



EXHIBIT I : SCOPE OF SERVICES
LIDAR ACQUISITION / PROCESSING

SCOPE OF SERVICES

The work covered by this Agreement shall include furnishing equipment, materials, professional, technical, and personnel resources necessary to perform vehicle-based field data collection and photograph all of MoDOT's highway system guardrail end terminals. All work must be completed before 12-31-2023. The CONSULTANT will store the collected data (i.e., point clouds and roadway images) and use an automated process to determine the location of all Trinity ET-Plus end terminals on the MoDOT highway system that are constructed with 4-inch guide/feeder channels (ETPLUS4) and perform damage assessments of the ETPLUS4 end terminals.

ETPLUS4 means the ET-Plus guardrail end terminal with 4-inch wide guide channels manufactured and sold by Trinity Highway Products, LLC. The term "feeder chutes" is synonymous with the term "guide channels." The ETPLUS4 designation used in the document refers only to the ET-Plus guardrail end terminals manufactured with 4-inch guide channels and not those manufactured with 5-inch guide channels (ETPLUS5). The primary purpose of this agreement is to locate all ETPLUS4 end terminals and perform damage assessments as part of a replacement program. The location of all MoDOT highway system guardrail end terminals will be determined as part of the work but ETPLUS4 and ETPLUS5 will be identified. Only ETPLUS4 end terminals require a damage assessment.

Identification of ETPLUS4 will be performed on all miles of MoDOT's highway system roads. The project length includes a single collection of all end terminals as well as data storage, including an additional year after completion of the project. Further, the COMMISSION has ownership of all data collected and/or extracted as part of this contract. The CONSULTANT will track what routes have been collected and completed and provide this information to MoDOT at scheduled updates in a manner agreed to by both parties.



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MoDOT has approximately 38,000 centerline miles on its highway system, including interstate, other state routes, ramps, and auxiliary roads.

I. PROJECT

The project consists of the following tasks.

Collection: The CONSULTANT will collect mobile-terrestrial LiDAR point clouds and digital images at all end terminal locations during the collection phase. These data sets are retained by the CONSULTANT.

Data Storage: The CONSULTANT must retain all the data collected for a period of one calendar year starting from the date of final acceptance. All data must be made available to the COMMISSION.

Processing: Automated processing of LiDAR data is performed by the CONSULTANT to identify ETPLUS4 and ETPLUS5 end terminals. Damage assessments are performed on ETPLUS4 end terminals and deliverable products are produced.

II. PROJECT LOCATION AND LIMITS

The project location includes all routes in the MoDOT highway system including exit ramps, and auxiliary roads. The location of these routes are in files furnished by the COMMISSION. Refer to the sections below for an overview of the electronic information provided.



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TABLE 1
APPROXIMATE PROJECT COLLECTION MILES BY COUNTY

County	Miles
ADAIR	284
ANDREW	294
ATCHISON	293
AUDRAIN	331
BARRY	345
BARTON	308
BATES	426
BENTON	348
BOLLINGER	281
BOONE	473
BUCHANAN	367
BUTLER	391
CALDWELL	237
CALLAWAY	535
CAMDEN	290
CAPE GIRARDEAU	375
CARROLL	297
CARTER	230
CASS	428
CEDAR	231
CHARITON	320
CHRISTIAN	290
CLARK	260
CLAY	442
CLINTON	252
COLE	284
COOPER	329
CRAWFORD	361
DADE	233
DALLAS	279
DAVISS	337
DEKALB	234
DENT	284



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DOUGLAS	362
DUNKLIN	296
FRANKLIN	573
GASCONADE	249
GENTRY	241
GREENE	643
GRUNDY	200
HARRISON	424
HENRY	351
HICKORY	193
HOLT	276
HOWARD	243
HOWELL	458
IRON	203
JACKSON	670
JASPER	472
JEFFERSON	483
JOHNSON	430
KNOX	234
LACLEDE	448
LAFAYETTE	440
LAWRENCE	378
LEWIS	278
LINCOLN	352
LINN	325
LIVINGSTON	231
MACON	432
MADISON	221
MARIES	225
MARION	300
MCDONALD	316
MERCER	225
MILLER	307
MISSISSIPPI	271
MONITEAU	211
MONROE	307
MONTGOMERY	312
MORGAN	276



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NEW MADRID	424
NEWTON	377
NODAWAY	419
OREGON	282
OSAGE	282
OZARK	296
PEMISCOT	375
PERRY	269
PETTIS	379
PHELPS	392
PIKE	381
PLATTE	375
POLK	378
PULASKI	285
PUTNAM	254
RALLS	278
RANDOLPH	278
RAY	287
REYNOLDS	253
RIPLEY	231
SALINE	420
SCHUYLER	172
SCOTLAND	194
SCOTT	294
SHANNON	300
SHELBY	262
ST. CHARLES	492
ST. CLAIR	342
ST. FRANCOIS	254
ST. LOUIS	816
ST. LOUIS CITY	119
STE. GENEVIEVE	253
STODDARD	451
STONE	249
SULLIVAN	337
TANEY	322
TEXAS	527



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VERNON	407
WARREN	250
WASHINGTON	281
WAYNE	340
WEBSTER	376
WORTH	139
WRIGHT	405
Total	38,024

III. SERVICES AND DATA PROVIDED BY THE COMMISSION

- A. Route locations shall be provided in ESRI geodatabase format.
- B. Access to the MoDOT Real Time Network (RTN) and 1 second data for post processing.

IV. SCOPE OF WORK

A. General Requirements

1. No work shall be done without MoDOT notification that work may begin.
2. The CONSULTANT will submit a project schedule and update it weekly.
3. The first section of data collection will be a location chosen by MoDOT and will serve as a validation test for the CONSULTANT's process.
4. Provide Terrestrial Mobile ground-based LiDAR and photography collection of all MoDOT guardrail end terminals.
5. Alternate methods of performing the work that do not utilize LiDAR technology will be considered if the proposed method is more cost effective and will meet the delivery requirements.
6. The CONSULTANT will perform data processing to determine all end terminal locations and identify the end terminals.



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7. The CONSULTANT will determine the methodology used to identify guardrail end terminals and their type. This document may be helpful: [AASHTO & FHWA Task Force – ET-Plus 4” Device Dimensions](#). There are three possible end terminal identification types: ETPLUS4, ETPLUS5 and Other.
8. The CONSULTANT will perform damage assessments of ETPLUS4 end terminals.
 - a. There are two possible ratings resulting from damage assessments: “Undamaged” and “Damaged”
 - b. The term "Undamaged" means that the device is not materially damaged to the point that an ordinary person exercising reasonable care in maintaining roads would remove the device. Ordinary wear and tear does not render a 4-inch ET Plus "damaged" as that term is used in this Agreement.
 - c. The term “Damaged” means that the device does not meet the standard of “Undamaged”.
9. MoDOT will perform random Quality Assurance field checks.
10. All data collected as part of this project must be retained by CONSULTANT for a period of one calendar year, starting at final delivery. During this period the COMMISSION may require access to the data for various purposes.
11. If any data are determined to be unacceptable by the COMMISSION, the CONSULTANT will be required to provide the corrected items within 30 calendar days, not to exceed the contract completion date.
12. Data will be collected at a speed so as to not impede the safe flow of traffic.
13. Deliverables for all interchange ramps will be required the same as all other roadways.



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14. The possibility exists that a road closure or closures may impact the CONSULTANT'S collection process. If this becomes the case, the closed route or routes must still be included in the collection once the route is re-opened for travel. Scheduling conflicts should be brought to the attention of the COMMISSION.
15. Post-Processing. The CONSULTANT shall be responsible for all post-processing of all data.
16. Mission Planning. Mobile LiDAR Mission planning should be conducted to perform the work in the most cost-effective manner.
17. Mobile LiDAR data collection (or other approved method) shall be conducted in a manner that provides reliable identification of ETPLUS4 and ETPLUS5 guardrail end terminals using automated methods.
18. Data Quality. The CONSULTANT shall be responsible for the professional quality, technical precision and the coordination of data, documents and other services furnished for this project. The CONSULTANT shall, without additional compensation, correct or revise any errors or deficiencies.
19. Additional Services. The COMMISSION reserves the right to request additional work beyond the scope of services addressed in this document. In this event, a supplemental agreement shall be executed and approved prior to the performance of additional services. Changes in compensation will be addressed in the supplemental agreement.
20. Documentation. The CONSULTANT shall provide any documentation necessary to explain, support and clarify the procedures used for data development. The CONSULTANT shall be available to the COMMISSION to discuss and interpret provided data.



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21. Data Ownership. All data and documents prepared in performance of this Scope of Services shall be delivered to and become the property of the COMMISSION upon suspension, abandonment, cancellation, termination, or completion of the CONSULTANT'S services.

B. Data Requirements

1. All Data

- a. All identified end terminals must be indexed by highway route, log mile and direction.

<https://www6.modot.mo.gov/mobilelogfinder/>

<http://traveler.modot.mo.gov/hpmaps/>

- b. The CONSULTANT will track what routes have been collected and work completed and provide this information at scheduled updates in a manner agreed to by both parties.

- c. Collected data must be synchronized to GPS locations.

2. Mobile-Terrestrial LiDAR Point Cloud Data

- a. The CONSULTANT shall collect, retain, and construct the point cloud data as part of this project available to the COMMISSION.
- b. Point cloud data must be made available as .laz files for the COMMISSION's use, conforming to the latest ASPRS standards for the file format. The use of additional file formats or storage methods will be at the selected vendor's discretion.
- c. Point cloud data must be divided into useable, logical sections. An indexing system must be provided that utilizes route and log mile as well as UTM15 coordinates.



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- d. The COMMISSION and the CONSULTANT will agree on a database schema for the delivered dataset prior to starting work.
3. Mobile Photography
 - a. The CONSULTANT shall collect, retain, and make the digital images of guardrail end terminal sections available to the COMMISSION.
 - b. Mobile photography images must be:
 - i. Free of distortion and sun overexposure
 - ii. High-resolution and collected in a manner sufficient for the purpose of damage assessments of the ETPLUS4 end terminals.
 - c. An indexing system for the photography must be provided that utilizes route and log mile as well as UTM15 coordinates.

C. Processing and Deliverable Requirements

1. Submit deliverables for completed routes as they are completed on an agreed schedule. The COMMISSION will have access to all data and files collected as part of this contract and further identified in Required Deliverables, for a period of one year after final acceptance.
 - a. Required Deliverables
 - Deliverable #1:** ESRI file geodatabase containing all end terminal features collected with required metadata. Attributes will contain the end terminal type (ETPLUS4, ETPLUS5 or Other) and the value of the damage assessment, route, log mile, log mile direction, and date/time of collection.



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Deliverable #2: Excel report of all end sections This report will contain the end terminal type, the value of the damage assessment, county, route, log mile, log mile direction, date/time of collection and the UTM15 coordinates.

- b. Guardrail end terminals asset datasets are to be delivered to the COMMISSION in ESRI File Geodatabase Feature Class format. Attributes will contain the end terminal type (ETPLUS4, ETPLUS5 or Other) and the value of the damage assessment, route, log mile, log mile direction and date/time of collection.
- c. All GIS data must be projected to NAD 83(2011), UTM 15, US Survey Foot.
- d. The CONSULTANT must be able to record GNSS coordinates at a minimum absolute positional accuracy (position on the earth) of 5 feet or less.
- e. The CONSULTANT must be able to identify the ETPLUS4 and ETPLUS5 end terminals in the point cloud and measure the top of the guide channel to an accuracy sufficient to reliably discern between the 4-inch and 5-inch guide channel.
- f. For assets appearing at intersections or colocation of multiple routes, a single record must be recorded for that asset, rather than one for each appearance along a highway route. Duplication of end terminals in the delivered database will not be allowed.
- g. The CONSULTANT must establish a progress reporting process and/or schedule agreeable to MoDOT, for the purpose of



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communicating project progress and other miscellaneous project information.

- h. The CONSULTANT will send invoices to a Settlement Administrator. Contact information for the Settlement Administrator will be provided by the COMMISSION.
- i. All work must be completed and invoices submitted before 12-31-2023