



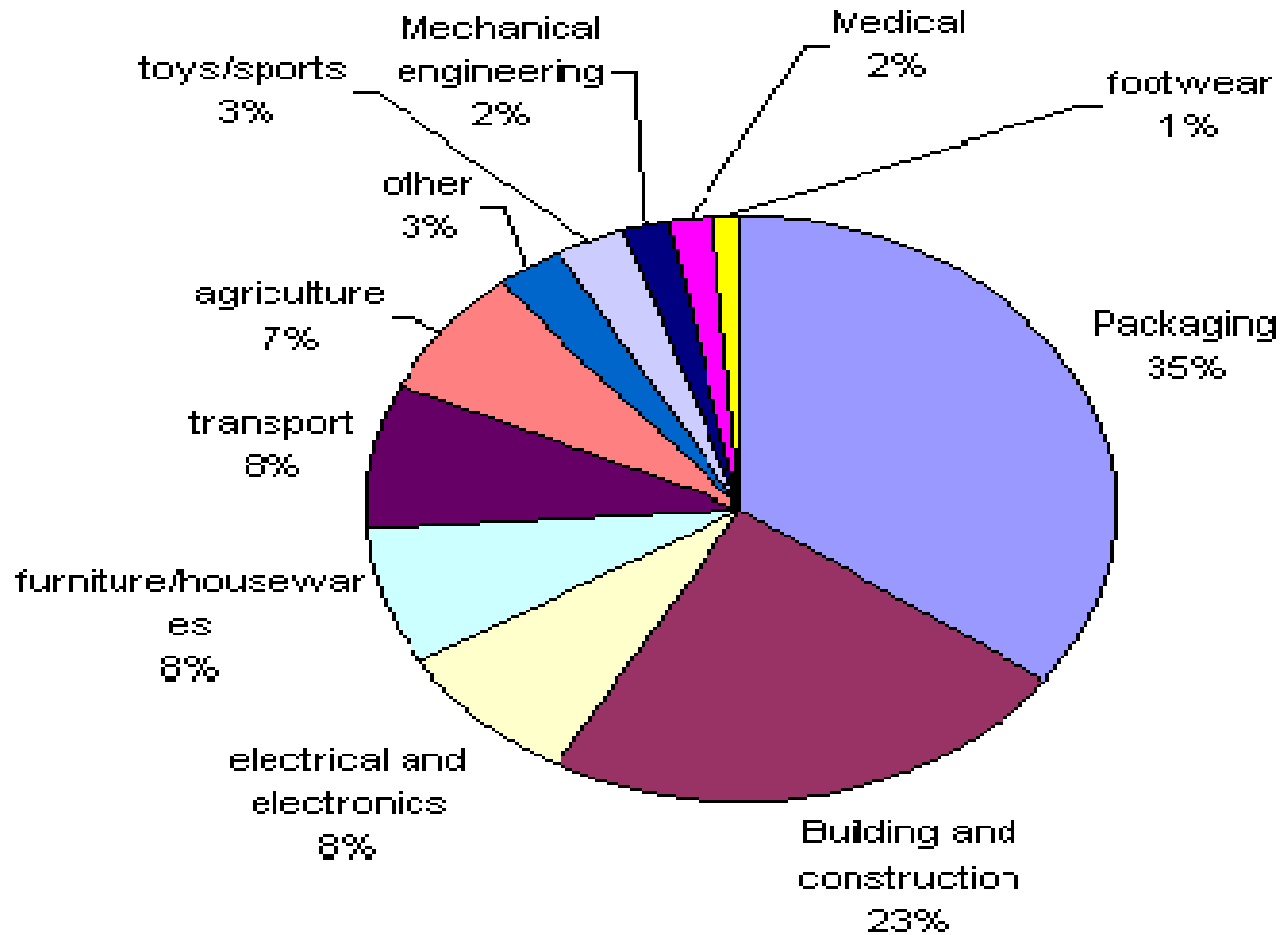
IE

Journey of Plastic : Waste to Bituminous Road

Plastic is Reshaping
Road Construction
in India

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CSIR-Central Road Research Institute
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Uses of Plastics - Statistics





EFFECT OF PLASTICS ON ENVIRONMENT!!!



Nainital



Chennai Beach



Delhi



Northeast



Solution



CAN WE AFFORD THIS?

WE CAN SURELY DO THIS?

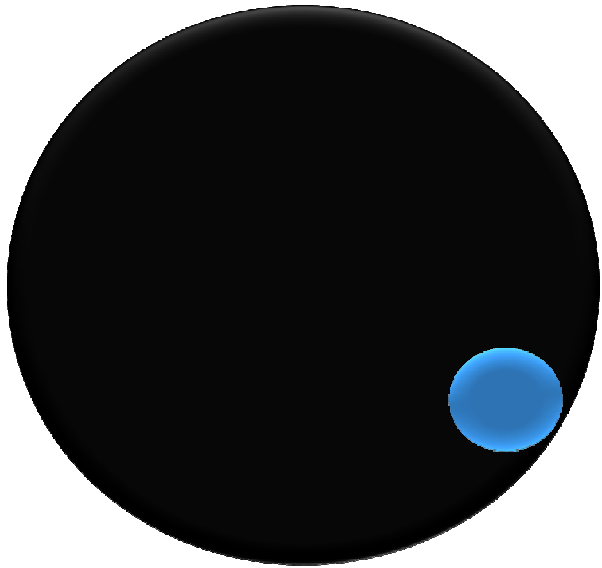


The BIG Picture

MSW 200,000 mtpd

Plastic 15,300 mtpd

(8%)



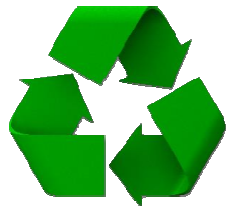
(8%)

6000

9300

food packaging
grocery bags

Pet bottles Caps
Milk Packets



3%





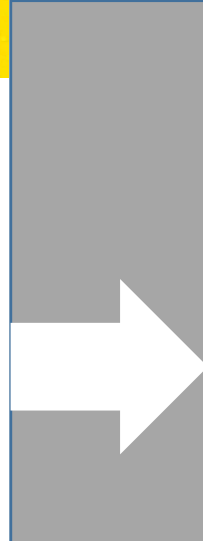
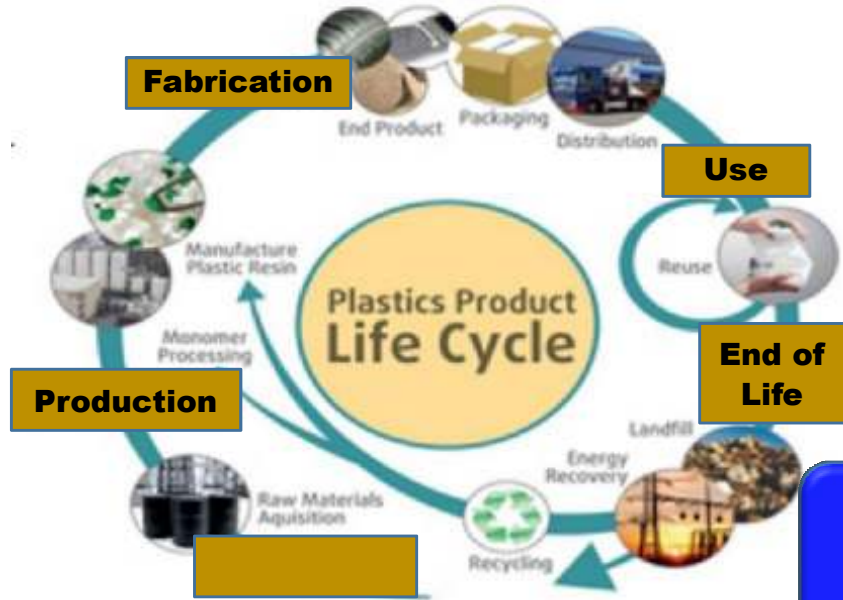
● 3%

70-80% of the **MSW** in volume

MAKE INDIA

SWACHH
BHARAT
ABHIYAN

CLEAN INDIA



This is the
Solution...

SOCIAL

LOGICAL

ECONOMICAL



Our roads



Solution



expensive

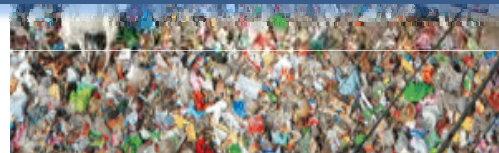
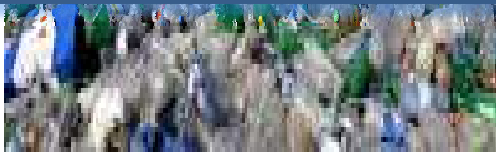
Bitumen/ bituminous mix modification

Polymer Modified Bitumen



Burying plastic forever into roads is the safest

We are going to be generating waste plastic, and we are going to be building roads for the foreseeable future. Then why not use it efficiently in road building



THE PROCESS

SEGREGATION

- Plastic waste collected from various sources must be separated from other waste
- Maximum thickness of 60 microns.



CLEANING PROCESS

- Plastic waste get cleaned & dried



SHREDDING PROCESS

- The plastic waste will be shredded or cut into small piece.
- The different types of plastic wastes are mixed together



COLLECTION PROCESS

- The plastic waste retaining in 2.36 mm is collected.



Type of Plastics to be Used

Examples of flexible packaging	Recommendation for use in wearing course
Flexible pouches/stand-up pouches/zip-lock pouches/ heat-sealed bags made from multi-layer packaging (MLP) films or single layer/ transparent packaging (SLP) films that are used to package food items, clothes, personal care and daily-use products, etc.	Recommended
Flexible carry bags, shopping bags, non-woven bags, trash bags	Recommended except for black bags/films.
Courier bags, bubble wrap films, air-bubble pouches, gift wrap films, big bag liners, agricultural mulch films	Recommended
Stretch film for wrapping pallets/boxes, shrink-wrap films for wrapping boxes	Recommended
Flexible labels of bottles, containers	Recommended only if they are not made from PVC
Products such as file covers, folders, diary covers, flexi-posters, mobile covers, electrical insulation tapes, adhesive tapes, confectionary twist wrap, photo album covering films, playing cards	Not recommended since PVC and/or high melting polymers are widely used to manufacture these items
Pharmaceutical strips for drugs/blister packaging	Not recommended since PVC is widely used to manufacture these items

WASTE PLASTICS COATED AGGREGATE- BITUMEN MIX

AGGREGATES $\xrightarrow{170\text{ }^{\circ}\text{C}}$ **HOT AGGREGATES**



**Waste
plastics**

**POLY.COATED
AGGREGATES**

**HOT
BITUMEN
160 $^{\circ}\text{C}$**

**POLYMER-BITUMEN -
AGGREGATES MIXTURE**



LABORATORY STUDY AT CRRRI

Materials Used for the Study

- Aggregate of 20mm, 10 mm, Stone Dust and Lime as Filler
- VG-30 grade bitumen
- Waste plastic in the shredded form



Mix Design by Marshall Method

- Grading and proportioning of aggregates
- Preparation of Marshall samples at varying bitumen content
- Testing of samples for bulk density, Marshall stability, flow and air voids
- Arriving at optimum bitumen content
- Verifying the Stability values with specified limits

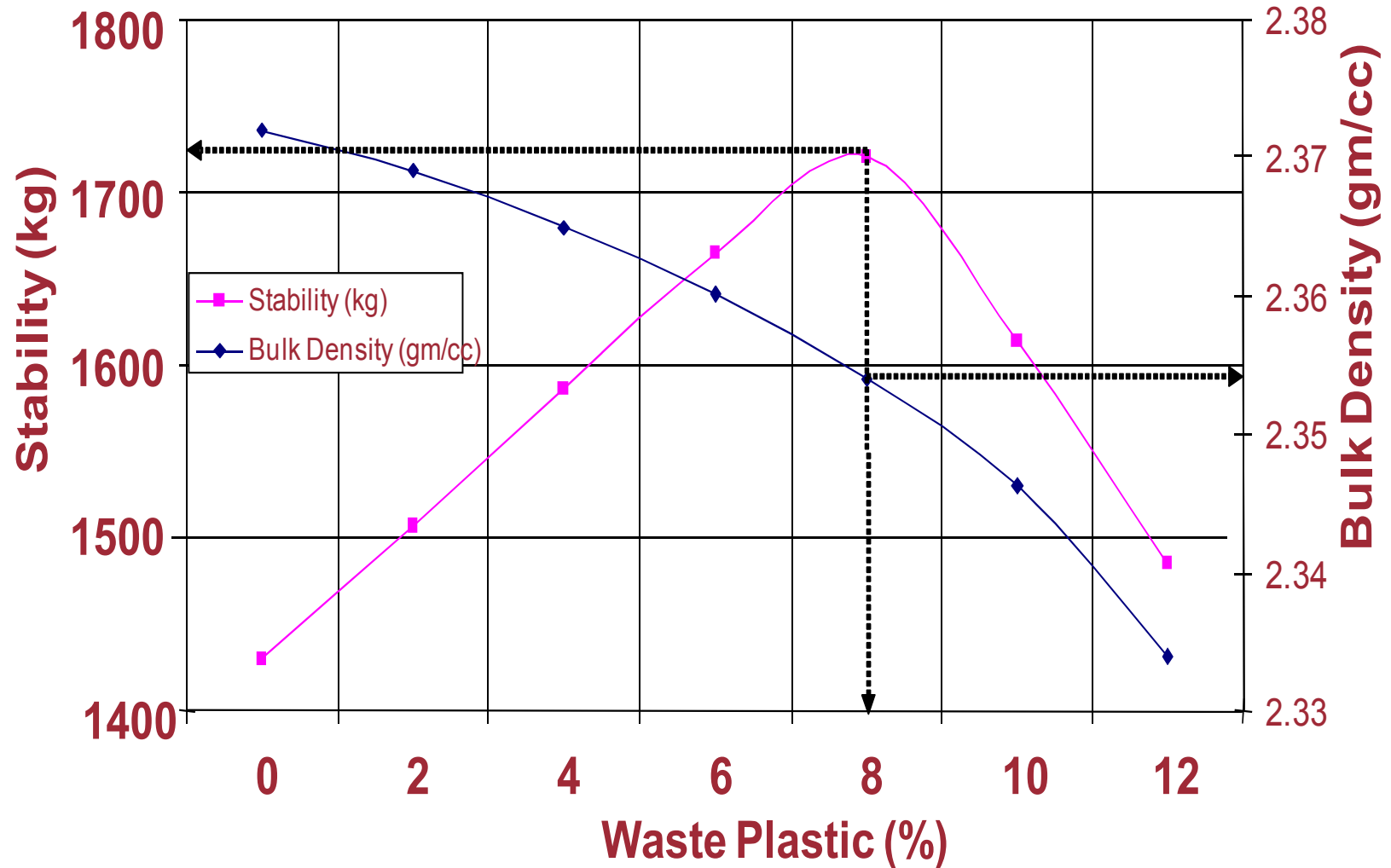


Auto Marshall Compactor

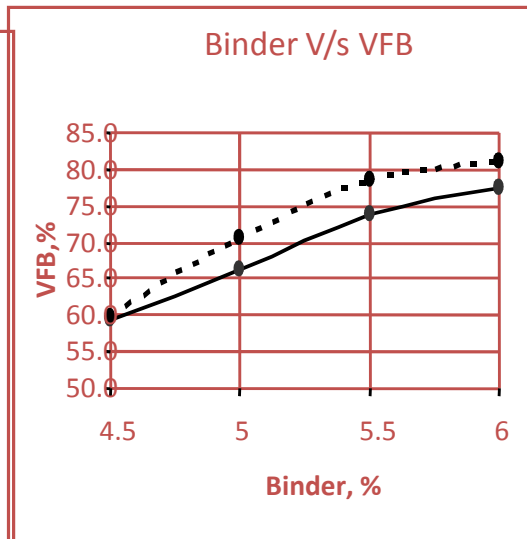
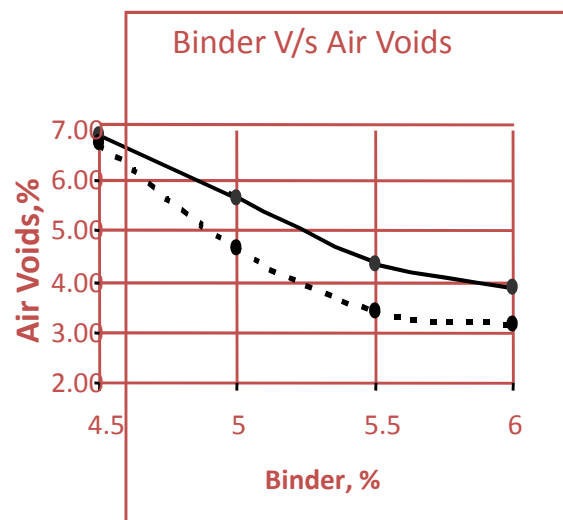
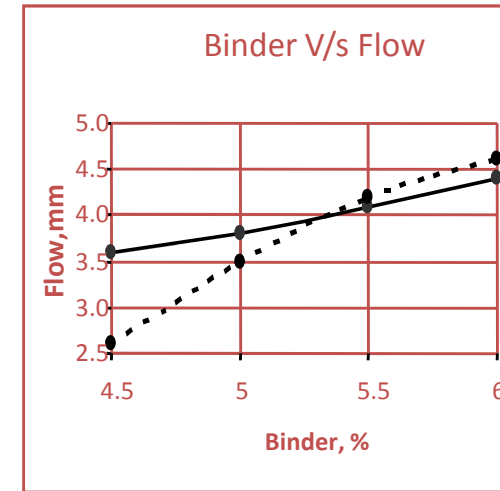
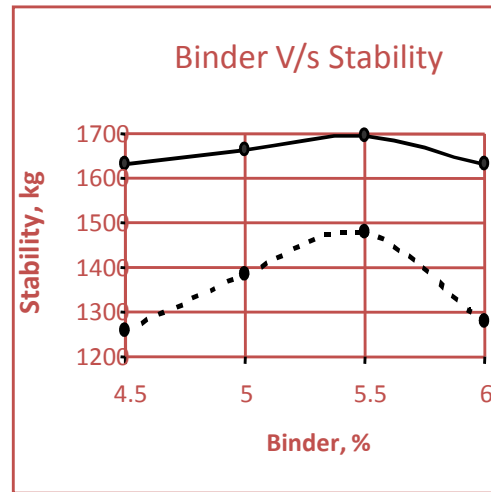
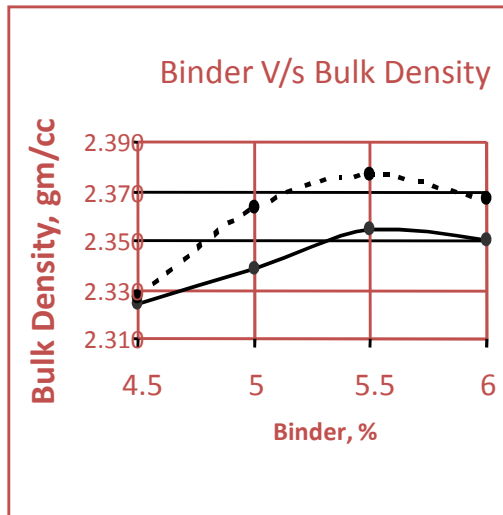


Auto Marshall Tester

Optimum Waste Plastic Content



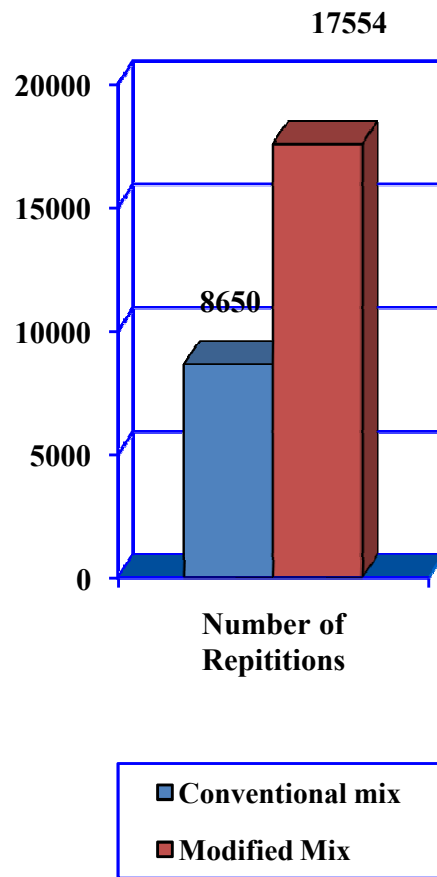
Comparison of Two Mixes



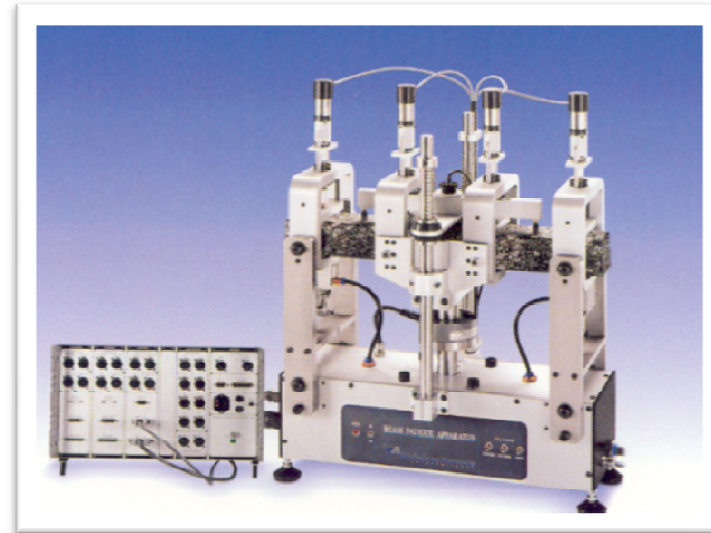
— *With Waste Plastics*

- - - *Without Waste Plastics*

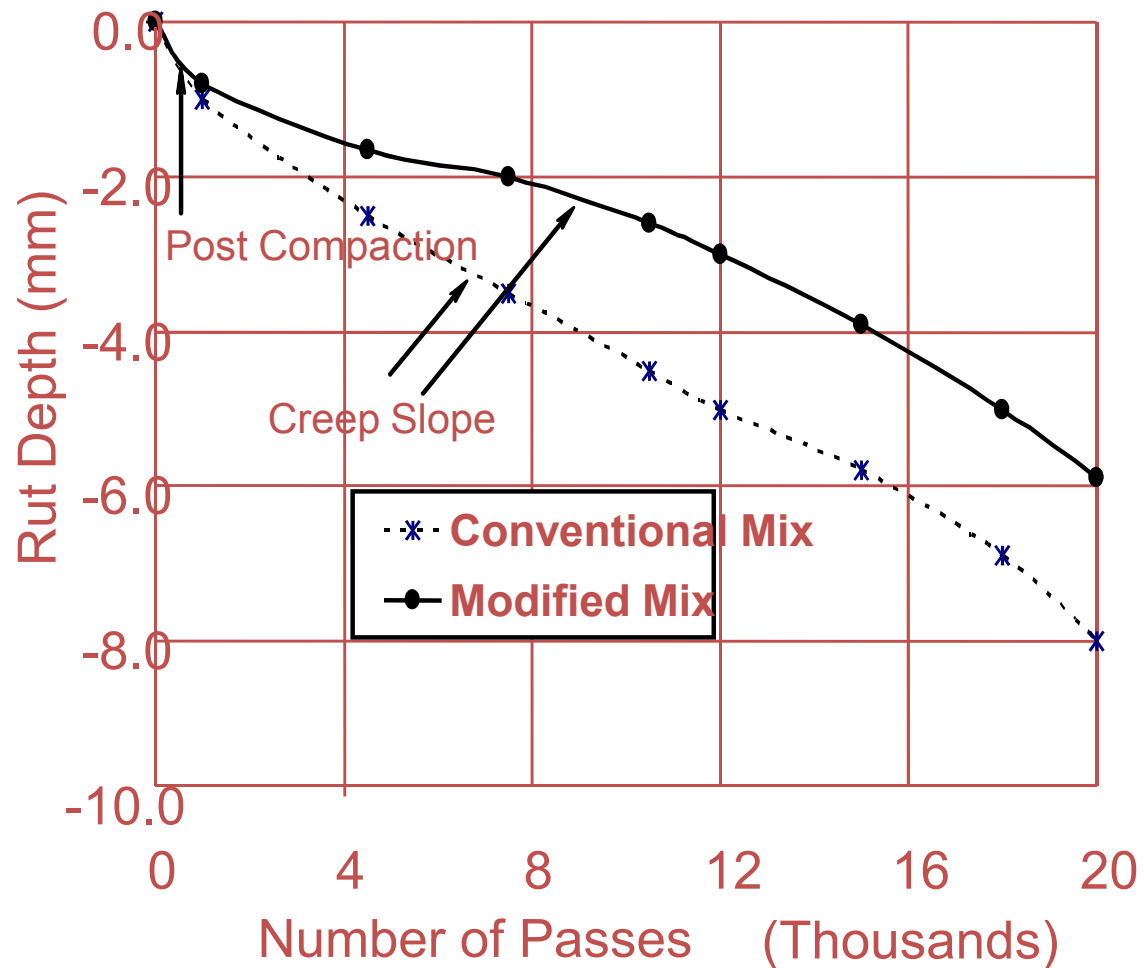
Fatigue Behavior of the Mixes



Fatigue equipment



Hamburg Wheel Track Test



Beam specimen after rutting test

Plastic Road Construction Work in HP





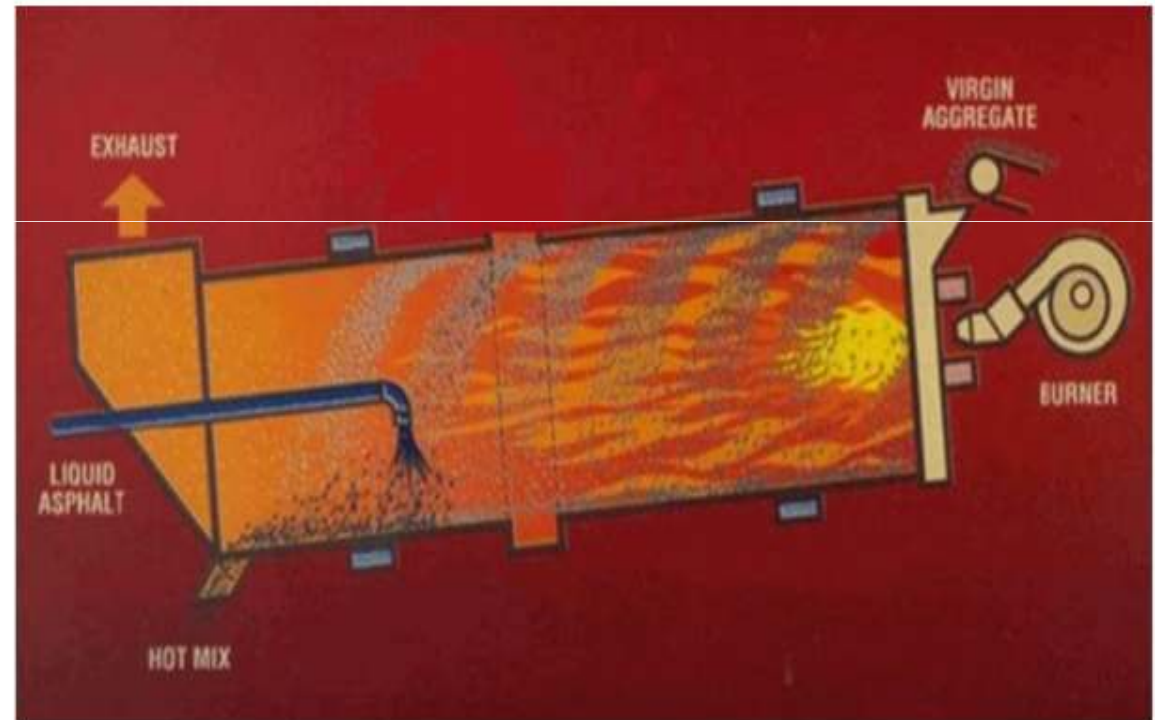








Parallel Flow Drum mix plant



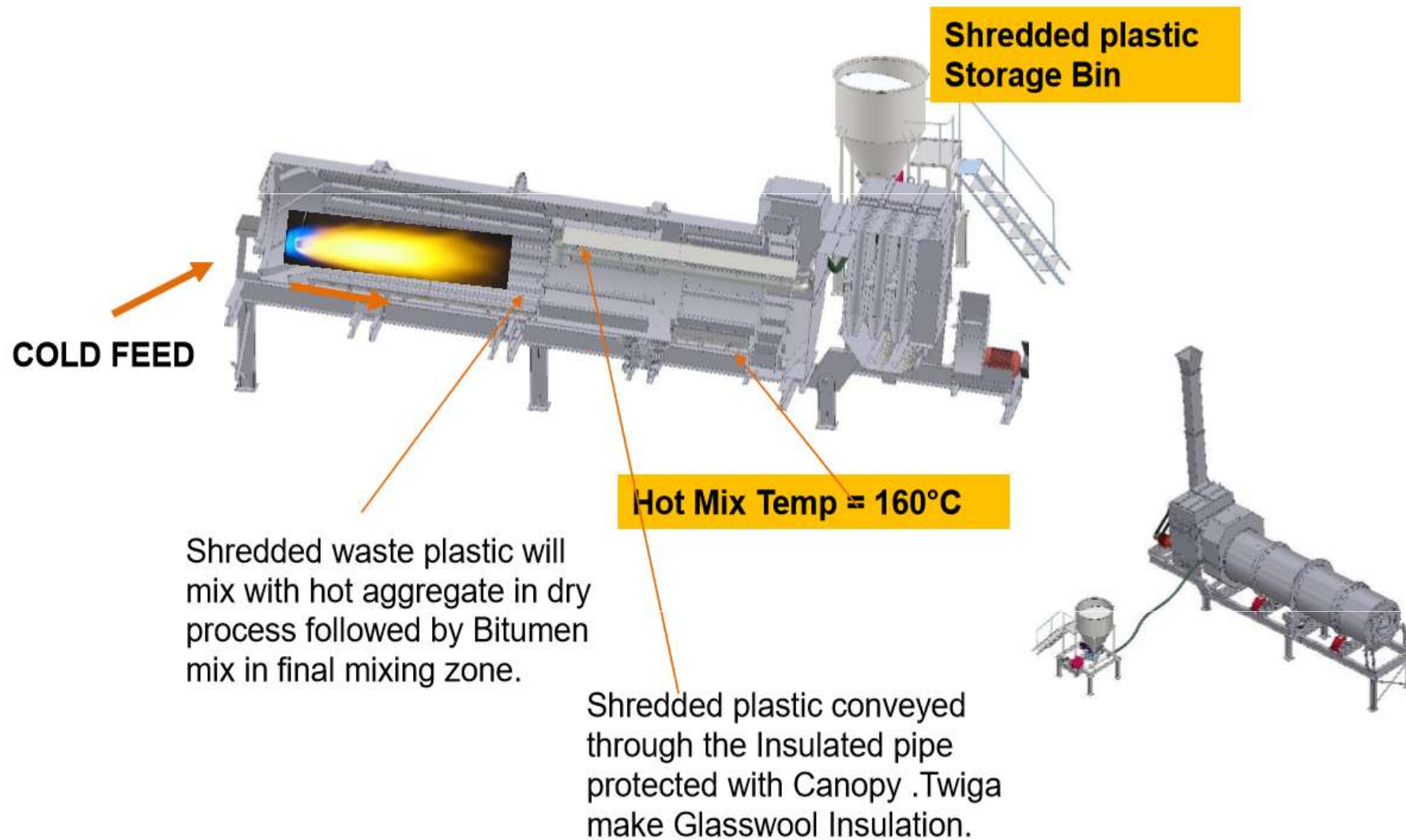
CONCERNS

High consumption of energy due to parallel flow of heat exchange

Limitation in use of Waste plastic: uneven mixing and coating of aggregate

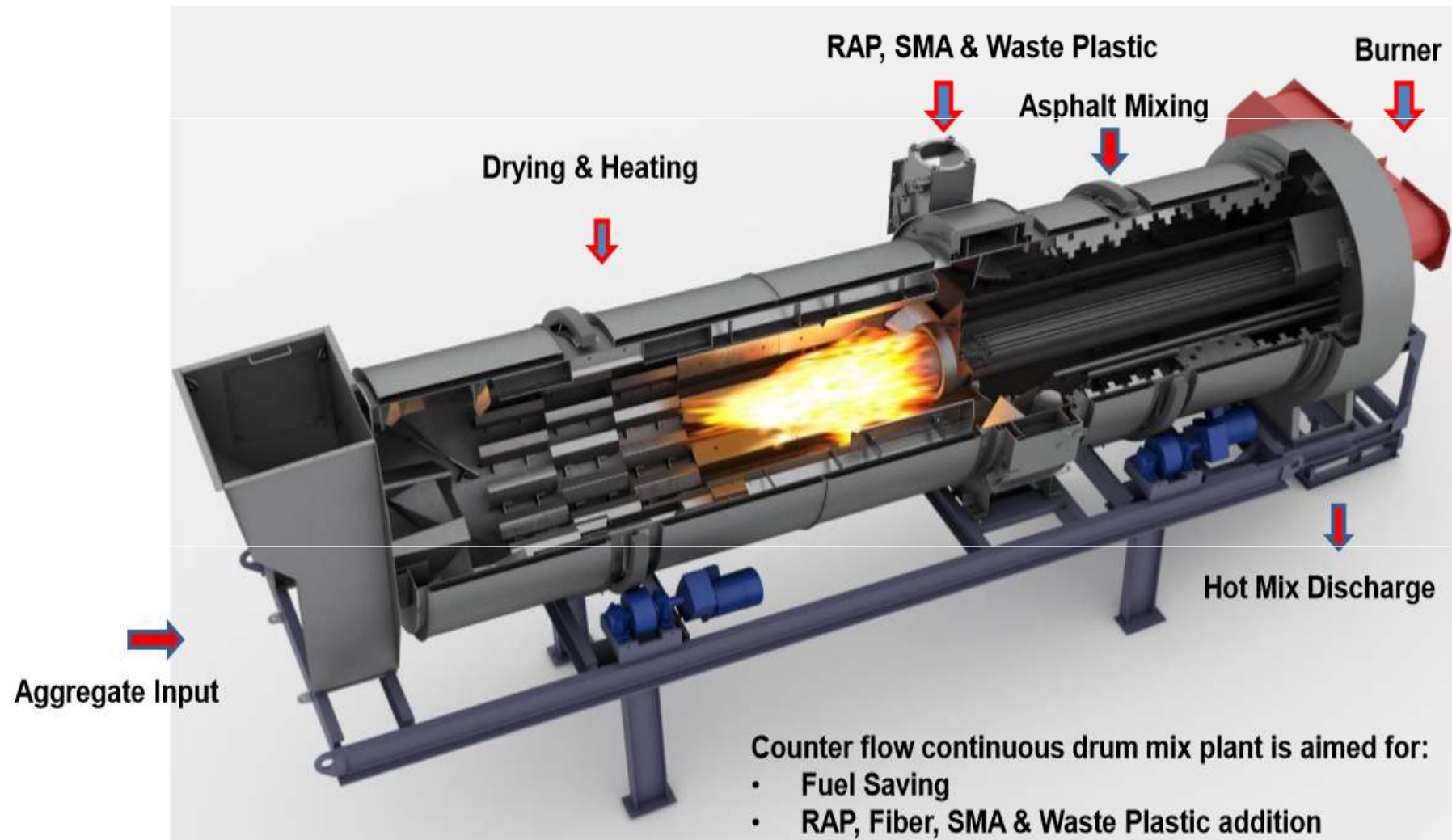
Chances of plastic degradation

Option 1: Parallel Flow Drum Mix Plant



Option2

Counter Flow drum mix plant with use of Waste Plastic



Plastic Roads

This innovative way of constructing roads with plastic waste will lead to :

- **Effective Waste Plastic Disposal**
- **Reduce the environment pollution**
- **Employment generation for rag pickers**
- **Increase the life span of roads**



Hurdles

- Waste management system
- Waste collection and segregation system
- We need to learn civilization /enforcement

From this



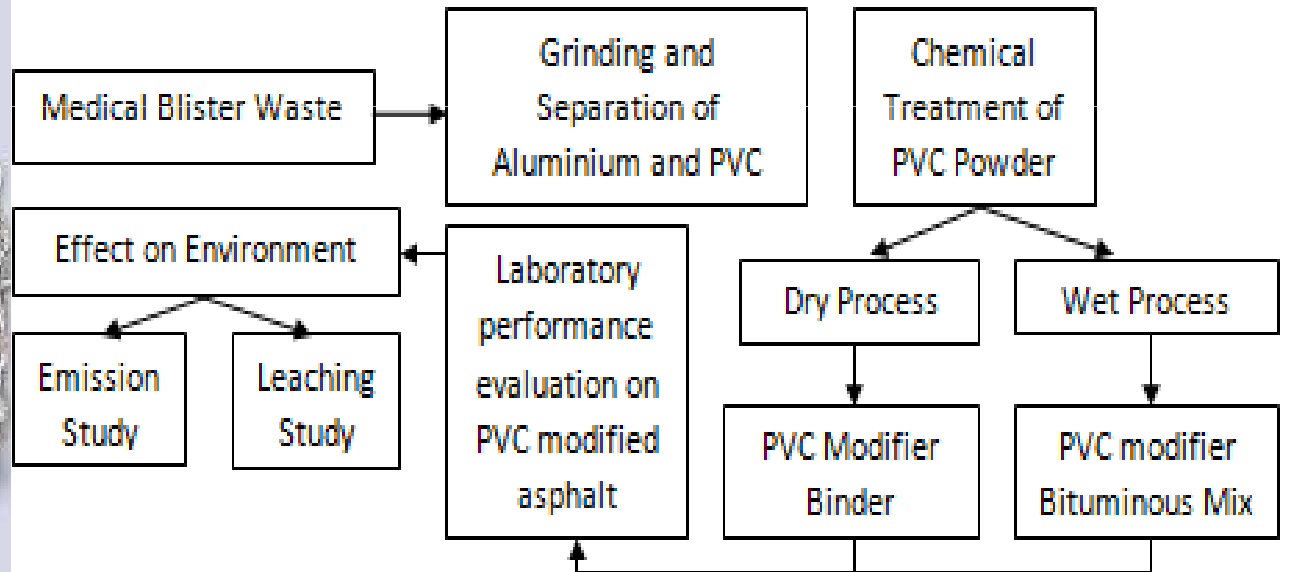
To this



Medical Waste : medicine blisters



- 2 billion pounds of such waste is discarded every year
- Main components are aluminium and plastics
- Crushed to powder: Aluminium is separated by electrostatic method
- Aluminium is then recycled & sold to alloy manufacturers





Thank you for your kind attention!

<https://scholar.google.co.in/citations?hl=en&user=ulRAMG0AAAAAJ>

https://www.researchgate.net/profile/Ambika_Behl