LABORATORY TESTING REPORT

Tests were performed over a 28 day period to determine if the strength performance of reinforced concrete was impacted by the use of KODI KLIP polycarbonate rebar connectors rather than tie wire.

- Compressive strength on concrete cylinders
- Flexural strength on concrete beams
- Determine area of placement
- Determine absorption percent

The following pages detail test results
December 29, 2014

Mr. Jon Kodi
Kodi Klip Corp.
314 S. Cumberland Street
Lebanon, TN 37087

Re: Results of Requested Lab Testing
AMEC Project No. 768214037

Dear Mr. Kodi:

AMEC has completed the laboratory testing which included the testing of concrete with reinforcing ties and Kodi Klips as requested to supply data for comparison purposes. Below is the laboratory testing that we performed and the results of these tests are attached.

- Twenty-eight day compressive strength of three 6" x 12" concrete cylinder with two #3 reinforcing bars placed horizontally at the mid-point of the cylinder and tied together with tie wire;
- Twenty-eight day compressive strength of three 6" x 12" concrete cylinder with two #3 reinforcing bars placed horizontally at the mid-point of the cylinder and connected with Kodi Klips;
- Twenty-eight day flexural strength of three 6" x 6" x 20" concrete beams with three #3 reinforcing bars placed horizontally at the mid-point of the beam (one 18" long and two 4" long, placed at third points of the beam) and tied together with tie wire;
- Twenty-eight day flexural strength of three 6" x 6" x 20" concrete beams with three #3 reinforcing bars placed horizontally at the mid-point of the beam (one 18" long and two 4" long, placed at third points of the beam) and connected with Kodi Klips;
- Determine the area displacement of the number 5 (white) Kodi Klips;
- Determine absorption on the number 5 (white) Kodi Klips;
- Cast two 6"x12" concrete cylinders with 2 #5 rebar and 1 Kodi Klip (after curing, saw through cylinders, rebar and Kodi Klip’s to show if any voids are present).
After performing the tests stated above the following results were determined:

- 6" x 12" cylinders – The average compressive strength of the concrete cylinders cast with tie wire was 8490 psi and the average compressive strength of the concrete cylinders cast with Kodi Klips was 8360 psi. This was a difference of 130 psi. After testing the cylinders and examining the cylinder, the Kodi Klips were still intact and were not damaged.
- 6"x6"x20" beams – The average strength of the concrete beams cast with tie wire was 1054 psi and the average strength of the concrete beams cast with Kodi Klips was 1024 psi. This was a difference of 30 psi.
- 6"x12" cylinders with #5 rebar and one Kodi Klip – Two concrete cylinders were cast with two pieces of #5 rebar and one Kodi Klip at the center location of the cylinder. After curing for five days the cylinders were sawed through the center of the cylinder, rebar and Kodi Klip. Cylinders were visually examined and there were no visual signs of voids around the kodi Klips or rebar.
- Attached are photos of the two cylinders that were sawed to examine for voids, one cylinder cast with tie wire that was tested for compressive strength, one cylinder cast with Kodi Klips that was tested for compressive strength and one beam that was tested for flexural strength.

While the laboratory testing yielded differences in the ultimate strength between the specimens using conventional tie wires and the Kodi Klips, it is difficult to determine the precise cause for the results. Deviations in results are inherent in all laboratory testing. The deviations in the results of our testing could have resulted from a variety of reasons, such as the concrete mix used, chemical interactions between the Kodi Klip and the cement, and/or from the reduced contact area between the concrete and rebar created by the presence of the Kodi Klips.

We understand that the intent of this testing was to determine whether Kodi Klips impacted the strength performance of reinforced concrete, and if there was an impact, would that impact present a major concern that would preclude their use in construction. Based on the results of our testing, the specimens that were prepared with Kodi Klips yielded somewhat lower strength than those prepared with conventional ties. Without knowing the intent/application/purpose of the reinforced concrete in which the Kodi Klip system is intended for use, we cannot render an opinion as to whether the strength reduction observed in our testing would preclude the use of Kodi Klips in general construction. That determination should be left to the structural engineer in charge of the reinforced concrete design on a case-by-case basis.

To assist structural engineers with that determination and/or to better understand the impact of the Kodi Klip system on reinforced concrete, you may wish to perform additional laboratory testing to increase the number of samples that are tested from which to base a determination such that a statistically significant number of tests/trials are performed. Additional testing could include not only an increase in the number of samples, but also variations in the mix designs (including admixtures), rebar sizes, curing duration (early and late), and specimen size.
AMEC appreciates this opportunity to be of service to Kodi Klip Corp. Let me know if you have any questions or require additional services.

Yours truly,
AMEC

Dale Truitt
Senior Project Manager
REPORT OF COMPRESSIVE STRENGTH OF 6" X 12" CYLINDRICAL TEST SPECIMENS

CLIENT: Kodi Kip Corp Lab
PROJECT NO: 30591-0004 (3506)

PROJECT DATA

MIX DESIGN NUMBER: H4
H-A (ADDEDigail): 
CLASS OF CONCRETE: 
TIME BATCHED: 
PLANT: 
TIME ARRIVED: 
TIME SAMPLED: 

SPECIFICATION REQUIREMENTS:

SPECIFIED STRENGTH: ___ PSI @ 28 DAYS
SPECIFIED SLUMP: ___

METHOD OF TEST: ASTM C31

PLACEMENT LOCATION: 3 6" x 12" concrete cylinders with 2 #3 rebar

TEST RESULTS (ASTM C39)

<table>
<thead>
<tr>
<th>CYLINDER MARKED</th>
<th>MEASURED SLUMP cm</th>
<th>DATE TESTED</th>
<th>A.S. (cm)</th>
<th>MAXIMUM LOAD (kips)</th>
<th>COMPRESSIVE STRENGTH (ksi)</th>
<th>CYLINDER DIAMETER (in)</th>
<th>BORE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>9400</td>
<td>28</td>
<td>12/01/14</td>
<td>38</td>
<td>238450</td>
<td>5.50</td>
<td>5.06</td>
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<td>5.06</td>
<td>1</td>
</tr>
</tbody>
</table>

**DO NOT APPLY SPORT TO COMPRESSIVE STRENGTH**

**AIR CONTENT DETERMINED PER ASTM C31 UNLESS OTHERWISE NOTED**

COMMENTS: 

DISTRIBUTION: 

LABORATORY SUPERVISOR: 

AMEC
REPORT OF COMPRESSIVE STRENGTH OF 6" X 12" CYLINDRICAL TEST SPECIMENS

CLIENT: Kodi Klip Corp Lab
PROJECT: Kodi Klip Corp Lab Testing
LOCATION: Kodi Klip Corp Lab Testing
SERVICES: Compressive strength tests on cylindrical concrete specimens

PROJECT DATA

CONTRACTOR: 
ST GUARD: 
LAB: 
SPECIFICATION REQUIREMENTS:
  SPECIFIED STRENGTH: PSI @ 28 DAYS
  SPECIFIED SLUMP: IN.
  SPECIFIED AIR CONTENT: %
  TIME ARRIVED: 
  TIME SAMPLED: 
  TIME EJECTED: 
  TEMPERATURE (°F): 
  AIR: 
  CONCRETE: 
  TRUCK NO: 
  ARTICULATING: 
  ACTUAL AIR CONTENT: %
  AIR TEMPERATURE: °F
  METHOD OF TEST:
  ASTM C110
  ASTM C110
  ASTM C110
  ASTM C110
  ASTM C110

TEST RESULTS (ASTM C39)

<table>
<thead>
<tr>
<th>CYLINDER MARKED</th>
<th>MEASURED SLUMP (IN)</th>
<th>DATE TESTED</th>
<th>AGE (HOURS)</th>
<th>MAXIMUM LOAD (KSI)</th>
<th>CYLINDRICAL STRENGTH (psi)</th>
<th>CYLINDER DIAMETER (IN)</th>
<th>BREAK TYPE</th>
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<tr>
<td>9307</td>
<td>12-10-11</td>
<td>28</td>
<td>23255</td>
<td>7.950</td>
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<td>245720</td>
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<td>234390</td>
<td>6.300</td>
<td>4.00</td>
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</tbody>
</table>

**Note**: Does not use specific compressive strength
**Note**: Air content determined per ASTM C39 unless otherwise noted.

COMMENTS:


DISTRIBUTION:

LABORATORY SUPERVISOR
### FLEXURAL STRENGTH OF CONCRETE (USING SIMPLE BEAM WITH THIRD POINT LOADING)

**ASTM C 78 / AASHTO T 97**

<table>
<thead>
<tr>
<th>PROJECT NAME:</th>
<th>Kodi Klip Lab Testing</th>
<th>DATE:</th>
<th>12/10/2014</th>
</tr>
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<tbody>
<tr>
<td>CLIENT:</td>
<td>Kodi Klip Corporation</td>
<td>PROJECT NO.:</td>
<td>768214037</td>
</tr>
<tr>
<td>REMARKS:</td>
<td>6&quot;x6&quot;x18&quot; Concrete Beams with 2 #3 Rebar &amp; Tie Wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAM TYPE:</td>
<td>X CAST-IN-PLACE SAWED</td>
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</table>

<table>
<thead>
<tr>
<th>Sample / Test Information</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>BEAM IDENTIFICATION</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>DATE RECEIVED</td>
<td>11/12/2014</td>
<td>11/12/2014</td>
<td>11/12/2014</td>
</tr>
<tr>
<td>DATE TESTED</td>
<td>12/10/2014</td>
<td>12/10/2014</td>
<td>12/10/2014</td>
</tr>
<tr>
<td>AGE OF SPECIMEN</td>
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<td>28</td>
<td>28</td>
</tr>
<tr>
<td>TOTAL LENGTH OF SPECIMEN (IN.)</td>
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<td>20.00</td>
<td>20.00</td>
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<tr>
<td>AVERAGE WIDTH (IN.)</td>
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<td>6.00</td>
<td>6.00</td>
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<tr>
<td>AVERAGE DEPTH (IN.)</td>
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<td>6.00</td>
<td>6.00</td>
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<tr>
<td>AVERAGE SPAN (IN.)</td>
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<td>18.00</td>
<td>18.00</td>
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<tr>
<td>SPECIMEN DEFECTS</td>
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<td>none</td>
<td>none</td>
</tr>
<tr>
<td>CURING HISTORY</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>MOISTURE CONDITION @ TESTING</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>MAXIMUM LOAD (lbs.)</td>
<td>12,585</td>
<td>12,740</td>
<td>12,625</td>
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<tr>
<td>MODULUS OF RUPTURE (psi)</td>
<td>1049</td>
<td>1062</td>
<td>1052</td>
</tr>
</tbody>
</table>

Calculate Modulus of Rupture (R) by: 

\[
R = \frac{PL}{bd^2}
\]

where: 
- \(P\) = maximum load
- \(L\) = span length
- \(b\) = average width
- \(d\) = average depth

1 = lime saturated water
2 = none (tested upon receipt)
3 = moist at time of testing
4 = as received

NOTE: Test results shown were derived from tests performed in accordance with the applicable test method(s), unless otherwise noted

Christine Tognoni
LABORATORY SUPERVISOR
### FLEXURAL STRENGTH OF CONCRETE (USING SIMPLE BEAM WITH THIRD POINT LOADING)

**ASTM C 78 / AASHTO T 97**

**PROJECT NAME:** Kodi Klip Lab Testing  
**DATE:** 12/10/2014

**CLIENT:** Kodi Klip Corporation  
**PROJECT NO.:** 768214037

**REMARKS:** 6"x6"x18" Concrete Beams with 2 #3 Rebar & 1 Kodi Klip

<table>
<thead>
<tr>
<th>BEAM TYPE</th>
<th>CAST-IN-PLACE</th>
<th>SAWED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Identification</td>
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</tr>
<tr>
<td>Date Received</td>
<td>11/12/2014</td>
<td>11/12/2014</td>
</tr>
<tr>
<td>Date Tested</td>
<td>12/10/2014</td>
<td>12/10/2014</td>
</tr>
<tr>
<td>Age of Specimen</td>
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<td>28</td>
</tr>
<tr>
<td>Total Length of Specimen (in.)</td>
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<td>20.00</td>
</tr>
<tr>
<td>Average Width (in.)</td>
<td>6.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Average Depth (in.)</td>
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<td>6.00</td>
</tr>
<tr>
<td>Average Span (in.)</td>
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<tr>
<td>Specimen Defects</td>
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<td>none</td>
</tr>
<tr>
<td>Curing History</td>
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<td>X</td>
</tr>
<tr>
<td>Moisture Condition @ Testing</td>
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<td>X</td>
</tr>
<tr>
<td>Maximum Load (lbs.)</td>
<td>12,330</td>
<td>12,230</td>
</tr>
<tr>
<td>Modulus of Rupture (psi)</td>
<td>1028</td>
<td>1019</td>
</tr>
</tbody>
</table>

Calculate Modulus of Rupture (R) by:

\[ R = \frac{PL}{bd^2} \]

where:
- \( P \) = maximum load
- \( L \) = span length
- \( b \) = average width
- \( d \) = average depth

1 = lime saturated water  
2 = none (tested upon receipt)  
3 = moist at time of testing  
4 = as received

**REMARKS:**

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**NOTE:** Test results shown were derived from tests performed in accordance with the applicable test method(s), unless otherwise noted

Christine Tognoni  
**LABORATORY SUPERVISOR**
SPECIFIC GRAVITY, ABSORPTION & DISPLACEMENT

SAMPLE NO. ____________________________

CLIENT: Kodi-Klip Corporation
PROJECT NO.: 768214037

PROJECT NAME: Kodi-Klip Laboratory Testing
DATE: December 2, 2014

DATE RECEIVED: ______________________

SPECIFIC GRAVITY (Bulk Calculation)

A) Oven Dried Weight of Sample 37.4 (gms)
B) Weight of Saturated Sample in Water 5.9 (gms)
C) Saturated Surface Dry Weight of Sample 37.5 (gms)

Gs = A / ( B - C )    Specific Gravity = 1.18

ABSORPTION
(test performed on four (4) #5 (white) Kodi Klips)

Absorption % = ((B - A) / A) x 100
Absorption = 0.3%

DISPLACEMENT

Four (4) #5 (white) Kodi Klips had a displacement of 1.831 cubic inches. (0.458 cubic inch displacement for each #5 (white) Kodi Klip)

NOTE: ______________________