Design, Manufacturing and Analysis of Foldable Toilet Using Composite Material

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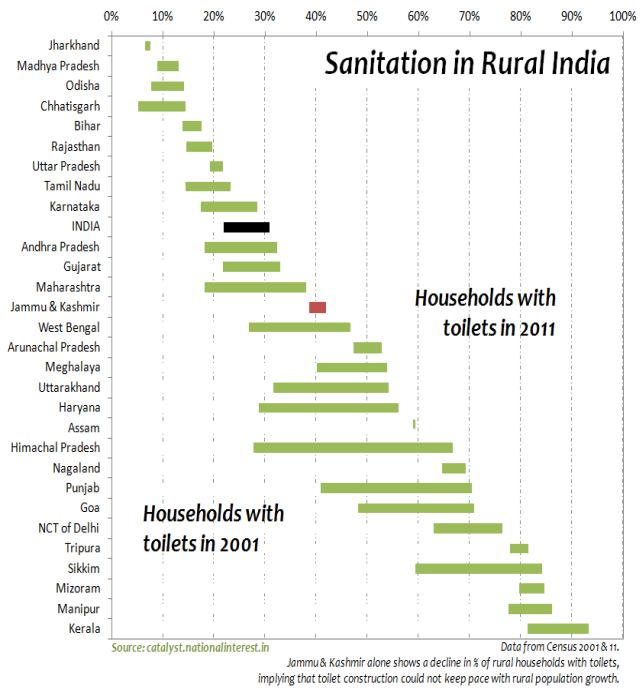
Abstract

In underdeveloped country like India there are many health problems occurs due to lack of cleanliness , sanitation , hygiene . Indian Government launches "Swaccha Bharat abhiyan". Under this project it is required to manufacture a huge volume of toilet structures that are cost efficient with less time required for manufacture . For which we proposed the foldable Toilet . Foldable Toilets that is easy to manufacture , light in weight , cost efficient as well compact and east to transfer . Above work describes about the concept of Foldable Toilet which is made from Composite Material.

Key Words :- Foldable Toilet , Composite Material

Introduction

In simple terms, a sanitation system is affordable to an individual or institution if they have the necessary financial or other resources with which to acquire it, and do not have higher priority uses for these resources. People on unacceptably low incomes cannot be expected to afford acceptable sanitation any more than they can afford acceptable clothing, food, and other commodities.. In practice, sanitation considered acceptable by authorities is not only unaffordable individually, but even collectively (i.e., even if the local public good problem could be overcome). Moreover, publicly funded sanitation providers often face their own affordability challenges, with mandated prices and coverage targets that are inconsistent with their revenues.



Problem Definition

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We need to built huge volume of toilets that are manufactured quickly from composite material ,easy to transport , light in weight and durable .

Literature Survey

Krushna Chandra Sahoo , Kristyna R.S. Hulland says While sanitation interventions have focused primarily on child health, women's unique health risks from inadequate sanitation are gaining recognition as a priority issue. This study examines the range of sanitation-related psychosocial stressors during routine sanitation practices in, India.

Stefan Dienera, Swaib Semiyagab, Ashley Murray studied that there is currently a lack of access to affordable sanitation in urban areas of Sub-Saharan Africa. Thisstudy evaluated the potential for resource recovery from innovative faecal sludge treatment processesto generate a profit that could help sustain the sanitation service chain.In urban areas of Sub-Saharan Africa, 80% of existing sanitationaccess is met by onsite technologies, and the sludge that accumu-lates in these systems is referred to as **faecal sludge** .

Chirjiv K. Anand, Defne S. Apul proposed that in today's flush based urban sanitation systems, toilets are connected to both the centralized water and wastewater infrastructures. This approach is not a sustainable use of our water and energy resources. In addition, in the U.S., there is a shortfall in funding for maintenance and upgrade of the water and wastewater infrastructures. The goal of this paper was to review the current knowledge on composting toilets since this technology is decentralized, requires no water, creates a value product (fertilizer) and can possibly reduce the burden on the current infrastructure as a sustainable sanitation approach.

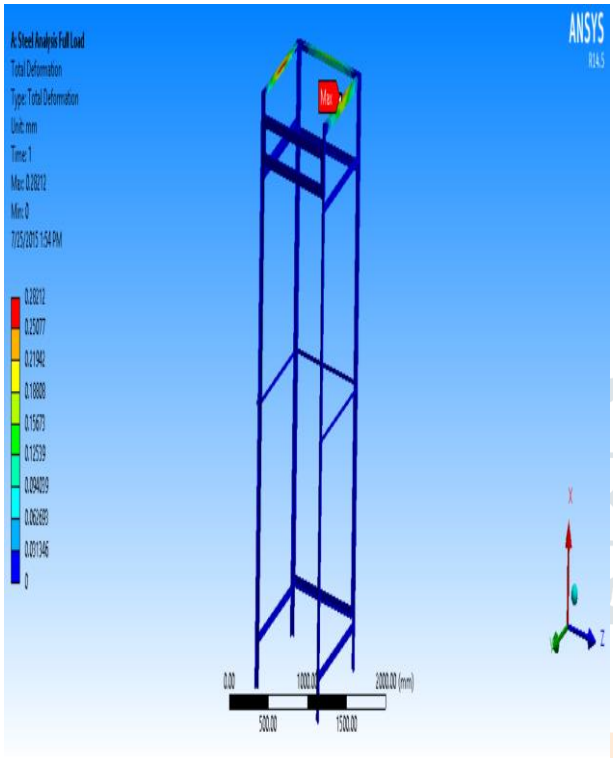
Phillips Petroleum chemists J. Paul Hogan and RobertL.Banks They first polymerized propylene in 1951. Many objects are made with polypropylene precisely because it is resilient and resistant to most solvents and glues. Also, there are very few glues available specifically for gluing PP. However, solid PP objects not subject to undue flexing can be satisfactorily joined with a two part epoxy glue or using hot-glue guns. Preparation is important and it is often helpful to roughen the surface with a file, emery paper or other abrasive material to provide better anchorage for the glue.

Experimental Method :-

1. **Material for Frame of Toilet :-**
   For selection of the material for frame of toilet it requires the properties such as it should be easily

available , easy to transport , recyclable , light in weight , durable & cost efficient. The material selected is **Mild steel** which have above properties & specification as :-

Youngs Modulus E : 210 GPa
Density : 7850 Kg/m^3
Poissions Ratio : 0.303
Ultimate tensile strength : 380 Mpa
Strength to weight ratio : 48.4 (KN-m/kg



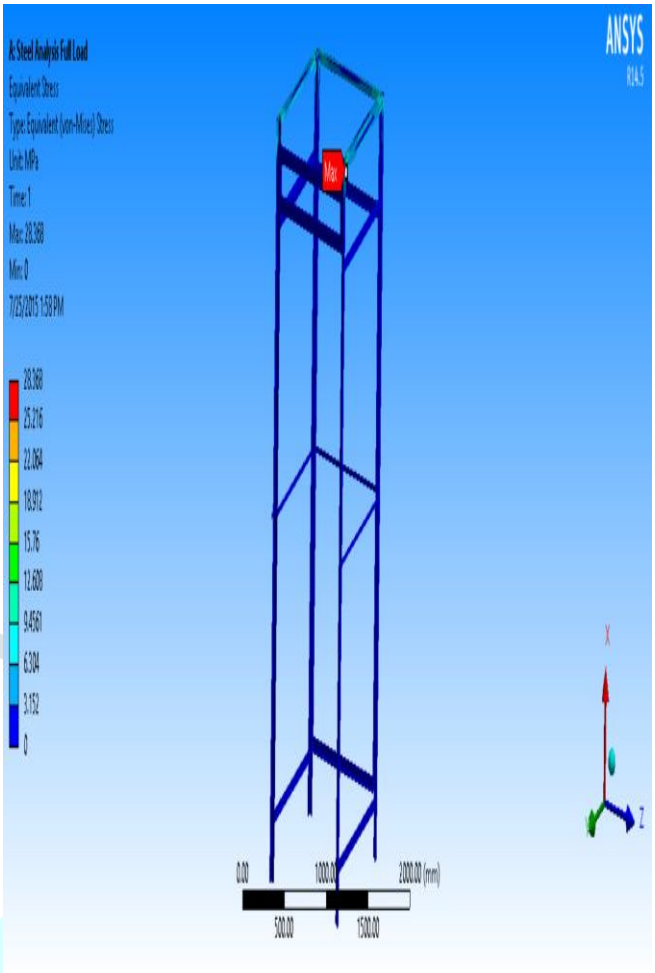
Deformation of frame Structure under waterTank

2.Material For side wall of Toilet:-

For selection of material of side wall of toilet it requires properties such as :-

- It should be light in weight.
- It should be easily processable
- It should be recyclable.
- It should be durable.
- It should be corrosion resistant.
- It should be easily available.
- It should be cost efficient.

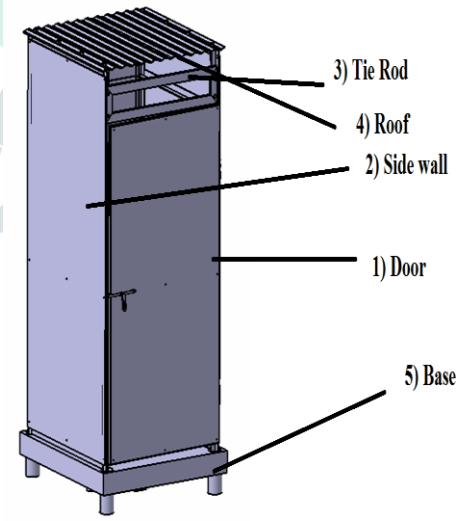
Based on above properties Material selected for Side wall is **Polypropylene** in the form os sheets.



Von-Mises stress for frame structure under water tank load

Three models are developed according to preference and use.

Toilet 1.

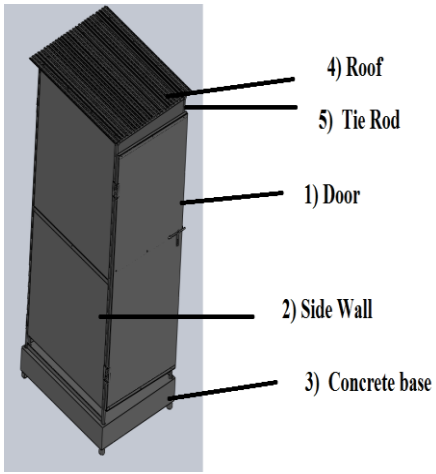


It having few limitations such as :-

1. More weight.
2. More peoples required to fit assembly.
3. More time required for manufacturing.
4. Cost is more.
5. Transportation is costly.

Hence second second Toilet assembly is proposed.

Toilet 2 :-

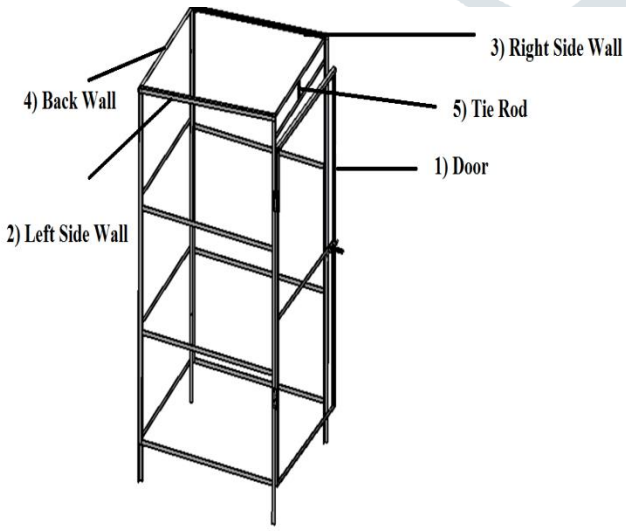


It also having few limitations such as :-

1. Sagging occurs at one end.
2. Gap remains in assembly
3. Assembling process takes time.

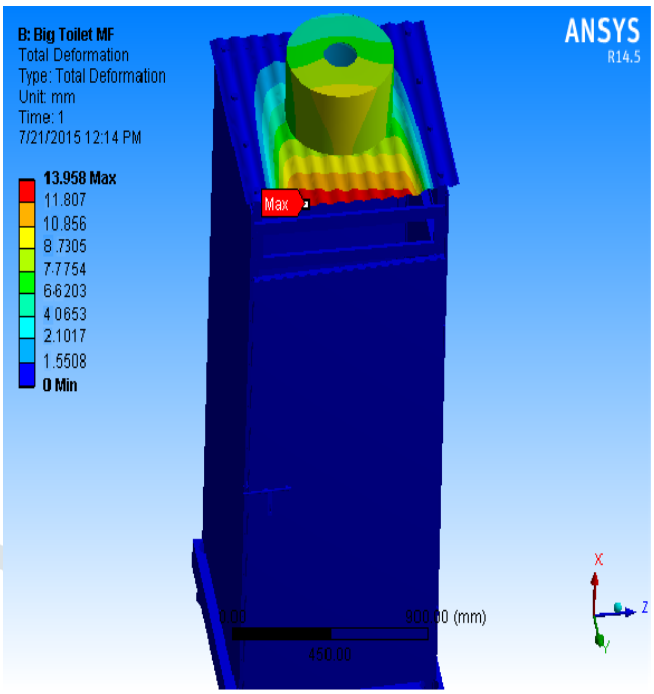
Hence again third toilet is proposed which overcomes the limitations of above two toilets and the frames are tapered.

Toilet 3 :-

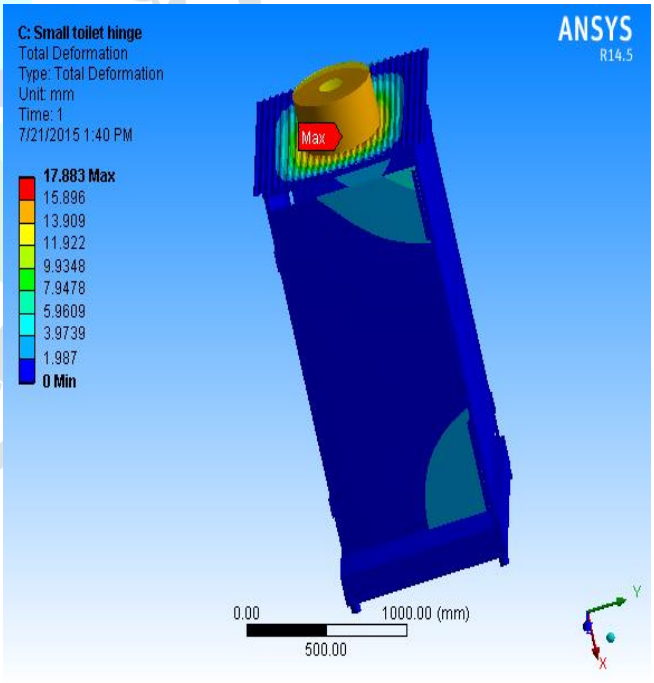


Software Analysis by Using Ansys :-

Toilet 1 under Water Tank Load :-

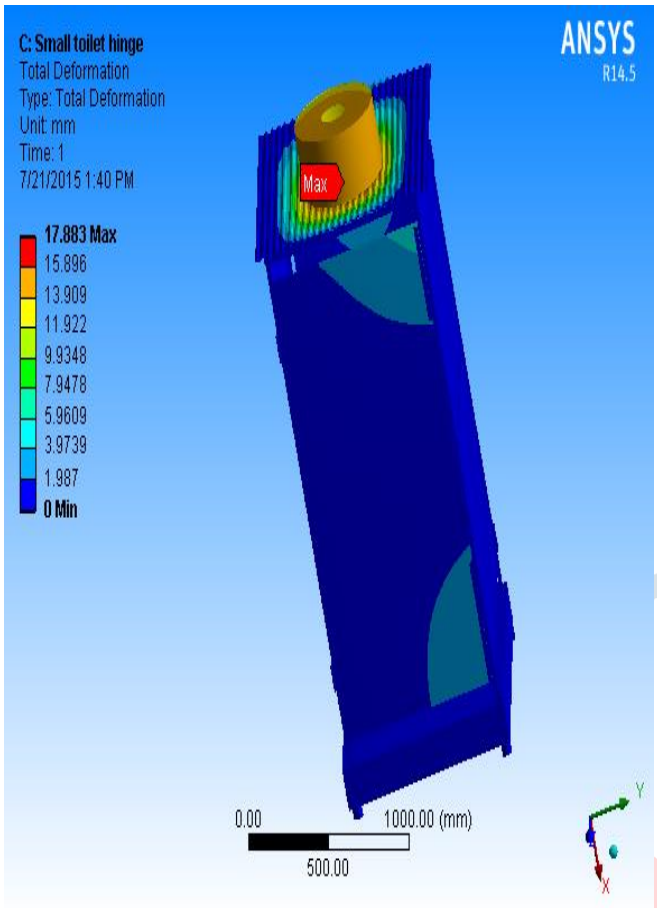


Deformation of Toilet 1 Under Water Tank



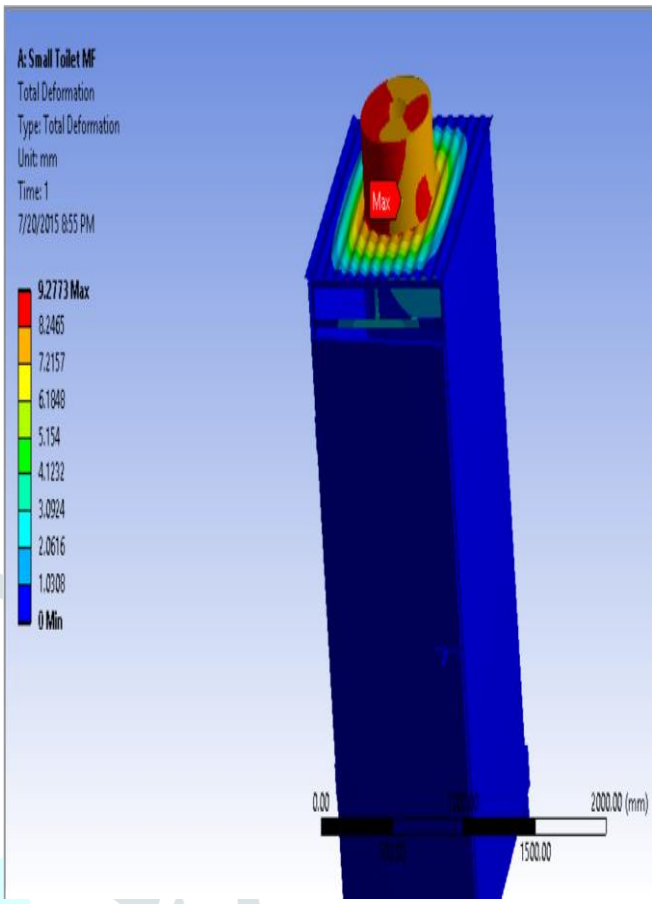
Equivalent Stress in Toilet 1

Toilet 2 Under Water Tank Load

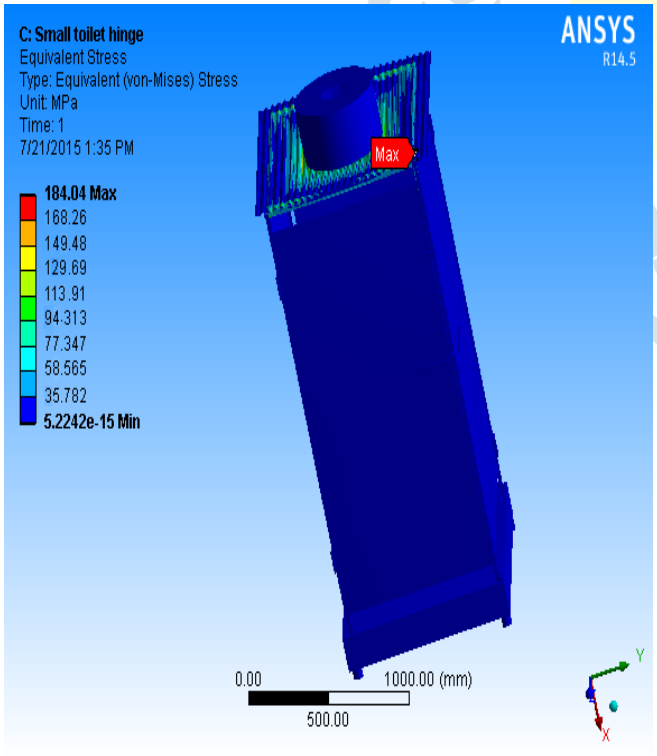


Deformation of Toilet 2 Under Water Tank

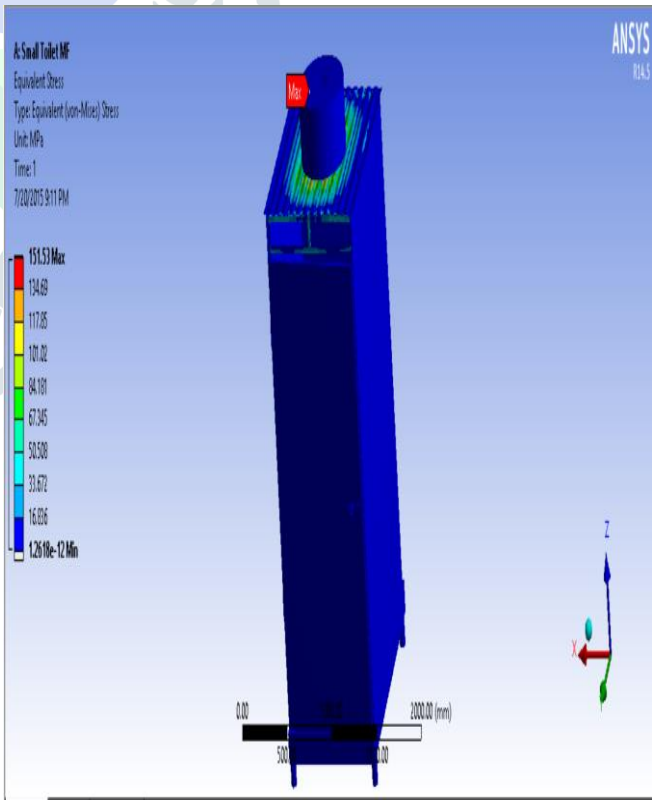
Toilet 3 under Water Tank Load :-



Deformation of Toilet 3 Under Water Tank



Equivalent Stress in Toilet 2



Equivalent stress in Toilet

Result of Software Work for all Toilets

Toilet	Water TankLoad (N)	Maximum Stress (MPa)	Maximum Deflection (mm)
Toilet 1	**510**	**182.4**	**13.95**
Toilet 2	**510**	**184.04**	**17.88**
Toilet 3	**510**	**151.53**	**9.27**

Conclusion

1.From above result table it is clear that Toilet 3 have least maximum deformation & equivalent stress hence it is more appropriate to use it.

2. Foldable Toilets are very useful for mass production of toilets to solve problem of sanitation as they are light in weight , manufactured quickly and cost efficient.

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