To determine whether or not your project is eligible for entry, please complete this page and then move on to the remaining pages as directed.

PROJECT NAME:  St. Louis Harbor River Training Structures

Projects can be entered if they meet the following eligibility criteria. Identify your project by checking the appropriate box and attesting to its eligibility:

☐ Bridges, tunnels, waterways, railways, roads (other than toll) -- eligible only when carrying traffic; the time of final completion or dedication is not important.

☐ Toll or similar regional roads: any portion in use is eligible. The entire road is eligible when it is 75% operational.

☐ Water supply, flood control dams: eligible when ready to take the full design head of water.

☐ Power dams: eligible when the major civil engineering construction is completed and the structure can take its design head of water.

☐ Fuel power plants: eligible when power goes online.

☐ Buildings and structures: eligible when ready for use.

☐ Airports and other similar large developments: eligible when initial phase is 75% operational. Individual structures or features (such as major buildings or runways) are eligible when operational, but will be considered separately from the entire project.

☐ Water supply, water treatment, and waste disposal: the entire project is eligible when it is 50% operational in its initial phase. Any completed component is eligible, but will be considered separately from the entire project.

☐ Port, coastal, ocean, and wetlands projects and offshore structures: eligible when complete.

☐ Military projects (such as bases, launching units, and harbor facilities) eligible for their engineering aspects.

I have placed my project in the category that best describes it and hereby attest, by the signing of my name, that it meets established eligibility requirements.

Signature  [Signature] Date  May 31, 2011

If your project meets eligibility requirements, continue the entry by completing remaining pages of this form.
PROJECT INFORMATION

Presented by the American Society of Civil Engineers to

Department of the Army, St. Louis Corps of Engineers

St. Louis Harbor River Training Structures

(name of owner)

(name of project)

Outstanding Civil Engineering Achievement Award

Example: Potomac Crossing Consultants
Woodrow Wilson Bridge Project

Project Location (city, state) St. Louis, MO

Completion Date 11/19/2009

ABOUT THE PROJECT:

Scheduled completion date: 12/31/2009

Actual completion date: 11/19/2009

Total project budget: 5,601,130

Actual cost: $5,630,130

NOMINATOR'S INFORMATION

Describe the nominator's role:

☐ Nominator only   ☐ Active in the Project

If active in the project, describe activity:

Submitted by Robert Davinroy
Title Chief, River Engineering Section, Hydrologic & Hydraulics Branch
Address CEMVS-EC-HR, U.S. Army Corps of Engineers, 1222 Spruce St.
City, State, Zip St. Louis, MO, 63103
Country U.S.
Phone 314-965-6326  Fax
Email robert.d.davinroy@usace.army.mil

Signature Date May 21, 2011

PROJECT OWNER INFORMATION

Project Owner's name Department of the Army, St. Louis, Corps of Engineers

Firm CEO N/A

Firm Representative Dawn Lamm
Address CEMVS-EC-HD U.S. Army Corps of Engineers 1222 Spruce St.
City, State, Zip St. Louis, MO, 63103 - 2833
Country U.S.
Phone 314-331-8354  Fax
Email dawn.lamm@usace.army.mil
**TEAM LEADER INFORMATION**

<table>
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<tr>
<td>Contractual Team Leader's name</td>
<td>Dawn Lamm</td>
</tr>
<tr>
<td>Address</td>
<td>CEMVS-EC-HD, U.S Army Corps of Engineers, 1222 Spruce St.</td>
</tr>
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<tr>
<td>Phone</td>
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<tr>
<td>Email</td>
<td><a href="mailto:dawn.lamm@usace.army.mil">dawn.lamm@usace.army.mil</a></td>
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**Engineer of Record's name** Leonard Hopkins

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<td>Phone</td>
<td>314-331-8346</td>
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<tr>
<td>Email</td>
<td><a href="mailto:leonard.l.hopkins@usace.army.mil">leonard.l.hopkins@usace.army.mil</a></td>
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**Architect of Record's name** N/A

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**General Contractor's name** Patton Tully

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<tbody>
<tr>
<td>Address</td>
<td>1242 North 2nd St.</td>
</tr>
<tr>
<td>City, State, Zip</td>
<td>Memphis, TN, 38107</td>
</tr>
<tr>
<td>Country</td>
<td>U.S.</td>
</tr>
<tr>
<td>Phone</td>
<td>901-576-1421</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:denny@pattontully.com">denny@pattontully.com</a></td>
</tr>
</tbody>
</table>
CONTRACTOR/SUBCONTRACTOR INFORMATION

Please provide contact information for all contractors and subcontractors who contributed to this project. If more space is needed, please photocopy this page.

Contact person's name: Denny Burns
Address: 1242 North 2nd St.
City, State, Zip: Memphis, TN, 38107
Country: U.S.
Phone: 901-576-1421
Fax:
Email:

Contact person's name: Albert Hamilton Jr.
Address: 1242 North 2nd St.
City, State, Zip: Memphis, TN, 38107
Country: U.S.
Phone: 901-576-1421
Fax:
Email:

Contact person's name:
Address:
City, State, Zip:
Country:
Phone:
Fax:
Email:

I hereby authorize submission of this project into the American Society of Civil Engineers' Outstanding Civil Engineering Achievement (OCEA) Award competition.

Senior Executive/Principal: Leonard Hopkins
Title: Chief of Hydrologic and Hydraulic Branch
Signature:
Address: CEMVS - EC - H&H US Corps of Engineers 1222 Spruce St.
City, State, Zip: St. Louis, MO, 63103
Country: U.S.
Phone: 314-331-8348
Fax: 314-331-8346
Email: leonard.l.hopkins@usace.army.mil
Signature:
Date: May 3, 2011
I believe the work of the engineer meets the intended uses and expectations for the project and hereby grant permission to enter this project in the OCEA competition, and authorize publication of its outstanding features, unique aspects or innovations.

Client/Owner Representative  N/A

Title

Signature  Date

Address

City, State, Zip

Country

Phone  Fax

Email

APPLICATION CHECKLIST

Entries for the Outstanding Civil Engineering Achievement (OCEA) Award should be presented in the following order:

☐ Completed, signed, entry form
☐ Addendum (We suggest an attachment that follows the topics outlined below):
  • Originality and Innovation – Must demonstrate new or innovative application of technology, design, materials, process/methods and construction.
  • Resourcefulness in Planning and Solving Design Challenges – Must describe the complexity of the project and, from an engineering perspective, must show creativity in solving challenges presented.
  • Sustainability Considerations – Must enumerate the ways in which the project addressed environmental, social and economic sustainability issues.
  • Project Planning and Delivery – Must describe how the project team structured financing, adherence to budget and whether or not it met client’s delivery schedule.
  • Contribution to the Well-being of People and Communities, including Aesthetic Value – Must articulate how the project has contributed to the well-being of community members and done so in a pleasing and aesthetic manner.
  • Exhibits – Minimum of six color photographs (more photos/slides are encouraged). Include local newspaper articles or trade journals, if available. Include only data and charts essential to understanding the project’s technical aspects or innovations. Videos will not be accepted as part of the nomination process. As jury members will receive one of the copies you submit, please be certain each of the 12 required copies includes photos. High quality images printed on a color printer are acceptable.

DEadline for all entries is 5:00 PM Eastern Time, June 1.
**Originality and Innovation**

The St. Louis Harbor Project is located in the Upper Mississippi River between the entrance to the Chain of Rocks Canal at River Mile 184.2 through the Downtown St. Louis area at River Mile 179.6. This project was designed to alleviate a repetitive dredging problem, improve dangerous navigation conditions through several bridge crossings and assist local facilities with shoaling problems all in an environmentally sensitive manner.

Sedimentation and navigation channel alignment are the primary challenges to maintaining the inland waterways system. The Army Corps of Engineers, as part of its mandate from Congress, must maintain a dependable navigation channel on these waterways, and thus, must confront sedimentation and alignment problems where they exist. In the past, these problems were largely solved by installing spur dikes perpendicular to the bank line to constrict the channel. However, these dikes as well as the resulting sedimentation surrounding them impeded access to the bankline and can create a river environment void of habitat diversity.

The project consisted of constructing three Chevrons through a shoaling area, raising and extending an existing Trail Dike at the entrance to the Chain of Rocks Canal, raising and extending another existing Dike and Trail and building three underwater weirs. These river training structures are constructed with 5000 lb top size limestone which is quarried along the Mississippi River and is natural and widely available. All construction materials and equipment is transported efficiently by river barge and all river training structures are constructed from the river, not from the bankline. Once placed, these structures are expected to have a life cycle of at least fifty years with minor repairs expected only after extreme flood or ice events. The chevrons, dikes and weirs have no ongoing energy demands once they are constructed. These structures are sustainable in both the material used, the energy demands to build them, and the minimal amount of O&M required. In fact, these structures will save a tremendous amount of energy by utilizing the natural power of the river to shape and maintain the navigation channel rather than repeatedly using a man-made dredge to shape the river.
Due to the success of chevrons in the St. Louis District, other Districts within the Mississippi Valley Division, with guidance from the St. Louis District, have started using these structures to create and promote split flow areas. In the past, chevrons were primarily used to deflect flows from natural side channel entrances to create small side channels through sedimentation areas or as a location to deposit dredge spoil. This project was the first of its kind in that it used chevrons to split the main navigation channel into two separate self sustaining navigable channels. By splitting the flow, deposition problems were alleviated in the main channel and along the bankline where facilities fleet.

**Resourcefulness in Planning and Solving Design Challenges**

As the third busiest port in the inland waterways system, it was important to create a dependable and efficient navigation channel that would not continue to cost the U.S Taxpayer through ongoing dredging requirements and inefficient transportation of commodities.

The project has been very successful in achieving its goals of improving the navigation channel by alleviating repetitive dredging areas, aligning the navigation channel under multiple bridge spans and assisting local facilities with shoaling problems all in an environmentally sensitive manner. The trail dike extension at the entrance to the Chain of Rocks Canal eliminated a dredging problem, concentrating flows toward the shoaling area and alleviated a cross current that made lining up for the bridge span treacherous. The chevrons created a split flow that resulted in two navigable channels, while also creating a diverse habitat area. Raising and extending the second trail dike helped align the navigation channel thalweg through additional bridge spans and deepened a channel crossing that often required dredging for depth. Lastly, the weirs assisted with an additional dredging area directly across from downtown St. Louis and further aligned the navigation channel through another set of bridge spans.

The size and scope of this project required the partnering of many disciplines within the Corps of Engineers to work from design through construction. This included Hydraulic Engineers, Surveyors, Fisheries Biologists, Dredging Managers, Project Analyst, Contract Specialists, and Construction Managers. Throughout the construction process the Hydraulic Design Engineers, Surveyors and
Construction Managers worked closely with the contractor, Patton Tully to insure the quality construction of these highly visible structures.

**Sustainability Considerations**

**Environmental Sustainability**

The structures in the St. Louis Harbor have also created a more sustainable aquatic environment. These chevrons in particular have provided a more diverse habitat than what was available in the St. Louis Harbor prior to their construction. The fish community before the construction of the chevrons in the St. Louis Harbor was typical of most open river habitat - very low catch rates with few species retrieved during samplings. Before construction, the harbor consisted of the usual main channel and channel border habitats along with stretches of quality, shallow water habitat along the right descending bank. In an effort to retain the shallow water habitat while enhancing the remaining habitat, the chevrons were designed to create a split-flow within the harbor.

Within the chevron field, there were many different habitat types created. The first habitat type is a deep scour hole enclosed by each chevron. As water overtops the chevron, it travels down towards the riverbed and scour a large, deep plunge pool. The large, deep plunge pools created by the chevrons provide protected overwintering habitat for several species. In addition to the deep plunge pools, a second habitat type forms when the surface water enclosed by the chevron has become pond-like (lower flow velocities) and supports many backwater fish species such as Largemouth Bass and Bluegill. The third type of habitat developed is a sand bar island. The sediment that is scoured during the formation of the deep plunge pools deposits immediately downstream of the chevrons, forming visible sand bar islands. These islands increase the acreage of shallow water habitat and habitat diversity in the St. Louis Harbor. The number of species retrieved post-construction is more than double that of pre-construction thus indicating the harbor is more diverse after chevron dike construction. Overall, an increase in the number of species collected and habitat diversity has been noted around the chevrons in the St. Louis Harbor of the Middle Mississippi River.
There are also positive environmental effects from the trail dikes constructed as part of this project. Like the chevrons mentioned above, the trail dikes create a backwater type habitat that is separated but accessible from the main flow of the channel.

**Social Sustainability**

The primary customers for this project are the Navigation Industry and the facilities that use the St. Louis Harbor as well as the U.S. Taxpayer. As the primary customers, the Navigation Industry was actively involved in the design of this project, which utilized a Hydraulic Sediment Response (HSR) Model. The HSR Model showed that a design could be achieved that would help reduce or alleviate the dredging problems while at the same time creating a split flow channel that allowed local businesses access to their riverbank facilities. The project has also streamlined the navigation channel thalweg through the appropriate navigable bridge spans and will reduce the risk of accidents associated with these bridge crossings.

Lange-Stegmann, a company located along the Missouri side of the Mississippi River and adjacent to the Chevrons had this to say:

"All of us at Lange-Stegmann Co. could not be more pleased with the results! We have experienced exactly zero (0) down days as a result of low water in the STL Harbor – compared to hundreds of thousands of dollars prior to this project. In fact, our major expansion project hinged on the success of this project, and it has performed tremendously!"  - Rich Coffman Lange-Stegmann Co.

**Economic Sustainability**

The St. Louis District has been tasked with providing a safe and dependable navigation channel within the Mississippi River between Upper Mississippi River Miles 300 to 0. Dredging is often used as a temporary solution to maintaining the navigation channel for either width or depth. However since this is only a temporary solution, river training structures are used as a permanent way to eliminate or reduce
Dredging needs in the navigation channel.

Dredging requirements within the St. Louis Harbor have resulted in a cost of $4.4 million to dredge 2.91 million cubic yards of material over the last 10 years. This averages to $440,000 spent each year for dredging. Construction cost for the St. Louis Harbor Project is $5.63 million, with environmental monitoring costing $120,000. Considering the average annual dredging requirements, the project is expected to pay for itself within 13 years.

Additional cost savings should be observed in the project area due to the expected reduction in accidents with a more reliable and aligned navigation channel. Between the years 1997 and 2007 there have been 41 accidents in the Upper Mississippi River between Miles 183.5 and 180.0. Accidents are defined as collisions (between two vessels), allisions (between a vessel and a stationary object) or groundings (between vessel and the channel bottom). Total costs of the accidents can vary depending on the severity and type of accident, however accidents in the St. Louis Harbor can have an impact to more than just the vessel involved since a channel shut down impacts any vessel trying to pass.

**Project Planning and Delivery**

The St. Louis Harbor Project was funded through the Corps of Engineers Regulating Works Project and additional Congressional Funding and was constructed within budget.

The clients for this project are the navigation industry, local fleeting operators, the environmental community, and the U.S. Taxpayer. The project is working as expected and industry appears to be satisfied with the reduction in dredging in the harbor.

**Contribution to the Well-being of People and Communications, Including Aesthetic Value**

The St. Louis Harbor Project has alleviated dredging problems and has created a split flow channel that allows local businesses access to their riverbank facilities. The project has also streamlined the
navigation channel thalweg through the appropriate navigable bridge spans and reduced the risk of accidents associated with these bridge crossings.

The design is also environmentally sensitive by creating habitat within the chevron and trail dike structures. During normal flow conditions, a chevron provides many different habitat benefits including a deep plunge pool in calm waters directly within the structure boundaries, fast and slow flow areas around the edges of the structure as well as shallow water and sandbar habitat in the downstream shadow of the structure. Since the construction of the Chevrons in the St. Louis Harbor, fisheries diversity has more than doubled and includes many desirable species that were not present before construction. Many recreational fishermen have discovered the calm waters behind these structures where fish thrive in an area of the river that historically had a habitat that was less diverse.

Reducing the dredging in this reach of the river has a cost savings to the taxpayer in both the cost of dredging and the elimination of the disruption dredging causes to the navigation industry. These cost saving are passed on to consumers using the products that are transported on the Mississippi River. The dredging savings in the St. Louis Harbor are projected to pay for the project in approximately 13 years.

The application and shape of river training structures is dictated by their intended purpose where form is defined by function. Because of this, traditional river training structures often appear in opposition to their surrounding environment, the neat stone lines of a dike can conflict with the sinuosity of the river or the unrestrained growth of natural habitat. One of the main benefits of the use of more innovative structures like chevrons is that they promote the growth of natural habitat by means of sandbar or island creation, which brings river training structures in tune with not just the dynamics of the river, but also the environmental and aesthetic aspects of their surroundings.

As a local benefit, with their proximity to downtown St. Louis and its famous landmark the Arch, the chevrons in the St. Louis Harbor invoke comparisons in the waterway to what has been built as part of the skyline. During the construction of the Chevrons, local news media often referred to the Chevrons as the Arches in the river.
Hydrographic Survey from May 2007 - Pre Construction
Depths are sufficient for Navigation from Blue to Gray

Hydrographic Survey from March 2009 - Post Construction
Depths are sufficient for Navigation from blue to grey