Approach Flow Rebuild Made In A 50TPD Waste Paper Based Plant - A Survival Strategy

Mohanty H. K.

ABSTRACT

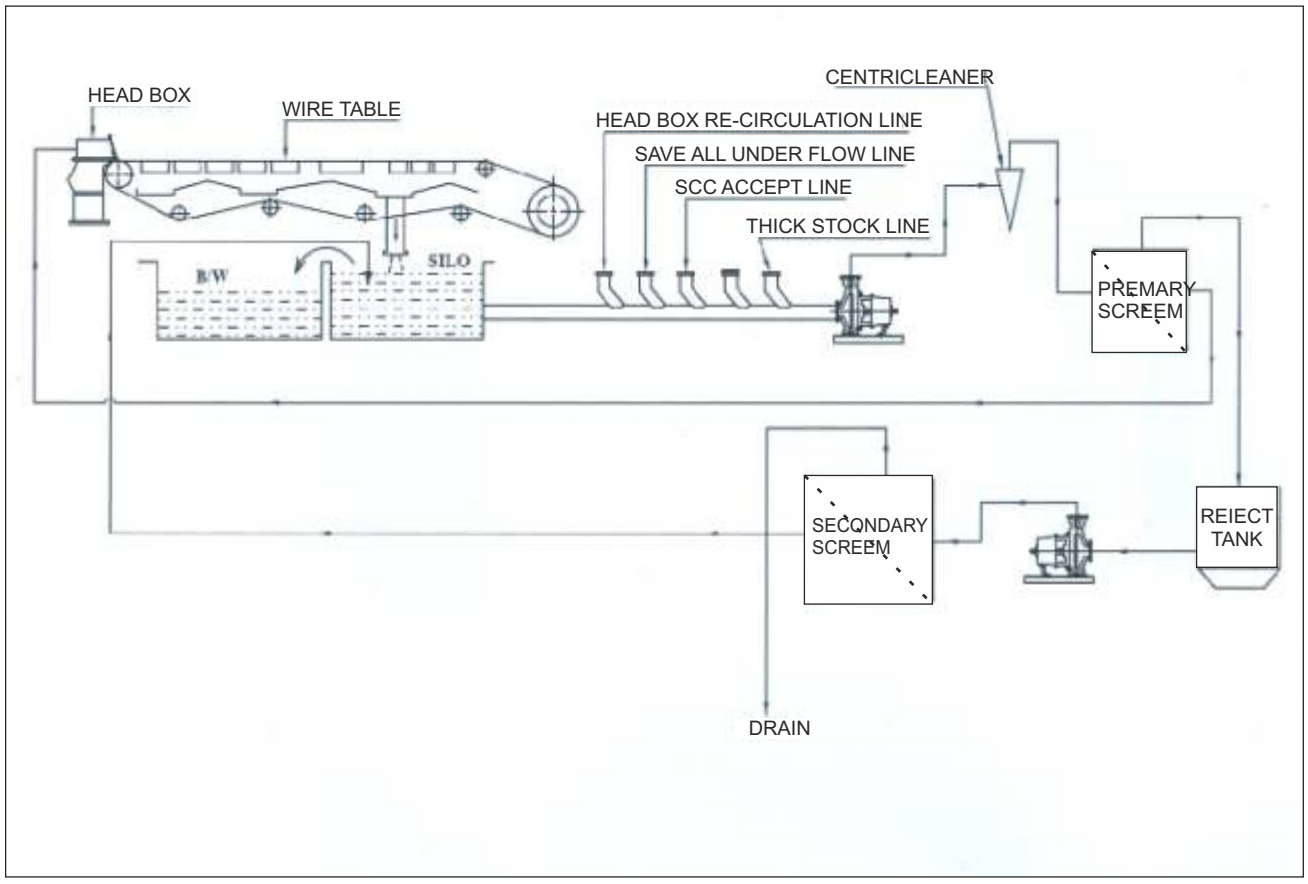
The paper machine approach flow system is a key process in paper making. The old and conventional *silo system* comprises of variety process and restricts the flow characteristics. The design of thick stock injection in to the silo white water, fan pumps suction and head box is critical for paper machine performance. The designing these large piping system in to existing facilities with a limited space creates potential compromise in complying with the design specifications that may affect the machine run ability and variation in quality.

An improvement over conventional silo system improves the Paper Machine working and this paper explains the advantages gained by converting the conventional silo system into "Hydro Mix" developed by VOITH.

Introduction

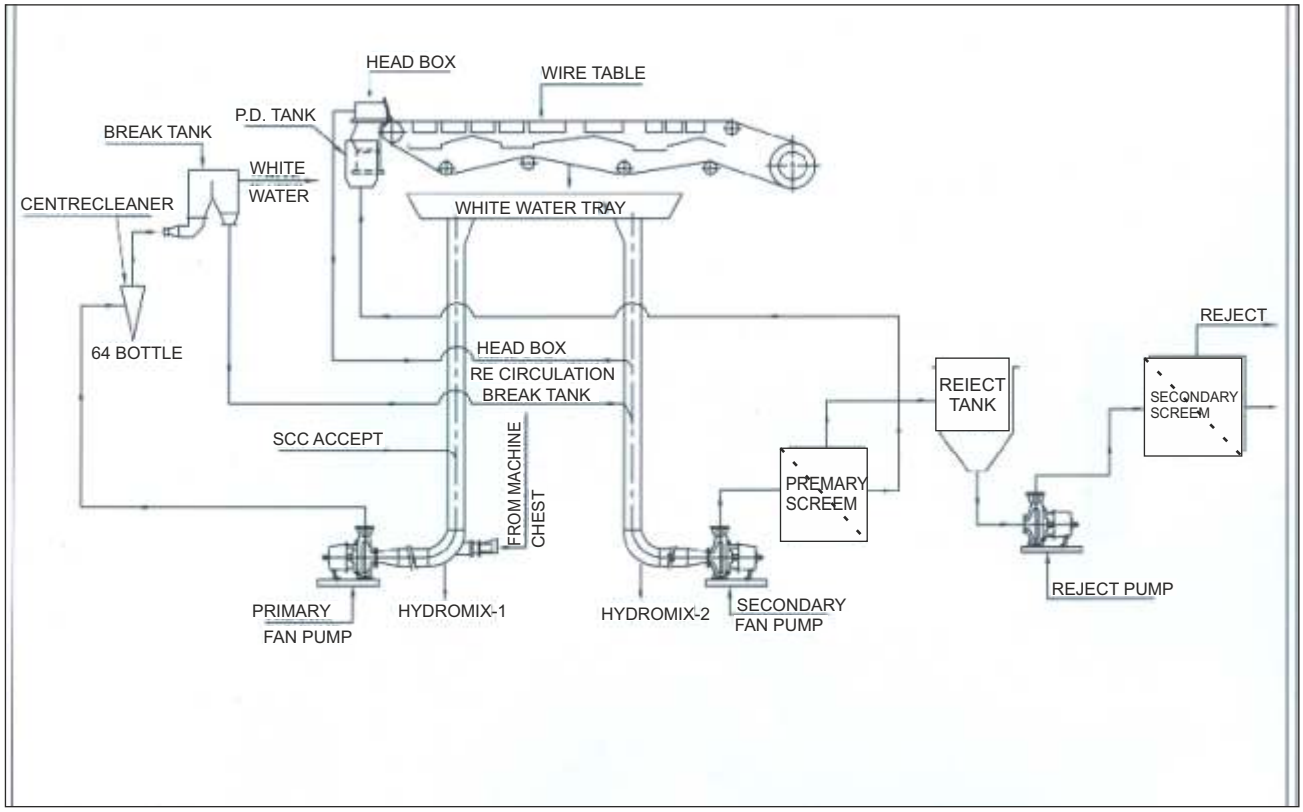
The approach flow system is one of the most important steps in paper making process, since it directly affects product quality. The key requirements in the approach flow system are consistency of stock and furnish composition, flow characteristics like velocity & pressure at the inlet of head box distributor pipe so that the stock flow, head level and profiles of sheet are maintained with minimum disturbance.

It is very much essential to optimise paper making requirements in each phase of approach flow system, using standard component which are adapted to local condition. The requirement of process is



APPROACH FLOW BEFORE REBUILD

Emami Paper Mills Ltd.
Unit., GulmoharR.N. Tagore Road,
P.O. Alam Bazar Kolkata -700 035



APPROACH FLOW AFTER REBUILD

i) Constant stock consistency both in main flow and white water loop.
ii) Maximum Hydraulic stability
iii) Optimum de-aeration
iv) Excellent cleaning & screening efficiency
v) Smaller vat volume to avoid deposition
vi) Minimum grade change time
vii) Minimum idle time for cleaning the system
viii) Lower investment cost

To achieve all these basic paper making requirements, suitable design of approach flow plays a key role.

***DISCUSSION*:**

Bigger is not always matter Stability what is matter.
The approach flow system has undergone and is still undergoing critical design and attention.
The poor design approach flow system radically affected efficiency of machine operation due to lack of system stability, poor cleaning & screening, poor piping lay out and air entrainment.
In improved design system or system rebuild for betterment, the following factor should be taken care are as follows,

System stability

i) Flow and mass balancing
ii) The pump design
iii) The constant pump head & NPSH
iv) Prevention of air entrainment

Stock cleaning devices

i) Proper sizing of close type pressure screens
ii) Removal of rejects from system

Advanced piping practices

i) Proper piping size to maintain required velocity & pressure of stock flow
ii) Pitching pipe runs to avoid air entrainment
iii) Proper pipe material and flash angles

Recirculation

i) Maintain constant velocity & pressure
ii) Flexibility of system design.

Process variation & rebuild issues in Emami Paper; Unit Gulmohar. Kolkata.

- Barring mark and wild formation
- Slime and stickies problem, cause paper breaks
- Higher fibre losses in the reject, cause less yield

Fig of Hydro mix & break tank

Hydro Mix I & II

Break tank

Quality issues

- Wide Grammage variation
- Foam spot in the paper, cause higher chemical cost
- Specky paper
- Higher number of joints in the reel
- Poor strength properties

***Action taken to resolve the issues*:**

i) *Flow balance:*
The mass and volume flow for the entire wet end and white water system calculated, balanced and designed with the expertise of M/S Voith Paper (India).

ii) *Hydraulic stability:*
To achieve Hydraulic stability the "Hydro mix" designed & engineered by Voith Paper, incorporated in two stages replacing old and conventional silo system.

Ecomizer with back flashing

Low DP cleaner

Various return flows are taken in to "Hydro mix" and then the medium consistency stock is piped concentrically to ensure homogeneous mixing.

For stable operation of "Hydro mix" adequate prior de-aeration like "Break tank" is considered, which results in reduction of downstream flow pulses after the fan pump.

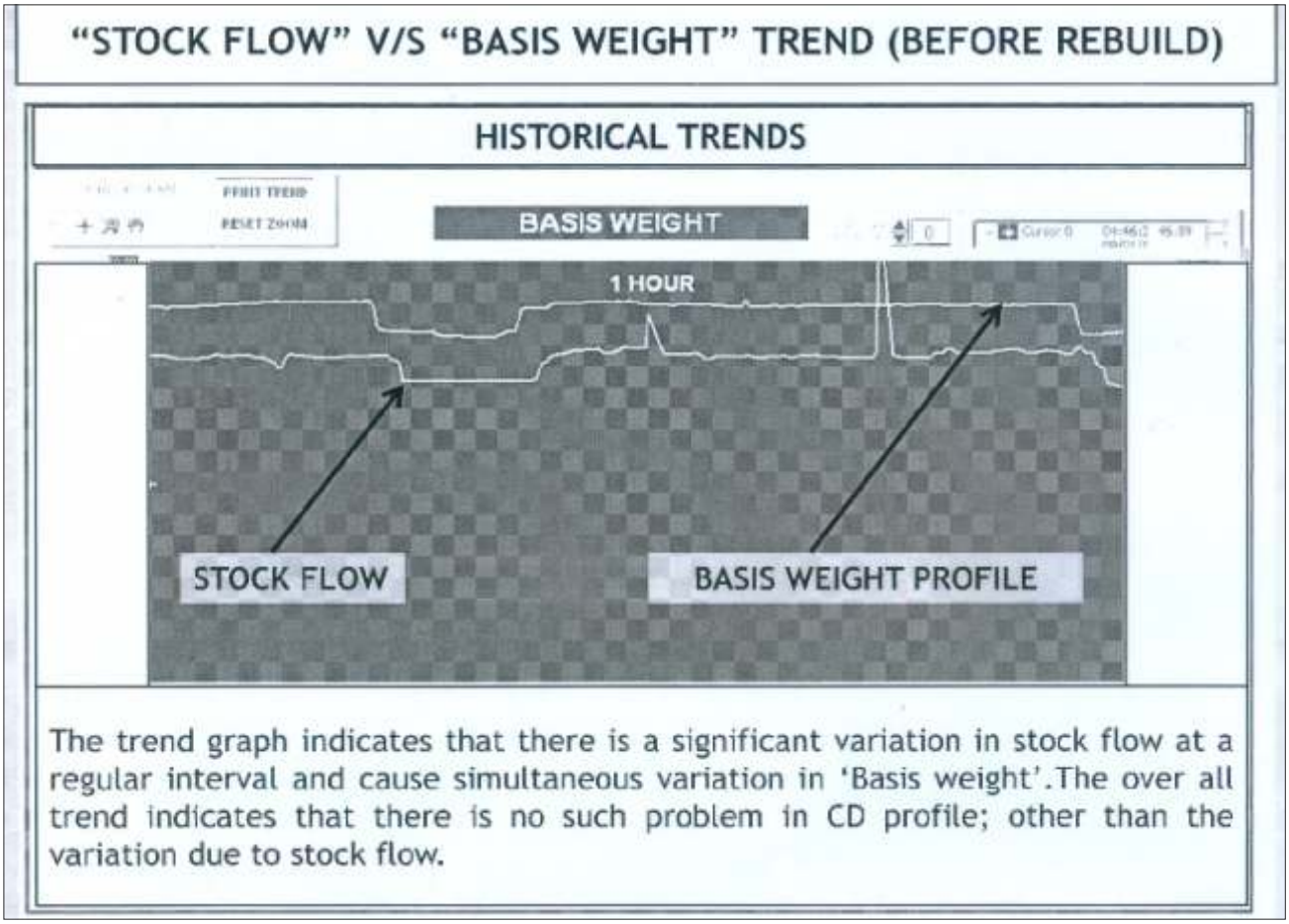
iii) *Homogeneous mixing:*

Table - 1

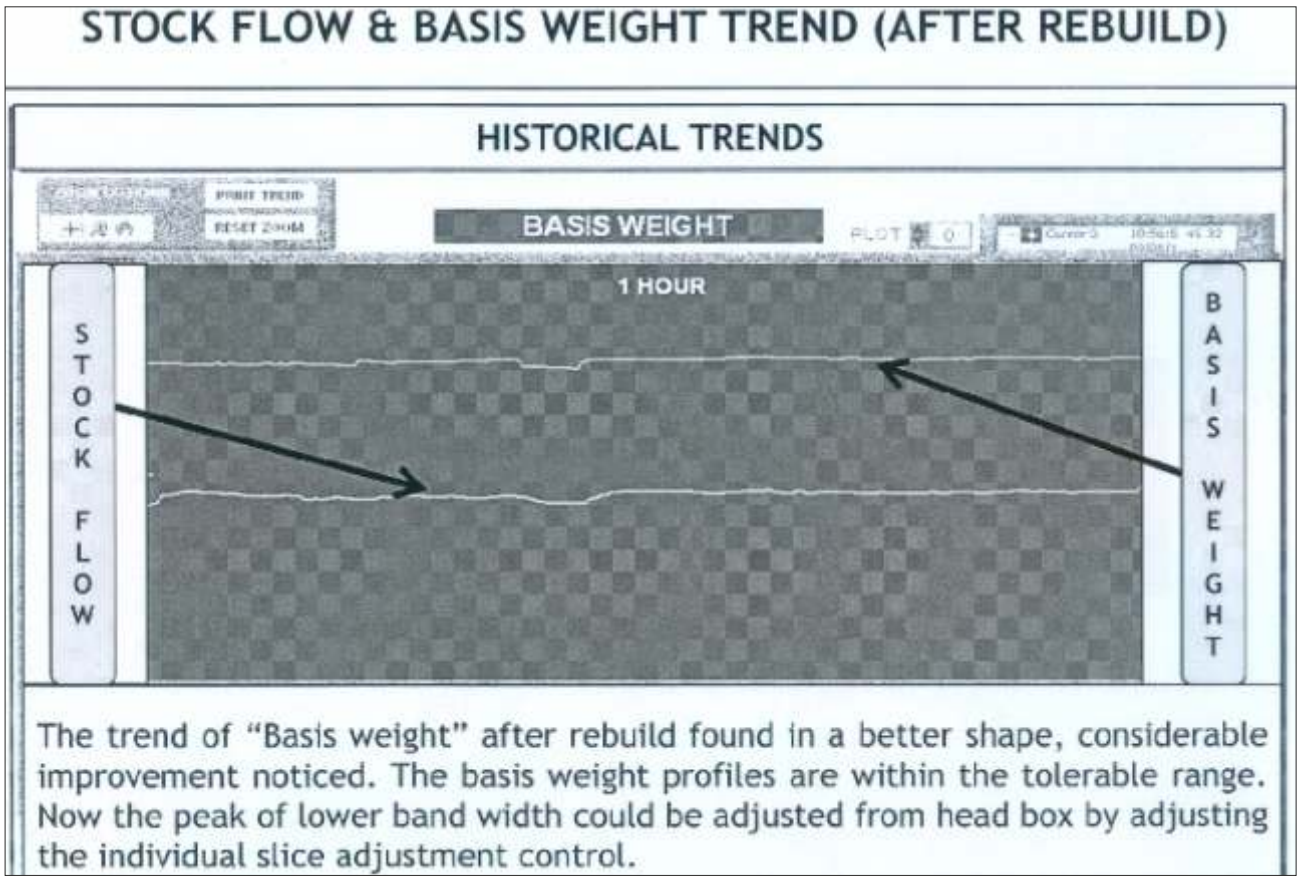
Process Capability Data; Newsprint 45GSM			
[illegible]			
S. N.	Roll No	Profile GSM	R
01	01	45,46,43,44,46,45,44,43,42,41	5
02	02	43,44,42,42,44,43,42,45,43,42	3
03	03	41,43,44,43,45,42,43,46,42,41	5
04	04	42,44,44,46,45,41,43,46,42,41	5
05	05	44,45,47,43,45,46,44,47,43,43	4
06	06	43,44,42,41,43,44,45,42,43,42	3
07	07	41,42,45,43,43,45,44,45,43,41	4
08	08	44,45,41,43,46,45,44,45,42,42	5
09	09	43,44,42,45,44,46,45,45,43,42	4
10	10	41,41,42,43,42,43,42,43,43,41	2
11	11	44,45,43,46,47,45,46,44,43,43	4
12	12	45,45,46,47,43,44,47,45,44,43	4
13	13	42,41,41,43,43,42,43,42,41,40	3
14	14	43,44,42,45,44,43,45,42,43,42	3
15	15	45,44,46,47,45,46,45,45,43,43	4
16	16	42,41,43,43,,42,43,44,43,41,41	3
17	17	45,44,46,47,46,44,46,45,43,42	5
18	18	41,43,44,43,45,44,45,44,42,41	4
19	19	43,44,43,44,45,44,43,43,43,42	3
20	20	44,44,46,45,47,46,47,45,45,43	4
21	21	41,42,41,43,44,43,43,44,43,42	3
22	22	45,43,45,44,46,45,46,46,43,43	3
23	23	41,40,41,43,43,43,44,43,42,40	4
24	24	44,43,45,45,46,47,45,44,45,43	3
25	25	42,43,45,46,47,45,43,42,43,42	5
		95	
$\bar{R}$ = R/n = 95/25 = 3.8			
Sigma = $\bar{R}/d_2$ = 3.8/3.078 = 1.234			
6 x sigma = 6 x 1.234 = 7.404			
USL – LSL = 46.8 – 43.2 = 3.6			
C_P = (USL – LSL)/6xsigma = 3.6/7.404 = 0.486			

Table - 2

Process Capability Data; Newsprint 45GSM			
[illegible]			
S.N.	Roll No	Profile GSM	R
01	01	44,44,46,46,45,45,44,45,44,44	2
02	02	43,44,45,44,45,44,45,44,43,43	2
03	03	44,45,45,43,43,44,45,45,43,43	2
04	04	44,44,44,45,45,44,44,45,44,44	1
05	05	42,43,44,44,43,44,44,43,43,42	2
06	06	43,43,45,44,45,44,45,44,43,43	2
07	07	44,43,44,45,44,45,44,44,43,43	2
08	08	43,42,43,44,44,44,45,43,43,42	3
09	09	43,44,44,44,43,43,44,44,43,43	1
10	10	45,44,44,44,45,46,46,46,45,44	2
11	11	44,44,45,45,44,46,45,45,44,44	2
12	12	42,42,43,43,42,42,43,43,43,42	1
13	13	43,43,44,45,45,44,45,45,44,43	2
14	14	41,42,42,42,43,43,43,43,42,42	2
15	15	42,43,43,44,44,44,44,43,42,42	2
16	16	45,45,45,46,46,45,46,45,44,44	2
17	17	44,44,44,44,45,45,45,44,44,44	1
18	18	44,43,43,45,44,44,45,44,43,43	2
19	19	45,44,44,45,45,46,46,45,44,44	2
20	20	43,43,44,44,45,44,45,44,43,43	2
21	21	44,44,45,44,44,45,45,45,44,44	1
22	22	43.42,43,43,43,43,42,44,44,42	2
23	23	45,45,44,44,45,44,44,45,44,44	1
24	24	42,42,43,43,44,43,44,44,44,43	2
25	25	44,44,45,44,45,44,45,45,45,44	1
		44	
$\bar{R}$ = R/n = 44/25 = 1.76			
Sigma = $\bar{R}/d_2$ = 1.76/3.078 = 0.571			
6 x sigma = 6 x 0.571 = 3.426			
USL – LSL = 46.8 – 43.2 = 3.6			
C_P = (USL – LSL)/6xsigma = 3.6/3.426 = 1.050			



B/W & Stock Flow Before Rebuild



B/W & Stock Flow After Rebuild

The mixing of stock of medium consistency under taken in two stages (double dilution) from white water trays.

The white water coming from the forming unit is split in to a large number of partial flows to enable rapid venting out of free air.

iv) Cleanliness:

The stock mixed in the Hydro mix is cleaned in the *ecomizer cleaner*, incorporate with back flashing arrangement in all the 5-stages cleaning system. The significant reduction of fibre in the rejects achieved and improved cleanliness of paper as well as improved waste paper yield.

v) Fine screen in approach flow:

The well-engineered approach flow with balanced flow and cleaned stock helps to incorporate 0.15 mm slotted basket in 2-stages.

The controlled flow to the secondary fan pump and the well designed rotor of pressure screen engineered & designed by M/S Voith, reduces pulse generation and totally eliminate the barring issues, improves stock distribution on to wire, having significant improvement in formation and physical properties of paper.

Result:

The rebuilt helps to maintain uniform basis weight profile and speeding up of machine. The complaint from the customer also eliminated because of improved formation and physical properties of paper.

The C_P (process capability index) value calculation and the data shows the improvement in basis weight profile before and after rebuild. (*Table 1 & 2*)

C_P = (USL LSL) / Six sigma

Where,

Sigma = $\bar{R} / d_2$, $\bar{R} = R/n$

R = Mean Range

n = Number of observation

USL = Upper specification limit (+4% of STD Grammage)

LSL = Lower specification limit (-4% of STD Grammage)

'd_2 = 3.078 const. for 10 sheet.

Higher the C_P value better would be the Basis weight. The C_P Value < 1 considered to be bad control.

Conclusion:

The "Hydro Mix" is a development over a conventional system of storage of white water in a tower or silo tank. It is purely based on Hydraulic flow mixing system. The individual flow enters and immediately passed on, without stagnation. The process of exhaustive flow defines the optimum condition for efficient stock mixing.

In today's scenario, the use of wide variety of waste paper having different level of fillers the proper mixing of retention chemicals with the flow of stock is extremely important for effectiveness of chemicals and the process of mixing involves 'Hydro dynamics', which could be taken care by "Hydro Mix".

The paper machine component required to design for an appropriate solution that minimises variation in paper quality parameter and improves machine runabilty. The "Hydro Mix" can provide a solution to the common problem of inadequate mixing before fan pump.

Reference:

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