This documentation highlights how to manufacture durable, resilient, and impact resistant hard points in composite sandwich panels. In buggy manufacturing, hard points are often used to secure steering mechanisms, axles, and safety attachments for a driver's harness. Note that there are several designs and manufacturing processes for hard points; this document highlights and explains a method that is simple, relatively inexpensive, reliable, and stress tested by members of the buggy community.

MATERIALS:

- Composite sandwich panel (i.e. the bottom of your buggy)
- Impact-resistant structural adhesive
    - https://next.henkel-adhesives.com/us/en/products/industrial-adhesives/central-pdp.html/loctite-ea-e-60hp/BP000000164722.html
- High-strength sandwich panel inserts
    - https://www.shur-lok.com/products/sandwich-panel-inserts.html
- Cleaning supplies (i.e. isopropyl alcohol)
- Gloves and respirator (depending on the structural adhesive)
- Drill and appropriately sized drill bit
- Punch
- Flat head screwdriver
- Pencil
- Paper towels

PROCESS:

- Draw out the layout of hardpoint locations on the sandwich panel.
- Lightly mark the center of the hole with a punch.
- Drill the holes.
    - The hole should be the same diameter as the panel insert.
    - Drill through only the top layers of carbon fiber.
- Remove the core material surrounding the center of the hole.
    - The diameter of the circle of cleared core material should be significantly larger than the diameter of the panel insert.
- Clean the inside of the hole thoroughly with an appropriate solvent and paper towels.
    - Ensure all of the surfaces are dry before continuing to the next step.
- Fill the entire hole with impact-resistant structural adhesive "potting compound".
    - It is important to ensure that every corner and crevice of the hole is filled with the adhesive, otherwise the strength of the panel insert will be compromised.
- Slowly push the panel insert into the hole.
    - Rotating the panel insert during insertion helps to eliminate voids in the adhesive.
    - Expect a significant amount of adhesive to overflow. Once the insert is in place, clean the excess with a paper towel.
- For panel inserts with potting holes: inject the adhesive through one of the potting holes until excess adhesive comes out the other potting hole.
    - This will ensure that all voids in the potting area are eliminated.
- Wait 24 hours for the adhesive to cure before use.

- For through hole inserts, drill through the spool and the bottom layers of carbon fiber.

STATISTICS:

In 2023, SDC Buggy manufactured several test panels using this method and performed stress tests with a load scale to validate the use of this technique for safety-critical hard points in buggies. A 1” panel insert with a 5/16” through hole was installed into a ½” thick composite sandwich panel. A steel climbing anchor was bolted to the hardpoint for testing, mimicking attachment to a driver’s harness.

Results:

- Withstood 30 kN (6,744 lbf) of static force
- Withstood a 6 m, 45 kg drop test

These results were encouraging as they indicated to SDC mechanics that this method is suitable for safety-critical applications in buggy.