TERMS OF REFERENCE (TORS)

SELECTION OF CONSULTANT FOR COMPREHENSIVE BRIDGE MANAGEMENT SYSTEM (BMS) DEVELOPMENT, IMPLEMENTATION, AND INTEGRATION WITH ROAD ASSET MANAGEMENT SYSTEM (RAMS) FOR COMMUNICATIONS AND WORKS DEPARTMENT, KHYBER PAKHTUNKHWA.

1. BACKGROUND AND CONTEXT

The Communications and Works (C&W) Department is custodian of more than 25,000 km of road network including more than 1000 bridges. Such a huge portfolio requires a proper management system. Earlier, there was no systematic and scientific way of maintaining road infrastructure, and most of the activities were carried out manually. The Communications and Works (C&W) Department is implementing a comprehensive Road Asset Management System (RAMS) to enhance the planning, maintenance, and management of road/bridge infrastructure. In this context, the C&W Department has already initiated inventory updating of road infrastructure and condition assessment of specified roads across the province.

As part of this strategic initiative, the department requires specialized expertise for the development and implementation of a Bridge Management System (BMS) that will integrate seamlessly with the existing RAMS framework. The BMS will serve as a critical component for systematic bridge inventory management, condition assessment, maintenance planning, and lifecycle cost optimization of bridge assets within the department's jurisdiction.

2. OBJECTIVES

- Develop and update existing bridge inventory/digital database for C&W Department
- Establish standardized bridge inspection and assessment protocols aligned with international standards
- Develop condition rating of all bridges in Khyber Pakhtunkhwa in line with international standards
- Develop deterioration models for optimal fund allocation for predictive maintenance

- Conduct detailed condition assessment of 50 prioritized bridges in various districts of the province with low condition rating (CR<6) using latest tools (i.e., various non-destructive testing methods, etc.)
- Prepare detailed design/retrofitting plans of bridges based on condition assessment, maintenance/rehabilitation work plans, and estimates based on prevailing MRS
- Develop and implement a comprehensive Bridge Management System (BMS) for C&W bridges
- Ensure seamless integration with the existing RAMS and road network data for comprehensive network planning
- Develop prioritization frameworks for bridge maintenance and rehabilitation
- Build internal capacity for BMS operations and maintenance
- Establish performance indicators and reporting mechanisms
- Develop long-term bridge asset management strategies
- Assess vulnerability of bridges to floods, earthquakes, and climatic impacts and plan retrofitting and relocation accordingly
- Ensure compliance with national and international bridge management standards

3. SCOPE OF SERVICES3.1 Bridge Inventory and Assessment

- **Inventory Development**: Develop a complete inventory of all bridges (1000+) in numbers and span length equal to or more than 20 ft under departmental jurisdiction
- **Condition Assessment Framework**: Develop standardized bridge inspection protocols and conduct visual assessment of all bridges in KP
- Develop **condition rating** of all bridges in Khyber Pakhtunkhwa in line with international standards
- Develop **deterioration models** for optimal fund allocation for predictive maintenance
- Conduct **detailed condition assessment of Prioritized 50 No. bridges** in various districts of Khyber Pakhtunkhwa with low condition rating

(CR<6) using latest tools (i.e., various non-destructive testing methods, etc.)

- Prepare **detailed design/retrofitting plans of Prioritized 50 No bridges** based on condition assessment, maintenance/rehabilitation work plans, and estimates based on prevailing MRS
- Develop and implement a comprehensive **Bridge Management System (BMS)** for C&W bridges
- Ensure seamless integration with the existing RAMS and road network data for comprehensive network planning
- **Automation of Condition Rating**: Develop a framework using computer vision to automate condition rating of bridges
- **Data Collection**: Establish methodologies for systematic data gathering
- **Historical Data Integration**: Incorporate existing bridge records and documentation

3.2 Interface / Dashboard development

- Design and provide BMS architecture ensuring compatibility with existing RAMS. The BMS interface / dashboard, complete in all respects, will be the property of C&W Department KP with all rights reserved
- **Integration Planning**: Ensure seamless data exchange between BMS and RAMS
- **Mobile/Cell phone Solutions**: Develop field data collection applications

3.4 Maintenance Management

- **Maintenance Planning**: Develop systematic maintenance scheduling frameworks
- **Priority Ranking**: Establish criteria for prioritizing bridge interventions
- **Budget Optimization**: Create tools for optimizing maintenance expenditure
- **Performance Monitoring**: Implement systems for tracking maintenance effectiveness

3.5 Training and Capacity Building

- **Staff Training**: Comprehensive training programs for system users, C&W selected officers, and bridge inspectors
- **Documentation**: Develop user manuals and standard operating procedures
- **Knowledge Transfer**: Ensure complete knowledge transfer to departmental staff
- **Ongoing Support**: Provide initial technical support and troubleshooting for at least 12 months

4. DELIVERABLES

Phase 1: Planning and Design (Month 1)

- Inception report with detailed work plan and methodology
- System requirements document
- Bridge inventory and prioritization methodology
- Bridge condition rating and condition assessment report
- Integration plan with existing RAMS
- Risk assessment and mitigation strategies

Phase 2: Development and Implementation (Months 2-10)

- Complete bridge inventory database
- Detailed condition assessment report as per the requirements mentioned in para 3.2
- Detailed design/retrofitting plan and report of bridges
- Maintenance/rehabilitation work plan and estimates based on prevailing MRS
- Implemented BMS dashboard
- Integration with RAMS completed
- Standard operating procedures/operational manual, etc.
- Training materials and documentation

Phase 3: Training and Handover (Months 11-12)

- Staff training programs
- System testing and validation reports
- Final implementation report
- Operation, maintenance, and support documentation

5. CONSULTANT QUALIFICATIONS AND EXPERIENCE

5.1 Technical Qualifications

- **Team Lead**: Minimum 20 years' experience in bridge engineering and asset management
- **BMS Expertise**: Proven experience in implementing BMS projects. Must have demonstrable experience in structural health monitoring, non-destructive testing, and contemporary inspection tools. Demonstrable experience with computer vision for inspection and laser-based techniques for condition assessment will be an asset
- **Interface development**: Demonstrated expertise in bridge management dashboards
- **Integration Experience**: Experience in integrating BMS with broader asset management systems

5.2 Professional Requirements

- Professional engineering licenses in relevant disciplines
- Certification in asset management
- Experience with international bridge management standards (AASHTO, CHBDC, etc.)

5.3 Team Composition

- **Team Lead**: Minimum 20 years' infrastructure project experience, preferably in bridge design/assessment or management
- **Bridge Management Specialist**: Expert in BMS implementation. Must have demonstrable experience in structural health monitoring, non-destructive testing, and contemporary inspection tools. Demonstrable experience with computer vision for inspection and laser-based techniques for condition assessment will be an asset

- **Database Specialist**: Expert in large-scale database design and management
- **Training Specialist**: Experienced in technical training and capacity building

5.4 Organizational Requirements

- Minimum 20 years in bridge/infrastructure consulting
- Proven track record with government agencies
- Financial stability
- Local presence, JV, or partnership arrangements

6. TECHNICAL REQUIREMENTS

6.1 System Requirements

- **Scalability**: Support for a minimum of 5,000 bridge structures
- **Integration**: Full compatibility with existing RAMS
- **Performance**: Response time <3 seconds for standard queries
- **Reliability**: 99.5% system uptime requirement
- **Security**: Compliance with government cybersecurity standards

6.2 Data Management

- **Standards Compliance**: Adherence to national data standards
- **Backup Systems**: Automated daily backup procedures
- **Data Migration**: Seamless migration of existing bridge data
- **Reporting**: Comprehensive reporting and analytics capabilities

6.3 Mobile Capabilities

- **Field Applications**: Mobile apps for inspection data collection
- **Offline Functionality**: Capability to work without internet connectivity
- **Synchronization**: Automated data synchronization when connected
- **Hardware Compatibility**: Support for tablets and smartphones

7. PROJECT TIMELINE AND MILESTONES

7.1 Project Duration

- **Total Duration**: 12 months from contract signing
- **Phase 1**: Month 1 (Planning and Design)
- **Phase 2**: Months 2-10 (Development and Implementation)
- **Phase 3**: Months 11-12 (Training and Handover)

7.2 Key Milestones

- **Month 1**: Inception Report and System Design
- **Month 3**: Complete Bridge Inventory (50% completion)
- **Month 4-6:** Condition rating of all bridges
- **Month 7-10**: Condition assessment of all bridges (CR<6)
- **Month 11**: BMS dashboard including prediction model
- **Month 11**: RAMS Integration Completion
- **Month 12**: Final Handover and Documentation

8. BUDGET AND FINANCIAL REQUIREMENTS

8.1 Payment Schedule

- **Mobilization Advance**: 10% of bid upon contract signing
- **Phase 1 Completion**: 10% of bid upon acceptance of inception report
- **Phase 2 Milestones**:
    - Submission of Bridge Inventory: 20%
    - Submission of Bridge Condition Assessment:20%
    - Development, testing and operationalization of BMS Dashboard: 20%
- Development of Manuals: 20%
- **Phase 3**
- Completion of Training: : 10%

8.2 Cost Components

The consultant shall provide detailed cost breakdown for:

- Personnel costs (local and international experts)
- Dashboard development costs (licensing etc)
- Equipment and hardware requirements
- Cost of testing and investigations
- Training and capacity building activities
- Travel and accommodation expenses
- Operational costs and overheads

9. PROPOSAL SUBMISSION REQUIREMENTS

9.1 Technical Proposal

- Company profile and organizational structure
- Understanding of the assignment and proposed methodology
- Team composition with detailed CVs
- Work plan and timeline
- Risk assessment and mitigation strategies
- Previous experience with similar projects (minimum 3 references)

9.2 Financial Proposal

- Detailed cost breakdown by phases and activities
- Personnel costs (monthly rates for each team member)
- Equipment and development of dashboard
- Other direct costs and overheads
- Total project cost in PKR

9.3 Supporting Documents

- Company registration and tax certificates
- JV documents if any
- Professional licenses and certifications

- Financial statements (last 3 years)
- Bank guarantee or performance bond capability
- References from previous clients

10. EVALUATION CRITERIA

10.1 Technical Evaluation (100)

- **Proposed Methodology**: 30%
- **Team Qualifications**: 30%
- **Firms Experience**: 40%

10.2 Financial Evaluation

- Cost competitiveness and value for money

10.3 Minimum Technical Score

- Proposals must achieve minimum 70% technical score to qualify for financial evaluation

11. CONTRACT CONDITIONS

11.1 Performance Standards

- **System Uptime**: Minimum 99.5% during operational phase
- **Response Time**: Maximum 3 seconds for standard queries
- **Data Accuracy**: 99% accuracy in bridge inventory data

11.2 Warranty and Support

- **System Warranty**: 12 months from final acceptance
- **Technical Support**: 24/7 helpdesk during first 6 months
- **Maintenance Support**: Monthly system health checks for first year

12. INTELLECTUAL PROPERTY AND DATA SECURITY

12.1 Ownership Rights

- All software, databases, and documentation developed shall be property of C&W Department
- Source codes and technical documentation must be provided

- No licensing restrictions on future modifications

12.2 Data Security and Confidentiality

- Compliance with Government of Pakistan data protection regulations
- Signed confidentiality agreements by all team members
- Secure data handling and transmission protocols
- Regular security audits and vulnerability assessments

13. QUALITY ASSURANCE

13.1 Quality Control Measures

- Regular progress reviews and milestone assessments
- Independent testing and validation procedures
- User acceptance testing at each phase
- Documentation review and approval processes

13.2 Compliance Requirements

- Adherence to national and international bridge management standards
- Compliance with government IT policies and cybersecurity frameworks
- Environmental and social safeguards compliance

14. COMMUNICATION AND REPORTING

14.1 Project Management

- **Project Manager**: Dedicated project manager from consultant team
- **Steering Committee**: Monthly meetings with department officials
- **Progress Reports**: Bi-weekly progress reports during implementation

14.2 Documentation Standards

- All reports in English language
- Electronic copies in PDF and editable formats
- Technical documentation with version control
- User manuals in local language (Urdu) where applicable