Launching the Safe Fleet Transition Plan

Technology and Process Best Practices

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Executive Summary

This report provides technical input for consideration in developing the New York City Department of Citywide Administrative Services (DCAS) Safe Fleet Transition Plan (SFTP), which will formalize a set of best-practice vehicle safety technologies for all City vehicles to prevent and mitigate crashes, in direct support of Vision Zero. The U.S. Department of Transportation's (USDOT) John A. Volpe National Transportation Systems Center (Volpe) has partnered with DCAS to broadly research these areas and identify implementation opportunities on the City Fleet. Most of the safety technologies identified in this report are already implemented within certain City agencies or in other U.S. fleets.[1]

The rules for the SFTP will be set out by DCAS in their Fleet Management Manual. DCAS may at its election use this report or parts thereof in the plan. **The City alone is responsible for issuing and implementing the SFTP.**

The SFTP best practices in this report are based on prior Volpe research as well as two analyses specific to this task: a large survey conducted by DCAS Fleet of City Fleet drivers (10,018 respondents), and a series of interviews conducted by Volpe of subject matter experts from ten NYC agencies with large vehicle fleets that include heavy- and medium-duty vehicles. The City Fleet driver survey demonstrated backup cameras to be a clear priority of drivers across most agencies. Additionally, Department of Education (DOE) drivers rated navigational systems and backup alarms among the most important technologies for perceived improvements to safety, and Department of Parks and Recreation (DPR) drivers rated additional mirrors among the most important.

Agency interviews revealed diverse experiences, interests, and ideas for implementing safety technologies as well as for a process to allow the City Fleet to convene and adopt a coordinated, state-of-the-practice Safe Fleet Transition Plan. Certain agencies already possess significant expertise with specific safety technologies while other agencies demonstrate interest in learning about and piloting those same technologies. There is also a demonstrated need for broader, objective evaluation of backup alarm types; preserving flexibility on the use of ignition interlocks for emergency response vehicles; discouraging operator over-reliance on backup cameras; and encouraging a standard, fleet-wide navigation system to promote driver compliance with the mobile device ban.

This report proposes that any technologies that DCAS chooses to require as part of its Safe Fleet Transition Plan be balanced with flexibility to adapt or exceed this baseline. One approach for the SFTP would be to use the UK-based Fleet Operator Recognition Scheme (FORS), which uses three levels of technology requirements: Shall (standard), Should (best practice), and May (exploratory technologies that require further analysis but have potential). The categories for SFTP technology designations can be directly adopted from FORS, or may be modified as shown in Table 1, where the FORS *Shall (standard)* becomes "*Tier 1*," the FORS *Should (best practice)* becomes "*Tier 2*," and the FORS *May (exploratory*

[1] This report *did not* conduct a technical review of all safety standards, a review of all relevant safety technology research, or a comprehensive literature review of the capabilities or efficacy of the safety system best practices. Further research that includes these other areas could be important input to inform measurements of efficacy of these best practices. This report is also not an endorsement of safety technology based on crash data analysis, testing, or verification.

technologies that require further analysis but have potential) becomes "*Tier 3*." DCAS may choose to require *Tier 1* technologies, encourage adoption of *Tier 2*, and further study *Tier 3*. Alternatively, DCAS may wish to implement a simplified designation consisting of only *Required by DCAS* and *Optional*.

Technologies and techniques for fleet safety evolve with time, so the SFTP's sustained progress in reducing crashes will depend on cross-agency communication, agency willingness to pilot new safety technologies, and regular revision of the Plan itself. The technologies identified by the SFTP should be reviewed and revised annually by DCAS in conjunction with the Fleet Federation agencies. This could include collecting and discussing annual updates on implemented technologies and techniques—e.g., before-and-after evaluations, case studies for specific vehicle types and operations, crash data and operator feedback. The revision cycle could align with the annual issuance of the Vision Zero Action Plan. With each cycle, an exploratory technology may be upgraded to a best practice technology and a best practice technology to technology that DCAS requires, tracking the adoption and availability of technologies and strategies. Finally, technologies may be phased out of the Safe Fleet Transition Plan as newer technology advancements become available and functionally replace them.

There are many safety technologies that are now standard or mandated by DCAS such as event data recorders (EDRs) and air bags. City vehicles will continue to come with these technologies as appropriate. The SFTP is focused on non-mandated technologies and City safety initiatives.

Table 1: SFTP technology designations for City Fleet vehicles.[2]

Tier 1	Tier 2 Best Practice Technologies	Tier 3 Exploratory Technologies
Additional mirrors/lenses where applicable including Fresnel lenses *	Automatic emergency braking (AEB) for medium- and heavy-duty vehicles (Class 3-8) §	Alcohol touch ignition interlock §
Appropriate technologies and techniques to see behind vehicle, such as but not exclusive to backup cameras	Blind spot monitors	Cell phone physical or app-based lock box/ docking station ignition interlock §
Automatic emergency braking (AEB) for light-duty vehicles (Class 1-2) §	Driver alert systems	Connected vehicle, or vehicle-to-vehicle (V2V), communication technology
Automatic headlights where available	Enhanced seat belt reminder systems (ESBRs)	Seatbelt assurance ignition interlock systems §
Enhanced truck rear underride guards *	High vision truck cabs *	Surround cameras *
Safety lights for work trucks, such as but not exclusive to side-visible turn signals and roadwork lights (amber)	Navigation systems	Turning alarms *
Side underride guards * consistent with Local Law	Power mirrors and heated mirrors *	
Smart backup alarms †	Speed governors * §	
Telematics to enable utilization, collision, speed, and safety reporting, among other uses §	Training in appropriate use of technologies, as needed	
Warning decals *		

Note: ∗ = Only apply to vehicles with gross vehicle weight rating of 10,000 lbs. or greater.

† = Only apply to vehicles with limited or no direct rear vision (e.g., passenger/cargo vans and trucks) and to vehicles with gross vehicle weight rating of 10,000 lbs. or greater.

§ = Only apply to non-emergency response vehicles

[2] The City alone is responsible for issuing and implementing the SFTP and its requirements, which do not represent USDOT requirements or policy.

1. Introduction

1.1 Background

Approximately 4,000 residents of New York City are seriously injured and some 250 are killed each year in traffic crashes. The Vision Zero Action Plan to eliminate traffic fatalities in NYC by 2024 includes 63 recommendations that fall into three main categories: enforcement, education and engineering. The third year of Vision Zero, 2016, was the safest year on NYC streets since record-keeping began in 1910.

Vision Zero Action Plan Recommendation #58 charges the New York City Department of Citywide Administrative Services (DCAS) with "recommend[ing] safety related devices and designs, such as high visibility vehicles, back-up cameras, and rear wheel side guards, for City vehicles and other vehicles under City regulation." DCAS is a critical partner in the Vision Zero program, leading by example with the 30,000-vehicle City Fleet and providing a model for potential broader adoption of life-saving safety technologies in the general fleet via citywide procurement and legislative approaches.[3] DCAS has already issued preliminary vehicle safety recommendations in response to the Vision Zero Action Plan, including the nation's largest truck side-guard implementation, and continues to assess and pilot new approaches and technologies that may enhance safety.

The U.S. Department of Transportation's (USDOT) John A. Volpe National Transportation Systems Center (Volpe) has partnered with DCAS to broadly review and categorize these technologies. This report provides input for use by DCAS in developing a Safe Fleet Transition Plan that will formalize a set of best-practice vehicle safety technologies for all City vehicles to prevent and mitigate crashes. Most of the safety technologies researched for the Safe Fleet Transition Plan are already implemented within certain City agencies or in other U.S. fleets. Therefore, the input is based primarily upon prior research in the field and on interviews of fleet directors, specification writers, and other subject matter experts from the NYC agencies with the largest vehicle fleets. The findings from these interviews and Volpe's analysis of DCAS's survey of over 10,000 City Fleet drivers inform the technology and process recommendations of this report.

1.2 Methodology

The best practices provided in this document are based on previous research conducted by Volpe, as well as two studies specific to this task: a focused analysis of a large survey distributed to City Fleet drivers (10,018 respondents), and a series of interviews conducted by Volpe of subject matter experts from ten NYC agencies with large vehicle fleets that include heavy- and medium-duty vehicles. DCAS Fleet has also drafted a review of available safety technologies, which they have shared with the Fleet Federation agencies.

The DCAS-administered Defensive Driver Course Evaluation survey provided a high-level census of "which type of equipment [drivers] consider the most important to improving safety." Drivers who completed the survey selected one or more technologies among 10 pre-filled choices and could fill in an

[3] http://www.nyc.gov/html/visionzero/assets/downloads/pdf/nyc-vision-zero-action-plan.pdf

open-ended response. Volpe analyzed the results data spreadsheet using pivot tables to assess agency-technology correlations and overall trends in the responses.

The ten NYC agencies that Volpe interviewed are listed below in Table 2.

Table 2: Agencies interviewed as part of research efforts to inform guidance for Safe Fleet Transition Plan.

Agency Interviewed	Point of Contact	Point of Contact Title
Department of Transportation (DOT)	Daniel Malone	Fleet Services/ Deputy Chief of Vehicles & Equipment
Department of Environmental Protection (DEP)	Rebecca Behle	Fleet Services Director
Fire Department (FDNY)	Victor Holdorf	Deputy Director, Fleet Services
Department of Sanitation (DSNY)	Eikar Lai	Senior Automotive Specialist
Department of Education (DOE)	Ronald Bundick	Deputy Director of Facilities Management Services
Department of Health and Mental Hygiene (DOHMH)	Isaac Suggs, Jr.	Director of Transportation
Police Department (NYPD)	James Korotki	Operations Supervisor
Department of Corrections (DOC)	Richard Fosbeck	Director of Fleet Services
Taxi and Limousine Commission (TLC)	Chris Rivera/ Kieran Duggins	Supervisor of Fleet Services
Department of Parks and Recreation (DPR)	Paris Apollon	Chief of Operations for Citywide Services

All interviewees also attended a Fleet Federation meeting on October 20, 2016, which served as the Safe Fleet Transition Plan kickoff, and participated in group discussion of a DCAS/Volpe-developed list of available fleet safety technologies. The interviews, conducted in December 2016 and March 2017, were based on an agency-specific discussion of the same technology list and on the interview guide shown below in Figure 1. The interviews were designed to be short (approximately 30-minute) conversations between Volpe researchers and agency stakeholders to facilitate open discussion about experiences, interests, and ideas about implementing safety technologies as well as contributing to a process that will allow the NYC Fleet to convene around a coordinated and up-to-date Safe Fleet Transition Plan.

New York City Department of Citywide Administrative Services
Safe Fleet Transition Plan: Vehicle-Based Safety Technologies
Questions for Fleet Specification Writers, Mechanics, and Operators

Volpe, The National Transportation Systems Center (USDOT), is assisting the New York City Department of Citywide Administrative Services (DCAS) in reviewing the availability and suitability of vehicle-based safety technologies as part of the Safe Fleet Transition Plan for Vision Zero. Your responses to the following questions will help us better understand and account for the needs of your fleet.

Please consider the questions below, referring to the spreadsheet of available technologies discussed at the Fleet Federation meeting on October 20, 2016.

1. What are the primary safety concerns for your agency that could be addressed by vehicle-based safety technologies?
    a. What are the *top 3-5 technologies* that are appropriate for your agency's fleet?
    b. Some agencies identified backup cameras as the most important equipment for improving safety. Do you agree? What is the primary appeal of backup cameras?
2. Which vehicle types/styles in your fleet are appropriate candidates for which of the *top 3-5 safety technologies* you identified above?
    a. What vehicle types may pose installation, operation, or maintenance challenges?
    b. Are there any safety concerns for drivers or maintenance staff with respect to the available technologies?
3. What vehicle-based safety technologies is your agency already operating? Which has your agency already considered? Does your agency have any experience with any of the available technologies listed?
    a. Can you share any success stories or data that your agency has collected that led to adopting these new technologies?
4. What type of flexibility is needed in considering the addition of new safety technologies for vehicles in your agency's fleet?
5. Are there any other considerations that we should be aware of as we research and recommend specifications?

Figure 1: Questionnaire used during interviews with subject matter experts from the agencies listed in Table 2.

2. Findings

2.1 Driver Survey Analysis

In response to the question "Which type of equipment do you consider the most important to improving safety?" drivers completing the Defensive Driver Course Evaluation survey could choose from a list of 10 technologies or write in a unique response. An analysis of the results data showed backup cameras to be a clear priority across agencies (see Figure 2).

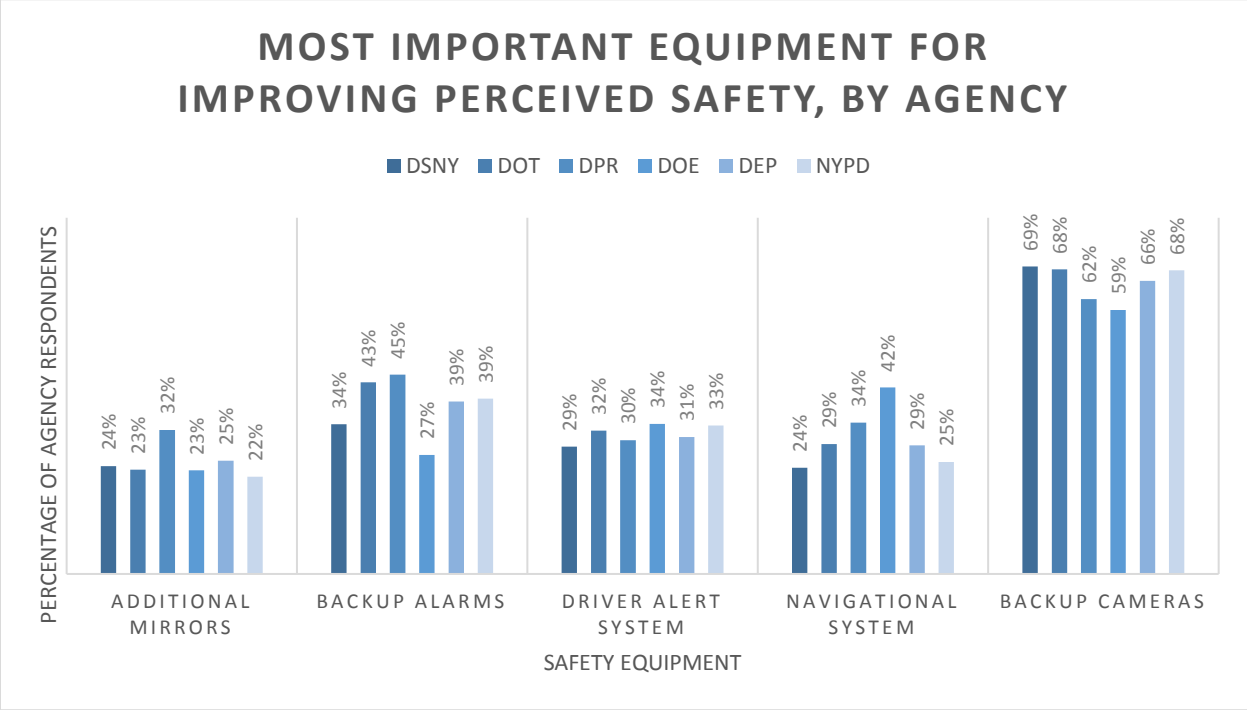

Figure 2: Chart showing the most important equipment for improving safety as identified by drivers from DSNY, DOT, DPR, DOE, DEP, and NYPD.

The analysis also showed that DOE drivers rated navigational systems among the most important technologies for perceived improvements to safety more than drivers from other agencies (42% of DOE drivers compared to 24-34% of drivers from other agencies). Other trends include DOE drivers rating backup alarms among the most important technologies less frequently than drivers from other agencies (27% compared to 34-45% elsewhere) and DPR drivers rating additional mirrors among the most important technologies more frequently than drivers from other agencies (32% compared to 22-25% elsewhere). This analysis informed the interview questions posed to all agencies, as well as supplemental questions asked of specific agencies.

2.2 Interview Findings

This section describes key takeaways from the agency interviews as well as agency-specific findings, both of which were used to inform the recommendations in the next section.

2.2.1 Key Cross-Agency Takeaways

1. Several agencies view their vehicle fleets as unique and diverse and support allowances for flexibility based on vehicle type and purpose in implementing any broad mandates.

2. Agencies have diverse experiences with these technologies and may not be aware of the resources available to them in the form of other agencies' experience (see Table 3 in Process section).

3. There is some disagreement about the effectiveness of white noise backup alarms compared to single-tone beepers that change volume based on ambient noise levels. All agencies with exposure to this technology agree that the audible alarm is distinct from the traditional single-tone beeper, but some agencies report positive outcomes (e.g., other road users are unable to tune it out as easily; attention is captured by unfamiliar sound), while others report negative outcomes (e.g., unfamiliar sound draws people toward the source of danger, unfamiliar sound is unrecognizable as a backup alarm and is therefore unintelligible).

4. Emergency response vehicles (including those that are typically used by civilians but may be used during an emergency) have greater needs for flexibility than other vehicles. Specifically, ignition interlock technologies (e.g., cell phone interlock, seatbelt assurance interlock, and alcohol touch interlock) are not appropriate for any vehicle that may for some reason need to move quickly from a parked position. Some automated braking technologies, speed governors, and telematics may be similarly inappropriate.

5. Backup cameras are only useful as supplemental technologies and should not replace best practices such as using direct vision, mirrors, and spotters to see behind the vehicle.

6. Offering standardized navigation systems may be more effective than cell phone lockbox technologies in enabling drivers to commit to hands-free operation.

7. Speed and location tracking capability is widely desired by agencies if technology improvements can make it more real-time and reliable.

2.2.2 Agency-Specific Findings

This section describes the highlights from each agency interview and identifies challenges and opportunities specific to individual departments, such as needs and expertise, special cases and reasonable exemptions, and unique perspectives on safety technologies. Additional research on the efficacy of the various vehicle safety technologies would be needed to properly assess actual safety impacts.

2.2.2.1 New York City Department of Transportation (NYC DOT)

NYC DOT sees itself as the face of Vision Zero, and has updated the appearance of its vehicles as well as its vehicle-based safety technologies to reflect that commitment. With a diverse fleet that serves many

purposes and parts of the city, NYC DOT considers each vehicle type a distinct project when it comes to evaluating and updating safety technologies.

NYC DOT has experience with white noise backup alarms, and it offers voluntary annual hearing tests for operators. It also has experience with safety lighting, 10-inch parabolic mirrors, and multi-camera systems, including backup cameras. Given that NYC DOT reports that it does not have a driver training program to supplement state-required commercial driver license training, it supports offering additional skills training to drivers where available (e.g., mirror scanning best practices for city driving) and educational campaigns aimed at operators and other road users.

2.2.2.2 New York City Department of Environmental Protection (DEP)

DEP is open to considering many types of emerging safety technologies, and is interested in reviewing or supporting research aimed at better understanding the safety impacts of certain equipment. DEP has strong experience with safety lighting and is willing to be a source of expertise for other agencies. Operators in DEP are requesting backup cameras, and DEP is open to providing them broadly as long as they are used as supplemental rather than replacement technologies. DEP is interested in providing a standard navigational tool to enable operators to better respond to the ban on cell phone use while driving, and it is particularly interested in transitioning the vehicle fleet to high-vision cab-over design. DEP operators observed that some promising technologies—such as lane departure warnings, blind spot monitors, and speed tracking—are underdeveloped or unreliable as implemented at present, but may be appropriate in the future.

2.2.2.3 Fire Department of the City of New York (FDNY)

The most relevant new technologies to FDNY are the crossover mirrors that resulted from a DCAS initiative about ten years ago, smart backup alarms, and backup cameras, which emerged around 2010. While NYC DOT finds white noise backup alarms highly effective, FDNY finds them ineffective due to a less recognizable tone, and instead opts for single-tone beepers that automatically adjust the decibel level according to ambient noise. FDNY operators report positive experiences with backup cameras, and the agency has experience choosing the appropriate camera and display screen setup for different vehicle types.

FDNY clarified that seatbelt interlock technology would not be appropriate for emergency response vehicles due to the potential safety concern for operators if a vehicle was unable to move quickly away from an unsafe area.

2.2.2.4 New York City Department of Sanitation (DSNY)

DSNY has an operator-driven approach to identifying and testing new vehicle-based safety technologies. Each evaluation process depends on the particular technology and vehicle type, and in general DSNY tries to apply safety technology wherever possible.

Collection trucks make use of a 12-mirror system with a unique configuration that prevents wiring door-mounted mirrors for heating or power operation. Strobe lights and decals are important components of DSNY's safety equipment portfolio, while the utility of driver alert systems and backup alarms remains uncertain. DSNY personnel commented that sensors associated with driver alert systems need to be

properly positioned, calibrated, and exposed, without interference from protective metal cages. Due to the need for standardization and reliable readings, DSNY does not see itself as a good candidate agency for testing turning alarms and driver alert systems. DSNY tested white noise backup alarms, and—like FDNY—found the unfamiliar tone to be ineffective for deterring pedestrians.

2.2.2.5 New York City Department of Education (NYC DOE)

NYC DOE considers the most relevant vehicle-based safety technologies to be backup alarms for vans and trucks, backup cameras for all vehicles, and speed governors and turning alarms for trucks in particular. NYC DOE has limited experience with white noise or smart backup alarms, and believes that speed governors may be too restrictive for light-duty vehicles. NYC DOE does not see a need for power mirrors or heated mirrors as mirror adjustment and de-icing are included in required daily vehicle checks, and operators are typically assigned to only one vehicle per day. NYC DOE operators identify navigation systems as relevant safety technologies to prevent cell phone use while driving, especially through school zones.

2.2.2.6 New York City Department of Health and Mental Hygiene (DOHMH)

DOHMH has limited exposure to backup cameras, smart or white noise backup alarms, speed governors, and driver alert systems; however, the agency is open to test most vehicle-based safety technologies. Speed governors may be particularly appropriate for DOHMH operators given that they rarely go on the highway. Meanwhile, backup cameras may be less helpful for the DOHMH fleet due to a high proportion of deliveries in open spaces and deliveries to familiar locations.

2.2.2.7 New York City Police Department (NYPD)

NYPD aims to obtain every relevant and available safety technology, and emphasizes maintaining recommended life cycles. NYPD identified a tradeoff between forward cameras and crossover mirrors, and has had positive experiences with backup cameras. As with FDNY, ignition interlock technologies (e.g., cell phone, seatbelt, alcohol) may pose safety concerns as all agency vehicles are considered emergency response vehicles even if they are typically driven by civilians. For related reasons, automatic braking technology also needs further evaluation before adoption by NYPD. The agency has also piloted Mobileye in a single vehicle and is interested in reviewing similar technologies. NYPD pointed to the annual National Association of Fleet Administrators (NAFA) Institute and Expo as a resource for gaining exposure to new technology.

2.2.2.8 New York City Department of Corrections (DOC)

DOC has added backup cameras to its new purchases, and reports that they have helped reduce the frequency of vehicles getting damaged in parking lots. The fleet does not have experience with 360/surround cameras or turning alarms, but it did have an opportunity to test Mobileye on six buses. Operators reported that the system was mounted in an inconvenient location on the dashboard and that the flashing alerts were distracting. With improvements, driver alert systems may be worth exploring further.

DOC is the only agency with a substantial number of Type C buses in its fleet, but does not report particular difficulty in operating in dense urban environments on their fixed routes. Nonetheless, the

agency expressed potential interest in turning alarms. Unlike school buses, DOC buses have only one crossover mirror. The agency reports using its standard mirror system and single tone backup alarm without issue and was unaware of other backup alarm types. DOC echoed other agencies' concerns about installing speed governors and ignition interlock technologies on emergency response vehicles, and reported that technologies aimed at reducing cell phone use are unnecessary as their drivers are not allowed to carry cell phones on the job.

2.2.2.9 New York City Taxi and Limousine Commission (TLC)

TLC operates a small fleet of vehicles used primarily for enforcement. Light duty vehicles make up the majority of the fleet, and vehicles of model year 2014 and newer (roughly 20 of nearly 130 sedans) come with backup cameras. The two Sprinter vans in the fleet are fitted with backup alarms and backup cameras, which operators report work well. Given the nature of enforcement work, TLC reports that navigation systems, speed governors, and seatbelt interlocks may not be necessary or appropriate. Roughly half of TLC's enforcement vehicles are equipped with a PRO-VISION Solid-State In-Car Video System that the agency uses to record interactions during traffic stops. The front and rear camera are always on when the vehicle is in operation, but video is recorded to a special folder when the overhead police light is turned on. The video recordings have also been helpful to view following accidents or collisions.

TLC has limited experience with automatic emergency braking (AEB) technology and Advanced Driver Assistance Systems (ADAS) such as Mobileye, but expressed that both might be useful in reducing rear end collisions and improving safe operation of its vans. As with other agencies, TLC finds CANceiver technology useful for tracking speeding, braking, and seatbelt usage, among other data, but reports spotty coverage and long lag due to Wi-Fi uploading issues. TLC expressed that the CANceiver mapping function was useful until it was discontinued, and that a real-time telematics system that provides real-time visual location information would be helpful.

2.2.2.10 New York City Department of Parks and Recreation (DPR)

The DPR fleet consists of 3,000 vehicles of diverse types and purposes. Newer vehicles have backup cameras, and DPR is interested in specifying cameras for all new vehicles as it does not have the resources to retrofit older vehicles without the assistance of a sponsor program. DPR is piloting Mobileye in four vehicles, but has not yet received feedback from the drivers. The CANceiver program provides useful information, but technical issues reduce the timeliness and reliability of this data for safety performance monitoring of the fleet. DPR suggests that, with improvements, it has the potential to be an effective program.

DPR is exploring piloting an online training program to help drivers refresh their skills and learn about new technologies and policies (from the citywide speed limit to AEB and ADAS) through a test-based curriculum that could potentially serve as a template for future DCAS-level training.

3. Best Practices

3.1 Technologies

3.1.1 Introduction to classification

NYC DCAS has stated the Safe Fleet Transition Plan will reflect and incorporate the most progressive existing safety practices of City agencies, ensuring that the City Fleet as a whole continues to pioneer vehicle-based safety technologies and practices. Reducing injuries associated with crashes will require adopting a consistent suite of safety technology and training, while still recognizing the unique operational considerations of different agency fleets.

This report proposes that any technologies that DCAS chooses to require as part of its Safe Fleet Transition Plan be balanced with flexibility to adapt or exceed this baseline. One approach for the SFTP would be to use the UK-based Fleet Operator Recognition Scheme (FORS), which uses three levels of technology requirements: Shall (standard), Should (best practice), and May (exploratory technologies that require further analysis but have potential). The categories for SFTP technology designations can be directly adopted from FORS, or may be modified as shown in Table 1, where the FORS *Shall (standard)* becomes "*Tier 1*," the FORS *Should (best practice)* becomes "*Tier 2*," and the FORS *May (exploratory technologies that require further analysis but have potential)* becomes "*Tier 3*." DCAS may choose to require *Tier 1* technologies, encourage adoption of *Tier 2*, and further study *Tier 3*. Alternatively, DCAS may wish to implement a simplified designation consisting of only *Required by DCAS* and *Optional*.

The classification of each technology highlighted below is meant to be a starting point that can change over time. As innovations appear on the market and as data and experience demonstrate the value of these new technologies, their classifications should be revisited as part of a regular process for updating the SFTP. With each revision cycle, an exploratory technology may be upgraded to a best practice technology and a best practice technology to technology that DCAS requires, based on the real-world adoption, results, and availability of safety technologies and techniques.

The Process section offers recommendations for this process.

3.1.2 Tier 1

Additional mirrors/lenses

Equipment: In addition to currently required mirror configurations, agency fleets could evaluate the mirror types available and make every effort to reduce blind spots to the maximum extent possible through use of an appropriately expanded mirror configuration. The following mirrors and lenses could be assessed for utility to reduce existing blind spots on trucks, vans, and other vehicles with limited direct vision from the driver's seat:

- Rear corner or crossover mirrors (typically mounted on the rear driver side top corner of a van body)
- Quadraspheric front crossover mirrors (which have less glare than spherical models)
- Lookdown mirrors (typically mounted on the passenger side door of large trucks and buses)

- Fresnel lenses (typically mounted on the bottom right of the passenger window in large truck cabs, or on the rear window of a passenger/cargo van)[4]

Training: Agencies could consider providing training to drivers in proper use of all mirror types, including correct adjustment, scanning when stopped and when driving, etc. This training could be implemented, for example, as a one-hour supplemental module within the defensive driver course for operators of large vehicles.

Appropriate technologies and techniques to see behind the vehicle

Equipment: All vehicles should have at least one mechanism that allows the driver to see the area behind the vehicle when operating in reverse. This may be accomplished with rear corner or crossover mirrors,[5] backup cameras[6] with screens of at least 3.5 inches measured diagonally,[7] 360/surround cameras, or by human spotters. Agencies could be enabled to choose the technologies and practices that are most appropriate for their vehicles. Operators of vehicles with bodies that do not permit the use of an in-cab rearview mirror together with the door-mounted rearview mirrors should, for example, rely on rear crossover mirrors, spotters, and backup cameras to drive in reverse.

Training: Most agencies already have appropriate standards in place, but driver training could emphasize that operators rely primarily on mirrors, spotters, and looking directly backwards, relying only secondarily on backup cameras for additional awareness. [8]

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[4] Based on a Transport Research Laboratory study using three large truck models in the U.K. and driver detection of cars, bicyclists, and pedestrians, the Fresnel lens was found to eliminate between 78% and 90% of the potential blind spots adjacent to the passenger side of the truck cabs.
See pages 44-45: http://02a9828.netsolhost.com/TRLreport.pdf

[5] The estimated potential backover risk reductions reported by NHTSA testing of rear-mounted mirror systems on vans and SUVs ranged from 33.4 percent (for the Toyota 4Runner rear crossview mirrors) to 2.2 percent (for the ScopeOut™ passenger car rear crossview mirror) (https://www-nrd.nhtsa.dot.gov/pdf/esv/esv21/09-0558.pdf). One manufacturer of step van rear-mounted corner mirrors claims that "Federal Express says 'Immediately after installing these mirrors, the backing up accident rate plummeted 36%.'" (http://www.sureplus.com/products/safety.htm). Volpe has not confirmed this statement but can confirm that both Federal Express and the U.S. Postal Service install these mirrors on step vans as standard practice.

[6] Placement can be at bumper level or higher on the rear of the vehicle body, in such a way that a 32-inch-tall child can be detected by the driver 1 foot behind the rear bumper face, consistent with light-duty vehicle backup cameras requirements: https://www.nhtsa.gov/staticfiles/rulemaking/pdf/Rear_Visibility_NPRM_12032010.pdf
Example backup camera installations on large trucks can be seen here: https://www.rearviewsafety.com/about-us/customer-installation.html

[7] Prior NHTSA research has shown that systems providing the driver with a 3.5-inch (measured diagonally) or larger visual image of the area behind the vehicle are more effective than other types of technologies in aiding the driver to avoid a backing crash, at least on light-duty vehicles. Test results showed that the reduction in crashes with an unexpected rear obstacle for the 3.5-inch image system (48 percent) was nearly twice that seen with a 2.4-inch image (26 percent) system or ultrasonic sensors (25 percent) (https://www.nhtsa.gov/DOT/NHTSA/NVS/Human%20Factors/Visibility%20and%20Lighting/811512.pdf).

[8] A mirror alignment-check grid of painted marks on the pavement, or cones, etc. can be implemented at the exits of vehicle garages for drivers to properly align mirrors when taking large vehicles out. If implemented, driver training should specifically cover how to align mirrors against this grid.

Automatic emergency braking (AEB): Class 1-2 vehicles (GVWR < 10,000 pounds)

New light duty vehicle purchases could include automatic emergency braking (AEB) when available on DCAS contract. While AEB experience and availability still has some limitations, the technology is promising (based on IIHS and NTSB research) for preventing and mitigating frontal collisions, a significant fraction of all City Fleet crashes.[9] As announced in March 2016, [10] 20 automakers representing more than 99 percent of the U.S. auto market have voluntarily committed to making automatic emergency braking a standard feature on virtually all new cars no later than Sept. 1, 2022. In FY17, DCAS reports that it has over 400 cars and SUVs on order with this technology, a first for the City.

Where different AEB systems are available for a vehicle, agencies could specify those that (1) provide crash imminent braking (automatically applies the vehicle's brakes rather than just pre-charges or supplements driver braking),[11] and (2) are designed to work at city street speeds, not only highway speeds. Exceptions could be made for emergency response vehicles that conduct operations incompatible with this technology.

Training: Agencies could educate drivers/operators about how, when, and where AEB activates since different systems operate in different ways.

Automatic headlights

Agencies could specify low-glare daytime running lights (DRL) and automatic headlights on all vehicles if available. When ambient light levels are high, the DRL should light; and when either ambient light levels are low or the windshield wipers are activated, the headlights, taillights, and dashboard lights should automatically turn on.[12]

Training: N/A

Enhanced truck rear underride guards

Equipment: Vehicles with gross vehicle weight rating 10,000 pounds or greater could be equipped with rear underride guards that meet or exceed Federal Motor Vehicle Safety Standards 223[13] and 224,[14] unless their body types (e.g., low-floor buses or certain waste collectors) already provide such rear underride protection.

Training: N/A

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[9] Studies by IIHS and NTSB predict that AEB systems will reduce rear-end crashes and the associated 1,700 fatalities and 500,000 injuries per year by between 40 percent and 80 percent (https://www.ntsb.gov/safety/safety-studies/Documents/SIR1501.pdf).

[10] http://www.iihs.org/iihs/news/desktopnews/u-s-dot-and-iihs-announce-historic-commitment-of-20-automakers-to-make-automatic-emergency-braking-standard-on-new-vehicles

[11] https://www.safercar.gov/Vehicle-Shoppers/Safety-Technology/AEB/aeb

[12] For example: https://owner.ford.com/how-tos/vehicle-features/lights-and-turn-signals/automatic-headlamps-with-wiper-activated-headlamp-feature.html and http://www.nissan-global.com/EN/TECHNOLOGY/OVERVIEW/smart_auto_headlight_wiper.html

[13] https://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol6/pdf/CFR-2011-title49-vol6-sec571-223.pdf

[14] https://www.gpo.gov/fdsys/pkg/CFR-2015-title49-vol6/pdf/CFR-2015-title49-vol6-sec571-224.pdf

Safety lights: side-visible turn signals and roadwork lights

Equipment: Agencies could evaluate appropriate applications for amber and white safety lights on all vehicles that conduct road work. Agencies could stipulate that the operation of safety lighting should not interfere with adherence to anti-idling restrictions. All vehicles could be equipped with at least one turn signal lamp on each of the left and right vehicle sides that is visible from any point to the left and right of the vehicle along its full length.

Training: N/A

Side guards

Equipment: NYC Local Law requires vehicles with gross vehicle weight rating 10,000 pounds or greater to be equipped with side underride protection. Consistent with Local Law 56 of 2015 and the USDOT Volpe Voluntary Standard DOT-VNTSC-OSTR-16-05, acceptable side underride protection can be provided by any combination of vehicle body, fuel tanks, tag axles, tool boxes, or purpose-built side guards comprising a smooth surface flush with the vehicle sidewall, meeting the required dimensional and strength specifications.[15]

Training: N/A

Smart backup alarms

Equipment: All vehicles with limited or no direct rear vision (e.g., passenger/cargo vans and trucks) as well as all vehicles with GVWR over 10,000 lbs. could be equipped with smart backup alarms that self-adjust their volume based on ambient noise level. This feature produces a volume that is audible and does not excessively contribute to noise pollution; it also eliminates the need for manual volume adjustment and may help prevent intentional alarm disconnection.[16] Traditional, fixed-volume alarms could be phased out.

Along with the other technologies and solutions discussed within this report, DCAS could conduct further research into the safety efficacy of this technology. Specifically, DCAS could consider evaluating the effectiveness of white noise alarms compared to single-tone alarms through an independent study and recommend their adoption based on the results. Part of the SFTP guidance developed could include a comparison of the technologies available for the benefit of fleet directors who may not be familiar with it.

Training: N/A

Telematics

Equipment: All agencies could incorporate DCAS-approved telematics systems that can be implemented in a manner consistent with the citywide policy prohibiting hand-free mobile device use by City drivers. As part of Vision Zero, DCAS began implementing fleet tracking in 2014 and is currently using various devices, with further development expected. Exceptions may be made for emergency response vehicles

[15] http://ntl.bts.gov/lib/60000/60000/60063/Truck_Side_Guard_Specifications.pdf
[16] http://www.cpwrconstructionsolutions.org/heavy_equipment/solution/792/self-adjusting-and-directional-backup-alarms.html

that conduct operations incompatible with this technology. The City could look to incorporate real time tracking and safety alerts to the extent feasible.

Training: Current driver awareness training could focus on the data collected and the performance, collision, and safety tracking that any selected mobile device-based telematics platform selected for the SFTP will be used for.

Warning decals

Equipment: All vehicles with gross vehicle weight rating 10,000 pounds or greater could be outfitted with educational messaging in the form of signs, stickers, or decals directed at vulnerable road users. Messaging could be informational (e.g., pointing out drivers' blind spots or identifying vehicles that make wide turns) rather than instructive (e.g., directing cyclists to "Stay back"), and when possible could be placed in the blind spots on the rear and sides of each vehicle. A standardized decal design used on vehicles citywide is likely the most visible. Light duty vehicles could incorporate Vision Zero messaging and stickers.

Training: N/A

3.1.3 Tier 2

Automatic emergency braking (AEB): Class 3-8 vehicles (GVWR > 10,000 pounds)

New medium- and heavy-duty vehicle purchases could include automatic emergency braking (AEB) when available. While AEB experience and availability is still limited, the technology is promising (based on IIHS and NTSB research) for preventing and mitigating forward collisions, a significant fraction of all City Fleet crashes.[17]

Where different AEB systems are available for a vehicle, agencies could specify those that (1) provide crash imminent braking (automatically applies the vehicle's brakes rather than just pre-charges or supplements driver braking),[18] and (2) are designed to work at city street speeds, not only highway speeds.[19] Exceptions could be made for emergency response vehicles that conduct operations incompatible with this technology.

Blind spot monitors

New vehicle purchases could be equipped with blind spot monitoring systems when available. This feature, which is usually available from the OEM for light-duty and is available aftermarket for medium/heavy-duty,[20] can warn the operator if a car—or sometimes other objects—is in the left or

[17] Studies by IIHS and NTSB predict that AEB systems will reduce rear-end crashes and the associated 1,700 fatalities and 500,000 injuries per year by between 40 percent and 80 percent (https://www.ntsb.gov/safety/safety-studies/Documents/SIR1501.pdf).
[18] https://www.safercar.gov/Vehicle-Shoppers/Safety-Technology/AEB/aeb
[19] While AEB is presently available for many (and by 2022, virtually all) light duty vehicles, it is increasingly also available and should be considered for vehicles over GVW 10,000 pounds. It is noteworthy that the casualties of the December 2016 hijacked truck terrorist attack in Berlin, Germany, were greatly reduced by the truck's AEB system, a safety feature that became required on new trucks starting 2011 by European Union regulations (http://www.dw.com/en/automatic-brakes-stopped-berlin-truck-during-christmas-market-attack/a-36936455).
[20] For example: http://preco.com/side_defender/

right blind spot. Warnings based on radar, ultrasonic, or other sensors will appear in the sideview mirrors or in the windshield frame and may give an audible or haptic warning when the driver uses the turn signal and there is a vehicle detected in the blind spot.[21] However, not all systems may be capable of detecting motorcycles, bicycles and other vehicles smaller than a regular-sized car. Even with blind spot monitors, operators should always do a visual head check to confirm there is not an object in the blind spot.

Driver alert systems

All vehicles could be equipped with either an OEM or aftermarket driver alert system. The driver alert system could either be a radar/LIDAR-based system such as Toyota SafetySense[22] or a vision-based advanced driver assistance system such as Mobileye one-camera and four-camera systems.

Enhanced seat belt reminder systems (ESBRs)

All vehicles could be equipped with either an OEM or aftermarket enhanced seat belt reminder system (ESBR), which uses a combination of auditory, visual, and text displays to provide a more conspicuous and persistent warning than currently required by the Federal Motor Vehicle Safety Standard (FMVSS).[23] A study conducted by NHTSA in 2007 found that ESBRs increased front occupant seat belt use by 3-4 percentage points compared to vehicles without ESBRs.[24] Exceptions could be made for emergency response or special-purpose vehicles. ESBRs are distinguished here from seatbelt assurance systems that use ignition interlocks to enforce seat belt use.

High vision truck cabs

Large trucks could be configured with cabs that allow the driver the greatest possible amount of direct vision and that minimize the need to rely on indirect vision through mirrors, cameras, and other devices. Truck cabs could be positioned as low to the ground as possible and include glazing that extends as far down on the front and sides as practical—e.g., fully glazed full-height entry doors similar to those on DSNY collectors. Trucks could be either cab-over-engine design whenever feasible, otherwise with a sloped conventional hood to minimize the front blind spot.[25] At a minimum, truck cab doors could have peeper windows.[26]

Navigation systems

Dashboard- or windshield-mounted GPS navigation systems could be rolled out on all vehicles to enable operators to receive audible and on-screen navigation directions without using their cell phones. Some

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[21] https://mycardoeswhat.org/safety-features/blind-spot-monitor/
[22] https://mycardoeswhat.org/safety-features/pedestrian-detection/
[23] FMVSS No. 208 requires a 4-8 second audible signal under circumstances when the driver's seat belt is not buckled, combined with a 60-second visual signal after the ignition switch is turned on (https://www.gpo.gov/fdsys/pkg/FR-2010-06-29/html/2010-15773.htm).
[24] NHTSA, 2007 (https://www.nhtsa.gov/DOT/NHTSA/NRD/Multimedia/PDFs/Human%20Factors/Reducing%20Unsafe%20behaviors/810844.pdf).
[25] For example: http://www.constructionequipment.com/heavy-duty-trucks-class-7-8-26000-gvw/slope-hood-international-workstar-offers-nice-view-ahead
[26] For example: http://www.lens-tech.com/fresnel-vision-aids/truck-lens/truck-peeper/

agencies strictly comply with the hands-free cell phone ban, while others may benefit from additional training. A separate navigation system eliminates a common reason that some drivers continue to use cell phones while driving. An (additional) informational campaign led by DCAS could be appropriate for getting the message out about the importance of not using cell phones while operating city vehicles.[27]

In implementing this measure, drivers could be consulted in identifying a mapping and navigation system based on experience. The selected system could allow for automatic updates of the base map, e.g., over Wi-Fi.

Power mirrors and heated mirrors

Except when infeasible (e.g., where the door configuration precludes installation) all vehicles could make use of mirror systems that can be adjusted and heated/de-iced from the driver's seat so that drivers have an easier time properly adjusting the mirrors when they enter the vehicle. Power and heated mirrors are most important for vehicles that may have multiple drivers in one day, and less important for vehicles that either have one driver assigned per day or are assigned to an individual operator for an extended period.

Regardless of the presence of power mirrors and heated mirrors, DCAS could consider using the SFTP to communicate that drivers are expected to adjust their mirrors as part of their overall vehicle check at the start of each operational shift. Scrapers could be made available to de-ice mirrors in cold weather.

Speed governors

All vehicles could be equipped with speed governors set to the highest speed limit of their operating environment. Vehicles that operate exclusively in the City could be limited to the highest posted speed limit of highways within the City limits. Vehicles that are driven outside the City (e.g., in Upstate New York) could be equipped with speed governors set to the New York State Thruway or other relevant highway speed limit. In addition, some speed governor technology coordinates with GPS and mapping systems to dynamically adjust the maximum speed of the vehicle to the speed limit for the precise road on which the vehicle is being operated.

Training in appropriate use of all technologies

To the extent applicable and available, drivers could receive additional training in the use of the vehicle-based safety equipment outlined in this section.

3.1.4 Tier 3

The following additional technologies could be explored by agencies interested in piloting a technology, potentially with assistance and guidance from DCAS:

- Alcohol touch ignition interlock
- Cell phone physical or app-based lock box/ docking station ignition interlock

[27] If a fleet-wide cell phone-based navigation system is ultimately selected instead of a standalone GPS, it should ensure call-blocking mode during navigation and record any inappropriate driver use of the phone during vehicle operation.

- Connected vehicle, or vehicle-to-vehicle (V2V), communication technology [28]
- Seatbelt assurance ignition interlock systems
- Surround cameras
- Turning alarms

Several agencies expressed interest in these technologies, particularly in any that might help ensure adherence to seatbelt laws and the ban on cell phone use while driving. The technologies currently available could be too nascent for the SFTP to recommend at present, but DCAS could assist agencies in testing and evaluating any emerging safety equipment.

3.2 Process

Technologies and techniques for improving fleet safety evolve with time, so the SFTP's continued effectiveness in reducing crashes toward zero will likely depend on cross-agency communication, agency willingness to pilot new safety technologies, and a regular revision of the Plan itself. The SFTP could be a "living document" that builds on DCAS's existing processes and convening of the agency fleets. As an example, the process used by FORS could be a solid framework to build upon. The safety technologies that FORS requires and recommends are revised every two years by a working group. In the same way, the technologies required by the SFTP could be reviewed and revised annually by the DCAS Fleet Federation. The revision cycle can strategically coincide with the annual revision of the Vision Zero Action Plan. With each cycle, a Tier 3 technology could be upgraded to a Tier 2 technology and a Tier 2 technology to a Tier 1 technology, tracking the adoption and availability of technologies and strategies. Finally, Tier 1 technologies could be phased out of the Safe Fleet Transition Plan as newer technology advancements become common vehicle equipment and functionally replace them.

In support of annual SFTP revisions that draw on the expertise and interests of all fleet agencies, in addition to reviewing technology research, recommendations, and standards from other sources, it could be important to:

- Maintain open lines of communication with fleet directors (e.g., through annual interviews or surveys).
- Make continued and strategic use of Fleet Federation meetings to share information and experiences with new technologies.
- Deliver annual evidence-based updates on implemented technologies and techniques.
- Collect data and perform before-and-after evaluations for newly implemented technologies by specific vehicles and operations (e.g., could include crash data or operator feedback).
- Discuss and update agency expertise areas and interests in the SFTP technologies, regularly updating and making available for reference a table similar to Table 3 below.

[28] The U.S. Department of Transportation's (USDOT) National Highway Traffic Safety Administration (NHTSA) has issued a Notice of Proposed Rulemaking (NPRM) to mandate vehicle-to-vehicle (V2V) communication technology for new light vehicles in the United States: https://icsw.nhtsa.gov/safercar/v2v/. Further, the NYC DOT is leading a Connected Vehicle Pilot Deployment Program sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO): http://www.its.dot.gov/pilots/pilots_nycdot.htm.

Table 3: Sample table showing selected agency experience and interest, which could be expanded by DCAS to keep track of and enable connections among agencies.

Technology type	Agencies that have experience with this technology	Agencies that could benefit from learning more about this technology
Amber safety lights	DEP, DOC	NYC DOT
Backup alarms	NYC DOT – white noise FDNY – "smart" volume-adjusting	DOHMH, DOC, TLC, DPR
Backup cameras	NYC DOT, DPR	DEP
High vision truck cabs	DSNY	DEP
ADAS	NYPD, DOC	DSNY, TLC

Appendix: Driver Survey

Please complete this important survey about the course and fleet safety

DATE _____ **STUDENT NAME**_____

INSTRUCTOR_____ **LOCATION**_____

EMAIL _____

DRIVER EVALUATION

1. **Please rate the Vision Zero section of this presentation (1 to 10, 1=low, 10=high)** _____
2. **Do you operate City light duty vehicles, trucks, or both? (write Light, Trucks, or Both; feel free to also add detailed types)** _____
3. **Does your agency purchase the right type of vehicles and equipment for you to do your job? (1 to 10, 1=low, 10=high)?** _____
4. **Do you operate a vehicle that uses alternative fuels? YES/NO (Circle all that apply)**

   If yes, which: Full EV / Biodiesel / Solar / Hybrid / Electric / CNG (Circle all that apply)
5. **Please share your thoughts on the design and equipping of City vehicles as relates to safety, including suggestions.** _____ _____
6. **Which type of equipment do you consider the most important to improving safety:**
   a. **Backup cameras**
   b. **Additional mirrors**
   c. **Backup alarms**
   d. **Driver alert system**
   e. **Navigational system**
   f. **Automatic Braking**
   g. **Seatbelt Control Systems**
   h. **Heated Sideview Mirrors**
   i. **Pedestrian/Bicyclist Turn Warnings**
   j. **Amber Safety Lights**
   k. **Other:** _____ _____

7. **How would you rate the quality of fleet service in general at your agency (1 to 10, 1=low, 10=high) _____**

8. **Please share your thoughts on improving fleet services at your agency. Be specific.**
   _____
   _____

9. **How would you help make your fleet safer based on your experience?**
   _____
   _____

U.S. Department of Transportation

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