Time Thieves

A New Computer-Driven Traffic Model Reveals the "Time Costs" of Traffic

By Charles Komanoff and Will Fisher
Sponsored by Nurture New York's Nature

Charles Komanoff is a public policy economist based in New York City. Will Fisher is a computer science major at Princeton University (class of 2010). This paper draws on modeling led by Komanoff and assisted by Fisher; is based on research by Fisher and assisted by Komanoff; and was written by both.

Space and time are joined, pronounced Einstein at the start of the 20th Century, detonating a revolution in physics that still reverberates.

Nowadays, drivers connect space and time a bit differently: they discover daily that taking *up* space takes *away* time. On any heavily-trafficked road, your car steals time from me by slowing me down, just as my car slows you and takes your time. Totaled across the millions of cars and drivers in New York and other cities, this mutual theft of time attains staggering dimensions.

In some respects, the story of the first century of urban traffic was one futile effort after another to stop time theft. Again and again, the seemingly commonsensical solution of widening existing roads and building new ones ran afoul of "induced traffic" — the phenomenon by which the ability to travel faster on the new highway lanes engendered new and longer trips. Almost invariably, the initial trickle of attracted trips became a flood that filled up the increased capacity all over again, recreating gridlock over a larger area.

The same fate has also befallen localized efforts to tame traffic. Synchronized signalization, "crackdowns" on double-parking, even provision of transit service all tend to attract new vehicle trips that soon exhaust the increase.

Stopping time theft requires a radically different approach. To grasp what that might be, we undertook an analysis that has rarely if ever been attempted: *quantifying time theft at the level of one individual trip*.

The popular literature on traffic is overflowing with estimates of time lost in congested traffic across an entire city or region. These "macro" figures help convey the scope of the problem. But they don't point toward solutions. For that, we need to grasp *the extent to which one additional trip slows down all other vehicles on the road*. As we show below, estimating this figure can lead to a radically new perspective on urban traffic and put society on a path to fixing it once and for all.

Time Theft

Time theft, we call this involuntary slowing of traffic for everyone due to any one individual's decision to drive. To picture how time theft works, say I elect to drive into lower Manhattan from Avenue U in Sheepshead Bay. Early in my journey, my car gets in the way of a few vehicles at the traffic signal on Ocean Parkway, delaying each of them by a few seconds. A bit later, I delay another handful of cars as I squeeze onto the Prospect Expressway. Likewise at the Prospect's merge with the BQE.

Though the delay my trip imposes on any single vehicle is small, the number of such delays quickly adds up when traffic is heavy. How much depends on … traffic. For trips made in the middle of the night, the relative absence of other cars and the resulting spare capacity in the road system ensure that the total delays caused by my trip are very small. But if my trip coincides with many others, then the opposite is true: there's little if any slack in the system and lots of vehicles to be slowed down. The result is many minutes of aggregate delay caused by each trip, including mine.

How to quantify delays per trip? In theory, we could approach the problem by timing every delay my trip causes other drivers with a stopwatch. But the inherent imprecision, not to mention the staggering effort required, dooms this "bottom up" method.

There's a different, "top down" route we can take instead. It follows these steps:

1. We specify an equation that approximates the relationship between traffic density and speeds — literally, the rate at which traffic on the road network is able to move faster when there's less of it, or its converse, the rate at which traffic slows down when there's more of it.
2. We use the equation to estimate the extent to which adding *one additional vehicle* to the network depresses travel speeds. This diminution will of course be small, but non-zero nonetheless. For example, if the average vehicle speed was 25.00 miles per hour with 10,000 vehicles in the network, adding a 10,001th vehicle ("our" car) might reduce the mathematically calculated average to, say, 24.99 mph.
3. Knowing the speeds and distances traveled by all of the other vehicles, we calculate the total time their journeys require with and without our car's being on the road with them.
4. The difference between these respective total times (with and without our car) will be the aggregate delay our trip creates.

This approach isn't work-free. The rate at which changes in traffic densities affect traffic speeds differs between local streets and highways, making it necessary to specify separate equations for each. To derive them, we must collect a great deal of data —

literally, how fast traffic goes at different densities — and then "curve-fit" equations to the data. We must also specify, or at least approximate, the number of other vehicles that are using the roads and how fast they travel under typical conditions.

In addition, because traffic density — literally, the number of vehicles per lane-mile of roadway — varies sharply by time of day or night, so will the time theft associated with an additional trip. Accordingly, our numbers need to be calibrated to each time period within the 24-hour cycle.

The good news is that we have performed all of these steps, and have embedded them in a computer model that we call the Balanced Transportation Analyzer, or BTA.[1] While the BTA has many dimensions, including the ability to calculate the traffic and revenue impacts of different toll and fare structures for driving and transit, it also is a tool with which we can calculate the time theft associated with a trip taken during any part of the day — morning peak, overnight or "graveyard" shift, and the intervals in between.

More precisely, the BTA is calibrated to analyze one iconic class of vehicle trips: journeys by car (or truck) into Manhattan — the commercial heart of Manhattan south of 60th Street, known as the Central Business District (CBD). Thus, *this paper concerns time theft resulting from trips into and within the CBD.*

The Fare Hike Four

For our first example, we've selected State Senators Pedro Espada of the Bronx and Carl Kruger of Brooklyn — half of the so-called Fare Hike Four who have vehemently fought bridge tolls and other forms of congestion pricing in New York City.

When not in Albany, Messrs. Espada and Kruger sometimes shuttle by car between their respective district offices in the Fordham district and Sheepshead Bay, and their Senate offices below Chambers Street, near City Hall. Without extra stops or detours, their one-way trips into lower Manhattan cover around 14 and 10 miles, respectively. Note that for both journeys, only the final mile or so takes place on local streets within the CBD. The rest is on what could be called the *approaches* to the Central Business District.

The distinction between CBD and non-CBD miles is important because traffic congestion is worse on city streets than on the approaches. Per mile driven, travel within the CBD causes several times as much traffic delay, on average, as does travel on the approaches, as Table 1 shows:

[1] The BTA may be downloaded via the link, http://www.nnyn.org/kheelplan/BTA_1.1.xls.

Table 1: Total delays caused per mile driven in CBD-bound trips (weekdays)

"Shift" in which trip is made	In CBD	Outside	In vs. Out
Graveyard (11 p.m. – 5 a.m.), inbound	0.3 min.	0.0 min.	N.A.
A.M. Peak (6 a.m. – 9 a.m.), inbound	26.3 min.	8.6 min.	3.1
Midday Peak (10 a.m. – 2 p.m.), inbound	12.0 min.	5.3 min.	2.3
P.M. Peak (2 p.m. – 8 p.m.), inbound	34.1 min.	12.1 min.	2.8
24-hour average (inbound)	**20.3 min.**	**7.5 min.**	**2.7**

For brevity, only four of the seven periods in which we have divided the 24 weekday hours are shown here. All seven are shown in the BTA spreadsheet (see Delays worksheet). The 24-hour average is weighted by number of trips in different periods.

Using the figures in Table 1, it is straightforward to calculate the time theft caused by any of Sen. Espada's or Sen. Kruger's car trips to the CBD: we simply multiply the number of miles driven within and approaching the CBD, by the respective per-mile delays in Table 1, and divide the resulting aggregate delay minutes by 60 to express them in hours. The results are shown in Table 2:

Table 2: Total delays caused by a single one-way trip into CBD (weekdays)

"Shift" in which trip is made	Espada	Kruger
Graveyard (11 p.m. – 5 a.m.), inbound	0.004 hrs	0.004 hrs
A.M. Peak (6 a.m. – 9 a.m.), inbound	2.34 hrs	1.77 hrs
Midday Peak (10 a.m. – 2 p.m.), inbound	1.37 hrs	1.02 hrs
P.M. Peak (2 p.m. – 8 p.m.), inbound	3.23 hrs	2.43 hrs
24-hour average (inbound)	**1.99 hrs**	**1.50 hrs**

For Kruger, we used Mapquest's "default" route from his district office at 2201 Avenue U, Brooklyn, NY 11229-3647, his to Manhattan office at 270 Broadway New York, NY 10007-2306, <http://www.mapquest.com/maps?1c=Brooklyln&1s=NY&1a=2201+Avenue+U&2a=270+Broadway&2z=10007>, a distance of 10.26 miles, of which we assigned 1.0 mile to the CBD. For Espada, we also used Mapquest's default route, from his district office at 400 East Fordham Road, Bronx, NY 10458-2201 to his Manhattan office (same address as Kruger's), <http://www.mapquest.com/maps?1a=400+East+Fordham+Road&1z=10458&2a=270+Broadway&2z=10007>, a distance of 14.24 miles, of which we assigned 1.0 mile to the CBD.

Table 2 shows what not just traffic specialists but savvy (or jaded) drivers have long understood: the amount of delay caused by a trip into the Manhattan CBD varies tremendously depending on time of day. Indeed, compared to trips in the overnight graveyard shift, trips in the p.m. peak cause nearly three orders of magnitude (a factor of 1,000) more delays to other drivers on the road.

Also striking is the sheer magnitude of the time theft. Averaged over the 24 hours of the day (but with the average weighted by the frequency of trips, which, by definition, is weighted toward the peaks), a typical car trip by Sen. Kruger from his Brooklyn district office to lower Manhattan imposes an aggregate delay of 1.5 hours on all other vehicles on the road. For Sen. Espada, traveling somewhat further from the Bronx, the overall delay caused by his trip is approximately 2 hours. And *these are only for the inbound leg of the journey*; delays caused by the return (outbound) legs are comparable.

FreshDirect

FreshDirect Operations

We move now from legislators whose policies help keep New York City trapped in gridlock to a company whose business model seems to require adding to it: FreshDirect.

FreshDirect (the company's name is a single word) is a service that delivers groceries to households in selected neighborhoods in New York City and New Jersey. Founded in 2002, FreshDirect competes with local supermarkets, greengrocers and, to a lesser extent, farmers markets. Customers log on to the FreshDirect website, select their desired groceries, and then specify the day and time range when they want their food delivered. There is no same-day delivery.

FreshDirect essentially outsources a household's grocery shopping, for a premium. Operating out of a centralized warehouse in an industrial area in Long Island City, where land is cheaper than in Manhattan, FreshDirect can compete price-wise with Manhattan-based supermarkets. The company has grown steadily and by 2009 its customer base had reached 35,000. Though still a relative newcomer, FreshDirect is already a New York icon of sorts: visible to all, valued by its customers, and an emblem of the ever-more frenetic pace maintained by New Yorkers of a certain demographic.

The company's delivery system presents a downside, however. The ubiquitous 9-ton FreshDirect delivery vehicles[2] are a sore point to many New Yorkers. Some complain about the fumes and racket from the parked trucks, which result not from idling engines but from refrigeration units kept running. The truckers have also been known to leave in their wake sidewalk "cardboard jungles" of discarded grocery boxes.[3]

It could be said that FreshDirect's operations result in a number of "externalized" costs — damages borne by "bystanders" rather than beneficiaries of the company's service. Another category of such costs is *time delays* imposed on other vehicle users in and around New York City, from the incremental traffic congestion caused by adding FreshDirect trucks to the traffic mix. Whether driving on area streets and highways or parked at curbside (or, more commonly, double-parked), the company's trucks add a measure of congestion which slows other traffic and prolongs journeys by car, taxi, truck and bus (not to mention on foot or by bike).

[2] http://www.uhaul.com/guide/index.aspx?equipment=truck-24 (approximate size).

[3] http://www.nytimes.com/2009/04/25/nyregion/25fresh.html.

Quantifying the Traffic Delays Caused by FreshDirect Operations

Because the company is so visible, and because its operations are heavily concentrated in the Manhattan Central Business District, the incremental traffic congestion it causes was a logical subject to investigate using the Balanced Transportation Analyzer (BTA) traffic model discussed earlier. Since FreshDirect management turned down our requests for truck travel data, we had to specify some assumptions, all of which are detailed here or in the BTA worksheet dedicated to FreshDirect.[4] Fortunately, company drivers whom we met on the streets were forthcoming with information, which we drew on here.

To begin, FreshDirect owns and operates approximately 150 trucks which deliver to an estimated 7,000 customers per day.[5] We estimate that half of the trucks service customers inside the CBD. All 75 trucks leave from the FreshDirect depot at the Queens side of the Queens Midtown Tunnel. Trucks routed to Midtown enter through the tunnel or the Queensboro (59th Street) bridge. Trucks bound for lower Manhattan travel via the BQE and enter Manhattan via either the Williamsburg or Manhattan Bridges.[6]

The average FreshDirect truck's 45-50 deliveries per day are made over an 8-10 hour shift.[7] The trucks and drivers are routed to minimize stops and deliver the grocery boxes within a small radius on foot, via hand trucks. We estimate that each day the typical truck travels 5 miles each way between the depot and the CBD, and another 6.5 miles within the CBD. We assume for simplicity that the trucks always double-park when making deliveries within the CBD — an assumption that appears to be reasonably accurate and does not distort the results in any event.[8]

The delays to other road users caused by the company's operations fall into two broad categories: delays due to FreshDirect trucks operating in traffic, and delays due to the trucks double-parking.

<u>Delays due to FreshDirect trucks operating in traffic</u>

Estimating delays in the first category — due to the trucks operating in traffic — is straightforward using the BTA. We simply increase the "baseline number" of vehicle

[4] As noted, the BTA may be downloaded via the link, http://www.nnyn.org/kheelplan/BTA_1.1.xls. The worksheet referenced in the text is called **FreshDirect**.

[5] <u>Ibid.</u>

[6] Informal on-street interviews with FreshDirect drivers.

[7] Based on FreshDirect Website guidelines for delivery times (weekdays, 2-11 p.m.; weekends, 7:30 a.m. - 9 p.m.).

[8] When a FreshDirect truck is parked at curbside, its use of the space in effect forces other vehicles to double-park, with the same impact on traffic as if the FreshDirect truck itself double-parked.

trips into the Manhattan Central Business District on weekdays, approximately 870,000, by 75 trucks, taking care to input them in the time periods that correspond to the company's actual delivery schedule. The BTA then recalculates the resulting traffic speeds within the CBD and on the approaches, which automatically generates the hours and minutes expended by all vehicles driving to and within the CBD. The difference between the total with the FreshDirect trucks and the baseline total without is the additional delay caused by the trucks' driving during their delivery process.[9]

This figure is approximately 280 hours of lost time per weekday, of which 169 lost hours are due to slowed traffic within the CBD, and another 112 hours outside. That is, on a typical weekday, the driving of FreshDirect trucks to destinations inside the Manhattan Central Business District cause other vehicles in the traffic mix to lose 280 hours due to slower traffic.

<u>Delays due to FreshDirect trucks double-parked while delivering groceries</u>

Time theft from FreshDirect deliveries to the CBD has an additional, separate component: delays to vehicles that are caused by parked FreshDirect trucks' blocking traffic lanes. To estimate this category of delays, we employed a facility in the BTA that recalculates CBD travel speeds in response to policy decisions to take specified amounts of road space out of service.

There are two operative concepts here. One is that double-parked vehicles take up space that would otherwise be available for use by vehicular traffic; two "deans" of the New York City traffic-engineering community, Sam Schwartz, P.E. and Brian Ketcham, P.E., independently gave us the same rule of thumb, that a roughly 9-ton truck such as FreshDirect uses, double-parked on an avenue, effectively eliminates road capacity equivalent to one traffic lane for half of one short block.[10] The other is that, as noted toward the beginning of this paper, the BTA model includes an equation that relates increases or decreases in road capacity to increases or decreases in travel speeds.

Elsewhere in the BTA, we derived an estimate that within the CBD there are 907 lane-miles of streets. Now consider the 75 FreshDirect trucks that operate in the CBD on a typical day, and recall that just above we stipulated that any one double-parked truck renders one traffic lane unusable for half-a-block as other vehicles are forced to merge into the remaining lanes. Assuming 20 blocks per mile, all 75 trucks would "take out" 1.88 lane-miles, from the CBD total of 907.[11]

---

[9] In performing the calculation, we exclude the hours and minutes expended by the FreshDirect trucks themselves, to ensure that the time comparison involves the baseline vehicles only.

[10] Personal communications, 2009.

[11] Halving 75 (since half of one lane mile is affected), and dividing the result by 20, yields 1.88.

Thus, anytime that all 75 trucks are parked within the CBD, they are occupying 0.21% of the district's entire road space (1.88 divided by 907). That figure is never reached, however, since each truck spends half or more of the 24-hour cycle parked at the depot in Queens, as well as other hours moving in traffic within, en route to, or from the CBD (whose impact on traffic we have already accounted for, earlier).

We handle this minor complexity by assuming that the 75 FreshDirect trucks are inside the CBD only during two periods of each weekday: the 2-8 "P.M. Peak" period, when, we assume, they are in the CBD 100% of the time; and the 8-11 "P.M. Post-Peak" period, when they are in the CBD two-thirds (67%) of the time. We also allow for time in motion during these periods, i.e., when the trucks are circulating rather than parked. The product of these assumptions is that the trucks are parked for 88% of the earlier period and 63% of the later one. With these estimates, the parked FreshDirect trucks are eliminating 0.18% of all available street space during the 2-8 p.m. period (0.21% x 88% occupancy), and 0.13% of the 8-11 p.m. period (0.21% x 63%).

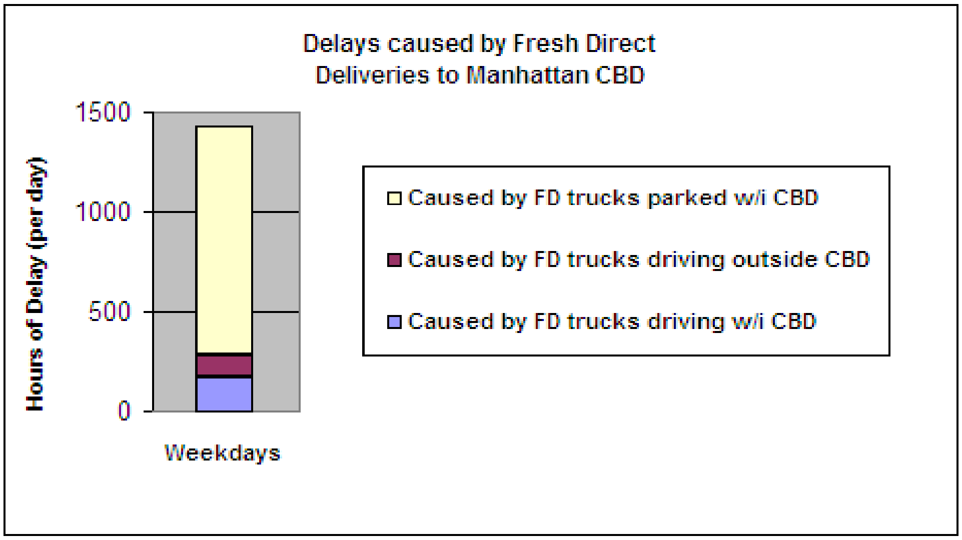
The resulting impacts on vehicular speeds in the CBD are calculated using the equation discussed near the beginning of this paper — the one that approximates the relationship between traffic density and speeds within a dense street network such as the Central Business District. In this case, the impacts, though modest, are not minuscule: an average 0.5% slowing of traffic between 2-8 p.m., and 0.3% during 8-11 p.m. The delays associated with these slowdowns come to 1,025 hours in the earlier period, and 119 hours in the later period.

The sum of those two figures — 1,144 hours — represents the time lost by other vehicles in the traffic mix due to FreshDirect trucks' double-parking to deliver groceries to customers within the Manhattan Central Business District, each weekday.

Total delays due to FreshDirect trucks

The delays from double-parked FreshDirect trucks tower over the delays caused by the trucks in motion, as the figure below shows. The total is 1,425 hours per day, on weekdays. The analogous figure for weekends and holidays is 919 hours per day.

That the greater portion of delays comes from parked as opposed to moving trucks should come as no surprise, insofar as the FreshDirect drivers spend far more time carting deliveries from trucks to households than actually driving. The lion's share of FreshDirect-caused delays come about because other road users must navigate in what is effectively a slightly-smaller CBD (or, more precisely, a CBD with slightly less road capacity due to double-parked FreshDirect trucks), rather than from having to compete for road space with moving FreshDirect trucks.



Monetizing the Traffic Delays Attributable to FreshDirect

While hours of delay is an interesting "metric" in its own right, it is most meaningful when monetized — expressed as the *value of lost time, in dollars*, for the other road users who are delayed because the FreshDirect vehicles are occupying scarce road space and slowing traffic.

The value of drivers' time varies, sometimes widely, from one trip to another. It is customary, in transportation economics, to assign average values of the value of time for different categories of trips, based on the number of occupants, the type of vehicle (cars vs. buses vs. vans vs. different classes of trucks) weekday vs. weekend (time during the latter is considered to be worth less because it subsumes more leisure travel) and whether the vehicle is traveling within or outside the CBD (with higher time values inside because vehicle users there have higher wages, on average).

The BTA spreadsheet meticulously assigns values for each category along with percentage weights, resulting in average values of time for vehicles in traffic ranging from around $50 per vehicle per hour (for CBD travel on weekdays) to around $20 (for non-CBD travel on weekends).[12] Factoring these rates times the daily delay hours noted above (1,425 hours per day on weekdays, 919 on weekends) yields daily estimates of time theft from FreshDirect delivery operations of approximately $68,000 on weekdays, and $26,000 on weekends. Aggregating these figures for a full year yields a figure of $20 million.

[12] See the BTA worksheet, **Value of Time**.

That is, the time losses suffered by other vehicle users due to FreshDirect deliveries to the Manhattan Central Business District total $20 million per year.

This aggregate figure is broken down in Table 3:

Table 3: Delay hours and costs for FreshDirect deliveries to CBD

	Per Weekday	Per Wknd Day
All FreshDirect trucks to CBD		
Total delay hours	1,425	919
Total delay costs	$68,000	$25,900
One FreshDirect truck to CBD		
Total delay hours	19.0	12.2
Total delay costs	$905	$345
One FreshDirect delivery to CBD		
Total delay minutes (not hours)	24.4	15.7
Total delay costs	$19.39	$7.40

Figures assume 75 trucks making 3,500 deliveries per day to CBD. Last column is weighted between weekdays (250 days per year) and weekends-holidays (115 days per year).

Of all the data in Table 3, arguably the most meaningful are those in the bottom row. *We estimate that each FreshDirect weekday delivery to a single customer in the CBD imposes more than $19 in delay costs on other vehicle users.* The per-delivery delay costs on weekends and holidays are significantly less, an estimated $7.40 per delivery, because both traffic delays and the value of a lost minute or hour are somewhat less. (Averaged across 365 days per year, the per-order delay cost is $15.61.)

At present, all of this delay burden is borne by the general road user, at no cost to FreshDirect or its customers. What if these costs were shifted — "internalized" — to the company, through a congestion charge? FreshDirect would either absorb these costs, diminishing its profits, or pass them onto its customers. Let us consider the latter. Media sources indicate that the average FreshDirect order has a price tag around $120.[13] Internalizing the average $15.60 delay cost of a typical FreshDirect delivery would thus increase this price by around one-eighth (13%).

Whether FreshDirect customers would pony up the higher price or abandon the service would require a separate analysis. The tradeoff between the convenience of receiving door-to-door grocery delivery and paying a premium price would vary from customer to customer and from day to day. A very rough estimate can be ventured, however, by

---

[13] FreshDirect did not divulge to us the value of its orders, In 2007, Forbes reported that the company "sells $200 million worth of food a year" in 2 million orders. This works out to $100 per order. We have bumped this up to $120 in the text to reflect markup and to allow for several media sources that gave higher per-order figures. These figures are approximate.

positing a “price-elasticity” for FreshDirect service. Luxury services are often considered to have a high price-elasticity insofar as they are discretionary rather than essential and typically have potential substitutes (conventional grocery shopping, in this case). If FreshDirect service is assigned a price-elasticity of negative two, then a 13% rise in the price would be expected to reduce demand for the Company’s service by a little over 20%.[14]

In any event, we note the irony of a business selling convenience to customers but employing a business model that “delivers” inconvenience to New Yorkers as a whole. Indeed, as Table 3 shows, the average weekday delivery of groceries to a single FreshDirect customer within the CBD costs general road users 24 minutes of delay time, a cost that probably rivals (and may even outweigh) the time savings that the service provides to that customer.

Countervailing Costs

FreshDirect does pay *something* for its trucks’ use of New York City roads and streets. The company pays an estimated $600,000 a year in city parking tickets,[15] and several hundred thousand dollars in tolls, according to our calculations.[16] Allowing for deliveries outside the Manhattan Central Business District, a reasonable estimate of tickets and tolls paid in service of FreshDirect deliveries within the CBD is half-a-million dollars a year. That is approximately 1/40 of the $20 million in time costs created by those deliveries.

It is true that in the absence of FreshDirect service, some of the company’s customers would use cars or taxicabs for some of their food shopping, which would exacerbate traffic congestion. A company spokesperson has cited this tendency, claiming that “On a typical day, 140 FreshDirect truck routes deliver 6000-7000 orders, reducing the number of car and taxi trips across the New York area.”[17] A complete accounting of traffic congestion from FreshDirect’s operations should of course estimate and net such trips from the traffic-impact figures estimated here.

---

[14] The calculation is: 1.13 (reflecting a 13% price rise) raised to the negative 2 power equals 0.783, meaning that baseline demand would rise by the complement of 0.783, which is 0.217, or 22%.

[15] We were unable to source this figure in time for publication.

[16] The MTA Bridges and Tunnels toll rate for the 9-ton trucks used by FreshDirect trucks is $8.25, with EZ-Pass. If all 150 of the company’s trucks paid one toll per day, every day of the year, the annual toll would be $450,000. Many of the trucks are routed through free East River bridges, however, making the actual payment somewhat less.

[17] E-mail from FreshDirect representative Sarah Coniski, June 25, 2009. The company also stated publicly, in 2007, “We love that our trucks have become a mass transit system for food, each one replacing the many cars and cabs that would otherwise be used to bring families and food together.” See Streetsblog, http://www.streetsblog.org/2007/10/02/fresh-direct-responds-to-environmental-critics/.

We expect that the impact would be slight. Within the CBD, supermarkets and grocery stores are in close enough proximity to residents to make food shopping reasonably convenient by foot; and many stores employ delivery personnel who operate on foot or tricycle. In any event, we invite the company to provide its estimate.[18]

The point of this exercise is not to suggest a special surcharge on FreshDirect service, but to illustrate ways in which, in the heart of New York City, travel behaviors and business choices can cut a wide swath of costs. It is sobering that entrepreneurs can launch a new business whose use of city streets imposes $20 million a year of delay costs to city drivers, truckers and bus riders — with no public review. Perhaps a new model for allocating and sharing street space is called for to balance New Yorkers' desire for convenience and comfort with their need for efficient mobility.

[18] In fact, we already extended such an invitation, in a June 23, 2009 e-mail proffering half-a-dozen detailed questions about the company's logistics, which were largely rebuffed.