U.S. Department of Transportation, Climate Change Center
Climate Strategies that Work

OFF-PEAK DELIVERY

Off-peak deliveries ease traffic congestion and reducing unsafe interactions between delivery trucks and vulnerable road users, while promoting efficient and sustainable freight practices.

Table of Contents

OVERVIEW

Best Suited for:
Long Term & Short Term
Urban, Suburban

Truck deliveries during peak periods can worsen traffic congestion, which can lead to idling, increased greenhouse gas emissions, and air pollution. Curb-side deliveries require that drivers spend time searching for parking (increasing vehicle miles traveled (VMT) and emissions) and when nearby parking is not available, drivers may be forced to park illegally across multiple spots and lanes. This behavior can impede the flow of traffic for passenger and transit vehicles, further contributing to increases in VMT and emissions. **Off-peak delivery (off-hours delivery) programs encourage delivery companies and receiving businesses to shift to evening or overnight deliveries.** These programs can increase the productivity of freight operations, decrease truck traffic, and reduce freight-related environmental impacts. Diesel trucks emit a disproportionate amount of traffic-related air pollutants, particularly during stop-and-go conditions and idling – shifting deliveries to off-hours can significantly reduce emissions.

Less truck activity during peak periods can also make roads safer for cyclists and pedestrians, who are more likely to be using roads during day-time hours.

Off-peak deliveries can reduce interactions between trucks and vulnerable road users and encourage walking and biking over car use. Businesses can also benefit from off-peak deliveries through faster unloading times, easier access to storefronts for customers, and less idling and emissions from delivery trucks.

Off-peak deliveries can be made through traditional assisted delivery (i.e., people in business available to receive delivery), or via delivery lockers or staging areas, which do not require direct access to the store. Curb management systems can be designed to encourage off-peak deliveries by allowing for free or lower-cost parking during specific periods. Road usage charges and other pricing strategies, which typically charge drivers higher tolls or per-mile fees during peak periods, can also encourage delivery to shift to off-peak hours.

Did you know?

During a New York City off-hour pilot program, delivery speeds in Manhattan increased by 50% during off-hours compared with morning (8 am to 10 am) and by 130% as compared to midday (10 am to 4 pm) and evening (4-10 pm) (NYCDOT, 2019).

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources

Off-peak delivery programs consist of three interconnected components:

Nighttime and Evening Delivery Windows

Business and Delivery Station Adaptation

Businesses and delivery stations play a crucial role in off-peak programs by:

- Adjusting Receiving Hours: Shifting receiving operations to accommodate evening or overnight deliveries creates a more flexible and efficient system.
- Investing in Nighttime Operations: Some businesses may need to invest in additional lighting or security measures to facilitate safe nighttime operations.

Incentivizing Off-Peak Delivery

Programs and regulations can encourage wider adoption of off-peak delivery practices, including:

- Financial Incentives: Discounts, subsidies, or tax breaks for businesses and delivery companies that utilize off-peak delivery windows.
- Congestion Pricing: Imposing higher tolls or fees on daytime deliveries in congested areas can encourage a shift towards off-peak options.

GREENHOUSE GAS REDUCTION POTENTIAL

This section provides an overview of greenhouse gas (GHG) emission reductions associated with the strategy. It highlights key findings and relevant metrics from GHG modeling resources, peer-reviewed studies, and real-world applications.

REDUCING EMISSIONS FROM DELIVERY TRUCKS

In a forthcoming modeling study, Argonne National Laboratory analyzed the effect of increasing off-peak deliveries in Chicago. Just a small fraction (5%) of businesses currently accept deliveries very early in the morning or at night. With a larger share (15%) of businesses accepting deliveries during these hours, delivery trips saw less idling and traffic congestion, leading to systemwide increases in delivery speeds of up to 8.6% (Auld et al., 2024).

A 2018 study used GPS data collected from delivery trucks in three U.S. cities to analyze the effect of off-peak versus regular-time deliveries on emissions. Off-peak delivery was found to reduce emissions by 13% to 67% compared to regular, peak periods (Holguín-Veras et al., 2018).

CITY-SPECIFIC OFF-HOURS PROGRAMS

Off-peak delivery in the Greater Toronto area could result in over 5,500 vehicle-hours saved per day, with light truck carriers benefiting the most by shifting to off-peak hours (Chowdhury et al., 2022).

Trucks represent about 10% of the Chicago region's traffic and 67% of the region's total freight volume. On several corridors where truck volumes are over 10,000 per day, congestion during morning peak periods increases travel times by an average of 60% (LaBelle and Frève, 2016).

A 2007-2010 New York City off-hour delivery pilot involved 33 food delivery companies that switched deliveries to between 7:00 pm and 6:00 am (Holguín-Veras et al., 2011).

- Average travel speeds for a key carrier-customer pairing increased by over 70% from 11.8 mph to 20.2 mph.

- A truck traveling for 10 miles making deliveries could save 1.25 hours of travel time due to increases in average speed from approximately 4 mph during regular hours and 8 mph during off-hours. The average fuel consumption rate and total emission rate during off-hours were found to be significantly lower than those during regular hours for the same segment. The differences were generally larger than 20% for highway and toll road segments, and over 50% for urban arterial road segments.
- The off-hours pilot also resulted in congestion and pollution savings for regular-hour road users. If about 20% of the deliveries in Manhattan were shifted to the off-hours, each receiver would be responsible for an annual reduction of about 551 vehicle miles traveled and 195 vehicle hours traveled.

CO-BENEFITS

This section outlines the multiple co-benefits associated with the strategy, including safety benefits, local air quality improvements, and improved accessibility. Each co-benefit presents examples that demonstrate how the strategy enhances regional or community well-being while addressing emissions.

SAFETY

Off-peak delivery programs reduce congestion during peak periods and improve road safety by reducing conflicts between trucks, passenger cars, cyclists, and pedestrians (Sánchez-Díaz et al., 2017).

Increased nighttime noise may be a concern for residents but can be mitigated with low-noise strategies and equipment, driver training, and enforcement (Holguín-Veras et al., 2014). The New York City Off Hours Delivery Program is promoting use of quiet delivery practices for both the drivers and receivers and the use of low noise delivery equipment, such as electric door motors, hydraulically operated ramps, and electric refrigeration units (NYCDOT, 2024b).

COST SAVINGS

Parking fines in New York City average $500-1,000 per truck per month for regular-hour deliveries, a portion of which companies may pass onto consumers. Since it is easier for drivers to find legal parking spaces near their delivery locations during the off-hours, every off-hour delivery route that replaces a regular-hour route saves about $9,000 per off-hour delivery tour in annual parking fines (Holguín-Veras et al., 2013).

Another study found that shifting deliveries to off-hours can result in 20-30% overall cost savings for businesses (Holguín-Veras et al., 2011).

During a New York City pilot program, every delivery tour that switched from regular to off-hours saved the carriers, on average, $212.50 per day or $42,500 per off-hour delivery tour annually (Holguín-Veras et al., 2013).

Trucks entering New York city can take advantage of off-peak pricing on the NY/NJ Port Authority bridges and tunnels. For example, 2-axel delivery trucks pay different tolls depending on time of day and save around 12% by entering New York overnight.

ECONOMIC GROWTH

Off-peak delivery offers cost savings to both carriers and business establishments, while decreasing the harmful economic effects of congestion and pollution (Holguín-Veras et al., 2011).

The New York City off-hour delivery pilot showed that economic benefits of a full implementation of the off-hour delivery program are in the range of $147 to $193 million per year, corresponding to savings on travel time and environmental pollution for regular-hour traffic as well as productivity increases for the freight industry (Holguín-Veras et al., 2011).

ACCESSIBILITY AND EQUITY

Off-peak delivery has the potential to open up additional curb and sidewalk space during daytime hours, which can make it easier for pedestrians to access storefronts and other local establishments (NYCDOT, 2019)**.**

Off-peak delivery programs can reduce travel times for all road users, including bicyclists and pedestrians.

Off-peak programs can be implemented in conjunction with street design improvements, such as creating complete streets and heavily restricting vehicle access (e.g., off-peak delivery or emergency vehicles only). Re-allocating road space and priority away from private vehicles improves the safety and comfort for all road and public transit users (Yanocha, 2021).

RURAL COMMUNITIES

While competition for curb space is particularly intense in metropolitan areas (Burnell et al., 2017), rural downtown districts can face many of the same challenges related to availability of loading areas and congestion during peak periods.

Large volumes of freight either originate in rural areas or are transported through rural areas by road, rail, and waterways. Two-thirds of rail freight originates in rural areas, and nearly half of all truck vehicle miles traveled (VMT) occur on rural roads (USDOT, 2023). Improvements to network efficiency and choosing less carbon intensive modes can reduce the impacts of freight transport on rural communities.

Many warehouses and manufacturing facilities that support urban freight deliveries are also located in rural areas. Shifting deliveries to off-peak hours can benefit rural communities through reduced traffic and emissions.

AIR QUALITY AND HEALTH

Off-peak delivery decreases incidence of truck idling and decreases truck-related congestion during peak hours. Reduced truck idling and congestion also reduces idling and congestion for other classes of vehicles.

Diesel freight is responsible for significant amounts of particulate matter pollution and adverse health effects, particularly in communities living near highways and ports (EPA, 2023).

Shifting approximately 20% of deliveries in New York City to off-hours results in significant pollution reductions: over 200 metric tons of carbon monoxide, approximately 12 tons of NOx, and 70 tons of PM10 annually (Holguín-Veras et al., 2014).

Higher speeds during off-peak hour deliveries resulted in lower emissions during an Ontario, Canada pilot program. Total CO_2 emissions per kilometer decreased by 10.6%, and emissions for air pollutants, including CO, NOx, PM10 and PM2.5, decreased by 10 to 15% (Mousavi et al., 2020).

COST CONSIDERATIONS

The cost to implement off-peak delivery varies widely depending on the scale, scope, and location of the project

Financial incentives for both goods carriers and receivers can encourage more deliveries to occur during off-hours. These may include one-time or annual payments, tax credits, and less expensive parking for off-hours deliveries.

Results from the New York City off-hours delivery pilot show that a one-time financial incentive of $10,000 to $15,000 per year can maximize program benefits. This amount helped divert 14 to 21% of total truck traffic in Manhattan during the pilot period (Holguín-Veras et al., 2011).

For example, the NYC off-hour delivery Incentive Program is providing up to $1.5M in one-time incentive payments to businesses that participate in Phase I of the expanded off-hours program. Incentives can be used towards access enhancements, security equipment, low-noise cargo handling equipment, and green delivery methods (e.g. cargo bikes, EV vans) (NYCDOT, 2024a; NYCDOT, 2019).

When delivery sites are located within or adjacent to residential areas, off-peak programs may increase noise pollution during overnight hours. Increased noise may result in additional costs to companies, including costs related to noise mitigation technologies and strategies, driver training, and using longer alternative routes (Holguín-Veras et al., 2018; NYCDOT, 2019).

Adopting off-peak hours may result in labor impacts on delivery drivers and receiving customers, as well as warehouses and distributors. Off-peak operations require customers to stay late to receive goods and supply chain partners to adopt off-peak operations. Extended and overnight hours may increase the cost of goods delivery in an area. However, previous pilot studies (New York City, Belgium, Peel) and behavioral studies have largely shown that extra labor costs are balanced by cost savings due to increased productivity and fewer parking violations (Holguín-Veras et al., 2018; Verlinde et al., 2011; Mousavi et al., 2020).

A pilot study in Peel, Australia asked participants specifically about added logistics costs and found that no additional costs were incurred as a result of the off-peak delivery pilot. One participant noted that their distribution centers already ran overnight shifts prior to the pilot and that retail stores were able to accommodate the after-hours staffing costs (Mousavi et al., 2020).

For costs related to establishing pricing programs and curb management programs, see the Road Pricing and Parking Reforms pages.

FUNDING OPPORTUNITIES

FHWA's **Congestion Relief Program,** established under the Bipartisan Infrastructure Law (BIL), provides competitive grant funding for programs that reduce congestion through pricing roadway use and parking, among other methods of decreasing congestion. This includes supporting activities that reduce or shift highway users to off-peak travel times or to nonhighway travel modes during peak travel times.

FHWA's **National Highway Freight Program (NHFP)** is aimed at improving the efficient movement of freight on the National Highway Freight Network (NHFN). The program supports investment in infrastructure and operational improvements that strengthen economic competitiveness, reduce congestion, reduce the cost of freight transportation, improve reliability, and increase productivity.

USDOT's **Strengthening Mobility and Revolutionizing Transportation (SMART) Grants Program** provides grants to eligible public sector agencies to conduct demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety. Delivery/logistics is included as a technology area for eligible projects.

COMPLEMENTARY STRATEGIES

The relationship between freight digitalization and off-peak delivery is increasingly intertwined, with digital technologies playing a pivotal role in enabling and optimizing off-peak delivery strategies. For example, freight digitalization strategies, such as real-time tracking systems and predictive analytics, allow logistics operators to optimize delivery routes and schedules, identifying opportunities for off-peak delivery based on factors like traffic patterns, delivery windows, and customer preferences. In addition, curb reservation systems, common carrier lockers, and other technological solutions can facilitate deliveries during off-peak hours.

Integrating micromobility deliveries with off-peak delivery can enhance the overall effectiveness of freight movement and avoid greenhouse gas emissions. Off-peak delivery times can alleviate congestion and improve efficiency for micromobility deliveries.

Off-peak delivery is one potential component of multimodal and intermodal freight planning that supports freight sector climate goals.

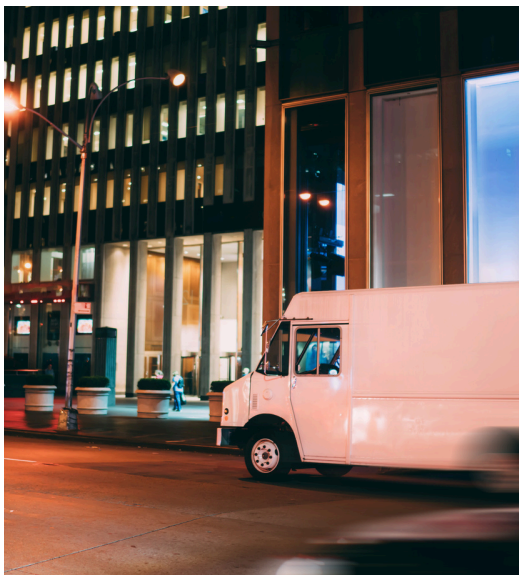
Parking reform initiatives, such as adjusting parking regulations, implementing dynamic pricing, creating dedicated loading zones, or other curb management approaches can influence the availability of curb space for commercial vehicles during non-peak hours. By reallocating parking spaces or implementing flexible parking policies that prioritize loading and unloading activities during non-peak times, communities can create more opportunities for off-peak deliveries without causing congestion or disrupting traffic flow.

Road usage charges and other pricing programs that charge higher tolls during peak hours may encourage carriers to shift deliveries to off-peak hours.

View All Strategies

CASE STUDIES

NEW YORK CITY OFF-HOUR DELIVERIES PROGRAM



The New York City DOT piloted an Off-Hour Deliveries (off-hour delivery) Program from 2007 to 2010 which was funded by USDOT and run in partnership with the Rensselaer Polytechnic Institute, Rutgers University, ALK Technologies, and New York University. Over 300 participants across 400 business locations agreed to shift delivery times from peak hours (between 7 am to 4 pm. to off-peak hours (between 7 pm and 6 am). As a result of the program, delivery speeds in Manhattan increased by 50% during off-hours compared with morning (8 am to 10 am) and by 130% as compared to midday (10 am to 4 pm) and evening (4-10 pm). The average service time at each individual stop was 30 minutes during off-hours, while drivers spent roughly 3 times longer at each stop during the day due to longer walks, wait at freight elevators, and other sources of delays. Due to the success of the pilot program, the DOT permanently adopted off-hour delivery in 2017 and expanded to additional retailers and delivery areas.

GREATER TORONTO AREA OFF-PEAK DELIVERY IMPACTS

A recent study in the Greater Toronto Hamilton Area (GTHA) analyzed traffic surveys and commercial vehicle counts to generate a model that could estimate the impacts off-peak deliveries. If 30% of freight carriers participated in off-peak deliveries, total daily travel time savings would exceed 5,500 vehicle hours. A similar modeling approach could be applied to other cities and regions to evaluate the benefits of implementing a off-peak hours policies and programs.

IMPLEMENTING OFF-PEAK DELIVERY: **WHAT TO READ NEXT**

Primers on Off-Hours Delivery

FHWA's Primer for Improved Urban Freight Mobility and Delivery includes a spotlight on off-hour delivery, including results from a logistics pilot in Stockholm, Sweden.

Researchers at the University of Stockholm provide a helpful comprehensive review paper on off-hours delivery programs: Shifting Urban Freight Deliveries to the Off-Peak Hours: A Review of Theory and Practice.

Jurisdiction of curb space typically falls under State, regional, or local agencies. To encourage State and local agencies to implement better curbside management strategies, DOTs can designate funding, include provisions in existing programs, or develop pilot programs that support curbside management. See findings from the New York City Off-Hours Delivery Pilot as an example.

Large Businesses Can Lead the Way

In New York City, it is estimated that large traffic generators (LTGs), including large buildings or landmarks and large establishments, generate approximately 4-8% of Manhattan's total truck traffic (Holguín-Veras et al., 2013).

- LTGs are a convenient target for off-hours programs, as managers can help coordinate deliveries and facilities tend to be well equipped to receive both staffed and unassisted deliveries (Jaller et al., 2015).
- LTGs will often have centralized delivery stations, which can receive deliveries during off-peak hours and then forward them to businesses during normal operating hours (Holguín-Veras et al., 2013; Jaller et al., 2015).
- Larger establishments (more than 250 employees) and buildings with many businesses yield the greatest savings in terms of the number of truck trips and cost-effective implementation, as additional costs can be shared among more customers (Holguín-Veras et al., 2013).
- The are over 182,000 estimated freight trips attracted (FTA) in Manhattan each day. Approximately 84% of the daily FTA is attributable to large establishments (Jaller et al., 2015).

Facilitating Unassisted Deliveries

Some recipients may not be able to receive deliveries at night – for example, due to storage space, personnel costs, and liability/security. Unassisted off-hour deliveries may help address these concerns. Options for unassisted programs include keyless entry system, DVR devices for access and internal surveillance, and insurance coverage provided by carriers (Holguín-Veras et al., 2013).

RESOURCES

GENERAL RESOURCES

National Level

DOE INcreasing Transportation Efficiency and Resiliency through MODeling Assets and Logistics (INTERMODAL) Exploratory Topic: The DOE funded various intermodal freight projects focused on developing tools and frameworks to support low-carbon intermodal freight transportation systems. Project highlights are available.

FHWA Primer for Improved Urban Freight Mobility and Delivery: The primer includes a spotlight on off-hour delivery, including results from a logistics pilot in Stockholm, Sweden.

University of Washington Urban Freight Lab: The lab is a public-private partnership with research goals that include reducing GHG from urban freight transportation and increasing urban freight efficiency.

Shifting Urban Freight Deliveries to the Off-Peak Hours: A Review of Theory and Practice: A review paper on off-hours delivery programs.

FHWA Tolling and Pricing Resources:

- Center for Innovative Finance Support
- Office of Operations
- Congestion Pricing

State and Local Level

American Institute of Architects New York Chapter (AIANY). 2022. Delivering the Goods: NYC Urban Freight in the age of E-Commerce: The publication provides details of the state of urban freight in New York City with the growth of e-commerce. The resource explores challenges, scenarios, and design considerations to move goods efficiently across the city.

New York City Off-Hour Deliveries Pilot: The resource provides high-level findings and follow-on Smart Truck Management Plan which covers a range of strategies including off-hours deliveries, providing better access to the curb, innovative delivery methods, and improved truck routing.

TOOLKITS AND MODELLING APPROACHES

DOE Argonne National Lab's POLARIS Transportation Simulation Tool: The tool can be used to model various travel and freight scenarios. Auld (2024) used POLARIS to evaluate the impacts of off-hours delivery on traffic conditions in Chicago.

EPA Motor Vehicle Emission Simulator (MOVES): MOVES can be used to generate per-mile and per-hour emission rates for delivery trucks and estimate emission reductions as a result of off-hour programs.

Freight Analysis Framework (FAF): The FHWA and BTS database contains freight flow data sourced from a variety of sectors to support freight analysis and inform decision-making. The database provides a comprehensive summary of current freight trends and can be used to predict future trends.

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For more information visit the DOT Climate Change Center, https://www.transportation.gov/priorities/climate-and-sustainability/dot-climate-change-center