Patent : Single Line Ducox Operation

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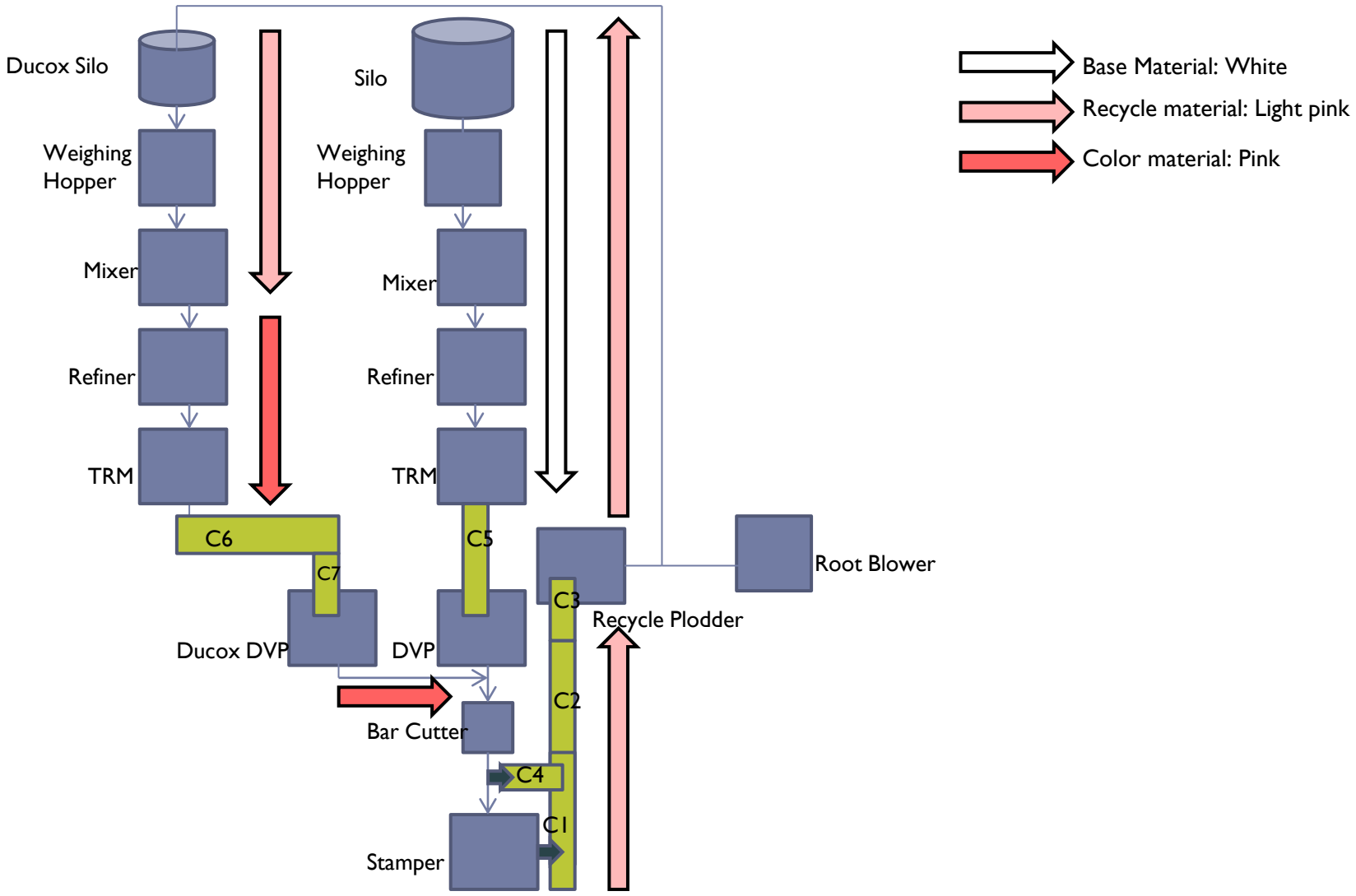
Objective

Objective : To run and stabilize the commercial production of Ducox operation on **self contained single line**.

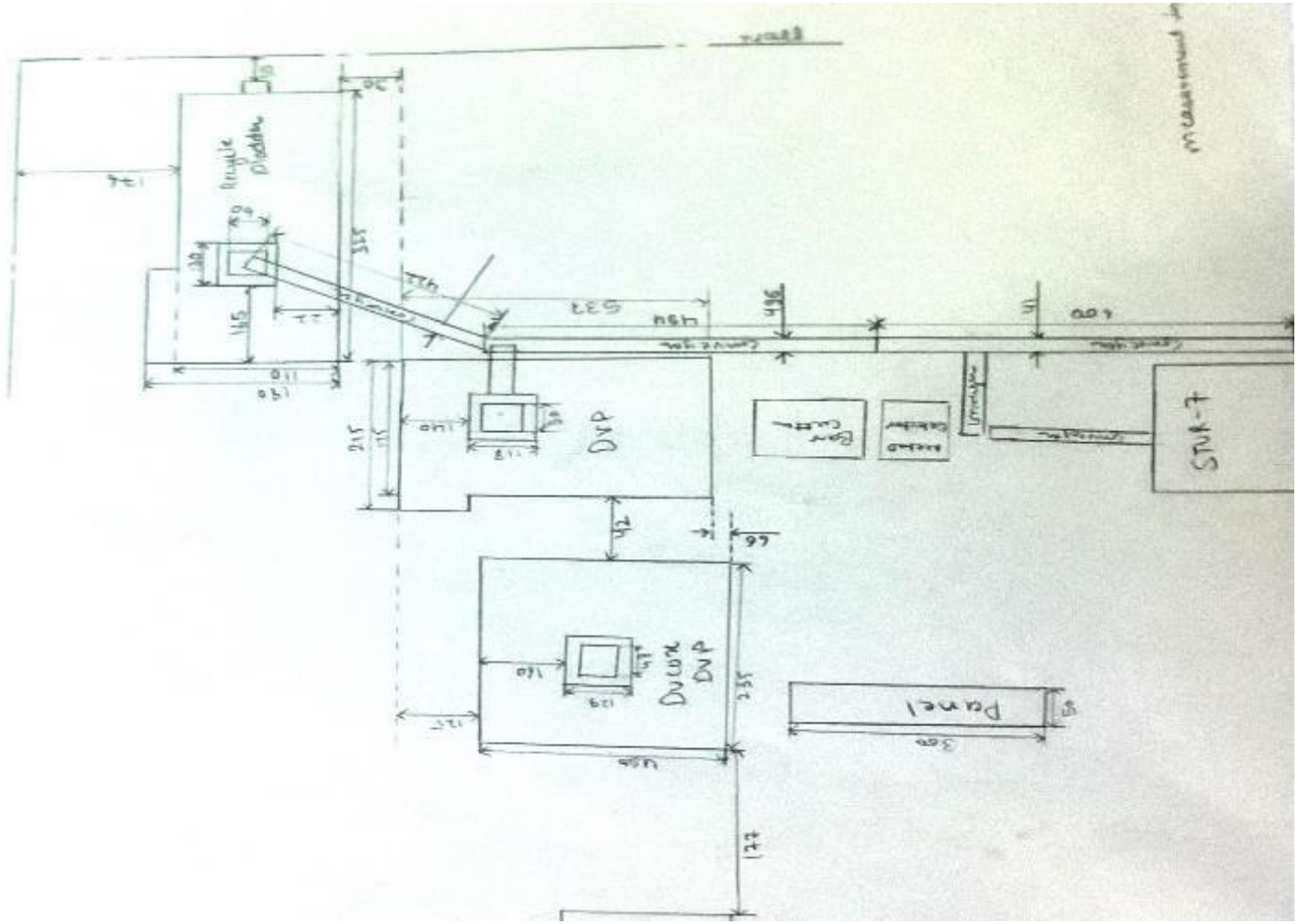
DuCoX Manufacturing @ Factory presently



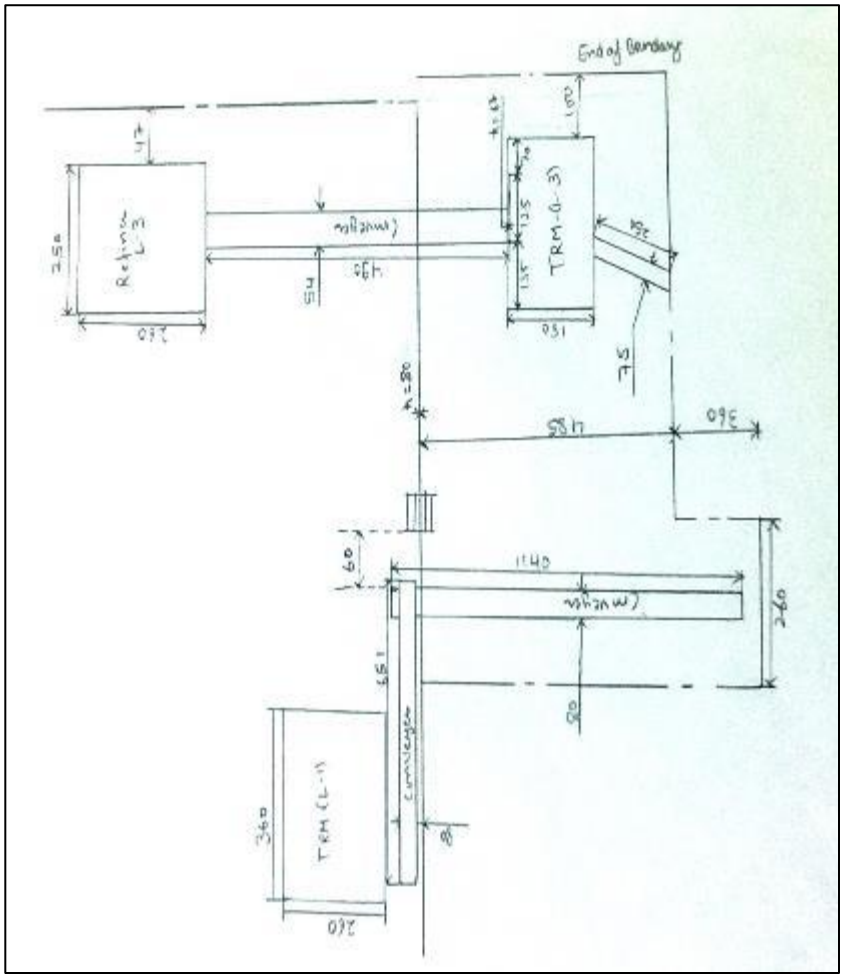
Current Process Description

- Ducox Soap is made by the alternative conjunction of two colours of materials viz. pink and white.
- Two DVP's are involved in the production process and soap bar is extruded from a mixing plate which sandwiches the two colours alternatively.
- The line usually runs on 28% recycle and this recycle is reused by adding additional colours.
- To add these colours recycle material the flashes are broken into smaller pieces in a twin worm plodder and is sent to the mixer of line 1 at 10m floor through a dedicated pneumatic conveying system. Then it uses the secondary line viz **Line 1** upto TRM to refine and mill the material. The pink material coming out of TRM of line 1 is then fed to DUCOX Colour DVP of line 3.
- Fresh colour batches are made at the start-up of the Ducox operation or as and when required depending upon the line speed and recycle material in Mixer 1 of line 1 and is dropped to Ducox Colour DVP of line 3 via Refiner and TRM of line 1.
- So holistically we can say that he line 1 is being used for two purposes.
  - To make fresh colour batches in Mixer 1
  - To homogenise and colour the recycle material.

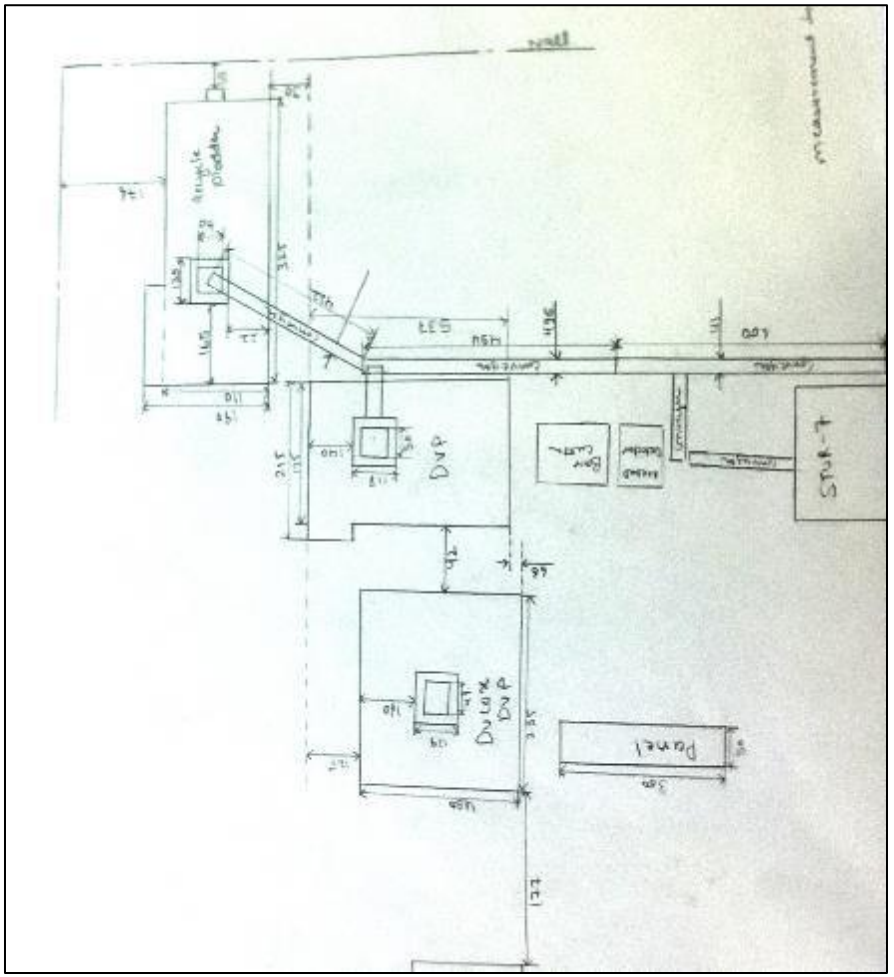
Line 3 - Layout Ground Floor



Line 3 Layout sketch



Top View: 5m Floor



Top View: Ground Floor

Single Line Ducox - Methodology

To eliminate the use of line I Equipments in the manufacturing of DuCoX soaps can be done by **Liquid Solid Marbleisation technique**.

Liquid Solid Marbleisation technique to be used in two stages:-

•First in recycle plodder to make base material light pink (as that of homogenised recycle material) from white

•Secondly at DuCoX Colour DVP to colour recycle material and output of recycle material from light pink to standard pink.

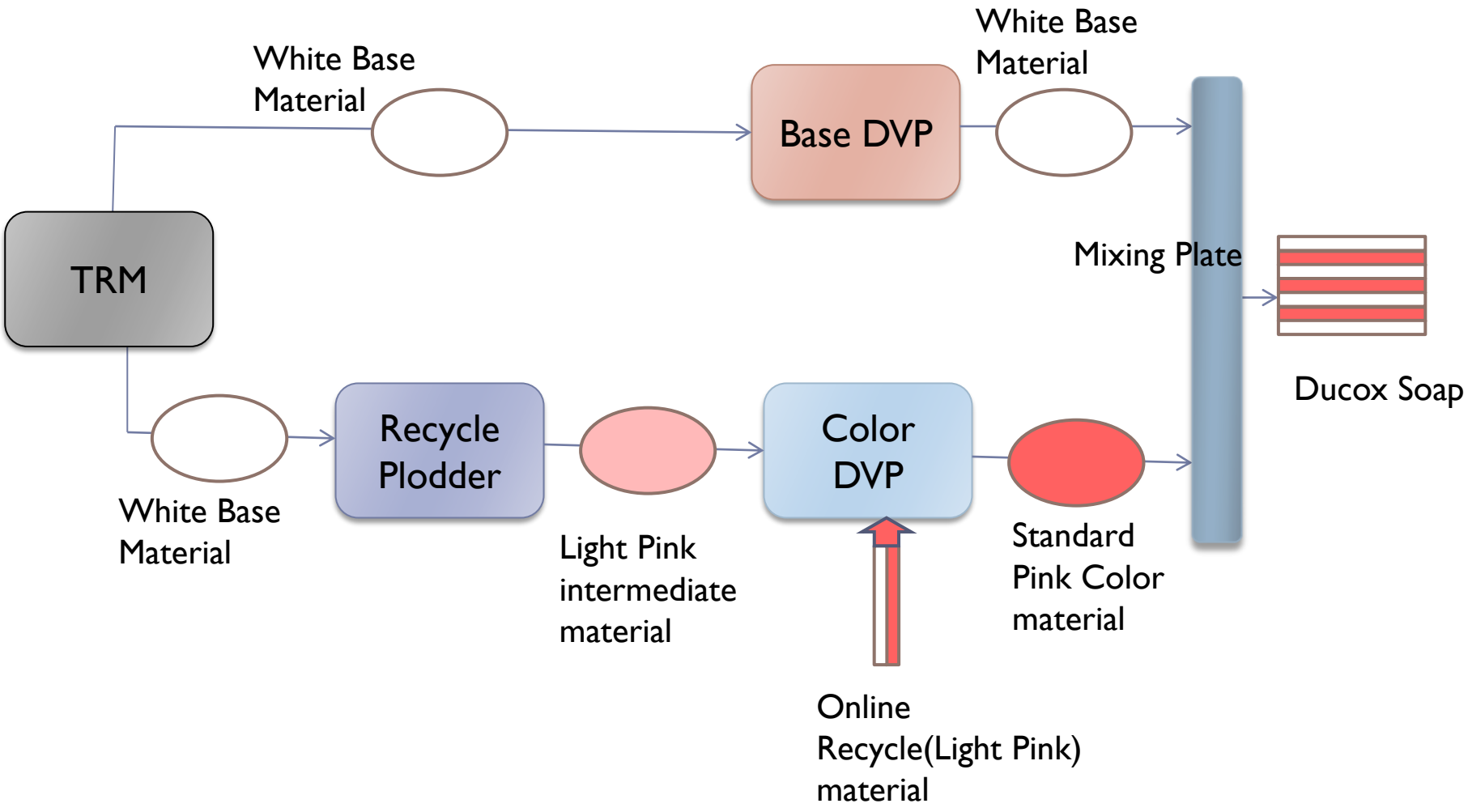
	Initial Colour Shade	Final Colour Shade	Colour Requirement	UOM	Remarks
Acc. To Batch Cards	White	Standard Pink	0.31	kg/ton	Fresh Batch
	Light Pink	Standard Pink	0.217	kg/ton	Recycle material
Hence	White	Light Pink	0.093	kg/ton	

Methodology

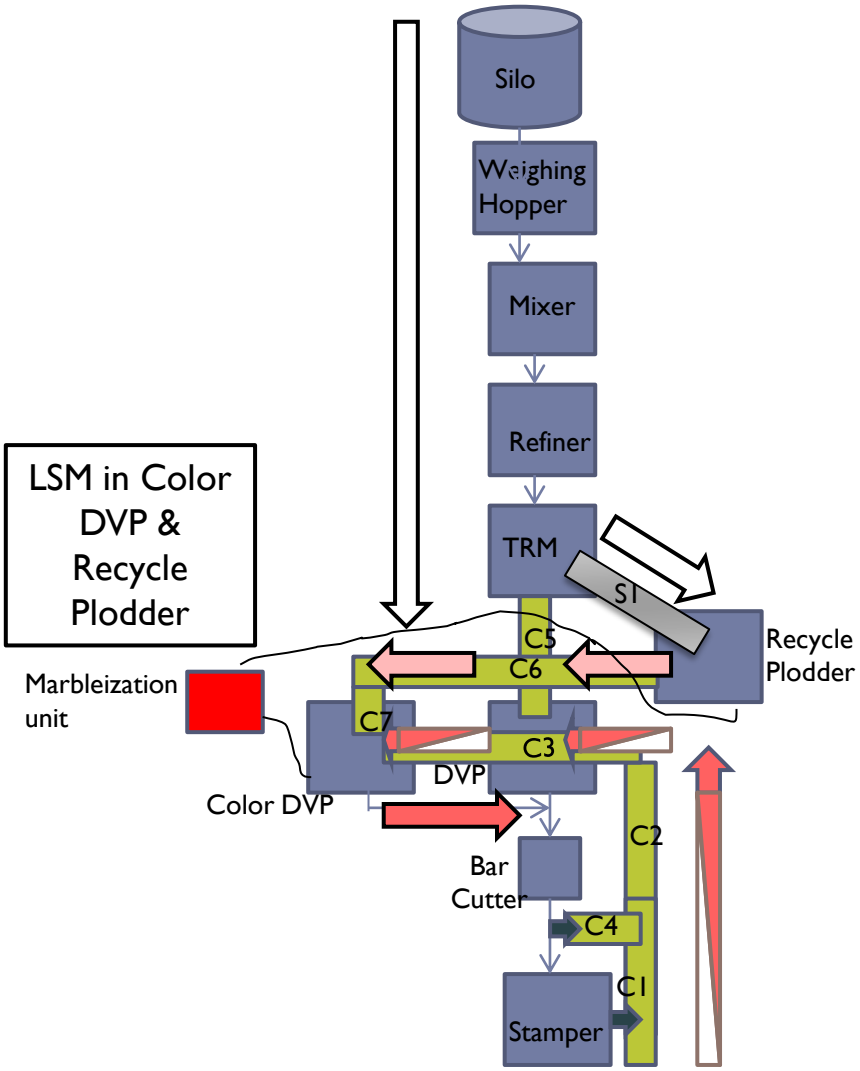
Acc. to Modified Process:

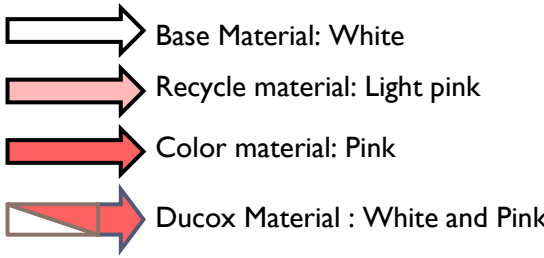
LSM Locations	Material Incoming from	Colour Shade Initial	Output material Destination	Colour Shade Final	Solid Colour Quantity to be dosed	Percentage of total colour	Type of Plodder	Provision for Nozzles (No.)
Recycle Plodder	TRM	White	Colour DVP	Light Pink	0.093 kg/ton	30%	Double barrel	4
Colour DVP	Online Recycle	Light Pink (White & Pink)	Mixing Plate	Standard Pink	0.271 kg/ton	70%	Simplex	4
Colour DVP	Recycle Plodder	Light Pink	Mixing Plate	Standard Pink	0.271 kg/ton	70%	Simplex	4

Block Diagram: Modified Process



Single Line Ducox Process





Composition Analysis

- Objective : To find out the composition of Base and color material in Extruded bar of MFC.
- Methodology: Cross sectional Slices were cut, Color and white material was sliced out and weighed separately in quality lab.

Hour	Base Compostion Wt (g)	Color Composition wt (g)	Base %	Color %
Hour 1	5.0652	3.3348	60.3	39.7
Hour 2	5.3144	3.7856	58.4	41.6
Hour 3	4.5738	3.1262	59.4	40.6
Hour 4	5.1492	3.2508	61.3	38.7
Hour 5	4.9167	3.1833	60.7	39.3
Hour 6	6.4636	4.8364	57.2	42.8
Hour 7	6.0883	4.6117	56.9	43.1
Hour 8	4.3435	2.9565	59.5	40.5
Average Compostion			**59.2125**	**40.7875**

Color Dosing Calculations

MFC Composition			
Description	**Value**	**Unit**	**Comment**
Downstream Capacity of Line 3	2	tph	
Recycle	28	%	
Upstream Capacity of Line 3	2.778	tph	
Base color material Composition	50	%	
Color material composition	50	%	
Base material requirement	1.389	tph	
Color material requirement	1.389	tph	
Stamping Flashes for Recycle	0.778	tph	
Fresh Supply of Colour Material	0.611	tph	
Solid Color requirement for recycle material	0.217	kg/ ton of recycled flashes material	As per batch cards
Solid Color Requirement for base material	0.093	kg/ ton of White base material	As per batch cards
Solid Color Requirement in Recycle Plodder	0.057	kg/h	
Solid Color Requirement in Ducox DVP	0.301	kg/h	
Final Color Solution to be made	5	Kg/ton	
Injection rate at Recycle Plodder	0.793	kg/h	
Injection rate at DUCOX DVP	4.207	kg/h	

Color dosing @ color DVP as a function of Frequency of Pre plodder

Pre Plodder output		
Frequency of Pre plodder	50.0000	
Output at 50 Hz	0.0250	tons per minute
output at given frequency	0.0250	tons per minute
Colour dosing per tones	0.2170	kg/ton
Colour dosing per min	0.0054	kg/min

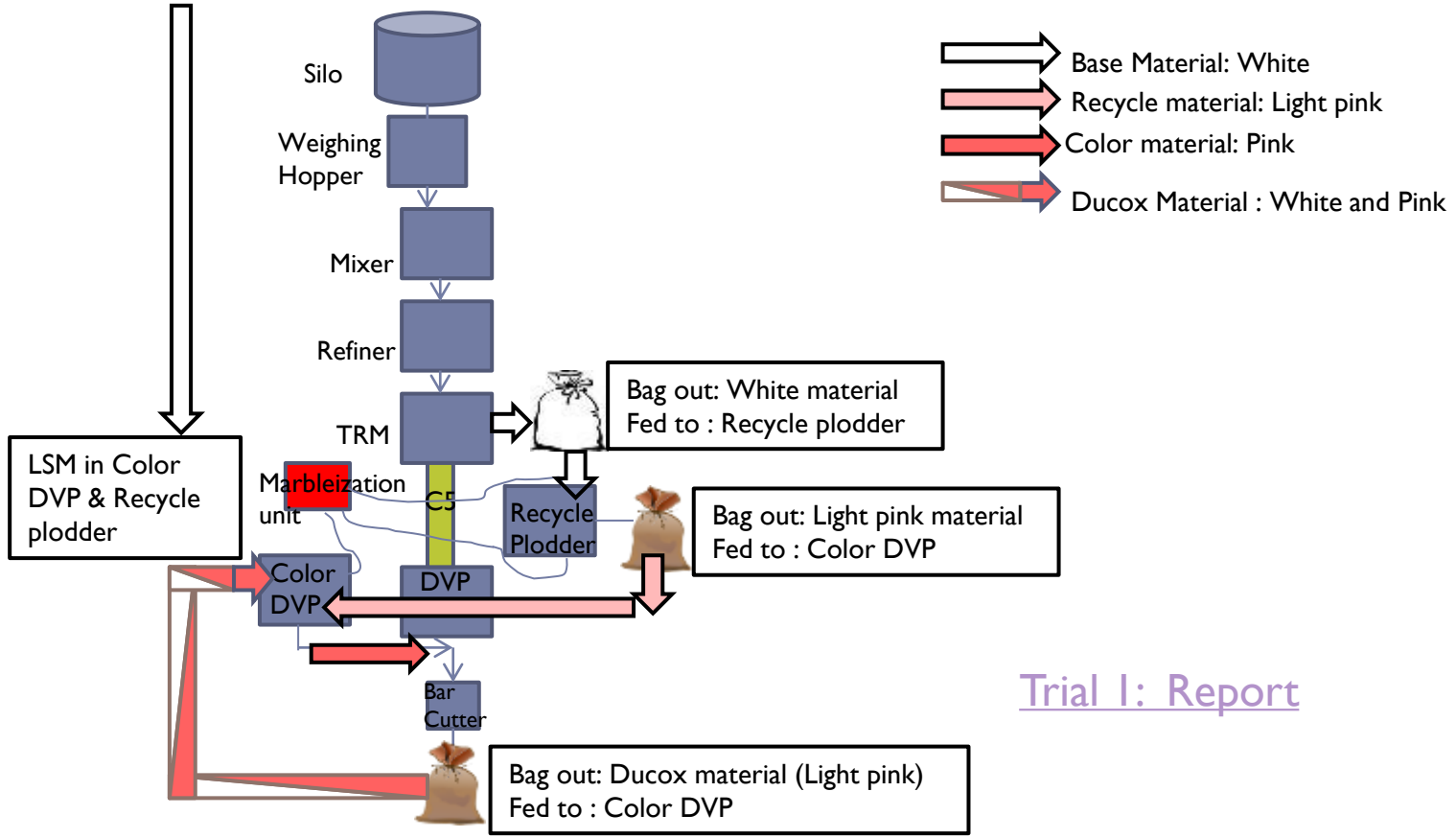
1.5tph

LSM Dosing- DVP		
solid colour	0.372	kg
Colour solution	26.000	kg
Colour solution per kg of solid colour	69.892	kg of solution/kg of solid colour
Colour solution to be dosed	0.379	kg of solution/min

Trial Arrangement : 1

Trial Arrangement

Objective	To determine the run ability of DuCoX operation using single line



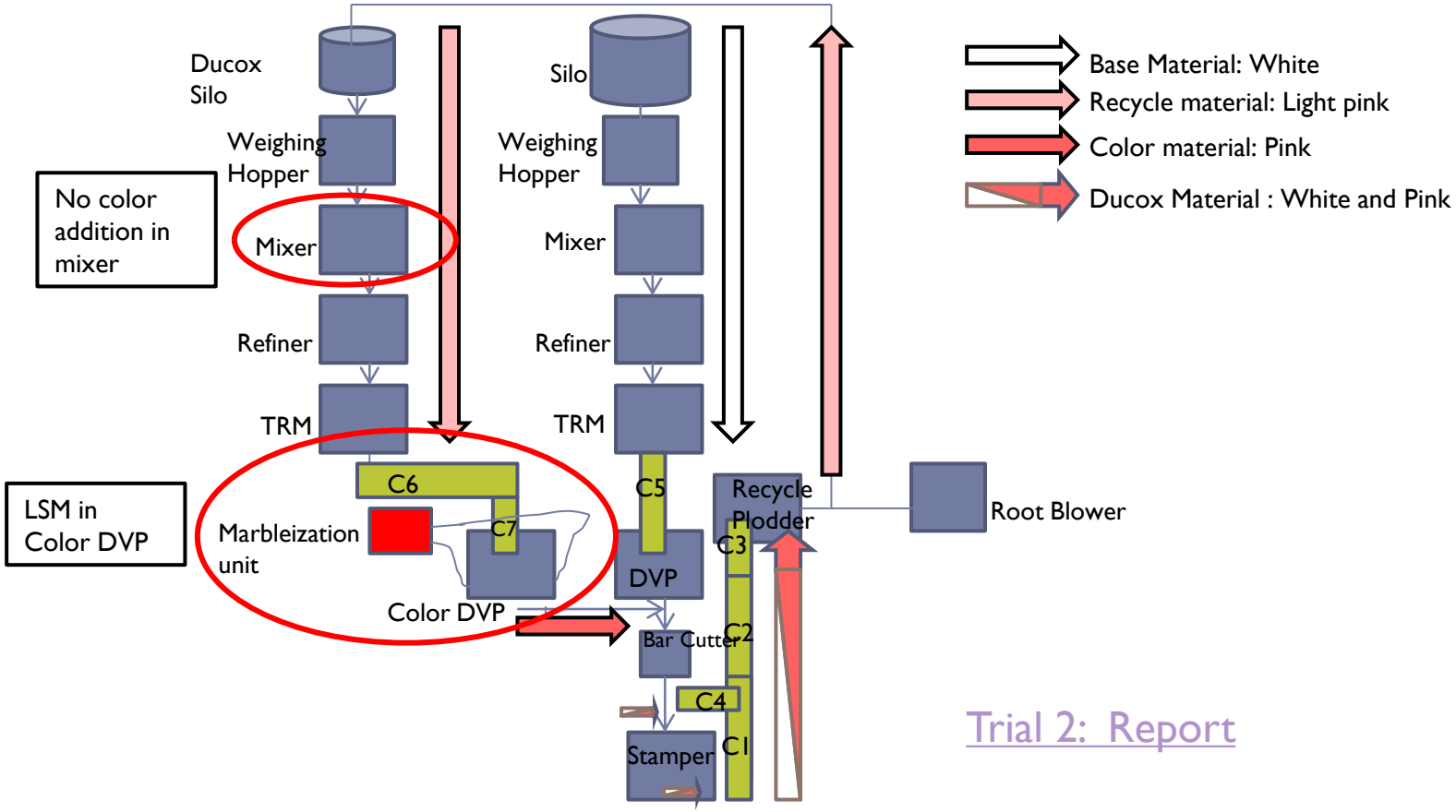
Trial 1: Report

Conclusion	The DuCoX operation is runnable on single line, Desired homogeneity levels were achieved whereas desired color levels are yet to be establish

Trial 2 (10th December, 2014)

Objective	To establish the desired color shade levels using LSM in color DVP for DuCoX Single line operation

Trial Arrangement



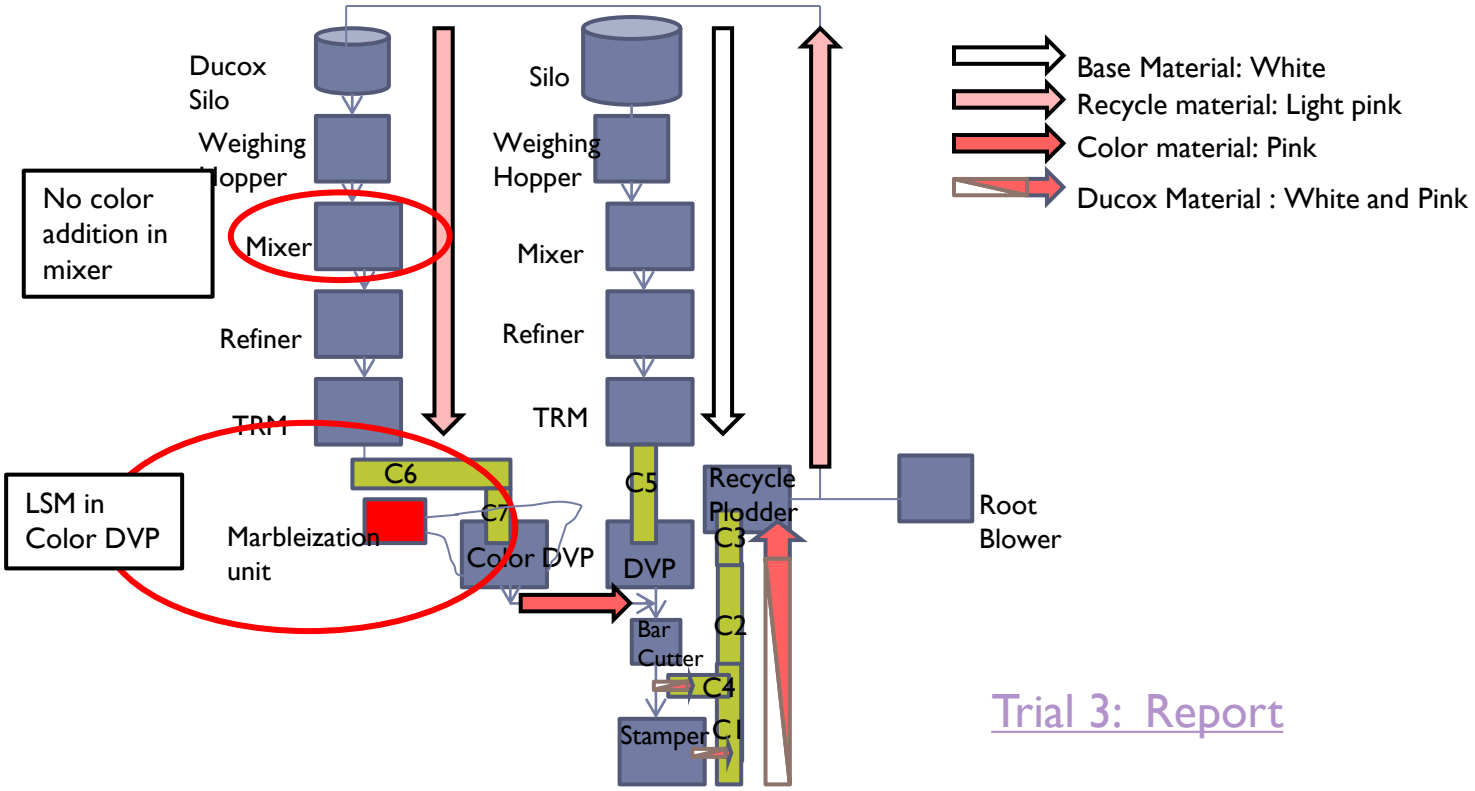
Trial 2: Report

Conclusion	Color transformation from Light Pink to standard pink is achievable in color DVP by using LSM technique. But exact color consumption couldn't be evaluated.

Trial 3 (17th Dec, 2014)

Objective	To Evaluate the color consumption patterns using LSM in color DVP for DuCoX Single line operation and compare it with theoretical color consumptions.

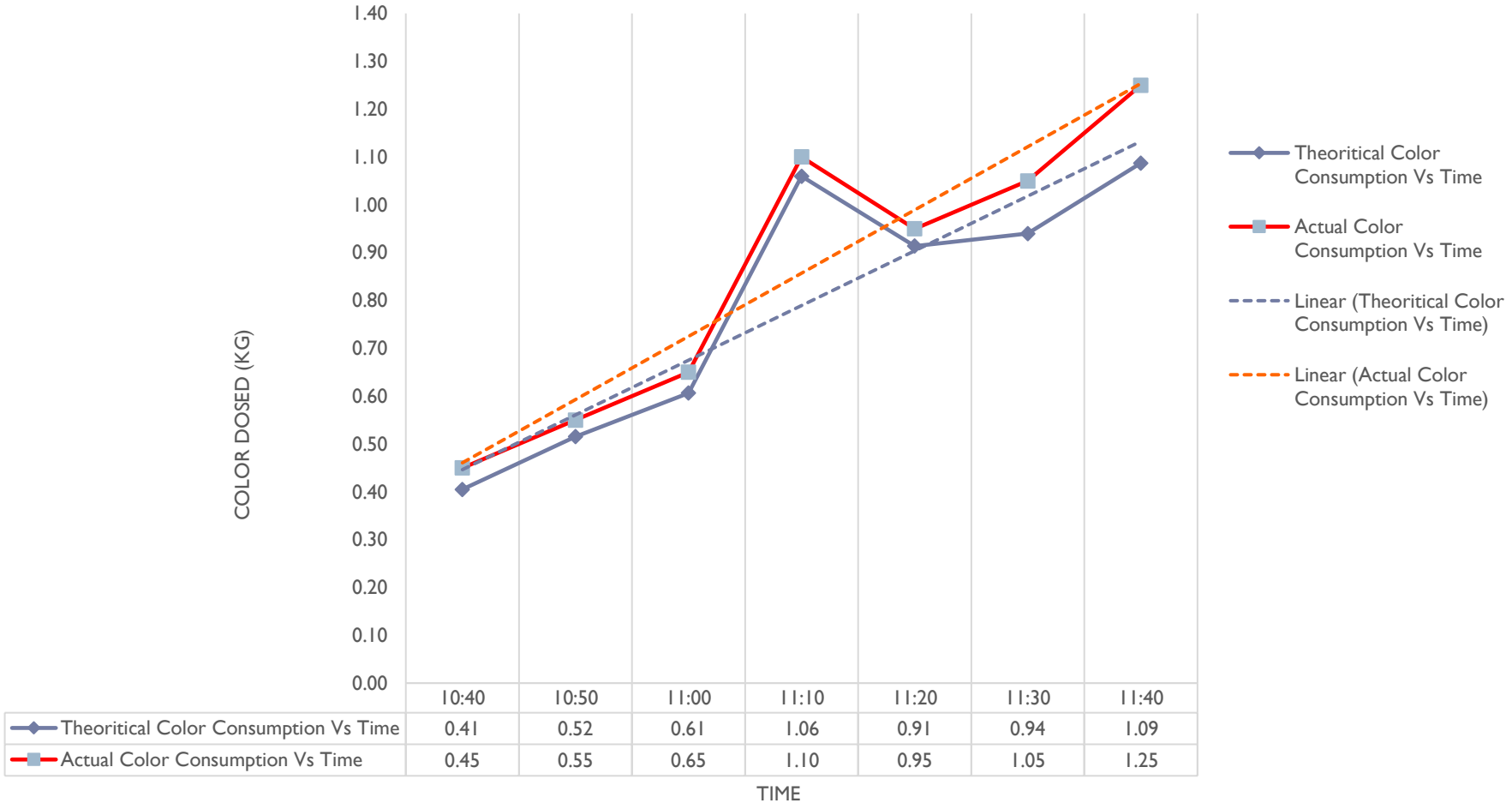
Trial Arrangement



Trial 3: Report

Conclusion	Color transformation from Light Pink to standard pink is achievable in color DVP by using LSM technique

Color Consumption Patterns wrt time intervals

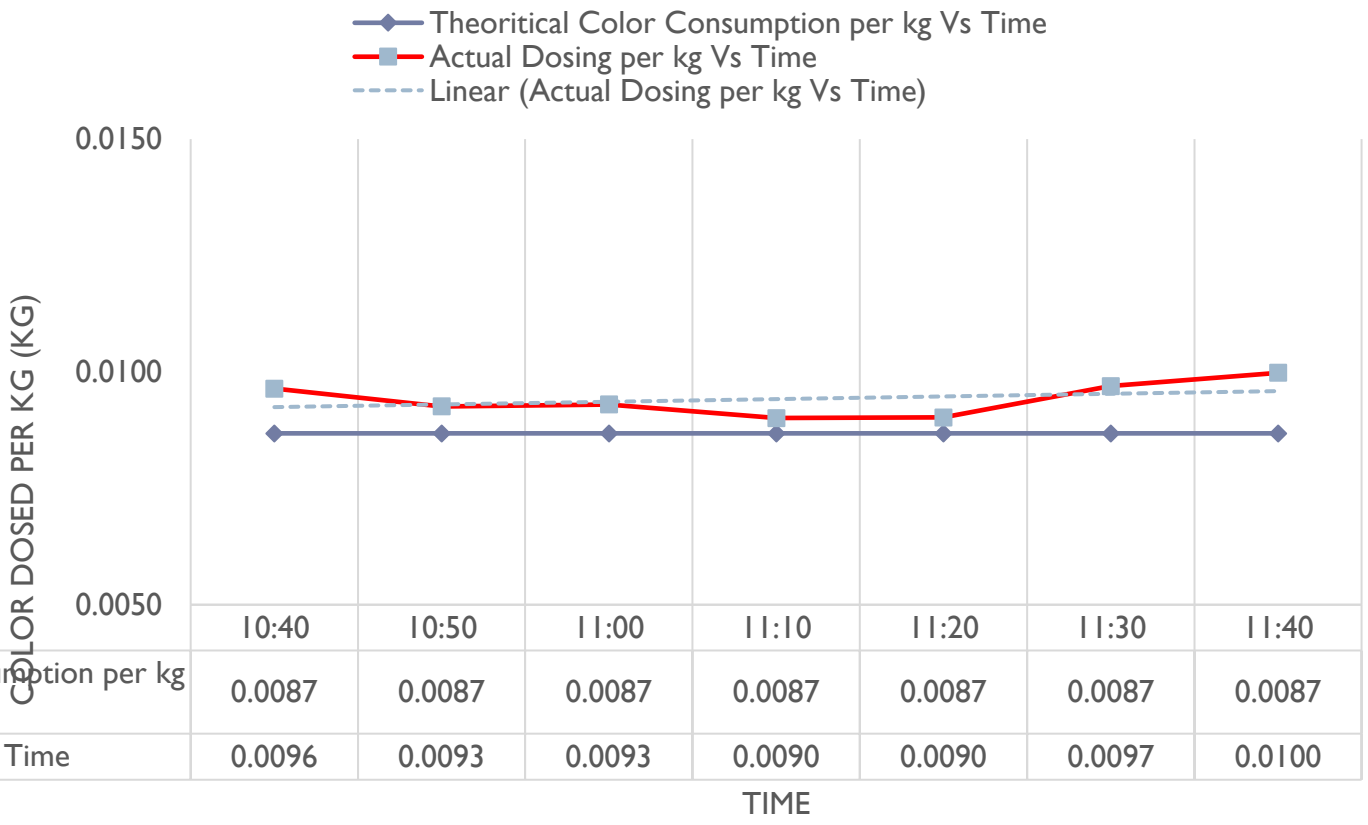


	10:40	10:50	11:00	11:10	11:20	11:30	11:40
Theoritical Color Consumption Vs Time	0.41	0.52	0.61	1.06	0.91	0.94	1.09
Actual Color Consumption Vs Time	0.45	0.55	0.65	1.10	0.95	1.05	1.25

Conclusion*	In Continuous run the overall color consumption is **6%** higher using LSM as compared to batch card.

* On start-up higher color consumptions have been observed upto 10% attributed to pipeline fill-ups.

Color Consumption Patterns per Kg material



	10:40	10:50	11:00	11:10	11:20	11:30	11:40
Theoritical Color Consumption per kg Vs Time	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
Actual Dosing per kg Vs Time	0.0096	0.0093	0.0093	0.0090	0.0090	0.0097	0.0100

Conclusion	In Continuous run the color consumption per kg is **6%** higher using LSM as compared to the batch cards.

Understanding LSM

Liquid Solid Marbleisation

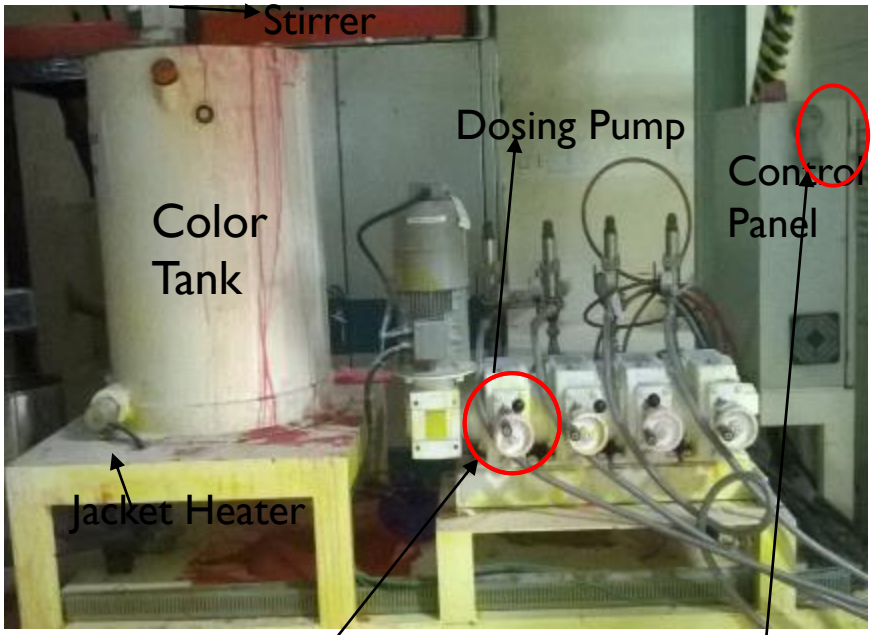
Liquid Solid Marbleisation is a technique to inject liquid color solution in white or faint coloured soap base using specially designed nozzles.

The liquid color solution is dosed through controlled manner by a dosing pump at different locations depending upon the provision for nozzles in worm barrel.

Dosing process variables

Variable	Location	Min Value	Max Value
Plodder Frequency (Hz)	Plodder	0	50
Stroke length (%)	LSM	0	100
Pump Frequency (Hz)	LSM	0	60
No. of Operating nozzles	LSM/Plodder	0	4

LSM Unit (Mazzoni)



Stroke Length adjustment Knob

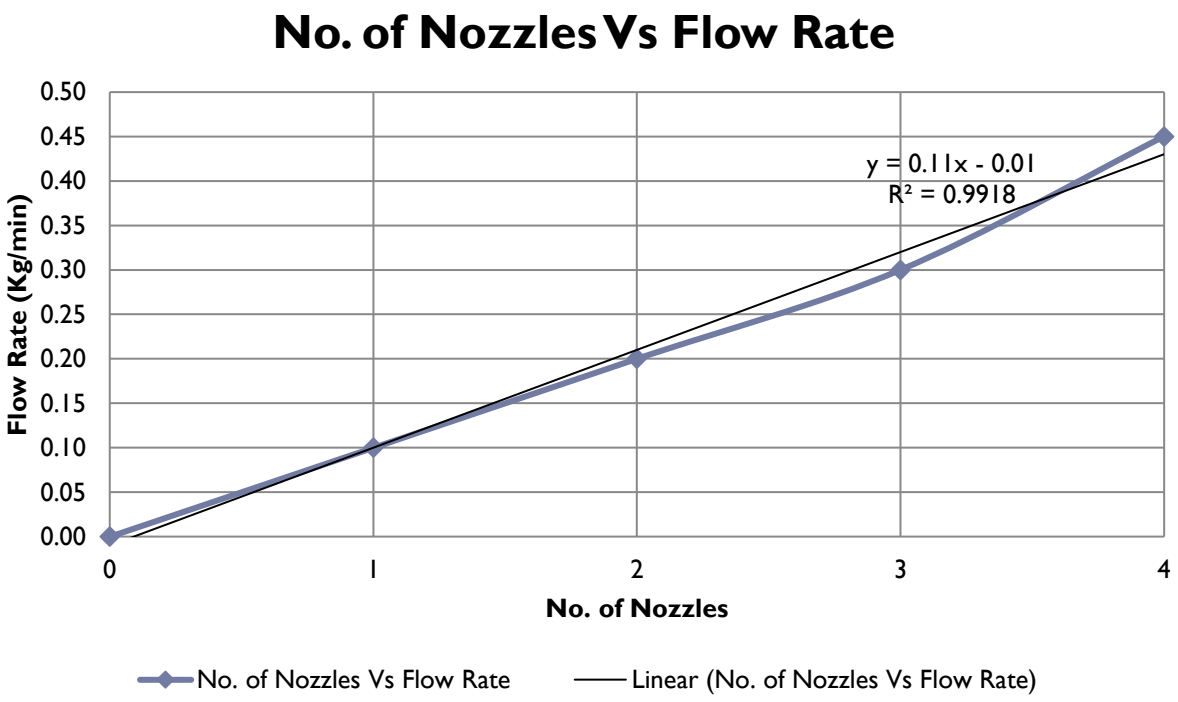
Pump Frequency adjustment at panel display

Process Variables - LSM

Objective	Flow rate of color solution at varying No. of operating nozzles is observed at constant pump frequency and stroke length.

Plot

Parameter	Value
No. of Nozzles	**Variable**
Dosing pump frequency	20
Stroke Length of Dosing pump	50%

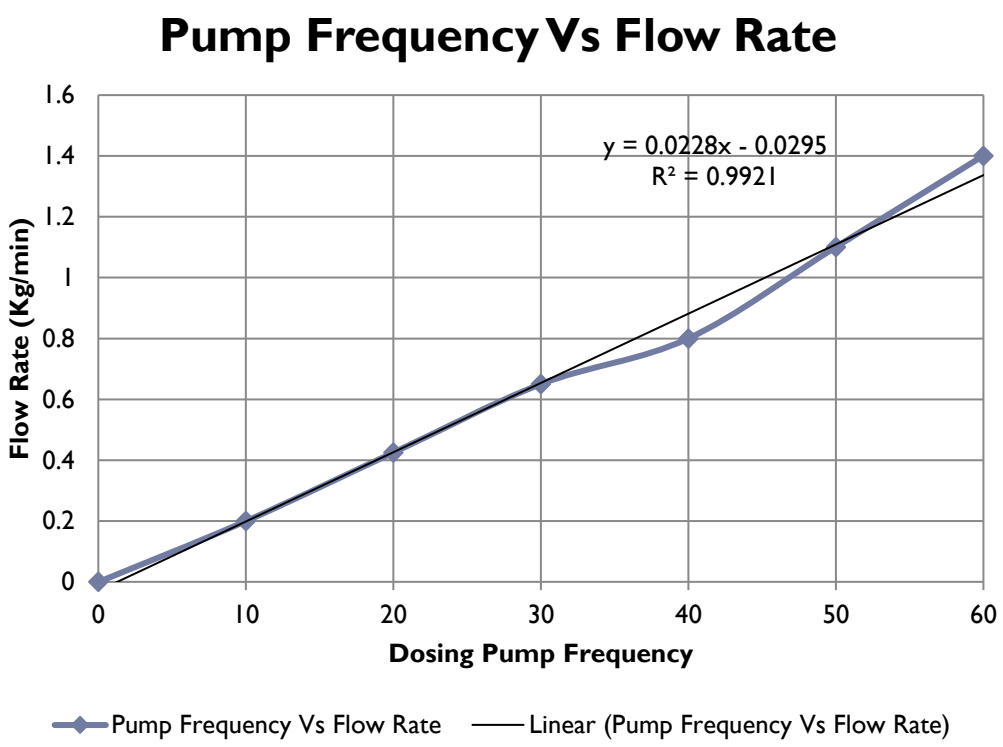


Conclusion	The flow rate of color solution through dosing pump varies linearly with the No. of operating nozzles.

Plot

Approach	Flow rate of color solution at varying pump frequencies is observed at constant no. of operating nozzles and stroke length.

Parameter	Value
No. of Nozzles	4
Dosing pump frequency	**Variable**
Stroke Length of Dosing pump	50%

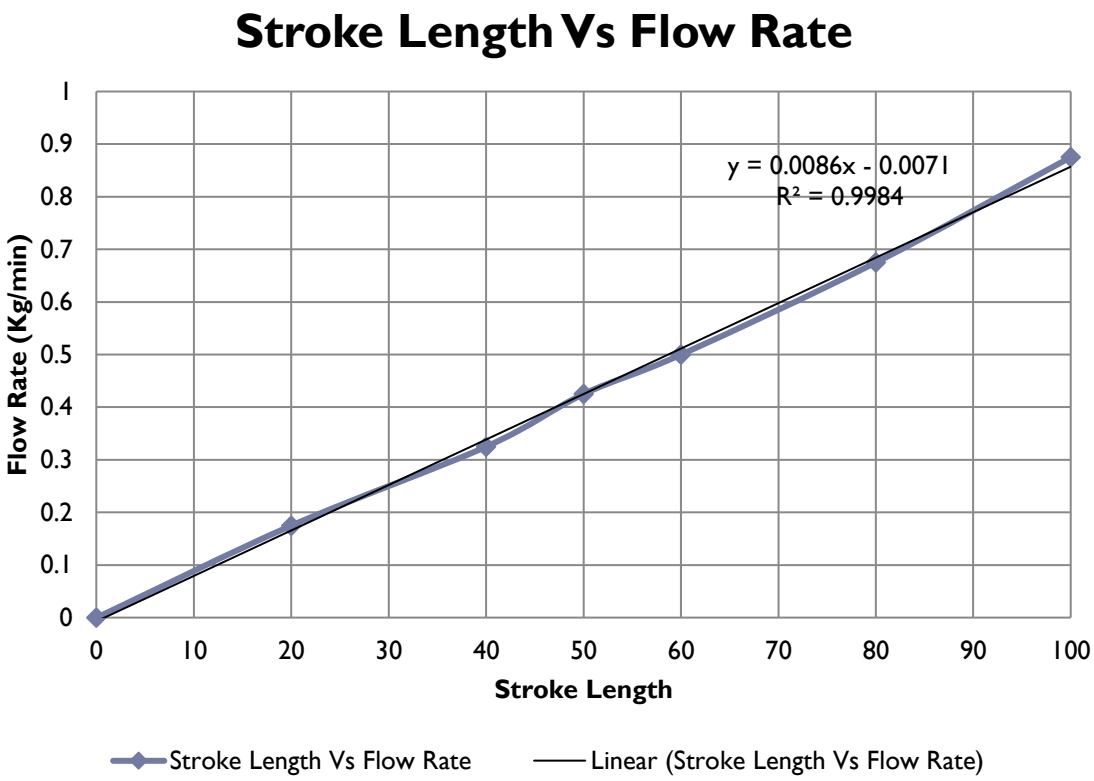


Conclusion	The flow rate of color solution through dosing pump varies linearly with the pump frequency.

Approach	Flow rate of color solution at varying Stroke length is observed at constant no. of operating nozzles and pump frequency.

Plot

Parameter	Value
No. of Nozzles	4
Dosing pump frequency	20
Stroke Length of Dosing pump	**Variable**



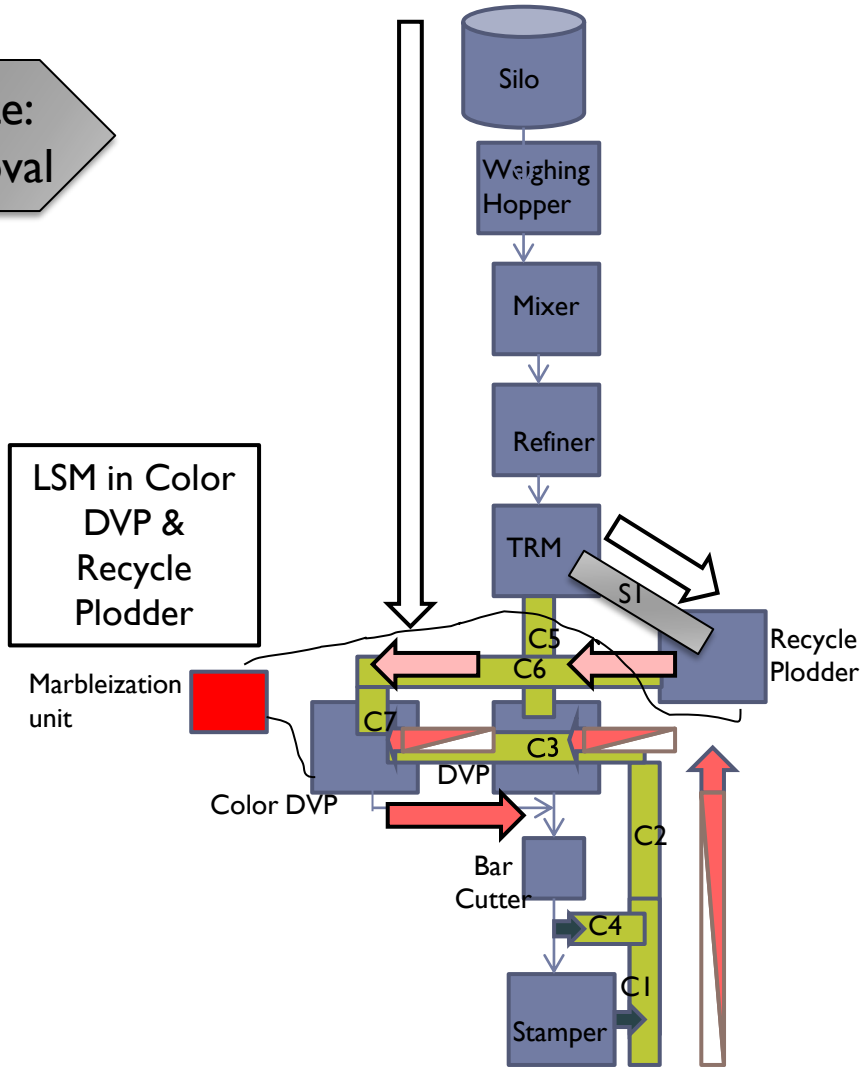
Conclusion	The flow rate of color solution through dosing pump varies linearly with the stroke length.

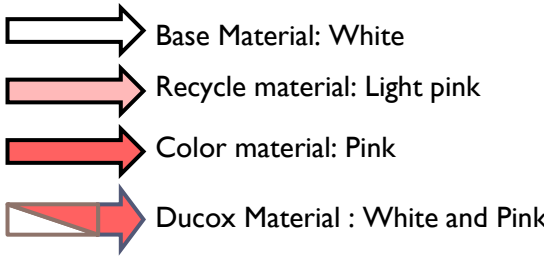
Key Observations

- Single line Ducox operation is runnable with slight modification in the current setup.
- Drill plate (3mm) is necessary at color DVP for desired homogeneity.
- High color consumptions in the early phase of startup were observed in LSM.
- After a run of approx 20 minutes color consumption is stabilized.
- Nozzle requirement for color DVP: 4, Recycle Plodder : 2.

Final Modified Process

Target Date:
After Approval



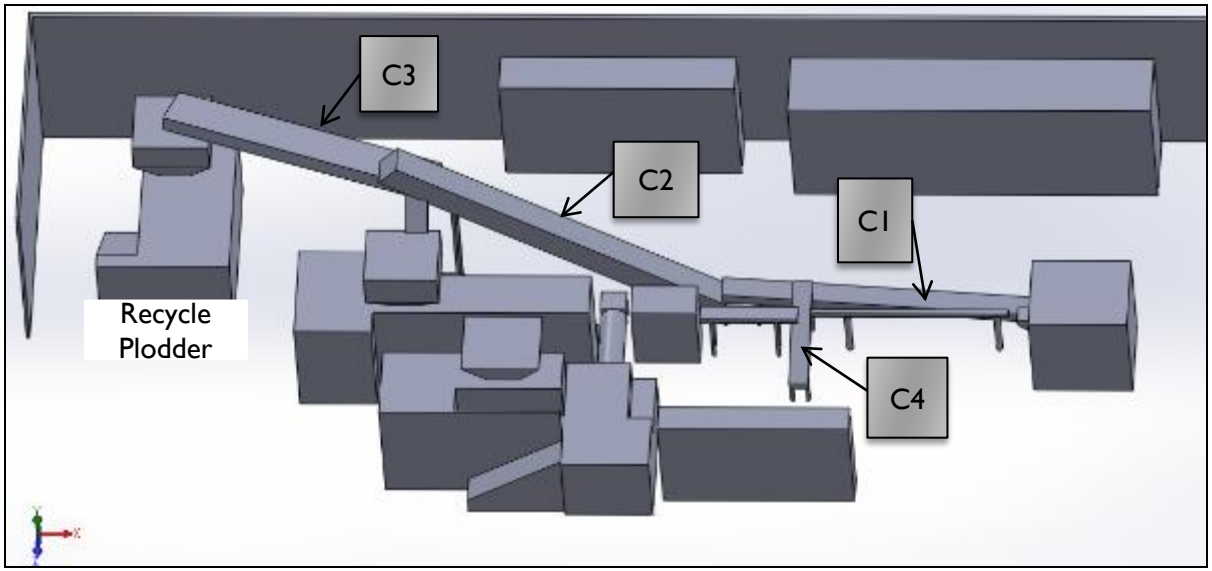


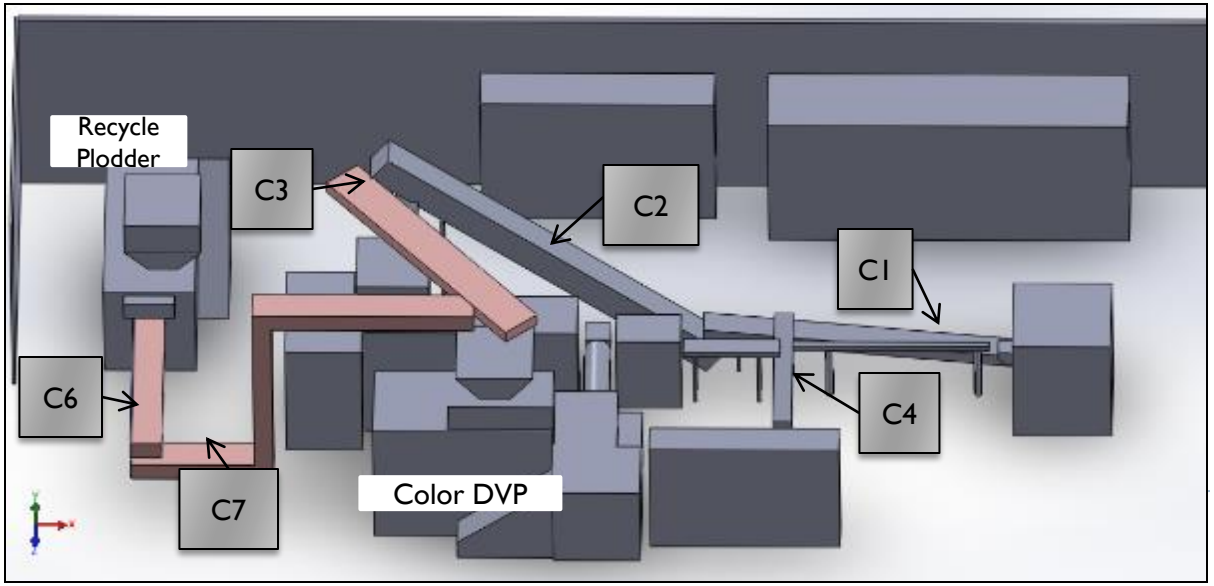
New Components:

S1 : Chute From TRM to Recycle plodder.

C6, C7: conveyers from recycle plodder to color DVP.

3D Layout – Ground Floor

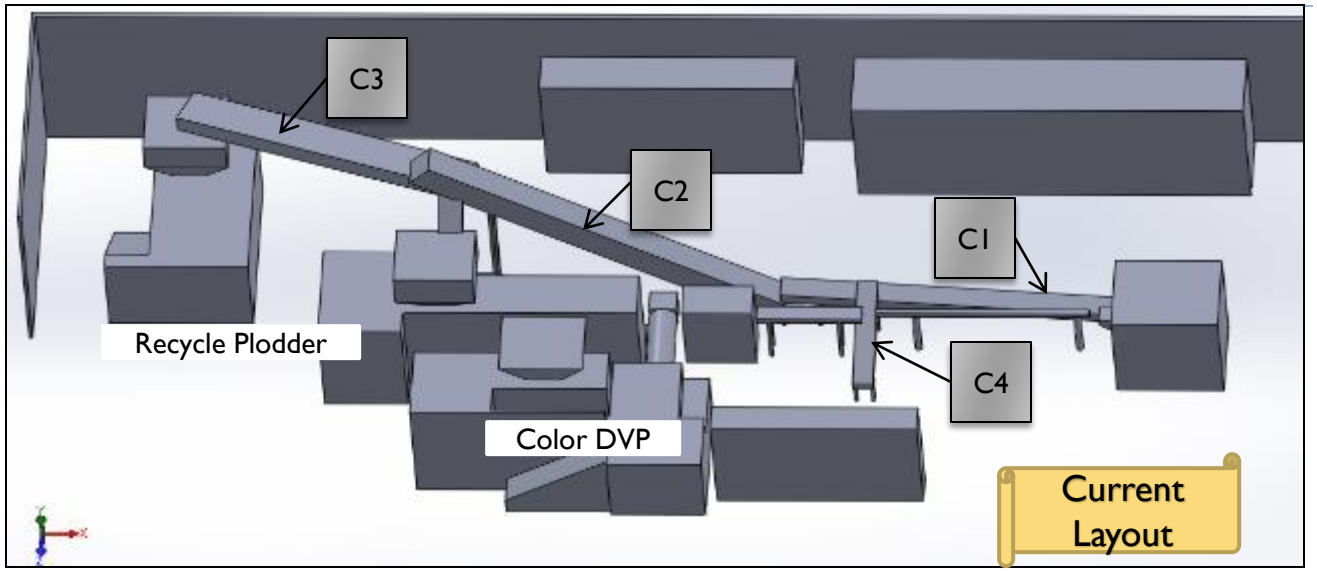


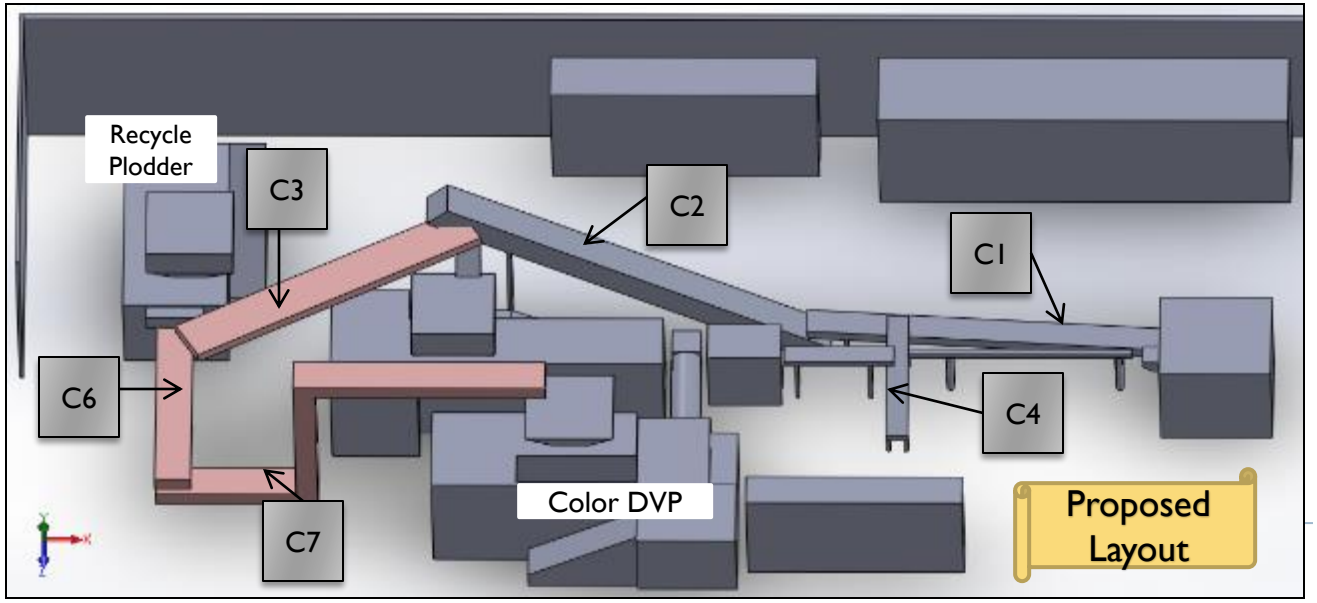


Modifications for Proposed layout

Equipment	Modification	Specification
Recycle Plodder	Rotation by 180°	
Conveyer – C3	Direction Change – C2 to Color DVP Hopper	
Conveyer – C6	New Installation	Horizontal Length : 300 cm
Conveyer – C7	New Installation	Horizontal Length: 460 cm Vertical Length: 350 cm

3D Layout – Ground Floor





Modifications for Proposed layout

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Conveyer – C3	Direction Change – C2 to C6	
Conveyer – C6	New Installation	Horizontal Length : 300 cm
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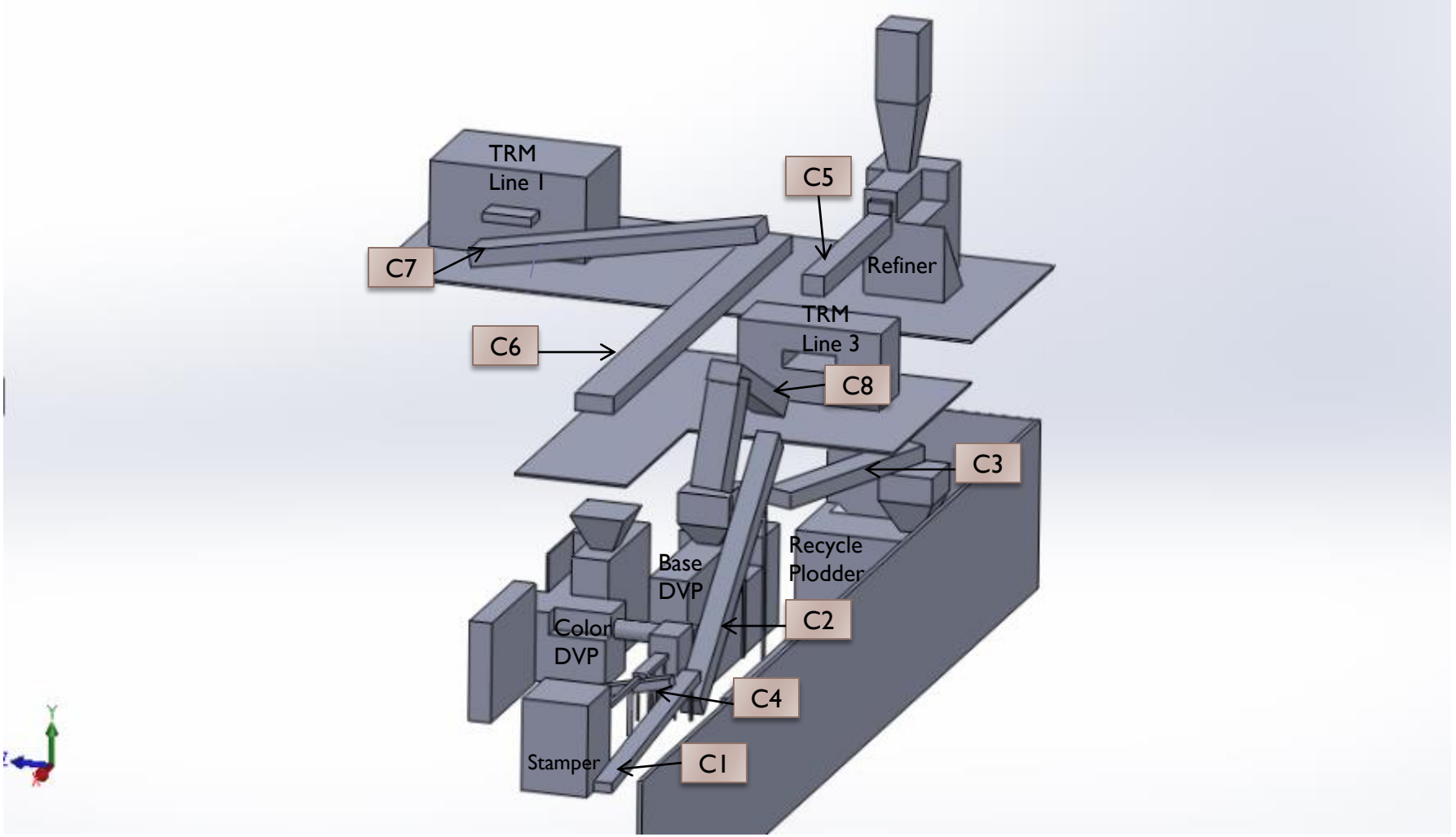
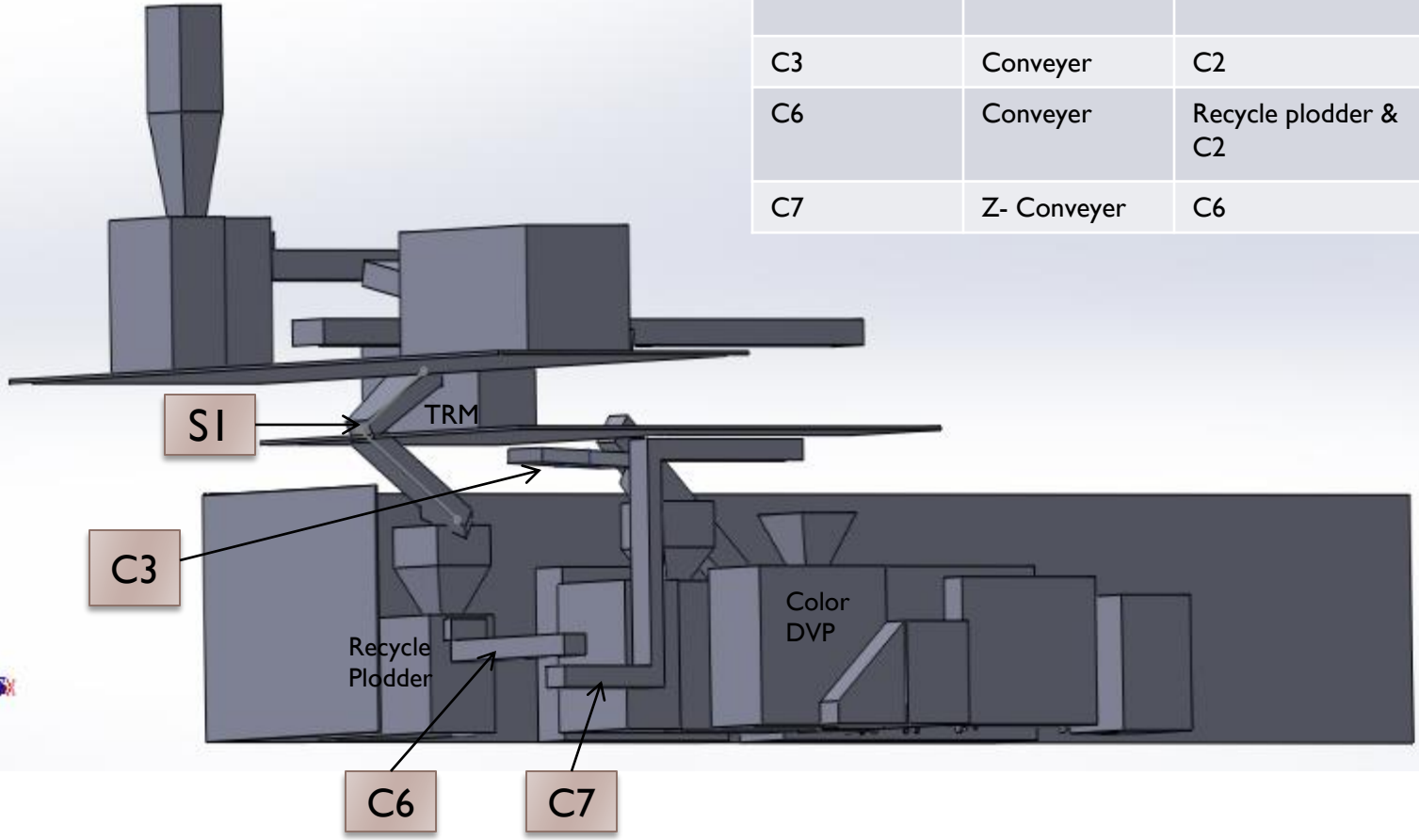
3D Current DuCoX Layout



3D Proposed DuCoX Layout (Back View)

New Components	Type	From	To
S1	Chute	TRM line 3	Recycle Plodder
C3	Conveyer	C2	C6
C6	Conveyer	Recycle plodder & C2	C7
C7	Z- Conveyer	C6	Color DVP



Thank You