



**STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION**

**REQUEST FOR INFORMATION
FOR**

Replacement of the TDOT CORS Network with Enterprise Subscription Service

**RFI # 40100-50914
July 13, 2022**

1. STATEMENT OF PURPOSE:

The State of Tennessee Department of Transportation issues this Request for Information (“RFI”) for the purpose of gathering information concerning an enterprise subscription service model for replacement equipment, administrative software, service and maintenance for all of the forty-three (43) GNSS reference stations across Tennessee (hereinafter “Sites” or “Stations”) which currently make up the TDOT CORS Network (hereinafter “CORS” or the “Network”). TDOT wishes to replace all of the existing TDOT GNSS reference Stations in the TDOT CORS Network with an enterprise subscription service (the “Subscription”) to improve the network redundancy and accuracy of network solutions. TDOT may also expand the CORS Network to as many as two hundred (200) stations.

We sincerely appreciate your input and participation in the process.

2. BACKGROUND:

TDOT has owned and operated the TDOT Continually Operated Reference Stations (“CORS”) Network since its inception in 2008. The existing CORS Network (hereinafter “CORS” or the “Network”) is comprised of forty-three (43) individual GNSS reference stations (hereinafter “Sites” or “Stations”), each consisting of a GPS antenna mounted outside a State agency building or other TDOT-approved facility such as, for example, the Tennessee College of Applied Technologies (TCAT) or various town hall buildings across Tennessee.

The GPS antennae are connected to GPS receivers inside each facility with either R-400 or R-600 coaxial cable, and the receivers are connected to the TDOT CORS Network with a network (ethernet) cable. Where applicable, the network connection is provided by the facility ISP, which is maintained by facility staff. Power for these receivers is provided by the facility.

Data collected by the receivers is sent to TDOT over a network connection and stored on TDOT servers. This data is available to Users in real-time through the TDOT server. The Station ID is broadcasted to Users from a server running server based GNSS software. Users access this server through the server IP address from survey equipment. Data generated by the CORS Network is also shared with National Oceanic and Atmospheric Administration (NOAA) and posted on the National Geodetic Survey (NGS) website for download.

TDOT provides the CORS Network for TDOT surveyors, authorized persons or entities under contract with the State who pay to access the data, for agricultural Users to guide tractors and agricultural equipment, and academic or university Users for research purposes. Additional information regarding the TDOT CORS Network can be found at the following State website:

<https://www.tn.gov/tdot/roadway-design/survey-standards/gnss-reference-network.html>

3. COMMUNICATIONS:

3.1. Please submit your response to this RFI to:

Gregg Bennett, Transportation Program Supervisor
Tennessee Department of Transportation
505 Deaderick St., Nashville, TN 37243
Email: TDOT.RFP@TN.gov

3.2. Please feel free to contact the Department of Transportation with any questions regarding this RFI. The main point of contact will be:

Gregg Bennett, Transportation Program Supervisor
Tennessee Department of Transportation
505 Deaderick St., Nashville, TN 37243
Email: TDOT.RFP@TN.gov

3.3. Please reference RFI # 40100-50914 with all communications to this RFI.

4. RFI SCHEDULE OF EVENTS:

EVENT		TIME (Central Time Zone)	DATE (all dates are State business days)
1.	RFI Issued		July 13, 2022
2.	RFI Response Deadline		August 15, 2022

5. GENERAL INFORMATION:

5.1. Please note that responding to this RFI is not a prerequisite for responding to any future solicitations related to this project and a response to this RFI will not create any contract rights. Responses to this RFI will become property of the State.

5.2. The information gathered during this RFI is part of an ongoing procurement. In order to prevent an unfair advantage among potential respondents, the RFI responses will not be available until after the completion of evaluation of any responses, proposals, or bids resulting from a Request for Qualifications, Request for Proposals, Invitation to Bid or other

procurement method. In the event that the state chooses not to go further in the procurement process and responses are never evaluated, the responses to the procurement including the responses to the RFI, will be considered confidential by the State.

5.3. The State will not pay for any costs associated with responding to this RFI.

6. INFORMATIONAL FORMS:

The State is requesting the following information from all interested parties. Please fill out the following forms. Items to consider including in your response:

- Key performance indicators
- Potential problems/risks with the subscription model
- Estimated time frames for implementation/installation
- Interest in responding to a future solicitation
- Pricing arrangements & options
- Any other important considerations
- Helpful comments

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TECHNICAL INFORMATIONAL FORM

1. RESPONDENT LEGAL ENTITY NAME:

2. RESPONDENT CONTACT PERSON:

Name, Title:

Address:

Phone Number:

Email:

3. Specifically, describe installations that you host and manage for other agencies that have a minimum of fifty (50) receivers and antennae where you host and support the network:

4. List websites or other links that we can use to view the website of these other networks:

5. **Requirements.** Please provide details on how the enterprise subscription service would fulfill each of the requirements detailed in Sections A-C below. The Subscription service should satisfy the minimum requirements for the Hardware, Software, and Service/Maintenance components as listed in each Section.

A. **Hardware as a Service (“HaaS”).**

6. **Receivers and Antennae.** TDOT is interested in replacing GNSS receivers and antennae, the network operating software required to operate and monitor the receivers (including all upgrades, firmware updates, etc.), peripheral accessories and equipment required to operate the receivers, plus the mounting hardware and brackets required for installation. Please describe in detail the new Contractor-owned, maintained, and serviced equipment which will replace the current CORS equipment as it relates to the minimum requirements described in the following Sections of this RFI.

6.1 **GNSS Technology and Tracking.** TDOT requires receivers and antennae which can track all signals on all available frequencies from the following GNSS constellations

- a. GPS (L1, L2, L2C, L5)
- b. GLONASS (L1, L2, L3)
- c. GALILEO (L1, E5A, E5B, AltBOC, E6)
- d. BEIDOU (B1, B2, B3)
- e. QZSS (L1, L2, L5, L6)
- f. IRNSS (NAVIC: L5)

6.2 TDOT requires receivers and antennae which can track all signals on all available frequencies from the following GNSS SBAS constellations.

- a. EGNOS (L1)
- b. MSAS (L1)
- c. WAAS (L1)

6.3 Can the receivers and antennae provided by the Subscription simultaneously track all available signals on all GNSS constellations listed in this section?

6.4 Do the receivers have enough physical and independent channels to accommodate all signals (Dynamic channel allocation is not an acceptable substitute for physical channels.)?

6.5 Describe how the GNSS receivers and antennae provided by the Subscription acquire and track the above-named signals:
6.6 Can the Subscription receivers enable and disable any pseudo range and/or phase smoothing?
6.7 Can the receivers enable or disable any receiver's clock correction system?
6.8 Do the receivers allow unfiltered and unsmoothed pseudo range, signal-to-noise, doppler, and carrier phase true observables from all signals individually (It is not acceptable to artificially generate observables from the primary signals for the other signals)?
6.9 Please describe how the receivers detect and reject degraded signals to improve position quality:
6.10 In the event the United States of America Department of Defense disables the GPS anti-spoofing please describe tracking capabilities of the Subscription receivers:
7. Receiver Input and Output Formats. Please describe what real-time correction formats the receivers support for input and output (Require, at a minimum, RTCM 2.x versions and RTCM 3.x versions, as well as CMR and CMR+):
7.1 Please describe the real-time formats the receivers support for observables, including any proprietary format (Require RTCM 3.x, BINEX at a minimum):
7.2 Can the receivers support the input and output of position and status information with NMEA-0183 protocol?
8. Measurement and Position Performance. Do the receivers support differential, real-time kinematic from single base and from networked RTK positions, and static post-processing positioning using industry standard formats? Please provide the performance capabilities of your equipment for each of the connection types:
8.1 Please describe the static post-processing positioning performance of the Subscription receivers (Require minimum performance of three (3.0) mm + one tenth (0.1) ppm RMS in horizontal and three (3.0) mm + one half (0.5) ppm RMS in vertical):
8.2 Please describe the real-time kinematic positioning and performance of the receivers (Require at least single baseline of less than thirty (30) km, with a performance of eight (8) mm + one (1) ppm RMS in horizontal and fifteen (15) mm + one (1) ppm RMS in vertical):
8.3 Please describe real-time kinematic positioning with networked RTK solution (Require, at a minimum, performance of eight (8) mm + one half (0.5) ppm RMS in horizontal and fifteen (15) mm + one half (0.5) ppm RMS in vertical):

9. Physical and Environmental Requirements.

9.1 Describe how the receiver interface allows configuration of the receiver, including network configuration parameters, antenna model, antenna height, position and Station name:

9.2 Receivers must meet at least the following environmental specifications:

- a. Operating temperature: -40°C - +65°C;
- b. Humidity: 100% condensing;
- c. Fully sealed with IP68 certification;
- d. Shock: 1 meter drop on hard surface

Please describe the environmental specifications of the receivers provided with the Subscription:

10. Power Specifications and Management.

10.1 The receiver must offer a minimum of two power inputs supporting both AC and DC operation, with an input power range of 9.5V to 28V DC. Please describe the power specifications of the Subscription receivers:

10.2 The receiver must automatically restart after loss of power and must operate with the same configuration it had when powered down or when the loss of power event happened, including all real-time data output and all logging sessions. Please describe the power management capabilities of the Subscription receivers:

11. Data Logging. The receivers must be compatible with removable external memory. Describe how much logging space the receivers support:

11.1 Describe the receivers capacity to connect to additional external storage:

11.2 Describe the receivers true logging rates from one hundred (100) Hz to sixty (60) seconds (Data generation with artificial methods is not a valid alternative):

11.3 Can the receivers support independent and concurrent logging sessions?

11.4 What file types can the receivers produce (RINEX, BINEX, etc.)?

11.5 Are the receivers capable of pushing logged and converted data files to separate servers (locations to be agreed upon with TDOT)?

11.6 Can the Data be protected from being overwritten in the case of external events input?

12. Communication Interfaces. The receiver shall include all necessary communication ports to connect by at least the following methods:

- a. TCP/IP via direct ethernet connection
- b. Direct Serial (RS 232)
- c. Dial Up Modem using wireless modem

12.1 Please describe the communications ports of the Subscription receivers:

<p>13. <u>Security Requirements.</u> The Subscription receivers must have, at a minimum, a secure network connection (secure means via an encrypted, authenticated session, or similar). Receivers must have the ability to be configured remotely using a secure connection.</p> <p>13.1 Please describe the security features for network connections and receivers:</p>
<p>14. <u>System Features.</u></p> <p>14.1 <u>Configuration.</u> TDOT requires receivers which have the ability of being configured either remotely through the Network software (or web site interface), or on Site via direct connection to a laptop or receiver display and keypad. Please describe the Subscription receiver configuration options as they relate to this requirement:</p>
<p>14.2 <u>Configuration Alerts.</u> TDOT requires receiver alert configuration to automatically inform of any changes in the position, data logging, configuration, tracking, power, communications, and system access events. Please describe the capacity to configure alerts in the Subscription receivers:</p>
<p>14.3 TDOT requires receivers with the ability to save the configuration of the receiver in a downloadable file to and upload it to other receivers to reconfigure them remotely. Please describe how the Subscription receiver will accomplish this:</p>
<p>15. <u>Peripheral Equipment.</u> The receivers must be accessible by a Contractor-provided keyboard and display at each Site, allow connection to a laptop, and allow a web connection for configuration. Please describe the peripheral equipment required to operate the receivers (including, but not limited to) keyboard, display, computer mouse, etc. and the type of peripheral equipment the Subscription will provide (brand/model):</p>
<p>16. <u>Antennae.</u> Acceptable mount types are described in Appendix A. Please describe how the Subscription will provide for new antennae (including installation, mounting, connections, testing, determination of choke ring antenna and radome or conventional antenna, etc.):</p>
<p>17. <u>Cabling & Connectors.</u> Please describe the types of connectors and cabling provided with the Subscription (TDOT only requires replacement where current cables or connector equipment is not serviceable):</p>
<p>18. <u>Capacity to Expand.</u> Does your organization have the capacity to install new equipment and provide service and maintenance for up to two hundred (200) Stations across Tennessee if the State elects to expand the TDOT CORS Network?</p>
<p>19. <u>Incremental Pricing for Expansion.</u> Describe if incremental pricing for expanding the stations is available and how that might be accomplished?</p>
<p>20. <u>Cellular Network Connectivity.</u> Please describe how your firm will accomplish cellular connectivity for the CORS network and describe any backup connection the Subscription will provide:</p>
<p>20.1 Describe the capacity of the receiver(s) and antennae to operate solely on a cellular network:</p>

<p>B. CORS Network Software as a Service (“SaaS”). TDOT is interested in a single enterprise license Subscription which provides both the hardware named above, as well as a fully functional and integrated Contractor-hosted SaaS application to operate and administer the TDOT CORS Network on a cloud-based server (the “Software”). The Software must allow TDOT authorized Users and external Subscribers to access Data captured by the TDOT CORS Network stations and shall become known as the TDOT Continuously Operated Reference Station Network Software (hereinafter “TN-CORSNet”). Please describe the Subscription Software as it relates to the requirements described in the following sections.</p>
<p>21. Administration. Please describe how the Software will allow TDOT to operate and administer the network, allocate and provision all Users and Subscriber licenses for TN-CORSNet:</p>
<p>21.1 TDOT requires TN-CORSNet Software to provide functionality through a web user interface which provides information, reporting and communication through that web interface. Please describe the functionality of the web user interface the Subscription Software will provide in detail:</p>
<p>21.2 Can you provide TN-CORSNet software which is compliant with section 508 ADA standards for web applications?</p>
<p>21.3 Will the Software have the capacity for TDOT to connect to other non-TDOT Stations, such as those from surrounding states?</p>
<p>21.4 In addition to the forty-three (43) Stations TDOC currently operates, does the Software have the ability to expand, connect to, and manage as many as 200 GNSS reference stations?</p>
<p>21.5 Please describe incremental pricing options for adding Stations to the Software:</p>
<p>C. Service and Maintenance. TDOT requires the Contractor to service and maintain the TN-CORSNet Software and all CORS Network equipment located at each CORS Site in good working order and performing in accordance with its manufacturer specifications and manuals including, but not limited to, receivers (and all software, firmware, and peripheral equipment required to operate the receivers), antennae, connectors and cables, as well as mounting hardware and brackets.</p> <ol style="list-style-type: none"> a. All decisions regarding Network operation shall be made by TDOT. b. Contractor shall perform all manufacturer-recommended Network hardware, firmware, and software changes/updates for all equipment. c. Contractor must obtain prior written or emailed approval from authorized TDOT staff to perform any software updates, firmware updates, coordinate changes, configuration changes, etc., to the Network hardware or Network software. d. Contractor shall keep each CORS Site in working order and performing in accordance with equipment manufacturer specifications and manuals twenty-four (24) hours per day, seven (7) days per week, three hundred sixty-five (365) days per year except for scheduled service/maintenance. e. No CORS Site shall be down for scheduled service/maintenance for more than forty-eight (48) hours. <p>22. Can the Subscription provide the above-named minimum service and maintenance requirements?</p>
<p>23. Does your organization have the capacity to provide service and maintenance for the forty-three (43) existing CORS Stations as part of the Subscription?</p>

24. Does your organization have the capacity to expand and provide service for up to two hundred (200) CORS Stations with the Subscription if TDOT elects to expand the CORS Network?

25. Please describe what the Subscription would offer as it relates to service and maintenance of all aspects of the Network:

COST INFORMATIONAL FORM

1. Please describe what pricing units you would utilize for the services described above (e.g., per hour, monthly or annual cost, etc.):

2. Please describe the typical price range for similar subscriptions you currently provide:

ADDITIONAL CONSIDERATIONS

1. Please provide input on alternative approaches or additional things to consider that might benefit the State:

APPENDIX A

Photographs of Acceptable Mount Types

Mount Style 1 – Building Mount (Nearby Power)



Mount Style 2 – Stand Alone Tower Mount (Nearby Power)



Mount Style 3 – Stand Alone Tower Mount (Tower, Remote Site, Solar Power required, Hardware Cabinet) Contractor to propose a solution that can power and communicate in a remote location. Images of solar panels and cabinets are shown as examples.



Mount Style 4 – Stand Alone UNAVCO Mount (UNAVCO Mount, Remote Site, Solar Power required, Hardware Cabinet) (Contractor to propose their solution that can power and communicate in a remote location. Images of solar panels and cabinets are shown as examples.)

