FIELD PRODUCT DEVELOPMENT / SOUTH AFRICA / SUMMER 2026

Emergency transport, designed with Langa

REACH bicycle-linked stretcher | MIT D-Lab / MassArt initiative | 2026 field iteration



FULL-SCALE PROTOTYPE Bicycle-powered stretcher / Langa, Cape Town

THE CHALLENGE

With no hospital in Langa, residents face lengthy ambulance delays and difficult routes to care. Building on earlier REACH work, we explored a locally maintainable bicycle transport solution.

THE PRODUCT

Our team fabricated two stretcher prototypes: one for rapid iteration and another more refined version. The system connects a patient platform to an ordinary bicycle through a purpose-built hitch.

COMMUNITY CARE PATHWAY / IMPLEMENTATION ONGOING

01 REQUEST
Nurse hotline

02 DISPATCH
Bicycle Hub

03 PICKUP
Neighborhood zone

04 CARE
Nursing station

DESIGN WITH THE COMMUNITY



Feedback from nurses, disabled residents, disability-center staff and bicycle-hub workers.

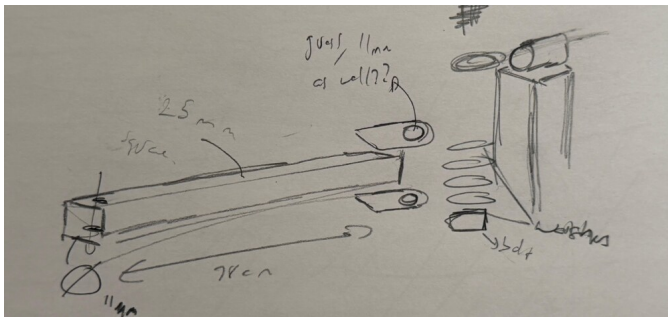


Hands-on assembly and design changes at the Langa Bicycle Hub.

Designing for loads beyond straight riding

The hardest mechanical problem was allowing the bike and loaded trailer to turn, twist and cross uneven pavement without overstressing the hitch.

FROM FIRST SKETCH TO FINAL HITCH ASSEMBLY



My connection sketch explored dimensions, tabs and an improvised washer-stack joint.



Redesigned hitch assembly: the universal coupling joins the angled tow arm to the support.

01 / INITIAL ASSEMBLY

Sleeve, pin and washer-loaded ball joint

The tow bars joined through a sleeve-and-pin connection. An improvised ball-style joint functioned in straight travel but became unreliable during turns and twisting under passenger-scale loads.

02 / DESIGN REVISION

Universal-joint hitch solution

After consulting a local trailer fabricator, I led the universal-joint redesign. We tested sharp turns, bumps and pavement cracks with a 250-lb rider (me), while varying stretcher elevation to improve handling.

FABRICATION + REAL-WORLD VALIDATION



Workshop fabrication: cutting, fit-up, welding and repeated adjustments.



Community demonstration and road use informed handling and stability changes.

MY CONTRIBUTIONS

Led hitch redesign and loaded field testing; adjusted stretcher elevation to study force transfer. Hand-sketched joint geometry, helped weld and fabricate parts, and worked with community partners.

RESULT: The revised hitch handled the observed 250-lb road test. This was not a rated capacity or safety certification; implementation discussions remain ongoing.

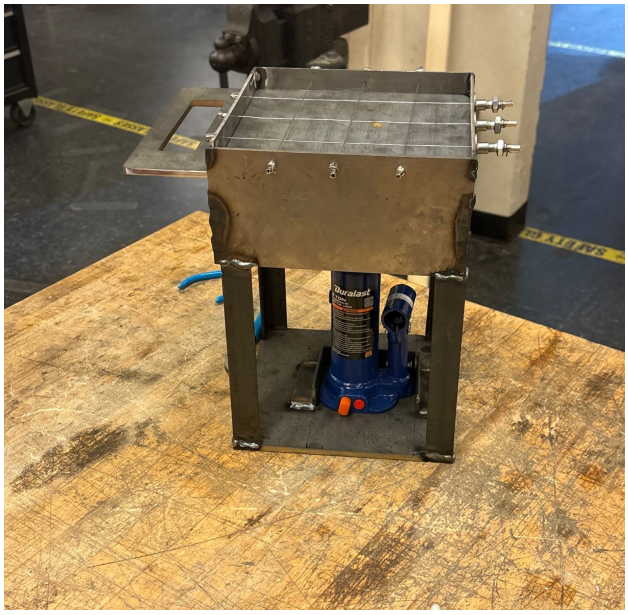
MECHANISM DESIGN / MANUFACTURING / MIT D-LAB / 2026

Redesigning a charcoal press for scale

A locally repairable, bottle-jack-driven press built to reduce part count, improve compression and form 16 briquettes per batch.

THE COMMUNITY NEED

South African partners described an urgent need to produce charcoal briquettes in substantial daily quantities, amid concerns about smoke exposure during existing cooking practices. Our task was to develop a faster, affordable press using tools available locally. Fuel emissions and health effects were outside the scope of our mechanical testing.



Fabricated welded-steel press and bottle jack during development of the batch-forming mechanism.

DESIGN TARGET / REPORTED CYCLE

16 briquettes

47 seconds

Per batch pressing cycle; drying is a separate step.

THE DESIGN CONSTRAINT

An earlier concept required **16 separate loading and compression compartments**. Its hinged upper platen descended at an angle, contacting one side first and compressing the mixture unevenly. The many individual components also made fabrication costly and labor-intensive.

THE REDESIGN

I designed a single shared mold and vertically actuated platen around a commercially available hydraulic bottle jack. Consultation with partners in South Africa confirmed that bottle jacks were obtainable locally, making this approach more practical than a bodyweight-driven device.

ENGINEERING FOR MANUFACTURABILITY

BEFORE

Sixteen individual mechanisms

High part count; hinged compression plate; uneven densification across the mold.

AFTER

One shared compression chamber

A single guided platen, central hydraulic loading and a steel structure made for repeatable fabrication.

MY OWNERSHIP

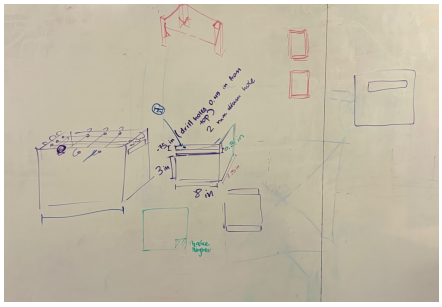
Led mechanism design and CAD; prepared files for waterjet cutting; welded, assembled and iterated the steel press, scoring components and jack interface.

ENGINEERING DEEP DIVE / PRODUCT ITERATION

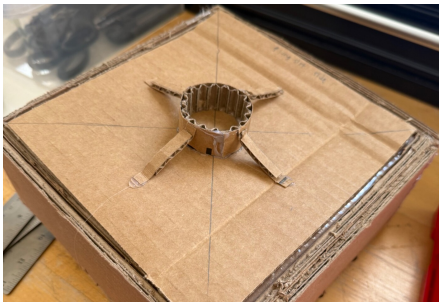
From fragile wet blocks to break-apart briquettes

Two critical changes addressed practical problems discovered in prototyping: controlling the compression path and separating a delicate product without destroying it.

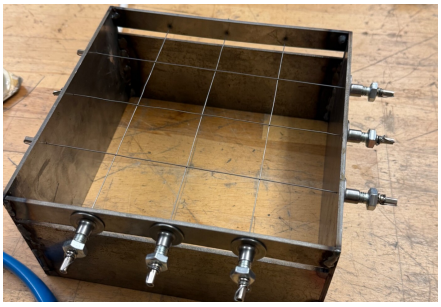
DESIGN DECISIONS, TESTED THROUGH PROTOTYPES



Early hand-drawn mold geometry and fabrication dimensions.



Cardboard study of the circular jack-centering feature.



Earlier wire-grid divider concept; final plate used raised metal ribs.

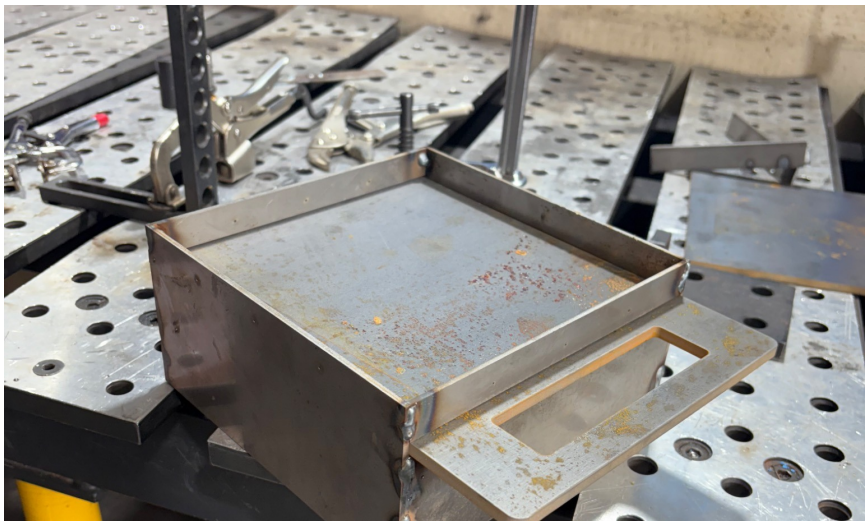
01 / KEEPING THE LOAD CENTERED

The jack applied force through a **circular locating feature** beneath the moving platen. Close-fitting guide rails restricted sideways motion, helping the plate remain aligned as the load was raised. This replaced the uneven contact of the earlier hinged design.

02 / DESIGNING THE SEPARATION INTO THE MOLD

Attempting to cut a compressed, wet slab caused cracking and breakup. Early wire-divider concepts led to **raised metal scoring ribs on the pressing plate**: the slab could dry with defined break lines before the 16 briquettes were snapped apart.

TRANSITION FROM PROTOTYPE TO STEEL



Cut, fitted and welded steel mold with sliding plate features. Waterjet-cut parts were integrated into the assembled press.



Form reference only. Illustrative briquettes supplied by the applicant, not made by this press.

OUTCOME AND NEXT VALIDATION

The team built a **16-briquette hydraulic press** with a reported **47-second operating cycle**. Further field validation is needed for sustained production rate, consistent briquette strength after drying, and safe repeatable operation.