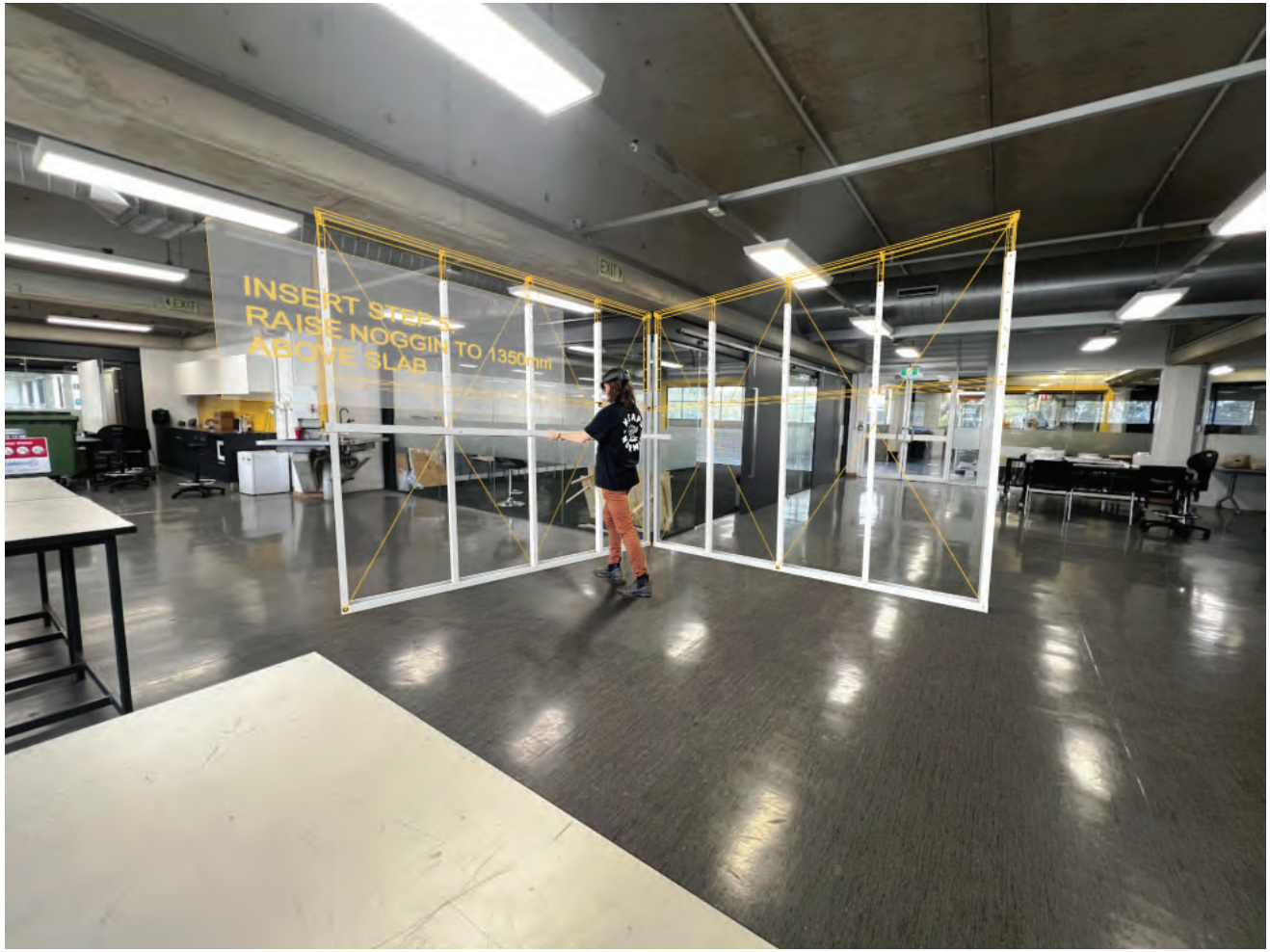
UTOPIC CONSTRUCTION

NATSPEC STUDENT COMPETITION

N23002



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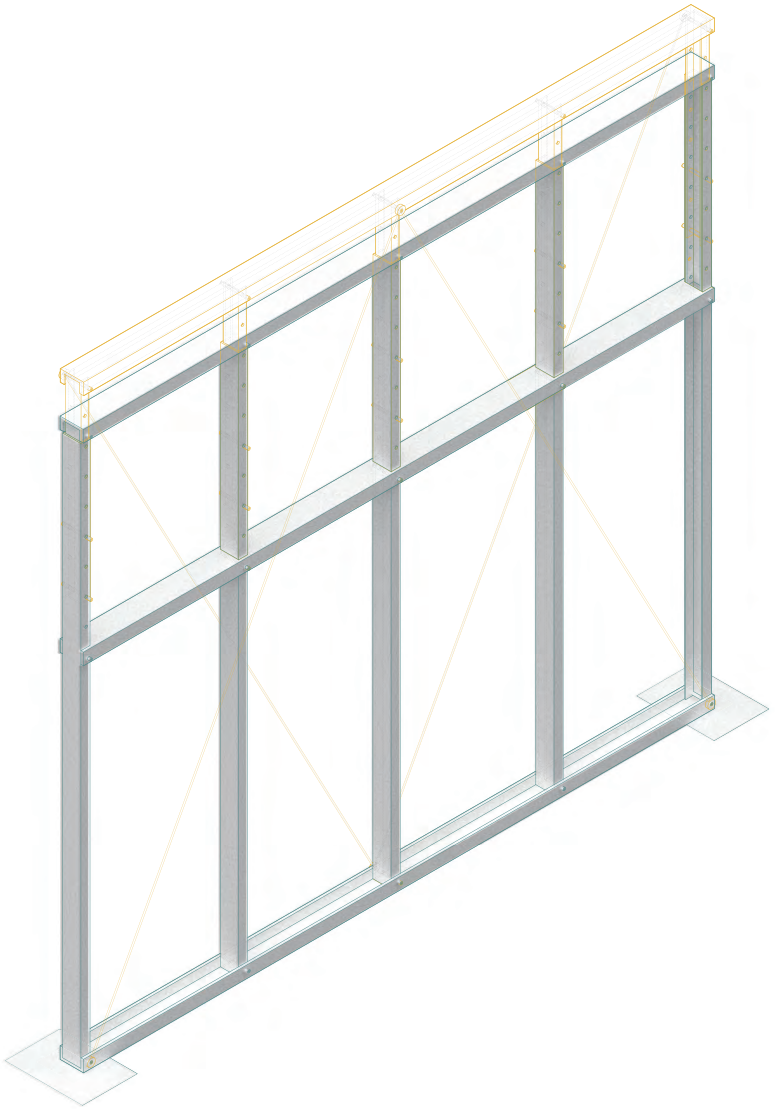
INTRODUCTION

Our proposal explores what the construction industry could look like in the future both from a sustainably proactive perspective but also explores how the construction industry can close the gap between documentation and on-site construction through augmented reality workflows.

The project proposes a plastic non load bearing wall system which uses no adhesive and can be up-cycled and/or recycled after the "End of Life" of a building or fit out. The design will focus on non-fire rated partition systems. The construction system will also be deployed by an augmented reality system enabled and developed in Fologram and used with both mobile devices and Hololens systems.



WHY PLASTIC?

Plastic is durable, lightweight, and versatile, which makes it useful in a wide range of applications. Depending on the type of plastic used, the plastic could be recycled or repurposed creating an upcycle system.

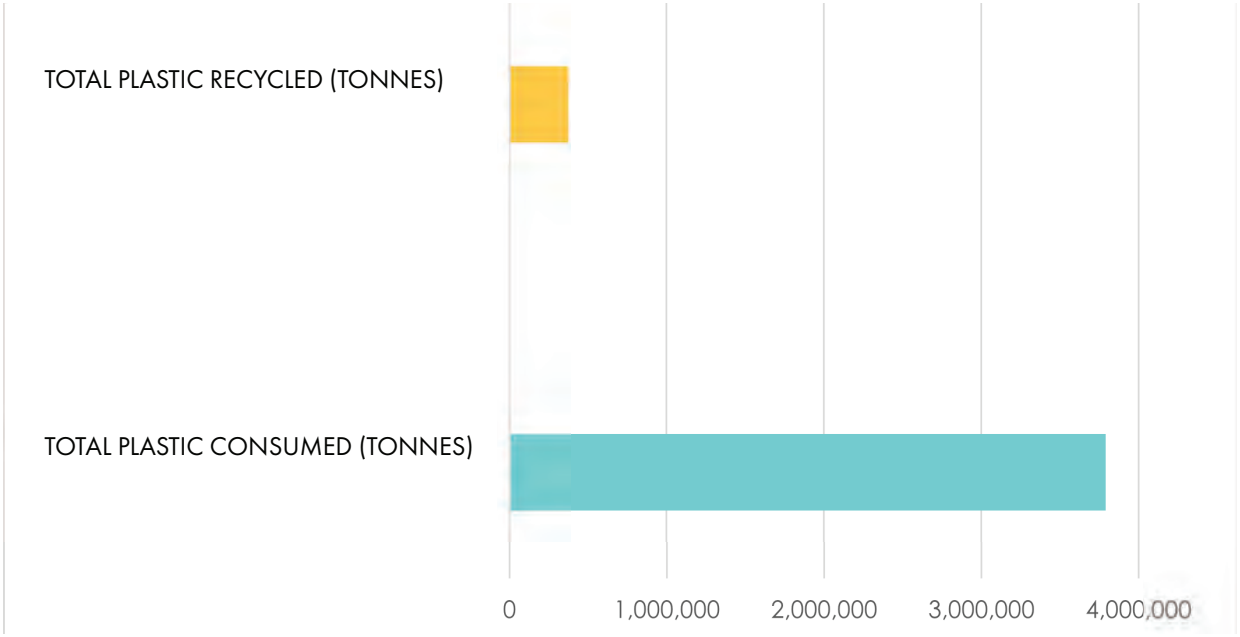
From the Department of Climate Change, Energy, the Environment and Water, in 2020 - 2021, Australia consumed 3,791,000 tonnes of plastic and from this 371,300 tonnes showing a 14% recovery rate.

From the 371,300 tonnes recycled:

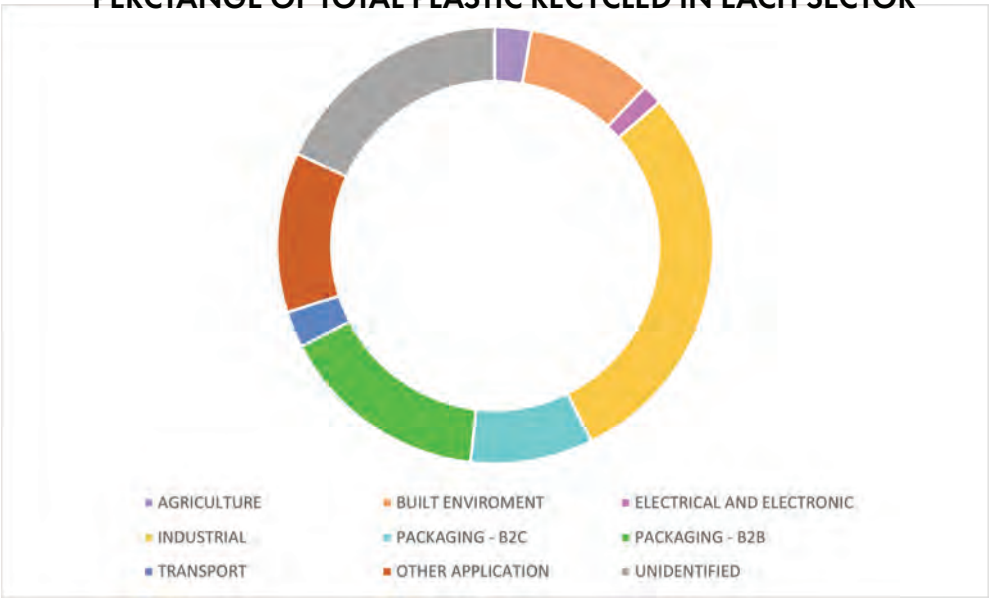
2.7% was from agriculture
9.4% was from built environment
1.5% from electrical and electronic
29.1% form industrial
9.1% from packaging - B2C
15.6% from packaging - B2B
2.7% from transport
11.8% from other application
11.5% unidentified

Looking at these stats, creating a system which brings these recycled plastics into the built environment could help increase the recovery rate of the plastic from the built environment and contributes to developing an upcycle/recycle system.

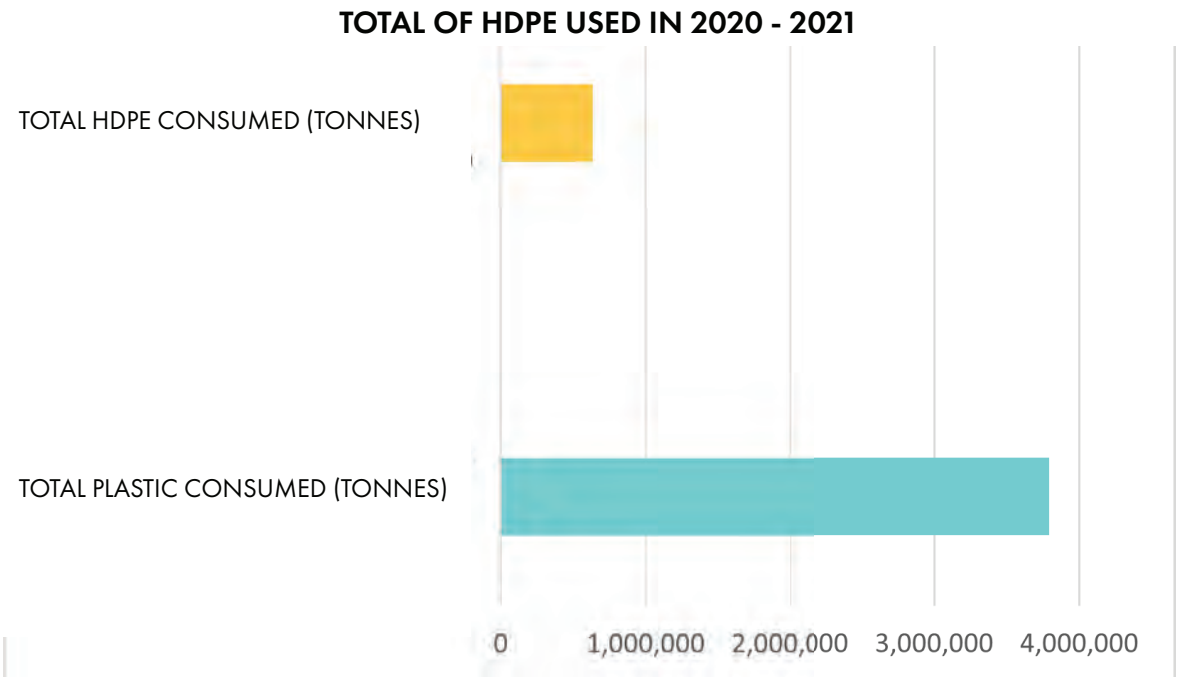
AUSTRALIA CONSUMPTION OF PLASTIC FROM 2020 -2021



PERCTANGE OF TOTAL PLASTIC RECYCLED IN EACH SECTOR



WHAT PLASTIC?



High density polyethylene (HDPE) is a commonly used plastic and is considered one of the most widely produced and versatile plastics globally. The properties of HDPE include high strength-to-density ratio, resistance to moisture, chemicals, and UV rays, as well as its recyclability. HDPE is commonly used in various applications across different industries. Some examples are:

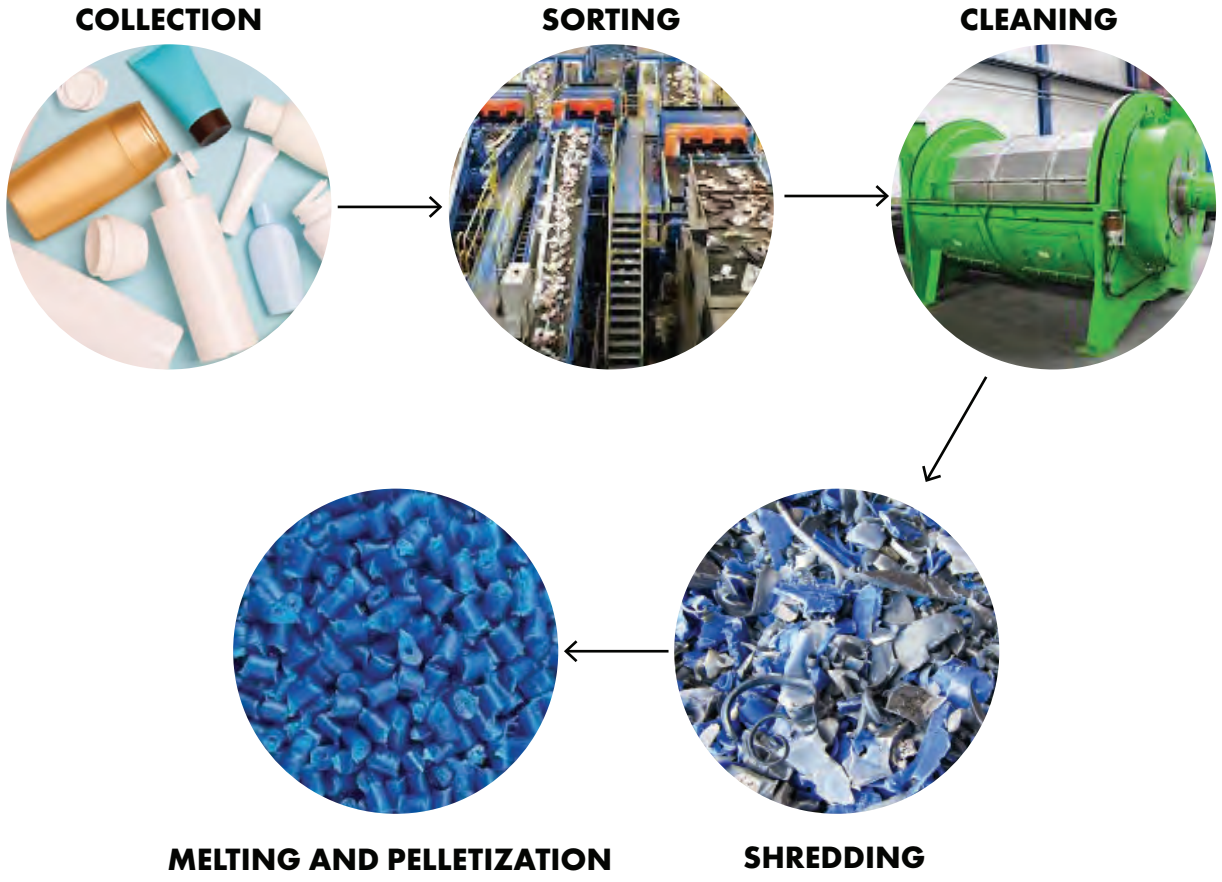
Packaging
Construction
Consumer goods
Automotive
Agriculture
Industrial applications
Recycling bins

In 2020-21, Australia consumed 633,500 tonnes of HDPE making it the highest polymer consumed in that year. Finding ways to retrieve this plastic and reuse it in a construction system can help with the reduction of waste in landfills, conservation of resources, and energy savings compared to producing virgin plastic.

THE PROCESS: RETRIVAL

There are several steps required to process the recycling of HDPE. These are:

1. **Collection/Retrieval:** the first step in recycling HDPE is the collection of used materials. This involves individuals, businesses, or municipalities collecting HDPE items such as bottles, containers, and packaging.
2. **Sorting:** Once collected, the HDPE items are transported to a recycling facility where they undergo sorting. Sorting is a critical step as it separates HDPE from other types of plastics. This can be done manually or through automated processes.
3. **Cleaning:** After sorting, the HDPE items are cleaned to remove any contaminants or residues. This may involve washing the items with water and detergents to ensure that the recycled material is of high quality.
4. **Shredding:** The cleaned HDPE items are then mechanically shredded into small pieces. This increases the surface area of the material, making it easier to process in subsequent steps.
5. **Melting and pelletization:** The shredded HDPE is melted down and formed into small pellets. These pellets serve as the raw material for manufacturing new HDPE products.



MANUFACTURING

END PRODUCT

THE PROCESS: REPURPOSE

From retrieving HDPE and changing them to pellets, we can then look at manufacturing these to something else. This process would be:

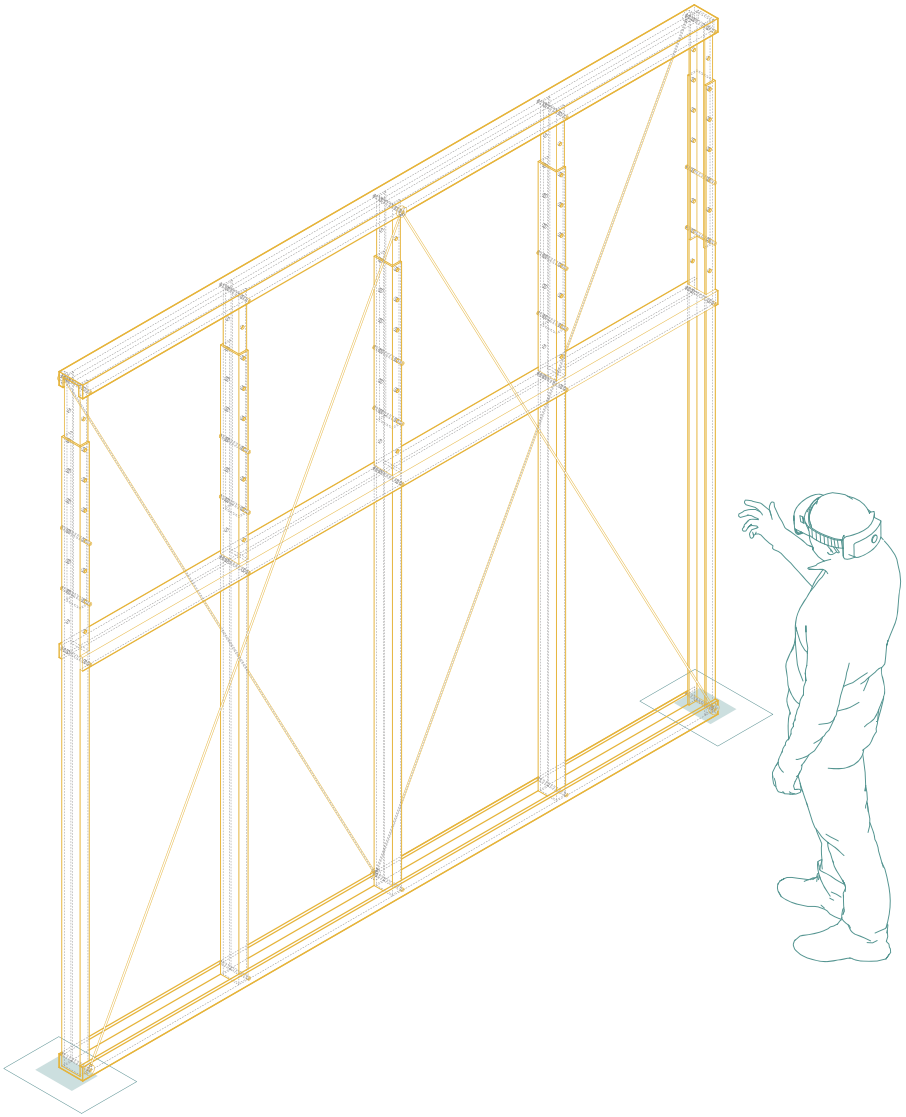
1. **Manufacturing:** The HDPE pellets are sent to manufacturers who use them to produce new products. These products can include bottles, containers, pipes, packaging materials, and more.
2. **End product:** The recycled HDPE products are then distributed and made available for consumer use. The cycle can repeat as these items are collected and recycled once they reach the end of their life.

Once the product has reached the end of life, the plastic can be retrieved and the process can start again and can be recycled 10 times according to tests done by ESE world B.V.

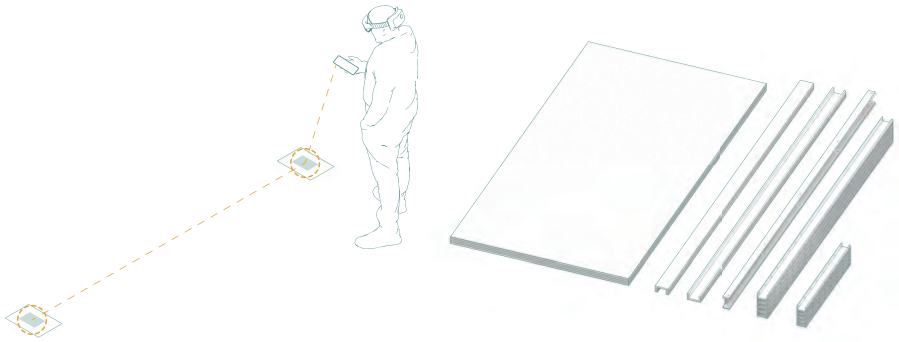
THE PROPOSAL

Due to the material properties of plastic it is not suited to fire-rated applications as defined in NCC C2D10.1 Non-Combustible Building Elements. However it does not exclude internal non-load bearing walls that are not “Common” or “zone” walls.

The augmented reality system would act as a guide for construction workers on site, providing a way of surveying existing sites through the use of QR markers that define junctions within partitions as well as provide step by step instructions informed by specifications. Bringing the role of specifications to the for-front of the industry. This not only helps educate workers on systems they may not be familiar with, creating a more versatile work-force but also acts as further assurance that a building will be built to specification.

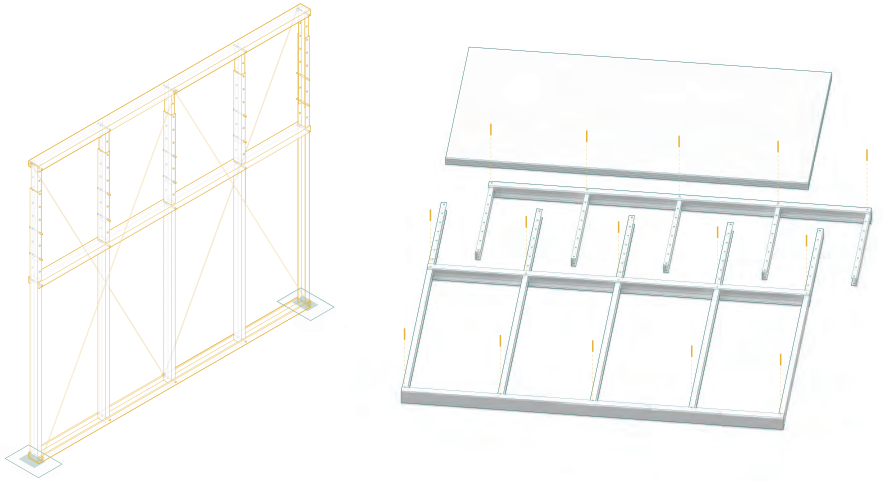


STEP BY STEP



STEP 01:

Scan QR markers at specified locations as defined by provided set-out plans. Cut members as specified by the augmented model.



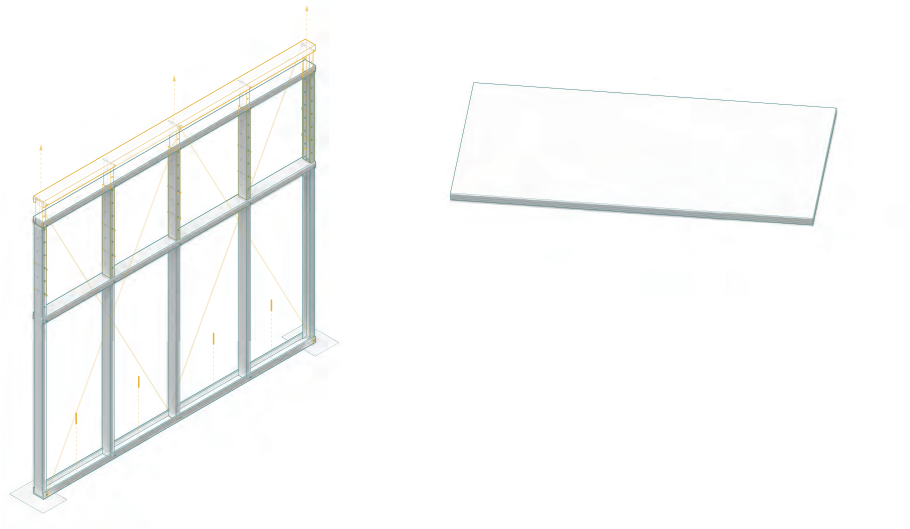
STEP 02:

Pre-Assemble bottom and top sections of stud-wall, Use provided Nylon-Pins, Slip and Pin Noggin rail to bottom stud at 1350mm from the bottom rail.

STEP BY STEP

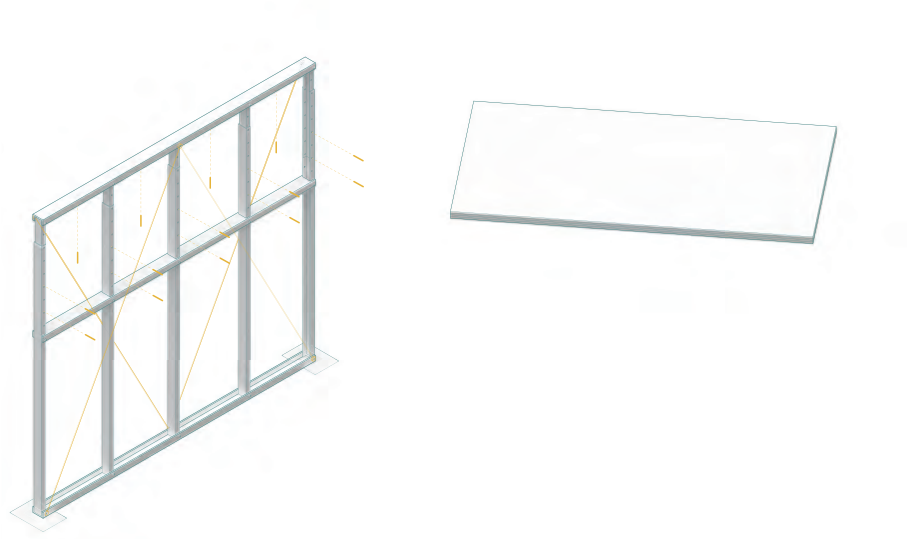
STEP 03:

Slip top stud profile into Bottom stud track, Raise Stud system and align to augmented projection. Fix bottom stud to slab with fixings appropriate to slab construction. Lift top stud assemblage to required height as indicated by augmented projection.

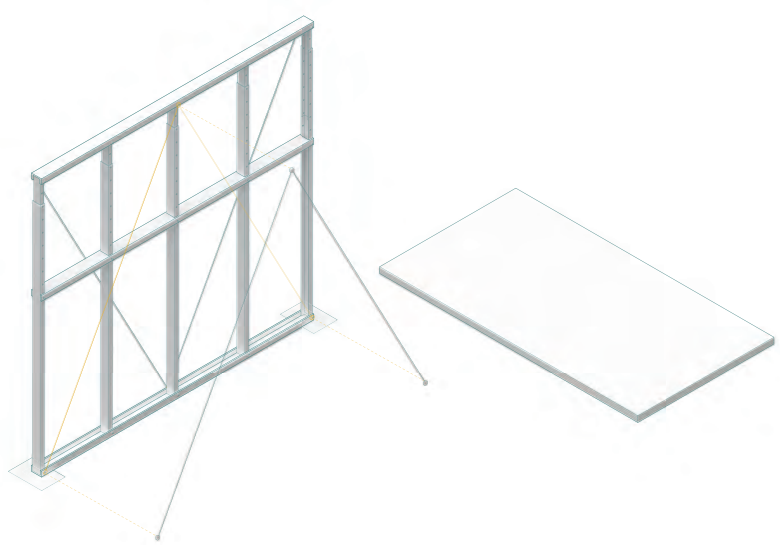


STEP 04:

Pin top and bottom stud profiles using provided nylon pins, once pinned, fix top rail to bottom of slab above using fixing appropriate to slab construction.

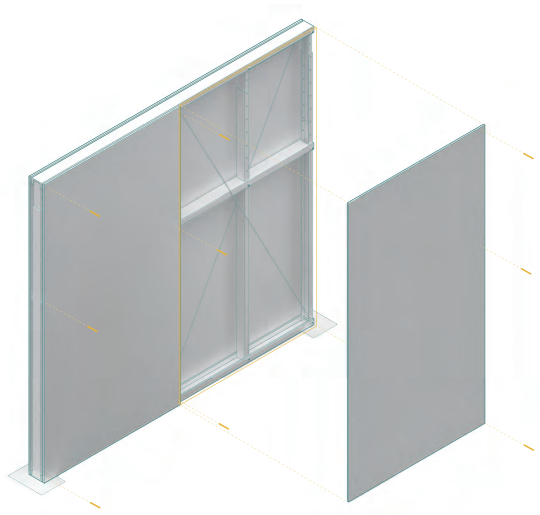


STEP BY STEP



STEP 05:

Attach nylon cord bracing to Stud pins at intermittent stud centers and attach using opposite pattern on alternate partition side. Bracing position to be informed by augmented projection.



STEP 06:

Attach cladding with Nylon screws aligned to Nylon pins, Location of pins to be informed by augmented projection through cladding system.

PROTOTYPING & CONCLUSION

This proposal also includes actual prototyping of a system rather that a conceptual framework. With substantial computation scripts to develop a system that could be deployed in today's industry and not just a futuristic fantasy.

Our proposal is by no means exhaustive but a potential outcome that explores how practitioners can explore both sustainable systems that promote upcycling as well as engaging in the next generation of documentation within augmented reality, closing the gap between documentation and on-site construction.

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