

# Design and Fabrication of Beach Sand Cleaning Machine

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**Abstract:** Beach sand cleaning machine work by collecting sand by the way of a scoop or drag mechanism and then raking or sifting anything large enough to be considered as foreign matter, including sticks, rubbish, wrapper, polyethene, etc. in to the bucket or storage tank. Similar this machine is also used at lake beaches, private sand fields, kinder garden, and sports playing field sandpits. The main purpose of this machine is to separate garbage from sand and collect that garbage in the bucket to make that area comfortable and visually pleasing for peoples. This machine is manually operated by pushing the machine in the direction of cleaning. The machine required manpower to operate.

**Keyword:** scoop or drag mechanism, raking or sifting, manually, manpower.



## 1. INTRODUCTION

Beach cleaners are machines that remove unwanted materials from beaches and make them comfortable and visually pleasing for beach goers. Various beach cleaners can be used to effectively remove litter, sharp shells, glass, rock, and excessive seaweed from the beaches. Beach cleaners also come in all shapes and sizes. The most popular kinds are tractor-towed and powered by a tractor's hydraulic PTO shaft. Smaller walk-behind models are also manufactured for private beaches and sandy areas.

### 1.2 Beach Cleaner Methods of Cleaning

Most popular beach cleaning machines today employ one of two prominent methods: mechanical raking or sifting (screening)

1. Mechanical Raking Beach Cleaners
2. Sifting Beach Cleaners
3. Combination raking and sifting

#### 1.2.1 Mechanical Raking Beach Cleaners

Beach cleaners that employ sifting technology use a cutting edge to lift all the sand on the beach on to a vibrating screen. The screen then sifts the unwanted materials from the sand, while the sand returns to the beach and the remaining debris is deposited in the bucket.

#### Mechanical Raking's strengths are as follow:

- **Versatility:** Of all available styles of beach cleaners, mechanical raking technology is the most versatile, as it is able to remove large beach debris, in addition to smaller items, like cigarette butts and bottle caps. Driftwood, buckets, large boxes, excessive seaweed, and full garbage bags can easily be removed, as well. It is the best "well-rounded" beach cleaner option available.
- **Speed:** Beach cleaners that employ mechanical tine raking are typically able to clean at much faster speeds than sifters or screeners, because they remove the materials directly from the sand instead of first removing the sand from the beach, passing it through screens to filter the materials, and then returning the sand to the beach.
- **Tideline Cleaning:** Beach cleaners with mechanical raking function optimally in wet sand.

#### 1.2.2 Sifting Beach Cleaners

Beach cleaners that employ sifting technology use a cutting edge to lift all the sand on the beach on to a vibrating screen. The screen then sifts the unwanted materials from the sand, while the sand returns to the beach and the remaining debris is deposited in the bucket.

Sifting technology is practiced on dry sand and soft surfaces. The sand and waste are collected via the pick-up blade of the vehicle onto a vibrating screening belt, which leaves the sand behind. The waste is gathered in a collecting tray which is often situated at the back of the vehicle. Because sand and waste are lifted onto the screening belt, sifters must allow time for the sand to sift through the screen and back onto the beach. The size of the materials removed is governed by the size of the holes in the installed screen.

**1.2.3 Combined raking and sifting**

Combined raking and sifting technology differ from pure sifters in that it uses rotating tines to scoop sand and debris onto a vibrating screen instead of relying simply on the pick-up blade. The tines' position can be adjusted to more effectively guide different-sized materials onto the screen. Once on the screen, combined raking and sifting machines use the same technology as normal sifters to remove unwanted debris from the sand.

**1.2.4 Use of beach cleaning machine**

- Municipalities
- Resorts
- Contractors

**1.2.5 Advantages**

- It takes less working time as compare to hand picking of garbage.
- Manpower require is less.

**1.2.6 Disadvantages**

- Machine cost is very high.
- High maintenance cost.

**2. REVIEW OF LITERATURE**

SR.NO.	Title	Author/Journal/Year	Conclusion
1	MACHINES FOR CLEANING SAND BEACHES	H.S.BARBER (Jan. 9, 1968)	Mechanism is taken as reference as per the pattern represented by "H.S.BARBER".
2	TINE RAKING DEVICE	John.H.Barber James.P.Barber (May 31, 2007)	Design of brush is taken as reference.
3	TRACTOR DRAWN GROUND SWEEPER	Donald K. Kratzer (Dec. 30, 1980)	Working mechanism is taken as reference.
4	A beach cleaning	Gilmour, Richard (1976)	Conveyor mechanism is

	apparatus		taken as reference.
5	Design And Fabrication Of River Cleaning Machine	Dr. Akash Langde (11/NOVEMBER/2017)	Conveyor belt mechanism is taken as reference.
6	Design and Construction of Beach Cleaning Trailer by Finite Element Method	Sakda Intaravichi (Apr 18, 2012)	Analysis of the design is dose as reference to this paper.

**3. DESIGN, ANALYSIS AND WORKING**



- Design of beach sand cleaning machine is done in "Solid works". Dimensions are 600mm length, 500mm high, 300 mm width and 250mm working width.





Study Results

Name	Type	Min	Max
Stress	VON: von	6.656e+03	1.392e+07
	Mises Stress	N/m <sup>2</sup> Node: 14547	N/m <sup>2</sup> Node: 13763
Displacement	URES:	0.000e+00	8.560e-02
	Resultant Displacement	mm Node: 398	mm Node: 1658
Deformation	Deformed shape		
Factor of Safety	Max von	6.933e+00	1.450e+04
	Mises Stress	Node: 13763	Node: 14547

- Analysis of the brush is done in solid works as per the load acting on the brush. We have assumed maximum 5N load acting on the brush as per the survey. As per the outcomes of the analysis the brush withstands the load occurs on the brush and conclude that the design is safe.

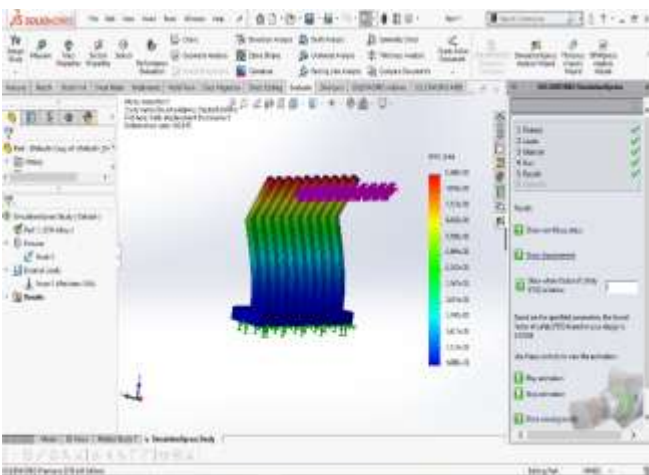
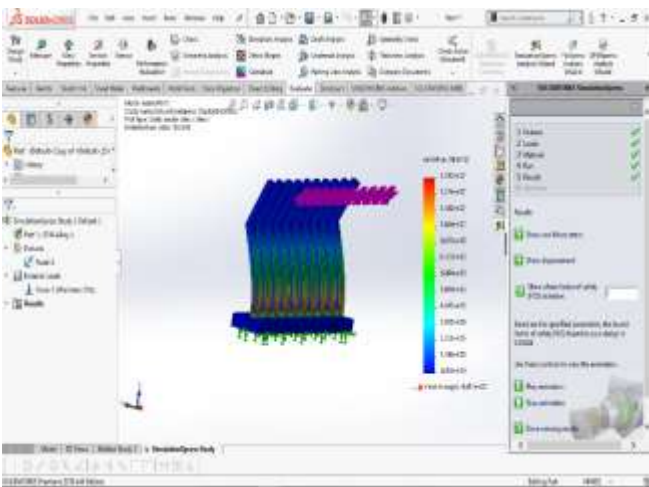
**Working:** The beach cleaner's mouldboard levels uneven areas in the sand to ensure an even surface for cleaning and controls the cleaning depth. It also guides the machine over large submerged objects, which protects the conveyor system and promises low-maintenance operation for the duration of the beach cleaner's life. Individually replaceable stainless-steel tines mounted on a belt-covered bar flight conveyor then rake debris from the sand toward the adjustable mouldboard deflector plate, removing surface and submerged debris with ease. As a result, refuse bounces off the beach cleaner's deflector mouldboard and is deposited on the elevating portion of the conveyor, which transports the garbage to the hopper, while residual sand fall. Finally, the garbage falls in the hopper/bucket, and the sand is cleaned.

4. CONCLUSION

It is an eco-friendly machine because it has no motor and battery. Sand cleaning machine is manually operated machine which required small effort or machine can be dragged by tractor also.

REFERENCES

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Material Properties

Name	2014 Alloy
Model type:	Linear Elastic Isotropic
Default failure criterion:	Max von Mises Stress
Yield strength:	9.65098e+07 N/m <sup>2</sup>
Tensile strength:	1.65445e+08 N/m <sup>2</sup>

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