and a public agency. One definition of a P3 centers on the transfer of risk, from public to private, private to public, where the best entity to take on risk will do so. For example, a public agency may take on the risk of public utilities location and relocation in an infrastructure project, while the private agency would take on the risk of construction or design malfunction. RTD was the first transit agency in the United States to enter into a full Design-Build-Finance-Operate-Maintain (DBFOM) P3 agreement to build the Eagle P3 rail line in Denver. In addition, the City and County of Denver recently opened the Performance-Based Infrastructure Office to "improve the lives of Denver residents by leveraging private-sector financing and expertise to build, operate, and maintain City-owned projects when that approach would deliver the best value" (Performance-Based Infrastructure, 2019).

But there is a substantial difference between partnering to building something like a rail line and partnering to provide a service. In a public-private partnership with a TNC, the main objective or definition of a partnership may not be the transference of risk. Centennial, CO, the public partner in the Go Centennial case study discussed below, has a history of contracting with the private sector to provide many of their municipal services, including public works. Because of their history contracting out to both public and private partners for municipal services, it was not a major leap for them to pilot a P3 to address first and last mile issues.

P3s are perceived to be an innovative solution for transit agency service provision. According to a transit agency representative, however, contracting is nothing new. RTD currently contracts out nearly 50% of its fixed route bus services and 100% of their commuter rail operations to private operators. Additionally, they contract out 100% of their on-demand service, which includes *Call-n-Ride* and *Access-a-Ride*. These contractors include taxi cab companies, which RTD has used for decades. According to the RTD representatives, partnerships involve more than just payment for services. What makes a true partnership with a TNC is, in the transit agency's view, the TNC bringing something new to the agency, such as being able to utilize the on-demand, ride-matching smartphone technology of an Uber or Lyft to better address on-demand transit needs. Or to enable the transit agency to have a more flexible non-dedicated vehicle fleet to address peak commuter needs and demand. This could be a more cost-effective way of providing potentially better quality service. So the reasons to enter into a relationship with a TNC are different than just risk transference as in a typical infrastructure P3. And they are different than just contracting with, say a cab or bus company. With increased private

sector participation at all levels of the public realm, the concept of what a P3 is has changed.

According to a representative of a TNC, the definition of a "partnership" is it must be a special contractual agreement or arrangement. If a public agency uses "off-the-shelf products," such as special coupon codes or subsidies, the public agency is merely paying for something that does not require a contractual relationship. Competing for and being awarded a contract to provide service through an RFP process is considered a partnership. As an example, Lyft has a program called Lyft for Business, which enables any company to utilize the TNC to provide transportation or subsidies for people, but this is not considered a "P3".

So why would a transit agency want to contract with a TNC or any other service provider? Cities, states, and other public agencies are increasingly looking to the private sector to save money in cash-strapped times with reductions in public funding and expenditures. The benefits of a typical contract with a private service provider might be lower costs and/ or better service. There are additional benefits for both the public and private partners in a P3, as discussed below. Essentially, a partnership with a TNC and public agency is defined by both parties as one that goes through an RFP process and is a contractual agreement resulting in the contract going to the lowest cost, highest qualified bidder. In addition, a true partnership, according to the transit agency, would utilize the new technology of the TNC to provide better use of current vehicle fleets and address peak demand.

Examples of recent P3s with TNCs in the U.S.

Public Agency	Location	Dates	Cost/ Subsidy	TNC partner
City of Centennial (Go Centennial)	Centennial, CO	August 2016-Feb 2017	Free rides to rail station	Lyft
GoMonrovia	Monrovia, CA	March 2018	$.50 rides	Lyft
Pinellas Suncoast Transit Authority (PSTA)	Pinellas Park, FL	2016	Up to $3 subsidy	Uber
City of Altamonte Springs, Lake Mary, Longwood, Maitland, Sandford	Altamonte Springs, FL	2016-2018	20% subsidy 25% subsidy for trips beginning/ending at Sunrail station	Uber
City of San Clemente	San Clemente, CA	2016	$2 ride + $9 subsidy on rides on former OCTA corridor	Lyft
City of Summit	Summit, NJ	2016	Free (with prepaid parking permit) or $2 to and from station	Uber then Lyft

Table 6: Selected national partnerships with TNCs

Case studies and partnership examples

The metropolitan region of Denver, Colorado has been the site of several innovative partnerships between the public and private sector in transportation. In particular, in the area of transit provision and service expansion, the Go Centennial pilot project stands out as an example of a partnership between the private TNC, Lyft, and the City of Centennial. In addition, the University of Denver piloted a project with Lyft. This section provides details of these pilot partnership projects, the results of the pilots, and the role of each in serving as a model for future partnerships.

Go Centennial Pilot project

The City of Centennial, a suburban area in the Denver metro region, is a young city. It was formed in 2001 from unincorporated areas of Arapahoe County, Colorado. Centennial has a history of working with the private sector and contracting out many of its city services, for example public works, to private companies, including CH2M. After winning a grant from Bloomberg Philanthropies' Innovation Team program, the Centennial Innovation Team (I-team) set out to improve mobility within the city[16]. The city is included in the RTD service area, but as is typical of suburban areas, it suffers from infrequent bus service and poor connections to the light rail station within its boundaries. The eligible service area was approximately four square miles. The I-team packaged a P3 pilot program to offer free shared Lyft Line rides to and from the Dry Creek light rail station (see map below).

[16] In 2014, Centennial was one of 12 U.S. cities to be selected for The Bloomberg Philanthrophies' Innovation Team program. It received $1.5 milllion over 3 years to develop an in-house group of innovation consultants. The goal of the I-team program is to improve the capacity of cities to effectively design and implement new approaches that improve citizen's lives. Centennial's focus was improving mobility across all modes within the city. The I-team program focuses on using data and innovation to solve urban challenges. For more information see https://www.bloomberg.org/program/government-innovation/innovation-teams/

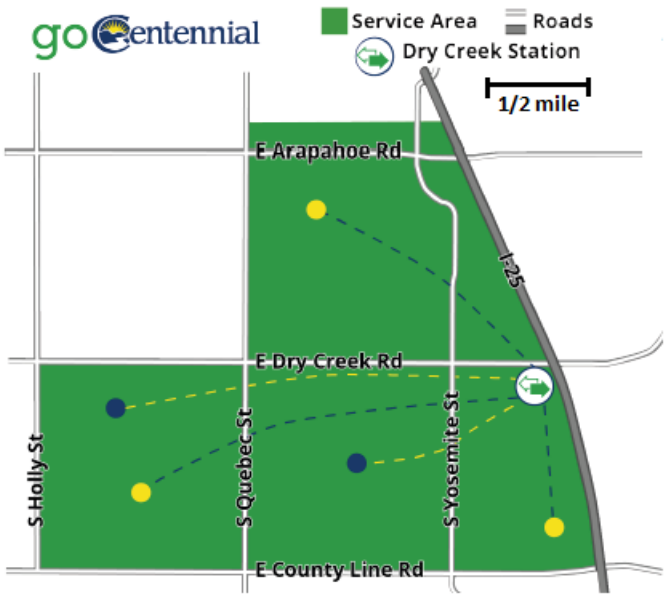


Figure 7: Map of Go Centennial coverage area and Dry Creek light rail station (Go Centennial report, 2017)

The primary goals of the Go Centennial pilot were to increase ridership to the station by maximizing the first and last mile services and increasing ridership at the light rail station. In order to provide a direct comparison to the RTD service, Go Centennial operated in the same boundaries as the RTD Call-n-Ride service, an existing "on-demand" service that picks up and drops off people to the light rail station, for a fare of $2.60 in 2017 (now $3 in 2019). The service offered a free transfer to other RTD services, so in essence, the cost to the rider was free if going to the light rail station. The cost to operate the Call-n-Ride service is heavily subsidized, with an average cost of $18.50 per one way trip (Go Centennial Report, 2017). Some of the problems with the Call-n-Ride service at the time were the need to sign up for a reservation in advance, limited capacity during peak commute times, and less flexibility to meet real-time demand for the service (Go Centennial report, 2017). The team thought that by providing

a free Lyft ride to the station, they could increase the ridership on the light rail and increase the quality of service provided.

The Go Centennial program provided free Lyft rides to and from the Dry Creek light rail station. The fully-subsidized service could be used between 5:30 am and 7:00 pm. Users had to go through the GoDenver app, a multi-modal trip planning app that was itself a P3 between the City of Denver and Xerox, later known as Conduent. Through the GoDenver app, a rider would be required to select a LyftLine option, which had the potential to match riders to share a Lyft vehicle. In addition, the pilot included the ability for anyone to request an accessible vehicle (WAV- wheelchair accessible vehicle) provided through VIA that would take people anywhere within the service area. The Go Centennial report outlines several types of partners involved in the pilot program: funding partners, service provision partners, operational partners, and integration partners. The program was publicly funded with $200,000 each from the City of Centennial and Southeast Public Improvement Metropolitan District (SPIMD) for the service provision. Costs for the I-team personnel and the marketing, evaluation and app development costs came from the Bloomberg grant.

Results of Go Centennial

The partners in the Go Centennial pilot program assessed the results of the pilot through a quantitative assessment of trip data and a qualitative assessment, using surveys of users and partners involved. The pilot resulted in 1,302 rides from 127 unique users between August 2016 and February 2017. Many of the users used the program multiple times. The final report assessed the success of the pilot at meeting the various goals of the

program. They found that the Go Centennial trips taken via Lyft were not likely replacing walking trips, since only 2 percent of trips were less than half a mile or less (p.24).

One of the best results was in the area of improving services levels for first and last mile riders. The average time between booking a ride and the arrival of the vehicles decreased from a minimum of two hours on RTD's Call-n-Ride to an average of five minutes for the Go Centennial program, which was a 95% reduction in booking time from Call-n-Ride (p. 27). The cost effectiveness of both the first/ last mile services and the paratransit service was also greatly improved. The user fee plus subsidy for the RTD Call-n-Ride was $21.14 compared to the Go Centennial service which was an average of $4.70, a decrease of 78%. The user fee plus subsidy for the RTD Access-a-Ride (paratransit) was $47.82 compared to the Go Centennial Access average cost of $20.07 per ride, a decrease of 42%. However, this is calculated based on whether the accessible vehicle has been used continuously during the program. Over $45,000 was spent to have the accessible vehicle in service, but it only made around twenty trips, which is unsustainable. Increased ridership in a larger service area would better distribute the high operating costs of the accessible vehicle.

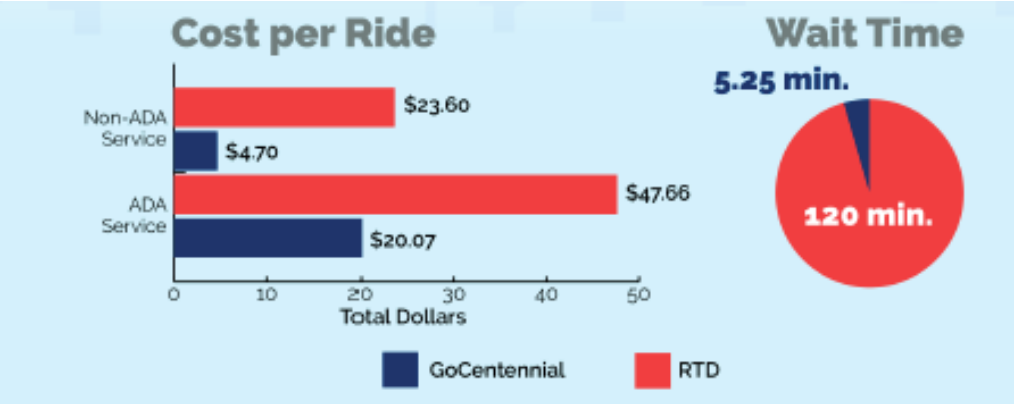


Figure 8: Cost effectiveness and service improvement outcomes for Go Centennial (Go Centennial Final Report, 2017)

Some of the goals saw improvements in their metrics, but did not meet the stated goal. For example, over 60% of users thought that booking a first/ last mile trip was easy, but it did not reach the goal of 90%. They increased the number of first and last mile trips to the light rail station by only 4.6%, which was much lower than the target increase of 50% (See Figure 9: Change in first last mile trips).

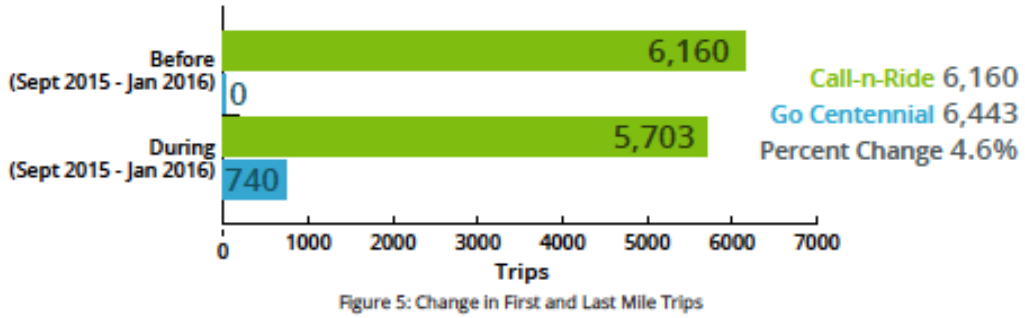


Figure 9: Go Centennial influence on first and last mile trips to the light rail station (Go Centennial Report 2017)

The success of the pilot was mixed depending on how success is measured, but an RTD representative stated, “I consider the Centennial/ Lyft project the premier pilot in the U.S., not because of something cool, but because they actually did the research.” Because the Go Centennial project was able to compare the side-by-side services of Call-n-Ride to the Lyft pilot, they could compare ridership and users of each service. A Lyft representative evaluated the partnership as

> All in all, the program was a huge success, and a great alpha test that we are trying to build on in subsequent rounds. The big successes were, we took a lot of people to the station, more than would have gone [without the pilot]. We didn’t hit the numbers that Centennial hoped for, but those numbers were very ambitious

> [improving trips to light rail by 50%]. We were very pleased with the number of people who utilized the program. Cost was extremely low...Key takeaway was we need to find a better way to do the wheelchair vehicle. (Interview, 2018)

Both the City of Centennial and Lyft stressed the importance of finding the right scale and geography to operate in an economic and scalable fashion. The accessible vehicle saw only 19 rides over 6 months, but used about 75% of the project's service funding. The partners knew going into the pilot that this was not a sustainable economic model, but they wanted to provide the accessible service for the community.

RTD's role in the PPP was as a stakeholder, rather than a partner. This meant that Go Centennial services were operating in parallel with the RTD services. If the first/ last mile services were consolidated, then ridership would increase, costs would decrease, and environmental benefits could increase. Other lessons learned as stated in the Go Centennial final report were the importance of formalizing pick-up and drop-off locations, improving the back-end integration, expanding the pilot duration, hours, and service area, and increasing marketing. They concluded that a larger service area would likely foster higher ridership and better utilization of the accessible vehicle, thereby this type of program has the potential to cut the cost of on-demand service provision in half while also improving the service quality through lower wait times (p.4). The City of Centennial has not decided to continue the program at this time, but views the pilot as a program that "provided a successful foundation for the planning and launching of a future first and last mile program in the region (p. 54)."

DU Moves

The DU Moves pilot project was a program at the University of Denver that was designed to test the concept of a campus shuttle, better connect the campus to the light rail station and bus stops by providing first and last mile connections, provide more mobility options to reduce the need for a car on campus with Lyft rides around campus, and provide a safe ride home option for students (See map in Figure 10). Several campus studies and master plans called for a shuttle around the campus to provide better access to the light rail station on the north end and dorms and academic buildings on the south end of campus.

The University is private, so it was not technically a public-private partnership. The partnership involved the University of Denver, Lyft, and Xfinity by Comcast. DU acted as the "public" partner, Lyft provided the service and operational support, and Xfinity by Comcast and DU provided funding for the subsidized rides. These services are defined as “off-the-shelf” coupon subsidies and did not require a contractual agreement or data-sharing agreement to be signed. The DU Moves program ran in the summer and fall of 2017. The subsidy was $2.25 off any Lyft Line ride in the DUMoves coverage area. There were no time parameters or constraints, but each Lyft user could only use the coupon ten times. The goal was to get the user cost of a Lyft Line ride to about $2 within the coverage area.

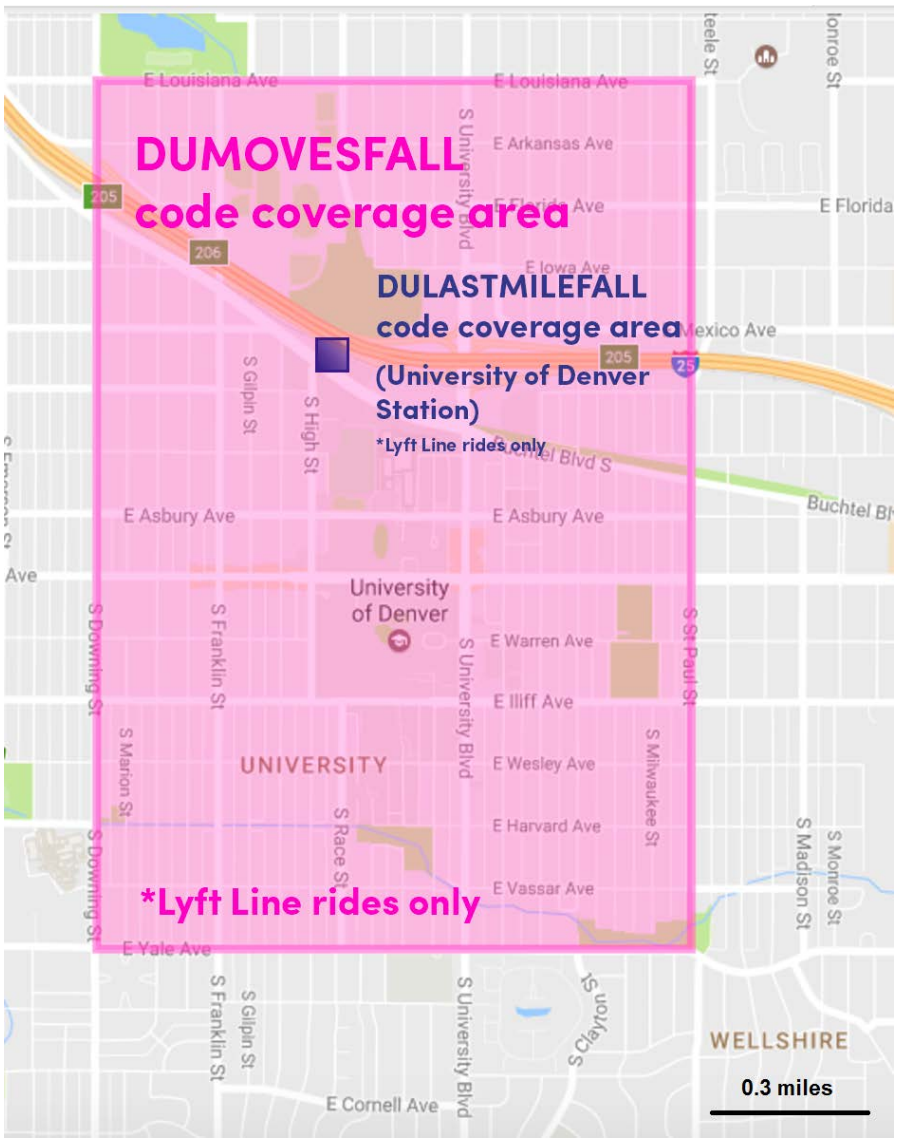
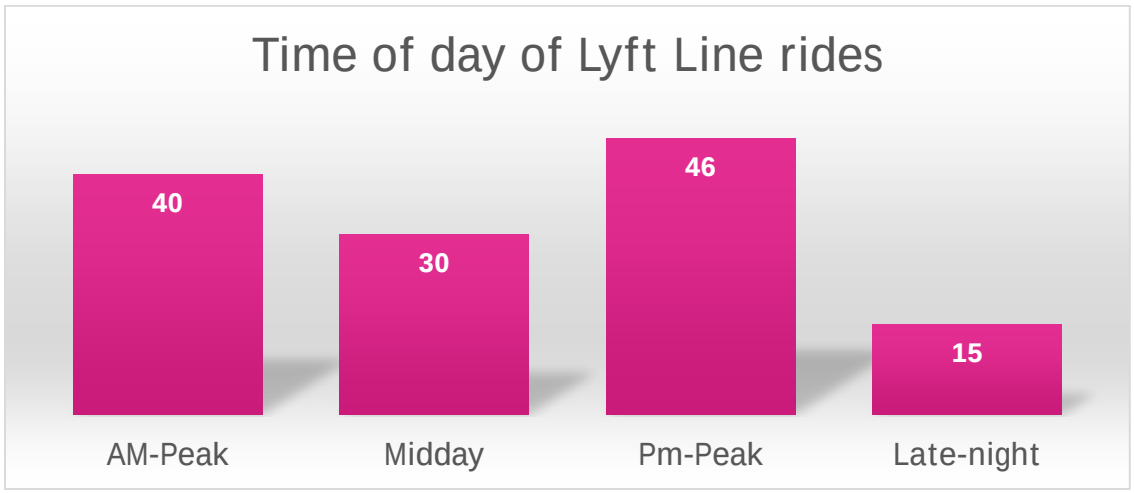


Figure 10: Map of coupon code coverage area for DU Moves (Source: S. Brady and Lyft)

Results of the DU Moves pilot

The total number of rides using the coupon was 131. The rides were split into those beginning or ending at the light rail station and any other ride. The majority of the rides, 75 of 131, were either to or from the DU light rail station. The peak day for the DUMoves rides was Wednesdays. This mirrors results from the public transit literature that shows the peak ridership day is Wednesdays. The time periods of the rides were

divided into AM-peak, midday, PM-Peak, and late-night. The most rides were taken during the PM-peak. This option was not heavily utilized as a late-night/ safe trip home option for students.



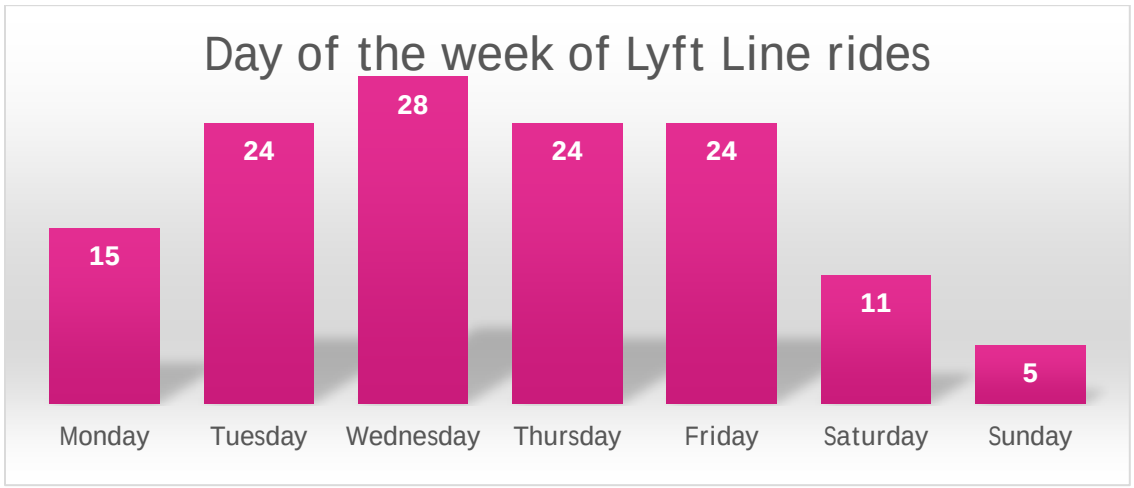


Figure 11: DU Moves data analysis rides by time of day and day of week

The location data Lyft provided was at the zip code level. This was a problem in fulfilling the goal to use it as a preliminary data source for where people want and need a shuttle stop. Although a workaround using two coupon codes enabled Lyft to determine which rides started or ended at the rail station, the zip code level data were not fine

grained enough to provide the type of data needed on a small urban campus. The time of day data was such a large span of time (6 hour increments) that it also did not provide the type of data needed to inform the hours of a future shuttle. The pilot did show that there is a need for transportation connections to and from the light rail station.

Purpose of partnerships/ goals

Partnerships with TNCs are usually meant to address several goals or purposes: improve first and last mile connections, decrease single-occupancy vehicles, encourage economic development, and improve customer service. Usually, public agencies are also seeking to maximize the amount and quality of service for minimum cost. Although some transit agencies have successfully utilized TNCs to take out bus service along a lightly used route and replace it with available TNC service (see San Clemente), most agencies seek out TNCs for small-scale service provision. The cars that the independent contractors use to drive for Lyft and Uber are small vehicles that usually hold between 2-6 passengers, sometimes more. Their use is limited by their capacity. The TNCs share the goal to reduce SOVs and car ownership because this will likely lead to an increase in their market for TNC rides.

First-last mile connections

One main goal of the Go Centennial pilot was to improve first/ last mile connections, which are a challenge in the area. Getting to the Dry Creek light rail station via transit is difficult because of infrequent service, and once people were in the car to drive, they were likely to continue driving to their final destination. In addition, because the area is a mix of about 50% housing and 50% residential, the last mile to employment centers was also a challenge for people getting off the rail to their jobs. This challenge

affects all transit agencies because of the inflexibility of fixed-route buses and rail. RTD recently completed a first-last mile strategic plan and put out an RFI for mobility on demand services. RTD's major ridership on the Call-n-Ride service is first and last mile connections to transit.

Lyft and Uber both see their role as valuable to address the first/ last mile conundrum. Lyft notes that first/ last mile connections using Lyft may be the "most valuable in areas with a robust backbone of transit, but maybe less dense population," for example in suburban areas with access to rail. Uber also sees its role as complementary to transit rather than siphoning rides from public transit. Based on their own observations of how Uber users apply the TNC service to transit trips, they saw the potential of partnering with transit agencies to provide complementary services as part of an area's mobility network.

Reduce Single-Occupancy Vehicle Trips through shared mobility

One goal of the major TNCs, Uber and Lyft, is to reduce SOV trips and car ownership overall. They benefit in the long run if fewer people own cars because their customers would likely use a TNC more often. Some recent research (Clewlow and Mishra, 2017; Schaller Consulting, 2017; Henao, 2017) has stated that increased mode share of Uber and Lyft increase congestion, and therefore increase carbon emissions as well. This has caused backlash from many sides, from the environmentalists to the car-driving citizens increasingly stuck in traffic. Partly because of this backlash, and partly because their bottom line improves with more paying customers in each car, Uber and Lyft have increasingly focused on improving their shared services and increasing the rates of shared rides. Lyft has announced a goal of 50% shared rides by 2020, while they

are currently at about 1/3 of all rides being shared. Uber also acknowledges that most of its trips are still SOV trips, but they are continually making steps toward eliminating cars from the road by improving and encouraging Uberpool and Uber Expresspool. Public agencies that desire to lower SOV rates can put stipulations in partnerships that riders must select a shared ride in order to decrease SOV TNC trips that could contribute to congestion, as was the case in the Go Centennial and DUMoves programs.

Both companies have explored options to complement and encourage the use of public transit and have stated that they are not trying to replace or compete with public transit. If fewer people own cars, they are more likely to use all of the other mobility options, such as bikes, scooters (both TNCs recently bought scooter companies), transit, and TNCs. Uber and Lyft recently announced partnerships with RTD to display public transit information in their app. Lyft merely shows "Nearby Transit" options including scooters and bikes. Uber states it will eventually allow a customer to purchase a RTD mobile ticket through their platform and currently allows the user to compare travel modes, including transit, Uber, and Uberpool rides. Lyft also sees an additional role for them in partnering with transit agencies:

> Where we are taking empty buses off the road because I say the only thing worse than a SOV is a SOB-(bus). [For example in San Clemente], programs where we can allow transit agencies to remove failing routes and double-down on trunk lines, and then let us handle the lower density routes, in my mind, that is the best way for us to work together. At the end of the day what we [all] want is full vehicles, full buses, and full Lyft vehicles, and that's how we solve congestion, pollution, and cost issues. (Interview, 2018)

Most transportation management agencies, city planners, and transportation officials are also trying to decrease the rate of drive-alone trips in their city in order to decrease pollution and traffic congestion. As previously stated, RTD is also concerned with getting people to use more shared modes.

Economic development/ Parking needs

Economic development also played into the goals of the Go Centennial partnership. Southeast Public Improvement Metropolitan District (SPIMD) was one of the public funding partners working with City of Centennial and Lyft. SPIMD found that employers were having trouble attracting new and talented workers that were most likely to want to live downtown. The long commute times to Centennial, which by transit would include a long rail trip and an additional walk on the end, made traveling by car shorter and easier. SPIMD saw the partnership as an opportunity to expand the economic development of the city by attracting new talent to the area.

The need to reduce the demand for parking has also been the reason for using TNCs to provide transit service. The city of Summit, New Jersey provides subsidized TNCs to meet parking demand at their rail station rather than building a new and expensive parking structure. The city began a partnership with Uber but recently switched to Lyft because of its ability to schedule rides in advance. The rides are free for people who have already purchased a parking pass, and $2 per ride for people who have not. This equates to the same cost as the daily parking fee. The number of residents eligible for the program started small, at 100 people, but it has since expanded to 150 and was approved by Summit voters (Tarrazi, 2017). The Go Centennial P3 also mentioned parking at the light rail as a concern, although not immediate. The average weekday

parking utilization rate is near 75%, so parking space is at a premium for light rail users. If more people take a ridehailing service to the rail, it could free up parking spots and reduce the need for cruising for parking and increase the reliability of finding parking for transit users (Co Centennial I-Team, 2017, p. 41)

Improving quality of service

Improving the customer experience and level of service for transit users and the community in general is another goal of partnerships with TNCs. A major goal of the Go Centennial pilot was not only to try to increase ridership at the station, but also to "enhance service and allow people to get service [to and from the station] much faster: in 5 minutes instead of 2 hours [using the Call-n-Ride or access a ride]." The results showed success in the service quality, through a 95% reduction in wait time for a vehicle. TNCs are also interested in improving their customers' experiences, and by partnering with a city or transit agency, they can offer better experiences such as designated pick up or drop off zones in front of a transit station or stop, and utilize the curb for waiting and picking up as well. These goals of partnerships can be mutually beneficial and also improve service for customers of both the TNC and transit.

Benefits of P3s for TNCs and public agencies

Benefits to TNCs

As stated above, public agencies, whether cities or transit agencies, seek partnerships with TNCs to meet a variety of mobility goals. In order for these partnerships to work, there should be mutual benefits to both partners. Both the TNC and the public agency must get something from the partnership beyond just the money they would earn or save engaging in a contractual relationship. The representatives of the

TNCs identified their biggest benefits of partnering with public agencies as increasing their rides, raising awareness of their product and gaining new users, creating good relationships with cities and citizens, and especially testing out innovative solutions to mobility problems and developing new knowledge of how to solve mobility problems in the current climate.

Both Uber and Lyft representatives acknowledge the short-term benefit of increasing the number of rides that their companies generated through partnerships with public agencies. Business development and brand awareness is certainly a driver of P3s for TNCs. The Go Centennial pilot showed that about 30% of the riders that utilized the free Lyft rides to and from the light rail station had never used Lyft or another rideshare before taking part in the pilot. However, each TNC noted that their end goal is not this short-term access to riders. An Uber rep stressed the organization's need to be good corporate citizens to help solve mobility problems that communities might have, and Lyft's rep noted that having a good relationship with cities and being a good community member is an important component of engaging in these partnerships. Lyft has a specific transit team, which sits on their commercial enterprise team, to develop these partnerships. In the end the team is judged on the number of rides that they generate, but the public good component is also a large part of its mission.

This public good aspect of partnering and an increase in customer rides does not outshine the long-term goals of both companies: to position themselves as the go-to

company for mobility as a service (MaaS)[17]. The more people they get to try their product, alone or in conjunction with a transit agency, the more likely a person may be to "get used to the idea that car ownership isn't an outright necessity like it used to be (Uber representative)," and the more people that give up their car, the larger the market for MaaS and for a TNC.

In addition, the idea that these partnerships can provide a testing ground for innovative mobility solutions and an opportunity to generate new knowledge is key to TNC willingness to participate in future partnerships. According to Lyft, "we are happy to work with transit. Even it if doesn't go exactly right, we learn from it." Uber is most interested in the "opportunity to advance a collective knowledge base of how transit and TNCs…can work together" and "big, bold ideas" to show there are still important step function changes to be made. In addition, they want to partner on more than just subsidized rides. While there is a value to passengers and citizens if there is a subsidy, there are many other places to work together for better passenger experiences. For instance, changing the traffic flow at transit locations to make it easier for picking up or dropping off, as well as improve the flow of traffic for other modes as well. Uber is especially excited about partnerships that are multi-faceted, such as their partnership with the City of Cincinnati, Ohio that connects mobility to economic development and career

[17] Mobility as a Service (Maas) describes a movement towards transportation being consumed as a service rather than a personal product, such as owning a car, bike, or scooter. A key component of MaaS is a one-stop travel planner, usually a smartphone app, that integrates multiple mobility services and fare payments.

development[18]. Using pilot partnerships as a testing ground for innovation, mobility improvements, and knowledge building is an important benefit to the TNCs.

Benefits to the public agency

The benefits to the public agency are inherently different than those for the TNC. In the end, the partnership is developed in order to address specific transit goals of an agency in a cost-effective manner. An RTD representative acknowledged one benefit of engaging in a partnership with a TNC is the potential to "carry more people more cost effectively or save money if we are able to coordinate our trips with another service provider," especially in terms of on-demand transit provision, such as Call-n-Ride services. Service expansion by an agency or company is a true benefit, especially for cities that do not currently have the infrastructure to provide transit service themselves. One benefit of utilizing a P3 as stated by a Centennial city employee is that it expands what the city staff can do, while also providing an avenue for more oversight than an internal employee might be given. The contractual relationship provides for specific oversight measures by the public agency.

Difficulties/ barriers with P3 partnerships

Despite these benefits, there are difficulties that come with developing a partnership between public and private agencies. No one in the interviews identified these difficulties as having the potential to derail the partnership, but being aware of these issues ensure that all parties can make a more calculated analysis of the costs and benefits of a partnership. These difficulties may include operational costs, legal agreements, and institutional barriers.

[18] For more information on this partnership, visit https://www.uber.com/newsroom/cities-as-partners/.

There is an operational cost to participation in a partnership for the TNC. While it is assumed that the transportation company would benefit through an increase in their number of rides, the cost in terms of assigned time for staff is worth noting. When a TNC enters into a partnership, it will often assign a person to work with the city or transit agency to make sure everything works and that the customer experience is good. Sometime Uber and Lyft might subsidize portions of a discounted ride as well when promoting certain partnerships.

For TNCs, the cost of doing business with the public can be paid in time. Speed is not a quality that the public sector is often known for. According to a representative from a TNC,

> We try to move at the speed of a nimble tech company, and transit agencies are beholden to so many bureaucratic rules that often things go very slowly. We understand the reasons, but it would be great if we get to the point where these types of partnerships are streamlined, and there aren't so many hoops to jump through and so much bureaucratic tape. (Interview, 2018)

This "bureaucratic tape" can include legal agreements and the institutional requirements and barriers to entry for the private sector in transportation.

Legal agreements have both a monetary and time cost. The potential legal back and forth between parties can extend the time needed to implement a P3. For example, in the DU/ Lyft pilot project, there were some sticking points in the process of approval by the university legal team that slowed down the initial launch of the pilot. As shown in chapter 2 (p. 47), legal agreements require legal expertise which can be costly, especially for agencies that do not have the expertise in house. TNC P3 legal agreements, however,

are not usually as complex as an infrastructure DBFOM P3 that might require hiring an outside legal firm. In fact, a partner in the Go Centennial pilot P3 stated that legal contracts were not a major hurdle to institute the partnership, since, "our legal agreement went back and forth twice and was signed really quickly, but I know that's been a challenge in some other cities."

Institutional barriers have the most potential to derail a P3. Institutional barriers are often put into place by a local, state or federal government in order to receive funding from different sources. Examples of institutional barriers or requirements include requiring public participation in a decision-making process, ensuring equity of access, for example in terms of cash payments and access to smartphone technology, ADA accessibility, and requiring more stringent background checks and drug testing for employees. These institutional requirements are a way to ensure the public is being served by various infrastructure and planning projects, but they may be seen as barriers by both private companies and public agencies seeking to work together.

Equity is a major concern of transit agencies and rightly so, because the federal government requires that a transit agency like RTD abide by Title VI of the Civil Rights Act of 1964, which prohibits discrimination on the basis of race, color, or national origin if an agency is to receive federal funding. In addition, they must meet all requirements of the Americans with Disabilities Act of 1990. However, TNCs have argued in court that because they are "technology companies" and not taxi companies that own or lease the vehicles used to pick up passengers, they do not have to adhere to the ADA guidelines.[19]

[19] See an example of an ADA case against Uber here: https://www.courthousenews.com/judge-advances-mens-ada-complaint-against-uber

However, both Lyft and Uber have a mechanism to request an accessible vehicle in some larger cities, but the ratio of wheelchair accessible vehicles (WAV) to regular vehicles is very low. It has been found that the number of WAVs in NYC are only 554 of the 118,000 active TNC vehicles (Taft, 2018). While several ADA lawsuits work their way through different courts, both Lyft and Uber have made efforts to increase their accessibility standards. This is a major concern for public transit agencies interested in partnerships with TNCs, since many are specifically interested in using the TNC app technology to better process on-demand vehicle requests for services such as Access-a-Ride or Call-n-Ride in the Denver metro area.

As stated in the FTA guidance document for the Americans with Disabilities Act (ADA),

> When a public entity enters into a contractual or other arrangement...with a private entity to operate fixed route or demand responsive service, the public entity shall ensure that the private entity meets the requirements of [Part 37] that would apply to the public entity if the public entity itself provided the service. (FTA, 2015, p. 1-5)

As further discussed in the guidance for ADA document, "private entities (e.g. contractors) 'stand in the shoes' of public entities with whom they contract to provide transportation services....while a public entity may contract out its services, it may not contract away its ADA responsibilities" (FTA, 2015, p.1-5).

Representatives from RTD still see these institutional requirements that the transit agency must meet to receive federal funding as a major barrier to implementing a partnership with a private TNC.

> Those institutional barriers are significant...it's pretty darn cool that you can hail a car by pressing a button on your phone, it's hard to argue about that, but in those

> confines that we operate in, it makes a partnership prove somewhat difficult." In the transit agency's mind, "for the most part, TNCs tend not to be able to meet those requirements. So it's problematic, is it not? (RTD interviewee, 2018)

Some of these regulatory issues are the reason why RTD was initially hesitant, back in 2016, to jump in "feet first" with the Go Centennial pilot. They wanted to make sure that some of these institutional barriers were worked out during this pilot project. If RTD was involved as an official partner and used the Go Centennial pilot to replace their Call-n-Ride service rather than use it in tandem, then they would have had to delay the launch date to ensure proper adherence to all requirements. In Lyft's partnership with San Clemente, however, they

> Have figured out ways to comply with FTA requirements so transit agencies can integrate our services into their program. We've heard, 'you can't do this,' but we can and we are. That's the message we send to transit agencies. This is something that is viable, and we can make it work. (Lyft representative, Interview 2018).

Despite their initial hesitance, RTD is interested in working on how to best meet the requirements for a future partnership with a TNC. One way to try to meet these requirements is to figure out the best way to offer trips through the TNC, in order to give certain trips, perhaps for persons with different abilities, to the transit agency, and send other trips to the TNC vehicles. Transit agencies, including RTD, have experience contracting out with taxi companies, which usually have the option of dispatching accessible vehicles as a part of their fleet. In the transit agency's mind, the contractual agreement must first meet the institutional requirements, including state, federal, RTD,

and customer requirements, then they can work on the technology part of trip coordination.

Withholding federal funding from a transit agency is a way to ensure compliance with ADA guidelines and Title VI. In terms of equity, there are no regulations requiring the TNCs to provide unbanked people, those who do not use banks or do not have their own bank accounts, with access to their services. A recent FDIC survey found that 6.5% of U.S. households were unbanked in 2017 (FDIC, 2017). There are also no requirements for TNCs to serve lower socio-economic areas. In the Go Centennial pilot, the City of Centennial was

> Very cognizant of that equity piece and making sure everybody would be serviced so we paid a lot to have that accessible vehicle in the service area. Without doing that, I think we could have run into some issues. We also were cognizant about finding a way for people without smartphones to use it, and because it was free, we were able to allow people without credit cards through that call in center. (Interview, City of Centennial representative, 2018)

As a stipulation to entering into a P3 with a TNC, public agencies could require the TNC to provide certain things that they otherwise would have no leverage to require.

Role of the transit agency

The role of the transit agency came up in the interviews regarding the agency's mission and role in providing transit versus mobility. How a transit agency defines itself and its mission determines whether transit agencies see shared mobility and TNCs as complementary or competition.

RTD's current mission statement is to "meet our constituents' present and future public transit needs by offering safe, clean, reliable, courteous, accessible, and cost-effective service throughout the district (RTD: Facts and Figures, 2019)." According to one interviewee, there are two ways of looking at the transit agency's role in a region. One is that their purpose is to "run buses and trains;" another is that they should provide mobility options to the region. LA Metro was offered up as one example of an agency that embodies the "mobility integrator" definition of a transit agency (Kuhr, 2017). LA County recently passed two tax resolutions to provide for multimodal transportation options, including mobility hubs and bike lanes, not just bus and rail transit. Their mission is to "provide a world-class transportation system that enhances the quality of life for all who live, work, and play in LA County (LA Metro, 2019)." The three elements of their vision specifically address providing mobility options. Transit agencies must innovate or they will be left behind as the private sector quickly enters the transportation arena. Choosing to partner with TNCs is one way that agencies signal they are willing to look beyond trains and buses to provide more service options to citizens. An RTD representative stated:

> The role of the transit agency is not to provide bus service. The transit agency's role (maybe just my opinion) is to improve mobility through the region. Whether it's on a bus, Uber, bike share, or people walking, I don't think it really matters. Whether or not our ridership is decreasing as a result of some other innovation that is happening, I don't think is a metric we should necessarily be paying attention to. We should be paying attention to, are more people getting out of single occupancy vehicles and shared modes, like a lot of the innovative services

> are offering now, more. Because that's really the primary objective, in my opinion, of the transit agency: To improve mobility and reduce congestion, by making any type of shared mobility more attractive to the general public including people who are driving now. So anytime those services can operate better together, the consumer understands how they can use a bike share with transit, with a TNC for example, that's a good thing. It operates more as a whole system, rather than in competition. (Interview, 2018).

So transit agencies have the choice to be an agency that provides and integrates multi-modal mobility options or one that sees other mobility options as a threat to their services. TNCs are providing new services that are increasingly using characteristics of transit, such as the LyftLine Saver and Uberpool Express, where passengers share a ride, but have to walk to a designated pickup spot and end at a drop-off spot and then walk to their final destination. Do transit agencies compete, complement, or coordinate with these services? In the Go Centennial pilot, RTD was a stakeholder, but not an official partner. The Centennial staff were aware that their pilot could be seen as competition, so they did not want to market it directly to RTD Call-n-Ride passengers. By having both services compete side by side, RTD saw it as an opportunity to test their Call-n-Ride service against the TNC model.

RTD also recognizes that it does not make sense to have competing services if they are serving the same market, so RTD's position is that they are increasingly interested in coordinating their services to avoid duplication and direct competition.

> If anything is to come of substance from this regional discussion of mobility, it's how do we coordinate those [locally free or subsidized] services such that we are

> able to leverage each other's strengths rather than compete against each other. That's part of the discussion with TNCs as well. When Uber launched Uber Express Pool, there was quite a bit of discussion about how that really looked a lot like public transit. (Interview, RTD representative, 2018)

And with the price differential of Uber Express Pool approaching the cost of a regional RTD fare for a shorter ride time, this leads to a discussion of the most effective way to expend both public and private funds. "It's like Lyft and Uber are huge transit agencies!" just technologically enabled.

Another RTD representative, however, asked the questions: "Do you coordinate or do you just compete? What's the matter with competition? What's wrong with that, just let Uberpool compete. People are getting more options for only a small premium, able to make a faster, more convenient trip" (Interview, 2018). Because in the end, even if RTD does take on the role of mobility integrator, they acknowledge that they are not a taxi service. Complementing and coordinating services could potentially allow TNCs to offer a transit combo trip, paired with transit. RTD's transit service can currently be viewed in both Lyft and Uber's apps, but one-step payment through their apps is not yet available.

Recommendations for creating a P3 with a TNC

The public stakeholders interviewed in this study provided some recommendations for agencies looking to partner with TNCs. Representatives from the TNCs also offered some advice for agencies in the hopes that future partnerships could become more streamlined. The recommendations center around the importance of data

sharing in a partnership agreement, the importance of marketing for a successful pilot, and knowing what the market for services is before developing a new service.

Data sharing

Many public agencies are enticed by the potential to mine large amounts of data from their tech savvy partners at the TNC, hoping to use the mobility data to solve problems of congestion, transit, parking, and mobility. The amount of spatial data of citizens' movements is increasing and has the potential to provide solutions to city woes. However, TNCs are becoming increasingly concerned with protecting users' privacy and data, especially after there were reports that Uber's app continued to monitor and record the location of app users up to five minutes after their official Uber trip ended[20]. Data sharing is a key piece of partnership agreements, but agencies should not be given a dump of private citizens' data. In some cases, data sharing is not automatic, unless a specific data sharing agreement is signed. Both public agencies and TNCs expressed the importance of data-sharing, and each had suggestions about how to satisfy the need for data on the public side and to protect the customer on the private side.

Privacy issues are very important for TNCs, especially when working with public agencies that must adhere to laws such as the Colorado Open Records Act (CORA) that require governmental agencies make available most public records to the public. Agencies should refrain from asking for data just for the sake of it. Agencies can instead identify what data are truly necessary and be willing to discuss the data-sharing component of a partnership upfront.

[20] Uber was found to be tracking user's locations on their phones, after they were dropped off. Uber has since ended this practice. https://www.npr.org/sections/thetwo-way/2017/08/29/547113818/uber-ends-its-controversial-post-ride-tracking-of-users-location.

> It is really important to explain why you want the data, tell [the TNC] the policy question that you need to answer. Because if you just say, 'give me what you got,' that's not going to work. But if you clearly say, I need this piece of information to prove to my council member that X, that's a much more compelling argument. (Interview, 2017)

Expect to have more access to aggregated data and discuss what level of geography is needed to answer the policy questions. According to Uber, "Our stance continues to evolve on what we are comfortable sharing and not, the privacy issue is a huge one." In 2016, the city of Boulder partnered with Uber and Lyft to provide rides to downtown Boulder over the winter holidays. This program was called "Door to Downtown" and provided a $5 credit for up to five downtown trips, funded by the City of Boulder and the Downtown Boulder Partnership. According to an Uber representative, the city began by asking for large amounts of location data and personal information, such as starting and ending addresses and names, but the availability of the data evolved to Uber suggesting using zip codes and anonymous, aggregated data on a larger spatial scale. The DU Lyft pilot did not include a signed data agreement either, which would be key to getting the kind of data that an agency needs. Zip code level data in a small area such as the DU campus were not very helpful to fulfill the mission of using the pilot as a simulation for future shuttle use and stop location.

In the DU Moves pilot with Lyft, DU did not enter into a contractual agreement and used "off-the shelf" products to subsidize rides. There was no signed data agreement about what Lyft would provide to the University, which affected the type of data that Lyft ultimately did provide. Over the course of a year of talks to begin utilizing the subsidized

coupon codes, it went from being able to get spatial coordinates for each starting and ending destinations along with start and end times for each trip, to later getting zip code level data for six-hour increments of time, such as the "late night" or "peak evening commute" period. This illustrates the changing degree of comfort with TNCs providing customer and trip data, as well as the realization that data are valuable and should be provided through a signed contractual agreement.

Uber has attempted to quell the resounding desire for its data by implementing a data platform called Uber Movement, designed for city planners to use regardless of any existing partnership with Uber. Data are not available in all markets, but only from select cities globally, including Boston, Seattle, Washington D.C., Pittsburgh, Cincinnati, San Francisco, and Los Angeles in the U.S. The data are anonymized and aggregated and can be used to study travel times, travel speeds, and even new micromobility modes such as electric bikes and scooters. The data-sharing piece of a partnership is incredibly important to discuss at the beginning of a partnership, but signing a data-sharing agreement and negotiating the terms of data-sharing should be based on specific policy questions that an agency wants to answer.

Marketing and the market

Marketing a new service or product can be challenging, but it is key to the success of pilot programs. In their follow-up surveys, the Go Centennial partners found that lack of awareness of the pilot program was the main reason people did not use the service.

> On projects like this, the marketing is more than just, hey this exists. People need to understand exactly how this impacts them, where to pick up, step-by-step of how they are going to do it, before they are comfortable enough to actually take

> the step and do it. The marketing was a little more challenging and more nuanced than I had anticipated (Go Centennial interviewee, 2017).

In the Go Centennial Final Report (2017), the team recommends starting comprehensive marketing early to allow people to plan commutes and understand the new service. Outreach to the community should be a natural strength and benefit of conducting a P3, since each sector has its own area of expertise and sphere of influence. For the pilot, the Go Centennial team decided not to directly market to the Call-n-Ride customers because they were cognizant that the program could be seen as a competing service. However, even though RTD was not an official partner and running a competing service, the transit agency handed out flyers to their Call-n-Ride passengers. They saw the Go Centennial pilot as a good way to test the market for a new service while still operating their service side by side. If a future partnership of this kind included RTD, then the target market would be customers who already use the Call-n-Ride or the Park-n-Ride, as well as car drivers. They further suggest marketing heavily to employers to reach employees who do not yet use public transit service.

For future partnerships that seek to develop a new transit service or pilot project, the Go Centennial team recommended to keep the restrictions and program requirements as simple as possible, in order to help with the marketing.

> To the extent that you can get rid of restrictions in your program, if you can, it's 24 hours, 7 days a week, just make it as simple as possible. We were telling people Monday through Friday, 5:30 am – 7 pm. Here is our weird service area. Are you in the boundary? Here is the coupon code. You gotta go to Lyft, give

them the phone number, give them all this stuff. I think that initial step was really hard. (Go Centennial interviewee, 2017)

In addition to developing a detailed and nuanced marketing plan for a new TNC partnership, it is important for agencies to know the market for the service. Transit agencies have usually developed a strong understanding of their ridership trends and users, but other public entities, such as cities, universities, or other agencies that do not have as much experience with transportation provision may not. RTD representatives focused on the importance of knowing the market when thinking of how a TNC or other innovative solution could be incorporated into their service. RTD, which operates the largest on-demand service in the country, hosts many transit agencies who are interested in how they provide their on-demand service Call-n-Ride. It is important for agencies to understand that

> Tech isn't the first or second thing. First, what is the market? What is the travel pattern? Who is our customer? And then what service meets your needs. Then maybe tech can help you. It's the hype. Someone higher up said just get it, not knowing anything about transportation, much less on-demand transportation, which is an order of magnitude more complex. (RTD interviewee, 2018)

Knowing why people choose to take transit is key. For example, to downtown Denver, people largely choose transit to save on parking cost and avoid congestion: "That is the market for transit" (RTD interviewee, 2017). Do the research about who may be willing to use the service. For example, in the Go Centennial pilot, the goal of the program was to increase first and last mile trips to the rail station by 50%, but they

achieved only a 4.6% increase even though it was a free service. A market for a new service will not magically appear.

RTD acknowledges the difficulty in promoting transit services, and transit across the nation only has about 4-5% of the market with ridership currently on the decline. It is not realistic to think that a new service, no matter who operates it, will magically draw a new market of customers. Customers have options. For example, the Go Centennial pilot operated in a suburban location, where transit ridership is closer to .5%. This is arguably the metric that the I-team should have been evaluating, rather than thinking they could increase ridership to the average metropolitan area numbers. Today, new options in the market are the Uber Expresspool and Lyft Shared Saver, which allow for a lower cost, shared TNC ride that may require the passenger to walk a short distance to their pickup location. These low cost fares that take a person directly to their destination, are the new competition for bus and rail service. The price point is closer to the transit fare (which recently rose for the average RTD user) and are usually quicker without any transfers. The market is expanding with choice, so knowing the market is extremely important before establishing a partnership.

Future partnerships

Future innovative partnerships between public and private agencies are likely throughout the country and in the metropolitan region of Denver. In 2017, the Regional Transportation District in Denver released a RFI for “Mobility as a Service, Mobility on Demand and Technology” and received 24 responses under the following categories: Service delivery (dedicated and non-dedicated vehicles), fixed route shuttles, trip planning, integrated payment, mobility on demand trip exchange, and branding. RTD

plans to follow up this RFI to explore adding non-dedicated vehicles, including taxis and TNCs, to the Call-n-Ride service, which has already been rebranded as FlexRide[21]. RTD sees their role in the future as a "mobility integrator." The new vision of RTD is that "RTD's transit network serves as the backbone for regional shared mobility in metro Denver. We are uniquely positioned to maximize this investment and be the regional integrator for metro Denver." In their "Transportation Transformation" summit and rebranding effort, RTD specifically highlights the need for pilot projects with private sector partners and to identify potential for efficient technology-leveraged investment as key goals of the regional approach to mobility.

RTD is especially interested in how TNCs and RTD can work together to come up with a better on-demand service by adding the on-demand technology of a TNC to their current Call-n-Ride services. Assigning different fares to different people could be a breakthrough use of P3s as well. For example, using a tech on-demand app for the transit company, an employer could cover the cost of a Lyft Line ride or the city might subsidize part of the fare and that would provide a lot of flexibility for a rider and the service provider. Additionally, the ability of a TNC to offer trips paired with public transit through their app has incredible potential to change the way people access the transit network.

Conclusion

As more public agencies look for efficient ways to expand mobility options in their regions, they are looking to the private sector as a source of new technology and to

[21] For more information about the FlexRide brand, see http://www.rtd-denver.com/FlexRide.shtml

expand their transit service provision. The pilot programs discussed here provide examples of innovative uses of P3s in transit.

Public agencies increasingly seek out collaboration with the private sector to provide more mobility options to citizens. This study sought to identify examples of innovative public-private partnerships between Transportation Network Companies (TNCs) and public agencies and describe their successes, benefits, and drawbacks. I answered the research questions by collecting and analyzing data from semi-structured interviews, document analysis, and desktop research. Two P3 pilot projects in the Denver metro area, Go Centennial and DU Moves, were used to examine the research questions within a case study framework.

As more agencies look to the private sector to decrease costs and improve quality of service, P3s in transit provision should be studied to provide informed recommendations to stakeholders and evaluate and document the results of these partnerships. The full impacts of using TNCs to enhance transit service provision are not fully understood. This study fills a gap in the transport literature on ridesourcing and more specifically on P3s with TNCs.

The Go Centennial partnership between the City of Centennial, Colorado and Lyft tested the use of free Lyft Line rides to improve first/ last mile connections to the light rail station. While the pilot program did not significantly increase ridership or first/ last mile connections at the rail station, it was found to improve the quality of service to passengers. The DU Moves pilot project used Lyft to test the concept of a campus shuttle and improve first-last mile connections to the light rail station. The predominant use of

the subsidized Lyft Line rides were to connect to the light rail station, and the time the rides were used was highest during the peak pm commute hours.

P3s between TNCs and public agencies address the following goals: improve first-last mile connections, reduce single-occupancy vehicle trips, encourage economic development, improve customer service, and reduce the demand for parking. For a P3 to work, there should be mutual benefit to both parties. The benefits to the TNC include increasing the number of rides they offer, raising awareness of their product to gain new users, creating positive relationships with cities and their citizens, and testing out innovative solutions to mobility issues. The benefits for a public agency include meeting their mobility goals in a more cost effective way and improving quality of service. Difficulties in establishing a P3 with a TNC, while not insurmountable, include overcoming institutional barriers and slower implementation times. Data sharing is an important aspect of P3s and should be clarified upfront in a partnership.

The role of the transit agency is changing, and agencies must choose whether they will work with or against TNCs. If they embrace the role of “mobility integrator,” more P3s are likely to take place for transit service provision. The transit agency may transform into a regulator, nudging TNCs to provide more accessible and equitable service through their partnerships.

There is much room for future research in the area of P3s in ridesourcing. With the recent public offerings of both Lyft and Uber, profitability of the companies will become more important to stockholders. In addition, the uncertain effect of autonomous vehicles on the transit industry and TNCs is yet to be seen. Future research on the viability and long-term results and effects of ridesourcing P3s is needed. A review of

these partnerships at the national level is needed to compare successes and failures after a pilot period. The financial and social costs of these P3s need to be analyzed to account for all costs and benefits (including environmental, social, and economic) to the passenger, agency, TNC, and the community at-large.

Chapter Five: Conclusion

Public-private partnerships are expected to increase in the U.S. transportation sector, as public funding for transportation becomes scarcer and the importance of maintaining and expanding mobility increases. Transportation provision is increasingly being pushed towards neoliberal policies of competition and efficiency. This research described and analyzed the use of public-private partnerships in the public transit sector. The studies provided literature reviews, desktop analyses, and in-depth interviews with public and private experts and stakeholders. The research investigated innovative infrastructure delivery of transportation P3s, shared-use rail corridor negotiations and agreements, and emerging ridesourcing partnerships with transit agencies, using Denver, Colorado as a case study. The studies together provide examples of opportunities for engagement of the private sector in the provision of public transportation infrastructure and service, as well as discusses recommendations for agencies interested in pursuing such partnerships.

Chapter two discussed several transportation P3s that were a part of RTD's FasTracks program to expand the regional rail and bus transit network. The innovative delivery model of the Eagle P3 was of particular note because it was the first full design-build-finance-operate-maintain P3 in transit infrastructure in the U.S. The FasTracks P3s were found to be a model for future transit agencies interested in pursuing private sector involvement in building out new transit rail lines. Chapter three discussed the shared-use

rail corridor agreements and negotiations that developed between private freight rail companies and public passenger rail agencies, focusing again on the buildout of FasTracks in freight rail corridors. Chapter four identified examples of pilot partnerships between transportation network companies, including Uber and Lyft, and public agencies and discussed the results of Denver area pilot programs. This chapter highlighted the changing role of the transit agency and the potential benefits and drawbacks of ridesourcing partnerships.

The research does have some limitations. The case study approach limits the generalizability and applicability of the results to all situations. However, the case study approach for this type of research was validated by previous research, especially since the number of transit P3s in the U.S. is still quite low. This research is most applicable to cities in North America where the public agencies are in the early stages of P3 adoption in transportation. It is important to be aware that the private sector actors that were interviewed tended to stick to the "company line," and private companies are constantly marketing themselves and thinking of the public relations angle that will be reflected through their interviews. The data collection and analysis for the FasTracks P3s took place prior to all the lines being in revenue service. Although the study was updated with ridership numbers since the lines opened, the interviews should be taken as a snapshot in time and may not represent current sentiment of all interviewees.

Defining a public-private partnership

The individual research projects provided analyses of P3s in specific and diverse contexts including the role of the private sector in transit infrastructure provision and

financing, private land acquisition for transit infrastructure, and transit service provision. When taken together, the research did reveal several overarching themes. The definition of a public-private partnership and the benefits of a P3 are context specific and evolving. P3s in transit that include private financing mechanisms are fairly new in the U.S. (see chapter two). The Eagle P3 rail line in Denver was the first full transit DBFOM in the states. This research showed that increasingly for infrastructure P3s, the private sector is expected to bring equity to the partnership and financing of the P3 is what is considered innovative. But there is a substantial difference between partnering to building something, such as the Eagle P3 rail line, and partnering to provide a service. The concept of what a P3 is has changed, since it was once innovative to "partner" with a private company to design and build transportation infrastructure through the design-bid-build (DBB) process, and now this process is considered the status quo. "A simplified definition [of a P3] is transfer of risk, from public to private, private to public (interview, 2018)" where the best entity to take on risk will do so (see Chapter 2). For example, a public agency may take on the risk of public utilities location and relocation in an infrastructure project, while the private agency would take on the risk of construction or design malfunction.

P3s with a TNC, however, are still in the stages of pilot programs, and the benefits of these partnerships to the public sector are yet to be fully explored. But risk transference is rarely the reason to engage in transit service P3s. Transit agencies often seek out these innovative partnerships with TNCs in order to expand service in less dense areas or improve the quality of transit service they can provide.

The differences between contracting and partnering with the private sector is an important distinction since the P3 label signifies a certain level of innovation and efficiency that contracting does not. The fundamental question is: Is there really a difference between contracting and a public private partnership? For example in the shared-use rail corridor partnerships between private freight rail companies and public transit agencies, the transit agency pays the freight rail company to utilize their ROW, share tracks, or purchase land to operate their trains. This could be called merely a contract, payment for services or land. But the private freight rail company does not have to enter into an agreement. They are not bidding on a contract. They tend to view it as a partnership, meaning it is mutually beneficial and for the public interest. Similar distinctions can be made in contracting with a TNC versus creating a partnership. It is difficult to develop a side-by-side comparison of such different partnership contexts.

Changing role of the transit agency

This research is significant because it addresses the question asked by Bruun and Givoni (2015): what kinds of governance work for transport systems? Bruun and Givoni (2015) state that with new innovations, like carsharing and ridehailing, there are great opportunities, but also risk. Chapter 4 addressed the innovative partnerships between transit agencies and ridesourcing companies and finds that the role of the transit agency could serve to help mitigate some of the risk of such partnerships with the private sector. The changing role of the transit agency became a focus of many of the interviews because it is the likely public partner in most of these transportation P3s. The transit agency's identity is changing to become more of a mobility integrator rather than just a

bus and rail operator. With more mobility options, the transit agency has a choice to maintain the status quo or evolve to keep up with competition and customer preferences. RTD's partnerships with the private sector in the TREX light rail project and the Eagle P3 project changed the way the agency approached building capital infrastructure projects. It had to relinquish some control over the design and building of these projects in order to achieve the cost and time saving benefits of the private sector. RTD is beginning to embrace its role as supervisor and integrator rather than builder and operator of transportation options in the region.

The transit agency's role may evolve to being a "watchdog" for private mobility operators to ensure that environmental and social justice is being maintained through the private transit provision. If the transit agency ends up contracting out more of its service operations or using TNCs or other private operators to enhance their mobility offerings, the agency will need to serve as the regulator to ensure proper adherence to industry guidelines and institutional requirements. The agency's influence over the private sector will increase, and it can use its power as a liaison with the federal government (which provides funding opportunities) to steer private companies into compliance with federal mandates and focus more on the social service aspect of transportation. In addition, the transit agency may have the opportunity to address local social needs such as requiring a TNC to operate in an underserved geographic area or subsidizing rides for lower-income people just as they currently subsidize rides on their buses and trains. Some issues of concern with partnering with TNCs such as driver wages and the availability of

accessible vehicles can be overcome if the agency takes on the role of industry watchdog and technology and mobility integrator.

Transport geography and future research

Transportation geographers today conduct a good deal of research on how to solve the problems created by automobility: congestion, fatalities, pollution, social exclusion, etc. We have reached a pivotal time in history where technology advancement and the pace of mobility growth are converging to create a sweeping change in the transportation landscape. One of the biggest potential advances in technology is automated and connected vehicles (AVs). Ridesourcing companies are betting on the technology to lower their labor costs and finally produce a profit for shareholders. Transport geographers have experience studying the spatial interactions of multiple modes and their interaction with human behavior as well as forecasting the changes in the transportation network that technology can bring. Connected and autonomous vehicles are likely to usher society into the next transportation epoch, but the full impacts and consequences have yet to be determined. Geographers must stay at the front lines of this burgeoning technology, influencing policy and practice, and studying the impacts of AVs on public transit.

Increasingly, transport geographers, planners, and policymakers are looking for solutions to congestion, population growth, access, and pollutions through a modal shift to more active modes as well as transit. Sustainable transport theory argues that environmental costs should be included in cost-benefit analyses and investment in sustainable transportation should be encouraged for longer-term economic development

(Black, 2010). Transport researchers must keep sustainability at the forefront of transportation discussions. Geographers look at the spatial aspects of transport, and this should include the spatial aspects of mobility equity and carbon emissions produced from the transport sector.

Neoliberalism in transportation has grown, and public transit has not been immune to the call to turn to the private sector for more efficiency and cost savings. Public transit was once seen as a public service for the common good, and agencies need to maintain their authority in providing mobility to all citizens. A recent opinion piece in the New York Times that discussed P3s with ridesourcing companies stated that "risks of privatization are grave," and these companies could draw people away from public transport all together, especially more elite and well-off people, which in turn would undermine financial support for public transit (Kim, 2019). In addition, the negative impacts of heavy reliance on ridesourcing such as congestion and pollution are significant externalities that should be at the forefront of partnership discussions. Public transit agencies strive to be transparent and are held accountable by their public constituents. Partnerships with TNCs could improve mobility and lower costs for one segment of the population, but at what other environmental and equity costs? This question is fundamental to measuring and assessing the impacts of ridesourcing in a city, and must be taken into account by public agencies seeking such partnerships. In any P3 that the transit agency enters into, it is paramount that it uses its position to ensure that public interests are being protected through the partnership.

As shown in the case studies in Chapter 4, TNCs could help solve the first and last mile problem, eliminate expensive paratransit and call-n-ride services, and fill in spatial and time gaps in the transit network, but they also introduce other negative externalities. One solution to leveraging ridesourcing benefits and reducing the negative externalities of deadhead, overhead, and chauffeured single-occupancy vehicles is the mobility hub. Mobility hubs typically include access to bike and car sharing near a high frequency bus or rail stop, harnessing the value of the growing shared economy. Placing multiple users in one place increases the opportunities for shared TNC rides, such as UberPool and LyftLine. The mobility hub allows TNCs to better complement and enhance public transit. Bringing in the private sector through public-private partnerships (P3s) with TNCs could help achieve innovation and efficiency in the mobility hub. Public agencies have the opportunity to engage with TNCs to ensure that the benefits of ridesourcing are shared widely and equitably with all potential users and help to encourage transit rather than threaten it (Feigon and Murphy, 2016; Kuhr, 2017). Partnerships with TNCs would need to result in lowering the cost of ridesourcing to make them a viable option for first and last mile connections, which could be done by the transit agency subsidizing fares or creating an incentive or preferred partner status for a specific TNC company. Partnership in the mobility hubs also generates large pools of customers, thereby maximizing ridematching rates and resulting in lower fares.

Transport geographers are grappling with how to sift through the ever increasing "big data" and best use it for policy and decision-making. Mobile phones and ubiquitous GPS technology provide 24-hour access to people's movements and travel, resulting in

huge spatial data sets for geographers to wade through. The full potential of this data have not yet been realized, but the availability of new data is likely to spur new applications and methods to answer transportation research questions. Much of this data collection relies on data sharing between public agencies, the private sector, and community or institutional stakeholders. An integrated smart card that can be used for all modes is the best way to gather data about individual users and their trips. Using one card for all modes allows you to track multimodal trips and trip chaining and spatially analyze the movement of users within the hub and the city. Data sharing agreements with TNCs can be included as a part of a preferred partnership with transit or in exchange for providing pick up and drop off zones at the hub. As more data becomes available from ridesourcing companies, statistical and spatial analysis can be used to more quantitatively measure the impact of partnerships on people's mobility and accessibility in order to more fully assess costs and benefits of service provision partnerships. This research shows that although P3s have been used to a lesser extent in the U.S., they are practical and possible in the context of growing private sector participation in transportation. The research presented in chapter 2 on transit infrastructure P3s in Denver showed that like other international P3 studies, the benefits P3s in the Denver case studies were lower costs, on-time completion, and transference of appropriate risks.

Additional future research in transportation infrastructure P3s should include a national comparative study across several cities to analyze P3 applications, agreements, and results in various contexts. Analysis of the full life cycle of an infrastructure P3 such as the Eagle P3 is required to determine whether such long-term concession agreements

end up being a good deal for the public agency and taxpayers. An analysis of the risk transfer in agreements like the Eagle P3 and U.S. 36 toll road is also necessary. A follow-up study is warranted to determine, in light of recent court filings and operations issues, if the Denver model of P3s in transport infrastructure can still be seen as a model for other agencies and cities interested in pursuing private sector involvement in infrastructure provision.

Future growth in shared-use rail corridors is likely to increase. Future research on the operations and maintenance agreements of both shared-use rail corridors and rail transit service provision should be undertaken to see how effective negotiated agreements were in anticipating future costs and needs of each party. Several past CDOT studies pointed to the Front Range corridor as the next feasible expansion of rail in Colorado, and the state legislature has now funded a Front Range Rail Passenger Commission to study the possibility of building different levels of service in this corridor. The Front Range corridor will require close collaboration and planning with the host railroads, and future research could help determine the best way to begin service and property acquisition.

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Appendix A

Survey instrument Paper 1

Interview Questions

1. Which of the following categories best describes your current affiliation:

Transit agency _____
Private contractor _____
Local Government _____
State Government _____
Federal Government _____
Business community _____
Non-profit advocacy organization _____
General public _____
Other (please specify)
_____

2. Please rate your level of familiarity with each of the following public-private partnership (PPP) projects in the Denver area:

Eagle P-3

Extremely Familiar ____	Generally Familiar ____	Somewhat Familiar ____	Not Familiar ____

Denver Union Station

Extremely Familiar ____	Generally Familiar ____	Somewhat Familiar ____	Not Familiar ____

US 36 Bus Rapid Transit

Extremely Familiar ____	Generally Familiar ____	Somewhat Familiar ____	Not Familiar ____

I-225 Line

Extremely Familiar ____	Generally Familiar ____	Somewhat Familiar ____	Not Familiar ____

North Metro Line

Extremely Familiar ____	Generally Familiar ____	Somewhat Familiar ____	Not Familiar ____

Additional comments:

_____

_____

3. How would you rate each of these projects based on how effectively they address transportation needs in the Denver region:

Eagle P-3

Extremely Effective ____	Generally Effective ____	Fairly Effective ____	Fairly Ineffective ____	Generally Ineffective ____	Extremely Ineffective _

Denver Union Station

Extremely Effective	Generally Effective	Fairly Effective	Fairly Ineffective	Generally Ineffective	Extremely Ineffective
____	____	____	____	____	_

US 36 Bus Rapid Transit

Extremely Effective	Generally Effective	Fairly Effective	Fairly Ineffective	Generally Ineffective	Extremely Ineffective
____	____	____	____	____	_

I-225 Line

Extremely Effective	Generally Effective	Fairly Effective	Fairly Ineffective	Generally Ineffective	Extremely Ineffective
____	____	____	____	____	_

North Metro Line

Extremely Effective	Generally Effective	Fairly Effective	Fairly Ineffective	Generally Ineffective	Extremely Ineffective
____	____	____	____	____	_

_

Additional comments:

_____

_____

4. How would you rate each of these projects based on their financial benefit for the Denver Regional Transportation District (RTD):

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Additional comments:

_____

_____

5. How would you rate each of these projects based on their financial benefit for the private consortium involved in each project:

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Additional comments:

_____

6. How would you rate each of these projects based on their financial and social benefits for the Denver community at-large:

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

Additional comments:

_____

_____

7. How would you rate each of these projects based on the level of information provided to the general public about these projects:

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

Additional comments:

_____

_____

8. How would you rate each of these projects based on its contribution to stronger regional collaboration:

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	____

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Additional comments:

_____

_____

9. Overall, how would you rate the success of each of these projects thus far:

Eagle P-3

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Denver Union Station

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

US 36 Bus Rapid Transit

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

I-225 Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

North Metro Line

Extremely Favorable	Generally Favorable	Fairly Favorable	Fairly Unfavorable	Generally Unfavorable	Extremely Unfavorable
____	____	____	____	____	

Additional comments:

_____

_____

10. How far do you agree or disagree with the following statements about transit public-private partnerships (circle your response as follows: 1=Strongly Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Strongly Disagree).

Such partnerships ….

(1) Reduce the financial burden on local taxpayers: 1 / 2 / 3 / 4 / 5

(2) Reduce public risk for major infrastructure projects: 1 / 2 / 3 / 4 / 5

(3) Transfer most of the burden to the private sector: 1 / 2 / 3 / 4 / 5

(4) Transfer most of the risk to the private sector: 1 / 2 / 3 / 4 / 5

(5) Spread the financial burden equitably between the public and private sectors: 1 / 2 / 3 / 4 / 5

(6) Spread the risk equitably between the public and private sectors: 1 / 2 / 3 / 4 / 5

(7) Make the local economy too dependent on federal funding: 1 / 2 / 3 / 4 / 5

(8) Make the local economy too dependent upon global investors: 1 / 2 / 3 / 4 / 5

(9) Enhance the delivery of major infrastructure projects: 1 / 2 / 3 / 4 / 5

(10) Reduce local public accountability for key infrastructure: 1 / 2 / 3 / 4 / 5

(11) Foster regional collaboration: 1 / 2 / 3 / 4 / 5

Additional comments on any or all of the above:

_____

_____

11. Overall, what in your view are the major benefits of these public-private partnerships?

(1) _____
(2) _____
(3) _____

12. Likewise, what are their major shortcomings?

(1) _____
(2) _____
(3) _____

13. To what extent do you feel that these transit public-private partnerships in Denver could serve as a model for other regions seeking to expand their transit infrastructure? Please be specific in explaining why or why not these PPPs could serve as a model.

_____

_____

_____

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_____

_____

(For transit agency and other respondents)

1. If you could choose whether these projects would be conducted as PPPs or conducted by the transit agency alone, which would you prefer and why?

_____
_____
_____
_____

2. What elements, if any, in these PPP contracts provide assurances that the greater public interest is being protected?

_____
_____
_____
_____

3. Do you know what the debt burden will be? Is there a danger that PPP instruments will deliberately be bankrupted and stick the public with a huge tab?

_____
_____
_____
_____

14. Please provide any additional comments about the public-private partnerships mentioned in this survey.

_____
_____
_____
_____
_____
_____
_____
_____

Thank you for your time and input!

Tables of Survey Results

Q3. How would you rate each of these projects based on how effectively they address transportation needs in the Denver region:															
	Extremely effective		Extremely/ Generally		Generally effective		Generally/ Fairly effective		Fairly favorable		Fairly effective		Generally ineffective		Extremely ineffective		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	70.0%	14	0.0%	0	25.0%	5	0.0%	0	5.0%	1	0.0%	0	0.0%	0	0.0%	0	20
Denver Union Station	95.0%	19	0.0%	0	5.0%	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
US 36 Bus Rapid Transit	73.7%	14	0.0%	0	26.3%	5	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	19
I-225 Line	27.8%	5	0.0%	0	55.6%	10	5.6%	1	11.1%	2	0.0%	0	0.0%	0	0.0%	0	18
North Metro Line	33.3%	6	0.0%	0	44.4%	8	0.0%	0	22.2%	4	0.0%	0	0.0%	0	0.0%	0	18

Q3	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	4	6	5.65	0.57	0.33	20
Denver Union Station	5	6	5.95	0.22	0.05	20
US 36 Bus Rapid Transit	5	6	5.74	0.44	0.19	19
I-225 Line	4	6	5.14	0.62	0.38	18
North Metro Line	4	6	5.11	0.74	0.54	18

Q4. How would you rate each of these projects based on their financial benefit for the Denver Regional Transportation District (RTD):															
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	85.0%	17	0.0%	0	15.0%	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
Denver Union Station	84.2%	16	0.0%	0	15.8%	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	19
US 36 Bus Rapid Transit	47.4%	9	0.0%	0	42.1%	8	0.0%	0	0.0%	0	10.5%	2	0.0%	0	0.0%	0	19
I-225 Line	46.7%	7	6.7%	1	33.3%	5	6.7%	1	6.7%	1	0.0%	0	0.0%	0	0.0%	0	15
North Metro Line	40.0%	6	6.7%	1	20.0%	3	6.7%	1	20.0%	3	6.7%	1	0.0%	0	0.0%	0	15

Q4	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	5	6	5.85	0.36	0.13	20
Denver Union Station	5	6	5.84	0.36	0.13	19
US 36 Bus Rapid Transit	3	6	5.26	0.91	0.83	19
I-225 Line	4	6	5.4	0.64	0.41	15
North Metro Line	3	6	5.07	0.95	0.9	15

Q5. How would you rate each of these projects based on their financial benefit for the private consortium involved in each project:																
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	18.8%	3	0.0%	0	62.5%	10	6.3%	1	12.5%	2	0.0%	0	0.0%	0	0.0%	0	16
Denver Union Station	41.2%	7	0.0%	0	52.9%	9	0.0%	0	5.9%	1	0.0%	0	0.0%	0	0.0%	0	17
US 36 Bus Rapid Transit	25.0%	3	0.0%	0	58.3%	7	0.0%	0	16.7%	2	0.0%	0	0.0%	0	0.0%	0	12
I-225 Line	30.0%	3	0.0%	0	50.0%	5	0.0%	0	20.0%	2	0.0%	0	0.0%	0	0.0%	0	10
North Metro Line	30.0%	3	0.0%	0	50.0%	5	0.0%	0	20.0%	2	0.0%	0	0.0%	0	0.0%	0	10

Q5	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	4	6	5.03	0.57	0.33	16
Denver Union Station	4	6	5.35	0.59	0.35	17
US 36 Bus Rapid Transit	4	6	5.08	0.64	0.41	12
I-225 Line	4	6	5.1	0.7	0.49	10
North Metro Line	4	6	5.1	0.7	0.49	10

Q6. How would you rate each of these projects based on their financial and social benefits for the Denver community at-large:																
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	80.0%	16	5.0%	1	15.0%	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
Denver Union Station	85.0%	17	0.0%	0	15.0%	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
US 36 Bus Rapid Transit	68.4%	13	0.0%	0	26.3%	5	0.0%	0	0.0%	0	0.0%	0	5.3%	1	0.0%	0	19
I-225 Line	41.2%	7	5.9%	1	41.2%	7	0.0%	0	11.8%	2	0.0%	0	0.0%	0	0.0%	0	17
North Metro Line	43.8%	7	6.3%	1	37.5%	6	0.0%	0	12.5%	2	0.0%	0	0.0%	0	0.0%	0	16

Q6	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	5	6	5.83	0.36	0.13	20
Denver Union Station	5	6	5.85	0.36	0.13	20
US 36 Bus Rapid Transit	2	6	5.53	0.94	0.88	19
I-225 Line	4	6	5.32	0.66	0.44	17
North Metro Line	4	6	5.34	0.68	0.46	16

Q7. How would you rate each of these projects based on the level of information provided to the general public about these projects:																	
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	45.0%	9	0.0%	0	25.0%	5	0.0%	0	25.0%	5	0.0%	0	5.0%	1	0.0%	0	20
Denver Union Station	45.0%	9	5.0%	1	35.0%	7	0.0%	0	10.0%	2	0.0%	0	5.0%	1	0.0%	0	20
US 36 Bus Rapid Transit	25.0%	5	0.0%	0	15.0%	3	0.0%	0	35.0%	7	5.0%	1	20.0%	4	0.0%	0	20
I-225 Line	44.4%	8	0.0%	0	33.3%	6	0.0%	0	16.7%	3	0.0%	0	5.6%	1	0.0%	0	18
North Metro Line	41.2%	7	0.0%	0	29.4%	5	0.0%	0	29.4%	5	0.0%	0	0.0%	0	0.0%	0	17

Q7	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	2	6	5.05	1.07	1.15	20
Denver Union Station	2	6	5.22	0.98	0.96	20
US 36 Bus Rapid Transit	2	6	4.2	1.4	1.96	20
I-225 Line	2	6	5.11	1.05	1.1	18
North Metro Line	4	6	5.12	0.83	0.69	17

Q8. How would you rate each of these projects based on its contribution to stronger regional collaboration:																	
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	52.6%	10	10.5%	2	31.6%	6	0.0%	0	5.3%	1	0.0%	0	0.0%	0	0.0%	0	19
Denver Union Station	63.2%	12	10.5%	2	15.8%	3	0.0%	0	10.5%	2	0.0%	0	0.0%	0	0.0%	0	19
US 36 Bus Rapid Transit	36.8%	7	10.5%	2	36.8%	7	0.0%	0	5.3%	1	5.3%	1	0.0%	0	5.3%	1	19
I-225 Line	27.8%	5	11.1%	2	50.0%	9	0.0%	0	11.1%	2	0.0%	0	0.0%	0	0.0%	0	18
North Metro Line	31.6%	6	10.5%	2	52.6%	10	0.0%	0	5.3%	1	0.0%	0	0.0%	0	0.0%	0	19

Q9. Overall, how would you rate the success of each of these projects thus far:																	
	Extremely favorable		Extremely/ Generally		Generally favorable		Generally/ Fairly		Fairly favorable		Fairly unfavorable		Generally unfavorable		Extremely unfavorable		Total
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	
Eagle P-3	60.0%	12	0.0%	0	40.0%	8	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
Denver Union Station	100.0%	20	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	20
US 36 Bus Rapid Transit	40.0%	8	0.0%	0	55.0%	11	0.0%	0	0.0%	0	5.0%	1	0.0%	0	0.0%	0	20
I-225 Line	28.6%	4	0.0%	0	50.0%	7	0.0%	0	21.4%	3	0.0%	0	0.0%	0	0.0%	0	14
North Metro Line	38.5%	5	0.0%	0	53.8%	7	0.0%	0	7.7%	1	0.0%	0	0.0%	0	0.0%	0	13

Q8	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	4	6	5.53	0.57	0.33	19
Denver Union Station	4	6	5.58	0.65	0.43	19
US 36 Bus Rapid Transit	1	6	5.05	1.22	1.5	19
I-225 Line	4	6	5.22	0.61	0.37	18
North Metro Line	4	6	5.32	0.54	0.3	19

Q9	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Eagle P-3	5	6	5.6	0.49	0.24	20
Denver Union Station	6	6	6	0	0	20
US 36 Bus Rapid Transit	3	6	5.3	0.71	0.51	20
I-225 Line	4	6	5.07	0.7	0.49	14
North Metro Line	4	6	5.31	0.61	0.37	13

Q10. How far do you agree or disagree with the following statements about transit public-private partnerships: Such partnerships...	Strongly agree	Strongly Agree/ Agree	Agree	Agree/ Neutral	Neutral	Disagree	Strongly Disagree	Total
(1) Reduce the financial burden on taxpayers	31.6% 6	0.0% 0	31.6% 6	5.3% 1	31.6% 6	0.0% 0	0.0% 0	19
(2) Reduce public risk for major infrastructure projects	60.0% 12	5.0% 1	25.0% 5	0.0% 0	5.0% 1	5.0% 1	0.0% 0	20
(3) Transfer most of the burden to the private sector	20.0% 4	0.0% 0	45.0% 9	0.0% 0	20.0% 4	10.0% 2	5.0% 1	20
(4) Transfer most of the risk to the private sector	25.0% 5	0.0% 0	45.0% 9	5.0% 1	15.0% 3	10.0% 2	0.0% 0	20
(5) Spread the financial burden evenly between the public and private sectors	15.0% 3	0.0% 0	40.0% 8	5.0% 1	25.0% 5	15.0% 3	0.0% 0	20
(6) Spread the risk evenly between the public and private sectors	15.0% 3	0.0% 0	45.0% 9	5.0% 1	15.0% 3	20.0% 4	0.0% 0	20
(7) Make the local economy too dependent on federal funding	0.0% 0	0.0% 0	0.0% 0	0.0% 0	15.0% 3	40.0% 8	45.0% 9	20
(8) Make the local economy too dependent upon global investors	0.0% 0	0.0% 0	5.0% 1	0.0% 0	10.0% 2	45.0% 9	40.0% 8	20
(9) Enhance the delivery of major infrastructure projects	85.0% 17	0.0% 0	10.0% 2	0.0% 0	5.0% 1	0.0% 0	0.0% 0	20
(10) Reduce local public accountability for key infrastructure	0.0% 0	0.0% 0	5.0% 1	0.0% 0	10.0% 2	45.0% 9	40.0% 8	20
(11) Foster regional collaboration	35.0% 7	5.0% 1	45.0% 9	0.0% 0	10.0% 2	0.0% 0	5.0% 1	20

Q 10	Minimum	Maximum	Mean	Std Deviation	Variance	Count
(1) Reduce the financial burden on taxpayers	3	5	3.97	0.8	0.64	19
(2) Reduce public risk for major infrastructure projects	2	5	4.47	0.8	0.64	20
(3) Transfer most of the burden to the private sector	1	5	3.65	1.06	1.13	20
(4) Transfer most of the risk to the private sector	2	5	3.88	0.89	0.8	20
(5) Spread the financial burden evenly between the public and private sectors	2	5	3.58	0.91	0.83	20
(6) Spread the risk evenly between the public and private sectors	2	5	3.58	0.97	0.93	20
(7) Make the local economy too dependent on federal funding	1	3	1.7	0.71	0.51	20
(8) Make the local economy too dependent upon global investors	1	4	1.8	0.81	0.66	20
(9) Enhance the delivery of major infrastructure projects	3	5	4.8	0.51	0.26	20
(10) Reduce local public accountability for key infrastructure	1	4	1.8	0.81	0.66	20
(11) Foster regional collaboration	1	5	4.13	0.95	0.9	20