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Challenges and Solutions in Freight Planning

Introduction

On September 12, 2013, the New York Times ran a story by Aman Batheja entitled "A New Boom for Oil, but a Bust for Texas' Rural Roads." Batheja reported that the Texas Department of Transportation has determined to convert 83 miles of road to gravel in rural Texas just north of the Mexican border. This decision steams from increased shale oil production in the region, which is putting more stress on the rural roads as more and more large freight carrying trucks make trips to and from the production areas. This article is one snapshot of a nation-wide problem: states and metropolitan areas frequently do not adequately consider freight in long-range planning efforts, as only one-third of metropolitan planning organizations have active interaction with the freight community (Freight Stakeholders National Network, 1997). This failure to plan for these heavy, frequent trips result in poorly designed, crumbling roads; congestions and bottlenecks near freight origins and destinations; and safety concerns. There are, however, solutions to these problems. Metropolitan areas such as Baltimore, Maryland; Duluth, Minnesota and Seattle, Washington have successfully integrated freight into the planning process. This paper will explore some of the traditional problems with integrating freight into the planning process, as well as look at regions that have had success in the process. The results will, hopefully, identify some best practices that states and metropolitan areas of any size can incorporate into the planning process.

Freight Defined

Before moving forward, however, it is important to establish what is meant by the term freight. Freight is the "*goods*" part of the Intermodal Surface Transportation Equity Act of 1991. The act stated:

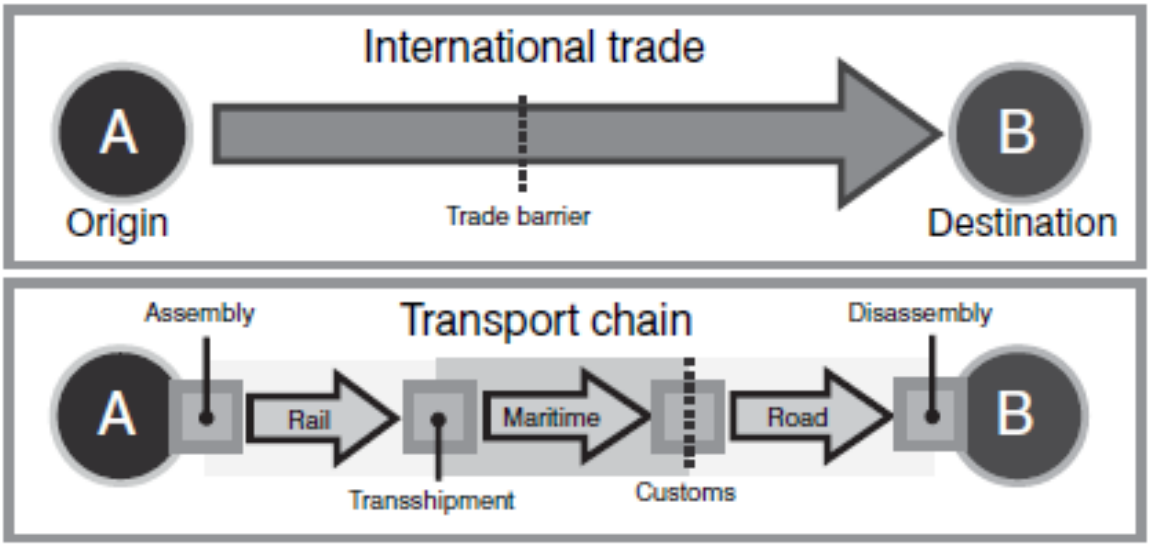
> "It is in the national interest to encourage and promote the development of transportation systems embracing various modes of transportation in a manner which will efficiently maximize mobility of people and **goods** within and throughout urbanized areas and minimize transportation related fuel consumption and air pollution." (emphasis added) (H.R. 2950, 1991)

While "*people*" in the above statement refers to, obviously, people commuting to work or for pleasure, "*goods*" refers to items that are produced for consumption. Goods can be anything from sweaters to oil to hard drives to fruit. And while most people's interaction with freight revolves around passing large trucks on the highway, the system is much more complicated than that. Imagine the following fictional scenario.

A man wakes up in the Guangxi Province in South China. He eats breakfast and then commutes by bicycle to the sweater factory at which he is employed. There, he spends his day making sweaters that are put on a truck headed for the rail station. The sweaters are then loaded with many other goods onto the train, shipped to the Port of Beijing, and loaded into a container. This container is then shipped by post-Panamax container ship to the Port of Los Angeles, where it is then placed on a train headed for Dallas, and, upon reaching Dallas, is placed on a truck headed for Opelousas, Louisiana to a Wal-Mart distribution center. Meanwhile, a woman in Lafayette, Louisiana wakes up one morning in September that is a bit uncharacteristically cooler than usual. Realizing she needs a new sweater for the winter, she goes online to Walmart.com, finds a blue sweater for $10.99, and has it shipped to her home. The next morning, she opens her door to find a box from Fed-Ex with one of the very same sweaters made in the Guangxi Province.

This is just one of numerous goods movements that happens daily, and highlights three of the four main modes to carry freight – truck, rail, and maritime (air being the fourth mode). It also speaks only to the final two movements, from manufacturing plant to distribution center and from distribution center to consumer. It misses the first steps of gathering raw material for manufacturing and then the manufacturing of that raw material into a usable product. The following figures help illustrate these principles.

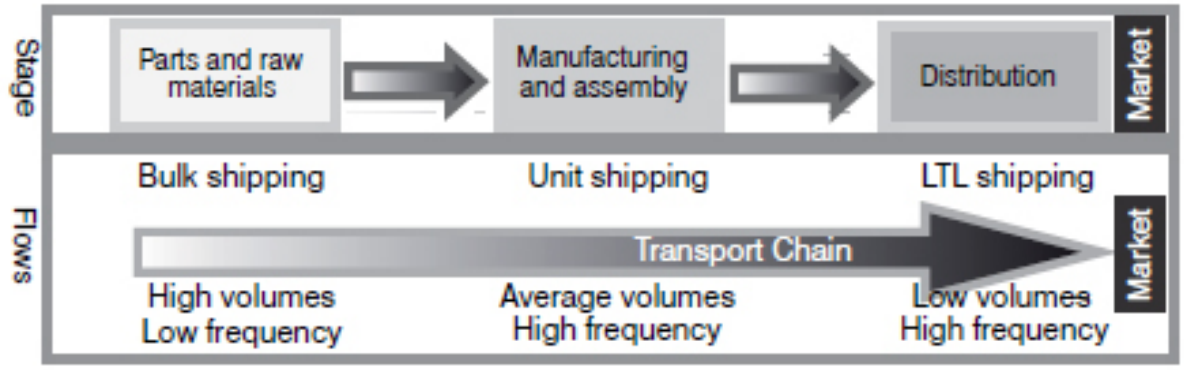
Figure 1: International Trande and Transport Chain



Source: Rodrige, Comtois & Slack, 2006, p. 149

Figure 1, above, illustrates the described scenario. Our fictional shoe factory worker can be said to exist in point A, the origin. Our fictional Walmart.com shopper can be said to exist shortly after point B. The above graphic also illustrates how traditional trade barriers that once precluded our fictional characters from interacting are handled. While decades ago such movements were highly expensive, today's modern climate removes trade barriers via agreements like the North American Free Trade Agreement (NAFTA) (Friedman, 2007). Many trade barriers that once existed, such as tariffs, are discouraged and eliminated from the system via these international agreements (*Ibid.*).

Figure 2: Commodity Chain



Source: Rodrige, Comtois & Slack, 2006, p. 152

Figure 2, above, illustrates the commodity chain. According to Rodrigue (2006, p. 152), the commodity chain represents each stage of production and transportation of a particular item as it moves from raw material to the marketplace. Each of these steps typically takes place in locations independent of each other, and requires some type of shipment from one location to the other.

The raw materials, or commodities, are typically represented by something unrefined or unusable for use in everyday life (*Ibid.*). It is at the very beginning stage of the chain, and represents things like crude oil, iron, coal, grain, or timber (*Ibid.*). These things are usually shipped in bulk – meaning in large amounts – and not very often, or at least less often than items in the other stages in the process (*Ibid.*). Typically, items are only shipped when a quantity large enough to justify the shipping cost arises (*Ibid.*). As these raw material tend to be comparatively cheap in nature (more of a supply than a demand), it makes more sense to ship them in large quantities with fewer shipments.

Stage 2 in the process is the manufacturing and assembly stage (*Ibid.*). At this point, the raw materials are refined and transformed into something useable. Oil because gasoline, plastics, and other materials. Timber is cut into sheets of wood for home construction or manufactured into desks, chairs, and other furniture. Grain is transformed into bread or cereals. These items then tend to be shipped to distribution centers or directly to stores for distribution to the public (stage 3) (*Ibid.*). More and more, these items are shipped as needed at a higher frequency than items in stage 1 (*Ibid.*).

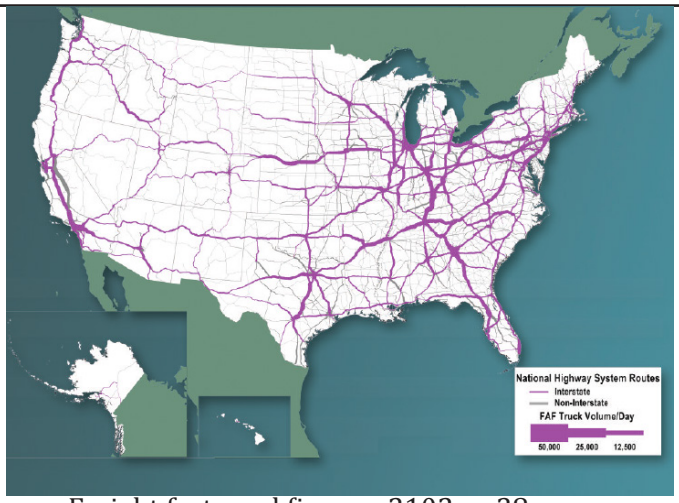
Stage 3, then, is the distribution stage (*Ibid.*). The items in this stage tend to be of a much higher value and more sensitive to time than in the earlier stages (*Ibid.*). Therefore, many companies determine than "LTL" – or less than truckload – shipping is the most efficient in terms of responding to the demand of the items (*Ibid.*). For example, a single pallet of cereal may be shipped from a distribution center to a store to keep up with the demand. While there may be room for more cereal on a truck, it makes sense to only send what is expected to be purchased before the next shipment. This saves the store costs in having to keep the excess cereal in storage, taking up valuable floor space that could be used for another item. In addition, the food could spoil while waiting for it to sell.

The Freight Challenge

While these stages make sense from a manufacturing perspective, it makes things very difficult for transportation planners and engineers responsible for the maintenance of roadways. Each stage represents another trip that must be made. It is another heavy truck on the road that conflicts with commuters in smaller vehicles. It is another big truck tearing up one of Texas' farm-to-market roads. And while businesses have determined that these modes are the most cost-effective for shipping product, it has short and long term effects on the transportation network that are not usually accounted for.

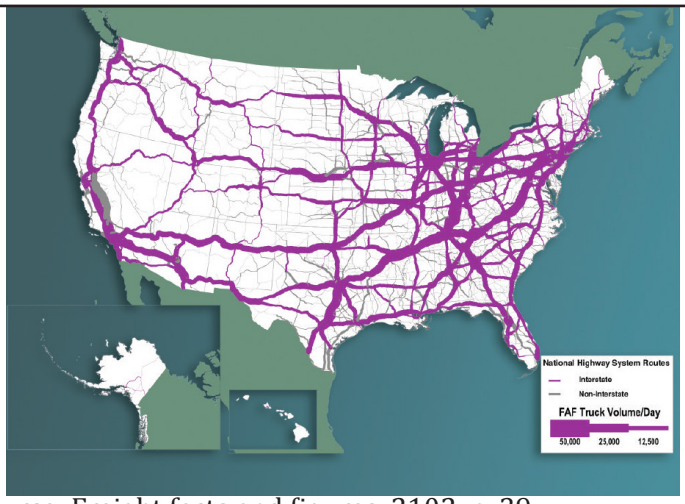
National trends indicate that the frequency of these trips will only increase. Between 1980 and 2003, truck miles logged nearly doubled (Sedor, 2006, p. 2). During that same period, however, roadway lane miles increased by only 5% (I*bid.*). Because of the ability of trucks to quickly respond to demand, they are by far the largest carrier of freight in the U. S. In 2011, an estimated 17,622 tons of goods were shipped via truck (Freight facts and figures, 2102, p. 9). In that same time period, all other modes accounted for 6,321 tons (*Ibid.*). And the number of truck miles driven is only expected to increase. Figure 3 displays freight levels in 2007, and Figure 4 displays the predicted increase in 2040 (*Ibid.*). Data models predict that truck traffic may reach up to 590 million miles per day

Figure 3: 2007 Long-Haul Truck Volumes



Source: Freight facts and figures, 2102, p. 38

Figure 4: 2020 Long-Haul Truck Volumes



Source: Freight facts and figures, 2102, p. 39

(Freight facts and figures, 2102, p. 39).

With these figures in mind, a conclusion can be drawn that an increased emphasis on freight planning is imperative. In fact, many state departments of transportation (DOT) and metropolitan planning organization (MPO) officials have indicated a need for better collaboration between the public and private sectors in these issues (Sedor, 2010, p. 3). Nationally, the federal government has enacted legislation under Moving Ahead for Progress in the 21st Century (MAP-21) that recognizes the need for freight planning (Blanton, 2013). The bill, despite no increase in funding from the previous transportation bill, has increased the federal share of funding to 95% for transportation projects identified as freight related (*Ibid.*). The caveat, of course, is that these projects must be identified in

a statewide freight plan (*Ibid.*).

And, while MAP-21 increases funding in the construction of freight-related infrastructure, it was not the first federal transportation bill to attempt to shift emphasis towards the field. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and the subsequent Transportation Equity Act for the 21st Century (TEA-21) of 1998 shifted the focus of federal funding from simply constructing more highway miles and maintaining that infrastructure to a focus on developing a National Intermodal Transportation System (Field, 2002, p. 34). This paradigm shift called on planners to consider the effects of the highway system on users beyond just single-occupancy vehicles during the work commute, but to look at modes such as transit and freight movements (Field, 2002, p. 37). It required transportation planners to consider the transportation network not just from a local perspective, but a national one as well (Field, 2002, p. 36). This legislation also established National Highway System High Priority Corridors with an intent to target these routes as necessary for efficient goods movements (Field, 2002, p. 37).

Despite this, however, freight research and planning is rarely done (Woudsma, 2001, p. 2439). There are several possible reasons for this. First, it may be argued that planners and researchers tend to focus on commuter traffic and cars rather than goods movement as trucks make up only 7-18% of traffic (Woudsma, 2001, p. 2440). It could also be said that freight movement is too complex to be captured and predicted by traditional planning tools such as travel demand models which are traditionally designed with daily journey to work trips in mind (*Ibid.*). These trends are not helped by the perceived lack of data to be used for freight planning. While government agencies such as the Federal Highway Administration (FHWA) have provided decent national-scale data, there is no definitive and reliable source for the local or regional level (*Ibid.*). In addition to these reasons, it can, frankly, be argued that little research is done in the area because it just simply does not carry the public's interest unless there is some safety issue involved (*Ibid.*).

In addition to the reasons stated about, another underlying cause can be pointed to: it is not in the best interests of shippers to share data with others (Puettmann, 2010, p. 811). This can steam from a fear of increased government regulations (Woudsma, 2001, p. 2440) to a perception that the sharing of data can compromise competitive advantages (Puettmann, 2010, p. 811). For example, time and cost are two of the major factors shipping companies consider in determining the routes by which items are shipped. Companies shipping from Beijing to the Chicago, for example, have a choice between sending items to a port along the western seaboard, such as L.A.,

Longbeach, or Portland to travel to Chicago via an inland mode, or sending shipments through the Panama Canal to New Orleans to be shipped up the Mississippi River. The choice is not always made by shortest difference, but is also determined by options for transfer to a secondary mode at the port and by shipping costs with these secondary carriers (Puettmann, 2010, p. 819, figure 3). While a good national freight model may predict an item from Beijing entering at L.A. due to the intermodal options, perhaps a particular shipper chooses New Orleans due to a discounted rate given to it by a riverboat operator trying to break into the business. This would send more shipments via that mode than models would estimate for, yet it is not within the purview of the shipping company to disclose the information.

Proposed Solutions and Tools for Freight Planners

A survey of the literature implies that there are three overall missing components in freight planning. Firstly, there is a lack of leadership from state and local levels (Sedor, 2006, p. 3). Secondly, there is a lack of data to use in planning efforts (Wousdma, 2001, p. 2440). And thirdly, there is a lack of knowledge in how to apply the existing data to transportation planning efforts (Beagan, 2007, p. 1-1). Moving forward, however, it appears as if the federal government recognizes this and is attempting to provide more tools to states and MPOs to improve the freight planning process.

The FHWA hosted a conference in in April 2005 between FHWA staff members, state DOT officials, and private-sector representatives (Sedor, 2006, p. 6). The entire conference centered on establishing a better working relationship between state officials and freight movers (*Ibid.*). From this, they identified that there is a need for leadership from the state level on these issues, specifically that each state needs to establish a statewide freight coordinator (*Ibid.*). These coordinators should not be political appointees, but should have a working knowledge of the industry (Sedor, 2006, p. 10). This person must be intimately familiar with freight issues and know how to transform the associated data into useable information for planners and policy makers (*Ibid.*). At the same time, states need advocates for freight that work at a higher level (Sedor, 2006, p. 6). This person would be a freight champion as opposed to a coordinator (*Ibid.*). These individuals would work together to develop state freight needs, goals and visions (Sedor, 2006, p. 10). These individuals would also liaison between the state and freight carriers, communicating the needs of both to the other (*Ibid.*). This coordination could perhaps take place through regional or statewide freight committees or coalitions (Ibid.).

Also pointed out at this conference was a need for better coordination between states (Sedor, 2006, p. 18). Freight, unlike most commuter travel, does not take place on a localized level, but is truly an interstate and inter-metro issue. It is necessary to coordinate with other officials in the region to ensure plans and policies are coordinated. For freight to truly be understood, it needs to be viewed as local, regional, and global in scale.

In addition, stakeholders have pointed to better integration of modes (Sedor, 2006, p. 4) and improvement of data analysis (*Ibid.*), perhaps through a more robust set of standards for data collection and reporting (Woudsma, 2001, p. 15). Ultimately, a better understanding of how land-use affects freight is needed (*Ibid.*), as well as better systems of modeling and predicting freight movement (Beagan. 2007, p.1).

One promising attempt has recently been completed in Oregon where a survey was used to capture the needs of shippers. Oregon, like most states, was having a difficult time in involving freight haulers in its planning process and commissioned research to determine a methodology for surveying shippers (Lawson, 2003, p. 131). The result was a survey that achieved a 61% response rate, identifying more than 2,200 infrastructure related problems (*Ibid.*). These problems tended to revolve around congestion and poor road conditions (Lawson, 2003, p. 142, table 5). The survey used 11 questions, some being two-part, and was administered via telephone calls to both large and small firms during regular business hours, with interviewers trained to ask probing and follow-up questions (Lawson, 2003, p. 139, 146). While Lawson described the technical aspects of the survey in deep detail, the main take away from Oregon's study is the realization that it is possible, given the right conditions and with the appropriate tools, to get good information from shippers. In thoughtfully framing the question in terms of not, "Where are you going?" but, "Can you think of any transportation problems you encounter in your company experiences on the roads?" (Lawson, 2003, p. 146) can result in specific infrastructure-deficient locations.

Surveys such as this one could ultimately become a good source of data for states and MPOs with budgets allowing for them. Other sources of data could perhaps also come through technological advances in GPS technologies (Woudsma, 2001, 9. 2453). All this data needs to be formatted into use for geographic information systems (GIS) that can be used to analyze the data in order to determine freight flows, bottlenecks, and other problems (Field, 2002, 44). These sources of data need to be applied in models that take an integrated approach and understand the different movements and choices that freight haulers make as opposed to commuters (Woudsma, 2001, p. 2446).

The federal government has also made an effort to support MPOs and state departments of transportation to incorporate freight in their modeling efforts. The federal government recognizes that the available data is extremely limited and not generally available to planning agencies (Beagan, 2007, p. 1-1). As such, the Quick Response Freight Manual II was published in 2007 to address these concerns and help planners incorporate freight data into travel demand models. The manual helps planners locate available data and gives techniques on converting this data into vehicle trip tables that are then merged with the other daily commute trips generated in the traditional four-step model process. Planners can then use this methodology to develop predictions pertaining to the amount of freight trips caused by new facilities such as regional warehouses, terminals and intermodal facilities.

Another tool provided by the federal government is the FHWA's Freight and Land Use Handbook (2012). This handbook was designed for both transportation and land use planners to use in determining the effects of land use decisions on freight movements as well as the impacts of freight movements on land use. It highlights policies that local governments and MPOs can enact, such as requiring access and impact studies or designating specific truck routes. It also outlines operation and management technics freight carriers can enact that would support regional transportation goals, such as off-peak deliveries and anti-idling technologies.

Success Stories

With these ideas in mind, this paper will now shift focus to consider the examples of three urban areas that have examined the freight topic in depth and the solutions they have determined. These three areas – Baltimore, Duluth-Superior, and Seattle – represent metropolitan areas with many of the same freight problems faced in metropolitan areas all over the nation. Each, just like many metros, has a fairly large port that supports the regional economic infrastructure yet conflicts with other existing transportation goals such as congestion management and safety. Unlike most areas, however, these MPOs have been at the forefront in developing ways to include freight movement in their transportation planning processes. This section will look at each of these regions to understand how the areas dealt with the freight problem.

Baltimore is served by the Port of Baltimore, which is the nation's sixth largest port; two Class I and three regional railroads; and the Baltimore-Washington International Airport (Baltimore metropolitan council, n.d.). The Baltimore Metropolitan Council (BMC), which serves as the MPO for the Baltimore region, facilitates a freight task force – the Freight Movement Task Force – and has implemented freight planning into both its short and long range

planning process (Aris, 2013).

Regina Aris, Assistant Director of Transportation Planning at BMC, made a presentation to the Association of Metropolitan Planning Organizations in 2013 suggesting that regions use the following steps to include freight carriers in the planning process. First, it is essential for transportation planners to determine what type of freight is being transported in the region. Planners need to use either public sources available from the FHWA or private, proprietary sources developed by consulting firms to get data on tonnage, commodity flows, and major modes used. If an area has a port, then planners need to identify if the port primarily imports or exports. Areas without ports but along major interstate corridors may determine that their primary interaction with freight is a through movement (one with both origins and destinations outside the region), with some deliveries being made to local business. Planners, secondly, need to determine how the individual region compares to the rest of the state. They should determine if the region is generally the same as the state or if the region is a niche market. For example, in the scenario used to open this paper, south Texas has a niche market unlike the rest of the state as it exports shale oil. This unique industry provides unique challenges that planners in the region would need to identify as being different from challenges in other parts of the state.

With these questions answered, planners then need determine with whom the region is trading. By now planners should know what is moving and the mode by which it is moving. This step enables planners to learn where they freight it moving. Answers for this step are very much dependent on the answers for the first step. If a region is an importer, than most likely goods are coming from oversees via ship and headed inland via another rail, truck, or air. Or, if area is primarily involved in exports, then the opposite thereof applies. It is also important to determine the geographic direction of freight flows. Are imports traveling north, south, or are they staying in the region?

Next, planners need to inventory existing infrastructure and needed infrastructure. Now knowing what is moving, where it is moving, and by what mode it is moving, it is necessary to determine if local infrastructure supports those movements. Going back to the example in south Texas, it is obvious that the crumbling infrastructure cannot support the movement of large trucks. In other, more populous regions, this may not be so obvious. These large trucks could be causing congestion on interstate highways or local roads, that is attributed to other patterns, such as commute traffic. Planners not taking freight movements into consideration may devise methods to reduce

commute congestion while it may be of minimal effect. Heavily used infrastructure should also be identified as needing more regular maintenance, or perhaps engineered to be able to handle a larger load.

The last step outlined by Aris is for planners to develop criteria to include freight projects in the long-range plan. This can be done, for example, through the development of a planning matrix which identifies how transportation projects match up to goals objectives outlined in the plan. For instance, a long-range plan could identify a community desirous of less congested roadways, more bike paths, and better truck access to the port. Projects could then be ranked via a numerical scale on how they contribute to these goals with the highest ranked projects receiving priority.

Aris also suggests that planners determine if there are land-use controls that would be helpful in controlling where freight is located. Zoning tools can help to focus the bulk of freight movements to fewer corridors. Additionally, this is helpful to the industrial community as it can remove uncertainty for companies wanting to move or expand locations.

Finally, Aris suggests that metropolitan planning organizations form task forces or committees with the sole focus of bringing together freight shippers in the community. These committees would be made up of planners, highway engineers, and industry leaders and would focus on specific projects that planners and engineers could work on to improve freight movement. These groups have been meeting successfully in places like Baltimore and Duluth-Superior (Chicka, 2013).

To the west, the Duluth-Superior Metropolitan Interstate Council (MIC) serves as the MPO for the bi-state area (*Ibid.*). Duluth, located in Minnesota, and Superior, located in Wisconsin, sit across from each other on Lake Superior and are served by their two respective ports (*Ibid*). The ports are importers of raw goods from Canada such as timber and metals (*Ibid.*). Chicka speaks to the unique relationship between MIC's transportation planners and the freight movers in the region. He explains that the MPO facilitates a freight committee – the Habor Technical Advisory Committee – that meets quarterly to discuss freight related issues. In attendance are both industry leaders and transportation officials and discussion includes ways to make roads better for freight movers. Chicka also explains that MPO staff members have made an effort to become involved with freight-related professional groups. This, he argues, has helped MIC build trust with these groups and was a way to be proactive in involving shippers in the planning process.

One of the biggest problems Chicka sees in the region is large trucks using local roads due to weight limits on interstate system. Carriers find it a hassle to get a special permit to carry heavy loads, and end up using non-regulated state or local roads instead. This adds extra maintenance costs to local jurisdictions which are not inclined to regulate local roads for various reasons. MIC's attempted solution is to petition the FHWA/Congress, so far to no avail, to lift the weight limits on the interstate system. He argues that allowing heaver trucks nation-wide would reduce the total number of trucks on the roadways as fewer trips are necessary.

And, finally, the City of Seattle Department of Transportation developed the Urban Mobility Plan in 2008, highlighting best practices in urban freight mobility (City of Seattle, 2008, p. 10A-1). While Baltimore and Duluth-Superior focused on including freight carriers in the planning process, Seattle looked at regulations it could impose on land and road uses. These regulations would govern when and how heavy trucks could access the transportation network. In fact, while areas like Duluth-Superior look for ways to make transportation easier for shipping companies, such as allowing overweight trucks free access to local roads (Chicka, 2013), Seattle's goals include avoiding congestion and improving safety (City of Seattle, 2008, p. 10A-1). Seattle's plan involves two components: 1) strategies for businesses and shippers to minimize logistics cost (City of Seattle, 2008, p. 10A-1), and 2) policies the city should implement to optimize the safety and capacity of city streets (City of Seattle, 2008, p. 10A-2).

The plan argues that companies could lower shipping costs by strategically locating distribution facilities to locations that minimize the travel distances and travel times (City of Seattle, 2008, p. 10A-1). Shippers should also utilize larger vehicles and co-load vehicles with items for multiple destinations along the route, rather than making multiple trips for each delivery (*Ibid.*). Lastly, the plan calls for shippers to schedule deliveries during off-peak travel times (*Ibid.*).

The plan also identifies eight policies for the city to set in place to help balance the goals of increased safety with the needs of the shipping industry (City of Seattle, 2008, p. 10A-2). The first policy is to restrict the time periods during which deliveries can be made (*Ibid.*). Seattle handles this by restricting large trucks from entering downtown between 6:00 A.M. and 7:00 P.M. on weekdays (*Ibid.*). The plan also calls for the city to reserve on-street parking for delivery vehicles, while mandating that new developments provide areas for off-street loading (*Ibid.*). Additionally, oversized trucks would be required to get a permit to travel on local roads (contrast with Duluth-Su-

perior's reluctance to enact this policy) and the city would install signage noting truck restrictions and approved truck routes (*Ibid.*). The city also is to make use of alley ways for truck deliveries (*Ibid.*). Lastly, the city is to implement several intelligent transportation system (ITS) solutions that would communicate real-time road conditions, both for pre-planned construction and detours and up-to-the-minute information on crashes and other incidents that may disrupt the transportation network (*Ibid.*).

Conclusion and Recommendations for MPOs

As quoted at the beginning of this papers, the number of MPOs making an effort to include freight movement in the planning process is less than one-third (Freight Stakeholders National Network, 1997). With the ever increasing number of heavy truck movements on the road, this number needs to change. While ideally leadership would come from the states, MPOs cannot wait for states to take the initiative. It is the roll and responsibility of the local governments that make up the MPOs to ensure its citizens are able to efficiently access the roadway network and receive goods in an efficient manner.

While this will take some effort on the part of MPO staff, it is not impossible as even a small urban area such as Duluth-Superior has demonstrated. In addition, the FHWA has created many tools such as the Quick Response Freight Manual II and the Freight and Land Use Handbook that help planners locate and make use of data. The key will come from MPOs taking the initiative to begin the freight conversation by attempting to answer the what, where, and how of the freight in their regions – what freight is moving through, where is it going, and how is it getting there? This can be done through surveys, as examined by Lawson, or through freight committees as established by Baltimore and Duluth-Superior. Whatever the tools, though, planners must be purposeful not to place undue blame on freight carriers for all the woes on the transportation network, but strive to truly make carriers partners in the planning process.

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