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Request for Expression of Interest (RFEI)

*For furnishing After Market Safety Devices
and Roadside Equipment for V2V and V2I
DSRC based safety applications for the*

New York City Connected Vehicle Pilot Deployment Project

June 21, 2016

Version 5

Responses due July 6, 2016

Demonstrations Week of July 11, 2016

NYC-CVPD-RFEI @transcore.com

Project: NYCDOT Connected Vehicle Pilot Deployment Program
Subject: ***Request for Expression of Interest*** (RFEI) for Furnishing Connected Vehicle field devices
Additional: This is an RFEI for supplying the in-vehicle *Aftermarket Safety Devices* (ASD) and the *Roadside Equipment* (RSE¹) including all applications pre-installed and ready for installation.

1 Introduction

This is a Request for Expression of Interest (RFEI) for furnishing Connected Vehicle (CV) technology to the City of New York. This technology primarily consists of Dedicated Short Range Communications (DSRC) based Aftermarket Safety Devices, Roadside Units and other infrastructure equipment, and the software applications executed by these devices. This document describes the project background, the purpose of this informational solicitation, the role of this solicitation in the procurement process, and describes specific information of interest. It then describes the anticipated schedule for the procurement.

2 Background

TransCore staff is providing services to New York City Department of Transportation (NYCDOT) for their contract with USDOT for the deployment of the connected vehicle project. New York City (NYC) is one of three Connected Vehicle (CV) pilot sites selected by USDOT to be initial “production” deployment sites of the CV technology. The other two sites are Wyoming DOT which is focused on interstate routes and commercial vehicles, and Tampa which will be deploying a number of different applications. The program is divided into three phases; the first is devoted to the project planning including a concept of operations, system requirements, safety plan, benefits evaluation plan, security management plan, and deployment plan. This phase (12 months) is nearing completion. The second phase (20 months) is anticipated to begin in September 2016, and will include the detailed design, software development, field equipment development and procurement, and integration including the installation of the in-vehicle devices, the roadside infrastructure, and the back office support systems. The third phase is an 18 month operating period during which the systems will collect data to evaluate the benefits of the deployment and document the lessons learned. The USDOT anticipates that the project’s ongoing benefits justify the sustainability of the operation and will encourage others to deploy CV technology, thus increasing the benefits to all.

The New York City deployment is primarily focused on safety applications (both Vehicle-to-Vehicle and Vehicle-to-Infrastructure) as tools to help the City reach its Vision Zero goals to eliminate traffic related deaths, reduce crash related injuries, and reduce damage to both the vehicles and infrastructure. As part of the pilot project, the City is planning to install the CV technology in approximately 10,000

¹ The term RSE is used in this document to include all equipment that must be ADDED to the existing traffic controller cabinets to support the CV applications proposed for the NYC Pilot Deployment. Thus, this includes DSRC radios, GPS, antennas, DSRC/CV application processing unit(s), power supply, and supplemental network devices

vehicles which frequent the streets of Manhattan and Brooklyn; this includes roughly 1,500 MTA buses,



500 UPS local delivery trucks, 500 NYCDOT vehicles, 500 Sanitation vehicles, and approximately 7,500 taxicabs. Note that these taxis represent approximately one-half of the yellow taxicabs that service Manhattan, are the only taxis that can pick up “hail fares” throughout the City including mid-town and lower Manhattan and at the major airports. This number of vehicles will provide an opportunity to experience a significant density of DSRC-based vehicle interactions. The City will also be installing approximately 380 RSEs in mid-town and lower Manhattan, at the vehicle “barns” (bus, taxi and fleet depots), along Flatbush Avenue in Brooklyn, and at other strategic locations

throughout the City. In addition, the City will be installing a number of RSU’s along portions of FDR drive to support applications such as curve speed warning and over dimension vehicle warnings (overheight and prohibited commercial vehicles).

The New York Deployment will include the following V2V safety applications on all vehicles:

- Vehicle Turning Right in Front of Bus Warning – intended to reduce the number of vehicle-bus crashes.
- Emergency Electronic Brake Light
- Lane Change Warning/Assist
- Forward Collision Warning
- Blind Spot Warning
- Intersection Movement Assist – to reduce crashes from cross traffic

The deployment will also include the following V2I/I2V safety applications:

- Red Light Violation Warning – to warn drivers when it appears that the vehicle will enter the intersection on red
- Over Dimension (height) and prohibited vehicle warnings to commercial vehicles along selected roadways
- Over Speed warnings when the vehicle is exceeding the speed limit for such locations as work zones, curves, and selected school zones
- Emergency Communications for such situations as emergency evacuation routes, detours and major situations needing immediate changes in the traffic pattern.

Because of the number of vehicles and roadside units involved, and the need to be able to update and adjust the operation of the various safety applications, the project has added a number of additional new applications including support for over-the-air (OTA)



software updates, real time RF monitoring of both the vehicles and the infrastructure, OTA changes to the operating parameters [of all of the applications] to be able to adjust thresholds and warnings, and traffic data collection to support the City's adaptive control system – Midtown-in-Motion. The City is also working with a number of pedestrian advocacy groups and will be deploying two pedestrian oriented applications; the first is to support the visually challenged by using the Signal Phase and Timing (SPaT message) information transmitted by the intersection and the geometric information (MAP message) about the intersection to assist the pedestrian in determining their orientation and the status of the pedestrian signals to assist them in crossing the street. At selected intersections, the City will also be installing traditional ITS pedestrian detection technology which will be able to determine if there is a potential conflict between an approaching CV equipped vehicle and the presence of a pedestrian in the crosswalk. Finally, the City's deployment will include a configurable data collection application that will be used to evaluate the benefits of the system and allow USDOT to perform additional evaluations of the overall system operation.

The City is confronting a number of challenges to the deployment of the CV technology in the dense urban environment. First, the ranges of the RSE infrastructure will overlap in all directions; the block spacing is approximately 70 meters for streets and as much as 200 meters for the avenues. Since the DSRC range is approximately 300 meters and far greater ranges have been observed in some previous projects, we expect that operational adjustments will be needed. In addition, where the density of vehicles for other projects has been very low, we are expecting that the percentage of instrumented vehicles is likely to approach 20% or more depending on the time-of-day and location since a large portion of the vehicles are taxicabs. All of the fleets which will be participating in this project service the



mid-town and lower section of Manhattan; hence one of the goals of the project is to foster frequent interactions amongst vehicles – all of which are to be equipped with the full complement of safety applications.

Second, NY City is known for its urban canyons which provide a challenging environment for GPS technology; as a result, additional techniques will need to be included in the positioning algorithms to provide the accuracy needed for many of the V2V and V2I safety applications. Continuous access to GPS positioning data is expected to be difficult in the urban canyons and therefore additional means of augmenting vehicle positioning are anticipated so that the safety applications can continue operating while the vehicle passes under bridges, elevated roadways, through tunnels, and navigate the typical Manhattan streetscapes and traffic environment.

Third, privacy is also a major consideration; although the vehicles involved are regulated fleet vehicles, the City will be implementing a number of measures to protect the privacy of the participants and to make sure that the data collected and used for the evaluation of the benefits and for maintenance support cannot be disaggregated and analyzed or



merged with other data (e.g. police accident records) to determine the exact actions and location history of any specific operator or vehicle. The system will make use of the Security Credential Management System (SCMS) being developed by USDOT and the data will be encrypted, normalized, and obfuscated as soon as the analysis of the benefits has been determined. All communications will contain security certificates that will allow the receiver to authenticate the origin of the information.

The New York connected vehicle deployment will only utilize DSRC (WAVE) technology (5.9 GHz) for all functions and applications listed above – including the security credentials distribution, data collection, and application uploading and adjustments. The system will be using 6 of the 7 DSRC channels allocated for CV use. All field devices including both the RSE and the in-vehicle unit ASD will contain 2 radios; one will be dedicated to monitoring or transmitting on channel 172 where it can “hear” the Basic Safety Message (BSM) from all vehicles within range of the radio communications; this is critical for the V2V applications. In addition, it will be able to receive the SPaT message and the MAP message and use this information to support the V2I safety applications. Channel 178 will be used as the control channel to inform approaching vehicles of available services Wave Service Announcement (WSA) and indicating which channel and protocol should be used for the service. The other channels (174, 176, 180, and 182) will be used to support the OTA software updates, application parameter management, and data collection from the in-vehicle event logs.

Finally, because of the size of the system and the number of vehicles and roadside locations, a number of maintenance support functions have been added to the system and hence must be added to both the ASD and the RSU. This will allow the City to monitor the operational reliability of all components, and track the range of all transmitters. This data will be used to assist the City in identifying where both preventative maintenance and corrective maintenance may be required.

The NYC project has also modified the performance data collection approach. Previous deployments have focused on research and analysis of the technology and attempted to collect virtually every message generated, transmitted, and received by all devices; this information was collected on removable media and periodically retrieved for the data analysis. Such an approach is not practical for the New York City (NYC) deployment project; hence, the NYC system limits the data collection to short periods of time before [configurable] and after [configurable] an “event” which might be a warning, alert, or some other triggering parameter within the vehicle. This allows us to evaluate the state of the vehicle before, during, and after the “trigger” and such data is collected whenever the vehicle passes an RSE advertising the event collection service; thus, the volume of data is manageable for both the RSE processing and the backhaul bandwidth to the TMC. The triggers will be configurable and will include BSM data, alarms and alerts, and parameters internal to the ASD.

The NYC project will be using the City’s private wireless network, NYCWiN, for all communications to/from the RSE as well as continuing to use this media for communications to the traffic controllers. The traffic controllers will have their firmware updated to support the CV applications; the previous procurement specification for the traffic controllers included sufficient processing power and available memory for these additional tasks; as soon as the NTCIP working group finalizes the 1202 standard with the CV data elements, we will be ready to update the controller firmware.

It is our intent that the RSE (V4+ as modified) and ASD (V3 – as modified) conform to the USDOT standards where they exist as closely as reasonably possible and that all messages conform (where applicable) to the latest versions of SCMS, SAE J2735, SAE 2945/x, IEEE 802.11p, IEEE 1609.x, NTCIP, ISO

19091, and related standards. While we recognize that some of these are still being developed, all of these standards are expected to be stable by the end of the 1Q2017 which is the planned start of the production units for this project.

Finally, while the above is a brief summary, the details of the NYCDOT pilot deployment are available on the USDOT web site – or are available on request from the NYCDOT project team.

This RFEI is being issued by TransCore with review and support by NYCDOT. All responders are to provide your proposal and documentation to TransCore with a copy to the NYCDOT's project manager, Mohamad Talas (Mtalas@dot.nyc.gov).

3 Purpose of RFEI

This Request for Expressions of Interest (“RFEI”) is issued as a briefing document to stimulate and assess interest in providing equipment and services to New York City Department of Transportation (“NYCDOT” or the “agency” or the “City”) for the CV Pilot Deployment and to solicit useful information from interested parties for the supply of elements of this system. The responses to the RFEI will assist NYCDOT in identifying issues, features, and functions or specific requirements surrounding the deployment of the CV devices and applications (ASD and RSE).

This RFEI seeks vendor expression of interest in the delivery of ASDs to be mounted in a number of different vehicle types and RSEs that will be mounted into existing traffic controller cabinets to support the applications listed above or at strategic locations without traffic controllers. Please note that a separate RFEI has been issued by NYCDOT for the 2 pedestrian applications; however, if the responder offers the pedestrian applications indicated above, feel free to demonstrate same and provide a response for those applications as well.

- Goal 1 of the RFEI is to advertise the opportunity and establish an incentive that motivates aggressive pursuit of commercial development and delivery of the CV devices and applications. This project will be the largest connected vehicle project attempted by anyone to date.
- Goal 2 of this RFEI is to verify the deployment state of the equipment and applications identified above.
- Goal 3 of this RFEI is to identify vendor commitment to interoperability.
- Goal 4 of this RFEI is to seek vendor insight into some of the challenges expected with the planned deployment in NYC. This includes such issues as location accuracy, DSRC message and channel saturation, and DSRC channel usage.
- Goal 5 of this RFEI is for NYCDOT to review the state of each vendor's commitment to and completion of equipment and applications which are commonly used for the CV safety applications.
- Goal 6 of this RFEI is to identify the vendor's proposed approaches to equipment certification such that the project can connect to and use the security credentials provided by the Security Credential Management System (SCMS) being developed by USDOT.

- Goal 7 of this RFEI is to gain a better understanding of the installation requirements, packaging options, the complexity of the application modifications, and help identify tuning parameters for the various applications.
- Goal 8 of this RFEI is to establish realistic project schedules for the procurement, installation, and testing of the ASDs and RSEs.

These are crucial aspects of the City's plans for the detailed design and procurement of the various CV devices for the pilot deployment project.

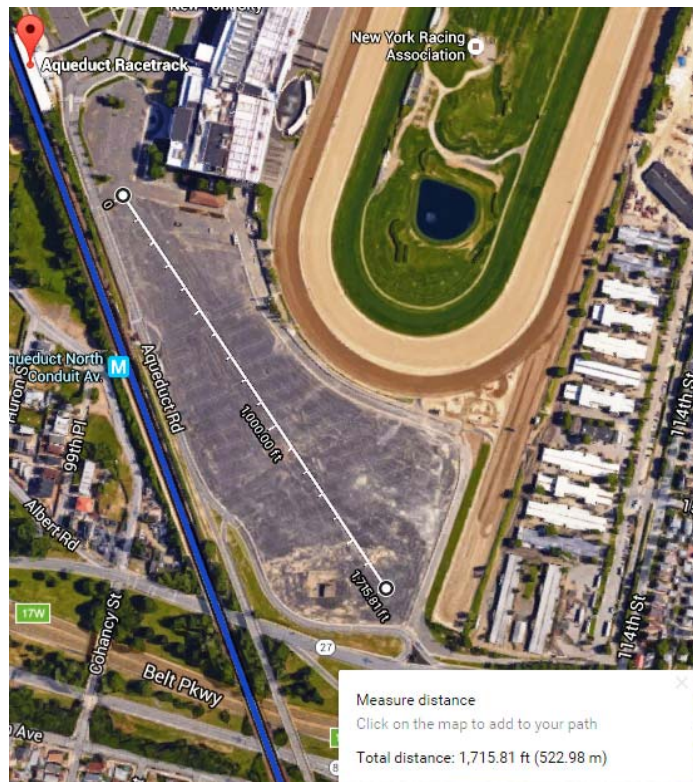
Note that vendors participating in this RFEI will be considered for the final bidding process (2017) for the 10,000+ ASDs and 300+ RSEs when those bid specifications are released. **A response to this RFEI is a requirement for participation in any future solicitation** that NYCDOT or TransCore ITS may undertake specifically for the supply of CV devices, services, or systems for this pilot project.

4 Vendor Demonstrations

All responders will be offered the opportunity to demonstrate their product(s); we also encourage the vendors to demonstrate the effectiveness of the products or systems currently both under development or available for purchase. NYCDOT will make available a "test location" [currently expected to be the Aqueduct Racetrack parking lot – see picture] which may be used by the responders to demonstrate their current applications. All vendors are required to demonstrate several of their V2V and V2I applications as described in the concept of operations for the NYC project. Responders are encouraged to visit the USDOT CV web site for the pilot deployments for documentation about the NYC project. NYCDOT will also make available the existing *Concept of Operations* (ConOps) document, however, this document is considered a "living document" and various elements are subject to change before the final bid documents are published.

Note that the test location does not offer power or intersection hardware of any sort. If the vendor requires any equipment to demonstrate their application such as an RSE broadcasting SPaT, MAP, and RTCM for location correction, it must be provided by the vendor. Each vendor will be provided 4 hours on the test facility – including setup, demonstration, and tear down.

There will be 2 demonstrations – one for the safety application and a second will demonstrate the location determination mechanism along a specific urban driving route which will include urban canyons



in lower Manhattan and midtown as well as excursions onto FDR drive and tunnels etc. to show how the applications function when confronted with these situations.

5 Other Information

The following information is provided to assist the responders in understanding the environment for the demonstration project. NYCDOT does not expect to see demonstrations of the all of the completed applications described in the ConOps. However, the bid specifications are being structured around the concept of purchasing “turn-key” solutions where the application firmware is embedded in the device (ASD or RSE) to support all of the applications listed in the ConOps and the final bid specifications. The bidder (and different bidders may be selected for different elements) will be responsible for providing the ASD complete with all firmware, a Hardware Security Module with enrollment certificates, and installation kits.

5.1 RSE

NYCDOT utilizes traffic controllers from Peek Traffic which have been supplied over the last 10 years and are currently installed at all intersections that will be used for the CV project. These controllers include additional Ethernet ports that will be used for the connection to the RSE. These controllers do not currently support the export of CV data – hence, any demonstration using/needng SPaT and MAP (RTCM etc.) must be provided by the responder for their demonstration. Software modifications to the traffic controllers will be made during phase 2 of the project to support the data export of SPaT, MAP, and the pedestrian application support.

5.2 ASD

The ASD will rely only on DSRC communications and the Driver Interface will be all audio using words or tones to alert/warn the driver. The ASD is expected to connect to the CAN or J bus of the vehicle as outlined in the ConOps.

Note that selected applications have been modified to provide warnings based on the regulatory or advisory speed and are not required to deal with the vehicle kinematics.

The nature of the additions and modifications to the ASD and RSE are largely due to the need for benefits analysis and operations/maintenance support.

Since some of the vendors may have developed other applications, responders are requested to highlight such additions if they feel they may be relevant to the NYC CV deployment project.

5.3 Certification

For the production system, NYCDOT expects that the vendor will conduct and verify all certifications necessary to show that their device fully complies with the requirements of the procurement specifications. How this is to be performed has not been determined, therefore, the vendors are encouraged to address their intended certification process for security, message handling, conformance to SAE 2735, 2945/x, IEEE 1609.x, IEEE 802.11p, NTCIP, automotive environmental specifications or NEMA traffic controller specifications, and FCC type acceptance.

For the RFEI demonstration, only the FCC certification is required.

5.4 Security

All messages shall support authentication (verification) using certificates provided by the SCMS. All certificates will only have a 1 week life, and each device will only be provided with one week's supply of certificates.

All data collected in the vehicle is required to be encrypted when stored (logged) and will pass in encrypted format to the TMC where it will be decrypted and analyzed (in real time) and then normalized, obfuscated, and aggregated to develop the benefits analysis and stored for future use or exported to the Research Data Exchange (RDE) or the independent evaluator.

Note that there are a large number of security requirements including general conformance to FIPS 140 2 Level 2 including secure Boot, verification of all firmware, and all communications.

The vendor shall discuss how these security requirements will be addressed in their units/devices including the impact on their hardware design (processing time) and software structures, but security is not a requirement for the demonstrations.

5.5 Communications

DSRC channel usage planned is shown below. This is preliminary and consistent with the recent SAE discussions of channel usage and power limitations. The RSE will broadcast the Wave Service Announcement (WSA) that will indicate any available firmware updates, application parameter updates, IP address of the server where the updates may be retrieved, the IP address of the TMC server where the performance data is to be stored, and the channel (for the subject RSE) to be used for the information transfer – which includes access to the SCMS.

This project plans to use 6 of the 7 channels, and all radios shall be able to operate on 2 channels:

Channel	Intended uses
172	SPaT, MAP, RTCM, BSM
174	OTA updates and application parameter changes, SCMS
176	OTA updates and application parameter changes, SCMS
178	WSA for the control channel
180	log file uploads to the TMC
182	log file uploads to the TMC
Note that the PSM, SSM, SRM, TIM have not been assigned	

The existing NYCWiN wireless network will be used to connect the RSE to the TMC where the back office processing will take place. This network only supports IPv4. It will be the responsibility of the vendor to work with NYCDOT and its suppliers and integrators to develop a solution for tunneling the IPv6 communications over this network as no changes will be made to the NYCWiN network devices or operation. While this is not a requirement for the demonstrations, the vendor shall indicate their approach to supporting IPv6.

5.6 Standards

We recognize that some of the standards are currently undergoing some modifications. The demonstration hardware and applications need not conform to the current versions, but must conform

to an older version where appropriate. This project will not accept any product which declares that its protocol is proprietary and subject to a license agreement. All protocols, messages, and MIBs shall be open to the public for use by any supplier in perpetuity without license fees.

5.7 Location accuracy

One of the demonstration courses [driving routes] is specifically intended to evaluate the accuracy of the ASD's location tracking mechanism. For this test, the device (ASD) is required to log its position ("bread crumbs") at least 10 times each second such that we can evaluate the accuracy of the location algorithms and hardware used by the device.

The expectation is that the location accuracy is sufficient to operate all of the V2I and V2V applications – and we plan to use the J2945/1 location accuracy requirement – but require this in the urban canyon.

6 Submission Requirements

The following sections describe the information to be submitted for this RFEI.

6.1 Content

The RFEI response must be provided in PDF format not exceeding 50 pages.

The RFEI response shall contain:

- a) Contact information, including the legal name of the respondent, business address, name of contact, telephone number and email address.
- b) A summary of respondent's background and experiences related to the development and deployment of DSRC CV products (not more than 5 pages).
- c) Responses to the challenges or issues listed in Section 5 and any other information that would be informative and responsive to this RFEI.
- d) A statement regarding the maturity of the applications listed [above] that will be used in NYC. Where they have been deployed (if any) and experience with their reliability.
- e) Note that USDOT requires that software developed with the funding of this project be placed in the public domain through the open source repository being developed for USDOT. In their responses, vendors shall indicate which software is considered prior intellectual property, and what is being developed with the funding of this project.
- f) Lead time after bid, for developing and furnishing a production sample of 100 ASDs and 10 RSEs. that will be used for preliminary test trials.
- g) Lead time after bid, for developing and furnishing production quantities of the ASDs and RSEs for large scale installation and testing after the test trials are completed.

6.2 Submission Details

Any inquiries related to this RFEI should be directed by e-mail, with the subject line “NYC CV RFEI for ASD and RSE” to the following email addresses:

mtalas@dot.nyc.gov, NYC-CVPD-RFEI@transcore.com

The deadline for submission of written requests for clarification is June 27, 2016 at 2:00 p.m. EST. TransCore will circulate questions and answers to respondents who provide e-mail addresses no later than July 1, 2016.

RFEI responses are due by July 6, 2016 at 2:00 p.m. EST. PDF format of the response shall be submitted via email to mtalas@dot.nyc.gov and NYC-CVPD-RFEI@transcore.com. If the document is larger than 10 MB, then the respondent shall separate the document at convenient boundaries such that it can be reassembled after receipt. All emails, with or without attachment(s), shall not exceed 10 MB.

Vendors will be asked to provide demonstrations of their CV applications and devices on the week of July 11. In your response please indicate at least 3 time slots when you would be prepared to conduct a demonstration. Note that each respondent will be allotted 2 demonstration slots: one for the safety applications at a location on Long Island and a second is a driving course in Manhattan (TBD).

Time allocation for demonstration:

	7/11	7/12	7/13	7/14	7/15
AM					
PM					

7 Additional Information

Note that this RFEI is offered by TransCore on behalf of NYCDOT. This RFEI is not intended as a formal offering for the award of a contract. **A response to this RFEI is a requirement for participation in any future solicitation** that NYCDOT or TransCore ITS may undertake specifically for the supply of CV devices, services, or systems for this pilot project.

Neither NYCDOT nor TransCore intend to grant or issue any agreements on the basis of this RFEI.

NYCDOT, the City and their officials, officers, agents and employees make no representation or warranty and assume no responsibility for the accuracy of the information set forth in this RFEI.

TransCore, NYCDOT, and the City shall not be liable for any costs incurred by any Respondent in the preparation, submittal, presentation, demonstration, clarification or revision of its submission.

TransCore, NYCDOT, and the City shall not be obligated to pay and shall not pay any costs in connection with the preparation of such submissions.

TransCore, at its sole discretion reserves, without limitation, the right to:

- Withdraw the RFEI at any time;
- To discuss various approaches with one or more Respondents (including parties not responding to the RFEI);
- Use the ideas and/or submissions in any manner deemed to be in the best interests of NYCDOT and the City, including but not limited to soliciting competitive submissions relating to such ideas or proposals and/or undertake the prescribed work in a manner other than that which is set forth herein; and
- Change any terms of the RFEI.

All submissions shall become the property of NYCDOT and the City and shall not be returned. Respondents acknowledge and understand that none of the information contained in the submissions shall be deemed confidential. Furthermore, information in the submissions will likely be shared with other governmental entities. Therefore, Respondents should not submit any information deemed to be proprietary information.

TransCore will be sharing all responses with NYCDOT. NYCDOT is subject to the New York State Freedom of Information Law, which governs the process for the public disclosure of certain records maintained by NYCDOT. (See: Public Officers Law, Sections 87 and 89). Individuals or firms that submit materials to NYCDOT may request that NYCDOT except all or part of such materials from public disclosure, on the grounds that the materials contains trade secrets, proprietary information, or that the information, if disclosed, would cause substantial injury to the competitive position of the individual or firm submitting the information. Such exception may extend to information contained in the request itself, if public disclosure would defeat the purpose for which the exception is sought. The request for such an exception must be in writing and state, in detail, the specific reasons for the requested exception. It must also specify the materials or portions thereof for which the exception is requested. If NYCDOT (working with TransCore) grants the request for exception from disclosure, NYCDOT shall keep such materials or portions thereof in secure facilities.