AN EVALUATION OF FACTORS AFFECTING LIVABILITY IN A FREIGHT-CENTRIC COMMUNITY IN MEMPHIS, TENNESSEE

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ABSTRACT

Community livability is increasingly being examined and promoted as exemplary practice, and the impact of freight on an urban community is significant. An analysis was conducted in Memphis, Tennessee in a region with heavy freight traffic. Following a broad literature review of globally applied strategies for enhancing livability and solving problems caused by freight, a survey was conducted of residential stakeholders regarding their perceived definition of livability, barriers to livability, and the impact of freight on the livability of their communities. The survey instrument was administered to a population of residents from both a freight-centric (FC) community and a non-freight-centric (NFC) community, and a comparison analysis was performed in order to determine if a statistically significant difference existed between the groups. While the results show that no significant difference exists between the two groups in terms of perceived barriers for livability, a significant difference does exist among the conditions within each type of community. It follows that while people from both groups have similar opinions about what makes a community livable or unlivable, the two groups are reporting very different realities within their regions in part due to an increased presence of freight. Finally, the methods identified in the literature review were then evaluated based on their success elsewhere, as well as their applicability in Memphis, Tennessee and the United States.

INTRODUCTION

When evaluating livability from a transportation perspective, numerous definitions exist between various stakeholders (i.e. residential, industrial, or political) in a community. Even among residents alone, the basic qualifications of a livable community may vary. Not only do the definition and priorities for livability vary among stakeholders, but they may also shift depending on an emphasis in the economic, social, or environmental aspects of livability for a community.

Furthermore, many communities change immensely in response to increased freight traffic and are put at higher risk for issues associated with the movement of freight. This research aims to identify barriers to livability for a specific type of community with a heavy freight presence. The type of community being observed in this research is considered to be a “freight-centric community” or one that is distinguished by having a high percentage of freight traffic/freight-producing facilities. A freight-centric community is also defined by a lack of a substantial buffer area between a freight generator and a residential area.

Methodology for this research was implemented within Shelby County, with specific emphasis along the Lamar Avenue Corridor in Memphis, Tennessee. The Lamar Corridor is a 6.5-mile long corridor in southeast Memphis. The area surrounding Lamar Avenue (or U.S. 78) has a heavy industrial presence with a significant volume of truck traffic present along the corridor. No adequate buffer exists between commercial/industrial regions and the residential landuses in this area; therefore, this part of Memphis is considered a freight-centric community.

In order to enhance livability in a given urban region, one must first understand the area-specific impedances to the concept, from any of the perspectives mentioned above. Data and observation, as well as literature, served as a basis for assumptions about barriers to livability in a given region, but this body of work ultimately identifies a representative perception of livability from the viewpoint of its residents. A survey instrument was developed to assist in understanding livability surrounding the Lamar Corridor, as well as to identify the impact of freight on livability from a residential perspective.

In addition to exploring various facets of livability in a freight-centric community, this work also identifies technology-based or strategy-based methods that may enhance livability in a community, as an evaluation of each method’s effectiveness and applicability is performed. This research has identified some benefits associated with the use of advanced technologies and practices to safely blend freight movements with passenger, transit, bicycle, and pedestrian traffic. These technologies or methods identified can mitigate a community’s safety, noise, congestion and environmental concerns, and accelerate implementation of improved practices. Ideally, the work done in Memphis, TN will be built upon and also applied to similar FC areas in the United States.
What is Livability?

In 2009, the U.S. Department of Transportation, Housing and Urban Development (HUD), and the Environmental Protection Agency (EPA), created the Partnership for Sustainable Communities focusing on six livability principles which have served as a framework for the advancement of performance measure development (1). These principles include the availability of many transportation options, equitable and affordable housing, enhanced economic competitiveness, support of existing communities, coordinated federal policies and investment, and an increased value for communities and neighborhoods (2). Furthermore, according to the Federal Highway Administration (FHWA), “livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets.” Under the FHWA framework, livability refers to personal mobility, but also to the “effect” of an increase or an introduction of freight activity in a community. Many communities experience change in response to an increase in freight traffic, including physical, environmental, and economic aspects associated with the movement of freight.

LITERATURE REVIEW

Inherent to the global roadway system are the problems of traffic congestion, air pollution, and noise pollution, as well as the potential for traffic accidents; all of which are amplified by the addition of necessary yet cumbersome freight traffic. Densely populated urban areas put increased demand on the U.S. freight transportation system, and it is becoming increasingly necessary that consideration be taken to mitigate freight’s effect on urban livability (3-5). Air pollution, noise pollution, decreased safety, traffic congestion, and resource consumption are all negative impacts that might weaken the livability of an urban area (3). This review provides information regarding suggested policy solutions and industry practices that may impact livability, as well as available strategies or advanced technologies that may improve livability.

Suggested Freight Solutions & Initiatives that Impact Livability

Livability and freight are conflicting concepts that have been of interest across multiple disciplines; from planning, to transportation, to logistics and public health. While researchers have begun examining the impacts of freight movements on livability in communities, the perception remains that communities trying to attract or retain industrial viability are considered less livable. Reducing, limiting, or mitigating freight operations, however, has direct and measurable economic and social impacts. Of the numerous suggested ways to organize alleviation techniques, the following divisions are used here: public infrastructure, landuse and logistics management, access conditions, traffic management, and trade node. Each of the initiatives for mitigating the inherent problems of increased freight volumes will be presented under these divisions. Methods dealing with infrastructure, consolidation, and access restriction may be handled by local authorities and policy makers, while specific vehicle enhancements (like efficient engines or aerodynamic vehicles) or technological solutions could by implemented in industry (3, 6-7).

Public Infrastructure

It is shown that the optimization of a network of transfer points both within a city center and on the outskirts will drastically improve the efficiency of the overall goods movement system. Properly located terminals stimulate efficiency by allowing the consolidation of trips and goods for one company or collaboration. The resulting improved organization may allow for the incorporation of better modal options, such as transitioning to rail, shuttle, waterway canals, or an underground system (6-7). Transitioning to rail or boats from trucks, however, often increases costs and requires subsidization (8).

Well-located hubs that allow for direct transition from trains to delivery vans are the most preferable (6-7). The creation and utilization of centrally located urban distribution hubs (that also potentially incorporate clean-energy delivery vehicles) is known to reduce the frequency of inner-city truck trips (9). These Urban Consolidation Centers (UCCs), also known as urban distribution centers, are typically set up in parking lots or other empty or shared spaces where freight vehicles may unload cargo to smaller
delivery vehicles. The presence of an inner-city terminal or hub may help alleviate congestion by
decreasing trip frequency and minimizing total vehicle miles travelled, as well as encouraging
consolidation of trips and improving the efficiency of loads (3, 7, 10). This methodology is considered by
some as one of the most all-encompassing and successful techniques (4). Others, however, have reported
this method to be “economically unfeasible” after a test period and the conclusion of external funding
(10).

Another strategy would be to incorporate the use of “Alternative Fuel Vehicles” or AFVs. This
strategy could be applied to transit busses or industry constituents that have large fleets (e.g., Fedex or
UPS); such companies are exploring the use of AFVs in both the U.S. and Europe, though hindrances
AFV use do exist. AFV usage includes the necessity of capital and higher operational costs, as well as
limited infrastructure for their re-fueling. In fact, diesel engines may still prove to be advantageous over
AFVs, especially for larger trucks (8).

Land use & Logistics Management

Land Use Even though the delineation of specific loading/unloading zones per destination is common
practice in many cities worldwide, demand for them is increasing, and it is recommended that building
regulations be updated to include accommodation for off street loading. In extreme cases such as on
narrow or one way roads where loading is still necessary, proper consideration, such as signalization
and/or premeditated regulations, should be used when blocking traffic, and only for short periods of time.

Although the idea may be met with opposition by certain stakeholders, it is known that in some
cases traffic congestion could be lessened by removing on-street parking altogether. This method would
be supplemented well by adding alternative parking lots or transit options, but is still controversial.
Success exists for carriers who have learned to share land, space, and technologies. It is suggested that
carriers collaborate in shipping hubs in order to jointly benefit from the space or technology. Furthermore,
while the specification for reserved space (like private, handicap, motorcycle parking, and taxi and bus
lanes) is crucial for the functionality of urban systems, they are often left empty for periods of time. When
these empty slots align with peak freight delivery periods, sharing would induce beneficial results (7).

Logistics Management

City Logistics Management Muñuzuri et al. define city logistics as “the specific logistic concepts and
practices involved in deliveries in congested urban areas, the ‘last mile’ transport, with specific problems
such as delays caused by congestion, lack of parking spaces, close interaction with other road users, etc.”
(7). In response, it is suggested that where possible parking lots left unused for time periods be
temporarily converted to loading/unloading zones as a means to take heavy vehicles off streets, thereby
reducing delay and congestion. Furthermore, the creation of designated parking spots for heavy vehicles,
where a driver may park for a longer period to deliver his goods on foot or dolly, would serve to decrease
noise, air, pollution and congestion.

Neighborhood Logistics Management In an effort to minimize the necessity for under-capacity loaded
trucks, it is suggested that neighborhoods/local regions designate one uniform package pick-up location
(9). This concept would remove time restrictions, as the receivers would not need to be present; nighttime
deliveries would also become appropriate. Such a method is especially applicable in dense areas that
receive a high number of packages (7).

Construction Logistics Management Berlin experienced massive success with the construction logistics
management they practiced redeveloping Potsdamer Platz. For example, policy was in place that
mandated concrete be mixed on-site, as well as that the majority of materials be moved by rail. The
resulting efficiency encouraged the establishment of national policy requiring major construction jobs to
include logistics management (9).
Access Conditions

As some of the first measures to be implemented in most European cities, these kinds of methods are already heavily used in Europe. The specifics vary, but benefits have been reported in many cities (6). Access may be controlled through a variety of measures, whether based on weight, volume, size or other load capacity factors (7). Disallowing the entrance of highly emitting vehicles in certain “zones” should have a positive impact on the environment (4). Also known as LEZs (Low Emission Zones), these restrictions are claimed by some to inspire the complete reorganization of freight operations with more effective results (8). In the Netherlands, however, results were less than anticipated. Although, this outcome could be due to an excess of permits allowing access of poorly rated vehicles (Browne et al., 2012). Numerous European cities have previously experienced diminishing harmful emissions by restricting admittance of old/out of standard heavy vehicles into inner-city areas (Goldman & Gorham, 2006). It is important to note, that while benefits of LEZs are apparent, the transferability of these to the U.S. is limited (8).

Another type of access condition is based on time of day. It is easy to see how restricting delivery/pick-up within congested urban areas to off-peak time periods could help minimize freight’s externalities. Furthermore, as trucks are present during night time or uncongested daytime periods, more parking or loading/unloading areas should be available (7).

Traffic Management

Due to variability among freight vehicles and companies, as well as urban regions, distinctions should be made to accommodate for varying needs of an urban transportation system. Classifications may be made based on the freight vehicle, delivery zone, or roadway characteristics.

TABLE 1 A summary of traffic management mitigation techniques

| Freight vehicle characteristics | Based on the percentage of full capacity of a given vehicle, a proportionate amount of time may be allowed for loading/unloading. Vehicles making multiple deliveries on a route should be allowed less time in any one zone, as opposed to vehicles making one stop and emptying a majority of their load. Access will vary based on content of load—depending on weight or size of goods to be delivered (7). As one of the most effective measures, strict emissions standards for fuel efficiency of trucks proves to have a significant influence on freight’s impact. For example, “The Los Angeles/Long Beach Ports Clean Truck Program is by far the most ambitious emissions reduction program in the United States and, in 4 years, led to large reductions in diesel truck emissions.” A sustainable option as well, fuel efficiency of freight and emissions standards will continue to negate air pollution and emissions in urban areas (8). |
| Delivery zone characteristics | Symptomatically based solutions will vary depending on delivery region (tourist, residential, commercial, or a combination of these). Depending on the nature of delivery destination, night time delivery may not be appropriate (7). |
| Street characteristics | Access to certain areas may be granted for trucks achieving a specific label or status. For example, cleaner emissions or minimal noise outputs may earn a truck access to a particular area (at a particular time). Such strategies are typically voluntary and would serve as useful ways to incentivize livable results for residents (8). - Access Streets - Restricted Access Streets - Load/unload streets - Non-freight streets - Pedestrian streets Consequently, it may assist freight distributing agents already facing numerous restrictions to consolidate basic strategies, where appropriate, across urban districts. Many of the previously mentioned methods for enhancing livability for urban residents and other local stakeholders, hamper the abilities and flexibly of the freight distributors themselves, while increasing their costs. |
Trade Node Solutions
Defined as including significant freight producing facilities such as ports, airports, or intermodal yards, trade nodes not only see the freight problems associated with urban last mile/first mile transactions, but they also see the additional problems associated with an increased concentration of freight traffic. The following strategies pertain specifically to trade node freight problems:

- Appointments and Pricing Strategies at Ports: In an attempt to better organize freight arrivals at ports or intermodal facilities, gate appointment strategies have been implemented in limited locations in the U.S. A successful example a pricing strategies in California shifted 40% of its freight cargo to the evening. This spacing of concentrated freight traffic should reduce congestion in nearby corridors. While the necessity of fees for peak-hour interactions is not yet prevalent at many trade nodes in the U.S., the implementation of such could also serve to spread concentrated freight arrivals in congested corridors.

- Road Pricing and Dedicated Truck Lanes to Manage Hub-Related Truck Traffic: Such strategies are sparsely found in practice, and much more research is needed to comment on their effectiveness. These strategies include tolls for freight traffic and/or the designation of certain lanes or roads for freight traffic only. Increased tolls for freight trucks would reduce truck competitiveness compared to rail, and thus would benefit the personal vehicle user, as well as the environment. The increased cost to the freight carrier, however, may prevent the rapid acceptance of freight tolling in the U.S. Furthermore, freight-only lanes are rarely found in the U.S., and the cost and land requirements are high and normally unjustified by the volume of freight traffic.

- Accelerated Truck Emissions Reduction Programs: To further the emissions standards mentioned above, these programs aim to reduce the average age of freight vehicles travelling through certain zones or trade node sites. Such strategies incentivize the replacement of older, poorer emitting vehicles with newer, cleaner ones.

- Equipment Management: These strategies incorporate increased management of chassis and cargo containers to improve their use and movement within freight transfer operations. With an overall goal to reduce VMT, such strategies would also reduce congestion and emissions.

- Rail Strategies: These strategies incorporate grade separations at rail sites, but also include high capital costs. Currently in the U.S., no funding exists for such projects.

- Border Crossings: These strategies typically include the use of ITS measures at locations where freight traffic crosses borders. Room for improvement of ITS at borders exists. Unlike solutions mentioned in previous sections, trade node solutions have typically been executed in U.S. locations. Of the above solutions, the road pricing and accelerated emissions programs are expected to be the most useful in promoting livability by reducing emissions and congestion (8).

Intelligent Transportation Systems (ITS)
Policy makers and industrial constituents may utilize the above classification schemes in combination with various technology-based strategies to help manage traffic. Intelligent internet and surveillance based reservation systems for loading/unloading, as well as the dissemination of information about other “real time” traffic situations provide valuable information to freight vehicles and controllers that could help alleviate delay, congestion, and higher costs. This is similar technology to the kind used to coordinate traffic signals and combat accidents in other intelligent transportation networks (7). The NCFRP Report 23 provides the following definition, “ITS for monitoring or managing urban freight includes technologies for providing real-time traffic (and parking) information, automated enforcement of parking or traffic regulations, automated toll collection, and automated access control.” ITS technologies incorporating GPS tracking of fleet vehicles or individual parcels are considered private initiatives (8).
While real-time traffic information is being utilized in larger U.S. cities, the UK, Spain, and Italy are currently more progressive and are using license plate scanners to monitor truck traffic. The U.S. is
continuously enhancing the technology used in national ITS measures, and the largest private shipping
companies are even more advanced in their internal monitoring. Intelligent parking management
strategies are slower to progress, and high cost and complicated systems are claimed to be the biggest
obstacle for these methods. Despite an increased initial cost for automatic enforcement systems, ITS like
these may sustainably decrease the monitoring of tolls or access-restricted zones. The applicability of
such systems in the U.S., however, is questionable and further exploration is needed (8).

BACKGROUND
What is A Freight Centric Community?
A freight-centric (FC) community experiences a high percentage of freight traffic, or freight-producing
facilities. These communities are characterized as residential areas that bear spillover effects from freight
movements through neighborhoods. They are also defined by a lack of a substantial buffer zone between
a freight generator and an adjoining residential area. Further characteristics of FC communities include
proximity to freight hubs. FC communities can also be located away from freight generators as is the case
of communities located along border crossings. These residential communities are traversed by arterials
with high percentages of trucks, and increasing periods where level of service (LOS) measures reflect
congestion. There may be a high frequency of trains, a rail yard in proximity, or long delays at grade
crossings. There may also be a high frequency of air traffic or truck traffic generated by air cargo
operations.

Corridor Description
Memphis, Tennessee contains three interstates, five Class I railroads, and one of the largest freight airport
hubs in the world (11). Lamar Avenue (U.S. Highway 78) is a crucial portion of Memphis’ freight and
passenger infrastructure. It serves as a commuter route to downtown Memphis as well as a critical freight
corridor with many freight-generating facilities in proximity. For this project, the portion of Lamar
Avenue being evaluated in the context of a FC community is a 6.5 mile-long corridor that runs from I-240
South to E Holmes Road. The five residential neighborhoods included within the study area are: Oakville,
Oakhaven, Parkway Village, Fox Meadows, and Hickory Hill.

Two of the major facilities within this study area include the Burlington Northern Santa Fe
(BNSF) rail yard with a capacity of 300,000 twenty-foot equivalent units (TEUs) per year and parking for
6,000 trucks, and the Memphis International Airport, the second busiest air-cargo hub in the world due to
FedEx. Truck volume on Lamar is 8,000 average annual daily trucks (AADTT) constituting
approximately 27% of the annual average daily traffic (AADT) (12). The total population of the 20
census tracks within in the study area is 83,712 people as of 2010. More than 35,000 jobs existed in 2011
within the study area. The highest percentage of jobs by industry sector was found in Transportation and
Warehousing (14.2%), Health Care and Social Assistance (13.0%), and Waste Management and
Remediation (12.4%). Of this population of workers, 80.1% are African American and 56.2% are female
(13). The communities surrounding Lamar Avenue are impacted by significant freight activity, can be
defined as freight-centric communities, and serve as the basis for the analysis in this research.

RESIDENTIAL SURVEY ANALYSIS
As they provide a “permanent source for inefficiencies,” the ever-changing mixture of conflicting and
overlapping needs of all the urban transportation constituents (freight carriers, passenger cars, transit
participants, local business owners, urban residents, etc.) requires adequate planning and consideration
when trying to achieve increased livability (7). In an effort to better understand perceptions of livability and
the impact freight has on such, a survey was administered to a population of residents from both the
freight-centric (FC) community and the non-freight-centric (NFC) community in Memphis, Tennessee.
Both the findings from the literature review and the collective experience of the research team were used
to inform development of the survey instrument.

The instrument was administered in both online and focus group formats, with the focus group
sessions specifically targeting residents living near the Lamar Corridor. Both the online survey
Rápalo, Ivey, Hart, Schroeckenthaler, and Adams


RESPONSES FROM THE FOCUS GROUPS AND ONLINE SURVEY EVENTS WERE USED TO IDENTIFY FACTORS AFFECTING LIVABILITY OF FC AND NFC COMMUNITIES AND SOLICIT PERCEPTIONS REGARDING THE IMPACT OF HIGH FREIGHT VOLUMES IN A NEIGHBORHOOD. THE SURVEY INCLUDED A NUMBER OF OPEN-ENDED, RANKING, AND RATING QUESTIONS THAT CAPTURED THE RESIDENTIAL OPINIONS REGARDING HOW FREIGHT TRAFFIC AFFECTS THE LIVABILITY OF THEIR NEIGHBORHOOD (FOR SPECIFIC ITEMS, SEE TABLE 2). PARTICIPANTS WERE ASKED ABOUT THEIR PERCEPTIONS OF HOW THEIR NEIGHBORHOOD HAS CHANGED OVER TIME, WHAT LIVABILITY MEANS, WHAT THE CONTRIBUTORS AND BARRIERS TO LIVABILITY ARE, AND WHAT FACTORS NEED IMPROVEMENT IN THEIR NEIGHBORHOOD.

TRANSPORTATION-RELATED ITEMS INCLUDED QUESTIONS ABOUT RESIDENTS’ PERSONAL COMMUTING PATTERNS (INCLUDING WHETHER OR NOT A HEAVY FREIGHT PRESENCE ALTERS THESE PATTERNS) AND A QUESTION ASKING PARTICIPANTS TO RANK THE IMPORTANCE OF DIFFERENT ELEMENTS OF A TRANSPORTATION NETWORK. PARTICIPANTS WERE ALSO ASKED TO DESCRIBE THEIR CURRENT INVOLVEMENT WITH PUBLIC/MUNICIPAL LEADERS AND TO INDICATE WHETHER OR NOT THEY WOULD BE WILLING TO BE MORE INVOLVED IN DECISIONS PERTAINING TO THEIR NEIGHBORHOOD. TABLE 2 SUMMARIZES THE INSTRUMENT AND SCALES FOR EACH QUESTION OF THE RESIDENTIAL SURVEY INSTRUMENT.

**TABLE 2 RESIDENTIAL SURVEY INSTRUMENT**

<table>
<thead>
<tr>
<th>Survey Questions Regarding Definitions of Livability and Perceived Barriers to Livability</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please tell us the closest intersection to where you live:</td>
<td>Short Answer</td>
</tr>
<tr>
<td>How has your neighborhood changed since you have lived here?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>How do you define livability for your community?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>In your opinion, what things are important for making a community livable?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>In your opinion, what things are barriers to livability?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>How do you rate your neighborhood for livability? 10 being very livable.</td>
<td>Rank 1-10</td>
</tr>
<tr>
<td>What are the most important contributors to livability? (Please pick your top 5 most important.)</td>
<td>Choose 5</td>
</tr>
<tr>
<td>• Having a park in my neighborhood</td>
<td>• Living in an economically thriving neighborhood</td>
</tr>
<tr>
<td>• Living close to school/work</td>
<td>• Having a sense of community</td>
</tr>
<tr>
<td>• Living near a hospital</td>
<td>• Having a say in what happens in my neighborhood</td>
</tr>
<tr>
<td>• Having a community center</td>
<td>• Quality affordable housing</td>
</tr>
<tr>
<td>• Knowing my neighbors</td>
<td>• Minimal road congestion</td>
</tr>
<tr>
<td>• Feeling safe in my neighborhood</td>
<td>• Clean air and water</td>
</tr>
<tr>
<td>• Having alternative transportation options (walk, bike, public transit)</td>
<td>• Good quality roads</td>
</tr>
<tr>
<td>• Good bus service</td>
<td>• Public art/ landscaping</td>
</tr>
<tr>
<td>In terms of transportation (walking, biking, driving, and public transportation), what are areas that need improvement in your neighborhood?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>How does freight traffic (rail, trucks, air) affect your neighborhood?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>Have you experienced any negative environmental effects in your neighborhood (smog, pollution, or otherwise)?</td>
<td>Yes or No (explain)</td>
</tr>
<tr>
<td>Do you attribute these environmental factors to the freight traffic in or around your neighborhood? Please explain.</td>
<td>Open-ended</td>
</tr>
<tr>
<td>Survey Questions Regarding Personal Commuting Patterns and Transportation and Public Policy Relationships and Needs</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Please tell us about your traffic experiences in the Lamar Corridor:</td>
<td>Rating: 0 – never, 1, 2 – just as often as elsewhere in Memphis, 3, or 4 – extremely often</td>
</tr>
<tr>
<td>• How often do you notice the presence of freight or heavy trucks?</td>
<td></td>
</tr>
<tr>
<td>• How often are you stuck in traffic due to this freight presence?</td>
<td></td>
</tr>
<tr>
<td>• How often are you stuck in traffic not caused by freight?</td>
<td></td>
</tr>
<tr>
<td>Do you find yourself taking alternative routes to avoid the Lamar Corridor?</td>
<td>Choose 1</td>
</tr>
<tr>
<td>• Yes • No • Sometimes • Other</td>
<td></td>
</tr>
<tr>
<td>What is your primary mode of travel?</td>
<td>Ranking</td>
</tr>
<tr>
<td>• Walk • Bus/public transit • Bike • Taxi • Car/personal vehicle • Carpool</td>
<td></td>
</tr>
<tr>
<td>Do you feel safe/ secure using these modes of transportation? Please explain.</td>
<td>Open-ended</td>
</tr>
<tr>
<td>What do you consider most important in terms of transportation options?</td>
<td>Ranking: 1 is most important and 9 is least important</td>
</tr>
<tr>
<td>• Sidewalks and/or paths to shopping, work, or school</td>
<td></td>
</tr>
<tr>
<td>• Bike lanes or paths to shopping, work, or school</td>
<td></td>
</tr>
<tr>
<td>• Reliable long-distance bus or train transportation to and from surrounding cities</td>
<td></td>
</tr>
<tr>
<td>• Reliable bus or rail transportation</td>
<td></td>
</tr>
<tr>
<td>• Major roads or highways that access and serve the community</td>
<td></td>
</tr>
<tr>
<td>• Easy access to the airport</td>
<td></td>
</tr>
<tr>
<td>• Pedestrian-friendly streets</td>
<td></td>
</tr>
<tr>
<td>• Adequate parking</td>
<td></td>
</tr>
<tr>
<td>• Minimal road congestion/delay</td>
<td></td>
</tr>
<tr>
<td>How much importance do you think you hold to industry leaders/ municipal decision makers?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>How much involvement do you have with industry leaders/ municipal decision makers?</td>
<td>Open-ended</td>
</tr>
<tr>
<td>Would you be willing to become more involved in the decisions made by industry and policy decision makers in or around your neighborhood?</td>
<td>Open-ended</td>
</tr>
</tbody>
</table>

**Demographic Questions**

- Are you currently renting or do you own your home/apartment?
- Do you work at a business on or near Lamar Avenue?
- How old are you?
- Which of the following race/ethnicity do you best identify with?
- Including yourself, how many people currently live in your household?
- How many children live in your household?
- Are you married, separated, divorced, widowed, or have you never been married?
- How many vehicles are owned, leased, or available for regular use by the people who currently live in your household?
- What is the highest level of education you have completed?
- Are you employed full-time, part-time, not employed for pay at the moment, retired, or a student?
- How many years have you lived in this neighborhood?
- Would you say your neighborhood is very safe, somewhat safe, or unsafe?
- During the last calendar year, about how much was your total family income before taxes?

1 After the first focus group session, the survey was calibrated to address questions that were difficult to interpret in the original instrument. The question, “How do you define livability for your community?” was changed to, “In your opinion, what does livability mean for a neighborhood?” The original version prompted a numerical response, where the later version prompted an open-ended response. The question,
“What do you think is the impact of the freight presence in your neighborhood?” was simplified to “How does freight traffic (rail, trucks, air) affect your neighborhood?” These questions, along with a demographic section provided insight on the residential perceptions about freight and livability characteristics.

Methodology for Statistical Analysis
Two statistical tests were used for comparing the FC and NFC data obtained from the residential survey. To analyze the statistical differences between the samples, the Chi-squared ($\chi^2$) test was used for survey items that yielded categorizable frequencies of non-ordinal data. Because many of the survey items were open-ended, responses were coded and frequencies were recorded for each unique response. Many of the respondents provided answers that spanned multiple categories, so the total frequency of responses is often higher than the total number in the sample. Contingency tables were set up for each question analyzed.

The Wilcoxon’s Rank Sum (WRS) test was used for questions that yielded a set of ordinal frequencies. This test compares the entire distribution rather than the median or mean of the distributions. The WRS test is also known as the Mann-Whitney U test. The null hypothesis is that the two sample populations (FC and NFC) are identical, and an alternative hypothesis is that the two sample populations are different.

Residential Survey Results and Discussion
In an effort to promote livability in urban, freight-centric communities, an understanding of what is important for residents’ livability as well as what barriers residents face is required. This research explored these concepts through statistical comparisons between FC and NFC samples. Initially, an analysis was performed that focused on answering whether or not the priorities and barriers to livability are statistically different between FC communities and NFC communities. Not only does this analysis illustrate the differences between the community types, but it also serves as an indication of whether or not heavy freight volumes impact livability in a community. Furthermore, as commonalities emerged in the open-ended data responses, it became clearer what priorities and barriers exist for both types of communities.

The three focus group sessions held within the study area combined with multiple online campaigns yielded a set of 421 complete residential survey responses, including 346 NFC responses and 75 FC responses. Survey responses were collected from October 2013 through June 2014.

Demographics
Of all respondents, 67% of FC and 70% of NFC members are employed full- or part-time; while 9% FC and 2% of NFC are not employed for pay. The rest of the population is either retired or in school (21% of FC and 17% of NFC). The large majority of FC respondents, or 80%, are Black or African American, while for the NFC sample 54.3% are Caucasian and 25.1% are Black or African American. The demographics of the FC respondents closely match that of the study area, indicating a representative sample was obtained. The age of respondents from both groups ranged from 18 to older than 66 years. The annual income of both groups ranged from less than $15,000 to greater than $75,000.

Livability Priorities and Barriers
One item from the residential survey instrument asked respondents to choose five of what they considered to be the most important contributors to livability (from a list of 16). The results are shown in Figure 1A below. Statistical analysis of this data was performed to determine if a significant difference existed between the opinions of the FC and NFC communities. Results yielded a $\chi^2$ value greater than $\chi^2 (0.05; 15)$. The null hypothesis that there is no difference between the FC and NFC distributions was rejected, and therefore, a significant difference does exist in this case.
A. Most Important Contributors to Livability
FC (n = 75) and NFC (n = 324)

B. Barriers for Livability
FC (n = 57) and NFC (n = 218)

FIGURE 1 (A) Results of “What are the most important contributors to livability.” Respondents were asked to choose 5 from a list of 16 contributors (B) Categorized open-ended responses regarding perceived barriers of livability.
To summarize, respondents were asked to identify the most important contributors for livability from a list of 16 options, the results of which yielded significantly different selections between the FC and NFC groups. The FC group identified the top five most important contributors as: (1st) feeling safe in my neighborhood, (2nd) knowing my neighbors, and (tied for 3rd, 4th, and 5th) living in an economically thriving neighborhood, having good roads, and having a community center. The NFC groups identified some different contributors: (1st) feeling safe in my neighborhood, (2nd) knowing my neighbors, (3rd) living in an economically thriving neighborhood, (4th) Having a sense of community, and (5th) having good roads. Despite a statistically significant difference of overall opinions regarding the most important contributors to livability, it is also true that each group named the same four out of five of the most important contributors. The differing responses in the top contributors were both community oriented. Thus, this indicates that the FC and NFC residents have very similar perceptions of contributors to livability, and while there is a statistically significant difference, the practical difference is minimal.

Open-ended responses for the next survey item were analyzed by testing categorical frequencies, again with the Chi-squared test. Respondents answered, “In your opinion, what things are barriers for livability?” (Figure 1B). Statistical analysis of the data regarding barriers to livability yielded a $\chi^2$ value less than $\chi^2 (0.05; 14)$, thus, the null hypothesis of no difference between the FC and NFC variables cannot be rejected. Open-ended response questions pertaining to the topics of barriers for livability did not elicit significant differences between the groups. The most prevalent barriers to livability in both the FC and NFC communities were crime, blight/poor upkeep of property, poverty/unemployment, apathetic attitudes within the community, and poor transportation infrastructure (i.e. potholes, lack of sidewalks, too few lanes, etc.). Again, the frequency of responses for FC respondents were not significantly different from those of the NFC community, who also identified lack of transportation options as a barrier.

Focus group discussions further identified a perception of FC residents that community leaders and officials address transportation infrastructure and general attention to needs of the community more for NFC neighborhoods than for FC neighborhoods. Aside from implementing measures that could mitigate air pollution or manage harmful emissions, it may be beneficial to increase efforts to engage FC residents in community planning activities and communication between residents and policy makers.

**Freight’s Impact on Livability**

Respondents were questioned about how often they “noticed the presence of freight,” and the WRS test for this set of ordinal data resulted in a $Z$-statistic greater than the level required to reject the null hypothesis. The distributions for the FC and NFC responses are significantly different and are shown in Figure 2A. It is to be expected that the FC respondents notice freight more often than the NFC respondents, as they live in an area with an increased volume of freight traffic according to the definition of a freight-centric community.

Using the WRS test, analysis was performed on the survey item in which residents ranked their neighborhoods on a scale of one to ten (ten being the most livable). The results are shown in Figure 2B. Figure 2B shows that the distribution of the NFC community was higher than the distribution of the FC community. The null hypothesis was rejected, and thus, the distribution of the FC and NFC responses are significantly different in this case. As residents ranked their communities for livability, results between the FC and NFC groups were statistically different. These results further the idea that the FC community sees significantly more negative externalities from the increased presence of freight in the community.
A. How often do you notice the presence of freight in your community?

![Graph showing frequencies of observations regarding the presence of freight traffic.]

B. Livability Rating
FC (n = 61) and NFC (n = 274)

![Graph showing response frequencies for “How do you rate your neighborhood for livability? 10 being very livable.”]

When asked, “How has your neighborhood changed over time?” common categories were formed and considered to be either negative, positive, or neutral or unknown (Figure 3). The Chi Squared test was used again in this case, and the null hypothesis that there is no difference between the FC and NFC was rejected, and therefore, a significant difference does exist in this case.
CONCLUSIONS

A goal of this research was to investigate factors that are important for an individual’s perception of livability in both the freight-centric and non-freight-centric community. Based on the outcome of this study it appears that while both FC and NFC residents recognize the important factors and barriers for livability of a community, FC residents are impacted significantly by freight externalities, and this alters their perceptions of livability in their respective neighborhoods. FC residents also perceive a difference in how government and community leaders address transportation infrastructure and community improvements between FC and NFC communities. While the FC community targeted here was well established, this technique can be used in emerging freight communities such as those where inland ports are being sited. This technique would be helpful in looking at livability disparities within cities and could allow planners to formulate holistic approaches that address region-specific barriers so that all
neighborhoods can be vibrant places to live and work. Responses demonstrate a range of perspectives, but generally indicate that the residential stakeholders recognize similar factors that influence livability.

The inherent problems (and related solutions) of high freight volumes within a community can be organized into three overlapping categories of last-mile/first-mile urban goods movement, environmental impact, and trade node (the most relevant category to this particular research). Table 3 summarizes the techniques identified in this research that may serve to improve hindrances to livability, specifically ones caused by an increased presence of freight traffic in a community (8). Following the results of the residential stakeholder surveys, a “Relevance to Lamar FC Community” score was added to the “Success Rating” and “U.S. Applicability Rating” proposed by Giuliano, O’Brien, Dablanc, & Holliday. The relevance factor applied was either a 0 or 1 based on whether or not the solution addresses an issue identified in the results of this analysis.

Additionally, because of the prevalence of freight in Memphis, Tennessee’s economy and infrastructure, the city’s metropolitan planning organization (MPO) developed a Memphis Freight Infrastructure Plan that informed a Memphis MPO Plan Score. Methods currently recognized in the MPO plan received a score of 1 (11). The total score in the last column of the following table could help identify strategies that may be most appropriate to consider in further research of livability for the freight-centric community in Memphis based upon possibility of success, applicability, and policies currently in place. This approach may be applied in other communities to inform planning decisions and address externalities of heavily traveled freight corridors.

### TABLE 3 A Summary of Technology-Based or Strategy-Based Solutions with Effectiveness Rating and Applicability to Problem Type and the U.S. (8)

<table>
<thead>
<tr>
<th>Type of Freight Problem</th>
<th>Description of Solution</th>
<th>Success Rating</th>
<th>U.S. Applicability Rating</th>
<th>Memphis MPO Plan Score</th>
<th>Relevance to this FC Community</th>
<th>Total Score</th>
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<td>7</td>
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REFERENCES


