POTENTIAL FOR OFF-PEAK FREIGHT DELIVERIES TO
CONGESTED URBAN AREAS (TIRC Project C-02-15)

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

In order to develop a full understanding of the feasibility and effectiveness of policies to foster off-peak deliveries (OPD) to the greater New York City Metropolitan region, the New York State Department of Transportation (NYSDOT) selected Rensselaer Polytechnic Institute as the lead contractor of this research project. The key objectives of the project were to:

- Define the set of policies and programs that would induce a shift in deliveries to off-peak hours (referred to here as off-peak delivery initiatives).
- Quantify the effectiveness of these initiatives.
- Quantify extra costs to stakeholders so that compensation schemes could be implemented, should off-peak deliveries be found to be economically beneficial to Society at large.
- Conduct the analyses using advanced statistical and econometric techniques to minimize the risk of biased results.

By express request from the NYSDOT, the project only considered policies and programs based on the voluntary participation of businesses. As a result, mandatory policies—such as the ones implemented in Beijing, China—requiring businesses to do OPD were not considered.

The project started in March 2003, with the original focus on off-peak deliveries in Manhattan. In May 2005, the project was extended to include a second phase focusing on of Brooklyn. This report describes the findings of the research conducted for both phases.

1.1 System Characterization

The first step in the research was to identify the key stakeholders that would be involved with any off-peak initiative, including shippers, warehouses, receivers and carriers. Of these four groups, receivers and carriers were identified as the key stakeholders that are primarily involved in the decision about delivery times, with the other two groups minimally affected.

With a solid understanding on the prior off-peak initiatives and who the key stakeholders were a comprehensive picture of the geographic patterns of economic activities in Manhattan and Brooklyn needed to be developed. This was achieved with the use of economic datasets which contain a breakdown of businesses and employment at the ZIP code level. The data were analyzed to define the sampling areas for receivers used for data collection and described in the corresponding section of this summary.
1.2 Outreach Activities

After identifying the economic centers of activity, outreach activities to the stakeholders in these regions were conducted. A variety of tools were employed, including, in-depth interviews, an on-line survey, and a focus group; all of which provided insights regarding the stakeholders’ willingness and feasibility to do off-peak deliveries.

In-Depth-Interviews (IDI) were used as a qualitative research tool to discuss off-peak deliveries with stakeholders from the private sector in Manhattan. In this project, IDI entailed: asking questions, listening to and recording the answers, and then posing additional questions to clarify or expand on a particular issue. The questions were open-ended and respondents were encouraged to express their own perceptions in their own words. In total, seventeen IDIs were conducted. Of these, two are trucking companies, four are a combination trucking and warehouse companies, three are shippers, four are a combination shipper, trucking, and warehouse companies, two are receivers, and two are lobbyists. The majority of the companies that are either trucking or trucking and warehouse providers indicated that they prefer to make deliveries during off-peak hours. The same is true for companies that are a combination shipper, trucker, and warehouse provider. The reason these companies prefer off-peak hours is that there are fewer problems with traffic congestion, double parking, and an increase in worker productivity because of faster deliveries. However, most of these companies do not perform off-peak deliveries because they are constrained by the operating hours of their customers who do not have staff working to accept deliveries during off-peak hours. The majority of the additional concerns are related to security for both the drivers and products, and getting crews to work during off-peak hours. The two lobbyists interviewed also concur with these opinions.

The three shipping companies that were interviewed are neutral on the subject of off-peak deliveries. They do not care when their products are delivered as long as the products get to the final destination on time. The receivers interviewed are both restaurants. Only one of the restaurants would like to receive off-peak deliveries. The receivers stated that the main obstacles for off-peak deliveries is the lack of parking, stating that approximately sixty percent of all trucks making deliveries to their establishment receive parking violations, and additional labor costs.

While these comments from stakeholders are important by themselves, additional information was obtained. During these interviews, the restaurant and bar industry appeared to be ideal for off-peak deliveries. These types of businesses are already open during off-
peak hours, with staff on hand to accept deliveries. Therefore, additional input was sought out by means of an Internet survey that, in essence, confirmed the basic findings of the IDIs and for that reason it will not be discussed in this summary.

Similar outreach activities were conducted in Brooklyn. A focus group was conducted on January 18th, 2006 from 10AM to 12PM at the office of the Southwest Brooklyn Industrial Development Corporation (SWBIDC) in Brooklyn, New York, with 6 company managers (1 carrier, 1 receiver, and 4 intermediaries) in attendance.

All the participants agreed that OPD is a good idea. In general both sets of stakeholders felt that it would provide easy access for truckers and store workers for the loading and unloading of goods. The only concern about whether OPD would be good for Brooklyn was that OPD might cause some inconvenience to those receivers that do not have their facilities open during off peak hours (i.e. 7pm-6am). The carrier and 75% of the intermediaries (defined as companies that receive and deliver goods) were open to the idea of their companies participating in OPD. They felt that they could participate in these operations because they would be more productive moving goods. However, there was some concern that receivers would not want to accept OPD as well as higher operating costs, such as worker wage differentials, and facility operating costs (i.e. security costs, electricity costs, etc.), that the business would incur.

When the participants were asked if they would consider a joint venture with other carriers to create a new company that could consolidate all final deliveries to Brooklyn customers, everyone was receptive to the idea, and thought that this idea would be an indirect way to reduce traffic congestion during peak hours.

Participants were also asked whether a staging area would help facilitate OPD. This staging area (in Brooklyn) would allow long distance off-peak trucks to travel to Brooklyn, stay overnight and then deliver or transload the cargoes during the daytime hours. The manager of the carrier company felt that this “staging area” concept would be beneficial since his business frequently gets parking fines because its operations involve obstruction of the local streets. He also felt that this “staging area” would also create additional costs because of the third party that would accept and distribute these goods, and the carriers would have to absorb these costs, which may balance their costs inherited from parking fines.

The receiver participant had mixed feelings towards this proposed “staging area.” On the positive side, he felt that this idea would reduce traffic levels, and would assist in the
receiver companies accepting larger shipments on daily/weekly basis. However, he thought that this company would have control over their receiving and company operation patterns.

The stakeholders were then asked what policies they would use to persuade companies to perform OPD. Tax deductions, substantial toll discounts during off peak hours, and no parking fines during the off peak hours of the day were suggested. Additionally, multiple “staging areas,” which would give truckers a place to park their trucks until receivers were ready to accept their goods without being penalized by receiving parking fines was suggested.

Outreach was also extended to public agencies. On December 1, 2004 three regulatory agencies for New York State were contacted to determine if they have restrictions pertaining to off-peak deliveries. They were: (1) the New York State Attorney General’s Office, (2) the New York State Department of Labor, and (3) the New York State Public Service Commission. In addition to these three state agencies, three other stakeholder groups were contacted: (1) New York City Department of Transportation, (2) New York Metropolitan Transportation Council. Based upon the findings from the individuals interviewed at the various regulatory agencies for New York State, the project team could not find any official regulations or laws, other than the traffic rules and regulations defined in Chapter 4 of the Rules of the City of New York, which would be impediments to off-peak delivery initiatives.

1.3 Cost Analyses

An important component of this research is related to the estimation of the costs associated with off-peak delivery initiatives. If receivers and carriers find that performing off-peak deliveries is not cost effective, then they will not undertake such an initiative. Therefore, a key objective of this research is to find the break-even point for carriers and receivers, which is where performing off-peak deliveries would bring positive returns to profit. To analyze the impact upon productivity and costs, a cost function was estimated for the most widely used truck types: (1) the Single Unit two axle truck (SU2); and, (2) the Semi Trailer with a 3 axles tractor and a two axles trailer (S3T2).

The productivity analyses are based on cost functions developed from proprietary data provided by trucking companies. The analyses found that off-peak deliveries are most cost effective for tour lengths longer than 40 kilometers. If the operational speed during the off-peak hours is 54.4 km/hr, the break even distance becomes 20 kilometers. Building upon
these findings, scenario analyses were conducted to determine how the percentage of customers requesting off-peak deliveries affects costs. The percent change in costs for carriers, as a function of the percentage of customers accepting off-peak deliveries. In general terms, if the percentage of customers requesting off-peak deliveries is small, the carriers would experience an increase in operating costs. The magnitude of this increase is in direct proportion to the distance to the first stop: the longer the distance, the higher the additional cost. Equally significant is that for the range of distances in the area (carriers from New Jersey transport to NYC for 10 to 20 miles), off-peak deliveries are profitable for relatively small amounts of the percentage of customers.

The farther away the carriers willing to participate in an off-peak deliveries program are, the greater their costs for the first 12% of their customers will be because the percentage change in costs increases within this range (0% - 12%). However, after the first 12% of customers requesting off-peak deliveries, carriers make profits at increasing rates as their percentage change in costs (%CHANGE) becomes negative. One final significant observation is that regardless of the distance to the first stop, carriers making 100% of their deliveries during off-peak hours will make a profit of nearly 28%. This finding confirm yet again that carriers stand to gain from OPD, as they would experience higher productivity and lower costs, even if paying premium wages to the crews. There shall be no doubt that, in equality of conditions, carriers prefer off-peak work to daytime deliveries in congested New York City.

![Figure 1: Percentage change in total cost as a function of distance to the first stop and percentage of customers requesting OPD](image)

Receivers (consignees) will bear the majority of the costs in a shift to off-peak
deliveries. Costs include: (1) labor, (2) management, (3) heating and air conditioning, (4) lighting, (5) security, and (6) insurance. Labor costs would be the biggest obstacle to overcome. However, other costs must be considered. For instance, management costs may increase due to scheduling problems and altering work shifts. Heating, air conditioning, and lighting costs will also increase for companies that are not currently open during off-peak hours. Security and insurance costs, either for merchandise or for employees, will be an issue for many businesses that would change to off-peak deliveries.

However, for the purposes of this project, labor costs were the only receiver costs calculated because the other costs listed are strictly company specific and highly variable from business to business. Assuming that businesses would pay workers between $8 and $12 per hour, three options were considered: (1) hire a part-time worker to work two hours during off-peak hours, (2) use a current employee and pay overtime (time and a half), and (3) hire an additional employee without benefits. The results indicated that, depending on the number of days per week considered that: (1) hiring a part-time worker for 2 hours during the off-peak would translate into an additional cost per year between $4,160 to $5,824 (at $8/hour) and $6,240 to $8,736 (at $12/hour); (2) using an existing worker for two hours charge at 50% overtime premium would increase these figures by a factor of 1.5; while (3) hiring an extra employee just for off-peak delivery purposes would translate into an additional cost of $16,640 (at $8/hour) to $24,960 (at $12/hour) without benefits.

1.4 Off-Peak Delivery Policies Considered

The project team and the NYSDOT representatives identified two groups of initiatives, one for receivers and another for carriers. The report considers two different policies for receivers: (R1) tax deductions; and (R2) lower shipping costs, both of which would be provided to receivers willing to accept OPD. In terms of carrier policies, originally, seven different policies for carriers were studied. These were: (C1) a request from receivers; (C2) a request from receivers together with parking availability during the off-peak hours; (C3) a request from receivers and security clearances at bridges and tunnels; (C4) a request from receivers and toll savings to carriers doing OPD; (C5) a request from receivers and financial rewards for each mile the carrier traveled during the off-peak hours; (C6) a request from receivers and an off-peak delivery permit that enables trucks to double park during the off-peak hours; and (C7) the creation of a (neutral) company to do the last leg of delivery to the congested areas of
New York City. During the Brooklyn phase, an additional carrier alternative (C8) was considered, which created a staging area in Brooklyn to allow trucks to travel to Brooklyn during the off-peak hours, spend the night at the staging area and then deliver to consignees during day hours. Another change in the Brooklyn phase was the elimination of policy C6 because of its poor performance in the Manhattan phase of the project.

1.5 Data Collection Plan

As part of an effort to obtain as much pertinent information as possible on the response of the private sector to the off-peak delivery policies considered here, two SP surveys targeting receivers and carriers were designed. The surveys contained questions about company characteristics, operational patterns and how the survey participants would react to different scenarios concerning OPD.

On the basis of the analyses of the employment data, it was decided that the sample of Manhattan receivers should cover the entire area of Manhattan, while the sample for Brooklyn should cover the Western portion of Brooklyn which is were most establishments are located. The analysis of Brooklyn’s data show that nearly 51% of the industrial employment; 52% of the industrial and commercial employment; and 44% of total of industrial, the commercial, and the office employment is located in the southwest and northwest areas of Brooklyn.

The target carriers were selected from two groups: for-hire carriers (those that provide services to the open market) and private carriers (those that provide transportation service to a parent or a related company). Considering the low probability of getting suitable private carriers from small companies, the sampling process focused on private carriers with at least 25 employees.

The sampling process focused on carriers located in New Jersey and New York; more specifically, from the New Jersey counties of Bergen, Essex, Hudson, Middlesex, Passaic and Union, and from Kings (Brooklyn) and Queens in New York. These counties were selected because previous studies (Holguin-Veras and Thorson, 2000) determined they are significant generators, or transshipment locations, of cargoes destined to NYC.

The collection process used for Brooklyn involved splitting the sampling population into two major groups: Brooklyn Receivers/Intermediaries and Carriers from Brooklyn and New Jersey. The former was subdivided into two subgroups consisting of: Pure Receivers (companies who only receive goods, and Intermediaries (companies who ship and receive goods).
Similarly, the carrier group was divided into two subgroups consisting of: *Carriers from Brooklyn* and *Carriers from New Jersey*. A nearly identical approach that was used for Manhattan was taken for Brooklyn. The key difference was that the overall target was to get 200 receiver/intermediary companies from Brooklyn to participate, and 200 carriers from both Brooklyn and New Jersey.

The surveys show that, although the vast majority of deliveries take place during normal hours, 4.09% of all deliveries to Manhattan take place during the off-peak hours, as defined in this study. Similarly, 11.71% of the carriers transporting to Manhattan reported doing off-peak deliveries. The figures for Brooklyn are 4.32% and 12.34% respectively.

One other finding that was confirmed with these surveys is that parking fines are a significant cost to delivery companies. Nearly twenty-one percent of the carriers delivering to Manhattan reported parking fines of $3,000 to $7,500 per driver per month. The majority of companies (69.7%) however, indicated that they pay $700 or less in fines per driver per month. The average amount of fines paid per driver per month for all 192 firms is $1,393, a large and significant operating cost to the firms. Excluding the top violators, the average of parking fines drop to $378 per truck per month.

A similar analysis was conducted for Brooklyn. About 56% of carriers reported paying no parking fines in Brooklyn. Furthermore, the majority of the companies indicated that they pay $400 or less in fines per driver per month. A significant percentage of carriers (36.91%) that pay spend between $100 and $400 per truck per month. The overall average is $147.84 which is relatively low, in comparison to parking fines paid in Manhattan. Companies classified as intermediaries of goods reported similar numbers with an average of $148.45 per truck / month.

### 1.6 Behavioral Modeling of Policies and Estimated Market Shares

While the data that was collected provide a large amount of useful information, behavioral modeling is necessary to determine the likelihood that stakeholders will participate in an off-peak delivery program. Discrete choice models were used to quantify the effectiveness of various policies to induce a shift to off-peak deliveries; and assessed the implications of those initiatives to receivers and carriers.

The two scenarios targeting receivers, from both Manhattan and Brooklyn, analyzed the likelihood of receivers to: (1) commit to do a given percentage of off-peak deliveries if they receive a tax deduction for one employee assigned to off-peak hours work; and (2) to
commit to do off-peak deliveries if delivery costs were less during the off-peak hours.

The four scenarios targeting carriers analyzed the likelihood of them making off-peak deliveries (to Manhattan and Brooklyn) if: (1) a percent of their customers requested it; (2) a percent of their customers requested it and if they save on the bridge and tunnel tolls during off-peak hours; (3) a percent of their customers requested it and if they get a financial reward for each mile traveled during off-peak hours; and (4) a percent of their customers requested it and if they would have to pay a yearly permit that let them double park for 20 minutes at each delivery stop. The scenarios considered for Brooklyn were the same with the exception of (4), which was removed from consideration because of its poor performance during the Manhattan phase.

The models take into account policy incentives (e.g. tax deductions, cost reductions, percent of customers requesting off-peak deliveries, toll savings, financial rewards and permits to double park); basic company characteristics like the type facility, number of employees, and primary line of business and various interaction terms between the policy variable and commodity types, and between total number of trips and commodity types. The interaction terms involving the commodity types are important because the commodity type is a proxy for the industry segment in which a company operates.

The modeling process revealed a number of important findings. It was found that the commodity type—which is a proxy for the industry type—plays a significant role in shaping the attitude of companies toward off-peak deliveries. The modeling process also found several important interaction terms linking the commodity types to policy variables. Some segments of the receiving industry (e.g., receivers of wood/lumber, alcohol, paper and food) were found to have a higher probability of accepting OPD; while some carrier segments (e.g., carriers of food, wood/lumber, computers/electronics and textiles/clothing) were found to have a higher probability of implementing OPD.

Another important finding indicated that the amount of money paid in parking fines increases the probability of carriers to make off-peak deliveries. The models show that carriers that do not get parking fines, or that pay small amounts in fines, are not interested in off-peak deliveries program incentives.

In terms of policy variables, it was found that tax deductions to an employee assigned to the off-peak work hours and delivery cost reductions to receivers would foster participation in off-peak programs. For both policies, receiver’s market share increases as the
incentives increase. However, since providing shipping cost discounts is not something under the control of policy makers, it follows that the only receiver policy available is to provide tax deductions to receivers.

The policy analyses for carriers revealed a number of major findings. In all the scenarios, the variable representing the percent of customers requesting off-peak deliveries was significant. More importantly, it was found that the percent of customers was, in all cases, more important to carriers than the carrier centered policy incentives (i.e., toll discounts, financial rewards). This indicates that number of carriers performing off-peak deliveries would increase as the percent of customers (receivers) increases. The alternative to sell permits to double-park was found to be ineffective, since this option represents increased costs for carriers rather than an incentive for off-peak deliveries.

Joint market shares were also calculated to determine how various incentive programs for both carriers and receivers will be effective. The results indicate that for Manhattan tax deductions may be effective in increasing the percentage of receivers willing to accept OPD, with market shares possibly increasing from 4.09% to 22.76%. This increase would likely increase the amount of carriers willing to make OPD ranging from 11.71% to 22.13%, depending upon the incentive policy used. However, the increase in joint market shares for Brooklyn do not increase nearly as much, with joint market shares ranging from 12.34% to 16.46% no matter what incentive policy is used.

1.7 Analyses of Special Industry Segments and Policies

The research conducted indicates that policies fostering collaborative logistics could capture a meaningful portion of truck traffic. As discussed earlier in this chapter, 17.40% of the carriers indicated they would use the services of a neutral company to do the last leg of deliveries to Manhattan; 16.41% of the carriers interviewed as part of the Brooklyn surveys indicated the same. Similarly, 15% of the carriers reported they would use a staging area in Brooklyn to allow off-peak trucks to travel to Brooklyn, stay overnight and do deliveries during the day hours. All of these are alternatives that clearly deserve closer scrutiny for implementation.

The analyses of policies aimed at large traffic generators, based on the Grand Central case study, revealed that about 35% of the stores are willing and able to accept OPD. Furthermore, since the central delivery station at Grand Central could be used to receive deliveries during the off-peak hours, it is entirely possible that large traffic generators
like Grand Central could play an important role in fostering OPD. In this context, deliveries could be received during the off-peak hours at the central receiving station; and then deliver to the consignees during normal hours.

The descriptive analyses of the scenarios considered in the restaurant case indicate that, in general terms, there exist a handful of key variables that increase the likelihood of the restaurant receiving OPD. Based upon the qualitative analyses that were conducted for this project, restaurants were identified as a good candidate for off-peak deliveries in the private sector. The reason that restaurants are such a good candidate is their ability to receive off-peak deliveries without having to implement drastic changes in operation because their marginal costs are very low. The estimates show that a tax deduction of $10,000 may lead to more than 20% of restaurants switching to OPD.