San Francisco Bay Conservation and Development Commission
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TO: All Engineering Criteria Review Board Members

FROM: Rafael Montes, Senior (Staff) Engineer (415/352-3670; rafael.montes@bcdc.ca.gov)

SUBJECT: Approved Minutes of March 21, 2017, BCDC Engineering Criteria Review Board Meeting

1. **Call to Order.** The meeting was called to order by the Chair, Dr. Roger Borcherdt, at 1:02 p.m., in the Monterey Conference Room at 455 Golden Gate Avenue, San Francisco, California.

The following Board Members were present: Dr. Roger Borcherdt, Board Chair, Robert "Bob" Battalio, PE, Professor Mary Comerio, James "Jim" French, PE (who was present only during the first discussion item), GE, Lou Gilpin, PhD, CEG, William Holmes, SE, Professor Jack Moehle, Frank Rollo, PE, GE (who was present only during the second discussion item)

The following Board Members were not present: Richard Dornhelm, PE, and Professor Martin Fischer.

BCDC Staff Members present were: Mr. Jhon Arbelaez-Novak, Permit Analyst, Tinya Hoang, Permit Analyst, Elena Perez, Permit Analyst, Alex Braud, NOAA Coastal Fellow, Ms. Jaime Michaels, Chief of Permits, Rafael Montes, Senior Staff Engineer and Board Secretary

The audience included the following: Bill Kennedy (Catellus), Damir Priskich (Catellus), Dave Irving (Catellus), Richard Rodgers, PE, GE (Langan), Juan Baez, PhD, PE (AGI), Steve Dickenson, PhD, PE (New Albion Geotechnical), Doug Schwarm, PE (Atlas Geotechnical), Gayle Johnson, PE (Simpson Gumpert & Heger), Chris Mills (BKF Engineers), Bill Bruin, (Simpson Gumpert & Heger), Shahram Aghamir, PE, City of Alameda, Jason Buenker (Shannon & Wilson, Inc.), Michael Clary, CH2M, Cleve Livingston, Laconia, Adam McCune, PE (HDR Inc.), Branden Strahm, PE (CFM Olsson Associates), Damian Wallner, Union Pacific Railroad

Mr. Montes addressed some housekeeping items at the start of the meeting. This included location of restrooms, exits and several other items.

Chair Borcherdt mentioned that the ECR Board was very privileged to have another member in the National Academy of Engineering. He welcomed everyone to the meeting and moved to Item 2, Approval of Draft Minutes of March 30, 2016.

He asked attendees to introduce themselves and give their affiliation. People introduced themselves and Chair Borcherdt asked for a motion to approve the March 30, 2016 Minutes.

2. **Approval of Draft Minutes of March 30, 2016 Engineering Criteria Review Board (ECRB) Meeting.**

MOTION: Board Member Moehle moved approval of the Minutes, seconded by Board Member Holmes.

Board Member Holmes corrected page 11, the last paragraph, fourth line: it says, "DC ration", it should be, "DC ratio".

VOTE: The motion carried with a vote of 7-0-0 with

Chair Borcherdt, Mr. Battalio, Ms. Comerio, Mr. French, Dr. Gilpin, Mr. Holmes, Mr. Moehle, voting, "YES", no "NO", votes and no one abstaining.

3. **Board Discussion: Alameda Landing "Waterfront Site" (Pre-Application).** The Board considered and reviewed the Catellus Development Corporation proposal of a mixed-use development at the terminus of Fifth Street on the shoreline opposite Jack London Square in the City of Alameda, Alameda County.

The development would include approximately 15,000 square feet of retail, 10,000 square feet of office space, a 124-room hotel, 40,000 square feet of warehouse, 445 housing units, including apartments, townhomes and detached single-family homes and an 8-acre waterfront park including a ferry or water shuttle landing and a kayak launch. The project proponent proposes to site the waterfront park at an existing 3,000-foot-long concrete wharf that was constructed prior to the Commission's establishment.

BCDC seeks the Board's advice on the engineering safety criteria of the existing wharf.

Mr. Bill Kennedy, Vice President of Construction with Catellus Development introduced himself and his team. He mentioned that he runs the construction group in the Bay Area.

Mr. Kennedy mentioned that his team was seeking an informational session and obtaining feedback from the Board. Catellus has not yet received local approval from the City of Alameda. They have met with members of BCDC at the project site and at the BCDC office.

This is the first piece of the Alameda Naval Air Station that has been transferred to the City of Alameda and onto private development. Catellus has a public/private partnership with the City of Alameda. The development was originally 220 acres consisting of the east housing facility.

In about 2002/2003 we developed this as the Day Port residential, 485 single-family homes with some affordable housing included and some multi-family units.

In March of 2015 we completed the retail portion which is the first phase of Alameda Landing. We are here to talk about the approximately 40 acres of the waterfront parcel.

This is all a mixed-use zone project right now. We are trying to work out how exactly the mixed-zoning is going to look in the final analysis.

In 2007 Catellus did a lot of research into the existing wharf structure but not a lot of modelling on soil structures. We have now done a lot more of the soil modelling for this project.

After a number of years of exploring a number of options we finally came back with the idea that if we were to cut the inland portion of the wharf and remove it and stabilize the soils there, an area where the cranes rails and the railroad rails were originally left in place, we could strengthen the soils behind that section. We could then ask what it would look like when we modeled all that together.

As we started evaluating this we realized that we could then progress the development part of the project closer to the water's edge, keep the existing edge at the outer edge of the wharf, open that up to public access and we determined that this was a win/win situation.

BCDC staff was excited about once again bringing the public out to the edge of the water. We could enhance the promenade area and we started looking at ways to create enough revenue to support that kind of development.

We are still trying very hard to keep a commercial, maritime component in the project.

The City of Alameda is building Estuary Park which would create more opportunity for public access in this area. There is a requirement in our development agreement to include some sort of public access to water sports such as kayaking and getting people to the water. We are also working on implementing a water taxi service.

We are here to let you know where the City stands on the project, the City wants to know where BCDC stands on this project criteria and our approach to mitigating that criteria. This is a technical discussion and we are interested in listening to what your Engineering Board has to say.

This is a very iterative process. We will address questions as they arise. The wharf and these structures were built around 1943 to 1946. We have to raise grades on average of about six feet. The top of the deck is effectively at grade for our design project. We step up from there to deal with sea level rise.

Board Member Battalio asked whether or not the raising of the grade has any effect on the drainage of the adjacent site and whether or not there are any plans for stormwater treatment, runoff treatment or anything similar.

Mr. Kennedy pointed out that all the storm drainage for the project will go through the new outfall that was constructed to drain the two individual warehouses. We have local bio-filtration treatment for all of the new development.

BKF engineers had developed the master plan back in the early 2000s which incorporated and contemplated the entire project to set the grades to make sure that everything falls and works hydraulically to eliminate water ponding to adjacent properties.

Board Member Battalio mentioned that the Board might want to have this confirmed in terms of flood risks.

Mr. Kennedy stated that the science, information and modelling about sea level rise is changing faster than anything else. We recognize that what we put in the master plan in 2003, 2007 and 2012 to address sea level rise is different from the situation that we are currently facing and we will discuss this later in our presentation.

We are using 36 inches short term and we are designing to 66 inches for the year 2100.

There are two things that have to be looked at in conjunction. One is the lateral displacement threat or impact, the unconsolidated fill zone – the dredged fill, the Bay mud zones. And the second issue is the ability of this soil to withstand this and the structure itself; how well does it stand on its own, how well does it respond in a seismic event?

Chair Borcherdt mentioned that the project was only at 25 percent design stage so the project proponent was really looking for feedback as opposed to any kind of resolutions dealing with final design.

Mr. Kennedy mentioned that Catellus was still not quite sure what the ECRB's role would be. Our objective is to let you see what we are doing and to make you aware of our methodology.

Staff Member Montes mentioned that the structures pre-dated BCDC, however, since they are going to be developed into a public-access structure this falls within the purview of the ECRB to let BCDC know whether the structure is going to be safe enough for the public.

If the proponent were to do nothing to the structures, the whole structure would be shoreline band; therefore, we have no purview in addressing safety of fills within the shoreline band. If they were to retrofit the buildings, then it becomes Bay.

Chair Borcherdt stated that it was important for the ECRB to understand this.

Mr. Montes said that he could not say this constituted Bay fill because the strategy has not been determined to retrofit or not.

Mr. Kennedy stated that they are proposing to keep approximately 100 feet from the existing edge of the wharf back to the yellow demarcated area on the slide.

We are currently looking at what needs to be done to the existing piles and whatever treatment we put on top of the existing concrete deck. We are not planning to do much structural work to the wharf.

The Board discussed a number of boundary demarcations on the slides and how this might impact the 100-foot shoreline jurisdiction of BCDC.

Mr. Kennedy mentioned that their goal was to get all the structures away back behind the 100-foot line, improve the soil there and only build from the 100-foot line back.

Dr. Juan Baez with AGI shared a slide listing many of the surveys, reports and background information that have come into play in the evaluations of the ground conditions and what needs to be done about it.

The Geotechnical reports have been prepared by Langan Treadwell & Rollo. We have been working with the structural engineers of Moffat & Nichols as well as SGH.

Once it was identified that the issues of liquefaction and lateral spread and potential settlement were applicable here it was our task to evaluate different options to make the project viable and work within the criteria established by the Engineers of Record.

We looked at the geotechnical reports, the drawings from 1944 from the U.S. Army Corps of Engineers as well as reports from Moffatt & Nichol and SGH from 2007 and 2017 regarding the deck and pile conditions. We were provided with properties for the piles including the deteriorating condition over time.

AGI and GeoDesign also conducted a number of pile integrity tests on the existing piles. We also evaluated information regarding the most recent construction in the area in 2001 to 2005 related to the deepening of the Inner Channel Turning Basin which is included in this property.

We also evaluated the topographic surveys from DKF and hydrographic surveys from NOAA in the years 2012 and 2016.

There are primarily three different features that affect the geotechnical evaluation and the stability of the wharf.

There were areas that were deepened in the early 2000s as part of the Port of Oakland's deepening channel project. There was new construction in 2005. Then we have the existing wharf with a deepened channel as the second case of conditions. The third case is the area where the Channel was not deepened and we have the 1940's wharf.

The initial assessment in 2014–2016 indicated the presence of compressible Bay muds, liquefiable soils, lateral spreading and no pile pinning effects were considered in the pseudo-static study performed. There was a consensus that there was the risk of significant deformation here that needed to be taken into account.

There were some early structural mitigations to the wharf that included an open-cell, sheet-pile bulkhead, a dead-man bulkhead and batter piles which is what was used for the Turning Basin, and we looked at ground improvement systems that included technologies that have been widely used in the Bay Area; stone columns, rapid-impact compaction, compaction grouting, jet grouting and cement deep soil mixing (CDSM).

The most cost-effective approach appeared to be cement deep soil mixing and that is what we have continued to explore.

We also looked at hybrid solutions that included a structural component as well as a ground improvement component that included primarily utilization of cement deep soil mixing with the inclusion of either an insert of steel beams in connections to the deck and the use of grade beams but we are not at a point where a final decision has been made on this.

Cement deep soil mixing is a mechanical blending of site soils (in place) with slurry of cement to increase the existing soil strength, bearing capacity, mitigate liquefaction and to reduce lateral spreading. It is very applicable to this project.

In the Bay Area there are several projects that have received this kind of technology to address liquefaction and lateral spreading.

Cement deep soil mixing is not a new technology. It has been around for many years and it has been tested under very severe and strong earthquakes. There are design guidelines for its usage and there are very relevant papers to the conditions and situations that we are dealing with on this project.

At the end of the day it is important to apply a technology that has a proven track record and has demonstrated through strong earthquakes its performance and validation.

Because of the varying conditions that exist at the project site we came up with six different cross sections to analyze. The more critical of these sections is the older construction of the wharf with the deepened channel which is Section D and E on this slide.

We have conducted a cluster of explorations to make sure that we are being very thorough about the conditions that exist from a geotechnical perspective.

We conducted pile integrity tests on the Raymond Piles as well as some of the concrete piles and the results of these tests are available for you to look at and we included these in the report.

The main culprits of conditions that are causing the instability are the liquefiable materials under the dike and the relatively loose layer of sandy silt that seems to be going underneath and it is a clear path for potential spreading.

We have conducted soil-structure-foundation-interaction evaluations recognizing the important nature of the different materials that we are dealing with and the effects of the wharf. We also looked at utilization of regional seismic hazards, ground motion

characterization and selection of motions, we conducted site-specific calibrations of the 2D numerical model used in PLAXIS, we looked at the calibration using the Loma Prieta event and we applied the 2D numerical model for the MCE motions and then conducted a parametric study to go through the engineering and cost optimization to make the project viable.

We looked at a number of conditions and site characteristics to be dealt with in order to move the project forward. We included this information in our AGI Report.

Mr. Gayle Johnson with SGH mentioned that they met with the City of Alameda Engineer and the Building Official to discuss the report.

We have looked at earthquake loads and that is what is going to wind up governing this. We are looking at kinematic loading from the soil displacement and inertial loading from the ground shaking.

We are setting a performance goal of non-collapse in an MCE event. Non-collapse is defined as, after the event you have continued gravity support and people can egress even with extensive damage to the area. This is a concrete structure so fire is not an issue.

Because this is going to be within the purview of the City of Alameda we would still like to not have to bring the whole structure up to code compliance as if it is a new structure. Even though there will be a different use for the property the risk category does not change because in order to go to a higher level for public egress you would have to define it as public assembly which would have occupant loads greater than 5,000 people. We actually have five isolated structures here that are totally separate structural systems.

The governing criteria that we are looking at for building code compliance are the California Existing Building Code (CEBC) under alterations to an existing structure and not treat it as a new structure.

Board Member Comerio stated that the proponent is still trying to say it is still a wharf but, in fact, it is and it is not public assembly. On a nice warm afternoon, on a Sunday; you are going to have a whole lot of people out there on that walkway. Somebody better think about how those people are going to be evacuated. It is not continuous evacuation because there are buildings in the way. There are new buildings coming and there is housing. If there are spaces between the buildings then it is not continuous. You really have to think about where your egress actually, physically is.

Mr. Kennedy answered that Board Member Comerio was absolutely right and Catellus has thought about it a lot. The walkway is a very large path where people can come and go and if something were to happen people need to get inland quickly. We are required under our master plan to have certain view corridors and access corridors. A number of our corridors are required to stay open all the way through to the shoreline. While certain areas will not have this characteristic others will be continuous.

What we have been able to model and prove is that the wharf can withstand a certain amount of lateral displacement. The next phase of the design will deal with effectively dealing with this. Can you still get off the wharf and back to safety? The wharf is not an assembly area.

Mr. Johnson mentioned that it was important to know that the displacements are not like the structure is going to move out many feet and be leaning over the water. We are talking about some displacement but it's not like you're looking down into a gap.

Mr. Priskich stated that the public promenade area is 100 feet from the edge of the water.

Board Member Comerio pointed out that three different conditions exist on the project site. One is over water, one is on soil and then you have one where there is a building. They are all going to behave somewhat differently. What happens in those intersections?

Mr. Johnson stated that they look at the deck and we don't expect non-linear behavior on the deck. All the damage that we expect to see would be in the piles itself; not on the deck. We would expect that you would not see any of the effects within the top of the structure. You should be on something stable and firm.

Board Member French shared a summary of concerns with the Board. He mentioned that some of the piles were pretty old and as corrosion weakened those has any steel been lost and is this going to reduce any of your ductility? This is something to look into. Loma Prieta calibration was done but this calibration was done to zero displacement and that does not necessarily prove your displacement exactly. It is good to not over predict but does make sense to refine your calibration. You had a handful of magnitude 7.0 earthquakes that you ran but nothing at 8.0 magnitude. You did cite an earthquake from Denali which was 7.9 and would have fit but you say all the numbers are for 7.0. So check and make sure that you have some hazard coming from the bigger San Andreas, long duration. When you are doing the site response and selecting time histories, the records and the ARS curves; it would be nice if you could show us what is your seed ARSs look like on the top of firm ground. And then show us how you are scaling it and what your method of scaling is. When you are getting the response back up, propagating back up through the underlying layers and hitting the top of old Bay clay, let's see what that ARS looks like and compare that with general ground motion attenuation relationship predictions. It would be nice to have an ARS at the ground surface also. Riprap is quite steep and I am curious about that. Finally, I think you have a great team together with a tremendous amount of knowledge available to you. It would make life a lot easier if you keep this team in place.

Mr. Johnson addressed the issue of pile conditions. Moffatt did a very substantial inspection about 10 years ago. We have identified a repair cost estimate for Catellus. The idea is to bring critical piles back to their original condition.

Mr. Bill Bruin with SGH stated that deterioration is focused on low-stress systems closer to the splash zone. When you get into the deck soffit the structure looks very, very good.

Board Member French asked what the liquefied, residual strengths of the non-riprap material were on the slope compared to the strengths of the Bay mud.

Dr. Baez stated that in terms of the load count the dike material is somewhere between 10 and 15 loads. We are dealing with approximately 400 PSF on the deck for residual strength. We did look at this but I don't have the numbers at hand right now.

Mr. Shahram Aghamir, P.E. city engineer for the City of Alameda commented that he was exposed to this project about seven or eight months ago. I am familiar with the soil investigations that have been done. We have had one of our consultants on the Review Board look at the project.

As the project evolves to more advanced stages we will be scrutinizing it in more detail. But at this point the project is going to improve the conditions of the existing deck and the wharf. In that sense we are looking forward to having a successful project.

Mr. Kennedy added that the wharf as it sits today is actually inaccessible and it is owned by the City of Alameda. It will remain under the City of Alameda's ownership but in Catellus' development agreement there is a zero-net added cost to the project. There is a tax assessment on the new users that will go into an MSD, a maintenance services district that will pay for the maintenance of the public open spaces. This could include pile inspection and repair over time.

Board Member French stated that design-criteria-wise the project was headed in the right direction from a geotech perspective.

Board Member Holmes commented that it seemed to him that the structural analysis of inertial loads on the top of the location of fixity of those piles and the effective length of those piles is going to change. The stiffness, what is going to take the load is going to start at those piles and as that slope goes down, things are going to change. So how are you deciding at what point to put that surface?

Mr. Johnson answered that they are actually modelling all the piles. We actually have non-linear, input springs along the entire length and we've got them very discreet in the areas where we are expecting differential displacement.

We did a simplified model to start with but this will be evolving through design.

Mr. Bruin mentioned that the soil properties of the high areas are very poor. The effective lengths are pretty uniform across the wharf. We modelled cutting the wharf in different segments to get a feel to where we could cut the wharf and we did not see dramatic changes in behavior because the upper site soils are very poor.

Chair Borcherdt mentioned that the extent of the wharf is quite considerable. The soft soils do vary along the extent of the wharf. Does Catellus feel that there are any special steps that need to be taken with respect to strengthening the wharf?

He also wanted to know what kind of evidence was available from the point of view of the response of the wharf during the Loma Prieta Earthquake. Then is the Oakland Harbor Wharf record relevant here from the point of view of Loma Prieta?

Mr. Steve Dickenson of New Albion Geotechnical replied that first of all I would concur with the observation that the Oakland Outer Harbor Wharf record provided a fantastic case study for validation of site response models but also SAP and other structural models as well. It is a nice first step moving toward what we can do at this site. It helps us to refine the analysis. However, the soil conditions are so dramatically different between what is going on at Berth 24/25 which is where that record was obtained and what we have along our portion of the Alameda Waterfront.

We acknowledge that we have not focused with SGH on a calibration of SAP using that particular case study. We are mindful and aware of the fact that the soils are different enough that we can't take at face value what happened at the Oakland Outer Harbor Wharf.

What we have done is to take the available records, observation, post-earthquake records – not strong, motion/time history records; we know that there was not massive damage because there have been so many post-earthquake inspections made recently.

We know that our calibration of the site response involved 1D modelling comparing to what we saw at the Alameda Naval Air Station, at Treasure Island and at all of the Bay mud sites that we could look at. We have calibrated the 1D site response models using those Loma Prieta records and many other records that have been obtained around the world in soft soils. Those motions go into the 2D soil-structure interaction model which PLAXIS was used for this. The calibration was done looking primarily at site response that we calculated in the 1D model for one location.

There are lateral variabilities of the soils at this site. As we progress further into analysis and design we will evaluate that through parametric analysis varying the soil properties to look at ground motion characteristics.

The calibration of the 2D soil-structure interaction model was intended to provide a data point on what is a curve of wharf response and seismic performance as a function of input motions. This allows us to then extrapolate to MCE level motions and close the gap between modeling with no calibration and with a good, solid calibration at moderate levels of shaking.

Mr. Priskich mentioned that one of the other items that Catellus was looking at was response with respect to future sea level rise.

Mr. Chris Mills of BKF commented, displaying the current FEMA map that showed the buildings on the site. Most of the project site documents are based on the City of Alameda datum which is based on mean, high, high water. We have taken time to relate those to each other and to the 1984 Army Corps' Stillwater Elevation Study that is the basis for all of the 100-year water elevations throughout the Bay.

With NOAA's more recent readings of the various tide gauges run that up to what the current sea level is so that we can make some projections.

We know that 66 inches of sea level rise is what the National Review Council of 2012 has projected as the high range. They have projected 36 inches of sea level rise out to 2100 with a range between 17 inches and 66 inches.

The intent of the development is to fill so that new structures are six inches above the highest range of sea level rise predictions.

Board Member Battalio stated that typically you would also consider the total water level that has a 100-year recurrence. My interpretation of your criteria is that you have used the state guidance that came out of the Protection Council in 2013 which is based on the National Research Council of 2012 which is good criteria.

Mr. Battalio commented that there are higher curves out there right now. I don't think anyone is designing to them. I feel your sea level rise criteria are reasonable.

I want to ask if you are looking at waves and total water levels. This existing FEMA map is not the newer provisional flood map. If you come back before the ECRB you should probably use the most recent map which would be effective by then or at least show the provisional map.

I will mention that there is a report which the Department of Water Resources put out called, "The Technical Methods Manual". It provides a way of adjusting existing conditions, FEMA maps to represent sea level rise so that the city planners and engineers can relate more to the projections.

The adaptive measures for the higher sea level rise are not really that clear. Your drawings seem very conceptual at this point.

Mr. Mills stated that the drawings are intentionally vague because there are a number of things we felt we could do for adaptive measures. We are debating what the requirements would be to get up and out of this structure knowing that its deck will be overtopped at some point in time. The view we are taking is that right now there is a waterfront promenade out there that could be perfectly accessible to the public for 50 or 60 years. Right now it is not; it's fenced off.

We have looked at everything from demolishing the deck to rebuilding it, to what we could possibly do to get this public access out there and one of the discussions we have had is – what if we allowed the public to use it for 65 years and then 15 days out of the year it gets wet.

We are trying to evaluate how much of that design do we bring in today and at what point?

Board Member Battalio commented that what he has seen people do is provide some description of the adaptation approach that you anticipate using it. It doesn't have to be fully designed or implemented. Blocking off this structure to public access during unsafe conditions could be an adaptation strategy. If that was the strategy then I would be interested to know what the frequency of overtopping of the deck might be. The question would be, how frequently would it be overtopped?

It may not make sense to raise the deck for something that happens very rarely. I think you can manage the life/safety risks in other ways.

You say that you are using the high 2100, 100-year, water level criteria and that you are building finished floor elevations or foundation tops for six inches; and I know that these elevations are plus or minus, you have to have slopes and drainage – I wonder if you are really using that elevation which is conservative, why are you cutting it so close with the fill? I understand that you don't want to fill it more than you have to but it seems like you're cutting it kind of close. I think you probably won't cut it that close if you meet the criteria.

I am also curious about the freeboard being small relative to your criterion.

Board Member Moehle asked at what point do waves that are entrapped underneath this wharf become a risk?

Mr. Kennedy stated that the fill zone which is on top of the cement soil mix columns; there are a number of treatments that we could put in there and we really didn't want to specify at this point which they were.

Mr. Bruin stated that the site is actually a protected site. Waves over a foot are very, very unlikely. The loads are nothing on this deck and it was designed for much larger loads.

Board Member Battalio mentioned that there is an issue with air getting trapped and high air pressures. I don't know if you have vents or what.

Mr. Montes asked for a summary of the discussion and/or points so that the agenda could move forward in a timely manner.

Chair Borcherdt said that from the point of view of this project coming back to the Board it would depend on whether BCDC is in a position to issue a permit. If that is the case I would assume that BCDC would want this to come back to the Board. This is a major project and it has been presented very well. This is an excellent team covering all of the bases. There are some major issues to be addressed in this project. We have received some really clear input with respect to what some of the problems are.

With that I wish the applicant good luck with this project and we thank you for your time.

4. **Board Discussion: Union Pacific Railroad (UPRR) Martinez Bridge Replacement Project BCDC Permit Application No. M2016.008.00.** A copy of the item's verbatim transcript is available upon request and on the BCDC's website. Please contact Rafael Montes at rafael.montes@bcdc.ca.gov for further information. The project involves the replacement of the existing railroad bridge over Refugio Creek in the City of Hercules. The ECRB evaluated the engineering safety criteria of the project.

The first inquiry of the ECRB was about the difference between this project and one reviewed by the Board in May 2010. UPRR representatives explained that such project is completely different in design and location from the current one. The current project is located relatively at the same site but has a slightly longer span than the existing. The 2010 version of the project involved a different design and location to the north of the existing and a new widened and straightened creek alignment. Further, such bridge replacement had been sponsored for funding by the City of Hercules. However, the City funds did not become available and UPRR resorted to funding its own bridge replacement at the same location. UPRR reported that the bridge had been added to its structure replacement program in the year 2010. As a result, the project was at a 100% design ready for construction.

Although a different version of this project had been first reviewed by the Board, UPRR had used the same criteria based on the American Railway Engineering and Maintenance-of-Way Association (AREMA) to design the new bridge. But because of funding, the project had remained quiet for all these years until year 2014 when UPRR decided to fund it itself. The project was delayed for construction until 2017.

The project presentation covered geotechnical including seismicity, hydrologic and hydraulic analysis and structural design.

The Board raised many concerns about the proposed safety criteria including UPRR's characterization of the localized soils that directly affected the design criteria. During questioning, it was revealed that although the analysis indicated a significant risk of liquefaction and settlement, the design did not account for potential lateral spreading or landslides.

Therefore, the Board's concerns were about a failure of a bridge collapse during a major seismic event that could risk lives and safety of the Bay resources from a derailment accident. UPRR opined that the risk of collapse was minimal due to the size of the structure whose pilings' depth would reach sandstone and, moreover, there had been no such failures in the region. The seismic design criteria were based on a "survivability" criteria of a 2,475-year return period or a 2% chance in 50 years. Such design had been used throughout the system elsewhere. According the UPRR, if the bridge were damaged during an earthquake, crews would be inspecting the structure before letting trains go through. If major damages are incurred, the bridge could be repaired in a few days.

The Board inquired about any automated systems that would shut down traffic during an earthquake to prevent derailments and whether it had special criteria for bridges and hazardous situations. UPRR did not have an answer for the first question and did not have any special criteria for the second.

During the hydraulic and hydrologic presentation, UPRR had decided to widen the creek channel to reduce the water velocities and water surface during storm events. However, the flood analysis indicated that despite the wider channel the bridge deck could be overtopped during FEMA 100-year flood events. In addition, water velocities could be high enough to cause severe scour that could deplete the riprap protecting the north bridge abutment. UPRR opined that scour is not notable today and that its measures would decrease the risks compared to current conditions. It also mentioned that its bridges are inspected on a biennial basis.

UPRR made a brief presentation of the impacts of sea level rise on the bridge. The scenarios included water levels to years 2070 and 2100. The analysis took into consideration water levels from the coastal and creek side of the bridge.

The Board recognized that flooding was a concern now and could be exacerbated in the future and asked about any adaption measures and the frequency expectations of these flood events that could shut down the system. UPRR opined that trains could run even under high water level conditions as long as the tracks remain above water.

Finally, UPRR presented the structural analysis. UPRR relies on specific prefabricated components for use on its system throughout the country. There had been no seismic analysis done for bridges like this from the structural component perspective. However, its bridges have performed well over the years. The AREMA are guidelines and not a code to comply with. Therefore, UPRR can deviate from them and use engineering judgement. UPRR claimed the bridge to be very compact and strong in its geometry. Further, the bridges are designed for future ballast increase.

The Board asked whether its comments would/could influence any changes on the design. However, UPRR did not want to commit to such request. Further, the Board had concerns about bridge deck side displacement due to the proposed pile-deck connections that relied on welded sections including angles plates and “seismic straps.”

In conclusion, the Board declared that it recognized the lack of seismic design for this bridge. It also sought to request a statement from UPRR addressing all the concerns highlighted in the meeting discussions regarding soils characterization, non-inclusion of lateral loading, not following the railroad’s guidelines on its own survivability criteria, flooding concerns, including sea level rise, regarding impacts to structure from overtopping and scour and lack of adaptation measures. It also let BCDC staff determine the appropriate permit conveyance and conditions to

the applicant. The minutes of the meeting would reflect the recommendations by the Board to be followed by a response from the applicant aimed at meeting such recommendations. The suitability of the applicant's response and ultimate decision to issue a permit would be made by the Commission.

Unagendized item: For the record, Chair Borcherdt indicated his participation at the invitation of BCDC in various meetings as an advisory panel member representing the ECRB with respect to proposed seismic instrumentation plans for projects previously reviewed by the Board as documented in the technical specification letters provided by California Strong Motion Instrumentation Program (CSMIP) and the applicant. Further, he asked the Board members if they had any comments on his involvement in such activities. He mentioned briefly the ongoing work of advising the scope of the instrumentation plan for the Treasure Island Project reviewed by the Board in 2015.The Board acknowledged the contributions of the California Geological Survey (CGS) and the work of Dr. Tony Shakal, the manager of the CSMIP under CGS.

The Board unanimously recommended that a letter be drafted to acknowledge the contributions of the CSMIP program. The Chair volunteered to draft a letter for review by the Board that would be sent to the Executive Director of BCDC for consideration.

Mr. Montes made a last reminder of the next ECRB meeting to be either on June 7th or May 24th of the current year.

5. **Adjournment.** There being no further old or new business, the meeting was adjourned at 4:57 p.m.

Respectfully submitted,

RAFAEL MONTES, P.E.
Board Secretary

Approved, as corrected, at the
Engineering Criteria Review Board Meeting
May 24, 2017.