

Statewide Program Specific Bridge Preventative Maintenance Structures Engineering Design Services Scope of Work

Contract Administration:

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CDOT Staff Bridge has identified tasks where additional resources may be needed. The contract supports design, construction, and management for structure replacement and rehabilitation projects throughout the state. This project includes all design and management support activities for all CDOT specialty groups as well as additional consultant support. These specialty groups include, but are not limited to roadway, environmental, traffic, geotechnical, materials, bridge, hydraulic, utilities, and ROW. These tasks include, but are not limited to, the following:

Preventative Maintenance Project Support - (Estimated portion of total contract = 80%)

Bridge, Wall, Culvert, and Tunnels Planning, Design, and Construction services

Emergency and Quick Response Services (Estimated portion of total contract = 0-10%)

Bridge, Wall, Culvert, and Tunnels Design, and Construction services

Program Support (Estimated portion of total contract = 0-10%)

Ratings, Policy and Standard Support, Grant Services, Asset Management Planning (SAM Plan), Structure Monitoring, drafting support, and Hydraulics

Note: This Scope of Work has been carefully reviewed and reflects an approach based on the known goals of the Design units of the Staff Bridge Branch and Bridge and Tunnel Enterprise. The Consultant's analysis of the program/project goals, its evaluation of the work elements, and its formulation of the work plan, coupled with its understanding of and sensitivity to the key issues may produce new approaches or modifications to the project's work elements. Therefore, the final Scope of Work for the program/project may change in some details to incorporate the Consultant's input.

I. GENERAL REQUIREMENTS

WORK DURATION

The time period for the work described in this scope will be 5 years from the execution of the contract. Work may be required: night or day; weekends; holidays; or on a split shift basis.

AUTHORIZATION TO PROCEED

Work shall not commence until the consultant receives the written Notice to Proceed for each task order. Work shall be completed within the allotted task order time.

ROUTINE REPORTING AND BILLING

The consultant shall provide the following on a routine basis:

- Monthly billing reports in formats suitable to the Contract Administrator for all contract activities performed by the Consultant's personnel authorized to perform work on this project.
- Periodic reports and billings as requested.

PREQUALIFICATION

The Consultant shall include a Colorado Registered Professional Engineer. The Consultant will also need a comprehensive knowledge of CDOT manuals, guidelines, policies and procedures. The Contract Administrator will approve all Consultant personnel task-specific qualifications.

All tasks assigned to the Consultant must be conducted by a person on the Consultant team that is qualified and has specific expertise in that task. The qualified person is a professional with the necessary education, certifications (including registrations and licenses), skills, experience, qualities, or attributes to complete a particular task. Design of any special project features must be directed, completed, and overseen by a professional engineer with significant experience in design of those special project features. See below for specific required qualifications.

This contract requires that the prime firm or any member of its team be pre-qualified in the following disciplines for the entire length of the contract:

BR Bridge Design
MT Materials Testing
EN Environmental Engineering
GE Geotechnical Engineering
HD Highways & Street Design
HY Hydraulics
SU Surveying
TC Traffic Control

DELIVERABLES

Deliverables for each task will be defined in the individual task orders.

II. GENERAL TASK DESCRIPTIONS:

A. General Engineering Services -The scope for general engineering services may include but shall not necessarily be limited to:

1. Provide conceptual drawings, graphs, data collection, or charts for the planning, environmental, or other units as needed.
2. Provide drafting support or CADD services. All CADD work for CDOT will be conducted using Bentley products including ORD, OBM, MicroStation, Inroads Software, and ProjectWise latest versions used by CDOT.
3. Write, review, and/or provide guidance or expertise related to manual preparation guidance documents.
4. Provide/prepare training, advice, or guidance as requested.
5. Provide Independent Cost Estimates
6. Provide Constructability Reviews
7. Provide Certified Welding Inspection Services
8. Provide funding guidance and or support including grant applications
9. Provide support, preparation, or guidance for Grant Applications including economic analysis.
10. Provide or acquire design services as required to complete tasks not specifically defined in the outline, but that may be required by specific task order.
11. Conduct or update studies for transportation, environmental, NEPA etc.
12. Provide support for region planning activities, including assistance with public meetings and/or public information including handouts, website support or development, and public meeting presentations.
13. Provide design support for off systems or other modes of transportation alternatives.
14. Provide lighting plans and analysis.
15. Provide research support or search county, state or other areas for records or documents relevant to the project or task.
16. Provide scoping services.
17. Provide scheduling in MS Project or other scheduling software as requested.
18. Prepare, provide support, coordinate Innovative Contracting documents or supporting information.
19. Provide Program Management support and/ or financial planning as requested.
20. Provide Local Agency/Enhancement project support, oversight, and/or guidance.

B. Bridge/Structural Design Activities -The scope of work for bridge/structural design activities may include:

1. Provide design services for various transportation structures or portions of transportation structures.
2. Furnish detailing services including drafting and quantity calculations for various transportation structures or portions of transportation structures.
3. Write Special Provisions and submit to the CDOT/PM with the completed plans

4. Inspect and load rate transportation bridges and culverts.
5. Provide bridge design and detailed review of work performed by other designers.
6. Provide wall design and detailed review of work performed by other designers.
7. Provide structural selection reports and structure type selection studies.
8. Provide a structure concept study.
9. Obtain structural data
10. Provide foundation investigation reports
11. Coordinate with outside agencies; for example, railroad agencies
12. Provide structure load rating packages per the CDOT Bridge Rating Manual
13. Prepare structure asset management (SAM) plans
14. Bridge deck non-destructive evaluation (NDE)
 - a) Providing traffic control for day or night deck NDE work
 - b) Bridge deck scanning utilizing impact echo (IE), spectral analysis of surface waves (SASW), ground penetrating radar (GPR), infrared thermography (IR), and high-resolution video (HRV)
 - c) Determining chloride concentration by weight of cement in bridge deck concrete
15. Updating or creating new Bridge Project Specials - CDOT has a need to update the current CDOT Bridge Project Specials to be in compliance with current code and CDOT specifications. The contractor must be capable of:
 - a) Being familiar or becoming familiar with CDOT specifications and CDOT Bridge Project Specials
 - b) Converting existing CDOT Bridge Project Specials to the most current MS Word template format used by the CDOT Specification Committee
 - c) Updating existing CDOT Bridge Project Specials to be in compliance with current code and CDOT Specifications
 - d) Soliciting review comments from internal and external stakeholders electronically or in person
 - e) Addressing review comments from internal and external stakeholders
16. Updating or creating new CDOT Bridge Worksheets - CDOT has a need to update or create new CDOT Bridge Worksheets to be in compliance with current code and CDOT specifications. The contractor must be capable of:
 - a) Being familiar with CDOT Bridge Design Manual requirements
 - b) Being familiar with CDOT Bridge Detail Manual requirements
 - c) Being familiar with CDOT Design requirements
 - d) Being familiar with AASHTO LRFD Bridge Design code
 - e) Preparing design and design check calculations to support any updated or new worksheets
 - f) Capable of updating existing worksheets utilizing Bentley® MicroStation with the CDOT configuration
 - g) Capable of creating new worksheets utilizing Bentley® MicroStation with the CDOT configuration

17. Provide Fabrication Quality Assurance Inspection Services.

C. STRUCTURE ASSET MANAGEMENT PROGRAM

1. Structure Data Collection and Programming: For each CDOT major structure, the consultant will collect available inspection data from CDOT and reference it into an application where the data will be processed to develop SAM Plans and STIP/Project Recommendation reports.
2. There is an existing application for the Major Structures (Bridges) in an excel format. The application and future development may include the following tasks:
 - a) Updating format as required to facilitate ease of use and reporting by the Asset Managers.
 - b) Maintaining and refining the Bridge SAM Plan and STIP/Project Recommendation application
 - c) Update the application with new inspection SIMSA data provided by CDOT.
 - d) Update application to include updated Essential Repairs as Stand-Alone Projects
 - e) Update application to include walls, culverts, and tunnels with new associated treatments and provide new cost estimate data for this work
 - f) Update application to include updated SAP project data
 - g) Update application to include BTE prioritization and Bridge Prioritization
 - h) Coordinate Scour Cost Estimate and Priority updates
 - i) Update the application to include additional treatments including but not limited to approach slabs and deck treatments.
 - j) Review bridge prioritization and interaction with the application for deck and joint priority
 - k) Back check cost estimate contingency percentage to evaluate estimate accuracy.
 - l) Update unit cost estimates based upon current cost projections
 - m) Develop new report format for Staff Bridge/OFMB as required
 - n) Update application to include a drop down list of predefined treatment types as defined by CDOT within the spreadsheet with no reference to plans
 - o) Documenting Cost Estimate Logic for each treatment including:
 - (1) Selection Logic with criteria and multiple cases as needed with base assumptions
 - (2) Treatment Cost Quantity Calculations with written formulas
 - (3) Treatment Cost Logic including base assumptions
 - (4) List of Pay items associated with the Treatment
 - (5) Inspection Coding Definitions used to trigger the selection of the Treatment
3. Selection and packaging of Bridges for the SAM Plan and the STIP/Project Recommendation List including conceptual cost estimate
4. SAM Plan and 10Yr plan development and Quality Review (as needed)

- a) The Consultant will help coordinate with each of the Staff Bridge Unit Leaders and Region representatives to produce a 4-year SAM Plan of projects, a 10-year STIP and a Recommended Project or needs list including Structure Preventative Maintenance (SPM), Structure Repair (Repair), Surface Treatment (ST), and Scour Mitigation Projects (Scour) and priorities. The SAM Plan report is updated semi-annually and will be maintained in CDOT server(s) in a pdf and excel file format.
- b) In order to optimize the project results, the Consultant will need to coordinate with Staff Bridge Inspection, Asset Management, Standards & Design units as well as the Bridge Portfolio Manager and Finals Engineers as to required products and roles and responsibilities for tracking, data requirements, treatment types and other data to assure optimal use of funding in both design and asset management results.
- c) The Consultant will coordinate work tasks with Staff Bridge and the Regions.
- d) The Consultant will prepare monthly progress reports and invoices including Regional tracking of design budgets and expenditures.
- e) The Consultant will attend virtually or in person meetings as requested by CDOT and send only the appropriate personnel as determined jointly by the Consultant and CDOT. It is anticipated that there will be meetings required for the following tasks:
 - (1) Power Point Presentation meetings with the Region Asset Manager and Staff Bridge Unit Leaders meet with each Region for review of the plans
 - (2) Meet with Region's Staff Bridge Unit for review of the plans. Consultants may track funding allocations and regional balances associated with the design funds.

D. Design Activities - Provide design services including quantity calculations for the various components of construction, which could include bridge, wall, culvert, and tunnel structures. Conduct plan, specification, and cost estimate checking and/or quality control.

- 1. Furnish detailing and drafting services utilizing Bentley MicroStation and ORD Software, or the latest CDOT adopted versions utilizing CDOT format. Other software products required for design services and communication of information are Microsoft Office products such as Word, Excel, and PowerPoint. In addition, Bentley ProjectWise, Microsoft SharePoint, or FTP sites may be required for file sharing. Other formats or software products may be required for specific tasks such as traffic modeling or truck turning movements.
- 2. Attend and/or conduct meetings as needed such as scoping reviews, design office reviews, field inspection reviews, and final office reviews and provide minutes as appropriate.
- 3. Prepare (P&S Package) final plans, specifications and provide the CDOT project manager with detailed estimates that can be entered into CDOT Transport application system at any point in the project.

4. Prepare revisions under-advertisement to plans or specifications when necessary.
 5. Design and layout of intersections and interchanges.
- E. Hydrology Activities -The scope of work for the hydrology activities may include:
1. Collect historical drainage data
 2. Establish drainage basin data.
 3. Select run-off parameters and predict peak flow.
- F. Hydraulics Design Activities - The scope of work for hydraulics design activities may include:
1. Furnish the size and location of drainage structures.
 2. Furnish storm sewer design.
 3. Furnish erosion protection design and NPDES requirements.
 4. Furnish design and quantity calculations for drainage structures including irrigation and permanent BMPs for surface drainage.
 5. Design of water and waste water systems.
 6. Irrigation system designs including, but not limited to, typical ditches, traveling gun irrigation systems and other center pivot systems.
 7. Design, advise, or plan for MS4 compliant facilities and calculations and/or plan preparation as needed.
 8. FEMA Flood Mapping Revisions and Amendments
- G. Traffic Engineering Activities -The scope of work for traffic engineering activities may include:
1. Collect traffic data.
 2. Perform traffic studies or analyses including traffic modeling.
 3. Perform in-field inventories of traffic control device locations and conditions.
 4. Furnish design and quantity calculations necessary to prepare signal, signing or pavement marking plans.
 5. Furnish detailing and drafting services.
 6. Attend meetings such as field inspection and final office review or others as requested.
 7. Prepare construction signing plans and schedules.
 8. Prepare final plans and specifications.
 9. Perform passing zone analysis to validate or update current striping logs or plans.
- H. Landscape Architectural Activities -The scope of work for landscape architectural activities may include:
1. Provide estimates of quantities of native seeding and mulching for the FIR plans.
 2. Determine most economic landscape alternative, finalize concept, and complete the plan.
 3. Verify that an acceptable safe recovery distance exists between traveled way and all trees to be planted.

4. Coordinate all special permits that may be required.
 5. Coordinate ROW requirements.
 6. Write Special Provisions and submit to the CDOT/PM with the completed roadside plans.
 7. Submit the approved plan/special provisions to the Design Engineer for inclusion in the Project Plans.
 8. Verify availability of plant materials and submit letter to the CDOT/PM certifying that designated plants are available.
 9. Provide recommendations for alternative landscape designs and recommendations for Best Management Practices for temporary and permanent erosion protection.
 10. Prepare Storm Water Management Plan (SWMP) Sheets with BMP locations and quantity calculations for each phase of construction.
- I. Noise Study -The scope of work for noise study activities may include:
1. Predict or measure present noise levels.
 2. Analyze noise levels for all alternatives, including the no-build. Noise level models will be made with at least CDOT's stamina noise computer model or better. Distances at which noise levels exceed acceptable levels will be determined for each alternate and plotted on corridor maps.
 3. Identify locations where noise abatement measures are needed, determine which measure is feasible and cost effective, and estimate construction and maintenance costs.
 4. Prepare a noise assessment report for acceptance by CDOT.
- J. Value Engineering (VE) -The scope of work for value engineering activities may include:
1. Conduct VE meetings and provide minutes. The VE meetings should be considered for the following efforts:
 2. Brain Storming
 - a) Evaluating alternatives upon meeting the project purposes and need
 - b) Recommend alternatives based upon: -Most benefit to purpose and need -Minimal or mitigatable impacts -Constructability -Cost -Best overall response to constraints and concerns
 3. Collect and compile VE cost and workhour data.
 4. Provide Final VE Report.
- K. Materials and Geotechnical Services for Design -The scope of work for design services include:
1. Provide field sampling and testing of existing pavements and soils necessary for proper pavement design as per the CDOT Pavement Design Manual.
 2. Perform boring and subsurface geotechnical investigations for Structure Selection Reports.
 3. Provide testing results used in the design process that are certified by a professional engineer.

4. Provide other materials and geotechnical services, including but not limited to pavement design, pavement justification reports, life cycle cost analysis, Subsurface investigations, instrumentation, foundation reports, landslide evaluations, MSE wall designs, soil nail wall designs and retaining wall designs
- L. Environmental Services -The scope of work for environmental services may include:
1. Review environmental conditions, determine required permits.
 2. Delineation and mitigation recommendations of wetlands.
 3. Prepare and/or review environmental documents for CDOT projects.
 4. Conduct and prepare environmental surveys and clearance reports.
 5. Preparation and processing of Nationwide and Individual Section 404 permits.
- M. Utility Services -The scope of work for Utility Services may include:
1. Survey/Research existing utilities.
 2. Map existing and relocated utilities
 3. Assist or facilitate utility agreements
 4. Coordinate and discuss utility impacts with utility companies
 5. exhibits or other support as needed for utilities
- N. Design Services under construction - the Scope of Work for design services under construction may include:
1. Review of actual subsurface conditions to verify structural design.
 2. Review and acceptance of shop drawings.
 3. Changes in design based on field conditions.
 4. Services as needed per PE stamp requirements on design drawings.
 5. Answer questions as needed on plans and specifications.
 6. Claim and schedule analysis.
 7. Analysis of VE proposals.
 8. Review/Analysis of construction phasing false work, shoring, methods statements, and CPM schedules (Microsoft Project and/or Primavera).
 9. Review/Analysis of bridge demolition plans, girder erection plans, structural stability, Project Safety Management Plans, and Safely Critical work.
 10. Field Visits, Meeting attendance, and re-design as needed.
- O. Surveying -The scope of work for surveying activities may include:
1. Obtain Right of Entry if needed
 2. Perform surveys related to the horizontal and vertical alignment of the project.
 3. Perform GPS control survey.
 4. Perform topographical surveys.
 5. Perform cross section surveys.
 6. ROW support for design.
 7. Perform utility surveys (includes potholing).
 8. Perform wetland survey
 9. Prepare project control diagram.
 10. Perform LiDAR surveys.

P. Right-of-Way Plan Preparation - The scope for right-of-way plan preparation may include:

1. Retrieve ownership/Title commitments as needed
2. Determine parcels.
3. Write parcel legal descriptions.
4. Determine parcel size.
5. Prepare ROW plan tabulation sheet.
6. Prepare ROW plan sheets.
7. Prepare monument tabulation sheets.
8. Prepare land survey control diagram.
9. Prepare total ownership maps.

Q. Program Support

1. Load Rating Major and Minor Structures: CDOT has a need to update load ratings on existing structures to satisfy FHWA and CDOT requirements. The contractor must be capable of:

- a) Load rating bridges and culverts in accordance with the CDOT Bridge Rating Manual primarily utilizing AASHTOWare Bridge Rating (BrR) or CANDE (Culvert Analysis and Design)
- b) Load rating structures when AASHTOWare BrR or CANDE are unable to be used by utilizing programs such as CSI Bridge, SAP2000, LARSA, MDX, LEAP, BRASS, MathCad, MS Excel, or other as approved by the Contract Administrator
- c) Load rating structures without plans using field investigation for steel structures, or physical inspection / non-destructive test loading for concrete bridges.

2. Grant Writing

CDOT Staff has an intermittent need to prepare grant applications for funding. The contractor shall be capable of:

- i. Providing support to the grant application preparation including writing, reviewing, economic analysis, expertise and guidance.
- ii. Identifying applicable grant opportunities for structures.

R. Other Services -As requested and specified in the task orders other services not specified above may be requested on an as needed basis. The scope of work for these services will include the details of the needs.

III. REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) and OTHER FEDERAL PUBLICATIONS (using latest approved versions):

- A. Standard Specifications for Highway Bridges

- B. Standard Specifications for Transportation Materials and Methods of Sampling and Testing - Part 1, Specifications and Part II, Tests
- C. Load Resistance Factor Design (LRFD) Specifications
- D. Guide Specifications for Design and Construction of Segmental Concrete Bridges
- E. Guide Specifications for LRFD Seismic Bridge Design
- F. Guidelines for Steel Girder Bridge Analysis
- G. LRFD Bridge Construction Specifications
- H. LRFD Bridge Design Specifications
- I. Manual for Bridge Element Inspection
- J. Manual for Bridge Evaluation
- K. AASHTO/AWS D1.5M/D1.5 Bridge Welding Code
- L. AASHTO/AWS D1.1M/D1.1 Welding Code
- M. CFR - Code of Federal Regulations
- N. Bridge Inspector's Reference Manual (FHWA NHI 12-049) (BIRM)
- O. FHWA HEC-18 Evaluating Scour at Bridges (FHWA-HIF-12-003)
- P. FHWA HEC-20 Stream Stability at Highway Structures (FHWA-HIF-12-004)
- Q. FHWA HEC-23 Bridge Scour and Stream Instability Countermeasures
- R. FHWA Highway Performance Monitoring System Field Manual
- S. FHWA Inspection of Fracture Critical Bridge Members
- T. FHWA Manual for the Safety Inspection of In-Service Bridges
- U. FHWA Manual on Uniform Traffic Control Devices for Streets and Highways
- V. FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (FHWA-PD-96-001)
- W. FHWA Specifications for the National Tunnel Inventory (FHWA-HIF-15-006)
- X. FHWA Specification for the National Bridge Inventory Bridge Elements
- Y. FHWA Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual (FHWA-HIF-15-005)
- Z. FHWA Underwater Inspection of Bridges (FHWA-DP-80-1)
- AA. FHWA Underwater Bridge Inspection Manual (FHWA-NHI-10-027)
- BB. FHWA Underwater Bridge Repair, Rehabilitation, and Countermeasures (FHWA-NHI-10-029)
- CC. FHWA Culvert Inspection Manual (FHWA-IP-86-2))
- DD. NCHRP Report 575 - Legal Truck Loads and AASHTO Legal Loads for Posting
- EE. NCHRP Report 816 - Guide for the Preservation of Highway Tunnel Systems
- FF. NCHRP Synthesis 474 - Service Life of Culverts
- GG. NCHRP Web Only Document 107: Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations

COLORADO DEPARTMENT OF TRANSPORTATION PUBLICATIONS (using latest approved versions):

- A. Bridge Inspection Manual
- B. Design Guide (all volumes)
- C. Bridge Design Manual
- D. Bridge Detailing Manual
- E. Bridge Rating Manual
- F. Bridge Worksheets
- G. Project Development Manual

- H. Cost Data Book
- I. Field Materials Manual
- J. Standard Plans, M & S Standards
- K. Standard Specifications for Road and Bridge Construction and Supplemental Specifications

IV. DEFINITIONS

Note: For other definitions and terms, refer to Section 101 of the CDOT Standard Specifications for Road and Bridge Construction, the CDOT Design Guide and the M&S Standards.

AASHTO	American Association of State Highway & Transportation Officials
ADT	Average two-way 24-hour Traffic in Number of Vehicles
AT&SF	Atchison, Topeka & Santa Fe Railway Company
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BNRR	Burlington Northern Railroad
BNSF	Burlington Northern/Santa Fe Railroad
CA	Contract Administrator - The CDOT Manager responsible for the satisfactory completion of the contract by the consultant.
CDOT	Colorado Department of Transportation
CDOT/PM	Colorado Department of Transportation Project Manager - The CDOT Engineer responsible for the day to day direction and CDOT Consultant coordination of the design effort (as defined in Section 2 of this document)
CEQ	Council on Environmental Quality
COG	Council of Governments
CONSULTANT	Consultant for the project
CONTRACT ADMINISTRATOR	Typically a Region Engineer or Branch Head. The CDOT employee directly responsible for the satisfactory completion of the contract by the Consultant. The contract administration is usually delegated to a CDOT Project Manager (as defined in Section 2 of this document).
C/PM	Consultant Project Manager - The Consultant Engineer responsible for combining the various inputs in the process of completing the project plans and managing the Consultant design effort.
DRCOG	Denver Regional Council of Governments
D&RGW	Denver & Rio Grande Western Railroad
ESAL	Equivalent Single Axle Load

FEMA	Federal Emergency Management Agency
FHPG	Federal Aid Highway Policy Guide
FHWA	Federal Highway Administration
FIR	Field Inspection Review
FONSI	Finding of No Significant Impact
GPS	Global Positioning System
MAJOR STRUCTURES	Bridges and culverts with a total clear span length greater than twenty feet. This length is measured along the centerline of roadway for bridges and culverts, from abutment face to abutment face, Retaining structures are measured along the horizontal distance along the top of the wall. Structures with exposed heights at any section over five feet and total lengths greater than a hundred feet as well as overhead structures including (bridge signs, cantilevers and butterflies extending over traffic) are also considered major structures.
MPO	Metropolitan Planning Organization (i.e. Denver Regional Council of Governments, Pikes Peak Area Council of Governments, Grand Junction MPO, Pueblo MPO, and North Front Range Council of Governments).
NFIP	National Flood Insurance Program
NICET	National Institute for Certification in Technology
PE	Professional Engineer registered in Colorado
PM	Program Manager
PROJECT	The work defined by this scope
ROW	Right-of-Way: A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a highway
ROWPR	Right-of-Way Plan Review
RTD	Regional Transportation Director
SFHA	Special Flood Hazard Area
SH	State Highway Numbers