



City of Naples Parking Garage

Condition Assessment

700 S 4th Ave, Naples, Florida
17R MJ 2033 9169

Rev 1- New letterhead. Addressing double Tee “panting”
January 11, 2023

November 8, 2021

Prepared for City of Naples



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[This document is intended to provide an overview of the conditions as found in the field. Recommendations are geared toward structural defects.]



1. EXECUTIVE SUMMARY

On October 18, 2021, Existing Structures Engineering, Inc. deployed to the above referenced facility to conduct a limited structural condition survey of the existing parking garage. There are no reported problems, the City is being proactive to prevent major issues. The scope of this study is limited to the structural aspect of the parking garages and does not cover MEP.

NB. Due to reported deflection of individual precast doubles Tees, we returned to site on December 15, 2022 to conduct further analysis.

This report was performed in general accordance with the ASCE Guideline for Condition Assessment of Existing Buildings, ASCE 11-99.

The assessment included a visual, hands-on and load testing with a truck assessment of ~180 precast double tees and supporting structure. Excluded from the scope are any non-structural items, including anything cosmetic or any aesthetic issues, interior build-out items, mechanical, electrical or plumbing, etc. In summary, the following are our findings and recommendations:

- The parking garage is structurally adequate and is presently suitable for service.
- A few spalls at welded joints need to be repaired.
- The landscape planters need to be drained and waterproofed.
- Urethane caulking around the garage perimeter needs to be replaced.
- Several welded connection between double Tee panels are broken and need repair.
- Other very minor maintenance issues need to be addressed.



Photograph 1: Corner of Building



Photograph 2: Aerial Image



2. DESCRIPTION

Site:	City Place Parking Garages
Location:	17R MJ 203 916 (USNG)
Sq. Ft:	33,000 ft ² footprint
Use:	Parking structure
Built/Installed:	~1998
Last Survey:	n/a
Construction:	Precast concrete
Roof:	Concrete parking surface



3. TECHNICAL APPROACH

3.1. Visual Inspection

The accessible structural components were visually evaluated. This condition evaluation was limited to the structural elements that could be observed and did not include material testing.

3.2. Structural Evaluation

The majority of the structural inspection work was conducted by visual and hands-on inspection by trained professionals. The inspection was intended to be non-destructive. By its nature, a visual and hands-on non-destructive inspection is limited to that which can be seen, heard or felt. Although it can be limited, it is quite effective for preliminary inspection and for allocating further analysis and repair resources.

The hands-on aspect included physical examination of the items within the scope of inspection including the welded joints between pre-cast double Tees which were load tested. Excluded from the scope are any non-structural items, including anything cosmetic or any aesthetic issues, electrical, interior build-out items, non-load bearing interior framing, mechanical, etc.

3.3. Defect Identification/Terminology

3.3.1. Concrete

3.3.1.1. Cracking or Gaps: A separation into two or more parts with a space between two surfaces, classified by:

Hairline - Crack or gap width less than 1/32 inch.

Fine - Crack or gap width between 1/32 inch and 1/16 inch.

Medium - Crack or gap width between 1/16 inch and 1/8 inch.

Wide - Crack or gap width greater than 1/8 inch.

3.3.2. Steel Elements

3.3.2.1. Corrosion: Corrosion is classified by the following:

Minor - light surface rust.

Moderate - rust that is loose and flaking with some pitting. This scaling, or exfoliation, can be removed with some effort by use of a scraper or chipping hammer. Element exhibits measurable but not significant loss of section.

Severe-Heavy - stratified rust or rust scales with extensive pitting. removal requires exerted effort and may require mechanical means. Element exhibits significant loss of section.

3.4. Glossary of Terms and Definitions



3.4.1. Definition of Investigation Types

- 3.4.1.1. **Visual Investigation:** The investigation from a reasonable distance of a member or element where the initial determination can be made that the condition is good enough that it does not warrant a hands-on investigation.
- 3.4.1.2. **Hands-on Investigation:** Close-up inspection, from no further away than arms length, where the member can be: sounded with a heavy rubber mallet, and/or probed with a steel awl.
- 3.4.1.3. **Load Testing:** A stock F150 pickup truck was slowly driven in the garage and the reaction of the structure was observed.
- 3.4.1.4. **Invasive Investigation:** Investigations where walls or elements are opened to allow for hands-on inspections to be made.

3.4.2. Rating Criteria

- 3.4.2.1. **Excellent:** As New Condition
- 3.4.2.2. **Good:** The structure system is sound and performing its function, although it shows signs of wear and may require some minor repairs, mostly routine.
- 3.4.2.3. **Fair:** The structure system is still performing adequately at this time, but needs priority and/or routine repair to prevent future deterioration and to restore it to good condition. Fair condition usually requires repairs which are considered asset preservation items.
- 3.4.2.4. **Poor:** The structure system cannot be relied upon to continue to perform its original function without immediate and/or priority repair. Poor condition could mean that there is life safety issue.

3.4.3. Definition of Recommendations

- 3.4.3.1. **Immediate:** Requires immediate action to repair the affected member or element or a replacement of the member as determined by the investigation engineer.
- 3.4.3.2. **Priority:** Conditions for which no immediate action may be required or for which immediate action has been completed, but further investigations, design and implementation of interim or long-term repairs should be undertaken on a priority basis, i.e., taking precedence over all other scheduled work.



3.4.3.3. Routine: Conditions requiring further investigation or remedial work, which can be undertaken as part of a scheduled maintenance program, other scheduled project, or routine facility maintenance, depending on the action required.



4. INSPECTION FINDINGS

4.1. Parking surface and overhead

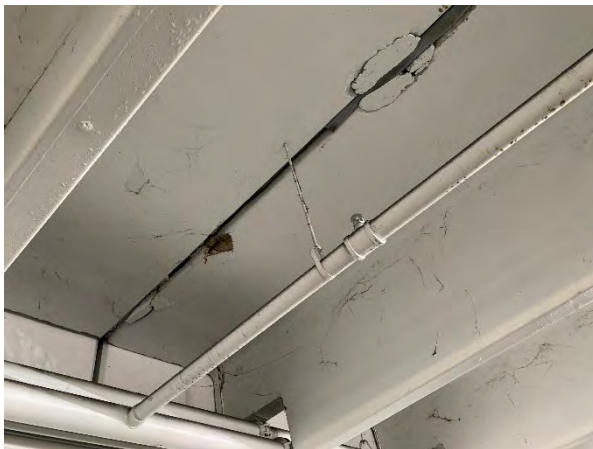
The parking garage is a 4 story, ~126' x ~263' precast reinforced concrete structure. The main load resisting structure consists of double tee precast deck beams bearing on spandrels and beams that bear on columns embedded in footers. The double tee beam joints are welded to spandrels and double tees to create shear diaphragms. The structure is in excellent condition.

Visual and hands-on assessment identified approximately 30 corrosion related spalls. Most of these were at weldments on the underside of double-tees but a few were at columns or column to beam weldments. 11 areas of weldment “pop-out” were located on the deck surface. These areas should be repaired by removing the loose material and replacing with a sand aggregate epoxy. The cracking was most likely caused by leaking that allowed chloride rich water from the marine environment into the weldment that then corroded and caused spalling.

The concrete driving deck to wall/parapet joint is sealed with a 1” cant bead of urethane sealant. This cant bead of sealant is in failure and needs to be replaced. The double-tee to double-tee joint is also caulked with urethane sealant. Only 1 or 2 of these joints are leaking. No action on this item is required at this time, but the leaking (during a good rainstorm) should be monitored.

Load testing revealed that welded connection between 37 double Tee panels were broken and the panels now react independently thus making the structure less stiff. This also reduces the structures wind loading resistance as the welds also behave as shear connections. These broken welds need to be remediated with carbon fiber epoxy inserts. See appendix AA.

A few areas of exposed welded wire fabric (WWF) were identified. These areas should be prepped and epoxy coated.



Photograph 3: Spalling in overhead



Photograph 4: Exposed WWF



4.2. Specialty Items

The parking floors are separated by post tension guard cables. The ends are exposed and the midspan is supported by rusting cable eyes. The ends should be packed with corrosion inhibited grout and the cable eyes should be prepped and painted with zinc rich spray paint.

The planters are known to leak. Excavation of the planters revealed no or poor caulking at the planter-planter expansion joint. The planters also have no means of drainage. Replace/install urethane caulking at 24 planter joints. Install 1”-2” diameter drain holes near the bottom of each planter section to drain the planters onto the parking deck or to the planter below.



Photograph 5: Rusting guard cable eyes



Photo 6: Exposed post tension cable ends



Photograph 7: Spalling of rebar and failed cant head

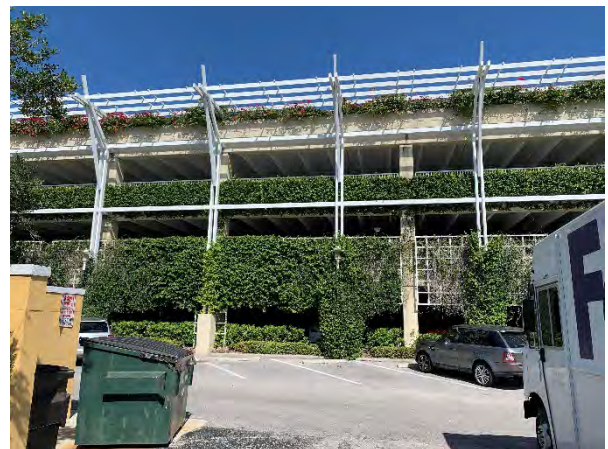


Photo 8: Leaking planters on upper floors



4.3. Miscellaneous

- Several instances of corroded steel imbeds were identified. Surface prep with hand tools and coat with a surface tolerant corrosion inhibited enamel to match existing color.

5. RECOMMENDATIONS

Existing Structures has prioritized the items below based on observations made in the field. The items are prioritized based on the definitions of recommendations as listed in section 3.4.3 above. Prioritizations are based on safety and not aesthetics.

5.1. Concrete Elements

1. Priority – Repair ~ 30 areas of loose concrete spalling in the overhead and on column to beams. It is especially important to see that loose debris is removed frequently to avoid damage to vehicles or injuries.
2. Routine – Remove ~20 pop-outs at double-tee weldments and repair with sand aggregate epoxy.
3. Routine – Repair the connection between 37 panels with CFRP connectors as indicated in Appendix AA.

5.2. Waterproofing

1. Routine – Remove and replace ~2300 linear feet of damaged cant bead at floor to exterior wall/parapets and replace with urethane.

5.3. Planters

1. Routine – Excavate 24 planters at midspan and install ~6' of urethane caulking at expansion joint.
2. Routine – Install 24 instances of 1"-2" drain holes at midspan of planters.

5.4. Miscellaneous

1. Routine – Pack ~22 post tension guard cables with corrosion inhibited mortar.
2. Routine – Surface prep and paint with zinc rich spray paint ~ 22 rusted steel cable eyes on guard cables.



6. CONCLUSION

The parking garage is in fair condition but in need of maintenance repairs as indicated above.

We make the above conclusions based solely on what can be seen or studied. The above findings are objective and unbiased. This is a preliminary structural assessment and not a repair specification.

Best Regards,

A handwritten signature in black ink that reads "Byron Evetts". The signature is written in a cursive style and is positioned above the printed name and title.

Byron Evetts, PE
Principal Engineer



Photo Log













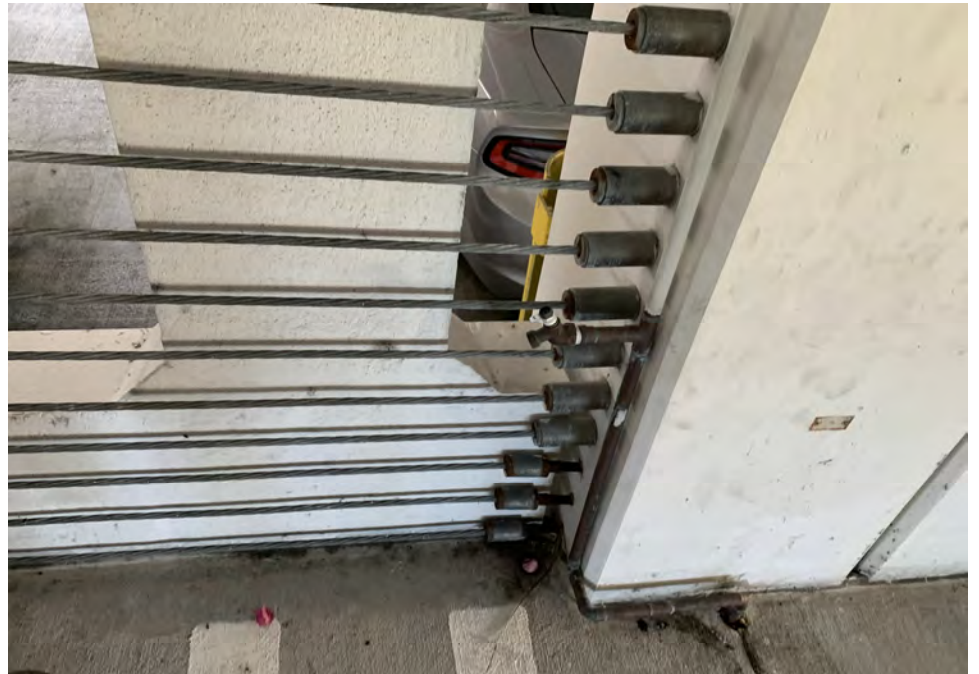


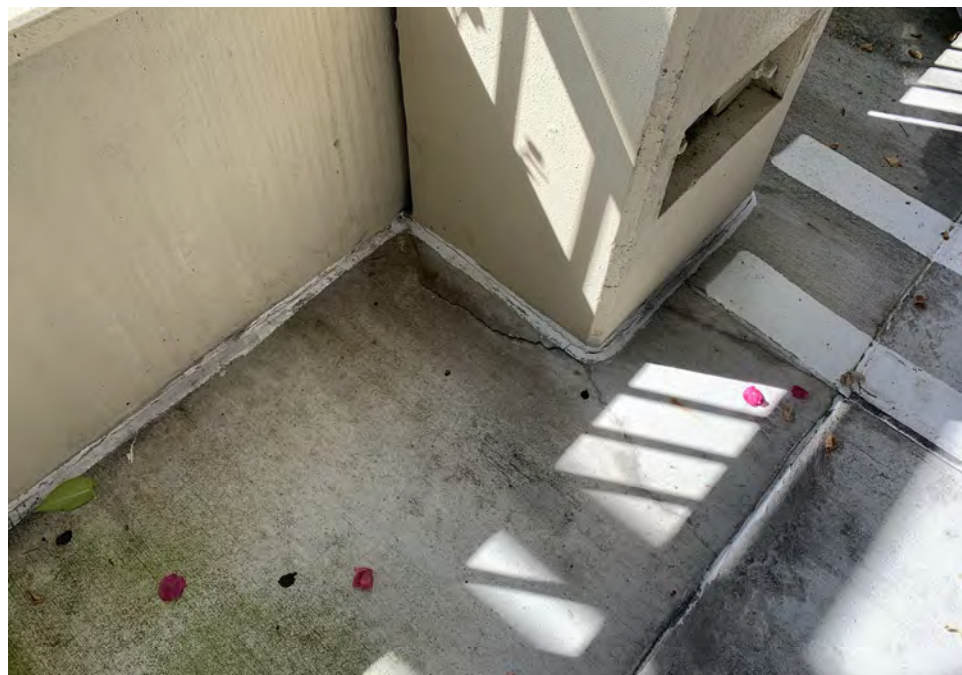
































Appendix AA

CFRP Specification



Fiber Reinforced Polymer (FRP) Tee to Tee Shear Connector Repair
Section TBD

1 GENERAL

1.1 DESCRIPTION OF WORK

- .1 This specification is intended to define the minimum requirements of structural repair of existing shear connectors
- .2 The work includes the furnishing of all materials, labor, equipment and services for the supply, installation and finish of adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors.
- .3 The general contractor or subcontractor shall furnish all materials, tools, equipment, transportation, necessary storage, access, labor and supervision required for the proper installation of the adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors.

1.2 WORK INCLUDED

- .1 This Section of the Specification is not necessarily complete in itself and must be administered in conjunction with the Contract Drawings.

1.3 REFERENCE STANDARDS

General

The publications listed below form a part of this specification to the extent referenced. Where a date is given for referenced standards, the edition of that date shall be used. Where no date is given for reference standards, the latest edition available on the date of the Drawings shall be used.

Canadian Standards Association (CSA)

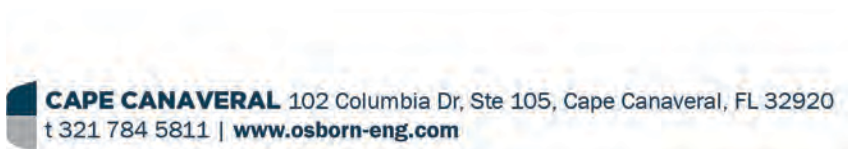
American Standard for Testing and Materials (ASTM)

International Federation of Structural Concrete

American Concrete Institute (ACI)

1.4 MATERIAL QUALIFICATIONS

- .1 Materials for the adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors have been pre-qualified and shall be supplied by:





V2 Structural Systems
770 Lee Road 191
Auburn, AL 36830
Tel: 334-502-3000

- .2 Alternate materials are not acceptable at this time.

1.5 SUBMITTALS

Quality Control and Quality Assurance:

Design and working drawings:

- .1 The application contractor shall submit proposed layout of all connectors.

Product Information:

- .2 Manufacturer's product data sheet indicating physical, mechanical and chemical characteristics of all materials used in the adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors.
- .3 Installation procedures, maintenance instructions, and general recommendations regarding Fiber Reinforced Polymer (FRP) tee to tee shear connectors.
- .4 Manufacturer's Material Safety Data Sheets (MSDS) for all materials to be used.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

- .1 Deliver adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors and materials in factory-sealed containers with the manufacturer's labels intact and legible with verification of date of manufacture and shelf life.
- .2 Store materials in a protected area at a temperature between 50°F (10°C) and 90°F (32°C).
- .3 Products shall be stored according to the manufacturer's requirements and shall avoid contact with soil and moisture.
- .4 Adhesively bonded Fiber Reinforced Polymer (FRP) tee to tee shear connectors and epoxy products shall be stored to avoid UV exposure.

1.7 COORDINATION WITH OTHER TRADES

- .1 Prior to construction, the trades shall be briefed on any new or unusual construction procedures to ensure that they are aware of special conditions (e.g. new penetrations).



2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS & COMPOSITE STRENGTHENING SYSTEM

.1 V2 Structural Systems T- Biscuits to be supplied by

V2 Composites
770 Lee Road 191
Auburn, AL 36830
Tel: 334-502-3000

.2 System components:

- a. Fiber Reinforced Polymer (FRP) tee to tee shear connectors: T- Biscuits
- b. Epoxy Adhesive: Biscuit Bond paste

2.2 CERTIFIED APPLICATORS

- .1 Installation of the V2 Structural System T biscuits shall be performed by certified applicators only. Certified applicators shall have the minimum experience and consent as recommended by the manufacturer (See Sections 1.5.4 & 1.5.16 of this specification).

2.3 OTHER MATERIALS

- .1 Contractor to provide compatible repair mortars and other materials recommended by the manufacturer as needed for the proper installation of the complete Fiber Reinforced Polymer (FRP) tee to tee shear connector system.

3 INSTALLATION

- .1 Installation procedure per manufacture's recommendation or as follows:

.1 Shear connector layout

- .2 Determine the location of the existing steel flange connectors and mark on top deck surface.

- .2 Lay out the Biscuit locations in accordance with the Q.



1) Quantity and Location

Qty of CFRP Biscuit

QTY	TIER	LANE	COLUMN LINE
11	2	A-B	5.5
11	2	B-C	2.7
11	2	B-C	3.3
11	2	B-C	4
11	2	B-C	4.3
11	2	B-C	4.7
11	2	B-C	5.5
11	2	B-C	6
11	2	B-C	6.7
11	2	B-C	7
11	2	B-C	7.3
11	2	B-C	8
11	2	B-C	8.7
11	3	A-B	2.7
11	3	A-B	3
11	3	A-B	3.7
11	3	A-B	4
11	3	A-B	5
11	3	A-B	5.5
11	3	A-B	6.7
11	3	A-B	7
11	3	A-B	7.3
11	3	B-C	4
11	3	B-C	4.3
11	3	B-C	4.7
11	3	B-C	6.3
11	3	B-C	8
11	4	A-B	3.3
11	4	A-B	4
11	4	A-B	4.3
11	4	A-B	4.7
11	4	A-B	5.5
11	4	A-B	7
11	4	B-C	4
11	4	B-C	4.3
11	4	B-C	6
11	4	B-C	7.3

Σ **407**



2) Location

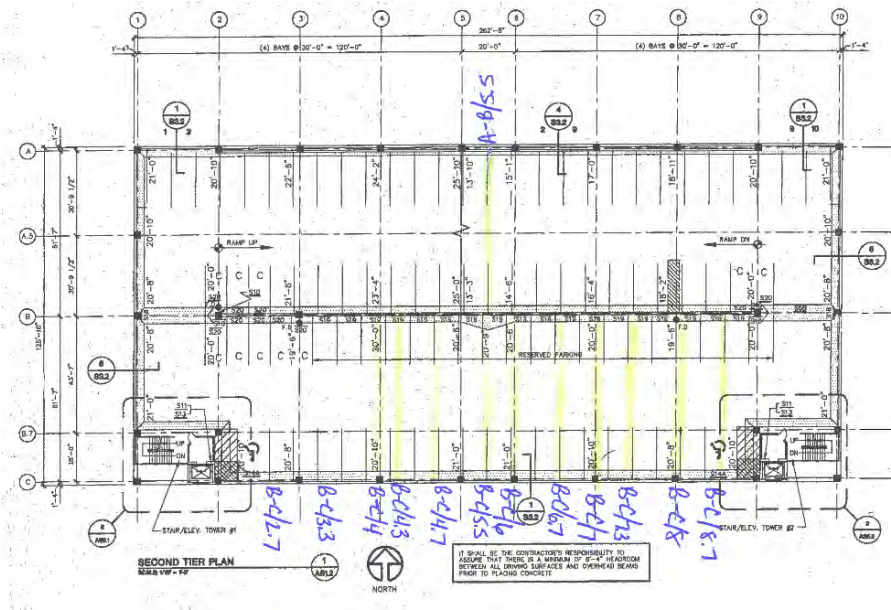


Figure 1 Second Tier Plan

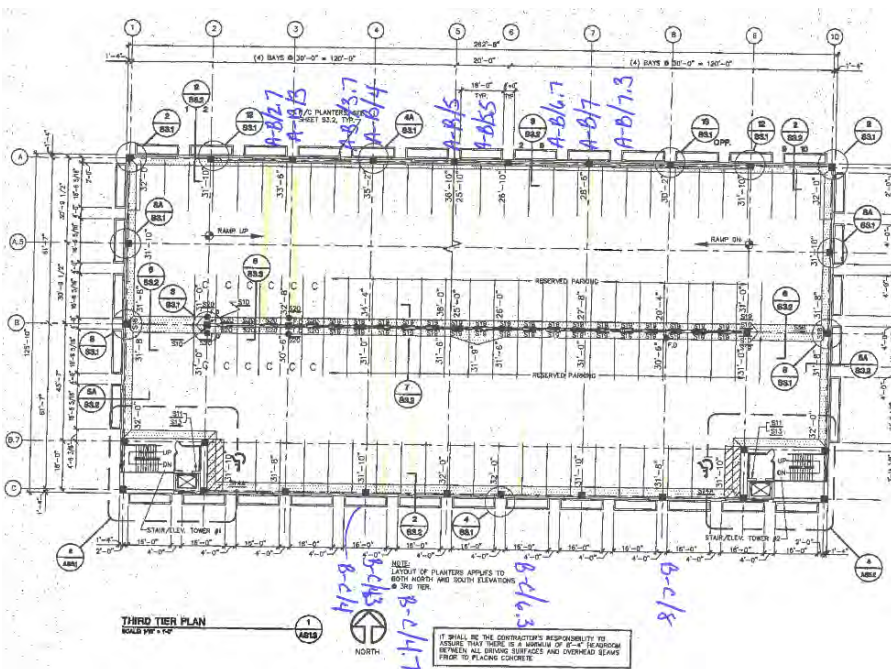


Figure 2 Third Tier Plan

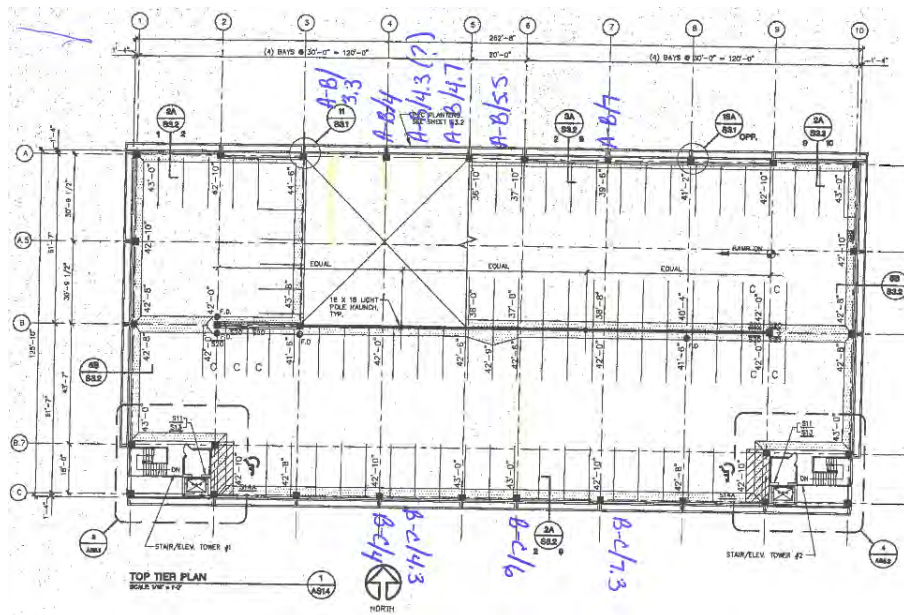


Figure 3 Top Tier Plan

3) Spacing

- .3 Relocate any biscuit placements that conflict with the existing connectors by at least 12 in.
- .4 Using an appropriate indelible marker draw a 18-19 in. line at approximately 90 degree angle across joint. Line should be centered at the joint.

.2 Cutting

- .1 Hand held or walk behind saws are acceptable.
- .2 Wet or dry cut depending on conditions and contractor's choice.
- .3 Saw blades must be 14 in. in diameter
- .4 0.25 in. blade thickness or use place 2 blades, 1/8 in. thick.
- .5 Set saw cut at 3.5 in. if total thickness at joint is 4 in.; otherwise, cut depth to 0.5 in. from bottom of double-tee beam flange.
- .6 Saw cut 18 in. long slot centered on joint.
- .7 Cuts to be made perpendicular to joint.
- .8 Check each cut with a biscuit to assure slot is fully and adequately cut.

.3 Cutting Clean Up and Slot Preparation

.1 Wet Cutting

- .1 Sweep up all slurry and remove.



- .2 Wash out slots using clean potable water (power washing preferred)
- .3 Allows slots to dry
- .4 Use Using 75 psi or greater oil free air to remove all dust and debris.
- .5 Using duct tape, mask off around each slot leaving approximately 1/16 in. of concrete showing at edge of slot. Make sure to push the tape down into the corners if the joint caulking is recessed.

.4 Dry Cutting

- .1 Sweep up all dust and chips.
- .2 Using 75 psi or greater oil free air, blow cuts clean of dust and debris.
- .3 Using duct tape, mask off around each slot leaving approximately 1/16 in. of concrete showing at edge of slot. Make sure to push the tape down into the corners if the joint caulking is recessed.

.5 Biscuit Preparation

- .1 Wipe biscuits down with MEK to remove any dirt and oils.
- .2 Set aside in clean dry location.

.6 Epoxy Mixing

- .1 The biscuit bond epoxy is a 1:1 ratio epoxy. That means that equal amounts of Base (A-Component) and Activator (B-component) must be used. Do not increase amount of Activator.
- .2 Use a dedicated scoop/spatula to remove a baseball sized amount of each component from their respective containers.
- .3 Place the two components on a mixing board adjacent to each other.
- .4 When ready to install a biscuit begin mixing the two components with each other using a 2 to 3 in. wide stiff scraper to trowel.
- .5 Mix epoxy until a uniform grey color is achieved and no visible black or white streaks remain.
- .6 Note: the proprietary epoxy paste is a very rapid hardening epoxy resin with high exothermic properties. Do not attempt to batch mix with mechanical mixers. Batch mixing will result in unworkable set times.

.7 Biscuit Installation

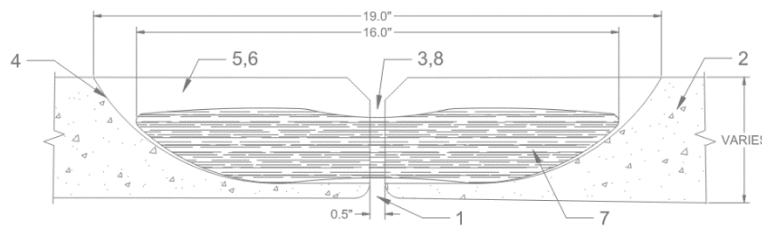
- .1 Using an appropriately sized putty knife or spatula, fill slot with epoxy paste.



- .2 Using putty knife and ¼ in. masonry tuck pointer, make sure epoxy is adhered to all sides of the slot.
- .3 Work out any air bubbles with putty knife by wiggling it back and forth in the slot.
- .4 Make sure the epoxy completely fills the slot
- .5 Coat a biscuit into epoxy, taking care to “work” it into the biscuits surface.
- .6 Place biscuit into epoxy filled slot assuring the entire biscuit is below the concrete deck surface.
- .7 Using putty knife, work the biscuit side to side in the slot to seat it and remove any trapped air.
- .8 Remove any excess epoxy level with taped surface.
- .9 Remove masking tape when epoxy begins to set. Do not let epoxy harden or the tape will be permanently adhered to the deck.

.8 Clean up

- .1 Clean up uncured epoxy using acetone or epoxy thinner.
- .2 Cured epoxy can only be removed by mechanical means.



1. IF JOINT IS OVER 1" WIDE CONTACT ENGINEER BEFORE PROCEEDING
2. EXISTING PRE-CAST DOUBLE TEE PLANK
3. EXISTING DOUBLE TEE JOINT WITH FAILED SHEAR CONNECTORS
4. 19" LONG X 3-1/2" DEEP SAW CUT MAXIMUM OF 0.5" FROM BOTTOM OF FLANGE MADE WITH ¼" WIDE X 14" DIAMETER BLADE
5. A) IF SAW CUTS WERE MADE WITH DRY BLADE, BLOW OUT SAW CUT WITH CLEAN COMPRESSED AIR
B) IF WET CUTTING WAS USED, POWER WASH OUT CUTS AND ALLOW TO DRY FOR 24 HOURS AND THEN BLOW OUT WITH CLEAN COMPRESSED AIR

Figure 4 Pre-Topped Biscuit Installation Detail

BISCUIT INSTALLATION DETAIL

PRE TOPPED



.9 Cure Time

- .1 The repair needs eight (8) hours to reach full cure at 65 degrees F or greater.
- .2 There can be no movement of the deck or beams during the cure time.

END OF SECTION XXXX



FREQUENTLY ASKED QUESTIONS

V2 COMPOSITES, INC
770 Lee Road 191 Auburn, AL 36830
Released: March 2022

Biscuit FAQ

Where do I get the Biscuits?

Tee Biscuits are sold directly from our main location in Auburn, Alabama.

Call 334-502-3000 or e-mail us at sales@V2composites.com

Is the epoxy paste included with the Biscuits?

The proprietary Biscuit bond paste is sold as a complete package with the Biscuits and is included in the price of the Biscuits.

How many can I buy at a time?

Our standard packaging is 20 Biscuits with a 2-gallon kit of Biscuit Bond Paste. You can buy as little as five Biscuits at an adjusted price, but we will also include a kit of paste.

Can I use any type of epoxy with the Biscuits?

No, the system is designed around the Biscuit Bond Paste. Use of any other type of adhesive without our written approval will void any warranties.

What warranty is on the Biscuits?

The Biscuits are fully warranted for their physical properties and manufacturing.



Do you warranty the installation?

We are only a material supplier and do not perform any installations, therefore we have no direct control over the actual installation. As such we cannot warranty the final installation.

Do you provide engineering designs?

We provide the design engineers with the necessary technical information to design any installations, but we do not provide direct engineering services for the Biscuits.

Do I need special training?

Most concrete restoration or masonry contractors possesses the skill set to properly install the Biscuits, however we do require that the Biscuits be installed only by V2 Composites certified installers. We offer onsite training for an additional fee to achieve or renew that training.

Do I need special tools?

There are minimal tools that are required to put in the Biscuits. A complete list is included in our Installation Manual. Most contractors already have these tools or they are easily obtained at the local supply house.

How many can be installed in a day?

That is very job and contractor specific. But generally, a three-person crew can install in excess of 30 a day.



Do I have to repair the existing connections first?

The existing connections do not need to be repaired for the T-Biscuits to function as designed.

What do I do about the existing connections?

That is up to the engineer and the owner. If they only have the welds broken and are not presenting a spalling issue, they can just be left as is.

Can the Biscuits be put into a full depth repair?

The Biscuits can be installed into a properly designed, executed, and cured full depth repair.

Can the Biscuits be put into a partial depth spall repair?

The Biscuits can be installed into a properly designed, executed, and cured full depth repair.

What type of saw do I use?

The method to cut the slot is up to the contractor. To date the most success has been with some sort of walk behind concrete saw, either wet or dry cutting using a 14" diameter blade(s). For smaller or jobs, contractors use a handheld cutoff saw.

What if the slot is wet?

The slot should be dry to the touch with no standing water in it before any Biscuits are installed.



Can the slot be at an angle to the joint?

We do not recommend this as it puts excess stress on the concrete deck on the acute angled portion. We highly recommend the biscuit is installed at a 90-degree angle across the seam.

Can I cut through the joint sealant?

Yes, you can cut through the sealant and install the Biscuit. The sealant can then be repaired locally following the sealant manufacturer's instructions

Can I caulk over the Biscuit?

The center of the Biscuit is designed to be at least $\frac{3}{4}$ " below the surface. The joint sealant should easily clear the top of the biscuit, so there should be no issue in applying sealant to the whole length of the joint. A proper bond breaker should be used over the actual Biscuit if it is in contact with the sealant.

Is the Biscuit repair waterproof?

While the nature of the Biscuit installation is waterproof, there are many external factors that affect an installations waterproofness. As such for full waterproof confidence, an additional waterproof membrane should be installed over the Biscuit installation.

Does the epoxy change color/fade in the sun (UV)?

The Biscuit Bond epoxy adhesive is structurally resistant to UV degradation, however there will be a slight change in color as it ages in the sun and is exposed to traffic.



The top of the Biscuit is interfering with the sealant, what do I do?

In certain cases, the top of the Biscuit extends into the sealant line. In such instances, the Biscuit can be slightly ground down to not interfere with the sealant.

Can I use a blower instead of an air compressor to clean out the slots?

No, a blower does not produce the needed velocity of air to properly remove the concrete dust from the slotting operation.

What diameter blade do I use?

The standard Biscuit is designed to be paired with a standard 14" diameter diamond concrete blade. Larger diameter blades will result in excessive cutting and paste usage.

How wide does the slot have to be?

The slot needs to be 1/4" to 5/16" in width.

What if I cut the slot in the wrong place?

You can fill the errant slot in with the Biscuit bond paste.

What happens if I get Biscuit half in, and the epoxy hardens?



You will have to grind it flat with the deck and then use the saw to re cut the slot thus removing the Biscuit.

The Biscuit is sticking out of the bottom of the deck, what do I do?

If the slot was over cut, or the decks were not in alignment, the Biscuit may protrude slightly from the bottom. It can be left that way or ground flush with the bottom. If it extends more than 1/2" of an inch contact us or the engineer.

How deep do I cut the slot?

The slot is always to be cut no less than 1/2" from the bottom face of the tee.

How long do I cut the slot?

For a standard depth slot, the cut should be 18" long centered on the joint.

What type of blade do I use to cut the slot?

A 1/4" wide x 14" diameter concrete blade is the top choice. Two standard 1/8" wide x 14" diameter blades can be stacked to achieve the same result.

Is the installation in a field top deck different from one in pre-topped tees?

There is no difference in how the Biscuits are installed. However, many field topped decks have a total thickness that is greater the standard pre-topped tee. This means that you may have to make the cut deeper and longer to get the Biscuit within 1/2" of the bottom.



How thin of a tee flange can the Biscuits be installed in?

The standard Biscuit can be installed in a deck as little as 3.25" thick. Custom Biscuits are available for decks as thin as 2.5"

What is the recommended spacing for the Biscuits?

The Biscuits are a one for one replacement for the existing connectors. Based on your engineers design they may be placed at a different spacing.

How close to an existing connector can I place a Biscuit?

Biscuits are to be placed no closer than 12" center to center of an existing connector.

How close to another Biscuit can I place a second one?

No closer than 12" center to center.

What is the widest gap between the tees is acceptable?

The maximum gap between the actual tees (not considering the sealant block out) is 1.0". Any greater than that you need to contact us or the engineer.

What is the lowest temperature that they can be installed?

A deck temperature of 40°F and rising is the lowest temperature that the Biscuits can be installed without special provisions.

What is the maximum installation temperature?



There is no actual temperature limit, however the Biscuit Bond will set to rapidly to be practically worked with in temperatures above 100°F. Also, extreme deck temperatures present some issues regarding thermal volume changes that should be discussed with your engineer.

How fast does the epoxy take to get hard?

The rate at which the Biscuit bond epoxy takes to set is very temperature dependent. At 70° the epoxy will set in about 15 minutes. This is not to be confused with the cure time which is of a much longer duration.

What is the ratio of Biscuits to existing connectors that is recommended?

The Biscuits are designed to be a 1:1 replacement for the existing connectors.

How close to the end of the tee should I put a Biscuit

No closer than 12"

Do I need to put more Biscuits in the drive lanes (middle) than the parking spaces (edges)

That is very dependent on the existing connector's locations. At times, design engineers have installed additional Biscuits in the drive lanes on specific decks. Consult with your design professional if you think they are needed.

Do I have to support or shore the deck to install the Biscuits?

No, you do not. However, you cannot allow the tees and newly installed Biscuits to be loaded prior to achieving full cure of the epoxy, which is 8 hours at 70°F.



How long do I have to wait until I can put traffic over the Biscuits?

At 70°F we recommend 8 hours of waiting time. For each 10 degrees change in temperature, cure time halves or doubles i.e., 60 degrees 16 hours, 80 degrees 4 hours.

Can I install them on a ramp?

Yes, you can.

Can I put them on a ramp/deck transition?

Yes, you can, but you will probably have to cut completely through the flat deck to accommodate the angle transition.

What if I cut through the deck?

Cutting through the deck is only an aesthetic and installation issue and does nothing to either the structural integrity of the deck or of the new Biscuit connection. Strong duct tape should be placed over the bottom of the cut to contain the epoxy during installation.

What if the adjacent tees are not level?

It is important to have the Biscuit no more than 1/2" from the bottom of both tees. This will necessitate having to cut through the bottom of the higher tee and having some Biscuit exposed. If the exposed Biscuit is aesthetically objectionable, it can be ground flush with the bottom of the deck.

Is it necessary to tape off the slots?



It is not necessary, but it leaves a very professional and aesthetically pleasing installation. It also makes the installation easier.

Do I have to use a tuck pointer or trowel in the slot?

Yes, this is a crucial step in getting a good solid bond with the existing concrete tee.

How much epoxy do I use?

A standard installation uses 10-12 oz of mixed Biscuit Bond. This is about a tennis ball size quantity of each component. Mix only one Biscuit worth of material at a time.

How do I mix the epoxy?

The Biscuit Bond epoxy is hand mixed on a board or other flat surface using a trowel or spatula.

Can I mix the epoxy with a mixing drill?

The use of mechanical mixers is strongly discouraged.

Can I mix in a bucket or pail?

Mixing in a bucket is impractical and strongly discouraged.

Can I use xylene, toluene, or paint thinner to clean the Biscuits off?

NO! These types of solvents contain oily additives that will inhibit the bond of the epoxy. Use only MEK or if unavailable Acetone.



How do I get the epoxy off my tools and or other items?

Uncured Biscuit Bond can be removed with Acetone. Hardened material can only be removed by abrasive methods.

How do I dispose of the excess/waste epoxy?

The hardened Biscuit Bond is environmentally safe to dispose of in standard refuse containers. The containers should be scraped clean and any excess mixed together and then disposed of in standard refuse containers.

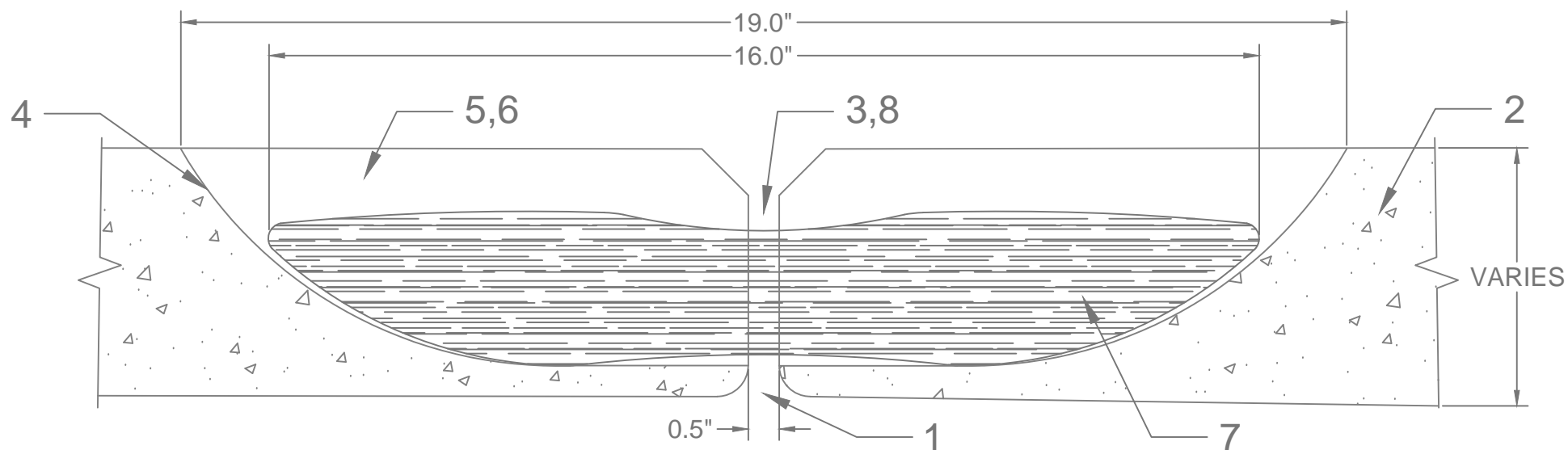
Why don't you put the epoxy in mixing cartridges?

Due to the viscosity (thickness) of the Biscuit Bond it is very difficult to use it in cartridges. Additionally, in warmer temperatures, you cannot get all the material mixed before the initial material starts to get hard.

If you have any questions that are not covered in this document or want further explanation to the answered questions, please contact us:

Call 334-502-3000 or e-mail us at sales@V2composites.com





1. IF JOINT IS OVER 1" WIDE CONTACT ENGINEER BEFORE PROCEEDING
2. EXISTING PRE-CAST DOUBLE TEE PLANK
3. EXISTING DOUBLE TEE JOINT WITH FAILED SHEAR CONNECTORS
4. 19" LONG X 3-1/2" DEEP SAW CUT MAXIMUM OF 0.5" FROM BOTTOM OF FLANGE MADE WITH 1/4" WIDE X 14" DIAMETER BLADE
5. A) IF SAW CUTS WERE MADE WITH DRY BLADE, BLOW OUT SAW CUT WITH CLEAN COMPRESSED AIR
B) IF WET CUTTING WAS USED, POWER WASH OUT CUTS AND ALLOW TO DRY FOR 24 HOURS AND THEN BLOW OUT WITH CLEAN COMPRESSED AIR
6. SAW CUT COMPLETELY FILLED WITH BISCUIT BOND EPOXY PASTE BY V2 COMPOSITES
7. APPLY BISCUIT BOND EPOXY PASTE TO BOTH SIDES OF BISCUIT AND INSERT INTO CUT SLOT
8. FOLLOWING BISCUIT INSTALLATION, REPLACE SEALANT 6" MINIMUM BOTH SIDES OF SAW CUT

BISCUIT INSTALLATION DETAIL

PRE TOPPED

Biscuit Bond Paste

High strength structural epoxy gel adhesive

Product Description

V2 Biscuit Bond Paste is a two component, 100% solids, high strength, structural epoxy gel adhesive specifically designed for the installation of V2 Repair Biscuits and the structural bonding of other V2 composite laminates.

Applications

- Bonding and embedding composite laminates to concrete, masonry, wood and steel
- Patching vertical and overhead concrete, masonry and wood surfaces
- Grouting deep dowel bars, bolts, pins, etc.
- Bonding similar and dissimilar materials such as concrete, metal, wood, etc.

Advantages

- Easy to work with; smooth gel consistency
- Super high strength
- Moisture insensitive
- Excellent bond strength
- Good chemical resistance
- USDA approved
- Conforms to ASTM C-881, types I, II, Grade 3, Class A, B and C

Physical Properties

Mix ratio A:B	1:1 by volume		
Viscosity	Non-sag thixotropic gel		
Color	Concrete gray		
Pot life	60 gram (golf ball)	½ gallon (softball)	Tack free (1/8" layer)
90°F (32°C)	4 min.	3 min.	40 min.
73°F (23 °C)	8 min.	7 min.	1 hr., 30 min.
50°F (10 °C)	18 min.	10 min.	2 hr., 15 min.
Coverage			
(Neat)	231 cubic inches per gallon		
(Smooth surfaces)	1/8" thick = 12 sq. ft. per gallon		
(Rough surfaces)	1/8" thick = 6 sq. ft. per gallon		

Test Data (strengths reported in PSI)

Compressive strength	ASTM D-695	7,050
Compressive modulus	ASTM D-638	2.30 x 105
Tensile strength	ASTM D-638	2,900
Tensile modulus	ASTM D-638	1.67 x 105
Bond strength	ASTM D-882	3,337 (2 day)
Dry cure		3,510 (14 day)
Elongation	ASTM D-638	1.8%
Shore hardness	D Scale	85
Heat deflection	ASTM D-648	124°F



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Product Data Sheet

Biscuit Bond Paste

Application Techniques

Material conditioning: Pre-condition materials to 65-85°F (19 -30°C) before using.

Surface preparation: Surface must be clean and free of any dust, oil, grease, laitance, curing compounds, or any other contaminants. On concrete and steel, this should be achieved by sandblasting, water blasting or other mechanical means. Composite laminates should be wiped with MEK following any other preparation recommended by the manufacturer.

Mixing considerations: Measure exactly 1 part "A" to 1 part "B" by volume into a clean pail or onto a palette. Mix epoxy using hand methods to achieve a smooth consistency and uniform color.
Note: Large batches of epoxy will set up much faster than small batches. Only mix the amount of material that can be used within the pot life.

Installing Material

Bonding and embedding: Apply material to the surfaces to be bonded taking care to work the material into the exposed surface. A glue line of 1/8" or less is desirable.

Patching overhead and vertical surfaces: Using a trowel or putty knife, apply material to area being patched. Up to one and a half parts oven dried sand may be added to the mixed epoxy to extend it and bring the coefficient of thermal expansion closer to that of concrete. Apply in 1-1/2" lifts or less.

Grouting bolts and anchor bars: Hole size should be no more than 1/8" larger than bar or bolt. Clean all dust out of the hole and grout with neat Biscuit Bond Paste.

Packaging

2-gallon units
10-gallon units

Limitations

- Mixing at other than 1:1 ratio will result in reduced properties and will potentially inhibit curing
- Do not use solvents to thin
- Minimum application temperature is 40°F (5°C)
- Minimum age of concrete must be 21-28 days
- Forms a vapor barrier after cure
- Full cure in 7 days

Caution

"A" material contains epoxy resins and may cause skin irritation. "B" material contains amines and may cause severe burns on skin.

Storage

Store resin in a dry environment at a temperature between 40 - 90°F (4 - 32°C). Ideal temperature range is 65 - 75°F (18 - 24°C). Temperature below 60°F (16°C) will cause epoxy to thicken, making it difficult to properly blend the components. Under proper conditions, the shelf life is twelve (12) months in unopened, damage-free containers. **Protect from moisture. Do not allow product to freeze.**

First Aid

Skin contact: Wipe off contaminated area and wash with soap and water.

Eye contact: Immediately flush eyes with large amounts of water. Seek medical attention.

Inhalation: Move to fresh air if symptoms occur. If breathing is difficult, get medical attention.

Ingestion: Seek immediate medical attention.

See MSDS for more information.



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V2 T-Biscuits

Custom carbon fiber reinforced plastic laminates

Product Description

V2 T-Biscuits are custom carbon fiber reinforced plastic laminates designed to repair the failed flange-to-flange shear connectors of pre-cast concrete (single & double) Tee beams. A specially engineered tri-axial carbon fabric is used to provide high strength, while a proprietary textured exterior face is provided for additional toughness as well as a rough bonding surface. The constituent resin matrix is a proprietary epoxy with proven ability to provide strength along with superior chemical resistance, especially to salt and gasoline. Using a proprietary aerospace composite manufacturing technique, the fabric and resin are combined to form a finished carbon fiber laminate.

Advantages

- Easy and fast installation
- Minimal disruption to operations
- Superior strength and toughness
- Chemical resistant

Typical Biscuit Properties At The Joint (Maximum 1.0" gap)			
Thickness in. (cm)	Tensile Capacity lbs. (kgs.)	Compressive Capacity lbs. (kgs.)	Shear Capacity lbs. (kgs.)
0.18 (0.45)	49,860 (22,665)	19,030 (8,650)	9,585 (4,355)
Laminate Properties			
Tensile Strength (along X/Y axis)		138,500 psi (955 MPa)	
Compressive Strength (along X/Y axis)		52,585 psi (363 MPa)	
Compressive Strength (through thickness)		9,200 psi (63 MPa)	
In Plane Shear Strength (along the Z axis or through thickness)		26,630 psi (184 MPa)	
Inter Laminar Shear (along X/Y axis)		5,075 psi (35 MPa)	
Bond Strength to Concrete (using V2 Biscuit Bond Epoxy)		2,760 psi (19 MPa)	
Design Value (5k psi concrete)			
		Ultimate Value lbs. (kgs.)	Design Value lbs. (kgs.)
Vertical Shear		8,000 lbs. (3,629)	6,000 (2,722)
Horizontal Shear		17,200 lbs.	13,000 (5,897)
Tension (Pull Out)		16,500 lbs.	12,400 (5,625)

Product Data Sheet



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Product Data Sheet

V2 T-Biscuits

Installation With V2 Biscuit Bond Paste

1. Using a 14" diameter concrete saw, make a cut .25" wide by 19" long at a 90° angle across the joint. The depth of the cut should be no greater than ½" from the bottom of the flange of the double T. Typically, the cut is approximately 3.5" deep.
2. If the slots were dry cut, using compressed air with a minimum of 100 psi, clean out the slots to remove dirt and dust. If the slots were wet cut, pressure wash the slots to remove slurry or dirt. Allow 24 hours to dry. Mask off the top of the groove with duct tape (for a cleaner look).
3. Mix the Biscuit Bond Paste **according to manufacturer's** instructions and fill the groove with a liberal amount of epoxy and work it in with a trowel or putty knife.
4. Apply Biscuit Bond to both sides of the T- Biscuit and place into the groove working all of the air out of the groove with a putty knife. Allow to gel. Once epoxy has set, remove duct tape.

Mixing Considerations for Paste

Measure exactly 1 part "A" to 1 part "B" by volume into clean pail or onto a palette. Mix epoxy using hand methods to achieve a smooth consistency and uniform color.

Note: Large batches of epoxy will set up much faster than small batches. Only mix the amount of material that can be used within the pot life.

Storage

T-Biscuits and Biscuit Bond Paste should be stored in a dry environment at a temperature between 40° to 90°F (4° to 32°C). Ideal temperature range is 65° to 75°F (18° to 24°C). Temperatures below 60°F (16°C) will cause epoxy to thicken, making it difficult to properly blend the components. Under proper conditions, the shelf life of epoxy is twelve (12) months in unopened, damage-free containers. Protect from moisture. Do not allow product to freeze.

Clean Up & First Aid

Clean equipment immediately after use with MEK or Acetone. Wash skin with soap and water. Wash contaminated clothing before re-use. See SDS for more information.

Caution

Paste "A" material contains epoxy resins and may cause skin irritation. Paste "B" material contains amines and may cause severe burns on skin.

Warranty

V2 Structural Systems warrants its products to be free from manufacturing defect and ensures those products meet the published characteristics when tested in accordance with ASTM and V2 standards. No other warranties by V2 are expressed or implied, including no warranty of merchantability or fitness for a particular purpose. V2 will not be liable for damages of any sort resulting from any claimed breach of warranty. **V2's** liability under this warranty is limited to replacement of material or refund of the sales price of the material. There are no warranties on any product that has exceeded the "shelf life" or "expiration date" printed on the package label.



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V2-Biscuit Installation Manual

V2-Biscuit Installation Manual

1. Introduction to V2-Biscuits
2. Materials Needed for Installation
3. Deck Layout and Biscuit Locations
4. Saw Cutting
5. Clean Up and Slot Preparations
6. Biscuit Preparations and Epoxy Mixing
7. Biscuit Installation
8. Clean Up and Cure Times



Rev.82917

Introduction to V2-Biscuits

General Description

V2 T-Biscuits are custom carbon/glass fiber reinforced plastic laminates designed to repair failed flange-to-flange shear connectors of pre-cast concrete (single & double) Tee beams.



Important Notice

V2 Biscuits™ must only be installed by contractors trained and qualified by V2 Composites AND all installations shall adhere to the guide lines described in this document. V2 Composites does not warrant and assumes no liability for V2-Biscuits™ products that are installed by anyone who is not certified by V2 Composites or are installed outside the guidelines of this document without express written permission of V2 Composites.

V2 Composites asserts no claim as to the fitness or final design of its products for a specific installation. That determination must be made by a qualified design professional.

This manual, including the referenced standards is subject to change at any time without notice. It is the responsibility of the installer to verify the latest edition of this manual from the V2 Composites website.

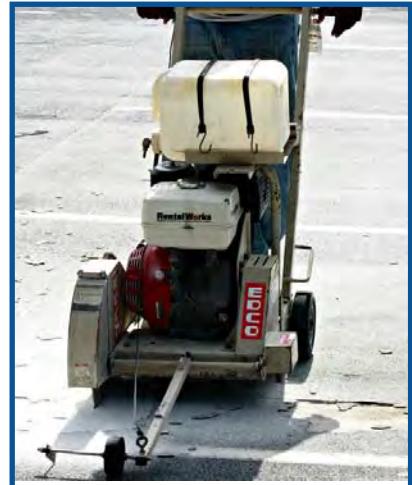
Materials Needed for Installation

Mandatory Equipment

- **Walk Behind Concrete Saw**
 - Will need 2 blades that are 1/8" width each
 - Saw may be dry cut or water cooled
 - If using wet, must clean debris from slot by power washing and allow a minimum of 24 hours to dry

OR

- **14" Hand Held Cut Off Saw**
 - Gas or electric
 - Same arbor size as walk behind
 - Will need 2 blades that are 1/8" width each



- **Air Compressor with Hose and Blow Down Nozzle**
 - This will be used to blow out saw cut
 - Compressor can be small one
 - Compressor must be a minimum of 100 psi of clean air



- **Hawk Boards or Scrap Plywood or Heavy Cardboard**
 - One piece for every 4-5 biscuits

Materials Needed for Installation

Mandatory Equipment Continued

- MEK (preferred) or Acetone
 - Will need 2 one-gallon cans
 - Do NOT use Xylene



- 3 Margin Trowels—1.5" to 2"
 - Can be inexpensive
 - One for each Paste Component and One to Mix



- Masonry Tuck Pointer -1/4"



- Plastic buckets (Two-gallon size)
 - Will need 2 or 3
 - Will need lids for 1 or 2



Materials Needed for Installation

Mandatory Equipment Continued

- Rubber Gloves
 - Recommend blue nitrile



Will also need:

- Plastic Putty Knives
- Safety Glasses
- Tape Measure
- Red or Black Lumber Crayon
- Utility Knife
- Duct Tape
- Rags
- Trash Receptacle



Optional Equipment

- 4" Grinder
 - Diamond cutoff wheel
 - Steel cut off wheel
 - Used to trim any biscuits, concrete or rebar, as needed
- Backer Rod
 - Used to keep epoxy from falling through deck
 - Sized for width of deck joint
 - 4" - 6" per biscuit



Deck Layout and Biscuit Locations

- Determine the location of the existing steel embedments/clips and mark on top deck surface.



- Lay out the biscuits locations per the engineer's design.
- Relocate any biscuit placements that conflict with the existing metal embedments by at least 12 inches.
- Mark saw cuts using appropriate indelible marker, 18" on center at 90 degrees across the joint.



Saw Cutting

- To make the cuts in the deck, use either a hand held or walk behind saw
 - Can be either wet or dry cut
 - Blade must be 14" in diameter



- Make a ¼" wide cut that is 18" long centered on the joint while using 2 blades 1/8" each.



- Cut depth should be within a ½" from the bottom of the flange of the T

- Check each cut with a biscuit to assure slot is adequately cut



Cutting Clean Up and Slot Preparation

• Wet Cutting

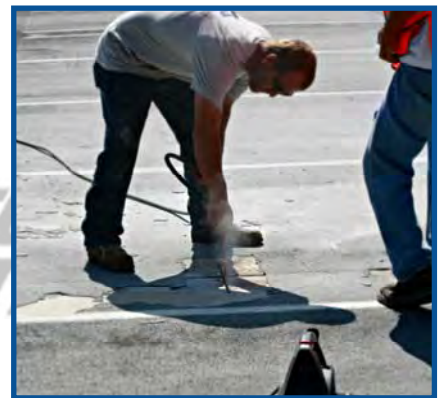
- Sweep up all slurry and remove.
- Wash out slots using clean potable water .(power washing preferred)
- Allow slots to dry.

* Use a high volume (40 CFM or better) - high pressure (100 psi or greater) air to dry slots if the installation is to be done immediately following saw cutting.



• Dry Cutting

- Sweep up all dust and chips.
- Using 100 psi or greater oil free air compressor, blow cuts clean of dust.



- Using duct tape, mask off around each slot leaving approximately 1/16" of concrete showing at the edge of the slot. Make sure to push the tape down in the corners if the joint caulking is recessed.



Biscuit Preparation and Epoxy Mixing

Biscuit Prep

- To prep the biscuits, wipe down with MEK (or acetone) to remove dirt and oil. Set aside in clean, dry location until ready to use.



Epoxy Mixing

- The biscuit bond epoxy is a 1:1 ratio epoxy. That means that equal amounts of Base (A-Component) and Activator (B-Component) must be used.

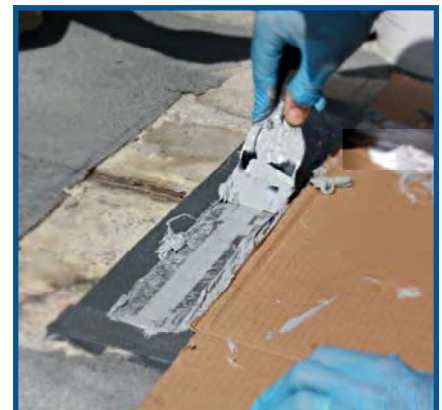
*BISCUIT BOND IS ALREADY SPECIALLY FORMULATED FOR A FAST STRONG SET. MIXING EXTRA ACTIVATOR WILL NOT INCREASE THE CURE TIME.

- Use a dedicated scoop/spatula to remove a baseball sized amount of each component from their respective containers.
- Place the two components on a mixing board adjacent to each other.
- When ready to install a biscuit, begin mixing the two components with each other using a 2" -3" stiff scraper or trowel.
- Mix the epoxy until a uniform grey color is achieved and no visible black or white streaks remain.



Biscuit Installation

- Using an appropriately sized putty knife or spatula, fill slot with epoxy paste.
 - Using putty knife and ¼" masonry tuck pointer, make sure epoxy is adhered to all sides of the slot .
 - Ensure there are no air bubbles with putty knife by working it back and forth in the slot.
 - Make sure that the epoxy completely fills the slot.
- Coat a biscuit with epoxy, taking care to "work" it into the biscuits surface.
- Place biscuit into epoxy filled slot assuring that the entire biscuit is below the concrete deck surface.
- Using putty knife, work the biscuit side to side in the slot to seat it and remove any trapped air.
- Remove any excess epoxy level with taped surface.
- Remove masking tape when epoxy begins to set. NOTE: DO NOT LET EPOXY HARDEN OR THE TAPE WILL BE PERMENATLY ADHERED TO THE DECK.



Clean Up and Cure Time

Clean Up

- Clean up uncured epoxy using acetone or epoxy thinner.
- Cured epoxy can only be removed by mechanical means.



Cure Time

- The repair needs eight (8) hours to reach full cure at 45 degrees F or greater.
- There can be no movement of the beams during the cure time.

