This is going to be an exciting presentation that is of great interest to me. The carport of my house was rotten and falling down and needed to be replaced. I’m going to give you all the information you will need to analyze a carport of your own and rebuild a new one that will properly shade your cars and not be blown away by wind, or rot from exposure. I’m Gavin Daniels….this is my story.
The existing carport was a one way structure. The structure consisted of 6 5” dia columns with 4” x 6” beams spliced together across the 10’ wide bays. The beams supported 2” x 6”, 20’ long joists with 1” x 6” decking and a sheet metal rolled roof. Over the 30+ years since it’s initial construction lack of maintenance and an initial roof slope of 1” in 3’ the carport began to leak. Years of rotting have rendered repair impossible, the only structural members still intact are the columns which show no signs of structural problems.
The Carport - Bryan, Texas

- Steel Columns embedded in concrete still in good condition
- Rotten wood
- Metal Straps prevented uplift on the structure

Existing Carport Analysis
The Carport - Bryan, Texas

- **Code Enforcement**
  - No permit required for demolition
  - A permit is required for new construction

- **Sources**
  - [http://www.bryantx.org/div_buildingservices/codes.htm](http://www.bryantx.org/div_buildingservices/codes.htm)
  - International Residential Building Code 2000

- **Materials**
  - Three 4x6 beams spanning the three bays was effective before and is well within the requirements of IRBC.
  - The IRBC allows 2x6 joists to span 16’ as long as they are spaced less than 24” apart.
  - Initially 3/8” plywood decking was going to be used on top of the joists. I determined the deflection would be excessive during construction and provide undo torsional stress on the joists. The 3/8” thick plywood would not have provided enough material for the metal roof to attach to either. IRBC also recommended having at least ¾” of material to fasten the roof covering to.
  - 1x4’s placed 12” o.c. were used in lieu of the plywood. They would be more rigid and by using two nails at each 2x6 also help control lateral deformation of the 2x6’s

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**Codes & Materials**

<table>
<thead>
<tr>
<th>3/8” plywood</th>
<th>Live Load</th>
<th>Deflection</th>
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<td>2x6 rotation about centroid</td>
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3 second gusts of 100+ mph wind must be withstood by the carport. There are no walls on the carport so, wind will create minimal lateral load on the carport (columns). The slope of the roof is 12” in 16’. This will encourage the uplift wind will surely produce on the carport. These forces must be counteracted through the use of proper fasteners and structural attachments.
The rafters on one end were placed on top of the 4x6 beam to increase the slope of the structure and encourage water flow off the roof. The hurricane straps used at this end were designed to withstand the high winds that are known to pass through this area. These winds would cause an uplift on the structure. When properly installed these ties can resist about 1,000 lbs of uplift. The straps are securely fastened with the manufacturer’s recommended nails.
The joist hangers on the opposite end of the Hurricane Ties serve two purposes. They support the dead load of the 2x6, 1x4’s and metal deck. They are also capable of resisting an upload of almost 1,000 lbs. This is well over any predicted worst case upload for this area and when paired with the hurricane ties assures the structure will remain intact during a storm.

Joist Hangers
The metal ties and joist hangers could hold 1,000’s of pound, but without the proper fasteners, they would be useless. 1.5” galvanized nails were used to attach the hangers per manufacturer’s recommendation.

So now I was sure the 2x6’s would not come loose. To ensure the 1x4’s would stay in place during extreme uplift situations I used two 1.5” ribbed galvanized roofing nails at each overlap of 1x4 and 2x6. The IRBC recommends that metal roof decking be fastened every 36” into at least ¾” of decking. I used 1.5” ribbed galvanized roofing nails with a neoprene washer around the head and fastened them in three evenly spaced runs every 24” along the length of the metal sheet.

The 4x6” beams are fastened to a metal plate welded to the top of each column. A ½” x 7” lag bolt was used for this with a ¾” washer at both ends.
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400+ lbs – 2x6’s; 100 lbs – 1x4’s & Mtl Deck =

500+ lbs Total Distributed Dead Load

83.33 lbs  166.67 lbs  166.67 lbs  83.33 lbs

Loads
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SHEER DIAGRAM

MOMENT DIAGRAM

Sheer & Moment
The metal deck acts like a folded plate and adds rigidity and stiffness to the structure. During installation and any future live loads on top of the carport, the metal deck will serve to distribute the weight of the live load. As it moves across the carport, The metal deck is placed in overlapping sheets. In the long direction of the sheets, they are over-lapped 4’, in the short direction the are overlapped two ridges. The four foot overlap decision was a purely constructability decision. The 8’ long, free, metal sheets dictated more than two sheets would be necessary to properly span the 16’ width of the carport. It was determined enough sheets were available to place three sheets every 24” along the 30’ length of the carport. Therefore the need to cut rusty metal sheets was eliminated. The metal deck also keep the rain off the structure and my truck!
I am quite certain that were my truck to run into a column, the column would win. The column is fixed at the ground and pinned at the top (K=0.7). The deflection of the columns under an extreme lateral load is shown above in red. Let’s hope this never happens!
In conclusion, the carport was built and it hasn't fallen down.

Special thanks to my Dad for his help during the construction of the carport. He’s a badass!