**AGREEMENT FOR TECHNICAL ASSISTANCE**
**BETWEEN THE SECRETARY OF TRANSPORTATION**
**AND THE UNIVERSITY OF KANSAS**

**THIS AGREEMENT** made this 19th day of November, 2008, by and between the Secretary of Transportation of the State of Kansas, hereinafter referred to as the "**Secretary**," and The University of Kansas, hereinafter referred to as "**KU**," acting by and through Barbara Armbrister, Director, Research Administration, its duly authorized representative. Collectively referred to as the "Parties."

**WITNESSETH**

**WHEREAS, the Secretary** has determined that research regarding "Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue" is needed and approved as part of the **KDOT** Research Program; and

**WHEREAS,** the proposed program is hereinafter called "Project;" and

**WHEREAS,** the **KU** has qualified personnel with demonstrated expertise available to conduct the Project; and

**WHEREAS,** the **Secretary** is willing, subject to the terms of the **Agreement,** to reimburse **KU** for the assistance provided.

**NOW THEREFORE,** in consideration of the mutual covenants herein contained, the Parties hereto agree as follows:

**Section 1.** Scope of Services. The **KU** shall furnish the necessary personnel, facilities, and such other services as may be required to fulfill the tasks identified and described in the Workplan which is attached hereto and incorporated herein as Special Attachment No. 3.

**Section 2.** Contract Dates. The **KU** may commence work in conformity with the Workplan (Special Attachment No. 3) of this **Agreement** upon acceptance by the **Secretary** of the Workplan and shall prosecute the work outlined herein to begin on or after September 1, 2008, and with completion not later than August 31, 2011, unless the time is extended by the **Secretary**, as evidenced in writing.

**Section 3.** Basis of Payment. The **Secretary** agrees to reimburse the **KU** for the work completed and actual costs incurred in performance of the **Agreement** in accordance with the proposed budget, page 12 through 14 of the Workplan, in an amount not to exceed a total price of $ 892,496. A combination of Federal monies and State monies are used to fund this Project. The project costs referred to in this **Agreement** shall be comprised of the allowable direct costs incidental to the performance of the work described in the Workplan and indirect costs. Indirect costs shall not exceed **forty-six (46)** percent of the total direct costs to the extent that Federal-aid

funds are used for payment. In the event final approval of Federal appropriation is not obtained, the **Secretary** will be responsible for only those noncancelable obligations incurred by **KU** for work under this **Agreement.**

The **Secretary** agrees to make progress payments to the **KU** upon presentation of proper billing and certification of work performed. The **Secretary** will reimburse allowable costs as requested by the **KU** less two percent retainage. Certification of work performed will be documented by progress reports required under Section 11 of the **Agreement**. The **KU** shall indicate on the last project billing that it is the final billing. The final request for payment shall not be disbursed until the **Secretary** determines that all obligations of the **Agreement** have been completed. Reimbursement of any cost pursuant to this **Section** shall not constitute a final determination by the **Secretary** of the allowability of such cost and shall not constitute a waiver of any violation of the terms of the **Agreement** committed by the **KU**.

The **KU** agrees to obligate matching funds for additional direct and indirect costs included in the proposed budget in an amount of $ NONE. In the event final approval of Federal appropriation is not obtained, the **KU** will be responsible for only those additional direct and indirect costs associated with noncancelable obligations incurred by **KU** for work under this **Agreement**.

The portion of funds provided under the provisions of 23 U.S.C. 504 as amended by Section 1702 of the SAFETEA-LU may not be used to reimburse travel, subsistence or salary costs of trainees.

The test of allowability of a cost to be applied in this **Agreement** is based on the reasonableness of the allocation of the cost under generally accepted cost accounting principles and practices and in accordance with 48 Code of Federal Regulations (CFR) 1-31.00 et. seq., and relevance to tasks identified and described in the Workplan. However, such costs are subject to limitation as per **Agreement**.

The final payment due under provisions of this **Agreement** shall be made within ninety (90) days after the **Secretary's** and the appropriate Federal agency's acceptance and approval of the Final Evaluation Report and **KU'S** compliance with OMB A-133, Single Audit Act.

**Section 4**. Covenant Against Contingent Fees. The **KU** warrants and guarantees that provisions for covenants against contingent fees found in Special Attachment No. 2 are incorporated in this **Agreement** and made a part hereof. For breach or violation of this warranty, the **Secretary** shall have the right to annul this **Agreement** without liability, or in his discretion to deduct from the **Agreement** price or consideration, or otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift, or contingent fee.

**Section 5**. Rights in the Project.

A. Rights in Data. The **KU** grants to the **Secretary**, for any governmental purposes, the right to publish, translate, reproduce, deliver, use and dispose of, and to authorize others to do so, all data, including reports, drawings, blueprints, computer software which includes but is not limited to documentation and source code, and other technical information resulting from the

performance of work under this **Agreement**. When the **Secretary** authorizes others to use, for governmental purposes, any patented or copyrighted items arising from the project, the **Secretary** will issue a standard restriction **Agreement** to each party receiving authorization for return to **KU**.

B. Rights in Equipment. Title to equipment acquired by KU with project funds shall vest in **KU.** It is mutually agreed by **KU** and the **Secretary** that all apparatus and equipment purchased with funds provided by the **Secretary** shall be used by the **KU** for the project.

C. Rights in Intellectual Property. Consistent with KDOT and Kansas Board of Regents policy, the **KU** will retain all rights to intellectual property including patents and copyrights arising from the project. The **Secretary** and the **U.S. Government** shall retain a royalty—free, nonexclusive, irrevocable license to use any patent or copyright arising from the project for any governmental purposes. If the **KU** elects not to pursue the patenting or copyrighting of intellectual property, the **KU** will provide written notification to the **Secretary** who shall be free to do so. The **KU** agrees to include, within the specification of any United States patent or copyright application and any patent and copyright issuing, the following statement, "The invention (copyright) was made with funds provided by the Federal government and State of Kansas through the Kansas Department of Transportation."

D. Confidentiality. The **Secretary** and the **KU** agree that information exchanged and generated pursuant to this **Agreement**, will generally be non-confidential and suitable for publication. Nevertheless the **Secretary**, or his or her duly authorized representatives, may disclose to **KU**, during the course of the project, confidential information including data and statistics not suitable for public dissemination. **KU** agrees to maintain such information in confidence, and to prevent the disclosure thereof to others to the extent that such information is disclosed in writing and marked as confidential or proprietary; if orally disclosed, noted at the time of disclosure as being confidential and or proprietary, and reduced to writing within thirty (30) days after such oral disclosure, the writing being marked as confidential or proprietary. **KU** agrees that neither the **KU** nor any of its colleagues, employees or agents shall use any of the confidential information for any purpose whatsoever, other than to complete this assignment for KDOT. The **KU** agrees that the **KU** or any of its colleagues, employees or agents shall not keep any copies of the information provided by the **Secretary** or his or her duly authorized representatives that has been identified as confidential or proprietary, and provided pursuant to this **Agreement**.

**Section 6.** Work Responsibility. The Parties hereto mutually agree that the services to be performed under the terms of this **Agreement** are to be performed by the **KU,** with principal offices at the University of Kansas, Lawrence, Kansas and that their time and effort as defined in the Workplan, Special Attachment No. 3, cannot be assigned, sublet, or transferred to any other party without the written consent of the **Secretary. KU** accepts full responsibility for the Project and its conduct. The **KU** will bill the **Secretary** for reimbursement as specified in the **Agreement** as awarded. For the purposes of administrative efficiency, the **KU** will subcontract to the University of Kansas Center for Research, Inc. (KUCR), as KUCR is the normal administrative agency for projects under The University of Kansas. This subcontractual arrangement will in no way affect the work on the project, the scientific personnel, or the billing between the **KU** and the **Secretary**.

arrangement will in no way affect the work on the project, the scientific personnel, or the billing between the **KU** and the **Secretary**.

**Section 7.** Inspection and Approval of Work. The **KU** shall permit the **Secretary** or his or her duly authorized representative to inspect and audit all work, material, computer programs and other data and records either during the performance of project or for three years after final acceptance of the project. All work will be performed according to the requirements as outlined in the Workplan, Special Attachment No. 3. Final inspection of the project will be conducted by the **Secretary** or his or her duly authorized representative.

**Section 8.** Publication Provisions. Publication by any party to this **Agreement** shall give credit to all other parties. However, if the **Secretary** does not wish to subscribe to the findings or conclusions of an interim report, the following statement shall be added: "The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Kansas Department of Transportation." In the event of failure to reach a consensus between the **Secretary** and the **KU** relative to the publication of a final report, or any other reports during the period of the **Agreement**, the **Secretary** reserves the right to publish independently in which event the nonconcurrence of the **KU** shall be set forth in said publication, if requested by the **KU**.

**Section 9.** Audit and Retention of Records. Arrangements shall be made by the **KU** for the required financial and compliance audit to ensure that the audit will be made within the prescribed audit reporting cycle, and a copy of the OMB A—133 audit will be provided to the **Secretary**.

The **KU** shall be required to maintain accounting records and other evidence pertaining to the costs incurred and to make the records available to their office at all reasonable times during the **Agreement** period and for three (3) years from the date of the final payment to the **KU** under this **Agreement**. Such accounting records and other evidence pertaining to the costs incurred will be made available for inspection by the **Secretary** or his or her duly authorized representatives and copies thereof shall be furnished if requested.

**Section 10.** Termination of **Agreement**. Either party has the right to terminate this **Agreement** by giving thirty (30) days written notice in the event a determination is made that the project should be abandoned or indefinitely postponed; **Provided**, however, that in any case, the **KU** shall be paid the amount due for the services rendered and for any noncancelable obligations incurred prior to the date of termination on the basis of the provisions of this **Agreement** and provided that the **Secretary** shall receive full reports of all work performed to the date of termination of this **Agreement**.

**Section 11.** Reports. The **KU** shall advise the **Secretary** regarding the progress of the project at such times and in such a manner as the **Secretary** may require, including but not limited to the following:

1) A monthly summary of project expenditures by task including the following cost elements: salary & fringe benefits, overhead, professional services, supplies, travel, cumulative total task cost, and cumulative total cost expressed as percent of estimated total task cost.

2) A final report evaluating the effectiveness of the program.

**Section 12.** Cooperation and Disputes. The **Secretary** and the **KU** agree to make a reasonable effort to promptly resolve any disputes or questions concerning the project. The **Secretary** and the **KU** ensure that personnel will cooperate fully in carrying out the intent and provisions of this **Agreement**. The **Secretary** shall, in all cases not disposed of by **Agreement** among or between the Parties to this **Agreement**, resolve any disputes which may arise in connection with the work being performed under this **Agreement**.

**Section 13.** Compliance with Laws. The **KU** in the implementation of the administrative service and the **KU** in the implementation of the Workplan, both as provided for in this **Agreement**, agree to comply with all federal, state and local laws, ordinances and regulations, including but not limited to Title VI, Title VII and Title IX of the Civil Rights Act of 1964 and Executive Order 11246 as amended by Executive Order 11375 entitled "Equal Employment Opportunity;" Executive Order 12549 regarding debarment, eligibility, indictments, convictions, or civil judgements; and 31 U.S.C. Section 1352: Section 319 P.L. 101.21 prohibiting use of Federal funds for lobbying activities which are incorporated herein as Special Attachments Nos. 1, 5 and 6, respectively.

**Section 14.** Responsibility to Employees. The **KU** accepts full responsibility for payment of unemployment insurance, workmen's compensation, and social security as well as all income tax deductions and any other taxes or payroll deductions required by the law for its employees engaged in the work authorized by the **Agreement**.

**Section 15.** Employment of **Secretary's** Employees. The **KU** will not, without written permission from the **Secretary**, engage the services of any person or persons in the employment of the **Secretary** for any work required by the terms of the **Agreement**.

**Section 16.** Contractual Provisions Attachment. The provisions found in Contractual Provisions Attachment Form DA—146a, Special Attachment No. 4, which is attached hereto, are hereby incorporated in this **Agreement** and made a part hereof.

**Section 17.** Indemnification **Agreement**. The **KU** agrees to indemnify and hold harmless the **Secretary** and the **Secretary's** duly authorized representatives from any and all costs, liabilities, expenses, suits, judgments, damages to person or property or claims of any nature whatsoever arising out of the negligent acts of the **KU**, the **KU** employees or subcontractors, in the performance of this **Agreement**. The **KU** shall not be required to indemnify and hold the **Secretary** harmless for negligent acts of the **Secretary** or his or her duly authorized representatives or employees. Nothing in this indemnification clause is meant to affect Section 4 Disclaimer of Liability of DA—146a, Special Attachment No. 4.

**Section 18.** Prohibited Interest. No member, officer or employee of the **KU** during his/her tenure or one year thereafter shall have any interest, direct or indirect, in this **Agreement** or the proceeds thereof other than that allowed by Board of Regents policy.

**IN WITNESS WHEREOF** the Parties hereto have caused this **Agreement** to be signed by their duly authorized officers on the day and year first above written.

**KU**

Barbara Armbrister
Director
Research Administration

ATTEST

**Secretary**

Debra L. Miller
Secretary of Transportation
By: Jerome T. Younger, P.E.
Deputy Secretary for Engineering and
State Transportation Engineer

ATTEST

FORM APPROVED BY
HKU 11/13/07
Legal Dept.
KDOT

Special Attachment No. 1, Civil Rights Act
Special Attachment No. 2, Certification - Covenant Against Fees
Special Attachment No. 3, Workplan
Special Attachment No. 4, Form DA-146a
Special Attachment No. 5, Certification - Debarment
Special Attachment No. 6, Certification - Federal Aid Contracts

KANSAS DEPARTMENT OF TRANSPORTATION

Special Attachment

To Contracts or Agreements Entered Into
By the Secretary of Transportation of the State of Kansas

NOTE: Whenever this Special Attachment conflicts with provisions of the Document to which it is attached, this Special Attachment shall govern.

THE CIVIL RIGHTS ACT OF 1964, AND ANY AMENDMENTS THERETO,
REHABILITATION ACT OF 1973, AND ANY AMENDMENTS THERETO,
AMERICANS WITH DISABILITIES ACT OF 1990, AND ANY AMENDMENTS THERETO,
AGE DISCRIMINATION ACT OF 1975, AND ANY AMENDMENTS THERETO
EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW INCOME POPULATIONS (1994) AND ANY AMENDMENTS THERETO,
49 C.F.R. PART 26.1 (DBE PROGRAM), AND ANY AMENDMENTS THERETO

NOTIFICATION

The Secretary of Transportation for the State of Kansas, in accordance with the provisions of Title VI and Title VII of the Civil Rights Act of 1964 (78 Stat. 252), §504 of the Rehabilitation Act of 1973 (87 Stat. 355) and the Americans with Disabilities Act of 1990 (42 USC 12101), the Age Discrimination Act of 1975 (42 USC 6101) and the Regulations of the U.S. Department of Transportation (49 C.F.R., Part 21, 23 and 27), issued pursuant to such Act, and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (1994), and the DBE Program (49 C.F.R., Part 26.1), hereby notifies all contracting parties that, the contracting parties will affirmatively insure that this contract will be implemented without discrimination on the grounds of race, religion, color, gender, age, disability, national origin, or minority populations and low income populations as more specifically set out in the following nine "Nondiscrimination Clauses".

CLARIFICATION

Where the term "consultant" appears in the following seven "Nondiscrimination Clauses", the term "consultant" is understood to include all parties to contracts or agreements with the Secretary of Transportation of the State of Kansas.

Nondiscrimination Clauses

During the performance of this contract, the consultant, or the consultant's assignees and successors in interest (hereinafter referred to as the "consultant's"), agrees as follows:

(1) Compliance with Regulations: The consultant will comply with the Regulations of the U.S. Department of Transportation relative to nondiscrimination in federally-assisted programs of the U.S. Department of Transportation (Title 49, Code of Federal Regulations, Parts 21, 23 and 27, hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

(2) Nondiscrimination: The consultant, with regard to the work performed by the consultant after award and prior to the completion of the contract work, will not discriminate on the grounds of race, religion, color, gender, age, disability, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The consultant will not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

(3) Solicitations for Subcontractors, Including Procurements of Materials and Equipment: In all solicitations, either competitive bidding or negotiation made by the consultant for work to be performed under a subcontract including procurements of materials or equipment, each potential subcontractor or supplier shall be notified by the consultant of the consultant's obligation under this contract and the Regulations relative to nondiscrimination on the grounds of race, religion, color, gender, age, disability, national origin or minority populations and low income populations.

(4) Information and Reports: The consultant will provide all information and reports required by the Regulations, or orders and instructions issued pursuant thereto, and the Secretary of Transportation of the State of Kansas will be permitted access to the consultants books, records, accounts, other sources of information, and facilities as may be determined by the Secretary of Transportation of the State of Kansas to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of a consultant is in the exclusive possession of another who fails or refuses to furnish this information, the consultant shall so certify to the Secretary of Transportation of the State of Kansas and shall set forth what efforts it has made to obtain the information.

(5) Employment: The consultant will not discriminate against any employee or applicant for employment because of race, religion, color, gender, age, disability, or national origin.

6) Sanctions for Noncompliance: In the event of the consultant's noncompliance with the nondiscrimination provisions of this contract, the Secretary of Transportation of the State of Kansas shall impose such contract sanctions as the Secretary of Transportation of the State of Kansas may determine to be appropriate, including, but not limited to,

(a) withholding of payments to the consultant under the contract until the contractor complies, and/or

(b) cancellation, termination or suspension of the contract, in whole or in part.

(7) Disadvantaged Business Obligation

(a) Disadvantaged Businesses as defined in the Regulations, shall have a level playing field to compete fairly for contracts financed in whole or in part with Federal funds under this contract.

(b) All necessary and reasonable steps shall be taken in accordance with the Regulations to ensure that Disadvantaged Businesses have equal opportunity to compete for and perform contracts. No person(s) shall be discriminated against on the basis of race, color, gender, or national origin in the award and performance of Federally-assisted contracts.

(8) Executive Order 12898

(a) To the extent permitted by existing law, and whenever practical and appropriate, all necessary and reasonable steps shall be taken in accordance with Executive Order 12898 to collect, maintain, and analyze information on the race, color, national origin and income level of persons affected by the programs, policies and activities of the Secretary of Transportation and use such information in complying with this Order.

(9) Incorporation of Provisions: The consultant will include the provisions of paragraph (1) through (8) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, order, or instructions issued pursuant thereto. The consultant will take such action with respect to any subcontract or procurement as the Secretary of Transportation of the State of Kansas may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that, in the event a consultant becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the consultant may request the State to enter into such litigation to protect the interests of the State.

# CERTIFICATION OF THE UNIVERSITY OF KANSAS

I hereby certify that I am the Director and duly authorized representative of Research Administration at The University of Kansas and that neither I nor the above agency I here represent has:

(a) employed or retained for the payment of a commission, percentage, brokerage, contingent fee, or other consideration, any firm or person (other than a bona fide employee working solely for me or a consultant) to solicit or secure this Agreement,

(b) agreed, as an express or implied condition for obtaining this Agreement, to employ or retain the services of any firm or person in connection with carrying out the contract, or

(c) paid, or agreed to pay, to any firm, organization of persons (other than a bona fide employee working solely for me or a consultant) any fee, contribution, donation, or consideration of any kind for, or in connection with, procuring or carrying out the Agreement;

except as here expressly stated (if any):

I acknowledge that this certificate is to be furnished to the Secretary of Transportation of the State of Kansas in connection with this Agreement and is subject to applicable State and Federal laws, both criminal and civil.

11/7/08
(Date)

Barbara Armbrister
Director, Research Administration

CERTIFICATION OF THE SECRETARY OF TRANSPORTATION

I hereby certify that I am the Secretary of Transportation of the State of Kansas, and that The University of Kansas or their representative has not been required, directly or indirectly as an express or implied condition in connection with obtaining or carrying out this Agreement to:

(a) employ or retain, or agree to employ or retain, any firm or person, or

(b) pay, or agree to pay, to any firm, person, or organization, any fee, contribution, donation, or consideration of any kind;

except as here expressly stated (if any):

I acknowledge that this certificate is to be furnished to the above referenced firm in connection with this Agreement, and is subject to applicable State and Federal laws, both criminal and civil.

11/19/08
(Date)

Debra L. Miller
Secretary of Transportation
By: Jerome T. Younger, P.E.
Deputy Secretary for Engineering and
State Transportation Engineer

FORM APPROVED BY
MAH 11/13/08
Legal Dept.
KDOT

Proposal to

Kansas Department of Transportation

For

**Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue**

Period of Performance: 09/01/2008-08/31/2011
Funds Requested: $892,496

from

The University of Kansas
2385 Irving Hill Road
Lawrence, KS 66045-7563

Project Personnel:
Caroline Bennett, PI
Assistant Professor, Department of Civil, Environmental, and Architectural Engineering
The University of Kansas
Lawrence, KS 66045

APPROVALS:

Caroline Bennett
Principal Investigator

Barbara J. Armbrister, Director
Research Administration

This is a proposal from the University of Kansas to the Kansas Department of Transportation for the period 09/01/2008 to 08/31/2011. The University of Kansas accepts full responsibility for the project and its conduct. The University will bill KDOT for reimbursement as specified in the contract as awarded. For the purposes of administrative efficiency, the University will subcontract to the Center for Research, Inc. (KUCR), as KUCR is the normal administrative agency for projects under the University of Kansas. This subcontractual arrangement will in no way affect the work on the project, the scientific personnel, or the billing between the University and the Department of Transportation.

THE UNIVERSITY OF KANSAS

Barbara J. Armbrister, Director
Research Administration
2385 Irving Hill Road
Lawrence, Kansas 66045-7563
Phone: (785) 864-7431
FAX: (785) 864-5049

11/7/08
Date

# Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue

Stan Rolfe, Adolfo Matamoros, Caroline Bennett, Ron Barrett-Gonzalez

## Executive Summary

A large number of steel bridges within the national inventory are affected by distortion-induced fatigue cracks. Repairs for this type of failure can be very costly, both in terms of direct construction costs and indirect costs due to disruption of traffic. Furthermore, physical constraints inherent to connection repairs conducted in the field sometimes limit the type of technique that may be employed. The goal of the proposed research is to investigate the relative merit of two different repair techniques for distortion-induced fatigue cracks: drilling undersized holes subsequently treated with Ultrasonic Impact Treatment (UIT) or bolt interference, and stiffening the connection with a layer of composite materials through Chopped-Fiber Spray Lamination. These techniques were selected because they can be implemented with limited or no disruption to traffic, and because it is possible to use them in areas with restricted space within bridge structures.

## Project Personnel

The proposed research will be carried out by a group of faculty from the University of Kansas in partnership with practicing professionals from the private and public sectors with expertise in the areas of fracture and fatigue, bridge maintenance, strengthening, and repair. The Fracture and Fatigue Research group at the University of Kansas is led by Dr. Stanley Rolfe (Civil, Environmental, and Architectural Engineering Dept.), who has vast experience in the field of fatigue and fracture. Professor Rolfe has published over 70 technical articles in fatigue and fracture of steel structures, and is a recipient of the ASTM Fracture Mechanics Medal. Dr. Adolfo Matamoros (CEAE Dept.) and Dr. Caroline Bennett (CEAE Dept.) have extensive experience in linear and nonlinear finite-element analyses, as well as field and laboratory experimental testing. Dr. Ron Barrett-Gonzalez (Aerospace Engineering Dept.) is an expert on the use of composite materials and applications. External partners include Dr. John Barsom (President of Barsom Consulting Ltd.) who is consultant in the area of fracture mechanics and failure analysis. He has authored more than 80 technical papers on fracture, fatigue, steel and weld metal properties, and performance of structural connections. Dr. William Clawson (Vice President of HNTB Corp.) will serve as consultant with expertise in design and retrofitting of steel bridges. The research group will work in close collaboration with John Jones and Kenneth Hurst, engineers from the Kansas Department of Transportation, and Ron Bruce (President of Builders Steel) who will be the fabrication partner throughout the research effort.

## Problem Statement and Objective

Distortion-induced fatigue cracks constitute a serious national problem given the large number of steel girder bridges constructed before 1985 that are affected by this type of failure. It is estimated that 90% of all fatigue-related cracks in bridges have arisen due to out-of-plane distortion (Connor and Fisher 2006). Finding, repairing, and potentially preventing fatigue cracks at details susceptible to out-of-plane distortion represents a significant expense to State DOTs. This problem is exacerbated by the fact that many of the affected bridge structures carry large traffic loads, or their geographical location is such that temporary closure would cause significant disruption to the economic activity of the local residents. While a number of repair and retrofit methods have been shown to be effective in addressing this problem (Roddis and Zhao 2001; Roddis and Zhao 2003; Stallings et al. 1999; Connor and Fisher 2006), these strategies can be time-consuming, expensive to implement, and often require temporary bridge closures. There are also instances in which these methods cannot be implemented due to lack of space in the affected region of the bridge. In those cases, the use of new and/or combined techniques may present a viable method for fatigue life extension.

The main objective of the proposed research is to ***explore the use of composite materials and hole treatments (ultrasonic impact treatment and bolt interference) to develop new retrofitting techniques aimed at extending the fatigue life of bridges with connection details susceptible to distortion-induced fatigue.*** The techniques that will be studied were selected because they are relatively inexpensive, easy to implement, and can be carried out without significant disruptions to traffic.

## Background

Distortion-induced fatigue cracks develop near or at connections between girders and out-of-plane elements (Figure 1). Prior to 1985 it was common practice to assume that stresses induced by the out-of-plane elements on bridge girders were secondary effects, and therefore negligible. Two common scenarios in which out-of-plane elements induce significantly high stresses on girders, making the distortion problem more pronounced, are: (1) skewed and/or horizontally curved girder bridges, in which the distance from a given station to the support is significantly different for two adjacent girders, and (2) bridges in which the superstructure is comprised of two or three deep girders. Due to the lack of redundancy in the latter case, a large fraction of the traffic load acting on the superstructure is transmitted directly to a single girder. In both cases, out-of-plane stresses are induced by differential deflections between adjacent girders.

For either of the two scenarios, secondary stresses caused by differential girder displacements often have the most detrimental effect at the junction of a connection plate welded to the girder web, usually near the top flange of the girder. Prior to 1985, the AASHTO Standard Specifications for Highway Bridges (AASHTO 1982) did not require any connectivity between connection plates and the top flanges of girders.

Therefore, a large percentage of the steel girder bridges built before 1985 lack this connection and are at risk of sustaining significant fatigue damage. Figure 1(a) shows a girder without a connection between the top flange and the connection plate.

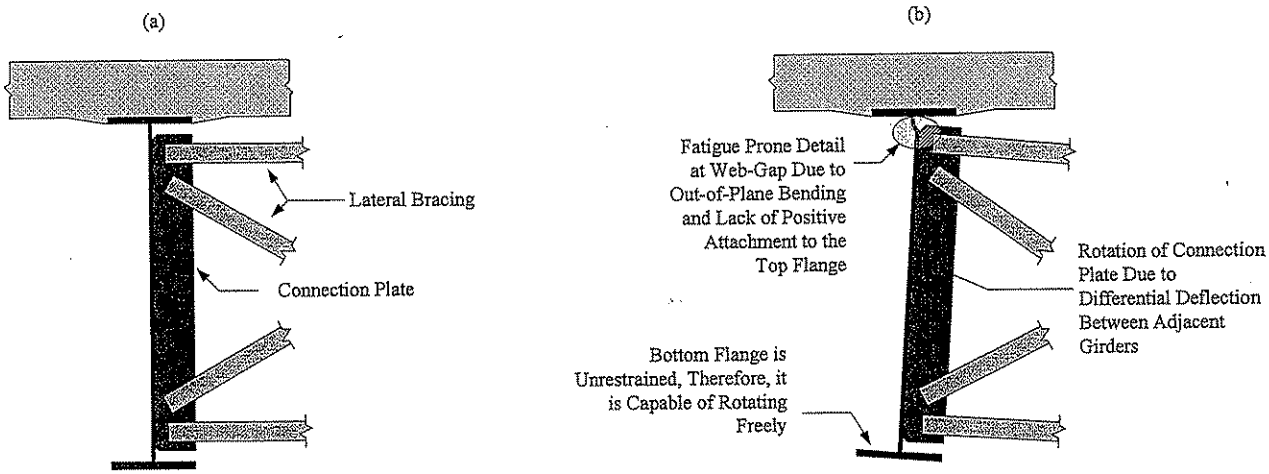


**Figure 1: (a) Girder Cross-Section before Differential Displacement**
**(b) Girder Cross-Section after Differential Displacement**

The aforementioned connection detail is particularly vulnerable because the top flange is restrained from rotating and displacing in the horizontal direction by the concrete deck. The out-of-plane flexural stiffness of the web is increased significantly by the connection plate, leaving a very short, relatively flexible region in the gap between the connection plate and the bridge deck. Equilibrium in the horizontal direction dictates that the out-of-plane loading must be transferred from the top of the connection plate to the top flange through this flexible web section, causing a significant out-of-plane distortion (Figure 1(b)). The short length of unstiffened web between the top flange and the connection plate is commonly referred to as the "web gap" region. Because the bottom flange is relatively unrestrained and it is able to rotate freely, the effects of distortion are significantly less at that location.

Successful retrofit strategies used in the past have been aimed at changing the out-of-plane stiffness of the connection. One such strategy (Figure 2) consists of providing an alternate load path for the lateral loads by introducing a mechanical connection between the plate and the girder flange (Roddis and Zhao, 2001). This strategy results in a significant increase in the stiffness of the connection. A different strategy relies on increasing the length of the web gap, which has the effect of decreasing the stiffness of the connection. While the effects of these two approaches are opposite on the lateral stiffness of the connection, both have been shown to be effective in reducing the stress range in the web-gap region (Roddis and Zhao 2001). Other strategies rely on disconnecting adjacent girders by removing lateral bracing or diaphragms (Stallings et al. 1999), allowing the girders to deflect independently without suffering damage from stresses due to out-of-

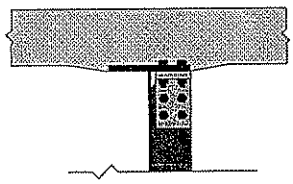

**Figure 2: Bolted Angle Retrofit Technique for Stiffening of Web-Gap Region**

plane loads. The main drawback of these techniques is their cost, and in some cases, complications associated with the use of field welds. These practices may require access to the full thickness of the girder top flange to install bolts, which can require removing portions of the concrete bridge deck. This type of work is difficult to perform without disruption to traffic. If the connection is to be stiffened using a welded retrofit, field welding must be performed in the least desirable positions, and in very tight conditions. An ideal solution to this problem should be inexpensive and easy to implement, should minimize traffic disruptions, and should be effective at mitigating future fatigue cracking. The proposed study will investigate retrofit techniques that meet the aforementioned characteristics.

Two techniques that have separately shown great promise as fatigue improvement methods are (1) the addition of bolts to provide an alternate load path, and (2) ultrasonic impact treatment (UIT) of welds to improve fatigue life of the welds (Wright 1996; Fisher et al. 2001). A study is currently under way at the University of Kansas to examine the effects of combining repair techniques to extend the fatigue life of a simple, two-dimensional, category E detail. The specimens used in the study (Figure 3) consist of two-plate assemblies representative of a bottom flange and a welded cover plate loaded in three-point bending. A total of fifteen specimens are being tested to evaluate the increase in fatigue life obtained by using the two retrofit measures separately and in combination.

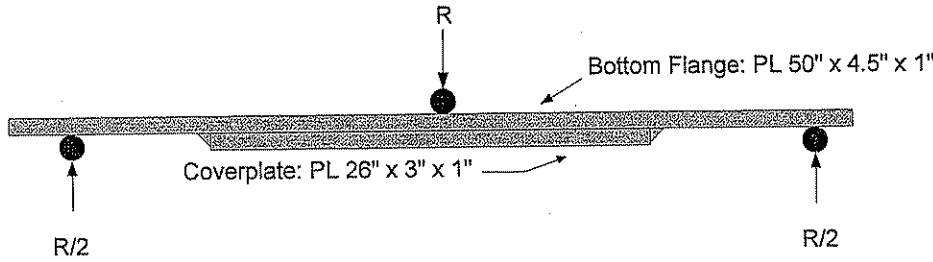


**Figure 3: Fatigue Specimen in Three-Pt. Bending**

A third retrofit measure currently being evaluated at the University of Kansas in a study sponsored by the KU Transportation Research Institute (TRI), is the attachment of composite materials to the specimens shown in Figure 3, with the primary goal of providing an alternate load path. A secondary goal of the KU TRI project is to explore the use of composites as fatigue life indicators, or "fuses". Figure 4 depicts the fatigue specimens outfitted with the composite doublers.

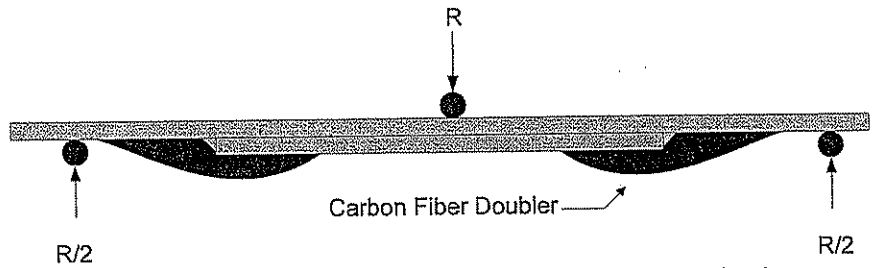


**Figure 4: Fatigue Specimen with Composite Application**

The KU research group is preparing to perform another preliminary study on flat plate specimens with undersized drilled crack "stop holes" treated with UIT and bolt interference. A method commonly implemented to arrest fatigue crack

propagation is to drill holes at the end of an existing crack. Hole drilling changes the crack geometry from being "infinitely sharp" at the crack tip to having a well-defined radius at its end. If the drilled hole radius is sufficiently large, it will completely halt crack propagation. The equation describing the required radius to halt crack propagation was developed by Barsom and McNicol (1974) and later extended by Fisher (Fisher et al. 1980), and is well-established. Due to tight geometry in regions such as the one pictured in Figure 1, it is not always possible to drill a stop-hole with a large enough radius to arrest crack propagation. For this reason, it would be highly beneficial to develop repair methods for crack arrestment that require hole diameters smaller than those dictated by the equation developed by Barsom and McNicol (1974). The combination of an undersized hole and additional treatment may be effective in reducing the diameter of the hole needed to arrest cracking. Treatment of the perimeter of the hole to induce residual compressive stresses has been shown to extend fatigue life in aerospace applications (Lanciotti and Polese 2005). This study will examine the effect of treatments on the performance of undersized holes drilled to stop the propagation of cracking on two-dimensional specimens. Sixteen flat plate specimens will be tested in fatigue to study the effect of hole treatments on crack propagation.

Preliminary research at the University of Kansas has yielded valuable information about the use of the aforementioned techniques to improve fatigue life. The proposed pooled fund research program will leverage this experience and use it to develop improved retrofit measures for distortion-induced fatigue cracks.

The composite material layers used in the TRI study currently underway at the University of Kansas consist of carbon fiber reinforced polymers. While this type of composite material has significant advantages in terms of stiffness, it shares many of the same constructability drawbacks that existing retrofit measures for distortion-induced fatigue suffer from. A more viable alternative in terms of cost and constructability is the use of chopped-fiber spray lamination. Chopped-fiber spray lamination takes advantage of low-cost fabrication techniques to build up a protective jacket of fiber reinforced plastic (FRP) around complex joints. This technique of FRP application has been used for decades in the creation of consumer goods, but also has promise in the bridge engineering arena. The technique relies on a gravity-fed spray gun, which mixes resin and chopped fibers at the nozzle. The user sprays the FRP mixture onto the piece being reinforced, eliminating many of the problems associated with conventional wet lay-up techniques.

The chopped-fiber spray laminations will be used to provide positive connectivity between the top flange and connection plate, as well as to reduce the severity of the stiffness change in the web gap region. Both of these effects have been shown to improve the fatigue resistance of complex joints that suffer from distortion-induced effects. Furthermore, this process may be used as an indication technique for detection of pending fatigue problems.

## Proposed Research

The proposed study will investigate innovative techniques for improving the fatigue life of steel girder bridges, specifically focusing on the urgent and ubiquitous problem of distortion-induced effects. The project will include computational and physical simulations of girder assemblies to evaluate the effectiveness of various retrofit techniques.

***Test Set-Up:*** The proposed experimental configuration is shown in Figure 5. The test set-up is comprised of a reaction frame and specimens consisting of one simply-supported bridge span with three I-girders connected through lateral bracing. A reinforced concrete deck will be cast on top of the girders to properly model the effects of the axial and flexural stiffness of the deck.

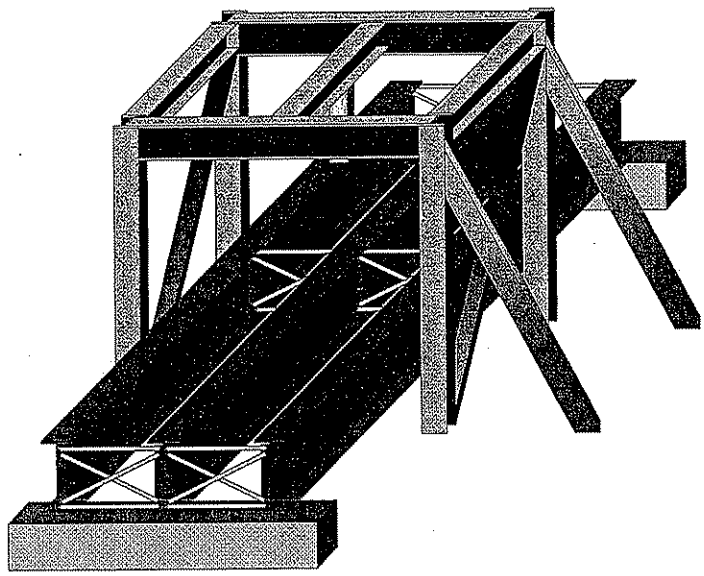

**Figure 5: Test Set-up for Loading Girder System**

The center girder will be loaded vertically at midspan causing a relative displacement between the center and exterior girders. The exterior girders are expected to be subjected to out-of-plane displacements, as illustrated in Figure 1(b).

The girders will be reduced-scale models of typical slab-on-girder systems. It is anticipated that a scale in the range of 25% - 50% of the actual girder size will be implemented. A span length of approximately 25 ft will be utilized. A scaled concrete slab will be constructed over the portion of the system being loaded; it will not be cast continuously over the entire span due to access and monitoring considerations. The concrete slab will span all three girders for a length of approximately 6 ft.

The retrofit techniques to be examined alone and in combination are (1) UIT and interference-fit fasteners and (2) Sprayed Chopped Fiber Composites.

***UIT and Bolt Interference:*** In the repair of bridge structures there are instances in which it is not possible to drill a hole large enough (Barsom and McNicol 1974) to prevent re-initiation of fatigue cracks. In these cases the use of a smaller hole with treatment of the interior perimeter may be sufficient to extend fatigue life, or at least to provide a viable measure until a better solution can be implemented. The use of UIT on welds has been examined by the KU Team on two-dimensional specimens. Application of UIT to the inner surface of crack-stop holes is being studied on two-dimensional flat plates, and will be investigated on three-dimensional connections to determine its effectiveness as an additional treatment when full-diameter stop holes cannot be drilled. Another potential method for arresting crack propagation is the use of interference-fit

fasteners, which introduce a compressive stress field that emanates outward from the interior of the bolt hole. Bolt interference has been previously studied in the aerospace field as means for improving the fatigue lives of aluminum structures (Lanciotti and Polese 2005); this study will apply that technology to steel bridges.

***Chopped-Spray Lamination Retrofit:*** The second technique to be examined is chopped-fiber spray lamination. Susceptible bridge details will be coated with chopped-fiber polymers, applied using a gravity-fed spray gun. The effects of this FRP on fatigue performance will be investigated. In previous work, it was shown that although the material stiffness of fiber reinforced plastic (FRP) is lower than steel, a build-up method can easily make the flexural stiffness of the FRP lamination much greater than the adjacent steel parts to be supported. As part of the chopped fiber lamination portion of this study, the investigators will also develop an indication technique aimed at helping inspectors detect fatigue failure. A method of indication is being developed at KU that would be refined as part of this project, and will be discussed in more detail in a full proposal.

***Test Sequence:*** The test sequence described in the following list will be performed to investigate the effects of different retrofit techniques on the fatigue life of steel girder systems.

- Two systems with no treatments
- Two systems with previously-studied, conventional retrofit techniques (bolted and/or welded angle techniques)
- Two systems with out-of-plane fatigue-prone details treated with UIT and undersized-diameter holes
- Two systems with chopped-fiber spray composites applied to the fatigue details
- Two systems with UIT, undersized-diameter holes, and chopped-fiber spray composites applied to the fatigue details

***Analytical Investigation:*** A comprehensive finite element study will be carried out using the commercial finite element modeling package, ABAQUS. The goals of the finite element analysis are: (1) To corroborate and explain the behavior observed in the experimental study, and (2) to perform numerical parametric studies to investigate different connection configurations and retrofit measures. Additionally, the development of accurate baseline finite element models will enable the researchers to better model the effect of adding chopped-fiber spray composite layers.

## Deliverables

The KU Fatigue and Fracture Research Group will produce recommendations concerning the proposed retrofit techniques, including (but not limited to) application techniques, expected levels of fatigue performance, methods of fatigue life indication, and implementation costs. The researchers will produce a Final Report, as well as

quarterly reports. The researchers intend to publicly disseminate results in public forums through such avenues as peer-reviewed publications and conference proceedings.

## Project Schedule

The proposed schedule of work for this project is shown in Table 1. Each year has been broken into quarters.

**Table 1: Schedule of Project Tasks**

| | Year 1 ('07-'08) | | | | Year 2 ('08-'09) | | | | Year 3 ('09-'10) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task Description** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| 1. Extensive Literature Review | | | | | | | | | | | | |
| 2. Review of proposed connection details with external review group. | | | | | | | | | | | | |
| 3. Bridge System Design | | | | | | | | | | | | |
| 4. Design of Test Frame | | | | | | | | | | | | |
| 5. Fabrication and Erection of Test Frame | | | | | | | | | | | | |
| 6. Fabrication of Test Specimens | | | | | | | | | | | | |
| 7. Full-Scale Finite Element Modeling | | | | | | | | | | | | |
| 8. Experimental Testing of Girder Systems | | | | | | | | | | | | |
| 9. Data Reduction of Recommendations | | | | | | | | | | | | |

## Budget Considerations

KU has been in continuous contact with the Kansas Department of Transportation (KDOT) throughout the process of preparing this proposal. KDOT has committed funds to design and fabricate the test frame in the amount of $75,000. KDOT is committed to participation in a pooled-fund study.

In addition to the KDOT grant for construction of the test set-up, the KU team is seeking funding support from the KU Transportation Research Institute (TRI) for testing of an initial girder assemblage. Preliminary discussions have taken place to establish a partnership with the American Institute of Steel Construction. The goal of the investigators is to secure partial funding from these sources, reserving pooled funds for specimen fabrication and experimental testing.

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Barsom, J.M. and McNicol, R.C. (1974). "Effect of Stress Concentration on Fatigue-Crack Initiation in HY-130 Steel," *ASTM STP 559,* American Society for Testing and Materials, Philadelphia, PA.

Connor, R. and Fisher, J. (2006). "Identifying effective and ineffective retrofits for distortion fatigue cracking in steel bridges using field instrumentation," *Journal of Bridge Engineering*, 11(6), 745-752.

Fisher, J. Statnikov, E., and Tehini, L. (2001). "Fatigue Strength Enhancement by Means of Weld Design Change and the Application of Ultrasonic Impact Treatment," ATLSS Engineering Research Center, Lehigh University, Bethlehem, Pennsylvania.

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Lanciotti, A. and Polese, C. (2005). "The effect of interference-fit fasteners on the fatigue life of central hole specimens," *Fatigue and Fracture of Engineering Materials and Structures*, 28, 587-597.

Roddis, K. and Zhao, Y. (2001). "Out-of-plane fatigue cracking in welded steel bridges," *Welding Innovations*, 27(2), 2-7.

Roddis, K. and Zhao, Y. (2003). "Finite-element analysis of steel bridge distortion-induced fatigue," *Journal of Bridge Engineering*, 8(5), 259-266.

Stallings, J., Cousins, T., and Stafford, T. (1999). "Removal of diaphragms from three-span steel girder bridge," 4(1), 63-70.

Wright, W. (1996). "Post-Weld Treatment of a Welded Bridge Girder by Ultrasonic Impact Treatment," Federal Highway Administration, Turner-Fairbank Highway Research Center, McLean, Virginia.

# PROPOSED BUDGET

Year 1 9/1/08 - 8/31/09

**SALARIES AND WAGES**

| Senior Personnel | | % time | Months | Rate | | |
|---|---|---|---|---|---|---|
| *Caroline Bennett, PI* | | | | | | |
| summer 2009 | | 100.00 | 1.10 | 8,060 | 8,866 | |
| *Stanley T. Rolfe, Co-I* | | | | | | |
| summer 2009 | 1 | 100.00 | 0.50 | 16,781 | 8,391 | |
| *Adolfo B. Matamoros, Co-I* | | | | | | |
| summer 2009 | 1 | 100.00 | 0.90 | 9,921 | 8,929 | |
| *Ron Barrett-Gonzalez, Co-I* | | | | | | |
| summer 2009 | 1 | 100.00 | 0.80 | 10,974 | 8,779 | |
| Total senior personnel | | | | | | 34,965 |
| Other Personnel | Persons | % time | Months | Rate | | |
| *Graduate Student (PhD)* | | | | | | |
| acad | 2 | 50 | 9.0 | 3,200 | 28,800 | |
| summer | 2 | 50 | 3.0 | 3,200 | 9,600 | |
| Total PhD student | | | | | 38,400 | |
| *Undergraduate Student(s)* | Persons | | Hours | Rate | | |
| calendar | 1 | | 500.0 | 10.00 | 5,000 | |
| *Administrative Assistant* | Persons | % time | Months | Rate | | |
| calendar | | | | | 0 | |
| *Lab Technician* | Persons | % time | Hours | Rate | | |
| calendar | 1 | 100 | 300.0 | 35.00 | 10,500 | |
| Total other personnel | | | | | | 53,900 |
| Total salaries and wages | | | | | | 88,865 |

**FRINGE BENEFITS**

| | | |
|---|---|---|
| 32% faculty and staff | 14,549 | |
| 12% students (employed 76% or more) | 0 | |
| 4% students (employed 75% or less) | 1,736 | |
| Total fringe benefits | | 16,285 |
| Total salaries, wages & fringe benefits | | 105,150 |

**EQUIPMENT**

| | |
|---|---|
| Actuator | 110,000 |

Note: At time of award any additionally needed funds will be provided by the University.

**TRAVEL**

| | |
|---|---|
| Total travel | 5,000 |

**OTHER DIRECT COSTS**

| | | | | | |
|---|---|---|---|---|---|
| Research materials & supplies | | | | 10,000 | |
| Publications (copying and distribution of research results) | | | | 0 | |
| Subawards-Test specimen construction and fabrication | | | | 55,000 | |
| Tuition | Fall 08 | Spring 09 | Sum 09 | | |
| PhD student @ | 3048 | 3048 | 1086 | 7,182 | |
| PhD student @ | 3048 | 3048 | 1086 | 7,182 | |
| Total Other Direct Costs | | | | | 79,364 |
| **TOTAL DIRECT COSTS** | | | | | 299,514 |
| **INDIRECT COSTS** | | | | | 66,769 |
| **TOTAL PROPOSED COSTS - YEAR 1** | | | | | **$366,283** |
| *TOTAL FOR ALL THREE YEARS* | | | | | *$892,496* |

# PROPOSED BUDGET

Year 2: 9/1/09 - 8/31/10

**SALARIES AND WAGES**

| Senior Personnel | | % time | Months | Rate | | |
|---|---|---|---|---|---|---|
| *Caroline Bennett, PI* | | | | | | |
| summer 2010 | | 100.00 | 1.10 | 8,463 | 9,309 | |
| *Stanley T. Rolfe, Co-I* | | | | | | |
| summer 2010 | 1 | 100.00 | 0.50 | 17,620 | 8,810 | |
| *Adolfo B. Matamoros, Co-I* | | | | | | |
| summer 2010 | 1 | 100.00 | 0.90 | 10,417 | 9,375 | |
| *Ron Barrett-Gonzalez, Co-I* | | | | | | |
| summer 2010 | 1 | 100.00 | 0.80 | 11,523 | 9,218 | |
| Total senior personnel | | | | | | 36,712 |
| Other Personnel | Persons | % time | Months | Rate | | |
| *Graduate Student (PhD)* | | | | | | |
| acad | 2 | 50 | 9.0 | 3,376 | 30,384 | |
| summer | 2 | 50 | 3.0 | 3,376 | 10,128 | |
| Total M.S. student | | | | | 40,512 | |
| *Undergraduate Student(s)* | Persons | | Hours | Rate | | |
| calendar | 1 | | 500.0 | 10.00 | 5,000 | |
| *Lab Technician* | Persons | % time | Hours | Rate | | |
| calendar | 1 | 100 | 300.0 | 35.00 | 10,500 | |
| Total other personnel | | | | | | 56,012 |
| Total salaries and wages | | | | | | 92,724 |

**FRINGE BENEFITS**

| | | |
|---|---|---|
| 32% faculty and staff | 15,108 | |
| 12% students (employed 76% or more) | 0 | |
| 4% students (employed 75% or less) | 1,820 | |
| Total fringe benefits | | 16,928 |
| Total salaries, wages & fringe benefits | | 109,652 |

**TRAVEL**

| | |
|---|---|
| Total travel | 10,000 |

**OTHER DIRECT COSTS**

| | | | | | |
|---|---|---|---|---|---|
| Research materials & supplies | | | | 10,000 | |
| Subawards-Test specimen construction and fabrication | | | | 55,000 | |
| Other: | | | | | |
| Tuition | Fall 09 | Spring 10 | Sum 10 | | |
| PhD student @ | 3186 | 3186 | 1132 | 7,504 | |
| PhD student @ | 3186 | 3186 | 1132 | 7,504 | |
| Total Other Direct Costs | | | | | 80,008 |

| | |
|---|---|
| **TOTAL DIRECT COSTS** | 199,660 |
| **INDIRECT COSTS** | 59,640 |
| **TOTAL PROPOSED COSTS - YEAR 2** | **$259,300** |
| **TOTAL PROPOSED COSTS YEAR 1 - YEAR 2** | **$625,583** |
| ***TOTAL FOR ALL THREE YEARS*** | ***$892,496*** |

# PROPOSED BUDGET

Year 3: 9/1/10 - 8/31/11

**SALARIES AND WAGES**

| Senior Personnel | | % time | Months | Rate | | |
|---|---|---|---|---|---|---|
| *Caroline Bennett, PI* | | | | | | |
| summer 2011 | 1 | 100.00 | 1.10 | 8,886 | 9,775 | |
| *Stanley T. Rolfe, Co-I* | | | | | | |
| summer 2011 | 1 | 100.00 | 0.50 | 18,501 | 9,251 | |
| *Adolfo B. Matamoros, Co-I* | | | | | | |
| summer 2011 | 1 | 100.00 | 0.90 | 10,938 | 9,844 | |
| *Ron Barrett-Gonzalez, Co-I* | | | | | | |
| summer 2011 | 1 | 100.00 | 0.80 | 12,099 | 9,679 | |
| Total senior personnel | | | | | | 38,549 |
| Other Personnel | Persons | % time | Months | Rate | | |
| *Graduate Student (PhD)* | | | | | | |
| acad | 2 | 50 | 9.0 | 3,562 | 32,058 | |
| summer | 2 | 50 | 3.0 | 3,562 | 10,686 | |
| Total M.S. student | | | | | 42,744 | |
| *Undergraduate Student(s)* | Persons | | Hours | Rate | | |
| calendar | 1 | | 500.0 | 10.00 | 5,000 | |
| *Lab Technician* | Persons | % time | Hours | Rate | | |
| calendar | 1 | 100 | 300.0 | 35.00 | 10,500 | |
| Total other personnel | | | | | | 58,244 |
| Total salaries and wages | | | | | | 96,793 |

**FRINGE BENEFITS**

| | | |
|---|---|---|
| 32% faculty and staff | 15,696 | |
| 12% students (employed 76% or more) | 0 | |
| 4% students (employed 75% or less) | 1,910 | |
| Total fringe benefits | | 17,606 |
| Total salaries, wages & fringe benefits | | 114,399 |

**TRAVEL**

| | |
|---|---|
| Total travel | 10,000 |

**OTHER DIRECT COSTS**

| | | | | | |
|---|---|---|---|---|---|
| Research materials & supplies | | | | 10,000 | |
| Subawards-Test specimen construction and fabrication | | | | 55,000 | |
| Other: | | | | | |
| Tuition | Fall 10 | Spring 11 | Sum 11 | | |
| PhD student @ | 3332 | 3332 | 1181 | 7,845 | |
| PhD student @ | 3332 | 3332 | 1181 | 7,845 | |
| Total Other Direct Costs | | | | | 80,690 |

| | |
|---|---|
| **TOTAL DIRECT COSTS** | 205,089 |
| **INDIRECT COSTS** | 61,824 |
| **TOTAL PROPOSED COSTS - YEAR 3** | **$266,913** |
| *TOTAL FOR ALL THREE YEARS* | ***$892,496*** |

State of Kansas
Department of Administration
DA-146a (Rev. 1-01)

# CONTRACTUAL PROVISIONS ATTACHMENT

Important: This form contains mandatory contract provisions and must be attached to or incorporated in all copies of any contractual agreement. If it is attached to the vendor/contractor's standard contract form, then that form must be altered to contain the following provision:

"The Provisions found in Contractual Provisions Attachment (Form DA-146a, Rev. 1-01), which is attached hereto, are hereby incorporated in this contract and made a part thereof."

The parties agree that the following provisions are hereby incorporated into the contract to which it is attached and made a part thereof, said contract being the _____ day of _____, 20____.

1. **Terms Herein Controlling Provisions**: It is expressly agreed that the terms of each and every provision in this attachment shall prevail and control over the terms of any other conflicting provision in any other document relating to and a part of the contract in which this attachment is incorporated.

2. **Agreement With Kansas Law**: All contractual agreements shall be subject to, governed by, and construed according to the laws of the State of Kansas.

3. **Termination Due To Lack Of Funding Appropriation**: If, in the judgment of the Director of Accounts and Reports, Department of Administration, sufficient funds are not appropriated to continue the function performed in this agreement and for the payment of the charges hereunder, State may terminate this agreement at the end of its current fiscal year. State agrees to give written notice of termination to contractor at least 30 days prior to the end of its current fiscal year, and shall give such notice for a greater period prior to the end of such fiscal year as may be provided in this contract, except that such notice shall not be required prior to 90 days before the end of such fiscal year. Contractor shall have the right, at the end of such fiscal year, to take possession of any equipment provided State under the contract. State will pay to the contractor all regular contractual payments incurred through the end of such fiscal year, plus contractual charges incidental to the return of any such equipment. Upon termination of the agreement by State, title to any such equipment shall revert to contractor at the end of State's current fiscal year. The termination of the contract pursuant to this paragraph shall not cause any penalty to be charged to the agency or the contractor.

4. **Disclaimer Of Liability**: Neither the State of Kansas nor any agency thereof shall hold harmless or indemnify any contractor beyond that liability incurred under the Kansas Tort Claims Act (K.S.A. 75-6101 et seq.).

5. **Anti-Discrimination Clause**: The contractor agrees: (a) to comply with the Kansas Act Against Discrimination (K.S.A. 44-1001 et seq.) and the Kansas Age Discrimination in Employment Act (K.S.A. 44-1111 et seq.) and the applicable provisions of the Americans With Disabilities Act (42 U.S.C. 12101 et seq.) (ADA) and to not discriminate against any person because of race, religion, color, sex, disability, national origin or ancestry, or age in the admission or access to, or treatment or employment in, its programs or activities; (b) to include in all solicitations or advertisements for employees, the phrase "equal opportunity employer"; (c) to comply with the reporting requirements set out at K.S.A. 44-1031 and K.S.A. 44-1116; (d) to include those provisions in every subcontract or purchase order so that they are binding upon such subcontractor or vendor; (e) that a failure to comply with the reporting requirements of (c) above or if the contractor is found guilty of any violation of such acts by the Kansas Human Rights Commission, such violation shall constitute a breach of contract and the contract may be cancelled, terminated or suspended, in whole or in part, by the contracting state agency or the Kansas Department of Administration; (f) if it is determined that the contractor has violated applicable provisions of ADA, such violation shall constitute a breach of contract and the contract may be cancelled, terminated or suspended, in whole or in part, by the contracting state agency or the Kansas Department of Administration.

   Parties to this contract understand that the provisions of this paragraph number 5 (with the exception of those provisions relating to the ADA) are not applicable to a contractor who employs fewer than four employees during the term of such contract or whose contracts with the contracting state agency cumulatively total $5,000 or less during the fiscal year of such agency.

6. **Acceptance Of Contract**: This contract shall not be considered accepted, approved or otherwise effective until the statutorily required approvals and certifications have been given.

7. **Arbitration, Damages, Warranties**: Notwithstanding any language to the contrary, no interpretation shall be allowed to find the State or any agency thereof has agreed to binding arbitration, or the payment of damages or penalties upon the occurrence of a contingency. Further, the State of Kansas shall not agree to pay attorney fees and late payment charges beyond those available under the Kansas Prompt Payment Act (K.S.A. 75-6403), and no provision will be given effect which attempts to exclude, modify, disclaim or otherwise attempt to limit implied warranties of merchantability and fitness for a particular purpose.

8. **Representative's Authority To Contract**: By signing this contract, the representative of the contractor thereby represents that such person is duly authorized by the contractor to execute this contract on behalf of the contractor and that the contractor agrees to be bound by the provisions thereof.

9. **Responsibility For Taxes**: The State of Kansas shall not be responsible for, nor indemnify a contractor for, any federal, state or local taxes which may be imposed or levied upon the subject matter of this contract.

10. **Insurance**: The State of Kansas shall not be required to purchase, any insurance against loss or damage to any personal property to which this contract relates, nor shall this contract require the State to establish a "self-insurance" fund to protect against any such loss of damage. Subject to the provisions of the Kansas Tort Claims Act (K.S.A. 75-6101 et seq.), the vendor or lessor shall bear the risk of any loss or damage to any personal property in which vendor or lessor holds title.

11. **Information**: **No provision of this contract shall be construed as limiting the Legislative Division of Post Audit from having access to information pursuant to K.S.A. 46-1101 et seq.**

12. **The Eleventh Amendment**: "The Eleventh Amendment is an inherent and incumbent protection with the State of Kansas and need not be reserved, but prudence requires the State to reiterate that nothing related to this contract shall be deemed a waiver of the Eleventh Amendment."

# CERTIFICATION BY PROSPECTIVE PARTICIPANTS AS TO CURRENT HISTORY REGARDING DEBARMENT, ELIGIBILITY, INDICTMENTS, CONVICTIONS, OR CIVIL JUDGMENTS

BARBARA ARMBRISTER, Director, Research Administration, the University of Kansas, being duly sworn (or under penalty of perjury under the laws of the United States), certifies that, except as noted below, the University of Kansas or any person associated therewith in the capacity of director, officer, principal investigator, project director, manager, auditor, or any position involving the administration of federal funds:

a) is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency;

b) has not been suspended, debarred, voluntarily excluded or determined ineligible by any federal agency within the past 3 years;

c) does not have a proposed debarment pending; and,

d) has not been indicted, convicted or has a civil judgment rendered against (it) by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

Exceptions: _____

_____

Providing false information may result in criminal prosecution or administrative sanctions.

11/7/08
Date

Barbara Armbrister
Director, Research Administration

This project or contract is being funded in part by federal funds, and therefore the following certification applies:

CERTIFICATION FOR FEDERAL AID CONTRACTS

The following provision shall apply to all applicants for or recipients of federal funding on federal contracts, grants, loans, or cooperative agreements in excess of $100,000, pursuant to 31 U.S.C. Section 1352: Sect. 319 of P.L. 101.121.

Each applicant for or recipient of any amount of federal funding shall signify in writing below the amount of federal funding applied for or received by this contract, loan, grant, or cooperative agreement, if known.

The prospective participant certifies, by signing below and submitting this bid, proposal, grant, loan, cooperative agreement, or contract, to the best of his or her knowledge and belief, that:

1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, load, or cooperative agreement, the undersigned shall complete Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions. (A copy of Standard Form LLL is attached.)

A disclosure form must also be submitted at the end of each calendar year quarter in which there occurs any event which requires disclosure or that materially affects the accuracy of the information contained in any previously filed disclosure form. The original of the disclosure form shall be submitted to:_____, the KDOT Project Manager for this project or contract.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Signature of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The prospective participant also agrees by signing below that he or she shall require that the language of this certification be included in all lower tier subcontracts which exceed $100,000, and that such subrecipients shall certify and disclose accordingly. The originals of all disclosure forms submitted to the prime contractor by lower tiers shall be sent to the KDOT Project Manager named above.

Barbara Armbrister 11/7/08

Signature — Barbara Armbrister, Director, Research Administration, University of Kansas

Date

Title

University of Kansas
Agency

Amount of Federal Funds (if known)

Project or Contract No.