DISPUTE REVIEW BOARD RECOMENDATIONS
September 23, 2005

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Project SR 528 Bridge over Indian River
Financial No 404601-1-52-01 and 404601-1-56-02
Contract No. T5037
Issue Pier 13 Footing Removal and Replacement

Gentlemen:

The Dispute Review Board (DRB) was requested jointly by both parties to this contract, at the July 07, 2005 meeting of this Board, to schedule and conduct a hearing concerning the subject issue.

The hearing was scheduled and conducted on September 01, 2005 at the DOT Fiske Blvd. office in Rockledge.

The purpose of the hearing is to determine whether or not the contractor (JBC) is entitled to compensation for the removal and replacement of Pier 13 Footing as directed by the Department, through its consultant, Parsons Transportation Group (PTG).

JBC POSITION:
Johnson Bros. Corporation Pier 13 Footing Removal and Replacement Position Statement received August 15, 2005
(Appendices not included)

> *I am forwarding our position paper and supporting documentation as referenced above. As you are aware, cracks formed in the Pier 13 footing shortly after placement. Johnson Bros Corporation proposed to repair the footing but the repair was rejected and we were directed to remove and replace the footing. We subsequently submitted a claim for the difference between the repair cost and the cost of removal and replacement.*
>
> *The attached "Basis of Claim" states our position and references the attached*

supporting documents. These documents are contained in Appendices D through J (Appendices A through C contained cost information and are not included).

The Appendices are as follows:
Appendix 0 -- Survey and Related Information
Appendix E -- Report by E & L Support Services
Appendix F -- Report by Bridge Concepts, Inc.
Appendix G -- Reports by WOP, Inc.
Appendix H -- Report by Concorr, Inc. (prepared for FOOT) Appendix I -- Miscellaneous supporting documents
Appendix J -- Claim letters and certification as submitted to FOOT
SR 528 Bridge over Indian River Cracking in Pier 13
Footing Basis of Claim

Introduction
Following the construction of the Pier 13 footing in June 2004, cracks appeared in the concrete. Based on FDOT's assumption that the cracks were the fault of the contractor, JBC was required to submit an engineered plan to repair the footing. JBC carried on an extensive investigation of the footing and proposed a repair consistent with Table I of Article 400-21 of the supplemental specifications.

Following a review by FDOT and the engineer of record, the repair method was disapproved and JBC was directed to remove and replace the footing. At that time, JBC notified FDOT that we would proceed as directed but that such repairs were considered to be beyond our contractual obligations and that we. would claim for the costs and impact of this action. The removal and replacement was completed in April 2005.

This claim includes the difference in cost between the method of repair proposed by JBC and the cost of removal and replacement. It also includes the cost of the engineering studies associated with the work. There was no impact on the overall schedule and no time extension or delay costs are included.

There are three issues to consider in this claim as listed here:

The cracks are non-structural and the repairs are specified in the contract documents. Remove and replace is outside of the specifications and, in fact, constitutes additional directed work.

Even if FDOT would claim that the cracks are structural, the proposed repair is a suitable method to resolve the problem. The costs for work beyond these appropriate repairs is extra work and should be compensated.
Removal and replacement of this footing for the minor cracking that occurred is far beyond industry standards and is something that was not and should not have been contemplated at the time of bid.

Repairs as Required by the Contract Documents

The repair of cracks in concrete is addressed in Article 400-21 of the Supplemental Specifications for this project. The cracks are classified as structural and non-structural. The repair of structural cracks requires the approval of the engineer. Repair of non-structural cracks is described in detail in this article and consists of no treatment, sealing, and/or epoxy injection depending on the environment and the width of the cracks. Per the contract documents, structural cracks are defined as "those which are induced by external forces which produce internal stresses exceeding the tensile strength of the concrete." In the same article, non-structural cracks are defined as "those which appear as a result of atmospheric effects and localized constraint effects."

This article allows that "the Engineer will determine the classification of cracks." This determination, however, cannot be arbitrary and capricious. In fact, findings by several outside consultants unanimously agree that the cracks are nonstructural as defined in the specifications. The determination by FDOT that the cracks are structural overrules these definitions. Clearly, it is not the intent of this sentence to allow the Engineer to change the specifications after the award of the contract.

Non-Structural Cracking

As part of the claim, we provided sealed engineering reports from three firms: E & L Support Services, Inc.; Bridge Concepts, Inc.; and Whitlock Dalrymple Poston & Associates. All of the reports were prepared by Principals of these firms who have significant expertise in this field and all state that the cracks are non-structural.

The first report, prepared by Mr. Rousch of E & L Services, lays out the proposed repairs. In his report Mr. Roush states that he observed and measured the cracks and proposed the solution defined in Table I of Article 400-21, "Criteria for Sealing Nonstructural Cracks During Construction." He also noted that there was one crack greater than .025 inches (the limit of the table) and he proposed the method to fix that crack also. (See pages E-1 through E-3).

Following a review by FDOT, they requested additional studies including a structural analysis. (See pages F-3 through F-9). For this, we hired Mr. Medina from Bridge Concepts. From observations made by Mr. Medina on site, he notes that "the size and pattern of these cracks do not suggest that they are structural." (See page F-3). He provided a structural analysis that indicated that the cracks were not significant. He makes further comments noted below regarding the relationship of these cracks to settlement.

*After further review, F*DOT *required additional studies including in-situ testing of the concrete. For this, we obtained the services of Dr. Poston with Whitlock Dalrymple Poston & Associates. Dr. Poston has done extensive studies of cracking in concrete and is the former chairman. of the ACI Committee on Cracking in Concrete. He has also published numerous papers on crack investigation and repair. Dr. Poston personally observed the cracks and performed the in-situ testing. His report notes* "The discontinuous and nonpatterned configuration of the cracking as well as the tapering widths with increasing depth suggest that the cracking

mechanism may be in part due to restrained shrinkage of the concrete. The relative size of the pile cap also suggests that thermal effects may have contributed to some extent, though these effects would have been localized based on the resulting crack configuration. The entirety of the cracking appears similar in nature to benign, localized shrinkage cracks, independent of other structural and materials-based cracking mechanisms." ***(Reference Page G-7).*** *In the summary, he notes that* "The nature of the cracking does not appear consistent with that of structurally significant mechanisms caused by aspects of design or construction; the cracking is' most likely attributed to localized effects of restrained drying shrinkage and possibly thermal effects." ***(Reference Page G-7).***

In a subsequent report dated 1/13/05 in which Dr. Poston reviewed the report prepared for FDOT by CONCORR, he again states "the observed cracking as previously assessed by WDP is nonstructural." ***(See page G-31).*** Later in the same report, He notes that "For nonstructural cracking, the contract specifications described cracking which is caused by atmospheric and localized constraint effects. This 'shrinkage cracking' is not the result of design structural loading. Thus, not only in a theoretical evaluation, but also in the specific context of contract specifications, the observed cracking is properly considered nonstructural in nature and should be approached as such with regard to contract specified remediation; repairs, where required by contract documents, should be affected in the case of nonstructural cracking, rather than complete structural replacement based on a fundamentally incorrect assessment of the observed cracking." ***(Page G-32)***

Dr. Poston prepared a letter report on that same day addressing the claim issues we noted above. He states "Whitlock Dalrymple Poston and Associates, Inc. (WDP) asserts that the observed cracking in the pile cap of Pier 13 at the Indian River Bridge is nonstructural in nature, and by extension, does not require repairs beyond those based on width requirements of the project Contract Specifications. This position is based on field work performed by WDP, including visual observation and limited nondestructive testing. The widths and configurations of the observed cracks are inconsistent with the theoretical concept of structural cracking as well as the definition of structural cracking described by the Contract Specifications. "***(Page G-37)***

When the footing was removed, it was cut into pieces and these pieces were available for observation. Both CONCORR (working for FOOT) and Dr. Poston observed these pieces as well as the portion of the pier cap that was still remaining. In a letter report dated 4/19/05, Dr. Poston states that "My observations of the removed concrete blocks in no way changes the analysis and opinions expressed in previous letter reports dated November 30, 2004 and January 13, 2005. In fact, observations that were made possible because of concrete removal only strengthened the opinions that I have previously presented." ***(Page G-39)***

Presumed Settlement of the Footing

The method used to support the falsework for this pier included pipe piles driven just inside the sheeting. The pipe piles in combination with the permanent concrete piles

provided support for the DYWIDAG hangers which in turn supported the bottom form of the footing as shown on JBC drawing 2280-6 rev C. (Page 1-2)

After the footing was poured and the cracks began to appear, JBC surveyed the top of the pipe piles at the request of PTG. This survey showed the pile tops ranging from 3.92 to 3.86 with the southwest pile being the lowest. (D-13) The proposed top of pipe elevation was 4.0. No surveys of the pipe piles were done before the pour since ~hey only needed to be close enough to make connections to the frame supporting the hangers which in turn were adjusted to set the formwork elevation.' (See note on Page 0-7) In fact, it is not reasonable to expect that we would make the costly effort into cutting all of the piles exactly at a given elevation since any difference in elevation is easily corrected by adjusting the nuts on the DYWIDAG rods.

This difference between a "paper elevation" of 4.00 and the measured elevation of 3.86 was interpreted by PTG/FDOT to represent a differential settlement of the southwest pipe pile and hence the falsework amounting to about 1-5/8." Actually, it only shows that the top of the pipe pile was not at elevation 4.0 and shows nothing about settlement. The elevation of the falsework is controlled by the hangers and is essentially independent of the top of pipe. While the survey shows the top of pipe elevation after the pour, there is no survey data to show what the top of pipe elevation was before the pour.

The elevation of the top of pipe is meaningless as only the footing is a controlled elevation. In fact, subsequent surveys showed that the southwest corner of the footing was approximately .01 feet high and all of the corners were within 0.01 feet of the planned elevation. (Page 0-15). Since the measured elevation of the footing is within .01 feet of the planned elevation, it is apparent that the're was no settlement of the falsework. Since the top of pipe survey says nothing about settlement, there is no conflict in these surveys. There was also a statement that the top of footing in the southwest corner was too low. Actually, the survey of the corner showed it was also slightly high when considering the required slope of the top of footing. The attached sheet summarizes the survey information.

This misinterpretation of the pipe pile survey led to the erroneous conclusion that the footing had settled and,. therefore, cracking was structural. (Pages 0-16 through 0-19 summarize the discussion regarding settlement).

As noted in Article 400-21 of the supplemental specifications regarding classification of the cracks, a structural crack is the result of an external force. In this case, FOOT asserts that the footing settled and this provided the external force. This is noted in several documents. An email dated July 13, 2004 form Mr. Hudec (PTG) to Mr. Juric (JBC), et al says "Since it is believed that the structural footing cracks originating from the settling of one or more of the form supporting pipe piles during the footing placement and or a spike in the concrete temperatures during the first day of mass concrete monitoring, it becomes a supposed failure due to the contractors means and

methods." *(Page 1-9) In reference to the concern regarding temperature it. should be noted that the temperature differential at no time exceeded the limit required in the concrete plan. It is further worth noting at this time that the supposed problem due to temperature is later eliminated in a subsequent email from Mr. Dan Haldi (FDOT) dated December 10, 2004. Mr. Haldi, states* "it is my opinion that the temperature differential did not initiate the cracking nor did it attribute to the extent, type and pattern of the observed cracks." *(Page 1-21)*

A letter to Mr. McDonald (JBC) from Mr. Hudec (PTG) dated October 22, 2004 also discusses the settlement. It states as follows: "JBC's latest contention which PTG first heard on 10/20/04 is that the footing did not settle during or after placement. The initial survey, provided by JBC, showed differential settlement of as much as 1-5/8" in the southwest comer. Discussions on 10/20/04 were centered around a new survey which JBC now contends indicates no settlement has occurred. JBC must provide both surveys with clear explanations regarding this conflicting information since one of the central issues regarding the disposition of Pier 13 is whether or not the footing settled." *(Page 1-11). It should be noted that, at this time, we are not able to find any documentation that JBC ever suggested that the footing had settled. We only provided the requested survey. As noted above, the surveys don't conflict. One is the measurement of the top of pipe pile and the other is the measurement of the bottom of footing. Both are correct but only the bottom of footing is meaningful.*

In an email from Mr.Shaw(KCA)toMr. Plotkin (FDOT) dated 8/9/2004, Mr. Shaw states "Section 400-21 of the Standard Specifications states that "structural cracks are those which are induced by external forces which produce internal stresses exceeding the tensile strength of the concrete.' Based upon t:he e-mail from Ed Hudec (Project Engineer), the cracks were first detected on 6/29/04 at which time it was revealed that the pipe piles supporting the falsework settled by as much as 1-5/8." It is my opinion that these cracks are a direct result of the settlement of the falsework while the concrete was still green and are thus structural cracks as defined by the specifications." *(Page 1-15)*

The response to this was an email from Mr. Plotkin on the same date where he states "This office agrees with Mr. Shaw's observations below as does the State Structures Office. Therefore, specification 400-21 which deals with nonstructural cracks does not apply." *(Page 1-14) Again, it appears that without any settlement, the cracks are considered non-structural.*

Mr. Shaw in a later letter to Mr. Plotkin (dated 10/5/2004) repeats his position "as previously mentioned, the original documentation provided by the contractor indicated that the falsework settled during the concrete pour by as much as 15/8." This would result in an external force induced on the footing and by definition this is a structural crack." (Page 1-18) He further states that "further investigation into whether or not the falsework settled or not may be warranted." (Page 1-18) In this letter, Mr. Shaw later notes "The methodology for supporting the falsework on subsequent piers was revised to carry the majority of the dead load of the fresh concrete and consequently no cracks have occurred. This tends to support the

'theory' that the cracks were a result of pile settlement and not merely shrinkage cracks as a result of atmospheric effects." *(Page 1-17) As noted by Mr. Shaw, the method to support the falsework was revised to carry the load on the concrete production piles. This modification was necessary to continue working. Since FOOT believed that settlement of the pipe piles resulted in cracking, a method using the pipe piles would likely be rejected. In addition to changing the support, method, JBC also made minor changes to the mix (reduced the retarder) and changed our approach to curing with this activity coming much sooner after the pour than was done for Pier 13. The latter changes would limit the atmospheric effects and lessen the chance that shrinkage cracks would form. We believe that the change to the curing is the reason that no subsequent cracking occurred.*

In a response to this letter, Mr. Plotkin writes "The crack size, depth and width and the fact that new cracks are forming and existing cracks are progressing,
clearly indicate that the cracking situation has not stabilized and is predominantly structural. *(Page 1-20) In conclusion he states that* "it is my opinion that the footing should be removed and replaced." *(Page 1-20)*

It should be noted that crack size, depth, width and formation of new cracks have nothing to do with the classification of the cracks. The contract's classification of structural cracking and non-structural cracking makes no mention of any of these items. Nothing in the contract defin.itions limit the depth of nonstructural cracks nor do they require that cracks are structural if new cracks form.

Our experts also addressed the issue of the assumed settlement of the falsework. In his September 27, 2004 letter report Mr. Medina (Bridge Concepts, Inc.) states "The theory previously offered that the falsework settled and caused cracking does not correspond with the orientation of the cracks to the falsework support layout." Furthermore, if the falsework settled during casting then either the top of concrete elevations at the footing would reflect that or the footing thickness around the pile cap would show a variation. Measurements at the footing did not show that to be the case." *(Page F-3) He goes on to state* "Cracks due to Falsework settlement would have been oriented in a pattern which could explain a particular strain to the concrete from particular location of the temporary structure settlement. Cracks that go in random circle-like patterns with no particular orientation to the temporary supports were the norm of what was observed on site." ***(Pages F-3 and F-4)***

*Dr. Poston (WDP) in his November 30, 2004 report similarly states "*No particular pattern was evident in the configuration of the surface cracking; surface cracks were relatively isolated and discontinuous." ***(Page G-4)*** *He later notes* "At all locations where cracking was discemable, no relative displacement was observed on opposite sides of crack surfaces; the respective pile cap surfaces remained planar in thee areas indicating no differential movement across the cracks." ***(Page G-4)***

The supposed settlement of the falsework at the time of the pour is not supported by the facts. Without this settlement, there is no external force to cause "structural" cracks. Furthermore, investigations by independent experts based on observation

and testing conclude that the cracking is non-structural. As such, the repairs were specified in the contract documents and those are the repairs which we proposed. Removal and replacement is beyond the requirements of the contract and constitutes additional work for which we should be fairly compensated.

Proposed Repairs were Adequate

Regardless of the cause of the cracks, the proposed repairs were adequate to resolve the problem. This could have been done at substantially less cost than the directed removal and replacement. Mr. Medina (Bridge Concepts, Inc.) in his September 27, 2004 report states "it is my professional opinion that the repair procedure previously submitted by Johnson Bros. Corporation, which follows the Florida Department of Transportation recommendations for sealing or injecting non-structural cracks, is adequate for the protection of this structural element." ***(Page F-4)***

Dr. Poston (WDP) notes in his original report notes that "the observed cracking is considered to be structurally insignificant for the intended service expoxure of the structure." ***(Page G-7)*** *He further notes* "WDP asserts that the observed cracks have no structural implications with regard to the anticipated performance of the pile cap. WDP does not recommend any repairs at this time." ***(Page G-7, G-8)***

In his review of the CONCORR report (dated January 13, 2005) Dr. Poston states "the observed cracking does not appear to have characteristics that would detrimentally affect the structural performance of the pile cap for the remainder of the projected service life." ***(Page G-31)*** *He later concludes* "It is an undisputed fact that cracking exists in the pile cap, and in an aggressive marine environment, this is a legitimate conceptual concern. As a consulting engineering firm, WDP has extensive experience in the design and analysis of concrete structures. Furthermore, WDP has extensive experience in evaluating, assessing, and repairing cracking in concrete structures of all varieties. Based on first hand knowledge of the cracking on-site and in the context of structural engineering principles, WDP maintains the original position presented in its letter dated 11/30/04 that the observed cracks have no structural implications with regard to the anticipated performance and longevity of the pile cap. The reports previously discussed in this letter *(CONCORRS report)* provide no significant compelling information to the contrary. As such, removal and replacement of the footing is not necessary based qn concerns of structural integrity." *(Page G-36)*

In his letter report of the same day, Dr. Poston adds "Any effort to remediate observed cracking by means of removal and replacement may be considered extremely excessive and completely unfounded. The principles of structural mechanics suggest that the observed cracking poses no threat to structural performance based on strength and integrity of the pile cap for the remainder of its projected service life." *(Page G-37)*

Investigations by outside experts conclude that the cracking was minor in nature and would not affect the structural integrity or the longevity of the structure. As

such, the proposed repairs were more than adequate to ensure the adequacy of the final product.

Industry Standards

In reviewing this problem with our outside experts, we asked if they could provide any history in the industry where removal and replacement was required for similar cracking. Neither we nor they are aware of any. Clearly, minor cracking is expected in concrete construction. As evidence of this, Article 400-21 allows for it and specifies a repair method based on the widths of cracking and environmental concerns. While the FDOT asserts that the cracks are structural, the majority of the cracks, were they defined as non-structural, would be repaired by simply using a penetrant sealer. Yet the same crack (defined as structural) is, in this case, cause for complete removal. Dr. Poston notes in his January 13 report notes that the preponderance of the cracking is less than 0.006 inches and within ACI design guidelines for no repair. Even though these cracks call for no repair when based on ACI standards, FOOT required complete removal in this case. We could not have anticipated that such minor cracking would be cause for complete removal and replacement at the time of bid. Industry standards would indicate that crack repair using epoxy and sealant would be appropriate.

Comments Regarding Concorr Draft Supplemental Report dated 3/11/ 2005

We have recently received the report from Concorr describing their investigation of the footing during the removal process. It is our opinion that any study carried on after the removal process is flawed since there is no way to determine the effects of the removal versus the in-situ properties of the footing concrete. In reviewing Concorr's report it appears that they have attempted to limit their comments to cracks which they could determine were not affected by the transport and storage. Note that this does not include the effects of cutting and the change in stresses incurred in the concrete as various blocks are removed. Furthermore, there does not appear to be any linkage between cracks observed in this report and known cracks in the in-situ footing. These cracks may be totally independent of the cracks that led to the removal of the footing. It is also possible that these cracks are the same as some noted in the original investigation but the width and length of the cracks may have been affected by the removal. In fact, the original cracks, since they were not repaired, would likely be affected by the removal as these cracks are areas of stress concentration.

This supplemental report shows cracks with widths ranging from 13 to 50 mils with all but one being 20 to 50 mils. In the previous studies by Concorr, E & L Support and WDP, no crack greater than 20 mils was discovered. In situ tests by WDP showed that the cracks narrowed with depth to widths less than .004". Dr. Poston from WDP also viewed the removed blocks and the remainder of the footing and, as previously noted, states clearly that his opinion is unchanged. In comparing data from this report with the in situ testing it is clear that the removal has caused or accentuated these cracks and the results can not be related to the intact footing.

FDOT/PTG POSITION:

Parsons Transportation Group Pier 13 Footing Removal and Replacement Issue Statement and Position Statement both articles dated August 15, 2005
(Exhibits not included)

Issue Statement

On June 23, 2005 Johnson Bros. Corporation (JBC) submitted a claim for costs incurred due to the removal and replacement of pier footing # 13. JBC was directed by PTG and the FDOT to remove and replace footing # 13 due to excessive structural cracking. Footing # 13 construction began in May 2004. The supporting falsework, for this footing only, consisted of miscellaneous lumber supported by tranverse I-beams. The 1Beams were simply supported by cross beams which rested on driven pipe piles. It should be noted that the contractor's shop drawings didn't indicate any bearing value for the pipe piles. Footing concrete was placed on June 13, 2004 with cracks developing by June 29, 2004 (Exhibit A). A crack map was originated for the purpose of observing any propagation of cracks. An updated version to the crack map did indicate that the cracks continued to grow (Exhibit B). On July 13, 2004 PTG sent an e-mail to JBC (Exhibit C) requesting a Specialty Engineer be retained to determine what effect the cracks would have on the required loading and structural integrity/longevity of the footing. The e-mail also requested the Specialty Engineer to propose a method of repair. At this time, early indications from JBC's survey, indicated the cracks were due to the settling of the pipe piles and by definition, were structural craCks. Structural and/or cracks in excess of .025" require an engineering analysis in accordance with Supplemental Specification 400-21.

On July 31, 2004, JBC's Specialty Engineer, Ken Rousch, P.E., provided the first repair procedure for the footing cracks. (Exhibit D). This correspondence was reviewed by the Engineer of Record Tom Shaw, P.E. Mr. Shaw's response of August 7, 2004, (Exhibit E) stated that he considered the cracking to be structural and required the Specialty Engineer to address the footing's diminished capacity and long term serviceability. On August 9, 2004, Steve Plotkin, P.E., State Construction Structures Engineer sent an e-mail (Exhibit F) stating that due to the severe structural cracking of the footing in question, the portion of supplemental specification 400-21 dealing with non-structural cracks, does not apply. Mr. Plotkin further stated that the contractor's repair plan must ensure the finished product has the full strength and durability required by design, which is based on an uncracked component.

On September 27, 2004, JBC's second specialty engineer, Hector Medina, P.E. stated that the cracks were mostly minor in nature, not exhibiting a pattern resulting from settlement and could be sealed as previously proposed. Mr. Medina also stated that the larger cracks, on the top surface, would be in compression upon loading. Mr. Medina's report was reviewed by Jim Boughanem, P.E., Brevard Resident Engineer (Exhibit G), Tom Shaw (Exhibit H) and again by Steve Plotkin (Exhibit I). All readdressed the issue of footing settlement and questioned why the capacity and footing durability issues had not been addressed. Steve Plotkin added that the footing should be removed and replaced.

On October 13, 2004, PTG responded (Exhibit J), to JBC's Specialty Engineer's report stating that sealing the cracks and putting the unit into service were not acceptable. PTG required further investigation into the depth of the cracks, to ensure they did not

exist below the neutral axis, which meant the cracks would be in tension instead of compression and requested a repair procedure that would provide for a maintenance free design life.

On October 20,2004, an on-site meeting was held with members present from JBC, JBC's Specialty Engineer, PTG, State Structures Office and the Engineer of Record. The purpose of the meeting was to offer the contractor further direction to proceed. A summary of the meeting, written on October 22,2004, (Exhibit K), required the contractor to provide answers to 6 (six) concerns: First, the burden of proof as to whether the footing
could be repaired and made functional was on the contractor. Second, provide an explanation to the survey question; did the footing settle or did it not. Third, address the issue of crack propagation. Fourth, address the issue of crack depth to include taking four foot deep cores. These cores will also be evaluated by the State Materials Engineer and State Materials Corrosion Office. Fifth, the contractor's final recommendation must be approved by the District and State Structures Design Offices. Sixth, the contractor must provide signed and sealed recommendations for the above six items, complete with back-up documentation.

Following the on-site meeting of October 20, 2004 it was decided that a teleconference would take place to discuss the Specialty Engineer's recommendations on December 10, 2004. To satisfy the fourth requirement listed in the above paragraph, the contractor had 10 (ten) four foot deep cores taken on November 41h and 51h 2004. The core locations were selected by PTG and the Engineer of Record. The FDOT employed the services of Concorr Florida, a corrosion specialist, to record crack depths, widths and to note any special characteristics of the cracks. The results of the report (Exhibit L), as summarized by Mike Bergin, P.E., State Structural Materials Engineer, (Exhibit M) stated the cracks appeared to be structural in nature and the durability of the footing was in question.

In the teleconference of December 10, 2004, JBC and their Specialty Engineers were not successful in convincing PTG and the FDOT that the cracks were not structural in nature. Nor was a proposal presented which adequately addressed the structural integrity and/or long term durability of the footing (Exhibit N). PTG therefore directed the contractor to remove and replace the footing in its letter of December 15, 2004 (Exhibit N).

During the removal stages of the footing Concorr Florida was again on site to further investigate crack widths and depths. This report (Exhibit 0) stated that seven cracks were documented, unrelated to the removal process, which ranged in depths from 43 to 84 inches and thicknesses of .013" to .050". In Mike Bergin's review of Concorr's report (Exhibit P), he stated that the durability of the structure was compromised and would not meet its intended lifecycle.

The issue is very simple. Should the FDOT have accepted a structure with questionable loading characteristics, an unknown life cycle and undetermined maintenance requirements?

Position Statement

As reflected in the issue statement. Parsons Transportation Group (PTG) did review the claim submitted by Johnson Bros. Corporation (JBC) for costs incurred due to the removal and replacement of footing # 13. In a letter written by PTG on

December 15, 2004 (Exhibit QJ, the contractor was directed to remove and replace footing # 13 due to the contractor's inability to prove the cracks non structural and for the lack of presenting a repair proposal that adequately addressed the structural integrity and long term durability of the defective footing. However the question of any monetary entitlement for removing and replacing the footing has been escalated to the Disputes Review Board for a ruling.

From the two reports by Concorr (Exhibit R), the earlier report dated December 8, 2004 stated that in two of the ten four foot cores taken, cracks extended to at least 36.5"
below the top of the footing. At that point the cracks became unidentifiable either due to exiting the core hole or due to an obstruction such as a pile top. In this extremely small number of cores as compared to the volume of concrete indications as earlier November 4, 2004, the date of the cores, indicdte cracks were close to the neutral axis. In Concorr's second report dated March 21, 2005 which was completed after witnessing removal of the footing blocks, seven cracks were identified to be between 43 inches and 84 inches (well below the neutral axis) long and from .013" to .050" wide. As addressed in the PTG letter of October 22,2004 (Exhibit S), the contractor was asked to determine the extent of cracking, specifically whether or not the cracks extended below the neutral axis. According to one of JBC's Specialty Engineers, Hector Medina, P.E. (exhibit T), as long as the cracks were above the neutral axis they would have a tendency to close (compression) upon pier loading. It should follow that cracks extending below the neutral axis would have a tendency to open (tension) upon loading. JBC never addressed possibility by providing new pier loading calculations nor with a repair procedure for achieving the seventy - five year design life of the structure. It is hard to conceive that cracks, below the neutral axis, would have no effect on these characteristics. The PTG/FDOT position was to reject the footing since neither structural integrity nor footing durability were addressed.

JBC REBUTTAL:

Johnson Bros. Corporation Pier 13 Footing Removal and Replacement Rebuttal dated August 25, 2005

Johnson Bros disagrees with the interpretation of the December 8, 2004 Concorr report as presented on page 3 of the issue statement. The issue statement says that "This report (Exhibit 0) stated that seven cracks were documented, unrelated to the removal process." In fact, the report states that "seven major cracks were found in the footing and were confirmed to be unrelated to removing blocks of concrete from the footing and transporting these to land."

The important clarification here is that the procedure used by Concorr does not show whether or not the cracks were present in the footing when the footing was intact. Concorr describes the method in Exhibit 0 on page 6 of 15. They note that "Confirmation of this was made by identifying cracks on blocks that had been removed from the footing and transported to land with corresponding cracks on the matching concrete face that was still intact in the cofferdam." This method only allows Concorr to determine blocks that were damaged in transport. How and when the crack occurred in the footing cannot be determined. Clearly, cracks can be

caused or expanded by the change in the state of stress in the concrete due to drilling core holes and cutting the concrete and associated forces created by temporary eccentric loading, stress relief, impact, cutting rebar and sawing of this and adjacent blocks. Assuming that a crack formed during the cutting and removal process, if the associated block was not damaged in transport, this crack would meet Concorr's criteria and would be "confirmed to be unrelated to removing blocks of concrete and transporting these to land" but would not have existed in the intact footing.

This post removal investigation basically has no relation to the footing prior to the initiation of the removal. It is not possible to determine the effects of saw cutting, block removal, impact loads from equipment and concrete blocks, stress relief, unbalanced gravity forces, moments in the concrete due to partial removal of the footing, temporary eccentric loads during cutting, etc. The footing was not designed to function with missing parts nor did our removal method consider minimizing cracking during removal. In fact, Dr. Poston with WDP performed an inspection of the concrete blocks and the exposed faces on the footing on 2/22/05. In his letter dated 4/19/05 (JBC Submittal document Appendix G, page G-39) he states that "My observations of the removed concrete blocks in no way changes the analysis and opinions expressed in previous letter reports dated November 30, 2004 and January 13, 2005. In fact, observations that were made possible because of concrete removal only strengthened the opinions that I have previously presented."

On page 2 of the issue statement, the results of Concorr's report is misstated. In the next to last paragraph, it states "The results of the report (Exhibit L), as summarized by Mike Bergin, P.E., State Structural Materials Engineer, (Exhibit M) stated the cracks appeared to be structural in nature and the durability of the footing was in question." This, in fact, is Mr. Bergin's opinion. In neither of their reports (Exhibit L and Exhibit 0) does Concorr express the opinion that the cracks are structural in nature. Oddly, in their December 8, 2004 report (Exhibit L) rather than express their opinion they include the following statement on page 21 of 24; "19. Mr. Michael Bergin, P.E., FDOT State Structural Materials Engineer, is of the opinion that the cracks in the footing are structural in nature and that the durability of the structure is questionable."

On page 2 of the Position Statement, we take exception to the comment that "Initially, as some enclosed correspondence indicates, PTG was told by JBC that the footing settled." We are unable to find any enclosed correspondence where JBC tells PTG that the footing settled. In fact, we are unable to find any correspondence from JBC to PTG enclosed. We are not aware that anyone from JBC told PTG that the footing settled but, even should that be the case, the survey data of the footing shows clearly that it did not settle. This survey data shows all four corners of the footing to be within 0.01 feet of the planned elevation. PTG includes in the same paragraph the statement that "it could not be proven, without any doubt, that the footing settled." Since the survey shows that the footing did not settle, that is obviously a true statement.

The initial information that was provided by JBC to PTG was a survey of the pipe piles. This was misinterpreted to indicate settlement of the footing and this

misinterpretation was the basis of the conclusion by FDOT that the cracks were structural. This is shown in FDOT's presentation in Exhibit C, Exhibit E, Exhibit G, Exhibit H, Exhibit I (which also incorrectly states that the top of the footing was non-uniformly too low), Exhibit J and Exhibit K.

On page 2 of FDOT's position statement, they note "...the falsework system used on footing # 13 was never duplicated in succeeding placements. The driven support piles were eliminated and all falsework was supported by the predriven 30" concrete piles. With this change there was never again an issue with footing cracks." An equally true statement could be made as follows: The curing procedure used on Footing # 13 was never duplicated in succeeding placements. For all subsequent pours, insulation was placed on the footing immediately after the pour. With this change, there was never again an issue with footing cracks.

What is not mentioned is that after Pier #13 (the first one poured, incidentally), JBC changed their curing procedures. For Pier #13 JBC did not place any insulation on the footing for about the first 18 hours. The temperature readings showed an early peak in differential temperatures in excess of 30 degrees within the first 20 hours. For all subsequent footings, JBC placed insulation on the footings essentially immediately after the pour. Once we started using this procedure, the cracking problem ended.

FDOT/ PTG REBUTTAL:

Parsons Transportation Group Pier 13 Footing Removal and Replacement Rebuttal dated August 25, 2005

As permitted by the DRB Operating Guidelines, please find the PTG/FDOT rebuttal to the position paper as submitted by Johnson Bros. Corporation (JBC).

According to Supplemental Specification 400-21, the classification of cracks are determined by the "Engineer". The definition of "Engineer" as defined in section 1-3 of the Standard Specifications is "The State Construction Engineer, acting directly or through duly authorized representatives: such representatives acting within the scope of the duties and authority assigned to them". That said, the "Engineer" can be any individual, employed by the FDOT, acting under the chain of command (escalation matrix) of The State Construction Engineer. Therefore the FDOT or its representatives determine whether or not the cracks are structural.

Early indication from JBC was that footing settlement occurred. No pre and post formwork/falsework elevations were taken by PTG. Therefore as early correspondence contained in both the issue and position statements indicates, the settlement issue originated from JBC. Later, after extensive research into survey data, it was concluded that not enough pre and post placement elevations tied to the same elements were taken. to indicate without question, whether settlement occurred. However, using the same argument, it cannot be ascertained without a doubt, that settlement did not occur. As the PTG Issue and Position statements indicate, footing # 13 was the only footing where the support falsework was supported by pipe piles.

These were placed without any bearing criteria. Therefore some settlement of the temporary pipe piles should have been expected. It also remains the only footing that developed cracks.

At the point Steve Plotkin, State Construction Structures Engineer. stated "the crack size, depth and width and the fact that new cracks are forming and existing cracks are progressing, clearly indicate that the cracking situation has not stabilized and is predominately structural" (Exhibit I of PTG's Issue statement), the cracks were determined to be structural as classified by the "Engineer". In accordance with Supplemental Specification 400-21, the repair procedure for structural cracking must be approved by the "Engineer".

JBC was given several opportunities to propose a repair procedure which would ensure footing durability for the entire design life (75 years). None however were presented. JBC's arguments were that the cracks were non-structural or minor and needed to be repaired in accordance with the guidelines for non-structural cracking. It also needs to be understood that JBC's arguments were based on opinions of their Specialty Engineers. These opinions may have been based on experience but were still just opinions.

In accordance with supplemental specification 400-21, "The Engineer" had already determined that the cracks were structural and was looking for calculations to satisfy possible reduced loading capacities of the cracked footing and repair procedures to answer the footing durability questions. The reduced loading of the footing was only addressed by Bridge Concepts, JBC's Specialty Engineer, in the statement that cracks above the neutral axis would tend to be in compression and close upon vertical loading. Neither JBC nor any of JBC's Specialty Engineers addressed the cracks below the neutral axis which would have a tendency to open under vertical loading and how this might effect the design life of the footing. The report by CONCORR confirmed seven major cracks in the footing unrelated to the demolition process. These cracks were both vertical and diagonal and ranged in length from 43" to 84" with widths from 13 to 50 mils. These cracks obviously extended below the neutral axis.

Standard Specification 5-3 states if the "Engineer" finds that the contractor has produced an inferior or unsatisfactory product, the contractor shall remove and replace or otherwise correct the work at no expense to the Department.

ISSUE BACKGROUND (As provided by DRB):

On June 23, 2004 the first pier footing (Pier Footing #13) was poured in connection with construction of the new East-bound Indian River bridge on the subject project. Cracks developed in the footing after the pour was completed.

Presence of the cracks prompted PTG to request that JBC retain a Specialty Engineer to

determine what effect the cracks might have on the required loading and structural integrity/longevity of the footing and also have a Specialty Engineer prepare a method of repair.

Subsequently, three Specialty Engineers were engaged by JBC and resulted in the following:

- E&L Support Services, Inc.
  Kenneth H. Rough, P.E.
  Report dated July 13, 2004 described cracks as non-structural and submitted a repair procedure.

- Bridge Concepts, Inc.
  Hector L. Medina, P.E.
  Report dated September 27, 2004 supports repair procedure, cracks do not suggest they are structural but is "map cracking". The one large crack appears to be the result of not finishing the concrete between bars. Describes forming and falsework construction and states, "it is clear that no settlement of the supporting piles has occurred."

- Whitlock, Dalrymple, Poston & Associates, Inc.
  Randall W. Poston, Ph.D., P.E. and James More, EIT
  Report dated November 30, 2004 finds that the cracking is considered to be structurally insignificant, "mostly attributed to localized efforts of restrained drying shrinkage and possibly thermal effects." "WDP does not recommend any repairs at this time."

- Whitlock, Dalrymple, Poston & Associates, Inc.
  Randall W. Poston, Ph.D., P.E.
  Letter dated January 13, 2005 addressed concerns of information from Ed Hudee and the draft report of Concorr Florida, Inc. of December 08, 2004. Poston states, "the observed cracking as previously assumed by WDP is non-structural. That is, the observed cracking does not appear to have characteristics that would detrimentally affect the structural performance or longevity, in terms of strength and integrity of the pile cap for the remainder of the projected service life."

- Whitlock, Dalrymple, Poston & Associates, Inc.
  Randall W. Poston, Ph.D., P.E.
  Letter of April 19, 2005 states, "my observation of the reviewed concrete blocks in no way changes the analysis and opinions exposed in previous letter reports dated November 30, 2004 and January 13, 2005. In fact, observations that were made possible became of concrete removal only strengthened the opinions that I previously presented."

In the meantime PTG/DOT utilized a Specialty Engineer, along with the Engineer of Record, the DOT State Structures Engineer and other staff member to investigate the cracking.

- Mehta & Associates, Inc.
  Lance Knutsen, PLS Survey Manager
  In memo to Ed Hudec, of the DOT, Knutsen states, “I have reviewed the notes and correspondence you forwarded to me regarding the settlement issue for this footing #13. The field notes and subsequent reductions all appear to be in order. Although there are entries for checks that were made regarding the vertical positioning, there does not appear to be sufficient data available that is tied to the same elements for pre and post concrete pour to indicate without question that the settlement has occurred.” He goes on to state, “based on the data in hand, I am not able to offer anything different or conclusive.”

- In a letter of December 7, 2004 from Michael Bergin, P.E., DOT State Structural Materials Engineer states, “based on my observations of the footer, the cores and the core holes in the footer, about the only conclusion that I can make is that the cracks appear to be structural in nature. This is apparent based on the depth and direction of the cracks as seen from the cores and the core holes in the structure. With that, it is the opinion of this office that the durability of the structure is questionable.”

- Concorr Florida, Inc.
  William T. Scannell, Principal Corrosion Specialist
  December 8, 2004 draft report describes and provides sketches and pictures of location, width and depth of cracks. Ten four inch diameter cores taken and analyzed. Conclusions reached were:

  Prior DOT experience with the long term effect or early age structural cracks on actual bridge footing has been costly. References the Callosahatchee Bridge and Crescent Beach Bridge footings.

  Even without development of additional new cracks or further propagation of existing cracks, significant expenditures will be required during the design service life to repair premature corrosion damage caused by the current cracking. If the current cracks can be adequately repaired to prevent long-term intrusion of moisture and chlorides into the concrete, concerns related to reinforcing steel corrosions would be eliminated. However, it is considered unlikely that such repairs could be implemented. Also, the possibility of additional cracks propagation and development of new cracks would still be of concern.

  The only approach other than complete removal of the footing that would effectively address the corrosion concerns related to the cracking in the footing would be to install a corrosion protection system, such as catheodic protection. However, all structural defects must be effectively and permanently remediated.

  There are cracks in the footing that extended below the neutral axis. These should be evaluated by a Structural Engineer to ascertain short-term and long-term structural complications.

- Letter of August 09, 2004 form Thomas J. Shaw, P.E., Engineer of Records stated, “it is my opinion that these cracks are a direct result of the settlement of the falsework while the concrete was still green and are thus structural cracks as defined by specifications.”

- Letter of October 05, 2004 from Thomas J. Shaw, P.E., Engineer of Records to Steve Plotkin, P.E., DOT State Construction Structures Engineer recommends further investigation, especially as to whether settlement of forms did occur as “in fact the contractor’s own surveyor provided the elevations on July 02, 2004 that shouwed the form work hard settled as much as 1 5/8” “

- A Supplemental Report dated March 21, 2005 was submitted by William Scannell, Principal Corrosions Specialist of Concorr Florida, Inc. This report contained findings obtained during inspection of 19 blocks of concrete removed during the demolition process, included photos and measurements of some major cracks confirmed to be present prior to demolishing the footing.

DRB REMARKS

Initially it was believed, from JBC survey data, that the SW support pile had settled about 1 5/8” during the pour. This was refuted by JBC on the basis that the pile elevations were not determined before the pour. The form elevation was controlled by hangers independent of the pile.

Six twenty-four inch pipe piling, not driven to bearing, were used as part of the support of the falsework support, along with ten of the twenty thirty inch permanent pile.

Survey data provided by JBC show elevations at the bottom of the footing at -0.98 before the pour, having a plan elevation of -1.00. After the pour the survey data showed two of the corners at -1.00 and two at -1.01.

The footing dimensions are 38’ by 32' by 7’, containing approximately 300 cubic yards of concrete with a design strength of 6500 PSI. The cylinders broke well in excess of the strength requirement and the heat did not exceed plan limits during the pour, however, approximately 18 hours passed before curing blankets were put into place.

The pour lasted from 4:00 a.m. to 8:00 p.m., approximately sixteen hours, at a rate of about twenty cu.yds./hour.

Subsequent piers eliminated the use of the pipe pile support, relied on permanent piles. No other footing displayed the distress exhibited in footing #13.

BOARD FINDINGS:

- Supplemental Specifications 400-21 provide the two classifications of cracks, [1.] structural and [2.] non-structural, 400-21 also provides that, in any case, the ENGINEER will determine the classification of cracks. Structural cracks are defined in 400-21 those which are INDUCED BY EXTERNAL FORCES. Nonstructural cracks are defined as those which appear as A RESULT OF ATMOSPHERIC EFFECTS AND LOCALIZED CONSTRAINTS EFFECTS.

- The Engineer had the authority by the specifications to make the determination of the type of cracks in evidence.

- No positive proof of settlement was presented beyond the theory that the SW corner of the form settled, based on the after-pour elevation of the SW corner pipe pile top. Had settlement occurred in the SW corner, the final elevation of the bottom of the footing would not have been level nor to plan grade as shown by the survey data. The random pattern of cracks, showing little connectivity, is not what would be expected in a structural cracking situation.

- The crack on the top surface having the greatest width was over the area where the forms were supported by the permanent piling and thus is not consistent with the corner settlement theory.

- Based on the construction lay-out experience of all three Board members, we concur that survey data presented by JBC, along with the statement made by the Mehta & Assocs. surveyor for PTG/DOT, supports the position that no measurable settlement of significance occurred.

- Because of the time involved in the investigation of the issue, with the approach of hurricanes in August 2004,pumping ceased in the cofferdam, leading to saltwater intrusion into the area of cracking, jeopardizing the corrosion resistance of the reinforcing steel and presenting the potentiality for concrete spalling.

- Although neither party expressed any concern regarding the composition or quality of the concrete mix, which contained slag as the aggregate, slag can absorb moisture more readily from the mix than other aggregates and subsequent piers were constructed with a mix using a different aggregate as well as a reduction in the amount of retardant used. There was also an admitted lengthy delay in application of the curing blanket following the initial pour. Curing blankets were placed immediately on subsequent pours. These two factors could have led to a greater degree of nonstructural cracking than might normally be expected.

- It seems with certainty that the length/depth and width of the cracks found during and after the removal process could have been affected during the removal process.

- The method of repair proposed by the contractor was in accordance with Supplemental Specification 400-21.

BOARD RECOMMENDATION

The Board, based on a diligent review of the position papers and supporting documents submitted by both parties, along with information and explanations received at the Hearing, is of the opinion that the Department was well within the specifications and certainly within their rights to require replacement of the footing because of the their concerns about corrosion and longevity; however, the Board also can find no evidence that disproves the Contractor's position that the cracks are nonstructural and that, in accordance with 400-21, he should have been allowed to repair the cracked areas as specified. The Board, therefore, finds that the Contractor is entitled to compensation for costs incurred with removal and replacement of Pier #13 footing beyond those that would have been incurred by repairing the non-structural cracks per the contract Supplemental Specifications, 400-21.

The Board sincerely appreciates the cooperation of all parties and the information presented for its review in this matter.

Please remember that a response to the Board and the other party of your acceptance or rejection of this recommendation is required within 15 days. Failure to respond constitutes an acceptance of this recommendation by the non-responding party. party.

I certify that I have participated in all of the meetings of this Board regarding these issues and concur with the findings and recommendations.

Respectfully,

Dispute Review Board
Charles C. Sylvester, Jr., P.E. Chairman
William B. McKelvy, P.E. Member
John C. Norton , P.E. Member

Signed for and with the concurrence of all members:

Charles C. Sylvester, Jr., P.E.
Chairman