

# Willamette Bridge Advisory Committee

November 13, 2008

## Meeting Notes

### **WRBAC Members Present:**

Mayor Vera Katz (Chair)  
David Knowles (Facilitator)  
Bob Durgan, Andersen Construction  
Art Johnson, KPFF Consulting Engineers  
Sue Keil, Portland Department of Transportation  
Guenevere Millius, SRM Architecture and Marketing, Inc.  
Ross Roberts, Metro  
Karl Rohde, Bicycle Transportation Alliance  
David Soderstrom, Portland Opera Board  
Chuck Steinwandell, Ross Island Sand and Gravel  
Mark Williams, Oregon Health & Science University  
Rick Williams, BPM Development  
Mike Zilis, Walker & Macy

### **WRBAC Members Absent:**

Pat LaCrosse, Oregon Museum of Science and Industry  
Christe White, Williams & Dame Development

**TriMet:** Rob Barnard, Sean Batty, Ann Becklund, Diane Goodwin, Neil McFarlane, Thomas Ngo, DeeAnn Sandberg, Gwen Snyder, Dave Unsworth

---

**Mayor Vera Katz (Chair)** welcomed everyone to the meeting.

**David Knowles (Facilitator)** presented the Bridge Study Status (slides 2-14). He reminds the committee of its vision, which is to build a bridge that embodies the Portland aesthetic: the right bridge for the context; functional for its use, site, and environment; and meets the budget. The committee's job is looking at viable bridge types that balance these three factors.

Regarding the vertical clearance issue, David says this committee is not dealing with this issue in the context of its work. More work will be done on this issue as engineering advances.

At the last meeting, the committee moved from “many” bridge types to “some.” The committee asked for more analysis of the five bridge types. At the October 28 and November 12 meetings, the Working Group did analysis of the five bridges, which will be presented today. Balancing will be more difficult now with the final five choices. It is difficult because risk factors that drive cost will be discussed. The committee’s two jobs are picking viable choices and documenting the process. It is important that we document our thoughts as we work to validate the viability of a few bridge types for a large public conversation.

**Rob Barnard (Director of Mall Design and Construction, TriMet)** presented a report from the October 28, 2008 Working Group (slides 15-25.)

Robert introduces the five bridge types that the WRBAC has narrowed down: Wave Frame, Tied Arch, Through Arch, and two types of Cable Stayed and discussed the evaluation criteria:

- **Cost:** Initial and life-cycle cost (maintenance).
- **Risk:** Cost escalation risk of superstructure; foundations and geotechnical; designs risk; bid risk; schedule risk; in-water construction risk; permitting risk (navigational and environmental); bridge width over shallow water.
- **Fundamental Performance:** Number, location and size of piers; seismic performance; model optimization of section; user comfort (deflection and vibration); service interruptions for special inspections.
- **Architectural:** Proportion and scale; experience on greenway, walkways, and river; experience crossing the river on the bridge.
- **Urban Context:** Portland core values, traditions, and symbolism; compatibility with existing context; reflection on current technology and innovation.
- **Greenway:** Vertical clearance; width of span over greenway; length of span over greenway (spacing between the column and abutment); greenway trail user experience
- **Environmental/Sustainability:** Environmental impacts during construction; resource use; availability of local materials; in-water piers in or near contaminated media cap.
- **Bridge Operations:** Line of sight between modes; OCS integration and complexity; emergency response on bridge; extent of inspections; access for inspections.
- **Miscellaneous:** Utility duct bank integration; pier proximity to existing subsurface utilities; accommodate asymmetrical loading; accommodation of curved greenway spans.
- **Opportunities:** Ability to treat stormwater on bridge; addition of wildlife habitat on/under bridge; additional fish habitat near bridge; habitat enhancement at staging site; incorporate alternative energy.

These criteria were considered for each bridge and they were ranked in each category (slide 25).

Rob noted that the slides of the bridges show the concrete structure in gray and the steel construction in white. This is important information to know when exploring risk and constructability.

### **Committee Discussion:**

**Mark Williams:** Is the Wave Frame unique?

**Rob Barnard:** Yes.

**Miguel Rosales:** The uniqueness of the Wave Frame is its open framework. The open framework of the Portland bridge is better than solid versions.

**Rob Barnard:** The Working Group looked at each individual criteria for each bridge type. This process provided the Working Group the opportunity to look at each bridge from multiple perspectives. For example, we looked at impact of piers in shallow water for each bridge. This was an extensive process, but it gave the Working Group a thorough understanding of how the bridges are different.

**Vera Katz:** Was there a scale used to judge these criteria?

**Rob Barnard:** Bridges were given 1-5 rating for each box.

**Rob Barnard and Paul Silvestri (National Contractors Group)** presented the Engineering Evaluation: Risk and Constructability Working Group Findings.

**Rob Barnard:** Each bridge type was evaluated for its structural performance. Computer models were created and then used to analyze service and seismic loading. With this information structural elements were sized. The team then generated a list of all the materials and quantities needed to construct each bridge and developed a proposed construction sequence. This information was given to the National Constructors Group, who used it to generate a “contractor style” cost estimate. The estimate uses labor rates, equipment types and durations, and cost of temporary and permanent materials. The costs estimates are under review by the team and will be discussed in more detail at a later meeting.

**Paul Silvestri** provided important information on risk in the following categories (slides 43-63):

- Foundations
- Material (substructure)
- Material (superstructure)
- Schedule
- Design
- Fabrication/Erection

*Foundation Risks:*

Conceptual method developed to minimize risks for unforeseen subsurface conditions, address environmental concerns regarding noise and vibration, and accommodates the available in-water construction window (July 1 – October 31). The conceptual method is the same for all bridge types.

*Material (Substructure) Risks:*

Will be made of readily available concrete, which will provide lower cost and schedule risk. Will be the same for all bridge substructures.

*Material (Superstructure) Risks:*

Tied and Through Arch types:

Superstructures made from readily available, standard steel.

Wave Frame:

Only bridge that uses high-performance steel, which is available from only one source in the U.S. Material sizes at upper limit of availability, higher cost, and volatile pricing.

Cable Stayed types:

Have concrete sub and superstructures, which can be made from readily available concrete.

*Fabrication/Erection Risks:*

Tied and Through Arch types: (standard steel superstructure)

Has moderate schedule and cost risk.

Wave Frame: (High-performance steel superstructure)

Complex, highly technical welding, higher cost and schedule risk.

Cable Stayed types: (concrete superstructure)

Lower schedule and cost risks.

*Schedule Risks:*

Tied and Through Arch types:

Moderate construction duration.

Wave Frame:

Longest Construction duration.

Cable Stayed types:

Shortest Construction durations.

*Design Risks:*

Tied and Through Arch types:

Conventional design. Complex steel to concrete connections. Moderate cost and schedule risk.

Wave Frame:

Prototype design. Complex steel to concrete connections. Non-redundant structure. Higher cost and schedule risk.

Four-Pier Cable-Stayed:

Conventional design. Complex construction of cantilevered walkway. Moderate cost and schedule risk.

Two-pier Cable-Stayed:

Conventional design. Lowest cost.

**Paul Silvestri:** Risks were evaluated to make recommendations to the Working Group.

*Substructure*

Concrete is being used for all substructures on all bridge types. It is readily available locally and this should keep down risk, including costs. Local concrete is good quality and cost is low. For the most part, substructures are the same on all the bridge types.

*Superstructure*

Wave Frame is made of high-performance steel. High-performance steel is only used in the Wave Frame bridge. This type of steel is rolled in one place in U.S. High-performance steel is different in that mills will not quote a price, will not quote delivery date or a rolling width until you give them a bonified purchase order.

Standard steel is suitable for use on the other bridge types. Structural steel prices have risen to the highest ever seen recently.

The steel used for Through and Tied Arch types is readily available, and there are local companies who can fabricate it.

Wave Frame needs sophisticated welding that hasn't been done in the U.S. Wave Frame uses very thick high performance steel plate. Two methods were explored for construction of the Wave Frame. One method would use a temporary platform and supports. This method reduces labor costs, helps manage construction and schedule risks but will require restricting navigation to a width of about 150' for three – four months. An alternate method would be to use a balanced cantilever method. This option reduces the cost for the temporary platform but has higher construction risks and requires in-water work with higher labor rates. Cost estimates were based on the use of temporary platforms and supports.

*Schedule and Design*

Building from both sides of the river for all bridges was the way cost was estimated. Estimate is 30-32 months (excluding design and material procurement) to build all the bridges in the group. With the Wave Frame there are still some unknowns about construction.

Paul related that he has seen a change in philosophy about the owner's role in building bridges. Owners are starting to be more assertive about being prescriptive about manner and method of construction or advancing portions of the work prior to awarding the construction contract.

## **Committee Discussion**

**Rob Barnard:** About how long it will take to build bridges?

**Paul Silvestri:** Wave Frame is harder to estimate because of unknowns.

**Art Johnson:** Can you lift wave and install it?

**Paul Silvestri:** Lifting could be possible perhaps by joining big pieces one by one and finding a way to connect them. There is an advantage to building on falsework.

**Art Johnson:** What is total amount of steel in the Wave Frame? Does the amount of steel vs. concrete make the bridge type more risky?

**Miguel Rosales:** Risk is not about quantity, but type of steel.

**Rob Barnard:** We need to give every bridge type our best effort. We want to know if there is a way to lower the Wave Frame's risk profile by making changes to its design. We need more time.

**Ross Roberts:** Is total amount of steel in Wave Frame much more than other bridges? Why is it more risky than concrete?

**Miguel Rosales:** All bridges have steel. It's the type of steel that matters not how much steel is used.

**Vera Katz:** Isn't it about the complexity of the design?

**Mark Williams:** What about design risk? Has anyone quantified this?

**Sean Batty:** Yes, we are looking at quantifying design risk.

**Mark Williams:** Because Wave Frame has never been made it's a risk because of its unique design and complexity.

**Bob Durgan:** Is one element better for the river than another?

**Paul Silvestri:** The foundation building goals were to keep marine equipment out of the water as much as possible. Environmental delays can be caused by using marine equipment. This is why we want to keep most construction on land.

**Mike Zilis:** Are all foundations of the bridges are the same?

**Paul Silvestri:** Yes, they are assumed to be the same for the purpose of cost and risk.

**Sean Batty:** There is no big difference between construction of different bridge foundations.

**Guenevere Millius:** Is there a difference in limiting navigability of river with different designs? (during construction)

**Paul Silvestri:** Yes, there is a difference. The form traveler used to construct Cable Stayed types hangs below superstructure, which lessens vertical clearance. This is only for a short period of time. Those constructed on falsework, Wave Frame and Through Arch, may have a more reduced horizontal clearance, again for a short duration.

**David Soderstrom:** I'd like to ask for a two-minute structural analysis of the Wave Frame.

**Miguel Rosales:** Wave curve is in tension, so all elements are intentional to create tension. A one-piece installation has not been explored. If there was a space on the ground to build then maybe wave can be built on shore and installed.

**David Soderstrom:** Is this information we are getting today about narrowing down the options?

**Mark Williams:** Are we narrowing down the options of bridges today?

**Neil McFarlane:** To analyze Wave Frame cost will not take too much more time just a couple more workshops.

**Vera Katz:** I'm nervous about going to community with one design. I don't want the Wave Frame eliminated yet. The Working Group needs to do more work on the Wave Frame construction issues before we make the decisions about last choices. It seems we've already eliminated the Tied Arch. I want design and construction risks explored before dropping the wave design. I want to hear from Miguel about the risk issues raised by Paul before the committee makes its decisions on the bridges.

**Karl Rohde:** CRHSC (Columbia Region Harbor Safety Committee) will not approve 75 feet height options. Is this an issue?

**David Knowles:** (David refers to the letter from Capt. Peter L. Richards sent to Vera Katz and WRBAC, which makes comments that a 75 feet vertical clearance presents an obstruction to commercial navigation in this reach of the river.) Bridge type is not as important to bridge height as it is to horizontal navigation. TriMet will work on 75 feet height issue during the next phase of design

**Vera Katz:** What planning will take place in next couple of weeks by the working group?

**Sean Batty:** A series of dialogues and workshops with the designers and contractors. Miguel will check with partners in Germany. The designers will look and see if we can remove some of the identified risks, including potentially looking at details of steel construction and building in U.S. We will look at issues Paul has raised. Collaboration with contractors and designers will bring a better costs estimate and risk assessment. For example, are there erection types that are more advantages to building the bridges? We need to get into details of the U.S. regulatory framework. We will focus on the Wave Frame primarily and look at numbers we've got for other bridge types. We can look at other bridge types and come up with cost estimates for those.

**Mark Williams:** At next meeting will we discuss same five options with more detail on cost and risk? Will a recommendation for a smaller group of bridge choices happen at next meeting?

**Sean Batty:** Yes, next meeting we will have cost, risk estimates on all five bridges.

**Bob Durgan:** four pier vs. two pier in the river is going to be a big issue. I thought arches were eliminated because they need four piers.

**Neil McFarlane:** We don't need to eliminate the arches. We'll only summarize them at the next meeting so no new work needs to be done on them. It can be done later after all the details are ironed out on cost and construction risk

**Mark Williams:** Will environmental issues be part of the analysis of each bridge option?

**Sean Batty:** Yes and no. A cost estimate from Paul will exclude some permit conditions, like mitigation, but will include cost for some disposal of hazardous materials from excavations.

**Vera Katz:** Let's go around the table to ask where you all would like to go before next time and what kind of information you want from the consultants.

**Rick Saito:** Need more information on cost and other categories as well. Environmental issues on constructability, too.

**Vera Katz:** What about aesthetics?

**Rick Williams:** Love the wave. Cable is too "2001 Space Odyssey."

**Karl Rohde:** We need better costs estimates. I like Cable Stayed designs even though Portlanders don't like monumental works. Would like to know whether bridges have a good or bad impact on river and banks? I'm concerned with height of bridge for people on the banks.

**David Knowles:** Horizontal clearance has big effect on bridge type choice. There are ways of addressing this issue during preliminary engineering.

**Guenevere Millius:** Love the Wave Frame. Portlanders are risk averse to fancy designs. I anticipate public relations issues around bridge because of the cost of the last project. Larger bridges will add to visual noise at this site. New bridge on I-5 from Lair Hill to South Waterfront looks like a Cable Stayed bridge.

**Art Johnson:** We should keep options open. It's a mistake to go in with just one option. Even though I like the Wave Frame best, I want to continue with at least one Cable Stayed option.

**Mike Zilis:** Wave and Cable Stayed are the best. Permitting on river will be a problem. Adding holes is a problem. How do the bridges land on the greenway? How will they feel from the bank? What are clearances? Bank enjoyment is important. Do any designs have environmental benefit for the river? We should be proactive on this issue.

**David Soderstrom:** I'd like to eliminate the Tied and Through Arch designs. Four piers in the river are a big problem with these designs. Let's avoid one problem with agencies because of piers in the river. This could be a big problem. Cable Stayed is easier design, but towers are bothersome, similar to Burning Man statues. Wave Frame has nice scale and delicacy. I want to know more about steel issue in Wave Frame design. Maybe the framework could be simplified.

**Sue Keil:** Cost is main issue. Environmental issues are important, too. I am more risk averse. Like the tram project, you are putting a cost on something before you know exactly what it is. This is risky.

**David Knowles:** Pass.

**Mark Williams:** I think consensus is to eliminate arches. The Wave Frame is pretty, but I am concerned about risk issues. Unique design, constructability, and steel issues make me concerned. I would eliminate wave design today with the information I have now. I need more certainty about risks to overcome my concerns.

**David Knowles:** How do you feel about Cable Stayed option, Mark?

**Mark Williams:** Shape of towers can change, that is good. Cutting-edge design of wave with a tight budget gives me a lot of concern. Budget is an issue.

**Ross Roberts:** Concern from Metro standpoint is cost and uncertainty of Wave Frame constructability. Risk impact on schedule, budget, etc. At the next meeting we should have estimates of cost on all bridges. Give us an evaluation and range of costs with some impediments worked in it. (For instance what if there was a fish issue, what would it cost?)

**Neil McFarlane:** I'm intrigued by the Wave Frame. We need to look at risk from perspective of getting federal funding. We need to come back with pretty solid answers about risk. Rigid FTA process for funding will be an issue. Federally funded projects are done by U.S. union labor, and steel has to come from U.S. Steel frame issues for example, sensitivity of welds is a concern as well. We need to be on cutting edge not bleeding edge.

**Bob Durgan:** Cost is an issue in this economy. Real costs inevitably go up from cost estimates. Cable Stayed design has the least risk and is a good-looking bridge.

**Vera Katz:** There is consensus to keep the two Cable Stay and Wave Designs and eliminate Tied Arch and Through Arch designs today. Consultants and staff should come back to next meeting with answers for group concerns as outlined above.

**David Knowles:** Next meeting is the December 11<sup>th</sup>. Please be flexible about agenda and location.

**Ann Becklund:** December 11th, since it's not a kick-off should be at another location not OMSI.

**Vera Katz:** December 11th should not be an open house. We are not ready yet. Perhaps we can have an open house after the next meeting.

**Karl Rohde:** Is the Through Arch design eliminated because of its environmental impact using a four-pier foundation?

**Vera Katz:** Is it more expensive to deal with the mitigation of the Through Arch than to just go with another design without the four piers? Miguel can you play around with tower design for next time?

**Miguel Rosales:** Making one Cable Stayed design out of two would be the next step, not coming back with two designs. It would be better to combine and consolidate the designs because they represent a "type" of bridge.

**Vera Katz:** So next time we'll have one Cable Stayed design and the Wave Frame design for two total designs to look at. Since there are so many Cable Stayed bridges over the world does Miguel have to design a new one?

**Sue Keil:** Cable Stayed is so common can we look at other designs around the country.

**Sean Batty:** I suggest collecting examples of other Cable Stayed designs that are already erected. Let's make our effort on getting answers on the Wave Frame to the committee. We know enough about Cable Stayed bridges so we should just come back with examples so were not wasting time. We already know the risks involved.

**Miguel Rosales:** To respond to tower discussion. We should have an idea of the design now to understand costs. Simple or more complicated tower design will have a cost impact.

**Sean Batty:** We don't need to do heavy work on tower design (for the Cable Stayed bridge) because we have lots of examples. Wave needs more work because of its unique design. Without doing a great level of analysis on costs of tower designs, we can give committee enough information to work with since this is a common bridge type. Wave Frame is more of an open question.

**Vera Katz:** I don't want a \$10 million "oops" on the tower either.

**Miguel Rosales:** It is important to make a Cable Stayed design for the specific site. Looking at pictures from other projects can be confusing. Proportion and scale are important to develop costs. You must live with this bridge for 100 years. There is always a risk with doing something special, but if you can do a calculated risk you can do something good. We built a new type bridge in Greenville, South Carolina and it had a positive impact on the economy of the city. It is now a landmark. A \$5 million dollar bridge can bring \$200 million of revenue to the city because it becomes a destination. You must think about other issues that make up for the cost of construction of the bridge.

**Teresa Boyle:** Should Miguel be working more on the Wave Frame or on the tower? Or equal amount of time for both configurations?

**Vera Katz:** I want work on other tower configurations.

**David Soderstrom:** Wave needs more engineering and analysis, but Miguel should come back with the most beautiful Cable Stayed version he can within budget.

**Guenevere Millius:** Other bridge designs of towers would muddy design for the Portland site. They should come back with one Cable Stayed design next time. Presenting one bridge design to the public is not enough.

**Karl Rohde:** Can sustainability be considered now as part of the design?

**Teresa Boyle:** Sustainability will be a PE final engineering focus after a bridge type is chosen. It will be an opportunity at the next level.

**Neil McFarlane:** We'll work with Miguel to be responsive to tower designs question and cable wave issues. Remember money is tight for this process.

**Miguel Rosales:** Once committee makes it's decision on the bridge, more change can happen.

**Vera Katz:** Thanked the group and sums up by saying that at the next meeting the committee will narrow down a Cable Stayed design and get more information on the Wave Frame design.

Next WRBAC meeting is the Dec 11 at the Portland Building, 1120 SW Fifth, Room B, 3-5pm.