Why Can’t We Be Friends?
Reducing Conflicts Between Bicycles and Trucks

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# Contents

1 Abstract 7

2 Introduction 9

3 Literature Review 11
   - Truck Driver Perceptions 11
   - Bicycle and Truck Incidents 11
   - Bicycle Lane Obstruction 12
   - Summary 13

4 Other Cities 15
   - Introduction 15
   - Portland, Oregon 15
   - Vancouver, British Columbia 17
   - San Francisco, California 19
   - Oakland, California 20
   - Long Beach, California 22
   - Los Angeles, California 23
   - New York City, New York 23
   - Jersey City, New Jersey 26
   - Pittsburgh, Pennsylvania 27
   - Summary 28

5 Incident Data Analysis 29
   - Introduction 29
   - Data 29
   - Findings 29
   - Summary 30

6 Media Search 33
   - Introduction 33
   - Methodology 33
   - Findings 34
   - Discussion and Summary 44

7 Conclusions 45

8 Future Research 47
   - Current Literature and Best Practices 47
   - Media Search 47
   - Incidents and Data 48

9 Appendix A 49
   - Additional Data from the Media Search 49
Abstract

Efficient urban goods movement is important to local and regional economies. In addition, many cities are seeking to reduce congestion and its environmental impacts, and to reduce obesity by encouraging shifts to bicycling. To encourage this shift, cities are often forced to designate bicycle routes along existing truck routes. Due to interest in mobility, concerns for safety, and the constraints of limited budgets and rights-of-way, these two modes are seemingly incompatible. This study explores the nature of the potential conflict between truck needs and bicycle needs in the City of Seattle, and seeks to identify approaches for handling these challenges. To accomplish this, the existing professional literature was reviewed, practices of similar cities were assessed, bicycle incidents in Seattle were analyzed, and a Seattle-based media search was conducted. The study finds that conflict between bicycling and trucking in Seattle appears to be more of a communication and relationship problem rather than a physical problem. The research indicates that bicycles and trucks can exist successfully in the same city by separating bicycle traffic from truck traffic and by developing context sensitive solutions.
Introduction

Efficient movement of freight on Seattle city streets is important to the local and regional economy. At the same time, the city has a stated goal to increase the use of bicycling in Seattle for all trip purposes. These two modes are seemingly incompatible: bicycles can impede truck flow, and the sheer size of trucks can be intimidating to bicyclists. Contributing to this problem is the fact that these two modes share a preference for avoiding both hills and frequent stops. Currently, options for new bicycle and truck roadway facilities are limited due to established and constrained street widths and are exacerbated by limited budgets. As a result there is a potential conflict between these two important groups of users on Seattle city streets.

This report represents a body of research completed by Master of Urban Planning students from the University of Washington’s Department of Urban Design and Planning as part of a second year land use and transportation studio. In this exploratory research the team sought insight to inform the work of several interested parties, including freight planners, bicycle planners, bicycle advocates, and the freight community.

The research was composed of four main content areas. A literature review was conducted to assess what is currently known or under discussion by the planning and related professional communities. The practices of other North American cities (Portland, Vancouver, B.C., San Francisco, Oakland, Long Beach, Los Angeles, New York City, Jersey City, and Pittsburgh) were investigated to expand the knowledge base of possible methods to address the issue. Plan review and interviews with personnel were conducted where possible. Seattle-specific bicycle/vehicle incident data were analyzed to assess the situation from a safety perspective. A disaggregation by vehicle type was performed on the incident data to identify which particular types of vehicles and trucks had the most frequent incidents with bicyclists. And, finally, a media search of bicycle and truck interactions over the past twenty years was conducted to better understand the current and historical relationship between freight interests and the bicycling community in Seattle and the surrounding areas.

Prior to researching the four main content areas listed above, several key spatial characteristics were assessed to identify existing conditions. The City of Seattle’s 178 lane miles of truck routes were overlaid with the 304 existing lane miles of bicycle routes identified in the 2007 Bicycle Master Plan: 79 of these miles were common to both (see fig. 1).

The most recent bicycle count data were also mapped. The highest bicycle counts are at some of the most important routes throughout the city (see fig. 2).

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1Seattle Bicycle Master Plan 2007
Figure 1: Bicycle and Truck Facility Overlaps

Figure 2: Bicycle Counts
Literature Review

Very little research exists that examines interactions between bicycles and trucks. The small body of research available includes studies on truck driver perceptions of safety standards and bicycle behavior, crashes between bicycles and trucks, and obstruction of bicycle lanes from parked trucks.

Truck Driver Perceptions

Truck driver perceptions of safety standards and bicycle behavior are addressed in one article. Pivo et al. collected information from truck driver focus groups around the Seattle area and found that truckers perceive themselves as being held to very high and ridged safety standards. Alternatively, they view bicyclists as exhibiting unpredictable behavior and as not being held to operational standards.²

Bicycle and Truck Incidents

The issue of incidents between trucks and bicycles has been the topic of several studies. A British study that investigated a high level of bicycling crashes involving "heavy goods vehicles" found these vehicles to be both a deterrent and a hazard to bicyclists on urban streets. On British roads, heavy goods vehicles caused 30 percent of the bicyclist fatalities and only accounted for 7 percent of the traffic volume.³

Another study, conducted by Moore et. al., analyzed crashes of bicycles with motor vehicles from 2002 to 2008 in Ohio. The authors found that pickup trucks, vans, mini vans, and semi-trucks accounted for approximately 23 percent of the crashes. They also found that at intersections the likelihood of severe injury increases by about 141 percent if the vehicle involved is a van, and at non-intersection locations the likelihood of severe injury increases by nearly 100 percent if the vehicle involved is a semi-truck.⁴

The most recent bicycle safety study in New York City showed similar results. Large vehicles, including trucks and buses, were implicated in nearly a third of fatal crashes, while only comprising between 5 and 17 percent of daily traffic.⁵ Ackerly et. al. analyzed road deaths reported by the National Highway Safety

Administration in 2008, along with non-bicyclists road deaths per state immediately before and after the sample period as a control. The authors found that bicycle deaths from large vehicle incidents, especially freight trucks, were common when compared with the control group.6

Allen-Munley and Daniel analyzed four years of bicycle crash data from Jersey City, New Jersey, and found that the probability of a crash resulting in death or serious injury was almost twice as likely on a truck route than on a non-truck route.7

Bicycle Lane Obstruction

The problem of bicycle lane obstruction was examined in several studies. Tuckel and Milczarski examined a five to six block bicycle lane in Midtown Manhattan, and found that over a given ten minute period there was a 60 percent likelihood of a vehicle obstruction. Of the vehicle obstructions, about 20 percent were caused by trucks and vans.8 Conway et. al. studied truck parking behavior in and adjacent to three curb use street configurations (see fig. 3) along high volume truck and bicycle routes in New York City.9

Figure 3: Bicycle Lane Configuration

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8Milczarski, W., and P. Tuckel. 2009. Bike Lanes or Blocked Lanes? Hunter College, CUNY.

Their study documented thirty-five conflicts. Twenty-six of these conflicts were caused by trucks parking in the bicycle lanes and two were a result of “trucks crossing the bike lane to park.” The remainder of the conflicts occurred when the trucks were located outside of the bicycle lane, which included bicycles that moved to avoid close proximity to the trucks or near “dooring” events. The researchers also found that the best design to prevent conflicts was the curbside bicycle lane with a buffer and vehicle parking between the bicycle lane and the traffic lane (see fig. 3). Alternatively, the design with the greatest conflict was the bicycle lane on the traffic side of the parking lane with a buffer strip between the bicycle lane and the traffic lane (see fig. 3). Obstructions may occur in this facility type because commercial vehicles park in the buffer and bicycle lane to remain protected from traffic. The conflicts observed in this study occurred primarily during delivery or pick-up, when trucks were parking in the bicycle lane or were crossing the bicycle lane to park.\(^\text{10}\)

In addition, Reynolds et al. analyzed twenty-three papers on transportation infrastructure and bicyclist safety and found that the literature was limited with regards to the range of facilities studied and the ability to control for exposure to risk. Examples of infrastructure that lacks safety studies include: traffic circles, bicycle boxes, sharrows, speed bumps/humps, and traffic diverters. The researchers also found that clearly-marked, bicycle-specific facilities are safer for bicyclists when compared to on-road cycling with traffic or off-road cycling with pedestrians and other users. These facilities reduce injury or crash rates by about half when compared to unmodified roadways. In addition, cyclist safety at night was affected by the quality of street-lighting, pavement and road maintenance, and the gradient of the road.\(^\text{11}\) Similarly, research conducted by Teschke et al. found that out of fourteen types of bicycle routes in Toronto and Vancouver, Canada, cycle tracks had the lowest risk of bicyclist injury.\(^\text{12}\)

**Summary**

In general, little research has been conducted that examines the effects on bicyclists from urban goods movement, and even less research exists that analyzes the effects on urban goods movement from bicycle infrastructure. Key findings from the literature review are that bicycle crashes with large vehicles are much more likely to cause severe injury or death to the bicyclist. Bicycle lane obstruction by trucks is a common problem and bicycle lane configuration can significantly affect the likelihood of bicycle lane obstruction. And most significantly, the creation of well-marked bicycle specific facilities significantly reduces the risk of bicycle crashes and injury.

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\(^{10}\) Ibid.


Other Cities

Introduction

To better understand the nature of bicycle and truck conflict and to explore potential solutions to the conflict, the research team investigated the practices of other cities in the United States and Canada. Cities were chosen based on the proximity to a port that generates truck traffic and/or climate and topography similar to Seattle.

For each city an analysis of the city’s bicycle plan and freight/truck plan was conducted when such documents were available. All cities had a bicycle plan, but some cities did not have freight/truck plans. In this case documents from the city’s port were examined. These documents were searched for terms such as “truck,” “freight,” and “bicycle” to determine if potential conflicts between these modes were addressed. Interviews with city and port planners were also conducted when possible. This section provides an overview of truck and bicycle interactions in different cities and identifies some of the ways that cities have addressed the challenges that result from overlaps in bicycle and truck routes.

The description of each city contains an overview of relevant bicycle and freight facts and figures, what is known about the issues in that city, and the relevance and applicability of these findings for Seattle.

Portland, Oregon

Overview of the Area

Portland is widely regarded as a national leader in cycling infrastructure. The first bicycling master plan was developed in 1996. Since that time bicycle mode share has risen from 2 percent in 1996 to 8 percent in 2008. By 2010 the city had established a bicycle network of over 300 miles. As Pacific Northwest neighbors, Portland and Seattle share many bicycling-related considerations, including issues with precipitation, topography, limited daylight hours in winter, and commercial and industrial waterfront activities.

What is known about the Issue in the Study Area

Portland’s freight planning community has taken a proactive approach in the management of the potential mode conflict between bicyclists and trucks. The Freight Master Plan, the Bicycle Master Plan, and...
the Street Design Guidelines for Trucks all contain substantive information on interactions with other modes. Truck routes are categorized as "designed for" or "accommodating" trucks. A different set of design guidelines is imposed depending on the distinction between "designed for" and "accommodated." These guidelines most commonly address intersection design. In the central city, most routes are adapted only to "accommodate" trucks, which makes it possible for them to maneuver, but has less of an emphasis on efficiency. The city has made a conscious trade-off between efficiency of truck movement in the central city and the optimization of non-motorized modes. These design guidelines address issues such as curb cuts, bicycle lane placement, and pedestrian refuges at intersections.

Robert Hillier with the Portland Department of Transportation, provided additional detail and specific examples of the city’s strategy to embrace "context-sensitive design" when addressing mode conflicts. Parking spaces have been removed in some cases in order to accommodate trucks downtown. Mr. Hillier noted that removing parking spaces is typically a major issue with downtown businesses. However, businesses near streets with limited road widths or near key intersections were convinced to "get on board and make [the] trade off" when the issues was framed in terms of greater efficiency and ease of delivery for trucks.

There is no one strategy that has been applied to managing the conflict between bicycling and freight in

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16Robert Hiillier, Portland Department of Transportation, personal communication, November 2012.
Portland. Each situation is examined on a case-by-case basis. According to Hillier, the freight community usually advocates for separation, but the city prefers to examine each situation independently. For example, in the central city some older streets that are preferred by both bicyclists and trucks, have only sharrows and the natural traffic calming effect of the narrow width of the road. No further facilities have been deemed necessary to accommodate both modes. On streets where it has been determined to be too difficult to safely accommodate both trucks and bicycles, the strategy has been to route bicycles to parallel streets.

The context-sensitive approach of Portland does appear to be somewhat ad hoc, and lacking in predictability. However, further research is warranted: it may be that when reviewed in more depth, especially by a transportation professional, this seemingly ad hoc approach is actually more systematic than it first appears.

Relevance to Seattle

Portland and Seattle share many characteristics, so much of Portland’s strategy may be relevant for Seattle. The over-arching strategy has been the application of a context-sensitive approach—separating where necessary, sharing on slower routes, and re-routing when possible—combined with the active engagement of the freight community. Additionally, the elimination of parking spaces at key intersections to better accommodate trucks may be promising for Seattle, especially when framed as a benefit to businesses in the form of increased access for deliveries.

Vancouver, British Columbia

Overview of the Area

Port Metro Vancouver is Canada’s busiest and largest port, located in the heart of downtown Vancouver, B.C. Cargo voyages are the port’s mainstay, with 2.5 million TEUs traveling through the port a year.\(^\text{17}\)

Bicycle use in Vancouver has risen steadily since the early 1990s. In 1994, 1.3 percent of all trips in the downtown area were by bicycle.\(^\text{18}\) In 2008, 3 percent of all trips were by bicycle. By the year 2020, Vancouver is planning for an increase to 7 percent and to 12 percent by 2040. In downtown Vancouver, currently more than 10 percent of the residents commute by bicycle.

What is known about the Issue in the Study Area

Streets in downtown Vancouver follow a grid pattern. Unlike Seattle’s dominant north/south layout, Vancouver more closely resembles a square. This geography makes it easier to take full advantage of the grid pattern where alternate routes are more feasible (see fig. 5).

Still, Vancouver does have some roadways dedicated to both trucks and bicycles. Of these, the lower volume streets have on-street facilities, in some cases only sharrows. The city has named some of the routes serving the port, specifically, as “key port truck routes.” The only key port truck route that is also a bicycle route has an off-street bikeway.

Relevance to Seattle

Vancouver has a higher level of cycling adoption than Seattle—more users, facilities, and investment. The terrain is less hilly, and Vancouver does not have the north/south constrained geography. However, Van-


Vancouver has a similar climate, limited daylight in winter, and a busy port with freight that must compete for city street space.

San Francisco, California

Overview of the Area

San Francisco is the second densest major city in the United States, behind New York City, and has just over 800,000 people. San Francisco’s share of commute trips is up from 2.1 percent in 2008 to 3.5 percent of trips in 2012. The city has a goal to increase bicycle trips to 20 percent of trips by the year 2020.

The city has sixty-five miles of bike lanes, twenty-five of which were added in the last five years. While this number might seem low, it should be noted that contrasted with Seattle, San Francisco is roughly half the size in square miles, with roughly half the number of lane miles. Since 2008, there has been a decrease in illegal sidewalk bicycle riding, with 94 percent of cyclists now riding legally. This could be due in part to the city’s willingness to cite cyclists not just for lack of helmet, but for actual riding behavior. They have been issuing fix-it tickets and requiring traffic school for infractions.

What is known about the Issue in the Study Area

Conflicts between freight and bicyclists are primarily focused on delivery vehicles because San Francisco does not have a major regional port. Across the San Francisco Bay, the Port of Oakland is the Northern California mega-region’s busiest port.

San Francisco has limited delivery zones in the downtown area. According to Elizabeth Sall of the San Francisco Municipal Transit Agency, problems exist between delivery trucks and bicycles when the trucks park in the bicycle lanes because they are not allowed to park curbside during certain hours. The city has adopted a strategy of physically separating bicycle lanes where possible so that commercial vehicles cannot block the lanes.

Enforcement and education measures are given substantial attention in the San Francisco Bicycle Plan. It is their practice to give citations for moving violations to cyclists, and their plan has a stated goal to increase citations for the violations that are related to the behaviors that pose the greatest safety threat.

The bicycle advocacy group, San Francisco Bicycle Coalition, has published a schematic designed to educate truck drivers to watch for cyclists. There is no known program for educating cyclists to the dangers of riding near trucks.

The city’s transportation plan advocates routing trucks and bicycles to separate streets where possible.


22Elizabeth Sall, San Francisco Metropolitan Transportation Authority, personal communication, November, 2012.


San Francisco is famously hilly, but the street grid pattern imposed over its broad, square shape enables the feasibility and the practicality of alternate routes.

**Relevance to Seattle**

Without a major port, San Francisco is in many ways not relevant to Seattle when it comes to long haul freight. However, like Seattle, they do have in interest in increasing bicycle mode share, and they also face challenges with delivery trucks on city streets. In many cases the strategy has been to separate facilities by promoting alternate routes or with at-grade separation. This is especially true in delivery zones in order to prevent trucks from blocking the lanes. The concept of citing cyclists for egregious behavior warrants further research. Determining how that practice affects the overall dialogue between the two user groups may be useful.

**Oakland, California**

**Overview of the Area**

The City of Oakland has the fourth busiest port in the nation with 2.3 million twenty-foot equivalent units in 2011.\(^{25}\)

Oakland has a strong bicycling community and developed a Bicycle Master Plan in 2007, which identified eighty-five miles of bicycle facilities. This plan lays out policies for the City to follow in the promotion of bicycling, a proposed bicycle network, design guidelines for bicycle facilities, and priorities for implementation.

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What is known about the Issue in the Study Area

The Port of Oakland has developed the Maritime Comprehensive Truck Management Program (CTMP), which includes strategies environmental and social responsibility and addressing the needs of neighboring communities, such as the City of Oakland. An analysis of the CTMP found no direct discussion of truck and bicycle conflict. The plan does mention that the Port is working with Caltrans, Californiaâ€™s department of transportation, and the City of Oakland to ensure “traffic compatibility” with pedestrians, bicyclists, and vehicles. The port is also initiating a study to investigate traffic, congestion, and safety hotspots around the neighboring community.

The term “freight” does not appear in Oakland’s Bicycle Master Plan, while “truck” appears twice under a section named “Constraints” (emphasis added):

“In some neighborhoods, Oakland’s irregular street grid provides cross-town connections on a limited number of streets, creating conflicts between cars, buses, trucks, and bicycles.”

“Diagonal parking as well as double-parked cars and trucks can create difficult situations for bicyclists.”26

Within the policy section, the plan recommends installing bicycle lanes where feasible on streets in the proposed bicycle network to address potential conflicts among user groups. On arterial and collector streets where bicycle lanes are not feasible, the plan recommends installing arterial bicycle routes. To address the problem of diagonal parking, the plan recommends discouraging the installation of this type of parking on streets in the bicycle network and relocating existing diagonal parking to streets that are not in the network.

Additional information from the Bicycle Master plan:

- The existing conditions report identifies the locations of collisions. Overall, they tend to be closer to downtown and not in close proximity to the Port. The most common cause of collision is cyclists disobeying traffic laws.
- The Port of Oakland has funded some bike path projects.
- There are bike routes and proposed routes near Port.

Jason Patton, the Bicycle and Pedestrian Program Manager, explained that when developing the Bicycle Master Plan, planners looked at existing truck routes to determine appropriate locations for bicycle facilities.27 80 bicycle route segments out of approximately 600 segments overlapped with a truck route. 16 of these facilities were rerouted or altered from initial plans. Some were altered because of road constraints and others for unspecified reasons. Warnings about traffic considerations and possible constraints on design were listed for additional unaltered segments.28

Finally, the Central Estuary Area, a notably poor travel area for both bicycles and trucks near the port, has a development plan. The plan’s purpose is to address infrastructure deficiencies and conflicting land uses in the area, particularly related to freight and other modes of transportation. In an interoffice memo to the Bicycle and Pedestrian Advisory Committee, a city planner discussed the effects of the Central Estuary Implementation Guide.29 The author recognizes the nature of modal conflicts in this area and highlighted the need for safe, connected bicycle paths and efficient truck routes. The guide identifies gaps in the bicycle network and suggests areas for connections. The guide proposes new roads and road extensions to separate trucks from cyclists and pedestrians and improved road designs to better accommodate trucks.

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27James Patton, email message to the author, October 10, 2012.


Relevance to Seattle

Both Oakland and Seattle have busy ports that generate considerable truck traffic. Both cities also have topography that constrains potential pathways for these modes. Seattle can learn from the Central Estuary Implementation Guide, in particular, which highlights the importance of maintaining truck efficiency while also allowing bicycle connectivity.

Long Beach, California

Overview of the Area

The Port of Long Beach is one of the world’s busiest ports and the second busiest port in the United States. Additionally, it borders the Port of Los Angeles. In 2011 the port handled the equivalent of 16,600 twenty-foot equivalent containers (TECs) each day.

A review of the available plans for the City of Long Beach shows a community actively engaged in promoting bicycling and improving bicycle facilities within the city. The first Bicycle Master Plan for the city was created in 2001. The City is currently in the process of updating this plan. The goals of the current Master Plan are to increase the real and perceived safety of bicycling for all types of users, while increasing ridership by 5 percent over current levels by 2020.

What is known about the Issue in the Study Area

The city has developed a bikeway class system that separates needed and existing bicycle routes into three classes. Class I facilities are completely separated from vehicular traffic, Class II facilities are bicycle lanes, and Class III facilities are bicycle routes. An analysis of reported accidents in the three years preceding the 2000 Bicycle Master Plan shows that there is not a particular hotspot for accidents within the city. The plan also makes no direct reference to freight/truck and bicycle interactions.

The port is currently working on further developing the bicycle facilities in the surrounding area to provide greater access to the waterfront, to promote tourism opportunities by linking the hotel district with the downtown business district, and to create more recreational opportunities for cyclists of all ages and abilities. Most of the proposed and existing facilities in the area of the city surrounding the port are Class I facilities. According to Matt Goldman, Port of Long Beach, the senior leadership of the port has been supportive of these efforts since discussions involving bicycle facilities during a bridge reconstruction project, which resulted in the addition of bicycle facilities to that plan.

In the surrounding area, the Alameda Corridor Transportation Authority has completed a series of projects over the last couple of decades that have significantly improved traffic conditions at the port and in the surrounding areas. From a brief review of these projects, the major strategy appears to be separating out freight movement from other modes. There is not much information regarding freight and bicycle interactions, although there are reports of improved conditions.

Relevance to Seattle

The topography and climate of Long Beach differs significantly from that of Seattle. Currently, there are a few individuals who commute via bicycle to the port, but the bicycle planner for the city, Allan Crawford,
thinks that the addition of facilities will result in increased ridership.\textsuperscript{38}

There are lessons for Seattle in the cooperative effort between the port and the city. The city is currently reaching out to longshoremen for feedback regarding the facilities.\textsuperscript{39} Additionally, the port has been supportive of and has contributed to the wider community’s effort to promote bicycling.\textsuperscript{40} In Long Beach, the major focus of bicycling facilities within and surrounding the port is for recreational, rather than commuting purposes.\textsuperscript{41} Seattle could learn from these efforts to support additional opportunities at the waterfront for tourists and commuters, alike.

The creation of additional bicycle access on the port is being met with mixed results.\textsuperscript{42} Most of the concerns stem from issues of safety. Safety issues related to mixing freight and bicycle traffic have not been addressed in any analytical framework. The general tendency appears to be to separate facilities for the greatest perceived comfort and safety of all users.

**Los Angeles, California**

Although the Port of Los Angeles is a major U.S. port, the substantial differences between Los Angeles and Seattle in the layout, topography, and climate may restrict the utility of direct comparisons of freight and bicycle policy and design decisions. The 2010 Bicycle Plan for the City of Los Angeles does not directly address the potential conflict between trucks and bicycles. A search of the plan resulted in few references to freight traffic or the port. The only such instances were in reference to increasing safety through education.\textsuperscript{43} The Port of Los Angeles is located substantially south of the heart of the city, a vast majority of the road network has below a 5 percent grade, and the climate allows for almost 300 days per year of ideal bicycling weather.\textsuperscript{44} The tone of the most recent bicycle plan seems to be directed toward promoting educational solutions for multi-modal conflicts within the city.\textsuperscript{45} More research should be done regarding the communities that surround the port facilities.

**New York City, New York**

**Overview of the Area**

Freight movement within, entering, and leaving New York City is substantial due to the city’s function as an economic center, a population center, and because it hosts the largest maritime port on the eastern seaboard of North America. Freight volume for the Port Authority of New York and New Jersey was nearly 4.1 million twenty-foot equivalent units in 2010.\textsuperscript{46} Approximately 90 percent of regional freight is transported by truck.\textsuperscript{47}

The New York City Department of Transportation (DOT) implements several programs to manage freight truck movement and parking throughout the city. These include the designation of truck routes, vehicle

\textsuperscript{38} Allan Crawford, personal communication, October 2012.
\textsuperscript{39} Ibid.
\textsuperscript{40} Matt Goldman, personal communication, October 2012.
\textsuperscript{41} Ibid.
\textsuperscript{42} Allan Crawford, personal communication, October 2012.
\textsuperscript{45} Ibid.
restrictions, parking and delivery rules, traffic rules, express lane permits, and cross-over mirror requirements.

In 2010, the Port Authority adopted a Bicycle Master Plan. When the plan was developed there were bicycle facilities on a couple of bridges managed by the Port Authority, and several bicycle routes adjacent to Port Authority facilities. The Bicycle Master Plan established the following goals: meet the growing demand for bicycling with appropriate facilities, remove unnecessary restriction on access, promote the safe co-existence of motor vehicles and bicycles at port facilities, and coordinate and collaborate bicycle facility improvements with regional stakeholders.

In 1997 New York City adopted its bicycle master plan, which is the first phase of the Bicycle Network Development program that envisions a 900 mile network of on- and off- street bicycle routes. This program is managed jointly between the Department of City Planning (DCP), the Department of Transportation, and the Department of Parks and Recreation. In implementing the Bicycle Network Development program objectives the city is trying to expand ridership in the “8 to 80” age range. Increased ridership has been observed in conjunctions with the development of the bicycle network (see fig. 8).

The number of bicyclists has increased in New York City from approximately 1,300 in 2,000 to about 2,700 in 2009. At the same time, bicycle lane miles increased from 325 miles to 650 miles.

What is known about the Issue in the Study Area

New York City designates local and through truck routes and requires commercial trucks to use the truck routes until the intersection closest to their destination. To improve safety at intersections, commercial trucks are required to install cross-over mirrors. In addition, it is against regulations to block a bicycle lane when commercial vehicles are allowed to double-park. If a bicycle lane is blocked, a fine may be issued.

The City is also conducting a pilot study of an after-hours delivery program. The incentive to participate in the program is that drivers spend less time stuck in traffic and, thus, can make more deliveries per unit of time. Participation in this program is voluntary.

In addition to placing rules and regulations on commercial trucks, the city is conducting educational outreach to teach pedestrians and bicyclists about the visual constraints of the vehicles.

The Port Authority of New York & New Jersey is currently working on improving bicycle access and infrastructure at all of its facilities. The Port Authority’s staff is directed to coordinate and collaborate with regional planning organizations, transportation providers, advocacy groups, and local governments on bicycle plans.


Lord, Hayes. 2012. “Email Corespondence”. New York City Department of Transportation.


Ibid.

New York City uses three main types of bicycle lanes within the road right-of-way. These are: standard bike lanes, which are located between a vehicle lane and the parking lane; buffered lanes, which have a buffer strip between the bicycle lane and the vehicle travel lane and are located street side of the parking lane; and protected paths, cycle tracks, which are painted between the curb and a lane of parked cars and have a buffer strip between the bike lane and the lane of parked cars.  

Each of these lane types has been used along truck routes. Recent research of the conflict between commercial vehicles and bicycles in New York City, by Conway et. al. 2012, found that the protected path configuration was the best design to prevent conflict. Buffered lane configurations experienced the greatest number of conflicts between commercial vehicles and bicycles. The conflicts observed in this study occurred primarily during delivery or pick-up, when trucks parked in the bicycle lane or were crossing the bicycle lane to park.

Bicycle advocacy groups in New York City actively pursue improved monitoring of bicycle accidents, the installation of cycle tracks, and modification to trucks to decrease the severity of injuries to bicyclists when there are crashes. The first comprehensive monitoring of bicycle crashes occurred in 2011.

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60 Ibid.
61 Ibid.
Relevance to Seattle

New York City bicyclists and trucks have fewer hills to contend with than in Seattle. However, like Seattle, the city is constrained by water. New York City has and is placing some bicycle routes along freight routes. Recent research on truck and bicycle conflicts in New York indicates that dedicated bicycle lanes adjacent to the curb and separated from traffic lanes by a buffer strip and parking lane yield the lowest number of conflicts when trucks need to park for delivery or pick-up of goods. This lane configuration also has the support of the bicycling community, as it is perceived to improve safety for cyclists.

Seattle may be able to learn from the positive relationship between the Port Authority and New York City. This relationship is evident in the port’s interest in coordination and collaboration on the development of bicycle plans.

Jersey City, New Jersey

Overview of the Area

Jersey City is considered a significant transportation center, functioning as a gateway for the movement of goods into New York City, the interior of the U.S., and international destinations. Jersey City is located near the geographical center of the Port Authority of New York & New Jersey, which moved nearly 4.1 million twenty-foot equivalent units in 2010. The facilities load and unload freight transported by both truck and railroad. The current master plan’s truck and freight related goals are to “facilitate the regional movement of goods and services... accommodate the local delivery of goods and services through community sensitive practices... [and] improve access between Jersey City and the greater region.”

The policies of the Port Authority of New York & New Jersey’s Bicycle Master Plan apply to their facilities in Jersey City as they do to facilities in New York City described above. When the plan was developed there were no bicycle facilities at the Auto Marine Terminal or Global Marine Terminal, which are located in Jersey City.

Jersey City prepared its first Bicycle Master Plan in 2000. The current city bicycle plan is embedded within the 2011 Amended Circulation Element of the City Master Plan. As of 2011, the City had designated bicycle routes but did not have dedicated bicycle lanes. In addition the City has several dedicated multi-use (pedestrian and bicycle) paths. In 2011, the city also adopted a Complete Streets Policy.

The bicycle related goals of the current Master Plan include the creation of a safe, city-wide, bicycle-friendly environment, to reduce the environmental impacts of travel, to improve air and water quality, and to encourage healthful lifestyles.

What is known about the Issue in the Study Area

The current Circulation Element of the City Master Plan makes no direct reference to freight/truck and bicycle interactions. However, bicycle facility types are matched to the right-of-way widths and the road-
way classification system. Based on this matching, cycle tracks and unbuffered bicycle lanes are used for bicycle routes on road rights-of-way of eighty to one-hundred feet.\textsuperscript{72}

The study of New Jersey Route 440/ US Routes 1 and 9T in 2011 provides an example of current Jersey City bicycle and truck planning efforts. This project proposes that the divided highway be turned into a multi-modal corridor, with improved pedestrian access and crossings, transit services, and a cycle track along its length. Although the proposed multi-modal corridor would be designed to accommodate the current freight truck traffic, the study also evaluated several options for diverting freight truck traffic away from the corridor.\textsuperscript{73}

The Port Authority is currently working on further improving bicycle access and infrastructure at all of its facilities. This includes assessing the feasibility of establishing bicycle routes at the Auto Marine Terminal and Global Marine Terminal.\textsuperscript{74}

Relevance to Seattle

Jersey City bicyclists and trucks have fewer hills to contend with than in Seattle. However, like Seattle, the City is constrained by water. Jersey City has and is placing bicycle routes along some freight routes. With the new Circulation Element of the Master Plan, the city has moved towards a policy of separate facilities along arterials with wider rights-of-way.\textsuperscript{75} Jersey City is also exploring options of diverting freight traffic from select routes where the city seeks to create multi-modal corridors. \textsuperscript{76}

Unlike Seattle, major bicycle routes do not appear to be adjacent to the port terminals in Jersey City. However, the Port Authority of New York and New Jersey is interested in developing bicycle facilities on its properties where feasible.

Pittsburgh, Pennsylvania

Overview of the Area

Pittsburgh is an industrial city with less mature bicycle planning than Seattle. Approximately 2 percent of trips occur by bicycle.\textsuperscript{77} The city began to develop a bicycle plan after it was noted that they were ranked the third worst city in the country for cyclists.\textsuperscript{78} This ranking was due to topography, numerous bridge crossings, and few bicycle facilities. The city has developed goals and objectives and a map of new facilities to improve their bicycle system.

What is known about the Issue in the Study Area

Pittsburgh’s bicycle plan begins with a vision statement that specifically addresses the need for multiple modes to exist on the transportation network:

\textit{In Pittsburgh, all street users—automobiles, trucks, buses, pedestrians, and bicycles—respect the rights of others on the road. All vehicle operators and pedestrians understand that the street network is shared by many different modes of transportation, and all street users abide by traffic laws and posted regulations.}\textsuperscript{79}
The plan also acknowledges the high level of conflict between bicycles and other user groups in Pittsburgh. The bicycle plan divides cyclists into three groups based on skill and reasons for cycling. Because the most advanced cyclists may use any street, the plan recommends that ALL streets have a minimum level of design for bicycle safety, such as wide curb lanes on arterial streets.

Finally, under criteria for the installation of bicycle racks, the plan states that "rack[s] must not conflict with pedestrian movements, bus or freight loading, building entrances or automobile parking."

**Relevance to Seattle**

Seattle is much further along in its bicycle planning than Pittsburgh. However, Seattle can learn from Pittsburgh’s goal to remember the needs of all transportation modes when engaging in bicycle planning.

**Summary**

The investigation of other cities shows that Seattle is not alone in facing the challenges of providing facilities to both bicycles and freight. The nature of truck and bicycle interactions varies by city and is further differentiated by the politics, climate, and geography of each city. For cities with the space, separating bicycles and trucks is the most common practice. Some cities have worked in collaboration with the port and the freight community to develop approaches for handling the potential conflict between these two user groups. The biggest lesson for Seattle may be from the collaboration of bicycle and freight interests in cities that has resulted in the joint planning of bicycle and truck facility networks to best serve both user groups.
Incident Data Analysis

Introduction

Seattle-specific bicycle and vehicle incident data were analyzed to assess the situation from a safety perspective. Because any serious incident is a major tragedy, the perception of safety can easily be out of sync with the actual safety records. The sheer difference in mass between trucks and bicycles naturally increases perceived danger. The goal of this analysis is to provide an objective view of the actual rates of incidents between trucks and bicycles.

Data

The Seattle Department of Transportation provided data for all incidents between January 2002 and November 2012. The data were based on police reports and included all reported incidents occurring in the Seattle right-of-way. Each record contains the date and location of the incident, number and type of vehicle(s), and severity of the collision (property damage only, injury collision, fatal collision).

A disaggregation by vehicle type identified which particular types of vehicles and trucks had the most frequent incidents with bicyclists. Vehicle incidents on selected roadway types were also examined to determine if incident rates varied based on if the streets were truck routes versus bicycle routes or a combination.

Findings

In total, there were sixty-one collisions between trucks and bicycles in Seattle over the roughly ten year period, and only sixteen of these involved large trucks. In comparison there were 3,721 total incidents between vehicles and bicycles. Figure 9 shows the summary of incidents by vehicle type.

Based on this summary, it is reasonable to conclude that there are relatively few incidents with large trucks. However, the small number of truck related bicycle incidents does not entirely address the question of safety on routes shared by trucks and bicycles. The research team hypothesized that safety issues might exist on streets commonly shared by bicycles and trucks, regardless of whether the incidents actually involved trucks. To that end, a comparison was made between the number of total incidents on truck streets, the bicycle network, and the streets common to both (see fig. 10).
Incident rates on roads common to both were 30 percent higher than incident rates on roads that did not overlap. Although this does not attempt to assign causality, especially since the analysis did not control for relative traffic volume, it is notable that the rate per lane mile of incidents is higher on these streets.

**Summary**

The higher rate of incidents involving non-truck vehicles on streets shared by bicycles and trucks supports the strategy of mode separation.

The overall frequency of incidents involving large trucks and bicycles is the lowest of any vehicle type, except school buses. Incidents with taxis and bicycles exceeded those of large trucks by 100 percent. The safety concerns expressed by bicyclists about sharing the road with a large truck seem to be greater than shown by the data, suggesting that, perhaps, large trucks have an image problem that might not be entirely warranted. The fact that incident rates are relatively low for large trucks, and for trucks in general, is an important piece of information for the non-motorized community to know, and can inform the dialogue in future discussions.
Figure 10: Incidents are 30 percent higher on the truck and bicycle overlap streets than on non-overlapping streets.

### Bicycle Incident Rates on Selected Roadway Types (All vehicle types)

<table>
<thead>
<tr>
<th>Roadway type</th>
<th>Number of incidents (Jan 2, 2002 to Nov 4, 2012)</th>
<th>Number of lane miles in Seattle</th>
<th>Incidents per lane mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle Street network</td>
<td>3,721</td>
<td>2,755</td>
<td>1.35</td>
</tr>
<tr>
<td>Arterials</td>
<td>3,209</td>
<td>764</td>
<td>4.20</td>
</tr>
<tr>
<td>Existing Sea bicycle network</td>
<td>992</td>
<td>304*</td>
<td>3.26</td>
</tr>
<tr>
<td>Major Truck streets</td>
<td>578</td>
<td>178</td>
<td>3.25</td>
</tr>
<tr>
<td>Truck bicycle overlap</td>
<td>336</td>
<td>79</td>
<td>4.25</td>
</tr>
</tbody>
</table>

* Based on existing bicycle facilities from the 2007 Bicycle Master Plan
Introduction

The history of bicycle and truck interactions in the City of Seattle is a long and divided one. To better understand the current and historical relationship between freight interests and the bicycling community in and around Seattle, a media search of bicycle and truck interactions over the past twenty years was performed. The focus was almost exclusively on these interactions as reported by mainstream, regional newspapers and resulted in the analysis of 216 articles published from 1992-2012. The relative number, perceived tone, and basic content of the articles was documented via search criteria detailed further below.

It was hypothesized that the number of articles devoted to this topic would increase over time, corresponding with a rise in bicycle use. The increased demand of the finite roadway space would be likely to create more conflicts with all vehicles, including trucks, and, thus, generate more discussion in the media. An a priori expectation was that there would be an overall trend toward increasing numbers of articles that were “pro bike” as the environmental, health, and economic benefits of bicycling became more mainstream and widely accepted.

No such increasing trend in articles devoted to bicycle and truck interactions over the twenty year timeframe was found. The general tone of the articles has fluctuated over time. In fourteen of the past twenty years, more than half of the articles related to this subject were neutral in tone. Although the content of the articles does not appear to have changed significantly over the timeframe, the results of the analysis tentatively suggest that more media attention may have been given to facilities, infrastructure, and safety over the past five years.

Certain issues garnered sustained media attention over many years, such as the missing link in the Burke-Gilman Trail. The steady stream of contentious articles on this topic may have contributed to negative public perception of how trucks and bicycles interact within the city. However, several articles contained a cooperative tone that could suggest that conflict can be resolved and initiatives can move forward in ways that may produce benefits to both sides.

Methodology

Database and Search Terms

The media search was performed with Newsbank Access World News, a searchable subscription news database that contains full text news articles from 1985 to the present. The search was limited geographically to the
ninety available sources in Washington State. A search for the following terms in "all text" from January 1, 1992 through November 11, 2012 was preformed: 30

- **Bicycle** was chosen to capture news articles that mention bicycles.
- **Truck** was chosen to capture news articles that mention trucks. The term "truck" was chosen over the term "freight" because it was believed that truck was more commonly used in the vernacular and would result in a more inclusive search. Additionally, the term "semi-" or other similar terms were not used because it was thought that these terms would be too restrictive.
- **Seattle** was chosen to par the search down from Washington State to focus more predominantly on bicycle and truck interactions in Seattle and the communities directly surrounding the city.
- **Pickup** was excluded from the search to eliminate the potential for the term truck to be used in reference to the smaller, personal vehicle that was not within the scope of the study.

This search resulted in approximately 2,700 articles. The results were then skimmed to eliminate clear miss-picks based on the headlines and contextual excerpts provided in the search results. After the initial elimination, 775 articles remained. Newscast transcripts were then eliminated because of their relative length. This elimination brought the number of articles to fewer than 700. An in depth analysis of the remaining articles was preformed as described below.

### Criteria, Content, and Tone

The approximately 700 remaining articles were skimmed for additional contextual relevance. 82 In this part of the process, articles that were not related to bicycle and truck interactions in the larger region (i.e. the Pacific Northwest) were eliminated, as well as additional irrelevant articles (i.e. all relevant terms appeared in the articles, but the article was not related to the subject matter of the analysis). Information regarding the tone, content, and source of each of the remaining 216 articles was then recorded. Additionally, specific mentions of any particular type of truck (e.g. semi-truck, flatbed, garbage, etc.) and if the particular content of the article was specifically relevant to Seattle were noted (see table 1). 83

### Limitations

The search terms employed may have affected the articles that were examined. If the term *bike* or the term *freight* had been chosen for the search, the resulting analysis may have produced different results. The term *freight* was not chosen because it may have included articles related to rail, which was outside of the scope of this study.

An additional limitation occurred because of the ambiguity of the term *truck*. It was not always clear what was meant by the term when it was used in the articles. It is likely that references to trucks, such as personal pickup trucks, that were not within the scope of this study were included, although efforts were made to identify and to eliminate such articles that referred to personal, pickup trucks from the analysis.

### Findings

#### Quantity of Articles

Both the number of articles and the tone of the articles have varied over the past two decades. There was an average of nine articles per year and a median of eleven articles, excluding incomplete data from 2012.
The number of annual articles has not increased steadily; although there was an initial spike in 2003 and what may prove to be a sustained increase in 2007 and thereafter. The majority of the articles in 2003 were related to a proposal to close the “missing link” in the Burke-Gilman Trail, while the majority of the articles examined in 2007 were related to accidents. Also in 2007, Seattle published the city’s first Bicycle Master Plan (see fig. 11).

**Tone of Articles**

The majority of articles in fourteen of the past twenty years were neutral in tone. Recent articles and articles that addressed issues that pertained directly to Seattle were less likely to be neutral (see figs. 12 and 13). For the details of the relative and absolute numbers of articles placed into each tonal category by year, please see Appendix A.
Figure 11: Number of Articles about Truck and Bicycle Interactions per Year

Figure 12: Percent of Articles by Tone

- **All Articles**
  - 62% Pro-Bike
  - 28% Pro-Truck
  - 10% Neutral

- **Articles Specific to Seattle**
  - 50% Pro-Bike
  - 15% Pro-Truck
  - 35% Neutral
Figure 13: Percent of Articles by Tone over Five-Year Increments

Years


Percent Pro Bike Percent Pro Truck Percent Neutral
Selected Quotes from Articles Representative of Overall Tone

For a representation of the types of issues that were raised and quotes from articles used to identify tone refer to table 2. These quotes demonstrate the types of discussions that were occurring in the study area over the past twenty years. Based on the study’s findings, it could be said that the conflict between modes in the City of Seattle is becoming more divisive over time.

Content Discussed in Articles

The majority of the 216 articles examined discussed more than one subject area. The most commonly occurring topic was accidents; 50 percent or 108 articles address accidents in some manner. If the articles are further disaggregated by their specificity to Seattle, the most commonly occurring theme shifts to facilities and infrastructure. To see the changes in three commonly occurring themes (accidents, safety, and facilities and infrastructure) over five-year time periods see figure 14. As Seattle works toward the goal of increased ridership and complete streets, these issues may occur in articles more frequently. For additional information regarding the breakdown of the articles by content type, please see Appendix A.

Types of Trucks Discussed in Articles

A substantial number of articles examined were not explicit about the type of truck that they were discussing. Figure 15 shows the distribution of the types of trucks referred to in the articles. Delivery trucks, logging trucks, and garbage trucks were not explicitly mentioned in any of the articles that had “pro truck” sentiments. Refer to Figures 16 and Appendix A for more information regarding the content and tone of the articles where these truck types were mentioned.

References for table 2:

### Table 2: Article Tone and Quotes

<table>
<thead>
<tr>
<th>Tone</th>
<th>Year</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro Track</td>
<td>2007</td>
<td>I have long believed that mixing bicycles with automobiles and trucks was less than bright. The idea of putting more bicycles on the roads, to prove how dangerous it was for bikers recalls a similar letter, years ago, from an avowed bicyclist, speaking about a particularly dangerous spot on Bond Road; in an accident two weeks later, he tragically proved his point. R.I.P.¹</td>
</tr>
<tr>
<td>Pro Bike</td>
<td>2009</td>
<td>Askervik predicted a tunnel also would funnel more cars to waterfront surface streets, making it harder for his trucks to deliver their cargoes. &quot;I don't think it's in the best long-term interests of the community,&quot; he said, likening it to other city decisions, such as the extension of the Burke-Gilman Trail near his business, that he said are making it harder for traditional industrial businesses to survive. &quot;As this city becomes more of a bedroom, pedestrian, bicycle community, they give no thought to industry.&quot;</td>
</tr>
<tr>
<td>Pro Bike</td>
<td>2010</td>
<td>Had Seattle's leaders with a better business sense or a more rational view of the affordability or lack of it of living on the city, things might be different. But every new bike lane can make a road less appealing to a car or a truck. Bicycles prevail; freight mobility takes a sorry hit.</td>
</tr>
<tr>
<td>Pro Bike</td>
<td>1997</td>
<td>For cyclists, oddly, it is safest to act like a car, Badal says.¹</td>
</tr>
<tr>
<td>Pro Bike</td>
<td>2008</td>
<td>People who think 225-lb. bicycles can safely share roadway space with 4,000-lb. cars and big trucks at 35, 45 and 55 mph are living in a dream world.³</td>
</tr>
<tr>
<td>Pro Bike</td>
<td>2010</td>
<td>In Seattle, transportation is a hot issue. Proposals for any change produce vigorous debate. It seems there is always conflict between modes of transportation. Sustainability and livability appear to fade before the desire to keep things as they are. Must it really be a case of either/or? Nickerson has to remain a 4-lane bike and pedestrian unfriendly traffic--way in order to sustain industry and commerce? It is possible that by re-configuring to a 3-lane with a left-turn center lane. Nickerson can both safely accommodate bicyclists and promote the success of industry and business by actually improving traffic flow. After all as one proponent of the &quot;road diet&quot; stated, &quot;It is cars that hold up truck traffic, not bicycles [or pedestrians].&quot;</td>
</tr>
<tr>
<td>Neutral</td>
<td>1996</td>
<td>Bicyclists who tend to favor trails completely separated from streets and motor vehicle traffic argued for extending the trail on the rail line if it becomes available. Owners of the businesses along the rail corridor protested, saying cyclists and skaters would create a safety hazard when they passed the heavy car-and-truck traffic that already jams the area. &quot;I think it is a great thing having trails away from traffic but I don't think having it in an industrial area is the thing to do,&quot; adds Ed Fryeck, owner of Ballard Inflatable Boats.</td>
</tr>
<tr>
<td>Neutral</td>
<td>2003</td>
<td>&quot;There’s not been, one inch of trail that’s not protested by residents. It took three years to put the trail through Biddell.&quot;¹</td>
</tr>
<tr>
<td>Neutral</td>
<td>2010</td>
<td>&quot;Feeling grudges like rival gang, neither side is willing to listen to the other, never mind retreat an inch.&quot;</td>
</tr>
</tbody>
</table>
Figure 14: Selected Content of Articles in Five-Year Intervals (Please note that one article may be assigned to more than one content category)

Figure 15: Types of Trucks Discussed in Newspaper Articles
Figure 16: Percentage of Article Tone by Truck Type
Discussion and Summary

The debate over truck and bicycle interactions has been active in the Seattle area for over twenty-years. The majority of the articles found in this search were neutral in tone and many of these articles were reports on accidents in the area. The same basic themes appeared repeatedly in both decades. The three main topics appear to be accidents, the Burke-Gilman Trail, and general safety and awareness on the road.

Reports of accidents pose an interesting conundrum in the interpretation of the debate because of the multiple meanings of the word truck. This analysis was focused on bicycle and freight movement; however, the word truck was used to mean both long haul and urban goods movement vehicles. The lack of clear distinction may influence people’s perceptions of the issues. Based on the number of accidents and types of trucks involved in this study, the conclusion can be drawn that not all trucks are equal when it comes to truck and bicycle interactions. These vehicle types operate on different streets, have different behaviors, and appear to be involved in differing amounts of physical interactions with cyclists. The vast majority of accidents described were attributed to vehicles involved in city logistics, rather than long-haul, semi-trucks.

Although no significant, linear trend in the number of articles that address these interactions is evident, there did seem to be an increase in media attention during and after the drafting of the City of Seattle Bicycle Master Plan in 2007, although there were also a substantial number of accidents in 2007. With the revisions to the plan that began in late 2012, it is likely that the increase in the numbers of articles is likely to continue in upcoming years.

The debate seems to intensify when changes to existing infrastructure are made or proposed that would disrupt the status quo. The disputes become particularly heated when the changes deal with facilities that serve both bicycle and freight interests, as evidenced by the dispute over the “missing link” in the Burke-Gilman Trail that lasted well over a decade. Based on the 2012 Bicycle Master Plan draft routes and the proposed overlaps with existing truck routes, it is likely that these types of issues will dominate the discussion. The opinions expressed will likely be divided and strong.
Conclusions

The purpose of this study was to explore the nature of the potential conflict between truck needs and bicycle needs in the City of Seattle and to begin to identify approaches for handling these challenges. Overall, there are seventy-nine lane miles of overlap in the designated truck routes and the designated bicycle routes in the city of Seattle. There is not much evidence to show that trucks pose a significant safety problem with regard to bicycles in Seattle, as there were relatively few accidents involving trucks and bicycles in the last ten years. Although incidents are low, there are other issues associated with trucks and bicycles sharing the roadway, such as perceived safety issues, pollution from exhaust, and noise.

While there have been few incidents in Seattle, a review of the literature on bicycle and truck issues found that accidents involving trucks are more likely to result in serious injury. Research has also found that the type of bicycle facility and the extent that these facilities are well-marked affects the number of truck and bicycle incidents. When bicycle facilities are separated, there are fewer incidents.

The review of the practices of other port cities found two common approaches to handling these challenges. First is the physical separation of bicycle traffic from truck traffic. This is supported by the literature review, which found research that asserts this configuration is the safest for cyclists. The second approach is to work with the bicycle and freight/truck communities to develop a matrix of solutions (e.g. physical separation, alternate routes, better signalization at dangerous intersections, and road modifications to improve flow), based on specified criteria (e.g. lane width, vehicle speed, availability of alternative routes, proximity to destinations, and importance of route to each user group).

An analysis of print media over the past twenty years shows that the majority of articles on the topic of truck and bicycle interactions are neutral in tone with no pro-bicycle or pro-truck slant. In the 1990s the majority of articles were accounts of accidents between trucks and bicycles. In the 2000s the number of articles about safety concerns and about infrastructure increased, becoming equally prominent with accident articles. One notable topic of discussion in the bicycle and industrial communities, as portrayed by the media, is the heated debate about how to address the gap in bicycle infrastructure in the “missing link” along the Burke-Gilman Trail in Ballard.

Aside from the physical solutions, programmatic solutions should also be considered to improve the relationships between different user groups. Much of the conflict stems from poor communication on all sides. For example, relative safety information regarding accident rates among various types of vehicles is an important message for the bicycling community to hear. Additionally, an intriguing opportunity lies in San Francisco’s practice of issuing citations for bicycling behaviors that pose the greatest safety risk. Not only would citations discourage some of the more egregious maneuvers routinely committed by bicyclists, but it might soften some of the rough edges of the discussion.
The research presented here indicates that bicycles and trucks can exist successfully in the same city and travel corridors, if not on the same streets. Seattle has the framework in place to make this happen, such as a bicycle planning committee and a freight advisory board. However, collaboration between these groups has been minimal and somewhat contentious. Seattle can learn from other cities that have developed avenues for collaboration between the bicycle and freight communities so that the needs of both are addressed and Seattle’s city streets are optimized.
Future Research

Current Literature and Best Practices

Planning literature should be cognizant of and current on strategies for road sharing best practices for bicycle and truck interactions. Currently, the literature is falling behind existing practices. After an exhaustive literature search, few articles were found that dealt with the interactions between bicyclists and urban goods movement vehicles. Additional research should be conducted in city logistics, especially as it pertains to bicycle facilities and behavior.

As was shown through the case studies of other port cities, it may be wise to devote research resources toward evaluating current systems throughout the country by monitoring bicycle and truck volumes, number of incidents, et cetera, on different facility types. Portland, Oregon’s context-specific approach could be supplemented with an overall bicycle and freight network strategy and be generalized to be applicable to additional jurisdictions. Continuing to learn from what other municipalities are doing is important, but these methodologies must also be evaluated for safety, effectiveness, and usability, from all road users’ perspectives. Investing in separated facilities appears to be a common trend in many of the cities that were studied, but before widespread adoption takes place, it should be determined that these investments meet the needs of the bicycling community and freight interests as well as other network users. Data collection and analysis pertaining to facility types and relative and absolute numbers of incidents; traffic flow for bicyclists and vehicles; ages of riders relative to facility type; and perception of safety from both cyclist and driver perspectives across facility types and context may be a worthwhile endeavor in providing concrete evidence that current trends are legitimate, and work toward the accomplishment of jurisdictional goals.

Media Search

Our media search did not show concrete trends over time, although, there was some evidence that trends are beginning to appear in both the content and number of annual articles published in Seattle area newspapers. Continuing to monitor the tone and content of articles pertaining to the city of Seattle and bicycle and truck interactions over time may prove useful. The search should be expanded beyond the bounds of traditional media sources to better capture the changing news landscape by monitoring popular transportation and bicycling blogs, as well as those pertaining to goods movement and city logistics. Additionally, further disaggregation of the specific types of trucks to which people refer when using the term truck in a general media context may also be beneficial.
Incidents and Data

Incident data should continue to be monitored over time. Better means for recording details of bicycle and truck interactions would contribute significantly in determining which types of trucks or cyclists are causing the greatest number of incidents. It may be useful to more fully examine self-reported data from near miss websites or to survey both truckers and cyclists about perceived danger areas. This research can be used to determine how best to make users of both of these modes feel most comfortable on shared (or not shared) roadways.
Appendix A

Additional Data from the Media Search

Table 3: Articles and Tone by Year in Relative and Absolute Terms

<table>
<thead>
<tr>
<th>Year</th>
<th>Pro Bike %</th>
<th>Pro Truck %</th>
<th>Neutral %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>3 60%</td>
<td>0 0%</td>
<td>2 40%</td>
</tr>
<tr>
<td>1993</td>
<td>1 8%</td>
<td>0 0%</td>
<td>11 92%</td>
</tr>
<tr>
<td>1994</td>
<td>2 17%</td>
<td>1 8%</td>
<td>9 75%</td>
</tr>
<tr>
<td>1995</td>
<td>2 67%</td>
<td>0 0%</td>
<td>1 33%</td>
</tr>
<tr>
<td>1996</td>
<td>1 17%</td>
<td>1 17%</td>
<td>4 67%</td>
</tr>
<tr>
<td>1997</td>
<td>1 11%</td>
<td>0 0%</td>
<td>8 89%</td>
</tr>
<tr>
<td>1998</td>
<td>1 9%</td>
<td>1 9%</td>
<td>9 82%</td>
</tr>
<tr>
<td>1999</td>
<td>1 33%</td>
<td>0 0%</td>
<td>2 67%</td>
</tr>
<tr>
<td>2000</td>
<td>3 33%</td>
<td>1 11%</td>
<td>5 56%</td>
</tr>
<tr>
<td>2001</td>
<td>0 0%</td>
<td>1 25%</td>
<td>3 75%</td>
</tr>
<tr>
<td>2002</td>
<td>2 50%</td>
<td>0 0%</td>
<td>2 50%</td>
</tr>
<tr>
<td>2003</td>
<td>4 19%</td>
<td>4 19%</td>
<td>13 62%</td>
</tr>
<tr>
<td>2004</td>
<td>1 33%</td>
<td>1 33%</td>
<td>1 33%</td>
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<tr>
<td>2005</td>
<td>6 75%</td>
<td>0 0%</td>
<td>2 25%</td>
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<td>2006</td>
<td>1 20%</td>
<td>1 20%</td>
<td>3 60%</td>
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<tr>
<td>2007</td>
<td>6 23%</td>
<td>2 8%</td>
<td>18 69%</td>
</tr>
<tr>
<td>2008</td>
<td>11 58%</td>
<td>0 0%</td>
<td>8 42%</td>
</tr>
<tr>
<td>2009</td>
<td>3 25%</td>
<td>1 8%</td>
<td>8 67%</td>
</tr>
<tr>
<td>2010</td>
<td>9 47%</td>
<td>3 16%</td>
<td>7 37%</td>
</tr>
<tr>
<td>2011</td>
<td>2 10%</td>
<td>2 10%</td>
<td>17 81%</td>
</tr>
<tr>
<td>2012</td>
<td>1 25%</td>
<td>2 50%</td>
<td>1 25%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>61 31%</td>
<td>21 9%</td>
<td>134 60%</td>
</tr>
</tbody>
</table>

Notes: The percentages listed in the total row are an average of the relative frequencies for the proceeding twenty years. They do not include 2012 data, as the set is not yet complete.
Figure 17: This graph shows the absolute numbers of the content of articles from the twenty-year search. Articles could be counted in more than one category. Please note that the information from the year 2012 is incomplete as the search was performed before the end of the year.

Table 4: Articles and Content Type Relative and Absolute Numbers.

<table>
<thead>
<tr>
<th>Category</th>
<th>Accidents</th>
<th>Policy</th>
<th>%</th>
<th>Funding/Taxes</th>
<th>%</th>
<th>Facilities/Infrastructure</th>
<th>%</th>
<th>Safety</th>
<th>%</th>
<th>Other</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Articles (216 Total)</td>
<td>106</td>
<td>47</td>
<td>22%</td>
<td>12</td>
<td>6%</td>
<td>84</td>
<td>39%</td>
<td>85</td>
<td>39%</td>
<td>40</td>
<td>19%</td>
</tr>
<tr>
<td>Articles Specific to Seattle (116 Total)</td>
<td>34</td>
<td>33</td>
<td>28%</td>
<td>30</td>
<td>9%</td>
<td>69</td>
<td>59%</td>
<td>60</td>
<td>52%</td>
<td>30</td>
<td>26%</td>
</tr>
<tr>
<td>Articles from the Seattle Times and the Seattle Post Intelligencer (135 Total)</td>
<td>61</td>
<td>29</td>
<td>21%</td>
<td>11</td>
<td>8%</td>
<td>68</td>
<td>50%</td>
<td>56</td>
<td>41%</td>
<td>31</td>
<td>23%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>200</td>
<td>109</td>
<td>53%</td>
<td>221</td>
<td>101</td>
<td>101</td>
<td>101</td>
<td>101</td>
<td>101</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Type of Truck and Content Type.

<table>
<thead>
<tr>
<th>Truck Type</th>
<th>Accident</th>
<th>%</th>
<th>Policy</th>
<th>%</th>
<th>Funding/Taxes</th>
<th>%</th>
<th>Facilities/Infrastructure</th>
<th>%</th>
<th>Safety</th>
<th>%</th>
<th>Other</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big, Heavy, or Large Trucks</td>
<td>15</td>
<td>41%</td>
<td>6</td>
<td>16%</td>
<td>2</td>
<td>5%</td>
<td>20</td>
<td>54%</td>
<td>15</td>
<td>41%</td>
<td>7</td>
<td>19%</td>
<td>37</td>
</tr>
<tr>
<td>Cement, Gravel, or Dump Trucks</td>
<td>17</td>
<td>77%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>4</td>
<td>18%</td>
<td>8</td>
<td>36%</td>
<td>6</td>
<td>27%</td>
<td>22</td>
</tr>
<tr>
<td>Delivery Trucks</td>
<td>10</td>
<td>63%</td>
<td>7</td>
<td>44%</td>
<td>1</td>
<td>6%</td>
<td>3</td>
<td>19%</td>
<td>5</td>
<td>31%</td>
<td>2</td>
<td>13%</td>
<td>16</td>
</tr>
<tr>
<td>Freight and Semi-Trucks</td>
<td>9</td>
<td>33%</td>
<td>8</td>
<td>30%</td>
<td>2</td>
<td>7%</td>
<td>16</td>
<td>59%</td>
<td>9</td>
<td>33%</td>
<td>3</td>
<td>11%</td>
<td>27</td>
</tr>
<tr>
<td>Garbage and Recycling Trucks</td>
<td>12</td>
<td>100%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>8%</td>
<td>1</td>
<td>8%</td>
<td>2</td>
<td>17%</td>
<td>1</td>
<td>8%</td>
<td>12</td>
</tr>
<tr>
<td>Logging Trucks</td>
<td>1</td>
<td>33%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>2</td>
<td>67%</td>
<td>2</td>
<td>67%</td>
<td>2</td>
<td>67%</td>
<td>3</td>
</tr>
<tr>
<td>Unknown or General</td>
<td>44</td>
<td>44%</td>
<td>26</td>
<td>26%</td>
<td>6</td>
<td>6%</td>
<td>38</td>
<td>38%</td>
<td>44</td>
<td>44%</td>
<td>19</td>
<td>19%</td>
<td>99</td>
</tr>
</tbody>
</table>