EXHIBIT N

CDM Smith

1301 Gervais Street, Suite 1600
Columbia, South Carolina 29201
tel: 803 758-4500
fax: 803 758-4561

June 29, 2012

Mr. Ehab Guirguis, P.E.
Senior Engineer, Transportation Dept., Lee County FL
5560 Zip Drive
Fort Myers, FL 33905

Project: Lee County – Department of Transportation
Project Nos. 5807 and 5814
County Road No. 869
Sanibel Causeway Improvements

Subject: Bridge Nos. 124114, 124115, and 124116
Sanibel Causeway Beam Cracking Report

Dear Mr. Guirguis:

Your office has engaged the structural design services of CDM Smith to evaluate small-to-hairline cracks near beam ends of project referenced above, using information currently available from the county, and my own on-site review of the beam cracks on April 24, 2012. The purpose of this evaluation is to give an expert opinion on the cause of the cracks; the public safety impact due to the cracks; and the possible effect on the continued maintenance program to the bridge due to the cracks. We agreed that this first stage effort to perform those tasks would be to

(1) Evaluate the original design for the beams against required AASHTO Specification, standard practice of this type beam's design, and any supplemental Florida DOT design requirements that should have been utilized

(2) Review the construction records for deviations to the design intent

(3) Offer a judgment on the apparent cause of the cracks, if the study reveals it

This initial study has been completed and this letter will report on the above tasks. Subsequent to your review of this report, and anticipated further dialog on the bridge safety implications, we will recommend remediation or maintenance procedures, if needed, that will assure the bridge life is safely reached.

Sanibel Causeway Bridges, Description and Design Data

The structures are located on County Road 867 near Sanibel Island over San Carlos Bay. They are also known as the Sanibel Causeway Boulevard bridges, and form the sole vehicular access to Sanibel Island. These bridges are owned by Lee County, and operate under a tolling system. All three bridge structures utilize precast, prestressed Florida Bulb-T 78 beams with a cast-in-place reinforced concrete deck. The substructures consist of reinforced concrete piers supported by spread footings with prestressed concrete piles.

All bridge record plans indicate a design period of 2003 to 2004, with revisions thru 2006. Public information gives the construction dates from August, 2004 to mid 2007, with the official traffic opening in September 2007. They were constructed during one contract and by one prime contractor.

Bridge record plans also state that the Design Specification was the AASHTO LRFD, Bridge Design Specifications, 2nd Ed., 1998 w/ Interims thru 2003. Also referenced and implicitly assumed is that the bridges' design was under the guidelines of the Florida DOT Structures Design Guidelines for LRFD, Jan 1, 2003. The plans were prepared under the Florida DOT Detailing Manual, Jan 1, 1999. State DOT's often have supplemental design criteria, or waive or modify the AASHTO Specification criteria, for bridges in their own state through their Structure Guidelines. It is common practice for design consultants to also use those DOT Guidelines for any bridge designed in that state, whether state-owned or not, for consistency to practice. It will be pointed out herein whether such differences existed at the time of these bridge designs

It is noted that two different design firms of record produced the plans for the three bridges; the higher northern Bridge (124116) over the prime navigational channel was designed by Hardesty and Hanover, while the somewhat lower southern Bridges (124115, 124114) were designed by URS. However, relative to the issues addressed by this report, all beam details utilized similar or identical reinforcing and prestressing patterns, and were drawn upon the same Florida DOT standard beam details. One notable design difference between the two firms design approach is that Hardesty and Hanover utilized "full" beam continuity, with 3-span "fully-continuous" span units and fully-competent concrete diaphragms at interior span joints to achieve that beam continuity for superimposed loads. URS utilized discontinuous beams but what is referred to as "slab continuity", that is, only the deck is continuous. While this difference in continuity does play a role in the bridges behavior, and could have influenced beam end cracking or at least inferred a variation of cracking between the two design approaches, such difference has not been noted in earlier inspections; the same or similar beam cracking has been observed in all beams. This observation is significant, as it makes less likely the influences of temperature or concrete shrinkage are primary contributing factors.

Bridge No. 124114 (Bridge C in record plans) has an overall bridge length of 3864'-0" consisting of 27 total spans of three span continuous deck units. All spans are 144'-0" except for the span over the Navigation Channel, which notably is the shortest at 120'-0". All beams for the 144'-0" spans have the same prestressing pattern, while the four beams in the 120'-0" have the same type, but fewer, strands. All beams have similar reinforcing steel, with the only variation coming some distance away from the beam ends.

Bridge No. 124115 (Bridge B in record plans) has an overall bridge length of 1872'-0" consisting of 13 total spans of three or four span continuous deck units. All spans are 144'-0". All beams have the same prestressing pattern and similar reinforcing steel.

Bridge No. 124116 (Bridge A in record plans) has an overall bridge length of 2996'-2½" consisting of 21 total spans of three span continuous units. Four units have 144'-0 spans, two units have two 144-0" spans and a 144'-1¼" span, and the Center Unit has two 130'-0 spans and a 144'-0" span. All beams in the Center Unit have the same prestressing pattern, while the other six units have the same type, but more, strands. All beams have similar reinforcing steel, with the only variation coming some distance away from the beam ends.

The contract plans state that the beams in all three bridge use Class VI concrete (f'c = 8.5 ksi). The plans show the same concrete stress limits for tension and compression at different construction stages for all bridges. All of the bridges have the same design loadings, except for ship vessel impact in which Bridge No. 124116 has an a higher vessel impact loading.

Because the focus of this report is on the concern over the many cracks in the prestressed beam ends, the remainder of this report will only contain information directly or indirectly related to the beam cracks.

Observed In situ Beam Cracks

The cracks in the beams that are the subject of study, as noted in the inspection reports and observed by our brief inspection, are only near beam ends. This is the typical location where, if any, cracks tend to appear in prestressed beams. During our brief inspection, we observed minor cracks that would fall into 3 categories:

- Very minor, almost imperceptible, random cracking of the bottom flange of the beams.
- Very minor horizontal cracking of the beam web at or near mid depth. This was only observed in one location but is not unusual in highly-prestressed beams of this depth.
- Minor but perceptible diagonal cracking that tends to begin at the span end at the bearing area and proceed up the web diagonally away from the bearing support. This is typical of a

"shear crack" and of the same orientation. It is this cracking, which is observed in a significant number of these bridges beams, that is the focus of this study.

Most of the cracks in this area are noted to be superficial. The diagonal cracks are up to 4 feet long and those observed were 1/64 inch wide maximum. In at least one location observed, the diagonal crack extended to the top flange. The inspection report for Bridge No. 124116 also refers to two particular cracks where one has increased in size over time (Beam 14-4 at Pier 14) while the other is a newly developed crack (Beam 16-4 at Pier 16). Also noted in the report for Bridge No. 124116 is a longitudinal hairline crack in the top flange of Beam 17-4 near Pier 18. Also mentioned in the inspection reports are some minor areas of delamination and spalling at the beam ends.

Beam End-Zone Cracking

As with all concrete elements, concrete beams crack when tensile stresses exceed the tensile strength of the concrete. The length, width, and depth of the crack depend on the magnitude and distribution of the tensile stresses and the amount and location of reinforcement within the area of the crack. Single span, reinforced concrete beams subject to normal vertical loads typically see their largest tensile stresses in the bottom of the bottom flange near midspan and in the webs near supports. Continuous span, reinforced concrete beams also develop tension in the top flange over continuous supports. The presence of cracks alone is not a sign of misbehavior or a problem. Properly reinforced concrete members are designed so that the tension forces transfer to the reinforcing steel as the concrete cracks, and properly distributed reinforcing steel keeps the cracks small and evenly distributed. It is a given that in large non-prestressed concrete beams certain cracking is predicable and acceptable, and controlled by the reinforcing steel present.

Prestressing a reinforced concrete beam changes the cracking behavior due to the superposition of the internal prestressing stresses. In typical prestressed highway bridge beams these internal forces act in opposition to the bending stresses from external loading to aid their "flexural" strength. As the prestressing forces are somewhat constant along the beam, the stresses from external forces vary. Therefore, prestress strands are either draped or selectively debonded near the ends, so that the prestressing that is intended to strengthen the beam does not itself produce harmful internal stresses at some points.

As modern prestressed beam design has advanced with higher concrete strengths, stronger prestressing strands, and optimized beam shapes, longer spans are reached with today's prestressed beams. As the technology advances, though, modern prestressed beams have become more-complex in their behavior as they are subjected to much higher internal and external loads than historically the case. It is especially true that in the end zones of large, longer span beams, that stress fields caused by high stressing can become problematical. In a relatively small end zone of the beam, we have the introduction of large prestressing forces, strand slippage as the strands transfer their forces to the concrete, the beam bearing forces, the forces resisting sliding of the

bridge (bearing shear), and the debonding (sheathing) of some strands to eliminate their effect. Modern bridge codes and state DOT's are constantly changing the design parameters today to effectively understand and control prestress beam end-zone design.

Several U.S. states, particularly Florida among them, have been the cradle for advancement of prestressing technology in the U.S. The economic factors of rapid transportation growth, and limited steel supply, have enabled more advancement in concrete design theory and sophistication of use than in other states. Simply put, the Florida Department of Transportation (FDOT) is a leader in the advancement of prestressed beam technology, and is often more aggressive than other agencies. The beams in these bridges are the culmination of decades of design evolution, but at the same time are at the leading edge of the use of prestressing to enable beams to go longer (thus more economically) than in the past.

Crack Investigation

Of the three types of end-zone cracks described earlier, only the diagonal cracking at the beam ends are reason for concern at the Sanibel Island site. The other crack types appear to be within the range of what might normally be expected for beams correctly designed to the AASHTO LRFD Specification. The AASHTO design recognizes the potential for these cracks and provides the appropriate reinforcement and/or maintains the appropriate stress level to control them.

The cracks that are present that are the most unpredictable, and the cause of this study, are the diagonal cracks near the supports. Typical depth beams, of modest spans and traditional prestressing are not known to develop cracking of this nature to quite the extent we see in the subject bridges. It should be noted that all of the cracks have very small widths which indicate the reinforcing steel in the vicinity of the cracks is likely to be performing adequately. However, we performed an analysis to confirm there is not a design flaw.

Design Check

This crack investigation is principally to determine if there is a design flaw, and therefore a possible safety issue with the prestressed beams. In the investigation, we have used only the codes, guidelines and practices which were present during the original design. In the following discussion, we evaluated the reinforcing steel used in the beam ends, and the prestressing applied, in view of the operable codes and the FDOT Structures Design Guidelines (SDG) of that time.

The concrete allowable stress limits in the contract plans match those used by the FDOT at the time of design, as expressed by its Structures Design Guide (SDG) and memo's to designers. FDOT added a requirement that the maximum compressive concrete strength at release must not be greater than 6,000 psi via its Temporary Design Bulletin C04-01 dated February 3, 2004. Bridge No. 124116 used a stated value of 6,800 psi, but it is not clear if C04-01 pre-dated the design. Assuming it did not, the 6800 psi value is not a code or policy violation, but it does indicate the designer's

intent to use more force at release than subsequently allowed. Still, this was an isolated incidence and most of the beams were designed clearly within the AASHTO and prescribed FDOT limits of the design period.

More significantly, another FDOT revisionary change in the same referenced memorandum is to limit the maximum bonded prestress force for our particular beam type. This limit was set at 1,430 kips. We note that the 144'-0" spans of all three bridges have a bonded prestress force of nearly 2,100 kips, or nearly 50% greater than the memorandum allows. Note that these memoranda occurred during the time of design, and it is unclear whether they could have been incorporated. But the result of this limit would be to effectively preclude the use of the prestressing force that was used, and so the beams pre-memo are acceptable but post-memo are unacceptable. Only the 120'-0" of Bridge No. 124114 comes close to remaining below the limit at about 1,450 kips. FDOT specifically states, in the memo (attached for reference): "The use of higher strength concrete, higher release strengths and 0.6 inch diameter strands in recent years, to accommodate longer spans and wider beam spacings, has resulted in much higher bursting forces in the ends of prestressed beams. This has aggravated the minor cracking traditionally observed in the ends of these beams. Additional reinforcing was added to the ends of prestressed beams in the June 30, 2000 release of the Standard Drawings to satisfy the Bursting Resistance in LRFD and utilize the full strand pattern available in most of these beams. Undesirable cracking in the ends of AASHTO and Florida Bulb-Tee beams has been reported for beam designs near the upper limits of the LRFD (2001) Bursting Resistance requirements." Based on this comparison, the designers did not violate limits set by FDOT or AASHTO at time of project letting. However, these same beams would not have satisfied the changes set forth by Temporary Design Bulletin C04-01. Stated more forcefully, these beams exceed allowable limits of prestressing that are in today's SDG.

In addition to determining the "code and SDG compliance" discussed above, we also performed an independent analysis of the state of stress in the beam end. We used "industry standard" procedures and mainstream software commonly used by designers. A beam analysis was performed using LEAP CONSPAN. CONSPAN is published by Bentley, a major design software supplier, and is industry-accepted prestressed beam design and analysis software. We were not able to locate a 2005 version, so a newer version of the software was used than would not have been available at the time of the design. While the analysis of concrete has not changed much over the years, software developers continue to refine the methods used to balance speed of analysis with accuracy of results. This means that an analysis run using the current version may not yield exactly the same results as previous version, but the results should be close. Given the specific bridge parameters and stress limits, CONSPAN calculates and compares concrete stresses at various stages during life of the prestressed concrete beams. Based on the analysis, the <u>only concrete stress limit violated</u> is compression in the bottom flange at release. The stress limit by AASHTO (and SDG) is 0.60*f'ci = 4.08 ksi, while the maximum compressive stress in this Sanibel bridge beam is 4.22 ksi. This is an overstress of about 3%. For the stress check at release of strands, which is a temporary

condition, this would be an acceptable overstress according to industry practices. Also, the amount of shear reinforcement is adequate per AASHTO and FDOT.

Another change made set forth by Temporary Design Bulletin C04-01 was to set a reduced limit on the stress in the vertical reinforcement near the beam ends due to the bursting force created by the anchorage of the prestressing strands. Per the memorandum, "Cracking in the ends of AASHTO and Florida Bulb-Tee beams has been observed with vertical bursting reinforcing designed to 20 ksi stress, based on 4% of the bonded prestressing force and distributed over a distance of h/5, in accordance with the LRFD (2001) Section 5.10.10.1." The change in LRFD 2002 was the distribution length increased to h/4. This allowed for an additional 12% of bonded strands based on FDOT's prestressed beam standard details. FDOT reduced the 20 ksi limit to 13 ksi. Prior to the memorandum, the maximum prestressing force allowed was 2,860 kips. The beams meet this requirement with only 2,100 kips. The memorandum set the maximum prestressing force at 1,730 kips. Based on the stress limit changes in the memorandum and the details in the plans, the maximum prestressing force allowed is 1,860 kips, still less than the 2,100 kips required and used in prestressing these beams. Even though the plans exceed what is allowed in the (later) memorandum, it is not a direct indication that this is the cause of the cracking, but the FDOT restrictions on the prestressing force, and the language used in the memo, suggests beam end cracking is a potential at the higher prestressing forces used in the Sanibel bridge beams.

The higher prestressing forces used in these beams may have initiated a problem that does not generally need to be considered in prestressed beams unless they are post-tensioned. (In post-tensioning, a very large force is entered into a concrete section in a very small area; in pretensioned beams it is normally applied by strand transfer, and thus a more gradual transfer of forces into a beam). Therefore, the last item investigated is the change in compressive stress distribution through the cross-section of the beam over the last few feet of the beam. At the very end of the beam, the compressive stress in the beam from the strands is very concentrated near the bottom of the beam. At a distance from the beam end approximately equal to the depth, the distribution of the compressive stress is more uniform across the section. The spreading of the compressive forces causes tensile stresses to form within the same area that are somewhat vertically inclined. The stresses can contribute to the type of cracking observed. The stress distribution in this area can only be estimated from a complex analysis (specifically a Finite Element Modeling analysis), which is beyond the scope of this investigation. While this phenomenon may be a contributing factor to the cracks, neither the AASHTO Specification nor FDOT SDG specifically require a check for this stress pattern. Beams with typical and normal prestressing levels have historically not exhibited problems from this effect. It could be that beams with higher prestress levels are more adversely affected by this lateral tension.

Conclusion

Reinforced concrete beam design, with and without prestressing, is understood very well. However, the introduction of the compression due to the prestressing greatly impacts the stress fields near supports. Over years of aggressive design practices that are intended to achieve maximum beam economy, larger amounts of prestressing forces have been used, possibly leading to the onset of cracking in the ends of prestressed beams. Due to this complexity of end-of-beam behavior, FDOT and AASHTO address the stresses near the beam ends by requiring large amounts of reinforcing near the supports based on empirical formulas. These formulas are satisfactory most of the time, but as prestressing become more aggressive, they may have to be adjusted, as they may not accurately capture all the forces within this end area of the beam. During the time of the design of the Sanibel beams, Florida (and others) noted that high levels of prestressing bought about early cracking near beam ends. In simple terms the design technology was pushed too far. FDOT later released Design Memo's restricting the high prestressing (Attachment 2). Those type adjustments were occurring in real time during the design of the Sanibel Causeway bridges, and the designers likely could not have captured the changes in design in sufficient time to change the design. However, it should also be noted that the bridges gained from the larger prestress being used, in that the beams were able to achieve longer spans, inferring that the constructed bridges were as economical as possible under the design guidelines of that period. A few observations to note:

- All beam stresses, prestressing forces, in the beams ends do meet the allowable set forth by the AASHTO and SDG "at the time" of the design. The slight compressive overstress mentioned above is well within normal acceptance.

- Shortly after, or during, the beam design, FDOT greatly reduced the amount of prestress force that could be used in these beams. Their discussion of that change includes the observation of cracking caused by too much prestressing.

- Our own independent "code checks" indicate that the beams were code and practice compliant at the time of design.

- We feel that the large prestressing forces that were used to make these "longer beams", that was later limited by SDG, has contributed to the end-zone cracking, but in a way that is not clearly explainable. Code checks infer acceptable reinforcing is used.

- If the above infers that the AASHTO and SDG are occasionally experimental, the safety of the structure and its users are not risk. In the instance of these beam web cracks, while the designers followed both FDOT and AASHTO code requirements at the time of design, we feel this is one of the instances where the code did not completely capture the reality of the large internal stresses. These stress may have tipped the boundary of crack initiation, (i.e. allowing cracks to occur/appear), but those cracks alone do not put public safety at risk.

- A more detailed, advance analysis could be done (example an FEM model) to determine the precise diagonal tension (shear) and judge whether the cracks now evident are predictable. However, there is no indication that further explanation would lead to additional concerns, as the beam is reinforced consistently with current AASHTO Code provisions.

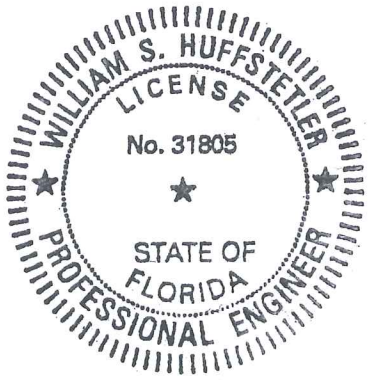
Recommendations

Due to the AASHTO code not completely capturing the results of the large end-zone internal stresses, which by policy are not acceptable in Florida today, we recommend the county set up a crack monitoring program. At some point the cracks should stabilize, but it is not predictable if we have reached that juncture. A monitoring program will give an accurate analysis of how the cracks are behaving. If the cracks are stable and not growing, the stresses in the structure have stabilized. Stable cracks will confirm that the bridge is safe and should require little-to-no maintenance for many years. If the cracks are growing, it does not mean the bridge is not safe. It only means the stresses are still undergoing distribution trying to find internal stability. If the measurement of crack growth suggests the cracks are not stable, and have not yet approached a decline in growth, then a retrofit could be recommended to force the stability of the internal stresses and not allow more redistribution. Although this is not anticipated, funds spent on crack growth measurement do allow more comfort in knowing that the rate of growth is either stable, declining, or problematical.

Crack monitoring can be done by several methods and deserves discussion on the means and methods used. We recommend a direct discussion with you and your staff. After the crack monitoring, depending on the measurements and predictions of rate of growth, we may recommend applying a concrete sealant to all beam ends past the extent of the cracks in each beam.

We also recommend repairing spalls and delaminations mentioned in the inspection reports at earliest convenience.

Sincerely,



William S. Huffstetler, P.E.
Vice President
CDM Smith Inc.

cc: Randy P Cerchie, Lee County
David Taylor, P.E., CDM Smith
Amy Davies, CDM Smith

Attachment No. 1

Additional Insight and Commentary on Prestressed Beam Behavior for Lee County reviewers

Prestressed concrete beams reduce the tensile stresses in the bottom flange via prestressing strands. Prestressing strands are tensioned prior to casting the concrete beam which causes elongation of the strands. After the concrete reaches a predetermined compressive strength, the strands are cut. With the tension removed from the ends of the strands, they want to shorten back to their original length. With the strands bonding with the concrete of the beams, the concrete resists this shortening which causes a compression in the concrete around the strands. The outcome is the concrete is in compression while the prestressing strands remain in tension, but less tension than before the strands were cut. There are many variables that go into calculating how much of the tension transfers from the strands to the concrete in the prestressed beam. There are even more variables that go into calculating the behavior of the beam with respect to time. Adding prestressed strands to bottom of a reinforced concrete beam is done to reduce tensile stresses in the bottom flange of concrete beams. In reinforced concrete beams, longitudinal reinforcing steel is used to resist tensile stresses in the bottom flange.

Continuous span, reinforced concrete bridges reduce the tensile stress in the concrete over supports by adding adequate reinforcing steel in the deck over the supports. Typically enough longitudinal reinforcing steel is added to prevent the top flange of the concrete beams to develop any significant tensile stresses.

Tensile stresses in the concrete also build up in webs near supports. As the vertical loads on the beam have to be transferred to the supports, shear in the beam increases near supports. Shear is resisted primarily by the web in beams. If cracks do form in the web, it is generally near the supports where the shear is highest. Tensile stress due to internal shear forces near beam ends is inclined, with respect to bottom of the beam, causing the cracks to form on a diagonal. Vertical steel (we typically call shear reinforced, or stirrups) is used to resist these internal tensile stresses.

Cracks in beams can also be caused by expansion and contraction, shrinkage, and creep. Concrete expands and contracts with changes in temperature. If the concrete has resistance to expansion or contraction, tension cracks can occur. Concrete shrinks in all direction naturally during the curing process. Again, if the concrete has resistance to this shrinkage, tension cracks can occur. This resistance can be in the longitudinal direction or internally. And internal restraint can occur when the surface of the concrete cures while the internal concrete has not. While the internal concrete cures and continues to shrink, the external concrete resists the internal shrinkage causing cracks to occur in the surface. This concept has brought about special requirements for Mass Concrete, cold construction, and hot construction methods. Concrete creeps due to permanent compressive loads. Prestressed concrete beams have a permanent compressive loading due to the prestressing causing the beams to shorten over time. Any resistance to this shortening can cause tension cracks.

All of these cracks and can be controlled and/or eliminated with good design practices, rebar placement, material selection, and construction practices. But moderate, well-dispersed and small (hairline) cracking is not necessarily cause for alarm.

Attachment No. 2

FDOT's Temporary Design Bulletin C04-01, February, 2004
FDOT Structures Design Guidelines (LRFD) Topic 625-020-154-b

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

February 3, 2004

M E M O R A N D U M

TO: District Structures Design Engineers:
(Gerard Moliere, Rod Nelson, Keith Shores, John Danielsen, Neil Kenis, Kim Saing, Jose Rodriguez, and Agnes Spielmann)

FROM: William N. Nickas, P.E., State Structures Design Engineer

COPIES: Assistant Secretary, Ken Morefield,
State Highway Engineer, Freddie Simmons,
Director Office of Design, Bob Greer,
District Directors of Production:
(Mike Williams, Dave Byrd, Gene Martin, Gerry O'Reilly, Noranne Downs, Javier Rodriguez, Donald Skelton, Nancy Clements)

SUBJECT: **Temporary Design Bulletin C04-01**
FDOT Structures Design Guidelines (LRFD) Topic 625-020-154-b
Section 4.3.1.C Prestressed Beams – Concrete Release Strength
Section 4.3.1.E Prestressed Beams – Maximum Bonded Prestress Force

REQUIREMENTS:

Add the following sentence to Section 4.3.1.C of the Structures Design Guidelines:

"The maximum compressive concrete strength at release must not be greater than 6000 psi for the design of prestressed beams."

Add the following sub-section "E" to Section 4.3.1 of the Structures Design Guidelines:

The maximum prestressing force from fully bonded strands at the ends of prestressed beams must be limited to the values shown on the Standard Drawings. No losses shall be applied to the calculated prestressing force. The minimum length of debonding from the ends of the beams is half the depth of the beam. The reinforcing in the ends of the beams shown in the Standard Drawings must not be modified without the approval of the State Structures Design Engineer.

For the current Standard Drawings with the following "Issue Dates", the maximum prestressing force from fully bonded strands at the ends of the beams must be limited to the values in the following table:

Beam Type	Standard Drawing (Issue Date)		Max. Bonded Prestress Force
AASHTO Type II	Index No. 120	(2-14-01)	650 kips
AASHTO Type III	Index No. 130	(2-14-01)	995 kips
AASHTO Type IV	Index No. 140	(2-14-01)	1270 kips
AASHTO Type V	Index No. 150	(7-31-03)	1635 kips
AASHTO Type VI	Index No. 160	(7-31-03)	1800 kips
Florida Bulb-T 72	Index No. 172	(7-31-03)	1300 kips
Florida Bulb-T 78	Index No. 178	(6-30-00)	1430 kips
Florida U 48	Index No. 248	(2-14-01)	2790 kips
Florida U 54	Index No. 254	(2-14-01)	2790 kips
Florida U 63	Index No. 263	(2-14-01)	3070 kips
Florida U 72	Index No. 272	(2-14-01)	3070 kips
Inverted-T	Index No. 320	(10-01-01)	310 kips

COMMENTARY:

Cracking in the ends of AASHTO and Florida Bulb-Tee beams has been observed with vertical bursting reinforcing designed to 20 ksi stress, based on 4% of the bonded prestressing force and distributed over a distance of h/5, in accordance with the **LRFD** (2001) Section 5.10.10.1. To minimize these cracks and accommodate the longer distribution length (h/4) adopted by **LRFD** in 2002, the maximum prestressing force in the ends of these beams has been limited. Additionally the maximum design concrete strength at release has been limited to 6000 psi to control the amount of prestress in the ends of these beams. The maximum prestressing force is based on 13 ksi bursting steel stress for AASHTO and Florida Bulb-Tee beams. This is approximately equivalent to a 20% decrease in allowable stress from the **LRFD** (2001) requirements. Florida-U beams and Inverted-T beams have not shown similar problems, so the maximum prestress force is based on 18 ksi and 20 ksi bursting steel stress respectively, which provides equivalent resistance to the previous **LRFD** (2001) requirements.

BACKGROUND:

The use of higher strength concrete, higher release strengths and 0.6” diameter strands in recent years, to accommodate longer spans and wider beam spacings, has resulted in much higher bursting forces in the ends of prestressed beams. This has aggravated the minor cracking traditionally observed in the ends of these beams. Additional reinforcing was added to the ends of the prestressed beams in the June 30, 2000 release of the Standard Drawings to satisfy the Bursting Resistance requirements in **LRFD** and utilize the full strand pattern available in most of these beams. Undesirable cracking in the ends of AASHTO and Florida Bulb-Tee beams has been reported for beam designs near the upper limits of the **LRFD** (2001) Bursting Resistance requirements. Additionally the 2002 Interim Revision to LRFD Section 5.10.10.1, which increased the bursting distribution length from h/5 to h/4, has effectively increased the allowable bursting forces by approximately 25%, necessitating reduction in the allowable bursting stress or

a limit on the maximum prestressing force in the ends of prestressed beams in Florida to control cracking.

FOLLOW-UP:

The standard reinforcing patterns in the February 2004 Structures Standard Drawings, Index Series 100, 200 & 300 will be modified to accommodate most beam designs when up to a maximum of 25% of the strands are debonded at the ends of the beams.

FDOT recognizes that for some beams the full strand pattern will not be completely utilized with the current limits on the pretressing force from fully bonded strands, however due to constructability considerations and to meet commitments to the Prestressed Concrete Industry in Florida, the reinforcing in the ends of prestressed beams should not be changed.

IMPLEMENTATION:

Effective immediately all projects under design using AASHTO Type II , III, IV, V & VI beams and Florida Bulb-Tees should comply with these new requirements for both LFD and LRFD designs. Florida-U Beams and Inverted-T Beams will not require any design changes if designed in accordance with Section 5.10.10.1 of the AASHTO LRFD Bridge Design Specifications prior to the 2002 Interim Revision.

All projects let after June 2004 shall use the revised February 2004 Standard Drawings. These Standard Drawings will have minor changes to the reinforcing in the ends of the AASHTO & Florida Bulb-Tee beams and list the Maximum Bonded Prestressing Force on the “Typical Beam Details and Notes” Index Nos. 110, 210 & 310. The shear stirrups in AASHTO Type V & VI and Florida Bulb-Tee beams will also be changed from #4 Bars 4K, to #5 Bars 5K.

For projects let in or before April 2004, any changes to the plans to meet these new requirements need only be made at the discretion of the District Structures Design Engineer after notification by the Project Manager, taking into consideration the amount of overstress at the ends of the beams and any adverse impact to the production schedule.

No changes to the Specification Package or Quantities will be required as a result of these changes.

WNN/sjn

Attachment No. 3

Typical 144’-0” Sanibel Causeway Bridge beam stress checks

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

PROJECT DATA

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Project            : Sanibel Causeway Imrovements Bridge Cracks check
Designer           : AEC
Date               : Jun/4/2012
Checked By         :
Date Checked       :
User job number    :
State              :                                State Job #:
State Specification: Florida
Comments           : Design check using single 144' span.
Design Mode        : AASHTO LRFD-US Units  [4th Edition, including 2009 Interims]
Design as:         : Simple span
Flared Girder:     : No
File Name          : P:\FL\Sanibel.Br.Cracks\Data\AEC\Conspan\Bridge A\144ft span (1 span).csl
```

GEOMETRY DATA

BRIDGE LAYOUT

```
Overall width     , ft  =       43.083
Left curb         , ft  =        1.542
Right curb        , ft  =        1.542
curb-to-curb width, ft  =       40.000
Number of spans         =            1
Number of lanes         =            3
Lane width        , ft  =       12.000
Eff Deck thick    , in  =        8.000
Sacrificial thick , in  =        0.500
Haunch thickness  , in  =        2.500
Haunch width      , in  =       60.000
Bridge c/s,MI(Ixx), in4 =   7625428.50
```

SPAN DATA

```
Precast length    , ft =    143.146
Bearing-to-bearing, ft =    142.146
Release span      , ft =    143.146
```

BEAM DATA

No	ID	Loc-prev ft	Area in2	MI(Ixx) in4	Height in	Yb in	B-topg in	B-Trib ft
1	Old FIB-78	4.729	1084.0	914998.0	78.00	39.78	60.00	10.333
2	Old FIB-78	11.208	1084.0	914998.0	78.00	39.78	60.00	11.208
3	Old FIB-78	11.208	1084.0	914998.0	78.00	39.78	60.00	11.208
4	Old FIB-78	11.208	1084.0	914998.0	78.00	39.78	60.00	10.333

MATERIAL DATA – Project Level

As defined in Material Tab. For beam level properties look at Beam Specific output.

CONCRETE PROPERTIES

	Precast	C.I.P.
f'c ,ksi =	8.500	5.500
Wc ,pcf =	150.000	150.000
Ec ,ksi =	5030.400	4046.450

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

```
K1         =      0.900      0.900
f'ci,ksi   =      6.800
Eci ,ksi   =   4499.330
K1         =      0.900
```

STRAND AND REBAR PROPERTIES

PRESTRESSED STEEL:

6/10-270K-LL, Low relaxation strands

```
     Straight Pattern
     Strand Diameter       =        0.600 in
     Tensile Strength(fpu) =      270.0 ksi
     Strand Area           =        0.217 in2
```

Use transformed strand and rebar: Strand Only

REINFORCING STEEL: Tension/Shear steel: fy = 60.0 ksi Es = 29000 ksi fs = 24.0 ksi

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

LOADS DATA:

LOADS GENERATED USING PERMANENT LOAD WIZARD: YES

Left Barrier Weight, klf	0.203
Right Barrier Weight, klf	0.203
Left Curb Weight, klf	0.200
Right Curb Weight, klf	0.000
Left Sidewalk, klf	0.000
Right Sidewalk, klf	0.000
Future Wearing Surface, ksf	0.015
Sacrificial Wearing Surface, in	0.500
Stay in Place Deck Forms, klf	0.000

LOADS ON PRECAST

UNITS: (Point: kips, Location: ft, Line: klf, Trapez: klf)

Span	Beam	DC/DW	Type	Mag.1	Loc.1	Mag.2	Loc.2	Description
1	1	DC	Line	0.065	0.00	0.065	142.15	Sacrificial Wearing Surface
1	2	DC	Line	0.070	0.00	0.070	142.15	Sacrificial Wearing Surface
1	3	DC	Line	0.070	0.00	0.070	142.15	Sacrificial Wearing Surface
1	4	DC	Line	0.065	0.00	0.065	142.15	Sacrificial Wearing Surface

DIAPHRAGM LOADS

UNITS: (Load: kips, Location: ft)

LOADS ON COMPOSITE

UNITS: (Point: kips, Location: ft, Line: klf, Trapez: klf)
(Area: ksf, Width: ft)

Span	DC/DW	Type	Mag.1	Loc.1/Width	Mag.2	Loc.2	Description
1	DC	Line	0.200	0.00	0.200	142.15	Left Curb Weight
1	DC	Line	0.203	0.00	0.203	142.15	Left Barrier Weight
1	DC	Line	0.203	0.00	0.203	142.15	Right Barrier Weight
1	DW	Area	0.015	40.00	-	-	Future Wearing Surface

LIVE LOADS

Live load deflection: not included.
ID: Design Lane (Type: Design Lane)
ID: Design Tandem (Type: Design Tandem)
ID: Design Truck (Type: Design Truck)

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

ANALYSIS DATA:

ANALYSIS PARAMETERS DATA

Truck impact: 1.330
Lane impact: 1.000
Strength II impact: 1.330
Fatigue impact: 1.150

DISTRIBUTION FACTORS (Art. 4.6.2.2):

Is Span Post-tensioned: NO
Include Rigid Cross Section Assumption (Art. 4.6.2.2.2d): YES
ADTT (Average Daily Truck Traffic) : 10000
Percent of the specified force effect : 1.00

NOTE: Beam specific dead and live load DFs are printed in beam level reports.

LOAD FACTORS: (Table 3.4.1-1 & 3.4.1-2)

	Live	DC(max)	DC(min)	DW(max)	DW(min)
Service I:	1.00	1.00	-	1.00	-
Service III:	0.80	1.00	-	1.00	-
Strength I:	1.75	1.25	0.90	1.50	0.65
Fatigue I:	1.50	-	-	-	-

Ductility Factor: 1.00
Redundancy Factor: 1.00
Importance Factor: 1.00

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

PROJECT PARAMETERS DATA:

MULTIPLIERS:

```
  Trans len mult: Bonded   = 1.00
                  Debonded = 1.00
  Dev len mult:   Bonded   = 1.60
                  Debonded = 2.00
```

Camber & Deflection Multiplier (PCI ref.)

	Erection	Final
Prestress:	1.80	2.20
Self. Wt:	1.85	2.40
Deck + Haunch:		2.30
Diaphragm:		3.00
DL-Prec.:		3.00
DL-Comp.:		3.00

MOMENT AND SHEAR PROVISIONS:

```
  Ultimate Moment Capacity, Mr-prvd computed:                AASHTO equations
  Horizontal Shear, Beam and Slab effects in Vu:             INCLUDED
  Negative Moment Design, Non-composite Moment effects in Mu: INCLUDED
```

STRESS LIMITS (Art. 5.9.4):

STRESS LIMITS AT RELEASE BEFORE LOSSES (Using Advanced Settings):

	PRECAST
Strength	6.80 ksi
Elasticity	4499.3 ksi
Max comp	4.08 ksi
Outer 15.00 %	
Max tens	-0.25 ksi
Max tens, w/reinf	-0.99 ksi
Center 70.00 %	
Max tens	-0.25 ksi
Max tens, w/reinf	-0.49 ksi

STRESS LIMITS AT FINAL AFTER LOSSES:

	PRECAST	DECK
Strength	8.50 ksi	5.50 ksi
Elasticity	5030.40 ksi	4046.45 ksi

STRESS LIMITS AT FINAL 1 (P/S + DL + LL):

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

	PRECAST	DECK
Max comp	5.10 ksi	3.30 ksi

STRESS LIMITS AT FINAL 2 (P/S + DL):

	PRECAST	DECK
Max comp	3.83 ksi	2.47 ksi

FATIGUE I STRESS LIMITS AT FINAL 3 (50% P/S + 50% DL + F_LL):

	PRECAST	DECK
Max comp	3.40 ksi	- ksi

SERVICE III (Tension):

	PRECAST	DECK
Max tens	-0.55 ksi	-0.45 ksi

RESISTANCE FACTORS (Art. 5.5.4.2):

Flexure Reinforced	
Compression controlled sections	0.75
Tension controlled sections	0.90
Flexure Prestressed	
Compression controlled sections	0.75
Tension controlled sections	1.00
Shear	0.90

PRESTRESS LOSSES:

Time Dependent Losses, Approximate Method (Art.5.9.5.3)
Days to release = 0.75
Rel. Humid.(RH) = 75.0 %

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span: 1, Beam: 1

PRECAST DATA:

Section Id: Old FIB-78
Type : I-Girder
Flng width: Top = 60.000 in Bot = 28.000 in
thick: Top = 3.000 in Bot = 8.000 in
Stems : No = 1
Top = 7.000 in
Bot = 7.000 in

Shear width = 7.000 in
Max. thick = 10.000 in
Fillet width = 3.000 in

GENERAL BRIDGE DATA:

Bridge Width = 43.08 ft
Curb-to-curb = 40.00 ft
Beam Spac. Lt./Rt. = 4.73/ 11.21 ft
Lane width = 12.00 ft
Number of lanes = 3
Interior/Exterior = Exterior
Start Skew Angle = 0.00 degrees
End Skew Angle = 0.00 degrees

TOPPING DATA:

Deck Thickness = 8.000 in
Haunch:
Thickness = 2.500 in
Width = 60.000 in
Effective width = 124.000 in (Art. 4.6.2.6.1)

GENERAL LOAD DATA:

Dead loads on precast:

UNITS: (Point: kips, Location: ft, Line: klf, Trapez: klf)

DC/DW	Type	Mag.1	Loc.1	Mag.2	Loc.2
DC	Line	0.065	0.00	0.065	142.15

Dead loads on composite: See Project info for composite loads

GENERAL SPAN DATA:

Overall length = 143.146 ft
Release length = 143.146 ft
Design length = 142.146 ft

Kern points:

Upper = 61.00 in
Lower = 17.69 in

DISTRIBUTION FACTORS (Art. 4.6.2.2):

Include Rigid Cross Section Assumption (Art. 4.6.2.2.2d): YES
Live Moment (2+ lanes loaded) : 0.982 (Calculated) (#)
Live Moment (1 lane loaded) : 1.006 (Calculated) (#)
Live Shear (2+ lanes loaded) : 0.982 (Calculated) (#)
Live Shear (1 lane loaded) : 1.006 (Calculated) (#)
(#) Lever rule (C4.6.2.2.1)

Dead Loads and Pedestrian Load distributed equally to all beams (Art. 4.6.2.2.1)

Pedestrian : 0.250 (Calculated)

Comp. DC : 0.250 (Calculated)
Comp. DW : 0.250 (Calculated)

RESISTANCE FACTORS (Art. 5.5.4.2):

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Flexure Reinforced:
Compression controlled sections : 0.75
Tension controlled sections : 0.90
Flexure Prestressed:
Compression controlled sections : 0.75
Tension controlled sections : 1.00
Shear : 0.90

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span: 1, Beam: 1

SECTION PROPERTIES:

		PRECAST	COMPOSITE
Area	=	1084.0 in2	2002.6 in2#
Total Height	=	78.00 in	88.50 in
Mom. of Inertia (Ixx)	=	914998 in4	1886197 in4#
Ht. of c.g.	=	39.78 in	59.98 in#
Density	=	150.00 pcf	150.00 pcf
Self-weight	=	1129.2 plf	2318.7 plf
Mom. of Inertia (Iyy)	=	96597.1 in4	
Poisson's Ratio	=	0.2	

(#) Of Total Section using Ect/Ec = 0.8044

Use transformed strand and rebar: Strand Only

TRANSFORMED SECTION PROPERTIES:

Location, ft	Bearing 0.00	Trans 2.50	H/2 3.69	0.10L 13.81	0.20L 28.13	0.30L 42.44	0.40L 56.76	Midspan 71.07
Precast: (At Release, using Ec = 4499.3 ksi)								
Area , in2	1093.3	1139.6	1139.6	1144.2	1151.1	1153.5	1155.8	1155.8
Yb , in	39.52	38.31	38.31	38.19	37.99	37.92	37.85	37.85
MI(Ixx) , in4	923370	963191	963191	967416	974626	977372	980113	980113
Composite: (At Final, using Ec = 5030.4 ksi)								
Area , in2	2010.7	2051.2	2051.2	2055.3	2061.3	2063.4	2065.4	2065.4
Yb , in	59.77	58.78	58.78	58.68	58.53	58.47	58.42	58.42
MI(Ixx) , in4	1906683	2006686	2006686	2017100	2034045	2040210	2046367	2046367

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span: 1, Beam: 1

STRESS LIMITS (Art. 5.9.4):

	PRECAST	DECK
STRESS LIMITS AT RELEASE BEFORE LOSSES (Using Advanced Settings):		
Strength =	6.80 ksi	
Elasticity =	4499.3 ksi	
Max comp =	4.08 ksi	
Outer 15.00 %:		
Max tens =	-0.25 ksi	
Max tens,w/reinf =	-0.99 ksi	
Center 70.00 %:		
Max tens =	-0.25 ksi	
Max tens,w/reinf =	-0.49 ksi	
STRESS LIMITS AT FINAL AFTER LOSSES:		
Strength =	8.50 ksi	5.50 ksi
Elasticity =	5030.40 ksi	4046.45 ksi
STRESS LIMITS AT FINAL 1 (P/S + DL + LL):		
Max comp =	5.10 ksi	3.30 ksi
STRESS LIMITS AT FINAL 2 (P/S + DL):		
Max comp =	3.83 ksi	2.47 ksi
FATIGUE I STRESS LIMITS AT FINAL 3 (50% P/S + 50% DL + F_LL):		
Max comp =	3.40 ksi	2.20 ksi
SERVICE III (Tension):		
Max tens =	-0.55 ksi	-0.45 ksi

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span: 1, Beam: 1

PRESTRESSED STEEL: 62 strands, 6/10-270K-LL, Low relaxation strands
Straight Pattern
END PATTERN (Ycg = 8.68 in):

11 @ 3.000 in	11 @ 5.000 in	11 @ 7.000 in	9 @ 9.000 in
7 @ 11.000 in	5 @ 13.000 in	3 @ 15.000 in	1 @ 17.000 in
1 @ 19.000 in	1 @ 21.000 in	1 @ 23.000 in	1 @ 25.000 in

Strand Diameter	= 0.600 in	Tensile Strength(fpu)	= 270.0 ksi
Strand Area	= 0.217 in2	Initial Prestress	= 0.75 fpu = 202.5 ksi
Total Strand Area	= 13.454 in2	Initial Pull	= 2724.4 kips
Trans. Len,bonded	= 3.000 ft	Dev. Len, bonded	= 11.549 ft
Trans. Len,debonded	= 3.000 ft	Dev. Len, debonded	= 14.436 ft
Holddown Force	= 0.000 kips	Beam Shrtng (PL/AE)	= 0.913 in

REINFORCING STEEL: Tension steel: fy = 60.0 ksi Es = 29000 ksi fs = 24.0 ksi
Stirrups:

# legs	Size	fy (ksi)	Area (in2)	Spacing (in)	Start (ft)	End (ft)
2	US#5[M16]	60.00	0.62	3.00	0.0000	1.5000
1	US#5[M16]	60.00	0.31	3.00	1.5000	6.2500
1	US#5[M16]	60.00	0.31	4.00	6.2500	18.2500
1	US#5[M16]	60.00	0.31	12.00	18.2500	42.2500
1	US#5[M16]	60.00	0.31	15.00	42.2500	100.8960
1	US#5[M16]	60.00	0.31	12.00	100.8960	124.8960
1	US#5[M16]	60.00	0.31	4.00	124.8960	136.8960
1	US#5[M16]	60.00	0.31	3.00	136.8960	141.6460
2	US#5[M16]	60.00	0.62	3.00	141.6460	143.1460

Midspan: Str. area = 13.4540 in2 Ycg = 8.68 in
P_init = 2724.4 kips Ecc = 31.10 in
Days to release = 0.75 Rel. Humid.(RH) = 75.0 % Es = 28500.0 ksi Eci = 4499 ksi

AASHTO LOSSES
Elastic Shortening ** 20.44 ksi (Eq 5.9.5.2.3a-1), (fcgp= 3.226 ksi)

Elastic Gains	Gains	Adjustment
due to Precast Loads	-6.41 ksi	0.00 ksi
due to Composite Loads	-1.26 ksi	0.00 ksi
due to Live Loads	-6.18 ksi	0.00 ksi

Time Dependent Losses (Approximate Method (Art.5.9.5.3))

	Initial	Final
Steel relaxation	0.00 ksi	2.40 ksi (Eq 5.9.5.3-1)
Concrete shrinkage	0.00 ksi	7.31 ksi (Eq 5.9.5.3-1)
Concrete creep	0.00 ksi	15.31 ksi (Eq 5.9.5.3-1)
Sub-total	20.44 ksi (10.09 %)	11.17 ksi (5.51 %)
Total Prestress Losses		31.60 ksi (15.61 %)

Prestressing Stress Limit Check (Table 5.9.3.1)
initial fpi = 202.5 ksi < 0.75 fpu, OK
initial fpe = 170.9 ksi < 0.80 fpy, OK

** Since the transformed section properties option has been selected, even though ES losses have been calculated explicitly here, they are not included as a part of stress calculations. Please see theory section for complete explanation.

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SHIELDING AND REDUCED INITIAL PULLS:

Group	Strands	Heights End	Heights Mid	Shielding End	Shielding Mid	Initial Pull Frac	Initial Pull Pull/Str
19	2	9.000 in	9.000 in	5.00 ft	0.00 ft	75.0 %	43.9
24	2	7.000 in	7.000 in	10.00 ft	0.00 ft	75.0 %	43.9
25	2	7.000 in	7.000 in	15.00 ft	0.00 ft	75.0 %	43.9
30	2	5.000 in	5.000 in	20.00 ft	0.00 ft	75.0 %	43.9
31	2	5.000 in	5.000 in	25.00 ft	0.00 ft	75.0 %	43.9
35	2	3.000 in	3.000 in	30.00 ft	0.00 ft	75.0 %	43.9
36	2	3.000 in	3.000 in	45.00 ft	0.00 ft	75.0 %	43.9

Check for Art. 5.11.4.3 (debond termination distances): OK

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SHEAR AND MOMENT ENVELOPE : Span : 1, Beam : 1, SERVICE I
Shears: kips, Moments: kft

		Bearing	Trans	H/2	0.10L	0.20L	0.30L	0.40L	Midspan
Location,	ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Self wt. :	M	0.0	197.1	288.3	1000.9	1810.7	2389.2	2736.2	2851.9
(Max)	V	80.3	77.4	76.1	64.7	48.5	32.3	16.2	0.0
DL-Prec. :	M	0.0	11.3	16.5	57.2	103.6	136.6	156.5	163.1
DC(Max)	V	4.6	4.4	4.4	3.7	2.8	1.8	0.9	0.0
DL-Prec. :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck + :	M	0.0	207.7	303.7	1054.5	1907.6	2517.0	2882.6	3004.5
Haunch (Max)	V	84.5	81.6	80.2	68.1	51.1	34.1	17.0	0.0
Diaphragm :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp :	M	-0.0	26.4	38.7	134.3	242.9	320.6	367.1	382.6
DC(Max)	V	10.8	10.4	10.2	8.7	6.5	4.3	2.2	0.0
DL-Comp :	M	-0.0	26.2	38.3	133.0	240.5	317.4	363.5	378.9
DW(Max)	V	10.7	10.3	10.1	8.6	6.4	4.3	2.1	0.0
LL + I :	M+	-0.0	332.3	485.9	1681.0	3022.2	3955.8	4513.4	4674.7
	V	135.8	132.4	130.8	117.2	98.4	79.5	10.5	34.3
LL + I :	M-	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I :	Vmx	135.8	132.4	130.9	117.4	100.0	83.5	67.9	53.3
	M	-0.0	328.0	478.5	1622.3	2813.6	3545.2	3856.5	3786.7
Total :	M+	0.0	801.0	1171.2	4060.9	7327.6	9636.5	11019.3	11455.7
	V	326.6	316.5	311.7	271.0	213.7	156.4	48.9	34.3
Total :	M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total :	Vmx	326.6	316.6	311.8	271.2	215.3	160.4	106.4	53.3
	M	0.0	796.7	1163.9	4002.2	7119.0	9225.9	10362.4	10567.7

		0.60L	0.70L	0.80L	0.90L	H/2	Trans	Bearing
Location,	ft	85.39	99.70	114.02	128.33	138.46	139.65	142.15
Self wt. :	M	2736.2	2389.2	1810.7	1000.9	288.3	197.1	0.0
(Max)	V	16.2	32.3	48.5	64.7	76.1	77.4	80.3
DL-Prec. :	M	156.5	136.6	103.6	57.2	16.5	11.3	0.0
DC(Max)	V	0.9	1.8	2.8	3.7	4.4	4.4	4.6
DL-Prec. :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck + :	M	2882.6	2517.0	1907.6	1054.5	303.7	207.7	0.0
Haunch (Max)	V	17.0	34.1	51.1	68.1	80.2	81.6	84.5
Diaphragm :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp :	M	367.1	320.6	242.9	134.3	38.7	26.4	0.0
DC(Max)	V	2.2	4.3	6.5	8.7	10.2	10.4	10.8
DL-Comp :	M	363.5	317.4	240.5	133.0	38.3	26.2	0.0
DW(Max)	V	2.1	4.3	6.4	8.6	10.1	10.3	10.7
LL + I :	M+	4513.4	3955.8	3022.2	1681.0	485.9	332.3	-0.0
	V	10.5	79.5	98.4	117.2	130.8	132.4	135.8
LL + I :	M-	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I :	Vmx	67.9	83.5	100.0	117.4	130.9	132.4	135.8
	M	3856.5	3545.2	2813.6	1622.3	478.5	328.0	0.0
Total :	M+	11019.3	9636.5	7327.6	4060.9	1171.2	801.0	0.0
	V	48.9	156.4	213.7	271.0	311.7	316.5	326.6
Total :	M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total :	Vmx	106.4	160.4	215.3	271.2	311.8	316.6	326.6
	M	10362.4	9225.9	7119.0	4002.2	1163.9	796.7	0.0

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

REACTIONS (kips), SERVICE I

Load Type	Left Support	Right Support
Self Wt.	80.3	80.3
Deck+Haunch	84.5	84.5
Diaphragm	0.0	0.0
DL-Prec.(DC)	4.6	4.6
DL-Prec.(DW)	0.0	0.0
DL-Comp.(DC)	43.1	43.1
DL-Comp.(DW)	42.6	42.6
Live	112.8	112.8
Pedestrian	0.0	0.0

Upward reactions are positive.
Live Load reactions are per lane with no distribution factor and no impact.
Non-composite load types are per beam.
Composite and Pedestrian load types are per total bridge width.

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SHEAR AND MOMENT ENVELOPE : Span : 1, Beam : 1, SERVICE III
Shears: kips, Moments: kft

		Bearing	Trans	H/2	0.10L	0.20L	0.30L	0.40L	Midspan
Location,	ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Self wt. :	M	0.0	197.1	288.3	1000.9	1810.7	2389.2	2736.2	2851.9
(Max)	V	80.3	77.4	76.1	64.7	48.5	32.3	16.2	0.0
DL-Prec. :	M	0.0	11.3	16.5	57.2	103.6	136.6	156.5	163.1
DC(Max)	V	4.6	4.4	4.4	3.7	2.8	1.8	0.9	0.0
DL-Prec. :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck + :	M	0.0	207.7	303.7	1054.5	1907.6	2517.0	2882.6	3004.5
Haunch (Max)	V	84.5	81.6	80.2	68.1	51.1	34.1	17.0	0.0
Diaphragm :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp :	M	-0.0	26.4	38.7	134.3	242.9	320.6	367.1	382.6
DC(Max)	V	10.8	10.4	10.2	8.7	6.5	4.3	2.2	0.0
DL-Comp :	M	-0.0	26.2	38.3	133.0	240.5	317.4	363.5	378.9
DW(Max)	V	10.7	10.3	10.1	8.6	6.4	4.3	2.1	0.0
LL + I :	M+	-0.0	265.9	388.7	1344.8	2417.8	3164.6	3610.7	3739.7
	V	108.6	105.9	104.7	93.8	78.7	63.6	8.4	27.4
LL + I :	M-	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I :	Vmx	108.6	106.0	104.7	93.9	80.0	66.8	54.4	42.6
	M	-0.0	262.4	382.8	1297.9	2250.9	2836.2	3085.2	3029.4
Total :	M+	0.0	734.5	1074.1	3724.7	6723.2	8845.4	10116.7	10520.8
	V	299.4	290.0	285.6	247.5	194.0	140.5	46.8	27.4
Total :	M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total :	Vmx	299.4	290.1	285.6	247.7	195.3	143.7	92.8	42.6
	M	0.0	731.1	1068.2	3677.8	6556.3	8516.9	9591.1	9810.4

		0.60L	0.70L	0.80L	0.90L	H/2	Trans	Bearing
Location,	ft	85.39	99.70	114.02	128.33	138.46	139.65	142.15
Self wt. :	M	2736.2	2389.2	1810.7	1000.9	288.3	197.1	0.0
(Max)	V	16.2	32.3	48.5	64.7	76.1	77.4	80.3
DL-Prec. :	M	156.5	136.6	103.6	57.2	16.5	11.3	0.0
DC(Max)	V	0.9	1.8	2.8	3.7	4.4	4.4	4.6
DL-Prec. :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck + :	M	2882.6	2517.0	1907.6	1054.5	303.7	207.7	0.0
Haunch (Max)	V	17.0	34.1	51.1	68.1	80.2	81.6	84.5
Diaphragm :	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp :	M	367.1	320.6	242.9	134.3	38.7	26.4	0.0
DC(Max)	V	2.2	4.3	6.5	8.7	10.2	10.4	10.8
DL-Comp :	M	363.5	317.4	240.5	133.0	38.3	26.2	0.0
DW(Max)	V	2.1	4.3	6.4	8.6	10.1	10.3	10.7
LL + I :	M+	3610.7	3164.6	2417.8	1344.8	388.7	265.9	-0.0
	V	8.4	63.6	78.7	93.8	104.7	105.9	108.6
LL + I :	M-	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I :	Vmx	54.4	66.8	80.0	93.9	104.7	106.0	108.6
	M	3085.2	2836.2	2250.9	1297.9	382.8	262.4	0.0
Total :	M+	10116.7	8845.4	6723.2	3724.7	1074.1	734.5	0.0
	V	46.8	140.5	194.0	247.5	285.6	290.0	299.4
Total :	M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total :	Vmx	92.8	143.7	195.3	247.7	285.6	290.1	299.4
	M	9591.1	8516.9	6556.3	3677.8	1068.2	731.1	0.0

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SHEAR AND MOMENT ENVELOPE : Span : 1, Beam : 1, STRENGTH I
Shears: kips, Moments: kft

		Bearing	Trans	H/2	0.10L	0.20L	0.30L	0.40L	Midspan
Location,	ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Self wt.	: M	0.0	246.4	360.3	1251.1	2263.4	2986.5	3420.3	3564.9
(Max)	V	100.3	96.8	95.1	80.8	60.6	40.4	20.2	0.0
Self wt.	: M	0.0	177.4	259.4	900.8	1629.7	2150.3	2462.6	2566.7
(Min)	V	72.2	69.7	68.5	58.2	43.6	29.1	14.5	0.0
DL-Prec.	: M	0.0	14.1	20.6	71.6	129.5	170.8	195.6	203.9
DC(Max)	V	5.7	5.5	5.4	4.6	3.5	2.3	1.2	0.0
DL-Prec.	: M	0.0	10.1	14.8	51.5	93.2	123.0	140.9	146.8
DC(Min)	V	4.1	4.0	3.9	3.3	2.5	1.7	0.8	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck +	: M	0.0	259.6	379.6	1318.1	2384.5	3146.3	3603.3	3755.6
Haunch (Max)	V	105.7	102.0	100.2	85.1	63.9	42.6	21.3	0.0
Deck +	: M	0.0	186.9	273.3	949.0	1716.9	2265.3	2594.4	2704.1
Haunch (Min)	V	76.1	73.4	72.1	61.3	46.0	30.7	15.3	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	-0.0	33.1	48.3	167.9	303.7	400.7	458.9	478.3
DC(Max)	V	13.5	13.0	12.8	10.8	8.1	5.4	2.7	0.0
DL-Comp	: M	-0.0	23.8	34.8	120.9	218.7	288.5	330.4	344.4
DC(Min)	V	9.7	9.3	9.2	7.8	5.9	3.9	2.0	0.0
DL-Comp	: M	-0.0	39.3	57.4	199.4	360.8	476.1	545.2	568.3
DW(Max)	V	16.0	15.4	15.2	12.9	9.7	6.4	3.2	0.0
DL-Comp	: M	-0.0	17.0	24.9	86.4	156.4	206.3	236.3	246.3
DW(Min)	V	6.9	6.7	6.6	5.6	4.2	2.8	1.4	0.0
LL + I	: M+	-0.0	581.6	850.2	2941.7	5288.9	6922.6	7898.4	8180.6
	V	237.6	231.7	228.9	205.2	172.2	139.2	18.3	60.0
LL + I	: M-	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: Vmx	237.6	231.8	229.0	205.5	175.0	146.2	118.9	93.2
	M	-0.0	574.0	837.3	2839.1	4923.8	6204.1	6748.8	6626.7
Total	: M+	0.0	1174.0	1716.6	5949.8	10730.8	14102.9	16121.7	16751.7
	V	478.8	464.4	457.6	399.5	317.9	236.3	66.9	60.0
Total	: M-	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	406.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	: Vmx	478.8	464.5	457.7	399.8	320.8	243.3	167.5	93.2
	M	0.0	1166.4	1703.6	5847.2	10365.6	13384.4	14972.2	15197.7

		0.60L	0.70L	0.80L	0.90L	H/2	Trans	Bearing
Location,	ft	85.39	99.70	114.02	128.33	138.46	139.65	142.15
Self wt.	: M	3420.3	2986.5	2263.4	1251.2	360.3	246.4	0.0
(Max)	V	20.2	40.4	60.6	80.8	95.1	96.8	100.3
Self wt.	: M	2462.6	2150.3	1629.7	900.8	259.4	177.4	0.0
(Min)	V	14.5	29.1	43.6	58.2	68.5	69.7	72.2
DL-Prec.	: M	195.6	170.8	129.5	71.6	20.6	14.1	0.0
DC(Max)	V	1.2	2.3	3.5	4.6	5.4	5.5	5.7
DL-Prec.	: M	140.9	123.0	93.2	51.5	14.8	10.1	0.0
DC(Min)	V	0.8	1.7	2.5	3.3	3.9	4.0	4.1
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck +	: M	3603.3	3146.3	2384.5	1318.1	379.6	259.6	0.0
Haunch (Max)	V	21.3	42.6	63.9	85.1	100.2	102.0	105.7

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Deck +	: M	2594.4	2265.3	1716.9	949.0	273.3	186.9	0.0
Haunch (Min)	V	15.3	30.7	46.0	61.3	72.1	73.4	76.1
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	458.9	400.7	303.7	167.9	48.3	33.1	0.0
DC(Max)	V	2.7	5.4	8.1	10.8	12.8	13.0	13.5
DL-Comp	: M	330.4	288.5	218.7	120.9	34.8	23.8	0.0
DC(Min)	V	2.0	3.9	5.9	7.8	9.2	9.3	9.7
DL-Comp	: M	545.2	476.1	360.8	199.4	57.4	39.3	0.0
DW(Max)	V	3.2	6.4	9.7	12.9	15.2	15.4	16.0
DL-Comp	: M	236.3	206.3	156.4	86.4	24.9	17.0	0.0
DW(Min)	V	1.4	2.8	4.2	5.6	6.6	6.7	6.9
LL + I	: M+	7898.4	6922.6	5288.9	2941.7	850.2	581.6	-0.0
	V	18.3	139.2	172.2	205.2	228.9	231.7	237.6
LL + I	: M-	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: Vmx	118.9	146.2	175.0	205.5	229.0	231.8	237.6
	M	6748.8	6204.1	4923.8	2839.1	837.3	574.0	0.0
Total	: M+	16121.7	14102.9	10730.8	5949.8	1716.6	1174.0	0.0
	V	66.9	236.3	317.9	399.5	457.6	464.4	478.8
Total	: M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	: Vmx	167.5	243.3	320.8	399.8	457.7	464.5	478.8
	M	14972.2	13384.4	10365.6	5847.2	1703.6	1166.4	0.0

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

REACTIONS (kips), STRENGTH I

Load Type	Left Support	Right Support
Self Wt.	100.3	100.3
Deck+Haunch	105.7	105.7
Diaphragm	0.0	0.0
DL-Prec.(DC)	5.7	5.7
DL-Prec.(DW)	0.0	0.0
DL-Comp.(DC)	53.8	53.8
DL-Comp.(DW)	64.0	64.0
Live	197.3	197.3
Pedestrian	0.0	0.0

Upward reactions are positive.
Live Load reactions are per lane with no distribution factor and no impact.
Non-composite load types are per beam.
Composite and Pedestrian load types are per total bridge width.

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SHEAR AND MOMENT ENVELOPE : Span : 1, Beam : 1, FATIGUE I
Shears: kips, Moments: kft

		Bearing	Trans	H/2	0.10L	0.20L	0.30L	0.40L	Midspan
Location,	ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Self wt.	: M	0.0	197.1	288.3	1000.9	1810.7	2389.2	2736.2	2851.9
(Max)	V	80.3	77.4	76.1	64.7	48.5	32.3	16.2	0.0
Self wt.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	11.3	16.5	57.2	103.6	136.6	156.5	163.1
DC(Max)	V	4.6	4.4	4.4	3.7	2.8	1.8	0.9	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck +	: M	0.0	207.7	303.7	1054.5	1907.6	2517.0	2882.6	3004.5
Haunch (Max)	V	84.5	81.6	80.2	68.1	51.1	34.1	17.0	0.0
Deck +	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haunch (Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	-0.0	26.4	38.7	134.3	242.9	320.6	367.1	382.6
DC(Max)	V	10.8	10.4	10.2	8.7	6.5	4.3	2.2	0.0
DL-Comp	: M	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	-0.0	26.2	38.3	133.0	240.5	317.4	363.5	378.9
DW(Max)	V	10.7	10.3	10.1	8.6	6.4	4.3	2.1	0.0
DL-Comp	: M	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: M+	0.0	221.5	323.5	1110.1	1967.5	2571.1	2896.4	2924.8
	V	90.8	88.9	88.0	80.4	69.9	6.6	3.8	31.9
LL + I	: M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: Vmx	90.8	88.9	88.0	80.4	69.9	59.5	49.1	38.7
	M	0.0	221.5	323.5	1110.1	1967.5	2526.8	2788.1	2751.3
Total	: M+	0.0	690.1	1008.9	3490.0	6272.9	8251.8	9402.3	9705.9
	V	281.6	273.0	268.9	234.1	185.2	83.4	42.3	31.9
Total	: M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	: Vmx	281.6	273.0	268.9	234.1	185.2	136.4	87.6	38.7
	M	0.0	690.1	1008.9	3490.0	6272.9	8207.6	9294.1	9532.3

		0.60L	0.70L	0.80L	0.90L	H/2	Trans	Bearing
Location,	ft	85.39	99.70	114.02	128.33	138.46	139.65	142.15
Self wt.	: M	2736.2	2389.2	1810.7	1000.9	288.3	197.1	0.0
(Max)	V	16.2	32.3	48.5	64.7	76.1	77.4	80.3
Self wt.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	156.5	136.6	103.6	57.2	16.5	11.3	0.0
DC(Max)	V	0.9	1.8	2.8	3.7	4.4	4.4	4.6
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Prec.	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deck +	: M	2882.6	2517.0	1907.6	1054.5	303.7	207.7	0.0
Haunch (Max)	V	17.0	34.1	51.1	68.1	80.2	81.6	84.5

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Deck +	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haunch (Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Max)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaphragm	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	367.1	320.6	242.9	134.3	38.7	26.4	0.0
DC(Max)	V	2.2	4.3	6.5	8.7	10.2	10.4	10.8
DL-Comp	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DL-Comp	: M	363.5	317.4	240.5	133.0	38.3	26.2	0.0
DW(Max)	V	2.1	4.3	6.4	8.6	10.1	10.3	10.7
DL-Comp	: M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DW(Min)	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: M+	2896.4	2571.1	1967.5	1110.1	323.5	221.5	0.0
	V	3.8	6.6	69.9	80.4	88.0	88.9	90.8
LL + I	: M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LL + I	: Vmx	49.1	59.5	69.9	80.4	88.0	88.9	90.8
	M	2788.1	2526.8	1967.5	1110.1	323.5	221.5	0.0
Total	: M+	9402.3	8251.8	6272.9	3490.0	1008.9	690.1	0.0
	V	42.3	83.4	185.2	234.1	268.9	273.0	281.6
Total	: M-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	: Vmx	87.6	136.4	185.2	234.1	268.9	273.0	281.6
	M	9294.1	8207.6	6272.9	3490.0	1008.9	690.1	0.0

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span : 1, Beam : 1, SERVICE I

RELEASE STRESSES, (ksi) (LOSS = 0.00 %)

	Trans	0.10L /0.90L	0.20L /0.80L	0.30L /0.70L	0.40L /0.60L	Midspan
Location, ft	3.00	14.31	28.63	42.94	57.26	71.57
Beam-Self						
Precast-top	0.117	0.514	0.912	1.196	1.365	1.422
Bottom	-0.113	-0.493	-0.866	-1.131	-1.287	-1.340
Prestress						
Precast-top	-0.646	-0.704	-0.812	-0.855	-0.899	-0.899
Bottom	4.261	4.588	5.087	5.257	5.426	5.426
Total						
Precast-top	-0.528	-0.190	0.100	0.340	0.466	0.523
Bottom	4.147*	4.095*	4.221*	4.126*	4.140*	4.086*

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SERVICE I

POSITIVE ENVELOPE STRESSES, (ksi) (LOSS = 12.35 %)

	Bearing	Trans	H/2	0.10L /0.90L	0.20L /0.80L	0.30L /0.70L	0.40L /0.60L	Midspan
Location, ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Prestress								
Precast-top	-0.103	-0.566	-0.566	-0.617	-0.712	-0.750	-0.788	-0.788
Bottom	0.677	3.734	3.734	4.021	4.459	4.608	4.756	4.756
Self wt.								
Precast-top	0.000	0.097	0.143	0.494	0.892	1.176	1.345	1.402
Bottom	-0.000	-0.094	-0.138	-0.474	-0.847	-1.112	-1.268	-1.322
DL-Prec (DC)								
Precast-top	0.000	0.006	0.008	0.028	0.051	0.067	0.077	0.080
Bottom	-0.000	-0.005	-0.008	-0.027	-0.048	-0.064	-0.073	-0.076
DL-Prec (DW)								
Precast-top	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Bottom	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Diaphragm								
Precast-top	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Bottom	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Deck + Haunch								
Precast-top	0.000	0.103	0.150	0.521	0.940	1.239	1.417	1.477
Bottom	-0.000	-0.099	-0.145	-0.499	-0.892	-1.172	-1.336	-1.392
DL-Comp (DC)								
Topping-top	0.000	0.004	0.006	0.019	0.035	0.046	0.052	0.054
Precast-top	0.000	0.003	0.004	0.015	0.028	0.037	0.042	0.044
Bottom	-0.000	-0.009	-0.014	-0.047	-0.084	-0.110	-0.126	-0.131
DL-Comp (DW)								
Topping-top	0.000	0.004	0.005	0.019	0.034	0.045	0.052	0.054
Precast-top	0.000	0.003	0.004	0.015	0.028	0.036	0.042	0.044
Bottom	-0.000	-0.009	-0.013	-0.046	-0.083	-0.109	-0.125	-0.130
LL+I(+)								
Topping-top	-0.000	0.048	0.069	0.240	0.430	0.562	0.640	0.663
Precast-top	-0.000	0.038	0.056	0.193	0.347	0.454	0.518	0.537
Bottom	0.000	-0.117	-0.171	-0.587	-1.044	-1.360	-1.546	-1.601
Final 1 (P/S + DL + LL)								
Topping-top	0.000	0.055	0.080	0.278	0.499	0.653	0.744	0.771
Precast-top	-0.103	-0.316	-0.200	0.650	1.574	2.260	2.654	2.796
Bottom	0.677	3.400	3.246	2.340	1.461	0.680	0.283	0.104
Final 2 (P/S + DL)								
Topping-top	0.000	0.008	0.011	0.038	0.069	0.091	0.104	0.108
Precast-top	-0.103	-0.354	-0.256	0.457	1.227	1.805	2.135	2.259
Bottom	0.677	3.517	3.417	2.927	2.504	2.041	1.829	1.706

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span : 1, Beam : 1, SERVICE III

RELEASE STRESSES, (ksi) (LOSS = 0.00 %)

	Trans	0.10L /0.90L	0.20L /0.80L	0.30L /0.70L	0.40L /0.60L	Midspan
Location, ft	3.00	14.31	28.63	42.94	57.26	71.57
Beam-Self						
Precast-top	0.117	0.514	0.912	1.196	1.365	1.422
Bottom	-0.113	-0.493	-0.866	-1.131	-1.287	-1.340
Prestress						
Precast-top	-0.646	-0.704	-0.812	-0.855	-0.899	-0.899
Bottom	4.261	4.588	5.087	5.257	5.426	5.426
Total						
Precast-top	-0.528	-0.190	0.100	0.340	0.466	0.523
Bottom	4.147	4.095	4.221	4.126	4.140	4.086
As_top (in2)	3.676	0.000	0.000	0.000	0.000	0.000

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

SERVICE III

POSITIVE ENVELOPE STRESSES, (ksi) (LOSS = 12.35 %)

	Bearing	Trans	H/2	0.10L /0.90L	0.20L /0.80L	0.30L /0.70L	0.40L /0.60L	Midspan
Location, ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
Prestress								
Precast-top	-0.103	-0.566	-0.566	-0.617	-0.712	-0.750	-0.788	-0.788
Bottom	0.677	3.734	3.734	4.021	4.459	4.608	4.756	4.756
Self wt.								
Precast-top	0.000	0.097	0.143	0.494	0.892	1.176	1.345	1.402
Bottom	-0.000	-0.094	-0.138	-0.474	-0.847	-1.112	-1.268	-1.322
DL-Prec (DC)								
Precast-top	0.000	0.006	0.008	0.028	0.051	0.067	0.077	0.080
Bottom	-0.000	-0.005	-0.008	-0.027	-0.048	-0.064	-0.073	-0.076
DL-Prec (DW)								
Precast-top	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Bottom	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Diaphragm								
Precast-top	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Bottom	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Deck + Haunch								
Precast-top	0.000	0.103	0.150	0.521	0.940	1.239	1.417	1.477
Bottom	-0.000	-0.099	-0.145	-0.499	-0.892	-1.172	-1.336	-1.392
DL-Comp (DC)								
Topping-top	-0.000	0.004	0.006	0.019	0.035	0.046	0.052	0.054
Precast-top	-0.000	0.003	0.004	0.015	0.028	0.037	0.042	0.044
Bottom	0.000	-0.009	-0.014	-0.047	-0.084	-0.110	-0.126	-0.131
DL-Comp (DW)								
Topping-top	-0.000	0.004	0.005	0.019	0.034	0.045	0.052	0.054
Precast-top	-0.000	0.003	0.004	0.015	0.028	0.036	0.042	0.044
Bottom	0.000	-0.009	-0.013	-0.046	-0.083	-0.109	-0.125	-0.130
LL+I(+)								
Topping-top	-0.000	0.038	0.056	0.192	0.344	0.450	0.512	0.531
Precast-top	-0.000	0.031	0.045	0.155	0.278	0.363	0.415	0.429
Bottom	0.000	-0.093	-0.137	-0.469	-0.835	-1.088	-1.237	-1.281
Final 1 (P/S + DL + LL)								
Topping-top	-0.000	0.046	0.067	0.230	0.413	0.540	0.616	0.639
Precast-top	-0.103	-0.324	-0.212	0.611	1.505	2.169	2.550	2.688
Bottom	0.677	3.424	3.280	2.458	1.669	0.953	0.593	0.425

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

Span : 1, Beam : 1, FATIGUE I
POSITIVE ENVELOPE STRESSES, (ksi)

	Bearing	Trans	H/2	0.10L /0.90L	0.20L /0.80L	0.30L /0.70L	0.40L /0.60L	Midspan
Location, ft	0.00	2.50	3.69	13.81	28.13	42.44	56.76	71.07
F_LL+I(+)								
Topping-top	-0.000	0.032	0.046	0.158	0.280	0.365	0.411	0.415
Precast-top	-0.000	0.025	0.037	0.128	0.226	0.295	0.333	0.336
Bottom	-0.000	-0.078	-0.114	-0.388	-0.679	-0.884	-0.992	-1.002
Final 3 (50% P/S + 50% DL + F_LL)								
Topping-top	-0.000	0.035	0.052	0.177	0.314	0.411	0.463	0.469
Precast-top	-0.051	-0.152	-0.091	0.356	0.839	1.198	1.400	1.465
Bottom	0.338	1.681	1.595	1.076	0.573	0.136	-0.077	-0.149

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

VERTICAL SHEAR (Art. 5.8) - Span : 1, Beam : 1, STRENGTH I
Using General Beta Theta Equation procedure - Art.5.8.3.4.2

Location (ft)	Vu (kips)	bv (in)	de (in)	Aps (in2)	Vp (kips)	eps_x	Theta	Vs-reqd (kips)	Av/s (in2/ft)	Av-prvd (in2/ft)	Al_reqd (in2)
	Mcor (kft)	a (in)	dv (in)	fpo (ksi)	vu/fc	Vc-com (kips)	Beta	Max.spc. (in)	min.Av/s (in2/ft)	pVn/Vu	Aps* (in2)
Bearing : 0.50											
	478.8	7.0	78.9	1.069	0.0	6.00e-3	50.0	487.7	1.478	2.480	0.00
	0.0	0.5	78.6	31.5	0.114	44.3	0.87	24.00	0.129	1.621	1.173
Transfer: 3.00											
	464.5	7.0	78.9	10.416	0.0	-0.34e-3	27.8	193.5	0.264	1.240	0.00
	1166.4	3.2	77.3	189.0	0.112	322.5	6.47	24.00	0.129	2.228	7.040
Critical: 6.92											
	442.1	7.0	78.9	10.850	0.0	-0.38e-3	27.7	156.3	0.213	0.930	0.00
	2820.3	3.9	77.0	189.0	0.107	335.0	6.74	24.00	0.129	2.073	8.945
0.1L : 14.31											
	399.8	7.0	79.0	11.284	0.0	-0.27e-3	28.1	147.8	0.206	0.930	0.00
	5847.2	5.0	76.5	189.0	0.098	296.4	6.01	24.00	0.129	2.170	10.706
0.2L : 28.63											
	320.8	7.0	79.4	12.586	0.0	-0.14e-3	28.5	91.1	0.129	0.310	0.00
	10365.6	5.6	76.6	189.0	0.078	265.3	5.37	24.00	0.129	1.358	11.925
0.3L : 42.94											
	243.3	7.0	79.6	13.020	0.0	-0.04e-3	28.9	25.6	0.129	0.248	0.00
	13384.4	5.9	76.7	189.0	0.059	244.7	4.95	24.00	0.129	1.543	12.963
0.4L : 57.26											
	167.5	7.0	79.8	13.454	0.0	-0.01e-3	29.0	0.0	0.129	0.248	0.00
	14972.2	6.1	76.8	189.0	0.041	239.8	4.84	24.00	0.129	2.213	13.371
0.5L : 71.57											
	93.2	7.0	79.8	13.454	0.0	-0.02e-3	28.9	0.0	0.129	0.248	0.00
	15197.7	6.1	76.8	189.0	0.023	242.1	4.89	24.00	0.129	4.000	13.454
0.6L : 85.89											
	167.5	7.0	79.8	13.454	0.0	-0.01e-3	29.0	0.0	0.129	0.248	0.00
	14972.2	6.1	76.8	189.0	0.041	239.8	4.84	24.00	0.129	2.213	13.371
0.7L : 100.20											
	243.3	7.0	79.6	13.020	0.0	-0.04e-3	28.9	25.6	0.129	0.248	0.00
	13384.4	5.9	76.7	189.0	0.059	244.7	4.95	24.00	0.129	1.543	12.963
0.8L : 114.52											
	320.8	7.0	79.4	12.586	0.0	-0.14e-3	28.5	91.1	0.129	0.310	0.00
	10365.6	5.6	76.6	189.0	0.078	265.3	5.37	24.00	0.129	1.358	11.925
0.9L : 128.83											
	399.8	7.0	79.0	11.284	0.0	-0.27e-3	28.1	147.8	0.206	0.930	0.00
	5847.2	5.0	76.5	189.0	0.098	296.4	6.01	24.00	0.129	2.170	10.706
Critical: 136.23											
	442.1	7.0	78.9	10.850	0.0	-0.38e-3	27.7	156.3	0.213	0.930	0.00
	2820.3	3.9	77.0	189.0	0.107	335.0	6.74	24.00	0.129	2.073	8.945
Transfer: 140.15											
	464.5	7.0	78.9	10.416	0.0	-0.34e-3	27.8	193.5	0.264	1.240	0.00
	1166.4	3.2	77.3	189.0	0.112	322.5	6.47	24.00	0.129	2.228	7.040
Bearing : 142.65											
	478.8	7.0	78.9	1.069	0.0	6.00e-3	50.0	487.7	1.478	2.480	0.00
	0.0	0.5	78.6	31.5	0.114	44.3	0.87	24.00	0.129	1.621	1.173

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

ANCHORAGE ZONE REINFORCEMENT (Art. 5.10.10)
Span : 1, Beam : 1
Fpi, kips = 2109.24
fs, ksi = 20.00
h/4, in = 19.50
Abrst_rqrd, in2 = 4.22

HORIZONTAL SHEAR (Art. 5.8.4) - Span : 1, Beam : 1
(Beam and Slab effects are INCLUDED in Vu).

Location (ft)	Vu (kips)	Vnh-req (kips)	de (in)	a (in)	dv (in)	s_max (in)	Avh-min (in2/ft)	Avh-sm (in2/ft)	Avh-rg (in2/ft)
Bearing :		0.00							
	478.8	6.76	78.92	0.55	78.64	24.00	0.600	0.063	0.000
Transfer:		2.50							
	464.5	6.68	78.92	3.23	77.30	24.00	0.600	0.060	0.000
Critical:		6.42							
	442.1	6.38	78.94	3.88	77.00	24.00	0.600	0.052	0.000
0.1L :		13.81							
	399.8	5.81	79.04	5.05	76.51	24.00	0.600	0.036	0.000
0.2L :		28.13							
	320.8	4.65	79.43	5.62	76.62	24.00	0.600	0.004	0.000
0.3L :		42.44							
	243.3	3.53	79.63	5.89	76.69	24.00	0.600	0.000	0.000
0.4L :		56.76							
	167.5	2.42	79.82	6.08	76.78	24.00	0.600	0.000	0.000
0.5L :		71.07							
	93.2	1.35	79.82	6.09	76.78	24.00	0.600	0.000	0.000
0.6L :		85.39							
	167.5	2.42	79.82	6.08	76.78	24.00	0.600	0.000	0.000
0.7L :		99.70							
	243.3	3.53	79.63	5.89	76.69	24.00	0.600	0.000	0.000
0.8L :		114.02							
	320.8	4.65	79.43	5.62	76.62	24.00	0.600	0.004	0.000
0.9L :		128.33							
	399.8	5.81	79.04	5.05	76.51	24.00	0.600	0.036	0.000
Critical:		135.73							
	442.1	6.38	78.94	3.88	77.00	24.00	0.600	0.052	0.000
Transfer:		139.65							
	464.5	6.68	78.92	3.23	77.30	24.00	0.600	0.060	0.000
Bearing :		142.15							
	478.8	6.76	78.92	0.55	78.64	24.00	0.600	0.063	0.000

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

CAMBER AND DEFLECTIONS: SERVICE I (Span : 1, Beam : 1; Units: in)

	Release	Mult	Erection	Mult	Final
At 0.1 x L = 13.81 ft					
Prestress	2.289	1.80	4.120	2.20	5.036
Self Wt.	-0.769	1.85	-1.423	2.40	-1.846
Deck + Haunch			-0.686	2.30	-1.577
DL-Prec. (DC)			-0.037	3.00	-0.112
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.042	3.00	-0.126
DL-Comp. (DW)			-0.041	3.00	-0.124
Live Load	Not Included				
Total	1.520		1.891		1.251
At 0.2 x L = 28.13 ft					
Prestress	4.076	1.80	7.337	2.20	8.968
Self Wt.	-1.445	1.85	-2.673	2.40	-3.467
Deck + Haunch			-1.312	2.30	-3.017
DL-Prec. (DC)			-0.071	3.00	-0.214
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.080	3.00	-0.240
DL-Comp. (DW)			-0.079	3.00	-0.238
Live Load	Not Included				
Total	2.631		3.122		1.792
At 0.3 x L = 42.44 ft					
Prestress	5.375	1.80	9.675	2.20	11.825
Self Wt.	-1.972	1.85	-3.649	2.40	-4.734
Deck + Haunch			-1.802	2.30	-4.143
DL-Prec. (DC)			-0.098	3.00	-0.293
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.110	3.00	-0.330
DL-Comp. (DW)			-0.109	3.00	-0.326
Live Load	Not Included				
Total	3.403		3.908		1.998
At 0.4 x L = 56.76 ft					
Prestress	6.144	1.80	11.059	2.20	13.517
Self Wt.	-2.304	1.85	-4.262	2.40	-5.529
Deck + Haunch			-2.109	2.30	-4.851
DL-Prec. (DC)			-0.115	3.00	-0.344
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.129	3.00	-0.386
DL-Comp. (DW)			-0.127	3.00	-0.382
Live Load	Not Included				
Total	3.840		4.318		2.025
At 0.5 x L = 71.07 ft					
Prestress	6.410	1.80	11.538	2.20	14.102
Self Wt.	-2.419	1.85	-4.475	2.40	-5.806
Deck + Haunch			-2.216	2.30	-5.098
DL-Prec. (DC)			-0.120	3.00	-0.361
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.135	3.00	-0.406
DL-Comp. (DW)			-0.134	3.00	-0.402
Live Load	Not Included				
Total	3.991		4.457		2.030

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

At 0.6 x L = 85.39 ft

Prestress	:	6.144	1.80	11.059	2.20	13.517
Self Wt.	:	-2.304	1.85	-4.262	2.40	-5.529
Deck + Haunch	:			-2.109	2.30	-4.851
DL-Prec. (DC)	:			-0.115	3.00	-0.344
Diaphragm	:			0.000	3.00	0.000
DL-Prec. (DW)	:			0.000	3.00	0.000
DL-Comp. (DC)	:			-0.129	3.00	-0.386
DL-Comp. (DW)	:			-0.127	3.00	-0.382
Live Load	:	Not Included				
Total	:	3.840		4.318		2.025

At 0.7 x L = 99.70 ft

Prestress	:	5.375	1.80	9.675	2.20	11.825
Self Wt.	:	-1.972	1.85	-3.649	2.40	-4.734
Deck + Haunch	:			-1.802	2.30	-4.143
DL-Prec. (DC)	:			-0.098	3.00	-0.293
Diaphragm	:			0.000	3.00	0.000
DL-Prec. (DW)	:			0.000	3.00	0.000
DL-Comp. (DC)	:			-0.110	3.00	-0.330
DL-Comp. (DW)	:			-0.109	3.00	-0.326
Live Load	:	Not Included				
Total	:	3.403		3.908		1.998

At 0.8 x L = 114.02 ft

Prestress	:	4.076	1.80	7.337	2.20	8.968
Self Wt.	:	-1.445	1.85	-2.673	2.40	-3.467
Deck + Haunch	:			-1.312	2.30	-3.017
DL-Prec. (DC)	:			-0.071	3.00	-0.214
Diaphragm	:			0.000	3.00	0.000
DL-Prec. (DW)	:			0.000	3.00	0.000
DL-Comp. (DC)	:			-0.080	3.00	-0.240
DL-Comp. (DW)	:			-0.079	3.00	-0.238
Live Load	:	Not Included				
Total	:	2.631		3.122		1.792

At 0.9 x L = 128.33 ft

Prestress	:	2.289	1.80	4.120	2.20	5.036
Self Wt.	:	-0.769	1.85	-1.423	2.40	-1.846
Deck + Haunch	:			-0.686	2.30	-1.577
DL-Prec. (DC)	:			-0.037	3.00	-0.112
Diaphragm	:			0.000	3.00	0.000
DL-Prec. (DW)	:			0.000	3.00	0.000
DL-Comp. (DC)	:			-0.042	3.00	-0.126
DL-Comp. (DW)	:			-0.041	3.00	-0.124
Live Load	:	Not Included				
Total	:	1.520		1.891		1.251

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

ULTIMATE - Span : 1, Beam : 1, STRENGTH I
(Mr-prvd computed by AASHTO equations, Art. 5.7.3.2/5.7.3.3)

Location (ft)	Mu k.ft	dp in	Aps in2	fps ksi	c in	a in	Mr-prvd k.ft	c/dt	Phi	1.2 Mcr k.ft	min Mr k.ft	Crkg Ratio	Mu-p/r Ratio
Transfer: 2.50													
1174.0	78.9	7.040	266.0	4.1	3.2	12064.7	0.050T	1.00	-	-	-	-	
H/2 : 3.69													
1716.6	78.9	7.509	265.8	4.4	3.4	12838.1	0.053T	1.00	-	-	-	-	
0.1L : 13.81													
5949.8	78.9	11.097	263.8	6.5	5.0	18640.6	0.078T	1.00	15322.0	7913.3	1.5	-	
0.2L : 28.13													
10730.8	79.2	12.372	263.1	7.2	5.6	20726.0	0.087T	1.00	16300.9	14271.9	1.5	-	
0.3L : 42.44													
14102.9	79.6	13.002	262.8	7.6	5.9	21829.3	0.091T	1.00	16379.6	16379.6	1.6	-	
0.4L : 56.76													
16121.7	79.8	13.427	262.6	7.8	6.1	22550.8	0.094T	1.00	16666.8	16666.8	1.6	-	
0.5L : 71.07													
16751.7	79.8	13.454	262.6	7.8	6.1	22603.4	0.094T	1.00	16563.5	16563.5	1.6	-	
0.6L : 85.39													
16121.7	79.8	13.427	262.6	7.8	6.1	22550.8	0.094T	1.00	16666.8	16666.8	1.6	-	
0.7L : 99.70													
14102.9	79.6	13.002	262.8	7.6	5.9	21829.3	0.091T	1.00	16379.6	16379.6	1.6	-	
0.8L : 114.02													
10730.8	79.2	12.372	263.1	7.2	5.6	20726.0	0.087T	1.00	16300.9	14271.9	1.5	-	
0.9L : 128.33													
5949.8	78.9	11.097	263.8	6.5	5.0	18640.6	0.078T	1.00	15322.0	7913.3	1.5	-	
H/2 : 138.46													
1716.6	78.9	7.509	265.8	4.4	3.4	12838.1	0.053T	1.00	-	-	-	-	
Transfer: 139.65													
1174.0	78.9	7.040	266.0	4.1	3.2	12064.7	0.050T	1.00	-	-	-	-	

Legend: C = Compression-Controlled (c/dt > 0.600)
: I = In-Transition (0.60 >= c/dt > 0.375)
: T = Tension-Controlled (c/dt <= 0.375)

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

DETENSIONING (Span : 1, Beam : 1; Groups 1-37; Units: ksi)

Grp	Str		Ys,in	3.00ft	8.00ft	13.00ft	18.00ft	23.00ft	28.00ft	33.00ft	48.00ft
1	2	E	3.00 Ft	0.067	0.251	0.422	0.578	0.720			
		M	3.00 Fb	0.087	-0.091	-0.254	-0.403	-0.54*			
2	1	E	25.00 Ft	0.081	0.266	0.436	0.593	0.735	0.863		
		M	25.00 Fb	0.149	-0.029	-0.193	-0.342	-0.476	-0.60*		
3	1	E	23.00 Ft	0.092	0.277	0.447	0.604	0.746	0.874		
		M	23.00 Fb	0.214	0.036	-0.128	-0.277	-0.412	-0.53*		
4	1	E	21.00 Ft	0.099	0.284	0.455	0.611	0.753	0.881	0.995	
		M	21.00 Fb	0.283	0.104	-0.060	-0.209	-0.344	-0.465	-0.57*	
5	1	E	19.00 Ft	0.103	0.288	0.458	0.615	0.757	0.885	0.999	
		M	19.00 Fb	0.355	0.176	0.012	-0.138	-0.273	-0.394	-0.50*	
6	1	E	17.00 Ft	0.103	0.288	0.459	0.615	0.757	0.886	1.000	1.258
		M	17.00 Fb	0.431	0.252	0.087	-0.063	-0.199	-0.320	-0.427	-0.67*
7	2	E	15.00 Ft	0.096	0.281	0.451	0.608	0.751	0.879	0.993	1.252
		M	15.00 Fb	0.590	0.410	0.244	0.093	-0.043	-0.165	-0.272	-0.52*
8	1	E	15.00 Ft	0.092	0.277	0.448	0.605	0.747	0.876	0.990	1.249
		M	15.00 Fb	0.669	0.489	0.323	0.172	0.035	-0.087	-0.195	-0.439
9	2	E	13.00 Ft	0.077	0.263	0.434	0.591	0.733	0.862	0.976	1.235
		M	13.00 Fb	0.835	0.653	0.487	0.335	0.198	0.075	-0.034	-0.278
10	2	E	13.00 Ft	0.063	0.248	0.419	0.576	0.719	0.848	0.963	1.222
		M	13.00 Fb	1.000	0.818	0.651	0.499	0.360	0.237	0.127	-0.118
11	1	E	13.00 Ft	0.056	0.241	0.412	0.569	0.712	0.841	0.956	1.215
		M	13.00 Fb	1.083	0.901	0.733	0.580	0.442	0.318	0.208	-0.038
12	2	E	11.00 Ft	0.034	0.219	0.391	0.548	0.691	0.820	0.935	1.195
		M	11.00 Fb	1.256	1.073	0.904	0.751	0.611	0.486	0.376	0.130
13	2	E	11.00 Ft	0.012	0.198	0.369	0.527	0.670	0.799	0.914	1.174
		M	11.00 Fb	1.428	1.245	1.075	0.921	0.781	0.655	0.544	0.297
14	2	E	11.00 Ft	-0.010	0.176	0.348	0.505	0.649	0.778	0.893	1.153
		M	11.00 Fb	1.601	1.416	1.247	1.091	0.950	0.824	0.712	0.464
15	1	E	11.00 Ft	-0.021	0.165	0.337	0.494	0.638	0.768	0.883	1.143
		M	11.00 Fb	1.687	1.502	1.332	1.177	1.035	0.908	0.796	0.547
16	2	E	9.00 Ft	-0.050	0.136	0.308	0.466	0.610	0.739	0.855	1.115
		M	9.00 Fb	1.867	1.681	1.510	1.354	1.212	1.084	0.970	0.721
17	2	E	9.00 Ft	-0.079	0.107	0.279	0.437	0.581	0.711	0.827	1.087
		M	9.00 Fb	2.046	1.860	1.688	1.531	1.388	1.260	1.145	0.895
18	2	E	9.00 Ft	-0.108	0.078	0.251	0.409	0.553	0.683	0.799	1.060
		M	9.00 Fb	2.226	2.039	1.866	1.708	1.565	1.435	1.320	1.069
19	2	E	9.00 Ft	-0.108	0.049	0.222	0.380	0.524	0.655	0.771	1.032
		M	9.00 Fb	2.226	2.218	2.044	1.886	1.741	1.611	1.495	1.243
20	1	E	9.00 Ft	-0.122	0.035	0.208	0.366	0.510	0.640	0.757	1.018

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

		M	9.00 Fb	2.315	2.307	2.133	1.974	1.829	1.699	1.582	1.330
21	2	E	7.00 Ft	-0.158	-0.001	0.172	0.330	0.475	0.605	0.722	0.983
		M	7.00 Fb	2.502	2.493	2.318	2.158	2.013	1.881	1.764	1.511
22	2	E	7.00 Ft	-0.195	-0.037	0.136	0.294	0.439	0.570	0.686	0.948
		M	7.00 Fb	2.689	2.679	2.503	2.343	2.196	2.064	1.945	1.692
23	2	E	7.00 Ft	-0.231	-0.073	0.100	0.258	0.403	0.534	0.651	0.913
		M	7.00 Fb	2.875	2.864	2.688	2.527	2.379	2.246	2.127	1.872
24	2	E	7.00 Ft	-0.231	-0.073	0.064	0.222	0.368	0.499	0.616	0.878
		M	7.00 Fb	2.875	2.864	2.873	2.711	2.563	2.429	2.309	2.053
25	2	E	7.00 Ft	-0.231	-0.073	0.064	0.187	0.332	0.463	0.581	0.843
		M	7.00 Fb	2.875	2.864	2.873	2.895	2.746	2.611	2.490	2.234
26	1	E	7.00 Ft	-0.249	-0.091	0.046	0.169	0.314	0.445	0.563	0.825
		M	7.00 Fb	2.968	2.957	2.966	2.987	2.838	2.703	2.581	2.324
27	2	E	5.00 Ft	-0.293	-0.135	0.002	0.126	0.271	0.403	0.521	0.783
		M	5.00 Fb	3.162	3.150	3.158	3.178	3.028	2.892	2.770	2.512
28	2	E	5.00 Ft	-0.336	-0.178	-0.041	0.083	0.228	0.360	0.478	0.741
		M	5.00 Fb	3.355	3.343	3.350	3.370	3.218	3.081	2.958	2.699
29	2	E	5.00 Ft	-0.380	-0.222	-0.084	0.040	0.186	0.317	0.436	0.699
		M	5.00 Fb	3.549	3.536	3.542	3.561	3.408	3.271	3.146	2.887
30	2	E	5.00 Ft	-0.380	-0.222	-0.084	0.040	0.143	0.275	0.393	0.656
		M	5.00 Fb	3.549	3.536	3.542	3.561	3.599	3.460	3.335	3.074
31	2	E	5.00 Ft	-0.380	-0.222	-0.084	0.040	0.143	0.232	0.351	0.614
		M	5.00 Fb	3.549	3.536	3.542	3.561	3.599	3.649	3.523	3.262
32	1	E	5.00 Ft	-0.401	-0.243	-0.106	0.018	0.121	0.211	0.330	0.593
		M	5.00 Fb	3.646	3.632	3.638	3.656	3.694	3.744	3.618	3.356
33	2	E	3.00 Ft	-0.452	-0.294	-0.156	-0.032	0.071	0.161	0.280	0.544
		M	3.00 Fb	3.846	3.832	3.836	3.854	3.891	3.940	3.813	3.550
34	2	E	3.00 Ft	-0.503	-0.345	-0.207	-0.083	0.021			
		M	3.00 Fb	4.047	4.031	4.035	4.052	4.09*			
35	2	E	3.00 Ft	-0.503	-0.345	-0.207	-0.083	0.021			
		M	3.00 Fb	4.047	4.031	4.035	4.052	4.09*			
36	2	E	3.00 Ft	-0.503	-0.345	-0.207	-0.083	0.021			
		M	3.00 Fb	4.047	4.031	4.035	4.052	4.09*			
37	1	E	3.00 Ft	-0.528							
		M	3.00 Fb	4.15*							

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

DESIGN SUMMARY

Span: 1, Beam: 1, Exterior beam
Beam type: I-Girder , Old FIB-78
Precast Length, ft: 143.15 Release Length, ft: 143.15
Strand Pattern: Straight
Strand: 6/10-270K-LL
Strand Es, ksi: 28500.0 No. of strands: 62
No. of strands, Draped: 0 No. of strands, Straight: 62
Concrete Strength, f'ci: 6.8 ksi f'c: 8.5 ksi f'ct 5.5 ksi
Initial losses: 10.09 % Final losses: 15.61 %

Specification

	Allowable	Computed	Location	Status
Release Stresses (ksi) (Art. 5.9.4.1) (Using Advanced Settings)				
Precast Bot (compression)	4.080	4.221*	0.2L/0.8L	NG
Outer 15.00 %:				
Precast Top w/ no reinf. (tension)	-0.247	-0.528	Trans	
Precast Top w/ reinf. (tension)	-0.989			
Center 70.00 %:				
Precast Top w/ no reinf. (tension)	-0.247	0.100	0.2L/0.8L	
Precast Top w/ reinf. (tension)	-0.495			
Strength I (Art. 3.4.1, 5.7.3.1.1)	Provided	Required	Location	Status
Ult. Moment (k.ft)	22603.39	16751.66	Midspan	OK
Debonding Limits (Art. 5.11.4.3)	Allowable	Computed		Status
Max. Debond per Row	40.00 %	36.36 %		OK
Max. Debond Total	25.00 %	22.58 %		OK

	Final 1			Final 2			Final 3		
Specification	Allow.	Comp.	Loc.	Allow.	Comp.	Loc.	Allow.	Comp.	Loc.
Positive Moment Envelope Stresses (ksi) (Art. 3.4.1 and 5.9.4.2)									
Service I Limit State - Compressive Stresses Only									
Top.Top:	3.300	0.771	Midspan	2.475	0.108	Midspan			
Pre.Top:	5.100	2.796	Midspan	3.825	2.259	Midspan			
Pre.Bot:	5.100	3.400	Transfer	3.825	3.517	Transfer			
Service III Limit State - Tensile Stresses Only									
Top.Top:	-0.446	-0.000	Bearing						
Pre.Top:	-0.554	-0.324	Transfer						
Pre.Bot:	-0.554	0.425	Midspan						
Fatigue I Limit State - Compressive Stresses Only									
Pre.Top:							3.400	1.465	Midspan
Pre.Bot:							3.400	1.681	Transfer

CAMBER / DEFLECTION: (PCI Design Handbook - 4th Ed.- Table 4.6.2)
0.5 x L = 71.07 ft

	Release	Mult	Erection	Mult	Final
Prestress	6.410	1.80	11.538	2.20	14.102
Self Wt.	-2.419	1.85	-4.475	2.40	-5.806
Deck + Haunch			-2.216	2.30	-5.098
DL-Prec. (DC)			-0.120	3.00	-0.361
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DL-Comp. (DC)			-0.135	3.00	-0.406
DL-Comp. (DW)			-0.134	3.00	-0.402
Live Load	Not Included				
Total	3.991		4.457		2.030

Positive values indicate upward deflection.

PROJECT: Sanibel Causeway Imrovements Bridge Cracks check

LIVE LOAD LIBRARY: Default.cs3

1 ID : Design Lane
Description: Design Lane as in AASHTO-LRFD
Type : Design Lane
Lane Load : Intensity = 0.64 klf, Width = 10.00 ft

2 ID : Design Tandem
Description: Design Tandem as in AASHTO-LRFD
Type : Design Tandem
First Axle Magnitude = 25.00 k, Wheel Spacing = 6.00 ft, Truck Width = 10.00 ft

#	Magnitude, k	Max Spacing,ft	Min Spacing,ft	Increment,ft
1	25.00	4.00	4.00	0.00

3 ID : Design Truck
Description: Design Truck as in AASHTO-LRFD
Type : Design Truck
First Axle Magnitude = 8.00 k, Wheel Spacing = 6.00 ft, Truck Width = 10.00 ft

#	Magnitude, k	Max Spacing,ft	Min Spacing,ft	Increment,ft
1	32.00	14.00	14.00	0.00
2	32.00	30.00	14.00	2.00