A New Approach to Converting Existing Carports to Solar Carports with Flexible PV Modules
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Rooftop solar has become commonplace on commercial buildings and homes. While often times a residential home has sufficient roof top area to power the home 100% with solar, this is not always true with multi-story commercial buildings, apartments, and condominiums. The properties often do not have the necessary roof space to offset their energy needs with solar. This situation can also apply to low-rise buildings with high electrical usage (i.e. factories, big box stores and warehouses).

Carports have become a standard feature on many commercial and multi-family properties, and even those buildings without carports have parking lots with space for them. Carports provide users the benefit of shading cars and protecting cars and people from rain and snow. Carports keep cars cool, reducing the power required to air condition them when they're started, and reduce sun damage to the car finish. From an environmental standpoint, carports help migrate the heat island effect in which large concrete and asphalt parking lots absorb heat during the day and release the heat at night. This additional heat can drastically change local weather patterns, especially in metropolitan areas.

In recent years, building owners have been installing new carports with solar PV modules. These solar carports have all the benefits of traditional carports with the added advantage of producing clean renewable solar energy while reducing the need to add rooftop solar to buildings.

In many places, existing carports were designed and built with minimal steel support structures and the metal roof and deck panels are already spanning the maximum distance between supports to keep cost down. Most were built to meet the minimum local wind and live-load code requirements. With the cost of solar installations falling, utility energy costs rising, and increased interest in improving the environment while reducing a building's carbon footprint, building owners are interested in retrofitting their existing carports with solar modules.

Unfortunately, many of these existing carport structures cannot support the additional four to six pounds-per-square-foot weight of standard crystalline PV modules and associated racking and rails. The only solution available to the owner is to structurally upgrade the carport or tear it down and replace it with a carport designed for the extra weight of solar. Even if the existing carport structure can support the weight, retrofitting the carport with solar can be technically challenging and expensive.

MiaSolé has developed two solar application solutions to solve the live-load limitations of many existing carports. MiaSolé manufacturers a flexible lightweight high-efficiency (16+ %) CIGS-based flexible PV module weighing less than 9 ounces per square foot in two format sizes:

the narrow format FLEX-N series designed for traditional architectural standing seam metal roof panels, and the wide format FLEX-W series. Both applied to the carport roof with a simple peel-n-stick adhesive.

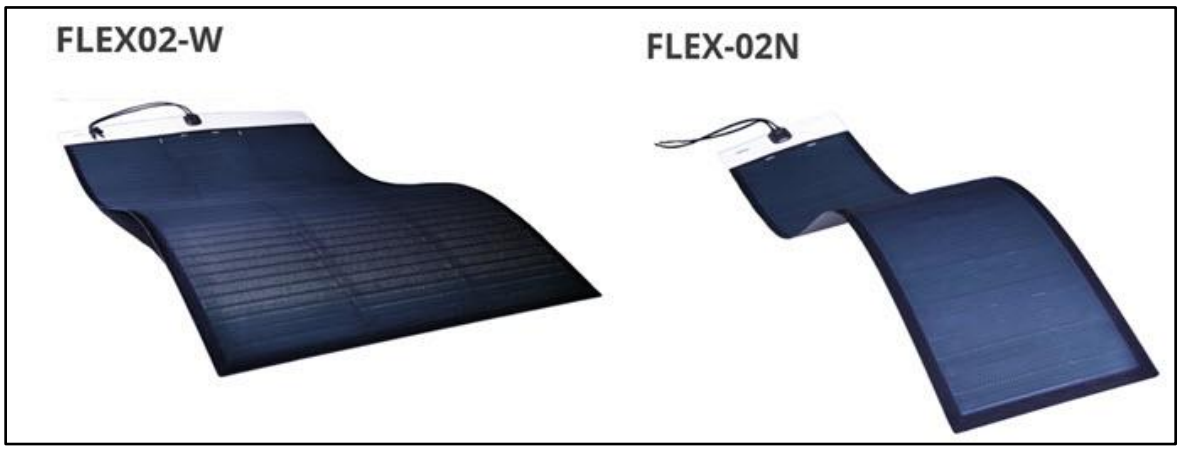

Figure 1 The Miasole FLEX Series PV Modules

Two roofers can easily apply the FLEX N series to the existing carport metal panels:

- Power wash the roof.
- Wipe down the areas where the FLEX-N modules will be applied with rubbing alcohol.
- On the standing seam metal panel (16”-to-18” wide) lay down the module.
- One roofer lifts up the module at the j-box end, removes the release film from the adhesive, and sets the module down.
- The second roofer at the other end lifts up and supports the module.
- The first roofer continues to remove the release film and lays down the module, rubbing the module with his hand to ensure full contact.
- Once the module is fully adhered, both roofers use a silicone roller to bond the module to the metal pan surface.

Figure 2 Miasole FLEX N on Standing Seam Metal Panels

While architectural standing seam panels are frequently used on carports, the 7.2 trapezoidal rib panel is the metal roof industry's most commonly used corrugated roof panel for carports. Nearly every major metal roof and steel building manufacturer offers a 7.2 rib panel type profile.

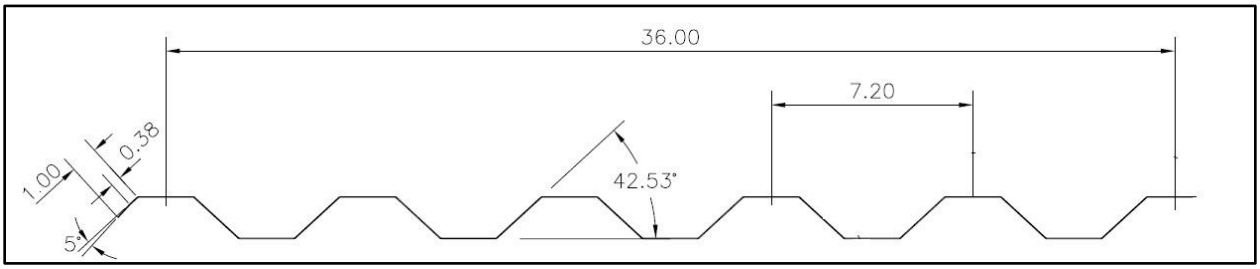

Figure 3 Typical 7.2 Metal Panel Profile

The 7.2 corrugated rib panel is economical, strong and aesthetically pleasing while offering excellent spanning and cantilever capabilities, making it an excellent choice for carports and walkway canopies. The 7.2 rib panel with its long-spanning performance helps lower costs by reducing the number of purlins and structural steel needed. The ability to use long metal panels and fastening with exposed fasteners on slopes as low as 1/12 greatly reduces labor cost.

Working with several major metal roof manufacturers such as McElroy Metal and one of the solar carport leading builders, Baja Construction, MiaSolé modified the adhesive patterns on the MiaSolé FLEX-W, the large format PV module originally designed for low slope single-ply roofs. The new adhesive pattern makes it simple to bond the MiaSolé Flex-W module directly across the standard 7.2 corrugated rib profile. By eliminating the need for racks and rails, the powerful 360-watt FLEX W PV module can be rapidly installed by just two roofers over any existing carport or walkway. With a low-slope roof canopy, solar orientation—the direction the carport is facing—is less critical.

Two roofers can easier apply the FLEX W series to the existing carport metal panels:

- The existing carport is power washed to remove any dirt and debris from the metal roof surface.
- Any loose metal panel fasteners are tightened and missing fasteners replaced.
- The areas where the FLEX modules are to be installed are cleaned again with rubbing alcohol.
- The FLEX modules are laid down across the corrugated ribs, and the adhesive strips are aligned with the ribs.
- On one end, the roofer lifts up the module, peels back the adhesive release film, lays the module back down on the 7.2 panel ribs and presses down to bond the module to the ribs.
- The second roofer on the other end repeats the same process.
- Both roofers finish bonding the module by rolling the adhesive areas with a silicone roller to ensure complete adhesion to the metal panel.

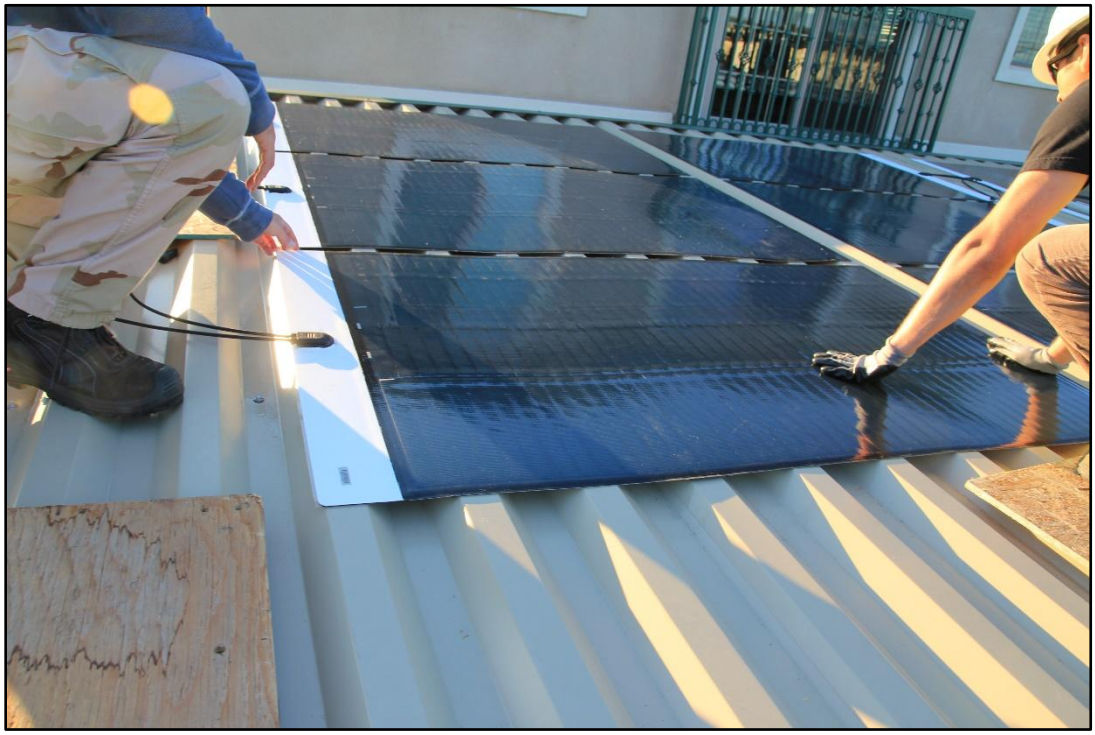

Figure 4 Installing the Miasole FLEX W on a 7.2 Metal panel

Figure 5 Completed Solar Carport with Wire Management

MiaSolé FLEX series PV modules make it possible to economically convert existing carports with live-load limitations into new solar carports without having to make any major structural modifications. Even on new solar carports, the MiaSolé FLEX series modules can reduce labor and construction cost by reducing the need for heavy steel support structures and allowing longer metal panels with fewer support purlins.

The simple peel-and-stick adhesive system reduces labor cost while speeding up installation time. Unlike conventional rigid crystalline panels, the flexible MiaSolé FLEX modules work over curved roof structures for solar carports, solar walkways, and solar awnings.