MOREnet, MODOT and RoundTrips Present:
Bridge Construction: The Great Collaboration

Date: May 1, 2009
Times: 9:00 a.m. to 9:50 a.m. Central Time and 10:00 a.m. to 10:50 a.m. Central Time
Grade Levels: 5-10
Cost: No Fee

Abstract:
So, how many people does it take to build a bridge? Find out when you meet the professionals who are working in a great collaboration to build a new bridge over the Missouri River. Ask questions about their careers, what it's like to work up high over water, build and design a bridge, etc.

Program Description:

How are all the elements of a mammoth construction process like a bridge over the Missouri River brought together? It takes the hard work of a great collaboration of people from diverse careers. Explore the careers of those who work in the bridge construction industry as you interact with the people constructing a new bridge over the Missouri River at Glasgow, Missouri. Find out what it's like to design a bridge, work with computer software, weld steel girders together, pour concrete, build new bridge piers, operate a crane, or run the barge that keeps vehicle traffic flowing while the bridge is closed for construction. See construction as it happens. View pictures and video of construction done earlier this year. And ask your questions of the people who work daily designing and building bridges.

Join us live from the construction site of the new bridge going over the Missouri River at Glasgow, Missouri for our eighth program in our continuing series of programs produced with the Missouri Department of Transportation.

Program Objectives:

1. The participant will explore the essential elements involved in basic bridge design and construction.

2. The participant will interact with experts involved in planning and executing bridge design and construction and learn about their occupations and work process.

3. The participant will gain knowledge about the engineering and construction of bridges and the careers involved in the bridge construction industry.

Program Format:
The program will focus on the various careers involved in bridge construction. Participants will view construction in progress and interact with individuals building the bridge.

Program Order—The videoconference program will consist of the following segments.

1. Welcome and Introduction—Student groups and experts will be introduced and welcomed to the program. Information will be given on the series of interactive programs that will continue throughout the school year as the new bridge is constructed.

2. The Elements of the Great Collaboration—Students will interact with construction personnel as they share video and pictures of the work they have completed so far on the bridge and view live video of bridge construction going on during the program. Personnel joining us for each program will vary. Upon receiving your enrollment in the program, we will send a list of the careers represented by the experts joining us for your particular program time slot. Use this list to help students explore those careers in advance of the program and determine questions they'd like to ask during the program.

3. Summary and Closing—We'll summarize the major concepts learned today, seek final questions from students, and invite participation in next Fall's programs which will show the completion of the bridge project.

Featured National Standards: (Science)
From the Center for Science, Mathematics and Engineering Education
6.5 Science and Technology Standards
Grades 9- 12
Abilities of technological design
Understanding about science and technology

Featured State Standards (Missouri):
No specific state standards are referenced for this program. Refer to your state's standards dealing with Career Education.

Participant Preparation:
1. Participants should come to the program with an interest in bridges, career discovery, engineering, math or science.

2. Participants should utilize preparatory materials provided for the program and other resources of their own to better understand the context of the program's subject and to think in advance of questions they wish to ask the experts. Any questions determined in advance, can be e-mailed to us prior to the program at roundtrips@clayton.k12.mo.us.

3. Participants should have pencil and paper ready to use during the program to jot down ideas and additional questions as they come to mind.

Pre-Program Activity Suggestions:

1. Students should explore the Missouri Department of Transportation website dealing with building the new Glasgow Bridge. That website can be found at http://www.modot.mo.gov/northcentral/glasgowbridgeproject.htm. The site includes information

about the original bridge, plans for the new bridge, and a web cam showing current work on the bridge. Students should develop questions about what they read to ask during the program or to send to us in advance of the program at roundtrips@clayton.k12.mo.us. Teachers might want to divide the class into groups and have each group investigate a specific part of the website to explore in depth. Students can then share their learning with the rest of the class and present the questions they have developed to ask of the program's experts.

2. Have students explore the PBS website http://www.pbs.org/wgbh/nova/bridge/build.html and play the game to build the bridge they believe is best for the locations shown. What questions do they have for the program's based on this experience?

3. View videos of bridges being built, their infrastructure and more at the How Stuff Works website ttp://videos.howstuffworks.com/tlc/28828-understanding-history-of-bridge-construction-video.htm. Students could split into small groups to view different videos and share what they have learned with each other. What questions do the students how that they would now like to ask the experts involved in the videoconference?

4. Go over the list of careers represented in the program that will be sent to you upon your enrollment in the program. Have students explore those careers via the web and other resources and determine questions they want to ask during the program. If you'd like to send any of those questions to us in advance of the program, e-mail them to us to roundtrips@clayton.k12.mo.us no later than 5 p.m. April 29.

Post-Program Activity Suggestions:

1. As a follow up to this program and as a lead in to the other programs in the upcoming series, have students create a list of questions they have about "what happens next" in the construction of the new bridge. Send those questions to us at roundtrips@clayton.k12.mo.us for MODOT experts to answer and reply to your students.

2. Have students share what they found most interesting and potentially frustrating about the careers they saw today. What would they like or dislike about being an engineer or bridge builder?

3. Have students check out the wide variety of weblinks at the About.com site on Architecture of bridges. Here they'll find tutorials on the basics of how bridges work, can participate in a bridge building challenge, learn about bridge coating materials and more. The website is http://architecture.about.com/od/bridgegallery/Bridge_Construction_and_Engineering.htm.

Vocabulary:

Live Load--The force exerted on a bridge as a result of the traffic moving across the bridge.

Dead Load--The force exerted by a bridge as a result of its own weight.

Dynamic Load--The force exerted on a bridge as a result of unusual environmental factors, such as earthquakes or strong gusts of wind.

Truss--A structure that consists of a number of triangles joined to each other.

Substructure--The understructure support of the bridge including foundation, piers, bents, caps, columns, footings, etc.

Abutment-- Point of contact between two objects or parts

Tension—In physics, tension is the magnitude of the pulling force exerted by a string, cable, chain, or similar object on another object.

Compression—Physical compression is the result of the subjection of a material to compressive stress, resulting in reduction of volume. The opposite of compression is tension.

Bending—In engineering mechanics, bending (also known as flexure) characterizes the behavior of a structural element subjected to an external load applied perpendicular to the axis of the element. A structural element subjected to bending is known as a beam. A closet rod sagging under the weight of clothes on clothes hangers is an example of a beam experiencing bending.

Torsion—In solid mechanics, torsion is the twisting of an object due to an applied torque.

Shear—A shear stress is defined as a stress that is applied parallel or tangential to a face of a material, as opposed to a normal stress which is applied perpendicularly. In other words, considering that weight is a force, hanging something from a wall creates a shear stress on the wall, since the weight of the object is acting parallel to the wall, as opposed to hanging something from the ceiling which creates a normal stress on the ceiling, since the weight is acting perpendicular to the ceiling.

Arch Bridge--The main supporting structure in an arch bridge is one or more curved elements. The dead and live forces that act on the arch bridge are transmitted along the curved line of the arch into abutments or supporting structures at either end. These abutments are sunk deep into the ground, into bedrock if at all possible.

Beam Bridge--The simplest type of bridge consists of a single piece of material that stretches from one side of a barrier to the other side. That piece of material—called a beam or girder—rests directly on the ground on each side or is supported on heavy foundations known as piers.

Suspension Bridge--In a suspension bridge, thick wire cables run across the top of at least two towers and are anchored to the shorelines within heavy abutments. In some cases, the roadway is supported directly by suspenders from the cables. In other cases, the suspenders are attached to a truss, on top of which the roadway is laid. In either case, the dead and live loads of the bridge are transmitted to the cables, which, in turn, exert stress on the abutments. That stress is counteracted by attaching the abutments to bedrock.

Cable-Stayed Bridge—A cable-stayed bridge is a bridge that consists of one or more columns (normally referred to as towers or pylons), with cables supporting the bridge deck.

Series Information:

This program is the eighth of a ten part series of programs dealing with the Missouri Department of Transportation building a new bridge over the Missouri River at Glasgow, Missouri. Schools may sign up for one program or any combination thereof. More information about the entire series of programs, including archived versions of previous programs in the series can be found at: http://mobridge.more.net.